Final Supplemental Environmental Impact Report for the Heritage Bluffs II Project, San Diego, California

Project No. 319435

SCH No. 1997111070

Appendices

August 2016

APPENDIX A
Notice of Preparation and Comments

THE CITY OF SAN DIEGO

DEVELOPMENT SERVICES DEPARTMENT

Date of Notice: February 11, 2015

PUBLIC NOTICE OF THE PREPARATION OF A SUBSEQUENT ENVIRONMENTAL IMPACT REPORT

SAP No. 24004059

PUBLIC NOTICE: The City of San Diego as the Lead Agency has determined that the project described below will require the preparation of a Subsequent Environmental Impact Report (SEIR) in compliance with the California Environmental Quality Act (CEQA). This Notice of Preparation of a project SEIR was publicly noticed and distributed on February 11, 2015. This notice was published in the SAN DIEGO DAILY TRANSCRIPT and placed on the City of San Diego website at: http://www.sandiego.gov/city-clerk/officialdocs/notices/index.shtml under the "California Environmental Quality Act (CEQA) Notices & Documents" section.

Written/mail-in comments may be sent to the following address: **E. Shearer-Nguyen, Environmental Planner, City of San Diego Development Services Center, 1222 First Avenue, MS 501, San Diego, CA 92101** or e-mail your comments to **DSDEAS@sandiego.gov** with the Project Name and Number in the subject line within 30 days of the receipt of the Public Notice. Responsible agencies are requested to indicate their statutory responsibilities in connection with this project when responding. A SEIR incorporating public input will then be prepared and distributed for the public to review and comment.

GENERAL PROJECT INFORMATION:

- **PROJECT NAME: HERITAGE BLUFFS II**
- **PROJECT NUMBER / SCH NO.: 319435 / 97111070**
- **COMMUNITY AREA:** Black Mountain Ranch Subarea I
- **COUNCIL DISTRICT:** 5

PROJECT DESCRIPTION: VESTING TENTATIVE MAP, a REZONE from AR-1-1 to RX-1-1 and RS-1-14, a PLANNED DEVELOPMENT PERMIT, a SITE DEVELOPMENT PERMIT, NEIGHBORHOOD USE PERMIT, and a MULTI-HABITAT PLANNING AREA (MHPA) BOUNDARY LINE ADJUSTMENT (BLA) to subdivide the project site and construct 171 single-family residential units. The balance of the 220 dwellings allocated to the property in the Black Mountain Ranch Subarea Plan (49 dwelling units) would be transferred to the Black Mountain Ranch North Village. This transfer of 49 dwellings to the North Village would include the 35 affordable dwellings required by the Subarea Plan for the site. The project would also construct various site improvements which include associated public and private streets, hardscape, retaining walls and landscaping. The approximate 170-acre project site lies south of Bernardo Center Drive / Carmel Valley Road and west of Interstate 15 in the AR-1-1 Zone of the Black Mountain Ranch Community Plan area. (LEGAL DESCRIPTION: Parcel 1: The southeast quarter of the southeast quarter of section 32, Township 13 south, Range 2 west, San Bernardino base and meridian, in City and County San Diego, as Instrument No. 111628. Parcel 2: Lots and 2 and the southeast quarter of the northeast quarter of Section 5, Township 14 south, range 2 west, San Bernardino base and meridian, in the City and County of San Diego, as Instrument No. 111628). **The site is not included on any Government Code listing of hazardous waste sites.**

APPLICANT: Black Mountain Ranch LLC

RECOMMENDED FINDING: Pursuant to Section 15060(d) of the CEQA Guidelines, it appears that the proposed project may result in significant environmental impacts in the following areas: **Land Use, Air Quality (construction), Biological Resources, Historical Resources (archaeology), Landform Alteration/Visual Quality (landform alteration), and Noise (construction).**

AVAILABILITY IN ALTERNATIVE FORMAT: To request the this Notice or the City's letter to the applicant detailing the required scope of work (EIR Scoping Letter) in alternative format, call the Development Services Department at (619) 446-5460 (800) 735-2929 (TEXT TELEPHONE).

ADDITIONAL INFORMATION: For environmental review information, contact Elizabeth Shearer-Nguyen at (619) 446-5369. The Scoping Letter and supporting documents may be reviewed, or purchased for the cost of reproduction, at the Fifth floor of the Development Services Department. **For information regarding public meetings/hearings on this project, contact the Project Manager, John Fisher at (619) 446-5231.** This notice was published in the SAN DIEGO DAILY TRANSCRIPT and distributed on February 11, 2015.

Kerry Santoro
Deputy Director
Development Services Department

DISTRIBUTION: See Attached.

ATTACHMENTS: Figure 1: Regional Location Map
Figure 2: Vesting Tentative Map – Site Plan
Scoping Letter

DISTRIBUTION:

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U.S. Fish & Wildlife Service (23)

STATE OF CALIFORNIA
California Department of Fish & Wildlife (32)
Department of Toxic Substance Control (39)
California Regional Water Quality Control Board (44)
California Transportation Commission (51)
California Department of Transportation (51A)
California Department of Transportation (51B)
Native American Heritage Commission (54)

CITY OF SAN DIEGO
Mayor's Office (91)
Councilmember Lightner, District 1 (MS 10A)
Councilmember Zapf, District 2 (MS 10A)
Councilmember Gloria, District 3 (MS 10A)
Councilmember Cole, District 4 (MS 10A)
Councilmember Kersey, District 5 (MS 10A)
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Councilmember Sherman, District 7 (MS 10A)
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Development Services Department
EAS
Project Manager
San Diego Fire-Rescue Department (MS 603)
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Transportation Development (78)
Development Coordination (78A)
Fire and Life Safety Services (79)
San Diego Fire – Rescue Department Logistics (80)
Library Department (81)
Central Library (81A)
Carmel Valley Branch Library (81F)
Historical Resources Board (87)
Environmental Services Department (93A)
Facilities Financing (MS 93B)
City Attorney's Office (MS 59)

OTHER GROUPS, ORGANIZATIONS AND INTERESTED INDIVIDUALS
Rancho Santa Ana Botanic Garden at Claremont (161)
Sierra Club (165)
San Diego Natural History Museum (166)
Mr. Jim Peugh (167A)
San Diego Audubon (167)

California Native Plant Society (170)
Citizens Coordinate for Century III (179)
Endangered Habitats League (182A)
Carmen Lucas (206)
South Coastal Information Center (210)
San Diego Archaeological Center (212)
Save Our Heritage Organisation (214)
Ron Christman (215)
Clint Linton (215B)
Frank Brown, Inter-Tribal Cultural Resources Council (216)
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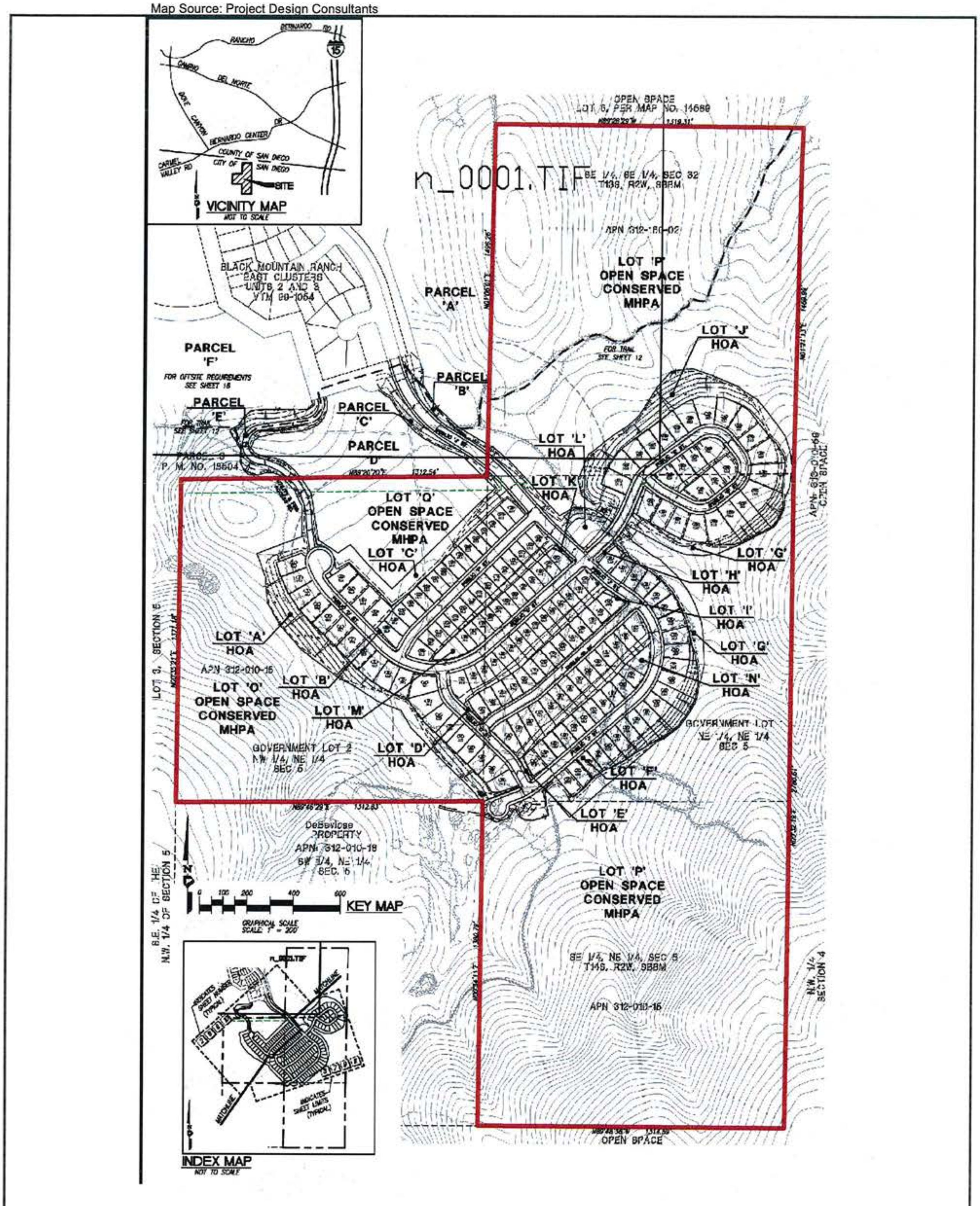
San Diego County Archaeological Society, Inc. (218)
Kumeyaay Cultural Heritage Preservation (223)
Kumeyaay Cultural Repatriation Committee (225)
Native American Distribution – Public Notice Only (225A-S)
Black Mountain Ranch – Subarea I (226C)
Black Mountain Ranch LLC, Applicant

Project Location

FIGURE 1

Regional Location

Map Source: Project Design Consultants



Project Boundary

FIGURE 2

Vesting Tentative Map

THE CITY OF SAN DIEGO

February 11, 2015

Mr. William Dumka
Senior Vice President
Standard Pacific
16010 Camino Del Sur
San Diego, CA 92127-2583

Subject: **Scope of Work for a Supplemental Environmental Impact Report for the Heritage Bluffs II Project (Project No. 319435)**

Dear Mr. Dumka:

Pursuant to Section 15060(d) of the California Environmental Quality Act (CEQA), the Environmental Analysis Section (EAS) of the City of San Diego Development Services Department has determined that the project may have significant effects on the environment, and the preparation of a Supplemental Environmental Impact Report (SEIR) is required. The SEIR shall tier to the certified Black Mountain Ranch (Subarea I) Subarea Area Plan EIR (LDR No. 96-7902; SCH No. 97111070). The SEIR shall consider the issues discussed in the first-tier document and evaluate whether a significant effect has been adequately addressed or if there is an effect that was not addressed in the previous report.

The purpose of this letter is to identify the specific issues to be addressed in the SEIR. The SEIR shall be prepared in accordance with the attached "City of San Diego Technical Report and Environmental Impact Guidelines" (Updated May 2005). A Notice of Preparation will be distributed to the Responsible Agencies and others who may have an interest in the project. Changes or additions to the scope of work may be required as a result of input received in response to the Notice of Preparation. Scoping Meetings are required by CEQA Section 21083.9(a)(2) for projects that may have statewide, regional, or area-wide environmental impacts. The City's EAS staff has determined that this project DOES NOT meet this threshold.

Additionally, changes or additions to the scope of work may be required as a result of input received in response to the Scoping Meeting and Notice of Preparation. In addition, the applicant may adjust the project over time, and these changes would be disclosed in the SEIR.

The project that would be the subject of the SEIR is briefly described as follows:

Project Description: The Heritage Bluffs II project (hereafter "project") would require approval of a Vesting Tentative Map, a Rezone from AR-1-1 to RX-1-1 and RS-1-14, a Planned Development Permit, a Site Development Permit, and a Multi-Habitat Planning Area (MHPA) Boundary Line Adjustment (BLA) to subdivide the project site and construct 171 single-family residential units. The balance of the 220 dwellings allocated to the property in the Black Mountain Ranch Subarea Plan (49 dwelling units) would be transferred to the Black Mountain Ranch North Village. This transfer of 49 dwellings to the North Village would include the 35 affordable dwellings required by the Subarea Plan for the site. Annexation approval from the Local Agency Formation Commission would also be required to move the project site from the City of San Diego Public Utilities District into the Olivenhain Municipal Water District (for sewer service).

Approximately 49.81 acres of the 169.85-acre site would be disturbed (through grading and brush management), while the remaining 120.04 acres would be preserved within the City's MHPA. A 2.87-acre Covenant of Easement (COE) within the brush management area would be recorded for the protection of an archaeological site. The COE would be granted to the City and would be added to the MHPA (as a subsequent action). The project would also include construction of various site improvements, including associated public and private streets, hardscape, retaining walls, and landscaping. Native low-fuel volume species would be used to re-vegetate the graded slopes. The treatment for the interior landscaping would primarily be parkway street trees and groundcover, ornamental in nature, fire-resistant, and would complement the building architecture. The recreation areas would be landscaped with a mix of low-maintenance ornamental and naturalized material.

Approximately 45.10 acres would be graded. Grading operations would entail approximately 630,000 cubic yards of cut and 775,000 cubic yards of fill. The maximum height of excavated manufactured (cut) slopes would be approximately 69 feet, with the maximum height of manufactured (fill) slopes being approximately 62 feet. Excess fill (145,000 cubic yards) would be obtained from the East Clusters project, Units 2 and 3, directly to the northeast of the project site. A limited amount of blasting would be required in areas of shallow bedrock. Up to 3,843 linear feet of retaining and crib walls would be necessary in specific areas. The maximum height of walls would be 8.5 feet.

Primary access to the project site would be provided by extending access from the proposed development to the north per the East Clusters Vesting Tentative Map via a public street, which would traverse the off-site area from the proposed East Clusters development to the project site. Six interior public streets would be constructed within the project site. Two existing unimproved trails would be revegetated as part of the project. The trails would be re-routed to avoid the Brodiaea preserve, and a public recreational trail easement would be provided.

The approximate 170-acre project site lies south of Bernardo Center Drive / Carmel Valley Road and west of Interstate 15 in the AR-1-1 Zone of the Black Mountain Ranch Community Plan area. (LEGAL DESCRIPTION: Parcel 1: The southeast quarter of the southeast quarter of section 32, Township 13 south, Range 2 west, San Bernardino base and meridian, in City and County San Diego, as Instrument No. 111628. Parcel 2: Lots and 2 and the southeast quarter of the northeast quarter of Section 5, Township 14 south, range 2 west, San Bernardino base and meridian, in the City and County of San Diego, as Instrument No. 111628).

SEIR FORMAT/CONTENT REQUIREMENTS

The SEIR serves to inform governmental agencies and the public of a project's environmental impacts. Emphasis in the SEIR must be on identifying feasible solutions to environmental problems. The objective is not to simply describe and document an impact, but to actively create and suggest mitigation measures or project alternatives to substantially reduce significant adverse environmental impacts. The adequacy of the SEIR will depend greatly on the thoroughness of this effort.

The SEIR must be written in an objective, clear, and concise manner, in plain language. Each section/issue area of the SEIR should provide a descriptive analysis of the project followed by a comprehensive evaluation of the issue area. Graphics and tables should be used to replace extensive word descriptions and to assist in clarification. Conclusions must be supported with quantitative, as well as qualitative information, to the extent feasible.

Prior to public review, conclusions to be attached at the front of the Draft SEIR will also need to be prepared. The conclusions cannot be prepared until an approved Draft has been submitted and accepted by the City. The Draft SEIR shall include a title page including the Project Tracking System (PTS) number and the date of the publication. The entire Draft SEIR must be left justified and shall include a table of contents and an executive summary of the following sections:

I. <u>INTRODUCTION</u>

Introduce the project with a brief discussion on the intended use and purpose of the SEIR. Describe and/or incorporate by reference any previously certified environmental documents that address the project site. Briefly describe areas where the project is in compliance or non-compliance with assumptions and mitigation contained in these previously certified documents. Additionally, this section shall provide a brief description of any other local, state, and federal agencies that may be involved in the project review and/or any grant approvals.

II. ENVIRONMENTAL SETTING

The SEIR shall describe the precise location of the project and present it on a detailed topographic map and regional map. Provide a local and regional description of the environmental setting of the project, as well as the zoning and land use designations of the site and its contiguous properties, area topography, drainage characteristics and vegetation. Include the existing and planned land uses in the vicinity, on-and off-site resources, the community plan area land use designations(s), MHPA, existing zoning, all utility easements and any required maintenance access, and any overlay zones within this section. Include any applicable jurisdictional boundaries, land use plans and overlay zones that affect the project site, such as the City of San Diego General Plan. This section shall also discuss the provision of emergency services.

III. PROJECT DESCRIPTION

Per CEQA Guideline Section 15124, the SEIR shall include a discussion of the goals and objectives of the project, in terms of public benefit (increase in housing supply, employment centers, etc.). Project objectives will be critical in determining the appropriate alternatives for the project, which would avoid or substantially reduce potentially significant impacts. As stated in CEQA Section 15124 (b), "A clearly written statement of objectives will help the lead agency develop a reasonable range of alternatives to evaluate in the EIR and will aid the decision makers in preparing findings or a statement of overriding consideration, if necessary. The description of the project shall include an overview of all major project features and phasing, including land use, grading quantities and locations, retaining walls (number of retaining walls and their individual heights and lengths), landscaping, drainage design, improvement plans, including any off-site components, vehicular access points, and parking areas associated with the project. The project description shall provide a discussion of all applicable discretionary actions required for the project (e.g., Site Development Permit), as well as a discussion of all permits and approvals required by federal, state, and other regulatory agencies.

IV. HISTORY OF PROJECT CHANGES

This section of the SEIR shall outline the history of the project and any physical changes that have been made to the project in response to environmental concerns identified during the City's review of the project.

V. ENVIRONMENTAL ANALYSIS

This section shall analyze those environmental categories having a potential for adverse environmental impacts because of the project's effect on the existing conditions and or modifications to the prior certified CEQA documents. Explain why the SEIR meets the requirements for subsequent analysis under Section 15162 of the State CEQA Guidelines, which requires that changes to the project that may result in significant impacts and that were not evaluated and disclosed in the previous CEQA documents be reviewed. The SEIR must include a complete discussion of the existing conditions, thresholds, impact analysis, significance, and mitigation for all the environmental issue sections. The SEIR must represent the independent analysis of the Lead Agency. The City's current CEQA Significance Determination Thresholds (2011) shall be used to establish significant effects unless otherwise directed by the City.

All environmental issues analyzed in the Subarea Plan EIR were considered during initial review of the project. The following issues were determined to either: 1) lack a site-specific impact analysis and/or adequate mitigation for project impacts; or 2) result in new impacts that may be potentially significant and require subsequent analysis and/or mitigation as part of this SEIR:

- Land Use (Environmentally Sensitive Land [ESL]/Regulatory Compliance, MHPA adjacency);
- Biological Resources;
- Cultural Resources;
- Landform Alteration/Visual Quality (landform alteration);
- Noise (construction); and
- Air Quality (construction)

Below are key environmental issue areas that have been identified for this project, within which the issue statements (from the Subarea Plan EIR) that must be addressed individually. The SEIR should summarize each required technical study or survey report within each respective issue section, and all requested technical reports must be included as the appendices to the SEIR and summarized in the text of the document.

Discussion of each issue statement shall include an explanation of the existing project site conditions, impact analysis, significance determination, and appropriate mitigation. The impact analysis shall address potential direct and indirect impacts that could be created through implementation of the project.

In each environmental issue section, mitigation measures to avoid or substantially lessen impacts must be clearly identified and discussed. The ultimate outcome after mitigation should also be discussed (e.g., significant but mitigated, significant and unmitigated). If other potentially significant issue areas arise during detailed environmental investigation of the project, consultation with Development Services Department is required to determine if these areas need to be added to the SEIR. As supplementary information is required, the SEIR may also need to be expanded.

LAND USE

Issue 1: Would the proposal require a deviation or variance and the deviation or variance would in turn results in a physical impact on the environment?

Issue 2: Would the proposal conflict with the provisions of the City's Multiple Species Conservation Program (MSCP) Subarea Plan or other approved local, regional or state habitat conservation plan?

An analysis of ESL (formerly Resource Protection Ordinance [RPO]) consistency was conducted in the Subarea Plan EIR for buildout of the Subarea Plan relative to floodplains, sensitive slopes, and biology and cultural resources. However, at the time the Subarea Plan EIR was prepared, no site-specific design or grading plan (footprint) was identified for the southeast perimeter properties. Therefore, the analysis in the 1998 EIR is inadequate to address specific ESL consistency impacts relative to the project. This section of the SEIR shall provide an analysis of the project's conformance with in the City of San Diego's ESL ordinance. Any required approval of findings for alternative compliance should be addressed in this section. The analysis should address the preservation of designated open space areas for sensitive biological and archaeological resources and any encroachments into steep slopes, as defined by the ESL ordinance.

The project site is within the City of San Diego Multiple Species Conservation Program (MSCP), and portions of the project are within the MSCP's MHPA or adjacent to MHPA. The section shall include a discussion of the existing MHPA lands on-site (acreage, quality, etc.) and evaluate the project's conformance with the final MSCP Plan (August 1998), with specific attention to the Land Use Adjacency Guidelines (Section 1.4.3) in terms of land use, drainage, toxic substances in runoff, lighting, noise, invasive plant species, and brush management requirements for the portions of the proposed development that would lie adjacent to the MHPA. A description of measures proposed to reduce any identified MHPA edge effects should be included within this section as well.

BIOLOGICAL RESOURCES

Issue 1: Would the proposal result in substantial adverse impact, either directly or through habitat modifications, to any species identified as a candidate, sensitive or special status species in the MSCP or other local or regional plans, policies or regulations,

of by the California Department of Fish and Wildlife (CDFW) or U.S. Fish and Wildlife Service (USFWS)?

Issue 2: Would the proposal result in a substantial adverse impact on any Tier I, Tier II, Tier IIIA or Tier IIIB habitats as identified in the Biology Guidelines of the Land Development Code or other sensitive natural community identified in local or regional plans, policies, regulations or by the CDFW or USFWS?

Issue 3: Would the proposal result in a substantial adverse impact on wetlands (including, but not limited to, marsh, vernal pools, riparian areas, etc.) through direct removal, filling, hydrological interruption, or other means?

Issue 4: Would the proposal interfere substantially with the movement of any native resident or migratory fish or wildlife species or with established native resident or migratory wildlife corridors, including linkages identified in the MSCP, or impede the use of native wildlife nursery sites?

Issue 5: Would the proposal conflict with the provisions of an adopted Habitat Conservation Plan (HCP), Natural Conservation Community Plan (NCCP), or other approved local, regional, or state habitat conservation plan, either within the MSCP plan area or in the surrounding region?

Issue 6: Would the proposal result in introducing a land use within an area adjacent to the MHPA that would result in adverse edge effects?

Issue 7: Would the proposal result in a conflict with any local policies or ordinances protecting biological resources?

Issue 8: Would the project result in the introduction of invasive species of plants into a natural open space area?

At the time of preparation of the Subarea Plan EIR, the entire Black Mountain Ranch ownership had been evaluated for biological impacts, including the additional 900 acres proposed for development under the Subarea I Plan. The biological resources evaluation in the Subarea Plan EIR focused upon the resources within the perimeter properties, MSCP core habitat and wildlife corridor areas, and their distribution relative to the natural open space being preserved within Black Mountain Ranch. However, because no site-specific grading plan was available at the time for the project site, the impact discussion relative to the development of the southeast perimeter properties was conceptual. Also, since the preparation of the Subarea Plan EIR, two previously unidentified sensitive biological resources were identified on the project site: native perennial grassland, a City of San Diego Tier I sensitive vegetation community, and thread-leaf Brodiaea, a state-listed endangered and federal-listed threatened plant species.

Vegetation and sensitive wildlife directly or indirectly affected by the project shall be fully discussed in this section of the SEIR. A biological resources report for the site shall be prepared in accordance with the City of San Diego's Biological Resources Guidelines (April 2012) and shall be included as an appendix to the SEIR. The report must identify sensitive flora and fauna that exist or have a potential to exist in the area of the project site and any impacts to sensitive habitats as well as discuss proposed mitigation measures for any impacts.

Any wetland habitat types shall be graphically delineated, including an adequate buffer to sustain their functionality. If impacts to any wetlands or their buffers are identified, a discussion of the infeasibility of avoiding such impacts with the project shall be included. Any wildlife corridors within the vicinity shall be identified, and potential impacts to linkages shall be discussed. Both the biological report and the biological resources section of the SEIR shall provide a detailed discussion and mapping of the MHPA and shall address potential adjacency impacts from the project and any proposed mitigation measures.

HISTORICAL RESOURCES (ARCHAEOLOGY)

Issue 1: Would the proposal result in an alteration, including the adverse physical or aesthetic effects and/or destruction of a prehistoric or historic building (including an architecturally significant building), structure, object or site?

Issue 2: Would the proposal result in any impact to existing religious or sacred uses within the potential impact area?

Issue 3: Would the proposal result in the disturbance of any human remains, including those interred outside of formal cemeteries?

The Subarea Plan EIR did not identify any impacts to cultural resources from buildout of the community. Two archaeological sites were identified during the 2007 field survey of the project site, one of which had been previously discovered and the other which does not meet the criteria for listing on the California Register of Historical Resources. The potential for project activities (e.g., grading) to impact historical resources shall be determined and mitigation discussed, if applicable.

An archaeological technical report is also required for the project. The report shall include the results of the initial archaeological site survey and literature review. Appropriate graphics, including a map of the Area of Potential Affect, shall be provided. The SEIR shall discuss the results of the archaeological report that was prepared for the project. The potential for grading activities to impact archaeological resources shall be determined. The report shall be included as an appendix with the records search results under separate cover as a confidential appendix. The SEIR shall summarize the results of the report and discuss the need for a research design and a data recovery program to mitigate impacts to sites that are determined to be significant and that would be directly impacted with project implementation. The SEIR shall also discuss the project's potential to impact religious or sacred uses or human remains.

LANDFORM ALTERATION/VISUAL QUALITY

Issue 1: Would the proposal result in a substantial change in the existing landform?

The Subarea Plan EIR included an analysis of visual quality impacts associated with buildout of the various land uses and properties within the Subarea Plan area. Because no site-specific design was proposed for the southeast perimeter properties at the time the Subarea Plan EIR was prepared, the EIR concluded that potential landform alteration impacts would be evaluated during subsequent environmental review.

The SEIR shall include an evaluation of the impacts on the natural landforms within the project boundary due to the proposed grading. Grading quantities (cut and fill) as well as the height of proposed manufactured slopes shall be identified. In accordance with the City of San Diego's Significance Determination Thresholds, the project may potentially create significant visual impacts in relation to landform alterations. The guidelines include the following in determining landform visual impact: alteration of more than 2,000 cubic-yards of earth per graded acre; creating manufactured slopes higher than 10 feet or steeper than 2:1 (50 percent); or changing the elevation of steep natural slopes (25 percent gradient or steeper) from existing grade to a proposed grade of more than 5 feet by either excavation or fill.

AIR QUALITY (CONSTRUCTION EMISSIONS)

Issue 1: Would the proposal result in a violation of any air quality standard or contribute substantially to an existing or projected air quality violation?

Issue 2: Would the proposal exceed 100 pound per day of Particulate Matter (PM)(dust)?

The Subarea Plan EIR identified significant direct and cumulative air quality impacts to regional air quality as a result of vehicle traffic and construction-related activities, respectively. The project is consistent with the land use and buildout assumptions for the perimeter properties as described in the Subarea Plan EIR; therefore, there would be no change in analysis relative to direct (traffic-related) air quality impacts.

The air quality analysis shall focus on the project's potential construction-related air quality impacts and how this might hinder or help the San Diego Air Basin meet the regional air quality strategies. The discussion shall include potential impacts that would occur during the construction phases of the specific project that is being proposed. In addition to the land development activities described in the Subarea Plan EIR, the project may require blasting in areas of shallow bedrock. Therefore, the SEIR shall include an analysis and discussion of construction-related air quality impacts associated with blasting. Appropriate mitigation measures from both the Subarea Plan EIR and project-specific construction/blasting analysis shall be included in the SEIR.

NOISE (CONSTRUCTION)

Issue 1: Would the proposal expose people to noise levels, which exceed the City's adopted noise ordinance?

Because the project is consistent with the land use and buildout assumptions and conceptual development footprint identified in the Subarea Plan, noise impacts associated project traffic and noise contours associated with surrounding roadways would be consistent with the analysis in the 1998 EIR. No change in analysis is required.

This section shall focus on any potential for the generation of construction-related noise that may affect sensitive biological resources or adjacent properties, including impacts associated with blasting, which may be required in areas of shallow bedrock. If significant noise impacts are identified, the SEIR shall include mitigation measures that would mitigate the impacts to below a level of significance.

VI. SIGNIFICANT ENVIRONMENTAL EFFECTS WHICH CANNOT BE AVOIDED IF THE PROJECT IS IMPLEMENTED

This section shall describe the significant unavoidable impacts of the project, including those significant impacts that can be mitigated but not reduced to below a level of significance.

VII. SIGNIFICANT IRREVERSIBLE ENVIRONMENTAL CHANGES

In conformance with CEQA Section 15126.2(b) and (c), the SEIR shall discuss the significant environmental effects which cannot be avoided if the project is implemented; and the significant irreversible changes that would result from the implementation of the project. Address the use of nonrenewable resources during the construction and life of the project.

VIII. GROWTH INDUCEMENT

The SEIR shall address the potential for growth inducement through implementation of the project. The SEIR shall discuss the ways in which the project could foster economic or population growth either directly or indirectly. Accelerated growth could further strain existing community facilities or encourage activities that could significantly affect the environment. This section need not conclude that growth-inducing impacts, if any, are significant unless the project would induce substantial growth or concentration of population.

IX. CUMULATIVE EFFECTS

When this project is considered with other past, present, and reasonable foreseeable future projects in the project area, implementation could result in significant environmental changes, which are individually limited but cumulatively considerable. Therefore, in accordance with Section 15130 of the CEQA Guidelines, potential cumulative impacts must be discussed in a separate section of the SEIR. If required, this section would update the cumulative discussion contained in the certified CEQA documents.

X. EIR SUBJECT AREAS REQUIRING NO CHANGE IN ANALYSIS

A separate section of the SEIR should include a brief discussion of why certain issues do not require supplemental analysis and are therefore not included in the SEIR. It is anticipated that these issues would include: Land Use (Plan Consistency), Traffic/Circulation, Hydrology and Water Quality, Visual Quality (Area Character, Unique Features, Landmark Trees), Air Quality (Direct [Traffic] Impacts), Geology and Soils, Agricultural Resources/Mineral Resources, Paleontological Resources, Noise (Traffic Noise), Public Facilities and Services, Water Conservation/Domestic Water/Wastewater, Public Safety, Population, and Greenhouse Gas Emissions. However, if these or other potentially significant issue areas arise during the detailed environmental investigation of the project, consultation with EAS staff is required to determine if these or other issue areas need to be addressed within the SEIR. Additionally, as supplementary information is submitted, the SEIR may need to be expanded to include additional areas.

XI. ALTERNATIVES

The SEIR shall place major attention on reasonable alternatives which avoid or reduce the project's significant environmental impacts. These alternatives shall be identified and discussed in detail, and shall address all significant impacts. The alternatives analysis shall be conducted in sufficient graphic and narrative detail to clearly assess the relative level of impacts and feasibility.

The analysis should consider the ability of each alternative to meet the project objectives while reducing significant environmental impacts. The following alternatives, at a minimum, must be considered:

No Project (No Development) Alternative: The No Project Alternative shall discuss the existing conditions of the site at the time the Notice of Preparation is published. Therefore, this alternative shall consist of the maintenance of the site in its current condition and would be equivalent to the existing environmental setting.

Reduced Project Alternative: The Reduced Project Alternative shall consider the construction of the project with a reduced project footprint to avoid impacts associated with grading and development.

If, through the environmental analysis process, other alternatives become apparent which would mitigate potential impacts, these options should be discussed with EAS staff before including them in the SEIR. The timely processing of the environmental review will likely be dependent on the thoroughness of effort exhibited in the alternatives analysis.

Preceding the detailed alternatives analysis, provide a section entitled "Alternatives Considered but Rejected." This section should include a discussion of preliminary alternatives that were considered but not analyzed in detail. The reasons for rejection must be explained in detail and demonstrate to the public the analytical route followed in rejecting certain alternatives.

XII. MITIGATION, MONITORING, AND REPORTING PROGRAM (MMRP)

For each of the issue areas discussed above, new mitigation measures should be clearly identified, discussed, and their effectiveness assessed in each issue section of the SEIR. A Mitigation, Monitoring, and Reporting Program (MMRP) for each mitigation measure must be identified. Mitigation from the Subarea Plan EIR that would be incorporated into the project also would be included in the MMRP. At a minimum, the program should identify: 1) the City department or other entity responsible for the monitoring; 2) the monitoring and reporting schedule; and 3) the completion requirements. The separate MMRP should also be contained (verbatim) as a separate chapter within the SEIR. When appropriate, EAS staff will provide the applicant with specific Mitigation Monitoring and Reporting Programs to be incorporated into the SEIR.

XIII. REFERENCES

Material must be reasonably accessible. Use the most up-to-date possible and reference source document.

XIV. INDIVIDUALS AND AGENCIES CONSULTED

List those consulted in preparation of SEIR. Seek out parties who would normally be expected to be a responsible agency or an interest in the project.

XV. CERTIFICATION PAGE

Include City and Consulting staff members, titles and affiliations.

XVI. APPENDICES

Include the NOP, Scoping Meeting Notice and comments received on the NOP and at the Scoping Meeting (Scoping Meeting verbal transcript). Include all accepted technical studies.

Conclusion:

If other potentially significant issue areas arise during detailed environmental investigation of the project, consultation with this division is required to determine if these other areas need to be addressed in the SEIR. Should the project description be revised, an additional scope of work may be required. Furthermore, as the project design progresses and supplementary information becomes available, the SEIR may need to be expanded to include additional issue areas.

It is important to note that timely processing of your project will be contingent in large part on your selection of a well-qualified consultant. Prior to starting work on the SEIR, a meeting between the consultant and EAS is required to discuss and clarify the scope of work. Until an SEIR screencheck is submitted which addresses all of the above issues, the environmental processing timeline for this project will be held in abeyance.

If you have any questions or need clarification regarding any of the information contained in the scoping letter, please contact Elizabeth Shearer-Nguyen at (619) 446-5369 or via email at Eshearer@sandiego.gov.

Sincerely,

Kerry Santoro
Deputy Director
Development Services Department

cc: Elizabeth Shearer-Nguyen, Development Services Department
Environmental Project File

From:	Cultural
To:	DSD EAS
Cc:	Dixon, Patti; Jeremy Zagarella
Subject:	Heritage Bluffs II, Project No. 319435
Date:	Tuesday, February 24, 2015 2:52:18 PM

The Pauma Band of Luiseno Indians has received the public notice of the Preparation of a Subsequent Environmental Impact Report for the Heritage Bluffs II Project. Our interest is in the preservation of ancient sites and resources. Please keep us informed on the progress of the SEIR specifically the cultural component to address any potential impacts to unkown sites on the project property.

Thank you,

Chris Devers
Cultural Clerk
Pauma Band of Luiseno Indians

From: AnneD <anned@san.rr.com>
Sent: Saturday, March 14, 2015 12:00 AM
To: DSD EAS
Subject: Response to Notice for SEIR for Heritage Bluff II project no. 319435/97111070
Attachments: Response to Notice 2015 Mar 13.docx

Dear Ms Shearer-Nguyen,

Earlier today I submitted a letter regarding the SEIR notice regarding Heritage Bluff II. I would appreciate it if you would substitute the enclosed letter and disregard the earlier draft. Thank you.

If you have any questions, you can contact me by email or by phone (858) 204-5354.

Thank you for your consideration.

Sincerely,
Anne DeBevoise

Anne E. DeBevoise, PhD
5072 San Joaquin Dr
San Diego, CA 92109
also,
anned@san.rr.com

Elizabeth Shearer-Nguyen, Environmental Planner
City of San Diego
Development Services Center
1222 First Avenue, MS 501
San Diego, CA 92101

March 13, 2015

re. Preparation of a SEIR for Heritage Bluff II

sent via email

Dear Ms Shearer-Nguyen,

This letter is in response to the public notice of a subsequent environmental impact report. The project name is Heritage Bluff II and the project number/SCH No is 319435/97111070.

I am the Trustee of the John and Betty DeBevoise Family Trust, which owns the land next to the proposed Heritage Bluff II project. Our property (APN 312-010-16) is approximately 41.5 acres and our family has owned it for nearly 60 years. In the Subarea I document, we are identified as property C. Together, figures 2.2 and 2.4 in the Subarea 1 Plan outline our development area, which is about 24 acres, with 117 du. Our development area and MHPA line were negotiated with the City and our respective attorneys over 16 years ago. To be clear, it is our intention to maximize the value of our property and develop all 117 du. We expect to have development plans submitted the City within the next 6 to 8 months. Plans were delayed due to the death of our father.

We share a common half-mile property line with the proposed Heritage Bluff II project. Yet, we were not noticed, despite the fact that we are the immediate neighbors, and are known to the City, the neighboring owners and Black Mt Ranch/Standard Pacific (see pages 3 and 4 of the notice). Plus, I have repeatedly asked the City to notice me on all plans and projects for (1) Heritage Bluff II, (2) Black Mt Ranch, and (3) Black Mountain Open Space Park. A friend at the Sierra Club alerted me there was a density transfer application, and only after looking into it did I find the Notice. I should have been noticed on February 11th. I ask again that you please notice me in the future on all matters related to these projects and entities.

The purpose of this letter is to once again express my deep concern regarding the Heritage Bluff II project and the impact it would have on our property. The way the project is currently designed, it would have a significant and irreversible negative impact on our property and property value.

In a presentation to the Rancho Penasquitos Planning Board on May 7, 2014, by Black Mountain Ranch, both the Board and I were reassured by Mr. William Dumka that the Heritage Bluff II project had included our property in their studies and their plans would provide sufficient infrastructure (water, sewer, roads, access, etc) to our property. It was only much later that I found out we would not get sufficient infrastructure.

First, It is important for you to understand that we only can get our roads and utilities from one direction, because the valley is surrounded by hills on three sides, much of which is part of Black Mountain Open Space Park. For nearly 60 years we have accessed our property via a long dirt road off of the old dirt Black Mountain Rd. The Heritage Bluff II Project Description should be revised to include a statement reflecting the location of this existing, historical dirt access road off of what was Black Mountain Road and is now Carmel Valley Road/Bernardo Center Dr. The dirt road has served our property and its rural residents since 1930 and is shown as existing in both USGS and Thomas Guide maps.

The dirt road comes off the paved Carmel Valley Rd/ Bernardo Center Dr road, crosses over what is now known as Black Mt Ranch's "Eastern Clusters" project and then the Mountain Glen Family LLC's proposed "Heritage Bluff II" project.

Second. We currently have many points of access to our property, plus internal dirt roads, too. It is critical to preserve an existing *internal* access over a dirt road that runs from east to west on the northern edge of our property, that is slated to be within the Heritage Bluff II projects MHPA open space. It is our intent to continue to use our property now and in the future, regardless of whether or when Heritage Bluff II is built, and preserving existing access is essential.

Third. On May 7 2014, the Rancho Penasquitos Planning Board and I were told that our access was on grade. Indeed, the engineering maps at the City showed that the one access point, a cul-de-sac, was on grade. But, a revised map (Nov 2014) shows the proposed cul-de-sac access is no longer at grade, but up 10 ft in the air. Therefore, we would need to add dirt to rise up to that level. However, the area on both sides is slated for MHPA. The MHPA map would need to be changed, plus necessary easements, to accommodate our need to make a road connection and to connect to the utilities. Note: Yesterday, March 12th, I learned from John Fisher that new maps and reports have been submitted to the City, but they will not be available for me to see until next Wednesday, March 18th. Therefore, I cannot adequately comment on the Heritage Bluff II project.

Fourth. We understand the applicant has reached an agreement with the City on a fire management issue, with a secondary access road on the western side of the Heritage Bluff II project. I want to confirm that our property will also be developable using that same secondary, fire-access road. And that we will not need to construct a second access between our property and the Heritage Bluff II project. The reason is because the Heritage Bluff II project plans have reduced us to just one access point. We want two access points and currently have 4 points of access. We want assurances from the City that we can develop our 117 units (per the Subarea I plan), without constructing our own secondary access. We were assured at the Rancho Penasquitos Planning Board meeting on May 7, 2014 that we would have adequate access.

Fifth. Despite assurances on May 7, 2014, that we would receive adequate water from the Heritage Bluff II project, the current plans will not provide adequate water pressure to our property. Long after May 2014, I learned from the designer of the water system for Heritage Bluff II, Mr. Stephen Nielsen, at Dexter Wilson Engineering, that the water pressure in the proposed Zone 920 water pipe system would be sufficient only to 780ft (That is, that the Zone 920 water pipes did not supply water up to 920 ft., but only to 780 ft). Our property rises another 170 ft, to an elevation of 950 ft. He said we would need a pump. Yet, Mr Nielsen also told me that the City instructed him to use a system that <u>had no pump</u>, so that the City would not have to maintain a pump in the future. It is my understanding that Mr Nielsen designed a second water-delivery system that used a pump with the Zone 793 pipes. However, to the best of my knowledge, that design and analysis has not been made public, or included in any of Mr Nielsen's reports for the Heritage Bluff II project. Yet, with the current pump-less design, we would only receive water to about 12% (or less) of our property. In a meeting with City Engineers Leonard Wilson and Mehdi Rastakhiz, I was as told we could construct a pump and reservoir. However, we also discussed that the cost of such a system could make it unfeasible for a small property, such as ours. I told them I believed adopting the Heritage Bluff II project as-is, would be akin to the City condemning us, without purchasing us. I asked then and I ask now that the City reconsider the water system to the valley and look at it in a comprehensive way, with a comprehensive solution, such that we get sufficient water pressure, too. (Rather than a hodgepodge of underground water pipes: Zone 793 pipes serving the Eastern Cluster, and Zone 920 pipes serving the Heritage Bluff II project and then we would be required to put in a pump.). I ask that Mr Nielsen's design with a water pump become available for review. And if it is adequate for Heritage Bluff and us, that it be adopted as the water-delivery system. After all, water is a shared resource. We are a family-owned, small property, not a 170-, 500- or 1000-acre property owner, and our only source of water (and all other utilities) is what will come down through the valley, through the Heritage Bluff II project. We need the City to look out for our needs, and not disregard us and the Subarea I plan. The City adopted the Subarea I plan in 1998 as THE PLAN for the Black Mt Ranch community. And subsequently our property's development area and MHCP line was codified by the City's and our attorney. A deal is a deal. Moreover, Subarea I is supposed to be smart growth and master planned. And not master planned, minus us.

Sixth. On May 7, 2014, I was assured, along with the Rancho Penasquitos Planning Board, that the sewage lines of the Heritage Bluff II project are sized to accommodate our future development needs. The Olivenhain water district is supposed to handle the waste water. How will the City ensure that there will be adequate sewage treatment capacity for the Heritage Bluff II and our development sites?

Seventh. The Heritage Bluff II plan shows that drainage from the development next to the MHPA areas will not be allowed to flow into the MHPA unrestrained by such devices as sedimentation basins, grassy swales and/or mechanical trapping methods. The drainage should not be allowed to expand the area of wetlands on to our property, where it abuts on the northeast corner of our land.

Eighth. The February 11th Notice states "The site is not included on any Government Code listing of hazardous waste sites." Due to the long-time use of the properties in the area by farmers, there is a possibility of buried hazardous material. Please provide more detail on the results of any survey or studies to determine where there is any contamination.

Ninth. Together the Heritage Bluff II and Eastern Clusters will bring over 270 homes to the valley. Assuming an average of 4 residents per home, that is over 1000 people and probably a minimum of 250 dogs. Currently, we have a serious problem with trespassers who use our property as a through-fare to come and go to Black Mountain Open Space Park. There is no legal access to the Park, but someone(s) illegally hacked a trail to connect our property to the

Park. I have been trying to shut down that trail ever since. The City Park & Rec Dept promised to close it down, too. But, just last weekend I stopped and instructed 7 mountain bikers (who were trespassing), that our property was not part of the Park, but private property. "No Trespassing" signs are posted. Yet, our barbed wire fences are regularly trampled and signs are destroyed. Trash is left by these trespassers (for me to clean up). Computers, other electronic waste and trash has been dumped on the Heritage Bluff II site, and I pick up that, too. The last time I spoke with the Police Dept, they didn't know which station had jurisdiction over our property. I believe they do not patrol the valley. So, how is the City going to keep the Heritage Bluff II open space from being tramped by unleashed dogs and mountain bikers who disregard signs? And how is the City going to ensure our safety and we are not invaded by hordes of trespassers, too? I worry about my personal safety now. I shudder to think what it will be like when there are potentially 1000+ people wanting to enter our property. And that some may try to permanently camp out in our bushes, as happened in McGonigle Canyon years ago.

Tenth. I am on the property regularly. Noise from the construction and future buildings will impact us. The noise studies appeared to not take our property into consideration. In which case, we hope the future construction on our property is afforded equal treatment by the City and neighboring property owners.

Unfortunately, I do not have time to submit more comments. I discovered this notice very late. Had I been noticed on February 11th, I would have had more time to comment on the Heritage Bluff II project.

Thank you for taking the time to review these comments. We look forward to working with the City and Black Mt Ranch (aka Standard Pacific) to resolve these and any other remaining issues.

Sincerely,

Anne E. DeBevoise, Trustee
DeBevoise Family Trust

APPENDIX B-1
Drainage Report

PRELIMINARY DRAINAGE REPORT

Heritage Bluffs II

City of San Diego, CA
November 7, 2014
PTS #319435

Prepared For:
SPIC DEL SUR LLC
16010 Camino Del Sur
San Diego, CA 92127

Prepared By:

PROJECT DESIGN CONSULTANTS
Planning | Landscape Architecture | Environmental | Engineering | Survey

701 B Street, Suite 800
San Diego, CA 92101
619.235.6471 Tel
619.234.0349 Fax

PDC Job No. 3255.30

REGISTERED PROFESSIONAL ENGINEER
DEBBY SUE REECE
No. C56148
Exp. 12-31-14
CIVIL
STATE OF CALIFORNIA

Prepared by: B. Polak
Updated by: T. Grace
Under the supervision of

____
Debby Reece, P.E. RCE 56148
Registration Expires 12/31/14

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FIGURES

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APPENDICES

LIST OF ACRONYMS

HGL .... Hydraulic Grade Line
IDF ....Intensity-Duration-Frequency
MHPA ....Multi-Habitat Planning Area
PDC..Project Design Consultants
RCP .... Reinforced Concrete Pipe
TM...Tentative Map
VTM..Vesting Tentative Map

1. INTRODUCTION

This drainage report has been prepared in support of a Site Development Permit / Vesting Tentative Map submittal for the Heritage Bluffs II project, which is located in the City of San Diego, California. The purpose of this report is to determine the hydrologic impact, if any, to the existing storm drain facilities or natural drainage, and to provide peak 100-year discharge values for the project.

The drainage analyses presented herein reflect a Tentative Map level-of-effort, which include peak 100-year storm event hydrologic analyses using preliminary grades. Hydraulic analyses for inlets, pipe inverts and HGL's will be provided during final engineering. *Therefore, the purpose of this report submittal is to acquire from the City of San Diego: 1) concept approval of the proposed storm drain layout, 2) approval of the methodology used in the evaluation of the Project storm drain system hydrology, and 3) identification of critical path drainage issues that need to be addressed during final engineering.*

This project has a gross acreage of 169.85 acres, and the net project area to be developed is approximately 43.5 acres. The property is located in the Black Mountain Ranch Subarea. Access to the project site will be provided by extending access from the proposed development to the north, as provided in the East Clusters VTM. A secondary emergency access for this project site will be provided from the East Clusters VTM. The remaining surrounding land (except for an adjacent parcel to the southwest identified as Area C in the Subarea Plan) is designated as open space in the Subarea Plan and is part of the MHPA. The project involves the construction of a residential subdivision with 171 single family residential lots and an approximate 0.35 acre recreation area consisting of recreational and utility facilities. See Figure 1 for the project vicinity map.

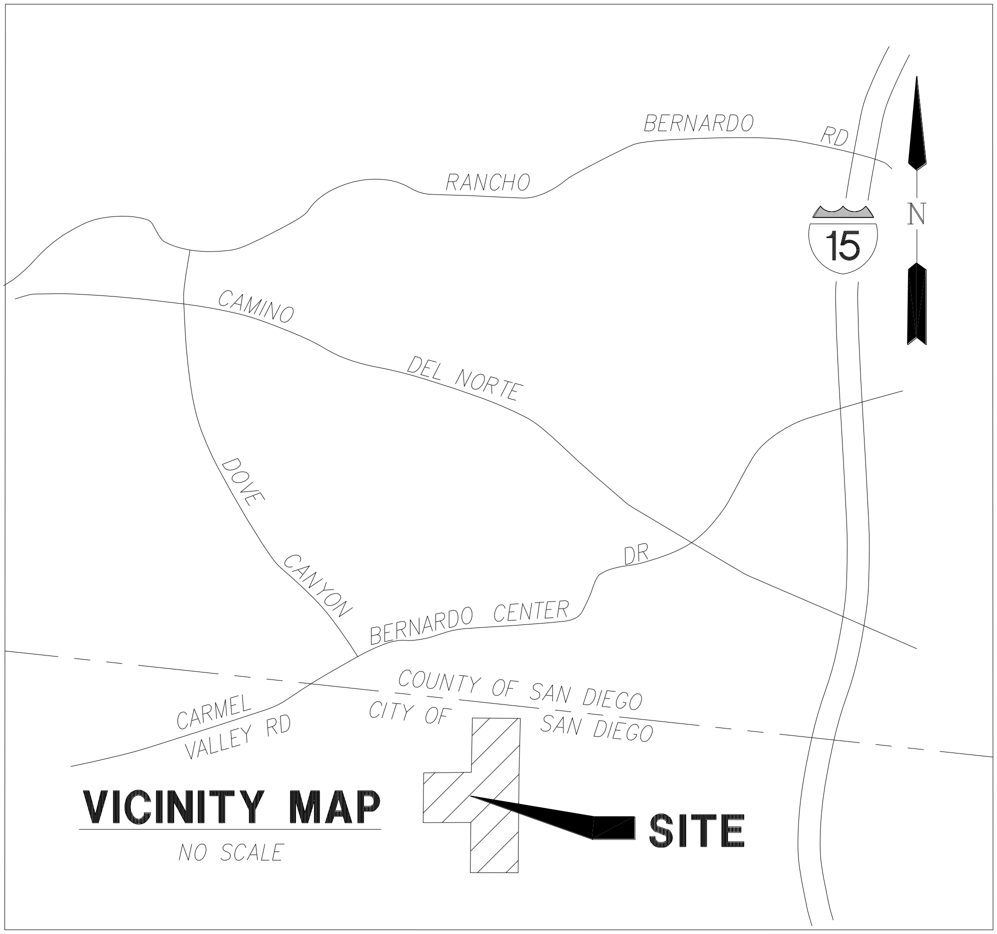


Figure 1: Project Vicinity Map

2. EXISTING AND PROPOSED DRAINAGE PATTERNS AND IMPROVEMENTS

Under exising conditions, the project area currently consists of terrain sloping in the northerly direction, with natural ground cover. The majority of the site is situated on a saddle between two natural drainage courses, which convey stormwater from upstream areas. The entire drainage area was analyzed previously by Rick Engineering in a drainage report for Carmel Valley Road to the north. The report, entitled Drainage Study for Carmel Valley Road, dated December 12, 2003 established peak 100-year discharges for the future condition, which includes the development of Heritage Bluffs II based on the original area set aside for development. This backbone study was used to size storm drain facilities in Carmel Valley Road, which since has been constructed. For this study, an existing condition analysis was also prepared in order to compare existing versus proposed flows. The proposed condition analysis will be compared to the backbone flows established with the Rick Engineering report and the existing condition flows established with this report.

Under proposed conditions, the drainage systems consisting of culverts, brow ditches, curb, gutter, storm drain inlets, and pipes. System 900, which consists of the developed area of the project, will drain into an underground storm drain system and will tie into the proposed underground storm drain within Street J to be built with the East Clusters project (located directly north of the Heritage Bluffs II project and to be developed by the same developer). The drainage system for the East Clusters project is being designed by Rick Engineering and the Water Quality and Hydromodification requirements for the Heritage Bluffs II project will be handled on a regional basis with the downstream East Clusters project. The other drainage analysis Systems (besides System 900) consist of natural canyon areas upstream, downstream, and surrounding the project. Refer to Exhibits B and C for the offsite drainage areas. For any proposed storm drain discharging to unimproved channels, energy dissipation will minimize erosion potential.

3. HYDROLOGIC CRITERIA, METHODOLOGY, AND RESULTS

This section of the report summarizes the drainage criteria that were used in the hydrologic analysis and key elements of the methodology.

3.1 Hydrology Criteria

The drainage basins were delineated using available topography and the preliminary proposed grading layout for the project. Table 1 summarizes the key hydrology assumptions and criteria used for the hydrologic modeling.

Table 1: Hydrology Criteria

Hydrology:	100-year storm frequency
Soil Type:	Hydrologic Soil Group D
Land Use / Runoff Coefficients:	Based on land use in sub-drainage area, from C=0.45 to 0.70. See Rational Method output.
Rainfall intensity:	Based on intensity duration frequency relationships presented in the 1984 City of San Diego Hydrology Manual

3.2 Hydrologic Methodology

Hydrology calculations were completed for proposed conditions in order to get a more accurate estimate of the runoff from the site. The Rick Engineering backbone study established future condition design flow rates in order to size downstream storm drain systems. Excerpts from the report are provided in Appendix 2 for reference.

For the proposed condition hydrology, the drainage areas were defined according to the preliminary grading concept for the site. Precise grading of the site during final engineering may alter the tributary drainage areas, but will not drastically alter the drainage plan for the site.

The limit lines for the future developable area to the southwest of Heritage Bluffs II were estimated by the Black Mountains Ranch East Clusters to anticipate future development by others. In accordance with the Black Mountains Ranch East Clusters, the remaining portion of the future developable area outside the project boundary was accounted for when the user-defined C values were calculated. (Refer to Appendix 1).

3.3 Description of Hydrologic Modeling Software

The Rational Method was used to determine the 100-year storm flow for the design of the storm system. The Civil-D Rational Method Program was used to perform the hydrologic calculations. This section provides a brief explanation of the computational procedure used in the computer model.

The Civil-D Modified Rational Method Hydrology Program is a computer-aided design program where the user develops a node link model of the watershed. Developing independent node link models for each interior watershed and linking these sub-models together at confluence points creates the node link model. The intensity-duration-frequency relationships are applied to each of the drainage areas in the model to get the peak flow rates at each point of interest.

4. HYDROLOGY ANALYSIS RESULTS

For results of the analysis, see Exhibit A for the existing conditions hydrology map, and Exhibits B and C for the proposed conditions hydrology maps in Appendix 6. Refer to the appendices for the hydrology calculations.

The project site's overall proposed drainage basin is similar to the conditions analyzed in the Rick Engineering backbone report, however there is a slight difference in Rational Method routing methodology and overall drainage areas between the two reports. It is reasonable to expect some discrepancy between the two reports considering the large drainage area, and the fact that different topography files where used to delineate the drainage areas for the two reports. The hydrology results for the existing and proposed conditions are summarized below.

Table 2: Hydrology Results

	EXISTING CONDITIONS		PROPOSED CONDITIONS			
System	Q_{100}	Contrib. Area	Q_{100}	% Difference of Existing Q_{100}=	Contrib. Area	Difference of Contrib. Area=
	(cfs)	(acres)	(cfs)		(acres)	
System 100	549.2	475.98	549.41	0.03%	467.57	-8.41
System 200	33.7	27.08	26.7	-21.0%	21.63	-5.45
System 300	35.2	26.89	35.6	1.1%	27.24	0.35
System 700	110.0	92.24	78.63	-28.5%	64.78	-27.46
System 900	---	---	67.7	---	40.93	40.93
Total=	728.1	622.2	758.0	4.1%	622.2	0.0

	"BACKBONE" (Q allowable from Rick Eng. Report)		PROPOSED CONDITIONS			
System	Q_{100}	Contrib. Area	Q_{100}	% Difference of backbone Q_{100}=	Contrib. Area	Difference of Contrib. Area=
	(cfs)	(acres)	(cfs)		(acres)	
System 100	561.6	473.32	549.41	-2.2%	467.57	-5.75
System 200	105.8	90.54	77.7	-26.5%	64.09	-26.45

The results of the hydrology analysis indicate that flows will increase slightly above existing conditions. In addition, the proposed peak flows at the two points of comparison (System 100 & 700) do not exceed the "backbone" condition peak flows established in Rick Engineering's report. Sheet 4 of the Black Mountain Ranch East Clusters TM (included in Appendix 5) shows the drainage patterns downstream of the project's outfalls. The western outfall is conveyed through a natural channel and flows underneath Carmel Valley Road through an 84-inch RCP. (See Drawing 31926-16-D in Appendix 5).

For the outfall east of Street J, System 900 will eventually combine with System 700 and therefore the combined flow will be addressed in Rick Engineering's East Clusters drainage report. The proposed condition peak flow for System 200 decreases compared to condition to existing conditions and the peak flows in System 300 remain relatively the same. The proposed condition flow rates will not cause a detrimental affect to the downstream drainage system.

For System 900, the project's runoff will flow north into the East Clusters property and will be collected into the proposed storm drain system and conveyed to a proposed detention basin at the southwest corner of Winecreek Road and Carmel Valley Road per the East Clusters Unit 3 TM.

The East Clusters project and the Heritage Bluffs II project are being developed by the same developer. The proposed drainage systems for both projects will be closely coordinated. PDC is coordinating with Rick Engineering, who is the civil engineering firm for the East Clusters Unit 3 project. The proposed condition flow from both projects will not adversely affect existing downstream systems. The drainage study by Rick Engineering for Black Mountain Ranch East Clusters Unit 3 (Final Engineering), dated March 12, 2014, is included in Appendix 7

5. CONCLUSION

This drainage report has been prepared in support of the preliminary design of the storm drain improvements for the Site Development Permit / Vesting Tentative Map for the Heritage Bluffs II project. The purpose of this report is to provide peak discharges for use in designing the storm drain system for the project.

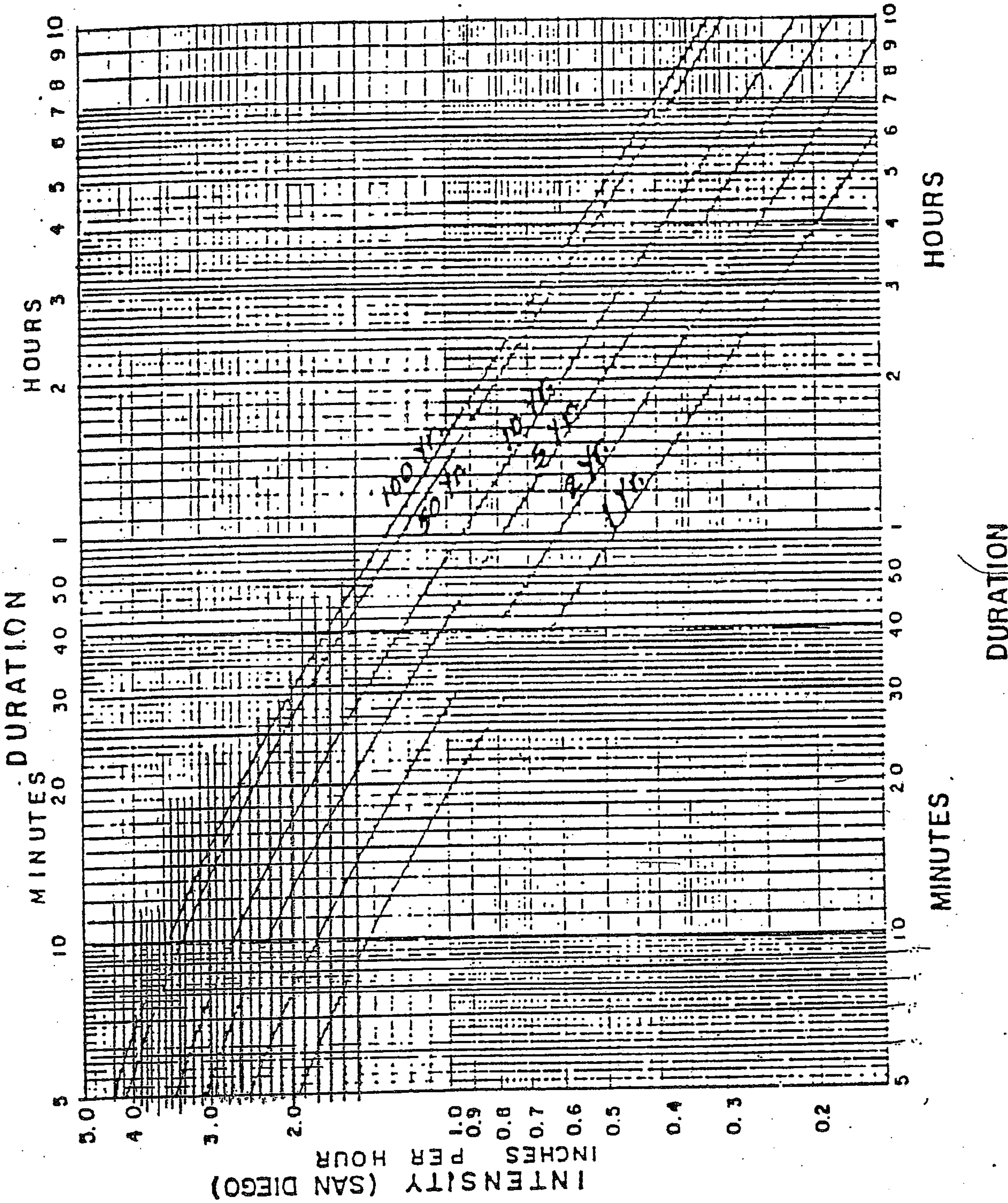
PDC will coordinate with the East Clusters Unit 3 downstream development to ensure that the downstream facilities will be able to handle this slight increase in proposed runoff, as well as the expected run-on from System 900.

Treatment Control and Hydromodification requirements for this project will be handled on a regional basis with the downstream East Clusters Unit 3 project, and are sized to accommodate the tributary drainage area.

APPENDIX 1

Supporting Documentation

(IDF Curve, Runoff Coefficients)



ELEV.	FACTOR
0–1500	1.00
1500–3000	1.25
3000–4000	1.42
4000–5000	1.60
5000–6000	1.70
DESERT	1.25

To obtain correct intensity, multiply intensity on chart by factor for design elevation.

RAINFALL INTENSITY – DURATION – FREQUEN CURVES for COUNTY OF SAN DIEGO

APPENDIX

TABLE 2

RUNOFF COEFFICIENTS (RATIONAL METHOD)

DEVELOPED AREAS (URBAN)

Land Use	Coefficient, C Soil Type (1)
Residential:	D
Single Family	.55
Multi-Units	.70
Mobile Homes	.65
Rural (lots greater than 1/2 acre)	.45
Commercial (2) 80% Impervious	.85
Industrial (2) 90% Impervious	.95

NOTES:

(1) Type D soil to be used for all areas.

(2) Where actual conditions deviate significantly from the tabulated imperviousness values of 80% or 90%, the values given for coefficient C, may be revised by multiplying 80% or 90% by the ratio of actual imperviousness to the tabulated imperviousness. However, in no case shall the final coefficient be less than 0.50. For example: Consider commercial property on D soil.

Actual imperviousness = 50%

Tabulated imperviousness = 80%

$$\text{Revised C} = \frac{50}{80} \times 0.85 = 0.53$$

PROJECT DESIGN CONSULTANTS

PLANNING | LANDSCAPE ARCHITECTURE
ENVIRONMENTAL | ENGINEERING | SURVEY

WWW.PROJECTDESIGN.COM

PROJECT: Heritage Bluff II
SUBJECT: Composite C Values
PAGE: 1 OF 1 JOB NO.: 3255.30
DRAWN BY: BJP DATE: 6/5/13
CHECKED BY: DATE:

System 100 Composite C Values
-Using Area weighting Average

(1) Node 115 to 135

land type	C	A
Rural	0.45	53.91 acre
Single family	0.55	5.98 acre
		Σ 59.89 acre

Composite C Value

$$C = \frac{0.45(53.91) + 0.55(5.98)}{59.89}$$

C = 0.46

(2) Node 125 to 156

land type	C	A
Rural	0.45	121.77
Single family	0.55	15.04
		Σ 136.81

Composite C Value

$$C = \frac{0.45(121.77) + 0.55(15.04)}{136.81}$$

C = 0.46

(3) Node 165 to 156

land type	C	A
Rural	0.45	2.17
Single Family	0.55	0.01
		Σ 2.18

Composite C Value

$$C = \frac{0.45(2.17) + 0.55(0.01)}{2.18}$$

C = 0.45

(4) Node 156 to 135

land type	C	A
Rural	0.45	2.58
Single Family	0.55	0.08
		Σ 2.66

Composite C Value

$$C = \frac{0.45(2.58) + 0.55(0.08)}{2.66}$$

C = 0.45

APPENDIX 2

Excerpts from Backbone Drainage Report

```
**************************************************************************

          RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE
          Reference: SAN DIEGO COUNTY FLOOD CONTROL DISTRICT
                       1985,1981 HYDROLOGY MANUAL
       (c) Copyright 1982-2000 Advanced Engineering Software (aes)
           Ver. 1.5A Release Date: 01/01/2000  License ID 1261

                         Analysis prepared by:

                        Rick Engineering Company
                           5620 Friars Road
                         San Diego, CA  92110
                            (619) 291-0707

************************ DESCRIPTION OF STUDY ************************
* CRV #14031                                                         *
* Basin 700 Offsite Developed Condition per Map #2                   *
* 11/19/02  SST                                                      *
**********************************************************************

  FILE NAME: A:\700A.DAT
  TIME/DATE OF STUDY: 14:38 11/19/2002
----------------------------------------------------------------------------
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
----------------------------------------------------------------------------
  USER SPECIFIED STORM EVENT(YEAR) = 100.00
  SPECIFIED MINIMUM PIPE SIZE(INCH) =  18.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.90
  RAINFALL-INTENSITY ADJUSTMENT FACTOR = 1.000
  *USER SPECIFIED:
  NUMBER OF [TIME,INTENSITY] DATA PAIRS =  9
   1)   5.000;  4.400
   2)  10.000;  3.450
   3)  15.000;  2.900
   4)  20.000;  2.500
   5)  25.000;  2.200
   6)  30.000;  2.000
   7)  40.000;  1.700
   8)  50.000;  1.500
   9)  60.000;  1.300
  SAN DIEGO HYDROLOGY MANUAL "C"-VALUES USED FOR RATIONAL METHOD
  NOTE: ONLY PEAK CONFLUENCE VALUES CONSIDERED
  *USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW MODEL*
     HALF-  CROWN TO   STREET-CROSSFALL:  CURB  GUTTER-GEOMETRIES:  MANNING
     WIDTH  CROSSFALL  IN-  / OUT-/PARK-  HEIGHT WIDTH  LIP   HIKE   FACTOR
NO.  (FT)     (FT)     SIDE / SIDE/ WAY   (FT)   (FT)  (FT)   (FT)    (n)
===  =====  =========  =================  ======  ===== ====== =====  =======
 1   20.0     15.0     0.020/0.020/0.020   0.50   2.00 0.0100 0.125  0.0180

  GLOBAL STREET FLOW-DEPTH CONSTRAINTS:
    1. Relative Flow-Depth =  0.00 FEET
       as (Maximum Allowable Street Flow Depth) - (Top-of-Curb)
    2. (Depth)*(Velocity) Constraint =  6.0 (FT*FT/S)
  *SIZE PIPE WITH A FLOW CAPACITY GREATER THAN
   OR EQUAL TO THE UPSTREAM TRIBUTARY PIPE.*
```

```
****************************************************************************
  FLOW PROCESS FROM NODE     700.00 TO NODE     701.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  RURAL DEVELOPMENT RUNOFF COEFFICIENT = .4800
  S.C.S. CURVE NUMBER (AMC II) =    0
  NATURAL WATERSHED NOMOGRAPH TIME OF CONCENTRATION (APPENDIX X-A)
  WITH 10-MINUTES ADDED =  21.10(MINUTES)
  INITIAL SUBAREA FLOW-LENGTH =  4700.00
  UPSTREAM ELEVATION =   1220.00
  DOWNSTREAM ELEVATION =    547.00
  ELEVATION DIFFERENCE =    673.00
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.434
  SUBAREA RUNOFF(CFS) =    105.79     65.47 + 25.07 = 90.54.
  TOTAL AREA(ACRES) =     90.54   TOTAL RUNOFF(CFS) =    105.79
============================================================================
  END OF STUDY SUMMARY:
  TOTAL AREA(ACRES)     =     90.54  TC(MIN.) =     21.10
  PEAK FLOW RATE(CFS)   =    105.79
============================================================================
============================================================================
  END OF RATIONAL METHOD ANALYSIS

1
```

Determing Runoff Coefficient "C" for Developed / Pre-Developed Area

C (pre-Developed) = 0.45 , C (Developed) = 0.55

Determine "C" using Area Weight Average.

$$C = \frac{(0.45)(65.47) + (0.55)(25.07)}{65.47 + 25.07}$$

$$= 0.48$$

****

RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE
Reference: SAN DIEGO COUNTY FLOOD CONTROL DISTRICT
1985,1981 HYDROLOGY MANUAL

Ver. 1.5A Release Date: 01/01/2000 License ID 1261

Analysis prepared by:

Rick Engineering Company
5620 Friars Road
San Diego, CA 92110
(619) 291-0707

```
************************** DESCRIPTION OF STUDY **************************
* CVR #14031                                                             *
* Basin 100 Offsite Developed Condition per Map #2                       *
* 02/22/03  SST                                                          *
**************************************************************************
```

FILE NAME: A:\100REV2.DAT
TIME/DATE OF STUDY: 16:06 02/22/2003

USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:

```
USER SPECIFIED STORM EVENT(YEAR) = 100.00
SPECIFIED MINIMUM PIPE SIZE(INCH) =  18.00
SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.90
RAINFALL-INTENSITY ADJUSTMENT FACTOR = 1.000
*USER SPECIFIED:
NUMBER OF [TIME,INTENSITY] DATA PAIRS =  9
 1)    5.000;  4.400
 2)   10.000;  3.450
 3)   15.000;  2.900
 4)   20.000;  2.500
 5)   25.000;  2.200
 6)   30.000;  2.000
 7)   40.000;  1.700
 8)   50.000;  1.500
 9)   60.000;  1.300
SAN DIEGO HYDROLOGY MANUAL "C"-VALUES USED FOR RATIONAL METHOD
NOTE: ONLY PEAK CONFLUENCE VALUES CONSIDERED
*USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW MODEL*
```

NO.	HALF-WIDTH (FT)	CROWN TO CROSSFALL (FT)	STREET-CROSSFALL: IN- / OUT-/PARK- SIDE / SIDE/ WAY	CURB HEIGHT (FT)	GUTTER-GEOMETRIES: WIDTH (FT)	LIP (FT)	HIKE (FT)	MANNING FACTOR (n)
1	20.0	15.0	0.020/0.020/0.020	0.50	2.00	0.0100	0.125	0.0180

```
GLOBAL STREET FLOW-DEPTH CONSTRAINTS:
  1. Relative Flow-Depth =  0.00 FEET
     as (Maximum Allowable Street Flow Depth) - (Top-of-Curb)
  2. (Depth)*(Velocity) Constraint =  6.0 (FT*FT/S)
*SIZE PIPE WITH A FLOW CAPACITY GREATER THAN
 OR EQUAL TO THE UPSTREAM TRIBUTARY PIPE.*
```

```
****************************************************************************
 FLOW PROCESS FROM NODE    100.00 TO NODE    100.10 IS CODE =  21
----------------------------------------------------------------------------

 >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
 RURAL DEVELOPMENT RUNOFF COEFFICIENT = .4500
 SOIL CLASSIFICATION IS "D"
 S.C.S. CURVE NUMBER (AMC II) =  87
 NATURAL WATERSHED NOMOGRAPH TIME OF CONCENTRATION (APPENDIX X-A)
 WITH 10-MINUTES ADDED =  13.90(MINUTES)
 INITIAL SUBAREA FLOW-LENGTH =  1650.00
 UPSTREAM ELEVATION =   1360.00
 DOWNSTREAM ELEVATION =    920.00
 ELEVATION DIFFERENCE =    440.00
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.021
 SUBAREA RUNOFF(CFS) =      46.32
 TOTAL AREA(ACRES) =      34.07   TOTAL RUNOFF(CFS) =      46.32

****************************************************************************
 FLOW PROCESS FROM NODE    100.10 TO NODE    100.20 IS CODE =  52
----------------------------------------------------------------------------

 >>>>>COMPUTE NATURAL VALLEY CHANNEL FLOW<<<<<
 >>>>>TRAVELTIME THRU SUBAREA<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =    920.00  DOWNSTREAM(FEET) =    640.00
 CHANNEL LENGTH THRU SUBAREA(FEET) =  3300.00   CHANNEL SLOPE =  0.0848
 CHANNEL FLOW THRU SUBAREA(CFS) =      46.32
 FLOW VELOCITY(FEET/SEC) =  11.03 (PER LACFCD/RCFC&WCD HYDROLOGY MANUAL)
 TRAVEL TIME(MIN.) =   4.99   Tc(MIN.) =  18.89
 LONGEST FLOWPATH FROM NODE    100.00 TO NODE    100.20 =  4950.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    100.20 TO NODE    100.20 IS CODE =  81
----------------------------------------------------------------------------

 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.589
 *USER SPECIFIED(SUBAREA):
 SINGLE FAMILY DEVELOPMENT RUNOFF COEFFICIENT = .4600
 S.C.S. CURVE NUMBER (AMC II) =  87
 SUBAREA AREA(ACRES) =  160.00   SUBAREA RUNOFF(CFS) =  190.55
 TOTAL AREA(ACRES) =   194.07   TOTAL RUNOFF(CFS) =  236.87
 TC(MIN) =  18.89
```

$$\frac{(0.45)(137.27)+(0.55)(22.73)}{137.27+22.73} = 0.46$$

```
****************************************************************************
 FLOW PROCESS FROM NODE    100.20 TO NODE    100.20 IS CODE =   1
----------------------------------------------------------------------------

 >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
 TOTAL NUMBER OF STREAMS =  2
 CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
 TIME OF CONCENTRATION(MIN.) =  18.89
 RAINFALL INTENSITY(INCH/HR) =   2.59
 TOTAL STREAM AREA(ACRES) =  194.07
 PEAK FLOW RATE(CFS) AT CONFLUENCE =     236.87
```

```
****************************************************************************
  FLOW PROCESS FROM NODE    100.40 TO NODE    100.41 IS CODE =  21
----------------------------------------------------------------------------

  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  RURAL DEVELOPMENT RUNOFF COEFFICIENT = .4500
  SOIL CLASSIFICATION IS "D"
  S.C.S. CURVE NUMBER (AMC II) =  87
  NATURAL WATERSHED NOMOGRAPH TIME OF CONCENTRATION (APPENDIX X-A)
  WITH 10-MINUTES ADDED =  12.69(MINUTES)
  INITIAL SUBAREA FLOW-LENGTH =  1140.00
  UPSTREAM ELEVATION =   1550.00
  DOWNSTREAM ELEVATION =   1170.00
  ELEVATION DIFFERENCE =    380.00
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.154
  SUBAREA RUNOFF(CFS) =     21.29
  TOTAL AREA(ACRES) =      15.00   TOTAL RUNOFF(CFS) =      21.29

****************************************************************************
  FLOW PROCESS FROM NODE    100.41 TO NODE    100.20 IS CODE =  52
----------------------------------------------------------------------------

  >>>>>COMPUTE NATURAL VALLEY CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    1170.00  DOWNSTREAM(FEET) =    640.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =  3360.00  CHANNEL SLOPE =  0.1577
  NOTE: CHANNEL SLOPE OF .1 WAS ASSUMED IN VELOCITY ESTIMATION
  CHANNEL FLOW THRU SUBAREA(CFS) =      21.29
  FLOW VELOCITY(FEET/SEC) =   9.64 (PER LACFCD/RCFC&WCD HYDROLOGY MANUAL)
  TRAVEL TIME(MIN.) =   5.81    Tc(MIN.) =  18.50
  LONGEST FLOWPATH FROM NODE    100.40 TO NODE    100.20 =  4500.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    100.20 TO NODE    100.20 IS CODE =  81
----------------------------------------------------------------------------

  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.620
  *USER SPECIFIED(SUBAREA):
  RURAL DEVELOPMENT RUNOFF COEFFICIENT = .4600
  S.C.S. CURVE NUMBER (AMC II) =  87
  SUBAREA AREA(ACRES) =    57.00   SUBAREA RUNOFF(CFS) =    68.69
  TOTAL AREA(ACRES) =     72.00   TOTAL RUNOFF(CFS) =     89.98
  TC(MIN) =  18.50

****************************************************************************
  FLOW PROCESS FROM NODE    100.20 TO NODE    100.20 IS CODE =   1
----------------------------------------------------------------------------

  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =  18.50
  RAINFALL INTENSITY(INCH/HR) =   2.62
  TOTAL STREAM AREA(ACRES) =   72.00
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     89.98
```

```
** CONFLUENCE DATA **
STREAM    RUNOFF      Tc        INTENSITY        AREA
NUMBER    (CFS)     (MIN.)    (INCH/HOUR)      (ACRE)
   1      236.87    18.89        2.589          194.07
   2       89.98    18.50        2.620           72.00

RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
CONFLUENCE FORMULA USED FOR  2 STREAMS.

** PEAK FLOW RATE TABLE **
STREAM    RUNOFF      Tc        INTENSITY
NUMBER    (CFS)     (MIN.)    (INCH/HOUR)
   1      324.07    18.50        2.620
   2      325.79    18.89        2.589

COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
PEAK FLOW RATE(CFS) =     325.79   Tc(MIN.) =    18.89
TOTAL AREA(ACRES) =    266.07
LONGEST FLOWPATH FROM NODE     100.00 TO NODE     100.20 =   4950.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE     100.20 TO NODE     100.30 IS CODE =  52
----------------------------------------------------------------------------
 >>>>>COMPUTE NATURAL VALLEY CHANNEL FLOW<<<<<
 >>>>>TRAVELTIME THRU SUBAREA<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =    640.00  DOWNSTREAM(FEET) =    590.00
 CHANNEL LENGTH THRU SUBAREA(FEET) =    960.00   CHANNEL SLOPE =  0.0521
 CHANNEL FLOW THRU SUBAREA(CFS) =    325.79
 FLOW VELOCITY(FEET/SEC) =  15.59 (PER LACFCD/RCFC&WCD HYDROLOGY MANUAL)
 TRAVEL TIME(MIN.) =   1.03    Tc(MIN.) =  19.91
 LONGEST FLOWPATH FROM NODE     100.00 TO NODE     100.30 =   5910.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE     100.30 TO NODE     100.30 IS CODE =   1
----------------------------------------------------------------------------
 >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
 TOTAL NUMBER OF STREAMS =  2
 CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
 TIME OF CONCENTRATION(MIN.) =  19.91
 RAINFALL INTENSITY(INCH/HR) =   2.51
 TOTAL STREAM AREA(ACRES) =  266.07
 PEAK FLOW RATE(CFS) AT CONFLUENCE =     325.79

****************************************************************************
 FLOW PROCESS FROM NODE     100.40 TO NODE     100.50 IS CODE =  21
----------------------------------------------------------------------------
 >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
 RURAL DEVELOPMENT RUNOFF COEFFICIENT = .4500
 SOIL CLASSIFICATION IS "D"
 S.C.S. CURVE NUMBER (AMC II) =  87
 NATURAL WATERSHED NOMOGRAPH TIME OF CONCENTRATION (APPENDIX X-A)
 WITH 10-MINUTES ADDED =  12.86(MINUTES)
 INITIAL SUBAREA FLOW-LENGTH =  1200.00
```

```
UPSTREAM ELEVATION =   1550.00
DOWNSTREAM ELEVATION =   1170.00
ELEVATION DIFFERENCE =    380.00
 100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.136
SUBAREA RUNOFF(CFS) =      15.80
TOTAL AREA(ACRES) =      11.20   TOTAL RUNOFF(CFS) =      15.80

****************************************************************************
FLOW PROCESS FROM NODE    100.50 TO NODE    100.30 IS CODE =  52
----------------------------------------------------------------------------
>>>>>COMPUTE NATURAL VALLEY CHANNEL FLOW<<<<<
>>>>>TRAVELTIME THRU SUBAREA<<<<<
============================================================================
ELEVATION DATA: UPSTREAM(FEET) =    1170.00  DOWNSTREAM(FEET) =    590.00
CHANNEL LENGTH THRU SUBAREA(FEET) =  3600.00   CHANNEL SLOPE =  0.1611
NOTE: CHANNEL SLOPE OF .1 WAS ASSUMED IN VELOCITY ESTIMATION
CHANNEL FLOW THRU SUBAREA(CFS) =      15.80
FLOW VELOCITY(FEET/SEC) =    8.90 (PER LACFCD/RCFC&WCD HYDROLOGY MANUAL)
TRAVEL TIME(MIN.) =   6.74   Tc(MIN.) =  19.60
LONGEST FLOWPATH FROM NODE    100.40 TO NODE    100.30 =  4800.00 FEET.

****************************************************************************
FLOW PROCESS FROM NODE    100.30 TO NODE    100.30 IS CODE =  81
----------------------------------------------------------------------------
>>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
 100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.532
RURAL DEVELOPMENT RUNOFF COEFFICIENT = .4500
SOIL CLASSIFICATION IS "D"
S.C.S. CURVE NUMBER (AMC II) =  87
SUBAREA AREA(ACRES) =   125.00   SUBAREA RUNOFF(CFS) =  142.42
TOTAL AREA(ACRES) =   136.20   TOTAL RUNOFF(CFS) =  158.23
TC(MIN) =  19.60
```

$$\frac{(0.45)(119.07)+(0.55)(5.93)}{119.07+5.93} = 0.45$$

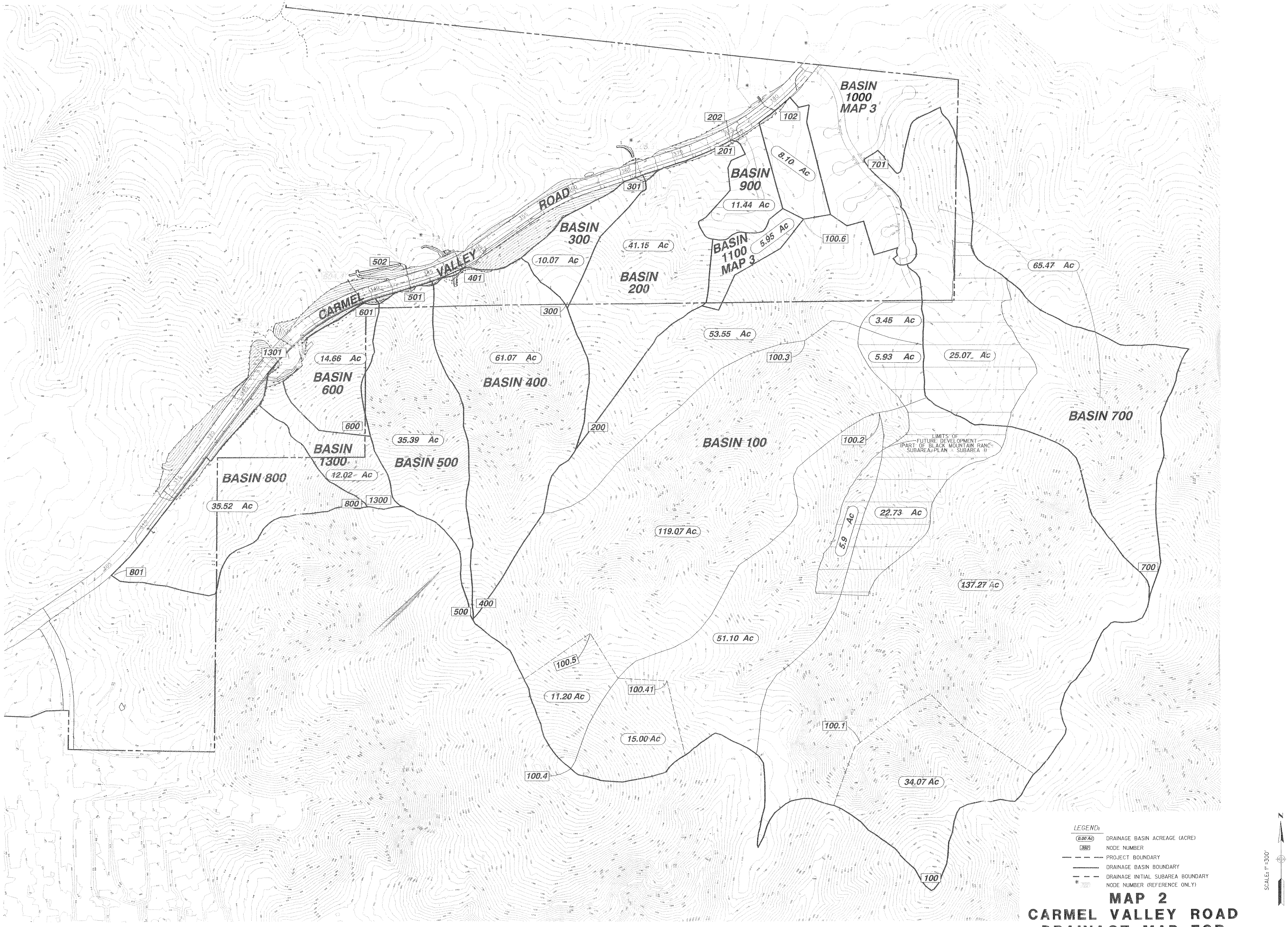
```
****************************************************************************
FLOW PROCESS FROM NODE    100.30 TO NODE    100.30 IS CODE =   1
----------------------------------------------------------------------------
>>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
>>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
TOTAL NUMBER OF STREAMS =  2
CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
TIME OF CONCENTRATION(MIN.) =  19.60
RAINFALL INTENSITY(INCH/HR) =   2.53
TOTAL STREAM AREA(ACRES) =  136.20
PEAK FLOW RATE(CFS) AT CONFLUENCE =    158.23

** CONFLUENCE DATA **
STREAM     RUNOFF      Tc      INTENSITY      AREA
NUMBER      (CFS)    (MIN.)   (INCH/HOUR)    (ACRE)
    1      325.79    19.91       2.507        266.07
    2      158.23    19.60       2.532        136.20

RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
CONFLUENCE FORMULA USED FOR  2 STREAMS.

** PEAK FLOW RATE TABLE **
```

```
 STREAM      RUNOFF       Tc        INTENSITY
 NUMBER       (CFS)     (MIN.)    (INCH/HOUR)
     1       480.79     19.60        2.532
*ERROR-TIME OF CONCENTRATION EXCEEDS RAINFALL TABLE
     2       482.45    402.27        1.300

 COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
 PEAK FLOW RATE(CFS) =      482.45   Tc(MIN.) =    19.91
 TOTAL AREA(ACRES) =      402.27
 LONGEST FLOWPATH FROM NODE      100.00 TO NODE      100.30 =   5910.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE      100.30 TO NODE      100.60 IS CODE =   52
----------------------------------------------------------------------------
 >>>>>COMPUTE NATURAL VALLEY CHANNEL FLOW<<<<<
 >>>>>TRAVELTIME THRU SUBAREA<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =     590.00  DOWNSTREAM(FEET) =      536.00
 CHANNEL LENGTH THRU SUBAREA(FEET) =   1150.00    CHANNEL SLOPE =   0.0470
 CHANNEL FLOW THRU SUBAREA(CFS) =      482.45
 FLOW VELOCITY(FEET/SEC) =   16.78 (PER LACFCD/RCFC&WCD HYDROLOGY MANUAL)
 TRAVEL TIME(MIN.) =    1.14     Tc(MIN.) =   21.06
 LONGEST FLOWPATH FROM NODE      100.00 TO NODE      100.60 =   7060.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE      100.60 TO NODE      100.60 IS CODE =   81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =   2.437
 *USER SPECIFIED(SUBAREA):
 RURAL DEVELOPMENT RUNOFF COEFFICIENT = .4600
 S.C.S. CURVE NUMBER (AMC II) =   87
 SUBAREA AREA(ACRES) =     57.00    SUBAREA RUNOFF(CFS) =     63.89
 TOTAL AREA(ACRES) =     459.27    TOTAL RUNOFF(CFS) =    546.34
 TC(MIN) =   21.06

****************************************************************************
 FLOW PROCESS FROM NODE      100.60 TO NODE      100.60 IS CODE =    1
----------------------------------------------------------------------------
 >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
 TOTAL NUMBER OF STREAMS =   2
 CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
 TIME OF CONCENTRATION(MIN.) =   21.06
 RAINFALL INTENSITY(INCH/HR) =    2.44
 TOTAL STREAM AREA(ACRES) =   459.27
 PEAK FLOW RATE(CFS) AT CONFLUENCE =      546.34

+--------------------------------------------------------------------------+
| From basin 1100 onsite/offsite development, MAP 3 - EAST clusters        |
| APPENDIX C, page 34                                                      |
|                                                                          |
+--------------------------------------------------------------------------+

****************************************************************************
 FLOW PROCESS FROM NODE      100.60 TO NODE      100.60 IS CODE =    7
```

$$\frac{(0.45)(53.55) + (0.55)(3.45)}{53.55 + 3.45} = 0.46$$

```
--------------------------------------------------------------------------
  >>>>>USER SPECIFIED HYDROLOGY INFORMATION AT NODE<<<<<
==========================================================================
  USER-SPECIFIED VALUES ARE AS FOLLOWS:
  TC(MIN) =  14.09   RAIN INTENSITY(INCH/HOUR) =  3.00
  TOTAL AREA(ACRES) =      5.95   TOTAL RUNOFF(CFS) =      8.09

**************************************************************************
  FLOW PROCESS FROM NODE    100.60 TO NODE    100.60 IS CODE =   1
--------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
==========================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =  14.09
  RAINFALL INTENSITY(INCH/HR) =   3.00
  TOTAL STREAM AREA(ACRES) =    5.95
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      8.09

  ** CONFLUENCE DATA **
  STREAM     RUNOFF      Tc       INTENSITY      AREA
  NUMBER      (CFS)    (MIN.)    (INCH/HOUR)    (ACRE)
     1       546.34    21.06        2.437        459.27
     2         8.09    14.09        3.000          5.95

  RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
  CONFLUENCE FORMULA USED FOR  2 STREAMS.

  ** PEAK FLOW RATE TABLE **
  STREAM     RUNOFF      Tc       INTENSITY
  NUMBER      (CFS)    (MIN.)    (INCH/HOUR)
     1       451.82    14.09        3.000
*ERROR-TIME OF CONCENTRATION EXCEEDS RAINFALL TABLE
     2       552.91   465.22        1.300

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =     552.91   Tc(MIN.) =   21.06
  TOTAL AREA(ACRES) =    465.22
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    100.60 =  7060.00 FEET.

**************************************************************************
  FLOW PROCESS FROM NODE    100.60 TO NODE    102.00 IS CODE =  52
--------------------------------------------------------------------------
  >>>>>COMPUTE NATURAL VALLEY CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA<<<<<
==========================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    536.00  DOWNSTREAM(FEET) =    500.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =  1020.00   CHANNEL SLOPE =  0.0353
  CHANNEL FLOW THRU SUBAREA(CFS) =    552.91
  FLOW VELOCITY(FEET/SEC) =  15.19 (PER LACFCD/RCFC&WCD HYDROLOGY MANUAL)
  TRAVEL TIME(MIN.) =   1.12    Tc(MIN.) =  22.17
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    102.00 =  8080.00 FEET.

**************************************************************************
  FLOW PROCESS FROM NODE    102.00 TO NODE    102.00 IS CODE =  81
--------------------------------------------------------------------------
```

```
>>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
 100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.370
 RURAL DEVELOPMENT RUNOFF COEFFICIENT = .4500
 SOIL CLASSIFICATION IS "D"
 S.C.S. CURVE NUMBER (AMC II) =  87
 SUBAREA AREA(ACRES) =     8.10  SUBAREA RUNOFF(CFS) =     8.64
 TOTAL AREA(ACRES) =   473.32   TOTAL RUNOFF(CFS) =  561.55
 TC(MIN) =  22.17
============================================================================
 END OF STUDY SUMMARY:
 TOTAL AREA(ACRES)      =     473.32  TC(MIN.) =      22.17
 PEAK FLOW RATE(CFS)    =     561.55
============================================================================
============================================================================
 END OF RATIONAL METHOD ANALYSIS

1
```



MAP 2
CARMEL VALLEY ROAD DRAINAGE MAP FOR OFFSITE DEVELOPED CONDITION

J. 14031
RICK ENGINEERING COMPANY
San Diego Riverside Orange Phoenix Tucson
5620 Friars Road · San Diego, CA 92110-2596 · (619) 291-0707 · FAX (619) 291-4165 · www.rickeng.com

APPENDIX 3

Existing Conditions 100-year Rational Method Computer Output

```
                San Diego County Rational Hydrology Program

CIVILCADD/CIVILDESIGN Engineering Software,(c)1991-2003 Version 6.3

Rational method hydrology  program based on
San Diego County Flood Control Division 1985 hydrology manual
        Rational Hydrology Study        Date: 05/31/13
------------------------------------------------------------------------
3255.30 HERITAGE BLUFFS
EXISTING CONDITIONS
SYSTEM 100
FILE: S100E100
------------------------------------------------------------------------
 *********   Hydrology Study Control Information **********

------------------------------------------------------------------------


Program License Serial Number 4049

------------------------------------------------------------------------
Rational hydrology study storm event year is   100.0
English (in-lb) input data Units used
English (in) rainfall data used

Standard intensity of Appendix I-B used for year and
Elevation 0 - 1500 feet
Factor (to multiply * intensity)  =  1.000
Only used if inside City of San Diego
San Diego hydrology manual 'C' values used
Runoff coefficients by rational method


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      100.000 to Point/Station      125.000
**** INITIAL AREA EVALUATION ****
______________________________________________________________________
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[RURAL(greater than 0.5 Ac, 0.2 ha) area type]
Time of concentration computed by the
natural watersheds nomograph (App X-A)
TC = [11.9*length(Mi)^3)/(elevation change(Ft.))]^.385 *60(min/hr) + 10 min.
Initial subarea flow distance  = 1461.000(Ft.)
Highest elevation = 1360.000(Ft.)
Lowest elevation =  940.000(Ft.)
Elevation difference =  420.000(Ft.)
TC=[(11.9*0.2767^3)/(420.00)]^.385=  3.45 + 10 min. =    13.45 min.
Rainfall intensity (I) =      3.028(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.450
Subarea runoff =     18.408(CFS)
Total initial stream area =       13.510(Ac.)
```



```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      125.000 to Point/Station      156.000
**** IMPROVED CHANNEL TRAVEL TIME ****
______________________________________________________________________
Upstream point elevation =   940.000(Ft.)
Downstream point elevation =   672.000(Ft.)
Channel length thru subarea  =  3082.000(Ft.)
Channel base width      =   30.000(Ft.)
Slope or 'Z' of left channel bank =   3.000
Slope or 'Z' of right channel bank =   3.000
Estimated mean flow rate at midpoint of channel =    111.611(CFS)
Manning's 'N'    = 0.030
Maximum depth of channel  =    3.000(Ft.)
Flow(q) thru subarea =    111.611(CFS)
Depth of flow =   0.437(Ft.), Average velocity =   8.159(Ft/s)
Channel flow top width =   32.621(Ft.)
Flow Velocity =     8.16(Ft/s)
Travel time  =     6.30 min.
Time of concentration =   19.75 min.
Critical depth =      0.734(Ft.)
 Adding area flow to channel
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[RURAL(greater than 0.5 Ac, 0.2 ha) area type]
Rainfall intensity =       2.595(In/Hr) for a   100.0 year storm
Runoff coefficient used for sub-area, Rational method,Q=KCIA, C = 0.450
Subarea runoff =    159.765(CFS) for  136.810(Ac.)
Total runoff =    178.172(CFS)  Total area =      150.32(Ac.)


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Process from Point/Station      125.000 to Point/Station      156.000
**** CONFLUENCE OF MINOR STREAMS ****
______________________________________________________________________
Along Main Stream number: 1 in normal stream number 1
Stream flow area =    150.320(Ac.)
Runoff from this stream =    178.172(CFS)
Time of concentration =   19.75 min.
Rainfall intensity =     2.595(In/Hr)


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Process from Point/Station      103.000 to Point/Station      109.000
**** INITIAL AREA EVALUATION ****
______________________________________________________________________
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[RURAL(greater than 0.5 Ac, 0.2 ha) area type]
Time of concentration computed by the
natural watersheds nomograph (App X-A)
TC = [11.9*length(Mi)^3)/(elevation change(Ft.))]^.385 *60(min/hr) + 10 min.
Initial subarea flow distance  = 1021.000(Ft.)
Highest elevation = 1240.000(Ft.)
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Lowest elevation =  956.000(Ft.)
Elevation difference =  284.000(Ft.)
TC=[(11.9*0.1934^3)/(284.00)]^.385=  2.65 + 10 min. =    12.65 min.
Rainfall intensity (I) =      3.097(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.450
Subarea runoff =     13.088(CFS)
Total initial stream area =       9.390(Ac.)


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Process from Point/Station      109.000 to Point/Station      156.000
**** IMPROVED CHANNEL TRAVEL TIME ****
______________________________________________________________________
Upstream point elevation =   956.000(Ft.)
Downstream point elevation =   672.000(Ft.)
Channel length thru subarea  =  1867.000(Ft.)
Channel base width       =   30.000(Ft.)
Slope or 'Z' of left channel bank =   3.000
Slope or 'Z' of right channel bank =   3.000
Estimated mean flow rate at midpoint of channel =     38.526(CFS)
Manning's 'N'    = 0.030
Maximum depth of channel  =    3.000(Ft.)
Flow(q) thru subarea =     38.526(CFS)
Depth of flow =   0.196(Ft.), Average velocity =   6.427(Ft/s)
Channel flow top width =   31.176(Ft.)
Flow Velocity =    6.43(Ft/s)
Travel time  =    4.84 min.
Time of concentration =   17.49 min.
Critical depth =      0.367(Ft.)
 Adding area flow to channel
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[RURAL(greater than 0.5 Ac, 0.2 ha) area type]
Rainfall intensity =      2.732(In/Hr) for a   100.0 year storm
Runoff coefficient used for sub-area, Rational method,Q=KCIA, C = 0.450
Subarea runoff =     44.879(CFS) for   36.500(Ac.)
Total runoff =     57.967(CFS)  Total area =       45.89(Ac.)


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Process from Point/Station      109.000 to Point/Station      156.000
**** CONFLUENCE OF MINOR STREAMS ****
______________________________________________________________________
Along Main Stream number: 1 in normal stream number 2
Stream flow area =     45.890(Ac.)
Runoff from this stream =     57.967(CFS)
Time of concentration =    17.49 min.
Rainfall intensity =      2.732(In/Hr)
Summary of stream data:

Stream   Flow rate      TC           Rainfall Intensity
 No.       (CFS)       (min)               (In/Hr)


1      178.172     19.75                 2.595
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```
2      57.967     17.49                 2.732
Qmax(1) =
          1.000 *    1.000 *   178.172) +
          0.950 *    1.000 *    57.967) + =     233.227
Qmax(2) =
          1.000 *    0.886 *   178.172) +
          1.000 *    1.000 *    57.967) + =     215.816

Total of 2 streams to confluence:
Flow rates before confluence point:
     178.172      57.967
Maximum flow rates at confluence using above data:
      233.227      215.816
Area of streams before confluence:
      150.320      45.890
Results of confluence:
Total flow rate =     233.227(CFS)
Time of concentration =    19.745 min.
Effective stream area after confluence =    196.210(Ac.)


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Process from Point/Station      156.000 to Point/Station      135.000
**** IMPROVED CHANNEL TRAVEL TIME ****
______________________________________________________________________
Upstream point elevation =   672.000(Ft.)
Downstream point elevation =   634.000(Ft.)
Channel length thru subarea  =   499.000(Ft.)
Channel base width       =   30.000(Ft.)
Slope or 'Z' of left channel bank =   3.000
Slope or 'Z' of right channel bank =   3.000
Estimated mean flow rate at midpoint of channel =     234.938(CFS)
Manning's 'N'    = 0.030
Maximum depth of channel  =    3.000(Ft.)
Flow(q) thru subarea =    234.938(CFS)
Depth of flow =   0.707(Ft.), Average velocity =  10.348(Ft/s)
Channel flow top width =   34.241(Ft.)
Flow Velocity =   10.35(Ft/s)
Travel time  =    0.80 min.
Time of concentration =   20.55 min.
Critical depth =      1.188(Ft.)
 Adding area flow to channel
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[RURAL(greater than 0.5 Ac, 0.2 ha) area type]
Rainfall intensity =      2.549(In/Hr) for a   100.0 year storm
Runoff coefficient used for sub-area, Rational method,Q=KCIA, C = 0.450
Subarea runoff =      3.304(CFS) for    2.880(Ac.)
Total runoff =    236.531(CFS)  Total area =      199.09(Ac.)


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Process from Point/Station      156.000 to Point/Station      135.000
**** CONFLUENCE OF MINOR STREAMS ****
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Along Main Stream number: 1 in normal stream number 1
Stream flow area =    199.090(Ac.)
Runoff from this stream =    236.531(CFS)
Time of concentration =   20.55 min.
Rainfall intensity =     2.549(In/Hr)


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Process from Point/Station      105.000 to Point/Station      115.000
**** INITIAL AREA EVALUATION ****

Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[RURAL(greater than 0.5 Ac, 0.2 ha) area type]
Time of concentration computed by the
natural watersheds nomograph (App X-A)
TC = [11.9*length(Mi)^3)/(elevation change(Ft.))]^.385 *60(min/hr) + 10 min.
Initial subarea flow distance  = 1061.000(Ft.)
Highest elevation = 1540.000(Ft.)
Lowest elevation = 1170.000(Ft.)
Elevation difference =  370.000(Ft.)
TC=[(11.9*0.2009^3)/(370.00)]^.385=  2.50 + 10 min. =    12.50 min.
Rainfall intensity (I) =      3.111(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.450
Subarea runoff =     15.525(CFS)
Total initial stream area =       11.090(Ac.)


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Process from Point/Station      115.000 to Point/Station      135.000
**** IMPROVED CHANNEL TRAVEL TIME ****

Upstream point elevation =  1170.000(Ft.)
Downstream point elevation =   634.000(Ft.)
Channel length thru subarea  =  3480.000(Ft.)
Channel base width       =   30.000(Ft.)
Slope or 'Z' of left channel bank =   3.000
Slope or 'Z' of right channel bank =   3.000
Estimated mean flow rate at midpoint of channel =     57.445(CFS)
Manning's 'N'    = 0.030
Maximum depth of channel  =    3.000(Ft.)
Flow(q) thru subarea =     57.445(CFS)
Depth of flow =   0.248(Ft.), Average velocity =   7.537(Ft/s)
Channel flow top width =   31.487(Ft.)
Flow Velocity =    7.54(Ft/s)
Travel time  =    7.70 min.
Time of concentration =   20.20 min.
Critical depth =      0.477(Ft.)
 Adding area flow to channel
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[RURAL(greater than 0.5 Ac, 0.2 ha) area type]
Rainfall intensity =      2.569(In/Hr) for a   100.0 year storm
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Runoff coefficient used for sub-area, Rational method,Q=KCIA, C = 0.450
Subarea runoff =     69.239(CFS) for   59.890(Ac.)
Total runoff =     84.764(CFS)  Total area =       70.98(Ac.)


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Process from Point/Station      115.000 to Point/Station      135.000
**** CONFLUENCE OF MINOR STREAMS ****

Along Main Stream number: 1 in normal stream number 2
Stream flow area =     70.980(Ac.)
Runoff from this stream =     84.764(CFS)
Time of concentration =   20.20 min.
Rainfall intensity =     2.569(In/Hr)
Summary of stream data:

Stream   Flow rate      TC             Rainfall Intensity
 No.       (CFS)       (min)                  (In/Hr)


1      236.531     20.55                  2.549
2       84.764     20.20                  2.569
Qmax(1) =
          1.000 *    1.000 *   236.531) +
          0.992 *    1.000 *    84.764) + =     320.643
Qmax(2) =
          1.000 *    0.983 *   236.531) +
          1.000 *    1.000 *    84.764) + =     317.259

Total of 2 streams to confluence:
Flow rates before confluence point:
     236.531      84.764
Maximum flow rates at confluence using above data:
      320.643      317.259
Area of streams before confluence:
      199.090      70.980
Results of confluence:
Total flow rate =    320.643(CFS)
Time of concentration =    20.549 min.
Effective stream area after confluence =    270.070(Ac.)


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Process from Point/Station      135.000 to Point/Station      140.000
**** IMPROVED CHANNEL TRAVEL TIME ****

Upstream point elevation =   634.000(Ft.)
Downstream point elevation =   586.000(Ft.)
Channel length thru subarea  =   998.000(Ft.)
Channel base width       =   30.000(Ft.)
Slope or 'Z' of left channel bank =   3.000
Slope or 'Z' of right channel bank =   3.000
Estimated mean flow rate at midpoint of channel =    333.133(CFS)
Manning's 'N'    = 0.030
Maximum depth of channel  =    3.000(Ft.)
Flow(q) thru subarea =    333.133(CFS)
Depth of flow =   0.995(Ft.), Average velocity =  10.156(Ft/s)
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Channel flow top width =   35.967(Ft.)
Flow Velocity =   10.16(Ft/s)
Travel time  =    1.64 min.
Time of concentration =   22.19 min.
Critical depth =      1.484(Ft.)
 Adding area flow to channel
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[RURAL(greater than 0.5 Ac, 0.2 ha) area type]
Rainfall intensity =      2.461(In/Hr) for a   100.0 year storm
Runoff coefficient used for sub-area, Rational method,Q=KCIA, C = 0.450
Subarea runoff =     23.297(CFS) for   21.040(Ac.)
Total runoff =    343.940(CFS)  Total area =      291.11(Ac.)


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Process from Point/Station      135.000 to Point/Station      140.000
**** CONFLUENCE OF MINOR STREAMS ****
______________________________________________________________________
Along Main Stream number: 1 in normal stream number 1
Stream flow area =    291.110(Ac.)
Runoff from this stream =    343.940(CFS)
Time of concentration =   22.19 min.
Rainfall intensity =     2.461(In/Hr)


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Process from Point/Station      110.000 to Point/Station      120.000
**** INITIAL AREA EVALUATION ****
______________________________________________________________________
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[RURAL(greater than 0.5 Ac, 0.2 ha) area type]
Time of concentration computed by the
natural watersheds nomograph (App X-A)
TC = [11.9*length(Mi)^3)/(elevation change(Ft.))]^.385 *60(min/hr) + 10 min.
Initial subarea flow distance  =  994.000(Ft.)
Highest elevation = 1550.000(Ft.)
Lowest elevation = 1200.000(Ft.)
Elevation difference =  350.000(Ft.)
TC=[(11.9*0.1883^3)/(350.00)]^.385=  2.37 + 10 min. =    12.37 min.
Rainfall intensity (I) =      3.123(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.450
Subarea runoff =     15.346(CFS)
Total initial stream area =       10.920(Ac.)


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Process from Point/Station      120.000 to Point/Station      140.000
**** IMPROVED CHANNEL TRAVEL TIME ****
______________________________________________________________________
Upstream point elevation =  1200.000(Ft.)
Downstream point elevation =   586.000(Ft.)
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Channel length thru subarea  =  3819.000(Ft.)
Channel base width       =   30.000(Ft.)
Slope or 'Z' of left channel bank =   3.000
Slope or 'Z' of right channel bank =   3.000
Estimated mean flow rate at midpoint of channel =     90.954(CFS)
Manning's 'N'    = 0.030
Maximum depth of channel  =    3.000(Ft.)
Flow(q) thru subarea =     90.954(CFS)
Depth of flow =   0.322(Ft.), Average velocity =   9.122(Ft/s)
Channel flow top width =   31.932(Ft.)
Flow Velocity =    9.12(Ft/s)
Travel time  =    6.98 min.
Time of concentration =   19.35 min.
Critical depth =      0.641(Ft.)
 Adding area flow to channel
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[RURAL(greater than 0.5 Ac, 0.2 ha) area type]
Rainfall intensity =      2.618(In/Hr) for a   100.0 year storm
Runoff coefficient used for sub-area, Rational method,Q=KCIA, C = 0.450
Subarea runoff =    126.771(CFS) for  107.600(Ac.)
Total runoff =    142.118(CFS)  Total area =      118.52(Ac.)


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Process from Point/Station      120.000 to Point/Station      140.000
**** CONFLUENCE OF MINOR STREAMS ****
______________________________________________________________________
Along Main Stream number: 1 in normal stream number 2
Stream flow area =    118.520(Ac.)
Runoff from this stream =    142.118(CFS)
Time of concentration =   19.35 min.
Rainfall intensity =     2.618(In/Hr)
Summary of stream data:

Stream   Flow rate      TC            Rainfall Intensity
 No.       (CFS)       (min)                 (In/Hr)


1      343.940    22.19                 2.461
2      142.118    19.35                 2.618
Qmax(1) =
        1.000 *    1.000 *   343.940) +
        0.940 *    1.000 *   142.118) + =      477.507
Qmax(2) =
        1.000 *    0.872 *   343.940) +
        1.000 *    1.000 *   142.118) + =      442.077

Total of 2 streams to confluence:
Flow rates before confluence point:
     343.940     142.118
Maximum flow rates at confluence using above data:
      477.507     442.077
Area of streams before confluence:
      291.110     118.520
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Results of confluence:
Total flow rate =    477.507(CFS)
Time of concentration =    22.187 min.
Effective stream area after confluence =    409.630(Ac.)


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Process from Point/Station      140.000 to Point/Station      145.000
**** IMPROVED CHANNEL TRAVEL TIME ****

Upstream point elevation =   586.000(Ft.)
Downstream point elevation =   574.000(Ft.)
Channel length thru subarea  =   236.000(Ft.)
Channel base width      =   30.000(Ft.)
Slope or 'Z' of left channel bank =   3.000
Slope or 'Z' of right channel bank =   3.000
Estimated mean flow rate at midpoint of channel =    478.212(CFS)
Manning's 'N'    = 0.030
Maximum depth of channel  =    3.000(Ft.)
Flow(q) thru subarea =    478.212(CFS)
Depth of flow =   1.209(Ft.), Average velocity =  11.759(Ft/s)
Channel flow top width =   37.256(Ft.)
Flow Velocity =   11.76(Ft/s)
Travel time  =    0.33 min.
Time of concentration =   22.52 min.
Critical depth =      1.875(Ft.)
 Adding area flow to channel
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[RURAL(greater than 0.5 Ac, 0.2 ha) area type]
Rainfall intensity =      2.443(In/Hr) for a   100.0 year storm
Runoff coefficient used for sub-area, Rational method,Q=KCIA, C = 0.450
Subarea runoff =      1.330(CFS) for    1.210(Ac.)
Total runoff =    478.837(CFS)  Total area =      410.84(Ac.)


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Process from Point/Station      140.000 to Point/Station      145.000
**** CONFLUENCE OF MINOR STREAMS ****

Along Main Stream number: 1 in normal stream number 1
Stream flow area =     410.840(Ac.)
Runoff from this stream =     478.837(CFS)
Time of concentration =   22.52 min.
Rainfall intensity =     2.443(In/Hr)


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Process from Point/Station      130.000 to Point/Station      131.000
**** INITIAL AREA EVALUATION ****

Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
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[RURAL(greater than 0.5 Ac, 0.2 ha) area type]
Time of concentration computed by the
natural watersheds nomograph (App X-A)
TC = [11.9*length(Mi)^3)/(elevation change(Ft.))]^.385 *60(min/hr) + 10 min.
Initial subarea flow distance  =  750.000(Ft.)
Highest elevation = 1140.000(Ft.)
Lowest elevation = 1000.000(Ft.)
Elevation difference =  140.000(Ft.)
TC=[(11.9*0.1420^3)/(140.00)]^.385=  2.44 + 10 min. =    12.44 min.
Rainfall intensity (I) =      3.117(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.450
Subarea runoff =      6.256(CFS)
Total initial stream area =        4.460(Ac.)


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Process from Point/Station      131.000 to Point/Station      145.000
**** IMPROVED CHANNEL TRAVEL TIME ****

Upstream point elevation =  1000.000(Ft.)
Downstream point elevation =   574.000(Ft.)
Channel length thru subarea  =  2371.000(Ft.)
Channel base width      =   30.000(Ft.)
Slope or 'Z' of left channel bank =   3.000
Slope or 'Z' of right channel bank =   3.000
Estimated mean flow rate at midpoint of channel =      22.617(CFS)
Manning's 'N'    = 0.030
Maximum depth of channel  =    3.000(Ft.)
Flow(q) thru subarea =      22.617(CFS)
Depth of flow =   0.136(Ft.), Average velocity =   5.487(Ft/s)
Channel flow top width =   30.813(Ft.)
Flow Velocity =    5.49(Ft/s)
Travel time  =    7.20 min.
Time of concentration =   19.64 min.
Critical depth =      0.258(Ft.)
 Adding area flow to channel
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[RURAL(greater than 0.5 Ac, 0.2 ha) area type]
Rainfall intensity =      2.601(In/Hr) for a   100.0 year storm
Runoff coefficient used for sub-area, Rational method,Q=KCIA, C = 0.450
Subarea runoff =      27.308(CFS) for   23.330(Ac.)
Total runoff =     33.564(CFS)  Total area =       27.79(Ac.)


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Process from Point/Station      131.000 to Point/Station      145.000
**** CONFLUENCE OF MINOR STREAMS ****

Along Main Stream number: 1 in normal stream number 2
Stream flow area =      27.790(Ac.)
Runoff from this stream =      33.564(CFS)
Time of concentration =   19.64 min.
Rainfall intensity =     2.601(In/Hr)
Summary of stream data:
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Stream   Flow rate      TC          Rainfall Intensity
 No.       (CFS)       (min)              (In/Hr)


1      478.837     22.52              2.443
2       33.564     19.64              2.601
Qmax(1) =
           1.000 *    1.000 *   478.837) +
           0.939 *    1.000 *    33.564) + =      510.363
Qmax(2) =
           1.000 *    0.872 *   478.837) +
           1.000 *    1.000 *    33.564) + =      451.143

Total of 2 streams to confluence:
Flow rates before confluence point:
     478.837      33.564
Maximum flow rates at confluence using above data:
      510.363      451.143
Area of streams before confluence:
      410.840      27.790
Results of confluence:
Total flow rate =    510.363(CFS)
Time of concentration =    22.521 min.
Effective stream area after confluence =    438.630(Ac.)


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Process from Point/Station      145.000 to Point/Station      150.000
**** IMPROVED CHANNEL TRAVEL TIME ****

Upstream point elevation =   547.000(Ft.)
Downstream point elevation =   538.000(Ft.)
Channel length thru subarea  =   952.000(Ft.)
Channel base width      =   30.000(Ft.)
Slope or 'Z' of left channel bank =   3.000
Slope or 'Z' of right channel bank =   3.000
Estimated mean flow rate at midpoint of channel =    526.594(CFS)
Manning's 'N'    = 0.030
Maximum depth of channel  =    3.000(Ft.)
Flow(q) thru subarea =    526.594(CFS)
Depth of flow =   2.080(Ft.), Average velocity =   6.985(Ft/s)
Channel flow top width =   42.481(Ft.)
Flow Velocity =    6.99(Ft/s)
Travel time  =    2.27 min.
Time of concentration =   24.79 min.
Critical depth =      1.969(Ft.)
 Adding area flow to channel
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[RURAL(greater than 0.5 Ac, 0.2 ha) area type]
Rainfall intensity =      2.330(In/Hr) for a   100.0 year storm
Runoff coefficient used for sub-area, Rational method,Q=KCIA, C = 0.450
Subarea runoff =     29.253(CFS) for   27.900(Ac.)
Total runoff =    539.616(CFS)  Total area =      466.53(Ac.)
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Process from Point/Station      150.000 to Point/Station      155.000
**** IMPROVED CHANNEL TRAVEL TIME ****

Upstream point elevation =   538.000(Ft.)
Downstream point elevation =   500.000(Ft.)
Channel length thru subarea  =  1010.000(Ft.)
Channel base width      =   30.000(Ft.)
Slope or 'Z' of left channel bank =   3.000
Slope or 'Z' of right channel bank =   3.000
Estimated mean flow rate at midpoint of channel =    545.081(CFS)
Manning's 'N'    = 0.030
Maximum depth of channel  =    3.000(Ft.)
Flow(q) thru subarea =    545.081(CFS)
Depth of flow =   1.425(Ft.), Average velocity =  11.160(Ft/s)
Channel flow top width =   38.550(Ft.)
Flow Velocity =   11.16(Ft/s)
Travel time  =    1.51 min.
Time of concentration =   26.30 min.
Critical depth =      2.031(Ft.)
 Adding area flow to channel
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[RURAL(greater than 0.5 Ac, 0.2 ha) area type]
Rainfall intensity =      2.259(In/Hr) for a   100.0 year storm
Runoff coefficient used for sub-area, Rational method,Q=KCIA, C = 0.450
Subarea runoff =      9.608(CFS) for    9.450(Ac.)
Total runoff =    549.224(CFS)  Total area =      475.98(Ac.)
End of computations, total study area =        475.980 (Ac.)
```

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            San Diego County Rational Hydrology Program

CIVILCADD/CIVILDESIGN Engineering Software,(c)1991-2003 Version 6.3

Rational method hydrology  program based on
San Diego County Flood Control Division 1985 hydrology manual
        Rational Hydrology Study        Date: 05/02/13
------------------------------------------------------------------------
3255.30 HERITAGE BLUFFS
EXISTING CONDITIONS
SYSTEM 200
FILE: S200E100
------------------------------------------------------------------------
 *********   Hydrology Study Control Information **********

------------------------------------------------------------------------


Program License Serial Number 4049

------------------------------------------------------------------------
Rational hydrology study storm event year is   100.0
English (in-lb) input data Units used
English (in) rainfall data used

Standard intensity of Appendix I-B used for year and
Elevation 0 - 1500 feet
Factor (to multiply * intensity)  =  1.000
Only used if inside City of San Diego
San Diego hydrology manual 'C' values used
Runoff coefficients by rational method


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      200.000 to Point/Station      205.000
**** INITIAL AREA EVALUATION ****

Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[RURAL(greater than 0.5 Ac, 0.2 ha) area type]
Time of concentration computed by the
natural watersheds nomograph (App X-A)
TC = [11.9*length(Mi)^3)/(elevation change(Ft.))]^.385 *60(min/hr) + 10 min.
Initial subarea flow distance  =  985.000(Ft.)
Highest elevation = 1070.000(Ft.)
Lowest elevation =  736.000(Ft.)
Elevation difference =  334.000(Ft.)
TC=[(11.9*0.1866^3)/(334.00)]^.385=  2.39 + 10 min. =    12.39 min.
Rainfall intensity (I) =      3.121(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.450
Subarea runoff =      5.956(CFS)
Total initial stream area =       4.240(Ac.)
```



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++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      205.000 to Point/Station      210.000
**** IMPROVED CHANNEL TRAVEL TIME ****

Upstream point elevation =   736.000(Ft.)
Downstream point elevation =   584.000(Ft.)
Channel length thru subarea  =  1851.000(Ft.)
Channel base width       =   15.000(Ft.)
Slope or 'Z' of left channel bank =   3.000
Slope or 'Z' of right channel bank =   3.000
Estimated mean flow rate at midpoint of channel =     21.996(CFS)
Manning's 'N'    = 0.030
Maximum depth of channel  =    2.000(Ft.)
Flow(q) thru subarea =     21.996(CFS)
Depth of flow =   0.254(Ft.), Average velocity =   5.497(Ft/s)
Channel flow top width =   16.523(Ft.)
Flow Velocity =     5.50(Ft/s)
Travel time  =     5.61 min.
Time of concentration =   18.00 min.
Critical depth =      0.395(Ft.)
 Adding area flow to channel
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[RURAL(greater than 0.5 Ac, 0.2 ha) area type]
Rainfall intensity =       2.700(In/Hr) for a   100.0 year storm
Runoff coefficient used for sub-area, Rational method,Q=KCIA, C = 0.450
Subarea runoff =     27.751(CFS) for    22.840(Ac.)
Total runoff =     33.706(CFS)  Total area =       27.08(Ac.)
End of computations, total study area =         27.080 (Ac.)
```

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                San Diego County Rational Hydrology Program

CIVILCADD/CIVILDESIGN Engineering Software,(c)1991-2003 Version 6.3

Rational method hydrology  program based on
San Diego County Flood Control Division 1985 hydrology manual
        Rational Hydrology Study        Date: 05/02/13
------------------------------------------------------------------------
3255.30 HERITAGE BLUFFS
EXISTING CONDITIONS
SYSTEM 300
FILE: S300E100
------------------------------------------------------------------------
 *********   Hydrology Study Control Information **********

------------------------------------------------------------------------


Program License Serial Number 4049

------------------------------------------------------------------------
Rational hydrology study storm event year is   100.0
English (in-lb) input data Units used
English (in) rainfall data used

Standard intensity of Appendix I-B used for year and
Elevation 0 - 1500 feet
Factor (to multiply * intensity)  =  1.000
Only used if inside City of San Diego
San Diego hydrology manual 'C' values used
Runoff coefficients by rational method


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      300.000 to Point/Station      305.000
**** INITIAL AREA EVALUATION ****
______________________________________________________________________
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[RURAL(greater than 0.5 Ac, 0.2 ha) area type]
Time of concentration computed by the
natural watersheds nomograph (App X-A)
TC = [11.9*length(Mi)^3)/(elevation change(Ft.))]^.385 *60(min/hr) + 10 min.
Initial subarea flow distance  =  930.000(Ft.)
Highest elevation = 1070.000(Ft.)
Lowest elevation =  734.000(Ft.)
Elevation difference =  336.000(Ft.)
TC=[(11.9*0.1761^3)/(336.00)]^.385=  2.23 + 10 min. =    12.23 min.
Rainfall intensity (I) =      3.136(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.450
Subarea runoff =      6.816(CFS)
Total initial stream area =       4.830(Ac.)
```



```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      305.000 to Point/Station      310.000
**** IMPROVED CHANNEL TRAVEL TIME ****
______________________________________________________________________
Upstream point elevation =   734.000(Ft.)
Downstream point elevation =   564.000(Ft.)
Channel length thru subarea  =  1316.000(Ft.)
Channel base width      =   15.000(Ft.)
Slope or 'Z' of left channel bank =   3.000
Slope or 'Z' of right channel bank =   3.000
Estimated mean flow rate at midpoint of channel =     22.383(CFS)
Manning's 'N'    = 0.030
Maximum depth of channel  =    2.000(Ft.)
Flow(q) thru subarea =     22.383(CFS)
Depth of flow =   0.224(Ft.), Average velocity =   6.370(Ft/s)
Channel flow top width =   16.345(Ft.)
Flow Velocity =     6.37(Ft/s)
Travel time  =     3.44 min.
Time of concentration =    15.67 min.
Critical depth =      0.398(Ft.)
 Adding area flow to channel
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[RURAL(greater than 0.5 Ac, 0.2 ha) area type]
Rainfall intensity =      2.856(In/Hr) for a   100.0 year storm
Runoff coefficient used for sub-area, Rational method,Q=KCIA, C = 0.450
Subarea runoff =      28.348(CFS) for    22.060(Ac.)
Total runoff =      35.164(CFS)  Total area =       26.89(Ac.)
End of computations, total study area =         26.890 (Ac.)




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               San Diego County Rational Hydrology Program

CIVILCADD/CIVILDESIGN Engineering Software,(c)1991-2003 Version 6.3

Rational method hydrology  program based on
San Diego County Flood Control Division 1985 hydrology manual
        Rational Hydrology Study        Date: 05/31/13
------------------------------------------------------------------------
3255.30 HERITAGE BLUFFS
EXISTING CONDITIONS
SYSTEM 700
FILE: S700E100
------------------------------------------------------------------------
 *********   Hydrology Study Control Information **********

------------------------------------------------------------------------


Program License Serial Number 4049

------------------------------------------------------------------------
Rational hydrology study storm event year is   100.0
English (in-lb) input data Units used
English (in) rainfall data used

Standard intensity of Appendix I-B used for year and
Elevation 0 - 1500 feet
Factor (to multiply * intensity)  =  1.000
Only used if inside City of San Diego
San Diego hydrology manual 'C' values used
Runoff coefficients by rational method


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      700.000 to Point/Station      705.000
**** INITIAL AREA EVALUATION ****

Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[RURAL(greater than 0.5 Ac, 0.2 ha) area type]
Time of concentration computed by the
natural watersheds nomograph (App X-A)
TC = [11.9*length(Mi)^3)/(elevation change(Ft.))]^.385 *60(min/hr) + 10 min.
Initial subarea flow distance  =  953.000(Ft.)
Highest elevation = 1210.000(Ft.)
Lowest elevation =  934.000(Ft.)
Elevation difference =  276.000(Ft.)
TC=[(11.9*0.1805^3)/(276.00)]^.385=  2.48 + 10 min. =    12.48 min.
Rainfall intensity (I) =      3.113(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.450
Subarea runoff =      11.923(CFS)
Total initial stream area =        8.510(Ac.)
```



```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      705.000 to Point/Station      720.000
**** IMPROVED CHANNEL TRAVEL TIME ****

Upstream point elevation =   934.000(Ft.)
Downstream point elevation =   550.000(Ft.)
Channel length thru subarea  =  3840.000(Ft.)
Channel base width        =   15.000(Ft.)
Slope or 'Z' of left channel bank =   3.000
Slope or 'Z' of right channel bank =   3.000
Estimated mean flow rate at midpoint of channel =     70.577(CFS)
Manning's 'N'    = 0.030
Maximum depth of channel  =    2.000(Ft.)
Flow(q) thru subarea =     70.577(CFS)
Depth of flow =   0.477(Ft.), Average velocity =   8.997(Ft/s)
Channel flow top width =   17.864(Ft.)
Flow Velocity =     9.00(Ft/s)
Travel time  =    7.11 min.
Time of concentration =   19.59 min.
Critical depth =      0.828(Ft.)
 Adding area flow to channel
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[RURAL(greater than 0.5 Ac, 0.2 ha) area type]
Rainfall intensity =      2.604(In/Hr) for a   100.0 year storm
Runoff coefficient used for sub-area, Rational method,Q=KCIA, C = 0.450
Subarea runoff =      98.121(CFS) for   83.730(Ac.)
Total runoff =    110.043(CFS)  Total area =       92.24(Ac.)
End of computations, total study area =         92.240 (Ac.)
```

APPENDIX 4

Proposed Conditions 100-year Rational Method Computer Output

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                 San Diego County Rational Hydrology Program

CIVILCADD/CIVILDESIGN Engineering Software,(c)1991-2003 Version 6.3

Rational method hydrology  program based on
San Diego County Flood Control Division 1985 hydrology manual
        Rational Hydrology Study        Date: 11/06/14
------------------------------------------------------------------------
3255.30 HERITAGE BLUFFS
PROPOSED CONDITIONS
SYSTEM 100
FILE: S100P100
------------------------------------------------------------------------
 *********   Hydrology Study Control Information **********

------------------------------------------------------------------------


Program License Serial Number 4049

------------------------------------------------------------------------
Rational hydrology study storm event year is   100.0
English (in-lb) input data Units used
English (in) rainfall data used

Standard intensity of Appendix I-B used for year and
Elevation 0 - 1500 feet
Factor (to multiply * intensity)  =  1.000
Only used if inside City of San Diego
San Diego hydrology manual 'C' values used
Runoff coefficients by rational method


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      100.000 to Point/Station      125.000
**** INITIAL AREA EVALUATION ****
______________________________________________________________________
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[RURAL(greater than 0.5 Ac, 0.2 ha) area type]
Time of concentration computed by the
natural watersheds nomograph (App X-A)
TC = [11.9*length(Mi)^3)/(elevation change(Ft.))]^.385 *60(min/hr) + 10 min.
Initial subarea flow distance  = 1461.000(Ft.)
Highest elevation = 1360.000(Ft.)
Lowest elevation =  940.000(Ft.)
Elevation difference =  420.000(Ft.)
TC=[(11.9*0.2767^3)/(420.00)]^.385=  3.45 + 10 min. =    13.45 min.
Rainfall intensity (I) =      3.028(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.450
Subarea runoff =     18.408(CFS)
Total initial stream area =       13.510(Ac.)
```



```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      125.000 to Point/Station      156.000
**** IMPROVED CHANNEL TRAVEL TIME ****
______________________________________________________________________
Upstream point elevation =   940.000(Ft.)
Downstream point elevation =   672.000(Ft.)
Channel length thru subarea  =  3082.000(Ft.)
Channel base width      =   30.000(Ft.)
Slope or 'Z' of left channel bank =   3.000
Slope or 'Z' of right channel bank =   3.000
Estimated mean flow rate at midpoint of channel =    110.875(CFS)
Manning's 'N'    = 0.030
Maximum depth of channel  =    3.000(Ft.)
Flow(q) thru subarea =    110.875(CFS)
Depth of flow =   0.435(Ft.), Average velocity =   8.139(Ft/s)
Channel flow top width =   32.611(Ft.)
Flow Velocity =    8.14(Ft/s)
Travel time  =    6.31 min.
Time of concentration =   19.76 min.
Critical depth =      0.734(Ft.)
 Adding area flow to channel
User specified 'C' value of 0.460 given for subarea
Rainfall intensity =       2.594(In/Hr) for a   100.0 year storm
Runoff coefficient used for sub-area, Rational method,Q=KCIA, C = 0.460
Subarea runoff =    161.968(CFS) for  135.730(Ac.)
Total runoff =    180.376(CFS)  Total area =      149.24(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      125.000 to Point/Station      156.000
**** CONFLUENCE OF MAIN STREAMS ****
______________________________________________________________________
The following data inside Main Stream is listed:
In Main Stream number: 1
Stream flow area =    149.240(Ac.)
Runoff from this stream =    180.376(CFS)
Time of concentration =   19.76 min.
Rainfall intensity =     2.594(In/Hr)
Program is now starting with Main Stream No. 2


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      103.000 to Point/Station      109.000
**** INITIAL AREA EVALUATION ****
______________________________________________________________________
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[RURAL(greater than 0.5 Ac, 0.2 ha) area type]
Time of concentration computed by the
natural watersheds nomograph (App X-A)
TC = [11.9*length(Mi)^3)/(elevation change(Ft.))]^.385 *60(min/hr) + 10 min.
Initial subarea flow distance  = 1021.000(Ft.)
Highest elevation = 1240.000(Ft.)
Lowest elevation =  956.000(Ft.)
Elevation difference =  284.000(Ft.)
```

```
TC=[(11.9*0.1934^3)/(284.00)]^.385=  2.65 + 10 min. =     12.65 min.
Rainfall intensity (I) =      3.097(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.450
Subarea runoff =     13.088(CFS)
Total initial stream area =        9.390(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      109.000 to Point/Station      164.000
**** IMPROVED CHANNEL TRAVEL TIME ****

Upstream point elevation =   956.000(Ft.)
Downstream point elevation =   708.000(Ft.)
Channel length thru subarea  =  1317.000(Ft.)
Channel base width      =  30.000(Ft.)
Slope or 'Z' of left channel bank =   3.000
Slope or 'Z' of right channel bank =   3.000
Estimated mean flow rate at midpoint of channel =     30.699(CFS)
Manning's 'N'    = 0.030
Maximum depth of channel  =    3.000(Ft.)
Flow(q) thru subarea =     30.699(CFS)
Depth of flow =   0.160(Ft.), Average velocity =   6.275(Ft/s)
Channel flow top width =    30.963(Ft.)
Flow Velocity =     6.28(Ft/s)
Travel time  =    3.50 min.
Time of concentration =   16.15 min.
Critical depth =      0.316(Ft.)
 Adding area flow to channel
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[RURAL(greater than 0.5 Ac, 0.2 ha) area type]
Rainfall intensity =      2.822(In/Hr) for a   100.0 year storm
Runoff coefficient used for sub-area, Rational method,Q=KCIA, C = 0.450
Subarea runoff =     32.092(CFS) for   25.270(Ac.)
Total runoff =     45.180(CFS)  Total area =       34.66(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      109.000 to Point/Station      164.000
**** CONFLUENCE OF MINOR STREAMS ****

Along Main Stream number: 2 in normal stream number 1
Stream flow area =     34.660(Ac.)
Runoff from this stream =     45.180(CFS)
Time of concentration =   16.15 min.
Rainfall intensity =     2.822(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      160.000 to Point/Station      161.000
**** INITIAL AREA EVALUATION ****

Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
```



```
Decimal fraction soil group D = 1.000
[RURAL(greater than 0.5 Ac, 0.2 ha) area type]
Time of concentration computed by the
natural watersheds nomograph (App X-A)
TC = [11.9*length(Mi)^3)/(elevation change(Ft.))]^.385 *60(min/hr) + 10 min.
Initial subarea flow distance  =  610.000(Ft.)
Highest elevation = 1056.000(Ft.)
Lowest elevation =  900.000(Ft.)
Elevation difference =  156.000(Ft.)
TC=[(11.9*0.1155^3)/(156.00)]^.385=  1.84 + 10 min. =     11.84 min.
Rainfall intensity (I) =      3.173(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.450
Subarea runoff =      0.871(CFS)
Total initial stream area =        0.610(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      161.000 to Point/Station      162.000
**** IMPROVED CHANNEL TRAVEL TIME ****

Upstream point elevation =   900.000(Ft.)
Downstream point elevation =   752.000(Ft.)
Channel length thru subarea  =   530.000(Ft.)
Channel base width      =  30.000(Ft.)
Slope or 'Z' of left channel bank =   3.000
Slope or 'Z' of right channel bank =   3.000
Estimated mean flow rate at midpoint of channel =      1.864(CFS)
Manning's 'N'    = 0.030
Maximum depth of channel  =    3.000(Ft.)
Flow(q) thru subarea =      1.864(CFS)
Depth of flow =   0.027(Ft.), Average velocity =   2.328(Ft/s)
Channel flow top width =   30.160(Ft.)
Flow Velocity =     2.33(Ft/s)
Travel time  =    3.79 min.
Time of concentration =   15.64 min.
Critical depth =      0.049(Ft.)
 Adding area flow to channel
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[RURAL(greater than 0.5 Ac, 0.2 ha) area type]
Rainfall intensity =      2.858(In/Hr) for a   100.0 year storm
Runoff coefficient used for sub-area, Rational method,Q=KCIA, C = 0.450
Subarea runoff =      1.788(CFS) for    1.390(Ac.)
Total runoff =      2.659(CFS)  Total area =        2.00(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      162.000 to Point/Station      163.000
**** IMPROVED CHANNEL TRAVEL TIME ****

Upstream point elevation =   752.000(Ft.)
Downstream point elevation =   738.000(Ft.)
Channel length thru subarea  =   383.000(Ft.)
Channel base width      =   0.500(Ft.)
Slope or 'Z' of left channel bank =   1.250
```

```
Slope or 'Z' of right channel bank =   1.250
Estimated mean flow rate at midpoint of channel =      6.648(CFS)
Manning's 'N'    = 0.015
Maximum depth of channel  =    1.000(Ft.)
Flow(q) thru subarea =     6.648(CFS)
Depth of flow =  0.606(Ft.), Average velocity =  8.720(Ft/s)
Channel flow top width =    2.015(Ft.)
Flow Velocity =    8.72(Ft/s)
Travel time  =    0.73 min.
Time of concentration =   16.37 min.
Critical depth =      0.938(Ft.)
 Adding area flow to channel
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[RURAL(greater than 0.5 Ac, 0.2 ha) area type]
Rainfall intensity =      2.807(In/Hr) for a   100.0 year storm
Runoff coefficient used for sub-area, Rational method,Q=KCIA, C = 0.450
Subarea runoff =      7.579(CFS) for    6.000(Ac.)
Total runoff =     10.238(CFS)  Total area =        8.00(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      163.000 to Point/Station      164.000
**** IMPROVED CHANNEL TRAVEL TIME ****
______________________________________________________________________
Upstream point elevation =   738.000(Ft.)
Downstream point elevation =   708.000(Ft.)
Channel length thru subarea  =   384.000(Ft.)
Channel base width      =    0.500(Ft.)
Slope or 'Z' of left channel bank =   1.250
Slope or 'Z' of right channel bank =   1.250
Manning's 'N'    = 0.015
Maximum depth of channel  =    1.000(Ft.)
Flow(q) thru subarea =     10.238(CFS)
Depth of flow =  0.621(Ft.), Average velocity =  12.916(Ft/s)
Channel flow top width =    2.053(Ft.)
Flow Velocity =   12.92(Ft/s)
Travel time  =    0.50 min.
Time of concentration =   16.86 min.
Critical depth =      1.125(Ft.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      163.000 to Point/Station      164.000
**** CONFLUENCE OF MINOR STREAMS ****
______________________________________________________________________
Along Main Stream number: 2 in normal stream number 2
Stream flow area =      8.000(Ac.)
Runoff from this stream =     10.238(CFS)
Time of concentration =   16.86 min.
Rainfall intensity =     2.774(In/Hr)
Summary of stream data:

Stream   Flow rate     TC            Rainfall Intensity
 No.       (CFS)      (min)                 (In/Hr)
```



```
1       45.180     16.15               2.822
2       10.238     16.86               2.774
Qmax(1) =
          1.000 *    1.000 *    45.180) +
          1.000 *    0.958 *    10.238) + =      54.985
Qmax(2) =
          0.983 *    1.000 *    45.180) +
          1.000 *    1.000 *    10.238) + =      54.641

Total of 2 streams to confluence:
Flow rates before confluence point:
     45.180      10.238
Maximum flow rates at confluence using above data:
      54.985      54.641
Area of streams before confluence:
      34.660       8.000
Results of confluence:
Total flow rate =      54.985(CFS)
Time of concentration =    16.149 min.
Effective stream area after confluence =     42.660(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      164.000 to Point/Station      165.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
______________________________________________________________________
Upstream point/station elevation =   708.000(Ft.)
Downstream point/station elevation =   700.000(Ft.)
Pipe length  =   183.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     54.985(CFS)
Nearest computed pipe diameter  =     27.00(In.)
Calculated individual pipe flow  =     54.985(CFS)
Normal flow depth in pipe =    19.10(In.)
Flow top width inside pipe =   24.57(In.)
Critical depth could not be calculated.
Pipe flow velocity =      18.28(Ft/s)
Travel time through pipe =    0.17 min.
Time of concentration (TC) =    16.32 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      165.000 to Point/Station      156.000
**** IMPROVED CHANNEL TRAVEL TIME ****
______________________________________________________________________
Upstream point elevation =   700.000(Ft.)
Downstream point elevation =   672.000(Ft.)
Channel length thru subarea  =   413.000(Ft.)
Channel base width      =   30.000(Ft.)
Slope or 'Z' of left channel bank =   3.000
Slope or 'Z' of right channel bank =   3.000
Estimated mean flow rate at midpoint of channel =      56.074(CFS)
Manning's 'N'    = 0.030
Maximum depth of channel  =    3.000(Ft.)
Flow(q) thru subarea =     56.074(CFS)
Depth of flow =  0.312(Ft.), Average velocity =  5.806(Ft/s)
```

```
Channel flow top width =   31.873(Ft.)
Flow Velocity =    5.81(Ft/s)
Travel time  =    1.19 min.
Time of concentration =   17.50 min.
Critical depth =      0.469(Ft.)
 Adding area flow to channel
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[RURAL(greater than 0.5 Ac, 0.2 ha) area type]
Rainfall intensity =      2.732(In/Hr) for a   100.0 year storm
Runoff coefficient used for sub-area, Rational method,Q=KCIA, C = 0.450
Subarea runoff =      2.078(CFS) for    1.690(Ac.)
Total runoff =     57.063(CFS)  Total area =       44.35(Ac.)


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Process from Point/Station      165.000 to Point/Station      156.000
**** CONFLUENCE OF MAIN STREAMS ****

The following data inside Main Stream is listed:
In Main Stream number: 2
Stream flow area =      44.350(Ac.)
Runoff from this stream =      57.063(CFS)
Time of concentration =   17.50 min.
Rainfall intensity =     2.732(In/Hr)
Summary of stream data:

Stream   Flow rate     TC            Rainfall Intensity
 No.       (CFS)      (min)                 (In/Hr)


1      180.376     19.76                2.594
2       57.063     17.50                2.732
Qmax(1) =
           1.000 *    1.000 *   180.376) +
           0.950 *    1.000 *    57.063) + =     234.564
Qmax(2) =
           1.000 *    0.886 *   180.376) +
           1.000 *    1.000 *    57.063) + =     216.816

Total of 2 main streams to confluence:
Flow rates before confluence point:
     180.376      57.063
Maximum flow rates at confluence using above data:
      234.564      216.816
Area of streams before confluence:
      149.240       44.350


Results of confluence:
Total flow rate =     234.564(CFS)
Time of concentration =    19.761 min.
Effective stream area after confluence  =    193.590(Ac.)
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Process from Point/Station      156.000 to Point/Station      135.000
**** IMPROVED CHANNEL TRAVEL TIME ****

Upstream point elevation =   672.000(Ft.)
Downstream point elevation =   634.000(Ft.)
Channel length thru subarea  =   499.000(Ft.)
Channel base width      =   30.000(Ft.)
Slope or 'Z' of left channel bank =   3.000
Slope or 'Z' of right channel bank =   3.000
Estimated mean flow rate at midpoint of channel =    236.169(CFS)
Manning's 'N'    = 0.030
Maximum depth of channel   =    3.000(Ft.)
Flow(q) thru subarea =    236.169(CFS)
Depth of flow =   0.709(Ft.), Average velocity =  10.368(Ft/s)
Channel flow top width =   34.254(Ft.)
Flow Velocity =   10.37(Ft/s)
Travel time  =    0.80 min.
Time of concentration =   20.56 min.
Critical depth =      1.188(Ft.)
 Adding area flow to channel
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[RURAL(greater than 0.5 Ac, 0.2 ha) area type]
Rainfall intensity =      2.549(In/Hr) for a   100.0 year storm
Runoff coefficient used for sub-area, Rational method,Q=KCIA, C = 0.450
Subarea runoff =      3.039(CFS) for    2.650(Ac.)
Total runoff =    237.603(CFS)  Total area =      196.24(Ac.)


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Process from Point/Station      156.000 to Point/Station      135.000
**** CONFLUENCE OF MINOR STREAMS ****

Along Main Stream number: 1 in normal stream number 1
Stream flow area =     196.240(Ac.)
Runoff from this stream =    237.603(CFS)
Time of concentration =   20.56 min.
Rainfall intensity =     2.549(In/Hr)


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Process from Point/Station      105.000 to Point/Station      115.000
**** INITIAL AREA EVALUATION ****

Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[RURAL(greater than 0.5 Ac, 0.2 ha) area type]
Time of concentration computed by the
natural watersheds nomograph (App X-A)
TC = [11.9*length(Mi)^3)/(elevation change(Ft.))]^.385 *60(min/hr) + 10 min.
Initial subarea flow distance  = 1061.000(Ft.)
Highest elevation = 1540.000(Ft.)
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Lowest elevation = 1170.000(Ft.)
Elevation difference =  370.000(Ft.)
TC=[(11.9*0.2009^3)/(370.00)]^.385=  2.50 + 10 min. =    12.50 min.
Rainfall intensity (I) =      3.111(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.450
Subarea runoff =     15.525(CFS)
Total initial stream area =       11.090(Ac.)


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Process from Point/Station      115.000 to Point/Station      135.000
**** IMPROVED CHANNEL TRAVEL TIME ****
______________________________________________________________________
Upstream point elevation =  1170.000(Ft.)
Downstream point elevation =   634.000(Ft.)
Channel length thru subarea  =  3480.000(Ft.)
Channel base width      =   30.000(Ft.)
Slope or 'Z' of left channel bank =   3.000
Slope or 'Z' of right channel bank =   3.000
Estimated mean flow rate at midpoint of channel =     57.445(CFS)
Manning's 'N'    = 0.030
Maximum depth of channel  =    3.000(Ft.)
Flow(q) thru subarea =     57.445(CFS)
Depth of flow =   0.248(Ft.), Average velocity =   7.537(Ft/s)
Channel flow top width =   31.487(Ft.)
Flow Velocity =    7.54(Ft/s)
Travel time  =    7.70 min.
Time of concentration =   20.20 min.
Critical depth =      0.477(Ft.)
 Adding area flow to channel
User specified 'C' value of 0.460 given for subarea
Rainfall intensity =      2.569(In/Hr) for a   100.0 year storm
Runoff coefficient used for sub-area, Rational method,Q=KCIA, C = 0.460
Subarea runoff =     70.777(CFS) for   59.890(Ac.)
Total runoff =     86.302(CFS)  Total area =       70.98(Ac.)


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Process from Point/Station      115.000 to Point/Station      135.000
**** CONFLUENCE OF MINOR STREAMS ****
______________________________________________________________________
Along Main Stream number: 1 in normal stream number 2
Stream flow area =     70.980(Ac.)
Runoff from this stream =     86.302(CFS)
Time of concentration =   20.20 min.
Rainfall intensity =     2.569(In/Hr)
Summary of stream data:

Stream   Flow rate      TC            Rainfall Intensity
 No.       (CFS)       (min)                 (In/Hr)


1      237.603     20.56               2.549
2       86.302     20.20               2.569
Qmax(1) =
           1.000 *    1.000 *   237.603) +
           0.992 *    1.000 *    86.302) + =     323.215
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Qmax(2) =
           1.000 *    0.982 *   237.603) +
           1.000 *    1.000 *    86.302) + =     319.690

Total of 2 streams to confluence:
Flow rates before confluence point:
     237.603      86.302
Maximum flow rates at confluence using above data:
      323.215      319.690
Area of streams before confluence:
      196.240      70.980
Results of confluence:
Total flow rate =    323.215(CFS)
Time of concentration =    20.563 min.
Effective stream area after confluence =    267.220(Ac.)


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Process from Point/Station      135.000 to Point/Station      140.000
**** IMPROVED CHANNEL TRAVEL TIME ****
______________________________________________________________________
Upstream point elevation =   634.000(Ft.)
Downstream point elevation =   586.000(Ft.)
Channel length thru subarea  =   998.000(Ft.)
Channel base width      =   30.000(Ft.)
Slope or 'Z' of left channel bank =   3.000
Slope or 'Z' of right channel bank =   3.000
Estimated mean flow rate at midpoint of channel =    332.377(CFS)
Manning's 'N'    = 0.030
Maximum depth of channel  =    3.000(Ft.)
Flow(q) thru subarea =    332.377(CFS)
Depth of flow =   0.993(Ft.), Average velocity =  10.147(Ft/s)
Channel flow top width =   35.959(Ft.)
Flow Velocity =   10.15(Ft/s)
Travel time  =    1.64 min.
Time of concentration =   22.20 min.
Critical depth =      1.484(Ft.)
 Adding area flow to channel
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[RURAL(greater than 0.5 Ac, 0.2 ha) area type]
Rainfall intensity =      2.460(In/Hr) for a   100.0 year storm
Runoff coefficient used for sub-area, Rational method,Q=KCIA, C = 0.450
Subarea runoff =     16.770(CFS) for   15.150(Ac.)
Total runoff =    339.984(CFS)  Total area =      282.37(Ac.)


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Process from Point/Station      135.000 to Point/Station      140.000
**** CONFLUENCE OF MINOR STREAMS ****
______________________________________________________________________
Along Main Stream number: 1 in normal stream number 1
Stream flow area =    282.370(Ac.)
Runoff from this stream =    339.984(CFS)
Time of concentration =   22.20 min.
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Rainfall intensity =     2.460(In/Hr)


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Process from Point/Station      110.000 to Point/Station      120.000
**** INITIAL AREA EVALUATION ****
______________________________________________________________________
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[RURAL(greater than 0.5 Ac, 0.2 ha) area type]
Time of concentration computed by the
natural watersheds nomograph (App X-A)
TC = [11.9*length(Mi)^3)/(elevation change(Ft.))]^.385 *60(min/hr) + 10 min.
Initial subarea flow distance  =  994.000(Ft.)
Highest elevation = 1550.000(Ft.)
Lowest elevation = 1200.000(Ft.)
Elevation difference =  350.000(Ft.)
TC=[(11.9*0.1883^3)/(350.00)]^.385=  2.37 + 10 min. =     12.37 min.
Rainfall intensity (I) =      3.123(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.450
Subarea runoff =      15.346(CFS)
Total initial stream area =       10.920(Ac.)


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Process from Point/Station      120.000 to Point/Station      140.000
**** IMPROVED CHANNEL TRAVEL TIME ****
______________________________________________________________________
Upstream point elevation =  1200.000(Ft.)
Downstream point elevation =   586.000(Ft.)
Channel length thru subarea  =  3819.000(Ft.)
Channel base width      =   30.000(Ft.)
Slope or 'Z' of left channel bank =   3.000
Slope or 'Z' of right channel bank =   3.000
Estimated mean flow rate at midpoint of channel =     90.954(CFS)
Manning's 'N'    = 0.030
Maximum depth of channel  =     3.000(Ft.)
Flow(q) thru subarea =     90.954(CFS)
Depth of flow =   0.322(Ft.), Average velocity =   9.122(Ft/s)
Channel flow top width =   31.932(Ft.)
Flow Velocity =     9.12(Ft/s)
Travel time  =     6.98 min.
Time of concentration =   19.35 min.
Critical depth =      0.641(Ft.)
 Adding area flow to channel
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[RURAL(greater than 0.5 Ac, 0.2 ha) area type]
Rainfall intensity =      2.618(In/Hr) for a   100.0 year storm
Runoff coefficient used for sub-area, Rational method,Q=KCIA, C = 0.450
Subarea runoff =     126.771(CFS) for  107.600(Ac.)
Total runoff =    142.118(CFS)  Total area =      118.52(Ac.)
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Process from Point/Station      120.000 to Point/Station      140.000
**** CONFLUENCE OF MINOR STREAMS ****
______________________________________________________________________
Along Main Stream number: 1 in normal stream number 2
Stream flow area =    118.520(Ac.)
Runoff from this stream =    142.118(CFS)
Time of concentration =   19.35 min.
Rainfall intensity =      2.618(In/Hr)
Summary of stream data:

Stream   Flow rate      TC            Rainfall Intensity
 No.       (CFS)      (min)                  (In/Hr)


1      339.984     22.20                  2.460
2      142.118     19.35                  2.618
Qmax(1) =
           1.000 *    1.000 *   339.984) +
           0.940 *    1.000 *   142.118) + =      473.507
Qmax(2) =
           1.000 *    0.872 *   339.984) +
           1.000 *    1.000 *   142.118) + =      438.419

Total of 2 streams to confluence:
Flow rates before confluence point:
     339.984     142.118
Maximum flow rates at confluence using above data:
      473.507      438.419
Area of streams before confluence:
      282.370      118.520
Results of confluence:
Total flow rate =    473.507(CFS)
Time of concentration =    22.203 min.
Effective stream area after confluence =    400.890(Ac.)


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Process from Point/Station      140.000 to Point/Station      145.000
**** IMPROVED CHANNEL TRAVEL TIME ****
______________________________________________________________________
Upstream point elevation =   586.000(Ft.)
Downstream point elevation =   574.000(Ft.)
Channel length thru subarea  =   236.000(Ft.)
Channel base width      =   30.000(Ft.)
Slope or 'Z' of left channel bank =   3.000
Slope or 'Z' of right channel bank =   3.000
Estimated mean flow rate at midpoint of channel =    474.222(CFS)
Manning's 'N'    = 0.030
Maximum depth of channel  =    3.000(Ft.)
Flow(q) thru subarea =    474.222(CFS)
Depth of flow =   1.203(Ft.), Average velocity =  11.724(Ft/s)
Channel flow top width =   37.221(Ft.)
Flow Velocity =    11.72(Ft/s)
Travel time  =    0.34 min.
Time of concentration =   22.54 min.
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Critical depth =      1.844(Ft.)
 Adding area flow to channel
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[RURAL(greater than 0.5 Ac, 0.2 ha) area type]
Rainfall intensity =      2.442(In/Hr) for a   100.0 year storm
Runoff coefficient used for sub-area, Rational method,Q=KCIA, C = 0.450
Subarea runoff =      1.330(CFS) for    1.210(Ac.)
Total runoff =    474.837(CFS)  Total area =      402.10(Ac.)


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Process from Point/Station      140.000 to Point/Station      145.000
**** CONFLUENCE OF MINOR STREAMS ****

Along Main Stream number: 1 in normal stream number 1
Stream flow area =     402.100(Ac.)
Runoff from this stream =    474.837(CFS)
Time of concentration =   22.54 min.
Rainfall intensity =     2.442(In/Hr)


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Process from Point/Station      130.000 to Point/Station      131.000
**** INITIAL AREA EVALUATION ****

Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[RURAL(greater than 0.5 Ac, 0.2 ha) area type]
Time of concentration computed by the
natural watersheds nomograph (App X-A)
TC = [11.9*length(Mi)^3)/(elevation change(Ft.))]^.385 *60(min/hr) + 10 min.
Initial subarea flow distance  =  750.000(Ft.)
Highest elevation = 1140.000(Ft.)
Lowest elevation = 1000.000(Ft.)
Elevation difference =  140.000(Ft.)
TC=[(11.9*0.1420^3)/(140.00)]^.385=  2.44 + 10 min. =    12.44 min.
Rainfall intensity (I) =      3.117(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.450
Subarea runoff =       6.256(CFS)
Total initial stream area =       4.460(Ac.)


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Process from Point/Station      131.000 to Point/Station      145.000
**** IMPROVED CHANNEL TRAVEL TIME ****

Upstream point elevation =  1000.000(Ft.)
Downstream point elevation =   574.000(Ft.)
Channel length thru subarea  =  2371.000(Ft.)
Channel base width         =   30.000(Ft.)
Slope or 'Z' of left channel bank =   3.000
Slope or 'Z' of right channel bank =   3.000
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Estimated mean flow rate at midpoint of channel =      22.617(CFS)
Manning's 'N'    = 0.030
Maximum depth of channel  =     3.000(Ft.)
Flow(q) thru subarea =      22.617(CFS)
Depth of flow =   0.136(Ft.), Average velocity =   5.487(Ft/s)
Channel flow top width =   30.813(Ft.)
Flow Velocity =      5.49(Ft/s)
Travel time  =     7.20 min.
Time of concentration =   19.64 min.
Critical depth =      0.258(Ft.)
 Adding area flow to channel
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[RURAL(greater than 0.5 Ac, 0.2 ha) area type]
Rainfall intensity =       2.601(In/Hr) for a   100.0 year storm
Runoff coefficient used for sub-area, Rational method,Q=KCIA, C = 0.450
Subarea runoff =     27.308(CFS) for   23.330(Ac.)
Total runoff =     33.564(CFS)  Total area =       27.79(Ac.)


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Process from Point/Station      131.000 to Point/Station      145.000
**** CONFLUENCE OF MINOR STREAMS ****

Along Main Stream number: 1 in normal stream number 2
Stream flow area =      27.790(Ac.)
Runoff from this stream =      33.564(CFS)
Time of concentration =   19.64 min.
Rainfall intensity =     2.601(In/Hr)
Summary of stream data:

Stream   Flow rate      TC             Rainfall Intensity
 No.       (CFS)      (min)                   (In/Hr)


1      474.837     22.54                    2.442
2       33.564     19.64                    2.601
Qmax(1) =
          1.000 *    1.000 *   474.837) +
          0.939 *    1.000 *    33.564) + =      506.351
Qmax(2) =
          1.000 *    0.871 *   474.837) +
          1.000 *    1.000 *    33.564) + =      447.349

Total of 2 streams to confluence:
Flow rates before confluence point:
     474.837      33.564
Maximum flow rates at confluence using above data:
      506.351      447.349
Area of streams before confluence:
      402.100       27.790
Results of confluence:
Total flow rate =     506.351(CFS)
Time of concentration =    22.538 min.
Effective stream area after confluence =    429.890(Ac.)
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Process from Point/Station      145.000 to Point/Station      190.000
**** IMPROVED CHANNEL TRAVEL TIME ****
______________________________________________________________________
Upstream point elevation =   574.000(Ft.)
Downstream point elevation =   540.000(Ft.)
Channel length thru subarea  =   772.000(Ft.)
Channel base width       =  30.000(Ft.)
Slope or 'Z' of left channel bank =   3.000
Slope or 'Z' of right channel bank =   3.000
Estimated mean flow rate at midpoint of channel =     513.848(CFS)
Manning's 'N'    = 0.030
Maximum depth of channel  =    3.000(Ft.)
Flow(q) thru subarea =     513.848(CFS)
Depth of flow =   1.315(Ft.), Average velocity =  11.510(Ft/s)
Channel flow top width =   37.891(Ft.)
Flow Velocity =   11.51(Ft/s)
Travel time  =    1.12 min.
Time of concentration =   23.66 min.
Critical depth =      1.953(Ft.)
 Adding area flow to channel
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[RURAL(greater than 0.5 Ac, 0.2 ha) area type]
Rainfall intensity =      2.386(In/Hr) for a   100.0 year storm
Runoff coefficient used for sub-area, Rational method,Q=KCIA, C = 0.450
Subarea runoff =     13.666(CFS) for   12.730(Ac.)
Total runoff =     520.017(CFS)  Total area =       442.62(Ac.)


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Process from Point/Station      190.000 to Point/Station      190.000
**** CONFLUENCE OF MAIN STREAMS ****
______________________________________________________________________
The following data inside Main Stream is listed:
In Main Stream number: 1
Stream flow area =    442.620(Ac.)
Runoff from this stream =     520.017(CFS)
Time of concentration =   23.66 min.
Rainfall intensity =     2.386(In/Hr)
Program is now starting with Main Stream No. 2


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Process from Point/Station      180.000 to Point/Station      181.000
**** INITIAL AREA EVALUATION ****
______________________________________________________________________
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[RURAL(greater than 0.5 Ac, 0.2 ha) area type]
Time of concentration computed by the
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natural watersheds nomograph (App X-A)
TC = [11.9*length(Mi)^3)/(elevation change(Ft.))]^.385 *60(min/hr)
Initial subarea flow distance  =   553.000(Ft.)
Highest elevation =  692.000(Ft.)
Lowest elevation =  654.000(Ft.)
Elevation difference =   38.000(Ft.)
TC=[(11.9*0.1047^3)/( 38.00)]^.385=  2.83
Rainfall intensity (I) =      5.641(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.450
Subarea runoff =     10.535(CFS)
Total initial stream area =        4.150(Ac.)


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Process from Point/Station      181.000 to Point/Station      182.000
**** IMPROVED CHANNEL TRAVEL TIME ****
______________________________________________________________________
Upstream point elevation =   654.000(Ft.)
Downstream point elevation =   602.000(Ft.)
Channel length thru subarea  =   400.000(Ft.)
Channel base width       =  30.000(Ft.)
Slope or 'Z' of left channel bank =   3.000
Slope or 'Z' of right channel bank =   3.000
Estimated mean flow rate at midpoint of channel =      17.275(CFS)
Manning's 'N'    = 0.030
Maximum depth of channel  =    2.000(Ft.)
Flow(q) thru subarea =     17.275(CFS)
Depth of flow =   0.127(Ft.), Average velocity =   4.473(Ft/s)
Channel flow top width =   30.763(Ft.)
Flow Velocity =    4.47(Ft/s)
Travel time  =    1.49 min.
Time of concentration =    4.32 min.
Critical depth =      0.215(Ft.)
 Adding area flow to channel
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[RURAL(greater than 0.5 Ac, 0.2 ha) area type]
Rainfall intensity =      4.664(In/Hr) for a   100.0 year storm
Runoff coefficient used for sub-area, Rational method,Q=KCIA, C = 0.450
Subarea runoff =     11.144(CFS) for    5.310(Ac.)
Total runoff =     21.679(CFS)  Total area =        9.46(Ac.)


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Process from Point/Station      186.000 to Point/Station      182.000
**** SUBAREA FLOW ADDITION ****
______________________________________________________________________
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[RURAL(greater than 0.5 Ac, 0.2 ha) area type]
Time of concentration =    4.32 min.
Rainfall intensity =      4.664(In/Hr) for a   100.0 year storm
Runoff coefficient used for sub-area, Rational method,Q=KCIA, C = 0.450
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Subarea runoff =      2.917(CFS) for    1.390(Ac.)
Total runoff =     24.596(CFS)  Total area =       10.85(Ac.)


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Process from Point/Station      182.000 to Point/Station      183.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****

Upstream point/station elevation =   602.000(Ft.)
Downstream point/station elevation =   584.000(Ft.)
Pipe length  =    35.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    24.596(CFS)
Nearest computed pipe diameter  =     12.00(In.)
Calculated individual pipe flow  =     24.596(CFS)
Normal flow depth in pipe =    9.46(In.)
Flow top width inside pipe =    9.81(In.)
Critical depth could not be calculated.
Pipe flow velocity =     37.05(Ft/s)
Travel time through pipe =     0.02 min.
Time of concentration (TC) =     4.34 min.


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Process from Point/Station      183.000 to Point/Station      190.000
**** IMPROVED CHANNEL TRAVEL TIME ****

Upstream point elevation =   584.000(Ft.)
Downstream point elevation =   540.000(Ft.)
Channel length thru subarea  =   558.000(Ft.)
Channel base width      =  30.000(Ft.)
Slope or 'Z' of left channel bank =   3.000
Slope or 'Z' of right channel bank =   3.000
Estimated mean flow rate at midpoint of channel =     29.277(CFS)
Manning's 'N'    = 0.030
Maximum depth of channel  =    2.000(Ft.)
Flow(q) thru subarea =     29.277(CFS)
Depth of flow =   0.202(Ft.), Average velocity =   4.726(Ft/s)
Channel flow top width =   31.214(Ft.)
Flow Velocity =    4.73(Ft/s)
Travel time  =    1.97 min.
Time of concentration =    6.31 min.
Critical depth =      0.305(Ft.)
 Adding area flow to channel
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[RURAL(greater than 0.5 Ac, 0.2 ha) area type]
Rainfall intensity =      4.002(In/Hr) for a   100.0 year storm
Runoff coefficient used for sub-area, Rational method,Q=KCIA, C = 0.450
Subarea runoff =      7.439(CFS) for    4.130(Ac.)
Total runoff =     32.035(CFS)  Total area =       14.98(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      190.000 to Point/Station      190.000
**** CONFLUENCE OF MAIN STREAMS ****
```



```
The following data inside Main Stream is listed:
In Main Stream number: 2
Stream flow area =     14.980(Ac.)
Runoff from this stream =     32.035(CFS)
Time of concentration =     6.31 min.
Rainfall intensity =      4.002(In/Hr)
Summary of stream data:

Stream   Flow rate      TC            Rainfall Intensity
 No.       (CFS)       (min)                 (In/Hr)


1      520.017     23.66                 2.386
2       32.035      6.31                 4.002
Qmax(1) =
          1.000 *    1.000 *   520.017) +
          0.596 *    1.000 *    32.035) + =     539.110
Qmax(2) =
          1.000 *    0.267 *   520.017) +
          1.000 *    1.000 *    32.035) + =     170.673

Total of 2 main streams to confluence:
Flow rates before confluence point:
     520.017     32.035
Maximum flow rates at confluence using above data:
      539.110     170.673
Area of streams before confluence:
      442.620      14.980


Results of confluence:
Total flow rate =    539.110(CFS)
Time of concentration =     23.656 min.
Effective stream area after confluence  =    457.600(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      190.000 to Point/Station      155.000
**** IMPROVED CHANNEL TRAVEL TIME ****

Upstream point elevation =   540.000(Ft.)
Downstream point elevation =    500.000(Ft.)
Channel length thru subarea  =  1192.000(Ft.)
Channel base width      =  30.000(Ft.)
Slope or 'Z' of left channel bank =   3.000
Slope or 'Z' of right channel bank =   3.000
Estimated mean flow rate at midpoint of channel =     544.983(CFS)
Manning's 'N'    = 0.030
Maximum depth of channel  =    2.000(Ft.)
Flow(q) thru subarea =    544.983(CFS)
Depth of flow =   1.473(Ft.), Average velocity =  10.750(Ft/s)
Channel flow top width =   38.838(Ft.)
Flow Velocity =   10.75(Ft/s)
Travel time  =    1.85 min.
Time of concentration =   25.50 min.
Critical depth =      2.031(Ft.)
```

```
 Adding area flow to channel
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[RURAL(greater than 0.5 Ac, 0.2 ha) area type]
Rainfall intensity =      2.296(In/Hr) for a   100.0 year storm
Runoff coefficient used for sub-area, Rational method,Q=KCIA, C = 0.450
Subarea runoff =     10.302(CFS) for    9.970(Ac.)
Total runoff =    549.413(CFS)  Total area =      467.57(Ac.)
End of computations, total study area =        467.570 (Ac.)
```

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                San Diego County Rational Hydrology Program

CIVILCADD/CIVILDESIGN Engineering Software,(c)1991-2003 Version 6.3

Rational method hydrology  program based on
San Diego County Flood Control Division 1985 hydrology manual
        Rational Hydrology Study        Date: 11/03/14
------------------------------------------------------------------------
3255.30 HERITAGE BLUFFS
PROPOSED CONDITIONS
SYSTEM 200
FILE: S200P100
------------------------------------------------------------------------
 *********   Hydrology Study Control Information **********

------------------------------------------------------------------------



Program License Serial Number 4049

------------------------------------------------------------------------
Rational hydrology study storm event year is   100.0
English (in-lb) input data Units used
English (in) rainfall data used

Standard intensity of Appendix I-B used for year and
Elevation 0 - 1500 feet
Factor (to multiply * intensity)  =  1.000
Only used if inside City of San Diego
San Diego hydrology manual 'C' values used
Runoff coefficients by rational method


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      200.000 to Point/Station      201.000
**** INITIAL AREA EVALUATION ****
______________________________________________________________________
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[RURAL(greater than 0.5 Ac, 0.2 ha) area type]
Time of concentration computed by the
natural watersheds nomograph (App X-A)
TC = [11.9*length(Mi)^3)/(elevation change(Ft.))]^.385 *60(min/hr) + 10 min.
Initial subarea flow distance  =  604.000(Ft.)
Highest elevation = 1070.000(Ft.)
Lowest elevation =  848.000(Ft.)
Elevation difference =  222.000(Ft.)
TC=[(11.9*0.1144^3)/(222.00)]^.385=  1.59 + 10 min. =     11.59 min.
Rainfall intensity (I) =      3.198(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.450
Subarea runoff =      2.548(CFS)
Total initial stream area =       1.770(Ac.)
```



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++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      201.000 to Point/Station      202.000
**** IMPROVED CHANNEL TRAVEL TIME ****
______________________________________________________________________
Upstream point elevation =   848.000(Ft.)
Downstream point elevation =   806.000(Ft.)
Channel length thru subarea  =   321.000(Ft.)
Channel base width      =   15.000(Ft.)
Slope or 'Z' of left channel bank =   3.000
Slope or 'Z' of right channel bank =   3.000
Estimated mean flow rate at midpoint of channel =      3.814(CFS)
Manning's 'N'    = 0.030
Maximum depth of channel  =    2.000(Ft.)
Flow(q) thru subarea =      3.814(CFS)
Depth of flow =   0.078(Ft.), Average velocity =   3.225(Ft/s)
Channel flow top width =   15.466(Ft.)
Flow Velocity =    3.22(Ft/s)
Travel time  =    1.66 min.
Time of concentration =   13.25 min.
Critical depth =      0.125(Ft.)
 Adding area flow to channel
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[RURAL(greater than 0.5 Ac, 0.2 ha) area type]
Rainfall intensity =      3.045(In/Hr) for a   100.0 year storm
Runoff coefficient used for sub-area, Rational method,Q=KCIA, C = 0.450
Subarea runoff =      2.412(CFS) for    1.760(Ac.)
Total runoff =      4.959(CFS)  Total area =       3.53(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      202.000 to Point/Station      204.000
**** IMPROVED CHANNEL TRAVEL TIME ****
______________________________________________________________________
Upstream point elevation =   806.000(Ft.)
Downstream point elevation =   724.000(Ft.)
Channel length thru subarea  =   500.000(Ft.)
Channel base width      =    0.500(Ft.)
Slope or 'Z' of left channel bank =   1.250
Slope or 'Z' of right channel bank =   1.250
Manning's 'N'    = 0.015
Maximum depth of channel  =    1.000(Ft.)
Flow(q) thru subarea =      4.959(CFS)
Depth of flow =   0.366(Ft.), Average velocity =  14.156(Ft/s)
Channel flow top width =    1.415(Ft.)
Flow Velocity =   14.16(Ft/s)
Travel time  =    0.59 min.
Time of concentration =   13.84 min.
Critical depth =      0.820(Ft.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      204.000 to Point/Station      206.000
**** IMPROVED CHANNEL TRAVEL TIME ****
______________________________________________________________________
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Upstream point elevation =   724.000(Ft.)
Downstream point elevation =   662.000(Ft.)
Channel length thru subarea  =   456.000(Ft.)
Channel base width      =   0.500(Ft.)
Slope or 'Z' of left channel bank =   1.250
Slope or 'Z' of right channel bank =   1.250
Manning's 'N'    = 0.015
Maximum depth of channel  =    1.000(Ft.)
Flow(q) thru subarea =      4.959(CFS)
Depth of flow =   0.383(Ft.), Average velocity =  13.206(Ft/s)
Channel flow top width =    1.459(Ft.)
Flow Velocity =   13.21(Ft/s)
Travel time  =   0.58 min.
Time of concentration =   14.41 min.
Critical depth =      0.820(Ft.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      206.000 to Point/Station      208.000
**** IMPROVED CHANNEL TRAVEL TIME ****
______________________________________________________________________
Upstream point elevation =   662.000(Ft.)
Downstream point elevation =   626.000(Ft.)
Channel length thru subarea  =   407.000(Ft.)
Channel base width      =  15.000(Ft.)
Slope or 'Z' of left channel bank =   3.000
Slope or 'Z' of right channel bank =   3.000
Estimated mean flow rate at midpoint of channel =      8.099(CFS)
Manning's 'N'    = 0.030
Maximum depth of channel  =    2.000(Ft.)
Flow(q) thru subarea =      8.099(CFS)
Depth of flow =   0.137(Ft.), Average velocity =   3.838(Ft/s)
Channel flow top width =   15.822(Ft.)
Flow Velocity =    3.84(Ft/s)
Travel time  =    1.77 min.
Time of concentration =   16.18 min.
Critical depth =      0.205(Ft.)
 Adding area flow to channel
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[RURAL(greater than 0.5 Ac, 0.2 ha) area type]
Rainfall intensity =      2.820(In/Hr) for a   100.0 year storm
Runoff coefficient used for sub-area, Rational method,Q=KCIA, C = 0.450
Subarea runoff =      5.672(CFS) for    4.470(Ac.)
Total runoff =     10.632(CFS)  Total area =       8.00(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      208.000 to Point/Station      210.000
**** IMPROVED CHANNEL TRAVEL TIME ****
______________________________________________________________________
Upstream point elevation =   626.000(Ft.)
Downstream point elevation =   584.000(Ft.)
Channel length thru subarea  =   842.000(Ft.)
Channel base width      =  15.000(Ft.)
```



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Slope or 'Z' of left channel bank =   3.000
Slope or 'Z' of right channel bank =   3.000
Estimated mean flow rate at midpoint of channel =      19.688(CFS)
Manning's 'N'    = 0.030
Maximum depth of channel  =    2.000(Ft.)
Flow(q) thru subarea =      19.688(CFS)
Depth of flow =   0.276(Ft.), Average velocity =   4.513(Ft/s)
Channel flow top width =   16.654(Ft.)
Flow Velocity =    4.51(Ft/s)
Travel time  =    3.11 min.
Time of concentration =   19.29 min.
Critical depth =      0.367(Ft.)
 Adding area flow to channel
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[RURAL(greater than 0.5 Ac, 0.2 ha) area type]
Rainfall intensity =      2.622(In/Hr) for a   100.0 year storm
Runoff coefficient used for sub-area, Rational method,Q=KCIA, C = 0.450
Subarea runoff =     16.080(CFS) for   13.630(Ac.)
Total runoff =     26.712(CFS)  Total area =       21.63(Ac.)
End of computations, total study area =          21.630 (Ac.)
```

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                San Diego County Rational Hydrology Program

CIVILCADD/CIVILDESIGN Engineering Software,(c)1991-2003 Version 6.3

Rational method hydrology  program based on
San Diego County Flood Control Division 1985 hydrology manual
        Rational Hydrology Study        Date: 11/03/14
------------------------------------------------------------------------
3255.30 HERITAGE  BLUFFS
PROPOSED CONDITIONS
SYSTEM 300
FILE: S300P100
------------------------------------------------------------------------
 *********   Hydrology Study Control Information **********

------------------------------------------------------------------------


Program License Serial Number 4049

------------------------------------------------------------------------
Rational hydrology study storm event year is   100.0
English (in-lb) input data Units used
English (in) rainfall data used

Standard intensity of Appendix I-B used for year and
Elevation 0 - 1500 feet
Factor (to multiply * intensity)  =  1.000
Only used if inside City of San Diego
San Diego hydrology manual 'C' values used
Runoff coefficients by rational method


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      300.000 to Point/Station      305.000
**** INITIAL AREA EVALUATION ****

Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[RURAL(greater than 0.5 Ac, 0.2 ha) area type]
Time of concentration computed by the
natural watersheds nomograph (App X-A)
TC = [11.9*length(Mi)^3)/(elevation change(Ft.))]^.385 *60(min/hr) + 10 min.
Initial subarea flow distance  =  930.000(Ft.)
Highest elevation = 1070.000(Ft.)
Lowest elevation =  734.000(Ft.)
Elevation difference =  336.000(Ft.)
TC=[(11.9*0.1761^3)/(336.00)]^.385=  2.23 + 10 min. =    12.23 min.
Rainfall intensity (I) =      3.136(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.450
Subarea runoff =       6.816(CFS)
Total initial stream area =       4.830(Ac.)
```



```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      305.000 to Point/Station      310.000
**** IMPROVED CHANNEL TRAVEL TIME ****

Upstream point elevation =   734.000(Ft.)
Downstream point elevation =   564.000(Ft.)
Channel length thru subarea  =  1316.000(Ft.)
Channel base width      =   15.000(Ft.)
Slope or 'Z' of left channel bank =   3.000
Slope or 'Z' of right channel bank =   3.000
Estimated mean flow rate at midpoint of channel =     22.630(CFS)
Manning's 'N'    = 0.030
Maximum depth of channel  =    2.000(Ft.)
Flow(q) thru subarea =     22.630(CFS)
Depth of flow =   0.226(Ft.), Average velocity =   6.396(Ft/s)
Channel flow top width =   16.354(Ft.)
Flow Velocity =    6.40(Ft/s)
Travel time  =    3.43 min.
Time of concentration =   15.66 min.
Critical depth =      0.402(Ft.)
 Adding area flow to channel
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[RURAL(greater than 0.5 Ac, 0.2 ha) area type]
Rainfall intensity =      2.857(In/Hr) for a   100.0 year storm
Runoff coefficient used for sub-area, Rational method,Q=KCIA, C = 0.450
Subarea runoff =      28.808(CFS) for   22.410(Ac.)
Total runoff =     35.624(CFS)  Total area =       27.24(Ac.)
End of computations, total study area =         27.240 (Ac.)
```

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                San Diego County Rational Hydrology Program

CIVILCADD/CIVILDESIGN Engineering Software,(c)1991-2003 Version 6.3

Rational method hydrology  program based on
San Diego County Flood Control Division 1985 hydrology manual
        Rational Hydrology Study        Date: 11/06/14
------------------------------------------------------------------------
3255.30 HERITAGE BLUFFS
PROPOSED CONDITIONS
SYSTEM 700
FILE: S700P100
------------------------------------------------------------------------
 *********   Hydrology Study Control Information **********

------------------------------------------------------------------------


Program License Serial Number 4049

------------------------------------------------------------------------
Rational hydrology study storm event year is   100.0
English (in-lb) input data Units used
English (in) rainfall data used

Standard intensity of Appendix I-B used for year and
Elevation 0 - 1500 feet
Factor (to multiply * intensity)  =  1.000
Only used if inside City of San Diego
San Diego hydrology manual 'C' values used
Runoff coefficients by rational method


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      700.000 to Point/Station      705.000
**** INITIAL AREA EVALUATION ****
______________________________________________________________________
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[RURAL(greater than 0.5 Ac, 0.2 ha) area type]
Time of concentration computed by the
natural watersheds nomograph (App X-A)
TC = [11.9*length(Mi)^3)/(elevation change(Ft.))]^.385 *60(min/hr) + 10 min.
Initial subarea flow distance  =  953.000(Ft.)
Highest elevation = 1210.000(Ft.)
Lowest elevation =  934.000(Ft.)
Elevation difference =  276.000(Ft.)
TC=[(11.9*0.1805^3)/(276.00)]^.385=  2.48 + 10 min. =     12.48 min.
Rainfall intensity (I) =      3.113(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.450
Subarea runoff =     11.923(CFS)
Total initial stream area =       8.510(Ac.)
```



```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      705.000 to Point/Station      707.000
**** IMPROVED CHANNEL TRAVEL TIME ****
______________________________________________________________________
Upstream point elevation =   934.000(Ft.)
Downstream point elevation =   696.000(Ft.)
Channel length thru subarea  =  1673.000(Ft.)
Channel base width         =    30.000(Ft.)
Slope or 'Z' of left channel bank =   3.000
Slope or 'Z' of right channel bank =   3.000
Estimated mean flow rate at midpoint of channel =     33.156(CFS)
Manning's 'N'    = 0.030
Maximum depth of channel  =    2.000(Ft.)
Flow(q) thru subarea =       33.156(CFS)
Depth of flow =   0.183(Ft.), Average velocity =   5.938(Ft/s)
Channel flow top width =   31.097(Ft.)
Flow Velocity =     5.94(Ft/s)
Travel time  =    4.70 min.
Time of concentration =   17.17 min.
Critical depth =      0.332(Ft.)
 Adding area flow to channel
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[RURAL(greater than 0.5 Ac, 0.2 ha) area type]
Rainfall intensity =       2.753(In/Hr) for a   100.0 year storm
Runoff coefficient used for sub-area, Rational method,Q=KCIA, C = 0.450
Subarea runoff =     37.553(CFS) for   30.310(Ac.)
Total runoff =     49.476(CFS)  Total area =      38.82(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      707.000 to Point/Station      708.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
______________________________________________________________________
Upstream point/station elevation =   696.000(Ft.)
Downstream point/station elevation =   684.000(Ft.)
Pipe length  =   147.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    49.476(CFS)
Nearest computed pipe diameter   =     24.00(In.)
Calculated individual pipe flow   =     49.476(CFS)
Normal flow depth in pipe =   15.73(In.)
Flow top width inside pipe =   22.81(In.)
Critical depth could not be calculated.
Pipe flow velocity =      22.67(Ft/s)
Travel time through pipe =    0.11 min.
Time of concentration (TC) =    17.28 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      708.000 to Point/Station      714.000
**** IMPROVED CHANNEL TRAVEL TIME ****
______________________________________________________________________
Upstream point elevation =   684.000(Ft.)
Downstream point elevation =   634.000(Ft.)
Channel length thru subarea  =   667.000(Ft.)
```

```
Channel base width      =  30.000(Ft.)
Slope or 'Z' of left channel bank =   3.000
Slope or 'Z' of right channel bank =   3.000
Estimated mean flow rate at midpoint of channel =     52.815(CFS)
Manning's 'N'    = 0.030
Maximum depth of channel  =    2.000(Ft.)
Flow(q) thru subarea =     52.815(CFS)
Depth of flow =   0.292(Ft.), Average velocity =   5.851(Ft/s)
Channel flow top width =   31.754(Ft.)
Flow Velocity =    5.85(Ft/s)
Travel time  =    1.90 min.
Time of concentration =   19.18 min.
Critical depth =      0.453(Ft.)
 Adding area flow to channel
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[RURAL(greater than 0.5 Ac, 0.2 ha) area type]
Rainfall intensity =      2.628(In/Hr) for a   100.0 year storm
Runoff coefficient used for sub-area, Rational method,Q=KCIA, C = 0.450
Subarea runoff =      6.197(CFS) for    5.240(Ac.)
Total runoff =     55.674(CFS)  Total area =       44.06(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      708.000 to Point/Station      714.000
**** CONFLUENCE OF MINOR STREAMS ****
______________________________________________________________________
Along Main Stream number: 1 in normal stream number 1
Stream flow area =     44.060(Ac.)
Runoff from this stream =      55.674(CFS)
Time of concentration =   19.18 min.
Rainfall intensity =      2.628(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      710.000 to Point/Station      711.000
**** INITIAL AREA EVALUATION ****
______________________________________________________________________
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[RURAL(greater than 0.5 Ac, 0.2 ha) area type]
Time of concentration computed by the
natural watersheds nomograph (App X-A)
TC = [11.9*length(Mi)^3)/(elevation change(Ft.))]^.385 *60(min/hr) + 10 min.
Initial subarea flow distance  =  523.000(Ft.)
Highest elevation =  692.000(Ft.)
Lowest elevation =  652.000(Ft.)
Elevation difference =   40.000(Ft.)
TC=[(11.9*0.0991^3)/( 40.00)]^.385=  2.60 + 10 min. =    12.60 min.
Rainfall intensity (I) =      3.102(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.450
Subarea runoff =      3.852(CFS)
Total initial stream area =        2.760(Ac.)
```



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++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      711.000 to Point/Station      714.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
______________________________________________________________________
Upstream point/station elevation =   652.000(Ft.)
Downstream point/station elevation =   634.000(Ft.)
Pipe length  =    174.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =      3.852(CFS)
Nearest computed pipe diameter  =      9.00(In.)
Calculated individual pipe flow  =      3.852(CFS)
Normal flow depth in pipe =    5.68(In.)
Flow top width inside pipe =    8.69(In.)
Critical depth could not be calculated.
Pipe flow velocity =     13.13(Ft/s)
Travel time through pipe =    0.22 min.
Time of concentration (TC) =    12.83 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      711.000 to Point/Station      714.000
**** CONFLUENCE OF MINOR STREAMS ****
______________________________________________________________________
Along Main Stream number: 1 in normal stream number 2
Stream flow area =      2.760(Ac.)
Runoff from this stream =       3.852(CFS)
Time of concentration =   12.83 min.
Rainfall intensity =      3.082(In/Hr)
Summary of stream data:

Stream   Flow rate      TC            Rainfall Intensity
 No.       (CFS)      (min)                  (In/Hr)


1       55.674     19.18                  2.628
2        3.852     12.83                  3.082
Qmax(1) =
           1.000 *    1.000 *    55.674) +
           0.853 *    1.000 *     3.852) + =      58.959
Qmax(2) =
           1.000 *    0.669 *    55.674) +
           1.000 *    1.000 *     3.852) + =      41.082

Total of 2 streams to confluence:
Flow rates before confluence point:
      55.674       3.852
Maximum flow rates at confluence using above data:
       58.959      41.082
Area of streams before confluence:
       44.060       2.760
Results of confluence:
Total flow rate =     58.959(CFS)
Time of concentration =    19.179 min.
Effective stream area after confluence =     46.820(Ac.)
```

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      714.000 to Point/Station      720.000
**** IMPROVED CHANNEL TRAVEL TIME ****
______________________________________________________________________

Upstream point elevation =   634.000(Ft.)
Downstream point elevation =   550.000(Ft.)
Channel length thru subarea  =  1312.000(Ft.)
Channel base width      =   30.000(Ft.)
Slope or 'Z' of left channel bank =   3.000
Slope or 'Z' of right channel bank =   3.000
Estimated mean flow rate at midpoint of channel =     70.267(CFS)
Manning's 'N'    = 0.030
Maximum depth of channel  =    2.000(Ft.)
Flow(q) thru subarea =     70.267(CFS)
Depth of flow =  0.363(Ft.), Average velocity =   6.221(Ft/s)
Channel flow top width =   32.180(Ft.)
Flow Velocity =    6.22(Ft/s)
Travel time  =    3.51 min.
Time of concentration =   22.69 min.
Critical depth =      0.547(Ft.)
 Adding area flow to channel
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[RURAL(greater than 0.5 Ac, 0.2 ha) area type]
Rainfall intensity =      2.434(In/Hr) for a   100.0 year storm
Runoff coefficient used for sub-area, Rational method,Q=KCIA, C = 0.450
Subarea runoff =     19.674(CFS) for   17.960(Ac.)
Total runoff =     78.633(CFS)  Total area =       64.78(Ac.)
End of computations, total study area =         64.780 (Ac.)
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                 San Diego County Rational Hydrology Program

CIVILCADD/CIVILDESIGN Engineering Software,(c)1991-2003 Version 6.3

Rational method hydrology  program based on
San Diego County Flood Control Division 1985 hydrology manual
        Rational Hydrology Study        Date: 11/03/14
------------------------------------------------------------------------
3255.30 HERITAGE BLUFFS
PROPOSED CONDITIONS
SYSTEM 900
FILE: S900P100
------------------------------------------------------------------------
 *********   Hydrology Study Control Information **********

------------------------------------------------------------------------


Program License Serial Number 4049

------------------------------------------------------------------------
Rational hydrology study storm event year is   100.0
English (in-lb) input data Units used
English (in) rainfall data used

Standard intensity of Appendix I-B used for year and
Elevation 0 - 1500 feet
Factor (to multiply * intensity)  =  1.000
Only used if inside City of San Diego
San Diego hydrology manual 'C' values used
Runoff coefficients by rational method


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Process from Point/Station      900.000 to Point/Station      902.000
**** INITIAL AREA EVALUATION ****

Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[SINGLE FAMILY area type                 ]
Initial subarea flow distance  =  100.000(Ft.)
Highest elevation =  749.500(Ft.)
Lowest elevation =  747.500(Ft.)
Elevation difference =     2.000(Ft.)
Time of concentration calculated by the urban
areas overland flow method (App X-C) =      7.86 min.
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.5500)*( 100.000^.5)/( 2.000^(1/3)]=   7.86
Rainfall intensity (I) =      3.684(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.550
Subarea runoff =      0.304(CFS)
Total initial stream area =       0.150(Ac.)
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S900P100.out
Printed: 11/3/2014 Modified: 11/3/2014 2:43:51 PM PM

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Process from Point/Station      902.000 to Point/Station      908.000
**** STREET FLOW TRAVEL TIME + SUBAREA FLOW ADDITION ****

Top of street segment elevation =   747.500(Ft.)
End of street segment elevation =   721.110(Ft.)
Length of street segment  =   710.000(Ft.)
Height of curb above gutter flowline  =    6.0(In.)
Width of half street (curb to crown)  =  16.000(Ft.)
Distance from crown to crossfall grade break  =  10.000(Ft.)
Slope from gutter to grade break (v/hz) =   0.020
Slope from grade break to crown (v/hz)  =   0.020
Street flow is on [1] side(s) of the street
Distance from curb to property line  =  12.000(Ft.)
Slope from curb to property line (v/hz) =  0.020
Gutter width =   1.500(Ft.)
Gutter hike from flowline =  1.500(In.)
 Manning's N in gutter =  0.0150
 Manning's N from gutter to grade break =  0.0180
 Manning's N from grade break to crown =  0.0180
Estimated mean flow rate at midpoint of street =      2.796(CFS)
Depth of flow =   0.270(Ft.), Average velocity =   3.358(Ft/s)
Streetflow hydraulics at midpoint of street travel:
Halfstreet flow width =   8.726(Ft.)
Flow velocity =   3.36(Ft/s)
Travel time =    3.52 min.     TC =   11.38  min.
 Adding area flow to street
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[SINGLE FAMILY area type                 ]
Rainfall intensity =      3.220(In/Hr) for a   100.0 year storm
Runoff coefficient used for sub-area, Rational method,Q=KCIA, C = 0.550
Subarea runoff =      4.356(CFS) for    2.460(Ac.)
Total runoff =      4.660(CFS)  Total area =        2.61(Ac.)
Street flow at end of street =      4.660(CFS)
Half street flow at end of street =      4.660(CFS)
Depth of flow =   0.311(Ft.), Average velocity =   3.776(Ft/s)
Flow width (from curb towards crown)=  10.784(Ft.)


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Process from Point/Station      908.000 to Point/Station      987.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****

Upstream point/station elevation =   707.000(Ft.)
Downstream point/station elevation =   706.200(Ft.)
Pipe length  =    24.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     4.660(CFS)
Nearest computed pipe diameter   =     12.00(In.)
Calculated individual pipe flow   =     4.660(CFS)
Normal flow depth in pipe =    7.51(In.)
Flow top width inside pipe =    11.61(In.)
Critical Depth =   10.77(In.)
Pipe flow velocity =      9.00(Ft/s)
Travel time through pipe =    0.04 min.
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Time of concentration (TC) =    11.43 min.


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Process from Point/Station     987.000 to Point/Station     987.000
**** CONFLUENCE OF MINOR STREAMS ****

Along Main Stream number: 1 in normal stream number 1
Stream flow area =      2.610(Ac.)
Runoff from this stream =      4.660(CFS)
Time of concentration =   11.43 min.
Rainfall intensity =     3.215(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station     990.000 to Point/Station     989.000
**** INITIAL AREA EVALUATION ****

Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[SINGLE FAMILY area type                 ]
Initial subarea flow distance  =  172.000(Ft.)
Highest elevation =  721.000(Ft.)
Lowest elevation =  710.600(Ft.)
Elevation difference =   10.400(Ft.)
Time of concentration calculated by the urban
areas overland flow method (App X-C) =      7.13 min.
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.5500)*( 172.000^.5)/( 6.047^(1/3)]=   7.13
Rainfall intensity (I) =      3.820(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.550
Subarea runoff =      0.756(CFS)
Total initial stream area =        0.360(Ac.)


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Process from Point/Station     989.000 to Point/Station     987.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****

Upstream point/station elevation =   707.400(Ft.)
Downstream point/station elevation =   706.200(Ft.)
Pipe length  =   165.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     0.756(CFS)
Nearest computed pipe diameter  =      9.00(In.)
Calculated individual pipe flow  =     0.756(CFS)
Normal flow depth in pipe =    4.69(In.)
Flow top width inside pipe =     8.99(In.)
Critical Depth =    4.76(In.)
Pipe flow velocity =      3.25(Ft/s)
Travel time through pipe =    0.85 min.
Time of concentration (TC) =     7.97 min.


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Process from Point/Station     987.000 to Point/Station     987.000
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**** CONFLUENCE OF MINOR STREAMS ****

Along Main Stream number: 1 in normal stream number 2
Stream flow area =      0.360(Ac.)
Runoff from this stream =      0.756(CFS)
Time of concentration =    7.97 min.
Rainfall intensity =     3.664(In/Hr)
Summary of stream data:

Stream   Flow rate      TC           Rainfall Intensity
 No.       (CFS)      (min)                (In/Hr)


1        4.660    11.43                 3.215
2        0.756     7.97                 3.664
Qmax(1) =
           1.000 *    1.000 *    4.660) +
           0.877 *    1.000 *    0.756) + =       5.324
Qmax(2) =
           1.000 *    0.698 *    4.660) +
           1.000 *    1.000 *    0.756) + =       4.008

Total of 2 streams to confluence:
Flow rates before confluence point:
      4.660      0.756
Maximum flow rates at confluence using above data:
       5.324       4.008
Area of streams before confluence:
       2.610      0.360
Results of confluence:
Total flow rate =      5.324(CFS)
Time of concentration =    11.426 min.
Effective stream area after confluence =      2.970(Ac.)


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Process from Point/Station     987.000 to Point/Station     912.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****

Upstream point/station elevation =   706.200(Ft.)
Downstream point/station elevation =   705.120(Ft.)
Pipe length  =   108.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     5.324(CFS)
Nearest computed pipe diameter  =     15.00(In.)
Calculated individual pipe flow  =     5.324(CFS)
Normal flow depth in pipe =   10.38(In.)
Flow top width inside pipe =   13.85(In.)
Critical Depth =   11.21(In.)
Pipe flow velocity =      5.88(Ft/s)
Travel time through pipe =    0.31 min.
Time of concentration (TC) =    11.73 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station     987.000 to Point/Station     912.000
**** CONFLUENCE OF MINOR STREAMS ****
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Along Main Stream number: 1 in normal stream number 1
Stream flow area =       2.970(Ac.)
Runoff from this stream =       5.324(CFS)
Time of concentration =   11.73 min.
Rainfall intensity =     3.184(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      904.000 to Point/Station      906.000
**** INITIAL AREA EVALUATION ****
______________________________________________________________________
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[SINGLE FAMILY area type                      ]
Initial subarea flow distance  =  100.000(Ft.)
Highest elevation =  750.400(Ft.)
Lowest elevation =  748.000(Ft.)
Elevation difference =     2.400(Ft.)
Time of concentration calculated by the urban
areas overland flow method (App X-C) =      7.39 min.
TC = [1.8*(1.1-C)*distance(Ft.)^.S)/(% slope^(1/3)]
TC = [1.8*(1.1-0.5500)*( 100.000^.5)/( 2.400^(1/3)]=   7.39
Rainfall intensity (I) =      3.768(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.550
Subarea runoff =      0.187(CFS)
Total initial stream area =        0.090(Ac.)


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Process from Point/Station      906.000 to Point/Station      910.000
**** STREET FLOW TRAVEL TIME + SUBAREA FLOW ADDITION ****
______________________________________________________________________
Top of street segment elevation =   748.000(Ft.)
End of street segment elevation =   719.200(Ft.)
Length of street segment  =   775.000(Ft.)
Height of curb above gutter flowline  =    6.0(In.)
Width of half street (curb to crown)  =  16.000(Ft.)
Distance from crown to crossfall grade break  =  10.000(Ft.)
Slope from gutter to grade break (v/hz) =   0.020
Slope from grade break to crown (v/hz)  =   0.020
Street flow is on [1] side(s) of the street
Distance from curb to property line  =  12.000(Ft.)
Slope from curb to property line (v/hz) =   0.020
Gutter width =   1.500(Ft.)
Gutter hike from flowline =  1.500(In.)
 Manning's N in gutter =  0.0150
 Manning's N from gutter to grade break =  0.0180
 Manning's N from grade break to crown =  0.0180
Estimated mean flow rate at midpoint of street =       0.369(CFS)
Depth of flow =   0.153(Ft.), Average velocity =   2.390(Ft/s)
Streetflow hydraulics at midpoint of street travel:
Halfstreet flow width =   2.886(Ft.)
Flow velocity =    2.39(Ft/s)
Travel time =    5.40 min.     TC =   12.80  min.
 Adding area flow to street
```



```
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[SINGLE FAMILY area type                      ]
Rainfall intensity =      3.084(In/Hr) for a   100.0 year storm
Runoff coefficient used for sub-area, Rational method,Q=KCIA, C = 0.550
Subarea runoff =      3.325(CFS) for    1.960(Ac.)
Total runoff =      3.511(CFS)  Total area =        2.05(Ac.)
Street flow at end of street =      3.511(CFS)
Half street flow at end of street =      3.511(CFS)
Depth of flow =   0.287(Ft.), Average velocity =   3.536(Ft/s)
Flow width (from curb towards crown)=   9.601(Ft.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      910.000 to Point/Station      912.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
______________________________________________________________________
Upstream point/station elevation =   710.500(Ft.)
Downstream point/station elevation =   705.120(Ft.)
Pipe length   =     25.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =      3.511(CFS)
Nearest computed pipe diameter   =      9.00(In.)
Calculated individual pipe flow   =      3.511(CFS)
Normal flow depth in pipe =     4.27(In.)
Flow top width inside pipe =     8.99(In.)
Critical depth could not be calculated.
Pipe flow velocity =      16.98(Ft/s)
Travel time through pipe =     0.02 min.
Time of concentration (TC) =    12.82 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      912.000 to Point/Station      912.000
**** CONFLUENCE OF MINOR STREAMS ****
______________________________________________________________________
Along Main Stream number: 1 in normal stream number 2
Stream flow area =       2.050(Ac.)
Runoff from this stream =       3.511(CFS)
Time of concentration =   12.82 min.
Rainfall intensity =     3.082(In/Hr)
Summary of stream data:

Stream   Flow rate      TC              Rainfall Intensity
 No.       (CFS)      (min)                    (In/Hr)


1        S.324     11.73                  3.184
2        3.511     12.82                  3.082
Qmax(1) =
            1.000 *     1.000 *      5.324) +
            1.000 *     0.915 *      3.511) + =        8.536
Qmax(2) =
            0.968 *     1.000 *      5.324) +
            1.000 *     1.000 *      3.511) + =        8.664
```

```
Total of 2 streams to confluence:
Flow rates before confluence point:
       5.324       3.511
Maximum flow rates at confluence using above data:
        8.536       8.664
Area of streams before confluence:
        2.970       2.050
Results of confluence:
Total flow rate =      8.664(CFS)
Time of concentration =    12.824 min.
Effective stream area after confluence =      5.020(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      912.000 to Point/Station      926.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****

Upstream point/station elevation =   704.800(Ft.)
Downstream point/station elevation =   700.100(Ft.)
Pipe length  =   196.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     8.664(CFS)
Nearest computed pipe diameter  =    15.00(In.)
Calculated individual pipe flow  =     8.664(CFS)
Normal flow depth in pipe =   10.78(In.)
Flow top width inside pipe =   13.49(In.)
Critical Depth =   13.72(In.)
Pipe flow velocity =      9.18(Ft/s)
Travel time through pipe =    0.36 min.
Time of concentration (TC) =    13.18 min.


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Process from Point/Station      926.000 to Point/Station      926.000
**** CONFLUENCE OF MINOR STREAMS ****

Along Main Stream number: 1 in normal stream number 1
Stream flow area =      5.020(Ac.)
Runoff from this stream =      8.664(CFS)
Time of concentration =   13.18 min.
Rainfall intensity =     3.051(In/Hr)


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Process from Point/Station      918.000 to Point/Station      920.000
**** INITIAL AREA EVALUATION ****

Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[SINGLE FAMILY area type                ]
Initial subarea flow distance  =  106.000(Ft.)
Highest elevation =  749.000(Ft.)
Lowest elevation =  744.000(Ft.)
Elevation difference =    5.000(Ft.)
Time of concentration calculated by the urban
areas overland flow method (App X-C) =     6.08 min.
```



```
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.5500)*( 106.000^.5)/( 4.717^(1/3)]=   6.08
Rainfall intensity (I) =      4.060(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.550
Subarea runoff =      0.246(CFS)
Total initial stream area =       0.110(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      920.000 to Point/Station      922.000
**** STREET FLOW TRAVEL TIME + SUBAREA FLOW ADDITION ****

Top of street segment elevation =   744.000(Ft.)
End of street segment elevation =   712.000(Ft.)
Length of street segment  =   933.000(Ft.)
Height of curb above gutter flowline  =    6.0(In.)
Width of half street (curb to crown)  =  16.000(Ft.)
Distance from crown to crossfall grade break  =  10.000(Ft.)
Slope from gutter to grade break (v/hz) =   0.020
Slope from grade break to crown (v/hz)  =   0.020
Street flow is on [1] side(s) of the street
Distance from curb to property line  =  12.000(Ft.)
Slope from curb to property line (v/hz) =   0.020
Gutter width =   1.500(Ft.)
Gutter hike from flowline =  1.500(In.)
 Manning's N in gutter =  0.0150
 Manning's N from gutter to grade break =  0.0180
 Manning's N from grade break to crown =  0.0180
Estimated mean flow rate at midpoint of street =      3.930(CFS)
Depth of flow =   0.300(Ft.), Average velocity =   3.519(Ft/s)
Streetflow hydraulics at midpoint of street travel:
Halfstreet flow width =  10.226(Ft.)
Flow velocity =   3.52(Ft/s)
Travel time =    4.42 min.     TC =   10.50  min.
 Adding area flow to street
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[SINGLE FAMILY area type                ]
Rainfall intensity =      3.315(In/Hr) for a   100.0 year storm
Runoff coefficient used for sub-area, Rational method,Q=KCIA, C = 0.550
Subarea runoff =      6.018(CFS) for    3.300(Ac.)
Total runoff =      6.263(CFS)  Total area =         3.41(Ac.)
Street flow at end of street =      6.263(CFS)
Half street flow at end of street =      6.263(CFS)
Depth of flow =   0.342(Ft.), Average velocity =   3.925(Ft/s)
Flow width (from curb towards crown)=  12.348(Ft.)


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Process from Point/Station      922.000 to Point/Station      924.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****

Upstream point/station elevation =   705.400(Ft.)
Downstream point/station elevation =   701.400(Ft.)
Pipe length  =    25.00(Ft.)   Manning's N = 0.013
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```
No. of pipes = 1  Required pipe flow  =     6.263(CFS)
Nearest computed pipe diameter  =     9.00(In.)
Calculated individual pipe flow  =     6.263(CFS)
Normal flow depth in pipe =    6.98(In.)
Flow top width inside pipe =    7.50(In.)
Critical depth could not be calculated.
Pipe flow velocity =     17.04(Ft/s)
Travel time through pipe =    0.02 min.
Time of concentration (TC) =    10.52 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      924.000 to Point/Station      926.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
______________________________________________________________________
Upstream point/station elevation =   701.100(Ft.)
Downstream point/station elevation =   700.100(Ft.)
Pipe length  =    52.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     6.263(CFS)
Nearest computed pipe diameter  =    15.00(In.)
Calculated individual pipe flow  =     6.263(CFS)
Normal flow depth in pipe =    9.23(In.)
Flow top width inside pipe =   14.59(In.)
Critical Depth =   12.13(In.)
Pipe flow velocity =      7.89(Ft/s)
Travel time through pipe =    0.11 min.
Time of concentration (TC) =    10.63 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      926.000 to Point/Station      926.000
**** CONFLUENCE OF MINOR STREAMS ****
______________________________________________________________________
Along Main Stream number: 1 in normal stream number 2
Stream flow area =      3.410(Ac.)
Runoff from this stream =      6.263(CFS)
Time of concentration =   10.63 min.
Rainfall intensity =     3.300(In/Hr)
Summary of stream data:

Stream   Flow rate     TC            Rainfall Intensity
 No.       (CFS)      (min)                 (In/Hr)


1        8.664     13.18                 3.051
2        6.263     10.63                 3.300
Qmax(1) =
           1.000 *     1.000 *     8.664) +
           0.924 *     1.000 *     6.263) + =        14.454
Qmax(2) =
           1.000 *     0.807 *     8.664) +
           1.000 *     1.000 *     6.263) + =        13.252

Total of 2 streams to confluence:
Flow rates before confluence point:
       8.664       6.263
Maximum flow rates at confluence using above data:
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```
      14.454       13.252
Area of streams before confluence:
       5.020       3.410
Results of confluence:
Total flow rate =     14.454(CFS)
Time of concentration =    13.180 min.
Effective stream area after confluence =      8.430(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      926.000 to Point/Station      936.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
______________________________________________________________________
Upstream point/station elevation =   699.800(Ft.)
Downstream point/station elevation =   695.900(Ft.)
Pipe length  =    80.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    14.454(CFS)
Nearest computed pipe diameter  =    18.00(In.)
Calculated individual pipe flow  =    14.454(CFS)
Normal flow depth in pipe =   10.29(In.)
Flow top width inside pipe =   17.81(In.)
Critical Depth =   16.72(In.)
Pipe flow velocity =     13.84(Ft/s)
Travel time through pipe =    0.10 min.
Time of concentration (TC) =    13.28 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      936.000 to Point/Station      936.000
**** CONFLUENCE OF MINOR STREAMS ****
______________________________________________________________________
Along Main Stream number: 1 in normal stream number 1
Stream flow area =      8.430(Ac.)
Runoff from this stream =     14.454(CFS)
Time of concentration =   13.28 min.
Rainfall intensity =     3.043(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      914.000 to Point/Station      916.000
**** INITIAL AREA EVALUATION ****
______________________________________________________________________
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[SINGLE FAMILY area type                    ]
Initial subarea flow distance  =  100.000(Ft.)
Highest elevation =  723.500(Ft.)
Lowest elevation =  721.500(Ft.)
Elevation difference =    2.000(Ft.)
Time of concentration calculated by the urban
areas overland flow method (App X-C) =      7.86 min.
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.5500)*( 100.000^.5)/( 2.000^(1/3)]=   7.86
Rainfall intensity (I) =      3.684(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.550
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Subarea runoff =      0.344(CFS)
Total initial stream area =       0.170(Ac.)


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Process from Point/Station      916.000 to Point/Station      934.000
**** STREET FLOW TRAVEL TIME + SUBAREA FLOW ADDITION ****
______________________________________________________________________
Top of street segment elevation =   721.500(Ft.)
End of street segment elevation =   708.000(Ft.)
Length of street segment  =   320.000(Ft.)
Height of curb above gutter flowline  =    6.0(In.)
Width of half street (curb to crown)  =  16.000(Ft.)
Distance from crown to crossfall grade break  =  10.000(Ft.)
Slope from gutter to grade break (v/hz) =   0.020
Slope from grade break to crown (v/hz)  =   0.020
Street flow is on [1] side(s) of the street
Distance from curb to property line  =  12.000(Ft.)
Slope from curb to property line (v/hz) =   0.020
Gutter width =   1.500(Ft.)
Gutter hike from flowline =  1.500(In.)
 Manning's N in gutter =  0.0150
 Manning's N from gutter to grade break =  0.0180
 Manning's N from grade break to crown =  0.0180
Estimated mean flow rate at midpoint of street =      1.307(CFS)
Depth of flow =   0.216(Ft.), Average velocity =   2.998(Ft/s)
Streetflow hydraulics at midpoint of street travel:
Halfstreet flow width =   6.038(Ft.)
Flow velocity =   3.00(Ft/s)
Travel time =    1.78 min.      TC =    9.64  min.
 Adding area flow to street
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[SINGLE FAMILY area type                    ]
Rainfall intensity =      3.420(In/Hr) for a   100.0 year storm
Runoff coefficient used for sub-area, Rational method,Q=KCIA, C = 0.550
Subarea runoff =      1.787(CFS) for    0.950(Ac.)
Total runoff =      2.131(CFS)  Total area =       1.12(Ac.)
Street flow at end of street =      2.131(CFS)
Half street flow at end of street =      2.131(CFS)
Depth of flow =   0.246(Ft.), Average velocity =   3.322(Ft/s)
Flow width (from curb towards crown)=   7.552(Ft.)


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Process from Point/Station      934.000 to Point/Station      936.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
______________________________________________________________________
Upstream point/station elevation =   697.800(Ft.)
Downstream point/station elevation =   695.900(Ft.)
Pipe length  =      5.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =      2.131(CFS)
Nearest computed pipe diameter  =       6.00(In.)
Calculated individual pipe flow  =      2.131(CFS)
Normal flow depth in pipe =     3.40(In.)
```



```
Flow top width inside pipe =     5.95(In.)
Critical depth could not be calculated.
Pipe flow velocity =      18.52(Ft/s)
Travel time through pipe =     0.00 min.
Time of concentration (TC) =     9.64 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      936.000 to Point/Station      936.000
**** CONFLUENCE OF MINOR STREAMS ****
______________________________________________________________________
Along Main Stream number: 1 in normal stream number 2
Stream flow area =      1.120(Ac.)
Runoff from this stream =      2.131(CFS)
Time of concentration =    9.64 min.
Rainfall intensity =     3.419(In/Hr)


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Process from Point/Station      928.000 to Point/Station      930.000
**** INITIAL AREA EVALUATION ****
______________________________________________________________________
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[SINGLE FAMILY area type                    ]
Initial subarea flow distance  =  100.000(Ft.)
Highest elevation =  730.000(Ft.)
Lowest elevation =  728.000(Ft.)
Elevation difference =    2.000(Ft.)
Time of concentration calculated by the urban
areas overland flow method (App X-C) =      7.86 min.
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.5500)*( 100.000^.5)/( 2.000^(1/3)]=   7.86
Rainfall intensity (I) =      3.684(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.550
Subarea runoff =      0.284(CFS)
Total initial stream area =       0.140(Ac.)


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Process from Point/Station      930.000 to Point/Station      932.000
**** STREET FLOW TRAVEL TIME + SUBAREA FLOW ADDITION ****
______________________________________________________________________
Top of street segment elevation =   728.000(Ft.)
End of street segment elevation =   708.000(Ft.)
Length of street segment  =   800.000(Ft.)
Height of curb above gutter flowline  =    6.0(In.)
Width of half street (curb to crown)  =  16.000(Ft.)
Distance from crown to crossfall grade break  =  10.000(Ft.)
Slope from gutter to grade break (v/hz) =   0.020
Slope from grade break to crown (v/hz)  =   0.020
Street flow is on [1] side(s) of the street
Distance from curb to property line  =  12.000(Ft.)
Slope from curb to property line (v/hz) =   0.020
Gutter width =   1.500(Ft.)
```

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Gutter hike from flowline =  1.500(In.)
 Manning's N in gutter =  0.0150
 Manning's N from gutter to grade break =  0.0180
 Manning's N from grade break to crown =  0.0180
Estimated mean flow rate at midpoint of street =      2.654(CFS)
Depth of flow =   0.281(Ft.), Average velocity =   2.847(Ft/s)
Streetflow hydraulics at midpoint of street travel:
Halfstreet flow width =    9.280(Ft.)
Flow velocity =    2.85(Ft/s)
Travel time =     4.68 min.      TC =    12.54  min.
 Adding area flow to street
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[SINGLE FAMILY area type                  ]
Rainfall intensity =      3.107(In/Hr) for a    100.0 year storm
Runoff coefficient used for sub-area, Rational method,Q=KCIA, C = 0.550
Subarea runoff =      3.999(CFS) for    2.340(Ac.)
Total runoff =      4.283(CFS)  Total area =        2.48(Ac.)
Street flow at end of street =      4.283(CFS)
Half street flow at end of street =      4.283(CFS)
Depth of flow =   0.321(Ft.), Average velocity =   3.180(Ft/s)
Flow width (from curb towards crown)=  11.294(Ft.)


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Process from Point/Station      932.000 to Point/Station      936.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
______________________________________________________________________
Upstream point/station elevation =   697.800(Ft.)
Downstream point/station elevation =   695.900(Ft.)
Pipe length   =    25.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =      4.283(CFS)
Nearest computed pipe diameter   =       9.00(In.)
Calculated individual pipe flow   =      4.283(CFS)
Normal flow depth in pipe =      6.93(In.)
Flow top width inside pipe =     7.58(In.)
Critical depth could not be calculated.
Pipe flow velocity =      11.74(Ft/s)
Travel time through pipe =    0.04 min.
Time of concentration (TC) =    12.58 min.


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Process from Point/Station      936.000 to Point/Station      936.000
**** CONFLUENCE OF MINOR STREAMS ****
______________________________________________________________________
Along Main Stream number: 1 in normal stream number 3
Stream flow area =      2.480(Ac.)
Runoff from this stream =      4.283(CFS)
Time of concentration =   12.58 min.
Rainfall intensity =     3.104(In/Hr)
Summary of stream data:

Stream   Flow rate     TC             Rainfall Intensity
 No.       (CFS)      (min)                  (In/Hr)
```



```
1       14.454     13.28                    3.043
2        2.131      9.64                    3.419
3        4.283     12.58                    3.104
Qmax(1) =
           1.000 *    1.000 *    14.454) +
           0.890 *    1.000 *     2.131) +
           0.980 *    1.000 *     4.283) + =       20.548
Qmax(2) =
           1.000 *    0.726 *    14.454) +
           1.000 *    1.000 *     2.131) +
           1.000 *    0.767 *     4.283) + =       15.910
Qmax(3) =
           1.000 *    0.947 *    14.454) +
           0.908 *    1.000 *     2.131) +
           1.000 *    1.000 *     4.283) + =       19.910

Total of 3 streams to confluence:
Flow rates before confluence point:
      14.454       2.131       4.283
Maximum flow rates at confluence using above data:
       20.548      15.910      19.910
Area of streams before confluence:
        8.430       1.120       2.480
Results of confluence:
Total flow rate =      20.548(CFS)
Time of concentration =    13.276 min.
Effective stream area after confluence =     12.030(Ac.)


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Process from Point/Station      936.000 to Point/Station      950.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
______________________________________________________________________
Upstream point/station elevation =   695.530(Ft.)
Downstream point/station elevation =   685.000(Ft.)
Pipe length   =   251.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     20.548(CFS)
Nearest computed pipe diameter   =      18.00(In.)
Calculated individual pipe flow   =     20.548(CFS)
Normal flow depth in pipe =    14.06(In.)
Flow top width inside pipe =    14.88(In.)
Critical depth could not be calculated.
Pipe flow velocity =      13.86(Ft/s)
Travel time through pipe =     0.30 min.
Time of concentration (TC) =    13.58 min.


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Process from Point/Station      950.000 to Point/Station      950.000
**** CONFLUENCE OF MINOR STREAMS ****
______________________________________________________________________
Along Main Stream number: 1 in normal stream number 1
Stream flow area =     12.030(Ac.)
Runoff from this stream =     20.548(CFS)
Time of concentration =   13.58 min.
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Rainfall intensity =     3.017(In/Hr)


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Process from Point/Station      938.000 to Point/Station      940.000
**** INITIAL AREA EVALUATION ****

Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[SINGLE FAMILY area type              ]
Initial subarea flow distance  =  100.000(Ft.)
Highest elevation =  707.000(Ft.)
Lowest elevation =  705.000(Ft.)
Elevation difference =    2.000(Ft.)
Time of concentration calculated by the urban
areas overland flow method (App X-C) =     7.86 min.
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.5500)*( 100.000^.5)/( 2.000^(1/3)]=   7.86
Rainfall intensity (I) =     3.684(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.550
Subarea runoff =      0.203(CFS)
Total initial stream area =       0.100(Ac.)


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Process from Point/Station      940.000 to Point/Station      942.000
**** STREET FLOW TRAVEL TIME + SUBAREA FLOW ADDITION ****

Top of street segment elevation =   705.000(Ft.)
End of street segment elevation =   698.440(Ft.)
Length of street segment  =   425.000(Ft.)
Height of curb above gutter flowline  =     6.0(In.)
Width of half street (curb to crown)  =  16.000(Ft.)
Distance from crown to crossfall grade break  =  10.000(Ft.)
Slope from gutter to grade break (v/hz) =    0.020
Slope from grade break to crown (v/hz)  =    0.020
Street flow is on [1] side(s) of the street
Distance from curb to property line  =  12.000(Ft.)
Slope from curb to property line (v/hz) =    0.020
Gutter width =   1.500(Ft.)
Gutter hike from flowline =  1.500(In.)
 Manning's N in gutter =  0.0150
 Manning's N from gutter to grade break =  0.0180
 Manning's N from grade break to crown =  0.0180
Estimated mean flow rate at midpoint of street =      1.935(CFS)
Depth of flow =   0.275(Ft.), Average velocity =   2.199(Ft/s)
Streetflow hydraulics at midpoint of street travel:
Halfstreet flow width =   8.993(Ft.)
Flow velocity =   2.20(Ft/s)
Travel time =    3.22 min.     TC =   11.08  min.
 Adding area flow to street
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
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```
[SINGLE FAMILY area type              ]
Rainfall intensity =     3.251(In/Hr) for a   100.0 year storm
Runoff coefficient used for sub-area, Rational method,Q=KCIA, C = 0.550
Subarea runoff =      3.058(CFS) for    1.710(Ac.)
Total runoff =      3.260(CFS)  Total area =        1.81(Ac.)
Street flow at end of street =       3.260(CFS)
Half street flow at end of street =       3.260(CFS)
Depth of flow =   0.318(Ft.), Average velocity =   2.480(Ft/s)
Flow width (from curb towards crown)=  11.151(Ft.)


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Process from Point/Station      942.000 to Point/Station      944.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****

Upstream point/station elevation =   695.000(Ft.)
Downstream point/station elevation =   690.770(Ft.)
Pipe length  =     7.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =      3.260(CFS)
Nearest computed pipe diameter  =      6.00(In.)
Calculated individual pipe flow  =     3.260(CFS)
Normal flow depth in pipe =    3.87(In.)
Flow top width inside pipe =    5.74(In.)
Critical depth could not be calculated.
Pipe flow velocity =     24.36(Ft/s)
Travel time through pipe =    0.00 min.
Time of concentration (TC) =    11.08 min.


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Process from Point/Station      944.000 to Point/Station      950.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****

Upstream point/station elevation =   690.770(Ft.)
Downstream point/station elevation =   685.000(Ft.)
Pipe length  =   297.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =      3.260(CFS)
Nearest computed pipe diameter  =     12.00(In.)
Calculated individual pipe flow  =     3.260(CFS)
Normal flow depth in pipe =    7.09(In.)
Flow top width inside pipe =   11.80(In.)
Critical Depth =     9.27(In.)
Pipe flow velocity =      6.75(Ft/s)
Travel time through pipe =    0.73 min.
Time of concentration (TC) =    11.82 min.


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Process from Point/Station      950.000 to Point/Station      950.000
**** CONFLUENCE OF MINOR STREAMS ****

Along Main Stream number: 1 in normal stream number 2
Stream flow area =      1.810(Ac.)
Runoff from this stream =      3.260(CFS)
Time of concentration =    11.82 min.
Rainfall intensity =     3.176(In/Hr)
Summary of stream data:
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Stream   Flow rate      TC            Rainfall Intensity
 No.       (CFS)       (min)                (In/Hr)


1       20.548     13.58              3.017
2        3.260     11.82              3.176
Qmax(1) =
           1.000 *    1.000 *    20.548) +
           0.950 *    1.000 *     3.260) + =       23.646
Qmax(2) =
           1.000 *    0.870 *    20.548) +
           1.000 *    1.000 *     3.260) + =       21.144

Total of 2 streams to confluence:
Flow rates before confluence point:
      20.548       3.260
Maximum flow rates at confluence using above data:
       23.646       21.144
Area of streams before confluence:
       12.030        1.810
Results of confluence:
Total flow rate =     23.646(CFS)
Time of concentration =    13.578 min.
Effective stream area after confluence =     13.840(Ac.)


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Process from Point/Station     950.000 to Point/Station     952.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****

Upstream point/station elevation =  685.000(Ft.)
Downstream point/station elevation =  684.000(Ft.)
Pipe length  =   100.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    23.646(CFS)
Nearest computed pipe diameter  =     24.00(In.)
Calculated individual pipe flow  =    23.646(CFS)
Normal flow depth in pipe =   20.81(In.)
Flow top width inside pipe =   16.29(In.)
Critical Depth =   20.70(In.)
Pipe flow velocity =      8.17(Ft/s)
Travel time through pipe =    0.20 min.
Time of concentration (TC) =    13.78 min.


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Process from Point/Station     952.000 to Point/Station     952.000
**** CONFLUENCE OF MINOR STREAMS ****

Along Main Stream number: 1 in normal stream number 1
Stream flow area =     13.840(Ac.)
Runoff from this stream =     23.646(CFS)
Time of concentration =   13.78 min.
Rainfall intensity =     3.000(In/Hr)


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Process from Point/Station     946.000 to Point/Station     948.000
**** INITIAL AREA EVALUATION ****

Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[SINGLE FAMILY area type                    ]
Initial subarea flow distance  =  100.000(Ft.)
Highest elevation =  701.000(Ft.)
Lowest elevation =  699.000(Ft.)
Elevation difference =    2.000(Ft.)
Time of concentration calculated by the urban
areas overland flow method (App X-C) =      7.86 min.
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.5500)*( 100.000^.5)/( 2.000^(1/3)]=   7.86
Rainfall intensity (I) =      3.684(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.550
Subarea runoff =      0.203(CFS)
Total initial stream area =        0.100(Ac.)


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Process from Point/Station     948.000 to Point/Station     956.000
**** STREET FLOW TRAVEL TIME + SUBAREA FLOW ADDITION ****

Top of street segment elevation =   699.000(Ft.)
End of street segment elevation =   698.000(Ft.)
Length of street segment  =   360.000(Ft.)
Height of curb above gutter flowline  =    6.0(In.)
Width of half street (curb to crown)  =  16.000(Ft.)
Distance from crown to crossfall grade break  =  10.000(Ft.)
Slope from gutter to grade break (v/hz) =   0.020
Slope from grade break to crown (v/hz)  =   0.020
Street flow is on [1] side(s) of the street
Distance from curb to property line  =  12.000(Ft.)
Slope from curb to property line (v/hz) =   0.020
Gutter width =   1.500(Ft.)
Gutter hike from flowline =  1.500(In.)
 Manning's N in gutter =  0.0150
 Manning's N from gutter to grade break =  0.0180
 Manning's N from grade break to crown =  0.0180
Estimated mean flow rate at midpoint of street =      2.472(CFS)
Depth of flow =   0.376(Ft.), Average velocity =   1.207(Ft/s)
Streetflow hydraulics at midpoint of street travel:
Halfstreet flow width =  14.058(Ft.)
Flow velocity =   1.21(Ft/s)
Travel time =    4.97 min.     TC =   12.83  min.
 Adding area flow to street
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[SINGLE FAMILY area type                    ]
Rainfall intensity =      3.082(In/Hr) for a   100.0 year storm
Runoff coefficient used for sub-area, Rational method,Q=KCIA, C = 0.550
Subarea runoff =      3.797(CFS) for    2.240(Ac.)
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Total runoff =      3.999(CFS)  Total area =        2.34(Ac.)
Street flow at end of street =      3.999(CFS)
Half street flow at end of street =      3.999(CFS)
Depth of flow =   0.431(Ft.), Average velocity =   1.388(Ft/s)
Note:  depth of flow exceeds top of street crown.
Flow width (from curb towards crown)=  16.000(Ft.)


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Process from Point/Station      956.000 to Point/Station      952.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****

______________________________________________________________________
Upstream point/station elevation =   690.000(Ft.)
Downstream point/station elevation =   684.000(Ft.)
Pipe length  =     7.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     3.999(CFS)
Nearest computed pipe diameter  =      6.00(In.)
Calculated individual pipe flow  =     3.999(CFS)
Normal flow depth in pipe =    3.95(In.)
Flow top width inside pipe =    5.69(In.)
Critical depth could not be calculated.
Pipe flow velocity =     29.18(Ft/s)
Travel time through pipe =    0.00 min.
Time of concentration (TC) =    12.83 min.


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Process from Point/Station      952.000 to Point/Station      952.000
**** CONFLUENCE OF MINOR STREAMS ****

______________________________________________________________________
Along Main Stream number: 1 in normal stream number 2
Stream flow area =      2.340(Ac.)
Runoff from this stream =      3.999(CFS)
Time of concentration =   12.83 min.
Rainfall intensity =     3.081(In/Hr)


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Process from Point/Station      988.000 to Point/Station      990.000
**** INITIAL AREA EVALUATION ****

______________________________________________________________________
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[SINGLE FAMILY area type                    ]
Initial subarea flow distance  =  100.000(Ft.)
Highest elevation =  706.000(Ft.)
Lowest elevation =  704.000(Ft.)
Elevation difference =     2.000(Ft.)
Time of concentration calculated by the urban
areas overland flow method (App X-C) =      7.86 min.
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.5500)*( 100.000^.5)/( 2.000^(1/3)]=   7.86
Rainfall intensity (I) =      3.684(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.550
Subarea runoff =      0.243(CFS)
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Total initial stream area =        0.120(Ac.)


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Process from Point/Station      990.000 to Point/Station      954.000
**** STREET FLOW TRAVEL TIME + SUBAREA FLOW ADDITION ****

______________________________________________________________________
Top of street segment elevation =   704.000(Ft.)
End of street segment elevation =   698.000(Ft.)
Length of street segment  =   790.000(Ft.)
Height of curb above gutter flowline  =     6.0(In.)
Width of half street (curb to crown)  =  16.000(Ft.)
Distance from crown to crossfall grade break  =  10.000(Ft.)
Slope from gutter to grade break (v/hz) =   0.020
Slope from grade break to crown (v/hz)  =   0.020
Street flow is on [1] side(s) of the street
Distance from curb to property line  =  12.000(Ft.)
Slope from curb to property line (v/hz) =   0.020
Gutter width =   1.500(Ft.)
Gutter hike from flowline =  1.500(In.)
 Manning's N in gutter =  0.0150
 Manning's N from gutter to grade break =  0.0180
 Manning's N from grade break to crown =  0.0180
Estimated mean flow rate at midpoint of street =      2.219(CFS)
Depth of flow =   0.315(Ft.), Average velocity =   1.727(Ft/s)
Streetflow hydraulics at midpoint of street travel:
Halfstreet flow width =  11.014(Ft.)
Flow velocity =   1.73(Ft/s)
Travel time =     7.62 min.      TC =    15.48  min.
 Adding area flow to street
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[SINGLE FAMILY area type                    ]
Rainfall intensity =      2.870(In/Hr) for a   100.0 year storm
Runoff coefficient used for sub-area, Rational method,Q=KCIA, C = 0.550
Subarea runoff =      3.078(CFS) for    1.950(Ac.)
Total runoff =      3.321(CFS)  Total area =        2.07(Ac.)
Street flow at end of street =      3.321(CFS)
Half street flow at end of street =      3.321(CFS)
Depth of flow =   0.354(Ft.), Average velocity =   1.900(Ft/s)
Flow width (from curb towards crown)=  12.949(Ft.)


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Process from Point/Station      954.000 to Point/Station      952.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****

______________________________________________________________________
Upstream point/station elevation =   690.000(Ft.)
Downstream point/station elevation =   684.000(Ft.)
Pipe length  =    25.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     3.321(CFS)
Nearest computed pipe diameter  =      9.00(In.)
Calculated individual pipe flow  =     3.321(CFS)
Normal flow depth in pipe =    4.01(In.)
Flow top width inside pipe =    8.95(In.)
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Critical depth could not be calculated.
Pipe flow velocity =     17.44(Ft/s)
Travel time through pipe =    0.02 min.
Time of concentration (TC) =    15.50 min.


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Process from Point/Station     952.000 to Point/Station     952.000
**** CONFLUENCE OF MINOR STREAMS ****

Along Main Stream number: 1 in normal stream number 3
Stream flow area =      2.070(Ac.)
Runoff from this stream =      3.321(CFS)
Time of concentration =   15.50 min.
Rainfall intensity =     2.868(In/Hr)
Summary of stream data:

Stream   Flow rate     TC          Rainfall Intensity
 No.       (CFS)      (min)             (In/Hr)


1       23.646     13.78               3.000
2        3.999     12.83               3.081
3        3.321     15.50               2.868
Qmax(1) =
           1.000 *    1.000 *    23.646) +
           0.974 *    1.000 *     3.999) +
           1.000 *    0.889 *     3.321) + =      30.492
Qmax(2) =
           1.000 *    0.931 *    23.646) +
           1.000 *    1.000 *     3.999) +
           1.000 *    0.828 *     3.321) + =      28.762
Qmax(3) =
           0.956 *    1.000 *    23.646) +
           0.931 *    1.000 *     3.999) +
           1.000 *    1.000 *     3.321) + =      29.646

Total of 3 streams to confluence:
Flow rates before confluence point:
      23.646      3.999      3.321
Maximum flow rates at confluence using above data:
       30.492       28.762       29.646
Area of streams before confluence:
       13.840        2.340        2.070
Results of confluence:
Total flow rate =     30.492(CFS)
Time of concentration =    13.782 min.
Effective stream area after confluence =     18.250(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station     952.000 to Point/Station     958.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****

Upstream point/station elevation =   683.200(Ft.)
Downstream point/station elevation =   682.300(Ft.)
Pipe length  =     92.00(Ft.)   Manning's N = 0.013
```


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No. of pipes = 1  Required pipe flow  =     30.492(CFS)
Nearest computed pipe diameter  =     27.00(In.)
Calculated individual pipe flow  =     30.492(CFS)
Normal flow depth in pipe =   22.03(In.)
Flow top width inside pipe =   20.93(In.)
Critical Depth =   22.93(In.)
Pipe flow velocity =      8.78(Ft/s)
Travel time through pipe =    0.17 min.
Time of concentration (TC) =    13.96 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station     958.000 to Point/Station     972.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****

Upstream point/station elevation =   682.000(Ft.)
Downstream point/station elevation =   674.100(Ft.)
Pipe length  =    420.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     30.492(CFS)
Nearest computed pipe diameter  =     24.00(In.)
Calculated individual pipe flow  =     30.492(CFS)
Normal flow depth in pipe =   19.31(In.)
Flow top width inside pipe =   19.03(In.)
Critical Depth =   22.44(In.)
Pipe flow velocity =     11.26(Ft/s)
Travel time through pipe =    0.62 min.
Time of concentration (TC) =    14.58 min.


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Process from Point/Station     972.000 to Point/Station     972.000
**** CONFLUENCE OF MINOR STREAMS ****

Along Main Stream number: 1 in normal stream number 1
Stream flow area =     18.250(Ac.)
Runoff from this stream =     30.492(CFS)
Time of concentration =   14.58 min.
Rainfall intensity =     2.937(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station     964.000 to Point/Station     966.000
**** INITIAL AREA EVALUATION ****

Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[SINGLE FAMILY area type                ]
Initial subarea flow distance  =  100.000(Ft.)
Highest elevation =  698.000(Ft.)
Lowest elevation =  696.000(Ft.)
Elevation difference =    2.000(Ft.)
Time of concentration calculated by the urban
areas overland flow method (App X-C) =     7.86 min.
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.5500)*( 100.000^.5)/( 2.000^(1/3)]=   7.86
```

```
Rainfall intensity (I) =      3.684(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.550
Subarea runoff =       0.263(CFS)
Total initial stream area =        0.130(Ac.)


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Process from Point/Station      966.000 to Point/Station      968.000
**** STREET FLOW TRAVEL TIME + SUBAREA FLOW ADDITION ****
______________________________________________________________________
Top of street segment elevation =   696.000(Ft.)
End of street segment elevation =   685.000(Ft.)
Length of street segment  =   370.000(Ft.)
Height of curb above gutter flowline  =     6.0(In.)
Width of half street (curb to crown)  =  16.000(Ft.)
Distance from crown to crossfall grade break  =  10.000(Ft.)
Slope from gutter to grade break (v/hz) =   0.020
Slope from grade break to crown (v/hz)  =   0.020
Street flow is on [1] side(s) of the street
Distance from curb to property line  =  12.000(Ft.)
Slope from curb to property line (v/hz) =   0.020
Gutter width =   1.500(Ft.)
Gutter hike from flowline =  1.500(In.)
 Manning's N in gutter =  0.0150
 Manning's N from gutter to grade break =  0.0180
 Manning's N from grade break to crown =  0.0180
Estimated mean flow rate at midpoint of street =       1.388(CFS)
Depth of flow =   0.230(Ft.), Average velocity =   2.641(Ft/s)
Streetflow hydraulics at midpoint of street travel:
Halfstreet flow width =   6.740(Ft.)
Flow velocity =   2.64(Ft/s)
Travel time =     2.33 min.     TC =    10.19  min.
 Adding area flow to street
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[SINGLE FAMILY area type                  ]
Rainfall intensity =       3.351(In/Hr) for a   100.0 year storm
Runoff coefficient used for sub-area, Rational method,Q=KCIA, C = 0.550
Subarea runoff =       2.046(CFS) for     1.110(Ac.)
Total runoff =       2.309(CFS)  Total area =         1.24(Ac.)
Street flow at end of street =        2.309(CFS)
Half street flow at end of street =        2.309(CFS)
Depth of flow =   0.264(Ft.), Average velocity =   2.950(Ft/s)
Flow width (from curb towards crown)=   8.435(Ft.)


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Process from Point/Station      968.000 to Point/Station      972.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
______________________________________________________________________
Upstream point/station elevation =   678.100(Ft.)
Downstream point/station elevation =   674.100(Ft.)
Pipe length  =      7.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =      2.309(CFS)
Nearest computed pipe diameter  =       6.00(In.)
```



```
Calculated individual pipe flow  =      2.309(CFS)
Normal flow depth in pipe =     3.16(In.)
Flow top width inside pipe =     5.99(In.)
Critical depth could not be calculated.
Pipe flow velocity =     22.06(Ft/s)
Travel time through pipe =     0.01 min.
Time of concentration (TC) =     10.20 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      972.000 to Point/Station      972.000
**** CONFLUENCE OF MINOR STREAMS ****
______________________________________________________________________
Along Main Stream number: 1 in normal stream number 2
Stream flow area =       1.240(Ac.)
Runoff from this stream =       2.309(CFS)
Time of concentration =    10.20 min.
Rainfall intensity =       3.350(In/Hr)


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Process from Point/Station      960.000 to Point/Station      962.000
**** INITIAL AREA EVALUATION ****
______________________________________________________________________
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[SINGLE FAMILY area type                  ]
Initial subarea flow distance  =    70.000(Ft.)
Highest elevation =  697.000(Ft.)
Lowest elevation =  695.000(Ft.)
Elevation difference =     2.000(Ft.)
Time of concentration calculated by the urban
areas overland flow method (App X-C) =       5.84 min.
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.5500)*(  70.000^.5)/( 2.857^(1/3)]=    5.84
Rainfall intensity (I) =      4.125(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.550
Subarea runoff =       0.340(CFS)
Total initial stream area =        0.150(Ac.)


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Process from Point/Station      962.000 to Point/Station      970.000
**** STREET FLOW TRAVEL TIME + SUBAREA FLOW ADDITION ****
______________________________________________________________________
Top of street segment elevation =   695.000(Ft.)
End of street segment elevation =   685.000(Ft.)
Length of street segment  =   350.000(Ft.)
Height of curb above gutter flowline  =     6.0(In.)
Width of half street (curb to crown)  =  16.000(Ft.)
Distance from crown to crossfall grade break  =  10.000(Ft.)
Slope from gutter to grade break (v/hz) =   0.020
Slope from grade break to crown (v/hz)  =   0.020
Street flow is on [1] side(s) of the street
Distance from curb to property line  =  12.000(Ft.)
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```
Slope from curb to property line (v/hz) =   0.020
Gutter width =   1.500(Ft.)
Gutter hike from flowline =  1.500(In.)
 Manning's N in gutter =  0.0150
 Manning's N from gutter to grade break =  0.0180
 Manning's N from grade break to crown =  0.0180
Estimated mean flow rate at midpoint of street =      1.520(CFS)
Depth of flow =   0.237(Ft.), Average velocity =   2.651(Ft/s)
Streetflow hydraulics at midpoint of street travel:
Halfstreet flow width =   7.087(Ft.)
Flow velocity =   2.65(Ft/s)
Travel time =    2.20 min.     TC =    8.04  min.
 Adding area flow to street
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[SINGLE FAMILY area type                    ]
Rainfall intensity =      3.653(In/Hr) for a   100.0 year storm
Runoff coefficient used for sub-area, Rational method,Q=KCIA, C = 0.550
Subarea runoff =      2.090(CFS) for    1.040(Ac.)
Total runoff =      2.430(CFS)  Total area =        1.19(Ac.)
Street flow at end of street =      2.430(CFS)
Half street flow at end of street =      2.430(CFS)
Depth of flow =   0.269(Ft.), Average velocity =   2.938(Ft/s)
Flow width (from curb towards crown)=   8.693(Ft.)


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Process from Point/Station      970.000 to Point/Station      972.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
______________________________________________________________________
Upstream point/station elevation =   678.100(Ft.)
Downstream point/station elevation =   674.100(Ft.)
Pipe length  =    25.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =      2.430(CFS)
Nearest computed pipe diameter  =      9.00(In.)
Calculated individual pipe flow  =      2.430(CFS)
Normal flow depth in pipe =    3.77(In.)
Flow top width inside pipe =    8.88(In.)
Critical Depth =    8.25(In.)
Pipe flow velocity =     13.83(Ft/s)
Travel time through pipe =    0.03 min.
Time of concentration (TC) =     8.07 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      972.000 to Point/Station      972.000
**** CONFLUENCE OF MINOR STREAMS ****
______________________________________________________________________
Along Main Stream number: 1 in normal stream number 3
Stream flow area =      1.190(Ac.)
Runoff from this stream =      2.430(CFS)
Time of concentration =    8.07 min.
Rainfall intensity =     3.648(In/Hr)
Summary of stream data:
```



```
Stream   Flow rate      TC            Rainfall Intensity
 No.       (CFS)       (min)                 (In/Hr)


1       30.492     14.58                  2.937
2        2.309     10.20                  3.350
3        2.430      8.07                  3.648
Qmax(1) =
            1.000 *     1.000 *     30.492) +
            0.877 *     1.000 *      2.309) +
            0.805 *     1.000 *      2.430) + =       34.472
Qmax(2) =
            1.000 *     0.700 *     30.492) +
            1.000 *     1.000 *      2.309) +
            0.918 *     1.000 *      2.430) + =       25.870
Qmax(3) =
            1.000 *     0.553 *     30.492) +
            1.000 *     0.791 *      2.309) +
            1.000 *     1.000 *      2.430) + =       21.132

Total of 3 streams to confluence:
Flow rates before confluence point:
      30.492       2.309       2.430
Maximum flow rates at confluence using above data:
       34.472      25.870      21.132
Area of streams before confluence:
       18.250       1.240       1.190
Results of confluence:
Total flow rate =      34.472(CFS)
Time of concentration =     14.578 min.
Effective stream area after confluence =     20.680(Ac.)


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Process from Point/Station      972.000 to Point/Station      986.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
______________________________________________________________________
Upstream point/station elevation =   674.000(Ft.)
Downstream point/station elevation =   669.000(Ft.)
Pipe length  =   349.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     34.472(CFS)
Nearest computed pipe diameter  =     27.00(In.)
Calculated individual pipe flow  =     34.472(CFS)
Normal flow depth in pipe =   20.60(In.)
Flow top width inside pipe =   22.96(In.)
Critical Depth =   24.00(In.)
Pipe flow velocity =     10.59(Ft/s)
Travel time through pipe =    0.55 min.
Time of concentration (TC) =    15.13 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      986.000 to Point/Station      986.000
**** CONFLUENCE OF MINOR STREAMS ****
______________________________________________________________________
Along Main Stream number: 1 in normal stream number 1
Stream flow area =     20.680(Ac.)
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Runoff from this stream =     34.472(CFS)
Time of concentration =   15.13 min.
Rainfall intensity =     2.895(In/Hr)


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Process from Point/Station      974.000 to Point/Station      976.000
**** INITIAL AREA EVALUATION ****

Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[SINGLE FAMILY area type                    ]
Initial subarea flow distance  =  100.000(Ft.)
Highest elevation =  689.400(Ft.)
Lowest elevation =  687.400(Ft.)
Elevation difference =    2.000(Ft.)
Time of concentration calculated by the urban
areas overland flow method (App X-C) =     7.86 min.
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.5500)*( 100.000^.5)/( 2.000^(1/3)]=   7.86
Rainfall intensity (I) =      3.684(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.550
Subarea runoff =      0.223(CFS)
Total initial stream area =        0.110(Ac.)


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Process from Point/Station      976.000 to Point/Station      978.000
**** STREET FLOW TRAVEL TIME + SUBAREA FLOW ADDITION ****

Top of street segment elevation =   687.400(Ft.)
End of street segment elevation =   680.500(Ft.)
Length of street segment  =   300.000(Ft.)
Height of curb above gutter flowline  =    6.0(In.)
Width of half street (curb to crown)  =  16.000(Ft.)
Distance from crown to crossfall grade break  =  10.000(Ft.)
Slope from gutter to grade break (v/hz) =   0.020
Slope from grade break to crown (v/hz)  =   0.020
Street flow is on [1] side(s) of the street
Distance from curb to property line  =  12.000(Ft.)
Slope from curb to property line (v/hz) =   0.020
Gutter width =   1.500(Ft.)
Gutter hike from flowline =  1.500(In.)
 Manning's N in gutter =  0.0150
 Manning's N from gutter to grade break =  0.0180
 Manning's N from grade break to crown =  0.0180
Estimated mean flow rate at midpoint of street =       1.347(CFS)
Depth of flow =   0.236(Ft.), Average velocity =   2.372(Ft/s)
Streetflow hydraulics at midpoint of street travel:
Halfstreet flow width =   7.048(Ft.)
Flow velocity =   2.37(Ft/s)
Travel time =    2.11 min.     TC =    9.97  min.
 Adding area flow to street
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
```



```
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[SINGLE FAMILY area type                    ]
Rainfall intensity =      3.378(In/Hr) for a   100.0 year storm
Runoff coefficient used for sub-area, Rational method,Q=KCIA, C = 0.550
Subarea runoff =      2.062(CFS) for     1.110(Ac.)
Total runoff =      2.285(CFS)  Total area =         1.22(Ac.)
Street flow at end of street =       2.285(CFS)
Half street flow at end of street =       2.285(CFS)
Depth of flow =   0.272(Ft.), Average velocity =   2.664(Ft/s)
Flow width (from curb towards crown)=   8.868(Ft.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      978.000 to Point/Station      986.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****

Upstream point/station elevation =   673.000(Ft.)
Downstream point/station elevation =   669.000(Ft.)
Pipe length   =      7.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow   =      2.285(CFS)
Nearest computed pipe diameter   =       6.00(In.)
Calculated individual pipe flow   =      2.285(CFS)
Normal flow depth in pipe =     3.13(In.)
Flow top width inside pipe =     5.99(In.)
Critical depth could not be calculated.
Pipe flow velocity =      22.00(Ft/s)
Travel time through pipe =    0.01 min.
Time of concentration (TC) =     9.97 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      986.000 to Point/Station      986.000
**** CONFLUENCE OF MINOR STREAMS ****

Along Main Stream number: 1 in normal stream number 2
Stream flow area =      1.220(Ac.)
Runoff from this stream =     2.285(CFS)
Time of concentration =     9.97 min.
Rainfall intensity =     3.378(In/Hr)


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Process from Point/Station      980.000 to Point/Station      982.000
**** INITIAL AREA EVALUATION ****

Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[SINGLE FAMILY area type                    ]
Initial subarea flow distance  =  100.000(Ft.)
Highest elevation =  689.500(Ft.)
Lowest elevation =  687.500(Ft.)
Elevation difference =    2.000(Ft.)
Time of concentration calculated by the urban
areas overland flow method (App X-C) =     7.86 min.
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```
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.5500)*( 100.000^.5)/( 2.000^(1/3)]=   7.86
Rainfall intensity (I) =       3.684(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.550
Subarea runoff =       0.203(CFS)
Total initial stream area =        0.100(Ac.)


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Process from Point/Station      982.000 to Point/Station      984.000
**** STREET FLOW TRAVEL TIME + SUBAREA FLOW ADDITION ****
______________________________________________________________________
Top of street segment elevation =   687.500(Ft.)
End of street segment elevation =   680.500(Ft.)
Length of street segment  =   300.000(Ft.)
Height of curb above gutter flowline  =    6.0(In.)
Width of half street (curb to crown)  =  16.000(Ft.)
Distance from crown to crossfall grade break  =  10.000(Ft.)
Slope from gutter to grade break (v/hz) =    0.020
Slope from grade break to crown (v/hz)  =    0.020
Street flow is on [1] side(s) of the street
Distance from curb to property line  =  12.000(Ft.)
Slope from curb to property line (v/hz) =    0.020
Gutter width =    1.500(Ft.)
Gutter hike from flowline =  1.500(In.)
 Manning's N in gutter =  0.0150
 Manning's N from gutter to grade break =  0.0180
 Manning's N from grade break to crown =  0.0180
Estimated mean flow rate at midpoint of street =      1.732(CFS)
Depth of flow =   0.252(Ft.), Average velocity =   2.519(Ft/s)
Streetflow hydraulics at midpoint of street travel:
Halfstreet flow width =    7.852(Ft.)
Flow velocity =    2.52(Ft/s)
Travel time =     1.99 min.      TC =     9.84  min.
 Adding area flow to street
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[SINGLE FAMILY area type                    ]
Rainfall intensity =      3.394(In/Hr) for a   100.0 year storm
Runoff coefficient used for sub-area, Rational method,Q=KCIA, C = 0.550
Subarea runoff =       2.818(CFS) for    1.510(Ac.)
Total runoff =       3.021(CFS)  Total area =        1.61(Ac.)
Street flow at end of street =       3.021(CFS)
Half street flow at end of street =       3.021(CFS)
Depth of flow =   0.294(Ft.), Average velocity =   2.855(Ft/s)
Flow width (from curb towards crown)=   9.933(Ft.)


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Process from Point/Station      984.000 to Point/Station      986.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
______________________________________________________________________
Upstream point/station elevation =   673.000(Ft.)
Downstream point/station elevation =   669.000(Ft.)
Pipe length  =     25.00(Ft.)   Manning's N = 0.013
```



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No. of pipes = 1  Required pipe flow  =      3.021(CFS)
Nearest computed pipe diameter  =       9.00(In.)
Calculated individual pipe flow  =      3.021(CFS)
Normal flow depth in pipe =     4.27(In.)
Flow top width inside pipe =     8.99(In.)
Critical depth could not be calculated.
Pipe flow velocity =      14.63(Ft/s)
Travel time through pipe =     0.03 min.
Time of concentration (TC) =      9.87 min.


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Process from Point/Station      986.000 to Point/Station      986.000
**** CONFLUENCE OF MINOR STREAMS ****
______________________________________________________________________
Along Main Stream number: 1 in normal stream number 3
Stream flow area =      1.610(Ac.)
Runoff from this stream =      3.021(CFS)
Time of concentration =     9.87 min.
Rainfall intensity =     3.390(In/Hr)
Summary of stream data:

Stream   Flow rate      TC             Rainfall Intensity
 No.       (CFS)      (min)                   (In/Hr)


1       34.472     15.13                  2.895
2        2.285      9.97                  3.378
3        3.021      9.87                  3.390
Qmax(1) =
           1.000 *    1.000 *    34.472) +
           0.857 *    1.000 *     2.285) +
           0.854 *    1.000 *     3.021) + =      39.012
Qmax(2) =
           1.000 *    0.659 *    34.472) +
           1.000 *    1.000 *     2.285) +
           0.996 *    1.000 *     3.021) + =      28.016
Qmax(3) =
           1.000 *    0.653 *    34.472) +
           1.000 *    0.990 *     2.285) +
           1.000 *    1.000 *     3.021) + =      27.777

Total of 3 streams to confluence:
Flow rates before confluence point:
      34.472      2.285       3.021
Maximum flow rates at confluence using above data:
       39.012      28.016      27.777
Area of streams before confluence:
       20.680       1.220       1.610
Results of confluence:
Total flow rate =     39.012(CFS)
Time of concentration =     15.128 min.
Effective stream area after confluence =     23.510(Ac.)


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Process from Point/Station      986.000 to Point/Station      992.000
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**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
______________________________________________________________________
Upstream point/station elevation =   668.200(Ft.)
Downstream point/station elevation =   667.000(Ft.)
Pipe length  =    86.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    39.012(CFS)
Nearest computed pipe diameter  =     27.00(In.)
Calculated individual pipe flow  =    39.012(CFS)
Normal flow depth in pipe =   24.30(In.)
Flow top width inside pipe =   16.20(In.)
Critical Depth =   24.94(In.)
Pipe flow velocity =     10.34(Ft/s)
Travel time through pipe =    0.14 min.
Time of concentration (TC) =    15.27 min.


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Process from Point/Station      992.000 to Point/Station      992.000
**** CONFLUENCE OF MAIN STREAMS ****
______________________________________________________________________
The following data inside Main Stream is listed:
In Main Stream number: 1
Stream flow area =     23.510(Ac.)
Runoff from this stream =     39.012(CFS)
Time of concentration =   15.27 min.
Rainfall intensity =     2.885(In/Hr)
Program is now starting with Main Stream No. 2


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Process from Point/Station      901.000 to Point/Station      903.000
**** INITIAL AREA EVALUATION ****
______________________________________________________________________
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[SINGLE FAMILY area type                 ]
Initial subarea flow distance  =  100.000(Ft.)
Highest elevation =  744.000(Ft.)
Lowest elevation =  742.000(Ft.)
Elevation difference =     2.000(Ft.)
Time of concentration calculated by the urban
areas overland flow method (App X-C) =      7.86 min.
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.5500)*( 100.000^.5)/( 2.000^(1/3)]=   7.86
Rainfall intensity (I) =      3.684(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.550
Subarea runoff =      0.344(CFS)
Total initial stream area =       0.170(Ac.)


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Process from Point/Station      903.000 to Point/Station      905.000
**** STREET FLOW TRAVEL TIME + SUBAREA FLOW ADDITION ****
______________________________________________________________________
Top of street segment elevation =   742.000(Ft.)
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End of street segment elevation =   724.000(Ft.)
Length of street segment  =   520.000(Ft.)
Height of curb above gutter flowline  =     6.0(In.)
Width of half street (curb to crown)  =  16.000(Ft.)
Distance from crown to crossfall grade break  =  10.000(Ft.)
Slope from gutter to grade break (v/hz) =   0.020
Slope from grade break to crown (v/hz)  =   0.020
Street flow is on [1] side(s) of the street
Distance from curb to property line  =  12.000(Ft.)
Slope from curb to property line (v/hz) =   0.020
Gutter width =   1.500(Ft.)
Gutter hike from flowline =  1.500(In.)
 Manning's N in gutter =  0.0150
 Manning's N from gutter to grade break =  0.0180
 Manning's N from grade break to crown =  0.0180
Estimated mean flow rate at midpoint of street =      3.090(CFS)
Depth of flow =   0.280(Ft.), Average velocity =   3.342(Ft/s)
Streetflow hydraulics at midpoint of street travel:
Halfstreet flow width =   9.238(Ft.)
Flow velocity =   3.34(Ft/s)
Travel time =    2.59 min.     TC =   10.45  min.
 Adding area flow to street
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[SINGLE FAMILY area type                 ]
Rainfall intensity =      3.321(In/Hr) for a   100.0 year storm
Runoff coefficient used for sub-area, Rational method,Q=KCIA, C = 0.550
Subarea runoff =      4.950(CFS) for    2.710(Ac.)
Total runoff =      5.294(CFS)  Total area =        2.88(Ac.)
Street flow at end of street =      5.294(CFS)
Half street flow at end of street =      5.294(CFS)
Depth of flow =   0.325(Ft.), Average velocity =   3.785(Ft/s)
Flow width (from curb towards crown)=  11.521(Ft.)


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Process from Point/Station      905.000 to Point/Station      907.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
______________________________________________________________________
Upstream point/station elevation =   715.000(Ft.)
Downstream point/station elevation =   713.000(Ft.)
Pipe length  =     7.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     5.294(CFS)
Nearest computed pipe diameter  =      9.00(In.)
Calculated individual pipe flow  =      5.294(CFS)
Normal flow depth in pipe =    5.02(In.)
Flow top width inside pipe =    8.94(In.)
Critical depth could not be calculated.
Pipe flow velocity =     20.91(Ft/s)
Travel time through pipe =    0.01 min.
Time of concentration (TC) =    10.46 min.


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Process from Point/Station      907.000 to Point/Station      919.000
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**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
______________________________________________________________________
Upstream point/station elevation =   713.000(Ft.)
Downstream point/station elevation =   707.500(Ft.)
Pipe length  =   160.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =      5.294(CFS)
Nearest computed pipe diameter  =      12.00(In.)
Calculated individual pipe flow  =      5.294(CFS)
Normal flow depth in pipe =    8.13(In.)
Flow top width inside pipe =   11.22(In.)
Critical Depth =   11.17(In.)
Pipe flow velocity =      9.35(Ft/s)
Travel time through pipe =    0.29 min.
Time of concentration (TC) =    10.74 min.


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Process from Point/Station      919.000 to Point/Station      919.000
**** CONFLUENCE OF MINOR STREAMS ****
______________________________________________________________________
Along Main Stream number: 2 in normal stream number 1
Stream flow area =      2.880(Ac.)
Runoff from this stream =      5.294(CFS)
Time of concentration =    10.74 min.
Rainfall intensity =     3.288(In/Hr)


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Process from Point/Station      909.000 to Point/Station      911.000
**** INITIAL AREA EVALUATION ****
______________________________________________________________________
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[SINGLE FAMILY area type                        ]
Initial subarea flow distance  =  100.000(Ft.)
Highest elevation =  744.000(Ft.)
Lowest elevation =  742.000(Ft.)
Elevation difference =    2.000(Ft.)
Time of concentration calculated by the urban
areas overland flow method (App X-C) =     7.86 min.
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.5500)*( 100.000^.5)/( 2.000^(1/3)]=   7.86
Rainfall intensity (I) =      3.684(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.550
Subarea runoff =      0.405(CFS)
Total initial stream area =       0.200(Ac.)


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Process from Point/Station      911.000 to Point/Station      913.000
**** STREET FLOW TRAVEL TIME + SUBAREA FLOW ADDITION ****
______________________________________________________________________
Top of street segment elevation =   742.000(Ft.)
End of street segment elevation =   717.900(Ft.)
Length of street segment  =   400.000(Ft.)
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Height of curb above gutter flowline  =     6.0(In.)
Width of half street (curb to crown)  =  16.000(Ft.)
Distance from crown to crossfall grade break  =  10.000(Ft.)
Slope from gutter to grade break (v/hz) =   0.020
Slope from grade break to crown (v/hz)  =   0.020
Street flow is on [1] side(s) of the street
Distance from curb to property line  =  12.000(Ft.)
Slope from curb to property line (v/hz) =   0.020
Gutter width =   1.500(Ft.)
Gutter hike from flowline =  1.500(In.)
 Manning's N in gutter =  0.0150
 Manning's N from gutter to grade break  =  0.0180
 Manning's N from grade break to crown =  0.0180
Estimated mean flow rate at midpoint of street =      1.631(CFS)
Depth of flow =   0.218(Ft.), Average velocity =   3.615(Ft/s)
Streetflow hydraulics at midpoint of street travel:
Halfstreet flow width =   6.164(Ft.)
Flow velocity =   3.61(Ft/s)
Travel time =    1.84 min.      TC =    9.70  min.
 Adding area flow to street
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[SINGLE FAMILY area type                        ]
Rainfall intensity =      3.411(In/Hr) for a   100.0 year storm
Runoff coefficient used for sub-area, Rational method,Q=KCIA, C = 0.550
Subarea runoff =      2.270(CFS) for    1.210(Ac.)
Total runoff =      2.675(CFS)  Total area =       1.41(Ac.)
Street flow at end of street =      2.675(CFS)
Half street flow at end of street =      2.675(CFS)
Depth of flow =   0.249(Ft.), Average velocity =   4.012(Ft/s)
Flow width (from curb towards crown)=   7.717(Ft.)


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Process from Point/Station      913.000 to Point/Station      919.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
______________________________________________________________________
Upstream point/station elevation =   709.000(Ft.)
Downstream point/station elevation =   707.500(Ft.)
Pipe length  =    25.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =      2.675(CFS)
Nearest computed pipe diameter  =       9.00(In.)
Calculated individual pipe flow  =      2.675(CFS)
Normal flow depth in pipe =    5.34(In.)
Flow top width inside pipe =    8.84(In.)
Critical Depth =    8.44(In.)
Pipe flow velocity =      9.80(Ft/s)
Travel time through pipe =    0.04 min.
Time of concentration (TC) =     9.74 min.


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Process from Point/Station      919.000 to Point/Station      919.000
**** CONFLUENCE OF MINOR STREAMS ****
______________________________________________________________________
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Along Main Stream number: 2 in normal stream number 2
Stream flow area =      1.410(Ac.)
Runoff from this stream =      2.675(CFS)
Time of concentration =    9.74 min.
Rainfall intensity =     3.406(In/Hr)
Summary of stream data:

Stream   Flow rate     TC             Rainfall Intensity
 No.       (CFS)      (min)                 (In/Hr)


1        5.294    10.74                 3.288
2        2.675     9.74                 3.406
Qmax(1) =
           1.000 *    1.000 *     5.294) +
           0.965 *    1.000 *     2.675) + =       7.877
Qmax(2) =
           1.000 *    0.907 *     5.294) +
           1.000 *    1.000 *     2.675) + =       7.478

Total of 2 streams to confluence:
Flow rates before confluence point:
      5.294       2.675
Maximum flow rates at confluence using above data:
       7.877       7.478
Area of streams before confluence:
       2.880        1.410
Results of confluence:
Total flow rate =       7.877(CFS)
Time of concentration =    10.742 min.
Effective stream area after confluence =       4.290(Ac.)


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Process from Point/Station      919.000 to Point/Station      929.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****

Upstream point/station elevation =   707.500(Ft.)
Downstream point/station elevation =   696.200(Ft.)
Pipe length  =   446.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =      7.877(CFS)
Nearest computed pipe diameter  =      15.00(In.)
Calculated individual pipe flow  =      7.877(CFS)
Normal flow depth in pipe =     9.84(In.)
Flow top width inside pipe =    14.25(In.)
Critical Depth =    13.30(In.)
Pipe flow velocity =       9.24(Ft/s)
Travel time through pipe =     0.80 min.
Time of concentration (TC) =     11.55 min.


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Process from Point/Station      929.000 to Point/Station      929.000
**** CONFLUENCE OF MINOR STREAMS ****

Along Main Stream number: 2 in normal stream number 1
Stream flow area =      4.290(Ac.)
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Runoff from this stream =      7.877(CFS)
Time of concentration =   11.55 min.
Rainfall intensity =     3.203(In/Hr)


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Process from Point/Station      921.000 to Point/Station      923.000
**** INITIAL AREA EVALUATION ****

Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[SINGLE FAMILY area type                    ]
Initial subarea flow distance  =  100.000(Ft.)
Highest elevation =  744.000(Ft.)
Lowest elevation =  742.000(Ft.)
Elevation difference =    2.000(Ft.)
Time of concentration calculated by the urban
areas overland flow method (App X-C) =      7.86 min.
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.5500)*( 100.000^.5)/( 2.000^(1/3)]=   7.86
Rainfall intensity (I) =      3.684(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.550
Subarea runoff =      0.365(CFS)
Total initial stream area =        0.180(Ac.)


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Process from Point/Station      923.000 to Point/Station      925.000
**** STREET FLOW TRAVEL TIME + SUBAREA FLOW ADDITION ****

Top of street segment elevation =   742.000(Ft.)
End of street segment elevation =   706.000(Ft.)
Length of street segment  =   770.000(Ft.)
Height of curb above gutter flowline  =     6.0(In.)
Width of half street (curb to crown)  =  16.000(Ft.)
Distance from crown to crossfall grade break  =  10.000(Ft.)
Slope from gutter to grade break (v/hz) =   0.020
Slope from grade break to crown (v/hz)  =   0.020
Street flow is on [1] side(s) of the street
Distance from curb to property line  =  12.000(Ft.)
Slope from curb to property line (v/hz) =   0.020
Gutter width =   1.500(Ft.)
Gutter hike from flowline =  1.500(In.)
 Manning's N in gutter =  0.0150
 Manning's N from gutter to grade break =  0.0180
 Manning's N from grade break to crown =  0.0180
Estimated mean flow rate at midpoint of street =       2.897(CFS)
Depth of flow =    0.264(Ft.), Average velocity =    3.700(Ft/s)
Streetflow hydraulics at midpoint of street travel:
Halfstreet flow width =    8.437(Ft.)
Flow velocity =    3.70(Ft/s)
Travel time =     3.47 min.     TC =    11.33  min.
 Adding area flow to street
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
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```
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[SINGLE FAMILY area type                ]
Rainfall intensity =      3.225(In/Hr) for a   100.0 year storm
Runoff coefficient used for sub-area, Rational method,Q=KCIA, C = 0.550
Subarea runoff =      4.435(CFS) for    2.500(Ac.)
Total runoff =      4.800(CFS)  Total area =        2.68(Ac.)
Street flow at end of street =      4.800(CFS)
Half street flow at end of street =      4.800(CFS)
Depth of flow =   0.303(Ft.), Average velocity =   4.151(Ft/s)
Flow width (from curb towards crown)=  10.416(Ft.)


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Process from Point/Station      925.000 to Point/Station      929.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****

Upstream point/station elevation =   698.200(Ft.)
Downstream point/station elevation =   696.200(Ft.)
Pipe length  =     25.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     4.800(CFS)
Nearest computed pipe diameter  =     12.00(In.)
Calculated individual pipe flow  =     4.800(CFS)
Normal flow depth in pipe =     5.83(In.)
Flow top width inside pipe =   12.00(In.)
Critical Depth =   10.87(In.)
Pipe flow velocity =     12.67(Ft/s)
Travel time through pipe =    0.03 min.
Time of concentration (TC) =    11.36 min.


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Process from Point/Station      929.000 to Point/Station      929.000
**** CONFLUENCE OF MINOR STREAMS ****

Along Main Stream number: 2 in normal stream number 2
Stream flow area =      2.680(Ac.)
Runoff from this stream =      4.800(CFS)
Time of concentration =   11.36 min.
Rainfall intensity =     3.222(In/Hr)


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Process from Point/Station      915.000 to Point/Station      917.000
**** INITIAL AREA EVALUATION ****

Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[SINGLE FAMILY area type                ]
Initial subarea flow distance  =  100.000(Ft.)
Highest elevation =  726.000(Ft.)
Lowest elevation =  724.000(Ft.)
Elevation difference =     2.000(Ft.)
Time of concentration calculated by the urban
areas overland flow method (App X-C) =     7.86 min.
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TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.5500)*( 100.000^.5)/( 2.000^(1/3)]=   7.86
Rainfall intensity (I) =      3.684(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.550
Subarea runoff =      0.426(CFS)
Total initial stream area =        0.210(Ac.)


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Process from Point/Station      917.000 to Point/Station      927.000
**** STREET FLOW TRAVEL TIME + SUBAREA FLOW ADDITION ****

Top of street segment elevation =   724.000(Ft.)
End of street segment elevation =   706.000(Ft.)
Length of street segment  =   555.000(Ft.)
Height of curb above gutter flowline  =    6.0(In.)
Width of half street (curb to crown)  =  16.000(Ft.)
Distance from crown to crossfall grade break  =  10.000(Ft.)
Slope from gutter to grade break (v/hz) =   0.020
Slope from grade break to crown (v/hz)  =   0.020
Street flow is on [1] side(s) of the street
Distance from curb to property line  =  12.000(Ft.)
Slope from curb to property line (v/hz) =   0.020
Gutter width =   1.500(Ft.)
Gutter hike from flowline =  1.500(In.)
 Manning's N in gutter =  0.0150
 Manning's N from gutter to grade break =  0.0180
 Manning's N from grade break to crown =  0.0180
Estimated mean flow rate at midpoint of street =      1.580(CFS)
Depth of flow =   0.235(Ft.), Average velocity =   2.809(Ft/s)
Streetflow hydraulics at midpoint of street travel:
Halfstreet flow width =   7.009(Ft.)
Flow velocity =   2.81(Ft/s)
Travel time =    3.29 min.     TC =   11.15  min.
 Adding area flow to street
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[SINGLE FAMILY area type                ]
Rainfall intensity =      3.244(In/Hr) for a   100.0 year storm
Runoff coefficient used for sub-area, Rational method,Q=KCIA, C = 0.550
Subarea runoff =      2.034(CFS) for    1.140(Ac.)
Total runoff =      2.459(CFS)  Total area =        1.35(Ac.)
Street flow at end of street =      2.459(CFS)
Half street flow at end of street =      2.459(CFS)
Depth of flow =   0.265(Ft.), Average velocity =   3.095(Ft/s)
Flow width (from curb towards crown)=   8.506(Ft.)


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Process from Point/Station      927.000 to Point/Station      929.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****

Upstream point/station elevation =   698.200(Ft.)
Downstream point/station elevation =   696.200(Ft.)
Pipe length  =      7.00(Ft.)   Manning's N = 0.013
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No. of pipes = 1  Required pipe flow  =     2.459(CFS)
Nearest computed pipe diameter  =     6.00(In.)
Calculated individual pipe flow  =     2.459(CFS)
Normal flow depth in pipe =     4.14(In.)
Flow top width inside pipe =    5.55(In.)
Critical depth could not be calculated.
Pipe flow velocity =      17.05(Ft/s)
Travel time through pipe =    0.01 min.
Time of concentration (TC) =    11.16 min.


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Process from Point/Station      929.000 to Point/Station      929.000
**** CONFLUENCE OF MINOR STREAMS ****

Along Main Stream number: 2 in normal stream number 3
Stream flow area =      1.350(Ac.)
Runoff from this stream =      2.459(CFS)
Time of concentration =   11.16 min.
Rainfall intensity =     3.243(In/Hr)
Summary of stream data:

Stream   Flow rate      TC            Rainfall Intensity
 No.       (CFS)       (min)                 (In/Hr)


1        7.877     11.55                 3.203
2        4.800     11.36                 3.222
3        2.459     11.16                 3.243
Qmax(1) =
           1.000 *    1.000 *    7.877) +
           0.994 *    1.000 *    4.800) +
           0.988 *    1.000 *    2.459) + =      15.077
Qmax(2) =
           1.000 *    0.984 *    7.877) +
           1.000 *    1.000 *    4.800) +
           0.994 *    1.000 *    2.459) + =      14.991
Qmax(3) =
           1.000 *    0.966 *    7.877) +
           1.000 *    0.982 *    4.800) +
           1.000 *    1.000 *    2.459) + =      14.784

Total of 3 streams to confluence:
Flow rates before confluence point:
      7.877      4.800      2.459
Maximum flow rates at confluence using above data:
      15.077      14.991      14.784
Area of streams before confluence:
       4.290       2.680       1.350
Results of confluence:
Total flow rate =     15.077(CFS)
Time of concentration =    11.547 min.
Effective stream area after confluence =      8.320(Ac.)


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Process from Point/Station      929.000 to Point/Station      937.000
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**** PIPEFLOW TRAVEL TIME (Program estimated size) ****

Upstream point/station elevation =   695.700(Ft.)
Downstream point/station elevation =   693.570(Ft.)
Pipe length  =     60.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    15.077(CFS)
Nearest computed pipe diameter  =    18.00(In.)
Calculated individual pipe flow  =    15.077(CFS)
Normal flow depth in pipe =   11.77(In.)
Flow top width inside pipe =   17.13(In.)
Critical Depth =   16.89(In.)
Pipe flow velocity =      12.33(Ft/s)
Travel time through pipe =    0.08 min.
Time of concentration (TC) =    11.63 min.


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Process from Point/Station      937.000 to Point/Station      939.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****

Upstream point/station elevation =   693.240(Ft.)
Downstream point/station elevation =   686.810(Ft.)
Pipe length  =     70.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    15.077(CFS)
Nearest computed pipe diameter  =    15.00(In.)
Calculated individual pipe flow  =    15.077(CFS)
Normal flow depth in pipe =    9.87(In.)
Flow top width inside pipe =   14.23(In.)
Critical depth could not be calculated.
Pipe flow velocity =      17.60(Ft/s)
Travel time through pipe =    0.07 min.
Time of concentration (TC) =    11.69 min.


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Process from Point/Station      939.000 to Point/Station      939.000
**** CONFLUENCE OF MINOR STREAMS ****

Along Main Stream number: 2 in normal stream number 1
Stream flow area =      8.320(Ac.)
Runoff from this stream =     15.077(CFS)
Time of concentration =   11.69 min.
Rainfall intensity =     3.188(In/Hr)


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Process from Point/Station      931.000 to Point/Station      933.000
**** INITIAL AREA EVALUATION ****

Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[SINGLE FAMILY area type                    ]
Initial subarea flow distance  =  100.000(Ft.)
Highest elevation =  750.500(Ft.)
Lowest elevation =  748.500(Ft.)
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Elevation difference =    2.000(Ft.)
Time of concentration calculated by the urban
areas overland flow method (App X-C) =      7.86 min.
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.5500)*( 100.000^.5)/( 2.000^(1/3)]=   7.86
Rainfall intensity (I) =      3.684(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.550
Subarea runoff =      0.304(CFS)
Total initial stream area =       0.150(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      933.000 to Point/Station      935.000
**** STREET FLOW TRAVEL TIME + SUBAREA FLOW ADDITION ****
______________________________________________________________________
Top of street segment elevation =   748.500(Ft.)
End of street segment elevation =   698.000(Ft.)
Length of street segment  =   710.000(Ft.)
Height of curb above gutter flowline  =     6.0(In.)
Width of half street (curb to crown)  =  16.000(Ft.)
Distance from crown to crossfall grade break  =  10.000(Ft.)
Slope from gutter to grade break (v/hz) =   0.020
Slope from grade break to crown (v/hz)  =   0.020
Street flow is on [1] side(s) of the street
Distance from curb to property line  =  12.000(Ft.)
Slope from curb to property line (v/hz) =   0.020
Gutter width =   1.500(Ft.)
Gutter hike from flowline =  1.500(In.)
 Manning's N in gutter =  0.0150
 Manning's N from gutter to grade break =  0.0180
 Manning's N from grade break to crown =  0.0180
Estimated mean flow rate at midpoint of street =       2.624(CFS)
Depth of flow =   0.243(Ft.), Average velocity =   4.264(Ft/s)
Streetflow hydraulics at midpoint of street travel:
Halfstreet flow width =    7.377(Ft.)
Flow velocity =    4.26(Ft/s)
Travel time =    2.78 min.     TC =   10.63  min.
 Adding area flow to street
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[SINGLE FAMILY area type                    ]
Rainfall intensity =      3.300(In/Hr) for a   100.0 year storm
Runoff coefficient used for sub-area, Rational method,Q=KCIA, C = 0.550
Subarea runoff =      4.156(CFS) for    2.290(Ac.)
Total runoff =      4.460(CFS)  Total area =        2.44(Ac.)
Street flow at end of street =      4.460(CFS)
Half street flow at end of street =      4.460(CFS)
Depth of flow =   0.280(Ft.), Average velocity =   4.798(Ft/s)
Flow width (from curb towards crown)=   9.265(Ft.)


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Process from Point/Station      994.000 to Point/Station      935.000
**** SUBAREA FLOW ADDITION ****
______________________________________________________________________
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User specified 'C' value of 0.700 given for subarea
Time of concentration =     10.63 min.
Rainfall intensity =      3.300(In/Hr) for a   100.0 year storm
Runoff coefficient used for sub-area, Rational method,Q=KCIA, C = 0.700
Subarea runoff =      0.785(CFS) for    0.340(Ac.)
Total runoff =      5.246(CFS)  Total area =        2.78(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      935.000 to Point/Station      939.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
______________________________________________________________________
Upstream point/station elevation =   690.810(Ft.)
Downstream point/station elevation =   686.810(Ft.)
Pipe length  =    27.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =      5.246(CFS)
Nearest computed pipe diameter  =       9.00(In.)
Calculated individual pipe flow  =      5.246(CFS)
Normal flow depth in pipe =     6.22(In.)
Flow top width inside pipe =    8.31(In.)
Critical depth could not be calculated.
Pipe flow velocity =      16.10(Ft/s)
Travel time through pipe =    0.03 min.
Time of concentration (TC) =    10.66 min.


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Process from Point/Station      939.000 to Point/Station      939.000
**** CONFLUENCE OF MINOR STREAMS ****
______________________________________________________________________
Along Main Stream number: 2 in normal stream number 2
Stream flow area =      2.780(Ac.)
Runoff from this stream =       5.246(CFS)
Time of concentration =    10.66 min.
Rainfall intensity =     3.297(In/Hr)
Summary of stream data:

Stream   Flow rate      TC            Rainfall Intensity
 No.       (CFS)      (min)                  (In/Hr)


1       15.077     11.69                 3.188
2        5.246     10.66                 3.297
Qmax(1) =
          1.000 *    1.000 *    15.077) +
          0.967 *    1.000 *     5.246) + =      20.149
Qmax(2) =
          1.000 *    0.912 *    15.077) +
          1.000 *    1.000 *     5.246) + =      18.990

Total of 2 streams to confluence:
Flow rates before confluence point:
      15.077       5.246
Maximum flow rates at confluence using above data:
       20.149       18.990
Area of streams before confluence:
        8.320        2.780
```

```
Results of confluence:
Total flow rate =     20.149(CFS)
Time of concentration =    11.694 min.
Effective stream area after confluence =     11.100(Ac.)


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Process from Point/Station     939.000 to Point/Station     992.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
______________________________________________________________________
Upstream point/station elevation =   686.460(Ft.)
Downstream point/station elevation =   667.970(Ft.)
Pipe length  =   210.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    20.149(CFS)
Nearest computed pipe diameter  =     18.00(In.)
Calculated individual pipe flow  =    20.149(CFS)
Normal flow depth in pipe =   10.54(In.)
Flow top width inside pipe =   17.74(In.)
Critical depth could not be calculated.
Pipe flow velocity =     18.76(Ft/s)
Travel time through pipe =    0.19 min.
Time of concentration (TC) =    11.88 min.


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Process from Point/Station     992.000 to Point/Station     992.000
**** CONFLUENCE OF MAIN STREAMS ****
______________________________________________________________________
The following data inside Main Stream is listed:
In Main Stream number: 2
Stream flow area =     11.100(Ac.)
Runoff from this stream =     20.149(CFS)
Time of concentration =   11.88 min.
Rainfall intensity =     3.170(In/Hr)
Summary of stream data:

Stream   Flow rate     TC           Rainfall Intensity
 No.       (CFS)      (min)                (In/Hr)


1       39.012     15.27                2.885
2       20.149     11.88                3.170
Qmax(1) =
           1.000 *    1.000 *    39.012) +
           0.910 *    1.000 *    20.149) + =      57.353
Qmax(2) =
           1.000 *    0.778 *    39.012) +
           1.000 *    1.000 *    20.149) + =      50.510

Total of 2 main streams to confluence:
Flow rates before confluence point:
     39.012      20.149
Maximum flow rates at confluence using above data:
      57.353      50.510
Area of streams before confluence:
      23.510      11.100
```



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Results of confluence:
Total flow rate =     57.353(CFS)
Time of concentration =    15.266 min.
Effective stream area after confluence  =     34.610(Ac.)


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Process from Point/Station     992.000 to Point/Station     953.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
______________________________________________________________________
Upstream point/station elevation =   666.640(Ft.)
Downstream point/station elevation =   612.890(Ft.)
Pipe length  =  1141.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    57.353(CFS)
Nearest computed pipe diameter  =     27.00(In.)
Calculated individual pipe flow  =    57.353(CFS)
Normal flow depth in pipe =   19.17(In.)
Flow top width inside pipe =   24.50(In.)
Critical depth could not be calculated.
Pipe flow velocity =     18.99(Ft/s)
Travel time through pipe =    1.00 min.
Time of concentration (TC) =    16.27 min.


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Process from Point/Station     953.000 to Point/Station     953.000
**** CONFLUENCE OF MINOR STREAMS ****
______________________________________________________________________
Along Main Stream number: 1 in normal stream number 1
Stream flow area =     34.610(Ac.)
Runoff from this stream =     57.353(CFS)
Time of concentration =   16.27 min.
Rainfall intensity =     2.814(In/Hr)


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Process from Point/Station     945.000 to Point/Station     947.000
**** INITIAL AREA EVALUATION ****
______________________________________________________________________
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[SINGLE FAMILY area type                    ]
Initial subarea flow distance  =   94.000(Ft.)
Highest elevation =  682.200(Ft.)
Lowest elevation =  674.600(Ft.)
Elevation difference =     7.600(Ft.)
Time of concentration calculated by the urban
areas overland flow method (App X-C) =     4.78 min.
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.5500)*(  94.000^.5)/( 8.085^(1/3)]=   4.78
Rainfall intensity (I) =     4.470(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.550
Subarea runoff =     0.172(CFS)
Total initial stream area =       0.070(Ac.)
```

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Process from Point/Station      947.000 to Point/Station      949.000
**** STREET FLOW TRAVEL TIME + SUBAREA FLOW ADDITION ****

Top of street segment elevation =   674.600(Ft.)
End of street segment elevation =   621.660(Ft.)
Length of street segment  =   713.000(Ft.)
Height of curb above gutter flowline  =    6.0(In.)
Width of half street (curb to crown)  =  16.000(Ft.)
Distance from crown to crossfall grade break  =  10.000(Ft.)
Slope from gutter to grade break (v/hz) =   0.020
Slope from grade break to crown (v/hz)  =   0.020
Street flow is on [1] side(s) of the street
Distance from curb to property line  =  12.000(Ft.)
Slope from curb to property line (v/hz) =   0.020
Gutter width =   1.500(Ft.)
Gutter hike from flowline =  1.500(In.)
 Manning's N in gutter =  0.0150
 Manning's N from gutter to grade break =  0.0180
 Manning's N from grade break to crown =  0.0180
Estimated mean flow rate at midpoint of street =      0.248(CFS)
Depth of flow =   0.107(Ft.), Average velocity =   3.621(Ft/s)
Streetflow hydraulics at midpoint of street travel:
Halfstreet flow width =   1.500(Ft.)
Flow velocity =   3.62(Ft/s)
Travel time =    3.28 min.     TC =    8.06  min.
 Adding area flow to street
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[SINGLE FAMILY area type                    ]
Rainfall intensity =      3.649(In/Hr) for a   100.0 year storm
Runoff coefficient used for sub-area, Rational method,Q=KCIA, C = 0.550
Subarea runoff =      1.766(CFS) for    0.880(Ac.)
Total runoff =     1.938(CFS)  Total area =       0.95(Ac.)
Street flow at end of street =      1.938(CFS)
Half street flow at end of street =      1.938(CFS)
Depth of flow =   0.222(Ft.), Average velocity =   4.068(Ft/s)
Flow width (from curb towards crown)=   6.365(Ft.)


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Process from Point/Station      949.000 to Point/Station      953.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****

Upstream point/station elevation =   615.000(Ft.)
Downstream point/station elevation =   612.890(Ft.)
Pipe length  =     9.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     1.938(CFS)
Nearest computed pipe diameter  =     6.00(In.)
Calculated individual pipe flow  =     1.938(CFS)
Normal flow depth in pipe =    3.74(In.)
Flow top width inside pipe =    5.81(In.)
Critical depth could not be calculated.
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Pipe flow velocity =     15.03(Ft/s)
Travel time through pipe =   0.01 min.
Time of concentration (TC) =    8.07 min.


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Process from Point/Station      953.000 to Point/Station      953.000
**** CONFLUENCE OF MINOR STREAMS ****

Along Main Stream number: 1 in normal stream number 2
Stream flow area =      0.950(Ac.)
Runoff from this stream =      1.938(CFS)
Time of concentration =    8.07 min.
Rainfall intensity =     3.647(In/Hr)


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Process from Point/Station      941.000 to Point/Station      943.000
**** INITIAL AREA EVALUATION ****

Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[SINGLE FAMILY area type                    ]
Initial subarea flow distance  =  100.000(Ft.)
Highest elevation =  698.200(Ft.)
Lowest elevation =  690.600(Ft.)
Elevation difference =    7.600(Ft.)
Time of concentration calculated by the urban
areas overland flow method (App X-C) =      5.04 min.
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.5500)*( 100.000^.5)/( 7.600^(1/3)]=    5.04
Rainfall intensity (I) =      4.376(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.550
Subarea runoff =      0.193(CFS)
Total initial stream area =       0.080(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      943.000 to Point/Station      951.000
**** STREET FLOW TRAVEL TIME + SUBAREA FLOW ADDITION ****

Top of street segment elevation =   690.600(Ft.)
End of street segment elevation =   621.660(Ft.)
Length of street segment  =   903.000(Ft.)
Height of curb above gutter flowline  =    6.0(In.)
Width of half street (curb to crown)  =  16.000(Ft.)
Distance from crown to crossfall grade break  =  10.000(Ft.)
Slope from gutter to grade break (v/hz) =   0.020
Slope from grade break to crown (v/hz)  =   0.020
Street flow is on [1] side(s) of the street
Distance from curb to property line  =  12.000(Ft.)
Slope from curb to property line (v/hz) =   0.020
Gutter width =   1.500(Ft.)
Gutter hike from flowline =  1.500(In.)
 Manning's N in gutter =  0.0150
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```
 Manning's N from gutter to grade break =  0.0180
 Manning's N from grade break to crown =  0.0180
Estimated mean flow rate at midpoint of street =      0.269(CFS)
Depth of flow =   0.110(Ft.), Average velocity =   3.734(Ft/s)
Streetflow hydraulics at midpoint of street travel:
Halfstreet flow width =   1.500(Ft.)
Flow velocity =   3.73(Ft/s)
Travel time =    4.03 min.      TC =     9.07  min.
 Adding area flow to street
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[SINGLE FAMILY area type                    ]
Rainfall intensity =      3.496(In/Hr) for a   100.0 year storm
Runoff coefficient used for sub-area, Rational method,Q=KCIA, C = 0.550
Subarea runoff =      1.519(CFS) for    0.790(Ac.)
Total runoff =      1.712(CFS)  Total area =        0.87(Ac.)
Street flow at end of street =      1.712(CFS)
Half street flow at end of street =      1.712(CFS)
Depth of flow =   0.214(Ft.), Average velocity =   4.012(Ft/s)
Flow width (from curb towards crown)=   5.961(Ft.)


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Process from Point/Station      951.000 to Point/Station      953.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
______________________________________________________________________
Upstream point/station elevation =   615.000(Ft.)
Downstream point/station elevation =   612.890(Ft.)
Pipe length  =    27.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     1.712(CFS)
Nearest computed pipe diameter  =      9.00(In.)
Calculated individual pipe flow  =     1.712(CFS)
Normal flow depth in pipe =    3.79(In.)
Flow top width inside pipe =    8.89(In.)
Critical Depth =    7.21(In.)
Pipe flow velocity =      9.68(Ft/s)
Travel time through pipe =    0.05 min.
Time of concentration (TC) =     9.11 min.


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Process from Point/Station      953.000 to Point/Station      953.000
**** CONFLUENCE OF MINOR STREAMS ****
______________________________________________________________________
Along Main Stream number: 1 in normal stream number 3
Stream flow area =      0.870(Ac.)
Runoff from this stream =      1.712(CFS)
Time of concentration =     9.11 min.
Rainfall intensity =     3.490(In/Hr)
Summary of stream data:

Stream   Flow rate      TC           Rainfall Intensity
 No.       (CFS)      (min)                 (In/Hr)
```



```
1       57.353      16.27                 2.814
2        1.938       8.07                 3.647
3        1.712       9.11                 3.490
Qmax(1) =
           1.000 *     1.000 *    57.353) +
           0.772 *     1.000 *     1.938) +
           0.806 *     1.000 *     1.712) + =      60.228
Qmax(2) =
           1.000 *     0.496 *    57.353) +
           1.000 *     1.000 *     1.938) +
           1.000 *     0.886 *     1.712) + =      31.919
Qmax(3) =
           1.000 *     0.560 *    57.353) +
           0.957 *     1.000 *     1.938) +
           1.000 *     1.000 *     1.712) + =      35.693

Total of 3 streams to confluence:
Flow rates before confluence point:
     57.353      1.938      1.712
Maximum flow rates at confluence using above data:
      60.228      31.919      35.693
Area of streams before confluence:
      34.610       0.950       0.870
Results of confluence:
Total flow rate =     60.228(CFS)
Time of concentration =     16.268 min.
Effective stream area after confluence =     36.430(Ac.)


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Process from Point/Station      953.000 to Point/Station      999.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
______________________________________________________________________
Upstream point/station elevation =   612.560(Ft.)
Downstream point/station elevation =   598.820(Ft.)
Pipe length  =    92.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    60.228(CFS)
Nearest computed pipe diameter  =     21.00(In.)
Calculated individual pipe flow  =    60.228(CFS)
Normal flow depth in pipe =   16.92(In.)
Flow top width inside pipe =   16.61(In.)
Critical depth could not be calculated.
Pipe flow velocity =     29.02(Ft/s)
Travel time through pipe =    0.05 min.
Time of concentration (TC) =    16.32 min.


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Process from Point/Station      999.000 to Point/Station      999.000
**** CONFLUENCE OF MAIN STREAMS ****
______________________________________________________________________
The following data inside Main Stream is listed:
In Main Stream number: 1
Stream flow area =     36.430(Ac.)
Runoff from this stream =     60.228(CFS)
Time of concentration =   16.32 min.
Rainfall intensity =     2.810(In/Hr)
```

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Program is now starting with Main Stream No. 2


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Process from Point/Station      955.000 to Point/Station      957.000
**** INITIAL AREA EVALUATION ****
________________________________________________________________________
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[SINGLE FAMILY area type               ]
Initial subarea flow distance  =  130.000(Ft.)
Highest elevation =  700.000(Ft.)
Lowest elevation =  698.000(Ft.)
Elevation difference =    2.000(Ft.)
Time of concentration calculated by the urban
areas overland flow method (App X-C) =     9.78 min.
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.5500)*( 130.000^.5)/( 1.538^(1/3)]=   9.78
Rainfall intensity (I) =      3.402(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.550
Subarea runoff =      0.412(CFS)
Total initial stream area =       0.220(Ac.)


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Process from Point/Station      957.000 to Point/Station      956.000
**** STREET FLOW TRAVEL TIME + SUBAREA FLOW ADDITION ****
________________________________________________________________________
Top of street segment elevation =   698.000(Ft.)
End of street segment elevation =   673.000(Ft.)
Length of street segment  =   630.000(Ft.)
Height of curb above gutter flowline  =     6.0(In.)
Width of half street (curb to crown)  =  16.000(Ft.)
Distance from crown to crossfall grade break  =  10.000(Ft.)
Slope from gutter to grade break (v/hz) =   0.020
Slope from grade break to crown (v/hz)  =   0.020
Street flow is on [2] side(s) of the street
Distance from curb to property line  =  12.000(Ft.)
Slope from curb to property line (v/hz) =   0.020
Gutter width =   1.500(Ft.)
Gutter hike from flowline =  1.500(In.)
 Manning's N in gutter =  0.0150
 Manning's N from gutter to grade break =  0.0180
 Manning's N from grade break to crown =  0.0180
Estimated mean flow rate at midpoint of street =      3.789(CFS)
Depth of flow =   0.240(Ft.), Average velocity =   3.161(Ft/s)
Streetflow hydraulics at midpoint of street travel:
Halfstreet flow width =   7.266(Ft.)
Flow velocity =   3.16(Ft/s)
Travel time =    3.32 min.     TC =    13.10  min.
 Adding area flow to street
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
```



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[SINGLE FAMILY area type               ]
Rainfall intensity =      3.0S8(In/Hr) for a   100.0 year storm
Runoff coefficient used for sub-area, Rational method,Q=KCIA, C = 0.550
Subarea runoff =      6.071(CFS) for    3.610(Ac.)
Total runoff =      6.483(CFS)  Total area =        3.83(Ac.)
Street flow at end of street =      6.483(CFS)
Half street flow at end of street =      3.241(CFS)
Depth of flow =   0.278(Ft.), Average velocity =   3.561(Ft/s)
Flow width (from curb towards crown)=   9.159(Ft.)


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Process from Point/Station      956.000 to Point/Station      959.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
________________________________________________________________________
Upstream point/station elevation =   668.000(Ft.)
Downstream point/station elevation =   602.800(Ft.)
Pipe length  =   770.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     6.483(CFS)
Nearest computed pipe diameter   =    12.00(In.)
Calculated individual pipe flow   =     6.483(CFS)
Normal flow depth in pipe =    6.88(In.)
Flow top width inside pipe =   11.87(In.)
Critical depth could not be calculated.
Pipe flow velocity =     13.93(Ft/s)
Travel time through pipe =    0.92 min.
Time of concentration (TC) =    14.02 min.


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Process from Point/Station      959.000 to Point/Station      959.000
**** SUBAREA FLOW ADDITION ****
________________________________________________________________________
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[SINGLE FAMILY area type               ]
Time of concentration =    14.02 min.
Rainfall intensity =      2.981(In/Hr) for a   100.0 year storm
Runoff coefficient used for sub-area, Rational method,Q=KCIA, C = 0.550
Subarea runoff =      1.098(CFS) for    0.670(Ac.)
Total runoff =      7.581(CFS)  Total area =        4.50(Ac.)


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Process from Point/Station      959.000 to Point/Station      999.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
________________________________________________________________________
Upstream point/station elevation =   602.300(Ft.)
Downstream point/station elevation =   598.200(Ft.)
Pipe length  =   630.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     7.581(CFS)
Nearest computed pipe diameter   =    18.00(In.)
Calculated individual pipe flow   =     7.581(CFS)
Normal flow depth in pipe =   13.29(In.)
Flow top width inside pipe =   15.82(In.)
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Critical Depth =   12.80(In.)
Pipe flow velocity =      5.42(Ft/s)
Travel time through pipe =    1.94 min.
Time of concentration (TC) =    15.96 min.


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Process from Point/Station      999.000 to Point/Station      999.000
**** CONFLUENCE OF MAIN STREAMS ****
______________________________________________________________________
The following data inside Main Stream is listed:
In Main Stream number: 2
Stream flow area =      4.500(Ac.)
Runoff from this stream =      7.581(CFS)
Time of concentration =   15.96 min.
Rainfall intensity =     2.836(In/Hr)
Summary of stream data:

Stream   Flow rate      TC           Rainfall Intensity
 No.       (CFS)      (min)                 (In/Hr)

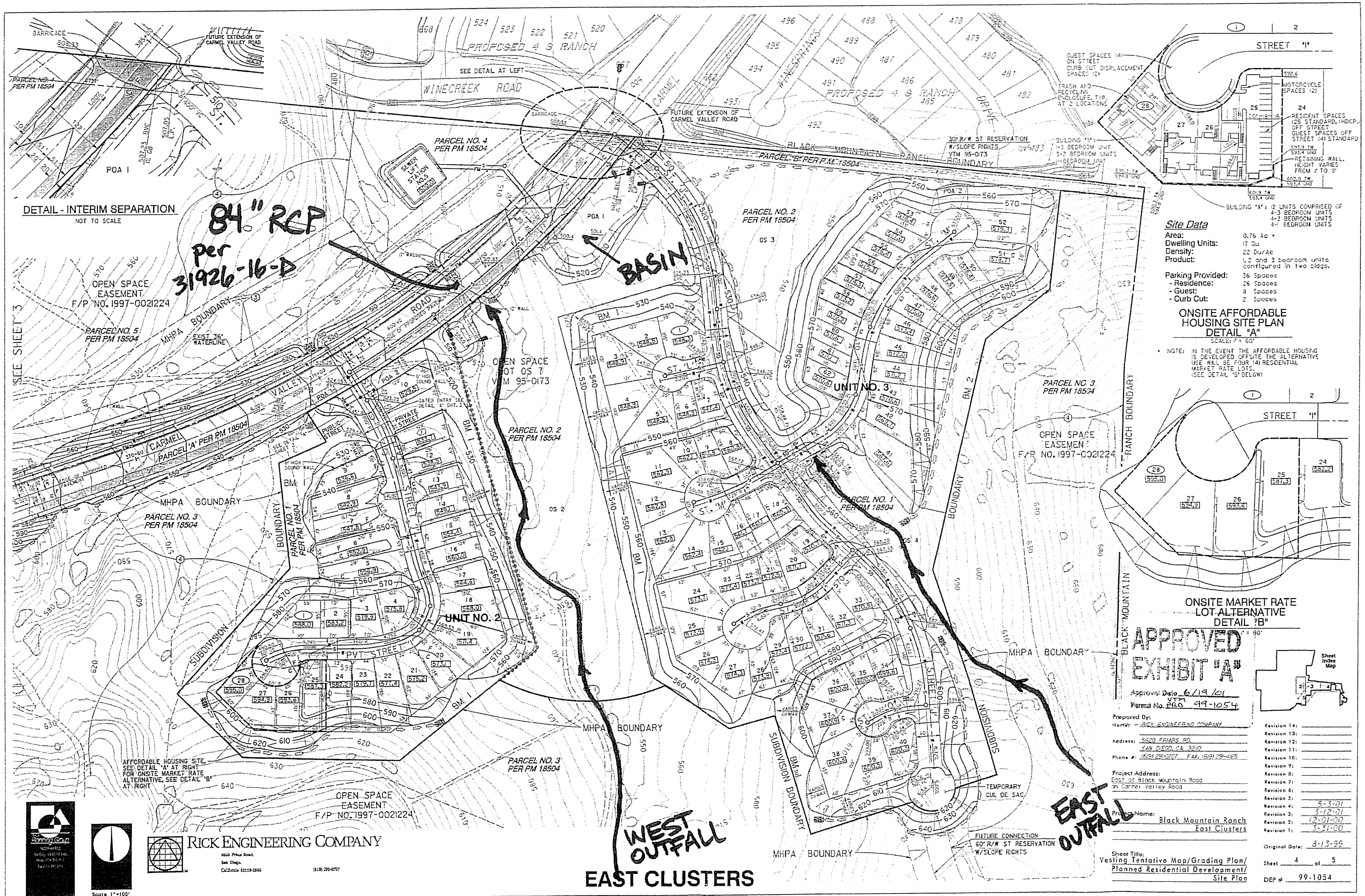

1       60.228     16.32                 2.810
2        7.581     15.96                 2.836
Qmax(1) =
           1.000 *    1.000 *    60.228) +
           0.991 *    1.000 *     7.581) + =      67.742
Qmax(2) =
           1.000 *    0.978 *    60.228) +
           1.000 *    1.000 *     7.581) + =      66.466

Total of 2 main streams to confluence:
Flow rates before confluence point:
      60.228       7.581
Maximum flow rates at confluence using above data:
       67.742       66.466
Area of streams before confluence:
       36.430        4.500


Results of confluence:
Total flow rate =     67.742(CFS)
Time of concentration =    16.321 min.
Effective stream area after confluence  =     40.930(Ac.)
End of computations, total study area =         40.930 (Ac.)
```

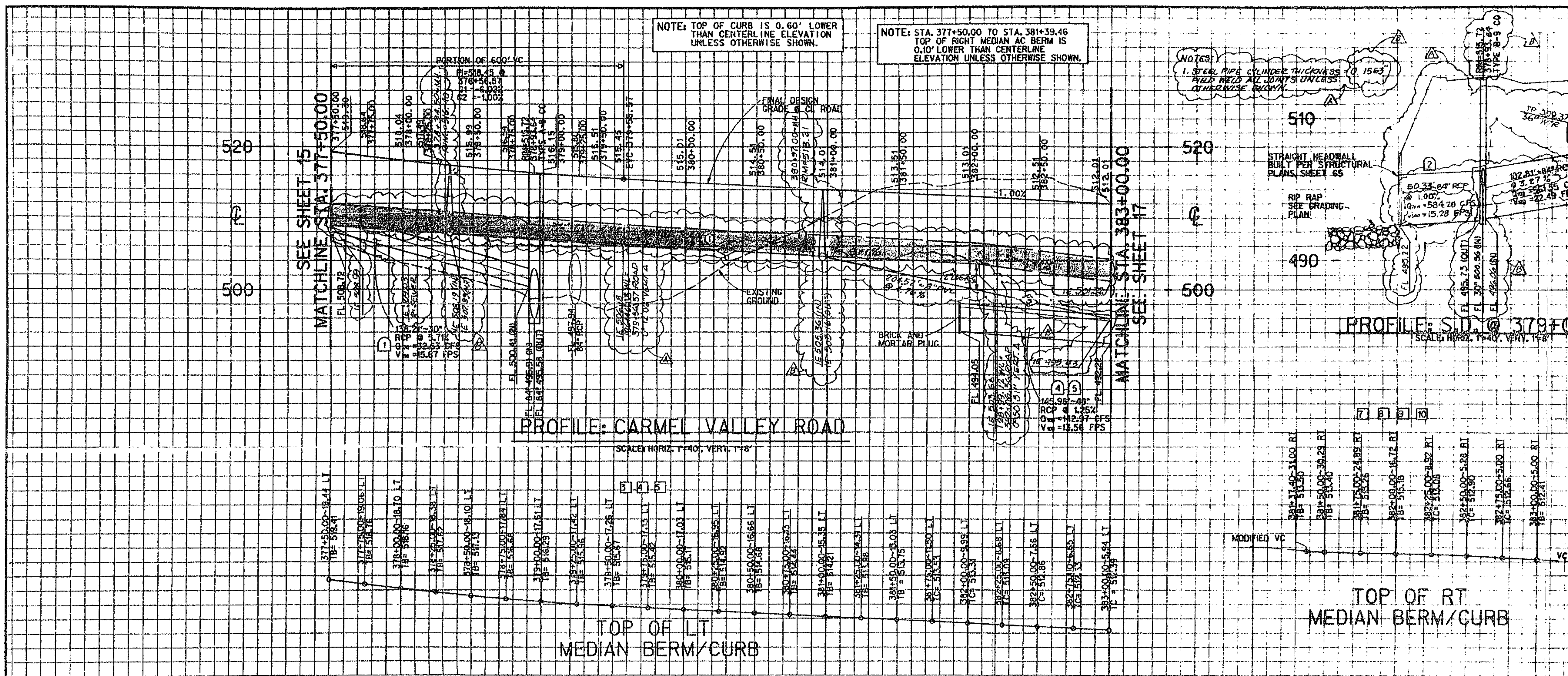
APPENDIX 5

Supporting Documentation for Downstream Capacity



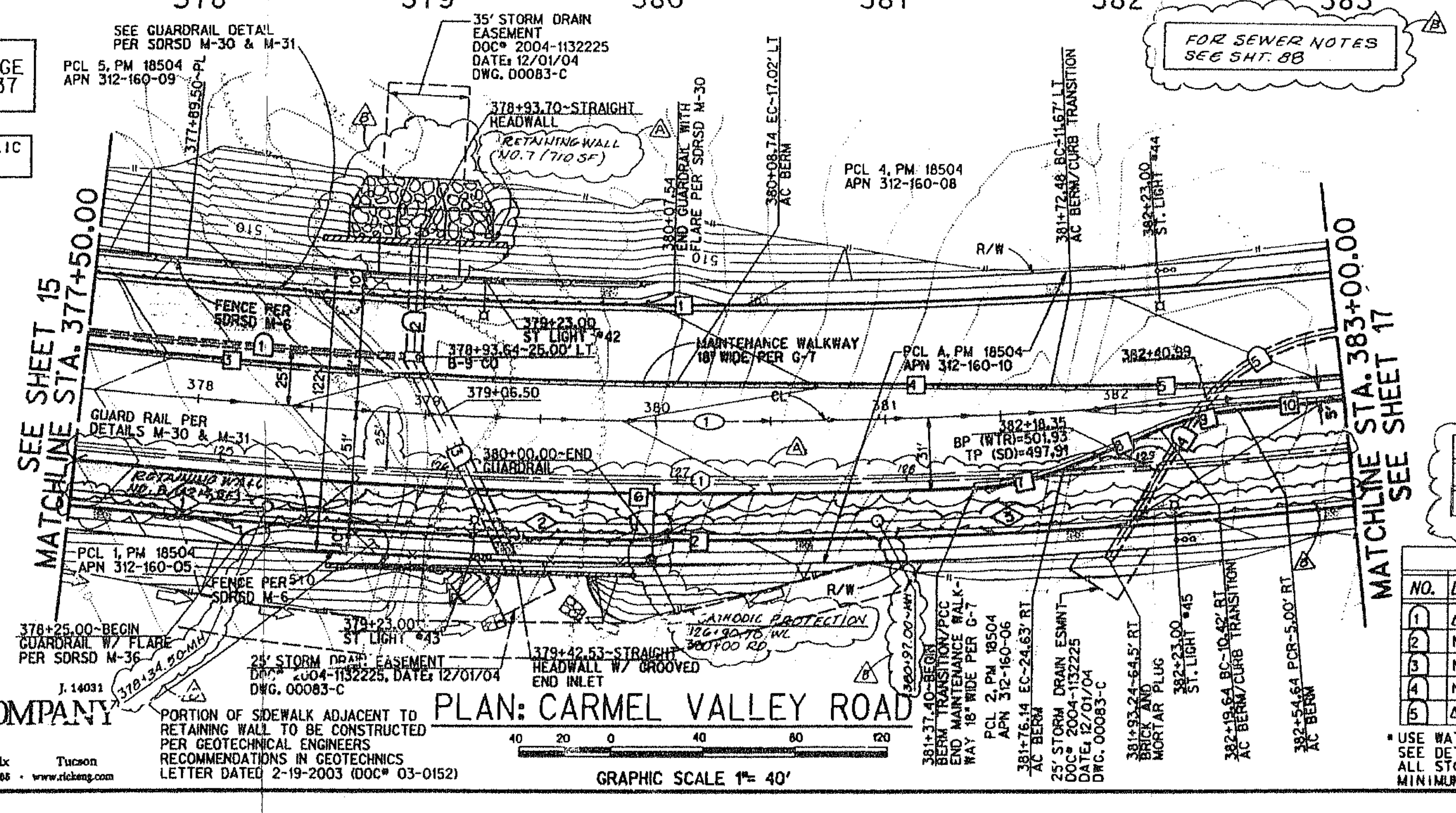
↓ TOWARDS HERITAGE BLUFFS SITE ↓

DOWNSTREAM DEVELOPMENT'S TM
(SHOWS DOWNSTREAM DRAINAGE FACILITIES)



FOR PROPOSED GRADING & DRAINAGE IN THIS AREA SEE SHEETS 36 & 37

NOTE: FOR PRIVATE RETAINING WALLS IN PUBLIC EASEMENT SEE EMRA #420459-2



PLAN: CARMEL VALLEY ROAD

GRAPHIC SCALE 1"= 40'

RICK ENGINEERING COMPANY

CENTERLINE DATA				
NO.	DELTA OR BRG.	RADIUS	LENGTH	REMARKS
1	Δ=12°36'18"	2500.00'	550.00'	

CURB DATA				
NO.	DELTA OR BRG.	RADIUS	LENGTH	REMARKS
1	Δ=12°36'18"	2449.00'	538.78'	6" TYPE "H" C&G
2	Δ=12°36'18"	2551.00'	561.22'	6" TYPE "H" C&G
3	Δ=6°41'05"	2202.00'	256.91'	6" AC BERM TYPE "A"
4	N48°56'03"E		162.85'	6" AC BERM TYPE "A"
5	Δ=5°16'02"	1384.00'	127.23'	6" TYPE "H" C&G
6	Δ=8°52'43"	2531.00'	392.20'	6" AC BERM TYPE "A"
7	Δ=19°21'45"	118.00'	39.88'	6" AC BERM TYPE "A"
8	N26°37'23"E		46.19'	6" AC BERM TYPE "A"
9	Δ=16°40'32"	122.00'	35.51'	6" TYPE "H" C&G
10	Δ=1°02'23"	2505.00'	45.45'	6" TYPE "H" C&G

WATER DATA					
NO.	DELTA OR BRG.	RADIUS	LENGTH	REMARKS	THICKNESS
1	Δ=12°36'18"	2525.00'	555.50'	36" CML&TCMC *	0.1563"

* FIELD WELD ALL JOINTS

STORM DRAIN DATA				
NO.	DELTA OR BRG.	RADIUS	LENGTH	REMARKS
1	Δ=3°11'58"	2475.00'	138.21'	30" RCP (1500-D)*
2	N38°25'41"W		50.33'	84" RCP (1500-D)
3	N67°40'12"W		102.81'	84" RCP (1500-D)*
4	N9°49'41"W		66.78'	48" RCP (1500-D)
5	Δ=50°42'05"	89.50'	79.20'	48" RCP (1500-D)

* USE WATER TIGHT JOINTS PER PROFILE SHOWN ABOVE.
SEE DETAIL "P", SHEET 30
ALL STORM DRAIN SECTIONS SHOWN ABOVE SHALL HAVE A MINIMUM 100 YEAR SERVICE LIFE.

SEWER DATA				
NO.	DELTA OR BRG.	RADIUS	LENGTH	REMARKS
1	Δ=1°53'30"	2544.00'	83.99'	8" PVC
2	Δ=5°55'33"	2544.00'	263.12'	8" PVC
3	Δ=4°36'27"	2544.00'	204.57'	8" C-900 PVC

BENCH MARK
NWBP STARGAZE AVENUE AND BLACK MOUNTAIN ROAD.
ELEV.=525.208 PER NVGD-29 M.S.L.

ENGINEER OF WORK

NORMAN C. ARNDT — R.C.E. 21693 — DATE

J# 14031

REGISTERED PROFESSIONAL ENGINEER — NORMAN C. ARNDT — No. 21693 — Exp. 9/30/05 — CIVIL — STATE OF CALIFORNIA

PRIVATE CONTRACT

PLANS FOR THE IMPROVEMENT OF :

CARMEL VALLEY ROAD

STA. 377+50.00 TO STA. 383+00.00

CITY OF SAN DIEGO, CALIFORNIA
DEVELOPMENT SERVICES DEPARTMENT
SHEET 16 OF 57 SHEETS

TM 99-1054
W.O. NO. 420459

FOR CITY ENGINEER — 1/7/05 — DATE

PTS 4243

DESCRIPTION	BY	APPROVED	DATE	FILMED
ORIGINAL	REC			
CHANGE A	REC		9/21/05	
CHANGE B	REC		4/21/06	
AS-BUILTS				

CONTRACTOR ____ DATE STARTED ____
INSPECTOR ____ DATE COMPLETED ____

1938-6289
298-1729
LAMBERT COORDINATES

31926-16-D

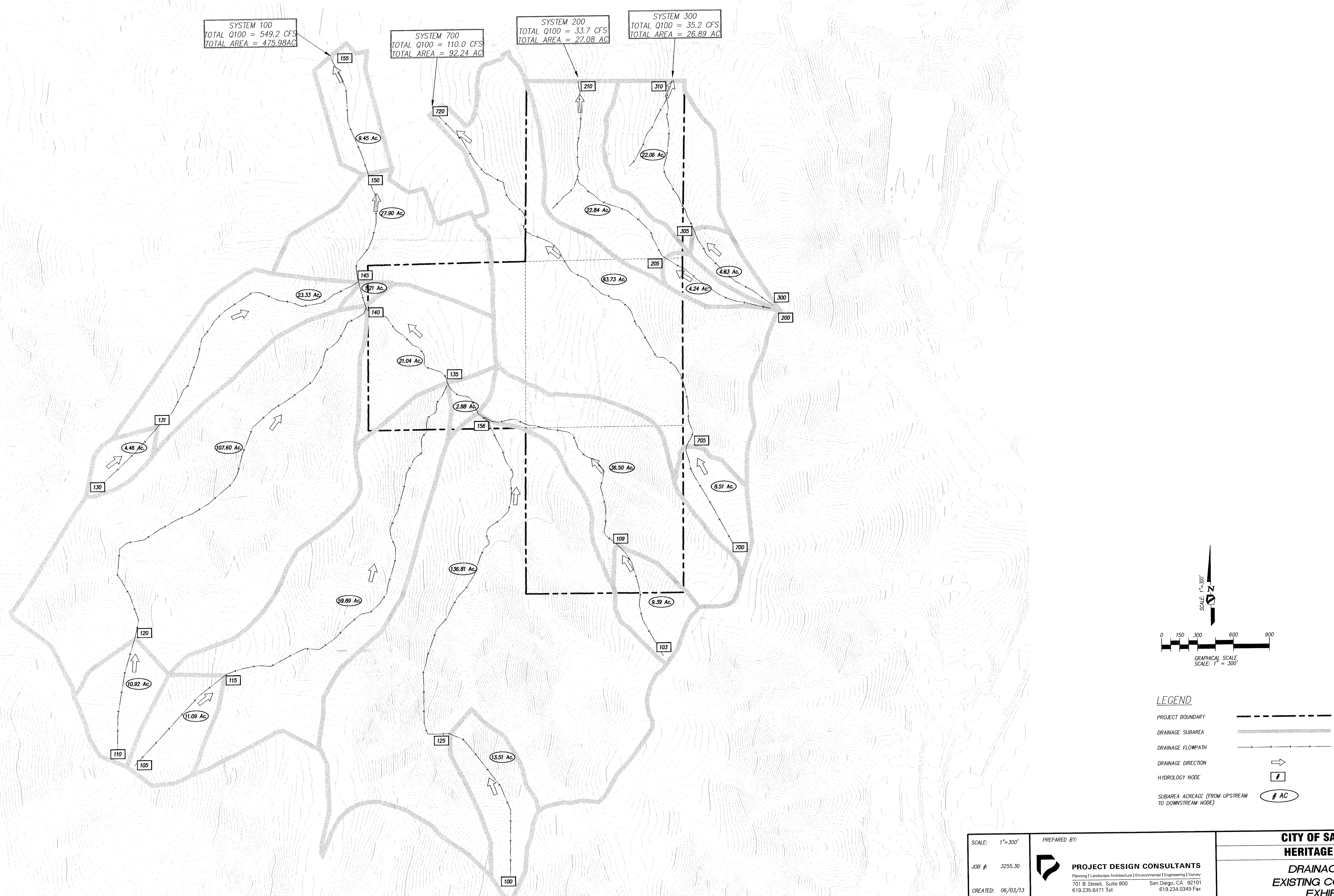
A: ADD 36" WATER LINE, RETAINING WALL QUANTITY, NOTE, & WATER DATA TABLE, REVISE TOTAL SHT. NO.'S & TITLE BLOCK

B: CHANGE WATERLINE PIPE THICKNESS, ADD 8" SEWER, ADJUST HEADWALL LOCATION

FILMED FROM THE ORIGINAL. BEST QUALITY OBTAINABLE. EXCESSIVE GRAY BACKGROUND MAY CAUSE A POOR QUALITY REPRODUCTION.

APPENDIX 6

Drainage Exhibits



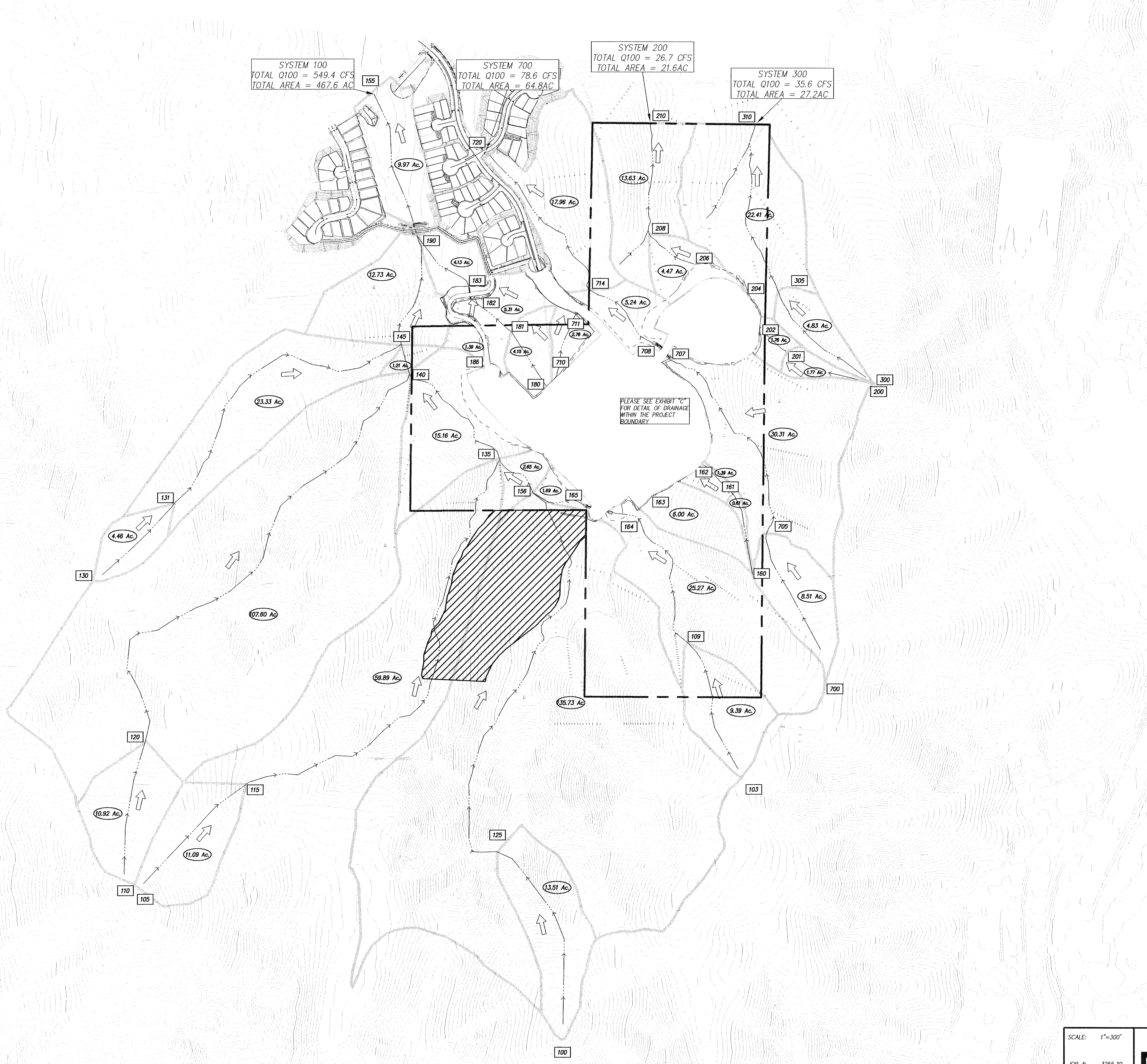
SCALE:	1"=300'
JOB #:	3255.30
CREATED:	06/03/13

PREPARED BY:

PROJECT DESIGN CONSULTANTS
Planning | Landscape Architecture | Environmental | Engineering | Survey
701 B Street, Suite 800 San Diego, CA 92101
619.235.6471 Tel 619.234.0349 Fax

CITY OF SAN DIEGO
HERITAGE BLUFFS

DRAINAGE MAP
EXISTING CONDITIONS
EXHIBIT A



SCALE: 1"=300'

0 150 300 600 900

GRAPHICAL SCALE
SCALE: 1" = 300'

LEGEND

PROJECT BOUNDARY

DRAINAGE SUBAREA

DRAINAGE FLOWPATH

DRAINAGE DIRECTION

HYDROLOGY NODE

POTENTIAL FUTURE DEVELOPMENT (BY OTHERS)

SUBAREA ACREAGE (FROM UPSTREAM TO DOWNSTREAM NODE)

SCALE:	1"=300'
JOB #:	3255.30
CREATED:	11/03/14

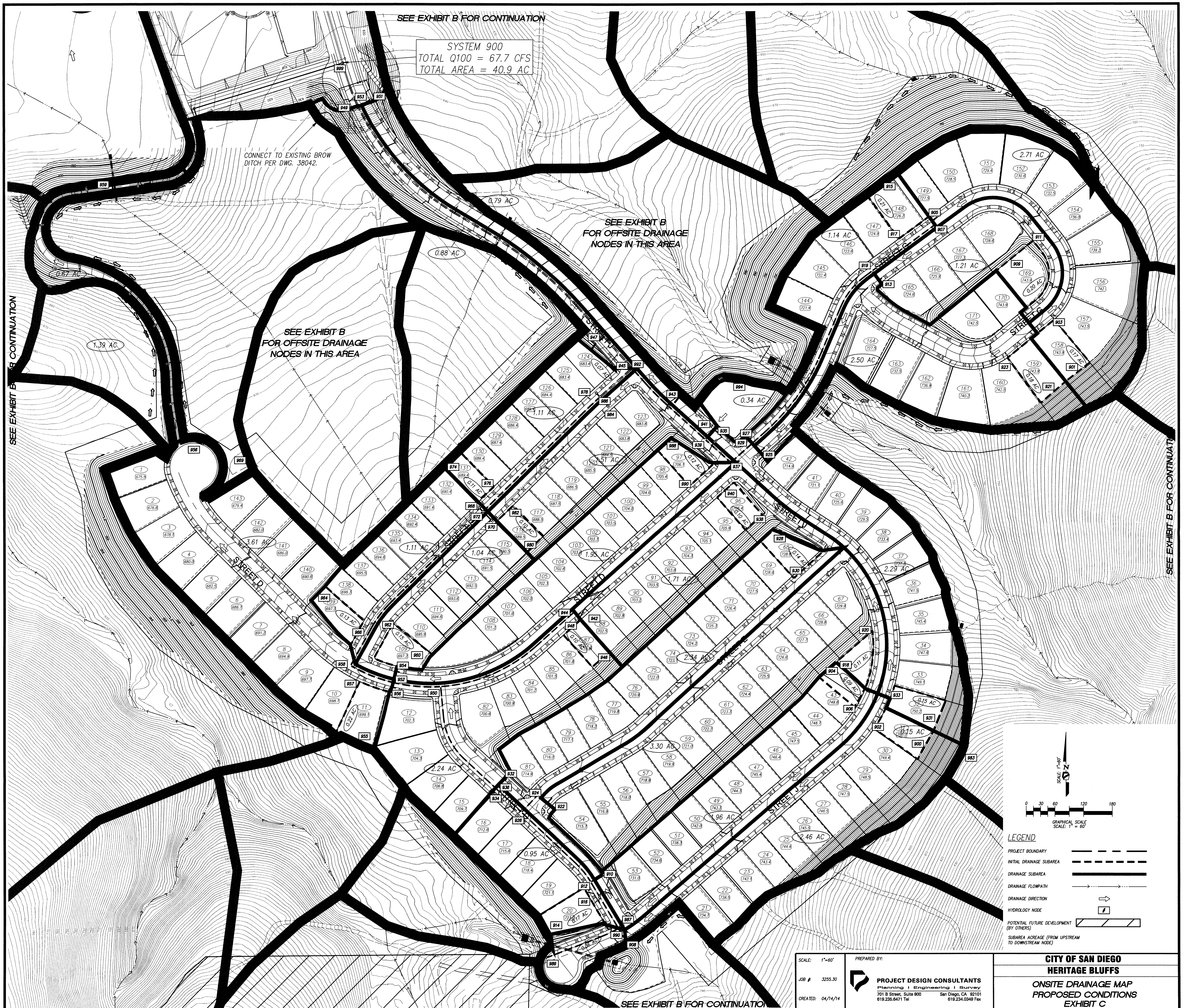
PREPARED BY:

PROJECT DESIGN CONSULTANTS
Planning | Engineering | Survey
701 B Street, Suite 800 San Diego, CA 92101
619.235.6471 Tel 619.234.0349 Fax

CITY OF SAN DIEGO

HERITAGE BLUFFS

DRAINAGE MAP
PROPOSED CONDITIONS
EXHIBIT B



LAST SAVED BY: Thomas Grace, FILE NAME: P:\3255.30\ENGR\REPORTS\DRAIN\EXH\ExhBandC.dwg, DATE SAVED LAST: 11/6/2014 7:19:27 PM, PLOTTED LAST: 11/6/2014 7:25:13 PM

APPENDIX 7

Drainage Study for Black Mountain Ranch

East Clusters Unit 3

(Final Engineering)

Prepared by Rick Engineering

DRAINAGE STUDY FOR BLACK MOUNTAIN RANCH EAST CLUSTERS UNIT 3

(FINAL ENGINEERING)

PTS # 363074

Job Number 15149-B

March 12, 2014

Revised: August 7, 2014
Project Address: South of the intersection of Carmel Valley Road and Winecreek Road

Contact Person: Kurt Bruskotter
Phone#: (858) 334-8322
Email Address: KBruskotter@stanpac.com

RICK ENGINEERING COMPANY
ENGINEERING COMPANY
RICK ENGINEERING CO

RICK
ENGINEERING COMPANY

DRAINAGE STUDY

FOR

BLACK MOUNTAIN RANCH

EAST CLUSTERS UNIT 3

(FINAL ENGINEERING)

PTS # 363074

Job Number 15149-B

Jayne Janda-Timba, P.E.
R.C.E. #70649
Exp. 06/15

REGISTERED PROFESSIONAL ENGINEER
JAYNE MARIE JANDA-TIMBA
NO. 70649
EXP. 6/30/15
CIVIL
STATE OF CALIFORNIA

Prepared For:

Black Mountain Ranch, LLC
16010 Camino Del Sur
San Diego, California 92103
(858) 792-7061

Prepared By:

Rick Engineering Company
Water Resources Department
5620 Friars Road
San Diego, California 92110-2596
(619) 291-0707

March 12, 2014
Revised: August 7, 2014

TABLE OF CONTENTS

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Tables:

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Map Pockets:

DRAINAGE STUDY
FOR
BLACK MOUNTAIN RANCH
EAST CLUSTERS UNIT 3
(FINAL ENGINEERING)

REVISION PAGE

August 7, 2014

This Drainage Study presents a revision to the March 12, 2014 report pursuant to the City of San Diego plan check comments. Included within this revision are the changes incurred from the upstream development (Heritage Bluffs II) access road and storm drain re-alignment. The re-aligned storm drain will connect to a lateral in Street N at Node 1030, which is further downstream from the original connection point. The pipeflow model downstream from Node 1030 is not updated because the change in flow is insignificant (i.e. - only a couple tenths of a cfs). The pipeflow model upstream from Node 1030 is updated to reflect the change in the storm drain alignment and flow. The post-project drainage map has been updated to reflect the final updates to the Grading and Improvement Plans. The following text identifies the plan check comment along with the response (in bold).

46. On the cover sheet provide:
    a. City of San Diego Project Number (PTS #363074)
    b. Project Address
    c. Project applicant info:
        i. Contact Person
        ii. Phone #
        iii. Email address

All of the above information is now provided on the cover sheet.

47. Page 3: Why is the report “Black Mountain Ranch Phase II Ownership” use the 25 years peak discharge storm event? Normally it should be the 100 years storm event. Provide an excerpt showing that this was the case at that time (some type of approved conditions).

The overall BMR project was conditioned many years ago at which time there were no detention or water quality requirements. The project agreed to incorporate 25-year detention for the overall project through a number of regional detention basins that collectively detain the overall project to pre-project conditions prior to Lusardi Creek leaving the downstream property boundary. Since that time, the project has continued to employ additional measures for detention and water quality, including HMP for the later phases of the development, including East Clusters Unit 3. This background for detention is provided for reference and is consistent with all other BMR project approvals. Please refer to other recent approvals for consistency (i.e. – Units 16-19, etc).

48. Page 13: Use detail SDD104.

The text throughout the report is updated to use SDD-104.

49. Provide a pre development map (add a table to the map if needed to organize the information).

A previous project was completed for Carmel Valley Road by BMR that evaluated pre-project and ultimate conditions for the project area, including the East Clusters Unit 3 project area. A copy of the map from that approved project has been provided for reference in Map Pocket 1 as the pre-development map. Refer to the tables on the post-project map in Map Pocket 2 for a summary of the pre and post-project conditions.

50. On the Drainage Map (pre and post) add the following information:

a. Flow path of travel.

b. Q & V at all discharge points.

The flow path of travel is added to the post-project drainage map. The pre and post-project Q's are provided at each discharge point. For locations where the project connects to an existing storm drain system, V's have not been provided.

1.0 INTRODUCTION

1.1 Project Description

This drainage study presents hydrologic and hydraulic analyses for the proposed Black Mountain Ranch East Clusters Unit 3 project. The project is located within the City of San Diego, south of the intersection of Carmel Valley Road and Winecreek Road. See Figure 1, Vicinity Map, located at the end of Section 1.0.

1.2 Project Background

An approved Tentative Map (TM) exists for the overall Black Mountain Ranch (BMR) East Clusters project. BMR East Clusters Unit 3 consists of approximately 41 acres of on-site development, including streets, residential lots, and open space. As part of the overall project design process, a Drainage Study for the area adjacent to the East Clusters Unit 3 was prepared and approved by the City of San Diego, report titled, "Drainage Study for Carmel Valley Road," dated December 12, 2003, prepared by Rick Engineering Company (J-14031). The drainage study for Carmel Valley Road (CVR) covers pre-project hydrologic characteristics for the East Clusters Unit 3 on Carmel Valley Road; however, this drainage study is focused on post-project conditions for the project site, and therefore, relies on information provided in the approved drainage study for existing site conditions, existing storm drain system, and design criteria related to downstream conditions. The project provides access to a proposed upstream development, known as the "Heritage Bluffs II," located to the south. Drainage updates incorporated into the design of this project were referenced from the report titled, "Preliminary Drainage Report: Heritage Bluffs II," prepared by Project Design Consultants, dated May 14, 2014.

1.3 Land Use and Drainage Characteristics

Pre-Project Drainage Characteristics

The natural topography of the vicinity area consists of native chaparral-type vegetation with gently to moderately sloping hillsides that generally descend to the north to an existing storm drain system at the intersection of Carmel Valley Road and Winecreek Road. The pre-project condition for this project originally consisted of approximately 640-acres of undeveloped watersheds, divided in three (3) basins. These drainage channels cross Carmel Valley Road via culverts and continue flowing north to Lusardi Creek which confluences with the San Dieguito River before discharging to the Pacific Ocean.

Post-Project Drainage Characteristics

The East Clusters Unit 3 project consists of the development of approximately 41 acres which will include the construction of single-family residential units, streets, and dedicated open space (such as parks and interior courtyards). The overall project will maintain two discharge locations—the Carmel Valley Road existing storm drain system and a culvert through an unnamed canyon. On-site flows from the east basin of East Clusters Unit 3 project will discharge to the CVR mainline, which continues downstream to an existing storm drain at Winecreek Road before discharging to Lusardi Creek. On-site flows from the 900 (west) basin of East Cluster Unit 3 will be detained in a bioretention basin before discharging to an existing unnamed channel which crosses CVR through a culvert. Both the existing CVR mainline and culvert were designed to accommodate additional discharge from the East Clusters Unit 3 project site based on the report previously discussed. Drainage from the upstream Heritage Bluffs II development, previously discussed, will also be incorporated into the design of this project.

1.4 Hydrology and Hydraulics

Hydrology and hydraulics are discussed in detail in Section 2.0 and 3.0 respectively of this report.

1.5 Detention

For the purposes of water quantity management, a regional detention plan has been implemented as part of the overall BMR development area. A report titled, "Black Mountain Ranch Phase II Ownership," dated August 24, 1999, was prepared by Rick Engineering Company to address section 3.b of an agreement between the Sierra Club and Black Mountain Ranch titled, "Agreement for Protection of the Environment." This agreement is hereon referred to as the "Sierra Club Agreement." The above-mentioned report provided recommendations to attenuate the peak discharge due to the development of Black Mountain Ranch back to the predevelopment peak discharge for the 25-year storm event. Specifically, the 25-year post-development peak discharge will be equal or less than the 25-year pre-development peak discharge as computed at the downstream end of the overall BMR project. This downstream point is the location where Lusardi Creek leaves the western boundary of the BMR development area, and the three locations where runoff leaves the BMR development area to the north of Camino Del Sur.

The proposed stormdrain outfall for Basin 900 flows into the adjacent detention basin, and then to an unnamed canyon located just to the east of Basin 900. Unnamed canyon flows north and eventually discharges to Lusardi Creek. The storm drain from Basin 1000 connects to the existing line along Carmel Valley Road; storm water flows north through Winecreek Road, and eventually discharges to Lusardi Creek. However, as mentioned earlier, detention for the overall Black Mountain Ranch project area was addressed with a regional detention plan, which provides over-detention within the proposed detention basins to balance those areas not flowing through these basins.

1.6 Water Quality

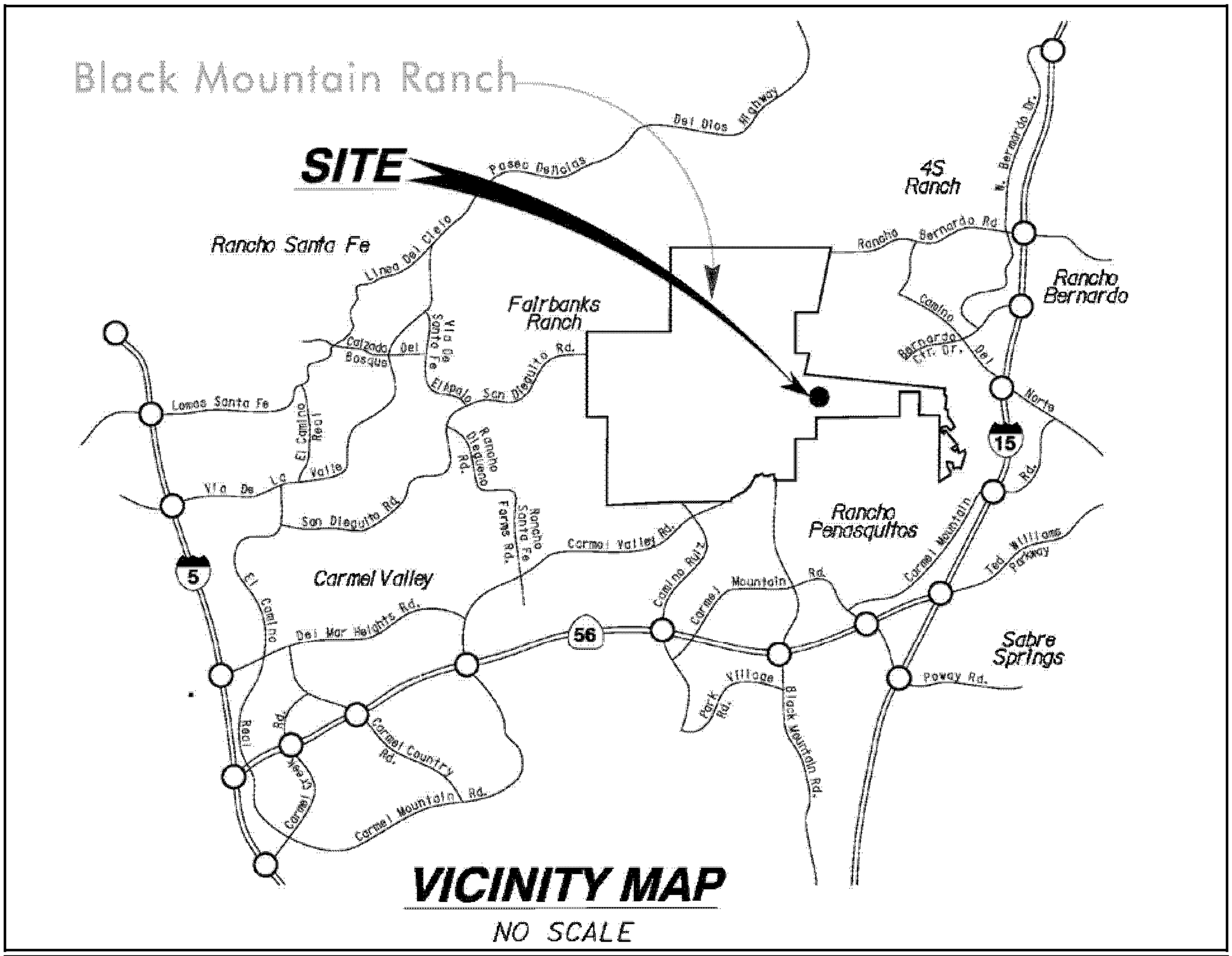
As part of the approval process, a Water Quality Technical Report (WQTR) was prepared for the project titled, "Water Quality Technical Report and Hydromodification Management Plan for Black Mountain Ranch East Clusters Unit 3," dated January 31, 2014, prepared by Rick

Engineering Company (J-15149-B). The overall concept for permanent water quality treatment BMPs consists of two (2) WQ/HMP basins to treat water from Basins 900 and 1000.

1.7 Hydromodification Management Requirements

This project is subject to hydromodification management requirements (HMP); for details see report prepared by Rick Engineering Company (J-15149-B), titled," Water Quality Technical Report and Hydromodification Management Plan for Black Mountain Ranch East Clusters Unit 3," dated August 7, 2014.

Figure 1: Vicinity Map



2.0 HYDROLOGY

2.1 Methodology

The *City of San Diego Drainage Design Manual April 1984* requires that the Rational Method be used for hydrologic analysis of a watershed up to but not exceeding 1.0 square-mile (640 acres). The 100-year storm event peak flow rates have been computed in this report to meet the City of San Diego's criteria. The Rational Method computer program developed by Advanced Engineering Software (AES 2003) was used for this study because it satisfies the City of San Diego's design criteria.

2.1.1 AES Rational Method Computer Model

The AES hydrologic model is developed by creating independent node-link models of each interior drainage basin and linking these sub-models together at confluence points. The AES program has the capability to perform calculations for 15 hydrologic processes. These processes are assigned code numbers that appear in the results. The code numbers and their significance are as follows:

Subarea Hydrologic Processes (Codes)

Code 1:	Confluence analysis at node
Code 2:	Initial subarea analysis
Code 3:	Pipe flow travel time (computer-estimate pipe sizes)
Code 4:	Pipe flow travel time (user-specified pipe size)
Code 5:	Trapezoidal channel travel time
Code 6:	Street flow analysis through a subarea
Code 7:	User-specified information at a node
Code 8:	Addition of the subarea runoff to mainline
Code 9:	V-Gutter flow through subarea
Code 10:	Copy mainstream data onto memory bank

Code 11:	Confluence a memory bank with the mainstream memory
Code 12:	Clear a memory bank
Code 13:	Clear the mainstream memory
Code 14:	Copy a memory bank onto the mainstream memory
Code 15:	Hydrologic data bank storage functions

In order to perform the hydrologic analysis; base information for the study area is required. This information includes the existing drainage facility locations and sizes, existing land uses, flow patterns, drainage basin boundaries, and topographic elevations. Drainage basin boundaries, flow patterns, and topographic elevations are shown on the drainage exhibits located in the map pockets.

2.2 Criteria

The hydrologic conditions were analyzed in accordance with the City of San Diego's design criteria as follows:

Design Storm:	100-year
Runoff Coefficients*:	
Industrial (Paved)	C = 0.95
Natural/ Landscaped	C = 0.45
Soil Type:	D
Rainfall Intensity:	Based on time-intensity criteria per City of San Diego

* Weighted runoff coefficients were used where appropriate based on a percentage of 0.95 and 0.45. Refer to Appendix B for backup materials.

2.3 Hydrologic Results

Modified Rational Method Results

For East Clusters Unit 3, there are two (2) main drainage basins on-site that are analyzed, Basins 900 and 1000.

Table 2.3.1, shown below, presents a summary of the Rational Method analyses for the main storm drain system proposed within the BMR East Clusters Unit 3 project. Basin 1000 receives off-site runoff from a southern watershed, and two (2) storm drain inlets located on Carmel Valley Road. These additional flows are incorporated into the Basin 1000 Rational Method using code 7's.

Table 2.3.1
Summary of 100-Year 6-Hour Proposed Peak Discharge Rates On-site
For BMR East Clusters Unit 3
(Post-project Condition)

Drainage Basin / Storm Drain System	Area (acres)	Time of Concentration (minutes)	100-Year 6-Hour Peak Flow Rate (cfs)[1]
900	8.6	8.3	26.0
1000	63.5	14.3	125.8

Note 1: cfs = cubic feet per second

Rational Method computer output for the ultimate conditions can be found in Appendix A. The watershed boundaries, rational method node numbers, flow patterns, and areas can be found on the workmap titled, "Drainage Study Map for BMR East Clusters Unit 3 Post-project Conditions," located in Map Pocket 2 of this report. For the pre-project condition Rational Method output, refer to report titled, "Drainage Study for Carmel Valley Road," prepared by Rick Engineering Company (J-14031), dated December 12, 2003. For the post-project condition Rational Method output from the Heritage Bluffs II development upstream, refer to the report titled, "Preliminary Drainage Report Heritage Bluffs II," prepared by Project Design Consultants, dated May 14, 2014.

Table 2.3.1
Summary of 100-Year 6-Hour Proposed Peak Discharge Rates Off-site[1]
Draining through BMR East Clusters Unit 3
(Post-project Condition)

	Drainage Node ID	Area (acres)	Time of Concentration (minutes)	100-Year 6-Hour Peak Flow Rate (cfs)[2]
Actual [3]	701	63.9	22.8	77.4
	1014	34.7	13.5	61.5
	1027	6.0	11.5	12.0
	Off-site	459.2	23.6	539.7
Assumed	701	63.9	22	80
	1014	34.7	13	63.5

Note 1: Off-site drainage characteristics were referenced from the report titled, "Preliminary Drainage Report Heritage Bluffs II," prepared by Project Design Consultants, dated May 14, 2014.

2: cfs = cubic feet per second

3: Assumed values were utilized in the East Cluster Unit 3 Rational Method models.

3.0 HYDRAULICS

3.1 Hydraulic Methodology and Criteria

The 100-year, 6-hour proposed peak flow rates determined using the Modified Rational Method (for post-project condition) were used to size the on-site storm drain system, including open channel sizing, proposed inlet sizing, dry lane calculations, pipe sizing, and energy dissipaters. The AES Pipe Flow Hydraulics computer program was used to analyze hydraulic losses that occur within the proposed storm drain system to determine the hydraulic grade lines (HGLs) within the mainline systems.

3.1.1 Open Channel Design

All open channels were designed using Manning's equation. The anticipated runoff to each channel was estimated either by the Modified Rational Method.

<u>Open Channel Results</u>

A minimum of 6-inches of freeboard is provided within each brow ditch and/or swale. The results of the brow ditch and swale calculations are provided in Appendix C of this report.

3.1.2 Inlet Sizing

Inlet design calculations were completed using a computer program based on the following equation for inlets on a grade and inlets in sump:

Type B Inlets on a Grade

$$Q = 0.7\ L\ (a + y)^{3/2}$$

Where:
- y = depth of flow approaching the curb inlet, in feet (ft)
- a = depth of depression of curb at inlet, in feet (ft)
- L = length of clear opening of inlet for total interception, in feet (ft)
- Q = interception capacity of the curb inlet, in cubic feet per second (cfs)

Type B Inlets in a Sump

$$Q/L = 1.5 \text{ cfs/ft}$$

Where: Q = inlet capacity, in cubic feet per second (cfs)

L = length of clear opening of inlet for total interception, in feet (ft)

Inlet Results

The inlet design calculations along with back-up information are provided in Appendix D. Inlets were sized for the 100-year storm event. Inlets are located throughout the development to provide enough inlets to maintain the depth of flow in the street for the 100-year storm according to the following criteria:

a) a minimum of 0.1 foot below the top of curb, or
b) at a depth equal to or less than the depth that results in the City of San Diego "Dry Lane" requirements being met.

Each inlet was sized to provide 100% capture of the flow draining to the inlet (no bypass flow at any inlet). Refer to the drainage study map provided in Map Pocket 2 for the location of each node.

3.1.3 Dry Lane Calculations

Per the request of the City of San Diego, a "dry lane" will be provided for all public streets throughout the project site. The "dry lane" is defined as the width of street that remains dry during the design storm. In other words, the combined width of roadway that does not fall within the computed spread width from either side of the street regardless of travel direction if no median is provided, or width of dry lane in each direction if a median is provided (as in this case for all the streets). A dry lane of 12-feet or greater is desirable during the 100-year peak storm event, however, a minimum dry lane width of 9-feet must be provided in all instances. In order to determine if an appropriate dry lane is provided, an allowable street gutter depth is calculated for each of the typical street widths proposed throughout the project site. Refer to

Appendix E of this report for a visual graphic of how each allowable gutter depth was determined.

Dry Lane Results

The allowable street gutter depth calculations are provided in Appendix E. The actual street gutter depth calculations are included as part of the inlet design calculations that are included in Appendix D. The actual street gutter depth is equal to or less than the allowable street gutter depth for each public roadway located within the proposed project.

3.1.4 Pipe Flow Design

The AES Pipe Flow Hydraulics computer program was used to calculate the hydraulic and energy grade lines for the proposed storm drain systems. The program performs gradually varied flow and pressure flow profile computations. The results are provided in an incremental and summarized form, and indicate reaches of open channel and pressure flow within a given reach of pipe. The program also accounts for losses that may occur due to friction, junction structures, pipe bends, etc. The codes and an explanation of their function are as follows:

Pipe Flow Hydraulic Processes (Codes)

Code 1:	Friction Losses
Code 2:	Manhole Losses
Code 3:	Pipe-bend Losses
Code 4:	Sudden Pipe-enlargement
Code 5:	Junction Losses
Code 6:	Angle-point Losses
Code 7:	Sudden Pipe-reduction
Code 8:	Catch Basin Entrance Losses
Code 9:	Transition Losses

The storm drain system will be constructed of Reinforced Concrete Pipe (RCP) or equivalent. The Manning's roughness coefficient "n" used for the hydraulic calculations for RCP is 0.013.

Pipe Flow Results

The AES Pipe Flow computer output is provided in Appendix F of this report. Node numbering used in the AES Pipe Flow computer analyses corresponds to the rational method node numbering used on the drainage study map, located in Map Pocket 1. The AES pipe flow analyses were used to determine the storm drain sizes required to convey the 100-year peak flow rates. The resulting pipe sizes from these analyses are shown on the improvement plans for the project site and are not included on the drainage study map provided in this report.

The City's Drainage Design Manual requires that the energy gradient (EGL) shall not exceed 6-inches below the gutter grade on inlets, grate for grated inlets, or 6-inches below the bottom of the roof slab on cleanouts. The EGL exceeds this requirement at some locations along the mainline; however, the HGL is contained below finished grade at all locations. Typically, when storm drain extends down a steep slope, velocities are high resulting in a large difference between the HGL and EGL (i.e-velocity head). For these locations, the system has been evaluated and where appropriate, joints have been thickened, pipe collars have been added, and/or the pipe thickness has been increased.

To determine the 100-year conveyance for the low flow (HMP) bypass pipe within basin 900 (Node 983), the discharge rate was adjusted within the Pipeflow analysis until the HGL at the bypass junction is approximately equivalent to 520.7 (100-year HGL based on mainline results). Based on the Pipeflow analysis, the bypass will convey 14.4 cfs. The Pipeflow analysis is included in Appendix F.

The emergency overflow structure for Basin 12 has been designed at elevation 505.8 with 1.4 feet of available head and Basin 13 has been designed at elevation 512.3 with 1.0 foot of available head. A schematic layout and backup calculations for the emergency overflow structures are included in Appendix H.

3.1.5 Energy Dissipater Design

Energy dissipaters (i.e. ripraps) at the storm drain outfalls will be specified using the City of San Diego – Standard Drawings for Public Works Construction drawing number SDD-104, which provides rock classifications for design velocities entering riprap outfalls.

The design velocity was determined from both the AES Pipe Flow hydraulic analyses for flow in the final reach of storm drain pipe leading to the outfall, and HEC-RAS hydraulic analyses for flow across the riprap pad immediately downstream of the outfall. The AES Pipe Flow hydraulic analyses were used to determine the velocities of flow exiting the pipes at the outfall locations and the HEC-RAS hydraulic analyses were used to determine the velocity of flow across the riprap pad and exiting the downstream end of the riprap pad.

HEC-RAS cross sections were taken at 1-foot intervals across the riprap pad in order to determine the location of the hydraulic jump that is expected to occur on the riprap pad. The flow regime after the hydraulic jump is subcritical flow at normal depth, and the flow velocity after the hydraulic jump is expected to be less than 6 feet per second. The riprap pad length was then specified based on the location of the hydraulic jump, in order to provide 5 feet of length beyond the hydraulic jump. The riprap pad width is based on City of San Diego Standard Drawing Riprap Energy Dissipation, drawing number SDD-104.

Energy Dissipater Results

The results of the riprap design are presented in Appendix G. The dimensions and size of riprap specified meet or exceed the requirements indicated on SDD-104. The final riprap pad dimensions are shown in the table below.

Table 3.1.5 Summary of Riprap Protecting Pads Sizes

Node #	Riprap Size (ton)	Riprap Length (ft)	Riprap Width (ft)	Riprap Thickness (ft)
995	1/4 ton	13	13.5	2.7
1182	1/2 ton	26	36	3.5
1190	2 ton	23	27	5.4
Double Box Culvert	1 ton	30	37.5	4.4

6.0 CONCLUSION

This drainage report presents the hydrologic and hydraulic calculations in support of the Black Mountain Ranch East Clusters Unit 3 project. The 100-year ultimate condition hydrologic analyses have been provided for BMR East Clusters Unit 3. The peak discharge rates were determined using the Modified Rational Method based on the hydrologic methodology and criteria described in the City of San Diego Drainage Manual April 1984.

The 100-year, 6-hour post-project peak flow rates were utilized to size the proposed drainage system, including sizing for open channels. Inlets were located and sized to provide 100% capture of flow and meet the City of San Diego dry lane requirements. The hydraulic grade lines (HGL) were determined for the proposed storm drain system, and each has been designed to convey flow in an open channel condition where feasible. Riprap pads will be provided at outfall locations to help reduce velocities and minimize erosion.

APPENDIX A

Modified Rational Method Analyses

[Post-Project]

- **Fire Access Road Basins 10 and 20**

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****************************************************************************

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                         Analysis prepared by:

                        RICK ENGINEERING COMPANY
                            5620 Friars Road
                       San Diego, California 92110
                     619-291-0707   Fax 619-291-4165

 ************************** DESCRIPTION OF STUDY **************************
* J-15149-B BMR East Clusters Unit 3                                       *
* 100-Year Storm Event                                                     *
* Basin 10 (Fire-Road) Post-Project                                        *
 **************************************************************************

  FILE NAME: EC310P00.RAT
  TIME/DATE OF STUDY: 16:37 03/11/2014
----------------------------------------------------------------------------
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
----------------------------------------------------------------------------
  USER SPECIFIED STORM EVENT(YEAR) = 100.00
  SPECIFIED MINIMUM PIPE SIZE(INCH) =  12.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.90
  RAINFALL-INTENSITY ADJUSTMENT FACTOR = 1.000
  *USER SPECIFIED:
  NUMBER OF [TIME,INTENSITY] DATA PAIRS =  9
   1)    5.000;  4.400
   2)   10.000;  3.450
   3)   15.000;  2.900
   4)   20.000;  2.500
   5)   25.000;  2.200
   6)   30.000;  2.000
   7)   40.000;  1.700
   8)   50.000;  1.500
   9)   60.000;  1.300
  SAN DIEGO HYDROLOGY MANUAL "C"-VALUES USED FOR RATIONAL METHOD
  NOTE: ONLY PEAK CONFLUENCE VALUES CONSIDERED
  *USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW MODEL*
     HALF-  CROWN TO  STREET-CROSSFALL:  CURB  GUTTER-GEOMETRIES:  MANNING
     WIDTH  CROSSFALL IN- / OUT-/PARK-  HEIGHT WIDTH  LIP   HIKE   FACTOR
NO.  (FT)     (FT)    SIDE / SIDE/ WAY   (FT)   (FT)  (FT)   (FT)    (n)
===  =====  ========= ================ ====== ===== ====== ===== =======
  1   20.0     15.0   0.020/0.020/0.020  0.50   2.00 0.0100 0.125 0.0180
  2   18.0     13.0   0.020/0.020/0.020  0.50   1.50 0.0313 0.125 0.0180
  3   17.0     12.0   0.020/0.020/0.020  0.50   1.50 0.0100 0.125 0.0180

  GLOBAL STREET FLOW-DEPTH CONSTRAINTS:
    1. Relative Flow-Depth = -0.10 FEET
       as (Maximum Allowable Street Flow Depth) - (Top-of-Curb)
    2. (Depth)*(Velocity) Constraint = 10.0 (FT*FT/S)
  *SIZE PIPE WITH A FLOW CAPACITY GREATER THAN
   OR EQUAL TO THE UPSTREAM TRIBUTARY PIPE.*

****************************************************************************
```

```
FLOW PROCESS FROM NODE      10.00 TO NODE      11.00 IS CODE =  21
----------------------------------------------------------------------------
 >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
 *USER SPECIFIED(SUBAREA):
 RURAL DEVELOPMENT RUNOFF COEFFICIENT = .8300
 S.C.S. CURVE NUMBER (AMC II) =    0
 INITIAL SUBAREA FLOW-LENGTH(FEET) =    100.00
 UPSTREAM ELEVATION(FEET) =     598.00
 DOWNSTREAM ELEVATION(FEET) =     594.00
 ELEVATION DIFFERENCE(FEET) =       4.00
 URBAN SUBAREA OVERLAND TIME OF FLOW(MIN.) =     3.062
 *CAUTION: SUBAREA SLOPE EXCEEDS COUNTY NOMOGRAPH
  DEFINITION. EXTRAPOLATION OF NOMOGRAPH USED.
 TIME OF CONCENTRATION ASSUMED AS 6-MIN.
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.210
 SUBAREA RUNOFF(CFS) =        0.70
 TOTAL AREA(ACRES) =       0.20   TOTAL RUNOFF(CFS) =        0.70

****************************************************************************
 FLOW PROCESS FROM NODE      11.00 TO NODE      12.00 IS CODE =  51
----------------------------------------------------------------------------
 >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
 >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =    594.00  DOWNSTREAM(FEET) =    560.00
 CHANNEL LENGTH THRU SUBAREA(FEET) =   400.00   CHANNEL SLOPE =  0.0850
 CHANNEL BASE(FEET) =    1.00   "Z" FACTOR =   0.500
 MANNING'S FACTOR = 0.018   MAXIMUM DEPTH(FEET) =    1.00
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.025
 *USER SPECIFIED(SUBAREA):
 ROAD(HARD SURFACE) COVER RUNOFF COEFFICIENT = .8300
 S.C.S. CURVE NUMBER (AMC II) =    0
 TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       1.54
 TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =    6.86
 AVERAGE FLOW DEPTH(FEET) =    0.20   TRAVEL TIME(MIN.) =    0.97
 Tc(MIN.) =    6.97
 SUBAREA AREA(ACRES) =       0.50        SUBAREA RUNOFF(CFS) =     1.67
 TOTAL AREA(ACRES) =        0.70          PEAK FLOW RATE(CFS) =       2.37

 END OF SUBAREA CHANNEL FLOW HYDRAULICS:
 DEPTH(FEET) =  0.26   FLOW VELOCITY(FEET/SEC.) =    7.92
 LONGEST FLOWPATH FROM NODE      10.00 TO NODE      12.00 =    500.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE      12.00 TO NODE      12.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.025
 *USER SPECIFIED(SUBAREA):
 RURAL DEVELOPMENT RUNOFF COEFFICIENT = .4500
 S.C.S. CURVE NUMBER (AMC II) =    0
 SUBAREA AREA(ACRES) =      0.10   SUBAREA RUNOFF(CFS) =      0.18
 TOTAL AREA(ACRES) =        0.80   TOTAL RUNOFF(CFS) =      2.55
 TC(MIN.) =    6.97
============================================================================
 END OF STUDY SUMMARY:
 TOTAL AREA(ACRES)        =       0.80  TC(MIN.) =       6.97
 PEAK FLOW RATE(CFS)      =       2.55
============================================================================
```

==
END OF RATIONAL METHOD ANALYSIS

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            Ver. 1.5A Release Date: 01/01/2003  License ID 1261

                         Analysis prepared by:

                        RICK ENGINEERING COMPANY
                            5620 Friars Road
                       San Diego, California 92110
                      619-291-0707   Fax 619-291-4165

 ************************** DESCRIPTION OF STUDY **************************
 * J-15149-B BMR East Clusters Unit 3                                       *
 * 100-Year Storm Event                                                     *
 * Basin 20 (Fire-Road) Post-Project                                        *
 ***************************************************************************

  FILE NAME: EC320P00.RAT
  TIME/DATE OF STUDY: 16:25 03/11/2014
----------------------------------------------------------------------------
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
----------------------------------------------------------------------------
  USER SPECIFIED STORM EVENT(YEAR) = 100.00
  SPECIFIED MINIMUM PIPE SIZE(INCH) =  12.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.90
  RAINFALL-INTENSITY ADJUSTMENT FACTOR = 1.000
  *USER SPECIFIED:
  NUMBER OF [TIME,INTENSITY] DATA PAIRS =  9
   1)   5.000;  4.400
   2)  10.000;  3.450
   3)  15.000;  2.900
   4)  20.000;  2.500
   5)  25.000;  2.200
   6)  30.000;  2.000
   7)  40.000;  1.700
   8)  50.000;  1.500
   9)  60.000;  1.300
  SAN DIEGO HYDROLOGY MANUAL "C"-VALUES USED FOR RATIONAL METHOD
  NOTE: ONLY PEAK CONFLUENCE VALUES CONSIDERED
  *USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW MODEL*
     HALF-  CROWN TO   STREET-CROSSFALL:  CURB  GUTTER-GEOMETRIES:  MANNING
     WIDTH  CROSSFALL  IN- / OUT-/PARK-  HEIGHT WIDTH  LIP   HIKE   FACTOR
NO.  (FT)     (FT)     SIDE / SIDE/ WAY   (FT)   (FT)  (FT)   (FT)    (n)
===  =====  =========  ================  ======  ===== ====== =====  =======
 1   20.0     15.0     0.020/0.020/0.020  0.50   2.00 0.0100 0.125  0.0180
 2   18.0     13.0     0.020/0.020/0.020  0.50   1.50 0.0313 0.125  0.0180
 3   17.0     12.0     0.020/0.020/0.020  0.50   1.50 0.0100 0.125  0.0180

  GLOBAL STREET FLOW-DEPTH CONSTRAINTS:
    1. Relative Flow-Depth = -0.10 FEET
       as (Maximum Allowable Street Flow Depth) - (Top-of-Curb)
    2. (Depth)*(Velocity) Constraint = 10.0 (FT*FT/S)
  *SIZE PIPE WITH A FLOW CAPACITY GREATER THAN
   OR EQUAL TO THE UPSTREAM TRIBUTARY PIPE.*

****************************************************************************
```

```
 FLOW PROCESS FROM NODE     20.00 TO NODE     21.00 IS CODE =  21
----------------------------------------------------------------------------
 >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
 *USER SPECIFIED(SUBAREA):
 ROAD(HARD SURFACE) COVER RUNOFF COEFFICIENT = .8300
 S.C.S. CURVE NUMBER (AMC II) =   0
 INITIAL SUBAREA FLOW-LENGTH(FEET) =   100.00
 UPSTREAM ELEVATION(FEET) =     613.20
 DOWNSTREAM ELEVATION(FEET) =     612.80
 ELEVATION DIFFERENCE(FEET) =       0.40
 URBAN SUBAREA OVERLAND TIME OF FLOW(MIN.) =    6.596
 *CAUTION: SUBAREA SLOPE EXCEEDS COUNTY NOMOGRAPH
  DEFINITION. EXTRAPOLATION OF NOMOGRAPH USED.
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.097
 SUBAREA RUNOFF(CFS) =        0.68
 TOTAL AREA(ACRES) =        0.20   TOTAL RUNOFF(CFS) =       0.68

****************************************************************************
 FLOW PROCESS FROM NODE     21.00 TO NODE     22.00 IS CODE =  51
----------------------------------------------------------------------------
 >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
 >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =    612.80  DOWNSTREAM(FEET) =    538.50
 CHANNEL LENGTH THRU SUBAREA(FEET) =   850.00   CHANNEL SLOPE =  0.0874
 CHANNEL BASE(FEET) =    1.00   "Z" FACTOR =   0.500
 MANNING'S FACTOR = 0.018   MAXIMUM DEPTH(FEET) =   1.00
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.765
 *USER SPECIFIED(SUBAREA):
 ROAD(HARD SURFACE) COVER RUNOFF COEFFICIENT = .8300
 S.C.S. CURVE NUMBER (AMC II) =   0
 TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       2.56
 TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =    8.10
 AVERAGE FLOW DEPTH(FEET) =   0.28   TRAVEL TIME(MIN.) =    1.75
 Tc(MIN.) =    8.34
 SUBAREA AREA(ACRES) =       1.20        SUBAREA RUNOFF(CFS) =     3.75
 TOTAL AREA(ACRES) =        1.40          PEAK FLOW RATE(CFS) =        4.43

 END OF SUBAREA CHANNEL FLOW HYDRAULICS:
 DEPTH(FEET) =  0.39   FLOW VELOCITY(FEET/SEC.) =    9.61
 LONGEST FLOWPATH FROM NODE      20.00 TO NODE      22.00 =    950.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE     22.00 TO NODE     22.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.765
 *USER SPECIFIED(SUBAREA):
 ROAD(HARD SURFACE) COVER RUNOFF COEFFICIENT = .9500
 S.C.S. CURVE NUMBER (AMC II) =   0
 SUBAREA AREA(ACRES) =      0.20   SUBAREA RUNOFF(CFS) =      0.72
 TOTAL AREA(ACRES) =        1.60   TOTAL RUNOFF(CFS) =      5.14
 TC(MIN.) =    8.34
============================================================================
 END OF STUDY SUMMARY:
 TOTAL AREA(ACRES)        =        1.60  TC(MIN.) =        8.34
 PEAK FLOW RATE(CFS)      =        5.14
============================================================================
============================================================================
```

END OF RATIONAL METHOD ANALYSIS

- **Basin 900**

```
****************************************************************************

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                          Analysis prepared by:

                         RICK ENGINEERING COMPANY
                             5620 Friars Road
                        San Diego, California 92110
                       619-291-0707   Fax 619-291-4165

 ************************** DESCRIPTION OF STUDY **************************
 * J-15149-B BMR East Clusters Unit 3                                     *
 * 100-Year Storm Event                                                   *
 * Basin West (900) Post-Project                                          *
 **************************************************************************

  FILE NAME: EC39HP00.RAT
  TIME/DATE OF STUDY: 13:09 02/28/2014
 ----------------------------------------------------------------------------
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
 ----------------------------------------------------------------------------
  USER SPECIFIED STORM EVENT(YEAR) = 100.00
  SPECIFIED MINIMUM PIPE SIZE(INCH) =  12.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.90
  RAINFALL-INTENSITY ADJUSTMENT FACTOR = 1.000
  *USER SPECIFIED:
  NUMBER OF [TIME,INTENSITY] DATA PAIRS =  9
   1)   5.000;  4.400
   2)  10.000;  3.450
   3)  15.000;  2.900
   4)  20.000;  2.500
   5)  25.000;  2.200
   6)  30.000;  2.000
   7)  40.000;  1.700
   8)  50.000;  1.500
   9)  60.000;  1.300
  SAN DIEGO HYDROLOGY MANUAL "C"-VALUES USED FOR RATIONAL METHOD
  NOTE: ONLY PEAK CONFLUENCE VALUES CONSIDERED
  *USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW MODEL*
      HALF-  CROWN TO   STREET-CROSSFALL:   CURB  GUTTER-GEOMETRIES:  MANNING
      WIDTH  CROSSFALL  IN- / OUT-/PARK-   HEIGHT  WIDTH  LIP   HIKE  FACTOR
 NO.  (FT)    (FT)      SIDE / SIDE/ WAY    (FT)   (FT)  (FT)   (FT)   (n)
 ===  =====  =========  =================  ======  =====  ======  =====  ======
  1   20.0     15.0     0.020/0.020/0.020   0.50    2.00  0.0100  0.125 0.0180
  2   18.0     13.0     0.020/0.020/0.020   0.50    1.50  0.0313  0.125 0.0180
  3   17.0     12.0     0.020/0.020/0.020   0.50    1.50  0.0100  0.125 0.0180

  GLOBAL STREET FLOW-DEPTH CONSTRAINTS:
    1. Relative Flow-Depth = -0.10 FEET
       as (Maximum Allowable Street Flow Depth) - (Top-of-Curb)
    2. (Depth)*(Velocity) Constraint = 10.0 (FT*FT/S)
  *SIZE PIPE WITH A FLOW CAPACITY GREATER THAN
   OR EQUAL TO THE UPSTREAM TRIBUTARY PIPE.*

 ****************************************************************************
```

```
FLOW PROCESS FROM NODE    902.00 TO NODE    906.00 IS CODE =  21
----------------------------------------------------------------------------
>>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
*USER SPECIFIED(SUBAREA):
SINGLE FAMILY DEVELOPMENT RUNOFF COEFFICIENT = .7500
S.C.S. CURVE NUMBER (AMC II) =   0
INITIAL SUBAREA FLOW-LENGTH(FEET) =    100.00
UPSTREAM ELEVATION(FEET) =     595.50
DOWNSTREAM ELEVATION(FEET) =     591.60
ELEVATION DIFFERENCE(FEET) =       3.90
URBAN SUBAREA OVERLAND TIME OF FLOW(MIN.) =    4.003
*CAUTION: SUBAREA SLOPE EXCEEDS COUNTY NOMOGRAPH
 DEFINITION. EXTRAPOLATION OF NOMOGRAPH USED.
TIME OF CONCENTRATION ASSUMED AS 6-MIN.
 100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.210
SUBAREA RUNOFF(CFS) =      1.89
TOTAL AREA(ACRES) =       0.60   TOTAL RUNOFF(CFS) =       1.89

****************************************************************************
FLOW PROCESS FROM NODE    906.00 TO NODE    908.00 IS CODE =  62
----------------------------------------------------------------------------
>>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>>(STREET TABLE SECTION #  3 USED)<<<<<
============================================================================
UPSTREAM ELEVATION(FEET) =  591.60  DOWNSTREAM ELEVATION(FEET) =  586.00
STREET LENGTH(FEET) =    170.00   CURB HEIGHT(INCHES) =  6.0
STREET HALFWIDTH(FEET) = 17.00

DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  12.00
INSIDE STREET CROSSFALL(DECIMAL) =  0.020
OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0180
Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

  **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =        3.11
  STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
  STREET FLOW DEPTH(FEET) =  0.29
  HALFSTREET FLOOD WIDTH(FEET) =    9.36
  AVERAGE FLOW VELOCITY(FEET/SEC.) =    3.23
  PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =     0.94
STREET FLOW TRAVEL TIME(MIN.) =   0.88   Tc(MIN.) =    6.88
 100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.043
*USER SPECIFIED(SUBAREA):
SINGLE FAMILY DEVELOPMENT RUNOFF COEFFICIENT = .7500
S.C.S. CURVE NUMBER (AMC II) =   0
SUBAREA AREA(ACRES) =    0.80      SUBAREA RUNOFF(CFS) =    2.43
TOTAL AREA(ACRES) =      1.40        PEAK FLOW RATE(CFS) =       4.32

END OF SUBAREA STREET FLOW HYDRAULICS:
DEPTH(FEET) = 0.32   HALFSTREET FLOOD WIDTH(FEET) =  10.77
FLOW VELOCITY(FEET/SEC.) =  3.47   DEPTH*VELOCITY(FT*FT/SEC.) =   1.11
LONGEST FLOWPATH FROM NODE    902.00 TO NODE    908.00 =   270.00 FEET.

****************************************************************************
FLOW PROCESS FROM NODE    908.00 TO NODE    910.00 IS CODE =  41
----------------------------------------------------------------------------
>>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
```

```
 >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
==============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =    580.00  DOWNSTREAM(FEET) =    579.50
 FLOW LENGTH(FEET) =    13.60   MANNING'S N =  0.013
 DEPTH OF FLOW IN  18.0 INCH PIPE IS   5.8 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =   8.76
 GIVEN PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =        4.32
 PIPE TRAVEL TIME(MIN.) =   0.03    Tc(MIN.) =    6.90
 LONGEST FLOWPATH FROM NODE     902.00 TO NODE     910.00 =    283.60 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE     910.00 TO NODE     913.00 IS CODE =  41
----------------------------------------------------------------------------

 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
==============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =    579.20  DOWNSTREAM(FEET) =    567.40
 FLOW LENGTH(FEET) =   176.00   MANNING'S N =  0.013
 DEPTH OF FLOW IN  18.0 INCH PIPE IS   5.0 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =  10.87
 GIVEN PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =        4.32
 PIPE TRAVEL TIME(MIN.) =   0.27    Tc(MIN.) =    7.17
 LONGEST FLOWPATH FROM NODE     902.00 TO NODE     913.00 =    459.60 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE     913.00 TO NODE     913.00 IS CODE =   1
----------------------------------------------------------------------------

 >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
==============================================================================
 TOTAL NUMBER OF STREAMS =  2
 CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
 TIME OF CONCENTRATION(MIN.) =    7.17
 RAINFALL INTENSITY(INCH/HR) =    3.99
 TOTAL STREAM AREA(ACRES) =     1.40
 PEAK FLOW RATE(CFS) AT CONFLUENCE =        4.32

****************************************************************************
 FLOW PROCESS FROM NODE     900.00 TO NODE     905.00 IS CODE =  21
----------------------------------------------------------------------------

 >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
==============================================================================
 *USER SPECIFIED(SUBAREA):
 SINGLE FAMILY DEVELOPMENT RUNOFF COEFFICIENT = .7500
 S.C.S. CURVE NUMBER (AMC II) =   0
 INITIAL SUBAREA FLOW-LENGTH(FEET) =   100.00
 UPSTREAM ELEVATION(FEET) =     586.20
 DOWNSTREAM ELEVATION(FEET) =     583.50
 ELEVATION DIFFERENCE(FEET) =       2.70
 URBAN SUBAREA OVERLAND TIME OF FLOW(MIN.) =    4.524
 *CAUTION: SUBAREA SLOPE EXCEEDS COUNTY NOMOGRAPH
  DEFINITION. EXTRAPOLATION OF NOMOGRAPH USED.
 TIME OF CONCENTRATION ASSUMED AS 6-MIN.
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.210
 SUBAREA RUNOFF(CFS) =       1.26
 TOTAL AREA(ACRES) =       0.40   TOTAL RUNOFF(CFS) =       1.26

****************************************************************************
 FLOW PROCESS FROM NODE     905.00 TO NODE     911.00 IS CODE =  62
----------------------------------------------------------------------------
```

```
>>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>>(STREET TABLE SECTION #  3 USED)<<<<<
==============================================================================
UPSTREAM ELEVATION(FEET) =  583.60  DOWNSTREAM ELEVATION(FEET) =  574.00
STREET LENGTH(FEET) =   135.00   CURB HEIGHT(INCHES) =  6.0
STREET HALFWIDTH(FEET) = 17.00

DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  12.00
INSIDE STREET CROSSFALL(DECIMAL) =  0.020
OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0180
Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

  **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       2.19
  STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
  STREET FLOW DEPTH(FEET) =  0.24
  HALFSTREET FLOOD WIDTH(FEET) =    6.73
  AVERAGE FLOW VELOCITY(FEET/SEC.) =    4.05
  PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.97
 STREET FLOW TRAVEL TIME(MIN.) =   0.56   Tc(MIN.) =   6.56
 100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.104
 *USER SPECIFIED(SUBAREA):
 SINGLE FAMILY DEVELOPMENT RUNOFF COEFFICIENT = .7500
 S.C.S. CURVE NUMBER (AMC II) =    0
 SUBAREA AREA(ACRES) =     0.60      SUBAREA RUNOFF(CFS) =     1.85
 TOTAL AREA(ACRES) =       1.00        PEAK FLOW RATE(CFS) =        3.11

 END OF SUBAREA STREET FLOW HYDRAULICS:
 DEPTH(FEET) = 0.26   HALFSTREET FLOOD WIDTH(FEET) =   7.95
 FLOW VELOCITY(FEET/SEC.) =  4.33   DEPTH*VELOCITY(FT*FT/SEC.) =   1.14
 LONGEST FLOWPATH FROM NODE     900.00 TO NODE    911.00 =   235.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    911.00 TO NODE    913.00 IS CODE =  41
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =   568.20  DOWNSTREAM(FEET) =   567.70
 FLOW LENGTH(FEET) =    15.00   MANNING'S N =  0.013
 DEPTH OF FLOW IN  18.0 INCH PIPE IS   5.0 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =   7.71
 GIVEN PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =     3.11
 PIPE TRAVEL TIME(MIN.) =   0.03    Tc(MIN.) =    6.59
 LONGEST FLOWPATH FROM NODE    900.00 TO NODE    913.00 =   250.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    913.00 TO NODE    913.00 IS CODE =   1
----------------------------------------------------------------------------
 >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
 >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
 TOTAL NUMBER OF STREAMS =  2
 CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
 TIME OF CONCENTRATION(MIN.) =    6.59
 RAINFALL INTENSITY(INCH/HR) =   4.10
 TOTAL STREAM AREA(ACRES) =     1.00
```

```
PEAK FLOW RATE(CFS) AT CONFLUENCE =        3.11

** CONFLUENCE DATA **
STREAM      RUNOFF       Tc        INTENSITY       AREA
NUMBER       (CFS)     (MIN.)    (INCH/HOUR)     (ACRE)
   1          4.32      7.17         3.987          1.40
   2          3.11      6.59         4.098          1.00

RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
CONFLUENCE FORMULA USED FOR  2 STREAMS.

** PEAK FLOW RATE TABLE **
STREAM      RUNOFF       Tc        INTENSITY
NUMBER       (CFS)     (MIN.)    (INCH/HOUR)
   1          7.31      6.59         4.098
   2          7.35      7.17         3.987

COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
PEAK FLOW RATE(CFS) =        7.35   Tc(MIN.) =     7.17
TOTAL AREA(ACRES) =        2.40
LONGEST FLOWPATH FROM NODE     902.00 TO NODE     913.00 =    459.60 FEET.

****************************************************************************
FLOW PROCESS FROM NODE    913.00 TO NODE    930.00 IS CODE =  41
----------------------------------------------------------------------------
>>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
ELEVATION DATA: UPSTREAM(FEET) =    567.40  DOWNSTREAM(FEET) =    546.70
FLOW LENGTH(FEET) =    272.20   MANNING'S N =  0.013
DEPTH OF FLOW IN  18.0 INCH PIPE IS   6.3 INCHES
PIPE-FLOW VELOCITY(FEET/SEC.) =  13.21
GIVEN PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
PIPE-FLOW(CFS) =        7.35
PIPE TRAVEL TIME(MIN.) =    0.34    Tc(MIN.) =     7.52
LONGEST FLOWPATH FROM NODE     902.00 TO NODE     930.00 =    731.80 FEET.

****************************************************************************
FLOW PROCESS FROM NODE    930.00 TO NODE    930.00 IS CODE =   1
----------------------------------------------------------------------------
>>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
TOTAL NUMBER OF STREAMS =  3
CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
TIME OF CONCENTRATION(MIN.) =    7.52
RAINFALL INTENSITY(INCH/HR) =    3.92
TOTAL STREAM AREA(ACRES) =     2.40
PEAK FLOW RATE(CFS) AT CONFLUENCE =        7.35

****************************************************************************
FLOW PROCESS FROM NODE    917.00 TO NODE    918.00 IS CODE =  21
----------------------------------------------------------------------------
>>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
*USER SPECIFIED(SUBAREA):
SINGLE FAMILY DEVELOPMENT RUNOFF COEFFICIENT = .7500
S.C.S. CURVE NUMBER (AMC II) =    0
INITIAL SUBAREA FLOW-LENGTH(FEET) =    100.00
UPSTREAM ELEVATION(FEET) =    584.30
DOWNSTREAM ELEVATION(FEET) =     577.70
ELEVATION DIFFERENCE(FEET) =       6.60
```

```
URBAN SUBAREA OVERLAND TIME OF FLOW(MIN.) =    3.359
*CAUTION: SUBAREA SLOPE EXCEEDS COUNTY NOMOGRAPH
 DEFINITION. EXTRAPOLATION OF NOMOGRAPH USED.
TIME OF CONCENTRATION ASSUMED AS 6-MIN.
 100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.210
SUBAREA RUNOFF(CFS) =         1.58
TOTAL AREA(ACRES) =        0.50   TOTAL RUNOFF(CFS) =         1.58

****************************************************************************
 FLOW PROCESS FROM NODE    918.00 TO NODE    920.00 IS CODE =  62
----------------------------------------------------------------------------

 >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>(STREET TABLE SECTION #  3 USED)<<<<<
============================================================================
 UPSTREAM ELEVATION(FEET) =  577.70  DOWNSTREAM ELEVATION(FEET) =  553.50
 STREET LENGTH(FEET) =   310.00   CURB HEIGHT(INCHES) =  6.0
 STREET HALFWIDTH(FEET) = 17.00

 DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  12.00
 INSIDE STREET CROSSFALL(DECIMAL) =  0.020
 OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

 SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
 STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
 Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0180
 Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

   **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =        2.18
   STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
   STREET FLOW DEPTH(FEET) =  0.24
   HALFSTREET FLOOD WIDTH(FEET) =     6.64
   AVERAGE FLOW VELOCITY(FEET/SEC.) =    4.13
   PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.98
 STREET FLOW TRAVEL TIME(MIN.) =   1.25   Tc(MIN.) =    7.25
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.972
 *USER SPECIFIED(SUBAREA):
 SINGLE FAMILY DEVELOPMENT RUNOFF COEFFICIENT = .7500
 S.C.S. CURVE NUMBER (AMC II) =    0
 SUBAREA AREA(ACRES) =     0.40      SUBAREA RUNOFF(CFS) =     1.19
 TOTAL AREA(ACRES) =       0.90         PEAK FLOW RATE(CFS) =        2.77

 END OF SUBAREA STREET FLOW HYDRAULICS:
 DEPTH(FEET) = 0.25   HALFSTREET FLOOD WIDTH(FEET) =    7.39
 FLOW VELOCITY(FEET/SEC.) =  4.38   DEPTH*VELOCITY(FT*FT/SEC.) =   1.11
 LONGEST FLOWPATH FROM NODE    917.00 TO NODE    920.00 =   410.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    920.00 TO NODE    930.00 IS CODE =  41
----------------------------------------------------------------------------

 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =   547.20  DOWNSTREAM(FEET) =   546.70
 FLOW LENGTH(FEET) =    15.30   MANNING'S N =  0.013
 DEPTH OF FLOW IN  18.0 INCH PIPE IS   4.8 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =   7.41
 GIVEN PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =         2.77
 PIPE TRAVEL TIME(MIN.) =   0.03    Tc(MIN.) =    7.29
 LONGEST FLOWPATH FROM NODE    917.00 TO NODE    930.00 =   425.30 FEET.
```

```
****************************************************************************
 FLOW PROCESS FROM NODE    930.00 TO NODE    930.00 IS CODE =   1
----------------------------------------------------------------------------
 >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
 TOTAL NUMBER OF STREAMS =  3
 CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
 TIME OF CONCENTRATION(MIN.) =    7.29
 RAINFALL INTENSITY(INCH/HR) =   3.97
 TOTAL STREAM AREA(ACRES) =     0.90
 PEAK FLOW RATE(CFS) AT CONFLUENCE =       2.77

****************************************************************************
 FLOW PROCESS FROM NODE    914.00 TO NODE    915.00 IS CODE =  21
----------------------------------------------------------------------------
 >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
 *USER SPECIFIED(SUBAREA):
 SINGLE FAMILY DEVELOPMENT RUNOFF COEFFICIENT = .7500
 S.C.S. CURVE NUMBER (AMC II) =    0
 INITIAL SUBAREA FLOW-LENGTH(FEET) =   100.00
 UPSTREAM ELEVATION(FEET) =     571.10
 DOWNSTREAM ELEVATION(FEET) =     568.00
 ELEVATION DIFFERENCE(FEET) =       3.10
 URBAN SUBAREA OVERLAND TIME OF FLOW(MIN.) =     4.321
 *CAUTION: SUBAREA SLOPE EXCEEDS COUNTY NOMOGRAPH
  DEFINITION. EXTRAPOLATION OF NOMOGRAPH USED.
 TIME OF CONCENTRATION ASSUMED AS 6-MIN.
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.210
 SUBAREA RUNOFF(CFS) =        2.21
 TOTAL AREA(ACRES) =        0.70   TOTAL RUNOFF(CFS) =        2.21

****************************************************************************
 FLOW PROCESS FROM NODE    915.00 TO NODE    925.00 IS CODE =  62
----------------------------------------------------------------------------
 >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>(STREET TABLE SECTION #  3 USED)<<<<<
============================================================================
 UPSTREAM ELEVATION(FEET) =  568.00  DOWNSTREAM ELEVATION(FEET) =  553.00
 STREET LENGTH(FEET) =   190.00   CURB HEIGHT(INCHES) =  6.0
 STREET HALFWIDTH(FEET) = 17.00

 DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  12.00
 INSIDE STREET CROSSFALL(DECIMAL) =  0.020
 OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

 SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
 STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
 Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0180
 Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

   **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =        3.59
   STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
   STREET FLOW DEPTH(FEET) =  0.27
   HALFSTREET FLOOD WIDTH(FEET) =      8.23
   AVERAGE FLOW VELOCITY(FEET/SEC.) =     4.69
   PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =     1.27
 STREET FLOW TRAVEL TIME(MIN.) =    0.67   Tc(MIN.) =    6.67
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.082
 *USER SPECIFIED(SUBAREA):
 SINGLE FAMILY DEVELOPMENT RUNOFF COEFFICIENT = .7500
```

```
S.C.S. CURVE NUMBER (AMC II) =    0
SUBAREA AREA(ACRES) =      0.90      SUBAREA RUNOFF(CFS) =     2.76
TOTAL AREA(ACRES) =        1.60        PEAK FLOW RATE(CFS) =        4.97

END OF SUBAREA STREET FLOW HYDRAULICS:
DEPTH(FEET) = 0.30   HALFSTREET FLOOD WIDTH(FEET) =   9.55
FLOW VELOCITY(FEET/SEC.) =  4.98   DEPTH*VELOCITY(FT*FT/SEC.) =   1.47
LONGEST FLOWPATH FROM NODE    914.00 TO NODE    925.00 =   290.00 FEET.

****************************************************************************
FLOW PROCESS FROM NODE    925.00 TO NODE    930.00 IS CODE =  41
----------------------------------------------------------------------------
>>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
ELEVATION DATA: UPSTREAM(FEET) =   547.20  DOWNSTREAM(FEET) =   546.70
FLOW LENGTH(FEET) =    15.30   MANNING'S N =  0.013
DEPTH OF FLOW IN  18.0 INCH PIPE IS   6.5 INCHES
PIPE-FLOW VELOCITY(FEET/SEC.) =   8.72
GIVEN PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
PIPE-FLOW(CFS) =        4.97
PIPE TRAVEL TIME(MIN.) =    0.03    Tc(MIN.) =    6.70
LONGEST FLOWPATH FROM NODE    914.00 TO NODE    930.00 =   305.30 FEET.

****************************************************************************
FLOW PROCESS FROM NODE    930.00 TO NODE    930.00 IS CODE =   1
----------------------------------------------------------------------------
>>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
>>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
TOTAL NUMBER OF STREAMS =  3
CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  3 ARE:
TIME OF CONCENTRATION(MIN.) =    6.70
RAINFALL INTENSITY(INCH/HR) =    4.08
TOTAL STREAM AREA(ACRES) =     1.60
PEAK FLOW RATE(CFS) AT CONFLUENCE =       4.97
```

** CONFLUENCE DATA **

STREAM NUMBER	RUNOFF (CFS)	Tc (MIN.)	INTENSITY (INCH/HOUR)	AREA (ACRE)
1	7.35	7.52	3.922	2.40
2	2.77	7.29	3.966	0.90
3	4.97	6.70	4.076	1.60

RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
CONFLUENCE FORMULA USED FOR 3 STREAMS.

** PEAK FLOW RATE TABLE **

STREAM NUMBER	RUNOFF (CFS)	Tc (MIN.)	INTENSITY (INCH/HOUR)
1	14.73	6.70	4.076
2	14.87	7.29	3.966
3	14.86	7.52	3.922

```
COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
PEAK FLOW RATE(CFS) =      14.87    Tc(MIN.) =     7.29
TOTAL AREA(ACRES) =        4.90
LONGEST FLOWPATH FROM NODE    902.00 TO NODE    930.00 =   731.80 FEET.

****************************************************************************
FLOW PROCESS FROM NODE    930.00 TO NODE    940.00 IS CODE =  41
```

```
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =   546.20  DOWNSTREAM(FEET) =   538.60
 FLOW LENGTH(FEET) =   112.00   MANNING'S N =  0.013
 DEPTH OF FLOW IN  24.0 INCH PIPE IS   8.4 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =  15.09
 GIVEN PIPE DIAMETER(INCH) =  24.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =      14.87
 PIPE TRAVEL TIME(MIN.) =   0.12    Tc(MIN.) =    7.41
 LONGEST FLOWPATH FROM NODE    902.00 TO NODE    940.00 =   843.80 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    940.00 TO NODE    940.00 IS CODE =   1
----------------------------------------------------------------------------
 >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
 TOTAL NUMBER OF STREAMS =  2
 CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
 TIME OF CONCENTRATION(MIN.) =    7.41
 RAINFALL INTENSITY(INCH/HR) =   3.94
 TOTAL STREAM AREA(ACRES) =    4.90
 PEAK FLOW RATE(CFS) AT CONFLUENCE =      14.87

****************************************************************************
 FLOW PROCESS FROM NODE    932.00 TO NODE    935.00 IS CODE =  21
----------------------------------------------------------------------------
 >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
 *USER SPECIFIED(SUBAREA):
 SINGLE FAMILY DEVELOPMENT RUNOFF COEFFICIENT = .7500
 S.C.S. CURVE NUMBER (AMC II) =   0
 INITIAL SUBAREA FLOW-LENGTH(FEET) =    100.00
 UPSTREAM ELEVATION(FEET) =     550.00
 DOWNSTREAM ELEVATION(FEET) =     547.70
 ELEVATION DIFFERENCE(FEET) =       2.30
 URBAN SUBAREA OVERLAND TIME OF FLOW(MIN.) =    4.773
 TIME OF CONCENTRATION ASSUMED AS 6-MIN.
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.210
 SUBAREA RUNOFF(CFS) =       0.63
 TOTAL AREA(ACRES) =       0.20   TOTAL RUNOFF(CFS) =       0.63

****************************************************************************
 FLOW PROCESS FROM NODE    935.00 TO NODE    938.00 IS CODE =  62
----------------------------------------------------------------------------
 >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>(STREET TABLE SECTION #  3 USED)<<<<<
============================================================================
 UPSTREAM ELEVATION(FEET) =  547.70  DOWNSTREAM ELEVATION(FEET) =  546.60
 STREET LENGTH(FEET) =     85.00   CURB HEIGHT(INCHES) =  6.0
 STREET HALFWIDTH(FEET) = 17.00

 DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  12.00
 INSIDE STREET CROSSFALL(DECIMAL) =  0.020
 OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

 SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
 STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
 Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0180
 Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200
```

```
  **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =        1.70
  STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
  STREET FLOW DEPTH(FEET) =  0.28
  HALFSTREET FLOOD WIDTH(FEET) =    8.89
  AVERAGE FLOW VELOCITY(FEET/SEC.) =    1.94
  PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.55
 STREET FLOW TRAVEL TIME(MIN.) =   0.73   Tc(MIN.) =   6.73
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.071
 *USER SPECIFIED(SUBAREA):
 SINGLE FAMILY DEVELOPMENT RUNOFF COEFFICIENT = .7500
 S.C.S. CURVE NUMBER (AMC II) =   0
 SUBAREA AREA(ACRES) =     0.70      SUBAREA RUNOFF(CFS) =    2.14
 TOTAL AREA(ACRES) =       0.90        PEAK FLOW RATE(CFS) =        2.77

 END OF SUBAREA STREET FLOW HYDRAULICS:
 DEPTH(FEET) = 0.32   HALFSTREET FLOOD WIDTH(FEET) =  10.86
 FLOW VELOCITY(FEET/SEC.) =  2.19   DEPTH*VELOCITY(FT*FT/SEC.) =   0.70
 LONGEST FLOWPATH FROM NODE    932.00 TO NODE    938.00 =   185.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    938.00 TO NODE    940.00 IS CODE =  41
----------------------------------------------------------------------------

 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =    539.50  DOWNSTREAM(FEET) =   538.60
 FLOW LENGTH(FEET) =     32.00   MANNING'S N =  0.013
 DEPTH OF FLOW IN  18.0 INCH PIPE IS   4.9 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =   7.02
 GIVEN PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =       2.77
 PIPE TRAVEL TIME(MIN.) =   0.08    Tc(MIN.) =    6.81
 LONGEST FLOWPATH FROM NODE    932.00 TO NODE    940.00 =   217.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    940.00 TO NODE    940.00 IS CODE =   1
----------------------------------------------------------------------------

 >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
 >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
 TOTAL NUMBER OF STREAMS =  2
 CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
 TIME OF CONCENTRATION(MIN.) =   6.81
 RAINFALL INTENSITY(INCH/HR) =   4.06
 TOTAL STREAM AREA(ACRES) =     0.90
 PEAK FLOW RATE(CFS) AT CONFLUENCE =       2.77

 ** CONFLUENCE DATA **
 STREAM     RUNOFF      Tc       INTENSITY      AREA
 NUMBER      (CFS)    (MIN.)    (INCH/HOUR)    (ACRE)
     1       14.87     7.41        3.942          4.90
     2        2.77     6.81        4.057          0.90

 RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
 CONFLUENCE FORMULA USED FOR  2 STREAMS.

 ** PEAK FLOW RATE TABLE **
 STREAM     RUNOFF      Tc       INTENSITY
 NUMBER      (CFS)    (MIN.)    (INCH/HOUR)
     1       17.21     6.81        4.057
```

```
    2       17.56     7.41       3.942

 COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
 PEAK FLOW RATE(CFS) =      17.56   Tc(MIN.) =     7.41
 TOTAL AREA(ACRES) =        5.80
 LONGEST FLOWPATH FROM NODE     902.00 TO NODE     940.00 =    843.80 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE     940.00 TO NODE     980.00 IS CODE =  41
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =    538.30  DOWNSTREAM(FEET) =   516.10
 FLOW LENGTH(FEET) =    300.00   MANNING'S N =  0.013
 DEPTH OF FLOW IN  24.0 INCH PIPE IS    9.0 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =  16.30
 GIVEN PIPE DIAMETER(INCH) =  24.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =      17.56
 PIPE TRAVEL TIME(MIN.) =   0.31    Tc(MIN.) =    7.72
 LONGEST FLOWPATH FROM NODE     902.00 TO NODE     980.00 =   1143.80 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE     980.00 TO NODE     980.00 IS CODE =   1
----------------------------------------------------------------------------
 >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
 TOTAL NUMBER OF STREAMS =  3
 CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
 TIME OF CONCENTRATION(MIN.) =    7.72
 RAINFALL INTENSITY(INCH/HR) =    3.88
 TOTAL STREAM AREA(ACRES) =      5.80
 PEAK FLOW RATE(CFS) AT CONFLUENCE =      17.56

****************************************************************************
 FLOW PROCESS FROM NODE     941.00 TO NODE     942.00 IS CODE =  21
----------------------------------------------------------------------------
 >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
 *USER SPECIFIED(SUBAREA):
 SINGLE FAMILY DEVELOPMENT RUNOFF COEFFICIENT = .7500
 S.C.S. CURVE NUMBER (AMC II) =   0
 INITIAL SUBAREA FLOW-LENGTH(FEET) =   100.00
 UPSTREAM ELEVATION(FEET) =     551.10
 DOWNSTREAM ELEVATION(FEET) =     548.30
 ELEVATION DIFFERENCE(FEET) =       2.80
 URBAN SUBAREA OVERLAND TIME OF FLOW(MIN.) =    4.470
 *CAUTION: SUBAREA SLOPE EXCEEDS COUNTY NOMOGRAPH
  DEFINITION. EXTRAPOLATION OF NOMOGRAPH USED.
 TIME OF CONCENTRATION ASSUMED AS 6-MIN.
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.210
 SUBAREA RUNOFF(CFS) =       1.58
 TOTAL AREA(ACRES) =       0.50   TOTAL RUNOFF(CFS) =       1.58

****************************************************************************
 FLOW PROCESS FROM NODE     942.00 TO NODE     948.00 IS CODE =  62
----------------------------------------------------------------------------
 >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>(STREET TABLE SECTION #  3 USED)<<<<<
============================================================================
 UPSTREAM ELEVATION(FEET) =  548.30  DOWNSTREAM ELEVATION(FEET) =  546.70
```

```
STREET LENGTH(FEET) =    100.00   CURB HEIGHT(INCHES) =  6.0
STREET HALFWIDTH(FEET) = 17.00

DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  12.00
INSIDE STREET CROSSFALL(DECIMAL) =  0.020
OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0180
Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

  **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =        2.19
  STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
  STREET FLOW DEPTH(FEET) =  0.29
  HALFSTREET FLOOD WIDTH(FEET) =     9.45
  AVERAGE FLOW VELOCITY(FEET/SEC.) =     2.23
  PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =     0.66
STREET FLOW TRAVEL TIME(MIN.) =    0.75   Tc(MIN.) =    6.75
 100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.068
*USER SPECIFIED(SUBAREA):
SINGLE FAMILY DEVELOPMENT RUNOFF COEFFICIENT = .7500
S.C.S. CURVE NUMBER (AMC II) =    0
SUBAREA AREA(ACRES) =     0.40       SUBAREA RUNOFF(CFS) =     1.22
TOTAL AREA(ACRES) =       0.90         PEAK FLOW RATE(CFS) =        2.80

END OF SUBAREA STREET FLOW HYDRAULICS:
DEPTH(FEET) = 0.31   HALFSTREET FLOOD WIDTH(FEET) =  10.39
FLOW VELOCITY(FEET/SEC.) =  2.40   DEPTH*VELOCITY(FT*FT/SEC.) =   0.75
LONGEST FLOWPATH FROM NODE     941.00 TO NODE     948.00 =   200.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    948.00 TO NODE    960.00 IS CODE =  62
----------------------------------------------------------------------------
 >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>(STREET TABLE SECTION #  3 USED)<<<<<
============================================================================
UPSTREAM ELEVATION(FEET) =  546.70  DOWNSTREAM ELEVATION(FEET) =  516.20
STREET LENGTH(FEET) =    310.00   CURB HEIGHT(INCHES) =  6.0
STREET HALFWIDTH(FEET) = 17.00

DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  12.00
INSIDE STREET CROSSFALL(DECIMAL) =  0.020
OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0180
Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

  **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =        3.28
  STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
  STREET FLOW DEPTH(FEET) =  0.26
  HALFSTREET FLOOD WIDTH(FEET) =     7.58
  AVERAGE FLOW VELOCITY(FEET/SEC.) =     4.97
  PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =     1.27
STREET FLOW TRAVEL TIME(MIN.) =    1.04   Tc(MIN.) =    7.79
 100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.871
*USER SPECIFIED(SUBAREA):
SINGLE FAMILY DEVELOPMENT RUNOFF COEFFICIENT = .8300
S.C.S. CURVE NUMBER (AMC II) =    0
```

```
 SUBAREA AREA(ACRES) =       0.30       SUBAREA RUNOFF(CFS) =     0.96
 TOTAL AREA(ACRES) =         1.20          PEAK FLOW RATE(CFS) =        3.76

 END OF SUBAREA STREET FLOW HYDRAULICS:
 DEPTH(FEET) = 0.27   HALFSTREET FLOOD WIDTH(FEET) =    8.05
 FLOW VELOCITY(FEET/SEC.) =  5.13   DEPTH*VELOCITY(FT*FT/SEC.) =   1.36
 LONGEST FLOWPATH FROM NODE     941.00 TO NODE     960.00 =   510.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE     960.00 TO NODE     980.00 IS CODE =  41
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =    517.20  DOWNSTREAM(FEET) =    516.70
 FLOW LENGTH(FEET) =     15.30    MANNING'S N = 0.013
 DEPTH OF FLOW IN  18.0 INCH PIPE IS    5.6 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =     8.08
 GIVEN PIPE DIAMETER(INCH) =  18.00     NUMBER OF PIPES =    1
 PIPE-FLOW(CFS) =         3.76
 PIPE TRAVEL TIME(MIN.) =    0.03     Tc(MIN.) =     7.82
 LONGEST FLOWPATH FROM NODE     941.00 TO NODE     980.00 =   525.30 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE     980.00 TO NODE     980.00 IS CODE =   1
----------------------------------------------------------------------------
 >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
 TOTAL NUMBER OF STREAMS =  3
 CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
 TIME OF CONCENTRATION(MIN.) =     7.82
 RAINFALL INTENSITY(INCH/HR) =     3.86
 TOTAL STREAM AREA(ACRES) =       1.20
 PEAK FLOW RATE(CFS) AT CONFLUENCE =        3.76

****************************************************************************
 FLOW PROCESS FROM NODE     950.00 TO NODE     952.00 IS CODE =  21
----------------------------------------------------------------------------
 >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
 *USER SPECIFIED(SUBAREA):
 SINGLE FAMILY DEVELOPMENT RUNOFF COEFFICIENT = .7500
 S.C.S. CURVE NUMBER (AMC II) =    0
 INITIAL SUBAREA FLOW-LENGTH(FEET) =    100.00
 UPSTREAM ELEVATION(FEET) =      553.50
 DOWNSTREAM ELEVATION(FEET) =      548.80
 ELEVATION DIFFERENCE(FEET) =        4.70
 URBAN SUBAREA OVERLAND TIME OF FLOW(MIN.) =     3.761
 *CAUTION: SUBAREA SLOPE EXCEEDS COUNTY NOMOGRAPH
  DEFINITION. EXTRAPOLATION OF NOMOGRAPH USED.
 TIME OF CONCENTRATION ASSUMED AS 6-MIN.
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.210
 SUBAREA RUNOFF(CFS) =        0.95
 TOTAL AREA(ACRES) =         0.30    TOTAL RUNOFF(CFS) =        0.95

****************************************************************************
 FLOW PROCESS FROM NODE     952.00 TO NODE     955.00 IS CODE =  62
----------------------------------------------------------------------------
 >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>(STREET TABLE SECTION #   3 USED)<<<<<
============================================================================
```

```
UPSTREAM ELEVATION(FEET) =  548.80  DOWNSTREAM ELEVATION(FEET) =  524.60
STREET LENGTH(FEET) =   350.00   CURB HEIGHT(INCHES) =  6.0
STREET HALFWIDTH(FEET) = 17.00

DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  12.00
INSIDE STREET CROSSFALL(DECIMAL) =  0.020
OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0180
Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

  **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       2.87
  STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
  STREET FLOW DEPTH(FEET) =  0.26
  HALFSTREET FLOOD WIDTH(FEET) =     7.77
  AVERAGE FLOW VELOCITY(FEET/SEC.) =    4.17
  PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =     1.08
STREET FLOW TRAVEL TIME(MIN.) =    1.40   Tc(MIN.) =    7.40
 100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.944
*USER SPECIFIED(SUBAREA):
SINGLE FAMILY DEVELOPMENT RUNOFF COEFFICIENT = .7500
S.C.S. CURVE NUMBER (AMC II) =    0
SUBAREA AREA(ACRES) =      1.30      SUBAREA RUNOFF(CFS) =     3.85
TOTAL AREA(ACRES) =      1.60         PEAK FLOW RATE(CFS) =        4.79

END OF SUBAREA STREET FLOW HYDRAULICS:
DEPTH(FEET) = 0.30   HALFSTREET FLOOD WIDTH(FEET) =    9.64
FLOW VELOCITY(FEET/SEC.) =  4.72   DEPTH*VELOCITY(FT*FT/SEC.) =   1.41
LONGEST FLOWPATH FROM NODE     950.00 TO NODE     955.00 =    450.00 FEET.

****************************************************************************
FLOW PROCESS FROM NODE     955.00 TO NODE     980.00 IS CODE =  41
----------------------------------------------------------------------------
>>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
ELEVATION DATA: UPSTREAM(FEET) =    516.70  DOWNSTREAM(FEET) =    516.20
FLOW LENGTH(FEET) =     15.00    MANNING'S N =  0.013
DEPTH OF FLOW IN  18.0 INCH PIPE IS    6.3 INCHES
PIPE-FLOW VELOCITY(FEET/SEC.) =    8.71
GIVEN PIPE DIAMETER(INCH) =  18.00     NUMBER OF PIPES =    1
PIPE-FLOW(CFS) =      4.79
PIPE TRAVEL TIME(MIN.) =    0.03     Tc(MIN.) =    7.43
LONGEST FLOWPATH FROM NODE     950.00 TO NODE     980.00 =    465.00 FEET.

****************************************************************************
FLOW PROCESS FROM NODE     980.00 TO NODE     980.00 IS CODE =   1
----------------------------------------------------------------------------
>>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
>>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
TOTAL NUMBER OF STREAMS =  3
CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  3 ARE:
TIME OF CONCENTRATION(MIN.) =     7.43
RAINFALL INTENSITY(INCH/HR) =    3.94
TOTAL STREAM AREA(ACRES) =      1.60
PEAK FLOW RATE(CFS) AT CONFLUENCE =       4.79

** CONFLUENCE DATA **
```

```
 STREAM     RUNOFF      Tc      INTENSITY      AREA
 NUMBER      (CFS)    (MIN.)   (INCH/HOUR)    (ACRE)
     1       17.56     7.72       3.884          5.80
     2        3.76     7.82       3.865          1.20
     3        4.79     7.43       3.939          1.60

 RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
 CONFLUENCE FORMULA USED FOR  3 STREAMS.

 ** PEAK FLOW RATE TABLE **
 STREAM     RUNOFF      Tc      INTENSITY
 NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
     1       25.80     7.43      3.939
     2       26.03     7.72      3.884
     3       25.94     7.82      3.865

 COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
 PEAK FLOW RATE(CFS) =      26.03   Tc(MIN.) =     7.72
 TOTAL AREA(ACRES) =       8.60
 LONGEST FLOWPATH FROM NODE     902.00 TO NODE     980.00 =  1143.80 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    980.00 TO NODE    990.00 IS CODE =  41
----------------------------------------------------------------------------

 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =   516.40  DOWNSTREAM(FEET) =   512.50
 FLOW LENGTH(FEET) =   277.00   MANNING'S N =  0.013
 ASSUME FULL-FLOWING PIPELINE
 PIPE-FLOW VELOCITY(FEET/SEC.) =   8.28
 PIPE FLOW VELOCITY = (TOTAL FLOW)/(PIPE CROSS SECTION AREA)
 GIVEN PIPE DIAMETER(INCH) =  24.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =      26.03
 PIPE TRAVEL TIME(MIN.) =   0.56    Tc(MIN.) =    8.27
 LONGEST FLOWPATH FROM NODE     902.00 TO NODE     990.00 =  1420.80 FEET.
============================================================================
 END OF STUDY SUMMARY:
 TOTAL AREA(ACRES)        =      8.60  TC(MIN.) =       8.27
 PEAK FLOW RATE(CFS)      =     26.03
============================================================================
============================================================================
 END OF RATIONAL METHOD ANALYSIS
```

- **Basin 1000**

```
****************************************************************************

          RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE
          Reference: SAN DIEGO COUNTY FLOOD CONTROL DISTRICT
                      2003,1985,1981 HYDROLOGY MANUAL
        (c) Copyright 1982-2003 Advanced Engineering Software (aes)
           Ver. 1.5A Release Date: 01/01/2003  License ID 1261

                          Analysis prepared by:

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                       San Diego, California 92110
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************************** DESCRIPTION OF STUDY **************************
* J-15149-B BMR East Clusters Unit 3                                     *
* 100-Year Storm Event                                                   *
* Basin East (1000) Post-Project                                         *
**************************************************************************

  FILE NAME: EC31KP00.RAT
  TIME/DATE OF STUDY: 10:50 07/23/2014
----------------------------------------------------------------------------
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
----------------------------------------------------------------------------
  USER SPECIFIED STORM EVENT(YEAR) = 100.00
  SPECIFIED MINIMUM PIPE SIZE(INCH) =  12.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.90
  RAINFALL-INTENSITY ADJUSTMENT FACTOR = 1.000
  *USER SPECIFIED:
  NUMBER OF [TIME,INTENSITY] DATA PAIRS =  9
   1)   5.000;  4.400
   2)  10.000;  3.450
   3)  15.000;  2.900
   4)  20.000;  2.500
   5)  25.000;  2.200
   6)  30.000;  2.000
   7)  40.000;  1.700
   8)  50.000;  1.500
   9)  60.000;  1.300
  SAN DIEGO HYDROLOGY MANUAL "C"-VALUES USED FOR RATIONAL METHOD
  NOTE: ONLY PEAK CONFLUENCE VALUES CONSIDERED
  *USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW MODEL*
     HALF-  CROWN TO   STREET-CROSSFALL:   CURB  GUTTER-GEOMETRIES:  MANNING
     WIDTH  CROSSFALL  IN-  / OUT-/PARK-  HEIGHT  WIDTH  LIP   HIKE  FACTOR
NO.   (FT)    (FT)     SIDE / SIDE/ WAY    (FT)    (FT)  (FT)  (FT)    (n)
===  =====  =========  ================  ======  ===== ====== ===== =======
  1   20.0     15.0    0.020/0.020/0.020   0.50    1.50 0.0100 0.125 0.0180
  2   18.0     13.0    0.020/0.020/0.020   0.50    1.50 0.0313 0.125 0.0180
  3   17.0     12.0    0.020/0.020/0.020   0.50    1.50 0.0100 0.125 0.0180

  GLOBAL STREET FLOW-DEPTH CONSTRAINTS:
    1. Relative Flow-Depth = -0.10 FEET
       as (Maximum Allowable Street Flow Depth) - (Top-of-Curb)
    2. (Depth)*(Velocity) Constraint = 10.0 (FT*FT/S)
   *SIZE PIPE WITH A FLOW CAPACITY GREATER THAN
    OR EQUAL TO THE UPSTREAM TRIBUTARY PIPE.*

****************************************************************************
```

```
FLOW PROCESS FROM NODE    1000.00 TO NODE    1002.00 IS CODE =  21
----------------------------------------------------------------------------
>>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
*USER SPECIFIED(SUBAREA):
SINGLE FAMILY DEVELOPMENT RUNOFF COEFFICIENT = .8300
S.C.S. CURVE NUMBER (AMC II) =   0
INITIAL SUBAREA FLOW-LENGTH(FEET) =    100.00
UPSTREAM ELEVATION(FEET) =     619.00
DOWNSTREAM ELEVATION(FEET) =     611.00
ELEVATION DIFFERENCE(FEET) =       8.00
URBAN SUBAREA OVERLAND TIME OF FLOW(MIN.) =    2.430
*CAUTION: SUBAREA SLOPE EXCEEDS COUNTY NOMOGRAPH
 DEFINITION. EXTRAPOLATION OF NOMOGRAPH USED.
TIME OF CONCENTRATION ASSUMED AS 6-MIN.
 100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.210
SUBAREA RUNOFF(CFS) =       0.35
TOTAL AREA(ACRES) =       0.10   TOTAL RUNOFF(CFS) =       0.35

****************************************************************************
FLOW PROCESS FROM NODE    1002.00 TO NODE    1010.00 IS CODE =  62
----------------------------------------------------------------------------
>>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>>(STREET TABLE SECTION #  1 USED)<<<<<
============================================================================
UPSTREAM ELEVATION(FEET) =  611.00  DOWNSTREAM ELEVATION(FEET) =  589.00
STREET LENGTH(FEET) =   285.00   CURB HEIGHT(INCHES) =  6.0
STREET HALFWIDTH(FEET) = 20.00

DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  15.00
INSIDE STREET CROSSFALL(DECIMAL) =  0.020
OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0180
Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

  **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       0.68
  STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
  STREET FLOW DEPTH(FEET) =  0.17
  HALFSTREET FLOOD WIDTH(FEET) =    3.39
  AVERAGE FLOW VELOCITY(FEET/SEC.) =    3.37
  PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.58
STREET FLOW TRAVEL TIME(MIN.) =    1.41   Tc(MIN.) =    7.41
 100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.942
*USER SPECIFIED(SUBAREA):
SINGLE FAMILY DEVELOPMENT RUNOFF COEFFICIENT = .8300
S.C.S. CURVE NUMBER (AMC II) =   0
SUBAREA AREA(ACRES) =     0.20      SUBAREA RUNOFF(CFS) =     0.65
TOTAL AREA(ACRES) =       0.30        PEAK FLOW RATE(CFS) =       1.00

END OF SUBAREA STREET FLOW HYDRAULICS:
DEPTH(FEET) = 0.19   HALFSTREET FLOOD WIDTH(FEET) =   4.43
FLOW VELOCITY(FEET/SEC.) =  3.56   DEPTH*VELOCITY(FT*FT/SEC.) =   0.69
LONGEST FLOWPATH FROM NODE   1000.00 TO NODE   1010.00 =   385.00 FEET.

****************************************************************************
FLOW PROCESS FROM NODE   1010.00 TO NODE   1010.00 IS CODE =  81
----------------------------------------------------------------------------
>>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
```

```
==============================================================================
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.942
 *USER SPECIFIED(SUBAREA):
 SINGLE FAMILY DEVELOPMENT RUNOFF COEFFICIENT = .7500
 S.C.S. CURVE NUMBER (AMC II) =   0
 SUBAREA AREA(ACRES) =     2.10   SUBAREA RUNOFF(CFS) =     6.21
 TOTAL AREA(ACRES) =       2.40   TOTAL RUNOFF(CFS) =      7.21
 TC(MIN.) =    7.41

****************************************************************************
 FLOW PROCESS FROM NODE   1010.00 TO NODE   1015.00 IS CODE =  41
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =   582.30  DOWNSTREAM(FEET) =   582.00
 FLOW LENGTH(FEET) =    10.30   MANNING'S N =  0.013
 DEPTH OF FLOW IN  18.0 INCH PIPE IS   8.2 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =   9.25
 GIVEN PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =       7.21
 PIPE TRAVEL TIME(MIN.) =   0.02    Tc(MIN.) =    7.43
 LONGEST FLOWPATH FROM NODE   1000.00 TO NODE   1015.00 =   395.30 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE   1015.00 TO NODE   1015.00 IS CODE =  10
----------------------------------------------------------------------------
 >>>>>MAIN-STREAM MEMORY COPIED ONTO MEMORY BANK # 1 <<<<<
============================================================================

+--------------------------------------------------------------------------+
| ACTUAL Q(100)=61.5 CFS A=34.7 AC Tc=13.5 MIN - BY PDC 05/14/2014         |
| ASSUMED Q(100)=63.5 CFS A=34.7 AC Tc=13 MIN                              |
| OFF-SITE RUNOFF FROM HERITAGE BLUFFS DEVELOPMENT                         |
+--------------------------------------------------------------------------+

****************************************************************************
 FLOW PROCESS FROM NODE   1014.00 TO NODE   1014.00 IS CODE =   7
----------------------------------------------------------------------------
 >>>>>USER SPECIFIED HYDROLOGY INFORMATION AT NODE<<<<<
============================================================================
 USER-SPECIFIED VALUES ARE AS FOLLOWS:
 TC(MIN) =  13.00   RAIN INTENSITY(INCH/HOUR) =  3.12
 TOTAL AREA(ACRES) =    34.70   TOTAL RUNOFF(CFS) =     63.50

****************************************************************************
 FLOW PROCESS FROM NODE   1014.00 TO NODE   1015.00 IS CODE =  41
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =   594.20  DOWNSTREAM(FEET) =   580.00
 FLOW LENGTH(FEET) =   288.40   MANNING'S N =  0.013
 DEPTH OF FLOW IN  42.0 INCH PIPE IS  15.7 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =  19.29
 GIVEN PIPE DIAMETER(INCH) =  42.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =      63.50
 PIPE TRAVEL TIME(MIN.) =   0.25    Tc(MIN.) =  13.25
 LONGEST FLOWPATH FROM NODE   1000.00 TO NODE   1015.00 =   683.70 FEET.

****************************************************************************
```

```
 FLOW PROCESS FROM NODE   1015.00 TO NODE   1015.00 IS CODE =  11
----------------------------------------------------------------------------
 >>>>>CONFLUENCE MEMORY BANK # 1 WITH THE MAIN-STREAM MEMORY<<<<<
============================================================================

 ** MAIN STREAM CONFLUENCE DATA **
 STREAM      RUNOFF      Tc       INTENSITY     AREA
 NUMBER       (CFS)    (MIN.)    (INCH/HOUR)   (ACRE)
    1         63.50     13.25        3.093       34.70
 LONGEST FLOWPATH FROM NODE   1000.00 TO NODE   1015.00 =    683.70 FEET.

 ** MEMORY BANK #  1 CONFLUENCE DATA **
 STREAM      RUNOFF      Tc       INTENSITY     AREA
 NUMBER       (CFS)    (MIN.)    (INCH/HOUR)   (ACRE)
    1          7.21      7.43        3.938        2.40
 LONGEST FLOWPATH FROM NODE   1000.00 TO NODE   1015.00 =    395.30 FEET.

 ** PEAK FLOW RATE TABLE **
 STREAM     RUNOFF        Tc       INTENSITY
 NUMBER      (CFS)      (MIN.)    (INCH/HOUR)
    1        57.08        7.43        3.938
    2        69.16       13.25        3.093

 COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
 PEAK FLOW RATE(CFS) =      69.16   Tc(MIN.) =    13.25
 TOTAL AREA(ACRES) =      37.10

****************************************************************************
 FLOW PROCESS FROM NODE   1015.00 TO NODE   1015.00 IS CODE =  12
----------------------------------------------------------------------------
 >>>>>CLEAR MEMORY BANK # 1 <<<<<
============================================================================

****************************************************************************
 FLOW PROCESS FROM NODE   1015.00 TO NODE   1030.00 IS CODE =  41
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =    579.70  DOWNSTREAM(FEET) =    558.30
 FLOW LENGTH(FEET) =    330.30    MANNING'S N =  0.013
 DEPTH OF FLOW IN  42.0 INCH PIPE IS  15.3 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =  21.81
 GIVEN PIPE DIAMETER(INCH) =  42.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =      69.16
 PIPE TRAVEL TIME(MIN.) =   0.25    Tc(MIN.) =  13.50
 LONGEST FLOWPATH FROM NODE   1000.00 TO NODE   1030.00 =   1014.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE   1030.00 TO NODE   1030.00 IS CODE =  10
----------------------------------------------------------------------------
 >>>>>MAIN-STREAM MEMORY COPIED ONTO MEMORY BANK # 3 <<<<<
============================================================================

****************************************************************************
 FLOW PROCESS FROM NODE   1020.00 TO NODE   1021.00 IS CODE =  21
----------------------------------------------------------------------------
 >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
 *USER SPECIFIED(SUBAREA):
 SINGLE FAMILY DEVELOPMENT RUNOFF COEFFICIENT = .7500
```

```
 S.C.S. CURVE NUMBER (AMC II) =    0
 INITIAL SUBAREA FLOW-LENGTH(FEET) =    100.00
 UPSTREAM ELEVATION(FEET) =     574.30
 DOWNSTREAM ELEVATION(FEET) =     571.60
 ELEVATION DIFFERENCE(FEET) =       2.70
 URBAN SUBAREA OVERLAND TIME OF FLOW(MIN.) =    4.524
 *CAUTION: SUBAREA SLOPE EXCEEDS COUNTY NOMOGRAPH
  DEFINITION. EXTRAPOLATION OF NOMOGRAPH USED.
 TIME OF CONCENTRATION ASSUMED AS 6-MIN.
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.210
 SUBAREA RUNOFF(CFS) =       1.58
 TOTAL AREA(ACRES) =       0.50   TOTAL RUNOFF(CFS) =       1.58

****************************************************************************
 FLOW PROCESS FROM NODE   1021.00 TO NODE   1022.00 IS CODE =  62
----------------------------------------------------------------------------
 >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>(STREET TABLE SECTION #  3 USED)<<<<<
============================================================================
 UPSTREAM ELEVATION(FEET) =  571.60  DOWNSTREAM ELEVATION(FEET) =  570.00
 STREET LENGTH(FEET) =   153.30   CURB HEIGHT(INCHES) =  6.0
 STREET HALFWIDTH(FEET) = 17.00

 DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  12.00
 INSIDE STREET CROSSFALL(DECIMAL) =  0.020
 OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

 SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
 STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
 Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0180
 Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

   **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       2.62
   STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
   STREET FLOW DEPTH(FEET) =  0.33
   HALFSTREET FLOOD WIDTH(FEET) =   11.05
   AVERAGE FLOW VELOCITY(FEET/SEC.) =    2.01
   PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.65
 STREET FLOW TRAVEL TIME(MIN.) =   1.27   Tc(MIN.) =   7.27
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.968
 *USER SPECIFIED(SUBAREA):
 SINGLE FAMILY DEVELOPMENT RUNOFF COEFFICIENT = .7500
 S.C.S. CURVE NUMBER (AMC II) =    0
 SUBAREA AREA(ACRES) =     0.70      SUBAREA RUNOFF(CFS) =     2.08
 TOTAL AREA(ACRES) =       1.20        PEAK FLOW RATE(CFS) =       3.66

 END OF SUBAREA STREET FLOW HYDRAULICS:
 DEPTH(FEET) = 0.36   HALFSTREET FLOOD WIDTH(FEET) =  12.64
 FLOW VELOCITY(FEET/SEC.) =  2.17   DEPTH*VELOCITY(FT*FT/SEC.) =   0.78
 LONGEST FLOWPATH FROM NODE   1020.00 TO NODE   1022.00 =   253.30 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE   1022.00 TO NODE   1026.00 IS CODE =  41
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =   562.70  DOWNSTREAM(FEET) =   562.50
 FLOW LENGTH(FEET) =    26.20   MANNING'S N =  0.013
 DEPTH OF FLOW IN  18.0 INCH PIPE IS   8.1 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =   4.73
```

```
 GIVEN PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =        3.66
 PIPE TRAVEL TIME(MIN.) =   0.09    Tc(MIN.) =   7.37
 LONGEST FLOWPATH FROM NODE   1020.00 TO NODE   1026.00 =   279.50 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE   1026.00 TO NODE   1026.00 IS CODE =   1
----------------------------------------------------------------------------
 >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
 TOTAL NUMBER OF STREAMS =  3
 CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
 TIME OF CONCENTRATION(MIN.) =    7.37
 RAINFALL INTENSITY(INCH/HR) =    3.95
 TOTAL STREAM AREA(ACRES) =     1.20
 PEAK FLOW RATE(CFS) AT CONFLUENCE =       3.66

****************************************************************************
 FLOW PROCESS FROM NODE   1023.00 TO NODE   1024.00 IS CODE =  21
----------------------------------------------------------------------------
 >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
 *USER SPECIFIED(SUBAREA):
 SINGLE FAMILY DEVELOPMENT RUNOFF COEFFICIENT = .7500
 S.C.S. CURVE NUMBER (AMC II) =   0
 INITIAL SUBAREA FLOW-LENGTH(FEET) =   100.00
 UPSTREAM ELEVATION(FEET) =     572.50
 DOWNSTREAM ELEVATION(FEET) =     571.50
 ELEVATION DIFFERENCE(FEET) =       1.00
 URBAN SUBAREA OVERLAND TIME OF FLOW(MIN.) =    6.300
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.153
 SUBAREA RUNOFF(CFS) =        1.87
 TOTAL AREA(ACRES) =       0.60   TOTAL RUNOFF(CFS) =       1.87

****************************************************************************
 FLOW PROCESS FROM NODE   1024.00 TO NODE   1025.00 IS CODE =  62
----------------------------------------------------------------------------
 >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>(STREET TABLE SECTION #  3 USED)<<<<<
============================================================================
 UPSTREAM ELEVATION(FEET) =  571.50  DOWNSTREAM ELEVATION(FEET) =  569.90
 STREET LENGTH(FEET) =   145.00   CURB HEIGHT(INCHES) =  6.0
 STREET HALFWIDTH(FEET) = 17.00

 DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  12.00
 INSIDE STREET CROSSFALL(DECIMAL) =  0.020
 OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

 SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
 STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
 Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0180
 Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

   **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       2.46
   STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
   STREET FLOW DEPTH(FEET) =  0.32
   HALFSTREET FLOOD WIDTH(FEET) =   10.67
   AVERAGE FLOW VELOCITY(FEET/SEC.) =    2.01
   PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.64
  STREET FLOW TRAVEL TIME(MIN.) =    1.20   Tc(MIN.) =    7.50
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.924
```

```
*USER SPECIFIED(SUBAREA):
SINGLE FAMILY DEVELOPMENT RUNOFF COEFFICIENT = .7500
S.C.S. CURVE NUMBER (AMC II) =    0
SUBAREA AREA(ACRES) =     0.40      SUBAREA RUNOFF(CFS) =     1.18
TOTAL AREA(ACRES) =       1.00        PEAK FLOW RATE(CFS) =       3.05

END OF SUBAREA STREET FLOW HYDRAULICS:
DEPTH(FEET) = 0.34   HALFSTREET FLOOD WIDTH(FEET) =  11.61
FLOW VELOCITY(FEET/SEC.) =  2.12   DEPTH*VELOCITY(FT*FT/SEC.) =   0.72
LONGEST FLOWPATH FROM NODE   1023.00 TO NODE   1025.00 =   245.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE   1025.00 TO NODE   1026.00 IS CODE =  41
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =   563.80  DOWNSTREAM(FEET) =   562.50
 FLOW LENGTH(FEET) =      5.30   MANNING'S N = 0.013
 DEPTH OF FLOW IN  18.0 INCH PIPE IS   3.0 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =  15.52
 GIVEN PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =        3.05
 PIPE TRAVEL TIME(MIN.) =   0.01    Tc(MIN.) =    7.51
 LONGEST FLOWPATH FROM NODE   1023.00 TO NODE   1026.00 =   250.30 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE   1026.00 TO NODE   1026.00 IS CODE =   1
----------------------------------------------------------------------------
 >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
 TOTAL NUMBER OF STREAMS =  3
 CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
 TIME OF CONCENTRATION(MIN.) =    7.51
 RAINFALL INTENSITY(INCH/HR) =   3.92
 TOTAL STREAM AREA(ACRES) =      1.00
 PEAK FLOW RATE(CFS) AT CONFLUENCE =       3.05

+--------------------------------------------------------------------------+
| OFF-SITE RUNOFF FROM HERITAGE BLUFFS BY PDC 05/14/2014                   |
|                                                                          |
|                                                                          |
+--------------------------------------------------------------------------+

****************************************************************************
 FLOW PROCESS FROM NODE   1027.00 TO NODE   1027.00 IS CODE =   7
----------------------------------------------------------------------------
 >>>>>USER SPECIFIED HYDROLOGY INFORMATION AT NODE<<<<<
============================================================================
 USER-SPECIFIED VALUES ARE AS FOLLOWS:
 TC(MIN) =  11.50   RAIN INTENSITY(INCH/HOUR) =  3.29
 TOTAL AREA(ACRES) =      6.00   TOTAL RUNOFF(CFS) =      12.00

****************************************************************************
 FLOW PROCESS FROM NODE   1027.00 TO NODE   1028.00 IS CODE =  41
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =   565.50  DOWNSTREAM(FEET) =   563.50
 FLOW LENGTH(FEET) =    270.00   MANNING'S N =  0.013
```

```
 DEPTH OF FLOW IN  24.0 INCH PIPE IS  14.1 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =   6.26
 GIVEN PIPE DIAMETER(INCH) =  24.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =      12.00
 PIPE TRAVEL TIME(MIN.) =   0.72    Tc(MIN.) =  12.22
 LONGEST FLOWPATH FROM NODE      0.00 TO NODE   1028.00 =   270.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE   1028.00 TO NODE   1026.00 IS CODE =  41
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =   563.50  DOWNSTREAM(FEET) =   562.50
 FLOW LENGTH(FEET) =   103.00   MANNING'S N =  0.013
 DEPTH OF FLOW IN  24.0 INCH PIPE IS  12.9 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =   6.94
 GIVEN PIPE DIAMETER(INCH) =  24.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =      12.00
 PIPE TRAVEL TIME(MIN.) =   0.25    Tc(MIN.) =  12.47
 LONGEST FLOWPATH FROM NODE      0.00 TO NODE   1026.00 =   373.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE   1026.00 TO NODE   1026.00 IS CODE =   1
----------------------------------------------------------------------------
 >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
 >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
 TOTAL NUMBER OF STREAMS =  3
 CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  3 ARE:
 TIME OF CONCENTRATION(MIN.) =  12.47
 RAINFALL INTENSITY(INCH/HR) =   3.18
 TOTAL STREAM AREA(ACRES) =     6.00
 PEAK FLOW RATE(CFS) AT CONFLUENCE =      12.00

 ** CONFLUENCE DATA **
 STREAM     RUNOFF      Tc      INTENSITY     AREA
 NUMBER      (CFS)    (MIN.)   (INCH/HOUR)   (ACRE)
    1         3.66     7.37       3.950        1.20
    2         3.05     7.51       3.923        1.00
    3        12.00    12.47       3.179        6.00

 RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
 CONFLUENCE FORMULA USED FOR  3 STREAMS.

 ** PEAK FLOW RATE TABLE **
 STREAM     RUNOFF      Tc      INTENSITY
 NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
    1        16.34     7.37       3.950
    2        16.41     7.51       3.923
    3        17.41    12.47       3.179

 COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
 PEAK FLOW RATE(CFS) =      17.41   Tc(MIN.) =   12.47
 TOTAL AREA(ACRES) =       8.20
 LONGEST FLOWPATH FROM NODE      0.00 TO NODE   1026.00 =   373.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE   1026.00 TO NODE   1030.00 IS CODE =  41
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
```

```
 >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
==============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =   562.10  DOWNSTREAM(FEET) =   560.30
 FLOW LENGTH(FEET) =   180.50   MANNING'S N =  0.013
 ASSUME FULL-FLOWING PIPELINE
 PIPE-FLOW VELOCITY(FEET/SEC.) =   9.85
 PIPE FLOW VELOCITY = (TOTAL FLOW)/(PIPE CROSS SECTION AREA)
 GIVEN PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =     17.41
 PIPE TRAVEL TIME(MIN.) =   0.31    Tc(MIN.) =  12.77
 LONGEST FLOWPATH FROM NODE       0.00 TO NODE   1030.00 =   553.50 FEET.

******************************************************************************
 FLOW PROCESS FROM NODE   1030.00 TO NODE   1030.00 IS CODE =  11
------------------------------------------------------------------------------
 >>>>>CONFLUENCE MEMORY BANK # 3 WITH THE MAIN-STREAM MEMORY<<<<<
==============================================================================

 ** MAIN STREAM CONFLUENCE DATA **
 STREAM     RUNOFF      Tc       INTENSITY     AREA
 NUMBER      (CFS)    (MIN.)    (INCH/HOUR)   (ACRE)
    1        17.41    12.77        3.145        8.20
 LONGEST FLOWPATH FROM NODE       0.00 TO NODE   1030.00 =   553.50 FEET.

 ** MEMORY BANK #  3 CONFLUENCE DATA **
 STREAM     RUNOFF      Tc       INTENSITY     AREA
 NUMBER      (CFS)    (MIN.)    (INCH/HOUR)   (ACRE)
    1        69.16    13.50        3.065       37.10
 LONGEST FLOWPATH FROM NODE   1000.00 TO NODE   1030.00 =  1014.00 FEET.

 ** PEAK FLOW RATE TABLE **
 STREAM    RUNOFF        Tc       INTENSITY
 NUMBER     (CFS)       (MIN.)   (INCH/HOUR)
    1       84.81       12.77        3.145
    2       86.13       13.50        3.065

 COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
 PEAK FLOW RATE(CFS) =      86.13    Tc(MIN.) =    13.50
 TOTAL AREA(ACRES) =      45.30

******************************************************************************
 FLOW PROCESS FROM NODE   1030.00 TO NODE   1030.00 IS CODE =  12
------------------------------------------------------------------------------
 >>>>>CLEAR MEMORY BANK # 3 <<<<<
==============================================================================

******************************************************************************
 FLOW PROCESS FROM NODE   1030.00 TO NODE   1031.00 IS CODE =  41
------------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
==============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =   558.00  DOWNSTREAM(FEET) =   555.60
 FLOW LENGTH(FEET) =    60.70   MANNING'S N =  0.013
 DEPTH OF FLOW IN  42.0 INCH PIPE IS  19.8 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =  19.30
 GIVEN PIPE DIAMETER(INCH) =  42.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =     86.13
 PIPE TRAVEL TIME(MIN.) =   0.05    Tc(MIN.) =  13.55
 LONGEST FLOWPATH FROM NODE   1000.00 TO NODE   1031.00 =  1074.70 FEET.
```

```
****************************************************************************
 FLOW PROCESS FROM NODE   1031.00 TO NODE   1031.00 IS CODE =   1
----------------------------------------------------------------------------
 >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
 TOTAL NUMBER OF STREAMS =  2
 CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
 TIME OF CONCENTRATION(MIN.) =  13.55
 RAINFALL INTENSITY(INCH/HR) =   3.06
 TOTAL STREAM AREA(ACRES) =    45.30
 PEAK FLOW RATE(CFS) AT CONFLUENCE =     86.13

****************************************************************************
 FLOW PROCESS FROM NODE   1016.00 TO NODE   1017.00 IS CODE =  21
----------------------------------------------------------------------------
 >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
 *USER SPECIFIED(SUBAREA):
 SINGLE FAMILY DEVELOPMENT RUNOFF COEFFICIENT = .8300
 S.C.S. CURVE NUMBER (AMC II) =   0
 INITIAL SUBAREA FLOW-LENGTH(FEET) =   100.00
 UPSTREAM ELEVATION(FEET) =    588.50
 DOWNSTREAM ELEVATION(FEET) =    582.20
 ELEVATION DIFFERENCE(FEET) =      6.30
 URBAN SUBAREA OVERLAND TIME OF FLOW(MIN.) =    2.632
 *CAUTION: SUBAREA SLOPE EXCEEDS COUNTY NOMOGRAPH
  DEFINITION. EXTRAPOLATION OF NOMOGRAPH USED.
 TIME OF CONCENTRATION ASSUMED AS 6-MIN.
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.210
 SUBAREA RUNOFF(CFS) =       0.35
 TOTAL AREA(ACRES) =       0.10   TOTAL RUNOFF(CFS) =       0.35

****************************************************************************
 FLOW PROCESS FROM NODE   1017.00 TO NODE   1018.00 IS CODE =  62
----------------------------------------------------------------------------
 >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>(STREET TABLE SECTION #  1 USED)<<<<<
============================================================================
 UPSTREAM ELEVATION(FEET) =  582.20  DOWNSTREAM ELEVATION(FEET) =  564.50
 STREET LENGTH(FEET) =   295.00   CURB HEIGHT(INCHES) =  6.0
 STREET HALFWIDTH(FEET) = 20.00

 DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  15.00
 INSIDE STREET CROSSFALL(DECIMAL) =  0.020
 OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

 SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
 STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
 Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0180
 Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

   **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       0.84
   STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
   STREET FLOW DEPTH(FEET) =  0.19
   HALFSTREET FLOOD WIDTH(FEET) =     4.26
   AVERAGE FLOW VELOCITY(FEET/SEC.) =    3.12
   PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.59
 STREET FLOW TRAVEL TIME(MIN.) =    1.58   Tc(MIN.) =    7.58
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.911
 *USER SPECIFIED(SUBAREA):
 SINGLE FAMILY DEVELOPMENT RUNOFF COEFFICIENT = .8300
```

```
 S.C.S. CURVE NUMBER (AMC II) =    0
 SUBAREA AREA(ACRES) =      0.30      SUBAREA RUNOFF(CFS) =     0.97
 TOTAL AREA(ACRES) =        0.40         PEAK FLOW RATE(CFS) =        1.32

 END OF SUBAREA STREET FLOW HYDRAULICS:
 DEPTH(FEET) = 0.22   HALFSTREET FLOOD WIDTH(FEET) =    5.56
 FLOW VELOCITY(FEET/SEC.) =  3.35   DEPTH*VELOCITY(FT*FT/SEC.) =   0.72
 LONGEST FLOWPATH FROM NODE   1016.00 TO NODE   1018.00 =   395.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE   1018.00 TO NODE   1018.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.911
 *USER SPECIFIED(SUBAREA):
 SINGLE FAMILY DEVELOPMENT RUNOFF COEFFICIENT = .7500
 S.C.S. CURVE NUMBER (AMC II) =    0
 SUBAREA AREA(ACRES) =      1.50   SUBAREA RUNOFF(CFS) =     4.40
 TOTAL AREA(ACRES) =        1.90   TOTAL RUNOFF(CFS) =     5.72
 TC(MIN.) =    7.58

****************************************************************************
 FLOW PROCESS FROM NODE   1018.00 TO NODE   1031.00 IS CODE =  41
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =    557.80  DOWNSTREAM(FEET) =   557.60
 FLOW LENGTH(FEET) =      10.30    MANNING'S N =  0.013
 DEPTH OF FLOW IN  18.0 INCH PIPE IS    8.0 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =    7.50
 GIVEN PIPE DIAMETER(INCH) =  18.00     NUMBER OF PIPES =    1
 PIPE-FLOW(CFS) =          5.72
 PIPE TRAVEL TIME(MIN.) =    0.02     Tc(MIN.) =     7.60
 LONGEST FLOWPATH FROM NODE   1016.00 TO NODE   1031.00 =   405.30 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE   1031.00 TO NODE   1031.00 IS CODE =   1
----------------------------------------------------------------------------
 >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
 >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
 TOTAL NUMBER OF STREAMS =  2
 CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
 TIME OF CONCENTRATION(MIN.) =    7.60
 RAINFALL INTENSITY(INCH/HR) =    3.91
 TOTAL STREAM AREA(ACRES) =      1.90
 PEAK FLOW RATE(CFS) AT CONFLUENCE =       5.72

 ** CONFLUENCE DATA **
 STREAM      RUNOFF       Tc       INTENSITY       AREA
 NUMBER       (CFS)     (MIN.)    (INCH/HOUR)     (ACRE)
     1        86.13     13.55        3.059          45.30
     2         5.72      7.60        3.906           1.90

 RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
 CONFLUENCE FORMULA USED FOR  2 STREAMS.

 ** PEAK FLOW RATE TABLE **
 STREAM      RUNOFF        Tc        INTENSITY
```

```
NUMBER        (CFS)     (MIN.)    (INCH/HOUR)
   1          73.17      7.60        3.906
   2          90.61     13.55        3.059

COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
PEAK FLOW RATE(CFS) =       90.61   Tc(MIN.) =    13.55
TOTAL AREA(ACRES) =      47.20
LONGEST FLOWPATH FROM NODE    1000.00 TO NODE    1031.00 =   1074.70 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    1031.00 TO NODE    1100.00 IS CODE =  41
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =    555.30  DOWNSTREAM(FEET) =    547.10
 FLOW LENGTH(FEET) =    226.80    MANNING'S N =  0.013
 DEPTH OF FLOW IN  42.0 INCH PIPE IS  20.9 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =  18.91
 GIVEN PIPE DIAMETER(INCH) =  42.00     NUMBER OF PIPES =    1
 PIPE-FLOW(CFS) =        90.61
 PIPE TRAVEL TIME(MIN.) =    0.20     Tc(MIN.) =  13.75
 LONGEST FLOWPATH FROM NODE    1000.00 TO NODE    1100.00 =   1301.50 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    1100.00 TO NODE    1100.00 IS CODE =  10
----------------------------------------------------------------------------
 >>>>>MAIN-STREAM MEMORY COPIED ONTO MEMORY BANK # 1 <<<<<
============================================================================

****************************************************************************
 FLOW PROCESS FROM NODE    1050.00 TO NODE    1051.00 IS CODE =  21
----------------------------------------------------------------------------
 >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
 *USER SPECIFIED(SUBAREA):
 SINGLE FAMILY DEVELOPMENT RUNOFF COEFFICIENT = .4500
 S.C.S. CURVE NUMBER (AMC II) =    0
 INITIAL SUBAREA FLOW-LENGTH(FEET) =    100.00
 UPSTREAM ELEVATION(FEET) =      704.30
 DOWNSTREAM ELEVATION(FEET) =      693.30
 ELEVATION DIFFERENCE(FEET) =       11.00
 URBAN SUBAREA OVERLAND TIME OF FLOW(MIN.) =     5.261
 *CAUTION: SUBAREA SLOPE EXCEEDS COUNTY NOMOGRAPH
  DEFINITION. EXTRAPOLATION OF NOMOGRAPH USED.
 TIME OF CONCENTRATION ASSUMED AS 6-MIN.
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.210
 SUBAREA RUNOFF(CFS) =        0.19
 TOTAL AREA(ACRES) =        0.10   TOTAL RUNOFF(CFS) =        0.19

****************************************************************************
 FLOW PROCESS FROM NODE    1051.00 TO NODE    1052.00 IS CODE =  51
----------------------------------------------------------------------------
 >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
 >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =    693.30  DOWNSTREAM(FEET) =    611.00
 CHANNEL LENGTH THRU SUBAREA(FEET) =    750.00   CHANNEL SLOPE =  0.1097
 CHANNEL BASE(FEET) =    10.00    "Z" FACTOR =    5.000
 MANNING'S FACTOR = 0.018   MAXIMUM DEPTH(FEET) =   10.00
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.495
```

```
*USER SPECIFIED(SUBAREA):
SINGLE FAMILY DEVELOPMENT RUNOFF COEFFICIENT = .4500
S.C.S. CURVE NUMBER (AMC II) =    0
TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      1.46
TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   3.32
AVERAGE FLOW DEPTH(FEET) =   0.04   TRAVEL TIME(MIN.) =   3.77
Tc(MIN.) =   9.77
SUBAREA AREA(ACRES) =      1.60        SUBAREA RUNOFF(CFS) =    2.52
TOTAL AREA(ACRES) =      1.70          PEAK FLOW RATE(CFS) =       2.71

END OF SUBAREA CHANNEL FLOW HYDRAULICS:
DEPTH(FEET) =  0.06   FLOW VELOCITY(FEET/SEC.) =   4.10
LONGEST FLOWPATH FROM NODE   1050.00 TO NODE   1052.00 =   850.00 FEET.

****************************************************************************
FLOW PROCESS FROM NODE   1052.00 TO NODE   1052.00 IS CODE =  81
----------------------------------------------------------------------------
>>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
 100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.495
*USER SPECIFIED(SUBAREA):
SINGLE FAMILY DEVELOPMENT RUNOFF COEFFICIENT = .4500
S.C.S. CURVE NUMBER (AMC II) =    0
SUBAREA AREA(ACRES) =     1.10   SUBAREA RUNOFF(CFS) =    1.73
TOTAL AREA(ACRES) =       2.80   TOTAL RUNOFF(CFS) =    4.44
TC(MIN.) =   9.77

****************************************************************************
FLOW PROCESS FROM NODE   1052.00 TO NODE   1061.00 IS CODE =  41
----------------------------------------------------------------------------
>>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
ELEVATION DATA: UPSTREAM(FEET) =   611.00  DOWNSTREAM(FEET) =   565.80
FLOW LENGTH(FEET) =   371.20   MANNING'S N =  0.013
DEPTH OF FLOW IN  24.0 INCH PIPE IS   4.0 INCHES
PIPE-FLOW VELOCITY(FEET/SEC.) =  13.11
GIVEN PIPE DIAMETER(INCH) =  24.00    NUMBER OF PIPES =   1
PIPE-FLOW(CFS) =      4.44
PIPE TRAVEL TIME(MIN.) =   0.47    Tc(MIN.) =  10.24
LONGEST FLOWPATH FROM NODE   1050.00 TO NODE   1061.00 =  1221.20 FEET.

****************************************************************************
FLOW PROCESS FROM NODE   1061.00 TO NODE   1061.00 IS CODE =   1
----------------------------------------------------------------------------
>>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
TOTAL NUMBER OF STREAMS =  3
CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
TIME OF CONCENTRATION(MIN.) =  10.24
RAINFALL INTENSITY(INCH/HR) =   3.42
TOTAL STREAM AREA(ACRES) =     2.80
PEAK FLOW RATE(CFS) AT CONFLUENCE =      4.44

****************************************************************************
FLOW PROCESS FROM NODE   1055.00 TO NODE   1056.00 IS CODE =  21
----------------------------------------------------------------------------
>>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
*USER SPECIFIED(SUBAREA):
SINGLE FAMILY DEVELOPMENT RUNOFF COEFFICIENT = .7500
```

```
 S.C.S. CURVE NUMBER (AMC II) =   0
 INITIAL SUBAREA FLOW-LENGTH(FEET) =   100.00
 UPSTREAM ELEVATION(FEET) =    580.20
 DOWNSTREAM ELEVATION(FEET) =    577.60
 ELEVATION DIFFERENCE(FEET) =      2.60
 URBAN SUBAREA OVERLAND TIME OF FLOW(MIN.) =    4.582
 *CAUTION: SUBAREA SLOPE EXCEEDS COUNTY NOMOGRAPH
  DEFINITION. EXTRAPOLATION OF NOMOGRAPH USED.
 TIME OF CONCENTRATION ASSUMED AS 6-MIN.
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.210
 SUBAREA RUNOFF(CFS) =       1.58
 TOTAL AREA(ACRES) =       0.50   TOTAL RUNOFF(CFS) =       1.58

****************************************************************************
 FLOW PROCESS FROM NODE   1056.00 TO NODE   1057.00 IS CODE =  62
----------------------------------------------------------------------------
 >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>(STREET TABLE SECTION #  3 USED)<<<<<
============================================================================
 UPSTREAM ELEVATION(FEET) =  577.70  DOWNSTREAM ELEVATION(FEET) =  573.00
 STREET LENGTH(FEET) =   820.00   CURB HEIGHT(INCHES) =  6.0
 STREET HALFWIDTH(FEET) = 17.00

 DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  12.00
 INSIDE STREET CROSSFALL(DECIMAL) =  0.020
 OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

 SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
 STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
 Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0180
 Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

   **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       3.40
   STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
   STREET FLOW DEPTH(FEET) =  0.38
   HALFSTREET FLOOD WIDTH(FEET) =   13.86
   AVERAGE FLOW VELOCITY(FEET/SEC.) =   1.69
   PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.65
 STREET FLOW TRAVEL TIME(MIN.) =    8.07   Tc(MIN.) =  14.07
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.003
 *USER SPECIFIED(SUBAREA):
 SINGLE FAMILY DEVELOPMENT RUNOFF COEFFICIENT = .7500
 S.C.S. CURVE NUMBER (AMC II) =   0
 SUBAREA AREA(ACRES) =     1.60      SUBAREA RUNOFF(CFS) =     3.60
 TOTAL AREA(ACRES) =      2.10         PEAK FLOW RATE(CFS) =        5.18

 END OF SUBAREA STREET FLOW HYDRAULICS:
 DEPTH(FEET) = 0.43   HALFSTREET FLOOD WIDTH(FEET) =  16.39
 FLOW VELOCITY(FEET/SEC.) =  1.87   DEPTH*VELOCITY(FT*FT/SEC.) =   0.81
 LONGEST FLOWPATH FROM NODE   1055.00 TO NODE   1057.00 =   920.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE   1057.00 TO NODE   1061.00 IS CODE =  41
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =   567.10  DOWNSTREAM(FEET) =   565.80
 FLOW LENGTH(FEET) =      5.30   MANNING'S N =  0.013
 DEPTH OF FLOW IN  18.0 INCH PIPE IS   3.9 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =  18.17
```

```
 GIVEN PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =        5.18
 PIPE TRAVEL TIME(MIN.) =   0.00    Tc(MIN.) =  14.07
 LONGEST FLOWPATH FROM NODE   1055.00 TO NODE   1061.00 =   925.30 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE   1061.00 TO NODE   1061.00 IS CODE =   1
----------------------------------------------------------------------------
 >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
 TOTAL NUMBER OF STREAMS =  3
 CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
 TIME OF CONCENTRATION(MIN.) =  14.07
 RAINFALL INTENSITY(INCH/HR) =   3.00
 TOTAL STREAM AREA(ACRES) =     2.10
 PEAK FLOW RATE(CFS) AT CONFLUENCE =      5.18

****************************************************************************
 FLOW PROCESS FROM NODE   1058.00 TO NODE   1059.00 IS CODE =  21
----------------------------------------------------------------------------
 >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
 *USER SPECIFIED(SUBAREA):
 SINGLE FAMILY DEVELOPMENT RUNOFF COEFFICIENT = .7500
 S.C.S. CURVE NUMBER (AMC II) =    0
 INITIAL SUBAREA FLOW-LENGTH(FEET) =    100.00
 UPSTREAM ELEVATION(FEET) =     579.80
 DOWNSTREAM ELEVATION(FEET) =     577.80
 ELEVATION DIFFERENCE(FEET) =       2.00
 URBAN SUBAREA OVERLAND TIME OF FLOW(MIN.) =     5.000
 TIME OF CONCENTRATION ASSUMED AS 6-MIN.
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.210
 SUBAREA RUNOFF(CFS) =       1.58
 TOTAL AREA(ACRES) =       0.50   TOTAL RUNOFF(CFS) =       1.58

****************************************************************************
 FLOW PROCESS FROM NODE   1059.00 TO NODE   1060.00 IS CODE =  62
----------------------------------------------------------------------------
 >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>(STREET TABLE SECTION #  3 USED)<<<<<
============================================================================
 UPSTREAM ELEVATION(FEET) =  577.80  DOWNSTREAM ELEVATION(FEET) =  573.00
 STREET LENGTH(FEET) =   235.00   CURB HEIGHT(INCHES) =  6.0
 STREET HALFWIDTH(FEET) = 17.00

 DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  12.00
 INSIDE STREET CROSSFALL(DECIMAL) =  0.020
 OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

 SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
 STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
 Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0180
 Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

   **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       1.87
   STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
   STREET FLOW DEPTH(FEET) =  0.27
   HALFSTREET FLOOD WIDTH(FEET) =     8.33
   AVERAGE FLOW VELOCITY(FEET/SEC.) =    2.40
   PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.65
 STREET FLOW TRAVEL TIME(MIN.) =   1.63   Tc(MIN.) =   7.63
```

```
 100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.900
 *USER SPECIFIED(SUBAREA):
 SINGLE FAMILY DEVELOPMENT RUNOFF COEFFICIENT = .7500
 S.C.S. CURVE NUMBER (AMC II) =   0
 SUBAREA AREA(ACRES) =     0.20      SUBAREA RUNOFF(CFS) =     0.58
 TOTAL AREA(ACRES) =       0.70        PEAK FLOW RATE(CFS) =        2.16

 END OF SUBAREA STREET FLOW HYDRAULICS:
 DEPTH(FEET) = 0.28   HALFSTREET FLOOD WIDTH(FEET) =    8.89
 FLOW VELOCITY(FEET/SEC.) =  2.47   DEPTH*VELOCITY(FT*FT/SEC.) =   0.70
 LONGEST FLOWPATH FROM NODE   1058.00 TO NODE   1060.00 =   335.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE   1060.00 TO NODE   1061.00 IS CODE =  41
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =   566.10  DOWNSTREAM(FEET) =   565.80
 FLOW LENGTH(FEET) =     25.20   MANNING'S N =  0.013
 DEPTH OF FLOW IN  18.0 INCH PIPE IS   5.4 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =   4.81
 GIVEN PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =        2.16
 PIPE TRAVEL TIME(MIN.) =    0.09     Tc(MIN.) =    7.72
 LONGEST FLOWPATH FROM NODE   1058.00 TO NODE   1061.00 =   360.20 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE   1061.00 TO NODE   1061.00 IS CODE =   1
----------------------------------------------------------------------------
 >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
 >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
 TOTAL NUMBER OF STREAMS =  3
 CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  3 ARE:
 TIME OF CONCENTRATION(MIN.) =    7.72
 RAINFALL INTENSITY(INCH/HR) =    3.88
 TOTAL STREAM AREA(ACRES) =     0.70
 PEAK FLOW RATE(CFS) AT CONFLUENCE =       2.16

 ** CONFLUENCE DATA **
 STREAM     RUNOFF      Tc       INTENSITY      AREA
 NUMBER      (CFS)    (MIN.)   (INCH/HOUR)    (ACRE)
    1         4.44    10.24        3.424          2.80
    2         5.18    14.07        3.002          2.10
    3         2.16     7.72        3.883          0.70

 RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
 CONFLUENCE FORMULA USED FOR  3 STREAMS.

 ** PEAK FLOW RATE TABLE **
 STREAM     RUNOFF      Tc      INTENSITY
 NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
    1        10.08     7.72       3.883
    2        10.89    10.24       3.424
    3        10.74    14.07       3.002

 COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
 PEAK FLOW RATE(CFS) =      10.89   Tc(MIN.) =    10.24
 TOTAL AREA(ACRES) =       5.60
 LONGEST FLOWPATH FROM NODE   1050.00 TO NODE   1061.00 =  1221.20 FEET.
```

```
****************************************************************************
  FLOW PROCESS FROM NODE   1061.00 TO NODE   1090.00 IS CODE =  41
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   565.00  DOWNSTREAM(FEET) =   552.00
  FLOW LENGTH(FEET) =   435.00   MANNING'S N = 0.013
  DEPTH OF FLOW IN  24.0 INCH PIPE IS   8.9 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  10.29
  GIVEN PIPE DIAMETER(INCH) =  24.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      10.89
  PIPE TRAVEL TIME(MIN.) =   0.70    Tc(MIN.) =  10.94
  LONGEST FLOWPATH FROM NODE   1050.00 TO NODE   1090.00 =  1656.20 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE   1090.00 TO NODE   1090.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  3
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =  10.94
  RAINFALL INTENSITY(INCH/HR) =   3.35
  TOTAL STREAM AREA(ACRES) =     5.60
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     10.89

****************************************************************************
  FLOW PROCESS FROM NODE   1065.00 TO NODE   1066.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  SINGLE FAMILY DEVELOPMENT RUNOFF COEFFICIENT = .7500
  S.C.S. CURVE NUMBER (AMC II) =   0
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   100.00
  UPSTREAM ELEVATION(FEET) =     572.90
  DOWNSTREAM ELEVATION(FEET) =     570.70
  ELEVATION DIFFERENCE(FEET) =       2.20
  URBAN SUBAREA OVERLAND TIME OF FLOW(MIN.) =    4.844
  TIME OF CONCENTRATION ASSUMED AS 6-MIN.
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.210
  SUBAREA RUNOFF(CFS) =       0.32
  TOTAL AREA(ACRES) =       0.10   TOTAL RUNOFF(CFS) =       0.32

****************************************************************************
  FLOW PROCESS FROM NODE   1066.00 TO NODE   1068.00 IS CODE =  62
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STREET TABLE SECTION #  3 USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  570.70  DOWNSTREAM ELEVATION(FEET) =  559.30
  STREET LENGTH(FEET) =   335.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 17.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  12.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
```

```
STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0180
Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

  **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =        1.76
  STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
  STREET FLOW DEPTH(FEET) =  0.25
  HALFSTREET FLOOD WIDTH(FEET) =    7.30
  AVERAGE FLOW VELOCITY(FEET/SEC.) =    2.84
  PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.71
STREET FLOW TRAVEL TIME(MIN.) =   1.96   Tc(MIN.) =   7.96
 100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.837
*USER SPECIFIED(SUBAREA):
SINGLE FAMILY DEVELOPMENT RUNOFF COEFFICIENT = .7500
S.C.S. CURVE NUMBER (AMC II) =   0
SUBAREA AREA(ACRES) =    1.00       SUBAREA RUNOFF(CFS) =    2.88
TOTAL AREA(ACRES) =      1.10         PEAK FLOW RATE(CFS) =        3.19

END OF SUBAREA STREET FLOW HYDRAULICS:
DEPTH(FEET) = 0.29   HALFSTREET FLOOD WIDTH(FEET) =   9.45
FLOW VELOCITY(FEET/SEC.) =  3.26   DEPTH*VELOCITY(FT*FT/SEC.) =   0.96
LONGEST FLOWPATH FROM NODE   1065.00 TO NODE   1068.00 =   435.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE   1068.00 TO NODE   1090.00 IS CODE =  41
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =   553.30  DOWNSTREAM(FEET) =   552.00
 FLOW LENGTH(FEET) =      5.30   MANNING'S N =  0.013
 DEPTH OF FLOW IN  18.0 INCH PIPE IS   3.1 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =  15.74
 GIVEN PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =      3.19
 PIPE TRAVEL TIME(MIN.) =   0.01     Tc(MIN.) =    7.97
 LONGEST FLOWPATH FROM NODE   1065.00 TO NODE   1090.00 =   440.30 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE   1090.00 TO NODE   1090.00 IS CODE =   1
----------------------------------------------------------------------------
 >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
 TOTAL NUMBER OF STREAMS =  3
 CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
 TIME OF CONCENTRATION(MIN.) =   7.97
 RAINFALL INTENSITY(INCH/HR) =   3.84
 TOTAL STREAM AREA(ACRES) =     1.10
 PEAK FLOW RATE(CFS) AT CONFLUENCE =      3.19

****************************************************************************
 FLOW PROCESS FROM NODE   1070.00 TO NODE   1071.00 IS CODE =  21
----------------------------------------------------------------------------
 >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
 *USER SPECIFIED(SUBAREA):
 SINGLE FAMILY DEVELOPMENT RUNOFF COEFFICIENT = .7500
 S.C.S. CURVE NUMBER (AMC II) =   0
 INITIAL SUBAREA FLOW-LENGTH(FEET) =   100.00
 UPSTREAM ELEVATION(FEET) =     573.00
 DOWNSTREAM ELEVATION(FEET) =     570.70
```

```
ELEVATION DIFFERENCE(FEET) =      2.30
URBAN SUBAREA OVERLAND TIME OF FLOW(MIN.) =    4.773
TIME OF CONCENTRATION ASSUMED AS 6-MIN.
 100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.210
SUBAREA RUNOFF(CFS) =      0.32
TOTAL AREA(ACRES) =      0.10   TOTAL RUNOFF(CFS) =      0.32

****************************************************************************
FLOW PROCESS FROM NODE   1071.00 TO NODE   1075.00 IS CODE =  62
----------------------------------------------------------------------------
>>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>>(STREET TABLE SECTION #  3 USED)<<<<<
============================================================================
UPSTREAM ELEVATION(FEET) =  570.70  DOWNSTREAM ELEVATION(FEET) =  559.30
STREET LENGTH(FEET) =   350.00   CURB HEIGHT(INCHES) =  6.0
STREET HALFWIDTH(FEET) = 17.00

DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  12.00
INSIDE STREET CROSSFALL(DECIMAL) =  0.020
OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0180
Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

  **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      3.37
  STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
  STREET FLOW DEPTH(FEET) =  0.30
  HALFSTREET FLOOD WIDTH(FEET) =    9.73
  AVERAGE FLOW VELOCITY(FEET/SEC.) =    3.26
  PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.98
STREET FLOW TRAVEL TIME(MIN.) =   1.79   Tc(MIN.) =   7.79
 100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.870
*USER SPECIFIED(SUBAREA):
SINGLE FAMILY DEVELOPMENT RUNOFF COEFFICIENT = .7500
S.C.S. CURVE NUMBER (AMC II) =    0
SUBAREA AREA(ACRES) =    2.10      SUBAREA RUNOFF(CFS) =    6.10
TOTAL AREA(ACRES) =      2.20        PEAK FLOW RATE(CFS) =       6.41

END OF SUBAREA STREET FLOW HYDRAULICS:
DEPTH(FEET) = 0.36   HALFSTREET FLOOD WIDTH(FEET) =  12.64
FLOW VELOCITY(FEET/SEC.) =  3.81   DEPTH*VELOCITY(FT*FT/SEC.) =   1.36
LONGEST FLOWPATH FROM NODE   1070.00 TO NODE   1075.00 =   450.00 FEET.

****************************************************************************
FLOW PROCESS FROM NODE   1075.00 TO NODE   1090.00 IS CODE =  41
----------------------------------------------------------------------------
>>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
ELEVATION DATA: UPSTREAM(FEET) =   552.20  DOWNSTREAM(FEET) =   552.00
FLOW LENGTH(FEET) =    25.30   MANNING'S N =  0.013
DEPTH OF FLOW IN  18.0 INCH PIPE IS  11.3 INCHES
PIPE-FLOW VELOCITY(FEET/SEC.) =   5.48
GIVEN PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
PIPE-FLOW(CFS) =      6.41
PIPE TRAVEL TIME(MIN.) =   0.08    Tc(MIN.) =   7.87
LONGEST FLOWPATH FROM NODE   1070.00 TO NODE   1090.00 =   475.30 FEET.

****************************************************************************
```

```
 FLOW PROCESS FROM NODE   1090.00 TO NODE   1090.00 IS CODE =   1
----------------------------------------------------------------------------
 >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
 >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
 TOTAL NUMBER OF STREAMS =  3
 CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  3 ARE:
 TIME OF CONCENTRATION(MIN.) =    7.87
 RAINFALL INTENSITY(INCH/HR) =   3.86
 TOTAL STREAM AREA(ACRES) =     2.20
 PEAK FLOW RATE(CFS) AT CONFLUENCE =       6.41

 ** CONFLUENCE DATA **
 STREAM      RUNOFF      Tc      INTENSITY       AREA
 NUMBER       (CFS)    (MIN.)   (INCH/HOUR)     (ACRE)
    1        10.89    10.94        3.346           5.60
    2         3.19     7.97        3.836           1.10
    3         6.41     7.87        3.855           2.20

 RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
 CONFLUENCE FORMULA USED FOR  3 STREAMS.

 ** PEAK FLOW RATE TABLE **
 STREAM      RUNOFF      Tc      INTENSITY
 NUMBER       (CFS)    (MIN.)   (INCH/HOUR)
    1        19.04     7.87       3.855
    2        19.07     7.97       3.836
    3        19.24    10.94       3.346

 COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
 PEAK FLOW RATE(CFS) =      19.24   Tc(MIN.) =   10.94
 TOTAL AREA(ACRES) =       8.90
 LONGEST FLOWPATH FROM NODE   1050.00 TO NODE   1090.00 =  1656.20 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE   1090.00 TO NODE   1100.00 IS CODE =  41
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =   551.10  DOWNSTREAM(FEET) =   548.60
 FLOW LENGTH(FEET) =     72.10   MANNING'S N =  0.013
 DEPTH OF FLOW IN  24.0 INCH PIPE IS  11.7 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =  12.63
 GIVEN PIPE DIAMETER(INCH) =  24.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =       19.24
 PIPE TRAVEL TIME(MIN.) =    0.10    Tc(MIN.) =   11.04
 LONGEST FLOWPATH FROM NODE   1050.00 TO NODE   1100.00 =  1728.30 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE   1100.00 TO NODE   1100.00 IS CODE =  11
----------------------------------------------------------------------------
 >>>>>CONFLUENCE MEMORY BANK # 1 WITH THE MAIN-STREAM MEMORY<<<<<
============================================================================

 ** MAIN STREAM CONFLUENCE DATA **
 STREAM      RUNOFF      Tc      INTENSITY      AREA
 NUMBER       (CFS)    (MIN.)   (INCH/HOUR)    (ACRE)
    1        19.24    11.04        3.336          8.90
 LONGEST FLOWPATH FROM NODE   1050.00 TO NODE   1100.00 =  1728.30 FEET.
```

```
** MEMORY BANK #  1 CONFLUENCE DATA **
STREAM      RUNOFF      Tc       INTENSITY      AREA
NUMBER       (CFS)    (MIN.)    (INCH/HOUR)    (ACRE)
   1         90.61     13.75       3.037        47.20
LONGEST FLOWPATH FROM NODE   1000.00 TO NODE   1100.00 =  1301.50 FEET.

** PEAK FLOW RATE TABLE **
STREAM     RUNOFF       Tc       INTENSITY
NUMBER      (CFS)     (MIN.)    (INCH/HOUR)
   1       101.73      11.04         3.336
   2       108.13      13.75         3.037

COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
PEAK FLOW RATE(CFS) =     108.13   Tc(MIN.) =   13.75
TOTAL AREA(ACRES) =      56.10

****************************************************************************
FLOW PROCESS FROM NODE   1100.00 TO NODE   1100.00 IS CODE =  12
----------------------------------------------------------------------------
>>>>>CLEAR MEMORY BANK # 1 <<<<<
============================================================================

****************************************************************************
FLOW PROCESS FROM NODE   1100.00 TO NODE   1100.00 IS CODE =   1
----------------------------------------------------------------------------
>>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
TOTAL NUMBER OF STREAMS =  2
CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
TIME OF CONCENTRATION(MIN.) =  13.75
RAINFALL INTENSITY(INCH/HR) =   3.04
TOTAL STREAM AREA(ACRES) =    56.10
PEAK FLOW RATE(CFS) AT CONFLUENCE =    108.13

****************************************************************************
FLOW PROCESS FROM NODE   1040.00 TO NODE   1041.00 IS CODE =  21
----------------------------------------------------------------------------
>>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
*USER SPECIFIED(SUBAREA):
SINGLE FAMILY DEVELOPMENT RUNOFF COEFFICIENT = .7500
S.C.S. CURVE NUMBER (AMC II) =    0
INITIAL SUBAREA FLOW-LENGTH(FEET) =   100.00
UPSTREAM ELEVATION(FEET) =     565.00
DOWNSTREAM ELEVATION(FEET) =     561.40
ELEVATION DIFFERENCE(FEET) =       3.60
URBAN SUBAREA OVERLAND TIME OF FLOW(MIN.) =    4.111
*CAUTION: SUBAREA SLOPE EXCEEDS COUNTY NOMOGRAPH
 DEFINITION. EXTRAPOLATION OF NOMOGRAPH USED.
TIME OF CONCENTRATION ASSUMED AS 6-MIN.
 100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.210
SUBAREA RUNOFF(CFS) =        2.53
TOTAL AREA(ACRES) =        0.80   TOTAL RUNOFF(CFS) =        2.53

****************************************************************************
FLOW PROCESS FROM NODE   1041.00 TO NODE   1042.00 IS CODE =  62
----------------------------------------------------------------------------
>>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>>(STREET TABLE SECTION #  3 USED)<<<<<
============================================================================
UPSTREAM ELEVATION(FEET) =  561.40  DOWNSTREAM ELEVATION(FEET) =  559.00
```

```
STREET LENGTH(FEET) =    115.00   CURB HEIGHT(INCHES) =  6.0
STREET HALFWIDTH(FEET) = 17.00

DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  12.00
INSIDE STREET CROSSFALL(DECIMAL) =  0.020
OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0180
Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

  **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =        3.14
  STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
  STREET FLOW DEPTH(FEET) =  0.31
  HALFSTREET FLOOD WIDTH(FEET) =    10.39
  AVERAGE FLOW VELOCITY(FEET/SEC.) =    2.69
  PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =     0.84
STREET FLOW TRAVEL TIME(MIN.) =    0.71   Tc(MIN.) =    6.71
 100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.075
*USER SPECIFIED(SUBAREA):
SINGLE FAMILY DEVELOPMENT RUNOFF COEFFICIENT = .7500
S.C.S. CURVE NUMBER (AMC II) =    0
SUBAREA AREA(ACRES) =     0.40      SUBAREA RUNOFF(CFS) =     1.22
TOTAL AREA(ACRES) =       1.20        PEAK FLOW RATE(CFS) =        3.75

END OF SUBAREA STREET FLOW HYDRAULICS:
DEPTH(FEET) = 0.33   HALFSTREET FLOOD WIDTH(FEET) =  11.14
FLOW VELOCITY(FEET/SEC.) =  2.82   DEPTH*VELOCITY(FT*FT/SEC.) =   0.93
LONGEST FLOWPATH FROM NODE   1040.00 TO NODE   1042.00 =   215.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE   1042.00 TO NODE   1046.00 IS CODE =  41
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =    552.00  DOWNSTREAM(FEET) =    551.70
 FLOW LENGTH(FEET) =     25.80   MANNING'S N =  0.013
 DEPTH OF FLOW IN  18.0 INCH PIPE IS   7.3 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =    5.55
 GIVEN PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =        3.75
 PIPE TRAVEL TIME(MIN.) =    0.08    Tc(MIN.) =    6.79
 LONGEST FLOWPATH FROM NODE   1040.00 TO NODE   1046.00 =   240.80 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE   1046.00 TO NODE   1100.00 IS CODE =  41
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =    551.40  DOWNSTREAM(FEET) =    549.10
 FLOW LENGTH(FEET) =     66.30   MANNING'S N =  0.013
 DEPTH OF FLOW IN  18.0 INCH PIPE IS   5.5 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =    8.24
 GIVEN PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =        3.75
 PIPE TRAVEL TIME(MIN.) =    0.13    Tc(MIN.) =    6.92
 LONGEST FLOWPATH FROM NODE   1040.00 TO NODE   1100.00 =   307.10 FEET.
```

```
****************************************************************************
 FLOW PROCESS FROM NODE   1100.00 TO NODE   1100.00 IS CODE =   1
----------------------------------------------------------------------------
 >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
 >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
 TOTAL NUMBER OF STREAMS =  2
 CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
 TIME OF CONCENTRATION(MIN.) =    6.92
 RAINFALL INTENSITY(INCH/HR) =    4.03
 TOTAL STREAM AREA(ACRES) =     1.20
 PEAK FLOW RATE(CFS) AT CONFLUENCE =       3.75

 ** CONFLUENCE DATA **
 STREAM      RUNOFF       Tc       INTENSITY       AREA
 NUMBER       (CFS)     (MIN.)    (INCH/HOUR)     (ACRE)
     1       108.13     13.75        3.037          56.10
     2         3.75      6.92        4.034           1.20

 RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
 CONFLUENCE FORMULA USED FOR  2 STREAMS.

 ** PEAK FLOW RATE TABLE **
 STREAM      RUNOFF       Tc       INTENSITY
 NUMBER       (CFS)     (MIN.)    (INCH/HOUR)
     1        85.15      6.92        4.034
     2       110.95     13.75        3.037

 COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
 PEAK FLOW RATE(CFS) =     110.95   Tc(MIN.) =    13.75
 TOTAL AREA(ACRES) =      57.30
 LONGEST FLOWPATH FROM NODE   1050.00 TO NODE   1100.00 =  1728.30 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE   1100.00 TO NODE   1105.00 IS CODE =  41
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =   546.80  DOWNSTREAM(FEET) =   545.70
 FLOW LENGTH(FEET) =     60.00   MANNING'S N =  0.013
 DEPTH OF FLOW IN  42.0 INCH PIPE IS  29.9 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =  15.16
 GIVEN PIPE DIAMETER(INCH) =  42.00    NUMBER OF PIPES =    1
 PIPE-FLOW(CFS) =     110.95
 PIPE TRAVEL TIME(MIN.) =   0.07     Tc(MIN.) =   13.82
 LONGEST FLOWPATH FROM NODE   1050.00 TO NODE   1105.00 =  1788.30 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE   1105.00 TO NODE   1105.00 IS CODE =   1
----------------------------------------------------------------------------
 >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
 TOTAL NUMBER OF STREAMS =  2
 CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
 TIME OF CONCENTRATION(MIN.) =  13.82
 RAINFALL INTENSITY(INCH/HR) =    3.03
 TOTAL STREAM AREA(ACRES) =     57.30
 PEAK FLOW RATE(CFS) AT CONFLUENCE =     110.95

****************************************************************************
```

```
 FLOW PROCESS FROM NODE   1035.00 TO NODE   1036.00 IS CODE =  21
----------------------------------------------------------------------------
 >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
 *USER SPECIFIED(SUBAREA):
 SINGLE FAMILY DEVELOPMENT RUNOFF COEFFICIENT = .8300
 S.C.S. CURVE NUMBER (AMC II) =   0
 INITIAL SUBAREA FLOW-LENGTH(FEET) =   100.00
 UPSTREAM ELEVATION(FEET) =    564.50
 DOWNSTREAM ELEVATION(FEET) =    561.00
 ELEVATION DIFFERENCE(FEET) =      3.50
 URBAN SUBAREA OVERLAND TIME OF FLOW(MIN.) =    3.201
 *CAUTION: SUBAREA SLOPE EXCEEDS COUNTY NOMOGRAPH
  DEFINITION. EXTRAPOLATION OF NOMOGRAPH USED.
 TIME OF CONCENTRATION ASSUMED AS 6-MIN.
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.210
 SUBAREA RUNOFF(CFS) =      0.35
 TOTAL AREA(ACRES) =      0.10   TOTAL RUNOFF(CFS) =      0.35

****************************************************************************
 FLOW PROCESS FROM NODE   1036.00 TO NODE   1045.00 IS CODE =  62
----------------------------------------------------------------------------
 >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>(STREET TABLE SECTION #  3 USED)<<<<<
============================================================================
 UPSTREAM ELEVATION(FEET) =  561.00  DOWNSTREAM ELEVATION(FEET) =  554.70
 STREET LENGTH(FEET) =   180.00   CURB HEIGHT(INCHES) =  6.0
 STREET HALFWIDTH(FEET) = 17.00

 DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  12.00
 INSIDE STREET CROSSFALL(DECIMAL) =  0.020
 OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

 SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
 STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
 Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0180
 Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

   **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       0.51
   STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
   STREET FLOW DEPTH(FEET) =  0.18
   HALFSTREET FLOOD WIDTH(FEET) =    3.71
   AVERAGE FLOW VELOCITY(FEET/SEC.) =    2.29
   PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.41
 STREET FLOW TRAVEL TIME(MIN.) =    1.31   Tc(MIN.) =    7.31
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.961
 *USER SPECIFIED(SUBAREA):
 SINGLE FAMILY DEVELOPMENT RUNOFF COEFFICIENT = .8300
 S.C.S. CURVE NUMBER (AMC II) =   0
 SUBAREA AREA(ACRES) =     0.10      SUBAREA RUNOFF(CFS) =     0.33
 TOTAL AREA(ACRES) =      0.20        PEAK FLOW RATE(CFS) =       0.68

 END OF SUBAREA STREET FLOW HYDRAULICS:
 DEPTH(FEET) = 0.19   HALFSTREET FLOOD WIDTH(FEET) =   4.43
 FLOW VELOCITY(FEET/SEC.) =  2.40   DEPTH*VELOCITY(FT*FT/SEC.) =   0.47
 LONGEST FLOWPATH FROM NODE   1035.00 TO NODE   1045.00 =   280.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE   1045.00 TO NODE   1045.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
```

```
==========================================================================
 100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.961
 *USER SPECIFIED(SUBAREA):
 SINGLE FAMILY DEVELOPMENT RUNOFF COEFFICIENT = .7500
 S.C.S. CURVE NUMBER (AMC II) =   0
 SUBAREA AREA(ACRES) =     1.40   SUBAREA RUNOFF(CFS) =    4.16
 TOTAL AREA(ACRES) =       1.60   TOTAL RUNOFF(CFS) =    4.84
 TC(MIN.) =   7.31

****************************************************************************
 FLOW PROCESS FROM NODE   1045.00 TO NODE   1105.00 IS CODE =  41
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =   546.20  DOWNSTREAM(FEET) =   545.70
 FLOW LENGTH(FEET) =      6.00   MANNING'S N =  0.013
 DEPTH OF FLOW IN  18.0 INCH PIPE IS   5.0 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =  12.14
 GIVEN PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =        4.84
 PIPE TRAVEL TIME(MIN.) =   0.01    Tc(MIN.) =   7.32
 LONGEST FLOWPATH FROM NODE   1035.00 TO NODE   1105.00 =   286.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE   1105.00 TO NODE   1105.00 IS CODE =   1
----------------------------------------------------------------------------
 >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
 >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
 TOTAL NUMBER OF STREAMS =  2
 CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
 TIME OF CONCENTRATION(MIN.) =    7.32
 RAINFALL INTENSITY(INCH/HR) =    3.96
 TOTAL STREAM AREA(ACRES) =      1.60
 PEAK FLOW RATE(CFS) AT CONFLUENCE =       4.84

 ** CONFLUENCE DATA **
 STREAM      RUNOFF       Tc       INTENSITY       AREA
 NUMBER       (CFS)     (MIN.)    (INCH/HOUR)     (ACRE)
    1        110.95     13.82        3.030          57.30
    2          4.84      7.32        3.960           1.60

 RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
 CONFLUENCE FORMULA USED FOR  2 STREAMS.

 ** PEAK FLOW RATE TABLE **
 STREAM      RUNOFF       Tc       INTENSITY
 NUMBER       (CFS)     (MIN.)    (INCH/HOUR)
    1         89.73      7.32        3.960
    2        114.65     13.82        3.030

 COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
 PEAK FLOW RATE(CFS) =      114.65    Tc(MIN.) =    13.82
 TOTAL AREA(ACRES) =      58.90
 LONGEST FLOWPATH FROM NODE   1050.00 TO NODE   1105.00 =  1788.30 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE   1105.00 TO NODE   1160.00 IS CODE =  41
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
```

```
 >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
==============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =   545.70  DOWNSTREAM(FEET) =   530.60
 FLOW LENGTH(FEET) =   300.00   MANNING'S N =  0.013
 DEPTH OF FLOW IN  42.0 INCH PIPE IS  21.8 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =  22.70
 GIVEN PIPE DIAMETER(INCH) =  42.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =    114.65
 PIPE TRAVEL TIME(MIN.) =   0.22    Tc(MIN.) =  14.04
 LONGEST FLOWPATH FROM NODE   1050.00 TO NODE   1160.00 =  2088.30 FEET.

******************************************************************************
 FLOW PROCESS FROM NODE   1160.00 TO NODE   1160.00 IS CODE =   1
------------------------------------------------------------------------------
 >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
==============================================================================
 TOTAL NUMBER OF STREAMS =  3
 CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
 TIME OF CONCENTRATION(MIN.) =  14.04
 RAINFALL INTENSITY(INCH/HR) =   3.01
 TOTAL STREAM AREA(ACRES) =    58.90
 PEAK FLOW RATE(CFS) AT CONFLUENCE =    114.65

******************************************************************************
 FLOW PROCESS FROM NODE   1106.00 TO NODE   1107.00 IS CODE =  21
------------------------------------------------------------------------------
 >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
==============================================================================
 *USER SPECIFIED(SUBAREA):
 SINGLE FAMILY DEVELOPMENT RUNOFF COEFFICIENT = .8300
 S.C.S. CURVE NUMBER (AMC II) =   0
 INITIAL SUBAREA FLOW-LENGTH(FEET) =   100.00
 UPSTREAM ELEVATION(FEET) =     555.00
 DOWNSTREAM ELEVATION(FEET) =     549.50
 ELEVATION DIFFERENCE(FEET) =       5.50
 URBAN SUBAREA OVERLAND TIME OF FLOW(MIN.) =    2.753
 *CAUTION: SUBAREA SLOPE EXCEEDS COUNTY NOMOGRAPH
  DEFINITION. EXTRAPOLATION OF NOMOGRAPH USED.
 TIME OF CONCENTRATION ASSUMED AS 6-MIN.
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.210
 SUBAREA RUNOFF(CFS) =       0.35
 TOTAL AREA(ACRES) =       0.10   TOTAL RUNOFF(CFS) =       0.35

******************************************************************************
 FLOW PROCESS FROM NODE   1107.00 TO NODE   1120.00 IS CODE =  62
------------------------------------------------------------------------------
 >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>(STREET TABLE SECTION #  1 USED)<<<<<
==============================================================================
 UPSTREAM ELEVATION(FEET) =  549.50  DOWNSTREAM ELEVATION(FEET) =  540.00
 STREET LENGTH(FEET) =   200.00   CURB HEIGHT(INCHES) =  6.0
 STREET HALFWIDTH(FEET) = 20.00

 DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  15.00
 INSIDE STREET CROSSFALL(DECIMAL) =  0.020
 OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

 SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
 STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
 Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0180
 Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200
```

```
  **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       0.68
  STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
  STREET FLOW DEPTH(FEET) =  0.19
  HALFSTREET FLOOD WIDTH(FEET) =    4.04
  AVERAGE FLOW VELOCITY(FEET/SEC.) =    2.72
  PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.51
STREET FLOW TRAVEL TIME(MIN.) =   1.22   Tc(MIN.) =   7.22
 100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.977
*USER SPECIFIED(SUBAREA):
SINGLE FAMILY DEVELOPMENT RUNOFF COEFFICIENT = .8300
S.C.S. CURVE NUMBER (AMC II) =   0
SUBAREA AREA(ACRES) =     0.20      SUBAREA RUNOFF(CFS) =    0.66
TOTAL AREA(ACRES) =       0.30         PEAK FLOW RATE(CFS) =       1.01

END OF SUBAREA STREET FLOW HYDRAULICS:
DEPTH(FEET) = 0.21   HALFSTREET FLOOD WIDTH(FEET) =   5.09
FLOW VELOCITY(FEET/SEC.) =  2.93   DEPTH*VELOCITY(FT*FT/SEC.) =   0.60
LONGEST FLOWPATH FROM NODE   1106.00 TO NODE   1120.00 =   300.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE   1110.00 TO NODE   1120.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.977
 *USER SPECIFIED(SUBAREA):
 SINGLE FAMILY DEVELOPMENT RUNOFF COEFFICIENT = .7500
 S.C.S. CURVE NUMBER (AMC II) =   0
 SUBAREA AREA(ACRES) =     2.10   SUBAREA RUNOFF(CFS) =    6.26
 TOTAL AREA(ACRES) =       2.40   TOTAL RUNOFF(CFS) =    7.27
 TC(MIN.) =    7.22

****************************************************************************
 FLOW PROCESS FROM NODE   1120.00 TO NODE   1160.00 IS CODE =  41
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =   533.50  DOWNSTREAM(FEET) =   532.60
 FLOW LENGTH(FEET) =     10.30    MANNING'S N =  0.013
 DEPTH OF FLOW IN  18.0 INCH PIPE IS    6.1 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =  13.85
 GIVEN PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =       7.27
 PIPE TRAVEL TIME(MIN.) =   0.01    Tc(MIN.) =    7.24
 LONGEST FLOWPATH FROM NODE   1106.00 TO NODE   1160.00 =   310.30 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE   1160.00 TO NODE   1160.00 IS CODE =   1
----------------------------------------------------------------------------
 >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
 TOTAL NUMBER OF STREAMS =  3
 CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
 TIME OF CONCENTRATION(MIN.) =    7.24
 RAINFALL INTENSITY(INCH/HR) =   3.97
 TOTAL STREAM AREA(ACRES) =      2.40
 PEAK FLOW RATE(CFS) AT CONFLUENCE =       7.27

****************************************************************************
```

```
FLOW PROCESS FROM NODE   1005.00 TO NODE   1010.00 IS CODE =  21
----------------------------------------------------------------------------
>>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
*USER SPECIFIED(SUBAREA):
SINGLE FAMILY DEVELOPMENT RUNOFF COEFFICIENT = .8300
S.C.S. CURVE NUMBER (AMC II) =   0
INITIAL SUBAREA FLOW-LENGTH(FEET) =   110.00
UPSTREAM ELEVATION(FEET) =    618.60
DOWNSTREAM ELEVATION(FEET) =    611.00
ELEVATION DIFFERENCE(FEET) =      7.60
URBAN SUBAREA OVERLAND TIME OF FLOW(MIN.) =    2.676
*CAUTION: SUBAREA SLOPE EXCEEDS COUNTY NOMOGRAPH
 DEFINITION. EXTRAPOLATION OF NOMOGRAPH USED.
TIME OF CONCENTRATION ASSUMED AS 6-MIN.
 100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.210
SUBAREA RUNOFF(CFS) =       0.70
TOTAL AREA(ACRES) =       0.20   TOTAL RUNOFF(CFS) =       0.70

****************************************************************************
FLOW PROCESS FROM NODE   1010.00 TO NODE   1150.00 IS CODE =  62
----------------------------------------------------------------------------
>>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>>(STREET TABLE SECTION #  1 USED)<<<<<
============================================================================
UPSTREAM ELEVATION(FEET) =  611.00  DOWNSTREAM ELEVATION(FEET) =  540.00
STREET LENGTH(FEET) =  1250.00   CURB HEIGHT(INCHES) =  6.0
STREET HALFWIDTH(FEET) = 20.00

DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  15.00
INSIDE STREET CROSSFALL(DECIMAL) =  0.020
OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0180
Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

  **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       2.34
  STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
  STREET FLOW DEPTH(FEET) =  0.25
  HALFSTREET FLOOD WIDTH(FEET) =    7.37
  AVERAGE FLOW VELOCITY(FEET/SEC.) =    3.72
  PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.94
STREET FLOW TRAVEL TIME(MIN.) =   5.60   Tc(MIN.) =  11.60
 100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.274
*USER SPECIFIED(SUBAREA):
SINGLE FAMILY DEVELOPMENT RUNOFF COEFFICIENT = .8300
S.C.S. CURVE NUMBER (AMC II) =   0
SUBAREA AREA(ACRES) =     1.20      SUBAREA RUNOFF(CFS) =     3.26
TOTAL AREA(ACRES) =       1.40        PEAK FLOW RATE(CFS) =       3.96

END OF SUBAREA STREET FLOW HYDRAULICS:
DEPTH(FEET) = 0.29   HALFSTREET FLOOD WIDTH(FEET) =    9.25
FLOW VELOCITY(FEET/SEC.) =  4.21   DEPTH*VELOCITY(FT*FT/SEC.) =   1.22
LONGEST FLOWPATH FROM NODE    1005.00 TO NODE   1150.00 =  1360.00 FEET.

****************************************************************************
FLOW PROCESS FROM NODE   1150.00 TO NODE   1160.00 IS CODE =  41
----------------------------------------------------------------------------
>>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
```

```
 >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
==============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =   533.50  DOWNSTREAM(FEET) =   532.60
 FLOW LENGTH(FEET) =    25.20   MANNING'S N =  0.013
 DEPTH OF FLOW IN  18.0 INCH PIPE IS   5.6 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =   8.46
 GIVEN PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =       3.96
 PIPE TRAVEL TIME(MIN.) =    0.05    Tc(MIN.) =   11.65
 LONGEST FLOWPATH FROM NODE   1005.00 TO NODE   1160.00 =  1385.20 FEET.

******************************************************************************
 FLOW PROCESS FROM NODE   1160.00 TO NODE   1160.00 IS CODE =   1
------------------------------------------------------------------------------
 >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
 >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
==============================================================================
 TOTAL NUMBER OF STREAMS =  3
 CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  3 ARE:
 TIME OF CONCENTRATION(MIN.) =  11.65
 RAINFALL INTENSITY(INCH/HR) =   3.27
 TOTAL STREAM AREA(ACRES) =     1.40
 PEAK FLOW RATE(CFS) AT CONFLUENCE =       3.96

 ** CONFLUENCE DATA **
 STREAM      RUNOFF       Tc       INTENSITY       AREA
 NUMBER       (CFS)     (MIN.)    (INCH/HOUR)     (ACRE)
    1        114.65     14.04        3.006          58.90
    2          7.27      7.24        3.975           2.40
    3          3.96     11.65        3.268           1.40

 RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
 CONFLUENCE FORMULA USED FOR  3 STREAMS.

 ** PEAK FLOW RATE TABLE **
 STREAM      RUNOFF       Tc       INTENSITY
 NUMBER       (CFS)     (MIN.)    (INCH/HOUR)
    1         97.22      7.24        3.975
    2        115.38     11.65        3.268
    3        123.79     14.04        3.006

 COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
 PEAK FLOW RATE(CFS) =     123.79    Tc(MIN.) =    14.04
 TOTAL AREA(ACRES) =       62.70
 LONGEST FLOWPATH FROM NODE   1050.00 TO NODE   1160.00 =  2088.30 FEET.

******************************************************************************
 FLOW PROCESS FROM NODE   1160.00 TO NODE   1182.00 IS CODE =  41
------------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
==============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =   530.10  DOWNSTREAM(FEET) =   501.50
 FLOW LENGTH(FEET) =   430.00   MANNING'S N =  0.013
 DEPTH OF FLOW IN  42.0 INCH PIPE IS  21.0 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =  25.69
 GIVEN PIPE DIAMETER(INCH) =  42.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =     123.79
 PIPE TRAVEL TIME(MIN.) =    0.28    Tc(MIN.) =   14.32
 LONGEST FLOWPATH FROM NODE   1050.00 TO NODE   1182.00 =  2518.30 FEET.
```

```
****************************************************************************
  FLOW PROCESS FROM NODE   1182.00 TO NODE   1182.00 IS CODE =  10
----------------------------------------------------------------------------
  >>>>>MAIN-STREAM MEMORY COPIED ONTO MEMORY BANK # 1 <<<<<
============================================================================

****************************************************************************
  FLOW PROCESS FROM NODE   1162.00 TO NODE   1164.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  SINGLE FAMILY DEVELOPMENT RUNOFF COEFFICIENT = .8300
  S.C.S. CURVE NUMBER (AMC II) =   0
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   100.00
  UPSTREAM ELEVATION(FEET) =    540.00
  DOWNSTREAM ELEVATION(FEET) =    530.50
  ELEVATION DIFFERENCE(FEET) =      9.50
  URBAN SUBAREA OVERLAND TIME OF FLOW(MIN.) =    2.295
  *CAUTION: SUBAREA SLOPE EXCEEDS COUNTY NOMOGRAPH
   DEFINITION. EXTRAPOLATION OF NOMOGRAPH USED.
  TIME OF CONCENTRATION ASSUMED AS 6-MIN.
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.210
  SUBAREA RUNOFF(CFS) =       0.35
  TOTAL AREA(ACRES) =       0.10   TOTAL RUNOFF(CFS) =       0.35

****************************************************************************
  FLOW PROCESS FROM NODE   1164.00 TO NODE   1172.00 IS CODE =  62
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STREET TABLE SECTION #  1 USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  530.50  DOWNSTREAM ELEVATION(FEET) =  508.60
  STREET LENGTH(FEET) =   420.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 20.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  15.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0180
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       0.82
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.19
    HALFSTREET FLOOD WIDTH(FEET) =    4.43
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    2.90
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.56
  STREET FLOW TRAVEL TIME(MIN.) =   2.42   Tc(MIN.) =   8.42
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.751
  *USER SPECIFIED(SUBAREA):
  SINGLE FAMILY DEVELOPMENT RUNOFF COEFFICIENT = .8300
  S.C.S. CURVE NUMBER (AMC II) =   0
  SUBAREA AREA(ACRES) =     0.30     SUBAREA RUNOFF(CFS) =     0.93
  TOTAL AREA(ACRES) =       0.40       PEAK FLOW RATE(CFS) =       1.28

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.22   HALFSTREET FLOOD WIDTH(FEET) =   5.67
```

```
 FLOW VELOCITY(FEET/SEC.) =  3.14   DEPTH*VELOCITY(FT*FT/SEC.) =   0.69
 LONGEST FLOWPATH FROM NODE   1162.00 TO NODE   1172.00 =   520.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE   1172.00 TO NODE   1180.00 IS CODE =  41
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =   500.00  DOWNSTREAM(FEET) =   499.20
 FLOW LENGTH(FEET) =     40.50   MANNING'S N =  0.013
 DEPTH OF FLOW IN  18.0 INCH PIPE IS   3.7 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =   4.95
 GIVEN PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =       1.28
 PIPE TRAVEL TIME(MIN.) =   0.14    Tc(MIN.) =   8.55
 LONGEST FLOWPATH FROM NODE   1162.00 TO NODE   1180.00 =   560.50 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE   1180.00 TO NODE   1180.00 IS CODE =   1
----------------------------------------------------------------------------
 >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
 TOTAL NUMBER OF STREAMS =  2
 CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
 TIME OF CONCENTRATION(MIN.) =    8.55
 RAINFALL INTENSITY(INCH/HR) =    3.72
 TOTAL STREAM AREA(ACRES) =      0.40
 PEAK FLOW RATE(CFS) AT CONFLUENCE =       1.28

****************************************************************************
 FLOW PROCESS FROM NODE   1168.00 TO NODE   1170.00 IS CODE =  21
----------------------------------------------------------------------------
 >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
 *USER SPECIFIED(SUBAREA):
 SINGLE FAMILY DEVELOPMENT RUNOFF COEFFICIENT = .8300
 S.C.S. CURVE NUMBER (AMC II) =   0
 INITIAL SUBAREA FLOW-LENGTH(FEET) =   100.00
 UPSTREAM ELEVATION(FEET) =     540.00
 DOWNSTREAM ELEVATION(FEET) =     530.00
 ELEVATION DIFFERENCE(FEET) =      10.00
 URBAN SUBAREA OVERLAND TIME OF FLOW(MIN.) =    2.256
 *CAUTION: SUBAREA SLOPE EXCEEDS COUNTY NOMOGRAPH
  DEFINITION. EXTRAPOLATION OF NOMOGRAPH USED.
 TIME OF CONCENTRATION ASSUMED AS 6-MIN.
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.210
 SUBAREA RUNOFF(CFS) =       0.35
 TOTAL AREA(ACRES) =       0.10   TOTAL RUNOFF(CFS) =       0.35

****************************************************************************
 FLOW PROCESS FROM NODE   1170.00 TO NODE   1180.00 IS CODE =  62
----------------------------------------------------------------------------
 >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>(STREET TABLE SECTION #  1 USED)<<<<<
============================================================================
 UPSTREAM ELEVATION(FEET) =  530.00  DOWNSTREAM ELEVATION(FEET) =  508.70
 STREET LENGTH(FEET) =    370.00   CURB HEIGHT(INCHES) =  6.0
 STREET HALFWIDTH(FEET) = 20.00

 DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  15.00
```

```
INSIDE STREET CROSSFALL(DECIMAL) =  0.020
OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0180
Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

  **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =        0.83
  STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
  STREET FLOW DEPTH(FEET) =  0.19
  HALFSTREET FLOOD WIDTH(FEET) =    4.32
  AVERAGE FLOW VELOCITY(FEET/SEC.) =    3.03
  PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.58
STREET FLOW TRAVEL TIME(MIN.) =   2.04   Tc(MIN.) =   8.04
 100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.823
*USER SPECIFIED(SUBAREA):
SINGLE FAMILY DEVELOPMENT RUNOFF COEFFICIENT = .8300
S.C.S. CURVE NUMBER (AMC II) =   0
SUBAREA AREA(ACRES) =    0.30      SUBAREA RUNOFF(CFS) =    0.95
TOTAL AREA(ACRES) =      0.40        PEAK FLOW RATE(CFS) =       1.30

END OF SUBAREA STREET FLOW HYDRAULICS:
DEPTH(FEET) = 0.22   HALFSTREET FLOOD WIDTH(FEET) =   5.56
FLOW VELOCITY(FEET/SEC.) =  3.29   DEPTH*VELOCITY(FT*FT/SEC.) =   0.71
LONGEST FLOWPATH FROM NODE   1168.00 TO NODE   1180.00 =   470.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE   1180.00 TO NODE   1180.00 IS CODE =   1
----------------------------------------------------------------------------
 >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
 >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
 TOTAL NUMBER OF STREAMS =  2
 CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
 TIME OF CONCENTRATION(MIN.) =    8.04
 RAINFALL INTENSITY(INCH/HR) =   3.82
 TOTAL STREAM AREA(ACRES) =     0.40
 PEAK FLOW RATE(CFS) AT CONFLUENCE =       1.30

 ** CONFLUENCE DATA **
 STREAM      RUNOFF      Tc       INTENSITY       AREA
 NUMBER       (CFS)    (MIN.)    (INCH/HOUR)     (ACRE)
    1          1.28     8.55        3.725           0.40
    2          1.30     8.04        3.823           0.40

 RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
 CONFLUENCE FORMULA USED FOR  2 STREAMS.

 ** PEAK FLOW RATE TABLE **
 STREAM      RUNOFF      Tc       INTENSITY
 NUMBER       (CFS)    (MIN.)    (INCH/HOUR)
    1          2.55     8.04       3.823
    2          2.55     8.55       3.725

 COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
 PEAK FLOW RATE(CFS) =       2.55   Tc(MIN.) =    8.04
 TOTAL AREA(ACRES) =        0.80
 LONGEST FLOWPATH FROM NODE   1162.00 TO NODE   1180.00 =   560.50 FEET.

****************************************************************************
```

```
 FLOW PROCESS FROM NODE   1180.00 TO NODE   1183.00 IS CODE =  41
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =   499.00  DOWNSTREAM(FEET) =   498.00
 FLOW LENGTH(FEET) =    25.00   MANNING'S N =  0.013
 DEPTH OF FLOW IN  18.0 INCH PIPE IS   4.3 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =   7.76
 GIVEN PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =       2.55
 PIPE TRAVEL TIME(MIN.) =   0.05    Tc(MIN.) =   8.09
 LONGEST FLOWPATH FROM NODE   1162.00 TO NODE   1183.00 =   585.50 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE   1182.00 TO NODE   1182.00 IS CODE =  11
----------------------------------------------------------------------------
 >>>>>CONFLUENCE MEMORY BANK # 1 WITH THE MAIN-STREAM MEMORY<<<<<
============================================================================

 ** MAIN STREAM CONFLUENCE DATA **
 STREAM     RUNOFF      Tc       INTENSITY     AREA
 NUMBER      (CFS)    (MIN.)   (INCH/HOUR)    (ACRE)
    1         2.55     8.09        3.813         0.80
 LONGEST FLOWPATH FROM NODE   1162.00 TO NODE   1182.00 =   585.50 FEET.

 ** MEMORY BANK #  1 CONFLUENCE DATA **
 STREAM     RUNOFF      Tc       INTENSITY     AREA
 NUMBER      (CFS)    (MIN.)   (INCH/HOUR)    (ACRE)
    1       123.79    14.32        2.975        62.70
 LONGEST FLOWPATH FROM NODE   1050.00 TO NODE   1182.00 =  2518.30 FEET.

 ** PEAK FLOW RATE TABLE **
 STREAM    RUNOFF        Tc      INTENSITY
 NUMBER     (CFS)      (MIN.)   (INCH/HOUR)
    1       99.14       8.09        3.813
    2      125.78      14.32        2.975

 COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
 PEAK FLOW RATE(CFS) =     125.78   Tc(MIN.) =    14.32
 TOTAL AREA(ACRES) =      63.50

****************************************************************************
 FLOW PROCESS FROM NODE   1182.00 TO NODE   1182.00 IS CODE =  12
----------------------------------------------------------------------------
 >>>>>CLEAR MEMORY BANK # 1 <<<<<
============================================================================

****************************************************************************
 FLOW PROCESS FROM NODE   1182.00 TO NODE   1030.00 IS CODE =  51
----------------------------------------------------------------------------
 >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
 >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =    501.50  DOWNSTREAM(FEET) =    498.00
 CHANNEL LENGTH THRU SUBAREA(FEET) =    255.00   CHANNEL SLOPE =  0.0137
 CHANNEL BASE(FEET) =    50.00    "Z" FACTOR =   3.000
 MANNING'S FACTOR = 0.030   MAXIMUM DEPTH(FEET) =  10.00
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.870
 *USER SPECIFIED(SUBAREA):
 SINGLE FAMILY DEVELOPMENT RUNOFF COEFFICIENT = .7500
```

```
 S.C.S. CURVE NUMBER (AMC II) =    0
 TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =    126.86
 TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   4.04
 AVERAGE FLOW DEPTH(FEET) =   0.61   TRAVEL TIME(MIN.) =   1.05
 Tc(MIN.) =  15.37
 SUBAREA AREA(ACRES) =      1.00       SUBAREA RUNOFF(CFS) =    2.15
 TOTAL AREA(ACRES) =     64.50          PEAK FLOW RATE(CFS) =     127.94

 END OF SUBAREA CHANNEL FLOW HYDRAULICS:
 DEPTH(FEET) =  0.61   FLOW VELOCITY(FEET/SEC.) =   4.06
 LONGEST FLOWPATH FROM NODE   1050.00 TO NODE   1030.00 =  2773.30 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE   1030.00 TO NODE    158.00 IS CODE =  41
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =    501.50  DOWNSTREAM(FEET) =   491.34
 FLOW LENGTH(FEET) =   276.00   MANNING'S N = 0.013
 DEPTH OF FLOW IN  48.0 INCH PIPE IS  23.6 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =  20.75
 GIVEN PIPE DIAMETER(INCH) =  48.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =    127.94
 PIPE TRAVEL TIME(MIN.) =   0.22    Tc(MIN.) =  15.59
 LONGEST FLOWPATH FROM NODE   1050.00 TO NODE    158.00 =  3049.30 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    158.00 TO NODE    158.00 IS CODE =   1
----------------------------------------------------------------------------
 >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
 TOTAL NUMBER OF STREAMS =  3
 CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
 TIME OF CONCENTRATION(MIN.) =  15.59
 RAINFALL INTENSITY(INCH/HR) =   2.85
 TOTAL STREAM AREA(ACRES) =    64.50
 PEAK FLOW RATE(CFS) AT CONFLUENCE =    127.94

****************************************************************************
 FLOW PROCESS FROM NODE    158.00 TO NODE    158.00 IS CODE =   7
----------------------------------------------------------------------------
 >>>>>USER SPECIFIED HYDROLOGY INFORMATION AT NODE<<<<<
============================================================================
 USER-SPECIFIED VALUES ARE AS FOLLOWS:
 TC(MIN) =  10.00   RAIN INTENSITY(INCH/HOUR) =  3.45
 TOTAL AREA(ACRES) =      1.30   TOTAL RUNOFF(CFS) =       4.30

****************************************************************************
 FLOW PROCESS FROM NODE    158.00 TO NODE    158.00 IS CODE =   1
----------------------------------------------------------------------------
 >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
 TOTAL NUMBER OF STREAMS =  3
 CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
 TIME OF CONCENTRATION(MIN.) =  10.00
 RAINFALL INTENSITY(INCH/HR) =   3.45
 TOTAL STREAM AREA(ACRES) =    1.30
 PEAK FLOW RATE(CFS) AT CONFLUENCE =      4.30

****************************************************************************
```

```
 FLOW PROCESS FROM NODE    158.00 TO NODE    158.00 IS CODE =   7
----------------------------------------------------------------------------
 >>>>>USER SPECIFIED HYDROLOGY INFORMATION AT NODE<<<<<
============================================================================
 USER-SPECIFIED VALUES ARE AS FOLLOWS:
 TC(MIN) =  10.10   RAIN INTENSITY(INCH/HOUR) =  3.44
 TOTAL AREA(ACRES) =      1.30   TOTAL RUNOFF(CFS) =       4.30

****************************************************************************
 FLOW PROCESS FROM NODE    158.00 TO NODE    158.00 IS CODE =   1
----------------------------------------------------------------------------
 >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
 >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
 TOTAL NUMBER OF STREAMS =  3
 CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  3 ARE:
 TIME OF CONCENTRATION(MIN.) =  10.10
 RAINFALL INTENSITY(INCH/HR) =   3.44
 TOTAL STREAM AREA(ACRES) =     1.30
 PEAK FLOW RATE(CFS) AT CONFLUENCE =       4.30

 ** CONFLUENCE DATA **
 STREAM     RUNOFF      Tc       INTENSITY      AREA
 NUMBER      (CFS)    (MIN.)   (INCH/HOUR)     (ACRE)
    1       127.94    15.59        2.853         64.50
    2         4.30    10.00        3.450          1.30
    3         4.30    10.10        3.439          1.30

 RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
 CONFLUENCE FORMULA USED FOR  3 STREAMS.

 ** PEAK FLOW RATE TABLE **
 STREAM     RUNOFF      Tc      INTENSITY
 NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
    1       114.37    10.00       3.450
    2       114.71    10.10       3.439
    3       135.06    15.59       2.853

 COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
 PEAK FLOW RATE(CFS) =     135.06    Tc(MIN.) =    15.59
 TOTAL AREA(ACRES) =      67.10
 LONGEST FLOWPATH FROM NODE   1050.00 TO NODE    158.00 =  3049.30 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    158.00 TO NODE    199.00 IS CODE =  41
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =    491.34  DOWNSTREAM(FEET) =    489.40
 FLOW LENGTH(FEET) =    130.50   MANNING'S N =  0.013
 DEPTH OF FLOW IN  48.0 INCH PIPE IS  32.8 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =  14.77
 GIVEN PIPE DIAMETER(INCH) =  48.00     NUMBER OF PIPES =    1
 PIPE-FLOW(CFS) =     135.06
 PIPE TRAVEL TIME(MIN.) =    0.15     Tc(MIN.) =  15.74
 LONGEST FLOWPATH FROM NODE   1050.00 TO NODE    199.00 =  3179.80 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    199.00 TO NODE    199.00 IS CODE =  10
----------------------------------------------------------------------------
```

```
 >>>>>MAIN-STREAM MEMORY COPIED ONTO MEMORY BANK # 1 <<<<<
==============================================================================

******************************************************************************
 FLOW PROCESS FROM NODE    701.00 TO NODE    701.00 IS CODE =   7
------------------------------------------------------------------------------
 >>>>>USER SPECIFIED HYDROLOGY INFORMATION AT NODE<<<<<
==============================================================================
 USER-SPECIFIED VALUES ARE AS FOLLOWS:
 TC(MIN) =  22.00   RAIN INTENSITY(INCH/HOUR) =  2.38
 TOTAL AREA(ACRES) =    63.90   TOTAL RUNOFF(CFS) =      80.00

******************************************************************************
 FLOW PROCESS FROM NODE    701.00 TO NODE   1190.00 IS CODE =  41
------------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
==============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =   545.00  DOWNSTREAM(FEET) =   542.20
 FLOW LENGTH(FEET) =    56.20   MANNING'S N =  0.013
 DEPTH OF FLOW IN  42.0 INCH PIPE IS  17.8 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =  20.62
 GIVEN PIPE DIAMETER(INCH) =  42.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =      80.00
 PIPE TRAVEL TIME(MIN.) =   0.05    Tc(MIN.) =  22.05
 LONGEST FLOWPATH FROM NODE   1050.00 TO NODE   1190.00 =  3236.00 FEET.

******************************************************************************
 FLOW PROCESS FROM NODE   1190.00 TO NODE   1192.00 IS CODE =  51
------------------------------------------------------------------------------
 >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
 >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
==============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =    542.20  DOWNSTREAM(FEET) =    510.00
 CHANNEL LENGTH THRU SUBAREA(FEET) =   866.00   CHANNEL SLOPE =  0.0372
 CHANNEL BASE(FEET) =    5.00    "Z" FACTOR =   3.000
 MANNING'S FACTOR = 0.018   MAXIMUM DEPTH(FEET) =  10.00
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.305
 *USER SPECIFIED(SUBAREA):
 SINGLE FAMILY DEVELOPMENT RUNOFF COEFFICIENT = .4500
 S.C.S. CURVE NUMBER (AMC II) =   0
 TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      83.63
 TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =  11.98
 AVERAGE FLOW DEPTH(FEET) =   0.91   TRAVEL TIME(MIN.) =   1.21
 Tc(MIN.) =  23.25
 SUBAREA AREA(ACRES) =      7.00        SUBAREA RUNOFF(CFS) =     7.26
 TOTAL AREA(ACRES) =     70.90          PEAK FLOW RATE(CFS) =      87.26

 END OF SUBAREA CHANNEL FLOW HYDRAULICS:
 DEPTH(FEET) =  0.93   FLOW VELOCITY(FEET/SEC.) =  12.12
 LONGEST FLOWPATH FROM NODE   1050.00 TO NODE   1192.00 =  4102.00 FEET.

******************************************************************************
 FLOW PROCESS FROM NODE   1192.00 TO NODE    199.00 IS CODE =  41
------------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
==============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =   504.00  DOWNSTREAM(FEET) =   489.40
 FLOW LENGTH(FEET) =   118.50   MANNING'S N =  0.013
 DEPTH OF FLOW IN  48.0 INCH PIPE IS  13.9 INCHES
```

```
 PIPE-FLOW VELOCITY(FEET/SEC.) =  29.03
 GIVEN PIPE DIAMETER(INCH) =  48.00    NUMBER OF PIPES =    1
 PIPE-FLOW(CFS) =      87.26
 PIPE TRAVEL TIME(MIN.) =   0.07    Tc(MIN.) =  23.32
 LONGEST FLOWPATH FROM NODE   1050.00 TO NODE    199.00 =  4220.50 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    199.00 TO NODE    199.00 IS CODE =  11
----------------------------------------------------------------------------
 >>>>>CONFLUENCE MEMORY BANK # 1 WITH THE MAIN-STREAM MEMORY<<<<<
============================================================================

 ** MAIN STREAM CONFLUENCE DATA **
 STREAM     RUNOFF      Tc       INTENSITY     AREA
 NUMBER      (CFS)    (MIN.)    (INCH/HOUR)   (ACRE)
    1        87.26    23.32        2.301        70.90
 LONGEST FLOWPATH FROM NODE   1050.00 TO NODE    199.00 =  4220.50 FEET.

 ** MEMORY BANK #  1 CONFLUENCE DATA **
 STREAM     RUNOFF      Tc       INTENSITY     AREA
 NUMBER      (CFS)    (MIN.)    (INCH/HOUR)   (ACRE)
    1       135.06    15.74        2.841        67.10
 LONGEST FLOWPATH FROM NODE   1050.00 TO NODE    199.00 =  3179.80 FEET.

 ** PEAK FLOW RATE TABLE **
 STREAM    RUNOFF        Tc       INTENSITY
 NUMBER     (CFS)      (MIN.)    (INCH/HOUR)
    1      205.73      15.74         2.841
    2      196.65      23.32         2.301

 COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
 PEAK FLOW RATE(CFS) =     205.73   Tc(MIN.) =    15.74
 TOTAL AREA(ACRES) =     138.00

****************************************************************************
 FLOW PROCESS FROM NODE    199.00 TO NODE    199.00 IS CODE =  12
----------------------------------------------------------------------------
 >>>>>CLEAR MEMORY BANK # 1 <<<<<
============================================================================
============================================================================
 END OF STUDY SUMMARY:
 TOTAL AREA(ACRES)       =     138.00  TC(MIN.) =      15.74
 PEAK FLOW RATE(CFS)     =     205.73
============================================================================
============================================================================
 END OF RATIONAL METHOD ANALYSIS
```

APPENDIX B

Backup Calculations

for

Weighted Runoff Coefficients

RICK ENGINEERING COMPANY™
5620 Friars Road
San Diego, CA 92110-2596

Tel: (619) 291-0707
Fax: (619) 291-4165

Date 2/27/14
Job No. 15149-F
Page 1
Done By SSL
Checked By

Back-up Weighted C Calculation

* For street + slope (Typical), use NODE 1005 to 1150

% Impervious Area ≃ 75%.

$$C_W = 0.95(\%\ Imp.) + 0.45(1 - \%\ Imp.)$$

$$= 0.95(0.75) + 0.45(1 - 0.75)$$

$$C_W = \underline{0.83}$$

* For Lot + Street (Typical)
17' Half-width

% Impervious Area ≃ 60%

$$C_W = 0.95(\%\ Imp) + 0.45(1 - \%\ Imp)$$

$$= 0.95(0.60) + 0.45(1 - 0.40)$$

$$C_W = \underline{0.75}$$

APPENDIX C

Open Channel Calculations

EAST CLUSTERS UNIT 3
J-15149-B
August 6, 2014

NORMAL DEPTH CALCULATIONS FOR OFF-SITE TRAPEZOIDAL CHANNEL

THE FOLLOWING CALCULATION IS FOR THE EASTERLY VEGETATED SWALE:

NORMAL DEPTH FOR TRAPEZOIDAL CHANNELS
CHANNEL SWALE CAPACITY RUN

DISCHARGE IS =	87.30	CFS	SLOPE IS =	0.0200	FT/FT
BOTTOM WIDTH IS =	5.00	FT	SIDE SLOPE (Z1) =	3.00	
MANNING'S N =	0.0600		SIDE SLOPE (Z2) =	3.00	
NORMAL DEPTH IS =	1.98	FT	FROUDE NUMBER IS =	0.63	
VELOCITY IS =	4.03	FPS	VELOCITY HEAD IS =	0.25	FT
AREA IS =	21.65	SQ FT	CRITICAL DEPTH =	1.55	FT
HYDRAULIC RADIUS =	1.24	FT	CRITICAL VELOCITY =	5.81	FPS
WETTED PERIMETER =	17.52	FT	TOP WIDTH FOR CRITICAL DEPTH =	14.33	FT
TOP WIDTH IS =	16.87	FT			

NORMAL DEPTH FOR TRAPEZOIDAL CHANNELS
CHANNEL SWALE VELOCITY RUN

DISCHARGE IS =	87.30	CFS	SLOPE IS =	0.0200	FT/FT
BOTTOM WIDTH IS =	5.00	FT	SIDE SLOPE (Z1) =	3.00	
MANNING'S N =	0.0350		SIDE SLOPE (Z2) =	3.00	
NORMAL DEPTH IS =	1.52	FT	FROUDE NUMBER IS =	1.04	
VELOCITY IS =	5.99	FPS	VELOCITY HEAD IS =	0.56	FT
AREA IS =	14.58	SQ FT	CRITICAL DEPTH =	1.55	FT
HYDRAULIC RADIUS =	1.00	FT	CRITICAL VELOCITY =	5.81	FPS
WETTED PERIMETER =	14.63	FT	TOP WIDTH FOR CRITICAL DEPTH =	14.33	FT
TOP WIDTH IS =	14.14	FT			

* NORMAL DEPTH FOR CIRCULAR PIPES
COPYRIGHT 1992 RICK ENGINEERING COMPANY
PIPE 18"

DISCHARGE IS =	0.70	CFS	SLOPE IS =	0.0200	FT/FT
DIAMETER IS =	1.50	FT	MANNING'S N =	0.018	
NORMAL DEPTH IS =	0.26	FT	CAPACITY IS =	10.73	CFS
VELOCITY IS =	3.42	FPS	FROUDE NUMBER IS =	1.42	
AREA IS =	0.20	SQ FT	VELOCITY HEAD IS =	0.18	FT
HYDRAULIC RADIUS =	0.16	FT	CRITICAL DEPTH =	0.31	FT
WETTED PERIMETER =	1.29	FT	CRITICAL VELOCITY =	2.65	FPS
TOP WIDTH IS =	1.13	FT			

* NORMAL DEPTH FOR CIRCULAR PIPES
COPYRIGHT 1992 RICK ENGINEERING COMPANY
PIPE 24"

DISCHARGE IS =	3.00	CFS	SLOPE IS =	0.0200	FT/FT
DIAMETER IS =	2.00	FT	MANNING'S N =	0.018	
NORMAL DEPTH IS =	0.49	FT	CAPACITY IS =	23.11	CFS
VELOCITY IS =	5.07	FPS	FROUDE NUMBER IS =	1.52	
AREA IS =	0.59	SQ FT	VELOCITY HEAD IS =	0.40	FT
HYDRAULIC RADIUS =	0.29	FT	CRITICAL DEPTH =	0.60	FT
WETTED PERIMETER =	2.06	FT	CRITICAL VELOCITY =	3.75	FPS
TOP WIDTH IS =	1.72	FT			

* NORMAL DEPTH FOR CIRCULAR PIPES
COPYRIGHT 1992 RICK ENGINEERING COMPANY
PIPE 30"

DISCHARGE IS =	8.00	CFS	SLOPE IS =	0.0200	FT/FT
DIAMETER IS =	2.50	FT	MANNING'S N =	0.018	
NORMAL DEPTH IS =	0.74	FT	CAPACITY IS =	41.89	CFS
VELOCITY IS =	6.58	FPS	FROUDE NUMBER IS =	1.59	
AREA IS =	1.22	SQ FT	VELOCITY HEAD IS =	0.67	FT
HYDRAULIC RADIUS =	0.42	FT	CRITICAL DEPTH =	0.94	FT
WETTED PERIMETER =	2.88	FT	CRITICAL VELOCITY =	4.74	FPS
TOP WIDTH IS =	2.28	FT			

* NORMAL DEPTH FOR CIRCULAR PIPES
COPYRIGHT 1992 RICK ENGINEERING COMPANY
PIPE 36"

DISCHARGE IS =	15.00	CFS	SLOPE IS =	0.0200	FT/FT
DIAMETER IS =	3.00	FT	MANNING'S N =	0.018	
NORMAL DEPTH IS =	0.96	FT	CAPACITY IS =	68.12	CFS
VELOCITY IS =	7.73	FPS	FROUDE NUMBER IS =	1.64	
AREA IS =	1.94	SQ FT	VELOCITY HEAD IS =	0.93	FT
HYDRAULIC RADIUS =	0.54	FT	CRITICAL DEPTH =	1.23	FT
WETTED PERIMETER =	3.60	FT	CRITICAL VELOCITY =	5.47	FPS
TOP WIDTH IS =	2.80	FT			

* EACH BROW DITCH SIZED PER TYPICAL REQUIREMENT

BMR EAST CLUSTERS UNIT 3
J-15149B
3-6-14

NORMAL DEPTH CALCULATIONS FOR CHANNEL WEST OF BASIN 900

NORMAL DEPTH FOR TRAPEZOIDAL CHANNELS
CHANNEL- ACTUAL RUN

DISCHARGE IS =	50.00	CFS	SLOPE IS =	0.1000 FT/FT
BOTTOM WIDTH IS =	8.00	FT	SIDE SLOPE (Z1) =	4.00
MANNING'S N =	0.0600		SIDE SLOPE (Z2) =	4.00
NORMAL DEPTH IS =	0.79	FT	FROUDE NUMBER IS =	1.26
VELOCITY IS =	5.63	FPS	VELOCITY HEAD IS =	0.49 FT
AREA IS =	8.88	SQ FT	CRITICAL DEPTH =	0.91 FT
HYDRAULIC RADIUS =	0.61	FT	CRITICAL VELOCITY =	4.72 FPS
WETTED PERIMETER =	14.55	FT	TOP WIDTH FOR	
TOP WIDTH IS =	14.35	FT	CRITICAL DEPTH =	15.28 FT

NORMAL DEPTH FOR TRAPEZOIDAL CHANNELS
CHANNEL- VELOCITY RUN

DISCHARGE IS =	50.00	CFS	SLOPE IS =	0.1000 FT/FT
BOTTOM WIDTH IS =	8.00	FT	SIDE SLOPE (Z1) =	4.00
MANNING'S N =	0.0300		SIDE SLOPE (Z2) =	4.00
NORMAL DEPTH IS =	0.54	FT	FROUDE NUMBER IS =	2.40
VELOCITY IS =	9.08	FPS	VELOCITY HEAD IS =	1.28 FT
AREA IS =	5.50	SQ FT	CRITICAL DEPTH =	0.91 FT
HYDRAULIC RADIUS =	0.44	FT	CRITICAL VELOCITY =	4.72 FPS
WETTED PERIMETER =	12.47	FT	TOP WIDTH FOR	
TOP WIDTH IS =	12.33	FT	CRITICAL DEPTH =	15.28 FT

APPENDIX D

Inlet/Catch Basin Calculations

BMR East Clusters Unit 3
J-15149-B
2-28-14

Type 'B' Inlet Sizes[1]

Drainage Node	Q_{100} (cfs)	Slope %	Opening Length Required (ft)	Inlet Type	Comments
908	4.3	5.6	14	15' Type B-1	
911	3.1	6.6	11	12' Type B-1	
920	2.8	7.7	10	11' Type B-1	
925	5.0	7.7	16	17' Type B-1	
938	2.8	1.5	9	10' Type B-1	
955	4.8	sump	4	5' Type B	
960	3.8	sump	4	5' Type B	
1010	7.3	6.1	20	21' Type B-1	
1018	5.7	4.0	16	17' Type B-1	
1022	3.7	1.9	11	12' Type B-1	
1025	3.1	1.9	9	10' Type B-1	
1042	3.8	2.7	11	12' Type B-1	
1045	4.8	3.8	14	15' Type B-1	
1057	5.2	2.5	14	15' Type B-1	
1060	2.2	2.5	8	9' Type B-1	
1068	3.2	4.6	11	12' Type B-1	
1075	6.4	4.6	18	19' Type B-1	
1120	7.3	6.1	20	21' Type B-1	
1150	4.0	6.1	12	13' Type B-1	
1172	1.3	sump	4	5' Type B	
1180	1.3	sump	4	5' Type B	

Notes:

1. Based on Drawing Number D-13 & D-15 in the San Diego Regional Standard Drawings.

BMR East Clusters Unit 3
J-15149-F
2-28-14

BASIN 900

****

CAPACITY OF TYPE B INLETS ON A GRADE

****

NODE 908

DISCHARGE = 4.3 CFS
STREET CROSS SLOPE = .02 FT/FT
STREET SLOPE = .056 FT/FT
COMPUTED DEPTH OF FLOW AT THE CURB = .27 FT
LENGTH OF INLET REQUIRED TO INTERCEPT 100% OF FLOW
USING THE FOLLOWING EQUATION Q=0.7L(A+Y)^3/2 = 13.1 FT
LENGTH OF INLET OPENING = 14 FT
LENGTH OF INLET TO BE USED = 15 FT

****

CAPACITY OF TYPE B INLETS ON A GRADE

****

NODE 911

DISCHARGE = 3.1 CFS
STREET CROSS SLOPE = .02 FT/FT
STREET SLOPE = .066 FT/FT
COMPUTED DEPTH OF FLOW AT THE CURB = .24 FT
LENGTH OF INLET REQUIRED TO INTERCEPT 100% OF FLOW
USING THE FOLLOWING EQUATION Q=0.7L(A+Y)^3/2 = 10.3 FT
LENGTH OF INLET OPENING = 11 FT
LENGTH OF INLET TO BE USED = 12 FT

****

CAPACITY OF TYPE B INLETS ON A GRADE

****

NODE 920

DISCHARGE = 2.8 CFS
STREET CROSS SLOPE = .02 FT/FT
STREET SLOPE = .077 FT/FT
COMPUTED DEPTH OF FLOW AT THE CURB = .23 FT
LENGTH OF INLET REQUIRED TO INTERCEPT 100% OF FLOW
USING THE FOLLOWING EQUATION Q=0.7L(A+Y)^3/2 = 9.6 FT
LENGTH OF INLET OPENING = 10 FT
LENGTH OF INLET TO BE USED = 11 FT

****

CAPACITY OF TYPE B INLETS ON A GRADE

****

NODE 925

DISCHARGE = 5 CFS
STREET CROSS SLOPE = .02 FT/FT
STREET SLOPE = .077 FT/FT
COMPUTED DEPTH OF FLOW AT THE CURB = .27 FT
LENGTH OF INLET REQUIRED TO INTERCEPT 100% OF FLOW
USING THE FOLLOWING EQUATION Q=0.7L(A+Y)^3/2 = 15.3 FT
LENGTH OF INLET OPENING = 16 FT
LENGTH OF INLET TO BE USED = 17 FT

****

CAPACITY OF TYPE B INLETS ON A GRADE

****

NODE 938

DISCHARGE = 2.8 CFS
STREET CROSS SLOPE = .02 FT/FT
STREET SLOPE = .015 FT/FT
COMPUTED DEPTH OF FLOW AT THE CURB = .29 FT
LENGTH OF INLET REQUIRED TO INTERCEPT 100% OF FLOW
USING THE FOLLOWING EQUATION Q=0.7L(A+Y)^3/2 = 8.1 FT
LENGTH OF INLET OPENING = 9 FT
LENGTH OF INLET TO BE USED = 10 FT

****

CAPACITY OF TYPE B INLETS IN A SUMP

****

NODE 955

DISCHARGE = 4.8 CFS
LENGTH OF INLET REQUIRED TO INTERCEPT 100% OF FLOW
USING CHART 1-103.6C (Q/L=1.5) = 3.2 FT
LENGTH OF INLET OPENING USED = 4 FT
LENGTH OF INLET TO BE USED = 5 FT

****

CAPACITY OF TYPE B INLETS ON A GRADE

****

NODE 955 (SUMP)

DISCHARGE = 4.8 CFS
STREET CROSS SLOPE = .02 FT/FT
STREET SLOPE = .085 FT/FT
COMPUTED DEPTH OF FLOW AT THE CURB = .27 FT
~~LENGTH OF INLET REQUIRED TO INTERCEPT 100% OF FLOW~~
~~USING THE FOLLOWING EQUATION Q=0.7L(A+Y)^3/2 = 14.9 FT~~
~~LENGTH OF INLET OPENING = 15 FT~~
~~LENGTH OF INLET TO BE USED = 16 FT~~

****

CAPACITY OF TYPE B INLETS IN A SUMP

****

NODE 960

DISCHARGE = 3.8 CFS
LENGTH OF INLET REQUIRED TO INTERCEPT 100% OF FLOW
USING CHART 1-103.6C (Q/L=1.5) = 2.5 FT
LENGTH OF INLET OPENING USED = 4 FT
LENGTH OF INLET TO BE USED = 5 FT

****

CAPACITY OF TYPE B INLETS ON A GRADE

****

NODE 960 (SUMP)

DISCHARGE = 3.8 CFS
STREET CROSS SLOPE = .02 FT/FT
STREET SLOPE = .085 FT/FT
COMPUTED DEPTH OF FLOW AT THE CURB = .25 FT
~~LENGTH OF INLET REQUIRED TO INTERCEPT 100% OF FLOW~~
~~USING THE FOLLOWING EQUATION Q=0.7L(A+Y)^3/2 = 12.4 FT~~
~~LENGTH OF INLET OPENING = 13 FT~~
~~LENGTH OF INLET TO BE USED = 14 FT~~

BMR East Clusters Unit 3
J-15149-F
2-28-14

BASIN 1000

****
CAPACITY OF TYPE B INLETS ON A GRADE

****
NODE 1010

DISCHARGE = 7.3 CFS
STREET CROSS SLOPE = .02 FT/FT
STREET SLOPE = .061 FT/FT
COMPUTED DEPTH OF FLOW AT THE CURB = .32 FT
LENGTH OF INLET REQUIRED TO INTERCEPT 100% OF FLOW
USING THE FOLLOWING EQUATION Q=0.7L(A+Y)^3/2 = 20 FT
LENGTH OF INLET OPENING = 20 FT
LENGTH OF INLET TO BE USED = 21 FT
****
CAPACITY OF TYPE B INLETS ON A GRADE

****
NODE 1018

DISCHARGE = 5.7 CFS
STREET CROSS SLOPE = .02 FT/FT
STREET SLOPE = .04 FT/FT
COMPUTED DEPTH OF FLOW AT THE CURB = .31 FT
LENGTH OF INLET REQUIRED TO INTERCEPT 100% OF FLOW
USING THE FOLLOWING EQUATION Q=0.7L(A+Y)^3/2 = 15.8 FT
LENGTH OF INLET OPENING = 16 FT
LENGTH OF INLET TO BE USED = 17 FT
****
CAPACITY OF TYPE B INLETS ON A GRADE

****
NODE 1022

DISCHARGE = 3.7 CFS
STREET CROSS SLOPE = .02 FT/FT
STREET SLOPE = .019 FT/FT
COMPUTED DEPTH OF FLOW AT THE CURB = .31 FT
LENGTH OF INLET REQUIRED TO INTERCEPT 100% OF FLOW
USING THE FOLLOWING EQUATION Q=0.7L(A+Y)^3/2 = 10.4 FT
LENGTH OF INLET OPENING = 11 FT
LENGTH OF INLET TO BE USED = 12 FT
****
CAPACITY OF TYPE B INLETS ON A GRADE

****
NODE 1025

DISCHARGE = 3.1 CFS
STREET CROSS SLOPE = .02 FT/FT
STREET SLOPE = .019 FT/FT
COMPUTED DEPTH OF FLOW AT THE CURB = .29 FT
LENGTH OF INLET REQUIRED TO INTERCEPT 100% OF FLOW
USING THE FOLLOWING EQUATION Q=0.7L(A+Y)^3/2 = 9 FT
LENGTH OF INLET OPENING = 9 FT
LENGTH OF INLET TO BE USED = 10 FT

****

CAPACITY OF TYPE B INLETS ON A GRADE

****

NODE 1042

DISCHARGE = 3.8 CFS
STREET CROSS SLOPE = .02 FT/FT
STREET SLOPE = .027 FT/FT
COMPUTED DEPTH OF FLOW AT THE CURB = .29 FT
LENGTH OF INLET REQUIRED TO INTERCEPT 100% OF FLOW
USING THE FOLLOWING EQUATION Q=0.7L(A+Y)^3/2 = 11 FT
LENGTH OF INLET OPENING = 11 FT
LENGTH OF INLET TO BE USED = 12 FT

****

CAPACITY OF TYPE B INLETS ON A GRADE

****

NODE 1045

DISCHARGE = 4.8 CFS
STREET CROSS SLOPE = .02 FT/FT
STREET SLOPE = .038 FT/FT
COMPUTED DEPTH OF FLOW AT THE CURB = .3 FT
LENGTH OF INLET REQUIRED TO INTERCEPT 100% OF FLOW
USING THE FOLLOWING EQUATION Q=0.7L(A+Y)^3/2 = 13.7 FT
LENGTH OF INLET OPENING = 14 FT
LENGTH OF INLET TO BE USED = 15 FT

****

CAPACITY OF TYPE B INLETS ON A GRADE

****

NODE 1057

DISCHARGE = 5.2 CFS
STREET CROSS SLOPE = .02 FT/FT
STREET SLOPE = .025 FT/FT
COMPUTED DEPTH OF FLOW AT THE CURB = .33 FT
LENGTH OF INLET REQUIRED TO INTERCEPT 100% OF FLOW
USING THE FOLLOWING EQUATION Q=0.7L(A+Y)^3/2 = 13.9 FT
LENGTH OF INLET OPENING = 14 FT
LENGTH OF INLET TO BE USED = 15 FT

****

CAPACITY OF TYPE B INLETS ON A GRADE

****
NODE 1060

DISCHARGE = 2.2 CFS
STREET CROSS SLOPE = .02 FT/FT
STREET SLOPE = .025 FT/FT
COMPUTED DEPTH OF FLOW AT THE CURB = .25 FT
LENGTH OF INLET REQUIRED TO INTERCEPT 100% OF FLOW
USING THE FOLLOWING EQUATION Q=0.7L(A+Y)^3/2 = 7.1 FT
LENGTH OF INLET OPENING = 8 FT
LENGTH OF INLET TO BE USED = 9 FT
****
CAPACITY OF TYPE B INLETS ON A GRADE

****
NODE 1068

DISCHARGE = 3.2 CFS
STREET CROSS SLOPE = .02 FT/FT
STREET SLOPE = .046 FT/FT
COMPUTED DEPTH OF FLOW AT THE CURB = .26 FT
LENGTH OF INLET REQUIRED TO INTERCEPT 100% OF FLOW
USING THE FOLLOWING EQUATION Q=0.7L(A+Y)^3/2 = 10.2 FT
LENGTH OF INLET OPENING = 11 FT
LENGTH OF INLET TO BE USED = 12 FT
****
CAPACITY OF TYPE B INLETS ON A GRADE

****
NODE 1075

DISCHARGE = 6.4 CFS
STREET CROSS SLOPE = .02 FT/FT
STREET SLOPE = .046 FT/FT
COMPUTED DEPTH OF FLOW AT THE CURB = .32 FT
LENGTH OF INLET REQUIRED TO INTERCEPT 100% OF FLOW
USING THE FOLLOWING EQUATION Q=0.7L(A+Y)^3/2 = 17.5 FT
LENGTH OF INLET OPENING = 18 FT
LENGTH OF INLET TO BE USED = 19 FT
****
CAPACITY OF TYPE B INLETS ON A GRADE

****
NODE 1120

DISCHARGE = 7.3 CFS
STREET CROSS SLOPE = .02 FT/FT
STREET SLOPE = .061 FT/FT
COMPUTED DEPTH OF FLOW AT THE CURB = .32 FT
LENGTH OF INLET REQUIRED TO INTERCEPT 100% OF FLOW
USING THE FOLLOWING EQUATION Q=0.7L(A+Y)^3/2 = 20 FT
LENGTH OF INLET OPENING = 20 FT
LENGTH OF INLET TO BE USED = 21 FT

****
CAPACITY OF TYPE B INLETS ON A GRADE

****
NODE 1150

DISCHARGE = 4 CFS
STREET CROSS SLOPE = .061 FT/FT
STREET SLOPE = .061 FT/FT
COMPUTED DEPTH OF FLOW AT THE CURB = .29 FT
LENGTH OF INLET REQUIRED TO INTERCEPT 100% OF FLOW
USING THE FOLLOWING EQUATION Q=0.7L(A+Y)^3/2 = 11.6 FT
LENGTH OF INLET OPENING = 12 FT
LENGTH OF INLET TO BE USED = 13 FT
****
CAPACITY OF TYPE B INLETS IN A SUMP

****
NODE 1172

DISCHARGE = 1.3 CFS
LENGTH OF INLET REQUIRED TO INTERCEPT 100% OF FLOW
USING CHART 1-103.6C (Q/L=1.5) = .9 FT
LENGTH OF INLET OPENING USED = 4 FT
LENGTH OF INLET TO BE USED = 5 FT
****
CAPACITY OF TYPE B INLETS ON A GRADE

****
NODE 1172 (SUMP)

DISCHARGE = 1.3 CFS
STREET CROSS SLOPE = .02 FT/FT
STREET SLOPE = .045 FT/FT
COMPUTED DEPTH OF FLOW AT THE CURB = .2 FT
~~LENGTH OF INLET REQUIRED TO INTERCEPT 100% OF FLOW~~
~~USING THE FOLLOWING EQUATION Q=0.7L(A+Y)^3/2 = 4.9 FT~~
~~LENGTH OF INLET OPENING = 5 FT~~
~~LENGTH OF INLET TO BE USED = 6 FT~~
****
CAPACITY OF TYPE B INLETS IN A SUMP

****
NODE 1180

DISCHARGE = 1.3 CFS
LENGTH OF INLET REQUIRED TO INTERCEPT 100% OF FLOW
USING CHART 1-103.6C (Q/L=1.5) = .9 FT
LENGTH OF INLET OPENING USED = 4 FT
LENGTH OF INLET TO BE USED = 5 FT
****
CAPACITY OF TYPE B INLETS ON A GRADE

****
NODE 1180 (SUMP)

DISCHARGE = 1.3 CFS
STREET CROSS SLOPE = .02 FT/FT
STREET SLOPE = .045 FT/FT
COMPUTED DEPTH OF FLOW AT THE CURB = .2 FT
~~LENGTH OF INLET REQUIRED TO INTERCEPT 100% OF FLOW~~
~~USING THE FOLLOWING EQUATION Q=0.7L(A+Y)^3/2 = 4.9 FT~~
~~LENGTH OF INLET OPENING = 5 FT~~
~~LENGTH OF INLET TO BE USED = 6 FT~~

APPENDIX E

Dry Lane Calculations

BMR East Clusters Unit 3
J-15149-B
2/28/2014

Calculations for Maximum Allowable Spread Width and Flow Depth at Curb for Public Streets

Maximum Allowable Spread Width = Street Half-Width - 0.5*(Dry Lane Width)
Maximum Allowable Flow Depth at Curb = 0.125 + 0.02*(Maximum Allowable Spread Width - 1.5)

Street Half-Width (feet)	Maximum Allowable Spread Width (feet)		Maximum Allowable Flow Depth at Curb (feet)	
	12-Foot Dry Lane	9-Foot Dry Lane	12-Foot Dry Lane	9-Foot Dry Lane
17	11.0	12.5	0.32	0.35
20	14.0	15.5	0.38	0.41

APPENDIX F

AES Pipe Flow Hydraulic Analyses

- **Basin 900**

```
****************************************************************************
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                         Analysis prepared by:

                        Rick Engineering Company
                           5620 Friars Road
                          San Diego, CA  92110
                            (619) 291-0707

 ************************** DESCRIPTION OF STUDY **************************
 * BLACK MOUNTAIN RANCH EAST CLUSTERS UNIT 3, J-15149-B                    *
 * LATERAL AT NODE 913                                                      *
 * 100-YR FLOW                                                              *
 **************************************************************************

  FILE NAME: 913.LAT
  TIME/DATE OF STUDY: 10:34 07/07/2014

****************************************************************************
             GRADUALLY VARIED FLOW ANALYSIS FOR PIPE SYSTEM
                        NODAL POINT STATUS TABLE
             (Note: "*" indicates nodal point data used.)
                  UPSTREAM RUN                     DOWNSTREAM RUN
  NODE    MODEL   PRESSURE     PRESSURE+         FLOW       PRESSURE+
 NUMBER  PROCESS  HEAD(FT)  MOMENTUM(POUNDS)   DEPTH(FT)  MOMENTUM(POUNDS)
 913.00-              0.76           38.83         0.35*           62.31
       } FRICTION
 911.00-              0.67*Dc        37.82         0.67*Dc         37.82
       } CATCH BASIN
 911.00-              0.98*          20.33         0.67 Dc         13.43
---------------------------------------------------------------------------
 MAXIMUM NUMBER OF ENERGY BALANCES USED IN EACH PROFILE =  25
---------------------------------------------------------------------------
 NOTE: STEADY FLOW HYDRAULIC HEAD-LOSS COMPUTATIONS BASED ON THE MOST
 CONSERVATIVE FORMULAE FROM THE CURRENT LACRD,LACFCD, AND OCEMA
 DESIGN MANUALS.
****************************************************************************
 DOWNSTREAM PIPE FLOW CONTROL DATA:
 NODE NUMBER =    913.00           FLOWLINE ELEVATION =    567.74
 PIPE FLOW =        3.10 CFS       PIPE DIAMETER =  18.00 INCHES
 ASSUMED DOWNSTREAM CONTROL HGL =    568.500 FEET
---------------------------------------------------------------------------
 NODE    913.00 : HGL = <   568.090>;EGL= <   569.614>;FLOWLINE= <   567.740>

****************************************************************************
 FLOW PROCESS FROM NODE   913.00 TO NODE   911.00 IS CODE =  1
 UPSTREAM NODE   911.00      ELEVATION =    569.28  (FLOW IS SUPERCRITICAL)
---------------------------------------------------------------------------
 CALCULATE FRICTION LOSSES(LACFCD):
 PIPE FLOW    =        3.10 CFS     PIPE DIAMETER =  18.00 INCHES
 PIPE LENGTH =       15.40 FEET          MANNING'S N  =  0.01300
---------------------------------------------------------------------------
 NORMAL DEPTH(FT) =       0.31           CRITICAL DEPTH(FT) =       0.67
===========================================================================
 UPSTREAM CONTROL ASSUMED FLOWDEPTH(FT) =      0.67
===========================================================================
```

GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:

DISTANCE FROM CONTROL(FT)	FLOW DEPTH (FT)	VELOCITY (FT/SEC)	SPECIFIC ENERGY(FT)	PRESSURE+ MOMENTUM(POUNDS)
0.000	0.670	4.059	0.926	37.82
0.006	0.655	4.176	0.926	37.85
0.027	0.641	4.300	0.928	37.94
0.063	0.627	4.432	0.932	38.09
0.118	0.612	4.571	0.937	38.31
0.192	0.598	4.718	0.944	38.59
0.290	0.583	4.875	0.953	38.95
0.414	0.569	5.042	0.964	39.39
0.568	0.555	5.220	0.978	39.92
0.757	0.540	5.409	0.995	40.53
0.988	0.526	5.612	1.015	41.24
1.266	0.511	5.829	1.039	42.06
1.601	0.497	6.062	1.068	42.99
2.005	0.482	6.312	1.101	44.04
2.490	0.468	6.581	1.141	45.23
3.076	0.454	6.872	1.188	46.57
3.787	0.439	7.188	1.242	48.06
4.657	0.425	7.529	1.306	49.74
5.732	0.410	7.901	1.380	51.61
7.083	0.396	8.307	1.468	53.71
8.817	0.382	8.752	1.572	56.05
11.117	0.367	9.240	1.694	58.67
14.325	0.353	9.778	1.838	61.61
15.400	0.350	9.904	1.874	62.31

NODE 911.00 : HGL = < 569.950>;EGL= < 570.206>;FLOWLINE= < 569.280>

****

FLOW PROCESS FROM NODE 911.00 TO NODE 911.00 IS CODE = 8
UPSTREAM NODE 911.00 ELEVATION = 569.28 (FLOW IS AT CRITICAL DEPTH)

CALCULATE CATCH BASIN ENTRANCE LOSSES(LACFCD):
PIPE FLOW = 3.10 CFS PIPE DIAMETER = 18.00 INCHES
FLOW VELOCITY = 4.06 FEET/SEC. VELOCITY HEAD = 0.256 FEET
CATCH BASIN ENERGY LOSS = .2*(VELOCITY HEAD) = .2*(0.256) = 0.051

NODE 911.00 : HGL = < 570.257>;EGL= < 570.257>;FLOWLINE= < 569.280>

****

UPSTREAM PIPE FLOW CONTROL DATA:
NODE NUMBER = 911.00 FLOWLINE ELEVATION = 569.28
ASSUMED UPSTREAM CONTROL HGL = 569.95 FOR DOWNSTREAM RUN ANALYSIS

==

END OF GRADUALLY VARIED FLOW ANALYSIS

```
****************************************************************************
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                     Analysis prepared by:

                    Rick Engineering Company
                       5620 Friars Road
                     San Diego, CA  92110
                        (619) 291-0707

 ************************** DESCRIPTION OF STUDY **************************
 * BLACK MOUNTAIN RANCH EAST CLUSTERS UNIT 3, J-15149-B                    *
 * EASTERLY LATERAL AT NODE 930                                            *
 * 100-YR FLOW                                                             *
 **************************************************************************

  FILE NAME: 930E.LAT
  TIME/DATE OF STUDY: 11:38 07/07/2014

****************************************************************************
         GRADUALLY VARIED FLOW ANALYSIS FOR PIPE SYSTEM
                    NODAL POINT STATUS TABLE
          (Note: "*" indicates nodal point data used.)
                  UPSTREAM RUN                  DOWNSTREAM RUN
  NODE    MODEL   PRESSURE     PRESSURE+        FLOW        PRESSURE+
 NUMBER  PROCESS  HEAD(FT)  MOMENTUM(POUNDS)  DEPTH(FT)  MOMENTUM(POUNDS)
 930.00-             0.86 Dc          70.41       0.47*           107.48
       } FRICTION
 925.00-             0.86*Dc          70.41       0.86*Dc          70.41
       } CATCH BASIN
 925.00-             1.28*            38.89       0.86 Dc          24.19
----------------------------------------------------------------------------
 MAXIMUM NUMBER OF ENERGY BALANCES USED IN EACH PROFILE =  25
----------------------------------------------------------------------------
 NOTE: STEADY FLOW HYDRAULIC HEAD-LOSS COMPUTATIONS BASED ON THE MOST
 CONSERVATIVE FORMULAE FROM THE CURRENT LACRD,LACFCD, AND OCEMA
 DESIGN MANUALS.
****************************************************************************
 DOWNSTREAM PIPE FLOW CONTROL DATA:
 NODE NUMBER =    930.00          FLOWLINE ELEVATION =   546.46
 PIPE FLOW =         5.00 CFS     PIPE DIAMETER =  18.00 INCHES
 ASSUMED DOWNSTREAM CONTROL HGL =    547.300 FEET
 *NOTE: ASSUMED DOWNSTREAM CONTROL DEPTH(  0.84 FT.)
        IS LESS THAN CRITICAL DEPTH(  0.86 FT.)
 ===> CRITICAL DEPTH IS ASSUMED AS DOWNSTREAM CONTROL DEPTH
      FOR UPSTREAM RUN ANALYSIS
----------------------------------------------------------------------------
 NODE    930.00 : HGL = <   546.932>;EGL= <   548.642>;FLOWLINE= <   546.460>

****************************************************************************
 FLOW PROCESS FROM NODE    930.00 TO NODE    925.00 IS CODE =   1
 UPSTREAM NODE    925.00      ELEVATION =    547.90  (FLOW IS SUPERCRITICAL)
----------------------------------------------------------------------------
 CALCULATE FRICTION LOSSES(LACFCD):
 PIPE FLOW    =        5.00 CFS     PIPE DIAMETER =  18.00 INCHES
 PIPE LENGTH =        15.30 FEET          MANNING'S N  =  0.01300
----------------------------------------------------------------------------
```

NORMAL DEPTH(FT) = 0.40 CRITICAL DEPTH(FT) = 0.86

==

UPSTREAM CONTROL ASSUMED FLOWDEPTH(FT) = 0.86

==

GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:

DISTANCE FROM CONTROL(FT)	FLOW DEPTH (FT)	VELOCITY (FT/SEC)	SPECIFIC ENERGY(FT)	PRESSURE+ MOMENTUM(POUNDS)
0.000	0.860	4.768	1.213	70.41
0.009	0.842	4.896	1.214	70.46
0.037	0.823	5.032	1.217	70.61
0.087	0.805	5.175	1.221	70.88
0.160	0.786	5.327	1.227	71.26
0.262	0.768	5.489	1.236	71.76
0.395	0.750	5.661	1.248	72.40
0.563	0.731	5.844	1.262	73.17
0.773	0.713	6.039	1.279	74.09
1.031	0.694	6.247	1.301	75.17
1.344	0.676	6.470	1.326	76.43
1.722	0.657	6.708	1.357	77.87
2.177	0.639	6.964	1.393	79.51
2.724	0.621	7.240	1.435	81.37
3.382	0.602	7.536	1.485	83.46
4.176	0.584	7.856	1.543	85.82
5.140	0.565	8.203	1.611	88.46
6.317	0.547	8.579	1.690	91.42
7.772	0.528	8.988	1.784	94.73
9.599	0.510	9.434	1.893	98.43
11.945	0.492	9.923	2.021	102.57
15.055	0.473	10.459	2.173	107.20
15.300	0.472	10.491	2.182	107.48

NODE 925.00 : HGL = < 548.760>;EGL= < 549.113>;FLOWLINE= < 547.900>

****

FLOW PROCESS FROM NODE 925.00 TO NODE 925.00 IS CODE = 8
UPSTREAM NODE 925.00 ELEVATION = 547.90 (FLOW IS AT CRITICAL DEPTH)

CALCULATE CATCH BASIN ENTRANCE LOSSES(LACFCD):
PIPE FLOW = 5.00 CFS PIPE DIAMETER = 18.00 INCHES
FLOW VELOCITY = 4.77 FEET/SEC. VELOCITY HEAD = 0.353 FEET
CATCH BASIN ENERGY LOSS = .2*(VELOCITY HEAD) = .2*(0.353) = 0.071

NODE 925.00 : HGL = < 549.184>;EGL= < 549.184>;FLOWLINE= < 547.900>

****

UPSTREAM PIPE FLOW CONTROL DATA:
NODE NUMBER = 925.00 FLOWLINE ELEVATION = 547.90
ASSUMED UPSTREAM CONTROL HGL = 548.76 FOR DOWNSTREAM RUN ANALYSIS

==

END OF GRADUALLY VARIED FLOW ANALYSIS

```
****************************************************************************
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                    Analysis prepared by:

                    Rick Engineering Company
                       5620 Friars Road
                     San Diego, CA  92110
                        (619) 291-0707

 ************************* DESCRIPTION OF STUDY *************************
* BLACK MOUNTAIN RANCH EAST CLUSTERS UNIT 3                               *
* WESTERLY LATERAL AT NODE 930                                            *
* 100-YR FLOW                                                             *
 ************************************************************************

  FILE NAME: 930W.LAT
  TIME/DATE OF STUDY: 11:51 07/07/2014
****************************************************************************
          GRADUALLY VARIED FLOW ANALYSIS FOR PIPE SYSTEM
                     NODAL POINT STATUS TABLE
          (Note: "*" indicates nodal point data used.)
                  UPSTREAM RUN                      DOWNSTREAM RUN
  NODE    MODEL   PRESSURE      PRESSURE+          FLOW       PRESSURE+
 NUMBER  PROCESS  HEAD(FT)   MOMENTUM(POUNDS)   DEPTH(FT)  MOMENTUM(POUNDS)
 930.00-            0.84*           37.81         0.55              34.35
       } FRICTION         } HYDRAULIC JUMP
 920.00-            0.64*Dc         33.17         0.64*Dc           33.17
       } CATCH BASIN
 920.00-            0.92*           17.78         0.64 Dc           11.83
----------------------------------------------------------------------------
 MAXIMUM NUMBER OF ENERGY BALANCES USED IN EACH PROFILE =  25
----------------------------------------------------------------------------
 NOTE: STEADY FLOW HYDRAULIC HEAD-LOSS COMPUTATIONS BASED ON THE MOST
 CONSERVATIVE FORMULAE FROM THE CURRENT LACRD,LACFCD, AND OCEMA
 DESIGN MANUALS.
****************************************************************************
 DOWNSTREAM PIPE FLOW CONTROL DATA:
 NODE NUMBER =    930.00            FLOWLINE ELEVATION =    546.46
 PIPE FLOW =        2.80 CFS        PIPE DIAMETER =  18.00 INCHES
 ASSUMED DOWNSTREAM CONTROL HGL =    547.300 FEET
----------------------------------------------------------------------------
 NODE    930.00 : HGL = <   547.300>;EGL= <   547.417>;FLOWLINE= <  546.460>

****************************************************************************
 FLOW PROCESS FROM NODE   930.00 TO NODE   920.00 IS CODE =  1
 UPSTREAM NODE   920.00      ELEVATION =   546.61  (HYDRAULIC JUMP OCCURS)
----------------------------------------------------------------------------
 CALCULATE FRICTION LOSSES(LACFCD):
 PIPE FLOW    =        2.80 CFS     PIPE DIAMETER =  18.00 INCHES
 PIPE LENGTH =       15.30 FEET          MANNING'S N  =  0.01300
----------------------------------------------------------------------------
 HYDRAULIC JUMP: DOWNSTREAM RUN ANALYSIS RESULTS
----------------------------------------------------------------------------
 NORMAL DEPTH(FT) =       0.53          CRITICAL DEPTH(FT) =       0.64
============================================================================
```

UPSTREAM CONTROL ASSUMED FLOWDEPTH(FT) = 0.64

GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:

DISTANCE FROM CONTROL(FT)	FLOW DEPTH (FT)	VELOCITY (FT/SEC)	SPECIFIC ENERGY(FT)	PRESSURE+ MOMENTUM(POUNDS)
0.000	0.635	3.931	0.875	33.17
0.011	0.631	3.966	0.875	33.18
0.046	0.627	4.000	0.876	33.18
0.108	0.623	4.036	0.876	33.19
0.198	0.619	4.072	0.876	33.21
0.319	0.614	4.108	0.877	33.23
0.475	0.610	4.145	0.877	33.26
0.670	0.606	4.183	0.878	33.29
0.907	0.602	4.222	0.879	33.33
1.193	0.598	4.261	0.880	33.37
1.534	0.594	4.300	0.881	33.42
1.937	0.590	4.341	0.882	33.47
2.412	0.585	4.382	0.884	33.53
2.970	0.581	4.424	0.885	33.59
3.626	0.577	4.467	0.887	33.66
4.399	0.573	4.510	0.889	33.73
5.313	0.569	4.554	0.891	33.81
6.403	0.565	4.600	0.893	33.90
7.714	0.561	4.645	0.896	33.99
9.318	0.556	4.692	0.899	34.09
11.319	0.552	4.740	0.901	34.20
13.898	0.548	4.788	0.904	34.31
15.300	0.547	4.808	0.906	34.35

HYDRAULIC JUMP: UPSTREAM RUN ANALYSIS RESULTS

DOWNSTREAM CONTROL ASSUMED FLOWDEPTH(FT) = 0.84

GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:

DISTANCE FROM CONTROL(FT)	FLOW DEPTH (FT)	VELOCITY (FT/SEC)	SPECIFIC ENERGY(FT)	PRESSURE+ MOMENTUM(POUNDS)
0.000	0.840	2.749	0.957	37.81
0.681	0.832	2.782	0.952	37.47
1.354	0.824	2.817	0.947	37.15
2.018	0.815	2.852	0.942	36.83
2.672	0.807	2.888	0.937	36.53
3.315	0.799	2.925	0.932	36.24
3.947	0.791	2.963	0.927	35.96
4.568	0.783	3.002	0.923	35.69
5.175	0.774	3.042	0.918	35.44
5.769	0.766	3.083	0.914	35.19
6.347	0.758	3.125	0.910	34.96
6.909	0.750	3.169	0.906	34.74
7.454	0.742	3.213	0.902	34.54
7.979	0.733	3.259	0.899	34.34
8.483	0.725	3.307	0.895	34.16
8.965	0.717	3.355	0.892	34.00
9.421	0.709	3.406	0.889	33.85
9.849	0.701	3.457	0.886	33.71
10.247	0.693	3.510	0.884	33.59
10.610	0.684	3.565	0.882	33.48
10.935	0.676	3.621	0.880	33.39
11.217	0.668	3.680	0.878	33.31
11.451	0.660	3.740	0.877	33.25

```
        11.629          0.652      3.802          0.876            33.21
        11.743          0.643      3.865          0.876            33.18
        11.784          0.635      3.931          0.875            33.17
        15.300          0.635      3.931          0.875            33.17
------------------------END OF HYDRAULIC JUMP ANALYSIS------------------------
| PRESSURE+MOMENTUM BALANCE OCCURS AT      9.38 FEET UPSTREAM OF NODE  930.00 |
|       DOWNSTREAM DEPTH = 0.710 FEET, UPSTREAM CONJUGATE DEPTH = 0.567 FEET |
-----------------------------------------------------------------------------
 NODE    920.00 : HGL = <  547.245>;EGL= <  547.485>;FLOWLINE= <  546.610>

*****************************************************************************
 FLOW PROCESS FROM NODE    920.00 TO NODE    920.00 IS CODE =  8
 UPSTREAM NODE   920.00      ELEVATION =   546.61  (FLOW IS AT CRITICAL DEPTH)
-----------------------------------------------------------------------------
 CALCULATE CATCH BASIN ENTRANCE LOSSES(LACFCD):
 PIPE FLOW =         2.80 CFS          PIPE DIAMETER =  18.00 INCHES
 FLOW VELOCITY =   3.93 FEET/SEC.    VELOCITY HEAD =  0.240 FEET
 CATCH BASIN ENERGY LOSS = .2*(VELOCITY HEAD) = .2*(  0.240) =  0.048
-----------------------------------------------------------------------------
 NODE    920.00 : HGL = <  547.533>;EGL= <  547.533>;FLOWLINE= <  546.610>

*****************************************************************************
 UPSTREAM PIPE FLOW CONTROL DATA:
 NODE NUMBER =    920.00            FLOWLINE ELEVATION =   546.61
 ASSUMED UPSTREAM CONTROL HGL =     547.25 FOR DOWNSTREAM RUN ANALYSIS

=============================================================================
 END OF GRADUALLY VARIED FLOW ANALYSIS
```

```
****************************************************************************
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                    Analysis prepared by:

                   Rick Engineering Company
                      5620 Friars Road
                    San Diego, CA  92110
                       (619) 291-0707

 ************************** DESCRIPTION OF STUDY **************************
 * BLACK MOUNTAIN RANCH EAST CLUSTERS UNIT 3, J-15149-B                    *
 * LATERAL AT NODE 940                                                     *
 * 100-YR FLOW                                                             *
 **************************************************************************

  FILE NAME: 940.LAT
  TIME/DATE OF STUDY: 13:08 07/07/2014
****************************************************************************
          GRADUALLY VARIED FLOW ANALYSIS FOR PIPE SYSTEM
                   NODAL POINT STATUS TABLE
          (Note: "*" indicates nodal point data used.)
                   UPSTREAM RUN                    DOWNSTREAM RUN
  NODE     MODEL   PRESSURE     PRESSURE+        FLOW         PRESSURE+
 NUMBER   PROCESS  HEAD(FT)  MOMENTUM(POUNDS)  DEPTH(FT)  MOMENTUM(POUNDS)
 940.00-              0.77           35.30       0.43*            41.14
       } FRICTION
 938.00-              0.64*Dc        33.17       0.64*Dc          33.17
       } CATCH BASIN
 938.00-              0.92*          17.78       0.64 Dc          11.83
---------------------------------------------------------------------------
 MAXIMUM NUMBER OF ENERGY BALANCES USED IN EACH PROFILE =  25
---------------------------------------------------------------------------
 NOTE: STEADY FLOW HYDRAULIC HEAD-LOSS COMPUTATIONS BASED ON THE MOST
 CONSERVATIVE FORMULAE FROM THE CURRENT LACRD,LACFCD, AND OCEMA
 DESIGN MANUALS.
****************************************************************************
 DOWNSTREAM PIPE FLOW CONTROL DATA:
 NODE NUMBER =    940.00             FLOWLINE ELEVATION =    538.63
 PIPE FLOW =        2.80 CFS         PIPE DIAMETER =  18.00 INCHES
 ASSUMED DOWNSTREAM CONTROL HGL =   539.400 FEET
---------------------------------------------------------------------------
 NODE   940.00 : HGL = <  539.058>;EGL= <  539.763>;FLOWLINE= <  538.630>

****************************************************************************
 FLOW PROCESS FROM NODE   940.00 TO NODE   938.00 IS CODE =  1
 UPSTREAM NODE   938.00      ELEVATION =   539.45  (FLOW IS SUPERCRITICAL)
---------------------------------------------------------------------------
 CALCULATE FRICTION LOSSES(LACFCD):
 PIPE FLOW   =       2.80 CFS     PIPE DIAMETER =  18.00 INCHES
 PIPE LENGTH =      32.10 FEET          MANNING'S N  =  0.01300
---------------------------------------------------------------------------
 NORMAL DEPTH(FT) =       0.41           CRITICAL DEPTH(FT) =      0.64
===========================================================================
 UPSTREAM CONTROL ASSUMED FLOWDEPTH(FT) =      0.64
===========================================================================
```

GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:

DISTANCE FROM CONTROL(FT)	FLOW DEPTH (FT)	VELOCITY (FT/SEC)	SPECIFIC ENERGY(FT)	PRESSURE+ MOMENTUM(POUNDS)
0.000	0.635	3.931	0.875	33.17
0.012	0.626	4.005	0.876	33.18
0.049	0.617	4.081	0.876	33.22
0.114	0.609	4.160	0.878	33.27
0.210	0.600	4.242	0.879	33.35
0.340	0.591	4.327	0.882	33.45
0.509	0.582	4.415	0.885	33.58
0.720	0.573	4.507	0.889	33.73
0.980	0.565	4.602	0.894	33.91
1.294	0.556	4.701	0.899	34.11
1.670	0.547	4.805	0.906	34.35
2.118	0.538	4.912	0.913	34.61
2.650	0.529	5.024	0.921	34.91
3.278	0.520	5.140	0.931	35.24
4.021	0.512	5.262	0.942	35.60
4.903	0.503	5.389	0.954	36.00
5.953	0.494	5.521	0.968	36.44
7.213	0.485	5.660	0.983	36.91
8.740	0.476	5.805	1.000	37.43
10.619	0.467	5.957	1.019	37.99
12.981	0.459	6.116	1.040	38.60
16.047	0.450	6.284	1.063	39.26
20.228	0.441	6.459	1.089	39.97
26.453	0.432	6.644	1.118	40.74
32.100	0.428	6.740	1.133	41.14

NODE 938.00 : HGL = < 540.085>;EGL= < 540.325>;FLOWLINE= < 539.450>

****

FLOW PROCESS FROM NODE 938.00 TO NODE 938.00 IS CODE = 8
UPSTREAM NODE 938.00 ELEVATION = 539.45 (FLOW IS AT CRITICAL DEPTH)

CALCULATE CATCH BASIN ENTRANCE LOSSES(LACFCD):
PIPE FLOW = 2.80 CFS PIPE DIAMETER = 18.00 INCHES
FLOW VELOCITY = 3.93 FEET/SEC. VELOCITY HEAD = 0.240 FEET
CATCH BASIN ENERGY LOSS = .2*(VELOCITY HEAD) = .2*(0.240) = 0.048

NODE 938.00 : HGL = < 540.373>;EGL= < 540.373>;FLOWLINE= < 539.450>

****

UPSTREAM PIPE FLOW CONTROL DATA:
NODE NUMBER = 938.00 FLOWLINE ELEVATION = 539.45
ASSUMED UPSTREAM CONTROL HGL = 540.09 FOR DOWNSTREAM RUN ANALYSIS

END OF GRADUALLY VARIED FLOW ANALYSIS

```
****************************************************************************
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                          Analysis prepared by:

                         Rick Engineering Company
                            5620 Friars Road
                          San Diego, CA  92110
                             (619) 291-0707

  ************************* DESCRIPTION OF STUDY *************************
 * BLACK MOUNTAIN RANCH EAST CLUSTERS UNIT 3, J-15149-B                   *
 * EASTERLY LATERAL AT NODE 980                                           *
 * 100-YR FLOW                                                            *
  ************************************************************************

  FILE NAME: 980E.LAT
  TIME/DATE OF STUDY: 13:45 07/24/2014

****************************************************************************
             GRADUALLY VARIED FLOW ANALYSIS FOR PIPE SYSTEM
                       NODAL POINT STATUS TABLE
              (Note: "*" indicates nodal point data used.)
                   UPSTREAM RUN                     DOWNSTREAM RUN
  NODE    MODEL   PRESSURE      PRESSURE+        FLOW         PRESSURE+
 NUMBER  PROCESS  HEAD(FT)   MOMENTUM(POUNDS)  DEPTH(FT)   MOMENTUM(POUNDS)
 980.00-            3.47*          325.20        0.50               93.27
       } FRICTION
 955.00-            2.47*          215.15        0.84 Dc            66.74
       } CATCH BASIN
 955.00-            2.61*          205.04        0.84 Dc            23.02
----------------------------------------------------------------------------
 MAXIMUM NUMBER OF ENERGY BALANCES USED IN EACH PROFILE =  25
----------------------------------------------------------------------------
 NOTE: STEADY FLOW HYDRAULIC HEAD-LOSS COMPUTATIONS BASED ON THE MOST
 CONSERVATIVE FORMULAE FROM THE CURRENT LACRD,LACFCD, AND OCEMA
 DESIGN MANUALS.
****************************************************************************
 DOWNSTREAM PIPE FLOW CONTROL DATA:
 NODE NUMBER =    980.00              FLOWLINE ELEVATION =   517.68
 PIPE FLOW =        4.80 CFS          PIPE DIAMETER =  18.00 INCHES
 ASSUMED DOWNSTREAM CONTROL HGL =   521.150 FEET
----------------------------------------------------------------------------
 NODE    980.00 : HGL = <  521.150>;EGL= <  521.265>;FLOWLINE= <  517.680>

****************************************************************************
 FLOW PROCESS FROM NODE   980.00 TO NODE   955.00 IS CODE =  1
 UPSTREAM NODE   955.00    ELEVATION =   518.71  (FLOW IS UNDER PRESSURE)
----------------------------------------------------------------------------
 CALCULATE FRICTION LOSSES(LACFCD):
 PIPE FLOW   =        4.80 CFS    PIPE DIAMETER =  18.00 INCHES
 PIPE LENGTH =       15.30 FEET         MANNING'S N  =  0.01300
 SF=(Q/K)**2 = ((       4.80)/(    105.086))**2 = 0.00209
 HF=L*SF = (      15.30)*(0.00209) =        0.032
----------------------------------------------------------------------------
 NODE    955.00 : HGL = <  521.182>;EGL= <  521.297>;FLOWLINE= <  518.710>
```

```
******************************************************************************
 FLOW PROCESS FROM NODE   955.00 TO NODE   955.00 IS CODE =  8
 UPSTREAM NODE   955.00      ELEVATION =   518.71  (FLOW IS UNDER PRESSURE)
------------------------------------------------------------------------------
 CALCULATE CATCH BASIN ENTRANCE LOSSES(LACFCD):
 PIPE FLOW =          4.80 CFS           PIPE DIAMETER =  18.00 INCHES
 FLOW VELOCITY =    2.72 FEET/SEC.    VELOCITY HEAD =  0.115 FEET
 CATCH BASIN ENERGY LOSS = .2*(VELOCITY HEAD) = .2*(  0.115) =  0.023
------------------------------------------------------------------------------
 NODE   955.00 : HGL = <  521.319>;EGL= <  521.319>;FLOWLINE= <  518.710>
******************************************************************************
 UPSTREAM PIPE FLOW CONTROL DATA:
 NODE NUMBER =    955.00               FLOWLINE ELEVATION =    518.71
 ASSUMED UPSTREAM CONTROL HGL =     519.55 FOR DOWNSTREAM RUN ANALYSIS
==============================================================================
 END OF GRADUALLY VARIED FLOW ANALYSIS
```

```
****************************************************************************
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                        San Diego, CA  92110
                          (619) 291-0707

 ************************** DESCRIPTION OF STUDY **************************
 * BLACK MOUNTAIN RANCH EAST CLUSTERS UNIT 3, J-15149-B                    *
 * WESTERLY LATERAL AT NODE 980                                            *
 * 100-YR FLOW                                                             *
 **************************************************************************

  FILE NAME: 980W.LAT
  TIME/DATE OF STUDY: 13:50 07/24/2014

****************************************************************************
          GRADUALLY VARIED FLOW ANALYSIS FOR PIPE SYSTEM
                   NODAL POINT STATUS TABLE
           (Note: "*" indicates nodal point data used.)
                 UPSTREAM RUN                    DOWNSTREAM RUN
  NODE    MODEL   PRESSURE     PRESSURE+        FLOW       PRESSURE+
 NUMBER  PROCESS  HEAD(FT)  MOMENTUM(POUNDS)  DEPTH(FT)  MOMENTUM(POUNDS)
 980.00-             3.52*        321.29         0.65            50.71
       } FRICTION
 960.00-             3.39*        306.95         0.75 Dc         49.22
       } CATCH BASIN
 960.00-             3.48*        300.62         0.75 Dc         17.28
----------------------------------------------------------------------------
 MAXIMUM NUMBER OF ENERGY BALANCES USED IN EACH PROFILE =  25
----------------------------------------------------------------------------
 NOTE: STEADY FLOW HYDRAULIC HEAD-LOSS COMPUTATIONS BASED ON THE MOST
 CONSERVATIVE FORMULAE FROM THE CURRENT LACRD,LACFCD, AND OCEMA
 DESIGN MANUALS.
****************************************************************************
 DOWNSTREAM PIPE FLOW CONTROL DATA:
 NODE NUMBER =    980.00           FLOWLINE ELEVATION =    517.68
 PIPE FLOW =        3.80 CFS       PIPE DIAMETER =  18.00 INCHES
 ASSUMED DOWNSTREAM CONTROL HGL =    521.200 FEET
----------------------------------------------------------------------------
 NODE    980.00 : HGL = <  521.200>;EGL= <  521.272>;FLOWLINE= <  517.680>

****************************************************************************
 FLOW PROCESS FROM NODE   980.00 TO NODE   960.00 IS CODE =  1
 UPSTREAM NODE   960.00      ELEVATION =   517.83  (FLOW IS UNDER PRESSURE)
----------------------------------------------------------------------------
 CALCULATE FRICTION LOSSES(LACFCD):
 PIPE FLOW   =        3.80 CFS     PIPE DIAMETER =  18.00 INCHES
 PIPE LENGTH =       15.30 FEET          MANNING'S N  =  0.01300
 SF=(Q/K)**2 = ((       3.80)/(   105.052))**2 = 0.00131
 HF=L*SF = (      15.30)*(0.00131) =        0.020
----------------------------------------------------------------------------
 NODE    960.00 : HGL = <  521.220>;EGL= <  521.292>;FLOWLINE= <  517.830>
```

```
******************************************************************************
 FLOW PROCESS FROM NODE   960.00 TO NODE   960.00 IS CODE =  8
 UPSTREAM NODE   960.00      ELEVATION =   517.83  (FLOW IS UNDER PRESSURE)
------------------------------------------------------------------------------
 CALCULATE CATCH BASIN ENTRANCE LOSSES(LACFCD):
 PIPE FLOW =         3.80 CFS           PIPE DIAMETER =  18.00 INCHES
 FLOW VELOCITY =    2.15 FEET/SEC.    VELOCITY HEAD =  0.072 FEET
 CATCH BASIN ENERGY LOSS = .2*(VELOCITY HEAD) = .2*(  0.072) =  0.014
------------------------------------------------------------------------------
 NODE   960.00 : HGL = <  521.306>;EGL= <  521.306>;FLOWLINE= <  517.830>

******************************************************************************
 UPSTREAM PIPE FLOW CONTROL DATA:
 NODE NUMBER =   960.00            FLOWLINE ELEVATION =   517.83
 ASSUMED UPSTREAM CONTROL HGL =     518.58 FOR DOWNSTREAM RUN ANALYSIS

==============================================================================
 END OF GRADUALLY VARIED FLOW ANALYSIS
```

```
****************************************************************************
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 ************************** DESCRIPTION OF STUDY **************************
* BLACK MOUNTAIN RANCH EAST CLUSTERS UNIT 3, J-15149-B                     *
* MAINLINE PIPE BASIN 900 - 100-YR FLOW                                    *
* H:\15149B\HYDRO\HYDRAULICS\PIPEFLOW\....                                 *
 **************************************************************************

  FILE NAME: 984.PIP
  TIME/DATE OF STUDY: 12:16 07/08/2014
****************************************************************************
          GRADUALLY VARIED FLOW ANALYSIS FOR PIPE SYSTEM
                   NODAL POINT STATUS TABLE
          (Note: "*" indicates nodal point data used.)
                 UPSTREAM RUN                      DOWNSTREAM RUN
 NODE     MODEL    PRESSURE      PRESSURE+         FLOW        PRESSURE+
 NUMBER   PROCESS  HEAD(FT)   MOMENTUM(POUNDS)  DEPTH(FT)  MOMENTUM(POUNDS)
 984.00-              2.67*         701.82         1.56          542.35
      } FRICTION
 983.00-              2.59*         676.04         1.73 Dc       533.96
      } JUNCTION
 983.00-              3.47*         947.84         1.33          588.60
      } FRICTION
 980.00-              3.42*         932.83         1.31          592.38
      } JUNCTION
 980.00-              3.42*         664.71         0.76          571.61
      } FRICTION            } HYDRAULIC JUMP
 975.00-              1.51 Dc       343.35         0.73*         595.03
      } FRICTION+BEND
 970.00-              1.51 Dc       343.35         0.75*         576.03
      } FRICTION
 940.00-              1.51 Dc       343.35         0.92*         457.34
      } JUNCTION
 940.00-              1.73          293.82         0.71*         450.97
      } FRICTION
 930.00-              1.39*Dc       273.80         1.39*Dc       273.80
      } JUNCTION
 930.00-              1.89          185.33         0.51*         204.98
      } FRICTION
 928.00-              1.05 Dc       118.56         0.55*         191.02
      } JUNCTION
 928.00-              1.05 Dc       118.56         0.52*         204.42
      } FRICTION+BEND
 927.00-              1.05 Dc       118.56         0.61*         167.64
      } JUNCTION
 927.00-              1.05 Dc       118.56         0.56*         186.72
      } FRICTION+BEND
 913.00-              1.05*Dc       118.56         1.05*Dc       118.56
```

```
      } JUNCTION
 913.00-           1.37              89.72        0.41*            96.07
      } FRICTION
 912.00-           0.79 Dc           57.80        0.46*            83.23
      } JUNCTION
 912.00-           0.79 Dc           57.80        0.46*            83.24
      } FRICTION+BEND
 910.00-           0.79*Dc           57.80        0.79*Dc          57.80
      } JUNCTION
 910.00-           1.03*             64.27        0.69             59.52
      } FRICTION       } HYDRAULIC JUMP
 908.00-           0.79*Dc           57.80        0.79*Dc          57.80
      } CATCH BASIN
 908.00-           1.18*             31.53        0.79 Dc          20.12
-------------------------------------------------------------------------------
 MAXIMUM NUMBER OF ENERGY BALANCES USED IN EACH PROFILE =  25
-------------------------------------------------------------------------------
 NOTE: STEADY FLOW HYDRAULIC HEAD-LOSS COMPUTATIONS BASED ON THE MOST
 CONSERVATIVE FORMULAE FROM THE CURRENT LACRD,LACFCD, AND OCEMA
 DESIGN MANUALS.
*******************************************************************************
 DOWNSTREAM PIPE FLOW CONTROL DATA:
 NODE NUMBER =    984.00           FLOWLINE ELEVATION =   517.13
 PIPE FLOW =       26.00 CFS       PIPE DIAMETER =  30.00 INCHES
 ASSUMED DOWNSTREAM CONTROL HGL =   519.800 FEET
-------------------------------------------------------------------------------
 NODE   984.00 : HGL = <  519.800>;EGL= <  520.236>;FLOWLINE= <  517.130>

*******************************************************************************
 FLOW PROCESS FROM NODE   984.00 TO NODE   983.00 IS CODE =  1
 UPSTREAM NODE   983.00      ELEVATION =   517.27  (FLOW IS UNDER PRESSURE)
-------------------------------------------------------------------------------
 CALCULATE FRICTION LOSSES(LACFCD):
 PIPE FLOW   =       26.00 CFS     PIPE DIAMETER =  30.00 INCHES
 PIPE LENGTH =       13.90 FEET          MANNING'S N  =  0.01300
 SF=(Q/K)**2 = ((      26.00)/(    410.185))**2 = 0.00402
 HF=L*SF = (      13.90)*(0.00402) =       0.056
-------------------------------------------------------------------------------
 NODE   983.00 : HGL = <  519.856>;EGL= <  520.291>;FLOWLINE= <  517.270>

*******************************************************************************
 FLOW PROCESS FROM NODE   983.00 TO NODE   983.00 IS CODE =  5
 UPSTREAM NODE   983.00      ELEVATION =   517.27  (FLOW IS UNDER PRESSURE)
-------------------------------------------------------------------------------
 CALCULATE JUNCTION LOSSES:
      PIPE         FLOW    DIAMETER   ANGLE    FLOWLINE   CRITICAL   VELOCITY
                   (CFS)   (INCHES) (DEGREES) ELEVATION  DEPTH(FT.)  (FT/SEC)
    UPSTREAM       26.00     30.00     90.00    517.27       1.74       5.297
   DOWNSTREAM      26.00     30.00       -      517.27       1.74       5.297
   LATERAL #1       0.00      0.00      0.00      0.00       0.00       0.000
   LATERAL #2       0.00      0.00      0.00      0.00       0.00       0.000
      Q5            0.00===Q5 EQUALS BASIN INPUT===

 LACFCD AND OCEMA FLOW JUNCTION FORMULAE USED:
 DY=(Q2*V2-Q1*V1*COS(DELTA1)-Q3*V3*COS(DELTA3)-
     Q4*V4*COS(DELTA4))/((A1+A2)*16.1)+FRICTION LOSSES
 UPSTREAM:    MANNING'S N = 0.01300;  FRICTION SLOPE = 0.00402
 DOWNSTREAM:  MANNING'S N = 0.01300;  FRICTION SLOPE = 0.00402
 AVERAGED FRICTION SLOPE IN JUNCTION ASSUMED AS 0.00402
 JUNCTION LENGTH =    4.00 FEET
 FRICTION LOSSES =  0.016 FEET         ENTRANCE LOSSES =  0.000 FEET
```

```
 JUNCTION LOSSES = (DY+HV1-HV2)+(ENTRANCE LOSSES)
 JUNCTION LOSSES = ( 0.887)+( 0.000) =    0.887
-----------------------------------------------------------------------------
 NODE   983.00 : HGL = <  520.743>;EGL= <  521.179>;FLOWLINE= <  517.270>

*****************************************************************************
 FLOW PROCESS FROM NODE   983.00 TO NODE   980.00 IS CODE =  1
 UPSTREAM NODE   980.00     ELEVATION =   517.35  (FLOW IS UNDER PRESSURE)
-----------------------------------------------------------------------------
 CALCULATE FRICTION LOSSES(LACFCD):
 PIPE FLOW   =        26.00 CFS     PIPE DIAMETER =  30.00 INCHES
 PIPE LENGTH =         7.70 FEET          MANNING'S N  =  0.01300
 SF=(Q/K)**2 = ((      26.00)/(   410.538))**2 = 0.00401
 HF=L*SF = (        7.70)*(0.00401) =        0.031
-----------------------------------------------------------------------------
 NODE   980.00 : HGL = <  520.774>;EGL= <  521.210>;FLOWLINE= <  517.350>

*****************************************************************************
 FLOW PROCESS FROM NODE   980.00 TO NODE   980.00 IS CODE =  5
 UPSTREAM NODE   980.00     ELEVATION =   517.68  (FLOW IS UNDER PRESSURE)
-----------------------------------------------------------------------------
 CALCULATE JUNCTION LOSSES:
      PIPE        FLOW    DIAMETER   ANGLE    FLOWLINE   CRITICAL   VELOCITY
                  (CFS)   (INCHES) (DEGREES) ELEVATION  DEPTH(FT.)  (FT/SEC)
    UPSTREAM       17.60    24.00      0.00    517.68      1.51        5.602
   DOWNSTREAM      26.00    30.00       -      517.35      1.74        5.297
   LATERAL #1       3.70    18.00     90.00    517.68      0.73        2.094
   LATERAL #2       4.70    18.00     90.00    517.68      0.83        2.660
      Q5            0.00===Q5 EQUALS BASIN INPUT===

 LACFCD AND OCEMA FLOW JUNCTION FORMULAE USED:
 DY=(Q2*V2-Q1*V1*COS(DELTA1)-Q3*V3*COS(DELTA3)-
     Q4*V4*COS(DELTA4))/((A1+A2)*16.1)+FRICTION LOSSES
 UPSTREAM:    MANNING'S N = 0.01300;  FRICTION SLOPE = 0.00605
 DOWNSTREAM:  MANNING'S N = 0.01300;  FRICTION SLOPE = 0.00402
 AVERAGED FRICTION SLOPE IN JUNCTION ASSUMED AS 0.00504
 JUNCTION LENGTH =   4.00 FEET
 FRICTION LOSSES =  0.020 FEET         ENTRANCE LOSSES =  0.000 FEET
 JUNCTION LOSSES = (DY+HV1-HV2)+(ENTRANCE LOSSES)
 JUNCTION LOSSES = ( 0.374)+( 0.000) =    0.374
-----------------------------------------------------------------------------
 NODE   980.00 : HGL = <  521.096>;EGL= <  521.583>;FLOWLINE= <  517.680>

*****************************************************************************
 FLOW PROCESS FROM NODE   980.00 TO NODE   975.00 IS CODE =  1
 UPSTREAM NODE   975.00     ELEVATION =   524.08  (HYDRAULIC JUMP OCCURS)
-----------------------------------------------------------------------------
 CALCULATE FRICTION LOSSES(LACFCD):
 PIPE FLOW   =        17.60 CFS     PIPE DIAMETER =  24.00 INCHES
 PIPE LENGTH =        99.70 FEET          MANNING'S N  =  0.01300
-----------------------------------------------------------------------------
 HYDRAULIC JUMP: DOWNSTREAM RUN ANALYSIS RESULTS
-----------------------------------------------------------------------------
 NORMAL DEPTH(FT) =       0.76          CRITICAL DEPTH(FT) =       1.51
=============================================================================
 UPSTREAM CONTROL ASSUMED FLOWDEPTH(FT) =      0.73
=============================================================================
 GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:
-----------------------------------------------------------------------------
 DISTANCE FROM         FLOW DEPTH  VELOCITY       SPECIFIC        PRESSURE+
  CONTROL(FT)             (FT)     (FT/SEC)      ENERGY(FT)    MOMENTUM(POUNDS)
```

0.000	0.733	16.858	5.149	595.03
1.823	0.734	16.824	5.132	593.94
3.719	0.735	16.791	5.116	592.86
5.695	0.737	16.757	5.099	591.78
7.758	0.738	16.723	5.083	590.71
9.916	0.739	16.690	5.067	589.63
12.179	0.740	16.656	5.050	588.57
14.560	0.741	16.623	5.034	587.51
17.070	0.742	16.590	5.018	586.45
19.727	0.743	16.557	5.002	585.39
22.548	0.744	16.524	4.987	584.35
25.557	0.745	16.491	4.971	583.30
28.781	0.746	16.459	4.955	582.26
32.255	0.747	16.426	4.940	581.22
36.022	0.749	16.394	4.924	580.19
40.139	0.750	16.361	4.909	579.16
44.679	0.751	16.329	4.894	578.14
49.743	0.752	16.297	4.879	577.12
55.469	0.753	16.265	4.864	576.10
62.064	0.754	16.233	4.849	575.09
69.846	0.755	16.202	4.834	574.08
79.347	0.756	16.170	4.819	573.08
91.568	0.757	16.139	4.804	572.08
99.700	0.758	16.124	4.797	571.61

HYDRAULIC JUMP: UPSTREAM RUN ANALYSIS RESULTS

DOWNSTREAM CONTROL ASSUMED PRESSURE HEAD(FT) = 3.42

PRESSURE FLOW PROFILE COMPUTED INFORMATION:

DISTANCE FROM CONTROL(FT)	PRESSURE HEAD(FT)	VELOCITY (FT/SEC)	SPECIFIC ENERGY(FT)	PRESSURE+ MOMENTUM(POUNDS)
0.000	3.416	5.602	3.903	664.71
24.356	2.000	5.602	2.487	387.11

ASSUMED DOWNSTREAM PRESSURE HEAD(FT) = 2.00

GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:

DISTANCE FROM CONTROL(FT)	FLOW DEPTH (FT)	VELOCITY (FT/SEC)	SPECIFIC ENERGY(FT)	PRESSURE+ MOMENTUM(POUNDS)
24.356	2.000	5.601	2.487	387.11
24.664	1.980	5.610	2.469	383.60
24.947	1.961	5.626	2.453	380.35
25.214	1.941	5.648	2.437	377.29
25.469	1.922	5.674	2.422	374.38
25.712	1.902	5.703	2.408	371.61
25.945	1.883	5.736	2.394	368.98
26.167	1.863	5.772	2.381	366.48
26.380	1.844	5.811	2.368	364.10
26.583	1.824	5.853	2.356	361.84
26.777	1.805	5.897	2.345	359.71
26.962	1.785	5.944	2.334	357.69
27.136	1.766	5.994	2.324	355.81
27.301	1.746	6.047	2.314	354.04
27.456	1.726	6.102	2.305	352.40
27.600	1.707	6.161	2.297	350.89
27.733	1.687	6.222	2.289	349.51
27.855	1.668	6.285	2.282	348.26
27.966	1.648	6.352	2.275	347.14

28.064	1.629	6.422	2.270	346.16
28.149	1.609	6.495	2.265	345.32
28.220	1.590	6.570	2.261	344.62
28.277	1.570	6.650	2.257	344.07
28.320	1.551	6.732	2.255	343.68
28.346	1.531	6.818	2.253	343.44
28.354	1.512	6.907	2.253	343.35
99.700	1.512	6.907	2.253	343.35

------------------------END OF HYDRAULIC JUMP ANALYSIS------------------------

| PRESSURE+MOMENTUM BALANCE OCCURS AT 8.13 FEET UPSTREAM OF NODE 980.00 |
| DOWNSTREAM DEPTH = 2.944 FEET, UPSTREAM CONJUGATE DEPTH = 0.757 FEET |

NODE 975.00 : HGL = < 524.813>;EGL= < 529.229>;FLOWLINE= < 524.080>

****

FLOW PROCESS FROM NODE 975.00 TO NODE 970.00 IS CODE = 3
UPSTREAM NODE 970.00 ELEVATION = 531.46 (FLOW IS SUPERCRITICAL)

CALCULATE PIPE-BEND LOSSES(OCEMA):
PIPE FLOW = 17.60 CFS PIPE DIAMETER = 24.00 INCHES
CENTRAL ANGLE = 17.000 DEGREES MANNING'S N = 0.01300
PIPE LENGTH = 99.40 FEET

NORMAL DEPTH(FT) = 0.73 CRITICAL DEPTH(FT) = 1.51

UPSTREAM CONTROL ASSUMED FLOWDEPTH(FT) = 0.75

GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:

DISTANCE FROM CONTROL(FT)	FLOW DEPTH (FT)	VELOCITY (FT/SEC)	SPECIFIC ENERGY(FT)	PRESSURE+ MOMENTUM(POUNDS)
0.000	0.753	16.263	4.862	576.03
1.588	0.752	16.288	4.874	576.83
3.247	0.751	16.314	4.886	577.64
4.983	0.750	16.339	4.898	578.44
6.803	0.750	16.364	4.910	579.25
8.716	0.749	16.390	4.922	580.06
10.731	0.748	16.415	4.935	580.88
12.859	0.747	16.441	4.947	581.70
15.113	0.746	16.467	4.959	582.51
17.509	0.745	16.492	4.971	583.34
20.064	0.744	16.518	4.984	584.16
22.800	0.744	16.544	4.996	584.99
25.745	0.743	16.570	5.009	585.82
28.932	0.742	16.596	5.021	586.65
32.404	0.741	16.623	5.034	587.49
36.214	0.740	16.649	5.047	588.33
40.433	0.739	16.675	5.060	589.17
45.159	0.738	16.701	5.072	590.01
50.528	0.737	16.728	5.085	590.86
56.738	0.737	16.754	5.098	591.71
64.096	0.736	16.781	5.111	592.56
73.120	0.735	16.808	5.124	593.41
84.776	0.734	16.835	5.137	594.27
99.400	0.733	16.858	5.149	595.03

NODE 970.00 : HGL = < 532.213>;EGL= < 536.323>;FLOWLINE= < 531.460>

****

FLOW PROCESS FROM NODE 970.00 TO NODE 940.00 IS CODE = 1
UPSTREAM NODE 940.00 ELEVATION = 538.30 (FLOW IS SUPERCRITICAL)

CALCULATE FRICTION LOSSES(LACFCD):
PIPE FLOW = 17.60 CFS PIPE DIAMETER = 24.00 INCHES
PIPE LENGTH = 96.20 FEET MANNING'S N = 0.01300

NORMAL DEPTH(FT) = 0.74 CRITICAL DEPTH(FT) = 1.51

UPSTREAM CONTROL ASSUMED FLOWDEPTH(FT) = 0.92

GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:

DISTANCE FROM CONTROL(FT)	FLOW DEPTH (FT)	VELOCITY (FT/SEC)	SPECIFIC ENERGY(FT)	PRESSURE+ MOMENTUM(POUNDS)
0.000	0.924	12.392	3.311	457.34
1.102	0.917	12.522	3.353	461.12
2.271	0.910	12.655	3.398	465.00
3.516	0.902	12.790	3.444	468.97
4.842	0.895	12.928	3.492	473.05
6.257	0.888	13.069	3.541	477.23
7.773	0.880	13.212	3.593	481.52
9.399	0.873	13.359	3.646	485.92
11.149	0.865	13.509	3.701	490.44
13.038	0.858	13.663	3.758	495.08
15.084	0.851	13.819	3.818	499.83
17.310	0.843	13.980	3.880	504.71
19.743	0.836	14.143	3.944	509.72
22.417	0.828	14.311	4.011	514.86
25.374	0.821	14.482	4.080	520.14
28.669	0.814	14.657	4.152	525.56
32.373	0.806	14.836	4.226	531.12
36.586	0.799	15.019	4.304	536.82
41.443	0.792	15.207	4.385	542.69
47.146	0.784	15.399	4.468	548.71
54.005	0.777	15.595	4.556	554.89
62.541	0.769	15.796	4.647	561.24
73.732	0.762	16.003	4.741	567.76
89.773	0.755	16.214	4.839	574.46
96.200	0.753	16.263	4.862	576.03

NODE 940.00 : HGL = < 539.224>;EGL= < 541.611>;FLOWLINE= < 538.300>

****

FLOW PROCESS FROM NODE 940.00 TO NODE 940.00 IS CODE = 5
UPSTREAM NODE 940.00 ELEVATION = 538.63 (FLOW IS SUPERCRITICAL)

CALCULATE JUNCTION LOSSES:

PIPE	FLOW (CFS)	DIAMETER (INCHES)	ANGLE (DEGREES)	FLOWLINE ELEVATION	CRITICAL DEPTH(FT.)	VELOCITY (FT/SEC)
UPSTREAM	14.90	24.00	0.00	538.63	1.39	14.987
DOWNSTREAM	17.60	24.00	-	538.30	1.51	12.396
LATERAL #1	2.70	18.00	82.00	538.63	0.62	3.671
LATERAL #2	0.00	0.00	0.00	0.00	0.00	0.000
Q5	0.00===Q5 EQUALS BASIN INPUT===					

LACFCD AND OCEMA FLOW JUNCTION FORMULAE USED:
DY=(Q2*V2-Q1*V1*COS(DELTA1)-Q3*V3*COS(DELTA3)-
Q4*V4*COS(DELTA4))/((A1+A2)*16.1)+FRICTION LOSSES
UPSTREAM: MANNING'S N = 0.01300; FRICTION SLOPE = 0.06029
DOWNSTREAM: MANNING'S N = 0.01300; FRICTION SLOPE = 0.03175
AVERAGED FRICTION SLOPE IN JUNCTION ASSUMED AS 0.04602
JUNCTION LENGTH = 4.00 FEET

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 FRICTION LOSSES =  0.184 FEET         ENTRANCE LOSSES =  0.000 FEET
 JUNCTION LOSSES = (DY+HV1-HV2)+(ENTRANCE LOSSES)
 JUNCTION LOSSES = ( 1.215)+( 0.000) =   1.215
-----------------------------------------------------------------------------
 NODE   940.00 : HGL = <  539.337>;EGL= <  542.825>;FLOWLINE= <  538.630>

******************************************************************************
 FLOW PROCESS FROM NODE   940.00 TO NODE   930.00 IS CODE =  1
 UPSTREAM NODE   930.00      ELEVATION =   545.96  (FLOW IS SUPERCRITICAL)
-----------------------------------------------------------------------------
 CALCULATE FRICTION LOSSES(LACFCD):
 PIPE FLOW    =      14.90 CFS      PIPE DIAMETER =  24.00 INCHES
 PIPE LENGTH =      104.50 FEET          MANNING'S N  =  0.01300
-----------------------------------------------------------------------------
 NORMAL DEPTH(FT) =        0.68           CRITICAL DEPTH(FT) =       1.39
=============================================================================
 UPSTREAM CONTROL ASSUMED FLOWDEPTH(FT) =       1.39
=============================================================================
 GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:
-----------------------------------------------------------------------------
 DISTANCE FROM       FLOW DEPTH  VELOCITY       SPECIFIC         PRESSURE+
  CONTROL(FT)           (FT)     (FT/SEC)     ENERGY(FT)     MOMENTUM(POUNDS)
        0.000           1.388      6.403           2.025            273.80
        0.023           1.359      6.551           2.026            274.01
        0.086           1.331      6.708           2.030            274.57
        0.194           1.303      6.874           2.037            275.50
        0.352           1.274      7.051           2.047            276.81
        0.567           1.246      7.238           2.060            278.54
        0.846           1.218      7.437           2.077            280.70
        1.197           1.189      7.649           2.098            283.33
        1.633           1.161      7.874           2.125            286.45
        2.164           1.133      8.115           2.156            290.10
        2.807           1.104      8.371           2.193            294.31
        3.580           1.076      8.645           2.237            299.13
        4.506           1.048      8.939           2.289            304.61
        5.615           1.020      9.253           2.350            310.79
        6.943           0.991      9.590           2.420            317.74
        8.538           0.963      9.953           2.502            325.53
       10.464           0.935     10.344           2.597            334.23
       12.809           0.906     10.766           2.707            343.93
       15.694           0.878     11.223           2.835            354.72
       19.301           0.850     11.719           2.983            366.74
       23.909           0.821     12.257           3.156            380.10
       29.993           0.793     12.845           3.356            394.97
       38.437           0.765     13.487           3.591            411.52
       51.239           0.736     14.192           3.866            429.98
       74.806           0.708     14.968           4.189            450.58
      104.500           0.707     14.982           4.195            450.97
-----------------------------------------------------------------------------
 NODE   930.00 : HGL = <  547.348>;EGL= <  547.985>;FLOWLINE= <  545.960>

******************************************************************************
 FLOW PROCESS FROM NODE   930.00 TO NODE   930.00 IS CODE =  5
 UPSTREAM NODE   930.00      ELEVATION =   546.46  (FLOW IS AT CRITICAL DEPTH)
 (NOTE: POSSIBLE JUMP IN OR UPSTREAM OF STRUCTURE)
-----------------------------------------------------------------------------
 CALCULATE JUNCTION LOSSES:
      PIPE         FLOW    DIAMETER   ANGLE    FLOWLINE   CRITICAL    VELOCITY
                   (CFS)   (INCHES) (DEGREES) ELEVATION  DEPTH(FT.)   (FT/SEC)
   UPSTREAM         7.40     18.00      0.00    546.46       1.05      13.796
   DOWNSTREAM      14.90     24.00       -      545.96       1.39       6.405
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 LATERAL #1       2.70     18.00      90.00     546.70        0.62          3.889
 LATERAL #2       4.80     18.00      90.00     546.70        0.84          4.700
   Q5             0.00===Q5 EQUALS BASIN INPUT===

LACFCD AND OCEMA FLOW JUNCTION FORMULAE USED:
DY=(Q2*V2-Q1*V1*COS(DELTA1)-Q3*V3*COS(DELTA3)-
    Q4*V4*COS(DELTA4))/((A1+A2)*16.1)+FRICTION LOSSES
UPSTREAM:     MANNING'S N = 0.01300;  FRICTION SLOPE = 0.07741
DOWNSTREAM:   MANNING'S N = 0.01300;  FRICTION SLOPE = 0.00633
AVERAGED FRICTION SLOPE IN JUNCTION ASSUMED AS 0.04187
JUNCTION LENGTH =   4.00 FEET
FRICTION LOSSES =  0.167 FEET          ENTRANCE LOSSES =  0.000 FEET
JUNCTION LOSSES = (DY+HV1-HV2)+(ENTRANCE LOSSES)
JUNCTION LOSSES = ( 1.945)+( 0.000) =   1.945
----------------------------------------------------------------------------
NODE   930.00 : HGL = <  546.975>;EGL= <  549.930>;FLOWLINE= <  546.460>

****************************************************************************
FLOW PROCESS FROM NODE   930.00 TO NODE   928.00 IS CODE =  1
UPSTREAM NODE   928.00     ELEVATION =   557.01  (FLOW IS SUPERCRITICAL)
----------------------------------------------------------------------------
CALCULATE FRICTION LOSSES(LACFCD):
PIPE FLOW   =        7.40 CFS      PIPE DIAMETER =  18.00 INCHES
PIPE LENGTH =      135.10 FEET          MANNING'S N  =  0.01300
----------------------------------------------------------------------------
NORMAL DEPTH(FT) =       0.51          CRITICAL DEPTH(FT) =       1.05
============================================================================
UPSTREAM CONTROL ASSUMED FLOWDEPTH(FT) =      0.55
============================================================================
GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:
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DISTANCE FROM CONTROL(FT)	FLOW DEPTH (FT)	VELOCITY (FT/SEC)	SPECIFIC ENERGY(FT)	PRESSURE+ MOMENTUM(POUNDS)
0.000	0.545	12.744	3.069	191.02
0.951	0.544	12.784	3.084	191.56
1.946	0.543	12.825	3.098	192.10
2.990	0.542	12.866	3.114	192.64
4.087	0.540	12.908	3.129	193.19
5.242	0.539	12.949	3.144	193.74
6.462	0.538	12.991	3.160	194.29
7.753	0.536	13.033	3.176	194.85
9.124	0.535	13.075	3.192	195.41
10.583	0.534	13.118	3.208	195.98
12.144	0.533	13.161	3.224	196.55
13.819	0.531	13.204	3.240	197.12
15.625	0.530	13.247	3.257	197.70
17.584	0.529	13.291	3.273	198.28
19.723	0.527	13.335	3.290	198.87
22.075	0.526	13.379	3.307	199.46
24.686	0.525	13.423	3.325	200.05
27.617	0.524	13.468	3.342	200.65
30.954	0.522	13.513	3.360	201.25
34.821	0.521	13.558	3.377	201.85
39.414	0.520	13.604	3.395	202.46
45.059	0.519	13.650	3.413	203.08
52.367	0.517	13.696	3.432	203.70
62.710	0.516	13.742	3.450	204.32
80.496	0.515	13.789	3.469	204.94
135.100	0.515	13.791	3.470	204.98

```
----------------------------------------------------------------------------
NODE   928.00 : HGL = <  557.555>;EGL= <  560.079>;FLOWLINE= <  557.010>
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****

FLOW PROCESS FROM NODE 928.00 TO NODE 928.00 IS CODE = 5
UPSTREAM NODE 928.00 ELEVATION = 557.34 (FLOW IS SUPERCRITICAL)

CALCULATE JUNCTION LOSSES:

PIPE	FLOW (CFS)	DIAMETER (INCHES)	ANGLE (DEGREES)	FLOWLINE ELEVATION	CRITICAL DEPTH(FT.)	VELOCITY (FT/SEC)
UPSTREAM	7.40	18.00	17.00	557.34	1.05	13.754
DOWNSTREAM	7.40	18.00	-	557.01	1.05	12.747
LATERAL #1	0.00	0.00	0.00	0.00	0.00	0.000
LATERAL #2	0.00	0.00	0.00	0.00	0.00	0.000
Q5	0.00===Q5 EQUALS BASIN INPUT===					

LACFCD AND OCEMA FLOW JUNCTION FORMULAE USED:
DY=(Q2*V2-Q1*V1*COS(DELTA1)-Q3*V3*COS(DELTA3)-
Q4*V4*COS(DELTA4))/((A1+A2)*16.1)+FRICTION LOSSES
UPSTREAM: MANNING'S N = 0.01300; FRICTION SLOPE = 0.07676
DOWNSTREAM: MANNING'S N = 0.01300; FRICTION SLOPE = 0.06222
AVERAGED FRICTION SLOPE IN JUNCTION ASSUMED AS 0.06949
JUNCTION LENGTH = 4.00 FEET
FRICTION LOSSES = 0.278 FEET ENTRANCE LOSSES = 0.000 FEET
JUNCTION LOSSES = (DY+HV1-HV2)+(ENTRANCE LOSSES)
JUNCTION LOSSES = (0.715)+(0.000) = 0.715

NODE 928.00 : HGL = < 557.856>;EGL= < 560.793>;FLOWLINE= < 557.340>

****

FLOW PROCESS FROM NODE 928.00 TO NODE 927.00 IS CODE = 3
UPSTREAM NODE 927.00 ELEVATION = 562.62 (FLOW IS SUPERCRITICAL)

CALCULATE PIPE-BEND LOSSES(OCEMA):
PIPE FLOW = 7.40 CFS PIPE DIAMETER = 18.00 INCHES
CENTRAL ANGLE = 18.000 DEGREES MANNING'S N = 0.01300
PIPE LENGTH = 65.70 FEET

NORMAL DEPTH(FT) = 0.51 CRITICAL DEPTH(FT) = 1.05

==

UPSTREAM CONTROL ASSUMED FLOWDEPTH(FT) = 0.61

==

GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:

DISTANCE FROM CONTROL(FT)	FLOW DEPTH (FT)	VELOCITY (FT/SEC)	SPECIFIC ENERGY(FT)	PRESSURE+ MOMENTUM(POUNDS)
0.000	0.611	10.934	2.469	167.64
0.750	0.607	11.031	2.498	168.87
1.544	0.603	11.131	2.528	170.12
2.384	0.599	11.232	2.559	171.41
3.276	0.595	11.334	2.591	172.71
4.224	0.591	11.439	2.624	174.05
5.236	0.587	11.545	2.658	175.41
6.316	0.583	11.654	2.693	176.80
7.475	0.579	11.764	2.729	178.22
8.720	0.575	11.876	2.766	179.67
10.064	0.571	11.990	2.804	181.15
11.521	0.566	12.106	2.844	182.66
13.107	0.562	12.224	2.884	184.20
14.844	0.558	12.345	2.926	185.78
16.757	0.554	12.467	2.969	187.38
18.881	0.550	12.592	3.014	189.03
21.261	0.546	12.719	3.060	190.70

23.958	0.542	12.849	3.107	192.41
27.055	0.538	12.981	3.156	194.16
30.679	0.534	13.116	3.207	195.95
35.023	0.530	13.253	3.259	197.77
40.410	0.526	13.393	3.313	199.64
47.447	0.522	13.535	3.368	201.54
57.499	0.518	13.681	3.426	203.49
65.700	0.516	13.750	3.453	204.42

NODE 927.00 : HGL = < 563.231>;EGL= < 565.089>;FLOWLINE= < 562.620>

FLOW PROCESS FROM NODE 927.00 TO NODE 927.00 IS CODE = 5
UPSTREAM NODE 927.00 ELEVATION = 562.95 (FLOW IS SUPERCRITICAL)

CALCULATE JUNCTION LOSSES:

PIPE	FLOW (CFS)	DIAMETER (INCHES)	ANGLE (DEGREES)	FLOWLINE ELEVATION	CRITICAL DEPTH(FT.)	VELOCITY (FT/SEC)
UPSTREAM	7.40	18.00	27.00	562.95	1.05	12.421
DOWNSTREAM	7.40	18.00	-	562.62	1.05	10.937
LATERAL #1	0.00	0.00	0.00	0.00	0.00	0.000
LATERAL #2	0.00	0.00	0.00	0.00	0.00	0.000
Q5	0.00===Q5 EQUALS BASIN INPUT===					

LACFCD AND OCEMA FLOW JUNCTION FORMULAE USED:
DY=(Q2*V2-Q1*V1*COS(DELTA1)-Q3*V3*COS(DELTA3)-
Q4*V4*COS(DELTA4))/((A1+A2)*16.1)+FRICTION LOSSES
UPSTREAM: MANNING'S N = 0.01300; FRICTION SLOPE = 0.05792
DOWNSTREAM: MANNING'S N = 0.01300; FRICTION SLOPE = 0.04085
AVERAGED FRICTION SLOPE IN JUNCTION ASSUMED AS 0.04938
JUNCTION LENGTH = 4.00 FEET
FRICTION LOSSES = 0.198 FEET ENTRANCE LOSSES = 0.000 FEET
JUNCTION LOSSES = (DY+HV1-HV2)+(ENTRANCE LOSSES)
JUNCTION LOSSES = (0.813)+(0.000) = 0.813

NODE 927.00 : HGL = < 563.506>;EGL= < 565.901>;FLOWLINE= < 562.950>

FLOW PROCESS FROM NODE 927.00 TO NODE 913.00 IS CODE = 3
UPSTREAM NODE 913.00 ELEVATION = 567.41 (FLOW IS SUPERCRITICAL)

CALCULATE PIPE-BEND LOSSES(OCEMA):
PIPE FLOW = 7.40 CFS PIPE DIAMETER = 18.00 INCHES
CENTRAL ANGLE = 18.000 DEGREES MANNING'S N = 0.01300
PIPE LENGTH = 66.90 FEET

NORMAL DEPTH(FT) = 0.54 CRITICAL DEPTH(FT) = 1.05

UPSTREAM CONTROL ASSUMED FLOWDEPTH(FT) = 1.05

GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:

DISTANCE FROM CONTROL(FT)	FLOW DEPTH (FT)	VELOCITY (FT/SEC)	SPECIFIC ENERGY(FT)	PRESSURE+ MOMENTUM(POUNDS)
0.000	1.054	5.578	1.537	118.56
0.014	1.033	5.701	1.538	118.63
0.058	1.012	5.831	1.540	118.83
0.135	0.991	5.969	1.545	119.19
0.250	0.971	6.115	1.552	119.70
0.407	0.950	6.270	1.561	120.37
0.611	0.929	6.434	1.572	121.22

0.870	0.909	6.608	1.587	122.25
1.189	0.888	6.793	1.605	123.47
1.580	0.867	6.989	1.626	124.90
2.052	0.846	7.199	1.651	126.56
2.619	0.826	7.422	1.681	128.45
3.298	0.805	7.660	1.716	130.59
4.110	0.784	7.914	1.757	133.01
5.081	0.763	8.186	1.805	135.73
6.245	0.743	8.478	1.859	138.76
7.649	0.722	8.791	1.923	142.14
9.354	0.701	9.128	1.996	145.91
11.448	0.681	9.491	2.080	150.08
14.059	0.660	9.883	2.177	154.72
17.389	0.639	10.307	2.290	159.86
21.772	0.618	10.767	2.420	165.55
27.841	0.598	11.268	2.570	171.86
37.016	0.577	11.814	2.745	178.87
53.858	0.556	12.411	2.949	186.65
66.900	0.556	12.417	2.951	186.72

NODE 913.00 : HGL = < 568.464>;EGL= < 568.947>;FLOWLINE= < 567.410>

****

FLOW PROCESS FROM NODE 913.00 TO NODE 913.00 IS CODE = 5
UPSTREAM NODE 913.00 ELEVATION = 567.74 (FLOW IS AT CRITICAL DEPTH)
(NOTE: POSSIBLE JUMP IN OR UPSTREAM OF STRUCTURE)

CALCULATE JUNCTION LOSSES:

PIPE	FLOW (CFS)	DIAMETER (INCHES)	ANGLE (DEGREES)	FLOWLINE ELEVATION	CRITICAL DEPTH(FT.)	VELOCITY (FT/SEC)
UPSTREAM	4.30	18.00	16.00	567.74	0.79	11.039
DOWNSTREAM	7.40	18.00	-	567.41	1.05	5.580
LATERAL #1	3.10	18.00	80.00	567.74	0.67	4.060
LATERAL #2	0.00	0.00	0.00	0.00	0.00	0.000
Q5	0.00===Q5 EQUALS BASIN INPUT===					

LACFCD AND OCEMA FLOW JUNCTION FORMULAE USED:
DY=(Q2*V2-Q1*V1*COS(DELTA1)-Q3*V3*COS(DELTA3)-
Q4*V4*COS(DELTA4))/((A1+A2)*16.1)+FRICTION LOSSES
UPSTREAM: MANNING'S N = 0.01300; FRICTION SLOPE = 0.06377
DOWNSTREAM: MANNING'S N = 0.01300; FRICTION SLOPE = 0.00702
AVERAGED FRICTION SLOPE IN JUNCTION ASSUMED AS 0.03540
JUNCTION LENGTH = 4.00 FEET
FRICTION LOSSES = 0.142 FEET ENTRANCE LOSSES = 0.000 FEET
JUNCTION LOSSES = (DY+HV1-HV2)+(ENTRANCE LOSSES)
JUNCTION LOSSES = (1.094)+(0.000) = 1.094

NODE 913.00 : HGL = < 568.148>;EGL= < 570.041>;FLOWLINE= < 567.740>

****

FLOW PROCESS FROM NODE 913.00 TO NODE 912.00 IS CODE = 1
UPSTREAM NODE 912.00 ELEVATION = 577.61 (FLOW IS SUPERCRITICAL)

CALCULATE FRICTION LOSSES(LACFCD):
PIPE FLOW = 4.30 CFS PIPE DIAMETER = 18.00 INCHES
PIPE LENGTH = 152.00 FEET MANNING'S N = 0.01300

NORMAL DEPTH(FT) = 0.41 CRITICAL DEPTH(FT) = 0.79

==

UPSTREAM CONTROL ASSUMED FLOWDEPTH(FT) = 0.46

==

GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:

DISTANCE FROM CONTROL(FT)	FLOW DEPTH (FT)	VELOCITY (FT/SEC)	SPECIFIC ENERGY(FT)	PRESSURE+ MOMENTUM(POUNDS)
0.000	0.461	9.329	1.813	83.23
0.633	0.459	9.390	1.829	83.68
1.298	0.456	9.452	1.845	84.13
2.001	0.454	9.515	1.861	84.59
2.743	0.452	9.578	1.878	85.06
3.528	0.450	9.642	1.894	85.54
4.362	0.448	9.707	1.912	86.02
5.250	0.446	9.773	1.930	86.50
6.197	0.443	9.839	1.948	87.00
7.211	0.441	9.907	1.966	87.50
8.301	0.439	9.975	1.985	88.01
9.477	0.437	10.044	2.004	88.53
10.752	0.435	10.114	2.024	89.05
12.142	0.433	10.185	2.044	89.59
13.668	0.430	10.256	2.065	90.13
15.354	0.428	10.329	2.086	90.67
17.236	0.426	10.402	2.107	91.23
19.359	0.424	10.477	2.129	91.80
21.787	0.422	10.552	2.152	92.37
24.617	0.420	10.628	2.175	92.95
27.995	0.417	10.706	2.198	93.54
32.167	0.415	10.784	2.222	94.14
37.596	0.413	10.863	2.247	94.75
45.318	0.411	10.944	2.272	95.36
58.665	0.409	11.025	2.297	95.99
152.000	0.408	11.036	2.301	96.07

NODE 912.00 : HGL = < 578.071>;EGL= < 579.423>;FLOWLINE= < 577.610>

****

FLOW PROCESS FROM NODE 912.00 TO NODE 912.00 IS CODE = 5
UPSTREAM NODE 912.00 ELEVATION = 577.94 (FLOW IS SUPERCRITICAL)

CALCULATE JUNCTION LOSSES:

PIPE	FLOW (CFS)	DIAMETER (INCHES)	ANGLE (DEGREES)	FLOWLINE ELEVATION	CRITICAL DEPTH(FT.)	VELOCITY (FT/SEC)
UPSTREAM	4.30	18.00	11.00	577.94	0.79	9.333
DOWNSTREAM	4.30	18.00	-	577.61	0.79	9.332
LATERAL #1	0.00	0.00	0.00	0.00	0.00	0.000
LATERAL #2	0.00	0.00	0.00	0.00	0.00	0.000
Q5	0.00===Q5 EQUALS BASIN INPUT===					

LACFCD AND OCEMA FLOW JUNCTION FORMULAE USED:
DY=(Q2*V2-Q1*V1*COS(DELTA1)-Q3*V3*COS(DELTA3)-
Q4*V4*COS(DELTA4))/((A1+A2)*16.1)+FRICTION LOSSES
UPSTREAM: MANNING'S N = 0.01300; FRICTION SLOPE = 0.03988
DOWNSTREAM: MANNING'S N = 0.01300; FRICTION SLOPE = 0.03987
AVERAGED FRICTION SLOPE IN JUNCTION ASSUMED AS 0.03988
JUNCTION LENGTH = 4.00 FEET
FRICTION LOSSES = 0.160 FEET ENTRANCE LOSSES = 0.000 FEET
JUNCTION LOSSES = (DY+HV1-HV2)+(ENTRANCE LOSSES)
JUNCTION LOSSES = (0.330)+(0.000) = 0.330

NODE 912.00 : HGL = < 578.401>;EGL= < 579.753>;FLOWLINE= < 577.940>

****

FLOW PROCESS FROM NODE 912.00 TO NODE 910.00 IS CODE = 3

UPSTREAM NODE 910.00 ELEVATION = 579.17 (FLOW IS SUPERCRITICAL)

CALCULATE PIPE-BEND LOSSES(OCEMA):
PIPE FLOW = 4.30 CFS PIPE DIAMETER = 18.00 INCHES
CENTRAL ANGLE = 6.000 DEGREES MANNING'S N = 0.01300
PIPE LENGTH = 20.00 FEET

NORMAL DEPTH(FT) = 0.41 CRITICAL DEPTH(FT) = 0.79

===

UPSTREAM CONTROL ASSUMED FLOWDEPTH(FT) = 0.79

===

GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:

DISTANCE FROM CONTROL(FT)	FLOW DEPTH (FT)	VELOCITY (FT/SEC)	SPECIFIC ENERGY(FT)	PRESSURE+ MOMENTUM(POUNDS)
0.000	0.795	4.521	1.112	57.80
0.010	0.780	4.632	1.113	57.84
0.043	0.764	4.750	1.115	57.94
0.101	0.749	4.874	1.118	58.12
0.187	0.734	5.004	1.123	58.37
0.304	0.718	5.141	1.129	58.71
0.457	0.703	5.286	1.137	59.13
0.651	0.688	5.439	1.147	59.64
0.891	0.672	5.601	1.160	60.24
1.184	0.657	5.773	1.175	60.95
1.538	0.642	5.955	1.193	61.77
1.963	0.627	6.148	1.214	62.70
2.473	0.611	6.354	1.238	63.76
3.081	0.596	6.572	1.267	64.94
3.809	0.581	6.806	1.300	66.27
4.681	0.565	7.055	1.339	67.76
5.732	0.550	7.321	1.383	69.41
7.007	0.535	7.607	1.434	71.24
8.572	0.519	7.914	1.493	73.27
10.521	0.504	8.245	1.560	75.52
13.003	0.489	8.601	1.638	78.00
16.265	0.473	8.987	1.728	80.75
20.000	0.461	9.330	1.813	83.24

NODE 910.00 : HGL = < 579.965>;EGL= < 580.282>;FLOWLINE= < 579.170>

****

FLOW PROCESS FROM NODE 910.00 TO NODE 910.00 IS CODE = 5
UPSTREAM NODE 910.00 ELEVATION = 579.50 (FLOW IS AT CRITICAL DEPTH)

CALCULATE JUNCTION LOSSES:

PIPE	FLOW (CFS)	DIAMETER (INCHES)	ANGLE (DEGREES)	FLOWLINE ELEVATION	CRITICAL DEPTH(FT.)	VELOCITY (FT/SEC)
UPSTREAM	4.30	18.00	89.00	579.50	0.79	3.327
DOWNSTREAM	4.30	18.00	-	579.17	0.79	4.522
LATERAL #1	0.00	0.00	0.00	0.00	0.00	0.000
LATERAL #2	0.00	0.00	0.00	0.00	0.00	0.000
Q5	0.00===Q5 EQUALS BASIN INPUT===					

LACFCD AND OCEMA FLOW JUNCTION FORMULAE USED:
DY=(Q2*V2-Q1*V1*COS(DELTA1)-Q3*V3*COS(DELTA3)-
Q4*V4*COS(DELTA4))/((A1+A2)*16.1)+FRICTION LOSSES
UPSTREAM: MANNING'S N = 0.01300; FRICTION SLOPE = 0.00252
DOWNSTREAM: MANNING'S N = 0.01300; FRICTION SLOPE = 0.00552
AVERAGED FRICTION SLOPE IN JUNCTION ASSUMED AS 0.00402
JUNCTION LENGTH = 4.00 FEET

FRICTION LOSSES = 0.016 FEET ENTRANCE LOSSES = 0.000 FEET
JUNCTION LOSSES = (DY+HV1-HV2)+(ENTRANCE LOSSES)
JUNCTION LOSSES = (0.419)+(0.000) = 0.419

NODE 910.00 : HGL = < 580.529>;EGL= < 580.701>;FLOWLINE= < 579.500>

****

FLOW PROCESS FROM NODE 910.00 TO NODE 908.00 IS CODE = 1
UPSTREAM NODE 908.00 ELEVATION = 579.64 (HYDRAULIC JUMP OCCURS)

CALCULATE FRICTION LOSSES(LACFCD):
PIPE FLOW = 4.30 CFS PIPE DIAMETER = 18.00 INCHES
PIPE LENGTH = 13.60 FEET MANNING'S N = 0.01300

HYDRAULIC JUMP: DOWNSTREAM RUN ANALYSIS RESULTS

NORMAL DEPTH(FT) = 0.66 CRITICAL DEPTH(FT) = 0.79

==

UPSTREAM CONTROL ASSUMED FLOWDEPTH(FT) = 0.79

==

GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:

DISTANCE FROM CONTROL(FT)	FLOW DEPTH (FT)	VELOCITY (FT/SEC)	SPECIFIC ENERGY(FT)	PRESSURE+ MOMENTUM(POUNDS)
0.000	0.795	4.521	1.112	57.80
0.014	0.790	4.559	1.113	57.81
0.059	0.784	4.597	1.113	57.82
0.137	0.779	4.636	1.113	57.84
0.252	0.774	4.676	1.114	57.87
0.407	0.769	4.717	1.114	57.90
0.606	0.763	4.758	1.115	57.95
0.855	0.758	4.800	1.116	58.00
1.158	0.753	4.843	1.117	58.07
1.523	0.747	4.887	1.118	58.14
1.958	0.742	4.931	1.120	58.22
2.473	0.737	4.976	1.122	58.31
3.080	0.732	5.022	1.123	58.41
3.793	0.726	5.069	1.126	58.52
4.631	0.721	5.117	1.128	58.64
5.619	0.716	5.166	1.130	58.77
6.788	0.710	5.215	1.133	58.91
8.181	0.705	5.266	1.136	59.06
9.859	0.700	5.317	1.139	59.23
11.910	0.695	5.370	1.143	59.40
13.600	0.691	5.405	1.145	59.52

HYDRAULIC JUMP: UPSTREAM RUN ANALYSIS RESULTS

==

DOWNSTREAM CONTROL ASSUMED FLOWDEPTH(FT) = 1.03

==

GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:

DISTANCE FROM CONTROL(FT)	FLOW DEPTH (FT)	VELOCITY (FT/SEC)	SPECIFIC ENERGY(FT)	PRESSURE+ MOMENTUM(POUNDS)
0.000	1.029	3.326	1.201	64.27
0.754	1.020	3.360	1.195	63.80
1.497	1.010	3.395	1.190	63.35
2.230	1.001	3.431	1.184	62.91
2.950	0.992	3.467	1.178	62.49
3.658	0.982	3.505	1.173	62.08
4.353	0.973	3.544	1.168	61.69

5.033	0.964	3.584	1.163	61.32
5.698	0.954	3.624	1.158	60.96
6.346	0.945	3.666	1.154	60.62
6.977	0.935	3.709	1.149	60.30
7.589	0.926	3.753	1.145	59.99
8.181	0.917	3.799	1.141	59.70
8.750	0.907	3.845	1.137	59.43
9.295	0.898	3.893	1.134	59.18
9.814	0.889	3.943	1.130	58.95
10.305	0.879	3.993	1.127	58.74
10.764	0.870	4.045	1.124	58.55
11.189	0.860	4.099	1.122	58.38
11.575	0.851	4.154	1.119	58.23
11.920	0.842	4.211	1.117	58.10
12.218	0.832	4.269	1.116	58.00
12.463	0.823	4.329	1.114	57.91
12.649	0.814	4.391	1.113	57.85
12.768	0.804	4.455	1.113	57.81
12.810	0.795	4.521	1.112	57.80
13.600	0.795	4.521	1.112	57.80

```
------------------------END OF HYDRAULIC JUMP ANALYSIS-----------------------
| PRESSURE+MOMENTUM BALANCE OCCURS AT     11.56 FEET UPSTREAM OF NODE  910.00 |
|       DOWNSTREAM DEPTH = 0.851 FEET, UPSTREAM CONJUGATE DEPTH = 0.741 FEET |
------------------------------------------------------------------------------
 NODE    908.00 : HGL = <  580.435>;EGL= <  580.752>;FLOWLINE= <  579.640>

******************************************************************************
 FLOW PROCESS FROM NODE    908.00 TO NODE    908.00 IS CODE =  8
 UPSTREAM NODE   908.00      ELEVATION =    579.64  (FLOW IS AT CRITICAL DEPTH)
------------------------------------------------------------------------------
 CALCULATE CATCH BASIN ENTRANCE LOSSES(LACFCD):
 PIPE FLOW =        4.30 CFS          PIPE DIAMETER =  18.00 INCHES
 FLOW VELOCITY =    4.52 FEET/SEC.    VELOCITY HEAD =  0.318 FEET
 CATCH BASIN ENERGY LOSS = .2*(VELOCITY HEAD) = .2*(  0.318) =  0.064
------------------------------------------------------------------------------
 NODE    908.00 : HGL = <  580.816>;EGL= <  580.816>;FLOWLINE= <  579.640>

******************************************************************************
 UPSTREAM PIPE FLOW CONTROL DATA:
 NODE NUMBER =    908.00            FLOWLINE ELEVATION =   579.64
 ASSUMED UPSTREAM CONTROL HGL =     580.43 FOR DOWNSTREAM RUN ANALYSIS

==============================================================================
 END OF GRADUALLY VARIED FLOW ANALYSIS
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PIPE-FLOW HYDRAULICS COMPUTER PROGRAM PACKAGE
(Reference: LACFCD,LACRD, AND OCEMA HYDRAULICS CRITERION)

Ver. 8.0 Release Date: 01/01/2000 License ID 1261

Analysis prepared by:

Rick Engineering Company
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San Diego, CA 92110
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```
************************** DESCRIPTION OF STUDY **************************
* BLACK MOUNTAIN RANCH EAST CLUSTERS UNIT 3, J-15149-B                     *
* STARTING HGL = 514.56-FT FROM 100-YR CONVEYANCE IN WEST BASIN           *
*                                                                         *
***************************************************************************
```

FILE NAME: 990.PIP
TIME/DATE OF STUDY: 14:27 07/24/2014

GRADUALLY VARIED FLOW ANALYSIS FOR PIPE SYSTEM
NODAL POINT STATUS TABLE
(Note: "*" indicates nodal point data used.)

		UPSTREAM RUN		DOWNSTREAM RUN	
NODE NUMBER	MODEL PROCESS	PRESSURE HEAD(FT)	PRESSURE+ MOMENTUM(POUNDS)	FLOW DEPTH(FT)	PRESSURE+ MOMENTUM(POUNDS)
990.00-		4.00*	585.77	1.14	325.66
}	FRICTION+BEND				
984.00-		3.84*	568.44	1.14	325.37
}	FRICTION				
984.00-		3.39*	518.62	1.19	317.75
}	FRICTION+BEND				
984.00-		3.43*	523.44	1.39 Dc	305.88
}	CATCH BASIN				
984.00-		4.67*	432.48	1.39 Dc	70.91

MAXIMUM NUMBER OF ENERGY BALANCES USED IN EACH PROFILE = 25

NOTE: STEADY FLOW HYDRAULIC HEAD-LOSS COMPUTATIONS BASED ON THE MOST CONSERVATIVE FORMULAE FROM THE CURRENT LACRD,LACFCD, AND OCEMA DESIGN MANUALS.

```
****************************************************************************
DOWNSTREAM PIPE FLOW CONTROL DATA:
NODE NUMBER =    990.00            FLOWLINE ELEVATION =   510.56
PIPE FLOW =       14.40 CFS        PIPE DIAMETER =  18.00 INCHES
ASSUMED DOWNSTREAM CONTROL HGL =   514.560 FEET
----------------------------------------------------------------------------
NODE   990.00 : HGL = <  514.560>;EGL= <  515.591>;FLOWLINE= <  510.560>

****************************************************************************
FLOW PROCESS FROM NODE   990.00 TO NODE   984.00 IS CODE =  3
UPSTREAM NODE   984.00     ELEVATION =   512.37  (FLOW IS UNDER PRESSURE)
----------------------------------------------------------------------------
CALCULATE PIPE-BEND LOSSES(OCEMA):
PIPE FLOW =        14.40 CFS          PIPE DIAMETER =  18.00 INCHES
CENTRAL ANGLE = 18.700 DEGREES        MANNING'S N = 0.01300
PIPE LENGTH =        81.70 FEET       BEND COEFFICIENT(KB) = 0.11396
```

```
 FLOW VELOCITY =    8.15 FEET/SEC.        VELOCITY HEAD =  1.031 FEET
 HB=KB*(VELOCITY HEAD) = ( 0.114)*( 1.031) =    0.118
 SF=(Q/K)**2 = ((      14.40)/(    105.042))**2 = 0.01879
 HF=L*SF = (      81.70)*(0.01879) =  1.535
 TOTAL HEAD LOSSES = HB + HF = ( 0.118)+( 1.535) =  1.653
------------------------------------------------------------------------------
 NODE    984.00 : HGL = <  516.213>;EGL= <  517.244>;FLOWLINE= <  512.370>

******************************************************************************
 FLOW PROCESS FROM NODE    990.00 TO NODE    984.00 IS CODE =  1
 UPSTREAM NODE    984.00      ELEVATION =   515.34  (FLOW IS UNDER PRESSURE)
------------------------------------------------------------------------------
 CALCULATE FRICTION LOSSES(LACFCD):
 PIPE FLOW    =       14.40 CFS      PIPE DIAMETER =  18.00 INCHES
 PIPE LENGTH =      134.00 FEET           MANNING'S N  =  0.01300
 SF=(Q/K)**2 = ((      14.40)/(    105.044))**2 = 0.01879
 HF=L*SF = (     134.00)*(0.01879) =       2.518
------------------------------------------------------------------------------
 NODE    984.00 : HGL = <  518.731>;EGL= <  519.762>;FLOWLINE= <  515.340>

******************************************************************************
 FLOW PROCESS FROM NODE    990.00 TO NODE    984.00 IS CODE =  3
 UPSTREAM NODE    984.00      ELEVATION =   516.00  (FLOW IS UNDER PRESSURE)
------------------------------------------------------------------------------
 CALCULATE PIPE-BEND LOSSES(OCEMA):
 PIPE FLOW =         14.40 CFS             PIPE DIAMETER =  18.00 INCHES
 CENTRAL ANGLE = 33.300 DEGREES            MANNING'S N = 0.01300
 PIPE LENGTH =        29.10 FEET           BEND COEFFICIENT(KB) = 0.15207
 FLOW VELOCITY =    8.15 FEET/SEC.         VELOCITY HEAD =  1.031 FEET
 HB=KB*(VELOCITY HEAD) = ( 0.152)*( 1.031) =    0.157
 SF=(Q/K)**2 = ((      14.40)/(    105.042))**2 = 0.01879
 HF=L*SF = (      29.10)*(0.01879) =  0.547
 TOTAL HEAD LOSSES = HB + HF = ( 0.157)+( 0.547) =  0.704
------------------------------------------------------------------------------
 NODE    984.00 : HGL = <  519.435>;EGL= <  520.466>;FLOWLINE= <  516.000>

******************************************************************************
 FLOW PROCESS FROM NODE    984.00 TO NODE    984.00 IS CODE =  8
 UPSTREAM NODE    984.00      ELEVATION =   516.00  (FLOW IS UNDER PRESSURE)
------------------------------------------------------------------------------
 CALCULATE CATCH BASIN ENTRANCE LOSSES(LACFCD):
 PIPE FLOW =         14.40 CFS          PIPE DIAMETER =  18.00 INCHES
 FLOW VELOCITY =    8.15 FEET/SEC.    VELOCITY HEAD =  1.031 FEET
 CATCH BASIN ENERGY LOSS = .2*(VELOCITY HEAD) = .2*(  1.031) =   0.206
------------------------------------------------------------------------------
 NODE    984.00 : HGL = <  520.672>;EGL= <  520.672>;FLOWLINE= <  516.000>

******************************************************************************
 UPSTREAM PIPE FLOW CONTROL DATA:
 NODE NUMBER =    984.00              FLOWLINE ELEVATION =    516.00
 ASSUMED UPSTREAM CONTROL HGL =     517.39 FOR DOWNSTREAM RUN ANALYSIS

==============================================================================
 END OF GRADUALLY VARIED FLOW ANALYSIS
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****************************************************************************
            PIPE-FLOW HYDRAULICS COMPUTER PROGRAM PACKAGE
       (Reference: LACFCD,LACRD, AND OCEMA HYDRAULICS CRITERION)
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         Ver. 8.0  Release Date: 01/01/2000  License ID 1261

                       Analysis prepared by:

                      Rick Engineering Company
                         5620 Friars Road
                       San Diego, CA  92110
                          (619) 291-0707

  ************************** DESCRIPTION OF STUDY *************************
 * BLACK MOUNTAIN RANCH EAST CLUSTERS UNIT 3, J-15149-B                    *
 * WEST BASIN OUTLET PIPE - 100-YEAR FLOW                                  *
 * H:\15149B\HYDRO\HYDRAULICS\PIPEFLOW\....                                *
  *************************************************************************

  FILE NAME: 995.PIP
  TIME/DATE OF STUDY: 15:32 07/24/2014

****************************************************************************
           GRADUALLY VARIED FLOW ANALYSIS FOR PIPE SYSTEM
                     NODAL POINT STATUS TABLE
            (Note: "*" indicates nodal point data used.)
                    UPSTREAM RUN                       DOWNSTREAM RUN
  NODE    MODEL   PRESSURE     PRESSURE+         FLOW         PRESSURE+
 NUMBER  PROCESS  HEAD(FT)  MOMENTUM(POUNDS)  DEPTH(FT)  MOMENTUM(POUNDS)
 995.00-             1.50*           310.10      1.39 Dc            305.88
       } FRICTION
 994.00-             1.68*           329.49      1.39 Dc            305.88
       } CATCH BASIN
 994.00-             2.91*           238.53      1.39 Dc             70.91
----------------------------------------------------------------------------
 MAXIMUM NUMBER OF ENERGY BALANCES USED IN EACH PROFILE =  25
----------------------------------------------------------------------------
 NOTE: STEADY FLOW HYDRAULIC HEAD-LOSS COMPUTATIONS BASED ON THE MOST
 CONSERVATIVE FORMULAE FROM THE CURRENT LACRD,LACFCD, AND OCEMA
 DESIGN MANUALS.
****************************************************************************
 DOWNSTREAM PIPE FLOW CONTROL DATA:
 NODE NUMBER =    995.00            FLOWLINE ELEVATION =   505.85
 PIPE FLOW =       14.40 CFS        PIPE DIAMETER =  18.00 INCHES
 ASSUMED DOWNSTREAM CONTROL HGL =   507.350 FEET
----------------------------------------------------------------------------
 NODE    995.00 : HGL = <  507.350>;EGL= <  508.381>;FLOWLINE= <  505.850>

****************************************************************************
 FLOW PROCESS FROM NODE   995.00 TO NODE   994.00 IS CODE =  1
 UPSTREAM NODE   994.00     ELEVATION =   506.05  (FLOW IS UNDER PRESSURE)
----------------------------------------------------------------------------
 CALCULATE FRICTION LOSSES(LACFCD):
 PIPE FLOW    =       14.40 CFS     PIPE DIAMETER =  18.00 INCHES
 PIPE LENGTH =        20.00 FEET          MANNING'S N  =  0.01300
 SF=(Q/K)**2 = ((      14.40)/(    105.043))**2 = 0.01879
 HF=L*SF = (      20.00)*(0.01879) =        0.376
----------------------------------------------------------------------------
 NODE    994.00 : HGL = <  507.726>;EGL= <  508.757>;FLOWLINE= <  506.050>
```

```
******************************************************************************
 FLOW PROCESS FROM NODE   994.00 TO NODE   994.00 IS CODE =  8
 UPSTREAM NODE   994.00      ELEVATION =   506.05  (FLOW IS UNDER PRESSURE)
------------------------------------------------------------------------------
 CALCULATE CATCH BASIN ENTRANCE LOSSES(LACFCD):
 PIPE FLOW =        14.40 CFS            PIPE DIAMETER =  18.00 INCHES
 FLOW VELOCITY =    8.15 FEET/SEC.     VELOCITY HEAD =  1.031 FEET
 CATCH BASIN ENERGY LOSS = .2*(VELOCITY HEAD) = .2*(  1.031) =  0.206
------------------------------------------------------------------------------
 NODE   994.00 : HGL = <  508.963>;EGL= <  508.963>;FLOWLINE= <  506.050>

******************************************************************************
 UPSTREAM PIPE FLOW CONTROL DATA:
 NODE NUMBER =   994.00              FLOWLINE ELEVATION =   506.05
 ASSUMED UPSTREAM CONTROL HGL =     507.44 FOR DOWNSTREAM RUN ANALYSIS

==============================================================================
 END OF GRADUALLY VARIED FLOW ANALYSIS
```

- **Basin 1000**

```
****************************************************************************
          PIPE-FLOW HYDRAULICS COMPUTER PROGRAM PACKAGE
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                      Analysis prepared by:

                     Rick Engineering Company
                        5620 Friars Road
                      San Diego, CA  92110
                         (619) 291-0707

 ************************** DESCRIPTION OF STUDY **************************
 * BLACK MOUNTAIN RANCH EAST CLUSTERS UNIT 3, J-15149-B                     *
 * EAST BASIN DISCHARGE MAIN PIPE                                           *
 * 100-YR FLOW                                                              *
 **************************************************************************

  FILE NAME: 158.PIP
  TIME/DATE OF STUDY: 08:25 07/25/2014

****************************************************************************
          GRADUALLY VARIED FLOW ANALYSIS FOR PIPE SYSTEM
                     NODAL POINT STATUS TABLE
           (Note: "*" indicates nodal point data used.)
                 UPSTREAM RUN                     DOWNSTREAM RUN
  NODE    MODEL   PRESSURE     PRESSURE+         FLOW       PRESSURE+
 NUMBER  PROCESS  HEAD(FT)  MOMENTUM(POUNDS)  DEPTH(FT)  MOMENTUM(POUNDS)
  158.00-          4.00*        4090.95         2.92          4020.85
       } FRICTION       } HYDRAULIC JUMP
 1195.00-          3.66         3935.47         2.91*         4029.46
       } FRICTION+BEND
 1195.00-          3.39 Dc      3900.27         2.87*         4049.71
       } FRICTION
 1195.00-          3.39*Dc      3900.27         3.39*Dc       3900.27
       } CATCH BASIN
 1195.00-          5.75*        2943.74         3.39 Dc       1107.56
-----------------------------------------------------------------------------
 MAXIMUM NUMBER OF ENERGY BALANCES USED IN EACH PROFILE =  25
-----------------------------------------------------------------------------
 NOTE: STEADY FLOW HYDRAULIC HEAD-LOSS COMPUTATIONS BASED ON THE MOST
 CONSERVATIVE FORMULAE FROM THE CURRENT LACRD,LACFCD, AND OCEMA
 DESIGN MANUALS.
****************************************************************************
 DOWNSTREAM PIPE FLOW CONTROL DATA:
 NODE NUMBER =    158.00             FLOWLINE ELEVATION =    491.71
 PIPE FLOW =      127.90 CFS         PIPE DIAMETER =  48.00 INCHES
 ASSUMED DOWNSTREAM CONTROL HGL =   495.710 FEET
-----------------------------------------------------------------------------
 NODE   158.00 : HGL = <  495.710>;EGL= <  497.319>;FLOWLINE= <  491.710>

****************************************************************************
 FLOW PROCESS FROM NODE   158.00 TO NODE  1195.00 IS CODE =  1
 UPSTREAM NODE  1195.00     ELEVATION =   492.40  (HYDRAULIC JUMP OCCURS)
-----------------------------------------------------------------------------
 CALCULATE FRICTION LOSSES(LACFCD):
 PIPE FLOW    =      127.90 CFS     PIPE DIAMETER =  48.00 INCHES
 PIPE LENGTH =        69.00 FEET         MANNING'S N  =  0.01300
-----------------------------------------------------------------------------
```

HYDRAULIC JUMP: DOWNSTREAM RUN ANALYSIS RESULTS

NORMAL DEPTH(FT) = 2.94 CRITICAL DEPTH(FT) = 3.39

UPSTREAM CONTROL ASSUMED FLOWDEPTH(FT) = 2.91

GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:

DISTANCE FROM CONTROL(FT)	FLOW DEPTH (FT)	VELOCITY (FT/SEC)	SPECIFIC ENERGY(FT)	PRESSURE+ MOMENTUM(POUNDS)
0.000	2.908	13.067	5.561	4029.46
4.494	2.909	13.061	5.560	4028.72
9.168	2.910	13.055	5.558	4027.98
14.036	2.911	13.049	5.557	4027.24
19.118	2.913	13.043	5.556	4026.50
24.434	2.914	13.036	5.555	4025.76
30.009	2.915	13.030	5.553	4025.03
35.870	2.917	13.024	5.552	4024.30
42.049	2.918	13.018	5.551	4023.57
48.586	2.919	13.012	5.550	4022.85
55.527	2.921	13.006	5.549	4022.13
62.928	2.922	12.999	5.548	4021.40
69.000	2.923	12.995	5.547	4020.85

HYDRAULIC JUMP: UPSTREAM RUN ANALYSIS RESULTS

DOWNSTREAM CONTROL ASSUMED PRESSURE HEAD(FT) = 4.00

GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:

DISTANCE FROM CONTROL(FT)	FLOW DEPTH (FT)	VELOCITY (FT/SEC)	SPECIFIC ENERGY(FT)	PRESSURE+ MOMENTUM(POUNDS)
0.000	4.000	10.175	5.609	4090.95
9.238	3.976	10.183	5.587	4073.82
16.615	3.951	10.198	5.567	4058.41
23.101	3.927	10.218	5.549	4044.13
28.960	3.902	10.241	5.532	4030.79
34.330	3.878	10.267	5.516	4018.28
39.296	3.853	10.296	5.500	4006.53
43.914	3.829	10.328	5.486	3995.48
48.225	3.804	10.362	5.473	3985.11
52.258	3.780	10.399	5.460	3975.39
56.034	3.755	10.438	5.448	3966.29
59.569	3.731	10.479	5.437	3957.80
62.874	3.706	10.522	5.427	3949.91
65.958	3.682	10.567	5.417	3942.61
68.826	3.658	10.614	5.408	3935.89
69.000	3.656	10.618	5.408	3935.47

-----------------------END OF HYDRAULIC JUMP ANALYSIS----------------------

| PRESSURE+MOMENTUM BALANCE OCCURS AT 31.81 FEET UPSTREAM OF NODE 158.00 |
| DOWNSTREAM DEPTH = 3.889 FEET, UPSTREAM CONJUGATE DEPTH = 2.917 FEET |

NODE 1195.00 : HGL = < 495.308>;EGL= < 497.961>;FLOWLINE= < 492.400>

****

FLOW PROCESS FROM NODE 158.00 TO NODE 1195.00 IS CODE = 3
UPSTREAM NODE 1195.00 ELEVATION = 493.21 (FLOW IS SUPERCRITICAL)

CALCULATE PIPE-BEND LOSSES(OCEMA):
PIPE FLOW = 127.90 CFS PIPE DIAMETER = 48.00 INCHES
CENTRAL ANGLE = 52.000 DEGREES MANNING'S N = 0.01300

PIPE LENGTH = 81.00 FEET

NORMAL DEPTH(FT) = 2.94 CRITICAL DEPTH(FT) = 3.39

UPSTREAM CONTROL ASSUMED FLOWDEPTH(FT) = 2.87

GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:

DISTANCE FROM CONTROL(FT)	FLOW DEPTH (FT)	VELOCITY (FT/SEC)	SPECIFIC ENERGY(FT)	PRESSURE+ MOMENTUM(POUNDS)
0.000	2.873	13.233	5.594	4049.71
4.788	2.876	13.219	5.591	4048.06
9.755	2.879	13.206	5.589	4046.43
14.917	2.881	13.193	5.586	4044.80
20.293	2.884	13.180	5.583	4043.18
25.903	2.887	13.167	5.581	4041.57
31.771	2.890	13.154	5.578	4039.97
37.926	2.892	13.141	5.575	4038.39
44.399	2.895	13.128	5.573	4036.81
51.230	2.898	13.115	5.570	4035.25
58.466	2.900	13.103	5.568	4033.69
66.160	2.903	13.090	5.565	4032.14
74.383	2.906	13.077	5.563	4030.61
81.000	2.908	13.067	5.561	4029.46

NODE 1195.00 : HGL = < 496.083>;EGL= < 498.804>;FLOWLINE= < 493.210>

****

FLOW PROCESS FROM NODE 158.00 TO NODE 1195.00 IS CODE = 1
UPSTREAM NODE 1195.00 ELEVATION = 494.21 (FLOW IS SUPERCRITICAL)

CALCULATE FRICTION LOSSES(LACFCD):
PIPE FLOW = 127.90 CFS PIPE DIAMETER = 48.00 INCHES
PIPE LENGTH = 80.00 FEET MANNING'S N = 0.01300

NORMAL DEPTH(FT) = 2.70 CRITICAL DEPTH(FT) = 3.39

UPSTREAM CONTROL ASSUMED FLOWDEPTH(FT) = 3.39

GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:

DISTANCE FROM CONTROL(FT)	FLOW DEPTH (FT)	VELOCITY (FT/SEC)	SPECIFIC ENERGY(FT)	PRESSURE+ MOMENTUM(POUNDS)
0.000	3.388	11.264	5.360	3900.27
0.112	3.361	11.344	5.360	3900.66
0.458	3.333	11.427	5.362	3901.83
1.056	3.306	11.513	5.365	3903.80
1.925	3.278	11.601	5.369	3906.57
3.091	3.250	11.692	5.374	3910.17
4.580	3.223	11.785	5.381	3914.60
6.426	3.195	11.882	5.389	3919.88
8.666	3.167	11.981	5.398	3926.03
11.348	3.140	12.083	5.408	3933.05
14.525	3.112	12.189	5.420	3940.98
18.265	3.084	12.297	5.434	3949.82
22.651	3.057	12.408	5.449	3959.60
27.783	3.029	12.523	5.466	3970.33
33.792	3.001	12.641	5.484	3982.04
40.843	2.974	12.762	5.505	3994.76
49.157	2.946	12.887	5.527	4008.49
59.030	2.919	13.015	5.551	4023.27

```
       70.881              2.891      13.147            5.577             4039.13
       80.000              2.873      13.233            5.594             4049.71
------------------------------------------------------------------------------
  NODE  1195.00 : HGL = <  497.598>;EGL= <  499.570>;FLOWLINE= <  494.210>

******************************************************************************
  FLOW PROCESS FROM NODE  1195.00 TO NODE  1195.00 IS CODE =  8
  UPSTREAM NODE  1195.00     ELEVATION =   494.21  (FLOW IS AT CRITICAL DEPTH)
------------------------------------------------------------------------------
  CALCULATE CATCH BASIN ENTRANCE LOSSES(LACFCD):
  PIPE FLOW =      127.90 CFS          PIPE DIAMETER =  48.00 INCHES
  FLOW VELOCITY =  11.27 FEET/SEC.     VELOCITY HEAD =  1.971 FEET
  CATCH BASIN ENERGY LOSS = .2*(VELOCITY HEAD) = .2*(  1.971) =  0.394
------------------------------------------------------------------------------
  NODE  1195.00 : HGL = <  499.964>;EGL= <  499.964>;FLOWLINE= <  494.210>

******************************************************************************
  UPSTREAM PIPE FLOW CONTROL DATA:
  NODE NUMBER =  1195.00              FLOWLINE ELEVATION =   494.21
  ASSUMED UPSTREAM CONTROL HGL =     497.60 FOR DOWNSTREAM RUN ANALYSIS

==============================================================================
  END OF GRADUALLY VARIED FLOW ANALYSIS
```

```
******************************************************************************
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                        Analysis prepared by:

                       Rick Engineering Company
                           5620 Friars Road
                         San Diego, CA  92110
                            (619) 291-0707

 ************************** DESCRIPTION OF STUDY **************************
 * BLACK MOUNTAIN RANCH EAST CLUSTERS UNIT 3, J-15149-B                    *
 * OFFSITE FLOW FROM EASTERLY CHANNEL                                      *
 * 100-YR CONDITIONS CONNECTING TO EXISTING SYSTEM                         *
 **************************************************************************

  FILE NAME: 199.PIP
  TIME/DATE OF STUDY: 17:11 07/02/2014
******************************************************************************
             GRADUALLY VARIED FLOW ANALYSIS FOR PIPE SYSTEM
                       NODAL POINT STATUS TABLE
             (Note: "*" indicates nodal point data used.)
```

NODE NUMBER	MODEL PROCESS	UPSTREAM RUN PRESSURE HEAD(FT)	UPSTREAM RUN PRESSURE+ MOMENTUM(POUNDS)	DOWNSTREAM RUN FLOW DEPTH(FT)	DOWNSTREAM RUN PRESSURE+ MOMENTUM(POUNDS)
199.00-		4.00	2743.58	1.62*	3307.01
	} FRICTION				
1193.00-		2.83*Dc	2296.73	2.83*Dc	2296.73
	} JUNCTION				
1193.00-		4.86*	3570.15	2.07	3138.48
	} FRICTION				
1192.00-		5.50*	3852.38	1.71	3749.67
	} JUNCTION				
1192.00-		2.83 Dc	2724.84	2.34*	2886.80
	} FRICTION				
1191.00-		2.83*Dc	2724.84	2.83*Dc	2724.84
	} CATCH BASIN				
1191.00-		5.80*	1898.80	2.83 Dc	586.72

```
------------------------------------------------------------------------------
 MAXIMUM NUMBER OF ENERGY BALANCES USED IN EACH PROFILE =  25
------------------------------------------------------------------------------
 NOTE: STEADY FLOW HYDRAULIC HEAD-LOSS COMPUTATIONS BASED ON THE MOST
 CONSERVATIVE FORMULAE FROM THE CURRENT LACRD,LACFCD, AND OCEMA
 DESIGN MANUALS.
******************************************************************************
 DOWNSTREAM PIPE FLOW CONTROL DATA:
 NODE NUMBER =    199.00           FLOWLINE ELEVATION =   490.47
 PIPE FLOW =       87.30 CFS       PIPE DIAMETER =  48.00 INCHES
 ASSUMED DOWNSTREAM CONTROL HGL =   494.470 FEET
------------------------------------------------------------------------------
 NODE   199.00 : HGL = <  492.085>;EGL= <  497.321>;FLOWLINE= <  490.470>

******************************************************************************
 FLOW PROCESS FROM NODE   199.00 TO NODE  1193.00 IS CODE =  1
 UPSTREAM NODE  1193.00     ELEVATION =   495.02  (FLOW IS SUPERCRITICAL)
------------------------------------------------------------------------------
```

CALCULATE FRICTION LOSSES(LACFCD):
PIPE FLOW = 87.30 CFS PIPE DIAMETER = 48.00 INCHES
PIPE LENGTH = 87.40 FEET MANNING'S N = 0.01300

NORMAL DEPTH(FT) = 1.41 CRITICAL DEPTH(FT) = 2.83

UPSTREAM CONTROL ASSUMED FLOWDEPTH(FT) = 2.83

GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:

DISTANCE FROM CONTROL(FT)	FLOW DEPTH (FT)	VELOCITY (FT/SEC)	SPECIFIC ENERGY(FT)	PRESSURE+ MOMENTUM(POUNDS)
0.000	2.829	9.184	4.140	2296.73
0.055	2.772	9.390	4.142	2298.23
0.217	2.716	9.608	4.150	2302.55
0.499	2.659	9.839	4.163	2309.84
0.915	2.602	10.084	4.182	2320.25
1.483	2.545	10.344	4.208	2333.98
2.220	2.489	10.620	4.241	2351.21
3.152	2.432	10.913	4.282	2372.15
4.306	2.375	11.226	4.333	2397.06
5.714	2.318	11.558	4.394	2426.19
7.418	2.261	11.913	4.466	2459.84
9.466	2.205	12.291	4.552	2498.33
11.918	2.148	12.696	4.652	2542.03
14.852	2.091	13.129	4.769	2591.36
18.363	2.034	13.593	4.905	2646.77
22.579	1.978	14.092	5.063	2708.79
27.664	1.921	14.628	5.245	2778.00
33.848	1.864	15.206	5.457	2855.09
41.451	1.807	15.830	5.701	2940.82
50.944	1.750	16.506	5.984	3036.06
63.061	1.694	17.240	6.311	3141.84
79.036	1.637	18.038	6.692	3259.32
87.400	1.615	18.357	6.851	3307.01

NODE 1193.00 : HGL = < 497.849>;EGL= < 499.160>;FLOWLINE= < 495.020>

****
FLOW PROCESS FROM NODE 1193.00 TO NODE 1193.00 IS CODE = 5
UPSTREAM NODE 1193.00 ELEVATION = 495.97 (FLOW IS AT CRITICAL DEPTH)

CALCULATE JUNCTION LOSSES:

PIPE	FLOW (CFS)	DIAMETER (INCHES)	ANGLE (DEGREES)	FLOWLINE ELEVATION	CRITICAL DEPTH(FT.)	VELOCITY (FT/SEC)
UPSTREAM	87.30	36.00	89.00	495.97	2.83	12.350
DOWNSTREAM	87.30	48.00	-	495.02	2.83	9.177
LATERAL #1	0.00	0.00	0.00	0.00	0.00	0.000
LATERAL #2	0.00	0.00	0.00	0.00	0.00	0.000
Q5	0.00===Q5 EQUALS BASIN INPUT===					

LACFCD AND OCEMA FLOW JUNCTION FORMULAE USED:
DY=(Q2*V2-Q1*V1*COS(DELTA1)-Q3*V3*COS(DELTA3)-
Q4*V4*COS(DELTA4))/((A1+A2)*16.1)+FRICTION LOSSES
UPSTREAM: MANNING'S N = 0.01300; FRICTION SLOPE = 0.01713
DOWNSTREAM: MANNING'S N = 0.01300; FRICTION SLOPE = 0.00512
AVERAGED FRICTION SLOPE IN JUNCTION ASSUMED AS 0.01112
JUNCTION LENGTH = 4.00 FEET
FRICTION LOSSES = 0.044 FEET ENTRANCE LOSSES = 0.000 FEET
JUNCTION LOSSES = (DY+HV1-HV2)+(ENTRANCE LOSSES)
JUNCTION LOSSES = (4.036)+(0.000) = 4.036

```
--------------------------------------------------------------------------------
 NODE  1193.00 : HGL = <  500.827>;EGL= <  503.196>;FLOWLINE= <  495.970>

********************************************************************************
 FLOW PROCESS FROM NODE  1193.00 TO NODE  1192.00 IS CODE =  1
 UPSTREAM NODE  1192.00     ELEVATION =   496.86  (FLOW IS UNDER PRESSURE)
--------------------------------------------------------------------------------
 CALCULATE FRICTION LOSSES(LACFCD):
 PIPE FLOW    =        87.30 CFS      PIPE DIAMETER =  36.00 INCHES
 PIPE LENGTH =         89.30 FEET           MANNING'S N  =  0.01300
 SF=(Q/K)**2 = ((       87.30)/(    666.985))**2 = 0.01713
 HF=L*SF = (       89.30)*(0.01713) =        1.530
--------------------------------------------------------------------------------
 NODE  1192.00 : HGL = <  502.357>;EGL= <  504.725>;FLOWLINE= <  496.860>

********************************************************************************
 FLOW PROCESS FROM NODE  1192.00 TO NODE  1192.00 IS CODE =  5
 UPSTREAM NODE  1192.00     ELEVATION =   505.77  (FLOW SEALS IN REACH)
 (NOTE: POSSIBLE JUMP IN OR UPSTREAM OF STRUCTURE)
--------------------------------------------------------------------------------
 CALCULATE JUNCTION LOSSES:
      PIPE          FLOW    DIAMETER   ANGLE    FLOWLINE   CRITICAL    VELOCITY
                   (CFS)   (INCHES) (DEGREES) ELEVATION  DEPTH(FT.)   (FT/SEC)
    UPSTREAM        87.30    36.00      75.00    505.77       2.83       14.760
   DOWNSTREAM       87.30    36.00        -      496.86       2.83       12.350
   LATERAL #1        0.00     0.00       0.00      0.00       0.00        0.000
   LATERAL #2        0.00     0.00       0.00      0.00       0.00        0.000
      Q5             0.00===Q5 EQUALS BASIN INPUT===

 LACFCD AND OCEMA FLOW JUNCTION FORMULAE USED:
 DY=(Q2*V2-Q1*V1*COS(DELTA1)-Q3*V3*COS(DELTA3)-
     Q4*V4*COS(DELTA4))/((A1+A2)*16.1)+FRICTION LOSSES
 UPSTREAM:      MANNING'S N = 0.01300;  FRICTION SLOPE = 0.01889
 DOWNSTREAM:  MANNING'S N = 0.01300;  FRICTION SLOPE = 0.01713
 AVERAGED FRICTION SLOPE IN JUNCTION ASSUMED AS 0.01801
 JUNCTION LENGTH =    4.00 FEET
 FRICTION LOSSES =   0.072 FEET          ENTRANCE LOSSES =   0.000 FEET
 JUNCTION LOSSES =  (DY+HV1-HV2)+(ENTRANCE LOSSES)
 JUNCTION LOSSES =  ( 6.767)+( 0.000)  =    6.767
--------------------------------------------------------------------------------
 NODE  1192.00 : HGL = <  508.110>;EGL= <  511.492>;FLOWLINE= <  505.770>

********************************************************************************
 FLOW PROCESS FROM NODE  1192.00 TO NODE  1191.00 IS CODE =  1
 UPSTREAM NODE  1191.00     ELEVATION =   506.27  (FLOW IS SUPERCRITICAL)
--------------------------------------------------------------------------------
 CALCULATE FRICTION LOSSES(LACFCD):
 PIPE FLOW    =        87.30 CFS      PIPE DIAMETER =  36.00 INCHES
 PIPE LENGTH =          5.00 FEET           MANNING'S N  =  0.01300
--------------------------------------------------------------------------------
 NORMAL DEPTH(FT) =        1.35           CRITICAL DEPTH(FT) =        2.83
================================================================================
 UPSTREAM CONTROL ASSUMED FLOWDEPTH(FT) =       2.83
================================================================================
 GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:
--------------------------------------------------------------------------------
 DISTANCE FROM        FLOW DEPTH  VELOCITY       SPECIFIC        PRESSURE+
  CONTROL(FT)            (FT)     (FT/SEC)      ENERGY(FT)    MOMENTUM(POUNDS)
        0.000            2.829     12.634           5.309          2724.84
        0.068            2.769     12.799           5.315          2727.31
        0.269            2.710     12.990           5.332          2734.54
```

```
      0.605              2.651       13.206             5.360              2746.39
      1.083              2.591       13.446             5.401              2762.85
      1.711              2.532       13.712             5.453              2784.00
      2.504              2.473       14.003             5.519              2809.98
      3.480              2.413       14.321             5.600              2840.99
      4.661              2.354       14.668             5.697              2877.28
      5.000              2.340       14.755             5.722              2886.80
------------------------------------------------------------------------------
  NODE   1191.00 : HGL = <  509.099>;EGL= <  511.579>;FLOWLINE= <  506.270>

******************************************************************************
  FLOW PROCESS FROM NODE  1191.00 TO NODE  1191.00 IS CODE =  8
  UPSTREAM NODE  1191.00     ELEVATION =   506.27  (FLOW IS AT CRITICAL DEPTH)
------------------------------------------------------------------------------
  CALCULATE CATCH BASIN ENTRANCE LOSSES(LACFCD):
  PIPE FLOW =       87.30 CFS           PIPE DIAMETER =  36.00 INCHES
  FLOW VELOCITY =  12.64 FEET/SEC.    VELOCITY HEAD =  2.480 FEET
  CATCH BASIN ENERGY LOSS = .2*(VELOCITY HEAD) = .2*(  2.480) =  0.496
------------------------------------------------------------------------------
  NODE  1191.00 : HGL = <  512.075>;EGL= <  512.075>;FLOWLINE= <  506.270>

******************************************************************************
  UPSTREAM PIPE FLOW CONTROL DATA:
  NODE NUMBER =  1191.00              FLOWLINE ELEVATION =   506.27
  ASSUMED UPSTREAM CONTROL HGL =    509.10 FOR DOWNSTREAM RUN ANALYSIS

==============================================================================
  END OF GRADUALLY VARIED FLOW ANALYSIS
```

****

PIPE-FLOW HYDRAULICS COMPUTER PROGRAM PACKAGE
(Reference: LACFCD,LACRD, AND OCEMA HYDRAULICS CRITERION)

Ver. 8.0 Release Date: 01/01/2000 License ID 1261

Analysis prepared by:

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************************** DESCRIPTION OF STUDY *************************
* BLACK MOUNTAIN RANCH EAST CLUSTERS UNIT 3, J-15149-B                    *
* WESTERLY LATERAL AT NODE 1015                                           *
* 100-YR FLOW                                                             *
**************************************************************************
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FILE NAME: 1015W.LAT
TIME/DATE OF STUDY: 15:42 07/23/2014

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GRADUALLY VARIED FLOW ANALYSIS FOR PIPE SYSTEM
NODAL POINT STATUS TABLE
(Note: "*" indicates nodal point data used.)

NODE NUMBER	MODEL PROCESS	UPSTREAM RUN PRESSURE HEAD(FT)	UPSTREAM RUN PRESSURE+ MOMENTUM(POUNDS)	DOWNSTREAM RUN FLOW DEPTH(FT)	DOWNSTREAM RUN PRESSURE+ MOMENTUM(POUNDS)
1015.00-		1.04 Dc	114.26	0.56*	175.93
}	FRICTION				
1010.00-		1.04*Dc	114.26	1.04*Dc	114.26
}	CATCH BASIN				
1010.00-		2.05*	142.83	1.04 Dc	37.35

```
-------------------------------------------------------------------------
MAXIMUM NUMBER OF ENERGY BALANCES USED IN EACH PROFILE =  25
-------------------------------------------------------------------------
NOTE: STEADY FLOW HYDRAULIC HEAD-LOSS COMPUTATIONS BASED ON THE MOST
CONSERVATIVE FORMULAE FROM THE CURRENT LACRD,LACFCD, AND OCEMA
DESIGN MANUALS.
*************************************************************************
DOWNSTREAM PIPE FLOW CONTROL DATA:
NODE NUMBER =  1015.00            FLOWLINE ELEVATION =   580.91
PIPE FLOW =       7.20 CFS        PIPE DIAMETER =  18.00 INCHES
ASSUMED DOWNSTREAM CONTROL HGL =   580.700 FEET
*NOTE: ASSUMED DOWNSTREAM CONTROL DEPTH( -0.21 FT.)
       IS LESS THAN CRITICAL DEPTH(  1.04 FT.)
===> CRITICAL DEPTH IS ASSUMED AS DOWNSTREAM CONTROL DEPTH
     FOR UPSTREAM RUN ANALYSIS
-------------------------------------------------------------------------
NODE  1015.00 : HGL = <  581.469>;EGL= <  583.699>;FLOWLINE= <  580.910>

*************************************************************************
FLOW PROCESS FROM NODE  1015.00 TO NODE  1010.00 IS CODE =  1
UPSTREAM NODE  1010.00     ELEVATION =   582.55  (FLOW IS SUPERCRITICAL)
-------------------------------------------------------------------------
CALCULATE FRICTION LOSSES(LACFCD):
PIPE FLOW   =       7.20 CFS     PIPE DIAMETER =  18.00 INCHES
PIPE LENGTH =      10.80 FEET          MANNING'S N  =  0.01300
-------------------------------------------------------------------------
```

NORMAL DEPTH(FT) = 0.43 CRITICAL DEPTH(FT) = 1.04

UPSTREAM CONTROL ASSUMED FLOWDEPTH(FT) = 1.04

GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:

DISTANCE FROM CONTROL(FT)	FLOW DEPTH (FT)	VELOCITY (FT/SEC)	SPECIFIC ENERGY(FT)	PRESSURE+ MOMENTUM(POUNDS)
0.000	1.039	5.511	1.511	114.26
0.008	1.015	5.659	1.512	114.35
0.034	0.990	5.817	1.516	114.65
0.080	0.965	5.987	1.522	115.15
0.148	0.941	6.169	1.532	115.87
0.242	0.916	6.363	1.546	116.83
0.366	0.892	6.573	1.563	118.05
0.524	0.867	6.798	1.585	119.54
0.721	0.843	7.040	1.613	121.33
0.965	0.818	7.301	1.647	123.43
1.262	0.794	7.583	1.687	125.89
1.623	0.769	7.889	1.736	128.73
2.060	0.745	8.220	1.795	131.99
2.590	0.720	8.581	1.864	135.71
3.231	0.696	8.974	1.947	139.94
4.011	0.671	9.403	2.045	144.73
4.965	0.647	9.874	2.162	150.17
6.141	0.622	10.393	2.300	156.31
7.608	0.598	10.965	2.466	163.27
9.469	0.573	11.599	2.663	171.14
10.800	0.559	11.979	2.789	175.93

NODE 1010.00 : HGL = < 583.589>;EGL= < 584.061>;FLOWLINE= < 582.550>

FLOW PROCESS FROM NODE 1010.00 TO NODE 1010.00 IS CODE = 8
UPSTREAM NODE 1010.00 ELEVATION = 582.11 (FLOW IS AT CRITICAL DEPTH)

CALCULATE CATCH BASIN ENTRANCE LOSSES(LACFCD):
PIPE FLOW = 7.20 CFS PIPE DIAMETER = 18.00 INCHES
FLOW VELOCITY = 5.51 FEET/SEC. VELOCITY HEAD = 0.472 FEET
CATCH BASIN ENERGY LOSS = .2*(VELOCITY HEAD) = .2*(0.472) = 0.094

NODE 1010.00 : HGL = < 584.155>;EGL= < 584.155>;FLOWLINE= < 582.110>

UPSTREAM PIPE FLOW CONTROL DATA:
NODE NUMBER = 1010.00 FLOWLINE ELEVATION = 582.11
ASSUMED UPSTREAM CONTROL HGL = 583.15 FOR DOWNSTREAM RUN ANALYSIS

END OF GRADUALLY VARIED FLOW ANALYSIS

```
*****************************************************************************
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                         Analysis prepared by:

                        Rick Engineering Company
                           5620 Friars Road
                          San Diego, CA  92110
                             (619) 291-0707

 ************************** DESCRIPTION OF STUDY **************************
 * BLACK MOUNTAIN RANCH EAST CLUSTERS UNIT 3, J-15149-B                    *
 * NORTHERLY LATERAL AT NODE 1026                                          *
 * 100-YR FLOW                                                             *
 **************************************************************************

  FILE NAME: 1026N.LAT
  TIME/DATE OF STUDY: 11:45 07/24/2014

*****************************************************************************
           GRADUALLY VARIED FLOW ANALYSIS FOR PIPE SYSTEM
                      NODAL POINT STATUS TABLE
           (Note: "*" indicates nodal point data used.)
                    UPSTREAM RUN                       DOWNSTREAM RUN
  NODE     MODEL    PRESSURE      PRESSURE+        FLOW        PRESSURE+
 NUMBER   PROCESS   HEAD(FT)   MOMENTUM(POUNDS)   DEPTH(FT)  MOMENTUM(POUNDS)
1026.00-              1.50*            93.24         0.38            56.26
       } FRICTION            } HYDRAULIC JUMP
1025.00-              0.67*Dc          37.82         0.67*Dc         37.82
       } CATCH BASIN
1025.00-              0.98*            20.33         0.67 Dc         13.43
-----------------------------------------------------------------------------
 MAXIMUM NUMBER OF ENERGY BALANCES USED IN EACH PROFILE =  25
-----------------------------------------------------------------------------
 NOTE: STEADY FLOW HYDRAULIC HEAD-LOSS COMPUTATIONS BASED ON THE MOST
 CONSERVATIVE FORMULAE FROM THE CURRENT LACRD,LACFCD, AND OCEMA
 DESIGN MANUALS.
*****************************************************************************
 DOWNSTREAM PIPE FLOW CONTROL DATA:
 NODE NUMBER =  1026.00              FLOWLINE ELEVATION =   561.30
 PIPE FLOW =        3.10 CFS         PIPE DIAMETER =  18.00 INCHES
 ASSUMED DOWNSTREAM CONTROL HGL =   562.800 FEET
-----------------------------------------------------------------------------
 NODE  1026.00 : HGL = <  562.800>;EGL= <  562.848>;FLOWLINE= <  561.300>

*****************************************************************************
 FLOW PROCESS FROM NODE  1026.00 TO NODE  1025.00 IS CODE =  1
 UPSTREAM NODE  1025.00     ELEVATION =   562.10  (HYDRAULIC JUMP OCCURS)
-----------------------------------------------------------------------------
 CALCULATE FRICTION LOSSES(LACFCD):
 PIPE FLOW   =        3.10 CFS     PIPE DIAMETER =  18.00 INCHES
 PIPE LENGTH =        5.30 FEET          MANNING'S N  =  0.01300
-----------------------------------------------------------------------------
 HYDRAULIC JUMP: DOWNSTREAM RUN ANALYSIS RESULTS
-----------------------------------------------------------------------------
 NORMAL DEPTH(FT) =      0.28           CRITICAL DEPTH(FT) =      0.67
=============================================================================
```

UPSTREAM CONTROL ASSUMED FLOWDEPTH(FT) = 0.67

GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:

DISTANCE FROM CONTROL(FT)	FLOW DEPTH (FT)	VELOCITY (FT/SEC)	SPECIFIC ENERGY(FT)	PRESSURE+ MOMENTUM(POUNDS)
0.000	0.670	4.059	0.926	37.82
0.005	0.654	4.186	0.927	37.85
0.021	0.639	4.322	0.929	37.96
0.049	0.623	4.466	0.933	38.14
0.091	0.607	4.619	0.939	38.39
0.148	0.592	4.782	0.947	38.73
0.224	0.576	4.957	0.958	39.16
0.321	0.561	5.144	0.972	39.69
0.442	0.545	5.344	0.989	40.31
0.592	0.529	5.559	1.010	41.05
0.775	0.514	5.791	1.035	41.91
0.997	0.498	6.041	1.065	42.90
1.266	0.483	6.311	1.101	44.04
1.592	0.467	6.603	1.144	45.33
1.987	0.451	6.922	1.196	46.80
2.467	0.436	7.268	1.257	48.45
3.053	0.420	7.647	1.329	50.33
3.775	0.405	8.063	1.415	52.44
4.676	0.389	8.521	1.517	54.83
5.300	0.380	8.791	1.581	56.26

HYDRAULIC JUMP: UPSTREAM RUN ANALYSIS RESULTS

DOWNSTREAM CONTROL ASSUMED PRESSURE HEAD(FT) = 1.50

GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:

DISTANCE FROM CONTROL(FT)	FLOW DEPTH (FT)	VELOCITY (FT/SEC)	SPECIFIC ENERGY(FT)	PRESSURE+ MOMENTUM(POUNDS)
0.000	1.500	1.754	1.548	93.24
0.218	1.467	1.763	1.515	89.65
0.432	1.434	1.781	1.483	86.13
0.645	1.400	1.805	1.451	82.69
0.855	1.367	1.834	1.419	79.33
1.064	1.334	1.866	1.388	76.06
1.270	1.301	1.904	1.357	72.87
1.475	1.268	1.946	1.326	69.79
1.677	1.234	1.992	1.296	66.80
1.877	1.201	2.043	1.266	63.93
2.074	1.168	2.099	1.236	61.16
2.269	1.135	2.161	1.207	58.52
2.459	1.102	2.228	1.179	55.99
2.646	1.068	2.302	1.151	53.60
2.829	1.035	2.383	1.123	51.34
3.007	1.002	2.471	1.097	49.23
3.178	0.969	2.568	1.071	47.26
3.342	0.935	2.674	1.047	45.45
3.499	0.902	2.791	1.023	43.80
3.645	0.869	2.920	1.002	42.32
3.779	0.836	3.062	0.982	41.03
3.899	0.803	3.220	0.964	39.93
4.002	0.769	3.395	0.949	39.04
4.083	0.736	3.591	0.937	38.38
4.137	0.703	3.811	0.929	37.97
4.156	0.670	4.059	0.926	37.82

```
        5.300           0.670      4.059          0.926           37.82
------------------------END OF HYDRAULIC JUMP ANALYSIS------------------------
| PRESSURE+MOMENTUM BALANCE OCCURS AT      3.18 FEET UPSTREAM OF NODE 1026.00 |
|       DOWNSTREAM DEPTH = 0.969 FEET, UPSTREAM CONJUGATE DEPTH = 0.447 FEET |
-------------------------------------------------------------------------------
 NODE  1025.00 : HGL = <  562.770>;EGL= <  563.026>;FLOWLINE= <  562.100>

*******************************************************************************
 FLOW PROCESS FROM NODE  1025.00 TO NODE  1025.00 IS CODE =  8
 UPSTREAM NODE  1025.00     ELEVATION =   562.10  (FLOW IS AT CRITICAL DEPTH)
-------------------------------------------------------------------------------
 CALCULATE CATCH BASIN ENTRANCE LOSSES(LACFCD):
 PIPE FLOW =        3.10 CFS          PIPE DIAMETER =  18.00 INCHES
 FLOW VELOCITY =    4.06 FEET/SEC.    VELOCITY HEAD =  0.256 FEET
 CATCH BASIN ENERGY LOSS = .2*(VELOCITY HEAD) = .2*(  0.256) =  0.051
-------------------------------------------------------------------------------
 NODE  1025.00 : HGL = <  563.077>;EGL= <  563.077>;FLOWLINE= <  562.100>

*******************************************************************************
 UPSTREAM PIPE FLOW CONTROL DATA:
 NODE NUMBER =  1025.00            FLOWLINE ELEVATION =   562.10
 ASSUMED UPSTREAM CONTROL HGL =    562.77 FOR DOWNSTREAM RUN ANALYSIS

===============================================================================
 END OF GRADUALLY VARIED FLOW ANALYSIS
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****************************************************************************
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                     Analysis prepared by:

                    Rick Engineering Company
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                     San Diego, CA  92110
                        (619) 291-0707

 ************************** DESCRIPTION OF STUDY **************************
* BLACK MOUNTAIN RANCH EAST CLUSTERS UNIT 3, J-15149-B                      *
* SOUTHERLY LATERAL AT NODE 1026                                            *
* 100-YR FLOW                                                               *
 **************************************************************************

  FILE NAME: 1026S.LAT
  TIME/DATE OF STUDY: 11:56 07/24/2014
****************************************************************************
          GRADUALLY VARIED FLOW ANALYSIS FOR PIPE SYSTEM
                    NODAL POINT STATUS TABLE
           (Note: "*" indicates nodal point data used.)
                UPSTREAM RUN                      DOWNSTREAM RUN
  NODE    MODEL   PRESSURE      PRESSURE+         FLOW        PRESSURE+
 NUMBER  PROCESS  HEAD(FT)   MOMENTUM(POUNDS)   DEPTH(FT)  MOMENTUM(POUNDS)
1026.00-             1.50*             97.72        0.42             69.89
        } FRICTION          } HYDRAULIC JUMP
1022.00-             0.73*Dc           47.54        0.73*Dc          47.54
        } CATCH BASIN
1022.00-             1.08*             25.73        0.73 Dc          16.72
----------------------------------------------------------------------------
 MAXIMUM NUMBER OF ENERGY BALANCES USED IN EACH PROFILE =  25
----------------------------------------------------------------------------
 NOTE: STEADY FLOW HYDRAULIC HEAD-LOSS COMPUTATIONS BASED ON THE MOST
 CONSERVATIVE FORMULAE FROM THE CURRENT LACRD,LACFCD, AND OCEMA
 DESIGN MANUALS.
****************************************************************************
 DOWNSTREAM PIPE FLOW CONTROL DATA:
 NODE NUMBER =  1026.00             FLOWLINE ELEVATION =   561.30
 PIPE FLOW =        3.70 CFS        PIPE DIAMETER =  18.00 INCHES
 ASSUMED DOWNSTREAM CONTROL HGL =   562.800 FEET
----------------------------------------------------------------------------
 NODE  1026.00 : HGL = <  562.800>;EGL= <  562.868>;FLOWLINE= <  561.300>

****************************************************************************
 FLOW PROCESS FROM NODE  1026.00 TO NODE  1022.00 IS CODE =  1
 UPSTREAM NODE  1022.00      ELEVATION =   562.72  (HYDRAULIC JUMP OCCURS)
----------------------------------------------------------------------------
 CALCULATE FRICTION LOSSES(LACFCD):
 PIPE FLOW    =       3.70 CFS      PIPE DIAMETER =  18.00 INCHES
 PIPE LENGTH =       25.30 FEET           MANNING'S N  =  0.01300
----------------------------------------------------------------------------
 HYDRAULIC JUMP: DOWNSTREAM RUN ANALYSIS RESULTS
----------------------------------------------------------------------------
 NORMAL DEPTH(FT) =       0.39           CRITICAL DEPTH(FT) =       0.73
============================================================================
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UPSTREAM CONTROL ASSUMED FLOWDEPTH(FT) = 0.73

GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:

DISTANCE FROM CONTROL(FT)	FLOW DEPTH (FT)	VELOCITY (FT/SEC)	SPECIFIC ENERGY(FT)	PRESSURE+ MOMENTUM(POUNDS)
0.000	0.735	4.298	1.022	47.54
0.010	0.721	4.403	1.022	47.57
0.042	0.707	4.514	1.024	47.65
0.097	0.693	4.630	1.027	47.79
0.180	0.680	4.752	1.031	47.99
0.292	0.666	4.881	1.036	48.26
0.439	0.652	5.017	1.043	48.59
0.625	0.638	5.160	1.052	48.99
0.854	0.625	5.311	1.063	49.46
1.134	0.611	5.470	1.076	50.02
1.473	0.597	5.639	1.091	50.66
1.879	0.583	5.818	1.109	51.39
2.364	0.570	6.007	1.130	52.21
2.943	0.556	6.209	1.155	53.13
3.635	0.542	6.423	1.183	54.17
4.463	0.528	6.651	1.216	55.32
5.459	0.515	6.895	1.253	56.60
6.666	0.501	7.156	1.296	58.02
8.144	0.487	7.435	1.346	59.58
9.982	0.473	7.734	1.403	61.31
12.319	0.460	8.056	1.468	63.21
15.386	0.446	8.402	1.543	65.31
19.618	0.432	8.777	1.629	67.63
25.300	0.420	9.136	1.717	69.89

HYDRAULIC JUMP: UPSTREAM RUN ANALYSIS RESULTS

DOWNSTREAM CONTROL ASSUMED PRESSURE HEAD(FT) = 1.50

GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:

DISTANCE FROM CONTROL(FT)	FLOW DEPTH (FT)	VELOCITY (FT/SEC)	SPECIFIC ENERGY(FT)	PRESSURE+ MOMENTUM(POUNDS)
0.000	1.500	2.093	1.568	97.72
0.545	1.469	2.103	1.538	94.42
1.079	1.439	2.122	1.509	91.21
1.605	1.408	2.147	1.480	88.08
2.124	1.378	2.177	1.451	85.03
2.638	1.347	2.212	1.423	82.05
3.145	1.316	2.251	1.395	79.17
3.646	1.286	2.294	1.368	76.37
4.140	1.255	2.342	1.340	73.66
4.627	1.225	2.395	1.314	71.06
5.106	1.194	2.453	1.287	68.56
5.576	1.163	2.515	1.262	66.16
6.036	1.133	2.584	1.236	63.88
6.486	1.102	2.658	1.212	61.72
6.924	1.071	2.739	1.188	59.68
7.347	1.041	2.826	1.165	57.77
7.754	1.010	2.922	1.143	55.99
8.143	0.980	3.026	1.122	54.36
8.510	0.949	3.138	1.102	52.88
8.853	0.918	3.262	1.084	51.55
9.165	0.888	3.396	1.067	50.39
9.442	0.857	3.544	1.052	49.41

```
      9.677          0.827      3.705         1.040              48.62
      9.861          0.796      3.883         1.030              48.04
      9.983          0.765      4.080         1.024              47.67
     10.027          0.735      4.298         1.022              47.54
     25.300          0.735      4.298         1.022              47.54
-----------------------END OF HYDRAULIC JUMP ANALYSIS------------------------
| PRESSURE+MOMENTUM BALANCE OCCURS AT     5.25 FEET UPSTREAM OF NODE 1026.00 |
|      DOWNSTREAM DEPTH = 1.184 FEET, UPSTREAM CONJUGATE DEPTH = 0.431 FEET |
----------------------------------------------------------------------------
 NODE  1022.00 : HGL = <  563.455>;EGL= <  563.742>;FLOWLINE= <  562.720>

****************************************************************************
 FLOW PROCESS FROM NODE  1022.00 TO NODE  1022.00 IS CODE =  8
 UPSTREAM NODE  1022.00     ELEVATION =   562.72  (FLOW IS AT CRITICAL DEPTH)
----------------------------------------------------------------------------
 CALCULATE CATCH BASIN ENTRANCE LOSSES(LACFCD):
 PIPE FLOW =        3.70 CFS          PIPE DIAMETER =  18.00 INCHES
 FLOW VELOCITY =    4.30 FEET/SEC.    VELOCITY HEAD =  0.287 FEET
 CATCH BASIN ENERGY LOSS = .2*(VELOCITY HEAD) = .2*(  0.287) =  0.057
----------------------------------------------------------------------------
 NODE  1022.00 : HGL = <  563.799>;EGL= <  563.799>;FLOWLINE= <  562.720>

****************************************************************************
 UPSTREAM PIPE FLOW CONTROL DATA:
 NODE NUMBER =  1022.00             FLOWLINE ELEVATION =   562.72
 ASSUMED UPSTREAM CONTROL HGL =     563.45 FOR DOWNSTREAM RUN ANALYSIS

============================================================================
 END OF GRADUALLY VARIED FLOW ANALYSIS
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****************************************************************************
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                         Analysis prepared by:

                        Rick Engineering Company
                            5620 Friars Road
                          San Diego, CA  92110
                             (619) 291-0707

 ************************** DESCRIPTION OF STUDY **************************
 * BLACK MOUNTAIN RANCH EAST CLUSTERS UNIT 3, J-15149-B                    *
 * LATERAL AT NODE 1030 - 100-YR FLOW                                      *
 * H:\15149B\HYDRO\HYDRAULICS\PIPEFLOW\....                                *
 **************************************************************************

  FILE NAME: 1030.LAT
  TIME/DATE OF STUDY: 11:24 07/24/2014

****************************************************************************
           GRADUALLY VARIED FLOW ANALYSIS FOR PIPE SYSTEM
                      NODAL POINT STATUS TABLE
             (Note: "*" indicates nodal point data used.)
                   UPSTREAM RUN                          DOWNSTREAM RUN
  NODE     MODEL    PRESSURE       PRESSURE+           FLOW        PRESSURE+
 NUMBER   PROCESS   HEAD(FT)   MOMENTUM(POUNDS)      DEPTH(FT)  MOMENTUM(POUNDS)
1030.00-             2.00*          382.79             1.21          359.48
       } FRICTION         } HYDRAULIC JUMP
1029.00-             1.50 Dc        338.01             1.22*         358.37
       } FRICTION+BEND
1028.00-             1.50 Dc        338.01             1.44*         338.80
       } FRICTION
1026.00-             1.50*Dc        338.01             1.50*Dc       338.01
       } JUNCTION
1026.00-             2.00*          284.78             1.04          214.28
       } FRICTION         } HYDRAULIC JUMP
1028.00-             1.24*Dc        205.08             1.24*Dc       205.08
       } CATCH BASIN
1028.00-             1.55*           89.57             1.24 Dc        69.26
-----------------------------------------------------------------------------
 MAXIMUM NUMBER OF ENERGY BALANCES USED IN EACH PROFILE =  25
-----------------------------------------------------------------------------
 NOTE: STEADY FLOW HYDRAULIC HEAD-LOSS COMPUTATIONS BASED ON THE MOST
 CONSERVATIVE FORMULAE FROM THE CURRENT LACRD,LACFCD, AND OCEMA
 DESIGN MANUALS.
****************************************************************************
 DOWNSTREAM PIPE FLOW CONTROL DATA:
 NODE NUMBER =  1030.00             FLOWLINE ELEVATION =    558.14
 PIPE FLOW =       17.40 CFS        PIPE DIAMETER =  24.00 INCHES
 ASSUMED DOWNSTREAM CONTROL HGL =    560.140 FEET
-----------------------------------------------------------------------------
 NODE  1030.00 : HGL = <  560.140>;EGL= <  560.616>;FLOWLINE= <  558.140>

****************************************************************************
 FLOW PROCESS FROM NODE  1030.00 TO NODE  1029.00 IS CODE =  1
 UPSTREAM NODE  1029.00     ELEVATION =   558.78  (HYDRAULIC JUMP OCCURS)
-----------------------------------------------------------------------------
```

CALCULATE FRICTION LOSSES(LACFCD):
PIPE FLOW = 17.40 CFS PIPE DIAMETER = 24.00 INCHES
PIPE LENGTH = 50.20 FEET MANNING'S N = 0.01300

HYDRAULIC JUMP: DOWNSTREAM RUN ANALYSIS RESULTS

NORMAL DEPTH(FT) = 1.21 CRITICAL DEPTH(FT) = 1.50

===

UPSTREAM CONTROL ASSUMED FLOWDEPTH(FT) = 1.22

===

GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:

DISTANCE FROM CONTROL(FT)	FLOW DEPTH (FT)	VELOCITY (FT/SEC)	SPECIFIC ENERGY(FT)	PRESSURE+ MOMENTUM(POUNDS)
0.000	1.221	8.661	2.386	358.37
1.644	1.220	8.664	2.387	358.43
3.361	1.220	8.667	2.387	358.50
5.156	1.219	8.670	2.388	358.56
7.038	1.219	8.674	2.388	358.62
9.014	1.219	8.677	2.389	358.68
11.095	1.218	8.680	2.389	358.74
13.291	1.218	8.684	2.390	358.81
15.617	1.218	8.687	2.390	358.87
18.086	1.217	8.690	2.391	358.93
20.719	1.217	8.694	2.391	358.99
23.538	1.216	8.697	2.392	359.06
26.569	1.216	8.700	2.392	359.12
29.848	1.216	8.703	2.393	359.18
33.418	1.215	8.707	2.393	359.25
37.334	1.215	8.710	2.394	359.31
41.668	1.214	8.713	2.394	359.37
46.521	1.214	8.717	2.395	359.44
50.200	1.214	8.719	2.395	359.48

HYDRAULIC JUMP: UPSTREAM RUN ANALYSIS RESULTS

===

DOWNSTREAM CONTROL ASSUMED PRESSURE HEAD(FT) = 2.00

===

GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:

DISTANCE FROM CONTROL(FT)	FLOW DEPTH (FT)	VELOCITY (FT/SEC)	SPECIFIC ENERGY(FT)	PRESSURE+ MOMENTUM(POUNDS)
0.000	2.000	5.537	2.476	382.79
2.572	1.980	5.546	2.458	379.21
4.867	1.960	5.563	2.441	375.90
7.008	1.940	5.585	2.425	372.78
9.031	1.921	5.611	2.410	369.81
10.956	1.901	5.641	2.395	366.98
12.794	1.881	5.675	2.381	364.29
14.553	1.861	5.711	2.368	361.73
16.239	1.841	5.750	2.355	359.29
17.855	1.821	5.793	2.343	356.98
19.402	1.801	5.838	2.331	354.80
20.882	1.781	5.886	2.320	352.74
22.295	1.762	5.937	2.309	350.80
23.639	1.742	5.990	2.299	348.99
24.913	1.722	6.047	2.290	347.31
26.113	1.702	6.106	2.281	345.76
27.238	1.682	6.168	2.273	344.34
28.281	1.662	6.233	2.266	343.05
29.240	1.642	6.301	2.259	341.91

30.105	1.622	6.372	2.253	340.90
30.872	1.603	6.446	2.248	340.04
31.529	1.583	6.524	2.244	339.32
32.067	1.563	6.604	2.241	338.76
32.473	1.543	6.688	2.238	338.35
32.730	1.523	6.776	2.236	338.10
32.821	1.503	6.867	2.236	338.01
50.200	1.503	6.867	2.236	338.01

-----------------------END OF HYDRAULIC JUMP ANALYSIS------------------------

| PRESSURE+MOMENTUM BALANCE OCCURS AT 16.27 FEET UPSTREAM OF NODE 1030.00 |
| DOWNSTREAM DEPTH = 1.841 FEET, UPSTREAM CONJUGATE DEPTH = 1.215 FEET |

NODE 1029.00 : HGL = < 560.001>;EGL= < 561.166>;FLOWLINE= < 558.780>

****

FLOW PROCESS FROM NODE 1029.00 TO NODE 1028.00 IS CODE = 3
UPSTREAM NODE 1028.00 ELEVATION = 560.43 (FLOW IS SUPERCRITICAL)

CALCULATE PIPE-BEND LOSSES(OCEMA):
PIPE FLOW = 17.40 CFS PIPE DIAMETER = 24.00 INCHES
CENTRAL ANGLE = 21.000 DEGREES MANNING'S N = 0.01300
PIPE LENGTH = 129.60 FEET

NORMAL DEPTH(FT) = 1.21 CRITICAL DEPTH(FT) = 1.50

UPSTREAM CONTROL ASSUMED FLOWDEPTH(FT) = 1.44

GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:

DISTANCE FROM CONTROL(FT)	FLOW DEPTH (FT)	VELOCITY (FT/SEC)	SPECIFIC ENERGY(FT)	PRESSURE+ MOMENTUM(POUNDS)
0.000	1.444	7.164	2.241	338.80
0.367	1.434	7.213	2.243	339.07
0.806	1.425	7.264	2.245	339.38
1.322	1.416	7.315	2.247	339.73
1.923	1.407	7.368	2.250	340.13
2.616	1.397	7.421	2.253	340.57
3.413	1.388	7.476	2.256	341.05
4.324	1.379	7.531	2.260	341.58
5.362	1.369	7.588	2.264	342.16
6.543	1.360	7.645	2.268	342.78
7.885	1.351	7.704	2.273	343.45
9.410	1.342	7.764	2.278	344.17
11.148	1.332	7.825	2.284	344.94
13.130	1.323	7.888	2.290	345.75
15.401	1.314	7.951	2.296	346.62
18.015	1.304	8.016	2.303	347.54
21.046	1.295	8.082	2.310	348.52
24.593	1.286	8.149	2.318	349.55
28.793	1.277	8.218	2.326	350.63
33.850	1.267	8.288	2.334	351.77
40.078	1.258	8.359	2.344	352.97
48.004	1.249	8.432	2.353	354.22
58.617	1.239	8.506	2.364	355.54
74.136	1.230	8.582	2.374	356.91
101.685	1.221	8.660	2.386	358.35
129.600	1.221	8.661	2.386	358.37

NODE 1028.00 : HGL = < 561.874>;EGL= < 562.671>;FLOWLINE= < 560.430>

****

FLOW PROCESS FROM NODE 1028.00 TO NODE 1026.00 IS CODE = 1
UPSTREAM NODE 1026.00 ELEVATION = 560.47 (FLOW IS SUPERCRITICAL)

CALCULATE FRICTION LOSSES(LACFCD):
PIPE FLOW = 17.40 CFS PIPE DIAMETER = 24.00 INCHES
PIPE LENGTH = 4.60 FEET MANNING'S N = 0.01300

NORMAL DEPTH(FT) = 1.38 CRITICAL DEPTH(FT) = 1.50

UPSTREAM CONTROL ASSUMED FLOWDEPTH(FT) = 1.50

GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:

DISTANCE FROM CONTROL(FT)	FLOW DEPTH (FT)	VELOCITY (FT/SEC)	SPECIFIC ENERGY(FT)	PRESSURE+ MOMENTUM(POUNDS)
0.000	1.503	6.867	2.236	338.01
0.020	1.498	6.890	2.236	338.02
0.080	1.494	6.912	2.236	338.03
0.186	1.489	6.935	2.236	338.06
0.341	1.484	6.958	2.236	338.09
0.549	1.479	6.981	2.237	338.14
0.816	1.475	7.005	2.237	338.19
1.149	1.470	7.028	2.238	338.26
1.555	1.465	7.052	2.238	338.33
2.042	1.460	7.077	2.239	338.42
2.621	1.456	7.101	2.239	338.51
3.304	1.451	7.126	2.240	338.62
4.108	1.446	7.150	2.241	338.73
4.600	1.444	7.164	2.241	338.80

NODE 1026.00 : HGL = < 561.973>;EGL= < 562.706>;FLOWLINE= < 560.470>

****

FLOW PROCESS FROM NODE 1026.00 TO NODE 1026.00 IS CODE = 5
UPSTREAM NODE 1026.00 ELEVATION = 560.80 (FLOW IS AT CRITICAL DEPTH)

CALCULATE JUNCTION LOSSES:

PIPE	FLOW (CFS)	DIAMETER (INCHES)	ANGLE (DEGREES)	FLOWLINE ELEVATION	CRITICAL DEPTH(FT.)	VELOCITY (FT/SEC)
UPSTREAM	12.00	24.00	0.00	560.80	1.24	3.820
DOWNSTREAM	17.40	24.00	-	560.47	1.50	6.870
LATERAL #1	2.50	18.00	90.00	561.30	0.60	1.824
LATERAL #2	2.90	18.00	90.00	561.30	0.65	2.116
Q5	0.00===Q5 EQUALS BASIN INPUT===					

LACFCD AND OCEMA FLOW JUNCTION FORMULAE USED:
DY=(Q2*V2-Q1*V1*COS(DELTA1)-Q3*V3*COS(DELTA3)-
Q4*V4*COS(DELTA4))/((A1+A2)*16.1)+FRICTION LOSSES
UPSTREAM: MANNING'S N = 0.01300; FRICTION SLOPE = 0.00278
DOWNSTREAM: MANNING'S N = 0.01300; FRICTION SLOPE = 0.00708
AVERAGED FRICTION SLOPE IN JUNCTION ASSUMED AS 0.00493
JUNCTION LENGTH = 4.00 FEET
FRICTION LOSSES = 0.020 FEET ENTRANCE LOSSES = 0.000 FEET
JUNCTION LOSSES = (DY+HV1-HV2)+(ENTRANCE LOSSES)
JUNCTION LOSSES = (0.320)+(0.000) = 0.320

NODE 1026.00 : HGL = < 562.800>;EGL= < 563.026>;FLOWLINE= < 560.800>

****

FLOW PROCESS FROM NODE 1026.00 TO NODE 1028.00 IS CODE = 1
UPSTREAM NODE 1028.00 ELEVATION = 561.83 (HYDRAULIC JUMP OCCURS)

CALCULATE FRICTION LOSSES(LACFCD):
PIPE FLOW = 12.00 CFS PIPE DIAMETER = 24.00 INCHES
PIPE LENGTH = 103.00 FEET MANNING'S N = 0.01300

HYDRAULIC JUMP: DOWNSTREAM RUN ANALYSIS RESULTS

NORMAL DEPTH(FT) = 1.04 CRITICAL DEPTH(FT) = 1.24

UPSTREAM CONTROL ASSUMED FLOWDEPTH(FT) = 1.24

GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:

DISTANCE FROM CONTROL(FT)	FLOW DEPTH (FT)	VELOCITY (FT/SEC)	SPECIFIC ENERGY(FT)	PRESSURE+ MOMENTUM(POUNDS)
0.000	1.244	5.839	1.774	205.08
0.025	1.236	5.885	1.774	205.09
0.103	1.228	5.932	1.774	205.13
0.239	1.219	5.981	1.775	205.20
0.439	1.211	6.030	1.776	205.30
0.709	1.203	6.079	1.777	205.43
1.055	1.194	6.130	1.778	205.59
1.488	1.186	6.182	1.780	205.78
2.016	1.178	6.235	1.782	206.00
2.651	1.169	6.289	1.784	206.25
3.408	1.161	6.343	1.786	206.54
4.304	1.153	6.399	1.789	206.86
5.359	1.144	6.456	1.792	207.21
6.600	1.136	6.514	1.795	207.59
8.058	1.128	6.573	1.799	208.01
9.777	1.119	6.633	1.803	208.46
11.810	1.111	6.694	1.807	208.95
14.234	1.102	6.757	1.812	209.48
17.152	1.094	6.821	1.817	210.04
20.719	1.086	6.886	1.823	210.65
25.173	1.077	6.952	1.828	211.29
30.914	1.069	7.020	1.835	211.97
38.689	1.061	7.089	1.842	212.69
50.182	1.052	7.160	1.849	213.45
70.790	1.044	7.232	1.857	214.26
103.000	1.044	7.233	1.857	214.28

HYDRAULIC JUMP: UPSTREAM RUN ANALYSIS RESULTS

DOWNSTREAM CONTROL ASSUMED FLOWDEPTH(FT) = 2.00

GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:

DISTANCE FROM CONTROL(FT)	FLOW DEPTH (FT)	VELOCITY (FT/SEC)	SPECIFIC ENERGY(FT)	PRESSURE+ MOMENTUM(POUNDS)
0.000	2.000	3.819	2.226	284.78
3.907	1.969	3.831	2.197	279.15
7.587	1.939	3.853	2.170	273.78
11.134	1.909	3.882	2.143	268.60
14.578	1.879	3.916	2.117	263.60
17.935	1.849	3.955	2.092	258.76
21.215	1.818	3.999	2.067	254.10
24.422	1.788	4.048	2.043	249.61
27.560	1.758	4.101	2.019	245.29
30.629	1.728	4.158	1.996	241.15
33.630	1.697	4.220	1.974	237.20

```
     36.559          1.667      4.287         1.953          233.43
     39.414          1.637      4.358         1.932          229.85
     42.190          1.607      4.434         1.912          226.48
     44.881          1.577      4.516         1.893          223.32
     47.479          1.546      4.602         1.876          220.37
     49.974          1.516      4.695         1.859          217.65
     52.353          1.486      4.793         1.843          215.17
     54.601          1.456      4.897         1.828          212.92
     56.698          1.426      5.008         1.815          210.93
     58.619          1.395      5.126         1.804          209.21
     60.333          1.365      5.251         1.794          207.77
     61.797          1.335      5.384         1.785          206.62
     62.957          1.305      5.526         1.779          205.78
     63.735          1.275      5.678         1.775          205.26
     64.026          1.244      5.839         1.774          205.08
    103.000          1.244      5.839         1.774          205.08
------------------------END OF HYDRAULIC JUMP ANALYSIS------------------------
| PRESSURE+MOMENTUM BALANCE OCCURS AT    54.16 FEET UPSTREAM OF NODE 1026.00 |
|       DOWNSTREAM DEPTH = 1.462 FEET, UPSTREAM CONJUGATE DEPTH = 1.053 FEET |
------------------------------------------------------------------------------
 NODE   1028.00 : HGL = <  563.074>;EGL= <  563.604>;FLOWLINE= <  561.830>

******************************************************************************
 FLOW PROCESS FROM NODE  1028.00 TO NODE  1028.00 IS CODE =  8
 UPSTREAM NODE  1028.00     ELEVATION =   562.16  (FLOW IS AT CRITICAL DEPTH)
------------------------------------------------------------------------------
 CALCULATE CATCH BASIN ENTRANCE LOSSES(LACFCD):
 PIPE FLOW =       12.00 CFS           PIPE DIAMETER =  24.00 INCHES
 FLOW VELOCITY =    5.84 FEET/SEC.     VELOCITY HEAD =  0.530 FEET
 CATCH BASIN ENERGY LOSS = .2*(VELOCITY HEAD) = .2*(  0.530) =  0.106
------------------------------------------------------------------------------
 NODE   1028.00 : HGL = <  563.710>;EGL= <  563.710>;FLOWLINE= <  562.160>

******************************************************************************
 UPSTREAM PIPE FLOW CONTROL DATA:
 NODE NUMBER =  1028.00              FLOWLINE ELEVATION =    562.16
 ASSUMED UPSTREAM CONTROL HGL =      563.40 FOR DOWNSTREAM RUN ANALYSIS

==============================================================================
 END OF GRADUALLY VARIED FLOW ANALYSIS
```

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****************************************************************************
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                       Analysis prepared by:

                      Rick Engineering Company
                         5620 Friars Road
                       San Diego, CA  92110
                          (619) 291-0707

 ************************** DESCRIPTION OF STUDY *************************
 * BLACK MOUNTAIN RANCH EAST CLUSTERS UNIT 3, J-15149-B                   *
 * WESTERLY LATERAL AT NODE 1031                                          *
 * 100-YR FLOW                                                            *
 **************************************************************************

  FILE NAME: 1031W.LAT
  TIME/DATE OF STUDY: 14:41 07/23/2014
****************************************************************************
          GRADUALLY VARIED FLOW ANALYSIS FOR PIPE SYSTEM
                    NODAL POINT STATUS TABLE
            (Note: "*" indicates nodal point data used.)
                 UPSTREAM RUN                      DOWNSTREAM RUN
  NODE    MODEL   PRESSURE     PRESSURE+         FLOW       PRESSURE+
 NUMBER  PROCESS  HEAD(FT)   MOMENTUM(POUNDS)   DEPTH(FT)  MOMENTUM(POUNDS)
 1031.00-           0.92 Dc            83.68     0.83*             85.01
        } FRICTION
 1018.00-           0.92*Dc            83.68     0.92*Dc           83.68
        } CATCH BASIN
 1018.00-           1.39*              47.03     0.92 Dc           28.35
----------------------------------------------------------------------------
 MAXIMUM NUMBER OF ENERGY BALANCES USED IN EACH PROFILE =  25
----------------------------------------------------------------------------
 NOTE: STEADY FLOW HYDRAULIC HEAD-LOSS COMPUTATIONS BASED ON THE MOST
 CONSERVATIVE FORMULAE FROM THE CURRENT LACRD,LACFCD, AND OCEMA
 DESIGN MANUALS.
****************************************************************************
 DOWNSTREAM PIPE FLOW CONTROL DATA:
 NODE NUMBER =  1031.00             FLOWLINE ELEVATION =   557.64
 PIPE FLOW =       5.70 CFS         PIPE DIAMETER =  18.00 INCHES
 ASSUMED DOWNSTREAM CONTROL HGL =   557.700 FEET
 *NOTE: ASSUMED DOWNSTREAM CONTROL DEPTH(  0.06 FT.)
        IS LESS THAN CRITICAL DEPTH(  0.92 FT.)
 ===> CRITICAL DEPTH IS ASSUMED AS DOWNSTREAM CONTROL DEPTH
      FOR UPSTREAM RUN ANALYSIS
----------------------------------------------------------------------------
 NODE  1031.00 : HGL = <  558.470>;EGL= <  558.971>;FLOWLINE= <  557.640>

****************************************************************************
 FLOW PROCESS FROM NODE  1031.00 TO NODE  1018.00 IS CODE =  1
 UPSTREAM NODE  1018.00      ELEVATION =   557.74  (FLOW IS SUPERCRITICAL)
----------------------------------------------------------------------------
 CALCULATE FRICTION LOSSES(LACFCD):
 PIPE FLOW   =       5.70 CFS     PIPE DIAMETER =  18.00 INCHES
 PIPE LENGTH =      10.30 FEET          MANNING'S N  =  0.01300
----------------------------------------------------------------------------
```

NORMAL DEPTH(FT) = 0.79 CRITICAL DEPTH(FT) = 0.92

==

UPSTREAM CONTROL ASSUMED FLOWDEPTH(FT) = 0.92

==

GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:

DISTANCE FROM CONTROL(FT)	FLOW DEPTH (FT)	VELOCITY (FT/SEC)	SPECIFIC ENERGY(FT)	PRESSURE+ MOMENTUM(POUNDS)
0.000	0.921	5.007	1.311	83.68
0.015	0.916	5.040	1.311	83.68
0.062	0.911	5.073	1.311	83.69
0.144	0.906	5.107	1.311	83.71
0.265	0.901	5.141	1.312	83.74
0.427	0.896	5.176	1.312	83.77
0.636	0.891	5.211	1.313	83.82
0.897	0.886	5.247	1.313	83.87
1.214	0.881	5.284	1.314	83.93
1.597	0.876	5.320	1.315	84.00
2.052	0.870	5.358	1.317	84.07
2.591	0.865	5.396	1.318	84.16
3.225	0.860	5.435	1.319	84.25
3.970	0.855	5.474	1.321	84.36
4.845	0.850	5.514	1.323	84.47
5.876	0.845	5.554	1.324	84.59
7.095	0.840	5.595	1.327	84.72
8.548	0.835	5.637	1.329	84.86
10.296	0.830	5.679	1.331	85.01
10.300	0.830	5.679	1.331	85.01

NODE 1018.00 : HGL = < 558.661>;EGL= < 559.051>;FLOWLINE= < 557.740>

****

FLOW PROCESS FROM NODE 1018.00 TO NODE 1018.00 IS CODE = 8
UPSTREAM NODE 1018.00 ELEVATION = 557.74 (FLOW IS AT CRITICAL DEPTH)

CALCULATE CATCH BASIN ENTRANCE LOSSES(LACFCD):
PIPE FLOW = 5.70 CFS PIPE DIAMETER = 18.00 INCHES
FLOW VELOCITY = 5.01 FEET/SEC. VELOCITY HEAD = 0.390 FEET
CATCH BASIN ENERGY LOSS = .2*(VELOCITY HEAD) = .2*(0.390) = 0.078

NODE 1018.00 : HGL = < 559.129>;EGL= < 559.129>;FLOWLINE= < 557.740>

****

UPSTREAM PIPE FLOW CONTROL DATA:
NODE NUMBER = 1018.00 FLOWLINE ELEVATION = 557.74
ASSUMED UPSTREAM CONTROL HGL = 558.66 FOR DOWNSTREAM RUN ANALYSIS

==

END OF GRADUALLY VARIED FLOW ANALYSIS

```
****************************************************************************
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                          Analysis prepared by:

                        Rick Engineering Company
                           5620 Friars Road
                         San Diego, CA  92110
                            (619) 291-0707

 ************************** DESCRIPTION OF STUDY **************************
 * BLACK MOUNTAIN RANCH EAST CLUSTERS UNIT 3, J-15149-B                     *
 * EASTERLY LATERAL AT NODE 1061                                            *
 * 100-YR FLOW                                                              *
 **************************************************************************

  FILE NAME: 1061E.LAT
  TIME/DATE OF STUDY: 16:00 07/01/2014

****************************************************************************
              GRADUALLY VARIED FLOW ANALYSIS FOR PIPE SYSTEM
                       NODAL POINT STATUS TABLE
            (Note: "*" indicates nodal point data used.)
                   UPSTREAM RUN                   DOWNSTREAM RUN
  NODE    MODEL   PRESSURE      PRESSURE+        FLOW       PRESSURE+
 NUMBER  PROCESS  HEAD(FT)   MOMENTUM(POUNDS)  DEPTH(FT)  MOMENTUM(POUNDS)
1061.00-              1.07*            46.87       0.47              25.48
        } FRICTION
1060.00-              0.80*            30.34       0.56 Dc           24.34
        } CATCH BASIN
1060.00-              0.90*            23.38       0.56 Dc            8.76
----------------------------------------------------------------------------
 MAXIMUM NUMBER OF ENERGY BALANCES USED IN EACH PROFILE =  25
----------------------------------------------------------------------------
 NOTE: STEADY FLOW HYDRAULIC HEAD-LOSS COMPUTATIONS BASED ON THE MOST
 CONSERVATIVE FORMULAE FROM THE CURRENT LACRD,LACFCD, AND OCEMA
 DESIGN MANUALS.
****************************************************************************
 DOWNSTREAM PIPE FLOW CONTROL DATA:
 NODE NUMBER =  1061.00             FLOWLINE ELEVATION =   565.83
 PIPE FLOW =        2.20 CFS        PIPE DIAMETER =  18.00 INCHES
 ASSUMED DOWNSTREAM CONTROL HGL =    566.900 FEET
----------------------------------------------------------------------------
 NODE  1061.00 : HGL = <  566.900>;EGL= <  566.941>;FLOWLINE= <  565.830>

****************************************************************************
 FLOW PROCESS FROM NODE  1061.00 TO NODE  1060.00 IS CODE =  1
 UPSTREAM NODE  1060.00     ELEVATION =   566.08  (FLOW IS SUBCRITICAL)
----------------------------------------------------------------------------
 CALCULATE FRICTION LOSSES(LACFCD):
 PIPE FLOW   =        2.20 CFS     PIPE DIAMETER =  18.00 INCHES
 PIPE LENGTH =       25.30 FEET          MANNING'S N  =  0.01300
----------------------------------------------------------------------------
 NORMAL DEPTH(FT) =        0.47          CRITICAL DEPTH(FT) =       0.56
============================================================================
 DOWNSTREAM CONTROL ASSUMED FLOWDEPTH(FT) =       1.07
============================================================================
```

GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:

DISTANCE FROM CONTROL(FT)	FLOW DEPTH (FT)	VELOCITY (FT/SEC)	SPECIFIC ENERGY(FT)	PRESSURE+ MOMENTUM(POUNDS)
0.000	1.070	1.631	1.111	46.87
2.010	1.050	1.665	1.093	45.32
4.011	1.029	1.702	1.074	43.81
6.003	1.009	1.740	1.056	42.35
7.986	0.988	1.781	1.038	40.93
9.957	0.968	1.824	1.020	39.56
11.916	0.948	1.869	1.002	38.24
13.862	0.927	1.917	0.984	36.96
15.792	0.907	1.969	0.967	35.74
17.705	0.886	2.023	0.950	34.57
19.599	0.866	2.081	0.933	33.45
21.470	0.846	2.142	0.917	32.39
23.316	0.825	2.207	0.901	31.38
25.134	0.805	2.277	0.885	30.43
25.300	0.803	2.284	0.884	30.34

NODE 1060.00 : HGL = < 566.883>;EGL= < 566.964>;FLOWLINE= < 566.080>

****

FLOW PROCESS FROM NODE 1060.00 TO NODE 1060.00 IS CODE = 8
UPSTREAM NODE 1060.00 ELEVATION = 566.08 (FLOW IS SUBCRITICAL)

CALCULATE CATCH BASIN ENTRANCE LOSSES(LACFCD):
PIPE FLOW = 2.20 CFS PIPE DIAMETER = 18.00 INCHES
FLOW VELOCITY = 2.29 FEET/SEC. VELOCITY HEAD = 0.081 FEET
CATCH BASIN ENERGY LOSS = .2*(VELOCITY HEAD) = .2*(0.081) = 0.016

NODE 1060.00 : HGL = < 566.980>;EGL= < 566.980>;FLOWLINE= < 566.080>

****

UPSTREAM PIPE FLOW CONTROL DATA:
NODE NUMBER = 1060.00 FLOWLINE ELEVATION = 566.08
ASSUMED UPSTREAM CONTROL HGL = 566.64 FOR DOWNSTREAM RUN ANALYSIS

===

END OF GRADUALLY VARIED FLOW ANALYSIS

```
****************************************************************************
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                       Analysis prepared by:

                      Rick Engineering Company
                          5620 Friars Road
                        San Diego, CA  92110
                           (619) 291-0707

 ************************** DESCRIPTION OF STUDY **************************
 * BLACK MOUNTAIN RANCH EAST CLUSTERS UNIT 3, J-15149-B                     *
 * WESTERLY LATERAL AT NODE 1061                                            *
 * 100-YR FLOW                                                              *
 **************************************************************************

  FILE NAME: 1061W.LAT
  TIME/DATE OF STUDY: 15:50 07/01/2014

****************************************************************************
             GRADUALLY VARIED FLOW ANALYSIS FOR PIPE SYSTEM
                       NODAL POINT STATUS TABLE
             (Note: "*" indicates nodal point data used.)
                   UPSTREAM RUN                      DOWNSTREAM RUN
  NODE    MODEL   PRESSURE     PRESSURE+         FLOW        PRESSURE+
 NUMBER  PROCESS  HEAD(FT)  MOMENTUM(POUNDS)   DEPTH(FT)  MOMENTUM(POUNDS)
1061.00-            1.07             78.77        0.47*          117.01
        } FRICTION
1057.00-            0.88*Dc          74.13        0.88*Dc         74.13
        } CATCH BASIN
1057.00-            1.31*            41.13        0.88 Dc         25.37
----------------------------------------------------------------------------
 MAXIMUM NUMBER OF ENERGY BALANCES USED IN EACH PROFILE =  25
----------------------------------------------------------------------------
 NOTE: STEADY FLOW HYDRAULIC HEAD-LOSS COMPUTATIONS BASED ON THE MOST
 CONSERVATIVE FORMULAE FROM THE CURRENT LACRD,LACFCD, AND OCEMA
 DESIGN MANUALS.
****************************************************************************
 DOWNSTREAM PIPE FLOW CONTROL DATA:
 NODE NUMBER =  1061.00            FLOWLINE ELEVATION =   565.83
 PIPE FLOW =        5.20 CFS       PIPE DIAMETER =  18.00 INCHES
 ASSUMED DOWNSTREAM CONTROL HGL =   566.900 FEET
----------------------------------------------------------------------------
 NODE  1061.00 : HGL = <  566.298>;EGL= <  568.193>;FLOWLINE= <  565.830>

****************************************************************************
 FLOW PROCESS FROM NODE  1061.00 TO NODE  1057.00 IS CODE =  1
 UPSTREAM NODE  1057.00     ELEVATION =   567.13  (FLOW IS SUPERCRITICAL)
----------------------------------------------------------------------------
 CALCULATE FRICTION LOSSES(LACFCD):
 PIPE FLOW   =        5.20 CFS    PIPE DIAMETER =  18.00 INCHES
 PIPE LENGTH =        5.30 FEET          MANNING'S N  =  0.01300
----------------------------------------------------------------------------
 NORMAL DEPTH(FT) =       0.32          CRITICAL DEPTH(FT) =       0.88
============================================================================
 UPSTREAM CONTROL ASSUMED FLOWDEPTH(FT) =       0.88
============================================================================
```

GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:

DISTANCE FROM CONTROL(FT)	FLOW DEPTH (FT)	VELOCITY (FT/SEC)	SPECIFIC ENERGY(FT)	PRESSURE+ MOMENTUM(POUNDS)
0.000	0.878	4.837	1.242	74.13
0.005	0.856	4.991	1.243	74.21
0.020	0.833	5.155	1.246	74.44
0.047	0.811	5.331	1.253	74.83
0.087	0.789	5.520	1.262	75.40
0.143	0.766	5.723	1.275	76.16
0.216	0.744	5.942	1.293	77.13
0.311	0.722	6.178	1.315	78.32
0.430	0.700	6.434	1.343	79.74
0.577	0.677	6.711	1.377	81.43
0.759	0.655	7.012	1.419	83.41
0.982	0.633	7.340	1.470	85.71
1.253	0.610	7.698	1.531	88.36
1.584	0.588	8.091	1.605	91.40
1.989	0.566	8.523	1.694	94.88
2.486	0.543	9.000	1.802	98.86
3.100	0.521	9.528	1.932	103.40
3.864	0.499	10.116	2.089	108.59
4.828	0.476	10.773	2.280	114.52
5.300	0.468	11.044	2.363	117.01

NODE 1057.00 : HGL = < 568.008>;EGL= < 568.372>;FLOWLINE= < 567.130>

****

FLOW PROCESS FROM NODE 1057.00 TO NODE 1057.00 IS CODE = 8
UPSTREAM NODE 1057.00 ELEVATION = 567.13 (FLOW IS AT CRITICAL DEPTH)

CALCULATE CATCH BASIN ENTRANCE LOSSES(LACFCD):
PIPE FLOW = 5.20 CFS PIPE DIAMETER = 18.00 INCHES
FLOW VELOCITY = 4.84 FEET/SEC. VELOCITY HEAD = 0.363 FEET
CATCH BASIN ENERGY LOSS = .2*(VELOCITY HEAD) = .2*(0.363) = 0.073

NODE 1057.00 : HGL = < 568.444>;EGL= < 568.444>;FLOWLINE= < 567.130>

****

UPSTREAM PIPE FLOW CONTROL DATA:
NODE NUMBER = 1057.00 FLOWLINE ELEVATION = 567.13
ASSUMED UPSTREAM CONTROL HGL = 568.01 FOR DOWNSTREAM RUN ANALYSIS

==

END OF GRADUALLY VARIED FLOW ANALYSIS

```
****************************************************************************
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                         Analysis prepared by:

                        Rick Engineering Company
                            5620 Friars Road
                          San Diego, CA  92110
                             (619) 291-0707

 ************************** DESCRIPTION OF STUDY **************************
 * BLACK MOUNTAIN RANCH EAST CLUSTERS UNIT 3, J-15149-B                     *
 * NORTHERLY LATERAL AT NODE 1090                                           *
 * 100-YR FLOW                                                              *
 **************************************************************************

  FILE NAME: 1090N.LAT
  TIME/DATE OF STUDY: 16:13 07/01/2014
****************************************************************************
            GRADUALLY VARIED FLOW ANALYSIS FOR PIPE SYSTEM
                       NODAL POINT STATUS TABLE
             (Note: "*" indicates nodal point data used.)
                  UPSTREAM RUN                        DOWNSTREAM RUN
  NODE    MODEL   PRESSURE      PRESSURE+         FLOW        PRESSURE+
 NUMBER  PROCESS  HEAD(FT)   MOMENTUM(POUNDS)   DEPTH(FT)  MOMENTUM(POUNDS)
1090.00-             1.84*          131.42        0.36            63.07
        } FRICTION         } HYDRAULIC JUMP
1068.00-             0.68*Dc         39.40        0.68*Dc         39.40
        } CATCH BASIN
1068.00-             0.99*           21.20        0.68 Dc         13.97
----------------------------------------------------------------------------
 MAXIMUM NUMBER OF ENERGY BALANCES USED IN EACH PROFILE =  25
----------------------------------------------------------------------------
 NOTE: STEADY FLOW HYDRAULIC HEAD-LOSS COMPUTATIONS BASED ON THE MOST
 CONSERVATIVE FORMULAE FROM THE CURRENT LACRD,LACFCD, AND OCEMA
 DESIGN MANUALS.
****************************************************************************
 DOWNSTREAM PIPE FLOW CONTROL DATA:
 NODE NUMBER =  1090.00            FLOWLINE ELEVATION =   551.96
 PIPE FLOW =        3.20 CFS       PIPE DIAMETER =  18.00 INCHES
 ASSUMED DOWNSTREAM CONTROL HGL =   553.800 FEET
----------------------------------------------------------------------------
 NODE  1090.00 : HGL = <  553.800>;EGL= <  553.851>;FLOWLINE= <  551.960>

****************************************************************************
 FLOW PROCESS FROM NODE  1090.00 TO NODE  1068.00 IS CODE =  1
 UPSTREAM NODE  1068.00     ELEVATION =   553.01  (HYDRAULIC JUMP OCCURS)
----------------------------------------------------------------------------
 CALCULATE FRICTION LOSSES(LACFCD):
 PIPE FLOW   =         3.20 CFS     PIPE DIAMETER =  18.00 INCHES
 PIPE LENGTH =         5.30 FEET          MANNING'S N  =  0.01300
----------------------------------------------------------------------------
 HYDRAULIC JUMP: DOWNSTREAM RUN ANALYSIS RESULTS
----------------------------------------------------------------------------
 NORMAL DEPTH(FT) =       0.27          CRITICAL DEPTH(FT) =       0.68
============================================================================
```

UPSTREAM CONTROL ASSUMED FLOWDEPTH(FT) = 0.68

GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:

DISTANCE FROM CONTROL(FT)	FLOW DEPTH (FT)	VELOCITY (FT/SEC)	SPECIFIC ENERGY(FT)	PRESSURE+ MOMENTUM(POUNDS)
0.000	0.681	4.100	0.942	39.40
0.004	0.664	4.235	0.943	39.44
0.017	0.648	4.378	0.946	39.56
0.041	0.631	4.531	0.950	39.76
0.077	0.615	4.694	0.957	40.06
0.126	0.598	4.868	0.966	40.45
0.191	0.581	5.056	0.978	40.94
0.273	0.565	5.257	0.994	41.54
0.377	0.548	5.473	1.014	42.27
0.506	0.532	5.707	1.038	43.12
0.664	0.515	5.959	1.067	44.12
0.857	0.498	6.233	1.102	45.27
1.092	0.482	6.530	1.144	46.60
1.377	0.465	6.854	1.195	48.11
1.723	0.448	7.208	1.256	49.84
2.147	0.432	7.597	1.329	51.80
2.668	0.415	8.024	1.416	54.02
3.313	0.399	8.496	1.520	56.55
4.122	0.382	9.020	1.646	59.42
5.152	0.365	9.604	1.798	62.69
5.300	0.364	9.672	1.817	63.07

HYDRAULIC JUMP: UPSTREAM RUN ANALYSIS RESULTS

DOWNSTREAM CONTROL ASSUMED PRESSURE HEAD(FT) = 1.84

PRESSURE FLOW PROFILE COMPUTED INFORMATION:

DISTANCE FROM CONTROL(FT)	PRESSURE HEAD(FT)	VELOCITY (FT/SEC)	SPECIFIC ENERGY(FT)	PRESSURE+ MOMENTUM(POUNDS)
0.000	1.840	1.811	1.891	131.42
1.724	1.500	1.811	1.551	93.93

ASSUMED DOWNSTREAM PRESSURE HEAD(FT) = 1.50

GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:

DISTANCE FROM CONTROL(FT)	FLOW DEPTH (FT)	VELOCITY (FT/SEC)	SPECIFIC ENERGY(FT)	PRESSURE+ MOMENTUM(POUNDS)
1.724	1.500	1.810	1.551	93.93
1.887	1.467	1.820	1.519	90.39
2.048	1.434	1.838	1.487	86.93
2.207	1.402	1.862	1.456	83.54
2.365	1.369	1.891	1.425	80.23
2.521	1.336	1.924	1.394	77.01
2.675	1.303	1.962	1.363	73.88
2.828	1.271	2.004	1.333	70.84
2.980	1.238	2.051	1.303	67.90
3.129	1.205	2.102	1.274	65.07
3.276	1.172	2.159	1.245	62.35
3.421	1.140	2.221	1.216	59.75
3.563	1.107	2.288	1.188	57.27
3.702	1.074	2.362	1.161	54.91
3.838	1.041	2.443	1.134	52.69
3.970	1.009	2.532	1.108	50.61

4.097	0.976	2.628	1.083	48.67
4.219	0.943	2.734	1.059	46.89
4.335	0.910	2.851	1.037	45.27
4.443	0.878	2.979	1.015	43.82
4.542	0.845	3.120	0.996	42.55
4.630	0.812	3.276	0.979	41.47
4.705	0.779	3.449	0.964	40.60
4.764	0.747	3.642	0.953	39.95
4.803	0.714	3.858	0.945	39.54
4.818	0.681	4.100	0.942	39.40
5.300	0.681	4.100	0.942	39.40

```
-----------------------END OF HYDRAULIC JUMP ANALYSIS----------------------
| PRESSURE+MOMENTUM BALANCE OCCURS AT     4.26 FEET UPSTREAM OF NODE 1090.00 |
|       DOWNSTREAM DEPTH = 0.931 FEET, UPSTREAM CONJUGATE DEPTH = 0.485 FEET |
-----------------------------------------------------------------------------
  NODE  1068.00 : HGL = <  553.691>;EGL= <  553.952>;FLOWLINE= <  553.010>

*****************************************************************************
  FLOW PROCESS FROM NODE  1068.00 TO NODE  1068.00 IS CODE =  8
  UPSTREAM NODE  1068.00     ELEVATION =   553.01  (FLOW IS AT CRITICAL DEPTH)
-----------------------------------------------------------------------------
  CALCULATE CATCH BASIN ENTRANCE LOSSES(LACFCD):
  PIPE FLOW =        3.20 CFS          PIPE DIAMETER =  18.00 INCHES
  FLOW VELOCITY =    4.10 FEET/SEC.    VELOCITY HEAD =  0.261 FEET
  CATCH BASIN ENERGY LOSS = .2*(VELOCITY HEAD) = .2*(  0.261) =  0.052
-----------------------------------------------------------------------------
  NODE  1068.00 : HGL = <  554.004>;EGL= <  554.004>;FLOWLINE= <  553.010>

*****************************************************************************
  UPSTREAM PIPE FLOW CONTROL DATA:
  NODE NUMBER =  1068.00             FLOWLINE ELEVATION =   553.01
  ASSUMED UPSTREAM CONTROL HGL =     553.69 FOR DOWNSTREAM RUN ANALYSIS

=============================================================================
  END OF GRADUALLY VARIED FLOW ANALYSIS
```

```
****************************************************************************
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                     Analysis prepared by:

                    Rick Engineering Company
                       5620 Friars Road
                     San Diego, CA  92110
                        (619) 291-0707

 ************************** DESCRIPTION OF STUDY **************************
* BLACK MOUNTAIN RANCH EAST CLUSTERS UNIT 3, J-15149-B                    *
* SOUTHERLY LATERAL AT NODE 1090                                          *
* 100-YR FLOW                                                             *
 **************************************************************************

  FILE NAME: 1090S.LAT
  TIME/DATE OF STUDY: 16:30 07/01/2014

****************************************************************************
         GRADUALLY VARIED FLOW ANALYSIS FOR PIPE SYSTEM
                   NODAL POINT STATUS TABLE
         (Note: "*" indicates nodal point data used.)
                UPSTREAM RUN                       DOWNSTREAM RUN
  NODE    MODEL   PRESSURE     PRESSURE+          FLOW       PRESSURE+
 NUMBER  PROCESS  HEAD(FT)  MOMENTUM(POUNDS)    DEPTH(FT)  MOMENTUM(POUNDS)
 1090.00-            1.84*          165.11          0.86               99.79
        } FRICTION
 1075.00-            1.68*          147.90          0.98 Dc            97.58
        } CATCH BASIN
 1075.00-            1.93*          129.93          0.98 Dc            32.54
----------------------------------------------------------------------------
 MAXIMUM NUMBER OF ENERGY BALANCES USED IN EACH PROFILE =  25
----------------------------------------------------------------------------
 NOTE: STEADY FLOW HYDRAULIC HEAD-LOSS COMPUTATIONS BASED ON THE MOST
 CONSERVATIVE FORMULAE FROM THE CURRENT LACRD,LACFCD, AND OCEMA
 DESIGN MANUALS.
****************************************************************************
 DOWNSTREAM PIPE FLOW CONTROL DATA:
 NODE NUMBER =  1090.00             FLOWLINE ELEVATION =    551.96
 PIPE FLOW =        6.40 CFS        PIPE DIAMETER =  18.00 INCHES
 ASSUMED DOWNSTREAM CONTROL HGL =   553.800 FEET
----------------------------------------------------------------------------
 NODE  1090.00 : HGL = <  553.800>;EGL= <  554.004>;FLOWLINE= <  551.960>

****************************************************************************
 FLOW PROCESS FROM NODE  1090.00 TO NODE  1075.00 IS CODE =  1
 UPSTREAM NODE  1075.00     ELEVATION =   552.21  (FLOW IS UNDER PRESSURE)
----------------------------------------------------------------------------
 CALCULATE FRICTION LOSSES(LACFCD):
 PIPE FLOW    =        6.40 CFS     PIPE DIAMETER =  18.00 INCHES
 PIPE LENGTH =       25.30 FEET          MANNING'S N  =  0.01300
 SF=(Q/K)**2 = ((       6.40)/(    105.034))**2 = 0.00371
 HF=L*SF = (      25.30)*(0.00371) =        0.094
----------------------------------------------------------------------------
 NODE  1075.00 : HGL = <  553.894>;EGL= <  554.098>;FLOWLINE= <  552.210>
```

```
*****************************************************************************
 FLOW PROCESS FROM NODE  1075.00 TO NODE  1075.00 IS CODE =  8
 UPSTREAM NODE  1075.00     ELEVATION =   552.21  (FLOW IS UNDER PRESSURE)
-----------------------------------------------------------------------------
 CALCULATE CATCH BASIN ENTRANCE LOSSES(LACFCD):
 PIPE FLOW =         6.40 CFS          PIPE DIAMETER =  18.00 INCHES
 FLOW VELOCITY =   3.62 FEET/SEC.    VELOCITY HEAD =  0.204 FEET
 CATCH BASIN ENERGY LOSS = .2*(VELOCITY HEAD) = .2*(  0.204) =  0.041
-----------------------------------------------------------------------------
 NODE  1075.00 : HGL = <  554.138>;EGL= <  554.138>;FLOWLINE= <  552.210>

*****************************************************************************
 UPSTREAM PIPE FLOW CONTROL DATA:
 NODE NUMBER =  1075.00                FLOWLINE ELEVATION =   552.21
 ASSUMED UPSTREAM CONTROL HGL =     553.19 FOR DOWNSTREAM RUN ANALYSIS

=============================================================================
 END OF GRADUALLY VARIED FLOW ANALYSIS
```

```
****************************************************************************
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                      Analysis prepared by:

                     Rick Engineering Company
                        5620 Friars Road
                      San Diego, CA  92110
                         (619) 291-0707

 ************************** DESCRIPTION OF STUDY **************************
 * BLACK MOUNTAIN RANCH EAST CLUSTERS UNIT 3, J-15149-B                    *
 * LATERAL AT NODE 1100 EAST - 100-YR FLOW                                 *
 * H:\15149B\HYDRO\HYDRAULICS\PIPEFLOW\....                                *
 **************************************************************************

  FILE NAME: 1100E.LAT
  TIME/DATE OF STUDY: 15:49 07/08/2014

****************************************************************************
          GRADUALLY VARIED FLOW ANALYSIS FOR PIPE SYSTEM
                    NODAL POINT STATUS TABLE
          (Note: "*" indicates nodal point data used.)
                 UPSTREAM RUN                    DOWNSTREAM RUN
  NODE    MODEL    PRESSURE      PRESSURE+        FLOW      PRESSURE+
 NUMBER  PROCESS   HEAD(FT)   MOMENTUM(POUNDS)   DEPTH(FT)  MOMENTUM(POUNDS)
 1100.00-             1.58 Dc       387.19         0.85*          589.27
        } FRICTION
 1090.00-             1.58*Dc       387.19         1.58*Dc        387.19
        } JUNCTION
 1090.00-             2.35*         337.62         0.65           276.41
        } FRICTION         } HYDRAULIC JUMP
 1087.00-             1.18 Dc       180.62         0.65*          273.94
        } FRICTION+BEND
 1085.00-             1.18 Dc       180.62         0.80*          220.64
        } JUNCTION
 1085.00-             1.18 Dc       180.62         0.87*          205.37
        } FRICTION
 1083.00-             1.18 Dc       180.62         0.88*          203.06
        } FRICTION+BEND
 1061.00-             1.18*Dc       180.62         1.18*Dc        180.62
        } JUNCTION
 1061.00-             1.71*         127.47         0.58            69.21
        } FRICTION+BEND    } HYDRAULIC JUMP
 1054.50-             0.80 Dc        59.56         0.59*           68.29
        } FRICTION
 1054.00-             0.80*Dc        59.56         0.80*Dc         59.56
        } JUNCTION
 1054.00-             0.96           62.75         0.64*           64.47
        } FRICTION
 1053.00-             0.80 Dc        59.56         0.31*          146.74
        } JUNCTION
 1053.00-             0.80 Dc        59.56         0.27*          172.02
        } FRICTION
 1052.00-             0.80*Dc        59.56         0.80*Dc         59.56
        } CATCH BASIN
 1052.00-             1.19*          32.54         0.80 Dc         20.70
```

MAXIMUM NUMBER OF ENERGY BALANCES USED IN EACH PROFILE = 25

NOTE: STEADY FLOW HYDRAULIC HEAD-LOSS COMPUTATIONS BASED ON THE MOST CONSERVATIVE FORMULAE FROM THE CURRENT LACRD,LACFCD, AND OCEMA DESIGN MANUALS.

DOWNSTREAM PIPE FLOW CONTROL DATA:
NODE NUMBER = 1100.00 FLOWLINE ELEVATION = 546.56
PIPE FLOW = 19.20 CFS PIPE DIAMETER = 24.00 INCHES
ASSUMED DOWNSTREAM CONTROL HGL = 546.900 FEET
*NOTE: ASSUMED DOWNSTREAM CONTROL DEPTH(0.34 FT.)
IS LESS THAN CRITICAL DEPTH(1.58 FT.)
===> CRITICAL DEPTH IS ASSUMED AS DOWNSTREAM CONTROL DEPTH
FOR UPSTREAM RUN ANALYSIS

NODE 1100.00 : HGL = < 547.411>;EGL= < 550.940>;FLOWLINE= < 546.560>

FLOW PROCESS FROM NODE 1100.00 TO NODE 1090.00 IS CODE = 1
UPSTREAM NODE 1090.00 ELEVATION = 551.13 (FLOW IS SUPERCRITICAL)

CALCULATE FRICTION LOSSES(LACFCD):
PIPE FLOW = 19.20 CFS PIPE DIAMETER = 24.00 INCHES
PIPE LENGTH = 72.10 FEET MANNING'S N = 0.01300

NORMAL DEPTH(FT) = 0.80 CRITICAL DEPTH(FT) = 1.58

UPSTREAM CONTROL ASSUMED FLOWDEPTH(FT) = 1.58

GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:

DISTANCE FROM CONTROL(FT)	FLOW DEPTH (FT)	VELOCITY (FT/SEC)	SPECIFIC ENERGY(FT)	PRESSURE+ MOMENTUM(POUNDS)
0.000	1.576	7.229	2.388	387.19
0.024	1.545	7.371	2.389	387.41
0.100	1.514	7.524	2.393	388.08
0.233	1.483	7.686	2.401	389.23
0.430	1.452	7.858	2.411	390.87
0.697	1.421	8.042	2.426	393.04
1.045	1.390	8.238	2.444	395.76
1.484	1.359	8.447	2.467	399.07
2.026	1.328	8.669	2.495	403.00
2.685	1.297	8.906	2.529	407.59
3.482	1.266	9.159	2.569	412.90
4.437	1.235	9.429	2.616	418.96
5.579	1.204	9.719	2.671	425.84
6.942	1.172	10.028	2.735	433.59
8.570	1.141	10.360	2.809	442.29
10.520	1.110	10.716	2.895	452.01
12.869	1.079	11.098	2.993	462.85
15.719	1.048	11.511	3.107	474.90
19.216	1.017	11.955	3.238	488.28
23.575	0.986	12.436	3.389	503.12
29.128	0.955	12.957	3.564	519.58
36.436	0.924	13.522	3.765	537.81
46.551	0.893	14.137	3.999	558.03
61.838	0.862	14.809	4.270	580.46
72.100	0.851	15.070	4.380	589.27

NODE 1090.00 : HGL = < 552.706>;EGL= < 553.518>;FLOWLINE= < 551.130>

****
FLOW PROCESS FROM NODE 1090.00 TO NODE 1090.00 IS CODE = 5
UPSTREAM NODE 1090.00 ELEVATION = 551.46 (FLOW IS AT CRITICAL DEPTH)

CALCULATE JUNCTION LOSSES:

PIPE	FLOW (CFS)	DIAMETER (INCHES)	ANGLE (DEGREES)	FLOWLINE ELEVATION	CRITICAL DEPTH(FT.)	VELOCITY (FT/SEC)
UPSTREAM	10.90	24.00	0.00	551.46	1.18	3.470
DOWNSTREAM	19.20	24.00	-	551.13	1.58	7.231
LATERAL #1	2.80	18.00	90.00	551.96	0.64	1.724
LATERAL #2	5.50	18.00	90.00	551.96	0.90	3.386
Q5	0.00===Q5 EQUALS BASIN INPUT===					

LACFCD AND OCEMA FLOW JUNCTION FORMULAE USED:
DY=(Q2*V2-Q1*V1*COS(DELTA1)-Q3*V3*COS(DELTA3)-
Q4*V4*COS(DELTA4))/((A1+A2)*16.1)+FRICTION LOSSES
UPSTREAM: MANNING'S N = 0.01300; FRICTION SLOPE = 0.00232
DOWNSTREAM: MANNING'S N = 0.01300; FRICTION SLOPE = 0.00777
AVERAGED FRICTION SLOPE IN JUNCTION ASSUMED AS 0.00505
JUNCTION LENGTH = 4.00 FEET
FRICTION LOSSES = 0.020 FEET ENTRANCE LOSSES = 0.000 FEET
JUNCTION LOSSES = (DY+HV1-HV2)+(ENTRANCE LOSSES)
JUNCTION LOSSES = (0.478)+(0.000) = 0.478

NODE 1090.00 : HGL = < 553.808>;EGL= < 553.995>;FLOWLINE= < 551.460>

****
FLOW PROCESS FROM NODE 1090.00 TO NODE 1087.00 IS CODE = 1
UPSTREAM NODE 1087.00 ELEVATION = 554.18 (HYDRAULIC JUMP OCCURS)

CALCULATE FRICTION LOSSES(LACFCD):
PIPE FLOW = 10.90 CFS PIPE DIAMETER = 24.00 INCHES
PIPE LENGTH = 59.70 FEET MANNING'S N = 0.01300

HYDRAULIC JUMP: DOWNSTREAM RUN ANALYSIS RESULTS

NORMAL DEPTH(FT) = 0.65 CRITICAL DEPTH(FT) = 1.18

===
UPSTREAM CONTROL ASSUMED FLOWDEPTH(FT) = 0.65
===
GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:

DISTANCE FROM CONTROL(FT)	FLOW DEPTH (FT)	VELOCITY (FT/SEC)	SPECIFIC ENERGY(FT)	PRESSURE+ MOMENTUM(POUNDS)
0.000	0.652	12.256	2.986	273.94
1.370	0.652	12.263	2.988	274.06
2.798	0.651	12.269	2.990	274.17
4.292	0.651	12.275	2.992	274.29
5.856	0.651	12.281	2.995	274.41
7.497	0.651	12.287	2.997	274.53
9.224	0.651	12.294	2.999	274.65
11.045	0.650	12.300	3.001	274.77
12.972	0.650	12.306	3.003	274.89
15.016	0.650	12.312	3.005	275.00
17.195	0.650	12.319	3.007	275.12
19.525	0.649	12.325	3.010	275.24
22.030	0.649	12.331	3.012	275.36
24.737	0.649	12.338	3.014	275.48
27.682	0.649	12.344	3.016	275.60
30.910	0.648	12.350	3.018	275.72

34.480	0.648	12.356	3.020	275.84
38.475	0.648	12.363	3.023	275.96
43.006	0.648	12.369	3.025	276.08
48.241	0.647	12.375	3.027	276.20
54.436	0.647	12.382	3.029	276.32
59.700	0.647	12.386	3.031	276.41

HYDRAULIC JUMP: UPSTREAM RUN ANALYSIS RESULTS

DOWNSTREAM CONTROL ASSUMED PRESSURE HEAD(FT) = 2.35

PRESSURE FLOW PROFILE COMPUTED INFORMATION:

DISTANCE FROM CONTROL(FT)	PRESSURE HEAD(FT)	VELOCITY (FT/SEC)	SPECIFIC ENERGY(FT)	PRESSURE+ MOMENTUM(POUNDS)
0.000	2.348	3.470	2.535	337.62
8.058	2.000	3.470	2.187	269.32

ASSUMED DOWNSTREAM PRESSURE HEAD(FT) = 2.00

GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:

DISTANCE FROM CONTROL(FT)	FLOW DEPTH (FT)	VELOCITY (FT/SEC)	SPECIFIC ENERGY(FT)	PRESSURE+ MOMENTUM(POUNDS)
8.058	2.000	3.468	2.187	269.32
8.781	1.967	3.481	2.156	263.19
9.476	1.935	3.503	2.125	257.30
10.152	1.902	3.533	2.096	251.61
10.813	1.869	3.568	2.067	246.09
11.460	1.837	3.608	2.039	240.75
12.094	1.804	3.653	2.011	235.59
12.713	1.771	3.703	1.984	230.61
13.319	1.739	3.758	1.958	225.81
13.910	1.706	3.817	1.932	221.20
14.486	1.673	3.881	1.907	216.79
15.045	1.641	3.951	1.883	212.58
15.588	1.608	4.025	1.860	208.59
16.112	1.575	4.105	1.837	204.81
16.615	1.543	4.190	1.816	201.26
17.096	1.510	4.282	1.795	197.95
17.552	1.477	4.380	1.775	194.89
17.981	1.445	4.484	1.757	192.08
18.380	1.412	4.596	1.740	189.55
18.745	1.379	4.715	1.725	187.30
19.072	1.347	4.842	1.711	185.34
19.355	1.314	4.979	1.699	183.70
19.590	1.282	5.125	1.690	182.39
19.769	1.249	5.281	1.682	181.42
19.884	1.216	5.449	1.678	180.83
19.925	1.184	5.629	1.676	180.62
59.700	1.184	5.629	1.676	180.62

-----------------------END OF HYDRAULIC JUMP ANALYSIS-----------------------

| PRESSURE+MOMENTUM BALANCE OCCURS AT 7.24 FEET UPSTREAM OF NODE 1090.00 |
| DOWNSTREAM DEPTH = 2.036 FEET, UPSTREAM CONJUGATE DEPTH = 0.647 FEET |

NODE 1087.00 : HGL = < 554.832>;EGL= < 557.166>;FLOWLINE= < 554.180>

****

FLOW PROCESS FROM NODE 1087.00 TO NODE 1085.00 IS CODE = 3
UPSTREAM NODE 1085.00 ELEVATION = 561.40 (FLOW IS SUPERCRITICAL)

CALCULATE PIPE-BEND LOSSES(OCEMA):
PIPE FLOW = 10.90 CFS
CENTRAL ANGLE = 48.000 DEGREES
PIPE LENGTH = 158.60 FEET
PIPE DIAMETER = 24.00 INCHES
MANNING'S N = 0.01300

NORMAL DEPTH(FT) = 0.65 CRITICAL DEPTH(FT) = 1.18

===

UPSTREAM CONTROL ASSUMED FLOWDEPTH(FT) = 0.80

===

GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:

DISTANCE FROM CONTROL(FT)	FLOW DEPTH (FT)	VELOCITY (FT/SEC)	SPECIFIC ENERGY(FT)	PRESSURE+ MOMENTUM(POUNDS)
0.000	0.800	9.283	2.139	220.64
0.879	0.794	9.379	2.161	222.23
1.815	0.788	9.478	2.184	223.86
2.812	0.782	9.578	2.207	225.54
3.878	0.776	9.680	2.232	227.27
5.018	0.769	9.785	2.257	229.04
6.241	0.763	9.891	2.283	230.87
7.556	0.757	10.000	2.311	232.74
8.974	0.751	10.111	2.339	234.66
10.507	0.745	10.224	2.369	236.64
12.171	0.739	10.339	2.399	238.68
13.984	0.732	10.457	2.431	240.77
15.969	0.726	10.578	2.465	242.91
18.154	0.720	10.701	2.499	245.12
20.573	0.714	10.826	2.535	247.38
23.272	0.708	10.955	2.572	249.71
26.312	0.702	11.086	2.611	252.11
29.772	0.695	11.220	2.651	254.56
33.767	0.689	11.357	2.693	257.09
38.461	0.683	11.498	2.737	259.69
44.114	0.677	11.641	2.782	262.36
51.157	0.671	11.788	2.830	265.10
60.398	0.665	11.938	2.879	267.92
73.655	0.658	12.092	2.930	270.82
96.763	0.652	12.249	2.983	273.80
158.600	0.652	12.256	2.986	273.94

NODE 1085.00 : HGL = < 562.200>;EGL= < 563.539>;FLOWLINE= < 561.400>

****

FLOW PROCESS FROM NODE 1085.00 TO NODE 1085.00 IS CODE = 5
UPSTREAM NODE 1085.00 ELEVATION = 561.73 (FLOW IS SUPERCRITICAL)

CALCULATE JUNCTION LOSSES:

PIPE	FLOW (CFS)	DIAMETER (INCHES)	ANGLE (DEGREES)	FLOWLINE ELEVATION	CRITICAL DEPTH(FT.)	VELOCITY (FT/SEC)
UPSTREAM	10.90	24.00	0.00	561.73	1.18	8.305
DOWNSTREAM	10.90	24.00	-	561.40	1.18	9.286
LATERAL #1	0.00	0.00	0.00	0.00	0.00	0.000
LATERAL #2	0.00	0.00	0.00	0.00	0.00	0.000
Q5	0.00===Q5 EQUALS BASIN INPUT===					

LACFCD AND OCEMA FLOW JUNCTION FORMULAE USED:
DY=(Q2*V2-Q1*V1*COS(DELTA1)-Q3*V3*COS(DELTA3)-
Q4*V4*COS(DELTA4))/((A1+A2)*16.1)+FRICTION LOSSES
UPSTREAM: MANNING'S N = 0.01300; FRICTION SLOPE = 0.01506
DOWNSTREAM: MANNING'S N = 0.01300; FRICTION SLOPE = 0.02043
AVERAGED FRICTION SLOPE IN JUNCTION ASSUMED AS 0.01775

JUNCTION LENGTH = 4.00 FEET
FRICTION LOSSES = 0.071 FEET ENTRANCE LOSSES = 0.000 FEET
JUNCTION LOSSES = (DY+HV1-HV2)+(ENTRANCE LOSSES)
JUNCTION LOSSES = (0.132)+(0.000) = 0.132

NODE 1085.00 : HGL = < 562.600>;EGL= < 563.671>;FLOWLINE= < 561.730>

****

FLOW PROCESS FROM NODE 1085.00 TO NODE 1083.00 IS CODE = 1
UPSTREAM NODE 1083.00 ELEVATION = 563.70 (FLOW IS SUPERCRITICAL)

CALCULATE FRICTION LOSSES(LACFCD):
PIPE FLOW = 10.90 CFS PIPE DIAMETER = 24.00 INCHES
PIPE LENGTH = 130.50 FEET MANNING'S N = 0.01300

NORMAL DEPTH(FT) = 0.87 CRITICAL DEPTH(FT) = 1.18

==

UPSTREAM CONTROL ASSUMED FLOWDEPTH(FT) = 0.88

==

GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:

DISTANCE FROM CONTROL(FT)	FLOW DEPTH (FT)	VELOCITY (FT/SEC)	SPECIFIC ENERGY(FT)	PRESSURE+ MOMENTUM(POUNDS)
0.000	0.884	8.141	1.913	203.06
1.408	0.883	8.148	1.915	203.15
2.879	0.882	8.155	1.916	203.24
4.418	0.882	8.161	1.917	203.34
6.032	0.881	8.168	1.918	203.43
7.728	0.881	8.174	1.919	203.53
9.515	0.880	8.181	1.920	203.62
11.402	0.880	8.188	1.921	203.72
13.401	0.879	8.194	1.922	203.81
15.526	0.879	8.201	1.924	203.91
17.792	0.878	8.208	1.925	204.00
20.219	0.878	8.214	1.926	204.10
22.832	0.877	8.221	1.927	204.19
25.659	0.876	8.228	1.928	204.29
28.738	0.876	8.234	1.929	204.39
32.118	0.875	8.241	1.931	204.48
35.862	0.875	8.248	1.932	204.58
40.055	0.874	8.255	1.933	204.68
44.818	0.874	8.261	1.934	204.78
50.327	0.873	8.268	1.935	204.88
56.856	0.873	8.275	1.937	204.97
64.862	0.872	8.282	1.938	205.07
75.205	0.872	8.288	1.939	205.17
89.812	0.871	8.295	1.940	205.27
114.872	0.871	8.302	1.941	205.37
130.500	0.870	8.302	1.941	205.37

NODE 1083.00 : HGL = < 564.584>;EGL= < 565.613>;FLOWLINE= < 563.700>

****

FLOW PROCESS FROM NODE 1083.00 TO NODE 1061.00 IS CODE = 3
UPSTREAM NODE 1061.00 ELEVATION = 565.00 (FLOW IS SUPERCRITICAL)

CALCULATE PIPE-BEND LOSSES(OCEMA):
PIPE FLOW = 10.90 CFS PIPE DIAMETER = 24.00 INCHES
CENTRAL ANGLE = 0.000 DEGREES MANNING'S N = 0.01300
PIPE LENGTH = 86.50 FEET

NORMAL DEPTH(FT) = 0.87 CRITICAL DEPTH(FT) = 1.18

UPSTREAM CONTROL ASSUMED FLOWDEPTH(FT) = 1.18

GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:

DISTANCE FROM CONTROL(FT)	FLOW DEPTH (FT)	VELOCITY (FT/SEC)	SPECIFIC ENERGY(FT)	PRESSURE+ MOMENTUM(POUNDS)
0.000	1.184	5.629	1.676	180.62
0.027	1.171	5.701	1.676	180.65
0.111	1.159	5.776	1.677	180.75
0.258	1.146	5.853	1.678	180.91
0.474	1.134	5.931	1.680	181.13
0.766	1.121	6.013	1.683	181.42
1.143	1.109	6.096	1.686	181.78
1.613	1.096	6.182	1.690	182.22
2.190	1.084	6.271	1.695	182.72
2.885	1.071	6.362	1.700	183.30
3.716	1.059	6.456	1.706	183.97
4.701	1.046	6.553	1.713	184.71
5.865	1.034	6.653	1.721	185.53
7.237	1.021	6.756	1.730	186.44
8.854	1.009	6.862	1.740	187.44
10.764	0.996	6.972	1.751	188.53
13.030	0.984	7.085	1.764	189.72
15.739	0.971	7.202	1.777	191.00
19.011	0.959	7.323	1.792	192.38
23.021	0.946	7.448	1.808	193.88
28.042	0.934	7.578	1.826	195.47
34.533	0.921	7.711	1.845	197.19
43.350	0.909	7.850	1.866	199.02
56.422	0.896	7.993	1.889	200.97
79.935	0.884	8.141	1.913	203.06
86.500	0.884	8.141	1.913	203.06

NODE 1061.00 : HGL = < 566.184>;EGL= < 566.676>;FLOWLINE= < 565.000>

****

FLOW PROCESS FROM NODE 1061.00 TO NODE 1061.00 IS CODE = 5
UPSTREAM NODE 1061.00 ELEVATION = 565.33 (FLOW IS AT CRITICAL DEPTH)

CALCULATE JUNCTION LOSSES:

PIPE	FLOW (CFS)	DIAMETER (INCHES)	ANGLE (DEGREES)	FLOWLINE ELEVATION	CRITICAL DEPTH(FT.)	VELOCITY (FT/SEC)
UPSTREAM	4.40	18.00	0.00	565.33	0.80	2.490
DOWNSTREAM	10.90	24.00	-	565.00	1.18	5.631
LATERAL #1	4.60	18.00	90.00	565.50	0.82	3.270
LATERAL #2	1.90	18.00	90.00	565.50	0.52	1.351
Q5	0.00===Q5 EQUALS BASIN INPUT===					

LACFCD AND OCEMA FLOW JUNCTION FORMULAE USED:
DY=(Q2*V2-Q1*V1*COS(DELTA1)-Q3*V3*COS(DELTA3)-
Q4*V4*COS(DELTA4))/((A1+A2)*16.1)+FRICTION LOSSES
UPSTREAM: MANNING'S N = 0.01300; FRICTION SLOPE = 0.00175
DOWNSTREAM: MANNING'S N = 0.01300; FRICTION SLOPE = 0.00537
AVERAGED FRICTION SLOPE IN JUNCTION ASSUMED AS 0.00356
JUNCTION LENGTH = 4.00 FEET
FRICTION LOSSES = 0.014 FEET ENTRANCE LOSSES = 0.000 FEET
JUNCTION LOSSES = (DY+HV1-HV2)+(ENTRANCE LOSSES)
JUNCTION LOSSES = (0.464)+(0.000) = 0.464

NODE 1061.00 : HGL = < 567.044>;EGL= < 567.140>;FLOWLINE= < 565.330>

****

FLOW PROCESS FROM NODE 1061.00 TO NODE 1054.50 IS CODE = 3
UPSTREAM NODE 1054.50 ELEVATION = 568.09 (HYDRAULIC JUMP OCCURS)

CALCULATE PIPE-BEND LOSSES(OCEMA):
PIPE FLOW = 4.40 CFS PIPE DIAMETER = 18.00 INCHES
CENTRAL ANGLE = 23.000 DEGREES MANNING'S N = 0.01300
PIPE LENGTH = 155.30 FEET

HYDRAULIC JUMP: DOWNSTREAM RUN ANALYSIS RESULTS

NORMAL DEPTH(FT) = 0.58 CRITICAL DEPTH(FT) = 0.80

===

UPSTREAM CONTROL ASSUMED FLOWDEPTH(FT) = 0.59

===

GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:

DISTANCE FROM CONTROL(FT)	FLOW DEPTH (FT)	VELOCITY (FT/SEC)	SPECIFIC ENERGY(FT)	PRESSURE+ MOMENTUM(POUNDS)
0.000	0.587	6.855	1.318	68.29
0.875	0.587	6.862	1.319	68.33
1.788	0.587	6.868	1.319	68.36
2.745	0.586	6.874	1.320	68.40
3.747	0.586	6.880	1.321	68.44
4.801	0.585	6.886	1.322	68.48
5.911	0.585	6.893	1.323	68.51
7.084	0.585	6.899	1.324	68.55
8.326	0.584	6.905	1.325	68.59
9.646	0.584	6.911	1.326	68.63
11.055	0.583	6.918	1.327	68.66
12.563	0.583	6.924	1.328	68.70
14.187	0.583	6.930	1.329	68.74
15.944	0.582	6.936	1.330	68.78
17.858	0.582	6.943	1.331	68.82
19.958	0.582	6.949	1.332	68.85
22.285	0.581	6.955	1.333	68.89
24.891	0.581	6.962	1.334	68.93
27.852	0.580	6.968	1.335	68.97
31.277	0.580	6.974	1.336	69.01
35.336	0.580	6.981	1.337	69.05
40.314	0.579	6.987	1.338	69.09
46.744	0.579	6.994	1.339	69.13
55.828	0.578	7.000	1.340	69.16
71.415	0.578	7.006	1.341	69.20
155.300	0.578	7.007	1.341	69.21

HYDRAULIC JUMP: UPSTREAM RUN ANALYSIS RESULTS

===

DOWNSTREAM CONTROL ASSUMED PRESSURE HEAD(FT) = 1.71

===

PRESSURE FLOW PROFILE COMPUTED INFORMATION:

DISTANCE FROM CONTROL(FT)	PRESSURE HEAD(FT)	VELOCITY (FT/SEC)	SPECIFIC ENERGY(FT)	PRESSURE+ MOMENTUM(POUNDS)
0.000	1.713	2.490	1.810	127.47
13.552	1.500	2.490	1.596	103.93

===

ASSUMED DOWNSTREAM PRESSURE HEAD(FT) = 1.50

===

GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:

DISTANCE FROM CONTROL(FT)	FLOW DEPTH (FT)	VELOCITY (FT/SEC)	SPECIFIC ENERGY(FT)	PRESSURE+ MOMENTUM(POUNDS)
13.552	1.500	2.489	1.596	103.93
15.227	1.472	2.500	1.569	100.96
16.848	1.444	2.519	1.543	98.09
18.437	1.417	2.545	1.517	95.29
19.998	1.389	2.575	1.492	92.56
21.536	1.361	2.611	1.467	89.92
23.050	1.333	2.650	1.442	87.36
24.542	1.305	2.695	1.418	84.87
26.011	1.277	2.743	1.394	82.48
27.456	1.250	2.796	1.371	80.17
28.875	1.222	2.854	1.348	77.96
30.267	1.194	2.916	1.326	75.85
31.629	1.166	2.984	1.305	73.84
32.958	1.138	3.057	1.284	71.93
34.251	1.111	3.136	1.263	70.14
35.502	1.083	3.221	1.244	68.46
36.706	1.055	3.312	1.225	66.90
37.856	1.027	3.411	1.208	65.47
38.945	0.999	3.518	1.192	64.18
39.961	0.971	3.633	1.176	63.02
40.891	0.944	3.757	1.163	62.02
41.720	0.916	3.892	1.151	61.17
42.427	0.888	4.038	1.141	60.49
42.985	0.860	4.196	1.134	59.98
43.357	0.832	4.369	1.129	59.67
43.495	0.805	4.557	1.127	59.56
155.300	0.805	4.557	1.127	59.56

-----------------------END OF HYDRAULIC JUMP ANALYSIS-----------------------

| PRESSURE+MOMENTUM BALANCE OCCURS AT 34.94 FEET UPSTREAM OF NODE 1061.00 |
| DOWNSTREAM DEPTH = 1.095 FEET, UPSTREAM CONJUGATE DEPTH = 0.578 FEET |

NODE 1054.50 : HGL = < 568.677>;EGL= < 569.408>;FLOWLINE= < 568.090>

****

FLOW PROCESS FROM NODE 1054.50 TO NODE 1054.00 IS CODE = 1
UPSTREAM NODE 1054.00 ELEVATION = 568.93 (FLOW IS SUPERCRITICAL)

CALCULATE FRICTION LOSSES(LACFCD):
PIPE FLOW = 4.40 CFS PIPE DIAMETER = 18.00 INCHES
PIPE LENGTH = 47.00 FEET MANNING'S N = 0.01300

NORMAL DEPTH(FT) = 0.58 CRITICAL DEPTH(FT) = 0.80

UPSTREAM CONTROL ASSUMED FLOWDEPTH(FT) = 0.80

GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:

DISTANCE FROM CONTROL(FT)	FLOW DEPTH (FT)	VELOCITY (FT/SEC)	SPECIFIC ENERGY(FT)	PRESSURE+ MOMENTUM(POUNDS)
0.000	0.805	4.557	1.127	59.56
0.016	0.795	4.622	1.127	59.57
0.068	0.786	4.689	1.128	59.61
0.158	0.777	4.759	1.129	59.67
0.290	0.768	4.830	1.131	59.76
0.469	0.759	4.904	1.133	59.87
0.701	0.750	4.979	1.135	60.01
0.990	0.741	5.058	1.138	60.18

1.344	0.732	5.138	1.142	60.38
1.772	0.723	5.222	1.146	60.61
2.283	0.713	5.308	1.151	60.87
2.890	0.704	5.397	1.157	61.16
3.607	0.695	5.489	1.163	61.48
4.453	0.686	5.584	1.170	61.84
5.451	0.677	5.682	1.179	62.23
6.631	0.668	5.783	1.188	62.66
8.032	0.659	5.888	1.197	63.13
9.708	0.650	5.997	1.208	63.64
11.733	0.640	6.110	1.221	64.19
14.218	0.631	6.227	1.234	64.78
17.331	0.622	6.348	1.248	65.41
21.358	0.613	6.474	1.264	66.10
26.834	0.604	6.604	1.282	66.83
34.957	0.595	6.740	1.301	67.61
47.000	0.587	6.855	1.318	68.29

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-----------------------------------------------------------------------------
NODE   1054.00 : HGL = <  569.734>;EGL= <  570.057>;FLOWLINE= <  568.930>

******************************************************************************
FLOW PROCESS FROM NODE  1054.00 TO NODE  1054.00 IS CODE =  5
UPSTREAM NODE  1054.00      ELEVATION =   569.26  (FLOW IS AT CRITICAL DEPTH)
(NOTE: POSSIBLE JUMP IN OR UPSTREAM OF STRUCTURE)
-----------------------------------------------------------------------------
CALCULATE JUNCTION LOSSES:
```

PIPE	FLOW (CFS)	DIAMETER (INCHES)	ANGLE (DEGREES)	FLOWLINE ELEVATION	CRITICAL DEPTH(FT.)	VELOCITY (FT/SEC)
UPSTREAM	4.40	18.00	75.00	569.26	0.80	6.168
DOWNSTREAM	4.40	18.00	-	568.93	0.80	4.558
LATERAL #1	0.00	0.00	0.00	0.00	0.00	0.000
LATERAL #2	0.00	0.00	0.00	0.00	0.00	0.000
Q5	0.00===Q5 EQUALS BASIN INPUT===					

```
LACFCD AND OCEMA FLOW JUNCTION FORMULAE USED:
DY=(Q2*V2-Q1*V1*COS(DELTA1)-Q3*V3*COS(DELTA3)-
    Q4*V4*COS(DELTA4))/((A1+A2)*16.1)+FRICTION LOSSES
UPSTREAM:     MANNING'S N = 0.01300;  FRICTION SLOPE = 0.01250
DOWNSTREAM:   MANNING'S N = 0.01300;  FRICTION SLOPE = 0.00555
AVERAGED FRICTION SLOPE IN JUNCTION ASSUMED AS 0.00902
JUNCTION LENGTH =   4.00 FEET
FRICTION LOSSES =  0.036 FEET          ENTRANCE LOSSES =  0.000 FEET
JUNCTION LOSSES = (DY+HV1-HV2)+(ENTRANCE LOSSES)
JUNCTION LOSSES = ( 0.430)+( 0.000) =   0.430
-----------------------------------------------------------------------------
NODE   1054.00 : HGL = <  569.896>;EGL= <  570.487>;FLOWLINE= <  569.260>

******************************************************************************
FLOW PROCESS FROM NODE  1054.00 TO NODE  1053.00 IS CODE =  1
UPSTREAM NODE  1053.00      ELEVATION =   570.17  (FLOW IS SUPERCRITICAL)
-----------------------------------------------------------------------------
CALCULATE FRICTION LOSSES(LACFCD):
PIPE FLOW    =        4.40 CFS      PIPE DIAMETER =  18.00 INCHES
PIPE LENGTH =       90.50 FEET           MANNING'S N  =  0.01300
-----------------------------------------------------------------------------
NORMAL DEPTH(FT) =       0.68           CRITICAL DEPTH(FT) =       0.80
=============================================================================
UPSTREAM CONTROL ASSUMED FLOWDEPTH(FT) =      0.31
=============================================================================
GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:
-----------------------------------------------------------------------------
```

DISTANCE FROM CONTROL(FT)	FLOW DEPTH (FT)	VELOCITY (FT/SEC)	SPECIFIC ENERGY(FT)	PRESSURE+ MOMENTUM(POUNDS)
0.000	0.306	16.967	4.779	146.74
3.027	0.321	15.863	4.231	137.57
6.089	0.336	14.878	3.775	129.43
9.186	0.351	13.996	3.394	122.19
12.321	0.366	13.201	3.073	115.71
15.495	0.380	12.483	2.801	109.90
18.711	0.395	11.831	2.570	104.67
21.974	0.410	11.237	2.372	99.96
25.288	0.425	10.693	2.201	95.69
28.659	0.439	10.195	2.055	91.84
32.094	0.454	9.737	1.927	88.34
35.602	0.469	9.315	1.817	85.16
39.195	0.484	8.925	1.721	82.28
42.886	0.499	8.563	1.638	79.66
46.695	0.513	8.227	1.565	77.27
50.645	0.528	7.914	1.501	75.11
54.766	0.543	7.623	1.446	73.15
59.102	0.558	7.350	1.397	71.37
63.712	0.573	7.095	1.355	69.75
68.683	0.587	6.856	1.318	68.30
74.152	0.602	6.632	1.286	66.99
80.344	0.617	6.421	1.258	65.81
87.688	0.632	6.222	1.233	64.76
90.500	0.636	6.166	1.227	64.47

NODE 1053.00 : HGL = < 570.476>;EGL= < 574.949>;FLOWLINE= < 570.170>

****

FLOW PROCESS FROM NODE 1053.00 TO NODE 1053.00 IS CODE = 5
UPSTREAM NODE 1053.00 ELEVATION = 570.50 (FLOW IS SUPERCRITICAL)

CALCULATE JUNCTION LOSSES:

PIPE	FLOW (CFS)	DIAMETER (INCHES)	ANGLE (DEGREES)	FLOWLINE ELEVATION	CRITICAL DEPTH(FT.)	VELOCITY (FT/SEC)
UPSTREAM	4.40	18.00	13.00	570.50	0.80	19.995
DOWNSTREAM	4.40	18.00	-	570.17	0.80	16.972
LATERAL #1	0.00	0.00	0.00	0.00	0.00	0.000
LATERAL #2	0.00	0.00	0.00	0.00	0.00	0.000
Q5	0.00===Q5 EQUALS BASIN INPUT===					

LACFCD AND OCEMA FLOW JUNCTION FORMULAE USED:
DY=(Q2*V2-Q1*V1*COS(DELTA1)-Q3*V3*COS(DELTA3)-
Q4*V4*COS(DELTA4))/((A1+A2)*16.1)+FRICTION LOSSES
UPSTREAM: MANNING'S N = 0.01300; FRICTION SLOPE = 0.33451
DOWNSTREAM: MANNING'S N = 0.01300; FRICTION SLOPE = 0.21023
AVERAGED FRICTION SLOPE IN JUNCTION ASSUMED AS 0.27237
JUNCTION LENGTH = 4.00 FEET
FRICTION LOSSES = 1.089 FEET ENTRANCE LOSSES = 0.000 FEET
JUNCTION LOSSES = (DY+HV1-HV2)+(ENTRANCE LOSSES)
JUNCTION LOSSES = (2.032)+(0.000) = 2.032

NODE 1053.00 : HGL = < 570.773>;EGL= < 576.981>;FLOWLINE= < 570.500>

****

FLOW PROCESS FROM NODE 1053.00 TO NODE 1052.00 IS CODE = 1
UPSTREAM NODE 1052.00 ELEVATION = 605.68 (FLOW IS SUPERCRITICAL)

CALCULATE FRICTION LOSSES(LACFCD):
PIPE FLOW = 4.40 CFS PIPE DIAMETER = 18.00 INCHES

PIPE LENGTH = 78.40 FEET MANNING'S N = 0.01300

NORMAL DEPTH(FT) = 0.25 CRITICAL DEPTH(FT) = 0.80

UPSTREAM CONTROL ASSUMED FLOWDEPTH(FT) = 0.80

GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:

DISTANCE FROM CONTROL(FT)	FLOW DEPTH (FT)	VELOCITY (FT/SEC)	SPECIFIC ENERGY(FT)	PRESSURE+ MOMENTUM(POUNDS)
0.000	0.805	4.557	1.127	59.56
0.003	0.783	4.718	1.128	59.63
0.011	0.761	4.891	1.132	59.85
0.027	0.739	5.077	1.139	60.23
0.050	0.716	5.278	1.149	60.78
0.083	0.694	5.496	1.164	61.51
0.126	0.672	5.731	1.183	62.44
0.183	0.650	5.987	1.207	63.59
0.254	0.628	6.265	1.238	64.98
0.342	0.606	6.569	1.277	66.63
0.453	0.584	6.902	1.325	68.57
0.589	0.562	7.268	1.383	70.84
0.756	0.540	7.672	1.455	73.47
0.963	0.518	8.119	1.543	76.52
1.218	0.496	8.615	1.650	80.03
1.535	0.474	9.170	1.781	84.09
1.931	0.452	9.793	1.943	88.76
2.432	0.430	10.496	2.142	94.16
3.071	0.408	11.295	2.391	100.42
3.905	0.386	12.208	2.702	107.69
5.017	0.364	13.261	3.097	116.20
6.553	0.342	14.484	3.602	126.19
8.790	0.320	15.920	4.258	138.04
12.353	0.298	17.624	5.124	152.21
19.263	0.276	19.672	6.289	169.36
78.400	0.273	19.989	6.481	172.02

NODE 1052.00 : HGL = < 606.484>;EGL= < 606.807>;FLOWLINE= < 605.680>

****

FLOW PROCESS FROM NODE 1052.00 TO NODE 1052.00 IS CODE = 8
UPSTREAM NODE 1052.00 ELEVATION = 605.68 (FLOW IS AT CRITICAL DEPTH)

CALCULATE CATCH BASIN ENTRANCE LOSSES(LACFCD):
PIPE FLOW = 4.40 CFS PIPE DIAMETER = 18.00 INCHES
FLOW VELOCITY = 4.56 FEET/SEC. VELOCITY HEAD = 0.323 FEET
CATCH BASIN ENERGY LOSS = .2*(VELOCITY HEAD) = .2*(0.323) = 0.065

NODE 1052.00 : HGL = < 606.872>;EGL= < 606.872>;FLOWLINE= < 605.680>

****

UPSTREAM PIPE FLOW CONTROL DATA:
NODE NUMBER = 1052.00 FLOWLINE ELEVATION = 605.68
ASSUMED UPSTREAM CONTROL HGL = 606.48 FOR DOWNSTREAM RUN ANALYSIS

END OF GRADUALLY VARIED FLOW ANALYSIS

```
*****************************************************************************
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                          Analysis prepared by:

                        Rick Engineering Company
                            5620 Friars Road
                          San Diego, CA  92110
                             (619) 291-0707

 ************************** DESCRIPTION OF STUDY **************************
 * BLACK MOUNTAIN RANCH EAST CLUSTERS UNIT 3, J-15149-B                     *
 * LATERAL AT NODE 1100 WEST - 100-YR FLOW                                  *
 * H:\15149B\HYDRO\HYDRAULICS\PIPEFLOW\....                                 *
 **************************************************************************

  FILE NAME: 1100W.LAT
  TIME/DATE OF STUDY: 14:15 07/01/2014

*****************************************************************************
              GRADUALLY VARIED FLOW ANALYSIS FOR PIPE SYSTEM
                        NODAL POINT STATUS TABLE
               (Note: "*" indicates nodal point data used.)
                    UPSTREAM RUN                       DOWNSTREAM RUN
  NODE    MODEL   PRESSURE     PRESSURE+          FLOW       PRESSURE+
 NUMBER  PROCESS  HEAD(FT)  MOMENTUM(POUNDS)   DEPTH(FT)  MOMENTUM(POUNDS)
 1100.00-            0.75 Dc          49.22        0.40*            78.92
        } FRICTION+BEND
 1046.00-            0.75*Dc          49.22        0.74*Dc          49.22
        } JUNCTION
 1046.00-            0.88             51.57        0.62*            51.63
        } FRICTION
 1042.00-            0.75*Dc          49.22        0.75*Dc          49.22
        } CATCH BASIN
 1042.00-            1.10*            26.67        0.75 Dc          17.28
-----------------------------------------------------------------------------
 MAXIMUM NUMBER OF ENERGY BALANCES USED IN EACH PROFILE =  25
-----------------------------------------------------------------------------
 NOTE: STEADY FLOW HYDRAULIC HEAD-LOSS COMPUTATIONS BASED ON THE MOST
 CONSERVATIVE FORMULAE FROM THE CURRENT LACRD,LACFCD, AND OCEMA
 DESIGN MANUALS.
*****************************************************************************
 DOWNSTREAM PIPE FLOW CONTROL DATA:
 NODE NUMBER =  1100.00             FLOWLINE ELEVATION =   547.06
 PIPE FLOW =        3.80 CFS        PIPE DIAMETER =  18.00 INCHES
 ASSUMED DOWNSTREAM CONTROL HGL =    546.900 FEET
 *NOTE: ASSUMED DOWNSTREAM CONTROL DEPTH( -0.16 FT.)
        IS LESS THAN CRITICAL DEPTH(  0.75 FT.)
 ===> CRITICAL DEPTH IS ASSUMED AS DOWNSTREAM CONTROL DEPTH
      FOR UPSTREAM RUN ANALYSIS
-----------------------------------------------------------------------------
 NODE  1100.00 : HGL = <  547.456>;EGL= <  549.073>;FLOWLINE= <  547.060>

*****************************************************************************
 FLOW PROCESS FROM NODE  1100.00 TO NODE  1046.00 IS CODE =  3
 UPSTREAM NODE  1046.00      ELEVATION =   551.37  (FLOW IS SUPERCRITICAL)
-----------------------------------------------------------------------------
```

CALCULATE PIPE-BEND LOSSES(OCEMA):

PIPE FLOW = 3.80 CFS PIPE DIAMETER = 18.00 INCHES

CENTRAL ANGLE = 5.000 DEGREES MANNING'S N = 0.01300

PIPE LENGTH = 66.30 FEET

NORMAL DEPTH(FT) = 0.38 CRITICAL DEPTH(FT) = 0.75

===

UPSTREAM CONTROL ASSUMED FLOWDEPTH(FT) = 0.74

===

GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:

DISTANCE FROM CONTROL(FT)	FLOW DEPTH (FT)	VELOCITY (FT/SEC)	SPECIFIC ENERGY(FT)	PRESSURE+ MOMENTUM(POUNDS)
0.000	0.742	4.358	1.037	49.22
0.013	0.728	4.469	1.038	49.26
0.047	0.713	4.586	1.040	49.36
0.103	0.699	4.708	1.043	49.53
0.185	0.684	4.838	1.048	49.77
0.296	0.670	4.974	1.054	50.08
0.439	0.656	5.118	1.063	50.46
0.619	0.641	5.270	1.073	50.92
0.841	0.627	5.431	1.085	51.47
1.111	0.612	5.601	1.100	52.10
1.438	0.598	5.782	1.117	52.84
1.830	0.583	5.974	1.138	53.67
2.298	0.569	6.178	1.162	54.61
2.857	0.555	6.396	1.190	55.67
3.525	0.540	6.628	1.223	56.86
4.326	0.526	6.877	1.261	58.18
5.289	0.511	7.143	1.304	59.65
6.459	0.497	7.428	1.354	61.28
7.893	0.483	7.735	1.412	63.09
9.681	0.468	8.065	1.479	65.09
11.956	0.454	8.422	1.556	67.31
14.949	0.439	8.808	1.645	69.75
19.086	0.425	9.227	1.748	72.46
25.331	0.411	9.682	1.867	75.46
36.777	0.396	10.180	2.006	78.78
66.300	0.396	10.202	2.013	78.92

NODE 1046.00 : HGL = < 552.112>;EGL= < 552.407>;FLOWLINE= < 551.370>

****

FLOW PROCESS FROM NODE 1046.00 TO NODE 1046.00 IS CODE = 5

UPSTREAM NODE 1046.00 ELEVATION = 551.70 (FLOW IS AT CRITICAL DEPTH)

(NOTE: POSSIBLE JUMP IN OR UPSTREAM OF STRUCTURE)

CALCULATE JUNCTION LOSSES:

PIPE	FLOW (CFS)	DIAMETER (INCHES)	ANGLE (DEGREES)	FLOWLINE ELEVATION	CRITICAL DEPTH(FT.)	VELOCITY (FT/SEC)
UPSTREAM	3.80	18.00	78.00	551.70	0.75	5.478
DOWNSTREAM	3.80	18.00	-	551.37	0.75	4.360
LATERAL #1	0.00	0.00	0.00	0.00	0.00	0.000
LATERAL #2	0.00	0.00	0.00	0.00	0.00	0.000
Q5	0.00===Q5 EQUALS BASIN INPUT===					

LACFCD AND OCEMA FLOW JUNCTION FORMULAE USED:

DY=(Q2*V2-Q1*V1*COS(DELTA1)-Q3*V3*COS(DELTA3)-
Q4*V4*COS(DELTA4))/((A1+A2)*16.1)+FRICTION LOSSES

UPSTREAM: MANNING'S N = 0.01300; FRICTION SLOPE = 0.01006

DOWNSTREAM: MANNING'S N = 0.01300; FRICTION SLOPE = 0.00543

AVERAGED FRICTION SLOPE IN JUNCTION ASSUMED AS 0.00775
JUNCTION LENGTH = 4.00 FEET
FRICTION LOSSES = 0.031 FEET ENTRANCE LOSSES = 0.000 FEET
JUNCTION LOSSES = (DY+HV1-HV2)+(ENTRANCE LOSSES)
JUNCTION LOSSES = (0.382)+(0.000) = 0.382

NODE 1046.00 : HGL = < 552.323>;EGL= < 552.789>;FLOWLINE= < 551.700>

****

FLOW PROCESS FROM NODE 1046.00 TO NODE 1042.00 IS CODE = 1
UPSTREAM NODE 1042.00 ELEVATION = 551.98 (FLOW IS SUPERCRITICAL)

CALCULATE FRICTION LOSSES(LACFCD):
PIPE FLOW = 3.80 CFS PIPE DIAMETER = 18.00 INCHES
PIPE LENGTH = 25.80 FEET MANNING'S N = 0.01300

NORMAL DEPTH(FT) = 0.61 CRITICAL DEPTH(FT) = 0.75

===

UPSTREAM CONTROL ASSUMED FLOWDEPTH(FT) = 0.75

===

GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:

DISTANCE FROM CONTROL(FT)	FLOW DEPTH (FT)	VELOCITY (FT/SEC)	SPECIFIC ENERGY(FT)	PRESSURE+ MOMENTUM(POUNDS)
0.000	0.745	4.336	1.037	49.22
0.014	0.740	4.376	1.037	49.22
0.058	0.734	4.417	1.037	49.23
0.134	0.729	4.459	1.038	49.25
0.245	0.723	4.502	1.038	49.28
0.396	0.718	4.546	1.039	49.32
0.590	0.713	4.590	1.040	49.37
0.832	0.707	4.636	1.041	49.43
1.128	0.702	4.682	1.042	49.49
1.484	0.696	4.729	1.044	49.57
1.908	0.691	4.777	1.046	49.65
2.410	0.686	4.826	1.048	49.75
3.002	0.680	4.876	1.050	49.85
3.698	0.675	4.927	1.052	49.96
4.516	0.669	4.979	1.055	50.09
5.481	0.664	5.032	1.058	50.22
6.622	0.659	5.087	1.061	50.37
7.984	0.653	5.142	1.064	50.53
9.623	0.648	5.199	1.068	50.70
11.628	0.642	5.256	1.072	50.88
14.132	0.637	5.315	1.076	51.07
17.359	0.632	5.376	1.081	51.27
21.733	0.626	5.437	1.086	51.49
25.800	0.623	5.477	1.089	51.63

NODE 1042.00 : HGL = < 552.725>;EGL= < 553.017>;FLOWLINE= < 551.980>

****

FLOW PROCESS FROM NODE 1042.00 TO NODE 1042.00 IS CODE = 8
UPSTREAM NODE 1042.00 ELEVATION = 551.98 (FLOW IS AT CRITICAL DEPTH)

CALCULATE CATCH BASIN ENTRANCE LOSSES(LACFCD):
PIPE FLOW = 3.80 CFS PIPE DIAMETER = 18.00 INCHES
FLOW VELOCITY = 4.34 FEET/SEC. VELOCITY HEAD = 0.292 FEET
CATCH BASIN ENERGY LOSS = .2*(VELOCITY HEAD) = .2*(0.292) = 0.058

NODE 1042.00 : HGL = < 553.076>;EGL= < 553.076>;FLOWLINE= < 551.980>

****

UPSTREAM PIPE FLOW CONTROL DATA:

NODE NUMBER = 1042.00 FLOWLINE ELEVATION = 551.98

ASSUMED UPSTREAM CONTROL HGL = 552.73 FOR DOWNSTREAM RUN ANALYSIS

==

END OF GRADUALLY VARIED FLOW ANALYSIS

```
****************************************************************************
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                      Analysis prepared by:

                     Rick Engineering Company
                        5620 Friars Road
                      San Diego, CA  92110
                         (619) 291-0707

 ************************** DESCRIPTION OF STUDY **************************
 * BLACK MOUNTAIN RANCH EAST CLUSTERS UNIT 3, J-15149-B                    *
 * WESTERLY LATERAL AT NODE 1105                                           *
 * 100-YR FLOW                                                             *
 **************************************************************************

  FILE NAME: 1105W.LAT
  TIME/DATE OF STUDY: 10:18 07/01/2014
****************************************************************************
           GRADUALLY VARIED FLOW ANALYSIS FOR PIPE SYSTEM
                     NODAL POINT STATUS TABLE
             (Note: "*" indicates nodal point data used.)
                  UPSTREAM RUN                       DOWNSTREAM RUN
  NODE    MODEL   PRESSURE      PRESSURE+         FLOW        PRESSURE+
 NUMBER  PROCESS  HEAD(FT)  MOMENTUM(POUNDS)   DEPTH(FT)  MOMENTUM(POUNDS)
 1105.00-             0.84 Dc          66.74       0.41*             118.64
        } FRICTION
 1045.00-             0.84*Dc          66.74       0.84*Dc            66.74
        } CATCH BASIN
 1045.00-             1.25*            36.72       0.84 Dc            23.02
----------------------------------------------------------------------------
 MAXIMUM NUMBER OF ENERGY BALANCES USED IN EACH PROFILE =  25
----------------------------------------------------------------------------
 NOTE: STEADY FLOW HYDRAULIC HEAD-LOSS COMPUTATIONS BASED ON THE MOST
 CONSERVATIVE FORMULAE FROM THE CURRENT LACRD,LACFCD, AND OCEMA
 DESIGN MANUALS.
****************************************************************************
 DOWNSTREAM PIPE FLOW CONTROL DATA:
 NODE NUMBER =  1105.00            FLOWLINE ELEVATION =   546.39
 PIPE FLOW =        4.80 CFS       PIPE DIAMETER =  18.00 INCHES
 ASSUMED DOWNSTREAM CONTROL HGL =   546.900 FEET
 *NOTE: ASSUMED DOWNSTREAM CONTROL DEPTH(  0.51 FT.)
        IS LESS THAN CRITICAL DEPTH(  0.84 FT.)
 ===> CRITICAL DEPTH IS ASSUMED AS DOWNSTREAM CONTROL DEPTH
      FOR UPSTREAM RUN ANALYSIS
----------------------------------------------------------------------------
 NODE  1105.00 : HGL = <  546.799>;EGL= <  549.154>;FLOWLINE= <  546.390>

****************************************************************************
 FLOW PROCESS FROM NODE  1105.00 TO NODE  1045.00 IS CODE =  1
 UPSTREAM NODE  1045.00     ELEVATION =   548.44  (FLOW IS SUPERCRITICAL)
----------------------------------------------------------------------------
 CALCULATE FRICTION LOSSES(LACFCD):
 PIPE FLOW    =        4.80 CFS     PIPE DIAMETER =  18.00 INCHES
 PIPE LENGTH =        10.30 FEET          MANNING'S N  =  0.01300
----------------------------------------------------------------------------
```

NORMAL DEPTH(FT) = 0.32 CRITICAL DEPTH(FT) = 0.84

===

UPSTREAM CONTROL ASSUMED FLOWDEPTH(FT) = 0.84

===

GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:

DISTANCE FROM CONTROL(FT)	FLOW DEPTH (FT)	VELOCITY (FT/SEC)	SPECIFIC ENERGY(FT)	PRESSURE+ MOMENTUM(POUNDS)
0.000	0.842	4.699	1.185	66.74
0.005	0.821	4.845	1.186	66.80
0.022	0.801	5.001	1.189	67.00
0.052	0.780	5.169	1.195	67.33
0.096	0.759	5.347	1.203	67.82
0.158	0.738	5.539	1.215	68.46
0.239	0.718	5.745	1.231	69.28
0.343	0.697	5.967	1.250	70.28
0.473	0.676	6.206	1.275	71.48
0.634	0.656	6.464	1.305	72.91
0.833	0.635	6.743	1.341	74.57
1.074	0.614	7.047	1.386	76.49
1.369	0.593	7.377	1.439	78.70
1.726	0.573	7.737	1.503	81.23
2.162	0.552	8.131	1.579	84.12
2.695	0.531	8.564	1.671	87.40
3.350	0.511	9.042	1.781	91.14
4.162	0.490	9.570	1.913	95.39
5.181	0.469	10.157	2.072	100.22
6.481	0.448	10.812	2.265	105.73
8.179	0.428	11.547	2.500	112.01
10.300	0.409	12.312	2.764	118.64

NODE 1045.00 : HGL = < 549.282>;EGL= < 549.625>;FLOWLINE= < 548.440>

****

FLOW PROCESS FROM NODE 1045.00 TO NODE 1045.00 IS CODE = 8
UPSTREAM NODE 1045.00 ELEVATION = 548.44 (FLOW IS AT CRITICAL DEPTH)

CALCULATE CATCH BASIN ENTRANCE LOSSES(LACFCD):
PIPE FLOW = 4.80 CFS PIPE DIAMETER = 18.00 INCHES
FLOW VELOCITY = 4.70 FEET/SEC. VELOCITY HEAD = 0.343 FEET
CATCH BASIN ENERGY LOSS = .2*(VELOCITY HEAD) = .2*(0.343) = 0.069

NODE 1045.00 : HGL = < 549.694>;EGL= < 549.694>;FLOWLINE= < 548.440>

****

UPSTREAM PIPE FLOW CONTROL DATA:
NODE NUMBER = 1045.00 FLOWLINE ELEVATION = 548.44
ASSUMED UPSTREAM CONTROL HGL = 549.28 FOR DOWNSTREAM RUN ANALYSIS

===

END OF GRADUALLY VARIED FLOW ANALYSIS

```
****************************************************************************
          PIPE-FLOW HYDRAULICS COMPUTER PROGRAM PACKAGE
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                    Analysis prepared by:

                  Rick Engineering Company
                      5620 Friars Road
                    San Diego, CA  92110
                       (619) 291-0707

 ************************** DESCRIPTION OF STUDY **************************
 * BLACK MOUNTAIN RANCH EAST CLUSTERS UNIT 3, J-15149-B                    *
 * EASTERLY LATERAL AT NODE 1160                                           *
 * 100-YR FLOW                                                             *
 **************************************************************************

  FILE NAME: 1160E.LAT
  TIME/DATE OF STUDY: 09:48 07/01/2014

****************************************************************************
         GRADUALLY VARIED FLOW ANALYSIS FOR PIPE SYSTEM
                   NODAL POINT STATUS TABLE
           (Note: "*" indicates nodal point data used.)
                 UPSTREAM RUN                     DOWNSTREAM RUN
  NODE    MODEL   PRESSURE    PRESSURE+         FLOW      PRESSURE+
 NUMBER  PROCESS  HEAD(FT)  MOMENTUM(POUNDS)  DEPTH(FT)  MOMENTUM(POUNDS)
 1160.00-          0.77 Dc          52.61       0.66*             54.55
        } FRICTION
 1150.00-          0.77*Dc          52.61       0.77*Dc           52.61
        } CATCH BASIN
 1150.00-          1.13*            28.58       0.77 Dc           18.41
---------------------------------------------------------------------------
 MAXIMUM NUMBER OF ENERGY BALANCES USED IN EACH PROFILE =  25
---------------------------------------------------------------------------
 NOTE: STEADY FLOW HYDRAULIC HEAD-LOSS COMPUTATIONS BASED ON THE MOST
 CONSERVATIVE FORMULAE FROM THE CURRENT LACRD,LACFCD, AND OCEMA
 DESIGN MANUALS.
****************************************************************************
 DOWNSTREAM PIPE FLOW CONTROL DATA:
 NODE NUMBER =  1160.00            FLOWLINE ELEVATION =   532.60
 PIPE FLOW =        4.00 CFS       PIPE DIAMETER =  18.00 INCHES
 ASSUMED DOWNSTREAM CONTROL HGL =    532.500 FEET
 *NOTE: ASSUMED DOWNSTREAM CONTROL DEPTH( -0.10 FT.)
        IS LESS THAN CRITICAL DEPTH(  0.77 FT.)
 ===> CRITICAL DEPTH IS ASSUMED AS DOWNSTREAM CONTROL DEPTH
      FOR UPSTREAM RUN ANALYSIS
---------------------------------------------------------------------------
 NODE  1160.00 : HGL = <  533.255>;EGL= <  533.707>;FLOWLINE= <  532.600>

****************************************************************************
 FLOW PROCESS FROM NODE  1160.00 TO NODE  1150.00 IS CODE =  1
 UPSTREAM NODE  1150.00     ELEVATION =   532.85  (FLOW IS SUPERCRITICAL)
---------------------------------------------------------------------------
 CALCULATE FRICTION LOSSES(LACFCD):
 PIPE FLOW    =        4.00 CFS     PIPE DIAMETER =  18.00 INCHES
 PIPE LENGTH =       25.30 FEET          MANNING'S N  =  0.01300
---------------------------------------------------------------------------
```

NORMAL DEPTH(FT) = 0.64 CRITICAL DEPTH(FT) = 0.77

===

UPSTREAM CONTROL ASSUMED FLOWDEPTH(FT) = 0.77

===

GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:

DISTANCE FROM CONTROL(FT)	FLOW DEPTH (FT)	VELOCITY (FT/SEC)	SPECIFIC ENERGY(FT)	PRESSURE+ MOMENTUM(POUNDS)
0.000	0.765	4.411	1.068	52.61
0.014	0.761	4.446	1.068	52.61
0.056	0.756	4.483	1.068	52.62
0.129	0.751	4.520	1.068	52.64
0.237	0.746	4.557	1.069	52.66
0.383	0.741	4.595	1.069	52.69
0.570	0.736	4.634	1.070	52.73
0.803	0.731	4.673	1.071	52.78
1.088	0.727	4.714	1.072	52.83
1.431	0.722	4.754	1.073	52.89
1.840	0.717	4.796	1.074	52.96
2.324	0.712	4.838	1.076	53.03
2.893	0.707	4.881	1.077	53.12
3.563	0.702	4.925	1.079	53.21
4.350	0.697	4.969	1.081	53.31
5.277	0.693	5.014	1.083	53.42
6.374	0.688	5.060	1.086	53.53
7.681	0.683	5.107	1.088	53.66
9.255	0.678	5.155	1.091	53.79
11.179	0.673	5.204	1.094	53.94
13.581	0.668	5.253	1.097	54.09
16.675	0.663	5.304	1.100	54.25
20.866	0.659	5.355	1.104	54.42
25.300	0.655	5.392	1.107	54.55

NODE 1150.00 : HGL = < 533.615>;EGL= < 533.918>;FLOWLINE= < 532.850>

****

FLOW PROCESS FROM NODE 1150.00 TO NODE 1150.00 IS CODE = 8
UPSTREAM NODE 1150.00 ELEVATION = 532.85 (FLOW IS AT CRITICAL DEPTH)

CALCULATE CATCH BASIN ENTRANCE LOSSES(LACFCD):
PIPE FLOW = 4.00 CFS PIPE DIAMETER = 18.00 INCHES
FLOW VELOCITY = 4.41 FEET/SEC. VELOCITY HEAD = 0.302 FEET
CATCH BASIN ENERGY LOSS = .2*(VELOCITY HEAD) = .2*(0.302) = 0.060

NODE 1150.00 : HGL = < 533.978>;EGL= < 533.978>;FLOWLINE= < 532.850>

****

UPSTREAM PIPE FLOW CONTROL DATA:
NODE NUMBER = 1150.00 FLOWLINE ELEVATION = 532.85
ASSUMED UPSTREAM CONTROL HGL = 533.62 FOR DOWNSTREAM RUN ANALYSIS

===

END OF GRADUALLY VARIED FLOW ANALYSIS

```
****************************************************************************
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                    Analysis prepared by:

                  Rick Engineering Company
                     5620 Friars Road
                   San Diego, CA  92110
                      (619) 291-0707

 ************************** DESCRIPTION OF STUDY **************************
* BLACK MOUNTAIN RANCH EAST CLUSTERS UNIT 3, J-15149-B                     *
* WESTERLY LATERAL AT NODE 1160                                            *
* 100-YR FLOW                                                              *
 **************************************************************************

  FILE NAME: 1160W.LAT
  TIME/DATE OF STUDY: 10:01 07/01/2014

****************************************************************************
            GRADUALLY VARIED FLOW ANALYSIS FOR PIPE SYSTEM
                       NODAL POINT STATUS TABLE
             (Note: "*" indicates nodal point data used.)
                   UPSTREAM RUN                     DOWNSTREAM RUN
  NODE    MODEL   PRESSURE     PRESSURE+        FLOW        PRESSURE+
 NUMBER  PROCESS  HEAD(FT)  MOMENTUM(POUNDS)  DEPTH(FT)  MOMENTUM(POUNDS)
1160.00-            1.05 Dc        116.40        0.77*          131.32
        } FRICTION
1120.00-            1.05*Dc        116.40        1.05*Dc        116.40
        } CATCH BASIN
1120.00-            1.62*           95.88        1.05 Dc         37.95
----------------------------------------------------------------------------
 MAXIMUM NUMBER OF ENERGY BALANCES USED IN EACH PROFILE =  25
----------------------------------------------------------------------------
 NOTE: STEADY FLOW HYDRAULIC HEAD-LOSS COMPUTATIONS BASED ON THE MOST
 CONSERVATIVE FORMULAE FROM THE CURRENT LACRD,LACFCD, AND OCEMA
 DESIGN MANUALS.
****************************************************************************
 DOWNSTREAM PIPE FLOW CONTROL DATA:
 NODE NUMBER =  1160.00            FLOWLINE ELEVATION =   532.60
 PIPE FLOW =        7.30 CFS       PIPE DIAMETER =  18.00 INCHES
 ASSUMED DOWNSTREAM CONTROL HGL =   532.500 FEET
 *NOTE: ASSUMED DOWNSTREAM CONTROL DEPTH( -0.10 FT.)
        IS LESS THAN CRITICAL DEPTH(  1.05 FT.)
 ===> CRITICAL DEPTH IS ASSUMED AS DOWNSTREAM CONTROL DEPTH
      FOR UPSTREAM RUN ANALYSIS
----------------------------------------------------------------------------
 NODE  1160.00 : HGL = <  533.373>;EGL= <  534.355>;FLOWLINE= <  532.600>

****************************************************************************
 FLOW PROCESS FROM NODE  1160.00 TO NODE  1120.00 IS CODE =  1
 UPSTREAM NODE  1120.00     ELEVATION =   532.97  (FLOW IS SUPERCRITICAL)
----------------------------------------------------------------------------
 CALCULATE FRICTION LOSSES(LACFCD):
 PIPE FLOW    =        7.30 CFS     PIPE DIAMETER =  18.00 INCHES
 PIPE LENGTH =       10.30 FEET          MANNING'S N  =  0.01300
----------------------------------------------------------------------------
```

NORMAL DEPTH(FT) = 0.63 CRITICAL DEPTH(FT) = 1.05

UPSTREAM CONTROL ASSUMED FLOWDEPTH(FT) = 1.05

GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:

DISTANCE FROM CONTROL(FT)	FLOW DEPTH (FT)	VELOCITY (FT/SEC)	SPECIFIC ENERGY(FT)	PRESSURE+ MOMENTUM(POUNDS)
0.000	1.046	5.544	1.524	116.40
0.019	1.030	5.644	1.525	116.45
0.077	1.013	5.747	1.526	116.58
0.180	0.996	5.856	1.529	116.81
0.332	0.980	5.970	1.533	117.13
0.538	0.963	6.089	1.539	117.56
0.806	0.946	6.215	1.546	118.09
1.141	0.929	6.346	1.555	118.74
1.555	0.913	6.483	1.566	119.50
2.056	0.896	6.628	1.578	120.38
2.658	0.879	6.780	1.593	121.39
3.376	0.863	6.939	1.611	122.54
4.230	0.846	7.107	1.631	123.83
5.242	0.829	7.283	1.653	125.27
6.444	0.812	7.469	1.679	126.87
7.873	0.796	7.666	1.709	128.64
9.580	0.779	7.873	1.742	130.59
10.300	0.773	7.948	1.755	131.32

NODE 1120.00 : HGL = < 534.016>;EGL= < 534.494>;FLOWLINE= < 532.970>

****

FLOW PROCESS FROM NODE 1120.00 TO NODE 1120.00 IS CODE = 8
UPSTREAM NODE 1120.00 ELEVATION = 532.97 (FLOW IS AT CRITICAL DEPTH)

CALCULATE CATCH BASIN ENTRANCE LOSSES(LACFCD):
PIPE FLOW = 7.30 CFS PIPE DIAMETER = 18.00 INCHES
FLOW VELOCITY = 5.55 FEET/SEC. VELOCITY HEAD = 0.478 FEET
CATCH BASIN ENERGY LOSS = .2*(VELOCITY HEAD) = .2*(0.478) = 0.096

NODE 1120.00 : HGL = < 534.589>;EGL= < 534.589>;FLOWLINE= < 532.970>

****

UPSTREAM PIPE FLOW CONTROL DATA:
NODE NUMBER = 1120.00 FLOWLINE ELEVATION = 532.97
ASSUMED UPSTREAM CONTROL HGL = 534.02 FOR DOWNSTREAM RUN ANALYSIS

END OF GRADUALLY VARIED FLOW ANALYSIS

```
****************************************************************************
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                     Analysis prepared by:

                   Rick Engineering Company
                      5620 Friars Road
                    San Diego, CA  92110
                       (619) 291-0707

 ************************** DESCRIPTION OF STUDY *************************
 * BLACK MOUNTAIN RANCH EAST CLUSTERS UNIT 3, J-15149-B                   *
 * MAINLINE PIPE BASIN 1000 - 100-YR FLOW                                 *
 * H:\15149B\HYDRO\HYDRAULICS\PIPEFLOW\....                               *
 **************************************************************************

  FILE NAME: 1182.PIP
  TIME/DATE OF STUDY: 13:49 07/23/2014

****************************************************************************
          GRADUALLY VARIED FLOW ANALYSIS FOR PIPE SYSTEM
                  NODAL POINT STATUS TABLE
           (Note: "*" indicates nodal point data used.)
```

NODE NUMBER	MODEL PROCESS	UPSTREAM RUN PRESSURE HEAD(FT)	UPSTREAM RUN PRESSURE+ MOMENTUM(POUNDS)	DOWNSTREAM RUN FLOW DEPTH(FT)	DOWNSTREAM RUN PRESSURE+ MOMENTUM(POUNDS)
1182.00-		5.50*	5104.20	3.34 Dc	3718.78
	} FRICTION				
1173.00-		5.53*	5126.67	3.34 Dc	3718.78
	} JUNCTION				
1173.00-		6.29	5809.56	1.73*	6470.89
	} FRICTION+BEND				
1172.00-		3.27 Dc	4085.04	1.65*	6862.06
	} JUNCTION				
1172.00-		3.27 Dc	4085.04	1.63*	6917.09
	} FRICTION+BEND				
1171.00-		3.27 Dc	4085.04	1.72*	6525.67
	} FRICTION				
1160.00-		3.27 Dc	4085.04	2.14*	5159.98
	} JUNCTION				
1160.00-		3.89	3924.04	1.87*	5128.78
	} FRICTION+BEND				
1160.50-		3.21 Dc	3628.46	2.41*	4065.45
	} FRICTION				
1105.00-		3.21 Dc	3628.46	2.61*	3863.65
	} JUNCTION				
1105.00-		3.39	3481.05	2.48*	3762.31
	} FRICTION				
1100.00-		3.72	3654.15	2.24*	4055.65
	} JUNCTION				
1100.00-		3.86	3287.18	1.72*	3969.20
	} FRICTION				
1095.00-		2.85 Dc	2884.13	1.96*	3506.85
	} FRICTION+BEND				
1092.00-		2.85 Dc	2884.13	2.15*	3244.80
	} FRICTION				
1031.00-		2.85 Dc	2884.13	2.22*	3174.31

```
         } JUNCTION
1031.00-            3.18            2769.27         2.01*           3120.39
         } FRICTION
1030.00-            3.19            2773.30         1.85*           3364.53
         } JUNCTION
1030.00-            4.37            2576.92         1.28*           3322.94
         } FRICTION
1029.00-            2.65 Dc         1915.75         1.34*           3141.02
         } FRICTION+BEND
1028.00-            2.65 Dc         1915.75         1.51*           2749.78
         } FRICTION
1015.00-            2.65 Dc         1915.75         1.50*           2763.13
         } JUNCTION
1015.00-            3.06            1792.83         1.30*           2764.39
         } FRICTION
1014.00-            2.56 Dc         1690.90         2.11*           1781.21
         } JUNCTION
1014.00-            2.56*Dc         1690.90         2.56*Dc         1690.90
         } CATCH BASIN
1014.00-            4.38*           1270.25         2.56 Dc          475.16
------------------------------------------------------------------------------
 MAXIMUM NUMBER OF ENERGY BALANCES USED IN EACH PROFILE =  25
------------------------------------------------------------------------------
 NOTE: STEADY FLOW HYDRAULIC HEAD-LOSS COMPUTATIONS BASED ON THE MOST
 CONSERVATIVE FORMULAE FROM THE CURRENT LACRD,LACFCD, AND OCEMA
 DESIGN MANUALS.
******************************************************************************
 DOWNSTREAM PIPE FLOW CONTROL DATA:
 NODE NUMBER =  1182.00             FLOWLINE ELEVATION =    501.00
 PIPE FLOW =       123.70 CFS       PIPE DIAMETER =  48.00 INCHES
 ASSUMED DOWNSTREAM CONTROL HGL =    506.500 FEET
------------------------------------------------------------------------------
 NODE  1182.00 : HGL = <   506.500>;EGL= <   508.005>;FLOWLINE= <   501.000>

******************************************************************************
 FLOW PROCESS FROM NODE  1182.00 TO NODE  1173.00 IS CODE =  1
 UPSTREAM NODE  1173.00      ELEVATION =    501.40  (FLOW IS UNDER PRESSURE)
------------------------------------------------------------------------------
 CALCULATE FRICTION LOSSES(LACFCD):
 PIPE FLOW    =       123.70 CFS     PIPE DIAMETER =  48.00 INCHES
 PIPE LENGTH =         57.80 FEET          MANNING'S N  =  0.01300
 SF=(Q/K)**2 = ((     123.70)/(  1436.423))**2 = 0.00742
 HF=L*SF = (      57.80)*(0.00742) =       0.429
------------------------------------------------------------------------------
 NODE  1173.00 : HGL = <   506.929>;EGL= <   508.433>;FLOWLINE= <   501.400>

******************************************************************************
 FLOW PROCESS FROM NODE  1173.00 TO NODE  1173.00 IS CODE =  5
 UPSTREAM NODE  1173.00      ELEVATION =    501.73  (FLOW IS UNDER PRESSURE)
 (NOTE: POSSIBLE JUMP IN OR UPSTREAM OF STRUCTURE)
------------------------------------------------------------------------------
 CALCULATE JUNCTION LOSSES:
      PIPE          FLOW    DIAMETER   ANGLE    FLOWLINE   CRITICAL   VELOCITY
                    (CFS)   (INCHES) (DEGREES) ELEVATION DEPTH(FT.)   (FT/SEC)
   UPSTREAM        123.70    42.00     58.00    501.73      3.27       26.088
  DOWNSTREAM       123.70    48.00       -      501.40      3.34        9.844
  LATERAL #1         0.00     0.00      0.00      0.00      0.00        0.000
  LATERAL #2         0.00     0.00      0.00      0.00      0.00        0.000
     Q5              0.00===Q5 EQUALS BASIN INPUT===

 LACFCD AND OCEMA FLOW JUNCTION FORMULAE USED:
```

```
DY=(Q2*V2-Q1*V1*COS(DELTA1)-Q3*V3*COS(DELTA3)-
    Q4*V4*COS(DELTA4))/((A1+A2)*16.1)+FRICTION LOSSES
UPSTREAM:     MANNING'S N = 0.01300;  FRICTION SLOPE = 0.06284
DOWNSTREAM:   MANNING'S N = 0.01300;  FRICTION SLOPE = 0.00742
AVERAGED FRICTION SLOPE IN JUNCTION ASSUMED AS 0.03513
JUNCTION LENGTH =    4.00 FEET
FRICTION LOSSES =   0.141 FEET          ENTRANCE LOSSES =   0.000 FEET
JUNCTION LOSSES = (DY+HV1-HV2)+(ENTRANCE LOSSES)
JUNCTION LOSSES = ( 5.595)+( 0.000) =    5.595
------------------------------------------------------------------------------
NODE  1173.00 : HGL = <  503.460>;EGL= <  514.029>;FLOWLINE= <  501.730>

******************************************************************************
FLOW PROCESS FROM NODE  1173.00 TO NODE  1172.00 IS CODE =  3
UPSTREAM NODE  1172.00       ELEVATION =   513.98  (FLOW IS SUPERCRITICAL)
------------------------------------------------------------------------------
CALCULATE PIPE-BEND LOSSES(OCEMA):
PIPE FLOW =      123.70 CFS             PIPE DIAMETER =  42.00 INCHES
CENTRAL ANGLE =  0.000 DEGREES          MANNING'S N = 0.01300
PIPE LENGTH =      203.00 FEET
------------------------------------------------------------------------------
NORMAL DEPTH(FT) =       1.75           CRITICAL DEPTH(FT) =       3.27
==============================================================================
UPSTREAM CONTROL ASSUMED FLOWDEPTH(FT) =      1.65
==============================================================================
GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:
------------------------------------------------------------------------------
```

DISTANCE FROM CONTROL(FT)	FLOW DEPTH (FT)	VELOCITY (FT/SEC)	SPECIFIC ENERGY(FT)	PRESSURE+ MOMENTUM(POUNDS)
0.000	1.646	27.812	13.665	6862.06
5.352	1.650	27.721	13.590	6841.25
10.909	1.654	27.630	13.516	6820.59
16.691	1.658	27.539	13.442	6800.07
22.718	1.663	27.449	13.370	6779.69
29.014	1.667	27.360	13.298	6759.45
35.607	1.671	27.271	13.227	6739.36
42.529	1.675	27.183	13.156	6719.40
49.817	1.680	27.095	13.087	6699.58
57.517	1.684	27.008	13.018	6679.90
65.681	1.688	26.922	12.949	6660.36
74.374	1.692	26.836	12.882	6640.94
83.674	1.696	26.750	12.815	6621.67
93.679	1.701	26.665	12.749	6602.52
104.512	1.705	26.581	12.683	6583.51
116.331	1.709	26.497	12.618	6564.63
129.343	1.713	26.414	12.554	6545.87
143.832	1.717	26.331	12.490	6527.24
160.192	1.722	26.249	12.427	6508.74
179.003	1.726	26.167	12.365	6490.37
201.162	1.730	26.086	12.303	6472.12
203.000	1.730	26.080	12.299	6470.89

```
------------------------------------------------------------------------------
NODE  1172.00 : HGL = <  515.626>;EGL= <  527.645>;FLOWLINE= <  513.980>

******************************************************************************
FLOW PROCESS FROM NODE  1172.00 TO NODE  1172.00 IS CODE =  5
UPSTREAM NODE  1172.00       ELEVATION =   514.31  (FLOW IS SUPERCRITICAL)
------------------------------------------------------------------------------
CALCULATE JUNCTION LOSSES:
     PIPE         FLOW    DIAMETER   ANGLE     FLOWLINE   CRITICAL    VELOCITY
                  (CFS)   (INCHES) (DEGREES) ELEVATION  DEPTH(FT.)   (FT/SEC)
```

UPSTREAM	123.70	42.00	0.00	514.31	3.27	28.063
DOWNSTREAM	123.70	42.00	-	513.98	3.27	27.821
LATERAL #1	0.00	0.00	0.00	0.00	0.00	0.000
LATERAL #2	0.00	0.00	0.00	0.00	0.00	0.000
Q5	0.00===Q5 EQUALS BASIN INPUT===					

LACFCD AND OCEMA FLOW JUNCTION FORMULAE USED:
DY=(Q2*V2-Q1*V1*COS(DELTA1)-Q3*V3*COS(DELTA3)-
Q4*V4*COS(DELTA4))/((A1+A2)*16.1)+FRICTION LOSSES
UPSTREAM: MANNING'S N = 0.01300; FRICTION SLOPE = 0.07643
DOWNSTREAM: MANNING'S N = 0.01300; FRICTION SLOPE = 0.07467
AVERAGED FRICTION SLOPE IN JUNCTION ASSUMED AS 0.07555
JUNCTION LENGTH = 4.00 FEET
FRICTION LOSSES = 0.302 FEET ENTRANCE LOSSES = 0.000 FEET
JUNCTION LOSSES = (DY+HV1-HV2)+(ENTRANCE LOSSES)
JUNCTION LOSSES = (0.529)+(0.000) = 0.529

NODE 1172.00 : HGL = < 515.945>;EGL= < 528.174>;FLOWLINE= < 514.310>

****

FLOW PROCESS FROM NODE 1172.00 TO NODE 1171.00 IS CODE = 3
UPSTREAM NODE 1171.00 ELEVATION = 520.94 (FLOW IS SUPERCRITICAL)

CALCULATE PIPE-BEND LOSSES(OCEMA):
PIPE FLOW = 123.70 CFS PIPE DIAMETER = 42.00 INCHES
CENTRAL ANGLE = 9.000 DEGREES MANNING'S N = 0.01300
PIPE LENGTH = 73.90 FEET

NORMAL DEPTH(FT) = 1.56 CRITICAL DEPTH(FT) = 3.27

==

UPSTREAM CONTROL ASSUMED FLOWDEPTH(FT) = 1.72

==

GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:

DISTANCE FROM CONTROL(FT)	FLOW DEPTH (FT)	VELOCITY (FT/SEC)	SPECIFIC ENERGY(FT)	PRESSURE+ MOMENTUM(POUNDS)
0.000	1.718	26.324	12.485	6525.67
3.793	1.712	26.447	12.579	6553.27
7.772	1.705	26.571	12.675	6581.15
11.955	1.699	26.696	12.772	6609.32
16.360	1.693	26.822	12.871	6637.78
21.010	1.687	26.949	12.971	6666.52
25.929	1.680	27.078	13.073	6695.57
31.148	1.674	27.207	13.176	6724.91
36.700	1.668	27.338	13.281	6754.56
42.626	1.662	27.471	13.387	6784.51
48.975	1.655	27.604	13.495	6814.77
55.805	1.649	27.739	13.605	6845.35
63.188	1.643	27.875	13.716	6876.25
71.213	1.637	28.012	13.829	6907.47
73.900	1.635	28.055	13.864	6917.09

NODE 1171.00 : HGL = < 522.658>;EGL= < 533.425>;FLOWLINE= < 520.940>

****

FLOW PROCESS FROM NODE 1171.00 TO NODE 1160.00 IS CODE = 1
UPSTREAM NODE 1160.00 ELEVATION = 530.27 (FLOW IS SUPERCRITICAL)

CALCULATE FRICTION LOSSES(LACFCD):
PIPE FLOW = 123.70 CFS PIPE DIAMETER = 42.00 INCHES
PIPE LENGTH = 104.40 FEET MANNING'S N = 0.01300

NORMAL DEPTH(FT) = 1.56 CRITICAL DEPTH(FT) = 3.27

UPSTREAM CONTROL ASSUMED FLOWDEPTH(FT) = 2.14

GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:

DISTANCE FROM CONTROL(FT)	FLOW DEPTH (FT)	VELOCITY (FT/SEC)	SPECIFIC ENERGY(FT)	PRESSURE+ MOMENTUM(POUNDS)
0.000	2.143	20.027	8.375	5159.98
2.436	2.120	20.287	8.514	5213.48
5.043	2.097	20.554	8.661	5268.91
7.838	2.074	20.830	8.815	5326.36
10.838	2.050	21.114	8.977	5385.90
14.067	2.027	21.406	9.147	5447.60
17.548	2.004	21.708	9.326	5511.55
21.310	1.981	22.018	9.513	5577.82
25.389	1.958	22.338	9.711	5646.50
29.824	1.935	22.668	9.919	5717.70
34.664	1.911	23.009	10.137	5791.50
39.966	1.888	23.360	10.367	5868.01
45.803	1.865	23.722	10.609	5947.35
52.262	1.842	24.097	10.864	6029.62
59.457	1.819	24.483	11.132	6114.95
67.530	1.795	24.883	11.416	6203.47
76.672	1.772	25.295	11.714	6295.32
87.140	1.749	25.722	12.029	6390.65
99.294	1.726	26.164	12.362	6489.60
104.400	1.718	26.324	12.485	6525.67

NODE 1160.00 : HGL = < 532.413>;EGL= < 538.645>;FLOWLINE= < 530.270>

****

FLOW PROCESS FROM NODE 1160.00 TO NODE 1160.00 IS CODE = 5
UPSTREAM NODE 1160.00 ELEVATION = 530.60 (FLOW IS SUPERCRITICAL)

CALCULATE JUNCTION LOSSES:

PIPE	FLOW (CFS)	DIAMETER (INCHES)	ANGLE (DEGREES)	FLOWLINE ELEVATION	CRITICAL DEPTH(FT.)	VELOCITY (FT/SEC)
UPSTREAM	114.50	42.00	0.00	530.60	3.21	21.945
DOWNSTREAM	123.70	42.00	-	530.27	3.27	20.033
LATERAL #1	5.90	18.00	90.00	532.60	0.94	5.076
LATERAL #2	3.30	18.00	90.00	532.60	0.69	4.142
Q5	0.00===Q5 EQUALS BASIN INPUT===					

LACFCD AND OCEMA FLOW JUNCTION FORMULAE USED:
DY=(Q2*V2-Q1*V1*COS(DELTA1)-Q3*V3*COS(DELTA3)-
Q4*V4*COS(DELTA4))/((A1+A2)*16.1)+FRICTION LOSSES
UPSTREAM: MANNING'S N = 0.01300; FRICTION SLOPE = 0.04177
DOWNSTREAM: MANNING'S N = 0.01300; FRICTION SLOPE = 0.03149
AVERAGED FRICTION SLOPE IN JUNCTION ASSUMED AS 0.03663
JUNCTION LENGTH = 4.00 FEET
FRICTION LOSSES = 0.147 FEET ENTRANCE LOSSES = 0.000 FEET
JUNCTION LOSSES = (DY+HV1-HV2)+(ENTRANCE LOSSES)
JUNCTION LOSSES = (1.300)+(0.000) = 1.300

NODE 1160.00 : HGL = < 532.466>;EGL= < 539.945>;FLOWLINE= < 530.600>

****

FLOW PROCESS FROM NODE 1160.00 TO NODE 1160.50 IS CODE = 3
UPSTREAM NODE 1160.50 ELEVATION = 543.21 (FLOW IS SUPERCRITICAL)

CALCULATE PIPE-BEND LOSSES(OCEMA):
PIPE FLOW = 114.50 CFS PIPE DIAMETER = 42.00 INCHES
CENTRAL ANGLE = 30.000 DEGREES MANNING'S N = 0.01300
PIPE LENGTH = 282.90 FEET

NORMAL DEPTH(FT) = 1.83 CRITICAL DEPTH(FT) = 3.21

UPSTREAM CONTROL ASSUMED FLOWDEPTH(FT) = 2.41

GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:

DISTANCE FROM CONTROL(FT)	FLOW DEPTH (FT)	VELOCITY (FT/SEC)	SPECIFIC ENERGY(FT)	PRESSURE+ MOMENTUM(POUNDS)
0.000	2.409	16.209	6.491	4065.45
2.613	2.386	16.384	6.557	4094.08
5.422	2.363	16.564	6.626	4123.89
8.444	2.340	16.748	6.698	4154.91
11.702	2.316	16.938	6.774	4187.17
15.218	2.293	17.133	6.854	4220.72
19.022	2.270	17.333	6.938	4255.59
23.145	2.247	17.539	7.027	4291.83
27.625	2.224	17.751	7.120	4329.47
32.508	2.201	17.969	7.217	4368.56
37.847	2.177	18.193	7.320	4409.16
43.707	2.154	18.423	7.428	4451.30
50.168	2.131	18.661	7.542	4495.04
57.329	2.108	18.905	7.661	4540.43
65.314	2.085	19.156	7.787	4587.54
74.284	2.062	19.415	7.919	4636.41
84.450	2.039	19.682	8.057	4687.13
96.098	2.015	19.956	8.203	4739.74
109.631	1.992	20.239	8.357	4794.33
125.636	1.969	20.531	8.519	4850.96
145.026	1.946	20.832	8.689	4909.72
169.330	1.923	21.142	8.868	4970.68
201.414	1.900	21.462	9.056	5033.94
247.721	1.876	21.792	9.255	5099.58
282.900	1.866	21.939	9.345	5128.78

NODE 1160.50 : HGL = < 545.619>;EGL= < 549.702>;FLOWLINE= < 543.210>

****

FLOW PROCESS FROM NODE 1160.50 TO NODE 1105.00 IS CODE = 1
UPSTREAM NODE 1105.00 ELEVATION = 544.06 (FLOW IS SUPERCRITICAL)

CALCULATE FRICTION LOSSES(LACFCD):
PIPE FLOW = 114.50 CFS PIPE DIAMETER = 42.00 INCHES
PIPE LENGTH = 23.21 FEET MANNING'S N = 0.01300

NORMAL DEPTH(FT) = 1.94 CRITICAL DEPTH(FT) = 3.21

UPSTREAM CONTROL ASSUMED FLOWDEPTH(FT) = 2.61

GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:

DISTANCE FROM CONTROL(FT)	FLOW DEPTH (FT)	VELOCITY (FT/SEC)	SPECIFIC ENERGY(FT)	PRESSURE+ MOMENTUM(POUNDS)
0.000	2.608	14.887	6.052	3863.65
2.310	2.581	15.047	6.099	3886.36
4.821	2.555	15.212	6.150	3910.32

7.553	2.528	15.381	6.204	3935.57
10.527	2.502	15.556	6.262	3962.12
13.768	2.475	15.737	6.323	3990.04
17.305	2.448	15.923	6.388	4019.35
21.171	2.422	16.115	6.457	4050.11
23.210	2.409	16.209	6.491	4065.45

NODE 1105.00 : HGL = < 546.668>;EGL= < 550.112>;FLOWLINE= < 544.060>

****

FLOW PROCESS FROM NODE 1105.00 TO NODE 1105.00 IS CODE = 5
UPSTREAM NODE 1105.00 ELEVATION = 544.39 (FLOW IS SUPERCRITICAL)

CALCULATE JUNCTION LOSSES:

PIPE	FLOW (CFS)	DIAMETER (INCHES)	ANGLE (DEGREES)	FLOWLINE ELEVATION	CRITICAL DEPTH(FT.)	VELOCITY (FT/SEC)
UPSTREAM	110.80	42.00	0.00	544.39	3.18	15.194
DOWNSTREAM	114.50	42.00	-	544.06	3.21	14.892
LATERAL #1	3.70	18.00	90.00	546.39	0.73	4.299
LATERAL #2	0.00	0.00	0.00	0.00	0.00	0.000
Q5	0.00===Q5 EQUALS BASIN INPUT===					

LACFCD AND OCEMA FLOW JUNCTION FORMULAE USED:
DY=(Q2*V2-Q1*V1*COS(DELTA1)-Q3*V3*COS(DELTA3)-
Q4*V4*COS(DELTA4))/((A1+A2)*16.1)+FRICTION LOSSES
UPSTREAM: MANNING'S N = 0.01300; FRICTION SLOPE = 0.01675
DOWNSTREAM: MANNING'S N = 0.01300; FRICTION SLOPE = 0.01581
AVERAGED FRICTION SLOPE IN JUNCTION ASSUMED AS 0.01628
JUNCTION LENGTH = 4.00 FEET
FRICTION LOSSES = 0.065 FEET ENTRANCE LOSSES = 0.000 FEET
JUNCTION LOSSES = (DY+HV1-HV2)+(ENTRANCE LOSSES)
JUNCTION LOSSES = (0.344)+(0.000) = 0.344

NODE 1105.00 : HGL = < 546.871>;EGL= < 550.456>;FLOWLINE= < 544.390>

****

FLOW PROCESS FROM NODE 1105.00 TO NODE 1100.00 IS CODE = 1
UPSTREAM NODE 1100.00 ELEVATION = 544.73 (FLOW IS SUPERCRITICAL)

CALCULATE FRICTION LOSSES(LACFCD):
PIPE FLOW = 110.80 CFS PIPE DIAMETER = 42.00 INCHES
PIPE LENGTH = 53.10 FEET MANNING'S N = 0.01300
===> NORMAL PIPEFLOW IS PRESSURE FLOW

NORMAL DEPTH(FT) = 3.50 CRITICAL DEPTH(FT) = 3.18

===

UPSTREAM CONTROL ASSUMED FLOWDEPTH(FT) = 2.24

===

GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:

DISTANCE FROM CONTROL(FT)	FLOW DEPTH (FT)	VELOCITY (FT/SEC)	SPECIFIC ENERGY(FT)	PRESSURE+ MOMENTUM(POUNDS)
0.000	2.239	17.040	6.751	4055.65
8.645	2.277	16.717	6.619	4001.63
17.158	2.314	16.408	6.497	3950.95
25.531	2.352	16.112	6.386	3903.45
33.753	2.389	15.830	6.283	3858.98
41.813	2.427	15.559	6.188	3817.41
49.697	2.464	15.300	6.102	3778.61
53.100	2.481	15.190	6.066	3762.31

NODE 1100.00 : HGL = < 546.969>;EGL= < 551.481>;FLOWLINE= < 544.730>

****

FLOW PROCESS FROM NODE 1100.00 TO NODE 1100.00 IS CODE = 5
UPSTREAM NODE 1100.00 ELEVATION = 545.06 (FLOW IS SUPERCRITICAL)

CALCULATE JUNCTION LOSSES:

PIPE	FLOW (CFS)	DIAMETER (INCHES)	ANGLE (DEGREES)	FLOWLINE ELEVATION	CRITICAL DEPTH(FT.)	VELOCITY (FT/SEC)
UPSTREAM	90.50	36.00	0.00	545.06	2.85	21.523
DOWNSTREAM	110.80	42.00	-	544.73	3.18	17.045
LATERAL #1	3.40	18.00	90.00	547.06	0.70	4.182
LATERAL #2	16.90	24.00	86.00	546.56	1.48	6.772
Q5	0.00===Q5 EQUALS BASIN INPUT===					

LACFCD AND OCEMA FLOW JUNCTION FORMULAE USED:
DY=(Q2*V2-Q1*V1*COS(DELTA1)-Q3*V3*COS(DELTA3)-
Q4*V4*COS(DELTA4))/((A1+A2)*16.1)+FRICTION LOSSES
UPSTREAM: MANNING'S N = 0.01300; FRICTION SLOPE = 0.04661
DOWNSTREAM: MANNING'S N = 0.01300; FRICTION SLOPE = 0.02219
AVERAGED FRICTION SLOPE IN JUNCTION ASSUMED AS 0.03440
JUNCTION LENGTH = 4.00 FEET
FRICTION LOSSES = 0.138 FEET ENTRANCE LOSSES = 0.000 FEET
JUNCTION LOSSES = (DY+HV1-HV2)+(ENTRANCE LOSSES)
JUNCTION LOSSES = (2.497)+(0.000) = 2.497

NODE 1100.00 : HGL = < 546.784>;EGL= < 553.977>;FLOWLINE= < 545.060>

****

FLOW PROCESS FROM NODE 1100.00 TO NODE 1095.00 IS CODE = 1
UPSTREAM NODE 1095.00 ELEVATION = 550.73 (FLOW IS SUPERCRITICAL)

CALCULATE FRICTION LOSSES(LACFCD):
PIPE FLOW = 90.50 CFS PIPE DIAMETER = 36.00 INCHES
PIPE LENGTH = 100.10 FEET MANNING'S N = 0.01300

NORMAL DEPTH(FT) = 1.62 CRITICAL DEPTH(FT) = 2.85

==

UPSTREAM CONTROL ASSUMED FLOWDEPTH(FT) = 1.96

==

GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:

DISTANCE FROM CONTROL(FT)	FLOW DEPTH (FT)	VELOCITY (FT/SEC)	SPECIFIC ENERGY(FT)	PRESSURE+ MOMENTUM(POUNDS)
0.000	1.959	18.500	7.277	3506.85
2.899	1.946	18.647	7.348	3528.51
5.971	1.932	18.797	7.422	3550.69
9.233	1.919	18.949	7.498	3573.40
12.702	1.905	19.104	7.576	3596.66
16.400	1.892	19.263	7.657	3620.47
20.350	1.879	19.424	7.741	3644.85
24.581	1.865	19.589	7.827	3669.81
29.125	1.852	19.756	7.916	3695.37
34.020	1.838	19.927	8.008	3721.53
39.314	1.825	20.102	8.103	3748.32
45.061	1.811	20.279	8.201	3775.74
51.331	1.798	20.461	8.302	3803.82
58.207	1.784	20.646	8.407	3832.56
65.796	1.771	20.834	8.515	3861.99
74.237	1.757	21.027	8.627	3892.12
83.710	1.744	21.223	8.742	3922.97

94.460	1.731	21.423	8.862	3954.55
100.100	1.724	21.516	8.917	3969.20

NODE 1095.00 : HGL = < 552.689>;EGL= < 558.007>;FLOWLINE= < 550.730>

****

FLOW PROCESS FROM NODE 1095.00 TO NODE 1092.00 IS CODE = 3
UPSTREAM NODE 1092.00 ELEVATION = 554.74 (FLOW IS SUPERCRITICAL)

CALCULATE PIPE-BEND LOSSES(OCEMA):
PIPE FLOW = 90.50 CFS PIPE DIAMETER = 36.00 INCHES
CENTRAL ANGLE = 12.000 DEGREES MANNING'S N = 0.01300
PIPE LENGTH = 111.10 FEET

NORMAL DEPTH(FT) = 1.87 CRITICAL DEPTH(FT) = 2.85

UPSTREAM CONTROL ASSUMED FLOWDEPTH(FT) = 2.15

GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:

DISTANCE FROM CONTROL(FT)	FLOW DEPTH (FT)	VELOCITY (FT/SEC)	SPECIFIC ENERGY(FT)	PRESSURE+ MOMENTUM(POUNDS)
0.000	2.155	16.647	6.461	3244.80
3.282	2.144	16.741	6.498	3257.40
6.756	2.132	16.835	6.536	3270.27
10.437	2.121	16.932	6.576	3283.41
14.346	2.110	17.030	6.616	3296.84
18.506	2.099	17.129	6.658	3310.54
22.941	2.088	17.230	6.700	3324.54
27.683	2.076	17.332	6.744	3338.83
32.766	2.065	17.436	6.789	3353.42
38.233	2.054	17.541	6.835	3368.31
44.133	2.043	17.649	6.882	3383.51
50.527	2.032	17.757	6.931	3399.03
57.489	2.020	17.868	6.981	3414.86
65.109	2.009	17.980	7.032	3431.01
73.503	1.998	18.094	7.085	3447.49
82.820	1.987	18.210	7.139	3464.31
93.254	1.975	18.327	7.194	3481.46
105.072	1.964	18.447	7.251	3498.97
111.100	1.959	18.500	7.277	3506.85

NODE 1092.00 : HGL = < 556.895>;EGL= < 561.201>;FLOWLINE= < 554.740>

****

FLOW PROCESS FROM NODE 1092.00 TO NODE 1031.00 IS CODE = 1
UPSTREAM NODE 1031.00 ELEVATION = 555.31 (FLOW IS SUPERCRITICAL)

CALCULATE FRICTION LOSSES(LACFCD):
PIPE FLOW = 90.50 CFS PIPE DIAMETER = 36.00 INCHES
PIPE LENGTH = 15.40 FEET MANNING'S N = 0.01300

NORMAL DEPTH(FT) = 1.86 CRITICAL DEPTH(FT) = 2.85

UPSTREAM CONTROL ASSUMED FLOWDEPTH(FT) = 2.22

GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:

DISTANCE FROM CONTROL(FT)	FLOW DEPTH (FT)	VELOCITY (FT/SEC)	SPECIFIC ENERGY(FT)	PRESSURE+ MOMENTUM(POUNDS)
0.000	2.223	16.112	6.256	3174.31

2.930	2.208	16.223	6.297	3188.68
6.050	2.193	16.336	6.340	3203.48
9.375	2.179	16.452	6.384	3218.70
12.925	2.164	16.569	6.430	3234.36
15.400	2.155	16.647	6.461	3244.80

NODE 1031.00 : HGL = < 557.533>;EGL= < 561.566>;FLOWLINE= < 555.310>

****

FLOW PROCESS FROM NODE 1031.00 TO NODE 1031.00 IS CODE = 5
UPSTREAM NODE 1031.00 ELEVATION = 555.64 (FLOW IS SUPERCRITICAL)

CALCULATE JUNCTION LOSSES:

PIPE	FLOW (CFS)	DIAMETER (INCHES)	ANGLE (DEGREES)	FLOWLINE ELEVATION	CRITICAL DEPTH(FT.)	VELOCITY (FT/SEC)
UPSTREAM	86.00	36.00	0.00	555.64	2.82	17.056
DOWNSTREAM	90.50	36.00	-	555.31	2.85	16.117
LATERAL #1	4.50	18.00	90.00	557.64	0.81	4.594
LATERAL #2	0.00	0.00	0.00	0.00	0.00	0.000
Q5	0.00===Q5 EQUALS BASIN INPUT===					

LACFCD AND OCEMA FLOW JUNCTION FORMULAE USED:
DY=(Q2*V2-Q1*V1*COS(DELTA1)-Q3*V3*COS(DELTA3)-
Q4*V4*COS(DELTA4))/((A1+A2)*16.1)+FRICTION LOSSES
UPSTREAM: MANNING'S N = 0.01300; FRICTION SLOPE = 0.02658
DOWNSTREAM: MANNING'S N = 0.01300; FRICTION SLOPE = 0.02279
AVERAGED FRICTION SLOPE IN JUNCTION ASSUMED AS 0.02469
JUNCTION LENGTH = 4.00 FEET
FRICTION LOSSES = 0.099 FEET ENTRANCE LOSSES = 0.000 FEET
JUNCTION LOSSES = (DY+HV1-HV2)+(ENTRANCE LOSSES)
JUNCTION LOSSES = (0.604)+(0.000) = 0.604

NODE 1031.00 : HGL = < 557.653>;EGL= < 562.170>;FLOWLINE= < 555.640>

****

FLOW PROCESS FROM NODE 1031.00 TO NODE 1030.00 IS CODE = 1
UPSTREAM NODE 1030.00 ELEVATION = 556.64 (FLOW IS SUPERCRITICAL)

CALCULATE FRICTION LOSSES(LACFCD):
PIPE FLOW = 86.00 CFS PIPE DIAMETER = 36.00 INCHES
PIPE LENGTH = 60.70 FEET MANNING'S N = 0.01300

NORMAL DEPTH(FT) = 2.47 & 3.00 CRITICAL DEPTH(FT) = 2.82
NOTE: SUGGEST CONSIDERATION OF WAVE ACTION, UNCERTAINTY, ETC.

UPSTREAM CONTROL ASSUMED FLOWDEPTH(FT) = 1.85

GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:

DISTANCE FROM CONTROL(FT)	FLOW DEPTH (FT)	VELOCITY (FT/SEC)	SPECIFIC ENERGY(FT)	PRESSURE+ MOMENTUM(POUNDS)
0.000	1.849	18.811	7.346	3364.53
8.650	1.873	18.517	7.201	3322.69
17.469	1.898	18.233	7.064	3282.67
26.473	1.923	17.959	6.935	3244.40
35.682	1.948	17.695	6.813	3207.82
45.117	1.973	17.439	6.699	3172.86
54.801	1.998	17.193	6.591	3139.46
60.700	2.013	17.051	6.530	3120.39

NODE 1030.00 : HGL = < 558.489>;EGL= < 563.986>;FLOWLINE= < 556.640>

****

FLOW PROCESS FROM NODE 1030.00 TO NODE 1030.00 IS CODE = 5
UPSTREAM NODE 1030.00 ELEVATION = 557.14 (FLOW IS SUPERCRITICAL)

CALCULATE JUNCTION LOSSES:

PIPE	FLOW (CFS)	DIAMETER (INCHES)	ANGLE (DEGREES)	FLOWLINE ELEVATION	CRITICAL DEPTH(FT.)	VELOCITY (FT/SEC)
UPSTREAM	69.20	36.00	0.00	557.14	2.65	24.061
DOWNSTREAM	86.00	36.00	-	556.64	2.82	18.817
LATERAL #1	16.80	24.00	90.00	558.14	1.48	6.752
LATERAL #2	0.00	0.00	0.00	0.00	0.00	0.000
Q5	0.00===Q5 EQUALS BASIN INPUT===					

LACFCD AND OCEMA FLOW JUNCTION FORMULAE USED:
DY=(Q2*V2-Q1*V1*COS(DELTA1)-Q3*V3*COS(DELTA3)-
Q4*V4*COS(DELTA4))/((A1+A2)*16.1)+FRICTION LOSSES
UPSTREAM: MANNING'S N = 0.01300; FRICTION SLOPE = 0.07505
DOWNSTREAM: MANNING'S N = 0.01300; FRICTION SLOPE = 0.03398
AVERAGED FRICTION SLOPE IN JUNCTION ASSUMED AS 0.05452
JUNCTION LENGTH = 4.00 FEET
FRICTION LOSSES = 0.218 FEET ENTRANCE LOSSES = 0.000 FEET
JUNCTION LOSSES = (DY+HV1-HV2)+(ENTRANCE LOSSES)
JUNCTION LOSSES = (3.423)+(0.000) = 3.423

NODE 1030.00 : HGL = < 558.420>;EGL= < 567.409>;FLOWLINE= < 557.140>

****

FLOW PROCESS FROM NODE 1030.00 TO NODE 1029.00 IS CODE = 1
UPSTREAM NODE 1029.00 ELEVATION = 560.96 (FLOW IS SUPERCRITICAL)

CALCULATE FRICTION LOSSES(LACFCD):
PIPE FLOW = 69.20 CFS PIPE DIAMETER = 36.00 INCHES
PIPE LENGTH = 40.70 FEET MANNING'S N = 0.01300

NORMAL DEPTH(FT) = 1.20 CRITICAL DEPTH(FT) = 2.65

==

UPSTREAM CONTROL ASSUMED FLOWDEPTH(FT) = 1.34

==

GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:

DISTANCE FROM CONTROL(FT)	FLOW DEPTH (FT)	VELOCITY (FT/SEC)	SPECIFIC ENERGY(FT)	PRESSURE+ MOMENTUM(POUNDS)
0.000	1.341	22.612	9.286	3141.02
2.699	1.336	22.734	9.367	3156.40
5.534	1.330	22.858	9.449	3171.95
8.516	1.325	22.983	9.532	3187.69
11.660	1.319	23.110	9.617	3203.61
14.982	1.314	23.237	9.704	3219.72
18.499	1.308	23.366	9.792	3236.01
22.234	1.303	23.497	9.881	3252.50
26.211	1.297	23.629	9.972	3269.17
30.460	1.292	23.762	10.065	3286.05
35.016	1.286	23.897	10.159	3303.12
39.923	1.281	24.033	10.255	3320.40
40.700	1.280	24.053	10.269	3322.94

NODE 1029.00 : HGL = < 562.301>;EGL= < 570.246>;FLOWLINE= < 560.960>

****

FLOW PROCESS FROM NODE 1029.00 TO NODE 1028.00 IS CODE = 3

UPSTREAM NODE 1028.00 ELEVATION = 578.11 (FLOW IS SUPERCRITICAL)

CALCULATE PIPE-BEND LOSSES(OCEMA):
PIPE FLOW = 69.20 CFS PIPE DIAMETER = 36.00 INCHES
CENTRAL ANGLE = 31.000 DEGREES MANNING'S N = 0.01300
PIPE LENGTH = 265.30 FEET

NORMAL DEPTH(FT) = 1.33 CRITICAL DEPTH(FT) = 2.65

===

UPSTREAM CONTROL ASSUMED FLOWDEPTH(FT) = 1.51

===

GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:

DISTANCE FROM CONTROL(FT)	FLOW DEPTH (FT)	VELOCITY (FT/SEC)	SPECIFIC ENERGY(FT)	PRESSURE+ MOMENTUM(POUNDS)
0.000	1.508	19.439	7.379	2749.78
2.834	1.501	19.553	7.442	2763.61
5.815	1.494	19.669	7.505	2777.63
8.957	1.487	19.786	7.570	2791.84
12.275	1.480	19.905	7.637	2806.25
15.786	1.473	20.025	7.704	2820.86
19.511	1.466	20.147	7.773	2835.67
23.472	1.460	20.270	7.843	2850.69
27.697	1.453	20.394	7.915	2865.92
32.219	1.446	20.520	7.988	2881.37
37.076	1.439	20.648	8.063	2897.03
42.313	1.432	20.777	8.139	2912.91
47.990	1.425	20.908	8.217	2929.01
54.175	1.418	21.040	8.296	2945.34
60.958	1.411	21.174	8.377	2961.90
68.454	1.404	21.310	8.460	2978.70
76.813	1.397	21.448	8.544	2995.73
86.240	1.390	21.587	8.630	3013.01
97.022	1.383	21.728	8.718	3030.53
109.578	1.376	21.871	8.808	3048.30
124.558	1.369	22.015	8.900	3066.33
143.053	1.362	22.162	8.993	3084.62
167.106	1.355	22.310	9.089	3103.17
201.310	1.348	22.460	9.186	3121.99
260.400	1.341	22.612	9.286	3141.08
265.300	1.341	22.612	9.286	3141.02

NODE 1028.00 : HGL = < 579.618>;EGL= < 585.489>;FLOWLINE= < 578.110>

****

FLOW PROCESS FROM NODE 1028.00 TO NODE 1015.00 IS CODE = 1
UPSTREAM NODE 1015.00 ELEVATION = 579.08 (FLOW IS SUPERCRITICAL)

CALCULATE FRICTION LOSSES(LACFCD):
PIPE FLOW = 69.20 CFS PIPE DIAMETER = 36.00 INCHES
PIPE LENGTH = 24.20 FEET MANNING'S N = 0.01300

NORMAL DEPTH(FT) = 1.53 CRITICAL DEPTH(FT) = 2.65

===

UPSTREAM CONTROL ASSUMED FLOWDEPTH(FT) = 1.50

===

GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:

DISTANCE FROM CONTROL(FT)	FLOW DEPTH (FT)	VELOCITY (FT/SEC)	SPECIFIC ENERGY(FT)	PRESSURE+ MOMENTUM(POUNDS)
0.000	1.501	19.549	7.440	2763.13

4.003	1.503	19.529	7.428	2760.68
8.170	1.504	19.509	7.417	2758.23
12.516	1.505	19.489	7.406	2755.80
17.058	1.506	19.468	7.395	2753.36
21.814	1.508	19.448	7.384	2750.94
24.200	1.508	19.439	7.379	2749.78

NODE 1015.00 : HGL = < 580.581>;EGL= < 586.520>;FLOWLINE= < 579.080>

****

FLOW PROCESS FROM NODE 1015.00 TO NODE 1015.00 IS CODE = 5
UPSTREAM NODE 1015.00 ELEVATION = 579.41 (FLOW IS SUPERCRITICAL)

CALCULATE JUNCTION LOSSES:

PIPE	FLOW (CFS)	DIAMETER (INCHES)	ANGLE (DEGREES)	FLOWLINE ELEVATION	CRITICAL DEPTH(FT.)	VELOCITY (FT/SEC)
UPSTREAM	63.50	36.00	0.00	579.41	2.56	21.653
DOWNSTREAM	69.20	36.00	-	579.08	2.65	19.555
LATERAL #1	5.70	18.00	90.00	580.91	0.92	5.009
LATERAL #2	0.00	0.00	0.00	0.00	0.00	0.000
Q5	0.00===Q5 EQUALS BASIN INPUT===					

LACFCD AND OCEMA FLOW JUNCTION FORMULAE USED:
DY=(Q2*V2-Q1*V1*COS(DELTA1)-Q3*V3*COS(DELTA3)-
Q4*V4*COS(DELTA4))/((A1+A2)*16.1)+FRICTION LOSSES
UPSTREAM: MANNING'S N = 0.01300; FRICTION SLOPE = 0.05994
DOWNSTREAM: MANNING'S N = 0.01300; FRICTION SLOPE = 0.04292
AVERAGED FRICTION SLOPE IN JUNCTION ASSUMED AS 0.05143
JUNCTION LENGTH = 4.00 FEET
FRICTION LOSSES = 0.206 FEET ENTRANCE LOSSES = 0.000 FEET
JUNCTION LOSSES = (DY+HV1-HV2)+(ENTRANCE LOSSES)
JUNCTION LOSSES = (1.470)+(0.000) = 1.470

NODE 1015.00 : HGL = < 580.709>;EGL= < 587.989>;FLOWLINE= < 579.410>

****

FLOW PROCESS FROM NODE 1015.00 TO NODE 1014.00 IS CODE = 1
UPSTREAM NODE 1014.00 ELEVATION = 592.13 (FLOW IS SUPERCRITICAL)

CALCULATE FRICTION LOSSES(LACFCD):
PIPE FLOW = 63.50 CFS PIPE DIAMETER = 36.00 INCHES
PIPE LENGTH = 193.00 FEET MANNING'S N = 0.01300

NORMAL DEPTH(FT) = 1.26 CRITICAL DEPTH(FT) = 2.56

==

UPSTREAM CONTROL ASSUMED FLOWDEPTH(FT) = 2.11

==

GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:

DISTANCE FROM CONTROL(FT)	FLOW DEPTH (FT)	VELOCITY (FT/SEC)	SPECIFIC ENERGY(FT)	PRESSURE+ MOMENTUM(POUNDS)
0.000	2.108	11.965	4.332	1781.21
0.877	2.074	12.178	4.378	1796.41
1.864	2.040	12.401	4.430	1813.03
2.974	2.006	12.635	4.487	1831.16
4.220	1.973	12.880	4.550	1850.85
5.616	1.939	13.137	4.620	1872.19
7.181	1.905	13.406	4.698	1895.26
8.936	1.872	13.688	4.783	1920.16
10.906	1.838	13.985	4.877	1946.97
13.120	1.804	14.296	4.979	1975.81

15.613	1.770	14.622	5.093	2006.80
18.429	1.737	14.966	5.217	2040.06
21.619	1.703	15.327	5.353	2075.73
25.250	1.669	15.708	5.503	2113.96
29.405	1.636	16.109	5.667	2154.92
34.191	1.602	16.531	5.848	2198.78
39.749	1.568	16.978	6.047	2245.75
46.273	1.535	17.449	6.265	2296.04
54.031	1.501	17.948	6.506	2349.89
63.421	1.467	18.476	6.771	2407.57
75.057	1.433	19.036	7.064	2469.37
89.970	1.400	19.630	7.387	2535.61
110.097	1.366	20.262	7.745	2606.65
139.786	1.332	20.934	8.141	2682.91
192.997	1.299	21.650	8.582	2764.82
193.000	1.299	21.647	8.579	2764.39

```
------------------------------------------------------------------------------
 NODE   1014.00 : HGL = <  594.237>;EGL= <  596.462>;FLOWLINE= <  592.130>

******************************************************************************
 FLOW PROCESS FROM NODE  1014.00 TO NODE  1014.00 IS CODE =  5
 UPSTREAM NODE  1014.00      ELEVATION =   592.46  (FLOW IS SUPERCRITICAL)
------------------------------------------------------------------------------
 CALCULATE JUNCTION LOSSES:
```

PIPE	FLOW (CFS)	DIAMETER (INCHES)	ANGLE (DEGREES)	FLOWLINE ELEVATION	CRITICAL DEPTH(FT.)	VELOCITY (FT/SEC)
UPSTREAM	63.50	36.00	0.00	592.46	2.56	9.880
DOWNSTREAM	63.50	36.00	-	592.13	2.56	11.968
LATERAL #1	0.00	0.00	0.00	0.00	0.00	0.000
LATERAL #2	0.00	0.00	0.00	0.00	0.00	0.000
Q5	0.00===Q5 EQUALS BASIN INPUT===					

```
 LACFCD AND OCEMA FLOW JUNCTION FORMULAE USED:
 DY=(Q2*V2-Q1*V1*COS(DELTA1)-Q3*V3*COS(DELTA3)-
     Q4*V4*COS(DELTA4))/((A1+A2)*16.1)+FRICTION LOSSES
 UPSTREAM:    MANNING'S N = 0.01300;  FRICTION SLOPE = 0.00848
 DOWNSTREAM:  MANNING'S N = 0.01300;  FRICTION SLOPE = 0.01281
 AVERAGED FRICTION SLOPE IN JUNCTION ASSUMED AS 0.01065
 JUNCTION LENGTH =   4.00 FEET
 FRICTION LOSSES =  0.043 FEET         ENTRANCE LOSSES =  0.000 FEET
 JUNCTION LOSSES = (DY+HV1-HV2)+(ENTRANCE LOSSES)
 JUNCTION LOSSES = ( 0.075)+( 0.000) =   0.075
------------------------------------------------------------------------------
 NODE   1014.00 : HGL = <  595.021>;EGL= <  596.537>;FLOWLINE= <  592.460>

******************************************************************************
 FLOW PROCESS FROM NODE  1014.00 TO NODE  1014.00 IS CODE =  8
 UPSTREAM NODE  1014.00      ELEVATION =   592.46  (FLOW IS AT CRITICAL DEPTH)
------------------------------------------------------------------------------
 CALCULATE CATCH BASIN ENTRANCE LOSSES(LACFCD):
 PIPE FLOW =      63.50 CFS         PIPE DIAMETER =  36.00 INCHES
 FLOW VELOCITY =   9.88 FEET/SEC.   VELOCITY HEAD =  1.516 FEET
 CATCH BASIN ENERGY LOSS = .2*(VELOCITY HEAD) = .2*(  1.516) =  0.303
------------------------------------------------------------------------------
 NODE   1014.00 : HGL = <  596.840>;EGL= <  596.840>;FLOWLINE= <  592.460>

******************************************************************************
 UPSTREAM PIPE FLOW CONTROL DATA:
 NODE NUMBER =  1014.00            FLOWLINE ELEVATION =   592.46
 ASSUMED UPSTREAM CONTROL HGL =    595.02 FOR DOWNSTREAM RUN ANALYSIS
```

==
END OF GRADUALLY VARIED FLOW ANALYSIS

```
****************************************************************************
              PIPE-FLOW HYDRAULICS COMPUTER PROGRAM PACKAGE
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                        Analysis prepared by:

                       Rick Engineering Company
                          5620 Friars Road
                        San Diego, CA  92110
                           (619) 291-0707

 ************************** DESCRIPTION OF STUDY **************************
 * BLACK MOUNTAIN RANCH EAST CLUSTERS UNIT 3, J-15149-B                    *
 * MAINLINE AT NODE 1183 - 100-YR FLOW                                     *
 * H:\15149B\HYDRO\HYDRAULICS\PIPEFLOW\....                                *
 **************************************************************************

  FILE NAME: 1183.PIP
  TIME/DATE OF STUDY: 16:50 06/30/2014

****************************************************************************
             GRADUALLY VARIED FLOW ANALYSIS FOR PIPE SYSTEM
                        NODAL POINT STATUS TABLE
              (Note: "*" indicates nodal point data used.)
                    UPSTREAM RUN                        DOWNSTREAM RUN
   NODE     MODEL   PRESSURE     PRESSURE+        FLOW        PRESSURE+
  NUMBER   PROCESS  HEAD(FT)  MOMENTUM(POUNDS)  DEPTH(FT)  MOMENTUM(POUNDS)
 1183.00-              5.47*          880.45       0.36              37.31
        } FRICTION
 1180.00-              4.64*          718.46       0.56 Dc           28.55
        } JUNCTION
 1180.00-              4.33*          396.78       0.36              13.08
        } FRICTION
 1172.00-              3.93*          352.26       0.43 Dc           12.45
        } CATCH BASIN
 1172.00-              3.94*          351.52       0.43 Dc            4.54
----------------------------------------------------------------------------
 MAXIMUM NUMBER OF ENERGY BALANCES USED IN EACH PROFILE =  25
----------------------------------------------------------------------------
 NOTE: STEADY FLOW HYDRAULIC HEAD-LOSS COMPUTATIONS BASED ON THE MOST
 CONSERVATIVE FORMULAE FROM THE CURRENT LACRD,LACFCD, AND OCEMA
 DESIGN MANUALS.
****************************************************************************
 DOWNSTREAM PIPE FLOW CONTROL DATA:
 NODE NUMBER =  1183.00           FLOWLINE ELEVATION =   502.03
 PIPE FLOW =        2.60 CFS      PIPE DIAMETER =  24.00 INCHES
 ASSUMED DOWNSTREAM CONTROL HGL =   507.500 FEET
----------------------------------------------------------------------------
 NODE  1183.00 : HGL = <  507.500>;EGL= <  507.511>;FLOWLINE= <  502.030>

****************************************************************************
 FLOW PROCESS FROM NODE  1183.00 TO NODE  1180.00 IS CODE =  1
 UPSTREAM NODE  1180.00     ELEVATION =   502.86  (FLOW IS UNDER PRESSURE)
----------------------------------------------------------------------------
 CALCULATE FRICTION LOSSES(LACFCD):
 PIPE FLOW    =        2.60 CFS    PIPE DIAMETER =  24.00 INCHES
 PIPE LENGTH =       27.80 FEET         MANNING'S N  =  0.01300
 SF=(Q/K)**2 = ((       2.60)/(    225.594))**2 = 0.00013
```

```
 HF=L*SF = (      27.80)*(0.00013) =       0.004
--------------------------------------------------------------------------------
 NODE  1180.00 : HGL = <  507.504>;EGL= <  507.514>;FLOWLINE= <  502.860>

********************************************************************************
 FLOW PROCESS FROM NODE  1180.00 TO NODE  1180.00 IS CODE =  5
 UPSTREAM NODE  1180.00      ELEVATION =   503.19  (FLOW IS UNDER PRESSURE)
--------------------------------------------------------------------------------
 CALCULATE JUNCTION LOSSES:
      PIPE         FLOW    DIAMETER   ANGLE    FLOWLINE   CRITICAL   VELOCITY
                   (CFS)   (INCHES) (DEGREES) ELEVATION  DEPTH(FT.)  (FT/SEC)
    UPSTREAM        1.30    18.00      0.00    503.19      0.43       0.736
   DOWNSTREAM       2.60    24.00       -      502.86      0.56       0.828
   LATERAL #1       0.00     0.00      0.00      0.00      0.00       0.000
   LATERAL #2       0.00     0.00      0.00      0.00      0.00       0.000
      Q5            1.30===Q5 EQUALS BASIN INPUT===

 LACFCD AND OCEMA FLOW JUNCTION FORMULAE USED:
 DY=(Q2*V2-Q1*V1*COS(DELTA1)-Q3*V3*COS(DELTA3)-
     Q4*V4*COS(DELTA4))/((A1+A2)*16.1)+FRICTION LOSSES
 UPSTREAM:     MANNING'S N = 0.01300;  FRICTION SLOPE = 0.00015
 DOWNSTREAM:   MANNING'S N = 0.01300;  FRICTION SLOPE = 0.00013
 AVERAGED FRICTION SLOPE IN JUNCTION ASSUMED AS 0.00014
 JUNCTION LENGTH =    4.00 FEET
 FRICTION LOSSES =  0.001 FEET          ENTRANCE LOSSES =  0.002 FEET
 JUNCTION LOSSES = (DY+HV1-HV2)+(ENTRANCE LOSSES)
 JUNCTION LOSSES = ( 0.013)+( 0.002) =   0.016
--------------------------------------------------------------------------------
 NODE  1180.00 : HGL = <  507.521>;EGL= <  507.530>;FLOWLINE= <  503.190>

********************************************************************************
 FLOW PROCESS FROM NODE  1180.00 TO NODE  1172.00 IS CODE =  1
 UPSTREAM NODE  1172.00      ELEVATION =   503.60  (FLOW IS UNDER PRESSURE)
--------------------------------------------------------------------------------
 CALCULATE FRICTION LOSSES(LACFCD):
 PIPE FLOW   =        1.30 CFS      PIPE DIAMETER =  18.00 INCHES
 PIPE LENGTH =      40.50 FEET           MANNING'S N  =  0.01300
 SF=(Q/K)**2 = ((       1.30)/(    105.111))**2 = 0.00015
 HF=L*SF = (      40.50)*(0.00015) =       0.006
--------------------------------------------------------------------------------
 NODE  1172.00 : HGL = <  507.528>;EGL= <  507.536>;FLOWLINE= <  503.600>

********************************************************************************
 FLOW PROCESS FROM NODE  1172.00 TO NODE  1172.00 IS CODE =  8
 UPSTREAM NODE  1172.00      ELEVATION =   503.60  (FLOW IS UNDER PRESSURE)
--------------------------------------------------------------------------------
 CALCULATE CATCH BASIN ENTRANCE LOSSES(LACFCD):
 PIPE FLOW =        1.30 CFS          PIPE DIAMETER =  18.00 INCHES
 FLOW VELOCITY =   0.74 FEET/SEC.    VELOCITY HEAD =  0.008 FEET
 CATCH BASIN ENERGY LOSS = .2*(VELOCITY HEAD) = .2*(  0.008) =  0.002
--------------------------------------------------------------------------------
 NODE  1172.00 : HGL = <  507.538>;EGL= <  507.538>;FLOWLINE= <  503.600>

********************************************************************************
 UPSTREAM PIPE FLOW CONTROL DATA:
 NODE NUMBER =  1172.00            FLOWLINE ELEVATION =   503.60
 ASSUMED UPSTREAM CONTROL HGL =    504.03 FOR DOWNSTREAM RUN ANALYSIS

================================================================================
 END OF GRADUALLY VARIED FLOW ANALYSIS
```

```
****************************************************************************
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                          Analysis prepared by:

                         Rick Engineering Company
                            5620 Friars Road
                          San Diego, CA  92110
                             (619) 291-0707

 ************************* DESCRIPTION OF STUDY *************************
 * BLACK MOUNTAIN RANCH EAST CLUSTERS UNIT 3, J-15149-B                  *
 * OFF-SITE EASTERLY CROSSING - 100-YR FLOW                              *
 * H:\15149B\HYDRO\HYDRAULICS\PIPEFLOW\....                              *
 ************************************************************************

  FILE NAME: 1190.PIP
  TIME/DATE OF STUDY: 14:28 08/04/2014

****************************************************************************
              GRADUALLY VARIED FLOW ANALYSIS FOR PIPE SYSTEM
                        NODAL POINT STATUS TABLE
               (Note: "*" indicates nodal point data used.)
                    UPSTREAM RUN                       DOWNSTREAM RUN
   NODE     MODEL   PRESSURE      PRESSURE+        FLOW         PRESSURE+
  NUMBER  PROCESS  HEAD(FT)  MOMENTUM(POUNDS)   DEPTH(FT)  MOMENTUM(POUNDS)
 1190.00-              3.00          2416.21        1.90*          2876.99
         } FRICTION
  701.00-              2.77*Dc       2380.21        2.77*Dc        2380.21
         } CATCH BASIN
  701.00-              5.33*         1691.13        2.77 Dc         561.66
----------------------------------------------------------------------------
 MAXIMUM NUMBER OF ENERGY BALANCES USED IN EACH PROFILE =  25
----------------------------------------------------------------------------
 NOTE: STEADY FLOW HYDRAULIC HEAD-LOSS COMPUTATIONS BASED ON THE MOST
 CONSERVATIVE FORMULAE FROM THE CURRENT LACRD,LACFCD, AND OCEMA
 DESIGN MANUALS.
****************************************************************************
 DOWNSTREAM PIPE FLOW CONTROL DATA:
 NODE NUMBER =  1190.00              FLOWLINE ELEVATION =   543.68
 PIPE FLOW =       80.00 CFS         PIPE DIAMETER =  36.00 INCHES
 ASSUMED DOWNSTREAM CONTROL HGL =   546.680 FEET
----------------------------------------------------------------------------
 NODE  1190.00 : HGL = <  545.576>;EGL= <  550.061>;FLOWLINE= <  543.680>

****************************************************************************
 FLOW PROCESS FROM NODE  1190.00 TO NODE   701.00 IS CODE =  1
 UPSTREAM NODE   701.00     ELEVATION =   546.76  (FLOW IS SUPERCRITICAL)
----------------------------------------------------------------------------
 CALCULATE FRICTION LOSSES(LACFCD):
 PIPE FLOW   =       80.00 CFS     PIPE DIAMETER =  36.00 INCHES
 PIPE LENGTH =       75.70 FEET          MANNING'S N  =  0.01300
----------------------------------------------------------------------------
 NORMAL DEPTH(FT) =       1.67          CRITICAL DEPTH(FT) =       2.77
============================================================================
 UPSTREAM CONTROL ASSUMED FLOWDEPTH(FT) =      2.77
============================================================================
```

GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:

DISTANCE FROM CONTROL (FT)	FLOW DEPTH (FT)	VELOCITY (FT/SEC)	SPECIFIC ENERGY (FT)	PRESSURE+ MOMENTUM (POUNDS)
0.000	2.770	11.727	4.907	2380.21
0.093	2.726	11.854	4.909	2381.32
0.375	2.682	11.995	4.917	2384.63
0.852	2.638	12.148	4.931	2390.11
1.533	2.593	12.314	4.949	2397.78
2.434	2.549	12.492	4.974	2407.67
3.573	2.505	12.684	5.005	2419.83
4.972	2.461	12.888	5.042	2434.32
6.660	2.417	13.107	5.086	2451.21
8.671	2.372	13.339	5.137	2470.60
11.047	2.328	13.587	5.196	2492.59
13.841	2.284	13.850	5.264	2517.30
17.116	2.240	14.129	5.342	2544.86
20.955	2.196	14.426	5.429	2575.41
25.459	2.152	14.740	5.528	2609.12
30.761	2.107	15.075	5.638	2646.16
37.039	2.063	15.430	5.762	2686.75
44.533	2.019	15.807	5.901	2731.09
53.580	1.975	16.207	6.056	2779.44
64.676	1.931	16.633	6.229	2832.07
75.700	1.896	16.990	6.381	2876.99

NODE 701.00 : HGL = < 549.530>;EGL= < 551.667>;FLOWLINE= < 546.760>

FLOW PROCESS FROM NODE 701.00 TO NODE 701.00 IS CODE = 8
UPSTREAM NODE 701.00 ELEVATION = 546.76 (FLOW IS AT CRITICAL DEPTH)

CALCULATE CATCH BASIN ENTRANCE LOSSES(LACFCD):
PIPE FLOW = 80.00 CFS PIPE DIAMETER = 36.00 INCHES
FLOW VELOCITY = 11.73 FEET/SEC. VELOCITY HEAD = 2.137 FEET
CATCH BASIN ENERGY LOSS = .2*(VELOCITY HEAD) = .2*(2.137) = 0.427

NODE 701.00 : HGL = < 552.094>;EGL= < 552.094>;FLOWLINE= < 546.760>

UPSTREAM PIPE FLOW CONTROL DATA:
NODE NUMBER = 701.00 FLOWLINE ELEVATION = 546.76
ASSUMED UPSTREAM CONTROL HGL = 549.53 FOR DOWNSTREAM RUN ANALYSIS

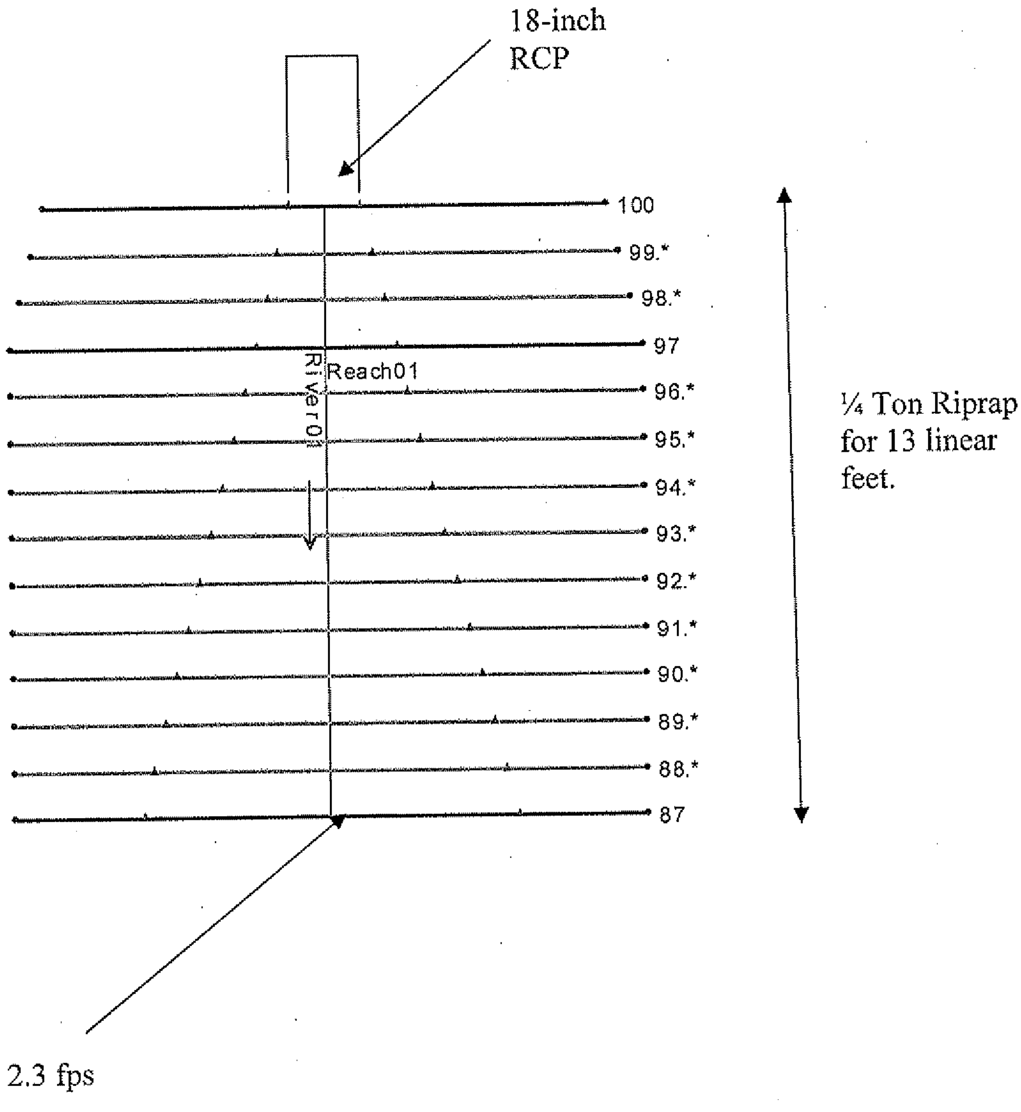
END OF GRADUALLY VARIED FLOW ANALYSIS

APPENDIX G

Energy Dissipaters Design

BLACK MOUNTAIN RANCH- EAST CLUSTERS UNIT 3
FINAL ENGINEERING
J-15149-B

Basin 900 – Basin Outfall
(Node 995)
18" RCP

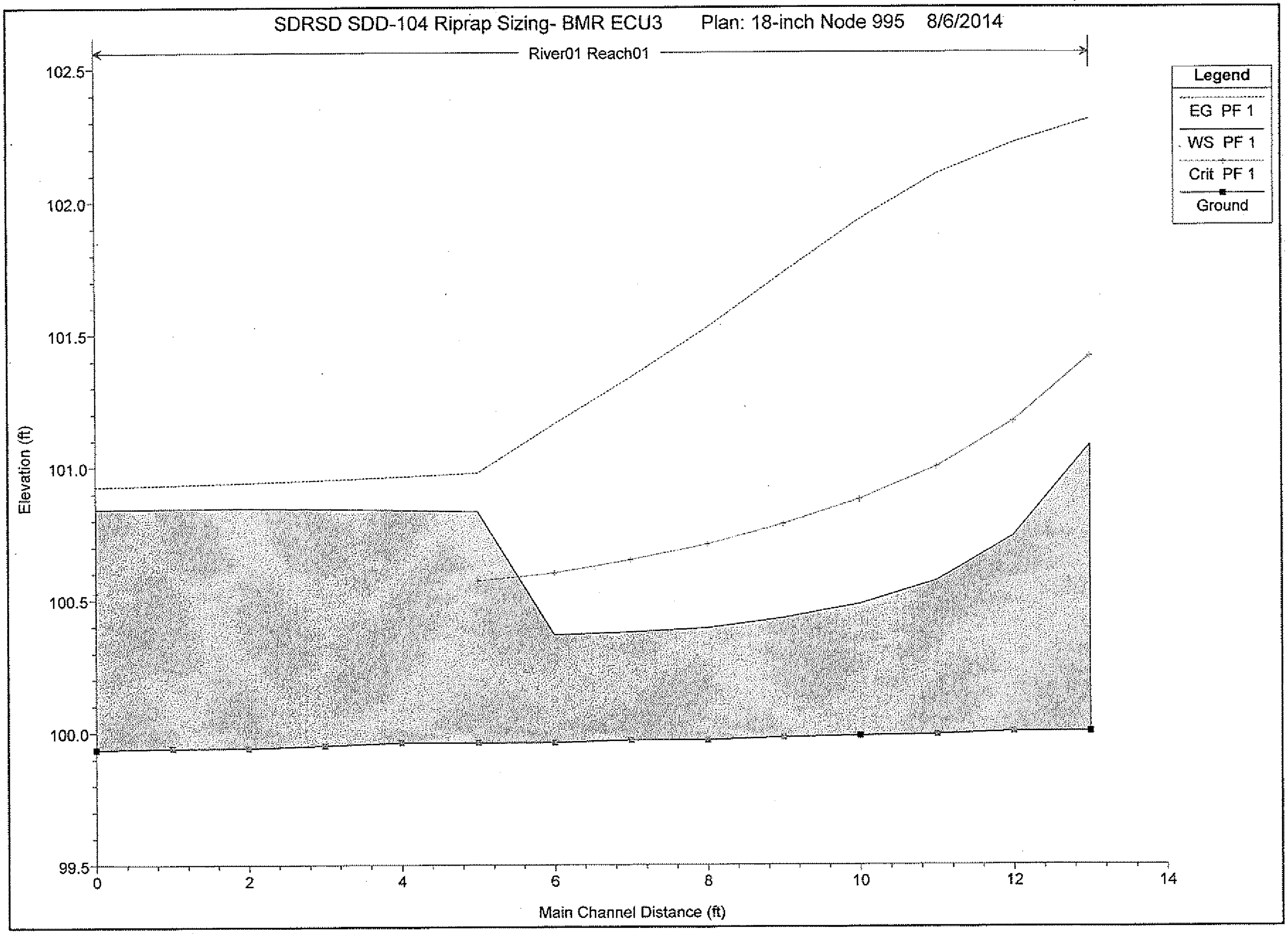


Q_{100} = 14.4 cfs
$V_{100\ (Riprap\ Exit)}$ = 2.3 fps

¼ Ton Riprap for 13.5'W * 13'L * 2.7'T from outlet of 18-inch RCP, per 2012 S.D.R.S.D SDD-104. Filter blanket material per soils engineers' specifications.

HEC-RAS Plan: 18-inch River: River01 Reach: Reach01 Profile: PF 1

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Reach01	100	PF 1	14.40	100.00	101.08	101.41	102.31	0.046634	8.89	1.62	9.48	1.51
Reach01	99.*	PF 1	14.40	100.00	100.74	101.17	102.22	0.093489	9.76	1.48	7.93	2.00
Reach01	98.*	PF 1	14.40	99.99	100.57	101.00	102.10	0.133262	9.93	1.45	7.48	2.30
Reach01	97	PF 1	14.40	99.99	100.48	100.88	101.93	0.154755	9.65	1.49	7.48	2.41
Reach01	96.*	PF 1	14.40	99.98	100.43	100.78	101.73	0.158816	9.15	1.57	7.20	2.40
Reach01	95.*	PF 1	14.40	99.97	100.39	100.71	101.52	0.150638	8.54	1.69	7.03	2.32
Reach01	94.*	PF 1	14.40	99.97	100.38	100.65	101.34	0.133673	7.86	1.83	6.94	2.17
Reach01	93.*	PF 1	14.40	99.96	100.37	100.60	101.16	0.112859	7.14	2.02	6.94	1.98
Reach01	92.*	PF 1	14.40	99.96	100.83	100.57	100.98	0.007592	3.05	4.71	9.73	0.58
Reach01	91.*	PF 1	14.40	99.96	100.84		100.96	0.006669	2.83	5.08	9.77	0.54
Reach01	90.*	PF 1	14.40	99.95	100.84		100.95	0.005828	2.63	5.47	9.86	0.51
Reach01	89.*	PF 1	14.40	99.94	100.85		100.94	0.005264	2.48	5.82	9.93	0.48
Reach01	88.*	PF 1	14.40	99.94	100.84		100.93	0.005129	2.39	6.03	9.93	0.47
Reach01	87	PF 1	14.40	99.94	100.84	100.53	100.93	0.005001	2.31	6.24	9.95	0.46


SDRSD SDD-104 Riprap Sizing- BMR ECU3 Plan: 18-inch Node 995 8/6/2014
River01 Reach01
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Elevation (ft)
102.5
102.0
101.5
101.0
100.5
100.0
99.5
0
2
4
6
8
10
12
14
Main Channel Distance (ft)

```
****************************************************************************
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                        Analysis prepared by:

                       Rick Engineering Company
                          5620 Friars Road
                        San Diego, CA  92110
                           (619) 291-0707

 ************************** DESCRIPTION OF STUDY **************************
 * BLACK MOUNTAIN RANCH EAST CLUSTERS UNIT 3, J-15149-B                     *
 * WEST BASIN OUTLET PIPE - 100-YEAR FLOW, VELOCITY RUN                     *
 * H:\15149B\HYDRO\HYDRAULICS\PIPEFLOW\....                                 *
 **************************************************************************

  FILE NAME: 995_V.PIP
  TIME/DATE OF STUDY: 15:46 07/24/2014

****************************************************************************
            GRADUALLY VARIED FLOW ANALYSIS FOR PIPE SYSTEM
                       NODAL POINT STATUS TABLE
            (Note: "*" indicates nodal point data used.)
                  UPSTREAM RUN                        DOWNSTREAM RUN
  NODE     MODEL   PRESSURE      PRESSURE+          FLOW         PRESSURE+
 NUMBER  PROCESS  HEAD(FT)   MOMENTUM(POUNDS)    DEPTH(FT)   MOMENTUM(POUNDS)
 995.00-             1.39*Dc         305.88         1.39*Dc            305.88
        } FRICTION
 994.00-             1.63*           324.12         1.39 Dc            305.88
        } CATCH BASIN
 994.00-             2.86*           233.16         1.39 Dc             70.91
----------------------------------------------------------------------------
 MAXIMUM NUMBER OF ENERGY BALANCES USED IN EACH PROFILE =  25
----------------------------------------------------------------------------
 NOTE: STEADY FLOW HYDRAULIC HEAD-LOSS COMPUTATIONS BASED ON THE MOST
 CONSERVATIVE FORMULAE FROM THE CURRENT LACRD,LACFCD, AND OCEMA
 DESIGN MANUALS.
****************************************************************************
 DOWNSTREAM PIPE FLOW CONTROL DATA:
 NODE NUMBER =    995.00            FLOWLINE ELEVATION =   505.85
 PIPE FLOW =       14.40 CFS        PIPE DIAMETER =  18.00 INCHES
 ASSUMED DOWNSTREAM CONTROL HGL =    505.850 FEET
 *NOTE: ASSUMED DOWNSTREAM CONTROL DEPTH(  0.00 FT.)
        IS LESS THAN CRITICAL DEPTH(  1.39 FT.)
 ===> CRITICAL DEPTH IS ASSUMED AS DOWNSTREAM CONTROL DEPTH
      FOR UPSTREAM RUN ANALYSIS
----------------------------------------------------------------------------
 NODE    995.00 : HGL = <  507.242>;EGL= <  508.343>;FLOWLINE= <  505.850>

****************************************************************************
 FLOW PROCESS FROM NODE   995.00 TO NODE   994.00 IS CODE =  1
 UPSTREAM NODE   994.00     ELEVATION =   506.05  (FLOW UNSEALS IN REACH)
----------------------------------------------------------------------------
 CALCULATE FRICTION LOSSES(LACFCD):
 PIPE FLOW    =      14.40 CFS     PIPE DIAMETER =  18.00 INCHES
 PIPE LENGTH =       20.00 FEET           MANNING'S N  =  0.01300
 ===> NORMAL PIPEFLOW IS PRESSURE FLOW
```

NORMAL DEPTH(FT) = 1.50 CRITICAL DEPTH(FT) = 1.39

DOWNSTREAM CONTROL ASSUMED FLOWDEPTH(FT) = 1.39

GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:

DISTANCE FROM CONTROL(FT)	FLOW DEPTH (FT)	VELOCITY (FT/SEC)	SPECIFIC ENERGY(FT)	PRESSURE+ MOMENTUM(POUNDS)
0.000	1.392	8.418	2.493	305.88
0.008	1.396	8.401	2.493	305.88
0.034	1.400	8.385	2.493	305.90
0.076	1.405	8.370	2.493	305.93
0.136	1.409	8.354	2.493	305.97
0.213	1.413	8.339	2.494	306.02
0.308	1.418	8.325	2.494	306.09
0.420	1.422	8.311	2.495	306.16
0.549	1.426	8.297	2.496	306.25
0.696	1.431	8.284	2.497	306.35
0.861	1.435	8.271	2.498	306.46
1.044	1.439	8.259	2.499	306.59
1.244	1.444	8.247	2.500	306.73
1.462	1.448	8.236	2.502	306.88
1.698	1.452	8.225	2.503	307.05
1.952	1.457	8.214	2.505	307.23
2.224	1.461	8.204	2.507	307.43
2.514	1.465	8.195	2.509	307.64
2.823	1.470	8.186	2.511	307.87
3.150	1.474	8.178	2.513	308.11
3.495	1.478	8.170	2.515	308.38
3.860	1.483	8.163	2.518	308.67
4.245	1.487	8.157	2.521	308.98
4.651	1.491	8.152	2.524	309.31
5.080	1.496	8.148	2.527	309.68
5.541	1.500	8.146	2.531	310.10
===> FLOW IS UNDER PRESSURE				
20.000	1.627	8.149	2.658	324.12

NODE 994.00 : HGL = < 507.677>;EGL= < 508.708>;FLOWLINE= < 506.050>

****

FLOW PROCESS FROM NODE 994.00 TO NODE 994.00 IS CODE = 8
UPSTREAM NODE 994.00 ELEVATION = 506.05 (FLOW IS UNDER PRESSURE)

CALCULATE CATCH BASIN ENTRANCE LOSSES(LACFCD):
PIPE FLOW = 14.40 CFS PIPE DIAMETER = 18.00 INCHES
FLOW VELOCITY = 8.15 FEET/SEC. VELOCITY HEAD = 1.031 FEET
CATCH BASIN ENERGY LOSS = .2*(VELOCITY HEAD) = .2*(1.031) = 0.206

NODE 994.00 : HGL = < 508.914>;EGL= < 508.914>;FLOWLINE= < 506.050>

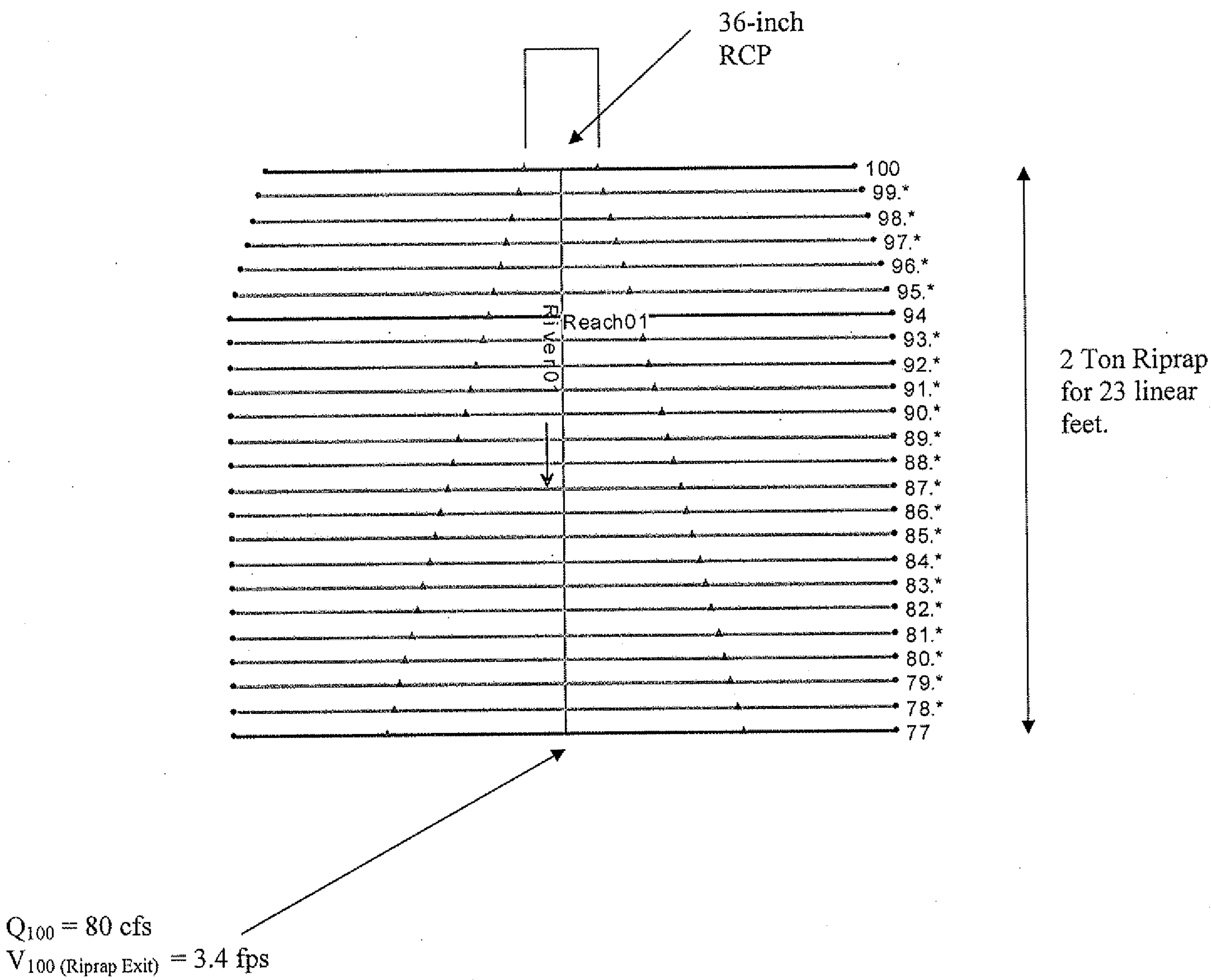
****

UPSTREAM PIPE FLOW CONTROL DATA:
NODE NUMBER = 994.00 FLOWLINE ELEVATION = 506.05
ASSUMED UPSTREAM CONTROL HGL = 507.44 FOR DOWNSTREAM RUN ANALYSIS

END OF GRADUALLY VARIED FLOW ANALYSIS

BLACK MOUNTAIN RANCH- EAST CLUSTERS UNIT 3
FINAL ENGINEERING
J-15149-B

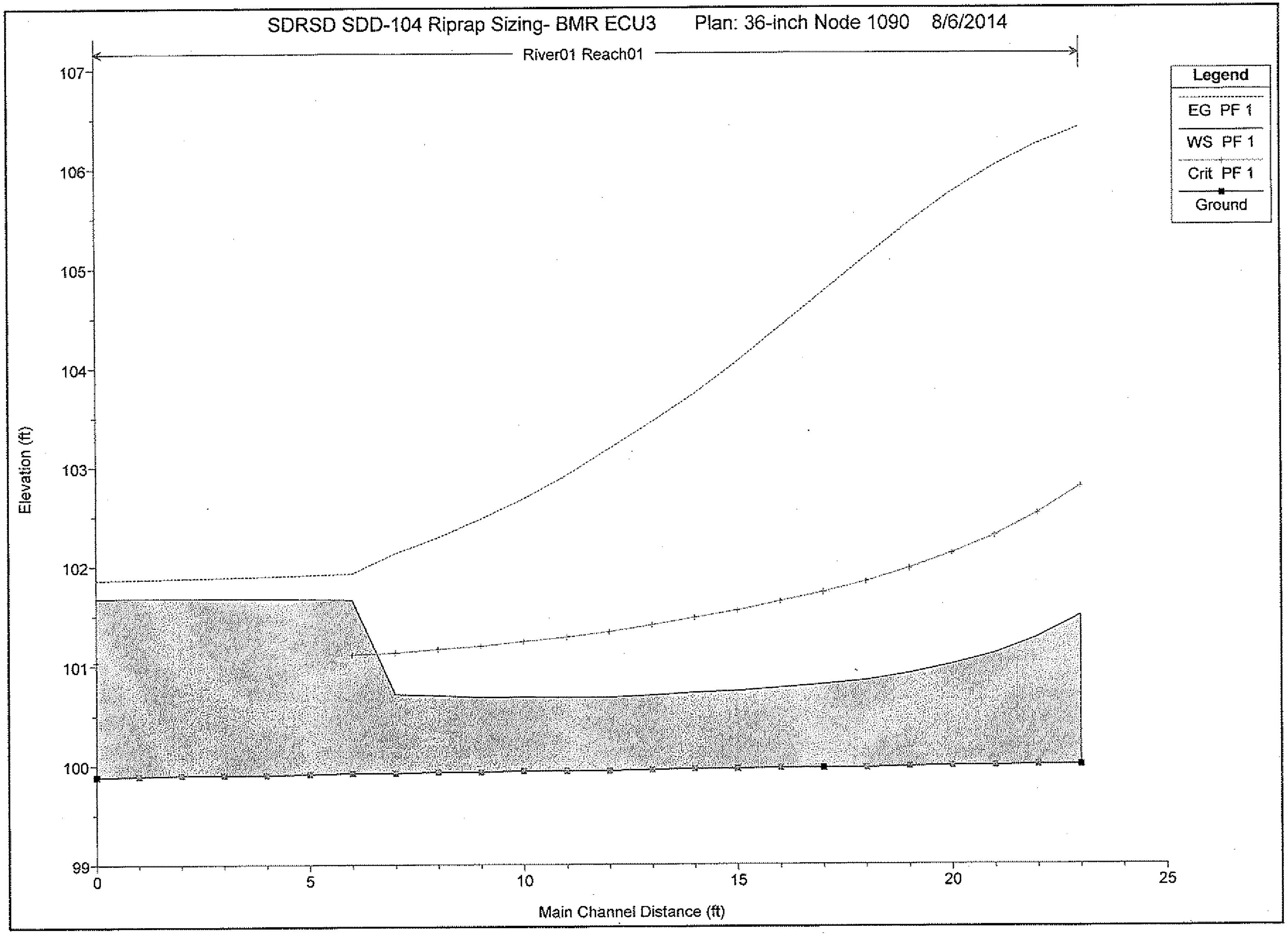
Basin 1000 – Basin Outfall
(Node 1190)
36" RCP



2 Ton Riprap for 27'W * 23'L * 5.4'T from outlet of 36-inch RCP, per 2012 S.D.R.S.D D-104. Filter blanket material per soils engineers' specifications.

HEC-RAS Plan: 36-inch River: River01 Reach: Reach01 Profile: PF 1

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Reach01	100	PF 1	80.00	100.00	101.50	102.80	106.41	0.147053	17.78	4.50	15.00	2.56
Reach01	99.*	PF 1	80.00	100.00	101.28	102.52	106.24	0.183723	17.87	4.48	14.17	2.78
Reach01	98.*	PF 1	80.00	99.99	101.12	102.30	106.02	0.215264	17.76	4.50	13.76	2.95
Reach01	97.*	PF 1	80.00	99.99	101.01	102.12	105.75	0.238527	17.48	4.58	13.60	3.05
Reach01	96.*	PF 1	80.00	99.98	100.92	101.97	105.44	0.253506	17.06	4.69	13.63	3.11
Reach01	95.*	PF 1	80.00	99.97	100.85	101.84	105.10	0.259503	16.54	4.84	13.78	3.11
Reach01	94	PF 1	80.00	99.97	100.81	101.73	104.75	0.256835	15.93	5.02	14.02	3.07
Reach01	93.*	PF 1	80.00	99.97	100.78	101.64	104.40	0.248484	15.27	5.24	13.84	3.00
Reach01	92.*	PF 1	80.00	99.96	100.74	101.55	104.05	0.235936	14.60	5.48	13.70	2.91
Reach01	91.*	PF 1	80.00	99.96	100.73	101.48	103.73	0.220031	13.91	5.75	13.60	2.80
Reach01	90.*	PF 1	80.00	99.95	100.70	101.40	103.45	0.206552	13.30	6.02	13.51	2.70
Reach01	89.*	PF 1	80.00	99.94	100.68	101.34	103.18	0.190807	12.67	6.31	13.46	2.59
Reach01	88.*	PF 1	80.00	99.94	100.68	101.28	102.91	0.170195	11.97	6.68	13.46	2.45
Reach01	87.*	PF 1	80.00	99.94	100.69	101.24	102.68	0.152517	11.32	7.07	13.48	2.31
Reach01	86.*	PF 1	80.00	99.93	100.68	101.19	102.47	0.137203	10.73	7.45	13.52	2.19
Reach01	85.*	PF 1	80.00	99.93	100.70	101.16	102.29	0.119760	10.10	7.92	13.64	2.05
Reach01	84.*	PF 1	80.00	99.92	100.71	101.13	102.12	0.105599	9.54	8.39	13.76	1.92
Reach01	83.*	PF 1	80.00	99.92	101.66	101.11	101.92	0.006731	4.10	19.52	19.46	0.55
Reach01	82.*	PF 1	80.00	99.91	101.67		101.91	0.006199	3.93	20.37	19.56	0.53
Reach01	81.*	PF 1	80.00	99.90	101.68		101.90	0.005768	3.78	21.17	19.65	0.51
Reach01	80.*	PF 1	80.00	99.90	101.68		101.89	0.005553	3.68	21.76	19.66	0.50
Reach01	79.*	PF 1	80.00	99.90	101.68		101.88	0.005389	3.59	22.30	19.66	0.49
Reach01	78.*	PF 1	80.00	99.89	101.68		101.87	0.005142	3.48	22.96	19.73	0.48
Reach01	77	PF 1	80.00	99.89	101.68	101.04	101.86	0.005001	3.41	23.49	19.76	0.47


SDRSD SDD-104 Riprap Sizing- BMR ECU3
Plan: 36-inch Node 1090
8/6/2014
River01 Reach01
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Elevation (ft)
107
106
105
104
103
102
101
100
99
0
5
10
15
20
25
Main Channel Distance (ft)

```
****************************************************************************
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                        Analysis prepared by:

                       Rick Engineering Company
                           5620 Friars Road
                         San Diego, CA  92110
                            (619) 291-0707

 ************************** DESCRIPTION OF STUDY **************************
 * BLACK MOUNTAIN RANCH EAST CLUSTERS UNIT 3, J-15149-B                     *
 * OFF-SITE EASTERLY CROSSING - 100-YR FLOW                                 *
 * VELOCITY RUN                                                             *
 **************************************************************************

  FILE NAME: 1190_V.PIP
  TIME/DATE OF STUDY: 14:32 08/04/2014
****************************************************************************
             GRADUALLY VARIED FLOW ANALYSIS FOR PIPE SYSTEM
                       NODAL POINT STATUS TABLE
              (Note: "*" indicates nodal point data used.)
                  UPSTREAM RUN                      DOWNSTREAM RUN
  NODE    MODEL   PRESSURE     PRESSURE+         FLOW        PRESSURE+
 NUMBER  PROCESS  HEAD(FT)  MOMENTUM(POUNDS)   DEPTH(FT)   MOMENTUM(POUNDS)
 1190.00-          2.77 Dc        2380.21         1.90*          2876.99
        } FRICTION
  701.00-          2.77*Dc        2380.21         2.77*Dc        2380.21
        } CATCH BASIN
  701.00-          5.33*          1691.13         2.77 Dc         561.66
----------------------------------------------------------------------------
 MAXIMUM NUMBER OF ENERGY BALANCES USED IN EACH PROFILE =  25
----------------------------------------------------------------------------
 NOTE: STEADY FLOW HYDRAULIC HEAD-LOSS COMPUTATIONS BASED ON THE MOST
 CONSERVATIVE FORMULAE FROM THE CURRENT LACRD,LACFCD, AND OCEMA
 DESIGN MANUALS.
****************************************************************************
 DOWNSTREAM PIPE FLOW CONTROL DATA:
 NODE NUMBER =  1190.00           FLOWLINE ELEVATION =   543.68
 PIPE FLOW =      80.00 CFS       PIPE DIAMETER =  36.00 INCHES
 ASSUMED DOWNSTREAM CONTROL HGL =   543.680 FEET
 *NOTE: ASSUMED DOWNSTREAM CONTROL DEPTH(  0.00 FT.)
        IS LESS THAN CRITICAL DEPTH(  2.77 FT.)
 ===> CRITICAL DEPTH IS ASSUMED AS DOWNSTREAM CONTROL DEPTH
      FOR UPSTREAM RUN ANALYSIS
----------------------------------------------------------------------------
 NODE  1190.00 : HGL = <  545.576>;EGL= <  550.061>;FLOWLINE= <  543.680>

****************************************************************************
 FLOW PROCESS FROM NODE  1190.00 TO NODE   701.00 IS CODE =  1
 UPSTREAM NODE   701.00     ELEVATION =   546.76  (FLOW IS SUPERCRITICAL)
----------------------------------------------------------------------------
 CALCULATE FRICTION LOSSES(LACFCD):
 PIPE FLOW   =      80.00 CFS     PIPE DIAMETER =  36.00 INCHES
 PIPE LENGTH =      75.70 FEET          MANNING'S N  =  0.01300
----------------------------------------------------------------------------
```

NORMAL DEPTH(FT) = 1.67 CRITICAL DEPTH(FT) = 2.77

UPSTREAM CONTROL ASSUMED FLOWDEPTH(FT) = 2.77

GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:

DISTANCE FROM CONTROL(FT)	FLOW DEPTH (FT)	VELOCITY (FT/SEC)	SPECIFIC ENERGY(FT)	PRESSURE+ MOMENTUM(POUNDS)
0.000	2.770	11.727	4.907	2380.21
0.093	2.726	11.854	4.909	2381.32
0.375	2.682	11.995	4.917	2384.63
0.852	2.638	12.148	4.931	2390.11
1.533	2.593	12.314	4.949	2397.78
2.434	2.549	12.492	4.974	2407.67
3.573	2.505	12.684	5.005	2419.83
4.972	2.461	12.888	5.042	2434.32
6.660	2.417	13.107	5.086	2451.21
8.671	2.372	13.339	5.137	2470.60
11.047	2.328	13.587	5.196	2492.59
13.841	2.284	13.850	5.264	2517.30
17.116	2.240	14.129	5.342	2544.86
20.955	2.196	14.426	5.429	2575.41
25.459	2.152	14.740	5.528	2609.12
30.761	2.107	15.075	5.638	2646.16
37.039	2.063	15.430	5.762	2686.75
44.533	2.019	15.807	5.901	2731.09
53.580	1.975	16.207	6.056	2779.44
64.676	1.931	16.633	6.229	2832.07
75.700	1.896	16.990	6.381	2876.99

NODE 701.00 : HGL = < 549.530>;EGL= < 551.667>;FLOWLINE= < 546.760>

****

FLOW PROCESS FROM NODE 701.00 TO NODE 701.00 IS CODE = 8
UPSTREAM NODE 701.00 ELEVATION = 546.76 (FLOW IS AT CRITICAL DEPTH)

CALCULATE CATCH BASIN ENTRANCE LOSSES(LACFCD):
PIPE FLOW = 80.00 CFS PIPE DIAMETER = 36.00 INCHES
FLOW VELOCITY = 11.73 FEET/SEC. VELOCITY HEAD = 2.137 FEET
CATCH BASIN ENERGY LOSS = .2*(VELOCITY HEAD) = .2*(2.137) = 0.427

NODE 701.00 : HGL = < 552.094>;EGL= < 552.094>;FLOWLINE= < 546.760>

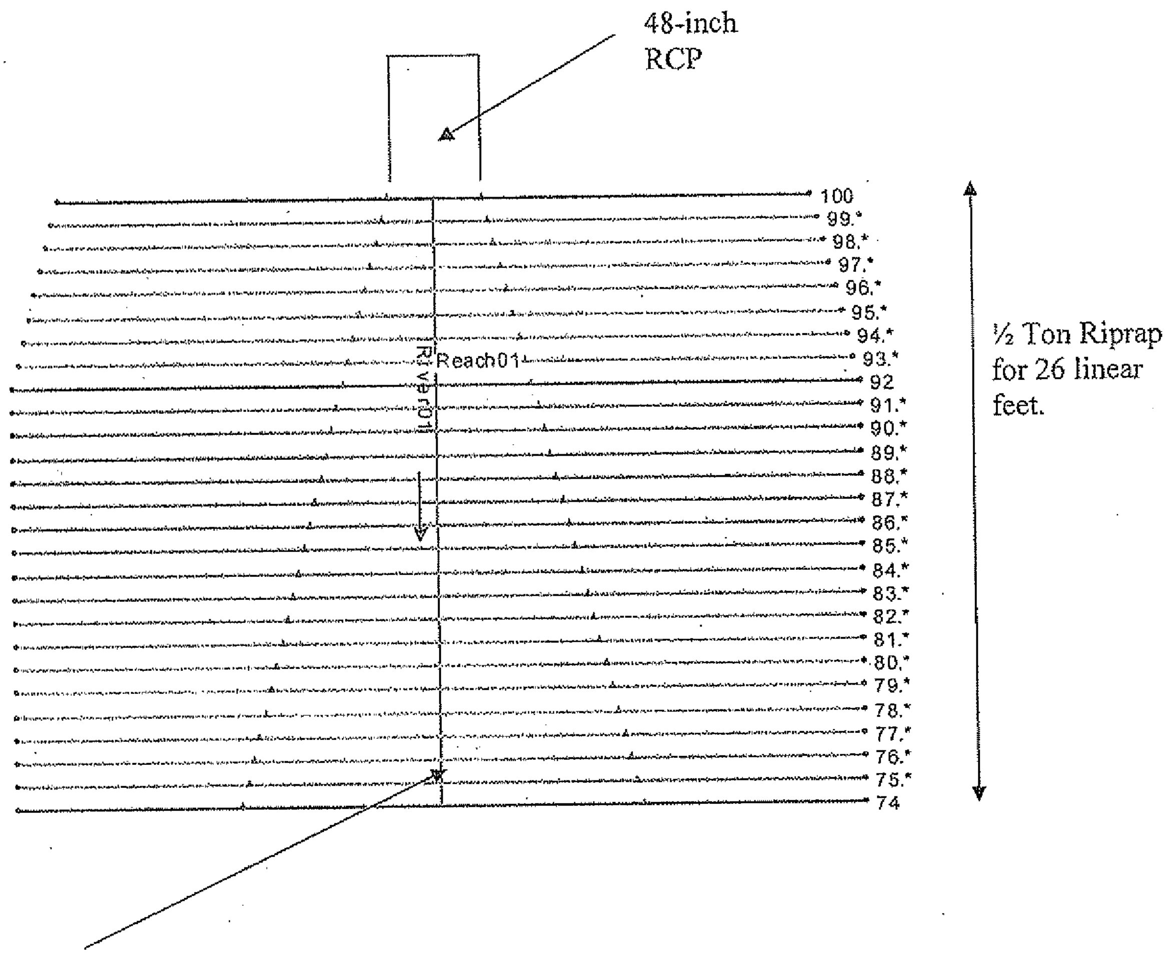
****

UPSTREAM PIPE FLOW CONTROL DATA:
NODE NUMBER = 701.00 FLOWLINE ELEVATION = 546.76
ASSUMED UPSTREAM CONTROL HGL = 549.53 FOR DOWNSTREAM RUN ANALYSIS

END OF GRADUALLY VARIED FLOW ANALYSIS

BLACK MOUNTAIN RANCH- EAST CLUSTERS UNIT 3
FINAL ENGINEERING
J-15149-B

Basin 1000 – Basin Outfall
(Node 1182)
48" RCP

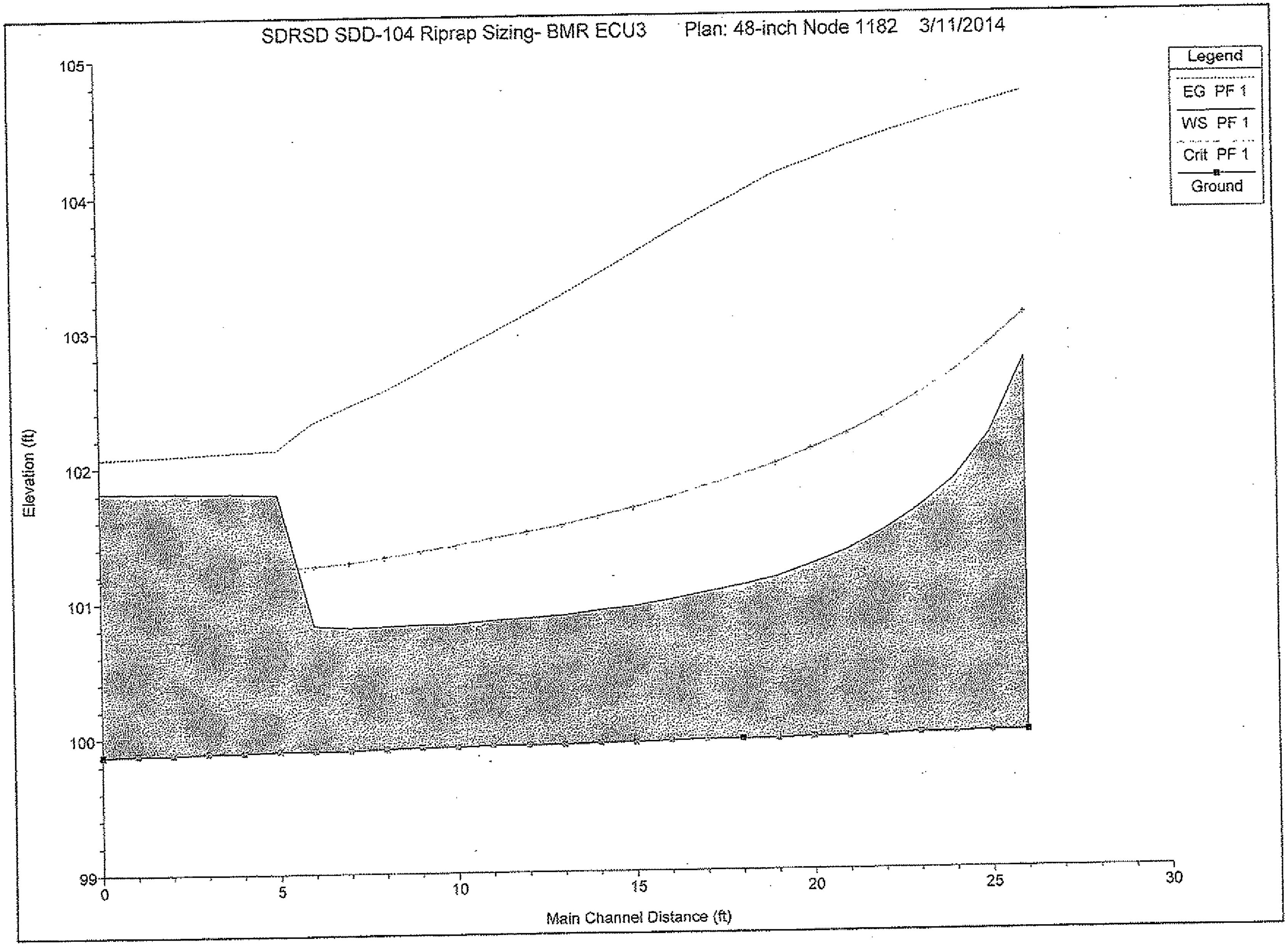


Q_{100} = 123.7 cfs
$V_{100\ (Riprap\ Exit)}$ = 4.0 fps

½ Ton Riprap for 36'W * 26'L * 3.5'T from outlet of 48-inch RCP, per 2012 S.D.R.S.D SDD-104. Filter blanket material per soils engineers' specifications.

HEC-RAS Plan: 48-inch River: River01 Reach: Reach01 Profile: PF 1

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Reach01	100	PF 1	123.70	100.00	102.75	103.09	104.71	0.022611	11.25	11.00	24.50	1.20
Reach01	99.*	PF 1	123.70	100.00	102.19	102.85	104.64	0.038265	12.56	9.85	21.63	1.50
Reach01	98.*	PF 1	123.70	99.99	101.86	102.65	104.57	0.051955	13.20	9.37	20.24	1.70
Reach01	97.*	PF 1	123.70	99.99	101.65	102.49	104.49	0.063807	13.52	9.15	19.48	1.85
Reach01	96.*	PF 1	123.70	99.98	101.48	102.34	104.41	0.075461	13.73	9.01	19.01	1.97
Reach01	95.*	PF 1	123.70	99.97	101.34	102.20	104.32	0.086415	13.85	8.93	18.75	2.08
Reach01	94.*	PF 1	123.70	99.97	101.25	102.10	104.22	0.095311	13.84	8.94	18.66	2.16
Reach01	93.*	PF 1	123.70	99.96	101.15	101.99	104.12	0.104265	13.83	8.94	18.65	2.23
Reach01	92	PF 1	123.70	99.96	101.09	101.90	103.98	0.108603	13.65	9.06	18.80	2.26
Reach01	91.*	PF 1	123.70	99.96	101.04	101.83	103.85	0.111973	13.44	9.20	18.50	2.28
Reach01	90.*	PF 1	123.70	99.95	100.99	101.75	103.70	0.113702	13.20	9.37	18.25	2.28
Reach01	89.*	PF 1	123.70	99.94	100.95	101.67	103.55	0.114307	12.94	9.56	18.04	2.27
Reach01	88.*	PF 1	123.70	99.94	100.92	101.62	103.39	0.112535	12.62	9.81	17.88	2.25
Reach01	87.*	PF 1	123.70	99.93	100.89	101.55	103.24	0.111116	12.32	10.04	17.74	2.22
Reach01	86.*	PF 1	123.70	99.93	100.87	101.50	103.10	0.108068	12.00	10.31	17.62	2.18
Reach01	85.*	PF 1	123.70	99.93	100.85	101.46	102.96	0.103930	11.65	10.62	17.54	2.14
Reach01	84.*	PF 1	123.70	99.92	100.83	101.41	102.83	0.100912	11.35	10.90	17.45	2.10
Reach01	83.*	PF 1	123.70	99.92	100.83	101.37	102.68	0.093842	10.92	11.33	17.45	2.02
Reach01	82.*	PF 1	123.70	99.91	100.82	101.33	102.55	0.088527	10.55	11.72	17.45	1.96
Reach01	81.*	PF 1	123.70	99.90	100.81	101.29	102.44	0.084609	10.25	12.07	17.45	1.91
Reach01	80.*	PF 1	123.70	99.90	100.82	101.27	102.32	0.077101	9.81	12.60	17.54	1.82
Reach01	79.*	PF 1	123.70	99.90	101.80	101.25	102.12	0.006383	4.58	27.01	23.39	0.59
Reach01	78.*	PF 1	123.70	99.89	101.81		102.11	0.005935	4.42	28.00	23.50	0.57
Reach01	77.*	PF 1	123.70	99.89	101.81		102.10	0.005698	4.31	28.73	23.52	0.56
Reach01	76.*	PF 1	123.70	99.88	101.81		102.09	0.005379	4.18	29.62	23.61	0.54
Reach01	75.*	PF 1	123.70	99.88	101.82		102.08	0.005231	4.09	30.26	23.62	0.53
Reach01	74	PF 1	123.70	99.87	101.82	101.17	102.07	0.005000	3.98	31.05	23.69	0.52


SDRSD SDD-104 Riprap Sizing- BMR ECU3 Plan: 48-inch Node 1182 3/11/2014
Legend
EG PF 1
WS PF 1
Crit PF 1
Ground
Elevation (ft)
105
104
103
102
101
100
99
0
5
10
15
20
25
30
Main Channel Distance (ft)

```
****************************************************************************
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                    Analysis prepared by:

                  Rick Engineering Company
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 ************************** DESCRIPTION OF STUDY **************************
 * BLACK MOUNTAIN RANCH EAST CLUSTERS UNIT 3, J-15149-B                    *
 * MAINLINE PIPE BASIN 1000 - 100-YR FLOW, VELOCITY RUN                    *
 * H:\15149B\HYDRO\HYDRAULICS\PIPEFLOW\....                                *
 **************************************************************************

  FILE NAME: 1182_V.PIP
  TIME/DATE OF STUDY: 09:29 03/10/2014
****************************************************************************
       GRADUALLY VARIED FLOW ANALYSIS FOR PIPE SYSTEM
                  NODAL POINT STATUS TABLE
         (Note: "*" indicates nodal point data used.)
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NODE NUMBER	MODEL PROCESS	UPSTREAM RUN PRESSURE HEAD(FT)	UPSTREAM RUN PRESSURE+ MOMENTUM(POUNDS)	DOWNSTREAM RUN FLOW DEPTH(FT)	DOWNSTREAM RUN PRESSURE+ MOMENTUM(POUNDS)
1182.00-		3.34*Dc	3718.78	3.34*Dc	3718.78
}	FRICTION				
1173.00-		3.41*	3721.40	3.34 Dc	3718.78
}	JUNCTION				
1173.00-		4.59	4789.28	1.77*	6319.69
}	FRICTION+BEND				
1172.00-		3.27 Dc	4085.04	1.64*	6869.30
}	JUNCTION				
1172.00-		3.27 Dc	4085.04	1.63*	6924.72
}	FRICTION+BEND				
1171.00-		3.27 Dc	4085.04	1.71*	6541.11
}	FRICTION				
1160.00-		3.27 Dc	4085.04	2.13*	5190.59
}	JUNCTION				
1160.00-		3.89	3924.04	1.86*	5161.25
}	FRICTION+BEND				
1160.50-		3.21 Dc	3628.46	2.17*	4415.53
}	FRICTION				
1105.00-		3.21 Dc	3628.46	2.24*	4302.10
}	JUNCTION				
1105.00-		3.39	3481.05	2.13*	4239.42
}	FRICTION				
1100.00-		3.18 Dc	3453.01	2.54*	3706.76
}	JUNCTION				
1100.00-		4.47	3283.47	1.70*	3621.87
}	FRICTION				
1095.00-		2.95 Dc	2568.15	1.72*	3590.87
}	FRICTION+BEND				
1092.00-		2.95 Dc	2568.15	1.76*	3497.37
}	FRICTION				
1031.00-		2.95 Dc	2568.15	1.78*	3470.35

```
        } JUNCTION
 1031.00-            3.14              2414.15          1.64*           3441.09
        } FRICTION
 1030.00-            2.89 Dc           2388.60          1.65*           3396.95
        } JUNCTION
 1030.00-            3.60              2422.66          1.35*           3793.10
        } FRICTION
 1029.00-            2.81 Dc           2184.28          1.36*           3786.57
        } FRICTION+BEND
 1028.00-            2.81 Dc           2184.28          1.46*           3477.94
        } FRICTION
 1015.00-            2.81 Dc           2184.28          1.49*           3377.10
        } JUNCTION
 1015.00-            3.11              2029.95          1.33*           3380.72
        } FRICTION
 1014.00-            2.71 Dc           1972.84          1.87*           2341.44
        } JUNCTION
 1014.00-            2.72*Dc           2158.68          2.72*Dc         2158.68
        } CATCH BASIN
 1014.00-            5.03*             1557.06          2.72 Dc          540.02
------------------------------------------------------------------------------
 MAXIMUM NUMBER OF ENERGY BALANCES USED IN EACH PROFILE =  25
------------------------------------------------------------------------------
 NOTE: STEADY FLOW HYDRAULIC HEAD-LOSS COMPUTATIONS BASED ON THE MOST
 CONSERVATIVE FORMULAE FROM THE CURRENT LACRD,LACFCD, AND OCEMA
 DESIGN MANUALS.
******************************************************************************
 DOWNSTREAM PIPE FLOW CONTROL DATA:
 NODE NUMBER =  1182.00            FLOWLINE ELEVATION =    502.07
 PIPE FLOW =     123.70 CFS        PIPE DIAMETER =  48.00 INCHES
 ASSUMED DOWNSTREAM CONTROL HGL =    502.070 FEET
 *NOTE: ASSUMED DOWNSTREAM CONTROL DEPTH(  0.00 FT.)
        IS LESS THAN CRITICAL DEPTH(  3.34 FT.)
 ===> CRITICAL DEPTH IS ASSUMED AS DOWNSTREAM CONTROL DEPTH
      FOR UPSTREAM RUN ANALYSIS
------------------------------------------------------------------------------
 NODE  1182.00 : HGL = <  505.411>;EGL= <  507.301>;FLOWLINE= <  502.070>

******************************************************************************
 FLOW PROCESS FROM NODE  1182.00 TO NODE  1173.00 IS CODE =  1
 UPSTREAM NODE  1173.00     ELEVATION =   502.47  (FLOW IS SUBCRITICAL)
------------------------------------------------------------------------------
 CALCULATE FRICTION LOSSES(LACFCD):
 PIPE FLOW   =     123.70 CFS     PIPE DIAMETER =  48.00 INCHES
 PIPE LENGTH =       57.80 FEET          MANNING'S N  =  0.01300
------------------------------------------------------------------------------
 NORMAL DEPTH(FT) =   3.42 &   3.97     CRITICAL DEPTH(FT) =      3.34
 NOTE: SUGGEST CONSIDERATION OF WAVE ACTION, UNCERTAINTY, ETC.
==============================================================================
 DOWNSTREAM CONTROL ASSUMED FLOWDEPTH(FT) =      3.34
==============================================================================
 GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:
------------------------------------------------------------------------------
 DISTANCE FROM       FLOW DEPTH  VELOCITY      SPECIFIC       PRESSURE+
  CONTROL(FT)           (FT)     (FT/SEC)     ENERGY(FT)    MOMENTUM(POUNDS)
       0.000           3.341      11.028         5.231          3718.78
       0.029           3.345      11.019         5.231          3718.79
       0.119           3.348      11.009         5.231          3718.80
       0.276           3.351      11.000         5.231          3718.83
       0.506           3.354      10.991         5.231          3718.86
       0.818           3.357      10.982         5.231          3718.91
```

1.219	3.361	10.972	5.231	3718.96
1.719	3.364	10.963	5.231	3719.03
2.332	3.367	10.954	5.231	3719.10
3.069	3.370	10.945	5.232	3719.19
3.949	3.373	10.936	5.232	3719.28
4.992	3.377	10.927	5.232	3719.39
6.221	3.380	10.918	5.232	3719.50
7.668	3.383	10.909	5.232	3719.63
9.371	3.386	10.900	5.232	3719.76
11.380	3.389	10.891	5.233	3719.91
13.760	3.393	10.883	5.233	3720.06
16.601	3.396	10.874	5.233	3720.23
20.025	3.399	10.865	5.233	3720.40
24.216	3.402	10.856	5.233	3720.59
29.455	3.405	10.848	5.234	3720.78
36.215	3.409	10.839	5.234	3720.98
45.383	3.412	10.830	5.234	3721.20
57.800	3.415	10.822	5.235	3721.40

NODE 1173.00 : HGL = < 505.885>;EGL= < 507.705>;FLOWLINE= < 502.470>

****

FLOW PROCESS FROM NODE 1173.00 TO NODE 1173.00 IS CODE = 5
UPSTREAM NODE 1173.00 ELEVATION = 502.80 (FLOW UNSEALS IN REACH)
(NOTE: POSSIBLE JUMP IN OR UPSTREAM OF STRUCTURE)

CALCULATE JUNCTION LOSSES:

PIPE	FLOW (CFS)	DIAMETER (INCHES)	ANGLE (DEGREES)	FLOWLINE ELEVATION	CRITICAL DEPTH(FT.)	VELOCITY (FT/SEC)
UPSTREAM	123.70	42.00	58.00	502.80	3.27	25.413
DOWNSTREAM	123.70	48.00	-	502.47	3.34	10.826
LATERAL #1	0.00	0.00	0.00	0.00	0.00	0.000
LATERAL #2	0.00	0.00	0.00	0.00	0.00	0.000
Q5	0.00===Q5 EQUALS BASIN INPUT===					

LACFCD AND OCEMA FLOW JUNCTION FORMULAE USED:
DY=(Q2*V2-Q1*V1*COS(DELTA1)-Q3*V3*COS(DELTA3)-
Q4*V4*COS(DELTA4))/((A1+A2)*16.1)+FRICTION LOSSES
UPSTREAM: MANNING'S N = 0.01300; FRICTION SLOPE = 0.05860
DOWNSTREAM: MANNING'S N = 0.01300; FRICTION SLOPE = 0.00694
AVERAGED FRICTION SLOPE IN JUNCTION ASSUMED AS 0.03277
JUNCTION LENGTH = 4.00 FEET
FRICTION LOSSES = 0.131 FEET ENTRANCE LOSSES = 0.000 FEET
JUNCTION LOSSES = (DY+HV1-HV2)+(ENTRANCE LOSSES)
JUNCTION LOSSES = (6.890)+(0.000) = 6.890

NODE 1173.00 : HGL = < 504.566>;EGL= < 514.594>;FLOWLINE= < 502.800>

****

FLOW PROCESS FROM NODE 1173.00 TO NODE 1172.00 IS CODE = 3
UPSTREAM NODE 1172.00 ELEVATION = 513.98 (FLOW IS SUPERCRITICAL)

CALCULATE PIPE-BEND LOSSES(OCEMA):
PIPE FLOW = 123.70 CFS PIPE DIAMETER = 42.00 INCHES
CENTRAL ANGLE = 0.000 DEGREES MANNING'S N = 0.01300
PIPE LENGTH = 203.00 FEET

NORMAL DEPTH(FT) = 1.80 CRITICAL DEPTH(FT) = 3.27

UPSTREAM CONTROL ASSUMED FLOWDEPTH(FT) = 1.64

GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:

DISTANCE FROM CONTROL(FT)	FLOW DEPTH (FT)	VELOCITY (FT/SEC)	SPECIFIC ENERGY(FT)	PRESSURE+ MOMENTUM(POUNDS)
0.000	1.644	27.844	13.691	6869.30
5.703	1.651	27.709	13.581	6838.66
11.615	1.657	27.576	13.472	6808.34
17.755	1.663	27.443	13.365	6778.33
24.143	1.669	27.312	13.260	6748.63
30.806	1.675	27.182	13.156	6719.23
37.769	1.682	27.054	13.053	6690.13
45.068	1.688	26.926	12.953	6661.32
52.739	1.694	26.800	12.853	6632.81
60.829	1.700	26.675	12.756	6604.58
69.392	1.706	26.551	12.659	6576.63
78.492	1.712	26.428	12.564	6548.97
88.211	1.719	26.306	12.471	6521.59
98.648	1.725	26.185	12.379	6494.48
109.928	1.731	26.066	12.288	6467.64
122.212	1.737	25.947	12.198	6441.07
135.712	1.743	25.830	12.110	6414.76
150.717	1.750	25.714	12.023	6388.72
167.628	1.756	25.598	11.937	6362.93
187.037	1.762	25.484	11.853	6337.40
203.000	1.766	25.405	11.794	6319.69

NODE 1172.00 : HGL = < 515.624>;EGL= < 527.671>;FLOWLINE= < 513.980>

****

FLOW PROCESS FROM NODE 1172.00 TO NODE 1172.00 IS CODE = 5
UPSTREAM NODE 1172.00 ELEVATION = 514.31 (FLOW IS SUPERCRITICAL)

CALCULATE JUNCTION LOSSES:

PIPE	FLOW (CFS)	DIAMETER (INCHES)	ANGLE (DEGREES)	FLOWLINE ELEVATION	CRITICAL DEPTH(FT.)	VELOCITY (FT/SEC)
UPSTREAM	123.70	42.00	0.00	514.31	3.27	28.097
DOWNSTREAM	123.70	42.00	-	513.98	3.27	27.853
LATERAL #1	0.00	0.00	0.00	0.00	0.00	0.000
LATERAL #2	0.00	0.00	0.00	0.00	0.00	0.000
Q5	0.00===Q5 EQUALS BASIN INPUT===					

LACFCD AND OCEMA FLOW JUNCTION FORMULAE USED:
DY=(Q2*V2-Q1*V1*COS(DELTA1)-Q3*V3*COS(DELTA3)-
Q4*V4*COS(DELTA4))/((A1+A2)*16.1)+FRICTION LOSSES
UPSTREAM: MANNING'S N = 0.01300; FRICTION SLOPE = 0.07668
DOWNSTREAM: MANNING'S N = 0.01300; FRICTION SLOPE = 0.07490
AVERAGED FRICTION SLOPE IN JUNCTION ASSUMED AS 0.07579
JUNCTION LENGTH = 4.00 FEET
FRICTION LOSSES = 0.303 FEET ENTRANCE LOSSES = 0.000 FEET
JUNCTION LOSSES = (DY+HV1-HV2)+(ENTRANCE LOSSES)
JUNCTION LOSSES = (0.531)+(0.000) = 0.531

NODE 1172.00 : HGL = < 515.943>;EGL= < 528.202>;FLOWLINE= < 514.310>

****

FLOW PROCESS FROM NODE 1172.00 TO NODE 1171.00 IS CODE = 3
UPSTREAM NODE 1171.00 ELEVATION = 520.94 (FLOW IS SUPERCRITICAL)

CALCULATE PIPE-BEND LOSSES(OCEMA):
PIPE FLOW = 123.70 CFS PIPE DIAMETER = 42.00 INCHES
CENTRAL ANGLE = 9.000 DEGREES MANNING'S N = 0.01300

PIPE LENGTH = 73.90 FEET

NORMAL DEPTH(FT) = 1.56 CRITICAL DEPTH(FT) = 3.27

UPSTREAM CONTROL ASSUMED FLOWDEPTH(FT) = 1.71

GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:

DISTANCE FROM CONTROL(FT)	FLOW DEPTH (FT)	VELOCITY (FT/SEC)	SPECIFIC ENERGY(FT)	PRESSURE+ MOMENTUM(POUNDS)
0.000	1.714	26.393	12.537	6541.11
3.806	1.708	26.513	12.630	6568.24
7.799	1.702	26.635	12.725	6595.64
11.995	1.696	26.758	12.821	6623.32
16.414	1.690	26.882	12.918	6651.27
21.077	1.684	27.007	13.016	6679.51
26.010	1.678	27.133	13.116	6708.03
31.243	1.672	27.260	13.218	6736.84
36.809	1.666	27.389	13.321	6765.94
42.749	1.659	27.518	13.425	6795.33
49.112	1.653	27.649	13.532	6825.02
55.956	1.647	27.781	13.639	6855.02
63.353	1.641	27.915	13.749	6885.32
71.392	1.635	28.050	13.860	6915.93
73.900	1.633	28.088	13.892	6924.72

NODE 1171.00 : HGL = < 522.654>;EGL= < 533.477>;FLOWLINE= < 520.940>

****

FLOW PROCESS FROM NODE 1171.00 TO NODE 1160.00 IS CODE = 1
UPSTREAM NODE 1160.00 ELEVATION = 530.27 (FLOW IS SUPERCRITICAL)

CALCULATE FRICTION LOSSES(LACFCD):
PIPE FLOW = 123.70 CFS PIPE DIAMETER = 42.00 INCHES
PIPE LENGTH = 103.90 FEET MANNING'S N = 0.01300

NORMAL DEPTH(FT) = 1.56 CRITICAL DEPTH(FT) = 3.27

UPSTREAM CONTROL ASSUMED FLOWDEPTH(FT) = 2.13

GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:

DISTANCE FROM CONTROL(FT)	FLOW DEPTH (FT)	VELOCITY (FT/SEC)	SPECIFIC ENERGY(FT)	PRESSURE+ MOMENTUM(POUNDS)
0.000	2.130	20.176	8.454	5190.59
2.463	2.107	20.435	8.595	5244.11
5.098	2.084	20.702	8.743	5299.55
7.920	2.062	20.976	8.898	5356.96
10.949	2.039	21.259	9.061	5416.41
14.205	2.016	21.550	9.232	5477.98
17.715	1.993	21.849	9.411	5541.74
21.506	1.971	22.158	9.599	5607.78
25.614	1.948	22.476	9.797	5676.18
30.078	1.925	22.804	10.005	5747.04
34.947	1.903	23.142	10.223	5820.44
40.279	1.880	23.490	10.453	5896.48
46.146	1.857	23.850	10.695	5975.28
52.635	1.834	24.221	10.949	6056.94
59.859	1.812	24.604	11.217	6141.59
67.961	1.789	24.999	11.499	6229.34
77.132	1.766	25.408	11.796	6320.34

87.627	1.743	25.830	12.110	6414.71
99.808	1.721	26.266	12.440	6512.61
103.900	1.714	26.393	12.537	6541.11

NODE 1160.00 : HGL = < 532.400>;EGL= < 538.724>;FLOWLINE= < 530.270>

****

FLOW PROCESS FROM NODE 1160.00 TO NODE 1160.00 IS CODE = 5
UPSTREAM NODE 1160.00 ELEVATION = 530.60 (FLOW IS SUPERCRITICAL)

CALCULATE JUNCTION LOSSES:

PIPE	FLOW (CFS)	DIAMETER (INCHES)	ANGLE (DEGREES)	FLOWLINE ELEVATION	CRITICAL DEPTH(FT.)	VELOCITY (FT/SEC)
UPSTREAM	114.50	42.00	0.00	530.60	3.21	22.108
DOWNSTREAM	123.70	42.00	-	530.27	3.27	20.182
LATERAL #1	5.90	18.00	90.00	532.60	0.94	5.076
LATERAL #2	3.30	18.00	90.00	532.60	0.69	4.142
Q5	0.00===Q5 EQUALS BASIN INPUT===					

LACFCD AND OCEMA FLOW JUNCTION FORMULAE USED:
DY=(Q2*V2-Q1*V1*COS(DELTA1)-Q3*V3*COS(DELTA3)-
Q4*V4*COS(DELTA4))/((A1+A2)*16.1)+FRICTION LOSSES
UPSTREAM: MANNING'S N = 0.01300; FRICTION SLOPE = 0.04259
DOWNSTREAM: MANNING'S N = 0.01300; FRICTION SLOPE = 0.03209
AVERAGED FRICTION SLOPE IN JUNCTION ASSUMED AS 0.03734
JUNCTION LENGTH = 4.00 FEET
FRICTION LOSSES = 0.149 FEET ENTRANCE LOSSES = 0.000 FEET
JUNCTION LOSSES = (DY+HV1-HV2)+(ENTRANCE LOSSES)
JUNCTION LOSSES = (1.320)+(0.000) = 1.320

NODE 1160.00 : HGL = < 532.455>;EGL= < 540.045>;FLOWLINE= < 530.600>

****

FLOW PROCESS FROM NODE 1160.00 TO NODE 1160.50 IS CODE = 3
UPSTREAM NODE 1160.50 ELEVATION = 543.21 (FLOW IS SUPERCRITICAL)

CALCULATE PIPE-BEND LOSSES(OCEMA):
PIPE FLOW = 114.50 CFS PIPE DIAMETER = 42.00 INCHES
CENTRAL ANGLE = 30.000 DEGREES MANNING'S N = 0.01300
PIPE LENGTH = 282.90 FEET

NORMAL DEPTH(FT) = 1.83 CRITICAL DEPTH(FT) = 3.21

UPSTREAM CONTROL ASSUMED FLOWDEPTH(FT) = 2.17

GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:

DISTANCE FROM CONTROL(FT)	FLOW DEPTH (FT)	VELOCITY (FT/SEC)	SPECIFIC ENERGY(FT)	PRESSURE+ MOMENTUM(POUNDS)
0.000	2.174	18.228	7.336	4415.53
3.463	2.160	18.365	7.400	4440.50
7.129	2.146	18.504	7.466	4466.04
11.018	2.133	18.645	7.534	4492.15
15.151	2.119	18.789	7.604	4518.84
19.552	2.105	18.935	7.676	4546.12
24.249	2.091	19.084	7.750	4574.01
29.275	2.078	19.236	7.827	4602.52
34.668	2.064	19.390	7.906	4631.66
40.473	2.050	19.547	7.987	4661.45
46.745	2.036	19.707	8.070	4691.89
53.549	2.023	19.869	8.157	4723.01

60.964	2.009	20.035	8.246	4754.82
69.089	1.995	20.203	8.337	4787.32
78.050	1.981	20.375	8.431	4820.55
88.007	1.968	20.549	8.529	4854.51
99.171	1.954	20.727	8.629	4889.22
111.830	1.940	20.908	8.732	4924.70
126.385	1.926	21.093	8.839	4960.96
143.424	1.913	21.281	8.949	4998.03
163.861	1.899	21.472	9.062	5035.92
189.225	1.885	21.667	9.179	5074.65
222.381	1.871	21.866	9.300	5114.24
269.773	1.858	22.068	9.425	5154.72
282.900	1.855	22.101	9.445	5161.25

NODE 1160.50 : HGL = < 545.384>;EGL= < 550.546>;FLOWLINE= < 543.210>

****

FLOW PROCESS FROM NODE 1160.50 TO NODE 1105.00 IS CODE = 1
UPSTREAM NODE 1105.00 ELEVATION = 544.06 (FLOW IS SUPERCRITICAL)

CALCULATE FRICTION LOSSES(LACFCD):
PIPE FLOW = 114.50 CFS PIPE DIAMETER = 42.00 INCHES
PIPE LENGTH = 22.80 FEET MANNING'S N = 0.01300

NORMAL DEPTH(FT) = 1.93 CRITICAL DEPTH(FT) = 3.21

UPSTREAM CONTROL ASSUMED FLOWDEPTH(FT) = 2.24

GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:

DISTANCE FROM CONTROL(FT)	FLOW DEPTH (FT)	VELOCITY (FT/SEC)	SPECIFIC ENERGY(FT)	PRESSURE+ MOMENTUM(POUNDS)
0.000	2.241	17.597	7.052	4302.10
3.690	2.228	17.710	7.101	4322.16
7.591	2.216	17.824	7.152	4342.62
11.724	2.204	17.941	7.205	4363.50
16.109	2.191	18.059	7.258	4384.80
20.772	2.179	18.178	7.313	4406.54
22.800	2.174	18.228	7.336	4415.53

NODE 1105.00 : HGL = < 546.301>;EGL= < 551.112>;FLOWLINE= < 544.060>

****

FLOW PROCESS FROM NODE 1105.00 TO NODE 1105.00 IS CODE = 5
UPSTREAM NODE 1105.00 ELEVATION = 544.39 (FLOW IS SUPERCRITICAL)

CALCULATE JUNCTION LOSSES:

PIPE	FLOW (CFS)	DIAMETER (INCHES)	ANGLE (DEGREES)	FLOWLINE ELEVATION	CRITICAL DEPTH(FT.)	VELOCITY (FT/SEC)
UPSTREAM	110.80	42.00	0.00	544.39	3.18	18.107
DOWNSTREAM	114.50	42.00	-	544.06	3.21	17.603
LATERAL #1	3.70	18.00	90.00	546.39	0.73	4.299
LATERAL #2	0.00	0.00	0.00	0.00	0.00	0.000
Q5	0.00===Q5 EQUALS BASIN INPUT===					

LACFCD AND OCEMA FLOW JUNCTION FORMULAE USED:
DY=(Q2*V2-Q1*V1*COS(DELTA1)-Q3*V3*COS(DELTA3)-
Q4*V4*COS(DELTA4))/((A1+A2)*16.1)+FRICTION LOSSES
UPSTREAM: MANNING'S N = 0.01300; FRICTION SLOPE = 0.02585
DOWNSTREAM: MANNING'S N = 0.01300; FRICTION SLOPE = 0.02365
AVERAGED FRICTION SLOPE IN JUNCTION ASSUMED AS 0.02475

```
JUNCTION LENGTH =   4.00 FEET
FRICTION LOSSES =  0.099 FEET          ENTRANCE LOSSES =  0.000 FEET
JUNCTION LOSSES = (DY+HV1-HV2)+(ENTRANCE LOSSES)
JUNCTION LOSSES = ( 0.496)+( 0.000) =   0.496
--------------------------------------------------------------------------
NODE  1105.00 : HGL = <  546.517>;EGL= <  551.608>;FLOWLINE= <  544.390>

**************************************************************************
FLOW PROCESS FROM NODE  1105.00 TO NODE  1100.00 IS CODE =  1
UPSTREAM NODE  1100.00     ELEVATION =   546.79  (FLOW IS SUPERCRITICAL)
--------------------------------------------------------------------------
CALCULATE FRICTION LOSSES(LACFCD):
PIPE FLOW    =       110.80 CFS     PIPE DIAMETER =  42.00 INCHES
PIPE LENGTH =         53.10 FEET          MANNING'S N  =  0.01300
--------------------------------------------------------------------------
NORMAL DEPTH(FT) =        1.79          CRITICAL DEPTH(FT) =       3.18
==========================================================================
UPSTREAM CONTROL ASSUMED FLOWDEPTH(FT) =      2.54
==========================================================================
GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:
--------------------------------------------------------------------------
```

DISTANCE FROM CONTROL(FT)	FLOW DEPTH (FT)	VELOCITY (FT/SEC)	SPECIFIC ENERGY(FT)	PRESSURE+ MOMENTUM(POUNDS)
0.000	2.542	14.800	5.945	3706.76
1.972	2.512	14.990	6.003	3733.48
4.128	2.481	15.186	6.065	3761.84
6.486	2.451	15.390	6.131	3791.88
9.065	2.421	15.600	6.202	3823.66
11.889	2.391	15.819	6.279	3857.25
14.985	2.361	16.045	6.361	3892.72
18.384	2.330	16.279	6.448	3930.12
22.123	2.300	16.522	6.542	3969.55
26.246	2.270	16.774	6.642	4011.07
30.805	2.240	17.034	6.748	4054.78
35.864	2.210	17.305	6.863	4100.75
41.500	2.179	17.586	6.985	4149.10
47.809	2.149	17.877	7.115	4199.91
53.100	2.127	18.101	7.218	4239.42

```
--------------------------------------------------------------------------
NODE  1100.00 : HGL = <  549.332>;EGL= <  552.735>;FLOWLINE= <  546.790>

**************************************************************************
FLOW PROCESS FROM NODE  1100.00 TO NODE  1100.00 IS CODE =  5
UPSTREAM NODE  1100.00     ELEVATION =   547.12  (FLOW IS SUPERCRITICAL)
--------------------------------------------------------------------------
CALCULATE JUNCTION LOSSES:
```

PIPE	FLOW (CFS)	DIAMETER (INCHES)	ANGLE (DEGREES)	FLOWLINE ELEVATION	CRITICAL DEPTH(FT.)	VELOCITY (FT/SEC)
UPSTREAM	90.50	42.00	0.00	547.12	2.95	19.457
DOWNSTREAM	110.80	42.00	-	546.79	3.18	14.805
LATERAL #1	3.40	18.00	90.00	549.12	0.70	4.182
LATERAL #2	16.90	24.00	86.00	548.62	1.48	6.772
Q5	0.00===Q5 EQUALS BASIN INPUT===					

```
LACFCD AND OCEMA FLOW JUNCTION FORMULAE USED:
DY=(Q2*V2-Q1*V1*COS(DELTA1)-Q3*V3*COS(DELTA3)-
    Q4*V4*COS(DELTA4))/((A1+A2)*16.1)+FRICTION LOSSES
UPSTREAM:     MANNING'S N = 0.01300;  FRICTION SLOPE = 0.03541
DOWNSTREAM:  MANNING'S N = 0.01300;  FRICTION SLOPE = 0.01576
AVERAGED FRICTION SLOPE IN JUNCTION ASSUMED AS 0.02559
JUNCTION LENGTH =   4.00 FEET
```

FRICTION LOSSES = 0.102 FEET   ENTRANCE LOSSES = 0.000 FEET
JUNCTION LOSSES = (DY+HV1-HV2)+(ENTRANCE LOSSES)
JUNCTION LOSSES = (1.968)+(0.000) = 1.968

NODE 1100.00 : HGL = < 548.824>;EGL= < 554.703>;FLOWLINE= < 547.120>

****

FLOW PROCESS FROM NODE 1100.00 TO NODE 1095.00 IS CODE = 1
UPSTREAM NODE 1095.00 ELEVATION = 550.73 (FLOW IS SUPERCRITICAL)

CALCULATE FRICTION LOSSES(LACFCD):
PIPE FLOW = 90.50 CFS   PIPE DIAMETER = 42.00 INCHES
PIPE LENGTH = 100.10 FEET   MANNING'S N = 0.01300

NORMAL DEPTH(FT) = 1.70   CRITICAL DEPTH(FT) = 2.95

===

UPSTREAM CONTROL ASSUMED FLOWDEPTH(FT) = 1.72

===

GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:

DISTANCE FROM CONTROL(FT)	FLOW DEPTH (FT)	VELOCITY (FT/SEC)	SPECIFIC ENERGY(FT)	PRESSURE+ MOMENTUM(POUNDS)
0.000	1.718	19.251	7.477	3590.87
4.367	1.717	19.264	7.484	3592.90
8.924	1.716	19.278	7.491	3594.93
13.689	1.716	19.291	7.498	3596.97
18.681	1.715	19.304	7.505	3599.00
23.922	1.714	19.317	7.512	3601.05
29.437	1.713	19.330	7.519	3603.09
35.256	1.712	19.343	7.526	3605.14
41.414	1.711	19.357	7.533	3607.19
47.953	1.710	19.370	7.540	3609.24
54.920	1.709	19.383	7.547	3611.30
62.376	1.708	19.396	7.554	3613.36
70.393	1.707	19.410	7.561	3615.43
79.061	1.706	19.423	7.568	3617.49
88.493	1.705	19.436	7.575	3619.56
98.835	1.705	19.450	7.582	3621.64
100.100	1.704	19.451	7.583	3621.87

NODE 1095.00 : HGL = < 552.448>;EGL= < 558.207>;FLOWLINE= < 550.730>

****

FLOW PROCESS FROM NODE 1095.00 TO NODE 1092.00 IS CODE = 3
UPSTREAM NODE 1092.00 ELEVATION = 554.74 (FLOW IS SUPERCRITICAL)

CALCULATE PIPE-BEND LOSSES(OCEMA):
PIPE FLOW = 90.50 CFS   PIPE DIAMETER = 42.00 INCHES
CENTRAL ANGLE = 12.000 DEGREES   MANNING'S N = 0.01300
PIPE LENGTH = 111.10 FEET

NORMAL DEPTH(FT) = 1.70   CRITICAL DEPTH(FT) = 2.95

===

UPSTREAM CONTROL ASSUMED FLOWDEPTH(FT) = 1.76

===

GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:

DISTANCE FROM CONTROL(FT)	FLOW DEPTH (FT)	VELOCITY (FT/SEC)	SPECIFIC ENERGY(FT)	PRESSURE+ MOMENTUM(POUNDS)
0.000	1.762	18.644	7.163	3497.37
4.158	1.759	18.680	7.181	3502.89

8.507	1.757	18.716	7.200	3508.43
13.062	1.754	18.753	7.218	3514.00
17.844	1.751	18.789	7.237	3519.60
22.875	1.749	18.826	7.255	3525.23
28.180	1.746	18.863	7.274	3530.88
33.789	1.743	18.900	7.293	3536.56
39.736	1.741	18.937	7.312	3542.26
46.063	1.738	18.974	7.332	3548.00
52.820	1.735	19.011	7.351	3553.75
60.064	1.733	19.049	7.370	3559.54
67.869	1.730	19.086	7.390	3565.36
76.324	1.727	19.124	7.410	3571.20
85.543	1.725	19.162	7.430	3577.07
95.672	1.722	19.200	7.450	3582.97
106.903	1.719	19.239	7.470	3588.89
111.100	1.718	19.251	7.477	3590.87

NODE 1092.00 : HGL = < 556.502>;EGL= < 561.903>;FLOWLINE= < 554.740>

****

FLOW PROCESS FROM NODE 1092.00 TO NODE 1031.00 IS CODE = 1
UPSTREAM NODE 1031.00 ELEVATION = 555.31 (FLOW IS SUPERCRITICAL)

CALCULATE FRICTION LOSSES(LACFCD):
PIPE FLOW = 90.50 CFS PIPE DIAMETER = 42.00 INCHES
PIPE LENGTH = 15.40 FEET MANNING'S N = 0.01300

NORMAL DEPTH(FT) = 1.68 CRITICAL DEPTH(FT) = 2.95

UPSTREAM CONTROL ASSUMED FLOWDEPTH(FT) = 1.78

GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:

DISTANCE FROM CONTROL(FT)	FLOW DEPTH (FT)	VELOCITY (FT/SEC)	SPECIFIC ENERGY(FT)	PRESSURE+ MOMENTUM(POUNDS)
0.000	1.775	18.467	7.074	3470.35
4.024	1.772	18.516	7.099	3477.81
8.238	1.768	18.565	7.123	3485.32
12.658	1.764	18.615	7.148	3492.88
15.400	1.762	18.644	7.163	3497.37

NODE 1031.00 : HGL = < 557.085>;EGL= < 562.384>;FLOWLINE= < 555.310>

****

FLOW PROCESS FROM NODE 1031.00 TO NODE 1031.00 IS CODE = 5
UPSTREAM NODE 1031.00 ELEVATION = 555.64 (FLOW IS SUPERCRITICAL)

CALCULATE JUNCTION LOSSES:

PIPE	FLOW (CFS)	DIAMETER (INCHES)	ANGLE (DEGREES)	FLOWLINE ELEVATION	CRITICAL DEPTH(FT.)	VELOCITY (FT/SEC)
UPSTREAM	86.00	42.00	0.00	555.64	2.89	19.508
DOWNSTREAM	90.50	42.00	-	555.31	2.95	18.473
LATERAL #1	4.50	18.00	90.00	556.50	0.81	4.594
LATERAL #2	0.00	0.00	0.00	0.00	0.00	0.000
Q5	0.00===Q5 EQUALS BASIN INPUT===					

LACFCD AND OCEMA FLOW JUNCTION FORMULAE USED:
DY=(Q2*V2-Q1*V1*COS(DELTA1)-Q3*V3*COS(DELTA3)-
Q4*V4*COS(DELTA4))/((A1+A2)*16.1)+FRICTION LOSSES
UPSTREAM: MANNING'S N = 0.01300; FRICTION SLOPE = 0.03693
DOWNSTREAM: MANNING'S N = 0.01300; FRICTION SLOPE = 0.03083

AVERAGED FRICTION SLOPE IN JUNCTION ASSUMED AS 0.03388
JUNCTION LENGTH = 4.00 FEET
FRICTION LOSSES = 0.136 FEET ENTRANCE LOSSES = 0.000 FEET
JUNCTION LOSSES = (DY+HV1-HV2)+(ENTRANCE LOSSES)
JUNCTION LOSSES = (0.800)+(0.000) = 0.800

NODE 1031.00 : HGL = < 557.275>;EGL= < 563.185>;FLOWLINE= < 555.640>

FLOW PROCESS FROM NODE 1031.00 TO NODE 1030.00 IS CODE = 1
UPSTREAM NODE 1030.00 ELEVATION = 558.00 (FLOW IS SUPERCRITICAL)

CALCULATE FRICTION LOSSES(LACFCD):
PIPE FLOW = 86.00 CFS PIPE DIAMETER = 42.00 INCHES
PIPE LENGTH = 60.70 FEET MANNING'S N = 0.01300

NORMAL DEPTH(FT) = 1.61 CRITICAL DEPTH(FT) = 2.89

UPSTREAM CONTROL ASSUMED FLOWDEPTH(FT) = 1.65

GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:

DISTANCE FROM CONTROL(FT)	FLOW DEPTH (FT)	VELOCITY (FT/SEC)	SPECIFIC ENERGY(FT)	PRESSURE+ MOMENTUM(POUNDS)
0.000	1.655	19.205	7.385	3396.95
4.092	1.653	19.231	7.399	3400.81
8.367	1.651	19.257	7.413	3404.68
12.841	1.649	19.283	7.427	3408.56
17.532	1.648	19.310	7.441	3412.46
22.462	1.646	19.336	7.455	3416.37
27.656	1.644	19.362	7.469	3420.29
33.141	1.642	19.389	7.483	3424.22
38.951	1.641	19.415	7.498	3428.16
45.126	1.639	19.442	7.512	3432.12
51.713	1.637	19.469	7.526	3436.09
58.769	1.635	19.495	7.541	3440.07
60.700	1.635	19.502	7.545	3441.09

NODE 1030.00 : HGL = < 559.655>;EGL= < 565.385>;FLOWLINE= < 558.000>

FLOW PROCESS FROM NODE 1031.00 TO NODE 1030.00 IS CODE = 5
UPSTREAM NODE 1030.00 ELEVATION = 558.33 (FLOW IS SUPERCRITICAL)

CALCULATE JUNCTION LOSSES:

PIPE	FLOW (CFS)	DIAMETER (INCHES)	ANGLE (DEGREES)	FLOWLINE ELEVATION	CRITICAL DEPTH(FT.)	VELOCITY (FT/SEC)
UPSTREAM	80.70	42.00	0.00	558.33	2.81	23.480
DOWNSTREAM	86.00	42.00	-	558.00	2.89	19.211
LATERAL #1	4.70	18.00	90.00	560.33	0.83	4.665
LATERAL #2	0.00	0.00	0.00	0.00	0.00	0.000
Q5	0.60===Q5 EQUALS BASIN INPUT===					

LACFCD AND OCEMA FLOW JUNCTION FORMULAE USED:
DY=(Q2*V2-Q1*V1*COS(DELTA1)-Q3*V3*COS(DELTA3)-
Q4*V4*COS(DELTA4))/((A1+A2)*16.1)+FRICTION LOSSES
UPSTREAM: MANNING'S N = 0.01300; FRICTION SLOPE = 0.06403
DOWNSTREAM: MANNING'S N = 0.01300; FRICTION SLOPE = 0.03544
AVERAGED FRICTION SLOPE IN JUNCTION ASSUMED AS 0.04973
JUNCTION LENGTH = 4.00 FEET
FRICTION LOSSES = 0.199 FEET ENTRANCE LOSSES = 1.146 FEET

JUNCTION LOSSES = (DY+HV1-HV2)+(ENTRANCE LOSSES)
JUNCTION LOSSES = (1.713)+(1.146) = 2.859

NODE 1030.00 : HGL = < 559.684>;EGL= < 568.245>;FLOWLINE= < 558.330>

****

FLOW PROCESS FROM NODE 1030.00 TO NODE 1029.00 IS CODE = 1
UPSTREAM NODE 1029.00 ELEVATION = 560.96 (FLOW IS SUPERCRITICAL)

CALCULATE FRICTION LOSSES(LACFCD):
PIPE FLOW = 80.70 CFS PIPE DIAMETER = 42.00 INCHES
PIPE LENGTH = 40.70 FEET MANNING'S N = 0.01300

NORMAL DEPTH(FT) = 1.35 CRITICAL DEPTH(FT) = 2.81

===

UPSTREAM CONTROL ASSUMED FLOWDEPTH(FT) = 1.36

===

GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:

DISTANCE FROM CONTROL(FT)	FLOW DEPTH (FT)	VELOCITY (FT/SEC)	SPECIFIC ENERGY(FT)	PRESSURE+ MOMENTUM(POUNDS)
0.000	1.356	23.428	9.884	3786.57
3.710	1.356	23.433	9.888	3787.29
7.579	1.356	23.438	9.891	3788.01
11.621	1.355	23.443	9.894	3788.74
15.852	1.355	23.448	9.898	3789.46
20.291	1.355	23.453	9.901	3790.19
24.958	1.355	23.458	9.904	3790.91
29.880	1.355	23.462	9.908	3791.64
35.083	1.354	23.467	9.911	3792.36
40.604	1.354	23.472	9.915	3793.09
40.700	1.354	23.472	9.915	3793.10

NODE 1029.00 : HGL = < 562.316>;EGL= < 570.844>;FLOWLINE= < 560.960>

****

FLOW PROCESS FROM NODE 1029.00 TO NODE 1028.00 IS CODE = 3
UPSTREAM NODE 1028.00 ELEVATION = 578.11 (FLOW IS SUPERCRITICAL)

CALCULATE PIPE-BEND LOSSES(OCEMA):
PIPE FLOW = 80.70 CFS PIPE DIAMETER = 42.00 INCHES
CENTRAL ANGLE = 31.000 DEGREES MANNING'S N = 0.01300
PIPE LENGTH = 265.30 FEET

NORMAL DEPTH(FT) = 1.35 CRITICAL DEPTH(FT) = 2.81

===

UPSTREAM CONTROL ASSUMED FLOWDEPTH(FT) = 1.46

===

GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:

DISTANCE FROM CONTROL(FT)	FLOW DEPTH (FT)	VELOCITY (FT/SEC)	SPECIFIC ENERGY(FT)	PRESSURE+ MOMENTUM(POUNDS)
0.000	1.456	21.311	8.513	3477.94
3.294	1.452	21.393	8.563	3489.77
6.746	1.447	21.476	8.614	3501.70
10.370	1.443	21.559	8.665	3513.72
14.183	1.439	21.643	8.717	3525.85
18.202	1.435	21.727	8.770	3538.07
22.450	1.431	21.812	8.823	3550.40
26.950	1.426	21.898	8.877	3562.83
31.732	1.422	21.984	8.932	3575.36

36.830	1.418	22.071	8.987	3587.99
42.285	1.414	22.159	9.043	3600.73
48.146	1.409	22.247	9.099	3613.58
54.474	1.405	22.336	9.157	3626.53
61.345	1.401	22.425	9.215	3639.60
68.851	1.397	22.516	9.274	3652.77
77.116	1.393	22.606	9.333	3666.05
86.298	1.388	22.698	9.393	3679.45
96.616	1.384	22.790	9.455	3692.95
108.373	1.380	22.883	9.516	3706.58
122.015	1.376	22.977	9.579	3720.31
138.232	1.372	23.071	9.642	3734.16
158.182	1.367	23.167	9.706	3748.14
184.034	1.363	23.263	9.771	3762.22
220.662	1.359	23.359	9.837	3776.43
265.300	1.356	23.428	9.884	3786.57

NODE 1028.00 : HGL = < 579.566>;EGL= < 586.623>;FLOWLINE= < 578.110>

****

FLOW PROCESS FROM NODE 1028.00 TO NODE 1015.00 IS CODE = 1
UPSTREAM NODE 1015.00 ELEVATION = 579.67 (FLOW IS SUPERCRITICAL)

CALCULATE FRICTION LOSSES(LACFCD):
PIPE FLOW = 80.70 CFS PIPE DIAMETER = 42.00 INCHES
PIPE LENGTH = 24.20 FEET MANNING'S N = 0.01300

NORMAL DEPTH(FT) = 1.35 CRITICAL DEPTH(FT) = 2.81

UPSTREAM CONTROL ASSUMED FLOWDEPTH(FT) = 1.49

GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:

DISTANCE FROM CONTROL(FT)	FLOW DEPTH (FT)	VELOCITY (FT/SEC)	SPECIFIC ENERGY(FT)	PRESSURE+ MOMENTUM(POUNDS)
0.000	1.493	20.610	8.093	3377.10
3.154	1.487	20.713	8.154	3391.92
6.466	1.482	20.818	8.215	3406.91
9.950	1.476	20.923	8.278	3422.06
13.621	1.470	21.030	8.342	3437.38
17.499	1.465	21.138	8.407	3452.87
21.603	1.459	21.246	8.473	3468.53
24.200	1.456	21.311	8.513	3477.94

NODE 1015.00 : HGL = < 581.163>;EGL= < 587.763>;FLOWLINE= < 579.670>

****

FLOW PROCESS FROM NODE 1015.00 TO NODE 1015.00 IS CODE = 5
UPSTREAM NODE 1015.00 ELEVATION = 580.00 (FLOW IS SUPERCRITICAL)

CALCULATE JUNCTION LOSSES:

PIPE	FLOW (CFS)	DIAMETER (INCHES)	ANGLE (DEGREES)	FLOWLINE ELEVATION	CRITICAL DEPTH(FT.)	VELOCITY (FT/SEC)
UPSTREAM	75.00	42.00	0.00	580.00	2.71	22.469
DOWNSTREAM	80.70	42.00	-	579.67	2.81	20.616
LATERAL #1	5.70	18.00	90.00	581.00	0.92	5.009
LATERAL #2	0.00	0.00	0.00	0.00	0.00	0.000
Q5	0.00===Q5 EQUALS BASIN INPUT===					

LACFCD AND OCEMA FLOW JUNCTION FORMULAE USED:
DY=(Q2*V2-Q1*V1*COS(DELTA1)-Q3*V3*COS(DELTA3)-

Q4*V4*COS(DELTA4))/((A1+A2)*16.1)+FRICTION LOSSES

UPSTREAM: MANNING'S N = 0.01300; FRICTION SLOPE = 0.05993

DOWNSTREAM: MANNING'S N = 0.01300; FRICTION SLOPE = 0.04487

AVERAGED FRICTION SLOPE IN JUNCTION ASSUMED AS 0.05240

JUNCTION LENGTH = 4.00 FEET

FRICTION LOSSES = 0.210 FEET ENTRANCE LOSSES = 0.000 FEET

JUNCTION LOSSES = (DY+HV1-HV2)+(ENTRANCE LOSSES)

JUNCTION LOSSES = (1.402)+(0.000) = 1.402

NODE 1015.00 : HGL = < 581.325>;EGL= < 589.165>;FLOWLINE= < 580.000>

****

FLOW PROCESS FROM NODE 1015.00 TO NODE 1014.00 IS CODE = 1

UPSTREAM NODE 1014.00 ELEVATION = 598.42 (FLOW IS SUPERCRITICAL)

CALCULATE FRICTION LOSSES(LACFCD):

PIPE FLOW = 75.00 CFS PIPE DIAMETER = 42.00 INCHES

PIPE LENGTH = 288.40 FEET MANNING'S N = 0.01300

NORMAL DEPTH(FT) = 1.30 CRITICAL DEPTH(FT) = 2.71

===

UPSTREAM CONTROL ASSUMED FLOWDEPTH(FT) = 1.87

===

GRADUALLY VARIED FLOW PROFILE COMPUTED INFORMATION:

DISTANCE FROM CONTROL(FT)	FLOW DEPTH (FT)	VELOCITY (FT/SEC)	SPECIFIC ENERGY(FT)	PRESSURE+ MOMENTUM(POUNDS)
0.000	1.873	14.306	5.053	2341.44
1.663	1.850	14.527	5.129	2366.15
3.460	1.827	14.755	5.210	2392.01
5.404	1.805	14.990	5.296	2419.07
7.511	1.782	15.234	5.387	2447.36
9.796	1.759	15.485	5.485	2476.95
12.282	1.736	15.745	5.588	2507.87
14.990	1.713	16.013	5.698	2540.19
17.950	1.690	16.291	5.814	2573.97
21.192	1.668	16.579	5.938	2609.27
24.756	1.645	16.876	6.070	2646.16
28.690	1.622	17.184	6.210	2684.71
33.051	1.599	17.504	6.360	2725.00
37.910	1.576	17.835	6.519	2767.10
43.359	1.554	18.178	6.688	2811.10
49.512	1.531	18.535	6.869	2857.11
56.525	1.508	18.905	7.061	2905.20
64.606	1.485	19.289	7.266	2955.50
74.045	1.462	19.689	7.485	3008.11
85.270	1.439	20.104	7.720	3063.15
98.946	1.417	20.537	7.970	3120.75
116.182	1.394	20.987	8.237	3181.06
139.064	1.371	21.456	8.524	3244.21
172.275	1.348	21.945	8.831	3310.39
230.842	1.325	22.455	9.160	3379.74
288.400	1.325	22.462	9.165	3380.72

NODE 1014.00 : HGL = < 600.293>;EGL= < 603.473>;FLOWLINE= < 598.420>

****

FLOW PROCESS FROM NODE 1014.00 TO NODE 1014.00 IS CODE = 5

UPSTREAM NODE 1014.00 ELEVATION = 598.92 (FLOW IS SUPERCRITICAL)

CALCULATE JUNCTION LOSSES:

PIPE	FLOW (CFS)	DIAMETER (INCHES)	ANGLE (DEGREES)	FLOWLINE ELEVATION	CRITICAL DEPTH(FT.)	VELOCITY (FT/SEC)
UPSTREAM	75.00	36.00	0.00	598.92	2.72	11.137
DOWNSTREAM	75.00	42.00	-	598.42	2.71	14.310
LATERAL #1	0.00	0.00	0.00	0.00	0.00	0.000
LATERAL #2	0.00	0.00	0.00	0.00	0.00	0.000
Q5	0.00===Q5 EQUALS BASIN INPUT===					

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LACFCD AND OCEMA FLOW JUNCTION FORMULAE USED:
DY=(Q2*V2-Q1*V1*COS(DELTA1)-Q3*V3*COS(DELTA3)-
    Q4*V4*COS(DELTA4))/((A1+A2)*16.1)+FRICTION LOSSES
UPSTREAM:     MANNING'S N = 0.01300;  FRICTION SLOPE = 0.01107
DOWNSTREAM:   MANNING'S N = 0.01300;  FRICTION SLOPE = 0.01771
AVERAGED FRICTION SLOPE IN JUNCTION ASSUMED AS 0.01439
JUNCTION LENGTH =   4.00 FEET
FRICTION LOSSES =  0.058 FEET          ENTRANCE LOSSES =  0.000 FEET
JUNCTION LOSSES = (DY+HV1-HV2)+(ENTRANCE LOSSES)
JUNCTION LOSSES = ( 0.092)+( 0.000) =   0.092
------------------------------------------------------------------------------
NODE  1014.00 : HGL = <  601.639>;EGL= <  603.565>;FLOWLINE= <  598.920>

******************************************************************************
FLOW PROCESS FROM NODE  1014.00 TO NODE  1014.00 IS CODE =  8
UPSTREAM NODE  1014.00     ELEVATION =   598.92  (FLOW IS AT CRITICAL DEPTH)
------------------------------------------------------------------------------
CALCULATE CATCH BASIN ENTRANCE LOSSES(LACFCD):
PIPE FLOW =        75.00 CFS           PIPE DIAMETER =  36.00 INCHES
FLOW VELOCITY =  11.14 FEET/SEC.    VELOCITY HEAD =  1.926 FEET
CATCH BASIN ENERGY LOSS = .2*(VELOCITY HEAD) = .2*(  1.926) =  0.385
------------------------------------------------------------------------------
NODE  1014.00 : HGL = <  603.950>;EGL= <  603.950>;FLOWLINE= <  598.920>

******************************************************************************
UPSTREAM PIPE FLOW CONTROL DATA:
NODE NUMBER =  1014.00              FLOWLINE ELEVATION =   598.92
ASSUMED UPSTREAM CONTROL HGL =     601.64 FOR DOWNSTREAM RUN ANALYSIS

==============================================================================
END OF GRADUALLY VARIED FLOW ANALYSIS
```
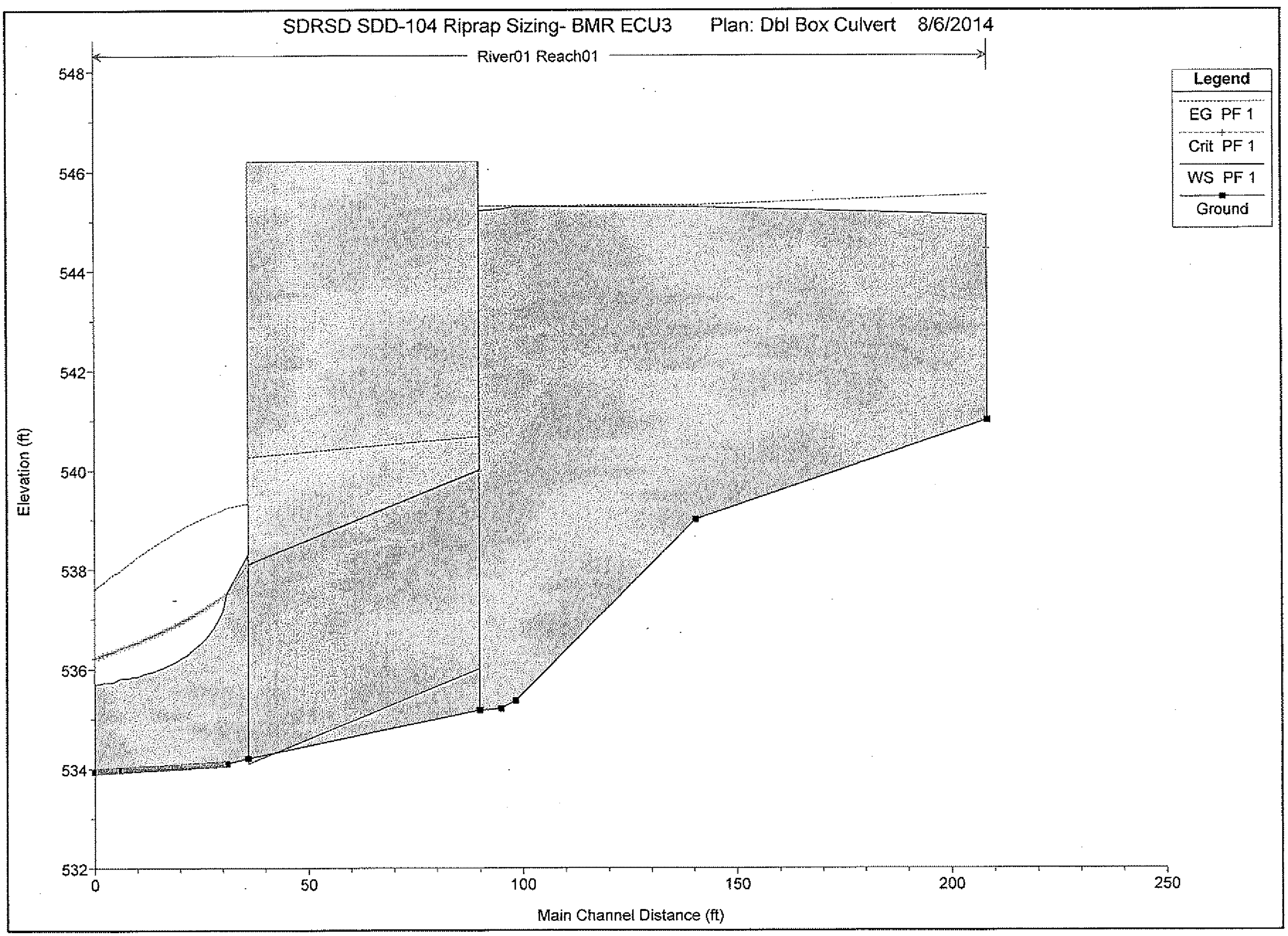

HEC-RAS Plan: Dbl Box Culvert River: River01 Reach: Reach01 Profile: PF 1 (WESTERLY OFF-SITE CROSSING)

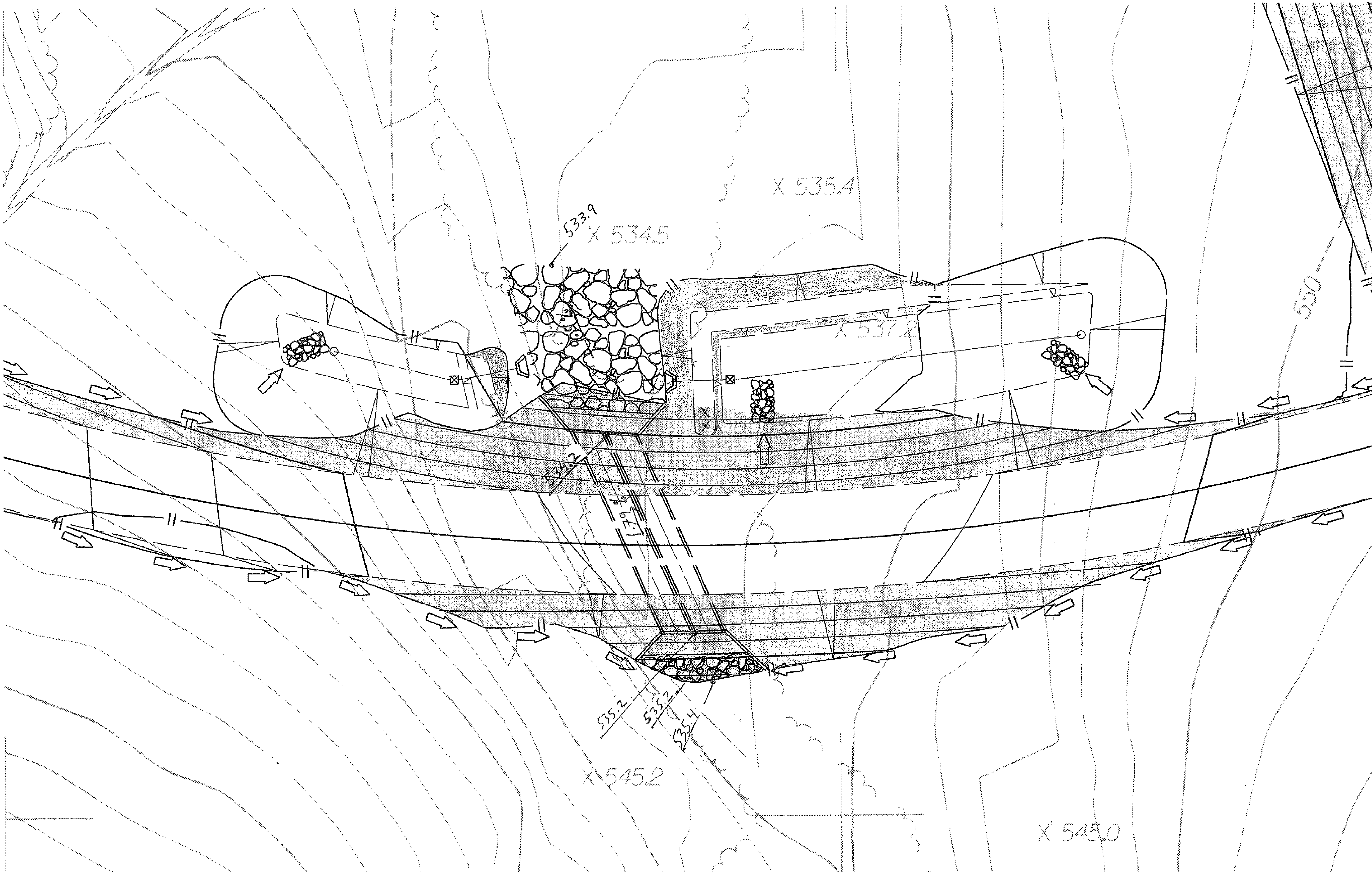
Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Reach01	279	PF 1	540.00	541.00	545.11	544.43	545.53	0.012902	5.28	107.19	56.14	0.58
Reach01	211	PF 1	540.00	539.00	545.28		545.32	0.000520	1.61	356.33	109.16	0.13
Reach01	169	PF 1	540.00	535.36	545.29		545.30	0.000067	1.08	584.19	129.73	0.07
Reach01	164	PF 1	540.00	535.20	545.24		545.30	0.000021	1.97	273.45	138.99	0.11
Reach01	159	PF 1	540.00	535.17	545.21	539.05	545.30	0.000077	2.79	421.35	142.36	0.16
Reach01	132		Culvert									
Reach01	105	PF 1	540.00	534.21	538.29	538.10	539.33	0.001349	8.17	66.12	16.20	0.71
Reach01	100	PF 1	540.00	534.10	537.52	537.52	539.24	0.016445	10.54	51.23	26.01	1.01
Reach01	99.*	PF 1	540.00	534.09	537.14	537.45	539.19	0.022754	11.50	46.97	27.23	1.16
Reach01	98.*	PF 1	540.00	534.09	536.97	537.39	539.16	0.026225	11.88	45.47	28.37	1.23
Reach01	97.*	PF 1	540.00	534.08	536.82	537.33	539.12	0.029546	12.19	44.32	29.44	1.30
Reach01	96.*	PF 1	540.00	534.08	536.71	537.28	539.09	0.032249	12.39	43.59	30.47	1.35
Reach01	95.*	PF 1	540.00	534.07	536.60	537.22	539.05	0.034934	12.57	42.96	31.45	1.39
Reach01	94.*	PF 1	540.00	534.07	536.52	537.17	539.01	0.037078	12.68	42.60	32.42	1.43
Reach01	93.*	PF 1	540.00	534.07	536.45	537.12	538.97	0.038908	12.74	42.37	33.37	1.46
Reach01	92.*	PF 1	540.00	534.06	536.37	537.07	538.93	0.040999	12.83	42.08	34.28	1.49
Reach01	91.*	PF 1	540.00	534.05	536.30	537.01	538.89	0.043298	12.93	41.76	35.14	1.52
Reach01	90.*	PF 1	540.00	534.05	536.25	536.97	538.84	0.044422	12.92	41.80	36.04	1.54
Reach01	89.*	PF 1	540.00	534.04	536.19	536.92	538.79	0.045829	12.93	41.75	36.90	1.55
Reach01	88.*	PF 1	540.00	534.04	536.15	536.88	538.75	0.047127	12.94	41.74	37.75	1.57
Reach01	87.*	PF 1	540.00	534.03	536.10	536.84	538.68	0.047811	12.89	41.90	38.60	1.58
Reach01	86.*	PF 1	540.00	534.03	536.07	536.80	538.63	0.048469	12.84	42.05	39.46	1.58
Reach01	85.*	PF 1	540.00	534.02	536.02	536.75	538.59	0.050047	12.87	41.97	40.22	1.60
Reach01	84.*	PF 1	540.00	534.02	535.99	536.72	538.53	0.050250	12.78	42.24	41.07	1.60
Reach01	83.*	PF 1	540.00	534.01	535.95	536.68	538.48	0.051261	12.77	42.30	41.86	1.61
Reach01	82.*	PF 1	540.00	534.01	535.93	536.64	538.42	0.050948	12.65	42.69	42.71	1.61
Reach01	81.*	PF 1	540.00	534.01	535.92	536.61	538.36	0.050608	12.53	43.08	43.54	1.60
Reach01	80.*	PF 1	540.00	534.00	535.88	536.57	538.30	0.051096	12.48	43.26	44.32	1.60
Reach01	79.*	PF 1	540.00	533.99	535.85	536.53	538.25	0.051556	12.43	43.44	45.09	1.61
Reach01	78.*	PF 1	540.00	533.99	535.85	536.50	538.17	0.049837	12.22	44.18	45.97	1.58
Reach01	77.*	PF 1	540.00	533.98	535.82	536.47	538.11	0.050072	12.16	44.42	46.74	1.58
Reach01	76.*	PF 1	540.00	533.98	535.82	536.44	538.04	0.048457	11.96	45.15	47.64	1.56
Reach01	75	PF 1	540.00	533.98	535.81	536.41	537.96	0.046918	11.77	45.89	48.51	1.53
Reach01	74.*	PF 1	540.00	533.97	535.77	536.37	537.92	0.048339	11.78	45.84	48.29	1.55
Reach01	73.*	PF 1	540.00	533.96	535.72	536.33	537.88	0.049622	11.78	45.83	48.08	1.56
Reach01	72.*	PF 1	540.00	533.96	535.72	536.31	537.80	0.047767	11.56	46.72	48.08	1.53
Reach01	71.*	PF 1	540.00	533.96	535.72	536.28	537.72	0.046015	11.35	47.60	48.08	1.51
Reach01	70.*	PF 1	540.00	533.95	535.69	536.24	537.66	0.045901	11.25	47.98	47.97	1.50

HEC-RAS Plan: Dbl Box Culvert River: River01 Reach: Reach01 Profile: PF 1 (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Reach01	69	PF 1	540.00	533.95	535.69	536.21	537.59	0.044276	11.05	48.86	47.97	1.47



SDRSD SDD-104 Riprap Sizing- BMR ECU3 Plan: Dbl Box Culvert 8/6/2014
River01 Reach01
Legend
EG PF 1
Crit PF 1
WS PF 1
Ground
Elevation (ft)
548
546
544
542
540
538
536
534
532
0
50
100
150
200
250
Main Channel Distance (ft)



X 535.4
533.9
X 534.5
X 537.2
550
534.2
1:7.9
535.2
535.2
535.4
X 545.2
X 545.0

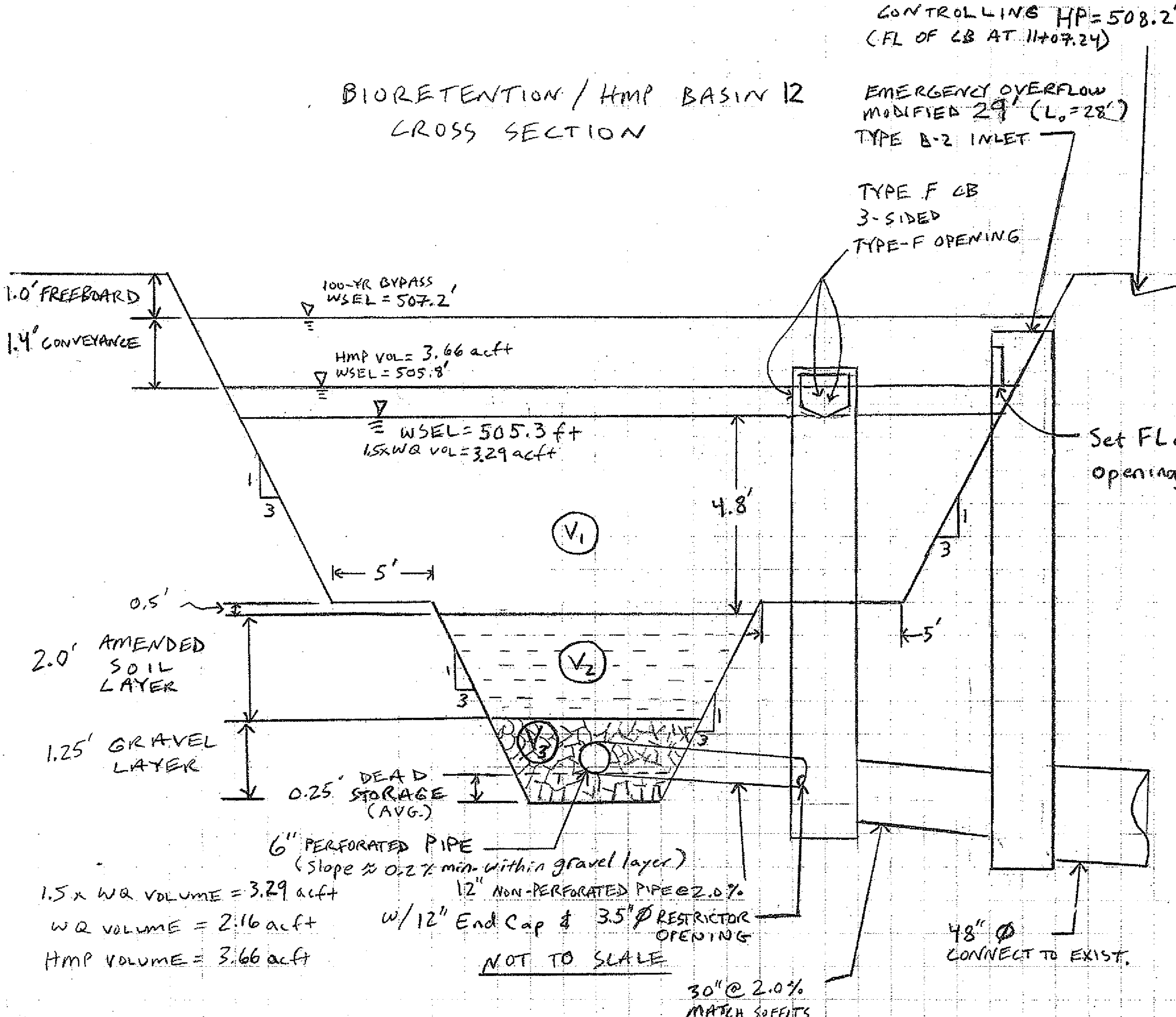
APPENDIX H

Schematic Layout and Backup Calculations

for

Emergency Overflow Structures

BIORETENTION / HMP BASIN 12 CROSS SECTION



1.5 x WQ VOLUME = 3.29 acft

WQ VOLUME = 2.16 acft

HMP VOLUME = 3.66 acft

NOT TO SCALE

RICK ENGINEERING COMPANY™
5620 Friars Road
San Diego, CA 92110-2596
Tel: (619) 291-0707
Fax: (619) 291-4165

Date 7-31-2014
Job No. 15149B
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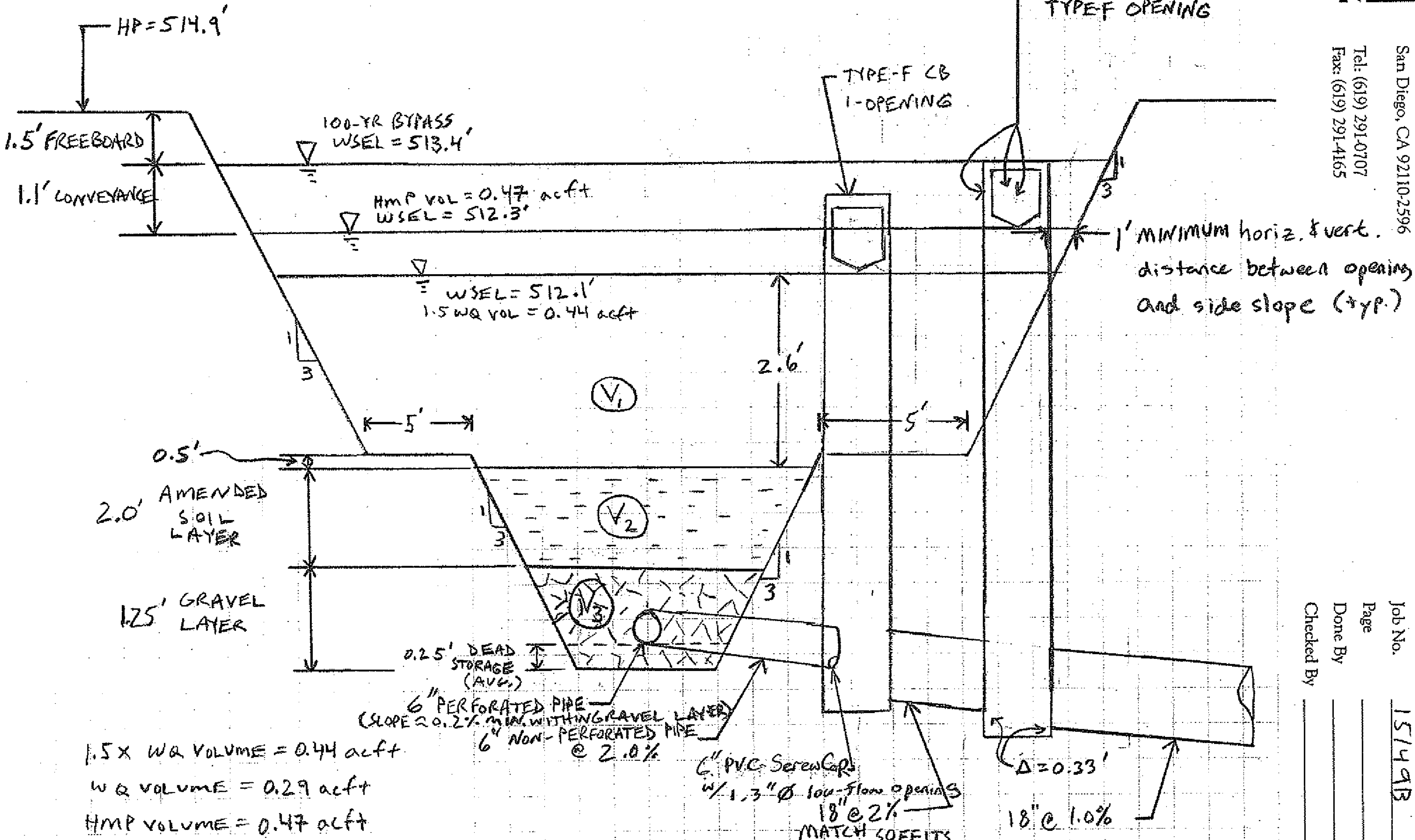
Done By
Checked By

BIORETENTION / HMP BASIN 13 CROSS SECTION



1.5 X WQ VOLUME = 0.44 acft

WQ VOLUME = 0.29 acft

HMP VOLUME = 0.47 acft

NOT TO SCALE

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BACK-UP CALCULATIONS FOR
EMERGENCY OVERFLOW

BASIN 12

TYPE B-2 INLET WEIR OVERFLOW: $Q_{100} = 130$ cfs (+/-)

$$Q = C L H^{3/2}$$

$$130 cfs = 3.0 (L)^{3/2}$$

$$L = \frac{130 cfs}{3.0 (1.4)^{3/2}} = 26.16 \therefore \text{ USE } L = 28'$$

(14' ON EACH SIDE)

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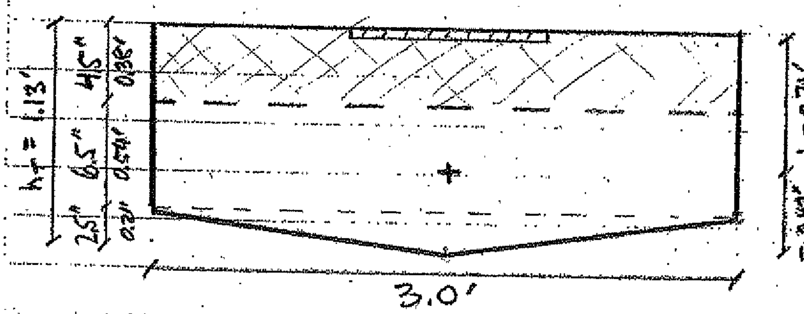
BASIN 13 BACK UP CALCULATIONS FOR EMERGENCY OVERFLOW

TYPE F CATCH BASIN CAPACITY CHECK

CAPACITY OF STANDARD BASIN:



$A = (3.0')(0.54') + \frac{1}{2}(3.0')(0.21')$

$A = 1.94\ ft^2$

$\bar{y} = \Sigma A_i y_i / \Sigma A_i$

$\bar{y} = \dfrac{(3.0')(0.54')(0.48') + \frac{1}{2}(3.0')(0.21')(0.1')}{1.94\ ft^2}$

$\bar{y} = 0.42'$ to centroid

Orifice Flow: $Q = 0.6A\sqrt{2gh}$

where A = effective orifice area

h = distance from centroid to top of basin (OR WSEL)

$Q = 0.6(1.94\ ft^2)\sqrt{2(32.2\ ft/s^2)(0.71')} = 7.9\ cfs$

For two openings $Q = 2(7.9) = 15.8\ cfs$

FOR THREE OPENINGS $Q = 3(7.9) = 23.7\ cfs$ ∴ USE 3-OPENINGS

MAP POCKET 1

Carmel Valley Road Drainage Map

for

Offsite Developed Condition

[Pre-Project]

MAP 2
CARMEL VALLEY ROAD
DRAINAGE MAP FOR
OFFSITE DEVELOPED CONDITION

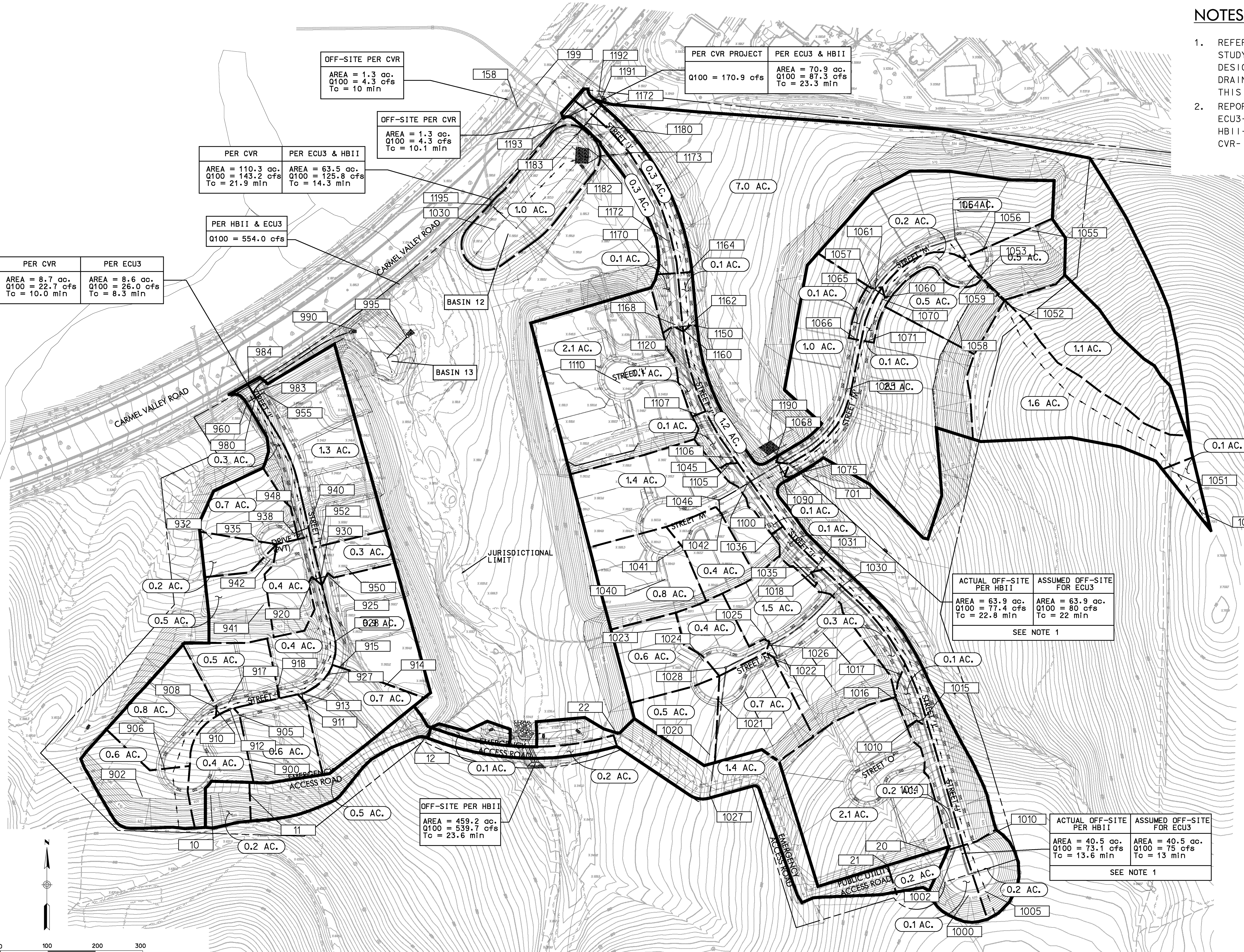
MAP POCKET 2

Drainage Study Map

for

BMR East Clusters Unit 3

[Post-Project]



NOTES:

1. REFER TO THE REPORT TITLED, "PRELIMINARY DRAINAGE STUDY FOR HERITAGE BLUFFS II," PREPARED BY PROJECT DESIGN CONSULTANTS, DATED MAY 14, 2014. ASSUMED DRAINAGE CHARACTERISTICS HAVE BEEN ADJUSTED FOR THIS PROJECT.
2. REPORT ABBREVIATIONS INCLUDE:
   ECU3- EAST CLUSTERS UNIT 3
   HBII- HERITAGE BLUFFS II
   CVR- CARMEL VALLEY ROAD

LEGEND:

(heavy line)	MAJOR BASIN BOUNDARY
(dashed line)	MINOR BASIN BOUNDARY
X.X AC.	SUB-BASIN AREA
XXX	NODE NUMBER
(arrows)	FLOW PATH
(dash-dot line)	PROJECT BOUNDARY

DRAINAGE STUDY MAP FOR EAST CLUSTERS UNIT 3 (FINAL ENGINEERING) [POST-PROJECT]

Date: March 12, 2014
Revised: August 7, 2014

J-15149-B

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J-15149-B

NOT FOR CONSTRUCTION - EXHIBIT FOR DRAINAGE STUDY REPORT ONLY

APPENDIX B-2
Water Quality Technical Report

WATER QUALITY TECHNICAL REPORT

HERITAGE BLUFFS II

CITY OF SAN DIEGO, CA

MARCH 13, 2015

PTS: 319435

Prepared For:

SPIC DEL SUR LLC
16010 Camino del Sur
San Diego, CA 92127

Prepared By:

PROJECT DESIGN CONSULTANTS
Planning | Landscape Architecture | Engineering | Survey

701 B Street, Suite 800
San Diego, CA 92101
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Job No. 3255.50

Prepared by: Chelisa Pack, PE
Updated by: Tom Grace

Under the supervision of

REGISTERED PROFESSIONAL ENGINEER
DEBBY SUE REECE
No. C56148
Exp. 12-31-16
CIVIL
STATE OF CALIFORNIA

Debby Reece, PE RCE 56148
Registration Expires 12/31/16

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APPENDICES

1. Storm Water Requirements Applicability Checklist

2. Project Maps

3. Educational Materials

4. Current version of East Clusters Water Quality Technical Report and Hydromodification Management Plan (For Reference)

1. PROJECT IDENTIFICATION

As part of the Final Engineering Grading plan, this Final Water Quality Technical Report (WQTR) was prepared to define selected project Best Management Practice (BMP) options that satisfy the requirements identified in the following documents:

- City of San Diego Municipal Code, Land Development Manual – Storm Water Standards (January 20, 2012),
- California Regional Water Quality Control Board, San Diego Region, Order No. R9-2007-0001, NPDES No. CAS0108758, Waste Discharge Requirements for Discharges of Urban Runoff from the Municipal Separate Storm Sewer Systems (MS4s) Draining the Watersheds of the County of San Diego, the Incorporated Cities of San Diego County, the San Diego Unified Port District, and the San Diego County Regional Airport Authority,
- State Water Resources Control Board (SWRCB) NPDES General Permit for Storm Water Discharges Associated with Construction and Land Disturbance Activities (Water Quality Order 2009-0009-DWQ).

Specifically, this report includes the following:

- Project description and location with respect to the Water Quality Control Plan for the San Diego Region (Basin Plan);
- BMP design criteria and water quality treatment calculations;
- BMP device information for the selected BMPs; and
- Operation, maintenance, and funding for the proposed BMPs.

1.1 Project Location/ Description

This WQTR is provided for Heritage Bluffs II, PTS # 319435. The project site consists of approximately 169.85 acres of vacant land located within the Black Mountain Ranch Subarea. The site is bounded by Black Mountain Park to the south and undeveloped land to the north, east, and west. The land to the north of Heritage Bluffs II is the Black Mountain Ranch East Clusters project, which is currently proposed for residential development. The vicinity and site maps are available in Appendix 2. The total project site consists of 169.85 acres, although the majority of the site be preserved as open space after development.

1.2 Pre-Project Area Description

The project area is currently undeveloped open space consisting of natural hills and canyons, which are covered with native and non-native vegetation consistent with the San Diego area. Under existing conditions, the project area currently consists of terrain sloping in the northerly direction, with natural ground cover. The site is situated on a saddle between two natural drainage courses, which convey stormwater from upstream areas. Under proposed conditions, an onsite drainage system consisting of yard swales, curbs, gutters, and storm drain pipes will discharge into the proposed storm drain system and will discharge to the underground storm drain system per the East Clusters project. Generally, the run-on from upstream areas will be re-directed where possible to the adjacent canyons in order to minimize commingling of onsite runoff with offsite runoff and to minimize the drainage area for treatment. Where necessary, energy dissipation is provided at the project outfalls to minimize erosion potential.

The hydrologic characteristics of the majority of the site can be classified as being within soil group D, as defined by the Natural Resources Conservation Service. Type D soils have a very slow infiltration rate when thoroughly wetted; they are chiefly clays that have a high shrink-swell potential, or soils that have a high permanent water table, or soils that have a claypan or clay layer at or near the surface, or soils that are shallow over nearly impervious material. Under existing conditions, the project area is <10% impervious with a runoff coefficient of 0.45. Under the proposed conditions, the overall runoff coefficient is expected to be 0.55 for the majority of the developed subareas.

1.3 Post-Project Description

The project proposes to build one hundred seventy-one (171) single family residential lots on approximately 43.5 acres. Access to the project site will be provided by extending access from the proposed development to the north, as provided in the Black Mountain Ranch East Clusters VTM. The project's water quality treatment requirements and hydromodification requirements will be handled on a regional scale through cooperative agreements with the downstream Black Mountain Ranch East Clusters project. Therefore, the processing and review of the Heritage Bluffs II WQTR will be closely coordinated with the Black Mountain Ranch East Clusters WQTR. The same developer is developing both this project (Heritage Bluffs II) and the downstream project (East Clusters).

2. WATERSHED LOCATION AND CONDITIONS

2.1 Basin Area Designation

The Heritage Bluffs II Project is located in the San Dieguito Watershed and is tributary to Lusardi Creek.[1] The project is within the San Dieguito Hydrologic Unit (905), Solana Beach Hydrologic Area (905.1), and the Lusardi Creek Hydrologic Subarea (905.12). The sections below provide the beneficial uses and identification of impaired water bodies within the project's hydrologic area.

2.2 Receiving Waters

The beneficial uses of the inland surface waters and the groundwater basins must not be threatened by the project. Tables 1 and 2 list the beneficial uses for the surface waters and groundwater within the project's hydrologic area.

TABLE 1. BENEFICIAL USES FOR INLAND SURFACE WATER

Surface Water	MUN	AGR	IND	PROC	GWR	FRSH	POW	REC1	REC2	BIOL	WARM	COLD	WILD	RARE	SPWN
Lusardi Creek, HSA 905.12	+	P	P	N	N	N	N	E	E	N	E	N	E	N	N

TABLE 2. BENEFICIAL USES FOR GROUNDWATER

Hydrologic Area	MUN	AGR	IND	PROC	FRSH	GWR
HA=Solana Beach, 905.1	E	E	E	N	N	N

Source: San Diego Regional Water Quality Control Board, Water Quality Control Plan for the San Diego Basin, Chapter 2, Table 2-2. Beneficial Uses of Inland Surface Waters, and Table 2-5. Beneficial Uses of Ground Waters (2007 update)

Notes for Tables 2 and 3:

+: Excepted from MUN (see text)

---

[1] Water Quality Control Plan for the San Diego Basin, San Diego Regional Water Quality Control Board

E: Existing beneficial use

P: Potential beneficial use

N: Not a beneficial use

MUN - Municipal and Domestic Supply: Includes use of water for community, military, or individual water supply systems including, but not limited to, drinking water supply.

AGR - Agricultural Supply: Includes use of water for farming, horticulture, or ranching including, but not limited to, irrigation, stock watering, or support of vegetation for range grazing.

IND - Industrial Services Supply: Includes use of water for industrial activities that do not depend primarily on water quality including, but not limited to, mining, cooling water supply, hydraulic conveyance, gravel washing, fire protection, or oil well re-pressurization.

PROC - Industrial Process Supply: Includes uses of water for industrial activities that depend primarily on water quality.

GWR - Ground Water Recharge: Includes uses of water for natural or artificial recharge of ground water for purposes of future extraction, maintenance of water quality, or halting of saltwater intrusion into freshwater aquifers.

FRSH - Freshwater Replenishment: Includes uses of water for natural or artificial maintenance of surface water quantity or quality (e.g., salinity).

POW - Hydropower Generation: Includes uses of water for hydropower generation.

REC1 - Contact Recreation: Includes use of water for recreational activities involving body contact with water where ingestion of water is reasonably possible. These uses include, but are not limited to, swimming, wading, water-skiing, skin and SCUBA diving, surfing, white water activities, fishing, or use of natural hot springs.

REC2 - Non-Contact Recreation: Includes use of water for recreation involving proximity to water, but not normally involving body contact with water where ingestion of water is reasonably possible. These uses include, but are not limited to, picnicking, sunbathing, hiking, camping, boating, tide pool and marine life study, hunting, sightseeing, or aesthetic enjoyment in conjunction with the above activities.

BIOL - Preservation of Biological Habitats of Special Significance: Includes uses of water that support designated areas or habitats, such as established refuges, parks, sanctuaries, ecological reserves, or Areas of Special Biological Significance (ASBS), where the preservation or enhancement of natural resources requires special protection.

WARM - Warm Freshwater Habitat: Includes uses of water that support warm water ecosystems including, but not limited to, preservation or enhancement of aquatic habitats, vegetation, fish or wildlife, including invertebrates.

COLD - Cold freshwater habitat: Includes uses of water that support cold water ecosystems including, but not limited to, preservation of or enhancement of aquatic habitats, vegetation, fish or wildlife, including invertebrates.

WILD - Wildlife Habitat: Includes uses of water that support terrestrial ecosystems including but not limited to, preservation and enhancement of terrestrial habitats, vegetation, wildlife, (e.g., mammals, birds, reptiles, amphibians, invertebrates), or wildlife and food sources.

RARE - Rare, Threatened, or Endangered Species: Includes uses of water that support habitats necessary, at least in part, for the survival and successful maintenance of plant or animal species established under state or federal law as rare, threatened or endangered.

SPWN - Spawning, Reproduction, and/or Early Development: Includes uses of water that support high quality aquatic habitats suitable for reproduction and early development of fish. This use is applicable only for the protection of anadromous fish.

Impaired Water Bodies

Under Section 303(d) of the Clean Water Act, states, territories and authorized tribes are required to develop a list of water quality limited segments. The waters on the list do not meet water quality standards, even after point sources of pollution have installed the minimum required levels of pollution control technology. The law requires that these jurisdictions establish priority rankings for waters on the lists and develop action plans, called Total Maximum Daily Loads (TMDLs), to improve water quality (40 CFR 130.7(b), 33 USC section 1313(b)). The list is known as the Section 303(d) list of impaired waters.

The proposed project is not directly tributary to a 2010 303(d) listed water body. The closest impaired water body is the San Dieguito River, which is 303(d) listed for indicator bacteria, nitrogen, phosphorus, and total dissolved solids, and toxicity.

3. POLLUTANTS OF CONCERN

3.1 Identification of Potential Project Pollutants

Anticipated pollutants from the site under proposed conditions may include sediment, nutrients, heavy metals, organic compounds, trash and debris, oxygen demanding substances, oil and grease, bacteria and viruses, and pesticides.

TABLE 3. ANTICIPATED AND POTENTIAL POLLUTANTS GENERATED BY LAND USE TYPE

General Project Categories	General Pollutant Categories								
	Sediment	Nutrients	Heavy Metals	Organic Compounds	Trash & Debris	Oxygen Demanding Substances	Oil & Grease	Bacteria & Viruses	Pesticides
Proposed:									
Housing Development	X	X			X	X	X	X	X
Steep Hillside Development	X	X			X	X	X		X
Streets, Highways & Freeways	X	P(1)	X	X(4)	X	P(5)	X		

Notes for Table 1:

X = Anticipated Pollutant
P = Potential Pollutant

(1) A potential pollutant if landscaping exists onsite.
(2) A potential pollutant if the project includes uncovered parking areas.
(3) A potential pollutant if land use involves food or animal waste products.
(4) Including petroleum hydrocarbons
(5) Including solvents

Source: "Table 2. Anticipated and Potential Pollutants Generated by Land Use Type," San Diego Storm Water Standards, January 20, 2012

3.2 Watershed Pollutants of Concern

The proposed project is located within the San Dieguito Watershed. According to the San Dieguito Watershed Urban Runoff Management Program, the pollutants of concern for the Watershed are Coliform bacteria, nutrients, sediment, lower dissolved oxygen, and trace metals.

3.3 Target Pollutants

Taking into account the proximity of the impaired water bodies, and the potential pollutants from the proposed development, the primary target pollutants for this project in order of general priority are nutrients, heavy metals, organic compounds, and bacteria. Secondary pollutants of concern include the rest of the anticipated and potential pollutants as identified in Table 3, which are sediment, trash and debris, oxygen demanding substances, oil and grease, and pesticides.

4. SITE DESIGN BMPS

Priority Development Project (PDP) LID BMPs

The City Storm Water Standards Manual (Section 4.3) requires priority projects to incorporate LID components, which include features that attempt to mimic natural hydrologic conditions for the water quality design storm. Each of the LID principles identified in the Storm Water Standards Manual are listed below followed by a description of how the principle is addressed in the project design.

LID Principle 1: Optimize the Site Layout

The site layout was optimized by planning for LID measures including the following: 1) setbacks from areas of natural endangered plants (conservation of Lot 'N' due to the endangered Brodiaea flowering plant), 2) grading setback stream buffer along easterly drainage course, 3) conformance to the site's natural topography to minimize grading, and 4) preservation of steep hillsides, canyons, and existing vegetation within proposed open space areas.

LID Principle 2: Minimize Impervious Footprint

The impervious areas within the site were minimized. However, per City direction, sidewalk is required on both sides of all streets, so the sidewalks could not be minimized. Street R/W widths set to minimum necessary to accommodate traffic volumes. Each single family home will include indoor parking.

LID Principle 3: Disperse Runoff to Adjacent Landscaping and IMPs

The design concept includes dispersion of a portion of the roof runoff onto adjacent side-yard vegetation before entering the public storm drain system. Impervious hardscape areas will be minimized within landscaping areas.

LID Principle 4: Design and Implementation of Pervious Surfaces

The site constraints do not allow for permeable paving or vegetated roofs.

LID Principle 5: Construction Considerations

Soil amendments will be used in landscaping areas to improve the soil's capacity to retain moisture.

LID Principle 6: Additional Considerations

Site will be stabilized with vegetation to reduce erosion potential. Runon from upstream areas will be re-directed away from the development to prevent slope instability. Energy dissipaters will be provided where required.

5. SOURCE CONTROL BMPS

Source control BMPs reduce the potential for urban runoff to pick up and transport pollutants. They are defined as any administrative action, design of a structural facility, usage of alternative materials, and operation, maintenance, and inspection procedures that eliminate or reduce urban runoff pollution. Table 4 addresses the source control BMPs required by the City according to Storm Water Standards (Section 4.2). The applicability of each source control BMP for the Heritage Bluffs II Project is noted in the table and is discussed in narrative form in the last column.

TABLE 4. SOURCE CONTROL BMPS

	Included		
Specific BMP	**Yes**	**No**	**Explanation of how BMP was included or why it was not included**
4.2.1 Maintenance Bays			
Maintenance bays shall include at least one of the following: • Repair/ maintenance bays shall be indoors; or, • Drainage system designed to preclude urban run-on and runoff. Maintenance bays shall include a repair/maintenance bay drainage system to capture all wash water, leaks, and spills. Drains shall be connected to a sump for collection and disposal. Direct connection of the repair/maintenance bays to the storm water conveyance system is prohibited.		No	No maintenance bays are proposed on this project.

Specific BMP	Included		Explanation of how BMP was included or why it was not included
	Yes	No	
4.2.2 Vehicle and Equipment Wash Areas			
Areas for washing/steam cleaning of vehicles and areas for outdoor equipment/accessory washing and steam cleaning shall be: • Self-contained to preclude run-on and run-off, covered with a roof or overhang, and equipped with a clarifier or other pretreatment facility; and • Properly connected to a sanitary sewer.		No	No wash areas proposed. CC&R's prohibit car washing drainage to enter storm drain system.
4.2.3 Outdoor Processing Areas			
Outdoor processing areas shall: • Cover or enclose areas that would be the most significant source of pollutants; • Slope the area toward a dead-end sump; or • Discharge to the sanitary sewer system. Berms or site grading shall be utilized to prevent run-on from surrounding areas. Installation of storm drains in areas of equipment repair is prohibited.		No	No outdoor processing areas proposed.
4.2.4 Retail and Non-Retail Fueling Areas			
Retail and non-retail fueling areas shall be: • Paved with Portland cement concrete or equivalent smooth impervious surface (asphalt concrete is prohibited); • Designed to extend 6.5 feet (2.0 meters) from the corner of each fuel dispenser, or the length at which the hose and nozzle assembly may be operated plus 1 foot (0.3 meter), whichever is less; • Sloped to prevent ponding; • Separated from the rest of the site by a grade break that prevents run-on of adjacent urban runoff; and • Designed to drain to the project's treatment control BMP(s) prior to discharging to the storm water conveyance		No	No fueling areas proposed.

	Included		
Specific BMP	Yes	No	Explanation of how BMP was included or why it was not included
system. The overhanging roof structure or canopy shall be: • Equal to or greater than the area within the fuel dispensing area's grade break; and • Designed to drain away from the fuel dispensing area.			
4.2.5 Steep Hillside Landscaping			
Steep hillside areas disturbed by project development shall be landscaped with deep-rooted, drought tolerant and/or native plant species selected for erosion control, in accordance with the Landscape Technical Manual.	Yes		Steep hillside areas will be landscaped with appropriate landscaping per the requirements. Refer to landscape plans for further detail.
4.2.6 Use Efficient Irrigation Systems & Landscape Design			
• Implement rain shutoff devices to prevent irrigation during and after precipitation events in accordance with section 2.3-4 of the City of San Diego's Landscape Standards (see Suggested Resources in Appendix A). • Reduce irrigation contribution to dry-weather runoff by avoiding spray irrigation patterns where overspray to paved surfaces or drain inlets will occur. • To avoid overwatering and potential irrigation runoff, design irrigation systems to each landscape area's specific water requirement. • Implement flow reducers or shutoff valves triggered by a pressure drop to control water loss in the event of broken sprinkler heads or lines. • Avoid locating drain inlets in lawn areas, since such inlets tend to be sources or irrigation runoff and the transport mechanism for lawn care products. Design the grading and drainage systems such that drain inlets can be located outside of the lawn area, or include a non-turf buffer	Yes		The applicable efficient irrigation methods included to the left will be included in design of the HOA areas within the project. The project will incorporate flow reducers and check valves.

Specific BMP	Included: Yes	Included: No	Explanation of how BMP was included or why it was not included
around the inlet.			
4.2.7 Design Trash Storage Areas to Reduce Pollution Contribution			
Trash storage areas shall: • Be paved with an impervious surface designed to prevent run-on from adjoining areas and screened or walled to prevent off-site transport of trash. • Contain attached lids on all trash containers to prevent rainfall intrusion. • Contain a roof or awning, at the discretion of the City, for high usage trash areas such as those fast food establishments, convenience stores, and high-density residential developments.		No	No trash areas are proposed. Individual trash receptacles will be standard-issue containers with attached lids.
4.2.8 Design Outdoor Material Storage Areas to Reduce Pollution Contribution			
Materials with the potential to contaminate urban runoff shall be: • Placed in an enclosure such as a cabinet, shed, or other structure that prevents contact with rainfall or runoff and prevents spillage to the storm water conveyance system, and • Protected by secondary containment structures such as berms, dikes, or curbs when the material storage area includes hazardous materials. The storage area shall be paved and sufficiently impervious to contain leaks and spills and be covered by a roof or awning to minimize direct precipitation within the secondary containment area.		No	No material storage areas are proposed.
4.2.9 Design Loading Docks to Reduce Pollution Contribution			
Loading docks areas shall: • Provide overhead cover where		No	No loading dock areas are proposed.

Specific BMP	Included Yes	Included No	Explanation of how BMP was included or why it was not included
appropriate to prevent precipitation contact with debris and potential spills, and • Isolate drainage in the loading dock area through the use of paved berms and/or grade breaks to prevent adjacent runoff from entering the loading area and to prevent liquid spills from discharging from the loading area. • Include an acceptable method of spill containment such as a shut-off valve and containment areas.			
4.2.10 Employ Integrated Pest Management Principles			
Integrated pest management (IPM) is an ecosystem-based pollution prevention strategy that focuses on long-term prevention of pests or their damage through a combination of techniques such as: • Biological control • Habitat manipulation • Use of resistant plant varieties Pesticides are used only after monitoring indicates they are needed according to established guidelines. Pest control materials are selected and applied in a manner that minimizes risks to human health, beneficial and non-target organisms, and the surrounding environment. More information regarding pesticide application may be obtained at the following University of California-Davis website: http://www.ipm.ucdavis.edu/WATER/U/index.html. To eliminate or reduce the need for pesticide use, the following strategies can be used: • Plant pest-resistant or well-adapted plant varieties	Yes		IPM educational materials on how to control pests using non-toxic methods are available in Appendix 3. Only professional pest controllers will be used for the application of pesticides within HOA-maintained areas.

	Included		
Specific BMP	**Yes**	**No**	**Explanation of how BMP was included or why it was not included**
• Discourage pests by modifying the site and landscaping design IPM educational materials should be distributed to future site residents and tenants. These educational materials should address the following: • Use of barriers, screens, and caulking to keep pests out of buildings and landscaping • Physical pest elimination techniques, such as weeding, washing, or trapping pests • Relying on natural enemies to eliminate pests • Proper use of pesticides as a last line of defense			
4.2.11 Provide Storm Water Conveyance System Stamping and Signage			
• Concrete stamping, or approved equivalent method, shall be provided for all storm water conveyance system inlets and catch basins within the project area. • Language associated with the stamping (e.g., "No Dumping – I Live in San Diego Bay") must be satisfactory to the City Engineer. Stamping may also be required in Spanish. • Post signs and prohibitive language (with graphical icons) which prohibit illegal dumping at trailheads, parks, building entrances and public access points along channels and creeks within the project area.	Yes		All storm drain inlets or catch basins onsite will be marked as required by the City.
4.2.12 Manage Fire Sprinkler System Discharges			
For new buildings with fire sprinkler systems, design fire sprinkler systems as follows: • Contain discharges from sprinkler systems' operational maintenance and	Yes		Building fire sprinklers will be designed as required.

Specific BMP	Included Yes	Included No	Explanation of how BMP was included or why it was not included
testing and convey discharges to the sanitary sewer system			
4.2.13 Manage Air Conditioning Condensate			
Air conditioning condensate is a source of dry-weather runoff and elevated copper levels. Include design features to manage this pollutant source, including the following: • Direct air conditioning condensate to the sanitary sewer system • Direct air conditioning condensate to landscaping areas	Yes		Air conditioning condensate will be managed according to City guidelines.
4.2.14 Use Non-Toxic Roofing Materials Where Feasible			
• Avoid the use of galvanized steel or copper for roofs, gutters, and downspouts • If using such materials, reduce the potential for leaching of metals by applying a coating or patina • Avoid composite roofing materials that contain copper	Yes		Non-toxic roofing materials will be used.
4.2.15 Other Source Control Requirements			
• Require implementation of post-construction soil stabilization practices, such as the re-vegetation of construction sites, in conformance with the approved Landscaping Plan and Grading Plans. • Provide for pet waste collection dispensers where applicable.		No	N/A.

Project BMP Plan Implementation

This section identifies the recommended BMP options that meet the applicable storm water and water quality ordinance requirements.

Construction BMPs

Construction is a dynamic operation where changes are expected. Storm water BMPs for construction sites are usually temporary measures that require frequent maintenance to maintain their effectiveness and may require relocation, revision and reinstallation, particularly as project grading progresses. During construction, BMPs such as desilting basins, silt fences, gravel bags, fiber rolls, and other erosion control measures will be employed consistent with the NPDES General Permit for Storm Water Discharges Associated with Construction Activity. Water quality during construction will be protected by the Storm Water Pollution Prevention Plan (SWPPP) prepared for Heritage Bluffs II, which will be kept onsite and updated as required for compliance. The objectives of the SWPPP are to:

- Identify all pollutant sources, including sources of sediment that may affect the water quality of storm water discharges associated with construction activity from the construction site;
- Identify non-storm water discharges;
- Identify, construct, implement in accordance with a time schedule, and maintain BMPs to reduce or eliminate pollutants in storm water discharges and authorized non-storm water discharges from the construction site during construction; and
- Document the inspection and maintenance of the BMPs installed during construction and monitor their effectiveness.

6. DMA DELINEATION

An exhibit showing the Drainage Management Areas within the Project Boundary is included in Appendix 2. For further information on project drainage, soil type and extent of assumed impervious areas, refer to the East Clusters Water Quality Technical Report and Hydromodification Management Study prepared by Rick Engineering, included as Appendix 4 of this report.

7. TREATMENT CONTROL BMPS

7.1 BMP Selection Procedure

According to Storm Water Standards (Section 4.4), structural treatment facilities are required to remove pollutants contained in storm water runoff. Target pollutants, removal efficiencies, expected flows, and space availability determine the selection of structural treatment BMP options. Only structural treatment BMPs with high or medium pollutant removal efficiency shall be selected for mitigation of the primary target pollutants identified in Section 3, which are nutrients, heavy metals, organic compounds, and bacteria.

As stated above, the treatment control and hydromodification control requirements for the Heritage Bluffs II project are being handled with a regional BMP facility located at the downstream end of the East Clusters project. Because the East Clusters report includes all of the required treatment control BMP information for the Heritage Bluffs II project, no additional details are provided herein. Refer to the Rick Engineering East Clusters WQTR. [Please refer to page 20 of the Rick Engineering East Clusters WQTR].

Note that regional BMPs are acceptable alternatives to treat multiple projects as long as the regional facility is constructed prior to occupancy. Since the Heritage Bluffs II project cannot be constructed prior to the access being provided through the East Clusters project, this should not be a concern.

Recommended Post-Construction BMP Plan

PDC has identified the following water quality BMP plan for the Heritage Bluffs II Project.

The recommended post-construction BMP plan includes LID, source control, and treatment control BMPs. The LID BMP options include protection of environmentally sensitive lands, minimization of impervious footprint, minimization of directly connected impervious areas, landscape topsoil improvements, protection of slopes and channels, and energy dissipation. The source control BMPs include steep hillside landscaping, efficient irrigation and landscaping design, integrated pest management principles, storm water conveyance system stenciling and signage, fire water and air conditioning condensate management, and use of non-toxic roofing materials. The treatment BMP(s) selected for this project are being handled in the downstream East Clusters project currently under design by Rick Engineering. Refer to the Rick Engineering East Clusters WQTR report for details. A copy of the current version of the East Clusters WQTR is included as Appendix 4 for reference.

8. HYDROMODIFICATION MANAGEMENT

Under the municipal permit, the project is subject to the Final Hydromodification Criteria. Since the downstream East Clusters project is being developed prior to the Heritage Bluffs II project and the owner (Standard Pacific) will be the same for both projects, it was decided that the water quality and hydromodification requirements of both projects should be handled on a regional basis. Therefore, the treatment control and hydromodification requirements for the Heritage Bluffs II project and the East Clusters project will be addressed at the downstream end of the East Clusters project and the documentation for the BMPs are included in the report prepared by Rick Engineering for the East Clusters project. Refer to the separate East Clusters Unit 3 Water Quality Technical Report/Hydromodification Management Plan, prepared by Rick Engineering and dated January 31, 2014 (or subsequent revision), for detailed information. [Please refer to page 26 of the Rick Engineering East Clusters WQTR].

9. OPERATION AND MAINTENANCE PLANS

The City Municipal Code requires a description of the long-term maintenance requirements of proposed BMPs and a description of the mechanism that will ensure ongoing long-term maintenance. The Storm Water Management and Discharge Control Maintenance Agreement Package will be prepared by Rick Engineering to satisfy the requirements of both projects. Maintenance responsibilities will be determined during internal negotiations between the Heritage Bluffs II HOA and the East Clusters HOA. [Please refer to page 32 of the Rick Engineering East Clusters WQTR].

APPENDIX 1

Storm Water Requirements Applicability Checklist

THE CITY OF SAN DIEGO	City of San Diego **Development Services** 1222 First Ave., MS-302 San Diego, CA 92101 (619) 446-5000	# Storm Water Requirements Applicability Checklist	FORM **DS-560** JANUARY 2011

Project Address: Black Mountain Ranch South of Carmel Valley & Winecreek Road	Project Number *(for City Use Only)*:

SECTION 1. Permanent Storm Water BMP Requirements:

Additional information for determining the requirements is found in the Storm Water Standards Manual.

Part A: Determine if Exempt from Permanent Storm Water BMP Requirements.

Projects that are considered maintenance, or are otherwise not categorized as "development projects" or "redevelopment projects" according to the Storm Water Standards manual are not required to install permanent storm water BMPs. **If "Yes" is checked for any line in Part A, proceed to Part C and check the box labeled "Exempt Project." If "No" is checked for all of the lines, continue to Part B.**

1.	The project is not a Development Project as defined in the Storm Water Standards Manual: for example habitat restoration projects, and construction inside an existing building.	☐ Yes ☑ No
2.	The project is only the construction of underground or overhead linear utilities.	☐ Yes ☑ No
3.	The project qualifies as routine maintenance (replaces or renews existing surface materials because of failed or deteriorating condition). This includes roof replacement, pavement spot repairs and resurfacing treatments such as asphalt overlay or slurry seal, and replacement of damaged pavement.	☐ Yes ☑ No
4.	The project only installs sidewalks, bike lanes, or pedestrian ramps on an existing road, and does not change sheet flow condition to a concentrated flow condition.	☐ Yes ☑ No

Part B: Determine if Subject to Priority Development Project Requirements.

Projects that match one of the definitions below are subject to additional requirements including preparation of a Water Quality Technical Report.

If "Yes" is checked for any line in Part B, proceed to Part C and check the box labeled "Priority Development Project." If "No" is checked for all of the lines, continue to Part C and check the box labeled "Standard Development Project."

1.	**Residential development of 10 or more units.**	☑ Yes ☐ No
2.	**Commercial development and similar non-residential development greater than one acre.** Hospitals; laboratories and other medical facilities; educational institutions; recreational facilities; municipal facilities; commercial nurseries; multi-apartment buildings; car wash facilities; mini-malls and other business complexes; shopping malls; hotels; office buildings; public warehouses; automotive dealerships; and other light industrial facilities.	☐ Yes ☑ No
3.	**Heavy industrial development greater than one acre.** Manufacturing plants, food processing plants, metal working facilities, printing plants, and fleet storage areas.	☐ Yes ☑ No
4.	**Automotive repair shop.** Facilities categorized in any one of Standard Industrial Classification (SIC) codes 5013, 5014, 5541, 7532-7534, or 7536-7539.	☐ Yes ☑ No
5.	**Restaurant.** Facilities that sells prepared foods and drinks for consumption, including stationary lunch counters and refreshment stands selling prepared foods and drinks for immediate consumption (SIC code 5812), and where the land area for development is greater than 5,000 square feet.	☐ Yes ☑ No
6.	**Hillside development greater than 5,000 square feet.** Development that creates 5,000 square feet of impervious surface and is located in an area with known erosive soil conditions and where the development will grade on any natural slope that is twenty-five percent or greater.	☑ Yes ☐ No
7.	**Water Quality Sensitive Area.** Development located within, directly adjacent to, or discharging directly to a Water Quality Sensitive Area (as depicted in Appendix C) in which the project either creates 2,500 square feet of impervious surface on a proposed project site or increases the area of imperviousness of a proposed project site to 10% or more of its naturally occurring condition. "Directly adjacent" is defined as being situated within 200 feet of the Water Quality Sensitive Area. "Discharging directly to" is defined as outflow from a drainage conveyance system that is composed entirely of flows from the subject development or redevelopment site, and not commingled with flows from adjacent lands.	☑ Yes ☐ No
8.	**Parking lot with a minimum area of 5,000 square feet or a minimum of 15 parking spaces** and potential exposure to urban runoff (unless it meets the exclusion for parking lot reconfiguration on line 11).	☐ Yes ☑ No

9.	**Street, road, highway, or freeway.** New paved surface in excess of 5,000 square feet used for the transportation of automobiles, trucks, motorcycles, and other vehicles (unless it meets the exclusion for road reconfiguration on line 11).	☑ Yes ☐ No
10.	**Retail Gasoline Outlet (RGO)** that is: (a) 5,000 square feet or more or (b) has a projected Average Daily Traffic (ADT) of 100 or more vehicles per day.	☐ Yes ☑ No
11.	**Significant Redevelopment**; project installs and/or replaces 5,000 square feet or more of impervious surface and the existing site meets at least one of the categories above. The project is not considered Significant Redevelopment if reconfiguring an existing road or parking lot without a change to the footprint of an existing developed road or parking lot. The existing footprint is defined as the outside curb or the outside edge of pavement when there is no curb.	☐ Yes ☑ No
12.	**Other Pollutant Generating Project.** Any other project not covered in the categories above, that disturbs one acre or more and is not excluded by the criteria below.	☐ Yes ☑ No

Projects creating less than 5,000 sf of impervious surface and where added landscaping does not require regular use of pesticides and fertilizers, such as slope stabilization using native plants. Calculation of the square footage of impervious surface need not include linear pathways that are for infrequent vehicle use, such as emergency maintenance access or bicycle pedestrian use, if they are built with pervious surfaces or if they sheet flow to surrounding pervious surfaces.

Part C: Select the appropriate category based on the outcome of Parts A & B.

1.	If "Yes" is checked for any line in Part A, then check this box. Continue to Section 2.	☐ Exempt Project
2.	If "No" is checked for all lines in Part A, and Part B, then check this box. Continue to Section 2.	☐ Standard Development Project
3.	If "No" is checked for all lines in Part A, and "Yes" is checked for at least one of the lines in Part B, then check this box. Continue to Section 2. See the Storm Water Standards Manual for guidance on determining if Hydromodification Management Plan requirements apply.	☑ Priority Development Project

SECTION 2. Construction Storm Water BMP Requirements:
For all projects, complete Part D. If "Yes" is checked for any line in Part D, then continue to Part E.

Part D: Determine Construction Phase Storm Water Requirements.

1.	Is the project subject to California's statewide General NPDES Permit for Storm Water Discharges Associated with Construction Activities? (See State Water Resources Control Board Order No. 2009-0009-DWQ for rules on enrollment)	☑ Yes ☐ No
2.	Does the project propose grading or soil disturbance?	☑ Yes ☐ No
3.	Would storm water or urban runoff have the potential to contact any portion of the construction area, including washing and staging areas?	☑ Yes ☐ No
4.	Would the project use any construction materials that could negatively affect water quality if discharged from the site (such as, paints, solvents, concrete, and stucco)?	☑ Yes ☐ No
5.	Check this box if "Yes" is checked for line 1. Continue to Part E.	☑ SWPPP Required
6.	Check this box if "No" is checked for line 1, and "Yes is checked for any line 2-4. Continue to Part E.	☐ WPCP Required
7.	Check this box if "No" is checked for all lines 1-4. Part E does not apply.	☐ No Document Required

Part E: Determine Construction Site Priority
This prioritization must be completed with this form, noted on the plans, and included in the SWPPP or WPCP. The City reserves the right to adjust the priority of the projects both before and during construction. [Note: The construction priority does NOT change construction BMP requirements that apply to projects; rather, it determines the frequency of inspections that will be conducted by City staff.]

☑ 1. **High Priority**
a) Projects where the site is 50 acres or more and grading will occur during the wet season
b) Projects 1 acre or more and tributary to an impaired water body for sediment (e.g., Peñasquitos watershed)
c) Projects 1 acre or more within or directly adjacent to or discharging directly to a coastal lagoon or other receiving water within a Water Quality Sensitive Area.
d) Projects subject to phased grading or advanced treatment requirements.

☐ **2 Medium Priority.** Projects 1 acre or more but not subject to a high priority designation.

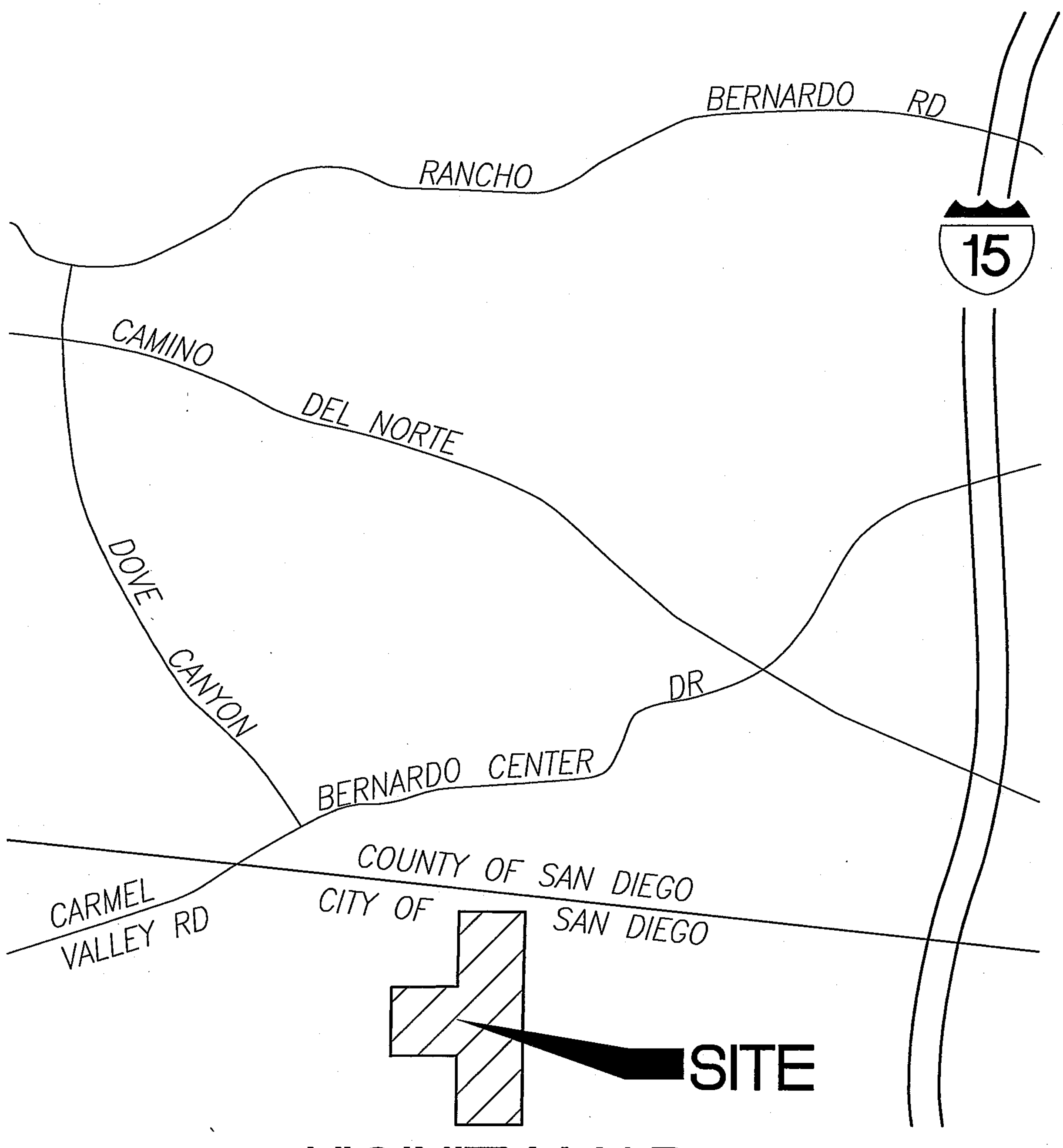
☐ **3 Low Priority.** Projects requiring a Water Pollution Control Plan but not subject to a medium or high priority designation.

Name of Owner or Agent *(Please Print)*: WILLIAM M. DUMKA Title: AUTHORIZED REP.

Signature: William M Dumka Date: 9/3/2013

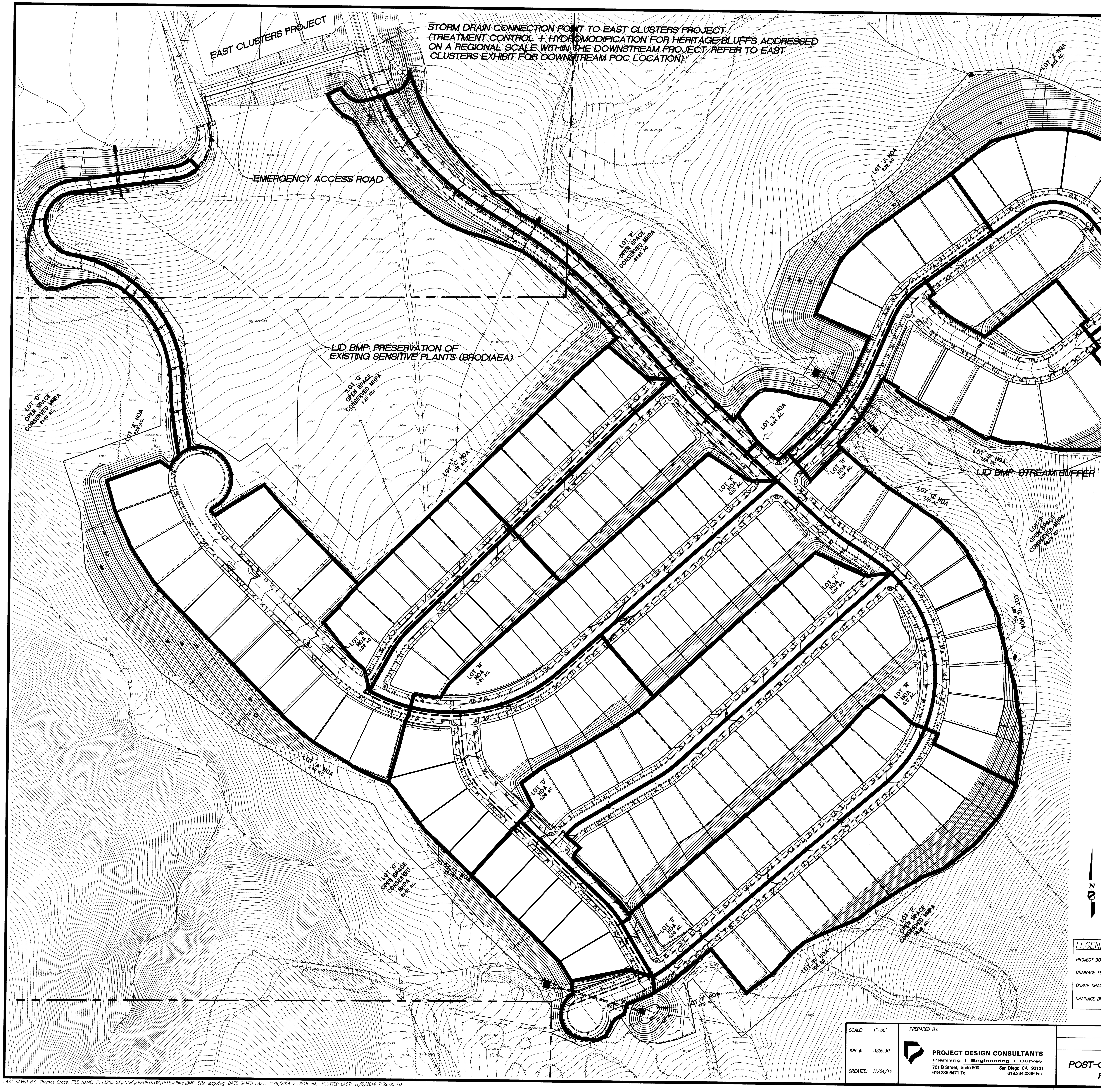
APPENDIX 2

Project Maps



VICINITY MAP

NOT TO SCALE



POST-CONSTRUCTION BMP NOTES:

1) USE OF IMPERVIOUS SURFACES WITHIN LANDSCAPED AREAS WILL BE MINIMIZED.

2) DEVELOPMENT HAS BEEN CLUSTERED/CONCENTRATED ON THE LEAST ENVIRONMENTALLY SENSITIVE PORTIONS OF THE SITE WITH SETBACKS FROM NATURAL DRAINAGES.

3) NATURAL DRAINAGE WITHIN THE MHPA AREA WILL BE PRESERVED. THE DEVELOPER WILL REFER TO THE CITY'S MHPA PLAN AND OTHER BIOLOGICAL REGULATIONS, AS REQUIRED.

4) IN HOA MAINTAINED AREAS, NATIVE OR DROUGHT-TOLERANT TREES AND LARGE SHRUBS WILL BE PLANTED INSTEAD OF NON-DROUGHT TOLERANT EXOTICS FOR WATER CONSERVATION AND CANOPY INTERCEPTION.

5) YARD SWALES WILL BE USED TO COLLECT RUNOFF FROM THE SINGLE FAMILY LOTS, DISCHARGING TO THE CURB AND GUTTER SYSTEM.

6) ANY DISTURBED SLOPES WILL BE STABILIZED WITH HYDROSEED OR EQUIVALENT EROSION CONTROL MEASURES UNTIL NATIVE OR DROUGHT-TOLERANT WELL ADAPTED VEGETATION BECOMES ESTABLISHED.

7) RUNOFF WILL BE CONVEYED SAFELY AWAY FROM THE TOPS OF SLOPES.

8) ALL OUTFALLS TO CHANNELS WILL BE EQUIPPED WITH AN ENERGY DISSIPATION DEVICE AND/OR RIPRAP IN ACCORDANCE WITH APPLICABLE STANDARDS AND SPECIFICATIONS TO MINIMIZE EROSION. ENERGY DISSIPATERS WILL BE INSTALLED IN SUCH A WAY AS TO MINIMIZE IMPACTS ON RECEIVING WATERS.

9) ALL ONSITE INLETS AND CATCH BASINS WILL BE STENCILED WITH PROHIBITIVE LANGUAGE SUCH AS "NO DUMPING – I LIVE DOWNSTREAM" AND GRAPHICAL ICONS TO DISCOURAGE ILLEGAL DUMPING, AS APPROVED BY THE CITY ENGINEER.

10) TIMINGS AND APPLICATION METHODS OF IRRIGATION MUST BE DESIGNED TO MINIMIZE RUNOFF OF EXCESS IRRIGATION WATER INTO THE STORM WATER CONVEYANCE SYSTEM IN HOA MAINTAINED AREAS.

11) IN HOA MAINTAINED AREAS, THE NEED FOR PESTICIDE WILL BE REDUCED TO THE MAXIMUM EXTENT PRACTICABLE BY USING PEST-RESISTENT OR WELL-ADAPTED NATIVE PLANT VARIETIES. INTEGRATED PEST MANAGEMENT (IPM) EDUCATIONAL MATERIALS WILL BE MADE AVAILABLE TO RESIDENTS AND GROUNDSKEEPERS.

12) ONLY PEST MANAGEMENT PROFESSIONALS WILL BE USED FOR THE APPLICATION OF PESTICIDES IN HOA MAINTAINED AREAS. MATERIALS ON HOW TO CONTROL PESTS USING NON-TOXIC METHODS WILL BE MADE AVAILABLE TO RESIDENTS AND GROUNDSKEEPERS.

13) THE TREATMENT & HYDROMODIFICATION BMPs FOR THIS PROJECT ARE ADDRESSED ON A REGIONAL SCALE AND WILL BE BUILT PER THE BLACK MOUNTAIN EAST CLUSTERS PROJECT TO THE NORTH.

SCALE: 1"=60'
JOB #: 3255.30
CREATED: 11/04/14

PREPARED BY:

PROJECT DESIGN CONSULTANTS
Planning I Engineering I Survey
701 B Street, Suite 800
San Diego, CA 92101
619.235.6471 Tel
619.234.0349 Fax

CITY OF SAN DIEGO

HERITAGE BLUFFS

POST-CONSTRUCTION BMP SITE MAP
PROPOSED CONDITIONS

APPENDIX 3

Educational Materials

FREE Pest Notes

for Home and Landscape from the University of California

Plant Diseases

Anthracnose
Apple and Pear Scab
Damping-off Diseases in the Garden
Fire Blight
Lawn Diseases: Prevention and Management
Mushrooms and Other Nuisance Fungi in Lawns
Oleander Leaf Scorch
Palm Diseases in the Landscape
Peach Leaf Curl
Phytophthora Root and Crown Rot in the Garden
Pitch Canker
Powdery Mildew on Fruits and Berries
Powdery Mildew on Ornamentals
Powdery Mildew on Vegetables
Roses: Diseases and Abiotic Disorders
Sooty Mold
Sudden Oak Death in California
Wood Decay Fungi in Landscape Trees

Weeds

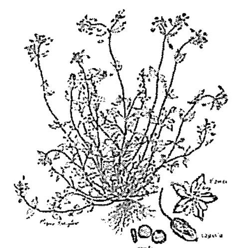
Annual Bluegrass
Bermudagrass
Brooms
Burning & Stinging Nettle
Chickweeds
Clovers
Common Groundsel
Common Knotweed
Common Purslane
Crabgrass
Creeping Woodsorrel and Bermuda Buttercup
Dallisgrass
Dandelions
Dodder
Field Bindweed
Green Kyllinga
Invasive Plants
Kikuyugrass
Mallows
Mistletoe
Nutsedge
Perennial Pepperweed
Plantains
Poison Oak
Puncturevine
Roses: Cultural Practices and Weed Control
Russian Thistle
Spotted Spurge
Weed Management in Landscapes
Weed Management in Lawns
Wild Blackberries
Woody Weed Invaders
Yellow Starthistle

Management Methods Including Pesticides and Biological Control

Biological Control & Natural Enemies
Bordeaux Mixture
Hiring a Pest Control Company
Pesticides: Safe and Effective Use in the Home and Landscape
Soil Solarization for Gardens and Landscapes

Miscellaneous

Delusory Parasitosis



For other University of California gardening publications, go to www.anrcatalog.ucdavis.edu.

UC IPM
Statewide Integrated Pest Management Program

University of California Agriculture and Natural Resources

University of California Cooperative Extension

Can't download?

Visit or call your local University of Calfiornia Cooperative Extension office.

To find your local office, go to http://ucanr.org/ce.cfm, or look in the county government pages of your phone book.

April 2010

www.ipm.ucdavis.edu

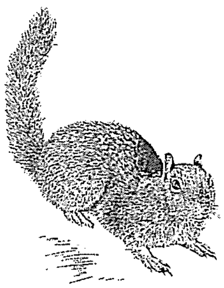
Visit our Web site to download any of these helpful guides or to check out all of our pest-related publications.

FREE Pest Notes

for Home and Landscape from the University of California

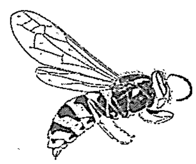
Birds, Mammals, and Reptiles

Bats
Cliff Swallows
Coyote
Deer
Ground Squirrel
House Mouse
Lizards
Moles
Opossum
Pocket Gophers
Rabbits
Raccoons
Rats
Rattlesnakes
Skunks
Tree Squirrels
Voles (Meadow Mice)
Woodpeckers

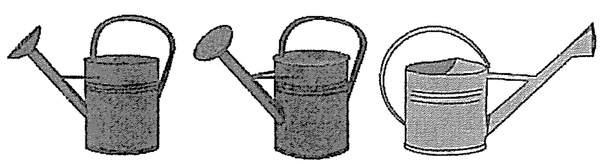


Insects, Mites, Mollusks, and Nematodes

Ants
Aphids
Avocado Lace Bug
Bark Beetles
Bed Bugs
Bee and Wasp Stings
Black Widow and Other Widow Spiders
Boxelder Bug
Brown Recluse and Other Recluse Spiders
California Oakworm
Carpenter Ants
Carpenter Bees
Carpenterworm
Carpet Beetles
Citrus Leafminer
Clearwing Moths
Clothes Moths
Cockroaches
Codling Moth



Conenose Bugs
Cottony Cushion Scale
Drywood Termites
Earwigs
Elm Leaf Beetle
Eucalyptus Longhorned Borers
Eucalyptus Redgum Lerp Psyllid
Eucalyptus Tortoise Beetles
Fleas
Flies
Fruittree Leafroller on Ornamental and Fruit Trees
Fungus Gnats, Shore Flies, Moth Flies, and March Flies
Giant Whitefly
Glassy-winged Sharpshooter
Grasshoppers
Hackberry Woolly Aphid
Head Lice
Hobo Spider
Hoplia Beetle
Horsehair Worms
Lace Bugs
Lawn Insects
Millipedes and Centipedes
Mosquitoes
Nematodes
Oak Pit Scales
Olive Fruit Fly
Pantry Pests
Psyllids
Red Imported Fire Ant
Redhumped Caterpillar
Roses: Insect and Mite Pests and Beneficials
Scales
Scorpions
Sequoia Pitch Moth
Silverfish and Firebrats
Sixspotted Spider Mite on Plumeria
Snails and Slugs
Spider Mites
Spiders
Springtails
Squash Bugs
Sycamore Scale
Termites
Thrips
Ticks (Lyme Disease in California)
Walnut Husk Fly
Whiteflies
Windscorpion
Wood-boring Beetles in Homes
Wood Wasps and Horntails
Yellowjackets and Other Social Wasps
Zoropsis Spinimana, A Mediterranean Spider in California



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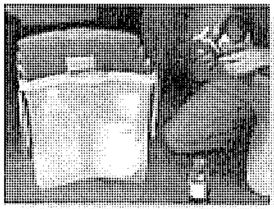
Visit our Web site to download any of these helpful guides or to check out all of our pest-related publications.

Preventing Pollution



...around your home.

≈ Store supplies such as paints, solvents and cleaners properly to avoid spilling.

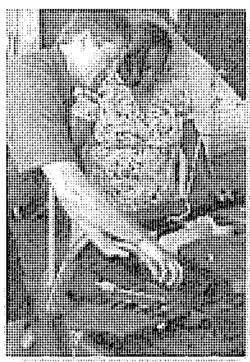
≈ When using water based paints, rinse paint brushes in the sink. Never clean brushes or pour paint in the gutter or storm drain.

≈ Pick up trash and litter around your yard and home.

≈ Dispose of drywall, concrete and mortar from home improvement projects in the trash. Sweep up all project debris.

Preventing Pollution

...from your vehicle.



≈ Regularly check your vehicle for fluid leaks and keep it serviced.

≈ When changing fluids in your car, drain into a clean container and dispose at a used oil collection site.

≈ Quickly contain fluid spills with rags or kitty litter, and dispose of properly.

≈ If you wash your car, use a trigger nozzle on your hose and wash your car on a landscaped surface it won t kill your grass.

Remember to "Scoop the Poop"

≈ Carry bags to pick up after your pet and dispose in the trash.

Important Resources and Contacts

To report Storm Water Pollution in San Diego, please call the Think Blue Hotline
(619) 235-1000

City of San Diego
Storm Water Department
(858) 541-4360

City of San Diego
Environmental Services Department
(858) 694-7000

If you are outside of the City of San Diego call: 1-800-CLEANUP or go to www.earth911.org to find your local hazardous waste program.

Under the City of San Diego s Municipal Code 43.0301, Storm Water Management and Discharge Control ordinance, it is illegal to discharge pollutants into the storm water conveyance system.

thinkBLUE
SAN DIEGO

www.ThinkBlue.org

Printed on recycled paper. TP-171 (12/08) 1500

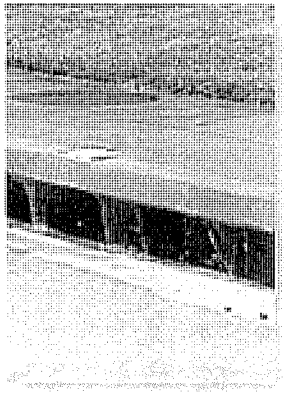
This information will be made available in alternative formats upon request

THE CITY OF SAN DIEGO

Think Blue Tips

Preventing Storm Water Pollution in San Diego

When it rains...



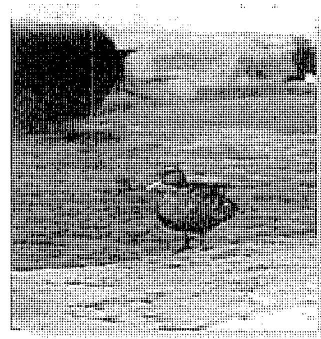
...or when water flows out of yards, it flows directly into storm drains.

Many people think that when water flows into a storm drain it is treated, but the storm drain system and sewer system are **not** connected.

Everything that enters storm drains flows untreated directly into our creeks, rivers, bays, beaches and ultimately the ocean. Storm water can contain harmful pollutants, including pesticides, pet waste, trash, and automobile fluids.

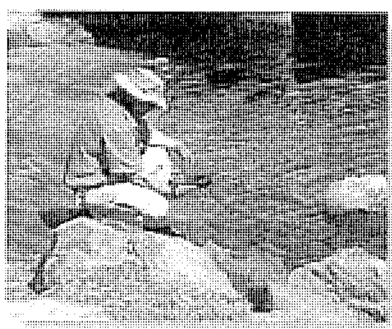
You and your family play an important role in pollution prevention. If everyone makes a few simple changes, we can help protect our San Diego lifestyle and environment.

Environmental Regulations



The Federal Clean Water Act prohibits disposal of waste and pollutants into creeks, rivers, bays, lakes and the ocean due to the harmful effects pollutants have on recreational waterways and wildlife. Some of San Diego s most popular beaches have been temporarily closed because of storm water pollution. By preventing pollution from occurring in our neighborhoods and at our businesses, we can protect our environment and our families health and safety.

"Think Blue San Diego"



Think Blue, the City s pollution prevention education program in the Storm Water Department, is responsible for educating residents, visitors and industry on ways to prevent pollution and protect our waterways in San Diego.

Preventing Pollution

...in your yard.

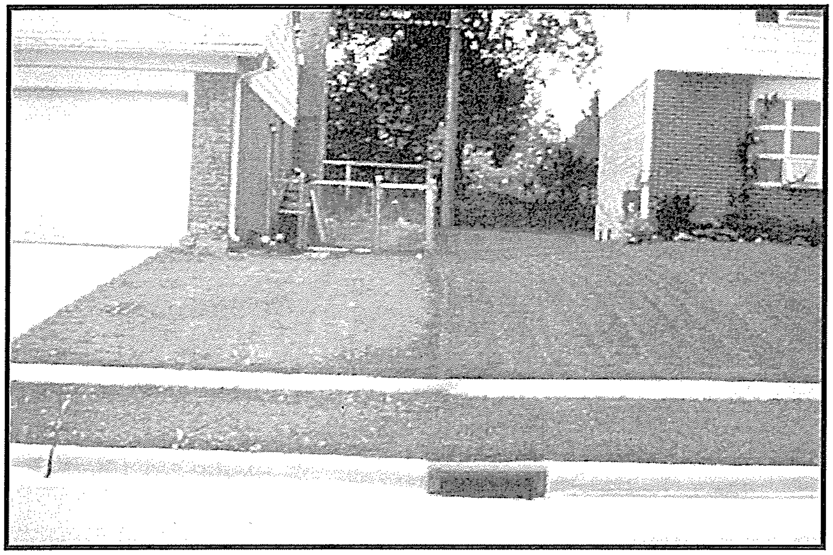
Before beginning an outdoor project, locate the nearest storm drain and take action to protect it from debris. This may require you to sweep the gutter between your project and the storm drain, *before* starting work.

- ≈ Use fertilizers and pesticides sparingly. Read labels carefully and only apply after it rains, not before
- ≈ Use mulch instead of herbicides to prevent weeds from growing and to help absorb water.
- ≈ Select drought resistant native plants that conserve water and prevent runoff.
- ≈ Adjust sprinklers and reduce water times to prevent over-irrigation runoff.
- ≈ Keep your gutters free of leaves and grass clippings. Sweep up instead of hosing down your driveway.

A Change for the better begins with you "Think Blue San Diego".

Efficient Irrigation

SD-12



Design Objectives

☑ Maximize Infiltration

☑ Provide Retention

☑ Slow Runoff

Minimize Impervious Land Coverage

Prohibit Dumping of Improper Materials

Contain Pollutants

Collect and Convey

Description

Irrigation water provided to landscaped areas may result in excess irrigation water being conveyed into stormwater drainage systems.

Approach

Project plan designs for development and redevelopment should include application methods of irrigation water that minimize runoff of excess irrigation water into the stormwater conveyance system.

Suitable Applications

Appropriate applications include residential, commercial and industrial areas planned for development or redevelopment. (Detached residential single-family homes are typically excluded from this requirement.)

Design Considerations

Designing New Installations

The following methods to reduce excessive irrigation runoff should be considered, and incorporated and implemented where determined applicable and feasible by the Permittee:

- Employ rain-triggered shutoff devices to prevent irrigation after precipitation.
- Design irrigation systems to each landscape area's specific water requirements.
- Include design featuring flow reducers or shutoff valves triggered by a pressure drop to control water loss in the event of broken sprinkler heads or lines.
- Implement landscape plans consistent with County or City water conservation resolutions, which may include provision of water sensors, programmable irrigation times (for short cycles), etc.

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CALIFORNIA STORMWATER QUALITY ASSOCIATION

- Design timing and application methods of irrigation water to minimize the runoff of excess irrigation water into the storm water drainage system.

- Group plants with similar water requirements in order to reduce excess irrigation runoff and promote surface filtration. Choose plants with low irrigation requirements (for example, native or drought tolerant species). Consider design features such as:

  - Using mulches (such as wood chips or bar) in planter areas without ground cover to minimize sediment in runoff

  - Installing appropriate plant materials for the location, in accordance with amount of sunlight and climate, and use native plant materials where possible and/or as recommended by the landscape architect

  - Leaving a vegetative barrier along the property boundary and interior watercourses, to act as a pollutant filter, where appropriate and feasible

  - Choosing plants that minimize or eliminate the use of fertilizer or pesticides to sustain growth

- Employ other comparable, equally effective methods to reduce irrigation water runoff.

Redeveloping Existing Installations

Various jurisdictional stormwater management and mitigation plans (SUSMP, WQMP, etc.) define "redevelopment" in terms of amounts of additional impervious area, increases in gross floor area and/or exterior construction, and land disturbing activities with structural or impervious surfaces. The definition of " redevelopment" must be consulted to determine whether or not the requirements for new development apply to areas intended for redevelopment. If the definition applies, the steps outlined under "designing new installations" above should be followed.

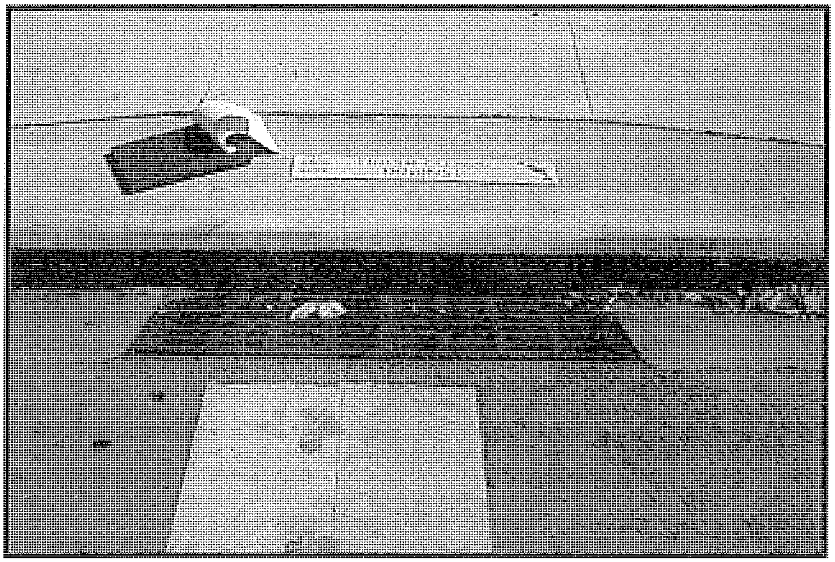
Other Resources

A Manual for the Standard Urban Stormwater Mitigation Plan (SUSMP), Los Angeles County Department of Public Works, May 2002.

Model Standard Urban Storm Water Mitigation Plan (SUSMP) for San Diego County, Port of San Diego, and Cities in San Diego County, February 14, 2002.

Model Water Quality Management Plan (WQMP) for County of Orange, Orange County Flood Control District, and the Incorporated Cities of Orange County, Draft February 2003.

Ventura Countywide Technical Guidance Manual for Stormwater Quality Control Measures, July 2002.



Design Objectives

Maximize Infiltration

Provide Retention

Slow Runoff

Minimize Impervious Land Coverage

☑ Prohibit Dumping of Improper Materials

Contain Pollutants

Collect and Convey

Description

Waste materials dumped into storm drain inlets can have severe impacts on receiving and ground waters. Posting notices regarding discharge prohibitions at storm drain inlets can prevent waste dumping. Storm drain signs and stencils are highly visible source controls that are typically placed directly adjacent to storm drain inlets.

Approach

The stencil or affixed sign contains a brief statement that prohibits dumping of improper materials into the urban runoff conveyance system. Storm drain messages have become a popular method of alerting the public about the effects of and the prohibitions against waste disposal.

Suitable Applications

Stencils and signs alert the public to the destination of pollutants discharged to the storm drain. Signs are appropriate in residential, commercial, and industrial areas, as well as any other area where contributions or dumping to storm drains is likely.

Design Considerations

Storm drain message markers or placards are recommended at all storm drain inlets within the boundary of a development project. The marker should be placed in clear sight facing toward anyone approaching the inlet from either side. All storm drain inlet locations should be identified on the development site map.

Designing New Installations

The following methods should be considered for inclusion in the project design and show on project plans:

- Provide stenciling or labeling of all storm drain inlets and catch basins, constructed or modified, within the project area with prohibitive language. Examples include "NO DUMPING

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– DRAINS TO OCEAN" and/or other graphical icons to discourage illegal dumping.

- Post signs with prohibitive language and/or graphical icons, which prohibit illegal dumping at public access points along channels and creeks within the project area.

Note - Some local agencies have approved specific signage and/or storm drain message placards for use. Consult local agency stormwater staff to determine specific requirements for placard types and methods of application.

Redeveloping Existing Installations

Various jurisdictional stormwater management and mitigation plans (SUSMP, WQMP, etc.) define "redevelopment" in terms of amounts of additional impervious area, increases in gross floor area and/or exterior construction, and land disturbing activities with structural or impervious surfaces. If the project meets the definition of "redevelopment", then the requirements stated under " designing new installations" above should be included in all project design plans.

Additional Information

Maintenance Considerations

- Legibility of markers and signs should be maintained. If required by the agency with jurisdiction over the project, the owner/operator or homeowner's association should enter into a maintenance agreement with the agency or record a deed restriction upon the property title to maintain the legibility of placards or signs.

Placement

- Signage on top of curbs tends to weather and fade.

- Signage on face of curbs tends to be worn by contact with vehicle tires and sweeper brooms.

Supplemental Information

Examples

- Most MS4 programs have storm drain signage programs. Some MS4 programs will provide stencils, or arrange for volunteers to stencil storm drains as part of their outreach program.

Other Resources

A Manual for the Standard Urban Stormwater Mitigation Plan (SUSMP), Los Angeles County Department of Public Works, May 2002.

Model Standard Urban Storm Water Mitigation Plan (SUSMP) for San Diego County, Port of San Diego, and Cities in San Diego County, February 14, 2002.

Model Water Quality Management Plan (WQMP) for County of Orange, Orange County Flood Control District, and the Incorporated Cities of Orange County, Draft February 2003.

Ventura Countywide Technical Guidance Manual for Stormwater Quality Control Measures, July 2002.

APPENDIX 4

Current Version of East Clusters Water Quality Technical Report and Hydromodification Management Plan (For Reference)

WATER QUALITY TECHNICAL REPORT AND HYDROMODIFICATION MANAGEMENT PLAN FOR BLACK MOUNTAIN RANCH EAST CLUSTERS UNIT 3

(FINAL ENGINEERING)

PTS # 363074

Job Number: 15149-B

January 31, 2014
Revised: August 7, 2014

Project Address: South of the intersection of Carmel Valley Road and Winecreek Road

Contact Person: Kurt Bruskotter
Phone#: (858) 334-8322
Email Address: KBruskotter@stanpac.com

RICK ENGINEERING COMPANY

RICK ENGINEERING COMPANY

WQTR Certification for MS4 Permit Compliance

Project Name: Black Mountain Ranch East Clusters Unit 3
Report Title: Water Quality Technical Report and Hydromodification Management Plan for Black Mountain Ranch East Clusters Unit 3
Report Date: August 7, 2014
City of San Diego PTS #: 363074
Rick Engineering Company Job Number: 15149-B

CERTIFICATION

This Water Quality Technical Report (WQTR) has been prepared under the direction of the following Registered Civil Engineer, and is subject to review and approval by the City of San Diego. The Registered Civil Engineer (Engineer) certifies to the technical information contained herein and the engineering data upon which the following design, recommendations, conclusions and decisions are based. To the best of my knowledge, the selection, sizing and design of storm water treatment and other control measures in this report meet the requirements of Regional Water Quality Control Board Order R9-2013-0001 and subsequent amendments in place prior to the date of this certification indicated below.

Jayne Janda-Timba, R.C.E. #70649

8/7/14
Date

WATER QUALITY TECHNICAL REPORT
AND
HYDROMODIFICATION MANAGEMENT PLAN
FOR
BLACK MOUNTAIN RANCH
EAST CLUSTERS UNIT 3

(FINAL ENGINEERING)

PTS # 363074

Job Number 15149-B

Jayne Janda-Timba, P.E.
R.C.E. #70649
Exp. 06/15

REGISTERED PROFESSIONAL ENGINEER
JAYNE MARIE JANDA-TIMBA
NO. 70649
EXP. 6/30/15
CIVIL
STATE OF CALIFORNIA

Prepared for:

Black Mountain Ranch, LLC
16010 Camino Del Sur
San Diego, California 92127
(858) 792-7061

Prepared by:

Rick Engineering Company
Water Resources Department
5620 Friars Road
San Diego, California 92110-2596
(619) 291-0707

January 31, 2014
Revised: August 7, 2014

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WATER QUALITY TECHNICAL REPORT
AND
HYDROMODIFICATION MANAGEMENT PLAN
FOR
BLACK MOUNTAIN RANCH
EAST CLUSTERS UNIT 3

(FINAL ENGINEERING)

REVISION PAGE

August 7, 2014

This Water Quality Technical Report (WQTR) and Hydromodification Management Plan (HMP) presents a revision to the January 31, 2014 report pursuant to the City of San Diego plan check comments. Included within this revision are the final HMP results. A sizing factor of 1.5 is applied to the water quality volumes which also increases the HMP volumes in order to meet the low flow threshold requirement. The maps have been updated to reflect the final updates to the Grading and Improvement Plans. The following text identifies the plan check comment along with the response (in bold).

51. On the cover sheet provide:
    a. City of San Diego Project Number (PTS #363074)
    b. Project Address
    c. Project applicant info:
        i. Contact Person
        ii. Phone #
        iii. Email address

    All of the above information is now provided on the cover sheet.

52. Number all Bioretention Basins and Self Treating/Retaining Areas and provide rough dimensions on the exhibit (Map Pocket 1).

The WQTR and HMP Exhibit in Map Pocket 1 is updated with each bioretention basin numerically identified and rough dimensions provided. Self- retaining areas are not proposed, and perimeter slopes draining away from the project system would be considered self-treating areas.

53. Provide copy of the SWMDCMA (DS-3247). Copy should include the following information/exhibits: a cross section detail of the bioretention basin. The cross section detail should call out the soil media section, soil media percentage, and plant type, per City of San Diego LID manual, vicinity map, Site Plan showing location and count of the Treatment BMP, Post Construction BMP Operation and Maintenance Procedure Table.

Note: Appendix F is missing.

The SWMDCMA is now provided in Appendix F.

54. Provide copy of Storm Water Applicability Checklist (DS-560). Include in report as an exhibit.

An extra detached copy of the Storm Water Applicability Checklist (DS-560) is now included. It is also included within the report in Appendix A.

55. Provide copy of BMP Installation Certification (DS-563). Include in report as an exhibit.

A copy of the BMP Installation Certification (DS-563) is included in Appendix G.

56. Provide cross-section detail of the Bio Retention Basin per appendix "B" of City of San Diego LID Manual. Include the following parameters:

a. Show soil media percentages
b. Soil depth
c. Plant type (per appendix "E")
d. Show overflow location (if applicable)

e. Provide Geotech Report if infiltrating (if applicable)

A typical cross section detail that is representative of the proposed bioretention basins is provided on the WQTR and HMP Exhibit in Map Pocket 1. All of the above information (a through e) is now provided.

57. See WQTR for additional comments.

All additional comments in the WQTR are addressed.

58. Provide a summary of pre and post-project drainage areas and design flows to each of the runoff discharge locations.

A summary of the pre and post-project drainage areas and design flows to each of the runoff discharge locations are provided in the drainage study titled "Drainage Study for Black Mountain Ranch East Clusters Unit 3", dated August 7, 2014.

59. The C values shall be consistent between the drainage study and WQTR. The WQTR call for 60% impervious and 40% pervious. Drainage Study has a weighted C value.

The WQTR uses runoff factors and the drainage study uses weighted C values. The runoff factors and weighted C values are not interchangeable. The drainage study and WQTR are consistent with the percent impervious used.

60. Provide a table with the Drawdown Results.

A table displaying the drawdown results for Basin 12 and 13 is now provided in Appendix D.

61. Appendix C, page 2:

It seems there is a discrepancy between the areas shown on the DMA (10-1 & 10-2) and Exhibit (Map Pocket 1). DMA call for 0.9 ac and the exhibit calls for 1 ac. Please address issue.

The DMA on the exhibit and the calculation table is now updated to be 0.9 acres.

61. Provide size of the orifice.

The orifice sizes are provided and discussed in section 3.4.4.

1.0 INTRODUCTION

1.1 Project Description

This water quality technical report (WQTR) summarizes storm water protection requirements for the Black Mountain Ranch (BMR) East Cluster Unit 3 project (herein referred to as "the project"). The project is located within the City of San Diego, southwest of the intersection of Carmel Valley Road and Winecreek Road. See Figure 1, Vicinity Map, located at the end of Section 1.0. The project consists of residential development and provides an access to a proposed residential development, known as "Heritage Bluffs II," to the south. The project will also provide a secondary emergency access to the Heritage Bluffs II development.

This WQTR describes the permanent storm water Best Management Practices (BMPs) and Hydromodification Management requirements (HMP) that will be incorporated into the project in order to mitigate the impacts of pollutants in storm water runoff from the proposed project, and to discharge storm water runoff similar to pre-project condition. For the purposes of post-construction storm water quality management, the project will follow the guidelines and requirements set forth in the City of San Diego Storm Water Standards, dated January 20, 2012 (herein "Storm Water Standards").

1.2 Determination for Permanent BMP Requirements

Requirements for permanent BMPs are determined based on criteria set forth in the City of San Diego's Storm Water Requirements Applicability Checklist. Projects are identified by three categories:

- Priority Development Project
- Standard Development Project
- Exempted Project

The project is a "Priority Development Project," based on the Storm Water Standards. The project applies to the following priority development project categories based on the City of San Diego's Storm Water Requirements Applicability Checklist: Residential Development of 10 or more units, hillside development greater than 5,000 square feet, development located directly adjacent to a water quality sensitive area, and streets. A copy of the Storm Water Requirements Applicability Checklist is located in Appendix A of this WQTR.

1.3 Drainage Characteristics

Pre-Project Drainage Characteristics

Runoff from the project area in the pre-project condition is conveyed via surface flow in a northerly direction towards an existing culvert and storm drain system within Carmel Valley Road. The culvert discharges into an existing channel that continues towards an existing culvert below Wine Creek Road. The existing storm drain system also discharges to the existing channel just downstream of Wine Creek Road into an open channel that continues in a northwesterly direction towards Lusardi Creek, which eventually confluences with San Dieguito River. San Dieguito River ultimately discharges into Pacific Ocean.

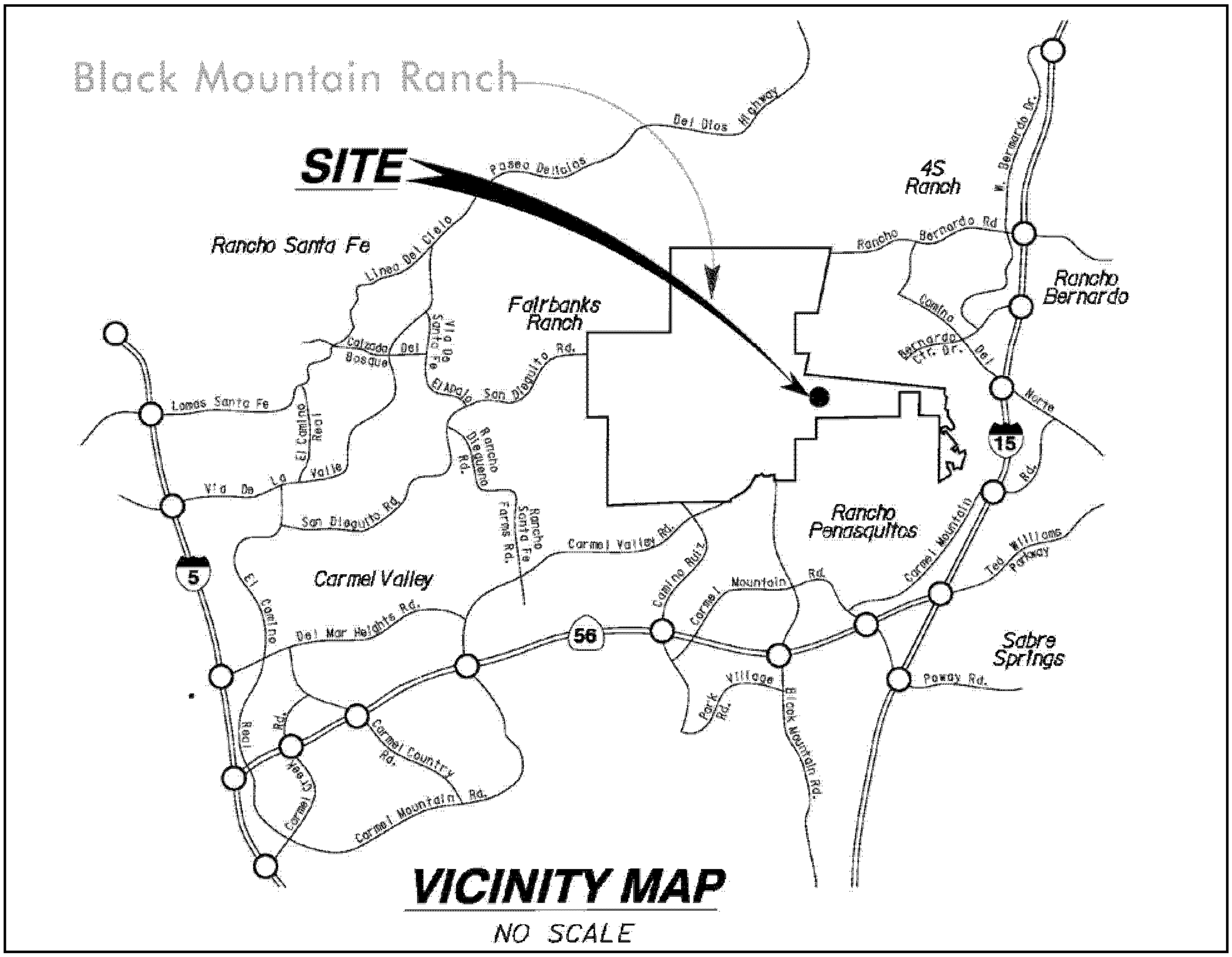
Post-Project Drainage Characteristics

The drainage characteristics in the post-project condition will be very similar as compared to the pre-project condition. Runoff from Basin 900 will be conveyed via a network of proposed on-site storm drain systems towards the existing culvert below Carmel Valley Road, west of Wine Creek Road. This culvert discharges into an existing channel that continues towards the existing culvert below Wine Creek Road. Runoff from Basin 1000 (Basin 12) will also be conveyed via a network of proposed on-site storm drain system towards the existing storm drain system within Carmel Valley Road and Wine Creek Road prior to connecting with the same existing storm drain system below Wine Creek Road.

For more information with regards to drainage characteristics, a separate drainage study titled, "Drainage Study for Black Mountain Ranch East Clusters Unit 3," will be prepared by Rick Engineering Company (Job Number 15149-B).

The following sections of this WQTR describe the pollutants and conditions of concern for the project (Section 2.0), the permanent BMPs to be implemented for the project as well as hydromodification management requirements (Section 3.0), and the operation and maintenance plan for permanent BMPs (Section 4.0).

Figure 1: Vicinity Map



2.0 IDENTIFICATION OF POLLUTANTS OF CONCERN

The project is a "Priority Development Project," based on the Storm Water Standards. Section 4 of the Storm Water Standards outlines the procedure for the selection of permanent storm water BMPs. The procedure begins with identification of pollutants of concern, a two-step process described in Section 4.1.5 and 4.1.6 of the Storm Water Standards. This section of the WQTR addresses each step to identify pollutants of concern.

2.1 Identification of Anticipated Project Pollutants

Table 4-1 of the Storm Water Standards Manual, "Anticipated and Potential Pollutants Generated by Land Use Type," identifies general pollutant categories that are either anticipated or potential pollutants for general project categories. The following general project categories listed in Table 2 apply to the project: "Detached Residential Housing Development", "Steep Hillside Development" and "Streets, Highways and Freeways". Table 4-1 of the Storm Water Standards is renamed as Table 2.1 and reproduced on the following page, with the Priority Development Project categories applicable to the project highlighted.

Table 2.1: Anticipated and Potential Pollutants Generated by Land Use Type

	General Pollutant Categories								
General Project Categories	**Sediments**	**Nutrients**	**Heavy Metals**	**Organic Compounds**	**Trash & Debris**	**Oxygen Demanding Substances**	**Oil & Grease**	**Bacteria & Viruses**	**Pesticides**
Detached Residential Housing Development	X	X			X	X	X	X	X
Attached Residential Development	X	X			X	P(1)	P(2)	P(1)	X
Commercial Development	P(1)	P(1)		P(2)	X	P(5)	X	P(3)	P(5)
Industrial Development	X		X	X	X	X	X		
Automotive Repair Shops			X	X(4)(5)	X		X		
Restaurants					X	X	X	X	P(1)
Steep Hillside Developments	X	X			X	X	X		X
Parking Lots	P(1)	P(1)	X		X	P(1)	X		P(1)
Streets, Highways & Freeways	X	P(1)	X	X(4)	X	P(5)	X	X	P(1)
Retail Gasoline Outlets (RGO)			X	X	X	X	X		

X = anticipated
P = potential
(1) A potential pollutant if landscaping exists on-site.
(2) A potential pollutant if the project includes uncovered parking areas.
(3) A potential pollutant if land use involves food or animal waste products.
(4) Including petroleum hydrocarbons.
(5) Including solvents.

Source: City of San Diego "Storm Water Standards," dated January 20, 2012.

Based on the highlighted rows, the project can be expected to generate: sediments, nutrients, heavy metals, organic compounds, trash and debris, oxygen demanding substances, oil & grease, bacteria & virus, and pesticides.

2.2 Identification of Pollutants of Concern for the Receiving Water

Based on Section 4.1.5 and 4.1.6 of the Storm Water Standards, to identify pollutants of concern in receiving waters, the following analysis shall be conducted and reported in the project's WQTR: (1) for each of the proposed project discharge points, identify the receiving water(s), including hydrologic unit facility number(s), as identified in the most recent version of the "Water Quality Control Plan for the San Diego Facility," prepared by the SDRWQCB; (2) identify any receiving waters included in the 2010 CWA Section 303(d) List of Water Quality Limited Segments, approved by the State Water Resources Control Board on November 12, 2010. List all pollutants for which the receiving waters are impaired; and (3) identify any receiving waters for which Total Maximum Daily Loads (TMDL) have been developed. List all pollutants for which the TMDL was developed.

2.2.1 Identification of Receiving Waters

According to the "Water Quality Control Plan for the San Diego Facility (9)," adopted by the California Regional Water Quality Control Board San Diego Region on September 8, 1994 approved by the SWRCB on December 13, 1994 (Facility Plan), the proposed project is located in the following hydrologic facility planning area:

Hydrologic Unit – San Dieguito (5)
Hydrologic Area – Solana Beach (1)
Hydrologic Subarea – La Jolla (2)

The corresponding number designation is 905.12 (Region ‘9’, Hydrologic Unit ‘05’, Hydrologic Area ‘1’, Hydrologic Subarea ‘2’). An exhibit has been provided in Appendix B of this report titled “Hydrologic Unit for BMR East Clusters Unit 3,” which shows the project location in reference to the hydrologic facility.

2.2.2 Identification of Receiving Water Impairments

On October 11, 2010, the SWRCB approved the 2010 CWA Section 303(d) List of Water Quality Limited Segments (303(d) List). Subsequently, on November 12, 2010, the United States Environmental Protection Agency (USEPA) approved the SWRCB’s inclusion of all waters and pollutants identified for the San Diego region in its 2010 List of Water Quality Limited Segments. Lusardi Creek located in Hydrologic Subarea 905.12 are not currently listed as impaired based on the 2010 303(d) List. In fact, there are no water bodies within Hydrologic Unit 905.12 listed for impairment on the 2010 CWA Section 303(d) List. As a note, Lusardi Creek confluences with San Dieguito River in Hydrologic Unit 905.11 (located downstream of Hydrologic Unit 905.12). San Dieguito River is listed on CWA 303(d) list as impaired for: enterococcus, fecal coliform, nitrogen, phosphorous, total dissolved solids, toxicity. However, the storm water discharge location for the project is greater than 200 feet from the confluence of Lusardi Creek and San Dieguito River. Therefore, the project is not directly discharging to the 303(d) listed water bodies as defined in the Storm Water Standards Manual. In conclusion, there are no additional pollutants of concern for the project based on pollutants of concern in the receiving waters.

2.3 Pollutants of Concern for the Project

Based on the Anticipated Project Pollutants and those of the Receiving Waters, the most significant pollutants of concern for the project are those that both are anticipated, and are a concern for the receiving water (as described by Section 4.4.1 of the Storm Water Standards). However, there are no water bodies within Hydrologic Unit 905.12 that are currently listed as impaired on the 2010 CWA Section 303(d) List; therefore, based on Table 2.1, the following are the project's pollutants of concern: sediments, nutrients, heavy metals, organic compounds, trash and debris, oxygen demanding substances, oil & grease, bacteria & virus, and pesticides. This information will be utilized in the selection procedure for Treatment BMPs, described in the following section of this WQTR.

3.0 PERMANENT STORM WATER BEST MANAGEMENT PRACTICES (BMPS)

The project is a Priority Development Project. The following discussion addresses requirements of Section 4 of the Storm Water Standards, to establish permanent BMPs. Projects subject to Priority Development Project requirements shall implement all applicable source control BMPs, low impact development (LID) design practices, and treatment control BMPs, as described in Sections 4.2, 4.3, and 4.4 of the Storm Water Standards, as well as hydromodification management requirements, as detailed in Section 4.5 of the Storm Water Standards (if applicable).

Sections 3.1 through 3.4 of this WQTR will discuss the permanent storm water BMPs proposed for the project.

3.1 Source Control BMPs

The term "source control BMP" refers to land use or site planning practices, or structures that aim to prevent urban runoff pollution by reducing the potential for contamination at the source of pollution. Source control BMPs minimize the contact between pollutants and urban runoff. The following text discusses the source control BMPs from Section 4.2 of the Storm Water Standards with respect to the project. Italicized text is taken directly from the Storm Water Standards, and reproduced for this report. Portions of the italicized text are condensed from the Storm Water Standards. Immediately following and written in regular text, will be the response as it applies to the project. For several source control BMP requirements, the project does not anticipate design features that would require them; however, if they are included within individual lot site plans within the BMR East Clusters Unit 3 project boundary, the design criteria will be implemented for each applicable location.

a. Maintenance Bays

- *Maintenance bays shall include at least one of the following:*
    1. *Repair/maintenance bays shall be indoors; or,*

2. *Drainage system designed to preclude urban run-on and runoff.*

Maintenance bays shall include a repair/maintenance bay drainage system to capture all wash water, leaks and spills. Drains shall be connected to a sump for collection and disposal. Direct connection of the repair/maintenance bays to the storm water conveyance system is prohibited.

The project does not propose any Maintenance Bays.

b. Vehicle and Equipment Wash Areas

- *Areas for washing/steam cleaning of vehicles and areas for outdoor equipment/accessory washing and steam cleaning shall be:*
    1. *Self-contained to preclude run-on and run-off, covered with a roof or overhang, and equipped with a clarifier or other pretreatment facility; and*
    2. *Properly connected to a sanitary sewer.*

The project does not propose vehicle and equipment wash areas.

c. Outdoor Processing Areas

- *Outdoor processing areas shall:*
    1. *Cover and enclose areas that would be the most significant source of pollutants;*
    2. *Slope the area toward a dead-end sump; or*
    3. *Discharge to the sanitary sewer system*

Berms or site grading shall be utilized to prevent run-on from surrounding areas. Installation of storm drains in areas of equipment repair is prohibited.

The project does not propose Outdoor Processing Areas.

d. Retail and Non-Retail Fueling Areas

- *Retail and non-retail fueling areas shall be:*
  1. *Paved with Portland cement concrete or equivalent smooth impervious surface (asphalt concrete is prohibited);*
  2. *Designed to extend 6.5 feet (2.0 meters) from the corner of each fuel dispenser, or the length at which the hose and nozzle assembly may be operated plus 1 foot (0.3 meter), whichever is less;*
  3. *Sloped to prevent ponding*
  4. *Separated from the rest of the site by a grade break that prevents run-on of adjacent urban runoff; and*
  5. *Designed to drain to the project's treatment control BMP(s) prior to discharging to the storm water conveyance system.*

- *The overhanging roof structure or canopy shall be:*
  1. *Equal to or greater than the area within the fuel dispensing area's grade break; and*
  2. *Designed to drain away from the fuel dispensing area.*

The project does not propose Retail and Non-Retail Fueling Areas.

e. Steep Hillside Landscaping

- *Steep hillside areas disturbed by project development shall be landscaped with deep-rooted, drought tolerant and/or native plans species selected for erosion control, in accordance with the Landscape Technical Manual.*

All steep hillside areas within the project will be landscaped in accordance with the City of San Diego's Landscape Technical Manual.

f. Use Efficient Irrigation Systems and Landscape Design

- *Implement rain shutoff devices to prevent irrigation during and after precipitation events in accordance with section 2.3-4 of the City of San Diego's Landscape Standards (See Suggested Resources in Appendix A)*
- *Reduce irrigation contribution to dry-weather runoff by avoiding spray irrigation patterns where overspray to paved surfaces or drain inlets will occur.*
- *To avoid overwatering and potential irrigation runoff, design the irrigation systems to each landscape area's specific water requirement*
- *Implement flow reducers or shutoff valves triggered by a pressure drop to control water loss in the event of broken sprinkler heads or lines*
- *Avoid locating drain inlets in lawn areas, since such inlets tend to be sources of irrigation runoff and the transport mechanism for lawn care products. Design the grading and drainage systems such that drain inlets can be located outside of the lawn area or include a non-turf buffer around the inlet.*

Irrigation systems for the project will be designed pursuant to the guidelines shown above.

g. Design Trash Storage Areas to Reduce Pollution Contribution

- *Trash storage areas shall:*
  1. *Be paved with an impervious surface designed to prevent run-on from adjoining areas and screened or walled to prevent off-site transport of trash.*
  2. *Contain attached lids on all trash containers to prevent rainfall intrusion.*
  3. *Contain a roof or awning, at the discretion of the City, for high usage trash areas such as those for fast food establishments, convenience stores, and high density residential developments.*

Trash storage areas for the project will be designed pursuant to the guidelines shown above.

h. Design Outdoor Material Storage Areas to Reduce Pollution Contribution

- *Materials with the potential to contaminate urban runoff shall be:*
  1. *Placed in an enclosure such as a cabinet, shed, or other structure that prevents contact with rainfall or runoff and prevents spillage to the storm water conveyance system, and*
  2. *Protected by secondary containment structures such as berms, dikes or curbs when the material storage area includes hazardous materials. The storage areas shall be paved and sufficiently impervious to contain leaks and spills and to be covered by a roof or awning to minimize direct precipitation within the secondary containment area.*

The project does not propose any outdoor material storage areas.

i. Design Loading Docks to Reduce Pollution Contribution

- *Loading dock areas shall:*
  1. *Provide overhead cover where appropriate to prevent precipitation contact with debris and potential spills, and*
  2. *Isolate drainage in the loading dock areas through the use of paved berms and/or grade breaks to prevent adjacent runoff from entering the loading area and to prevent liquid spills from discharging from the loading area.*
  3. *Include an acceptable method of spill containment such as a shut-off valve and containment areas.*

The project does not propose loading docks.

j. Employ Integrated Pest Management Principles

- *Integrated pest management (IPM) is an ecosystem-based pollution prevention strategy that focuses on long-term prevention of pests or their damage through a combination of techniques such as:*

  1. *Biological Control*
  2. *Habitat Manipulation*
  3. *Use of resistant plant varieties*

  Pesticides are used only after monitoring indicates they are needed according to established guidelines. Pest control materials are selected and applied in a manner that minimizes risks to human health, beneficial and non-target organisms, and the surrounding environment. More information regarding pesticide application may be obtained at the following University of California-Davis website: *http://www.ipm.cdavis.edu/WATER/U/index.html.*

- *To eliminate or reduce the need for pesticide use, the following strategies can be used:*
  1. *Plant pest-resistant or well-adapted plant varieties*
  2. *Discourage pests by modifying the site and landscape design*

- *IPM educational materials should be distributed to future site residents and tenants. These materials should address the following:*
  1. *Use of barriers, screens, and caulking to keep pests out of buildings and landscaping*
  2. *Physical pest elimination techniques, such as weeding, washing, or trapping pests*
  3. *Relying on natural enemies to eliminate pests*
  4. *Proper use of pesticides as a last line of defense*

The project will include landscaping in accordance with the City of San Diego's Landscape requirements. The party responsible to ensure implementation and funding of maintenance of permanent BMPs will be responsible to require IPM to be implemented in the landscape maintenance procedures.

k. Provide Storm Water Conveyance System Stamping and Signage

- *Concrete stamping, or approved equivalent method, shall be provided for all storm water conveyance system inlets and catch facilities within the project area.*
- *Language associated with the stamping (e.g., "No Dumping- I Live in San Diego Bay") must be satisfactory to the City Engineer. Stamping may also be required in Spanish.*
- *Post signs and prohibitive language (with graphical icons) which prohibit illegal dumping at trailheads, parks, building entrances and public access points along channels and creeks within the project area.*

Concrete stamping, or the equivalent with prohibitive language will be provided for curb inlets, catch basins, and any Brooks Box inlets located within the project site pursuant to the guidelines shown above.

l. Manage Fire Sprinkler System Discharges

- *For new buildings with fire sprinkler systems, design fire sprinkler system as follows:*
    1. *Contain discharged from sprinkler systems' operational maintenance and testing and convey discharges to the sanitary sewer system*

The fire sprinkler systems will be designed pursuant to the guidelines shown above.

m. Manage Air Conditioning Condensate

- *Air conditioning condensate is a source of dry-weather runoff and elevated copper levels. Include design features to manage this pollutant source, including the following:*
  1. *Direct air conditioning condensate to the sanitary sewer system*
  2. *Direct air conditioning condensate to landscaping areas*

The air conditioning condensate will be managed pursuant to the guidelines shown above.

n. Use Non-Toxic Roofing Materials Where Feasible

- *Avoid the use of galvanized steel or copper for roofs, gutters, and downspouts*
- *If using such materials, reduce the potential for leaching of metals by applying a coating or patina*
- *Avoid composite roofing materials that contain copper*

The use of roofing materials will be designed pursuant to the guidelines above where feasible.

o. Other Source Control Requirements

- *Require implementation of post-construction soil stabilization practices, such as the re-vegetation of construction sites, in conformance with the approved Landscaping Plan and Grading Plans*
- *Provide for pet waste and collection dispensers where applicable*
- *Restrict the use of galvanized and copper roofing materials*

The project will implement post-construction soil stabilization practices in conformance with the approved Landscaping Plan and Grading Plans. Pet waste and collection dispensers will be provided in the park areas. No galvanized and copper roofing materials are proposed.

3.2 Low Impact Development (LID) Design Practices

The term LID means a storm water management and land development strategy that emphasizes conservation and the use of on-site natural features integrated with engineered, small-scale hydrologic controls to more closely reflect pre-development hydrologic functions. The following text discusses the LID design practices from Section 4.3 of the Storm Water Standards with respect to the project. Italicized text is taken directly from the Storm Water Standards, and reproduced for this report. Portions of the italicized text are condensed from the Storm Water Standards. Immediately following and written in regular text, will be the response as it applies to the project.

3.2.1 Suitable Facilities

Suitable LID facilities are those facilities that retain, reuse or promote evapotranspiration of storm water. Four (4) bioretention basins (basins 12, 13, 14A, & 14B) are located along the northerly and southerly boundaries of the project. Bioretention basins 12 and 13 will provide water quality treatment and hydromodification management for the project. Bioretention basins 14A and 14B will provide water quality treatment for the emergency access road. These bioretention basins will help contribute toward these LID design practices.

The landscape plans will include more trees and other plants that add foliage material for rainwater interception and evapotranspiration. Refer to the exhibit located in Map Pocket 1 titled "Water Quality Technical Report Exhibit for Black Mountain Ranch East Clusters Unit 3" for the location of the proposed bioretention basins. The landscaping for the project will be designed in accordance with the City of San Diego's Landscape Technical Manual.

3.2.2 Additional Guidance on Low-Impact Development Design

1. *Optimize the site layout.*

The site layout is optimized by utilizing topography and draining the upper elevations of the site to BMPs at the lower elevations of the site. The project is also configured to allow the two (2) main surface channels to remain. Large portions of open space have been preserved. The project will incorporate additional trees, shrubs, and vegetation throughout the development footprint.

2. *Minimize Impervious Footprint*

Streets will be built to the minimum widths necessary, and landscaping/vegetated areas are included within the public right-of-way, and throughout individual lots.

3. *Disperse Runoff to Adjacent Landscaping and IMPs*

The project proposes landscaped vegetation to be incorporated throughout the project site, which will reduce directly connected impervious areas. Rooftop runoff will also be discharged through vegetated areas wherever feasible prior to entering the storm drain system for additional water quality pre-treatment and conveyance.

4. *Design and Implementation of Pervious Surfaces*

Implementation of pervious surfaces will be considered within the individual site plans of the respective lots.

5. *Construction Considerations*

The project will minimize soil compaction. Special soil amendments will be implemented for landscaped areas and bioretention basins.

6. *Additional Consideration*

The site will be stabilized and landscaped in accordance with the City's Landscape Technical Manual. Runoff will be conveyed safely away from the top of slopes via swales, brow ditches, and open channels. Energy dissipaters have been designed for each of the outfall locations, and splash pads and/or landscape rocks will be provided for roof drain outlets and concentrated outlets into landscaped areas to help minimize potential erosion.

3.3 Treatment Control BMPs

Pursuant to Section 4.4 of the Storm Water Standards, after source control BMPs and LID have been incorporated into the project, applicants of Priority Development Projects shall design a single or combination of treatment control BMPs designed to infiltrate, filter, and/or treat runoff from the project footprint. The required LID BMPs may be applied towards the numeric sizing treatment standards satisfactory to the City Engineer.

Pursuant to Section 4.4.1, *selection of treatment control BMPs shall be based on the following criteria, in conjunction with the performance ratings provided in Table 4-3:*

- *For the anticipated project pollutants identified in section 4.1.5, the highest performing BMPs available shall be considered. Site constraints that limit the selection shall be described in the WQTR*
- *The most significant pollutants of concern for the project are those that both are anticipated, according to section 4.1.5, and are a concern for the receiving water, according to section 4.1.6. The minimum performance for the most significant pollutants of concern is "medium removal efficiency."*

Priority Development Projects shall select a single or combination of treatment BMPs from the categories in Table 4-3 of the Storm Water Standards that maximize pollutant removal for the particular pollutants of concern. This means that the selected treatment control BMPs must collectively provide minimum pollutant removal efficiencies of “medium” or “high” for all pollutants of concern.

Table 4-3 of the Storm Water Standards, “Structural Treatment Control BMP Selection Matrix,” provides a guide for treatment control BMP selection. Table 4-3 is renamed as Table 3.1 and reproduced below. The Structural Treatment Control BMPs selected for this project are highlighted on Table 3.1 below.

Table 3.1: Structural BMP Treatment Control Selection Matrix

BMP	LID	HMP Control	Sediment	Nutrients	Trash	Metals	Bacteria	Oils and Grease	Organics
Infiltration Facility	Y	Y	H	H	H	H	H	H	H
Bioretention Basin	Y	Y	H	M	H	H	H	H	H
Cistern Plus Bioretention	Y	Y	H	M	H	H	H	H	H
Vault plus Bioretention	Y	Y	H	M	H	H	H	H	H
Self-retaining Area	Y	Y	H	H	H	H	H	H	H
Dry Wells	Y	Y	H	H	H	H	H	H	H
Constructed Wetlands	Y	Y	H	M	H	H	H	H	H
Extended Detention Facility	Y	N	M	L	H	M	M	M	M
Vegetated Swale	Y	N	M	L	L	M	L	M	M
Vegetated Buffer Strips	Y	N	H	L	M	H	L	H	M
Flow-Through Planter Boxes	Y	Y	H	M	H	H	H	H	H
Vortex Seperator or Wet Vault	N	N	M	L	M	L	L	L	L
Media Filter	N	N	H	L	H	H	M	H	H

H High removal efficiency
M Medium removal efficiency
L Low removal efficiency

The following discussion identifies the treatment control BMPs proposed for the project, pursuant to the structural treatment BMP selection procedure described in Section 4.4 of the Storm Water Standards Manual.

As discussed in Section 2.0, the project can be expected to generate the following "anticipated" and "potential" pollutants: sediments, nutrients, heavy metals, organic compounds, trash and debris, oxygen demanding substances, oil and grease, bacteria & viruses, and pesticides.

Nutrients will be managed using source control BMPs, which can be more effective than treatment. The landscaped areas will be managed with source controls to prevent off-site transport of nutrients by runoff. Source controls will include designing the landscape and irrigation system in accordance with the City of San Diego's Landscape Technical Manual, and ensuring on-going maintenance of the landscape and irrigation system. These source controls will also be effective for reducing transport of sediment from the project site.

All of the BMPs listed in the Storm Water Standards – Table 4-3 were evaluated. It was determined that the most practicable treatment BMP would be:

- Four (4) Bioretention Basins (Basins 12, 13, 14A, & 14B)

The proposed bioretention basins have 2.0-feet layer of amended soil and 1.0-feet layer of gravel to promote water quality treatment. Basins 12 & 13 provide storage for hydromodification management (for more details on hydromodification management plan please refer to Section 3.4 of this report). The bioretention basins promote filtering/settling throughout and absorption/retention into the amended soil and plant roots that will provide "medium" to "high" pollutant removal efficiency for all pollutants of concern.

The bioretention basins were selected for the project based on the following considerations:

- The bioretention basins will treat for sediment, nutrients, trash, metals, bacteria, oil and grease, and organics at a medium to high level of removal efficiency.
- The bioretention basins provide treatment through filtering/settling throughout the facility. The 2.0-feet layer of amended soil will promote absorption/retention into the amended soil and plant roots will promote additional treatment.

3.3.1 Numeric Sizing Requirements for Treatment Control BMPs

Page 85 of the future MS4 Permit Order No. R9-2013-0001 states that, "Each Priority Development Project must be required to implement LID BMPs that are designed to retain (i.e. – intercept, store, infiltrate evaporate, and evapotranspire) on-site pollutants contained in the volume of storm water runoff produced from a 24-hour 85th percentile storm event (design capture volume);" however, the permit states in E.3.c.1.a that, "If a Copermittee determines that implementing BMPs to retain the full design capture volume on-site for a Priority Development Project is not technically feasible, then the Copermittee may allow the Priority Development Project to utilize biofiltration BMPs. Biofiltration BMPs must be sized to: (a) treat 1.5 times the design capture volume not reliably retained on-site…"

Based on the exhibit titled *Soil Hydrologic Groups* within Appendix A of the *San Diego County Hydrology Manual,* (June 2003), the soil in the vicinity is classified as 'Type D' soil, which is considered to have a very slow infiltration rate. It is believed that technical infeasibility of infiltration in this area can be shown; therefore, a biofiltration BMP will be provided instead. Based on the assumption of infeasibility of infiltration, the biofiltration basin was designed to provide storage and treatment of 1.5 times the water quality volume (option 'a' above).

The treatment volume was determined as the maximum volume of runoff produced from the 85th percentile storm event. The rational method equation was used to determine the treatment volumes, based on the following equation:

For volume-based Bioretention Basin design (applicable to Basins 12 & 13):

- Rational method equation: $V = R_F PA$
- 'V' is the treatment volume in acre-feet (ac-ft),
- 'R_F' is the weighted runoff factor for the drainage area,
- 'P' is the 85_{th} percentile precipitation in inches (in) [85_{th} percentile storm event per volume based numeric sizing criteria], converted to feet (ft) and
- 'A' is the drainage area is acres (ac).

The 85th percentile storm event precipitation for the project is 0.65-inches, according to the County of San Diego 85th Percentile Isopluvial Maps, dated August 7, 2003.

Utilizing the void space within the biofiltration basin, including the subsurface amended soil and gravel layers, storage of 1.5 times the water quality volume has been provided. The water quality outlet structure is a 6-inch perforated sub-drain located within the gravel layer.

For flow-based treatment control BMPs, the treatment flow rates were calculated based on the following equation:

For flow-based Bioretention Basin design (applicable to Basins 14A & 14B):

- Rational method equation: $Q = R_F IA$
- 'Q' is the treatment flow rate in cubic feet per second (cfs),
- 'R_F' is the weighted runoff factor,
- 'I' is the rainfall intensity in inches per hour (in/hr) [0.2 in/hr per flow-based numeric sizing criteria], and
- 'A' is the drainage area is acres (ac).

The water quality treatment calculations are included in Appendix C of this report. Typical details of the selected Treatment Control BMPs are included in Appendix E. The locations of all storm water management features are shown on the exhibit titled "Water Quality Technical Report Exhibit for BMR East Clusters Unit 3," located in Map Pocket 1.

3.4 Hydromodification Management Requirements

3.4.1 Background

The intent of this section is to meet requirements of Provision D.1.g of the California Regional Water Quality Control Board San Diego Region Order R9-2007-0001, which requires the San Diego Storm water Copermittees to implement a Hydromodification Management Plan (HMP). Hydromodification refers to changes in a watershed's runoff characteristics resulting from development, together with associated morphological changes to channels receiving the runoff, such as changes in sediment transport characteristics and the hydraulic geometry (width, depth, and slope) of channels. These changes can result in stream bank erosion and sedimentation, leading to habitat degradation due to loss of overhead cover and loss of in-stream habitat structures. As required by Permit Order No. R9-2007-0001, each Copermittee was required to incorporate the approved Hydromodification Management Plan (HMP) into its local Standard

Urban Storm Water Mitigation Plan (SUSMP) and implement the HMP for all applicable priority Development Projects (PDP) by January 14, 2011.

The BMR East Clusters Unit 3 project is subject to the Final Hydromodification Management Criteria. Therefore, a hydromodification management strategy has been developed based on the Final Hydromodification Management Plan (HMP), dated March 2011. The project has utilized continuous simulation modeling to demonstrate compliance with the Final HMP. The storm water management features will also provide Priority Development Project LID requirements to the maximum extent practicable and water quality treatment, as described in Section 3.0.

3.4.2 Methodology and Criteria

Based on the Final Hydromodification Management Plan, dated March 2011, a range of runoff flow rates was required to identify the range for which Priority Development Project (PDP) post-project runoff flows and durations shall not exceed pre-project runoff flows and durations. In order to meet these criteria, results of a hydromodification management analysis must meet the following criteria:

- For flow rates between the pre-project lower flow threshold and the pre-project 10-year event, the post-project discharge rates and durations may not deviate above the pre-project rates and durations by more than 10% of the length of the flow duration curve.
- Lower flow thresholds may be determined using the HMP Decision Matrix along with a critical flow calculator and channel screening tools developed by the Southern California Coastal Water Research Project (SCCWRP). These methods identify lower flow thresholds for a range of channel conditions. The critical flow calculator recommends a lower flow value of $0.1Q_2$, $0.3Q_2$, or $0.5Q_2$ depending on the receiving channel material and dimensions. This value will be compared to the channel's susceptibility rating (High, Medium, or Low) as determined from the SCCWRP screening tools to determine the final lower flow threshold.

- The lower flow threshold may alternately be determined as 10 percent of the pre-project 2-year runoff event, or $0.1Q_2$. This approach, which is outlined in the HMP Decision Matrix, is available if the project applicant chooses not to complete the channel screening analysis.

The project has elected to perform the continuous simulation modeling using the lower flow threshold of $0.3Q_2$ for both the easterly drainage basin (i.e., Basin 1000) and westerly drainage basin (i.e., Basin 900). A geomorphic assessment was performed for the channels downstream of those drainage basins to show that $0.3Q_2$ is the appropriate low flow threshold.

The continuous simulation modeling for this project was performed using the San Diego Hydrology Model (SDHM) from Clear Creek Solutions, Inc. The release date for the version of SDHM utilized for the project is July 30, 2014. SDHM was used to analyze the proposed project for compliance with the Final Hydromodification Management Criteria. The software is capable of modeling hydromodification management (flow control) facilities to mitigate the effects of increased runoff from the post-project land use changes that may cause negative impacts (i.e. erosions) to downstream channels.

Standards developed as part of the Final HMP to control runoff peak flows and durations are based on a continuous simulation of runoff using local rainfall data. SDHM is based on actual recorded precipitation data. Based on the agreement with the City of San Diego, the rainfall gauge selected for this project was the Poway gauge, which represents the project appropriately based on isopluvial and precipitation zone characteristics and has hourly data for the period of record of 1962 to 2008.

The program is a continuous simulation program accounting for all storm events, which differ from typical methods of using the peak from a single storm event (i.e. 100-year). SDHM uses the Hydrologic Simulation Program-Fortran (HSPF) software as its computational engine to run rainfall-runoff algorithms.

3.4.3 Partial Duration

The peak flow frequency statistics (i.e. Q_2 and Q_{10}) estimates how often flow rates will exceed a given threshold. There are two common methods to determine the frequency of recurrence of flood data: annual maximum series or partial duration series. The annual maximum series selects the highest peak discharge in one year. The partial duration series considers multiple storm events in a given year. According to the Final HMP, the need for partial duration statistics is more pronounced for control standards based on more frequent return intervals (such as the 2-year runoff event) since the peak annual series does not perform as well in the estimation of such events. The use of a partial duration series is recommended for semi-arid climates similar to San Diego County, where prolonged dry periods can skew peak flow frequency results determined by a peak annual series for more frequent runoff events. The partial duration series provides better resolution for assigning recurrence intervals to events that occur more frequently than once per 10 years, which are the events that are most important for the HMP. San Diego Hydrology Model (SHM), dated July 18, 2013, defaults to compute peak flow frequency statistics by constructing a partial duration series. For the statistical analysis of the rainfall record, partial duration series events have been separated into discrete rainfall events assuming the following criteria:

- To determine a discrete rainfall event, a lower flow limit was set to a very small value, equal to 0.002 cfs per acre of contributing drainage area.
- A new discrete event is designated when the flow falls below 0.002 cfs per acre for a time period of 24 hours.

3.4.4 HMP Strategies/Results

The BMR East Clusters Unit 3 area consists of two (2) major drainage basin boundaries that drain to Basin 12 and Basin 13. The two major drainage basins lie on Type D soils. Land use in the pre-project condition is mainly comprised of undeveloped area (pervious) and slopes for the project range from “moderate” (5 to 10% slopes) to “steep” (greater than 10%). One TC-BMP has been provided in each of the drainage basins.

The following is the post-project land use breakdown within the two major drainage basin boundaries (refer to “HMP Exhibit for BMR East Clusters Unit 3” in Map Pocket 1).

Basin 12

The overall tributary area to Basin 12 boundary is 62.2 acres (22.6 acres for East Clusters Unit 3 and 39.6 acres for Heritage Bluffs). Basin 12 tributary area consists of the following post-project surface type and acreage breakdown: Single-family residential and roadways based on 60% impervious and 40% pervious.

Basin 13

The overall tributary area to Basin 13 boundary is 8.5 acres. Basin 13 tributary area consists of the following post-project surface type and acreage breakdown: Single-family residential and roadways based on 60% impervious and 40% pervious.

In order to comply with the HMP requirements, the two (2) bioretention basins were sized pursuant to volume-based approach (i.e. – minimum water quality volume are increased by 150% to comply with the 2013 MS4 Permit). The HMP volume was provided in the final configuration of each bioretention basin, and the low-flow orifices were manually resized to accommodate for any difference in head between the modeling and the geometry provided.

The SDHM results are located in Appendix D of this report. Based on the result, the required HMP volumes for Basin 12 and Basin 13 are 3.65 acre-feet (approximately 158,994 cubic feet (ft^3)), and 0.47 acre-feet (approximately 20,473 cubic feet (ft^3)), respectively. The ponding depth for the Basin 12 and Basin 13 is 5.3 feet and 2.8 feet, respectively. The orifice is sized to discharge 30% of Q_2. The diameter of the low flow orifice in Basin 12 is 3.5 inches, and Basin 13 is 1.3 inches.

A compact disc (CD) is provided at the end of this report (CD pocket) that includes the electronic files for the SDHM.

3.4.5 Results for Drawdown Time Calculations

The HMP drawdown time calculations have been performed and provided in Section D of this report. The HMP drawdown time calculations indicate that the all bioretention basins will drain within 96 hours to meet the requirements of the Final HMP, dated March 2011.

3.4.6 HMP Conclusion

This study presents water quality and hydromodification management information for BMR East Clusters Unit 3, in the City of San Diego, California. The following are findings and conclusions of the hydromodification management section of this report.

- The project will utilize treatment control/hydromodification management BMPs for storm water treatment and hydromodification management (flow control).
- HMP analyses using the San Diego Hydrology Model (SDHM) were performed to size the two (2) basins (Basins 12 & 13) for water quality treatment and hydromodification management for the project.
- The results of the SDHM demonstrate that the post-project peak flows and durations do not exceed the pre-project peak flow and durations, thus complying with the Final Hydromodification Management Plan requirements.

4.0 OPERATION AND MAINTENANCE PLAN (OMP)

The owner of the project will enter into a Storm Water Management and Discharge Control Maintenance Agreement (SWMDCMA) with the City of San Diego to ensure maintenance of permanent BMPs for the project. A copy of the SWMDCMA is located in Appendix F.

4.1 Maintenance Responsibility

The owner of the project is the site operator and will be the party responsible to ensure implementation and funding of maintenance of permanent BMPs.

It is anticipated that the owner of the project will manage multiple separate maintenance contracts for different types of maintenance (e.g., landscape maintenance vs. maintenance of the BMPs). Throughout this section, the owner of the project is the "party responsible to ensure implementation and funding of maintenance of permanent BMPs." The party who actually performs the activities is the "inspector," "maintenance contractor," or "maintenance operator."

4.2 Inspection and Maintenance Activities

4.2.1 Inspection and Maintenance Activities for LID, Source Control, and Treatment Control BMPs

The following LID and source control BMPs for the project requires permanent maintenance: concrete stamping, landscaped areas, and irrigation systems within the landscaped areas. The discussions below provide inspection criteria, maintenance indicators, and maintenance activities for the above-listed LID and source control BMPs that require permanent maintenance.

Landscaped Areas

Inspection and maintenance of the vegetated areas may be performed by the landscape maintenance contractor.

During inspection, the inspector shall check for the maintenance indicators given below:

- Erosion in the form of rills or gullies
- Ponding water
- Bare areas or less than 70% vegetation cover
- Animal burrows, holes, or mounds
- Trash

Routine maintenance of vegetated areas shall include mowing and trimming vegetation, and removal and proper disposal of trash.

If erosion, ponding water, bare areas, poor vegetation establishment, or disturbance by animals are identified during the inspection, additional (non-routine) maintenance will be required to correct the problem. For ponding water or erosion, see also inspection and maintenance measures for irrigation systems. In the event that any non-routine maintenance issues are persistently encountered such as poor vegetation establishment, erosion in the form of rills or gullies, or ponding water, the party responsible to ensure that maintenance is performed in perpetuity shall consult a licensed landscape architect or engineer as applicable.

As applicable, IPM procedures must be incorporated in any corrective measures that are implemented in response to damage by pests. This may include using physical barriers to keep pests out of landscaping; physical pest elimination techniques, such as, weeding, squashing, trapping, washing, or pruning out pests; relying on natural enemies to eat pests; or proper use of pesticides as a last line of defense. More information can be obtained at the UC Davis website (http://www.ipm.ucdavis.edu/WATER/U/index.html).

Outlet Protection

Routine maintenance of outlet protection shall include removing trash, debris, and leaves. For outlet protection, immediately reposition all displaced energy dissipaters. If soil erosion is found, extend energy dissipater (i.e. landscape rocks and/or splash pads); reposition or increase limits of energy dissipater to fully cover eroded area.

Concrete Stamping

Inspection/maintenance of the concrete stamping may be performed by the building/facilities maintenance contractor or other employees of the owner, as applicable. In addition, there may be storm drain maintenance contractors who will perform this service for a fee.

During inspection, the inspector(s) shall check for the maintenance indicators given below:

- Faded, vandalized, or otherwise unreadable concrete stamping

There are no routine maintenance activities for the concrete stamping. If inspection indicates the concrete stamping is intact, no action is required.

If inspection indicates the concrete stamping is not legible, the concrete stamping shall be repaired or replaced as applicable.

Irrigation Systems

Inspection and maintenance of the irrigation system may be performed by the landscape maintenance contractor.

During inspection, the inspector shall check for the maintenance indicators given below:

- Eroded areas due to concentrated flow

- Ponding water
- Refer to proprietary product information for the irrigation system for other maintenance indicators, as applicable

Refer to proprietary product information for the irrigation system for routine maintenance activities for the irrigation system, as applicable. If none of the maintenance indicators listed above are identified during inspection of the irrigation system, no other action is required.

If any of the maintenance indicators listed above are identified during the inspection, additional (non-routine) maintenance will be required to restore the irrigation system to an operable condition. If inspection indicates breaks or leaks in the irrigation lines or individual sprinkler heads, the affected portion of the irrigation system shall be repaired. If inspection indicates eroded areas due to concentrated flow from the irrigation system, the eroded areas shall be repaired and the irrigation system shall be adjusted or repaired as applicable to prevent further erosion. If inspection indicates ponding water resulting from the irrigation system, the irrigation system operator shall identify the cause of the ponded water and adjust or repair the irrigation system as applicable to prevent ponding water. Refer to proprietary product information for the irrigation system for other non-routine maintenance activities as applicable.

Bioretention Basins

During inspection, the inspector shall check for the maintenance indicators given below:

- Inspect basins at least twice annually for erosion, damage to vegetation, and sediment and debris accumulation preferably at the end of the wet season to schedule summer maintenance and before major fall runoff to be sure the bioretention basins are ready for winter. However, additional inspection after periods of heavy runoff is desirable, including after the first couple of storm events following installation to ensure proper functioning.
- The bioretention basin should be checked for debris and litter, and areas of sediment accumulation, specifically at the inlets/outlets. The need for litter removal is determined

through periodic inspection, but litter should always be removed prior to mowing. Sediment accumulating in the bioretention basin should be removed when it builds up to 3 inches at any spot, or covers vegetation.

- Inspect for standing water in the storage and draining layer indicating clogging of the under drains. Regularly inspect bioretention basins for pools of standing water. Bioretention basins can become a nuisance due to mosquito breeding in standing water if obstructions develop (e.g. debris accumulation, invasive vegetation) and/or if proper drainage slopes are not implemented and maintained.
- Mulch replacement of the entire area may be required every two or three years, although spot mulching may be sufficient when there are random void areas.

Routine maintenance of the bioretention basins shall include removal and proper disposal of accumulated materials (e.g., sediment, litter).

If inspection indicates that the underdrains for the bioretention basins are clogged, the additional non-routine maintenance will be required to backwash and clear the underdrains. Depending on pollutant loads, soils may need to be replaced within 5 to 10 years. The party responsible to ensure implementation and funding of maintenance of permanent BMPs shall contract for additional cleaning and disposal services as necessary if non-routine cleaning and disposal is required.

4.3 Inspection and Maintenance Frequency

The Table below lists the BMPs to be inspected and maintained and the minimum frequency of inspection and maintenance activities.

Table 4.1: Summary Table of Inspection and Maintenance Frequency

BMP	Inspection Frequency	Maintenance Frequency
Landscaped Areas	Monthly	Routine mowing and trimming and trash removal: monthly Non-routine maintenance as-needed based on maintenance indicators in Section 4.2.1
Outlet Protection	Twice a year, and after major storm events	Routine maintenance to remove trash, debris, and leaves. Repair any damage to roof drains. Immediately reposition all displaced energy dissipaters. If soil erosion is found, reposition or increase limits of energy dissipater to fully cover eroded area. Non-routine maintenance as-needed
Concrete Stamping (or equivalent)	Annual	As-needed based on maintenance indicators in Section 4.2.1
Irrigation Systems	Monthly	As-needed based on maintenance indicators in Section 4.2.1
Bioretention Basin (treatment control BMP)	Twice a year, and after major storm events	Routine maintenance to remove accumulated materials such as trash and debris and sediments: twice a year, on or before September 30th and following the rainy season after May 1st. As-needed maintenance based on maintenance indicators in Section 4.2.2

The frequencies given in the Summary Table of Inspection and Maintenance Frequency are minimum recommended frequencies for inspection and maintenance activities for the project. Typically, the frequency of maintenance required for permanent BMPs is site and drainage area specific. If it is determined during the regularly scheduled inspection and/or routine maintenance that a BMP requires more frequent maintenance (e.g., to remove accumulated trash), it may be necessary to increase the frequency of inspection and/or routine maintenance.

4.4 Recordkeeping Requirements

The party responsible to ensure implementation and funding of maintenance of permanent BMPs shall maintain records documenting the inspection and maintenance activities. The records must be kept a minimum of 5 years and shall be made available to the City of San Diego for inspection upon request at any time.

5.0 SUMMARY

This water quality technical report (WQTR) summarizes permanent storm water management requirements and proposed design features to meet these requirements for the Black Mountain Ranch (BMR) East Cluster Unit 3 project. The project planned development will include the construction of single-family residential units and surface streets.

The project applies to the following priority development project (PDP) categories based on the City of San Diego's Storm Water Requirements Applicability Checklist: residential development of 10 or more units, hillside development greater than 5,000 square feet, water quality sensitive area, and streets. Therefore, the project is considered a PDP.

Pollutants of concern for the project are based on those anticipated for the project area and those that have been identified as causing impairment in the receiving waters. The receiving waters for the project are not currently listed as impaired based on the 2010 303(d) List.

The project will incorporate source control BMPs, LID design practices, and Treatment Control BMPs (TC-BMPs) to meet storm water management requirements and address the pollutants of concern for the project. The following provides a summary of treatment control BMPs selected for the project, each of which will provide "Medium" to "High" removal efficiencies for all targeted pollutants of concern:

- Bioretention Basins

In order to comply with the Final HMP requirements and the DSD Notice, HMP analyses using the San Diego Hydrology Model (SDHM) were performed to size two (2) basins (i.e. – Basin 12 and Basin 13) for water quality treatment and hydromodification management for the project. The results of the SDHM show that pre-project flow rates do not exceed post-project flow rates; therefore, the project complies with the requirements of the Final Hydromodification Management Plan, dated March 2011.

An Operation and Maintenance Plan (OMP) has been included to identify maintenance for the following permanent BMPs: landscaped areas, outlet protection, concrete stamping, irrigation system, and bioretention basins (Basins 12, 13, 14A, & 14B). The OMP information provided in Section 4.0 of this WQTR provides inspection criteria, maintenance indicators, and maintenance activities for the above-listed BMPs that require permanent maintenance. A SWMDCMA has also been prepared to ensure long-term maintenance of these BMPs.

The project has incorporated storm water management features in accordance with the City of San Diego Storm Water Standards, dated January 20, 2012 and the future MS4 Permit Order No. R9-2013-0001.

APPENDIX A

Storm Water Requirements Applicability Checklist

City of San Diego
Development Services
1222 First Ave., MS-302
San Diego, CA 92101
(619) 446-5000

THE CITY OF SAN DIEGO

Storm Water Requirements Applicability Checklist

FORM DS-560
JANUARY 2011

Project Address: South of the intersection of Carmel Valley Road and Wine Creek Road	Project Number *(for City Use Only)*:

SECTION 1. Permanent Storm Water BMP Requirements:
Additional information for determining the requirements is found in the Storm Water Standards Manual.

Part A: Determine if Exempt from Permanent Storm Water BMP Requirements.
Projects that are considered maintenance, or are otherwise not categorized as "development projects" or "redevelopment projects" according to the Storm Water Standards manual are not required to install permanent storm water BMPs.
If "Yes" is checked for any line in Part A, proceed to Part C and check the box labeled "Exempt Project." If "No" is checked for all of the lines, continue to Part B.

1.	The project is not a Development Project as defined in the Storm Water Standards Manual: for example habitat restoration projects, and construction inside an existing building.	☐ Yes ☑ No
2.	The project is only the construction of underground or overhead linear utilities.	☐ Yes ☑ No
3.	The project qualifies as routine maintenance (replaces or renews existing surface materials because of failed or deteriorating condition). This includes roof replacement, pavement spot repairs and resurfacing treatments such as asphalt overlay or slurry seal, and replacement of damaged pavement.	☐ Yes ☑ No
4.	The project only installs sidewalks, bike lanes, or pedestrian ramps on an existing road, and does not change sheet flow condition to a concentrated flow condition.	☐ Yes ☑ No

Part B: Determine if Subject to Priority Development Project Requirements.
Projects that match one of the definitions below are subject to additional requirements including preparation of a Water Quality Technical Report.
If "Yes" is checked for any line in Part B, proceed to Part C and check the box labeled "Priority Development Project." If "No" is checked for all of the lines, continue to Part C and check the box labeled "Standard Development Project."

1.	**Residential development of 10 or more units.**	☑ Yes ☐ No
2.	**Commercial development and similar non-residential development greater than one acre.** Hospitals; laboratories and other medical facilities; educational institutions; recreational facilities; municipal facilities; commercial nurseries; multi-apartment buildings; car wash facilities; mini-malls and other business complexes; shopping malls; hotels; office buildings; public warehouses; automotive dealerships; and other light industrial facilities.	☐ Yes ☑ No
3.	**Heavy industrial development greater than one acre.** Manufacturing plants, food processing plants, metal working facilities, printing plants, and fleet storage areas.	☐ Yes ☑ No
4.	**Automotive repair shop.** Facilities categorized in any one of Standard Industrial Classification (SIC) codes 5013, 5014, 5541, 7532-7534, or 7536-7539.	☐ Yes ☑ No
5.	**Restaurant.** Facilities that sells prepared foods and drinks for consumption, including stationary lunch counters and refreshment stands selling prepared foods and drinks for immediate consumption (SIC code 5812), and where the land area for development is greater than 5,000 square feet.	☐ Yes ☑ No
6.	**Hillside development greater than 5,000 square feet.** Development that creates 5,000 square feet of impervious surface and is located in an area with known erosive soil conditions and where the development will grade on any natural slope that is twenty-five percent or greater.	☑ Yes ☐ No
7.	**Water Quality Sensitive Area.** Development located within, directly adjacent to, or discharging directly to a Water Quality Sensitive Area (as depicted in Appendix C) in which the project either creates 2,500 square feet of impervious surface on a proposed project site or increases the area of imperviousness of a proposed project site to 10% or more of its naturally occurring condition. "Directly adjacent" is defined as being situated within 200 feet of the Water Quality Sensitive Area. "Discharging directly to" is defined as outflow from a drainage conveyance system that is composed entirely of flows from the subject development or redevelopment site, and not commingled with flows from adjacent lands.	☑ Yes ☐ No
8.	**Parking lot with a minimum area of 5,000 square feet or a minimum of 15 parking spaces** and potential exposure to urban runoff (unless it meets the exclusion for parking lot reconfiguration on line 11).	☐ Yes ☑ No

9.	**Street, road, highway, or freeway.** New paved surface in excess of 5,000 square feet used for the transportation of automobiles, trucks, motorcycles, and other vehicles (unless it meets the exclusion for road reconfiguration on line 11).	☑ Yes ☐ No
10.	**Retail Gasoline Outlet (RGO)** that is: (a) 5,000 square feet or more or (b) has a projected Average Daily Traffic (ADT) of 100 or more vehicles per day.	☐ Yes ☑ No
11.	**Significant Redevelopment**; project installs and/or replaces 5,000 square feet or more of impervious surface and the existing site meets at least one of the categories above. The project is not considered Significant Redevelopment if reconfiguring an existing road or parking lot without a change to the footprint of an existing developed road or parking lot. The existing footprint is defined as the outside curb or the outside edge of pavement when there is no curb.	☐ Yes ☑ No
12.	**Other Pollutant Generating Project.** Any other project not covered in the categories above, that disturbs one acre or more and is not excluded by the criteria below.	☐ Yes ☑ No

Projects creating less than 5,000 sf of impervious surface and where added landscaping does not require regular use of pesticides and fertilizers, such as slope stabilization using native plants. Calculation of the square footage of impervious surface need not include linear pathways that are for infrequent vehicle use, such as emergency maintenance access or bicycle pedestrian use, if they are built with pervious surfaces or if they sheet flow to surrounding pervious surfaces.

Part C: Select the appropriate category based on the outcome of Parts A & B.

1.	If "Yes" is checked for any line in Part A, then check this box. Continue to Section 2.	☐ Exempt Project
2.	If "No" is checked for all lines in Part A, and Part B, then check this box. Continue to Section 2.	☐ Standard Development Project
3.	If "No" is checked for all lines in Part A, and "Yes" is checked for at least one of the lines in Part B, then check this box. Continue to Section 2. See the Storm Water Standards Manual for guidance on determining if Hydromodification Management Plan requirements apply.	☑ Priority Development Project

SECTION 2. Construction Storm Water BMP Requirements:
For all projects, complete Part D. If "Yes" is checked for any line in Part D, then continue to Part E.

Part D: Determine Construction Phase Storm Water Requirements.

1.	Is the project subject to California's statewide General NPDES Permit for Storm Water Discharges Associated with Construction Activities? (See State Water Resources Control Board Order No. 2009-0009-DWQ for rules on enrollment)	☑ Yes ☐ No
2.	Does the project propose grading or soil disturbance?	☑ Yes ☐ No
3.	Would storm water or urban runoff have the potential to contact any portion of the construction area, including washing and staging areas?	☑ Yes ☐ No
4.	Would the project use any construction materials that could negatively affect water quality if discharged from the site (such as, paints, solvents, concrete, and stucco)?	☑ Yes ☐ No
5.	Check this box if "Yes" is checked for line 1. Continue to Part E.	☑ SWPPP Required
6.	Check this box if "No" is checked for line 1, and "Yes is checked for any line 2-4. Continue to Part E.	☐ WPCP Required
7.	Check this box if "No" is checked for all lines 1-4. Part E does not apply.	☐ No Document Required

Part E: Determine Construction Site Priority
This prioritization must be completed with this form, noted on the plans, and included in the SWPPP or WPCP. The City reserves the right to adjust the priority of the projects both before and during construction. [Note: The construction priority does NOT change construction BMP requirements that apply to projects; rather, it determines the frequency of inspections that will be conducted by City staff.]

☑ 1. **High Priority**
a) Projects where the site is 50 acres or more and grading will occur during the wet season
b) Projects 1 acre or more and tributary to an impaired water body for sediment (e.g., Peñasquitos watershed)
c) Projects 1 acre or more within or directly adjacent to or discharging directly to a coastal lagoon or other receiving water within a Water Quality Sensitive Area.
d) Projects subject to phased grading or advanced treatment requirements.

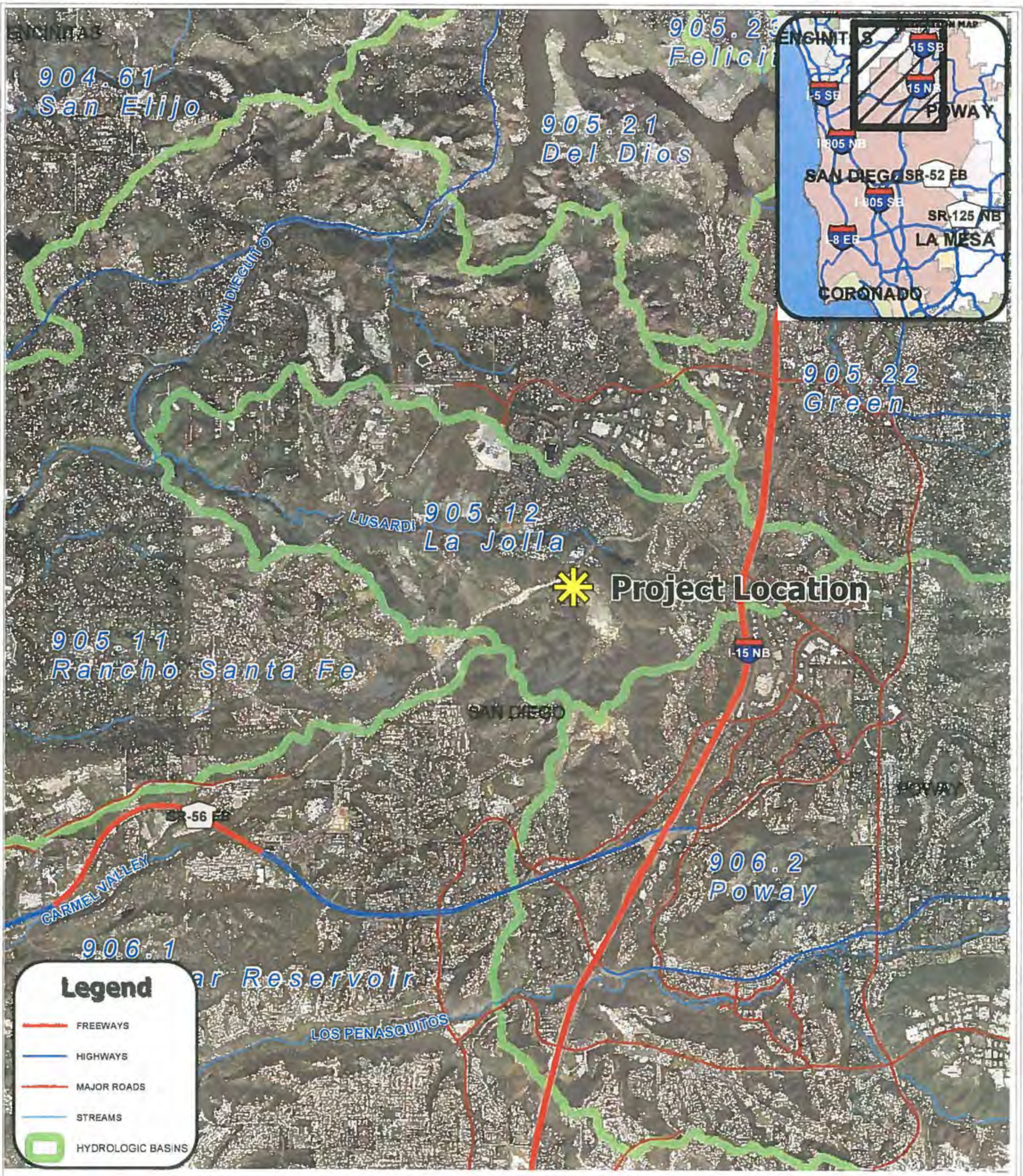
☐ **2 Medium Priority.** Projects 1 acre or more but not subject to a high priority designation.

☐ **3 Low Priority.** Projects requiring a Water Pollution Control Plan but not subject to a medium or high priority designation.

Name of Owner or Agent *(Please Print)*:	Title:
Signature:	Date:

APPENDIX B

Hydrologic Unit Map



RICK
ENGINEERING COMPANY
PREPARED BY
GIS SERVICES DIVISION

1 inch = 6,000 feet

0 3,000 6,000 12,000 Feet

EXHIBIT DATE: 1/31/2013 REC JN: 15149-B
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HYDROLOGIC UNIT FOR BMR EAST CLUSTER UNIT 3

THIS PROJECT LOCATED WITHIN THE CITY OF SAN DIEGO

APPENDIX C

Water Quality Treatment Calculations
and
BMP Details

Water Quality Treatment Calculations - Bioretention Basin

											Water Quality Calculations (volume-based)				Water Quality Calculations (flow-based)		
Drainage Management Area (DMA)	East Clusters Unit 3 DMA (acres)	Off-site Heritage Bluffs DMA (acres)	Overall DMA (acres)	Overall DMA (ft^2)	Impervious Percentage	Post-Project Surface Type		DMA Runoff Factor	DMA Area x Runoff Factor (ft^2)	Effective Impervious Area (ft^2)	85th Percentile (inches)	Minimum Water Quality Volume (ft^3)	1.5 x Minimum Water Quality Volume (ft^3) (acft)	Provided Water Quality Volume (acft)	Sizing Factor	Required Area (ft^2)	Provided Area (ft^2)
Basin 12 [1,2] (includes Heritage Bluffs)	22.6	39.6	62.2	2,709,432	60%	Impervious	1,625,659	1.0	1,625,659	1,734,036	0.65	93,927	140,890	3.29	n/a	n/a	n/a
						Pervious	1,083,773	0.1	108,377				3.23				
Basin 13 [1,2]	8.5	n/a	8.5	370,260	60%	Impervious	222,156	1.0	222,156	236,966	0.65	12,836	19,254	0.44	n/a	n/a	n/a
						Pervious	148,104	0.1	14,810				0.44				
Basin 14A	n/a	n/a	n/a	35,074	31%	Impervious	11,023	1.0	11,023	13,428	n/a	n/a	n/a	n/a	0.04	537	657
						Pervious	24,051	0.1	2,405								
Basin 14B	n/a	n/a	n/a	69,683	37%	Impervious	25,749	1.0	25,749	30,142	n/a	n/a	n/a	n/a	0.04	1,206	2,273
						Pervious	43,934	0.1	4,393								

Note:
1. The weighted impervious percentage is based on supporting calculations included in the Drainage Study: 60% impervious for "typical lot + half street"; 75% impervious for "typical street only + slopes"; and 0% impervious for "natural hill slopes".
2. The volume based design increases the minimum water quality volume by 150% to meet the requirements of the 2013 MS4 Permit.

APPENDIX D

HMP Calculations and Supporting Materials
(Used for HMP Volumes Only, Refer to TC-BMP Calculations for Water Quality)

East Clusters Unit 3
J-15149-B
August 5, 2014

Summary of HMP Volume (per Final HMP, dated March 2011)

Basin	Low-flow Threshold	Volume Required		Volume Provided	
		(ft^3)	(ac-ft)	(ft^3)	(ac-ft)
Basin 12 w/ HB	$0.3Q_2$	158,994	3.65	159,330	3.66
Basin 13	$0.3Q_2$	20,473	0.47	20,674	0.47

East Clusters Unit 3
J-15149-B
August 5, 2014

HMP - VOLUME CALCULATIONS USING BIORETENTION CROSS-SECTION:

BMP ID: Basin 12

Input Parameters:

Surface Area at Ponding Layer:	①	33251	ft^2 (to be provided @ ponding depth specified below)
Bottom Surface Area of Outer Ponding Layer Ledge:	②	22119	ft^2
Bottom Surface Area of Inner Ponding Layer Ledge:	③	18555	ft^2
Top Surface Area of Bioretention Soil Mix:	④	17516	ft^2
Bottom Surface Area of Bioretention Soil Mix:	⑤	13503	ft^2
Bottom Surface Area of Gravel Layer:	⑥	11582	ft^2

Freeboard: 1.00 ft
Head to convey Q_{100}: 1.40 ft

Ponding Depth Layer: 5.3 ft
Ponding Depth Layer Side Slopes (Average): 3 :1

Amended Soil Layer Depth: 2.0 ft — Porosity= 0.400
Amended Soil Layer Side Slopes (Average): 3 :1

Gravel Layer Depth: 1.0 ft (measured to FL of Perf. Pipe) — Porosity= 0.400
Gravel Layer Side Slopes (Average): 3 :1

Perf. Pipe Size: 6.0 in
Dead Storage Layer Depth: 0.25 ft — Low-flow Restrictor (if any): 3.5 in

Output Values:

V_1	141,906	ft^3
V_2	12,408	ft^3
V_3	5,017	ft^3
Σ	159,330	ft^3

East Clusters Unit 3
J-15149-B
August 5, 2014

HMP - VOLUME CALCULATIONS USING BIORETENTION CROSS-SECTION:

BMP ID: **Basin 13**

Input Parameters:

Parameter	No.	Value	Unit
Surface Area at Ponding Layer:	1	8042	ft^2 (to be provided @ ponding depth specified below)
Bottom Surface Area of Outer Ponding Layer Ledge:	2	5657	ft^2
Bottom Surface Area of Inner Ponding Layer Ledge:	3	4089	ft^2
Top Surface Area of Bioretention Soil Mix:	4	3651	ft^2
Bottom Surface Area of Bioretention Soil Mix:	5	2077	ft^2
Bottom Surface Area of Gravel Layer:	6	1394	ft^2

Freeboard: 1.50 ft

Head to convey Q_{100}: 1.00 ft

Ponding Depth Layer: 2.8 ft

Ponding Depth Layer Side Slopes (Average): 3 :1

Amended Soil Layer Depth: 2.0 ft — Porosity= 0.400

Amended Soil Layer Side Slopes (Average): 3 :1

Gravel Layer Depth: 1.0 ft (measured to FL of Perf. Pipe) — Porosity= 0.400

Gravel Layer Side Slopes (Average): 3 :1

Perf. Pipe Size: 6.0 in

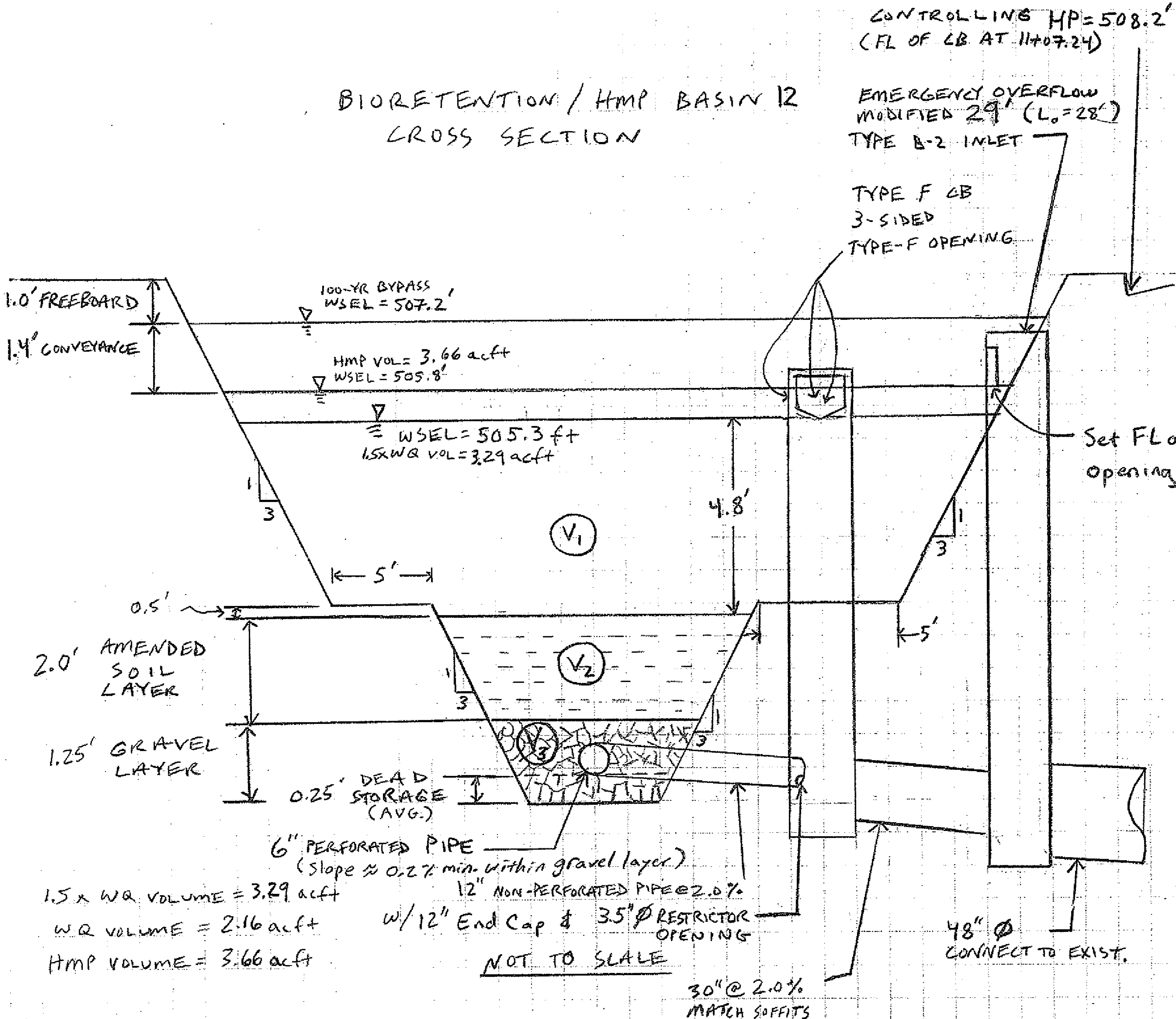
Dead Storage Layer Depth: 0.25 ft

Low-flow Restrictor (if any): 1.3 in

Output Values:

V_1	17,689	ft^3
V_2	2,291	ft^3
V_3	694	ft^3
Σ	20,674	ft^3

BIORETENTION / HMP BASIN 12 CROSS SECTION



RICK ENGINEERING COMPANY™
5620 Friars Road
San Diego, CA 92110-2596
Tel: (619) 291-0707
Fax: (619) 291-4165

Date 7-31-2014
Job No. 15149B
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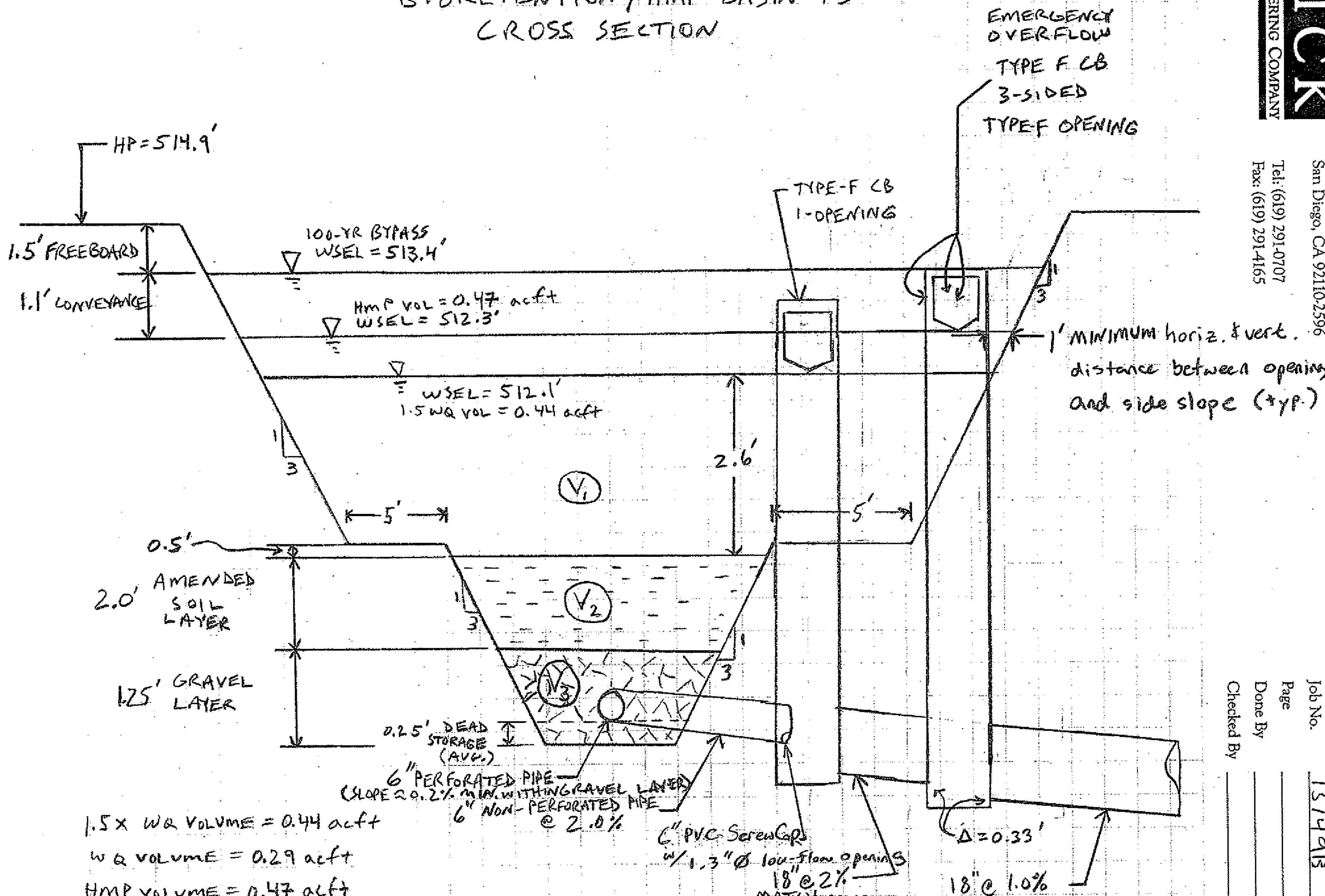
BIORETENTION / HMP BASIN 13 CROSS SECTION



NOT TO SCALE

RICK ENGINEERING COMPANY
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Date 7/31/2014
Job No. 15493
Page
Done By
Checked By

SDHM
PROJECT REPORT

General Model Information

Project Name:	15149B-BMR_ECU3-HB
Site Name:	BMR East Clusters Unit 3 - Basin East w/ HB
Site Address:	
City:	San Diego
Report Date:	8/5/2014
Gage:	POWAY
Data Start:	10/01/1963
Data End:	09/30/2004
Timestep:	Hourly
Precip Scale:	1.00
Version:	2014/07/30

POC Thresholds

Low Flow Threshold for POC1:	30 Percent of the 2 Year
High Flow Threshold for POC1:	10 Year

Landuse Basin Data
Predeveloped Land Use

ECU3

Bypass:	No
GroundWater:	No
Pervious Land Use	Acres
D,Grass,MOD(5-10%)	8.4
D,Grass,STEEP(10-20	14.2
Pervious Total	22.6
Impervious Land Use	Acres
Impervious Total	0
Basin Total	22.6

Element Flows To:

Surface	Interflow	Groundwater

HB

Bypass:	No
GroundWater:	No
Pervious Land Use	Acres
D,Grass,MOD(5-10%)	15.8
D,Grass,STEEP(10-20	23.8
Pervious Total	39.6
Impervious Land Use	Acres
Impervious Total	0
Basin Total	39.6

Element Flows To:

Surface	Interflow	Groundwater

Mitigated Land Use

ECU3

Bypass:	Yes
GroundWater:	No
Pervious Land Use	Acres
D,Grass,FLAT(0-5%)	9
Pervious Total	9
Impervious Land Use	Acres
IMPERVIOUS-FLAT	13.6
Impervious Total	13.6
Basin Total	22.6

Element Flows To:

Surface	Interflow	Groundwater
SSD Table-BASIN 12		

HB

Bypass:	Yes
GroundWater:	No
Pervious Land Use	Acres
D,Grass,FLAT(0-5%)	15.8
Pervious Total	15.8
Impervious Land Use	Acres
IMPERVIOUS-FLAT	23.8
Impervious Total	23.8
Basin Total	39.6

Element Flows To:

Surface	Interflow	Groundwater
SSD Table-BASIN 12		

Routing Elements

Predeveloped Routing

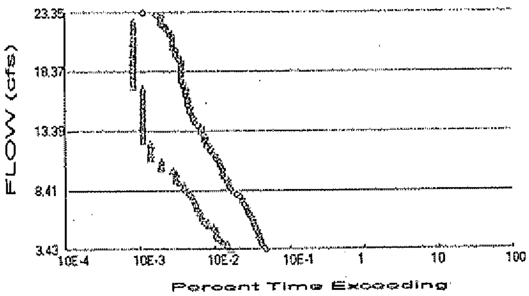
Mitigated Routing

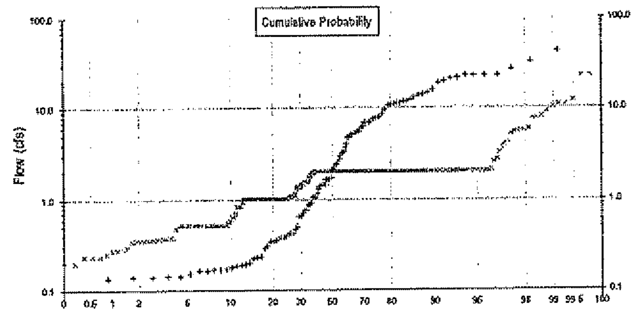
SSD Table-BASIN 12
Depth: 506.4 ft.
Element Flows To:
Outlet 1 Outlet 2

SSD Table Hydraulic Table

Stage (ft)	**Area (ac)**	**Volume (ac-ft)**	**Manual**	**NotUsed**	**NotUsed**	**NotUsed**	**NotUsed**
496.8	0.000	0.000	0.000	0.000	0.000	0.000	0.000
497.5	11582	0.000	2.027	0.000	0.000	0.000	0.000
498.5	13503	0.120	2.027	0.000	0.000	0.000	0.000
500.5	17516	0.400	2.027	0.000	0.000	0.000	0.000
501.0	22119	0.610	2.027	0.000	0.000	0.000	0.000
505.3	32032	3.290	2.027	0.000	0.000	0.000	0.000
505.4	32276	3.370	2.730	0.000	0.000	0.000	0.000

Analysis Results
POC 1





+ Predeveloped   x Mitigated

Predeveloped Landuse Totals for POC #1
Total Pervious Area: 62.2
Total Impervious Area: 0

Mitigated Landuse Totals for POC #1
Total Pervious Area: 24.8
Total Impervious Area: 37.4

Flow Frequency Method: Cunnane

Flow Frequency Return Periods for Predeveloped. POC #1

Return Period	**Flow(cfs)**
2 year	11.435297
5 year	21.551447
10 year	23.347295
25 year	32.048664

Flow Frequency Return Periods for Mitigated. POC #1

Return Period	**Flow(cfs)**
2 year	2.769967
5 year	7.982729
10 year	10.955144
25 year	21.806906

Duration Flows
The Facility PASSED

Flow(cfs)	Predev	Mit	Percentage	Pass/Fail
3.4306	175	58	33	Pass
3.6318	165	55	33	Pass
3.8329	153	52	33	Pass
4.0341	148	46	31	Pass
4.2353	144	43	29	Pass
4.4365	141	39	27	Pass
4.6377	141	38	26	Pass
4.8388	133	38	28	Pass
5.0400	130	37	28	Pass
5.2412	124	35	28	Pass
5.4424	122	30	24	Pass
5.6436	117	29	24	Pass
5.8447	116	26	22	Pass
6.0459	112	24	21	Pass
6.2471	106	24	22	Pass
6.4483	103	23	22	Pass
6.6495	100	23	23	Pass
6.8506	97	21	21	Pass
7.0518	93	21	22	Pass
7.2530	88	20	22	Pass
7.4542	83	20	24	Pass
7.6553	83	19	22	Pass
7.8565	78	18	23	Pass
8.0577	70	17	24	Pass
8.2589	64	16	25	Pass
8.4601	59	15	25	Pass
8.6612	56	14	25	Pass
8.8624	55	14	25	Pass
9.0636	54	12	22	Pass
9.2648	53	11	20	Pass
9.4660	48	11	22	Pass
9.6671	47	11	23	Pass
9.8683	46	11	23	Pass
10.0695	46	10	21	Pass
10.2707	44	7	15	Pass
10.4718	43	7	16	Pass
10.6730	42	7	16	Pass
10.8742	41	7	17	Pass
11.0754	38	5	13	Pass
11.2766	38	5	13	Pass
11.4777	34	5	14	Pass
11.6789	32	5	15	Pass
11.8801	32	5	15	Pass
12.0813	29	5	17	Pass
12.2825	29	5	17	Pass
12.4836	27	4	14	Pass
12.6848	27	4	14	Pass
12.8860	27	4	14	Pass
13.0872	26	4	15	Pass
13.2884	24	4	16	Pass
13.4895	24	4	16	Pass
13.6907	24	4	16	Pass
13.8919	22	4	18	Pass

14.0931	20	4	20	Pass
14.2942	19	4	21	Pass
14.4954	19	4	21	Pass
14.6966	18	4	22	Pass
14.8978	17	4	23	Pass
15.0990	17	4	23	Pass
15.3001	17	4	23	Pass
15.5013	16	4	25	Pass
15.7025	16	4	25	Pass
15.9037	16	4	25	Pass
16.1049	16	4	25	Pass
16.3060	15	4	26	Pass
16.5072	15	4	26	Pass
16.7084	15	4	26	Pass
16.9096	15	4	26	Pass
17.1108	14	3	21	Pass
17.3119	14	3	21	Pass
17.5131	13	3	23	Pass
17.7143	13	3	23	Pass
17.9155	13	3	23	Pass
18.1166	13	3	23	Pass
18.3178	13	3	23	Pass
18.5190	13	3	23	Pass
18.7202	13	3	23	Pass
18.9214	13	3	23	Pass
19.1225	13	3	23	Pass
19.3237	12	3	25	Pass
19.5249	12	3	25	Pass
19.7261	11	3	27	Pass
19.9273	11	3	27	Pass
20.1284	11	3	27	Pass
20.3296	10	3	30	Pass
20.5308	10	3	30	Pass
20.7320	10	3	30	Pass
20.9331	10	3	30	Pass
21.1343	10	3	30	Pass
21.3355	10	3	30	Pass
21.5367	9	3	33	Pass
21.7379	9	3	33	Pass
21.9390	8	3	37	Pass
22.1402	8	3	37	Pass
22.3414	7	3	42	Pass
22.5426	7	3	42	Pass
22.7438	7	0	0	Pass
22.9449	7	0	0	Pass
23.1461	6	0	0	Pass
23.3473	4	0	0	Pass

Water Quality

Model Default Modifications

Total of 0 changes have been made.

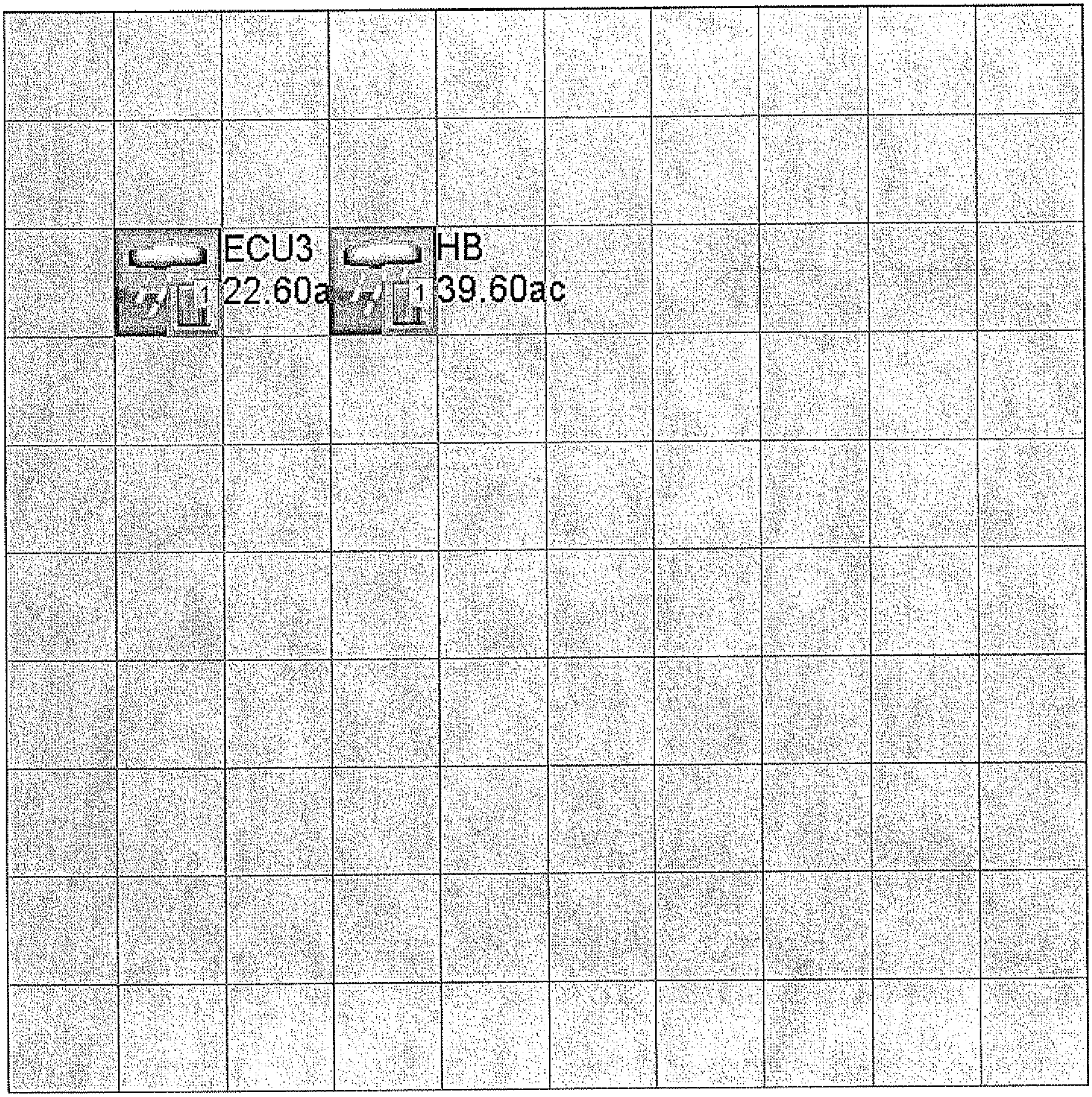
PERLND Changes

No PERLND changes have been made.

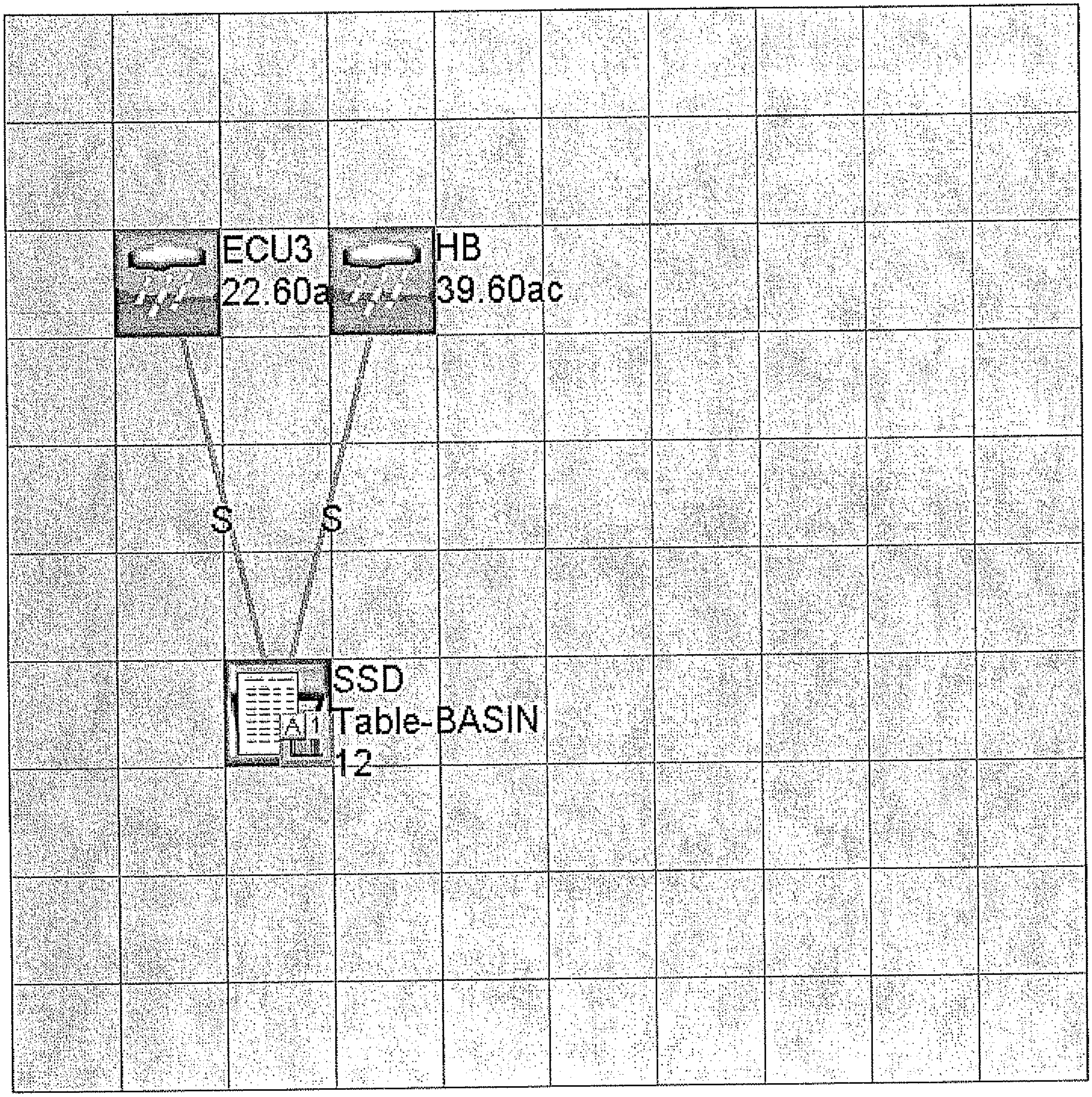
IMPLND Changes

No IMPLND changes have been made.

Appendix
Predeveloped Schematic



Mitigated Schematic



Predeveloped UCI File

```
RUN

GLOBAL
  WWHM4 model simulation
  START       1963 10 01        END    2004 09 30
  RUN INTERP OUTPUT LEVEL    3    0
  RESUME      0 RUN      1                UNIT SYSTEM     1
END GLOBAL

FILES
<File>  <Un#>   <-----------File Name------------------------------>***
<-ID->                                                              ***
WDM        26   15149B-BMR_ECU3-HB.wdm
MESSU      25   Pre15149B-BMR_ECU3-HB.MES
           27   Pre15149B-BMR_ECU3-HB.L61
           28   Pre15149B-BMR_ECU3-HB.L62
           30   POC15149B-BMR_ECU3-HB1.dat
END FILES

OPN SEQUENCE
    INGRP              INDELT 00:60
      PERLND      29
      PERLND      30
      COPY       501
      DISPLY       1
    END INGRP
END OPN SEQUENCE
DISPLY
  DISPLY-INFO1
    # -  #<----------Title----------->***TRAN PIVL DIG1 FIL1  PYR DIG2 FIL2 YRND
    1        ECU3                        MAX                   1    2   30    9
  END DISPLY-INFO1
END DISPLY
COPY
  TIMESERIES
    # -  #  NPT  NMN ***
    1         1    1
  501         1    1
  END TIMESERIES
END COPY
GENER
  OPCODE
    #    # OPCD ***
  END OPCODE
  PARM
    #    #         K ***
  END PARM
END GENER
PERLND
  GEN-INFO
    <PLS ><-------Name------->NBLKS  Unit-systems  Printer ***
    # -  #                      User t-series Engl Metr ***
                                      in  out          ***
   29      D,Grass,MOD(5-10%)    1    1    1    1   27    0
   30      D,Grass,STEEP(10-20   1    1    1    1   27    0
  END GEN-INFO
  *** Section PWATER***

  ACTIVITY
    <PLS > ************* Active Sections *****************************
    # -  # ATMP SNOW PWAT  SED  PST  PWG PQAL MSTL PEST NITR PHOS TRAC ***
   29         0    0    1    0    0    0    0    0    0    0    0    0
   30         0    0    1    0    0    0    0    0    0    0    0    0
  END ACTIVITY

  PRINT-INFO
    <PLS > ***************** Print-flags ***************************** PIVL  PYR
    # -  # ATMP SNOW PWAT  SED  PST  PWG PQAL MSTL PEST NITR PHOS TRAC  *********
```

```
  29         0    0    4    0    0    0    0    0    0    0    0    0    1    9
  30         0    0    4    0    0    0    0    0    0    0    0    0    1    9
 END PRINT-INFO

 PWAT-PARM1
   <PLS >  PWATER variable monthly parameter value flags  ***
   # -  # CSNO RTOP UZFG  VCS  VUZ  VNN VIFW VIRC  VLE INFC  HWT ***
  29         0    1    1    1    0    0    0    0    1    1    0
  30         0    1    1    1    0    0    0    0    1    1    0
 END PWAT-PARM1

 PWAT-PARM2
   <PLS >     PWATER input info: Part 2          ***
   # -  # ***FOREST      LZSN    INFILT      LSUR     SLSUR     KVARY     AGWRC
  29              0       4.5      0.03       200       0.1         3      0.92
  30              0       4.2      0.02       200      0.15         3      0.92
 END PWAT-PARM2

 PWAT-PARM3
   <PLS >     PWATER input info: Part 3          ***
   # -  # ***PETMAX    PETMIN    INFEXP    INFILD    DEEPFR    BASETP    AGWETP
  29             35        30         2         2       0.4      0.05      0.05
  30             35        30         2         2       0.4      0.05      0.05
 END PWAT-PARM3
 PWAT-PARM4
   <PLS >     PWATER input info: Part 4                                 ***
   # -  #     CEPSC      UZSN      NSUR     INTFW       IRC     LZETP ***
  29           0.08       0.6       0.2       1.5       0.7       0.5
  30           0.08       0.6       0.2       1.5       0.7       0.5
 END PWAT-PARM4
 MON-LZETPARM
   <PLS >     PWATER input info: Part 3          ***
   # -  #  JAN  FEB  MAR  APR  MAY  JUN  JUL  AUG  SEP  OCT  NOV  DEC  ***
  29       0.4  0.4  0.4  0.4  0.6  0.6  0.6  0.6  0.6  0.4  0.4  0.4
  30       0.4  0.4  0.4  0.4  0.6  0.6  0.6  0.6  0.6  0.4  0.4  0.4
 END MON-LZETPARM
 MON-INTERCEP
   <PLS >     PWATER input info: Part 3          ***
   # -  #  JAN  FEB  MAR  APR  MAY  JUN  JUL  AUG  SEP  OCT  NOV  DEC  ***
  29       0.1  0.1  0.1  0.1 0.06 0.06 0.06 0.06 0.06  0.1  0.1  0.1
  30       0.1  0.1  0.1  0.1 0.06 0.06 0.06 0.06 0.06  0.1  0.1  0.1
 END MON-INTERCEP

 PWAT-STATE1
   <PLS > *** Initial conditions at start of simulation
              ran from 1990 to end of 1992 (pat 1-11-95) RUN 21 ***
   # -  # ***  CEPS      SURS       UZS      IFWS       LZS      AGWS      GWVS
  29              0         0      0.15         0         4      0.05         0
  30              0         0      0.15         0         4      0.05         0
 END PWAT-STATE1

END PERLND

IMPLND
  GEN-INFO
    <PLS ><-------Name------->   Unit-systems   Printer ***
    # -  #                     User  t-series Engl Metr ***
                                      in  out           ***
  END GEN-INFO
  *** Section IWATER***

  ACTIVITY
    <PLS > ************* Active Sections *****************************
    # -  # ATMP SNOW IWAT  SLD  IWG IQAL   ***
  END ACTIVITY

  PRINT-INFO
    <ILS > ******** Print-flags ******** PIVL  PYR
    # -  # ATMP SNOW IWAT  SLD  IWG IQAL    *********
  END PRINT-INFO
```

```
  IWAT-PARM1
    <PLS >  IWATER variable monthly parameter value flags  ***
    # -  # CSNO RTOP  VRS  VNN RTLI      ***
  END IWAT-PARM1

  IWAT-PARM2
    <PLS >      IWATER input info: Part 2          ***
    # -  # ***  LSUR     SLSUR      NSUR      RETSC
  END IWAT-PARM2

  IWAT-PARM3
    <PLS >      IWATER input info: Part 3          ***
    # -  # ***PETMAX    PETMIN
  END IWAT-PARM3

  IWAT-STATE1
    <PLS > *** Initial conditions at start of simulation
    # -  # ***  RETS      SURS
  END IWAT-STATE1

END IMPLND

SCHEMATIC
<-Source->                    <--Area-->     <-Target->   MBLK    ***
<Name>   #                    <-factor->     <Name>   #   Tbl#    ***
ECU3***
PERLND  29                          8.4      COPY   501     12
PERLND  29                          8.4      COPY   501     13
PERLND  30                         14.2      COPY   501     12
PERLND  30                         14.2      COPY   501     13
HB***
PERLND  29                         15.8      COPY   501     12
PERLND  29                         15.8      COPY   501     13
PERLND  30                         23.8      COPY   501     12
PERLND  30                         23.8      COPY   501     13

******Routing******
END SCHEMATIC

NETWORK
<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Target vols> <-Grp> <-Member->  ***
<Name>   #        <Name> # #<-factor->strg <Name>   #   #        <Name> # #  ***
COPY   501 OUTPUT MEAN   1 1   12.1        DISPLY   1     INPUT  TIMSER 1


<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Target vols> <-Grp> <-Member->  ***
<Name>   #        <Name> # #<-factor->strg <Name>   #   #        <Name> # #  ***
END NETWORK

RCHRES
  GEN-INFO
    RCHRES       Name        Nexits   Unit Systems   Printer                 ***
    # -  #<------------------><---> User T-series  Engl Metr LKFG            ***
                                           in  out                           ***

  END GEN-INFO
  *** Section RCHRES***

  ACTIVITY
    <PLS > ************* Active Sections *****************************
    # -  # HYFG ADFG CNFG HTFG SDFG GQFG OXFG NUFG PKFG PHFG ***
  END ACTIVITY

  PRINT-INFO
    <PLS > ***************** Print-flags ******************* PIVL  PYR
    # -  # HYDR ADCA CONS HEAT  SED  GQL OXRX NUTR PLNK PHCB PIVL  PYR  *********
  END PRINT-INFO

  HYDR-PARM1
```

```
    RCHRES  Flags for each HYDR Section                                         ***
    # -  #  VC A1 A2 A3  ODFVFG for each *** ODGTFG for each     FUNCT  for each
            FG FG FG FG  possible  exit  *** possible  exit      possible  exit
             *  *  *  *    *  *  *  *  *       *  *  *  *  *          ***
  END HYDR-PARM1

  HYDR-PARM2
    # -  #    FTABNO       LEN     DELTH     STCOR        KS      DB50       ***
  <------><--------><--------><--------><--------><--------><-------->       ***
  END HYDR-PARM2
  HYDR-INIT
    RCHRES  Initial conditions for each HYDR section                        ***
    # -  # ***   VOL     Initial  value  of COLIND     Initial  value  of OUTDGT
         *** ac-ft     for each possible exit       for each possible exit
  <------><-------->     <---><---><---><---><---> *** <---><---><---><---><--->
  END HYDR-INIT
END RCHRES

SPEC-ACTIONS
END SPEC-ACTIONS
FTABLES
END FTABLES

EXT SOURCES
<-Volume-> <Member> SsysSgap<--Mult-->Tran <-Target vols> <-Grp> <-Member->  ***
<Name>   # <Name> # tem strg<-factor->strg <Name>   #   #        <Name> # #  ***
WDM      2 PREC     ENGL     1             PERLND   1 999 EXTNL  PREC
WDM      2 PREC     ENGL     1             IMPLND   1 999 EXTNL  PREC
WDM      1 EVAP     ENGL     1             PERLND   1 999 EXTNL  PETINP
WDM      1 EVAP     ENGL     1             IMPLND   1 999 EXTNL  PETINP

END EXT SOURCES

EXT TARGETS
<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Volume-> <Member> Tsys Tgap Amd ***
<Name>   #        <Name> # #<-factor->strg <Name>   # <Name>    tem strg strg***
COPY   501 OUTPUT MEAN   1 1     12.1      WDM    501 FLOW     ENGL      REPL
END EXT TARGETS

MASS-LINK
<Volume>   <-Grp> <-Member-><--Mult-->     <Target>       <-Grp> <-Member->***
<Name>            <Name> # #<-factor->     <Name>                <Name> # #***
  MASS-LINK       12
PERLND     PWATER SURO       0.083333      COPY           INPUT  MEAN
  END MASS-LINK   12

  MASS-LINK       13
PERLND     PWATER IFWO       0.083333      COPY           INPUT  MEAN
  END MASS-LINK   13


END MASS-LINK

END RUN
```

Mitigated UCI File

```
RUN

GLOBAL
  WWHM4 model simulation
  START       1963 10 01        END    2004 09 30
  RUN INTERP OUTPUT LEVEL    3    0
  RESUME      0 RUN      1                UNIT SYSTEM     1
END GLOBAL

FILES
<File>  <Un#>   <-----------File Name------------------------------>***
<-ID->                                                              ***
WDM        26   15149B-BMR_ECU3-HB.wdm
MESSU      25   Mit15149B-BMR_ECU3-HB.MES
           27   Mit15149B-BMR_ECU3-HB.L61
           28   Mit15149B-BMR_ECU3-HB.L62
           30   POC15149B-BMR_ECU3-HB1.dat
END FILES

OPN SEQUENCE
    INGRP              INDELT 00:60
      PERLND      28
      IMPLND       1
      RCHRES       1
      COPY         1
      COPY       501
      COPY       601
      DISPLY       1
    END INGRP
END OPN SEQUENCE
DISPLY
  DISPLY-INFO1
    # -  #<----------Title----------->***TRAN PIVL DIG1 FIL1  PYR DIG2 FIL2 YRND
    1        SSD Table-BASIN 12          MAX                   1    2   30    9
  END DISPLY-INFO1
END DISPLY
COPY
  TIMESERIES
    # -  #  NPT  NMN ***
    1         1    1
  501         1    1
  601         1    1
  END TIMESERIES
END COPY
GENER
  OPCODE
    #    # OPCD ***
  END OPCODE
  PARM
    #    #         K ***
  END PARM
END GENER
PERLND
  GEN-INFO
    <PLS ><-------Name------->NBLKS   Unit-systems   Printer ***
    # -  #                          User  t-series Engl Metr ***
                                          in  out           ***
   28      D,Grass,FLAT(0-5%)     1    1    1    1   27    0
  END GEN-INFO
  *** Section PWATER***

  ACTIVITY
    <PLS > ************* Active Sections *****************************
    # -  # ATMP SNOW PWAT  SED  PST  PWG PQAL MSTL PEST NITR PHOS TRAC ***
   28         0    0    1    0    0    0    0    0    0    0    0    0
  END ACTIVITY

  PRINT-INFO
```

```
    <PLS > ***************** Print-flags ***************************** PIVL  PYR
    # -  # ATMP SNOW PWAT  SED  PST  PWG PQAL MSTL PEST NITR PHOS TRAC  *********
   28       0    0    4    0    0    0    0    0    0    0    0    0    1    9
  END PRINT-INFO

  PWAT-PARM1
    <PLS >  PWATER variable monthly parameter value flags  ***
    # -  # CSNO RTOP UZFG  VCS  VUZ  VNN VIFW VIRC  VLE INFC  HWT ***
   28       0    1    1    1    0    0    0    0    1    1    0
  END PWAT-PARM1

  PWAT-PARM2
    <PLS >      PWATER input info: Part 2         ***
    # -  # ***FOREST      LZSN    INFILT      LSUR     SLSUR     KVARY     AGWRC
   28            0       4.8      0.04       200      0.05         3      0.92
  END PWAT-PARM2

  PWAT-PARM3
    <PLS >      PWATER input info: Part 3         ***
    # -  # ***PETMAX    PETMIN    INFEXP    INFILD    DEEPFR    BASETP    AGWETP
   28           35        30         2         2       0.4      0.05      0.05
  END PWAT-PARM3
  PWAT-PARM4
    <PLS >     PWATER input info: Part 4                                     ***
    # -  #     CEPSC      UZSN      NSUR     INTFW       IRC     LZETP ***
   28           0.08       0.6       0.2       1.5       0.7       0.5
  END PWAT-PARM4
  MON-LZETPARM
    <PLS >      PWATER input info: Part 3         ***
    # -  #  JAN  FEB  MAR  APR  MAY  JUN  JUL  AUG  SEP  OCT  NOV  DEC  ***
   28       0.4  0.4  0.4  0.4  0.6  0.6  0.6  0.6  0.6  0.4  0.4  0.4
  END MON-LZETPARM
  MON-INTERCEP
    <PLS >      PWATER input info: Part 3         ***
    # -  #  JAN  FEB  MAR  APR  MAY  JUN  JUL  AUG  SEP  OCT  NOV  DEC  ***
   28       0.1  0.1  0.1  0.1 0.06 0.06 0.06 0.06 0.06  0.1  0.1  0.1
  END MON-INTERCEP

  PWAT-STATE1
    <PLS > *** Initial conditions at start of simulation
               ran from 1990 to end of 1992 (pat 1-11-95) RUN 21 ***
    # -  # ***  CEPS      SURS       UZS      IFWS       LZS      AGWS      GWVS
   28            0         0      0.15         0         4      0.05         0
  END PWAT-STATE1

END PERLND

IMPLND
  GEN-INFO
    <PLS ><-------Name------->   Unit-systems   Printer ***
    # -  #                    User  t-series Engl Metr ***
                                     in  out           ***
    1       IMPERVIOUS-FLAT      1    1    1   27    0
  END GEN-INFO
  *** Section IWATER***

  ACTIVITY
    <PLS > ************* Active Sections *****************************
    # -  # ATMP SNOW IWAT  SLD  IWG IQAL   ***
    1         0    0    1    0    0    0
  END ACTIVITY

  PRINT-INFO
    <ILS > ******** Print-flags ******** PIVL  PYR
    # -  # ATMP SNOW IWAT  SLD  IWG IQAL   *********
    1         0    0    6    0    0    0    1    9
  END PRINT-INFO

  IWAT-PARM1
    <PLS >  IWATER variable monthly parameter value flags  ***
```

```
    # -  # CSNO RTOP  VRS  VNN RTLI      ***
    1       0    0    0    0    1
  END IWAT-PARM1

  IWAT-PARM2
    <PLS >      IWATER input info: Part 2          ***
    # -  # ***  LSUR      SLSUR      NSUR     RETSC
    1            100      0.035      0.05       0.1
  END IWAT-PARM2

  IWAT-PARM3
    <PLS >      IWATER input info: Part 3          ***
    # -  # ***PETMAX    PETMIN
    1            0          0
  END IWAT-PARM3

  IWAT-STATE1
    <PLS > *** Initial conditions at start of simulation
    # -  # ***  RETS       SURS
    1            0          0
  END IWAT-STATE1

END IMPLND

SCHEMATIC
<-Source->                     <--Area-->     <-Target->   MBLK    ***
<Name>   #                     <-factor->     <Name>   #   Tbl#    ***
ECU3***
PERLND  28                              9     RCHRES   1      2
IMPLND   1                           13.6     RCHRES   1      5
HB***
PERLND  28                           15.8     RCHRES   1      2
IMPLND   1                           23.8     RCHRES   1      5

******Routing******
PERLND  28                              9     COPY     1     12
IMPLND   1                           13.6     COPY     1     15
PERLND  28                           15.8     COPY     1     12
IMPLND   1                           23.8     COPY     1     15
RCHRES   1                              1     COPY   501     16
END SCHEMATIC

NETWORK
<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Target vols> <-Grp> <-Member->  ***
<Name>   #        <Name> # #<-factor->strg <Name>   #   #        <Name> # #  ***
COPY   501 OUTPUT MEAN   1 1   12.1        DISPLY   1     INPUT  TIMSER 1


<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Target vols> <-Grp> <-Member->  ***
<Name>   #        <Name> # #<-factor->strg <Name>   #   #        <Name> # #  ***
END NETWORK

RCHRES
  GEN-INFO
    RCHRES       Name         Nexits   Unit Systems   Printer            ***
    # -   #<------------------><---> User T-series  Engl Metr LKFG        ***
                                           in  out                        ***
    1     SSD Table-BASIN -006    1    1    1    1    28    0    1
  END GEN-INFO
  *** Section RCHRES***

  ACTIVITY
    <PLS > ************* Active Sections *****************************
    # -  # HYFG ADFG CNFG HTFG SDFG GQFG OXFG NUFG PKFG PHFG ***
    1        1    0    0    0    0    0    0    0    0    0
  END ACTIVITY

  PRINT-INFO
    <PLS > ***************** Print-flags ****************** PIVL  PYR
```

```
    #  -   # HYDR ADCA CONS HEAT  SED  GQL OXRX NUTR PLNK PHCB PIVL  PYR  *********
    1         4    0    0    0    0    0    0    0    0    0    1    9
  END PRINT-INFO

  HYDR-PARM1
                                                                                 ***
    RCHRES  Flags for each HYDR Section
    #  -  #  VC A1 A2 A3  ODFVFG for each *** ODGTFG for each     FUNCT  for each
             FG FG FG FG  possible   exit *** possible   exit     possible  exit
              *  *  *  *    *  *  *  *  *       *  *  *  *  *          ***
    1         0  1  0  0    4  0  0  0  0       0  0  0  0  0      2  2  2  2  2
  END HYDR-PARM1

  HYDR-PARM2
   #  -  #     FTABNO       LEN      DELTH      STCOR         KS       DB50      ***
  <------><--------><--------><--------><--------><--------><-------->        ***
    1              1      0.01        0.0        0.0        0.5        0.0
  END HYDR-PARM2
  HYDR-INIT
    RCHRES  Initial conditions for each HYDR section                              ***
    #  -  # ***   VOL      Initial  value  of COLIND     Initial  value  of OUTDGT
           *** ac-ft      for each possible exit        for each possible exit
  <------><-------->      <---><---><---><---><---> *** <---><---><---><---><--->
    1           0          4.0  0.0  0.0  0.0  0.0       0.0  0.0  0.0  0.0  0.0
  END HYDR-INIT
END RCHRES

SPEC-ACTIONS
END SPEC-ACTIONS
FTABLES
  FTABLE       1
   8    4
     Depth       Area     Volume  Outflow1 Velocity  Travel Time***
      (ft)    (acres) (acre-ft)    (cfs)   (ft/sec)    (Minutes)***
  496.8000  0.000000  0.000000  0.000000
  497.5000  11582.00  0.000010  2.027000
  498.5000  13503.00  0.120000  2.027000
  500.5000  17516.00  0.400000  2.027000
  501.0000  22119.00  0.610000  2.027000
  505.3000  32032.00  3.290000  2.027000
  505.4000  32276.00  3.370000  2.730000
  506.4000  34737.00  4.120000  25.73000
  END FTABLE  1
END FTABLES

EXT SOURCES
<-Volume-> <Member> SsysSgap<--Mult-->Tran <-Target vols> <-Grp> <-Member->  ***
<Name>   # <Name> # tem strg<-factor->strg <Name>   #   #        <Name> # #  ***
WDM      2 PREC     ENGL     1             PERLND   1 999 EXTNL  PREC
WDM      2 PREC     ENGL     1             IMPLND   1 999 EXTNL  PREC
WDM      1 EVAP     ENGL     1             PERLND   1 999 EXTNL  PETINP
WDM      1 EVAP     ENGL     1             IMPLND   1 999 EXTNL  PETINP
WDM      1 EVAP     ENGL     1             RCHRES   1     EXTNL  POTEV

END EXT SOURCES

EXT TARGETS
<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Volume-> <Member> Tsys Tgap Amd ***
<Name>   #        <Name> # #<-factor->strg <Name>   # <Name>    tem strg strg***
RCHRES   1 HYDR   RO     1 1         1     WDM   1002 FLOW     ENGL      REPL
RCHRES   1 HYDR   STAGE  1 1         1     WDM   1003 STAG     ENGL      REPL
COPY     1 OUTPUT MEAN   1 1      12.1     WDM    701 FLOW     ENGL      REPL
COPY   501 OUTPUT MEAN   1 1      12.1     WDM    801 FLOW     ENGL      REPL
COPY   601 OUTPUT MEAN   1 1      12.1     WDM    901 FLOW     ENGL      REPL
END EXT TARGETS

MASS-LINK
<Volume>   <-Grp> <-Member-><--Mult-->     <Target>       <-Grp> <-Member->***
<Name>            <Name> # #<-factor->     <Name>                <Name> # #***
  MASS-LINK        2
PERLND     PWATER SURO       0.083333      RCHRES         INFLOW IVOL
```

```
  END MASS-LINK     2

  MASS-LINK         5
IMPLND       IWATER SURO          0.083333      RCHRES          INFLOW IVOL
  END MASS-LINK     5

  MASS-LINK        12
PERLND       PWATER SURO          0.083333      COPY            INPUT  MEAN
  END MASS-LINK    12

  MASS-LINK        15
IMPLND       IWATER SURO          0.083333      COPY            INPUT  MEAN
  END MASS-LINK    15

  MASS-LINK        16
RCHRES       ROFLOW                             COPY            INPUT  MEAN
  END MASS-LINK    16

END MASS-LINK

END RUN
```

ERROR/WARNING ID: 341 6

DATE/TIME: 1980/ 1/29 5: 0

RCHRES: 1

The volume of water in this reach/mixed reservoir is greater than the value in the "volume" column of the last row of RCHTAB(). To continue the simulation the table has been extrapolated, based on information contained in the last two rows. This will usually result in some loss of accuracy. If depth is being calculated it will also cause an error condition. Relevant data are:

NROWS	V1	V2	VOL
8	1.4680E+05	1.7947E+05	1.8185E+05

ERROR/WARNING ID: 341 5

DATE/TIME: 1980/ 1/29 5: 0

RCHRES: 1

Calculation of relative depth, using Newton's method of successive approximations, converged to an invalid value (not in range 0.0 to 1.0). Probably ftable was extrapolated. If extrapolation was small, no problem. Remedy; extend ftable. Relevant data are:

A	B	C	RDEP1	RDEP2	COUNT
1.0720E+08	2.8119E+09	-3.132E+09	1.0700	1.0700E+00	3

ERROR/WARNING ID: 341 6

DATE/TIME: 1980/ 2/20 24: 0

RCHRES: 1

The volume of water in this reach/mixed reservoir is greater than the value in the "volume" column of the last row of RCHTAB(). To continue the simulation the table has been extrapolated, based on information contained in the last two rows. This will usually result in some loss of accuracy. If depth is being calculated it will also cause an error condition. Relevant data are:

NROWS	V1	V2	VOL
8	1.4680E+05	1.7947E+05	2.0419E+05

ERROR/WARNING ID: 341 5

DATE/TIME: 1980/ 2/20 24: 0

RCHRES: 1

Calculation of relative depth, using Newton's method of successive approximations, converged to an invalid value (not in range 0.0 to 1.0). Probably ftable was extrapolated. If extrapolation was small, no problem. Remedy; extend ftable. Relevant data are:

A	B	C	RDEP1	RDEP2	COUNT
1.0720E+08	2.8119E+09	-5.128E+09	1.7121	1.7120	3

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SDHM
PROJECT REPORT

General Model Information

Project Name:	Basin_1
Site Name:	BMR East Clusters Unit 3 - Basin West
Site Address:	
City:	San Diego
Report Date:	8/5/2014
Gage:	POWAY
Data Start:	10/01/1963
Data End:	09/30/2004
Timestep:	Hourly
Precip Scale:	1.00
Version:	2014/07/30

POC Thresholds

Low Flow Threshold for POC1:	30 Percent of the 2 Year
High Flow Threshold for POC1:	10 Year

Landuse Basin Data

Predeveloped Land Use

Basin 13(West)

Bypass:	No
GroundWater:	No
Pervious Land Use	Acres
D,Grass,STEEP(10-20	8.5
Pervious Total	8.5
Impervious Land Use	Acres
Impervious Total	0
Basin Total	8.5

Element Flows To:

Surface	Interflow	Groundwater

Mitigated Land Use

Basin 13(West)

Bypass:	No
GroundWater:	No
Pervious Land Use	Acres
D,Grass,FLAT(0-5%)	2.6
D,Grass,STEEP(10-20	0.8
Pervious Total	3.4
Impervious Land Use	Acres
IMPERVIOUS-FLAT	3.9
IMPERVIOUS-MOD	1.2
Impervious Total	5.1
Basin Total	8.5

Element Flows To:

Surface	Interflow	Groundwater
Flow Splitter Basin 13(West) 1	Flow Splitter Basin 13(West) 1	

Routing Elements
Predeveloped Routing

Mitigated Routing

Flow Splitter Basin 13(West) 1

Bottom Length: 10.00 ft.
Bottom Length: 10.00 ft.
Depth: 10 ft.
Side slope 1: 0 To 1
Side slope 2: 0 To 1
Side slope 3: 0 To 1
Side slope 4: 0 To 1
Threshold Splitter Hydraulic Table

Stage(ft)	Area(ac)	Volume(ac-ft)	Primary(cfs)	Secondary(cfs)
0.000	0.002	0.000	3.540	0.000
0.111	0.002	0.000	3.540	0.000
0.222	0.002	0.000	3.540	0.000
0.333	0.002	0.000	3.540	0.000
0.444	0.002	0.001	3.540	0.000
0.555	0.002	0.001	3.540	0.000
0.666	0.002	0.001	3.540	0.000
0.777	0.002	0.001	3.540	0.000
0.888	0.002	0.002	3.540	0.000
1.000	0.002	0.002	3.540	0.000
1.111	0.002	0.002	3.540	0.000
1.222	0.002	0.002	3.540	0.000
1.333	0.002	0.003	3.540	0.000
1.444	0.002	0.003	3.540	0.000
1.555	0.002	0.003	3.540	0.000
1.666	0.002	0.003	3.540	0.000
1.777	0.002	0.004	3.540	0.000
1.888	0.002	0.004	3.540	0.000
2.000	0.002	0.004	3.540	0.000
2.111	0.002	0.004	3.540	0.000
2.222	0.002	0.005	3.540	0.000
2.333	0.002	0.005	3.540	0.000
2.444	0.002	0.005	3.540	0.000
2.555	0.002	0.005	3.540	0.000
2.666	0.002	0.006	3.540	0.000
2.777	0.002	0.006	3.540	0.000
2.888	0.002	0.006	3.540	1000
3.000	0.002	0.006	3.540	1000
3.111	0.002	0.007	3.540	1000
3.222	0.002	0.007	3.540	1000
3.333	0.002	0.007	3.540	1000
3.444	0.002	0.007	3.540	1000
3.555	0.002	0.008	3.540	1000
3.666	0.002	0.008	3.540	1000
3.777	0.002	0.008	3.540	1000
3.888	0.002	0.008	3.540	1000
4.000	0.002	0.009	3.540	1000
4.111	0.002	0.009	3.540	1000
4.222	0.002	0.009	3.540	1000
4.333	0.002	0.009	3.540	1000
4.444	0.002	0.010	3.540	1000
4.555	0.002	0.010	3.540	1000
4.666	0.002	0.010	3.540	1000
4.777	0.002	0.011	3.540	1000
4.888	0.002	0.011	3.540	1000

5.000	0.002	0.011	3.540	1000
5.111	0.002	0.011	3.540	1000
5.222	0.002	0.012	3.540	1000
5.333	0.002	0.012	3.540	1000
5.444	0.002	0.012	3.540	1000
5.555	0.002	0.012	3.540	1000
5.666	0.002	0.013	3.540	1000
5.777	0.002	0.013	3.540	1000
5.888	0.002	0.013	3.540	1000
6.000	0.002	0.013	3.540	1000
6.111	0.002	0.014	3.540	1000
6.222	0.002	0.014	3.540	1000
6.333	0.002	0.014	3.540	1000
6.444	0.002	0.014	3.540	1000
6.555	0.002	0.015	3.540	1000
6.666	0.002	0.015	3.540	1000
6.777	0.002	0.015	3.540	1000
6.888	0.002	0.015	3.540	1000
7.000	0.002	0.016	3.540	1000
7.111	0.002	0.016	3.540	1000
7.222	0.002	0.016	3.540	1000
7.333	0.002	0.016	3.540	1000
7.444	0.002	0.017	3.540	1000
7.555	0.002	0.017	3.540	1000
7.666	0.002	0.017	3.540	1000
7.777	0.002	0.017	3.540	1000
7.888	0.002	0.018	3.540	1000
8.000	0.002	0.018	3.540	1000
8.111	0.002	0.018	3.540	1000
8.222	0.002	0.018	3.540	1000
8.333	0.002	0.019	3.540	1000
8.444	0.002	0.019	3.540	1000
8.555	0.002	0.019	3.540	1000
8.666	0.002	0.019	3.540	1000
8.777	0.002	0.020	3.540	1000
8.888	0.002	0.020	3.540	1000
9.000	0.002	0.020	3.540	1000
9.111	0.002	0.020	3.540	1000
9.222	0.002	0.021	3.540	1000
9.333	0.002	0.021	3.540	1000
9.444	0.002	0.021	3.540	1000
9.555	0.002	0.021	3.540	1000
9.666	0.002	0.022	3.540	1000
9.777	0.002	0.022	3.540	1000
9.888	0.002	0.022	3.540	1000
10.00	0.002	0.023	3.540	1000
10.11	0.002	0.023	3.540	1000

Discharge Structure
Riser Height: 0 ft.
Riser Diameter: 0 in.
Element Flows To:

Outlet 1	Outlet 2
SSD Table Basin 13	Channel 1

Channel 1

Bottom Length: 500.00 ft.
Bottom Width: 5.00 ft.
Manning's n: 0.03
Channel bottom slope 1: 0.01 To 1
Channel Left side slope 0: 2 To 1
Channel right side slope 2: 2 To 1
Discharge Structure
Riser Height: 0 ft.
Riser Diameter: 0 in.
Element Flows To:
Outlet 1 Outlet 2

Channel Hydraulic Table

Stage(ft)	Area(ac)	Volume(ac-ft)	Discharge(cfs)	Infilt(cfs)
0.0000	0.057	0.000	0.000	0.000
0.0556	0.059	0.003	0.201	0.000
0.1111	0.062	0.006	0.643	0.000
0.1667	0.065	0.010	1.272	0.000
0.2222	0.067	0.013	2.067	0.000
0.2778	0.070	0.017	3.019	0.000
0.3333	0.072	0.021	4.119	0.000
0.3889	0.075	0.025	5.365	0.000
0.4444	0.077	0.030	6.754	0.000
0.5000	0.080	0.034	8.284	0.000
0.5556	0.082	0.039	9.954	0.000
0.6111	0.085	0.043	11.76	0.000
0.6667	0.088	0.048	13.71	0.000
0.7222	0.090	0.053	15.80	0.000
0.7778	0.093	0.058	18.04	0.000
0.8333	0.095	0.063	20.41	0.000
0.8889	0.098	0.069	22.94	0.000
0.9444	0.100	0.074	25.60	0.000
1.0000	0.103	0.080	28.41	0.000
1.0556	0.105	0.086	31.37	0.000
1.1111	0.108	0.092	34.48	0.000
1.1667	0.111	0.098	37.75	0.000
1.2222	0.113	0.104	41.16	0.000
1.2778	0.116	0.110	44.73	0.000
1.3333	0.118	0.117	48.45	0.000
1.3889	0.121	0.124	52.34	0.000
1.4444	0.123	0.130	56.38	0.000
1.5000	0.126	0.137	60.58	0.000
1.5556	0.128	0.144	64.95	0.000
1.6111	0.131	0.152	69.48	0.000
1.6667	0.133	0.159	74.18	0.000
1.7222	0.136	0.166	79.05	0.000
1.7778	0.139	0.174	84.09	0.000
1.8333	0.141	0.182	89.30	0.000
1.8889	0.144	0.190	94.68	0.000
1.9444	0.146	0.198	100.2	0.000
2.0000	0.149	0.206	105.9	0.000
2.0556	0.151	0.215	111.9	0.000
2.1111	0.154	0.223	118.0	0.000
2.1667	0.156	0.232	124.2	0.000

2.2222	0.159	0.240	130.7	0.000
2.2778	0.162	0.249	137.4	0.000
2.3333	0.164	0.258	144.2	0.000
2.3889	0.167	0.268	151.3	0.000
2.4444	0.169	0.277	158.5	0.000
2.5000	0.172	0.287	165.9	0.000
2.5556	0.174	0.296	173.5	0.000
2.6111	0.177	0.306	181.3	0.000
2.6667	0.179	0.316	189.4	0.000
2.7222	0.182	0.326	197.6	0.000
2.7778	0.185	0.336	206.0	0.000
2.8333	0.187	0.346	214.6	0.000
2.8889	0.190	0.357	223.5	0.000
2.9444	0.192	0.368	232.5	0.000
3.0000	0.195	0.378	241.8	0.000
3.0556	0.197	0.389	251.2	0.000
3.1111	0.200	0.400	260.9	0.000
3.1667	0.202	0.412	270.8	0.000
3.2222	0.205	0.423	280.9	0.000
3.2778	0.207	0.434	291.2	0.000
3.3333	0.210	0.446	301.8	0.000
3.3889	0.213	0.458	312.6	0.000
3.4444	0.215	0.470	323.6	0.000
3.5000	0.218	0.482	334.8	0.000
3.5556	0.220	0.494	346.2	0.000
3.6111	0.223	0.506	357.9	0.000
3.6667	0.225	0.519	369.8	0.000
3.7222	0.228	0.531	382.0	0.000
3.7778	0.230	0.544	394.4	0.000
3.8333	0.233	0.557	407.0	0.000
3.8889	0.236	0.570	419.9	0.000
3.9444	0.238	0.583	432.9	0.000
4.0000	0.241	0.596	446.3	0.000
4.0556	0.243	0.610	459.9	0.000
4.1111	0.246	0.624	473.7	0.000
4.1667	0.248	0.637	487.8	0.000
4.2222	0.251	0.651	502.1	0.000
4.2778	0.253	0.665	516.7	0.000
4.3333	0.256	0.679	531.5	0.000
4.3889	0.258	0.694	546.6	0.000
4.4444	0.261	0.708	561.9	0.000
4.5000	0.264	0.723	577.5	0.000
4.5556	0.266	0.738	593.3	0.000
4.6111	0.269	0.752	609.4	0.000
4.6667	0.271	0.767	625.8	0.000
4.7222	0.274	0.783	642.4	0.000
4.7778	0.276	0.798	659.3	0.000
4.8333	0.279	0.813	676.5	0.000
4.8889	0.281	0.829	693.9	0.000
4.9444	0.284	0.845	711.6	0.000
5.0000	0.287	0.861	729.6	0.000
5.0556	0.289	0.877	747.8	0.000

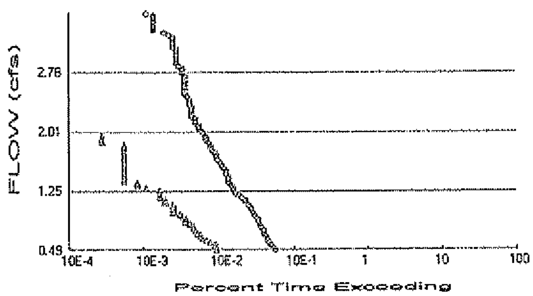
SSD Table Basin 13

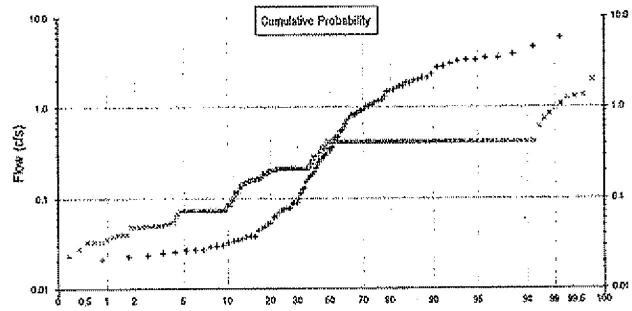
Depth: 513.2 ft.
Element Flows To:
Outlet 1 Outlet 2

SSD Table Hydraulic Table

Stage (ft)	Area (ac)	Volume (ac-ft)	Manual	NotUsed	NotUsed	NotUsed	NotUsed
505.9	0.000	0.000	0.000	0.000	0.000	0.000	0.000
506.5	1394	0.000	0.423	0.000	0.000	0.000	0.000
507.5	2077	0.015	0.423	0.000	0.000	0.000	0.000
509.5	3651	0.068	0.423	0.000	0.000	0.000	0.000
510.0	4089	0.112	0.423	0.000	0.000	0.000	0.000
512.1	7823	0.442	0.423	0.000	0.000	0.000	0.000
512.2	7932	0.461	1.134	0.000	0.000	0.000	0.000

Analysis Results
POC 1





+ Predeveloped x Mitigated

Predeveloped Landuse Totals for POC #1
Total Pervious Area: 8.5
Total Impervious Area: 0

Mitigated Landuse Totals for POC #1
Total Pervious Area: 3.4
Total Impervious Area: 5.1

Flow Frequency Method: Cunnane

Flow Frequency Return Periods for Predeveloped. POC #1

Return Period	**Flow(cfs)**
2 year	1.63912
5 year	3.13793
10 year	3.536676
25 year	4.563735

Flow Frequency Return Periods for Mitigated. POC #1

Return Period	**Flow(cfs)**
2 year	0.423
5 year	0.658215
10 year	1.175122
25 year	1.353115

Duration Flows
The Facility PASSED

Flow(cfs)	Predev	Mit	Percentage	Pass/Fail
0.4917	201	34	16	Pass
0.5225	188	34	18	Pass
0.5532	178	33	18	Pass
0.5840	169	28	16	Pass
0.6148	161	25	15	Pass
0.6455	158	22	13	Pass
0.6763	150	21	14	Pass
0.7070	146	19	13	Pass
0.7378	143	18	12	Pass
0.7685	137	17	12	Pass
0.7993	132	17	12	Pass
0.8301	124	15	12	Pass
0.8608	121	13	10	Pass
0.8916	117	13	11	Pass
0.9223	110	12	10	Pass
0.9531	106	11	10	Pass
0.9838	102	9	8	Pass
1.0146	98	9	9	Pass
1.0454	93	9	9	Pass
1.0761	89	9	10	Pass
1.1069	84	7	8	Pass
1.1376	82	7	8	Pass
1.1684	73	6	8	Pass
1.1991	67	6	8	Pass
1.2299	60	6	10	Pass
1.2607	56	6	10	Pass
1.2914	56	4	7	Pass
1.3222	53	3	5	Pass
1.3529	51	3	5	Pass
1.3837	49	2	4	Pass
1.4144	49	2	4	Pass
1.4452	48	2	4	Pass
1.4760	46	2	4	Pass
1.5067	46	2	4	Pass
1.5375	43	2	4	Pass
1.5682	41	2	4	Pass
1.5990	39	2	5	Pass
1.6297	38	2	5	Pass
1.6605	35	2	5	Pass
1.6913	34	2	5	Pass
1.7220	34	2	5	Pass
1.7528	32	2	6	Pass
1.7835	30	2	6	Pass
1.8143	29	2	6	Pass
1.8450	29	2	6	Pass
1.8758	27	1	3	Pass
1.9066	25	1	4	Pass
1.9373	25	1	4	Pass
1.9681	24	1	4	Pass
1.9988	23	0	0	Pass
2.0296	21	0	0	Pass
2.0603	20	0	0	Pass
2.0911	20	0	0	Pass

2.1219	18	0	0	Pass
2.1526	18	0	0	Pass
2.1834	18	0	0	Pass
2.2141	16	0	0	Pass
2.2449	16	0	0	Pass
2.2756	16	0	0	Pass
2.3064	16	0	0	Pass
2.3372	16	0	0	Pass
2.3679	15	0	0	Pass
2.3987	15	0	0	Pass
2.4294	15	0	0	Pass
2.4602	14	0	0	Pass
2.4909	13	0	0	Pass
2.5217	13	0	0	Pass
2.5525	13	0	0	Pass
2.5832	13	0	0	Pass
2.6140	13	0	0	Pass
2.6447	13	0	0	Pass
2.6755	13	0	0	Pass
2.7062	13	0	0	Pass
2.7370	13	0	0	Pass
2.7678	12	0	0	Pass
2.7985	12	0	0	Pass
2.8293	12	0	0	Pass
2.8600	11	0	0	Pass
2.8908	10	0	0	Pass
2.9215	10	0	0	Pass
2.9523	10	0	0	Pass
2.9831	10	0	0	Pass
3.0138	10	0	0	Pass
3.0446	10	0	0	Pass
3.0753	10	0	0	Pass
3.1061	9	0	0	Pass
3.1368	9	0	0	Pass
3.1676	9	0	0	Pass
3.1983	9	0	0	Pass
3.2291	9	0	0	Pass
3.2599	8	0	0	Pass
3.2906	7	0	0	Pass
3.3214	5	0	0	Pass
3.3521	5	0	0	Pass
3.3829	5	0	0	Pass
3.4136	5	0	0	Pass
3.4444	5	0	0	Pass
3.4752	5	0	0	Pass
3.5059	5	0	0	Pass
3.5367	4	0	0	Pass

Water Quality

Model Default Modifications

Total of 0 changes have been made.

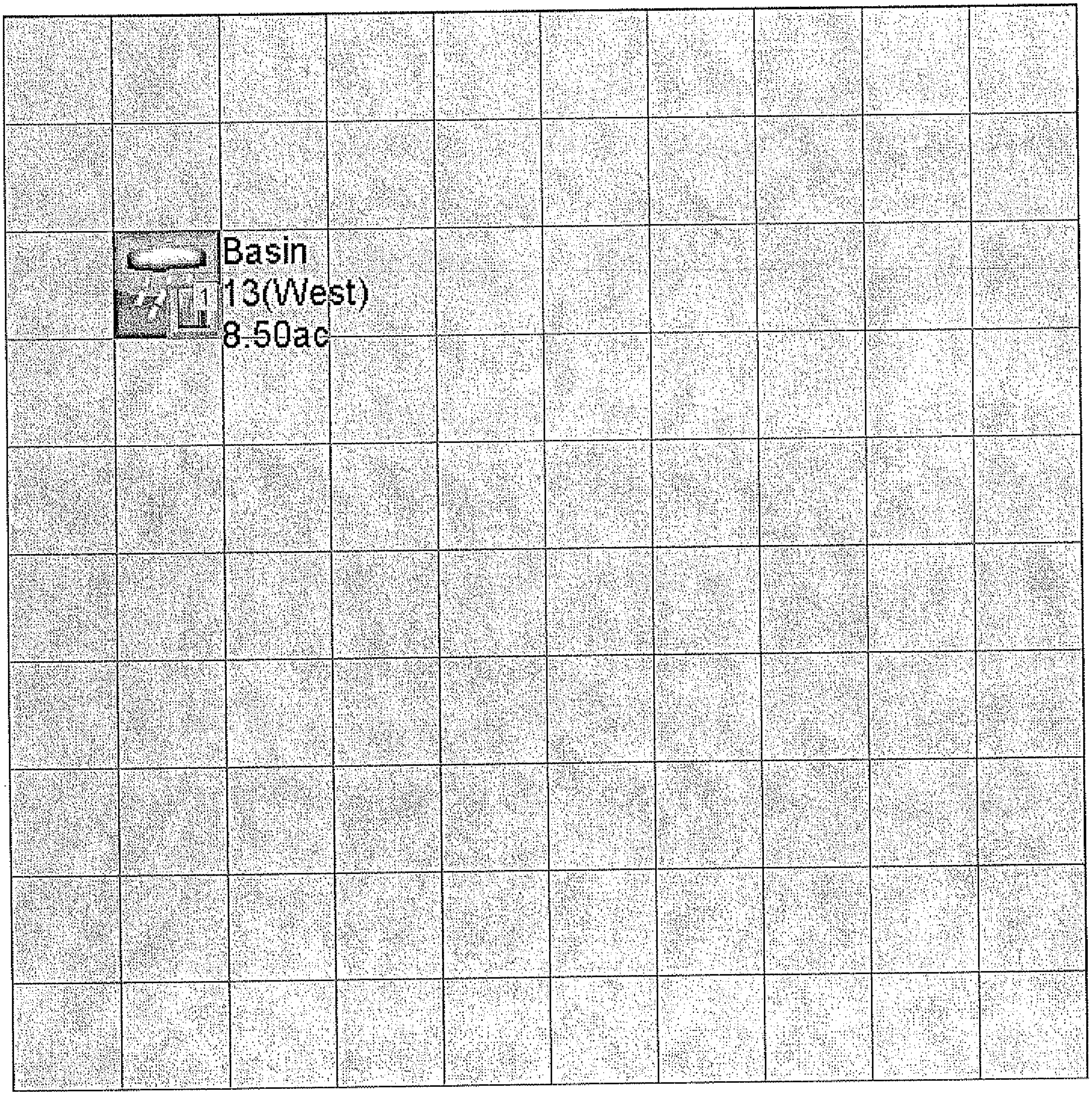
PERLND Changes

No PERLND changes have been made.

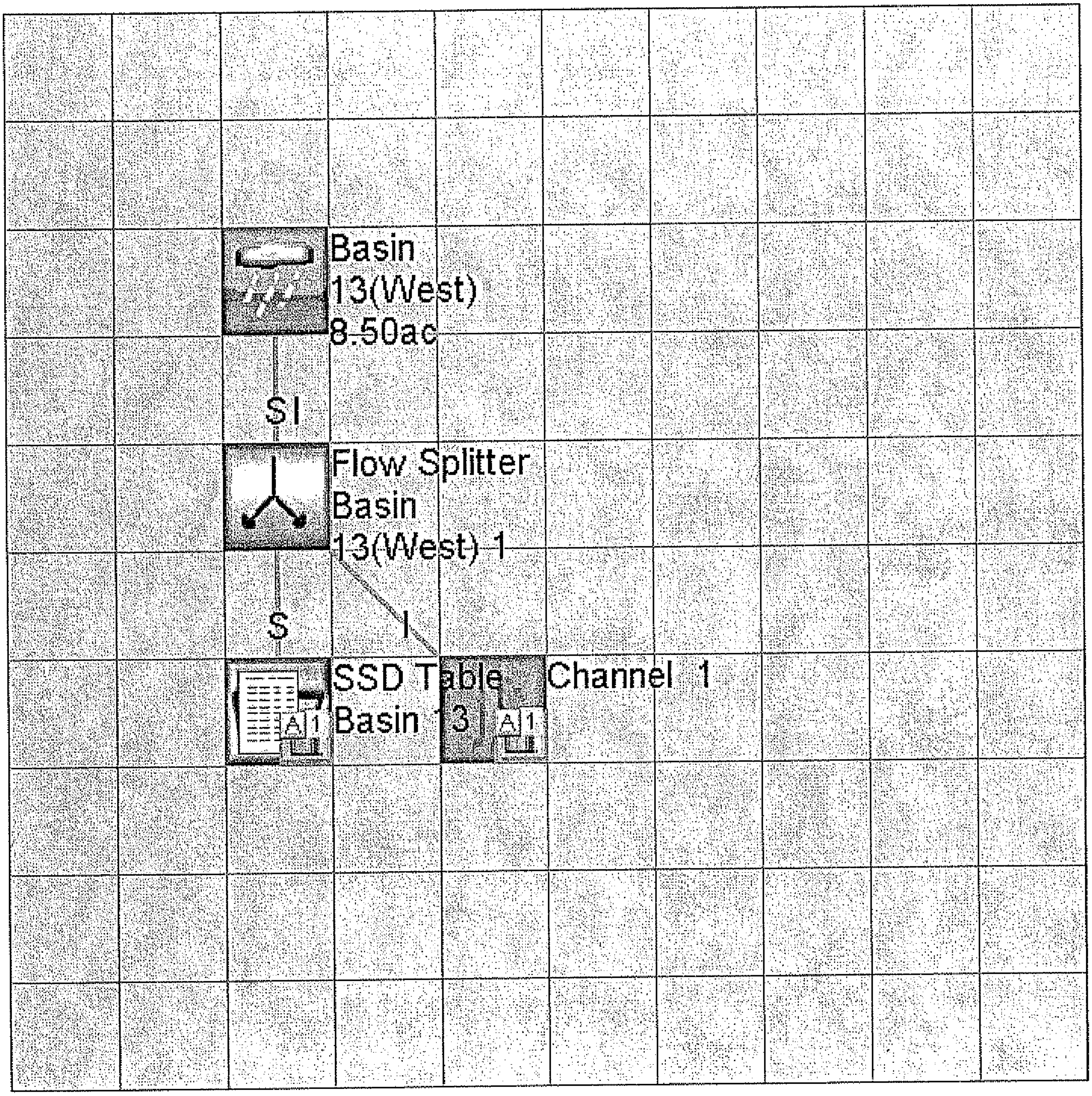
IMPLND Changes

No IMPLND changes have been made.

Appendix
Predeveloped Schematic



Mitigated Schematic



Predeveloped UCI File

```
RUN

GLOBAL
  WWHM4 model simulation
  START       1963 10 01        END    2004 09 30
  RUN INTERP OUTPUT LEVEL    3    0
  RESUME      0 RUN      1                   UNIT SYSTEM     1
END GLOBAL

FILES
<File>  <Un#>   <-----------File Name------------------------------>***
<-ID->                                                              ***
WDM        26   Basin_1.wdm
MESSU      25   PreBasin_1.MES
           27   PreBasin_1.L61
           28   PreBasin_1.L62
           30   POCBasin_11.dat
END FILES

OPN SEQUENCE
    INGRP              INDELT 00:60
      PERLND      30
      COPY       501
      DISPLY       1
    END INGRP
END OPN SEQUENCE
DISPLY
  DISPLY-INFO1
    # -  #<----------Title----------->***TRAN PIVL DIG1 FIL1  PYR DIG2 FIL2 YRND
    1        Basin 13(West)              MAX                    1    2   30    9
  END DISPLY-INFO1
END DISPLY
COPY
  TIMESERIES
    # -  #  NPT  NMN ***
    1         1    1
  501         1    1
  END TIMESERIES
END COPY
GENER
  OPCODE
    #    # OPCD ***
  END OPCODE
  PARM
    #    #         K ***
  END PARM
END GENER
PERLND
  GEN-INFO
    <PLS ><-------Name------->NBLKS   Unit-systems   Printer ***
    # -  #                          User  t-series Engl Metr ***
                                           in  out           ***
   30      D,Grass,STEEP(10-20    1    1    1    1   27    0
  END GEN-INFO
  *** Section PWATER***

  ACTIVITY
    <PLS > ************* Active Sections *****************************
    # -  # ATMP SNOW PWAT  SED  PST  PWG PQAL MSTL PEST NITR PHOS TRAC ***
   30         0    0    1    0    0    0    0    0    0    0    0    0
  END ACTIVITY

  PRINT-INFO
    <PLS > ***************** Print-flags ***************************** PIVL  PYR
    # -  # ATMP SNOW PWAT  SED  PST  PWG PQAL MSTL PEST NITR PHOS TRAC  *********
   30         0    0    4    0    0    0    0    0    0    0    0    0    1    9
  END PRINT-INFO
```

```
  PWAT-PARM1
    <PLS >  PWATER variable monthly parameter value flags   ***
    # -  # CSNO RTOP UZFG  VCS  VUZ  VNN VIFW VIRC  VLE INFC  HWT ***
   30         0    1    1    1    0    0    0    0    1    1    0
  END PWAT-PARM1

  PWAT-PARM2
    <PLS >      PWATER input info: Part 2               ***
    # -  # ***FOREST      LZSN    INFILT      LSUR     SLSUR     KVARY     AGWRC
   30             0        4.2      0.02       200      0.15         3      0.92
  END PWAT-PARM2

  PWAT-PARM3
    <PLS >      PWATER input info: Part 3               ***
    # -  # ***PETMAX    PETMIN    INFEXP    INFILD    DEEPFR    BASETP    AGWETP
   30            35        30         2         2       0.4      0.05      0.05
  END PWAT-PARM3
  PWAT-PARM4
    <PLS >     PWATER input info: Part 4                                  ***
    # -  #     CEPSC      UZSN      NSUR     INTFW       IRC     LZETP ***
   30           0.08       0.6       0.2       1.5       0.7       0.5
  END PWAT-PARM4
  MON-LZETPARM
    <PLS >      PWATER input info: Part 3               ***
    # -  #  JAN  FEB  MAR  APR  MAY  JUN  JUL  AUG  SEP  OCT  NOV  DEC  ***
   30       0.4  0.4  0.4  0.4  0.6  0.6  0.6  0.6  0.6  0.4  0.4  0.4
  END MON-LZETPARM
  MON-INTERCEP
    <PLS >      PWATER input info: Part 3               ***
    # -  #  JAN  FEB  MAR  APR  MAY  JUN  JUL  AUG  SEP  OCT  NOV  DEC  ***
   30       0.1  0.1  0.1  0.1 0.06 0.06 0.06 0.06 0.06  0.1  0.1  0.1
  END MON-INTERCEP

  PWAT-STATE1
    <PLS > *** Initial conditions at start of simulation
               ran from 1990 to end of 1992 (pat 1-11-95) RUN 21 ***
    # -  # ***  CEPS      SURS       UZS      IFWS       LZS      AGWS      GWVS
   30             0         0      0.15         0         4      0.05         0
  END PWAT-STATE1

END PERLND

IMPLND
  GEN-INFO
    <PLS ><-------Name------->   Unit-systems   Printer ***
    # -  #                    User  t-series Engl Metr ***
                                     in  out           ***
  END GEN-INFO
  *** Section IWATER***

  ACTIVITY
    <PLS > ************* Active Sections *****************************
    # -  # ATMP SNOW IWAT  SLD  IWG IQAL    ***
  END ACTIVITY

  PRINT-INFO
    <ILS > ******** Print-flags ******** PIVL  PYR
    # -  # ATMP SNOW IWAT  SLD  IWG IQAL    *********
  END PRINT-INFO

  IWAT-PARM1
    <PLS >  IWATER variable monthly parameter value flags   ***
    # -  # CSNO RTOP  VRS  VNN RTLI      ***
  END IWAT-PARM1

  IWAT-PARM2
    <PLS >      IWATER input info: Part 2           ***
    # -  # ***  LSUR     SLSUR      NSUR     RETSC
  END IWAT-PARM2
```

```
  IWAT-PARM3
    <PLS >      IWATER input info: Part 3          ***
    # -  # ***PETMAX    PETMIN
  END IWAT-PARM3

  IWAT-STATE1
    <PLS > *** Initial conditions at start of simulation
    # -  # ***  RETS      SURS
  END IWAT-STATE1

END IMPLND

SCHEMATIC
<-Source->                  <--Area-->    <-Target->   MBLK   ***
<Name>   #                  <-factor->    <Name>   #   Tbl#   ***
Basin 13(West)***
PERLND  30                        8.5     COPY   501     12
PERLND  30                        8.5     COPY   501     13

******Routing******
END SCHEMATIC

NETWORK
<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Target vols> <-Grp> <-Member->  ***
<Name>   #        <Name> # #<-factor->strg <Name>   #   #        <Name> # #  ***
COPY   501 OUTPUT MEAN   1 1   12.1        DISPLY   1     INPUT  TIMSER 1


<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Target vols> <-Grp> <-Member->  ***
<Name>   #        <Name> # #<-factor->strg <Name>   #   #        <Name> # #  ***
END NETWORK

RCHRES
  GEN-INFO
    RCHRES       Name        Nexits   Unit Systems   Printer                 ***
    # -  #<------------------><---> User T-series  Engl Metr LKFG            ***
                                             in  out                         ***
  END GEN-INFO
  *** Section RCHRES***

  ACTIVITY
    <PLS > ************* Active Sections *****************************
    # -  # HYFG ADFG CNFG HTFG SDFG GQFG OXFG NUFG PKFG PHFG ***
  END ACTIVITY

  PRINT-INFO
    <PLS > ***************** Print-flags ******************* PIVL  PYR
    # -  # HYDR ADCA CONS HEAT  SED  GQL OXRX NUTR PLNK PHCB PIVL  PYR  *********
  END PRINT-INFO

  HYDR-PARM1
    RCHRES  Flags for each HYDR Section                                      ***
    # -  #  VC A1 A2 A3  ODFVFG for each *** ODGTFG for each     FUNCT  for each
            FG FG FG FG  possible  exit  *** possible  exit      possible  exit
             *  *  *  *     *  *  *  *  *       *  *  *  *  *          ***
  END HYDR-PARM1

  HYDR-PARM2
    # -  #    FTABNO       LEN      DELTH      STCOR        KS       DB50     ***
  <------><--------><--------><--------><--------><--------><-------->        ***
  END HYDR-PARM2
  HYDR-INIT
    RCHRES  Initial conditions for each HYDR section                         ***
    # -  # ***   VOL     Initial  value  of COLIND     Initial  value  of OUTDGT
           *** ac-ft    for each possible exit      for each possible exit
  <------><-------->     <---><---><---><---><---> *** <---><---><---><---><--->
  END HYDR-INIT
END RCHRES
```

```
SPEC-ACTIONS
END SPEC-ACTIONS
FTABLES
END FTABLES

EXT SOURCES
<-Volume-> <Member> SsysSgap<--Mult-->Tran <-Target vols> <-Grp> <-Member->  ***
<Name>   # <Name> # tem strg<-factor->strg <Name>   #   #        <Name> # #  ***
WDM      2 PREC     ENGL     1             PERLND   1 999 EXTNL  PREC
WDM      2 PREC     ENGL     1             IMPLND   1 999 EXTNL  PREC
WDM      1 EVAP     ENGL     1             PERLND   1 999 EXTNL  PETINP
WDM      1 EVAP     ENGL     1             IMPLND   1 999 EXTNL  PETINP

END EXT SOURCES

EXT TARGETS
<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Volume-> <Member> Tsys Tgap Amd ***
<Name>   #        <Name> # #<-factor->strg <Name>   # <Name>    tem strg strg***
COPY   501 OUTPUT MEAN   1 1     12.1      WDM    501 FLOW     ENGL      REPL
END EXT TARGETS

MASS-LINK
<Volume>   <-Grp> <-Member-><--Mult-->     <Target>        <-Grp> <-Member->***
<Name>            <Name> # #<-factor->     <Name>                 <Name> # #***
  MASS-LINK       12
PERLND     PWATER SURO       0.083333      COPY            INPUT  MEAN
  END MASS-LINK   12

  MASS-LINK       13
PERLND     PWATER IFWO       0.083333      COPY            INPUT  MEAN
  END MASS-LINK   13

END MASS-LINK

END RUN
```

Mitigated UCI File

```
RUN

GLOBAL
  WWHM4 model simulation
  START       1963 10 01        END    2004 09 30
  RUN INTERP OUTPUT LEVEL    3    0
  RESUME     0 RUN      1                UNIT SYSTEM     1
END GLOBAL

FILES
<File>  <Un#>   <-----------File Name------------------------------>***
<-ID->                                                             ***
WDM        26   Basin_1.wdm
MESSU      25   MitBasin_1.MES
           27   MitBasin_1.L61
           28   MitBasin_1.L62
           30   POCBasin_11.dat
END FILES

OPN SEQUENCE
    INGRP              INDELT 00:60
      PERLND      28
      PERLND      30
      IMPLND       1
      IMPLND       2
      RCHRES       1
      RCHRES       2
      RCHRES       3
      COPY         1
      COPY       501
      DISPLY       1
    END INGRP
END OPN SEQUENCE
DISPLY
  DISPLY-INFO1
    # -  #<----------Title----------->***TRAN PIVL DIG1 FIL1  PYR DIG2 FIL2 YRND
    1         Channel  1                  MAX                   1    2   30    9
  END DISPLY-INFO1
END DISPLY
COPY
  TIMESERIES
    # -  #  NPT  NMN ***
    1         1    1
  501         1    1
  END TIMESERIES
END COPY
GENER
  OPCODE
    #    # OPCD ***
  END OPCODE
  PARM
    #    #         K ***
  END PARM
END GENER
PERLND
  GEN-INFO
    <PLS ><-------Name------->NBLKS   Unit-systems   Printer ***
    # -  #                          User  t-series Engl Metr ***
                                          in  out           ***
   28       D,Grass,FLAT(0-5%)     1    1    1    1   27    0
   30       D,Grass,STEEP(10-20    1    1    1    1   27    0
  END GEN-INFO
  *** Section PWATER***

  ACTIVITY
    <PLS > ************* Active Sections *****************************
    # -  # ATMP SNOW PWAT  SED  PST  PWG PQAL MSTL PEST NITR PHOS TRAC ***
   28         0    0    1    0    0    0    0    0    0    0    0    0
```

```
 30          0    0    1    0    0    0    0    0    0    0    0    0
END ACTIVITY

PRINT-INFO
  <PLS > ***************** Print-flags ***************************** PIVL  PYR
  # -  # ATMP SNOW PWAT  SED  PST  PWG PQAL MSTL PEST NITR PHOS TRAC  *********
 28          0    0    4    0    0    0    0    0    0    0    0    0    1    9
 30          0    0    4    0    0    0    0    0    0    0    0    0    1    9
END PRINT-INFO

PWAT-PARM1
  <PLS >  PWATER variable monthly parameter value flags  ***
  # -  # CSNO RTOP UZFG  VCS  VUZ  VNN VIFW VIRC  VLE INFC  HWT ***
 28          0    1    1    1    0    0    0    0    1    1    0
 30          0    1    1    1    0    0    0    0    1    1    0
END PWAT-PARM1

PWAT-PARM2
  <PLS >      PWATER input info: Part 2               ***
  # -  # ***FOREST      LZSN    INFILT      LSUR     SLSUR     KVARY     AGWRC
 28              0       4.8      0.04       200      0.05         3      0.92
 30              0       4.2      0.02       200      0.15         3      0.92
END PWAT-PARM2

PWAT-PARM3
  <PLS >      PWATER input info: Part 3               ***
  # -  # ***PETMAX    PETMIN    INFEXP    INFILD    DEEPFR    BASETP    AGWETP
 28             35        30         2         2       0.4      0.05      0.05
 30             35        30         2         2       0.4      0.05      0.05
END PWAT-PARM3
PWAT-PARM4
  <PLS >     PWATER input info: Part 4                                     ***
  # -  #     CEPSC      UZSN      NSUR     INTFW       IRC     LZETP ***
 28           0.08       0.6       0.2       1.5       0.7       0.5
 30           0.08       0.6       0.2       1.5       0.7       0.5
END PWAT-PARM4
MON-LZETPARM
  <PLS >      PWATER input info: Part 3               ***
  # -  #  JAN  FEB  MAR  APR  MAY  JUN  JUL  AUG  SEP  OCT  NOV  DEC ***
 28       0.4  0.4  0.4  0.4  0.6  0.6  0.6  0.6  0.6  0.4  0.4  0.4
 30       0.4  0.4  0.4  0.4  0.6  0.6  0.6  0.6  0.6  0.4  0.4  0.4
END MON-LZETPARM
MON-INTERCEP
  <PLS >      PWATER input info: Part 3               ***
  # -  #  JAN  FEB  MAR  APR  MAY  JUN  JUL  AUG  SEP  OCT  NOV  DEC ***
 28       0.1  0.1  0.1  0.1 0.06 0.06 0.06 0.06 0.06  0.1  0.1  0.1
 30       0.1  0.1  0.1  0.1 0.06 0.06 0.06 0.06 0.06  0.1  0.1  0.1
END MON-INTERCEP

PWAT-STATE1
  <PLS > *** Initial conditions at start of simulation
              ran from 1990 to end of 1992 (pat 1-11-95) RUN 21 ***
  # -  # ***  CEPS      SURS       UZS      IFWS       LZS      AGWS      GWVS
 28              0         0      0.15         0         4      0.05         0
 30              0         0      0.15         0         4      0.05         0
END PWAT-STATE1

END PERLND

IMPLND
 GEN-INFO
  <PLS ><-------Name-------> Unit-systems   Printer ***
  # -  #                     User  t-series Engl Metr ***
                                    in  out           ***
  1      IMPERVIOUS-FLAT        1    1    1   27    0
  2      IMPERVIOUS-MOD         1    1    1   27    0
 END GEN-INFO
 *** Section IWATER***

 ACTIVITY
```

```
    <PLS > ************* Active Sections *****************************
    # -  # ATMP SNOW IWAT  SLD  IWG IQAL   ***
    1         0    0    1    0    0    0
    2         0    0    1    0    0    0
  END ACTIVITY

  PRINT-INFO
    <ILS > ******** Print-flags ******** PIVL  PYR
    # -  # ATMP SNOW IWAT  SLD  IWG IQAL   *********
    1         0    0    4    0    0    0    1    9
    2         0    0    4    0    0    0    1    9
  END PRINT-INFO

  IWAT-PARM1
    <PLS >  IWATER variable monthly parameter value flags  ***
    # -  # CSNO RTOP  VRS  VNN RTLI     ***
    1         0    0    0    0    1
    2         0    0    0    0    1
  END IWAT-PARM1

  IWAT-PARM2
    <PLS >      IWATER input info: Part 2        ***
    # -  # ***  LSUR      SLSUR      NSUR     RETSC
    1             100      0.035      0.05       0.1
    2             100        0.1      0.05       0.1
  END IWAT-PARM2

  IWAT-PARM3
    <PLS >      IWATER input info: Part 3        ***
    # -  # ***PETMAX    PETMIN
    1               0         0
    2               0         0
  END IWAT-PARM3

  IWAT-STATE1
    <PLS > *** Initial conditions at start of simulation
    # -  # ***  RETS      SURS
    1              0         0
    2              0         0
  END IWAT-STATE1

END IMPLND

SCHEMATIC
<-Source->                    <--Area-->      <-Target->   MBLK    ***
<Name>   #                    <-factor->      <Name>   #   Tbl#    ***
Basin 13(West)***
PERLND  28                          2.6       RCHRES   1      2
PERLND  28                          2.6       RCHRES   1      3
PERLND  30                          0.8       RCHRES   1      2
PERLND  30                          0.8       RCHRES   1      3
IMPLND   1                          3.9       RCHRES   1      5
IMPLND   2                          1.2       RCHRES   1      5

******Routing******
RCHRES   1                            1       RCHRES   3      7
RCHRES   1                                    COPY     1     17
RCHRES   2                            1       COPY   501     16
RCHRES   3                            1       COPY   501     16
END SCHEMATIC

NETWORK
<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Target vols> <-Grp> <-Member->  ***
<Name>   #        <Name> # #<-factor->strg <Name>   #   #        <Name> # #  ***
COPY   501 OUTPUT MEAN   1 1   12.1        DISPLY   1     INPUT  TIMSER 1


<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Target vols> <-Grp> <-Member->  ***
<Name>   #        <Name> # #<-factor->strg <Name>   #   #        <Name> # #  ***
```

```
END NETWORK

RCHRES
  GEN-INFO                                                                               ***
    RCHRES       Name        Nexits   Unit Systems   Printer                             ***
    # -  #<------------------><---> User T-series  Engl Metr LKFG                        ***
                                           in  out
    1     Flow Splitter Ba-004    2     1     1    1    28    0    1
    2     Channel  1              1     1     1    1    28    0    1
    3     SSD Table  Basin-007    1     1     1    1    28    0    1
  END GEN-INFO
  *** Section RCHRES***

  ACTIVITY
    <PLS > ************* Active Sections *****************************
    # -  # HYFG ADFG CNFG HTFG SDFG GQFG OXFG NUFG PKFG PHFG ***
    1         1    0    0    0    0    0    0    0    0    0
    2         1    0    0    0    0    0    0    0    0    0
    3         1    0    0    0    0    0    0    0    0    0
  END ACTIVITY

  PRINT-INFO
    <PLS > ***************** Print-flags ****************** PIVL  PYR
    # -  # HYDR ADCA CONS HEAT  SED  GQL OXRX NUTR PLNK PHCB PIVL  PYR   *********
    1         4    0    0    0    0    0    0    0    0    0    1    9
    2         4    0    0    0    0    0    0    0    0    0    1    9
    3         4    0    0    0    0    0    0    0    0    0    1    9
  END PRINT-INFO

  HYDR-PARM1                                                                         ***
    RCHRES  Flags for each HYDR Section
    # -  #  VC A1 A2 A3  ODFVFG for each *** ODGTFG for each     FUNCT  for each
            FG FG FG FG  possible   exit *** possible   exit     possible   exit
             *  *  *  *    *  *  *  *  *       *  *  *  *  *        ***
    1        0  1  0  0    4  5  0  0  0       0  0  0  0  0     2  2  2  2  2
    2        0  1  0  0    4  0  0  0  0       0  0  0  0  0     2  2  2  2  2
    3        0  1  0  0    4  0  0  0  0       0  0  0  0  0     2  2  2  2  2
  END HYDR-PARM1

  HYDR-PARM2
    # -  #    FTABNO       LEN     DELTH     STCOR        KS      DB50           ***
  <------><--------><--------><--------><--------><--------><-------->           ***
    1             1      0.01       0.0       0.0       0.5       0.0
    2             2      0.09       0.0       0.0       0.5       0.0
    3             3      0.01       0.0       0.0       0.5       0.0
  END HYDR-PARM2
  HYDR-INIT
    RCHRES  Initial conditions for each HYDR section                                 ***
    # -  # ***   VOL     Initial  value  of COLIND     Initial  value  of OUTDGT
         *** ac-ft    for each possible exit        for each possible exit
  <------><-------->    <---><---><---><---><---> *** <---><---><---><---><--->
    1           0         4.0  0.0  0.0  0.0  0.0       0.0  0.0  0.0  0.0  0.0
    2           0         4.0  0.0  0.0  0.0  0.0       0.0  0.0  0.0  0.0  0.0
    3           0         4.0  0.0  0.0  0.0  0.0       0.0  0.0  0.0  0.0  0.0
  END HYDR-INIT
END RCHRES

SPEC-ACTIONS
END SPEC-ACTIONS
FTABLES
  FTABLE       1
   90     5
     Depth      Area     Volume  Outflow1  Outflow2  Velocity  Travel Time***
      (ft)   (acres) (acre-ft)     (cfs)     (cfs)  (ft/sec)    (Minutes)***
  0.000000  0.002296  0.000000  3.540000  0.000000
  0.111111  0.002296  0.000255  3.540000  0.000000
  0.222222  0.002296  0.000510  3.540000  0.000000
  0.333333  0.002296  0.000765  3.540000  0.000000
  0.444444  0.002296  0.001020  3.540000  0.000000
  0.555556  0.002296  0.001275  3.540000  0.000000
```

0.666667	0.002296	0.001530	3.540000	11.00000
0.777778	0.002296	0.001786	3.540000	21.00000
0.888889	0.002296	0.002041	3.540000	31.00000
1.000000	0.002296	0.002296	3.540000	41.00000
1.111111	0.002296	0.002551	3.540000	51.00000
1.222222	0.002296	0.002806	3.540000	61.00000
1.333333	0.002296	0.003061	3.540000	71.00000
1.444444	0.002296	0.003316	3.540000	81.00000
1.555556	0.002296	0.003571	3.540000	91.00000
1.666667	0.002296	0.003826	3.540000	101.0000
1.777778	0.002296	0.004081	3.540000	111.0000
1.888889	0.002296	0.004336	3.540000	121.0000
2.000000	0.002296	0.004591	3.540000	131.0000
2.111111	0.002296	0.004846	3.540000	141.0000
2.222222	0.002296	0.005102	3.540000	151.0000
2.333333	0.002296	0.005357	3.540000	161.0000
2.444444	0.002296	0.005612	3.540000	171.0000
2.555556	0.002296	0.005867	3.540000	181.0000
2.666667	0.002296	0.006122	3.540000	191.0000
2.777778	0.002296	0.006377	3.540000	201.0000
2.888889	0.002296	0.006632	3.540000	211.0000
3.000000	0.002296	0.006887	3.540000	221.0000
3.111111	0.002296	0.007142	3.540000	231.0000
3.222222	0.002296	0.007397	3.540000	241.0000
3.333333	0.002296	0.007652	3.540000	251.0000
3.444444	0.002296	0.007907	3.540000	261.0000
3.555556	0.002296	0.008162	3.540000	271.0000
3.666667	0.002296	0.008418	3.540000	281.0000
3.777778	0.002296	0.008673	3.540000	291.0000
3.888889	0.002296	0.008928	3.540000	301.0000
4.000000	0.002296	0.009183	3.540000	311.0000
4.111111	0.002296	0.009438	3.540000	321.0000
4.222222	0.002296	0.009693	3.540000	331.0000
4.333333	0.002296	0.009948	3.540000	341.0000
4.444444	0.002296	0.010203	3.540000	351.0000
4.555556	0.002296	0.010458	3.540000	361.0000
4.666667	0.002296	0.010713	3.540000	371.0000
4.777778	0.002296	0.010968	3.540000	381.0000
4.888889	0.002296	0.011223	3.540000	391.0000
5.000000	0.002296	0.011478	3.540000	401.0000
5.111111	0.002296	0.011733	3.540000	411.0000
5.222222	0.002296	0.011989	3.540000	421.0000
5.333333	0.002296	0.012244	3.540000	431.0000
5.444444	0.002296	0.012499	3.540000	441.0000
5.555556	0.002296	0.012754	3.540000	451.0000
5.666667	0.002296	0.013009	3.540000	461.0000
5.777778	0.002296	0.013264	3.540000	471.0000
5.888889	0.002296	0.013519	3.540000	481.0000
6.000000	0.002296	0.013774	3.540000	491.0000
6.111111	0.002296	0.014029	3.540000	501.0000
6.222222	0.002296	0.014284	3.540000	511.0000
6.333333	0.002296	0.014539	3.540000	521.0000
6.444444	0.002296	0.014794	3.540000	531.0000
6.555556	0.002296	0.015049	3.540000	541.0000
6.666667	0.002296	0.015305	3.540000	551.0000
6.777778	0.002296	0.015560	3.540000	561.0000
6.888889	0.002296	0.015815	3.540000	571.0000
7.000000	0.002296	0.016070	3.540000	581.0000
7.111111	0.002296	0.016325	3.540000	591.0000
7.222222	0.002296	0.016580	3.540000	601.0000
7.333333	0.002296	0.016835	3.540000	611.0000
7.444444	0.002296	0.017090	3.540000	621.0000
7.555556	0.002296	0.017345	3.540000	631.0000
7.666667	0.002296	0.017600	3.540000	641.0000
7.777778	0.002296	0.017855	3.540000	651.0000
7.888889	0.002296	0.018110	3.540000	661.0000
8.000000	0.002296	0.018365	3.540000	671.0000
8.111111	0.002296	0.018621	3.540000	681.0000
8.222222	0.002296	0.018876	3.540000	691.0000
8.333333	0.002296	0.019131	3.540000	701.0000

8.444444	0.002296	0.019386	3.540000	711.0000
8.555556	0.002296	0.019641	3.540000	721.0000
8.666667	0.002296	0.019896	3.540000	731.0000
8.777778	0.002296	0.020151	3.540000	741.0000
8.888889	0.002296	0.020406	3.540000	751.0000
9.000000	0.002296	0.020661	3.540000	761.0000
9.111111	0.002296	0.020916	3.540000	771.0000
9.222222	0.002296	0.021171	3.540000	781.0000
9.333333	0.002296	0.021426	3.540000	791.0000
9.444444	0.002296	0.021681	3.540000	801.0000
9.555556	0.002296	0.021937	3.540000	811.0000
9.666667	0.002296	0.022192	3.540000	821.0000
9.777778	0.002296	0.022447	3.540000	831.0000
9.888889	0.002296	0.022702	3.540000	841.0000

END FTABLE 1

FTABLE 2

91 4

Depth (ft)	Area (acres)	Volume (acre-ft)	Outflow1 (cfs)	Velocity (ft/sec)	Travel Time*** (Minutes)***
0.000000	0.057392	0.000000	0.000000		
0.055556	0.059943	0.003259	0.201735		
0.111111	0.062494	0.006660	0.643686		
0.166667	0.065045	0.010203	1.272329		
0.222222	0.067596	0.013888	2.067751		
0.277778	0.070147	0.017714	3.019109		
0.333333	0.072698	0.021682	4.119844		
0.388889	0.075249	0.025791	5.365847		
0.444444	0.077800	0.030043	6.754560		
0.500000	0.080351	0.034436	8.284482		
0.555556	0.082902	0.038970	9.954860		
0.611111	0.085453	0.043647	11.76550		
0.666667	0.088004	0.048465	13.71660		
0.722222	0.090555	0.053425	15.80872		
0.777778	0.093106	0.058527	18.04263		
0.833333	0.095657	0.063770	20.41933		
0.888889	0.098208	0.069155	22.93996		
0.944444	0.100759	0.074682	25.60578		
1.000000	0.103310	0.080351	28.41819		
1.055556	0.105861	0.086161	31.37865		
1.111111	0.108412	0.092113	34.48869		
1.166667	0.110963	0.098207	37.74990		
1.222222	0.113514	0.104442	41.16393		
1.277778	0.116066	0.110820	44.73246		
1.333333	0.118617	0.117338	48.45720		
1.388889	0.121168	0.123999	52.33988		
1.444444	0.123719	0.130802	56.38229		
1.500000	0.126270	0.137746	60.58618		
1.555556	0.128821	0.144832	64.95336		
1.611111	0.131373	0.152059	69.48565		
1.666667	0.133924	0.159429	74.18484		
1.722222	0.136475	0.166940	79.05278		
1.777778	0.139026	0.174592	84.09128		
1.833333	0.141578	0.182387	89.30218		
1.888889	0.144129	0.190323	94.68732		
1.944444	0.146680	0.198401	100.2485		
2.000000	0.149231	0.206621	105.9877		
2.055556	0.151783	0.214983	111.9065		
2.111111	0.154334	0.223486	118.0070		
2.166667	0.156885	0.232131	124.2909		
2.222222	0.159437	0.240918	130.7600		
2.277778	0.161988	0.249846	137.4163		
2.333333	0.164539	0.258916	144.2614		
2.388889	0.167091	0.268128	151.2973		
2.444444	0.169642	0.277482	158.5257		
2.500000	0.172194	0.286977	165.9485		
2.555556	0.174745	0.296614	173.5674		
2.611111	0.177296	0.306393	181.3844		
2.666667	0.179848	0.316314	189.4011		
2.722222	0.182399	0.326376	197.6195		
2.777778	0.184951	0.336581	206.0412		

```
 2.833333  0.187502  0.346927  214.6680
 2.888889  0.190054  0.357414  223.5019
 2.944444  0.192605  0.368044  232.5444
 3.000000  0.195157  0.378815  241.7974
 3.055556  0.197708  0.389728  251.2627
 3.111111  0.200260  0.400782  260.9420
 3.166667  0.202811  0.411979  270.8370
 3.222222  0.205363  0.423317  280.9496
 3.277778  0.207914  0.434797  291.2815
 3.333333  0.210466  0.446418  301.8343
 3.388889  0.213017  0.458182  312.6099
 3.444444  0.215569  0.470087  323.6100
 3.500000  0.218121  0.482134  334.8362
 3.555556  0.220672  0.494323  346.2904
 3.611111  0.223224  0.506653  357.9741
 3.666667  0.225775  0.519125  369.8892
 3.722222  0.228327  0.531739  382.0373
 3.777778  0.230879  0.544495  394.4202
 3.833333  0.233430  0.557392  407.0394
 3.888889  0.235982  0.570432  419.8968
 3.944444  0.238534  0.583613  432.9939
 4.000000  0.241085  0.596935  446.3325
 4.055556  0.243637  0.610400  459.9142
 4.111111  0.246189  0.624006  473.7407
 4.166667  0.248741  0.637754  487.8136
 4.222222  0.251292  0.651644  502.1347
 4.277778  0.253844  0.665676  516.7055
 4.333333  0.256396  0.679849  531.5277
 4.388889  0.258948  0.694164  546.6029
 4.444444  0.261499  0.708621  561.9329
 4.500000  0.264051  0.723220  577.5191
 4.555556  0.266603  0.737960  593.3633
 4.611111  0.269155  0.752842  609.4670
 4.666667  0.271707  0.767866  625.8319
 4.722222  0.274259  0.783032  642.4596
 4.777778  0.276810  0.798339  659.3517
 4.833333  0.279362  0.813788  676.5099
 4.888889  0.281914  0.829379  693.9356
 4.944444  0.284466  0.845112  711.6305
 5.000000  0.287018  0.860987  729.5961
  END FTABLE  2
  FTABLE      3
   8    4
    Depth      Area     Volume   Outflow1 Velocity  Travel Time***
     (ft)   (acres) (acre-ft)    (cfs)   (ft/sec)     (Minutes)***
 505.9000  0.000000  0.000000  0.000000
 506.5000  1394.000  0.000010  0.423000
 507.5000  2077.000  0.015000  0.423000
 509.5000  3651.000  0.068000  0.423000
 510.0000  4089.000  0.112000  0.423000
 512.1000  7823.000  0.442000  0.423000
 512.2000  7932.000  0.461000  1.134000
 513.2000  9038.000  0.652000  8.323000
  END FTABLE  3
END FTABLES

EXT SOURCES
<-Volume-> <Member> SsysSgap<--Mult-->Tran <-Target vols> <-Grp> <-Member->  ***
<Name>   # <Name> # tem strg<-factor->strg <Name>   #   #        <Name> # #  ***
WDM      2 PREC     ENGL    1              PERLND   1 999 EXTNL  PREC
WDM      2 PREC     ENGL    1              IMPLND   1 999 EXTNL  PREC
WDM      1 EVAP     ENGL    1              PERLND   1 999 EXTNL  PETINP
WDM      1 EVAP     ENGL    1              IMPLND   1 999 EXTNL  PETINP
WDM      1 EVAP     ENGL    1              RCHRES   3     EXTNL  POTEV

END EXT SOURCES

EXT TARGETS
<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Volume-> <Member> Tsys Tgap Amd ***
<Name>   #        <Name> # #<-factor->strg <Name>   # <Name>    tem strg strg***
```

```
RCHRES    2 HYDR   RO      1 1          1      WDM   1002 FLOW       ENGL       REPL
RCHRES    2 HYDR   STAGE   1 1          1      WDM   1003 STAG       ENGL       REPL
COPY      1 OUTPUT MEAN    1 1       12.1      WDM    701 FLOW       ENGL       REPL
COPY    501 OUTPUT MEAN    1 1       12.1      WDM    801 FLOW       ENGL       REPL
RCHRES    3 HYDR   RO      1 1          1      WDM   1004 FLOW       ENGL       REPL
RCHRES    3 HYDR   STAGE   1 1          1      WDM   1005 STAG       ENGL       REPL
END EXT TARGETS

MASS-LINK
<Volume>   <-Grp> <-Member-><--Mult-->     <Target>        <-Grp> <-Member->***
<Name>            <Name> # #<-factor->     <Name>                 <Name> # #***
  MASS-LINK        2
PERLND     PWATER SURO       0.083333      RCHRES          INFLOW IVOL
  END MASS-LINK    2

  MASS-LINK        3
PERLND     PWATER IFWO       0.083333      RCHRES          INFLOW IVOL
  END MASS-LINK    3

  MASS-LINK        5
IMPLND     IWATER SURO       0.083333      RCHRES          INFLOW IVOL
  END MASS-LINK    5

  MASS-LINK        7
RCHRES     OFLOW  OVOL    1                RCHRES          INFLOW IVOL
  END MASS-LINK    7

  MASS-LINK        16
RCHRES     ROFLOW                          COPY            INPUT  MEAN
  END MASS-LINK    16

  MASS-LINK        17
RCHRES     OFLOW  OVOL    1                COPY            INPUT  MEAN
  END MASS-LINK    17

END MASS-LINK

END RUN
```

Disclaimer

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Drawdown Time Calculations

BMP Basin: 12

Proposed Mitigation Measure: Bioretention

Note: Following data were obtained from TAPE 21 as resulted from HEC-1 analyses.
Each ordinate = 20 minutes

HMPv / WQ_v (acre-feet)			WSEL (ft)			$Q_{out, max}$ (cfs)	
	3.66	@		5.3	⟶		11.930

Note: Infiltration is not considered in the following drawdown time calculations.

Ordinate	*1st*	*2nd*	*3rd*	*4th*	*5th*	*6th*	*7th*	*8th*	*9th*	*10th*	
0	11.93	4.844	2.453	2.027	2.027	2.027	2.027	2.027	2.027	2.027	
200	2.027	2.027	2.027	2.027	2.027	2.027	2.027	2.027	2.027	2.027	
400	2.027	2.027	2.027	2.027	2.027	2.027	2.027	2.027	2.027	2.027	
600	2.027	2.027	2.027	2.027	2.027	2.027	2.027	2.027	2.027	2.027	
800	2.027	2.027	2.027	2.027	2.027	2.027	2.027	2.027	2.027	2.027	
1000	2.027	1.911	1.463	1.119	0.857	0.656	0.502	0.384	0.294	0.225	
1200	0.172	0.132	0.101	0.077	0.059	0.045	0.035	0.026	0.02	0.015	
1400	0.012	0.009	0.007	0.005	0.004	0.003	0.002	0.002	0.001	0.001	
1600	0.001	0.001	0	0	0	0	0	0	0	0	1660
1800	0	0	0	0	0	0	0	0	0	0	
2000											
2200											

Drawdown Time (hours): **27.7** (Measured @ Finished Grade) 1660

Check all the conditions/questions that apply below and state the applicable results: (Results) ☑ ☐

☑ Per the City of San Diego, is the HMP drawdown time within 96 hours? (Yes)

Drawdown Time Calculations BMP Basin: 13

Proposed Mitigation Measure: Bioretention

Note: Following data were obtained from TAPE 21 as resulted from HEC-1 analyses.
Each ordinate = 20 minutes

HMPv / WQ_v (acre-feet)	0.47	@	WSEL (ft)	2.8	⟶	$Q_{out, max}$ (cfs)	8.323

Note: Infiltration is not considered in the following drawdown time calculations.

Ordinate	1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th	
0	8.323	2.62	0.837	0.423	0.423	0.423	0.423	0.423	0.423	0.423	
200	0.423	0.423	0.423	0.423	0.423	0.423	0.423	0.423	0.423	0.423	
400	0.423	0.423	0.423	0.423	0.423	0.423	0.423	0.423	0.423	0.423	
600	0.423	0.405	0.302	0.225	0.168	0.125	0.093	0.07	0.052	0.039	
800	0.029	0.022	0.016	0.012	0.009	0.007	0.005	0.004	0.003	0.002	
1000	0.002	0.001	0.001	0.001	0	0	0	0	0	0	1100
1200	0	0	0	0	0	0	0	0	0	0	
1400											
1600											

Drawdown Time (hours): **18.3** (Measured @ Finished Grade) 1100

Check all the conditions/questions that apply below and state the applicable results: (Results) ☑ ☐

☑ Per the City of San Diego, is the HMP drawdown time within 96 hours? (Yes)

APPENDIX E

Geomorphic Assessment

GEOMORPHIC ASSESSMENT

The following geomorphic assessment (channel screening analysis) for the drainage basins (i.e., Basins 900 and 1000) is divided into the following sections:

- Point of Compliance (POC)
- Domain of Analysis (DOA)
- Initial Desktop Analysis
- Field Screening: Vertical and Lateral Susceptibility
- San Diego BMP Sizing Calculator Results

Point of Compliance (POC)

The initial step in performing the SCCWRP channel screening analysis is to identify the point of compliance (POC). For Basin 900 of the BMR East Clusters Unit 3 project, the geomorphic assessment point of compliance is the downstream end of an existing culvert below Carmel Valley Road, west of Wine Creek Road. This culvert discharges into an existing channel that continues towards an existing culvert below Wine Creek Road. Basin 1000 of the BMR East Clusters Unit 3 project is collected and conveyed through a storm drain system within Carmel Valley Road and Wine Creek Road. The geomorphic assessment POC for Basin 1000 is the existing outfall for the aforementioned storm drain, on the east side of Wine Creek Road. This storm drain discharges into an existing channel that continues northward.

Domain of Analysis (DOA)

The next step is to define the domain of analysis (i.e., upstream and downstream study limits). The Final HMP, dated March 2011, specifies that the downstream domain of analysis shall be based on the following criteria (whichever is reached first governs):

- At least one reach downstream of the first grade-control point (preferably second downstream grade control location)

- Tidal backwater / Lentic (still water) waterbody
- Equal order tributary
- Accumulation of 50 percent drainage area for stream systems
- Accumulation of 100 percent drainage area for urban conveyance systems

Based on the evaluation of each bullet item above, the DOA for Basin 900 consists of Reaches 1, 2, and 3. The upstream end begins one reach length (566-feet) upstream of the culvert below Carmel Valley Road. Reach 2 consists of the 500 feet of channel between the culverts below Carmel Valley Road and Wine Creek Road, and the downstream limit of the DOA is 190 feet downstream of the Wine Creek Road Outfall, and is labeled as Reach 3. The culvert below Wine Creek Road, at the downstream end of Reach 2, is the first grade-control point for the geomorphic assessment of Basin 900; therefore, the downstream limit is established by the first bullet item above.

The DOA for Basin 1000 consists of Reaches 3 and 4. The upstream limit begins at the outfall along Wine Creek Road; Reach 3 extends from this outfall, to the subsequent culvert, 190 feet downstream. The downstream reach for Basin 1000 is Reach 4, and extends from the aforementioned culvert, downstream for 566-feet. The culvert downstream of Wine Creek Road is the first grade-control point the geomorphic assessment of Basin 300; therefore, the downstream limit is established by the first bullet time.

The channel limits, grade-control points, and drainage areas tributary to the upstream and downstream ends of each DOA are each provided in the attachments included as attachments in Section E-2 of this Appendix. Photographs from the field visit are also included in Section E-3 of this appendix.

Based on the above information, the Basin 900 study reach has been divided pursuant to the SCCWRP criteria described in the Final HMP, dated March 2011. The result is a total of three (3) reaches since the channel has very similar geometry throughout each study reach. In a similar fashion, the Basin 1000 study reach has been divided evenly into two (2) reaches.

Initial Desktop Analysis

Once the domain of analysis is defined, the Final HMP requires an initial desktop analysis to be completed. The required input data for the initial desktop analysis are: contributing area (in square miles), mean annual precipitation (in inches), valley slope, and valley width (in meters). This information was obtained using the project's flown topography, City of San Diego 2-foot contour topography, an aerial photograph, and the Western Regional Climate Center for annual precipitation. The initial desktop analysis for each reach is included in Section E-1 of this Appendix.

Field Screening: Vertical and Lateral Susceptibility

After the initial desktop analysis is completed, a field visit is required to assess the vertical and lateral susceptibility of each channel reach, for each DOA. As part of the field visit, measurements are conducted including: observations or pebble counts to determine d_{50}, measurements of the bank height and bank angles, and assessing bottom widths of the channel. These field observations and measurements are used throughout the channel screening to identify a vertical susceptibility rating and lateral susceptibility rating. These ratings then correlate to a low, medium, or high susceptibility for vertical and lateral susceptibility, which then results in a combined channel susceptibility for each reach.

In order to assess vertical susceptibility rating, a SCCWRP vertical susceptibility flow chart in the Final HMP, dated March 2011, was used as a guide to determine each reach's susceptibility. In regards to the channel bed resistance, "Intermediate Bed" was selected for each reach since the existing channels were well consolidated and vegetated, which is most representative of the "hardpan of uncertain depth" criteria. Since the Intermediate Bed was selected, additional steps were required to determine the vertical rating and susceptibility. In order to determine the vertical rating, three (3) risk factors needed to be evaluated: armoring potential, grade control, and proximity to incision threshold. A letter grade (A = 3, B = 6, and C = 9) was assigned to each risk factor based on the field observations and SCCWRP guidelines. As a result, each reach for Basins 900 and 1000 received the following grades for each risk factor: B for armoring potential, B for grade control and B for proximity to incision threshold. Therefore, with the SCCWRP vertical susceptibility rating equation, each reach in Basins 900 and 1000 receive a rating of 6. Since this rating is between 4.5 and 7, the vertical susceptibility is "medium," as defined by SCCWRP. Please refer to the supporting vertical susceptibility forms for each reach in Section E-1 of this Appendix for more details.

In a similar manner, a SCCWRP lateral susceptibility flow chart in the Final HMP, dated March 2011, was utilized to assess the lateral susceptibility for each reach. Since each study reach was well consolidated and vegetated, according to the SCCWRP Form 5, titled Sequence of Lateral Susceptibility Questions Option, the channels received a "low" for lateral susceptibility based on the fact that both banks were consolidated, and none of the risk factors were present. Please refer to the supporting lateral susceptibility forms for each reach in Section E-1 of this Appendix for more details.

In summary, the vertical susceptibility for the channel reaches downstream of Basins 900 and 1000 are "medium", and the lateral susceptibilities are "low."

San Diego BMP Sizing Calculator Results and Conclusion

The final step of the geomorphic assessment is to determine the channel susceptibility and low flow threshold using the San Diego BMP Sizing Calculator (i.e., "POC" tab). The required input data in the San Diego BMP Sizing Calculator are watershed area, vertical susceptibility, lateral susceptibility, channel bed material, channel top width, channel bottom width, channel height, and channel slope. The San Diego BMP Sizing Calculator output, including the supporting SCCWRP channel screening results, is included in Section E-1 of this Appendix. The information is organized for Basin 900 (Reaches 1, 2, and 3) and Basin 1000 (Reaches 3 and 4). The San Diego BMP Sizing Calculator identified "medium" channel susceptibility with $0.3Q_2$ for each reach within Basin 900 and 1000. Therefore, the SCCWRP channel screening analyses and the San Diego BMP Sizing Calculator show that the HMP analyses for Basins 900 and 1000 can be modeled using $0.3Q_2$. This result is consistent with previous general assessments that these downstream reaches had 'medium' susceptibility to erosion.

In response to the Final HMP criteria, the results of the 0.3Q2 threshold have been used to prepare HMP analyses for Basins 900 and 1000 to meet Final HMP criteria prior to the project discharge at each outfall location. Refer the HMP analyses for additional detailed information regarding the modeling and design solutions implemented to meet the Final HMP criteria.

Geomorphic Assessment Attachments

The following sections of this geomorphic assessment provide backup information, as follows:

Section E-1: Geomorphic Assessment Results

Section E-2: Geomorphic Assessment Exhibits

Section E-3: Field Photographs

SECTION E-1

Geomorphic Assessment Results

For

Reach 1, 2, 3, and 4

The Package Includes:

- San Diego BMP Sizing Calculator Results

(for Low Flow Threshold Only)

- Initial Desktop Analysis Results

- SCCWRP Vertical Susceptibility Results

- SCCWRP Lateral Susceptibility Results

- SCCWRP Probability of Mass Wasting Results

S.CA Hydromodification Screening Tool version 1.0

user: edelval@rickengineering.com

stream: **Reach 1 - Channel Upstream of Point of Connection 1**

latitude (decimal degrees): 32.9960

longitude (decimal degrees): -117.11

FORM 1: INITIAL DESKTOP ANALYSIS

GIS metrics and screening indices (for detailed instructions/examples see 'Field Screening Companion Document')

Symbol	Variable	units	Value	Description & Source
A	Drainage Area	mi^2	0.77	contributing drainage area to screening location via *published HUCs and/or 30-m (or better) National Elevation Data (NED), USGS seamless server*
P	Mean annual precipitation	inches	13.24	area-weighted annual precipitation via *USGS delineated polygons using records from 1900 to 1960 (which was more significant in hydrologic models than polygons delineated from shorter record lengths)*
S_v	Valley slope	m/m	0.03	valley slope at site *via NED, measured over a relatively homogeneous valley segment as indicated by slope, hillslope coupling/confinement, valley alignment, confluences, etc., over a distance of up to ~500 meters or 10% of the main-channel length (whatever is smaller)*
W_v	Valley width	meters	21	valley bottom width at site *between natural valley walls as dictated by clear breaks in hillslope on NED raster, irrespective of potential armoring from floodplain encroachement, levees, etc. (Imprecise measurements have negligible effect on rating in wide valleys where VWI >>2, as defined in lateral decision tree)*
Q_{10cfs}	10-year peak flow, US units	ft^3/s	106	$Q_{10cfs} = 18.2 * A^{0.87} * P^{0.77}$ *(Hawley and Bledsoe, In review)*
Q_{10}	10-year peak flow	m^3/s	3.00	$Q_{10} = 0.0283 * Q_{10cfs}$
INDEX	10-year mobility index	$m^{1.5}/s^{0.5}$	0.052	$INDEX = S_v * Q_{10}^{0.5}$
W_{ref}	Reference width	meters	11.31	$W_{ref} = 6.99 * Q_{10}^{0.438}$
VWI	Valley width index	m/m	1.86	$VWI = W_v / W_{ref}$

S.CA Hydromodification Screening Tool version 1.0

user: edelval@rickengineering.com stream: Reach 1 - Change Upstream of Point of Connection 1

latitude: 32.9960

longitude: -117.11

FORM 3: PEBBLE COUNT & MOBILITY INDEX THRESHOLD

Pebble Count

Count	Station	d (mm)
1	0	128
2	1	45
3	2	32
4	3	32
5	4	32
6	5	22.6
7	6	32
8	7	22.6
9	8	32
10	9	22.6
11	9	16
12	8	22.6
13	7	32
14	6	22.6
15	5	22.6
16	4	32
17	3	16
18	2	32
19	1	22.6
20	0	16
21	0	2
22	1	5.6
23	2	22.6
24	3	4
25	4	5.6
26	5	2
27	6	8
28	7	2
29	8	16
30	9	16
31	9	45
32	8	16
33	7	2
34	6	16
35	5	2
36	4	16
37	3	5.6
38	2	5.6
39	1	4
40	0	4
41	0	4
42	1	2
43	2	2
44	3	2
45	4	22.6
46	5	22.6
47	6	11
48	7	16
49	8	16
50	9	16
51	9	11

*If it is necessary to estimate d50, perform a pebble count using a minimum of 100 particles with a standard phi template or by measuring along the intermediate axis of each pebble. Use a grid and tape for systematic/complete transects across riffle sections (i.e. if the 100th particle is in the middle of a transect, complete the full transect before stopping the count). If fines (sand/silt) are less than ½-inch thick (~ one finger width) at point of sample, it is appropriate to sample the coarser buried substrate; otherwise record an observation of fines (i.e. ≤2 mm, **recorded in spreadsheet as 2 mm**). Take photographs to support the results.*

total particles	d_{50} (mm)	%sand
100	16	11%

mobility index $S_vQ_{10}^{0.5}$ ($m^{1.5}/s^{0.5}$)	mobility index corresponding to 50% risk for d_{50}	Incision/ Braiding Risk
0.052	0.049	>50%

Pebble count data in the table on the left are example data for illustrative purposes only. You must replace these data with actual pebble count data from your field site. Once populated the pebble count results will be used to automatically populate fields on Form 2 and Form 4.

52	8	11
53	7	11
54	6	11
55	5	11
56	4	8
57	3	8
58	2	16
59	1	8
60	0	11
61	0	16
62	1	11
63	2	11
64	3	11
65	4	32
66	5	16
67	6	22.6
68	7	22.6
69	8	32
70	9	11
71	9	11
72	8	11
73	7	16
74	6	16
75	5	2
76	4	16
77	3	11
78	2	11
79	1	22.6
80	0	32
81	0	32
82	1	22.6
83	2	22.6
84	3	22.6
85	4	2
86	5	16
87	6	16
88	7	22.6
89	8	16
90	9	16
91	9	16
92	8	16
93	7	11
94	6	8
95	5	8
96	4	5.6
97	3	45
98	2	22.6
99	1	11
100	0	2
101		
102		
103		
104		
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119		

REACH 1

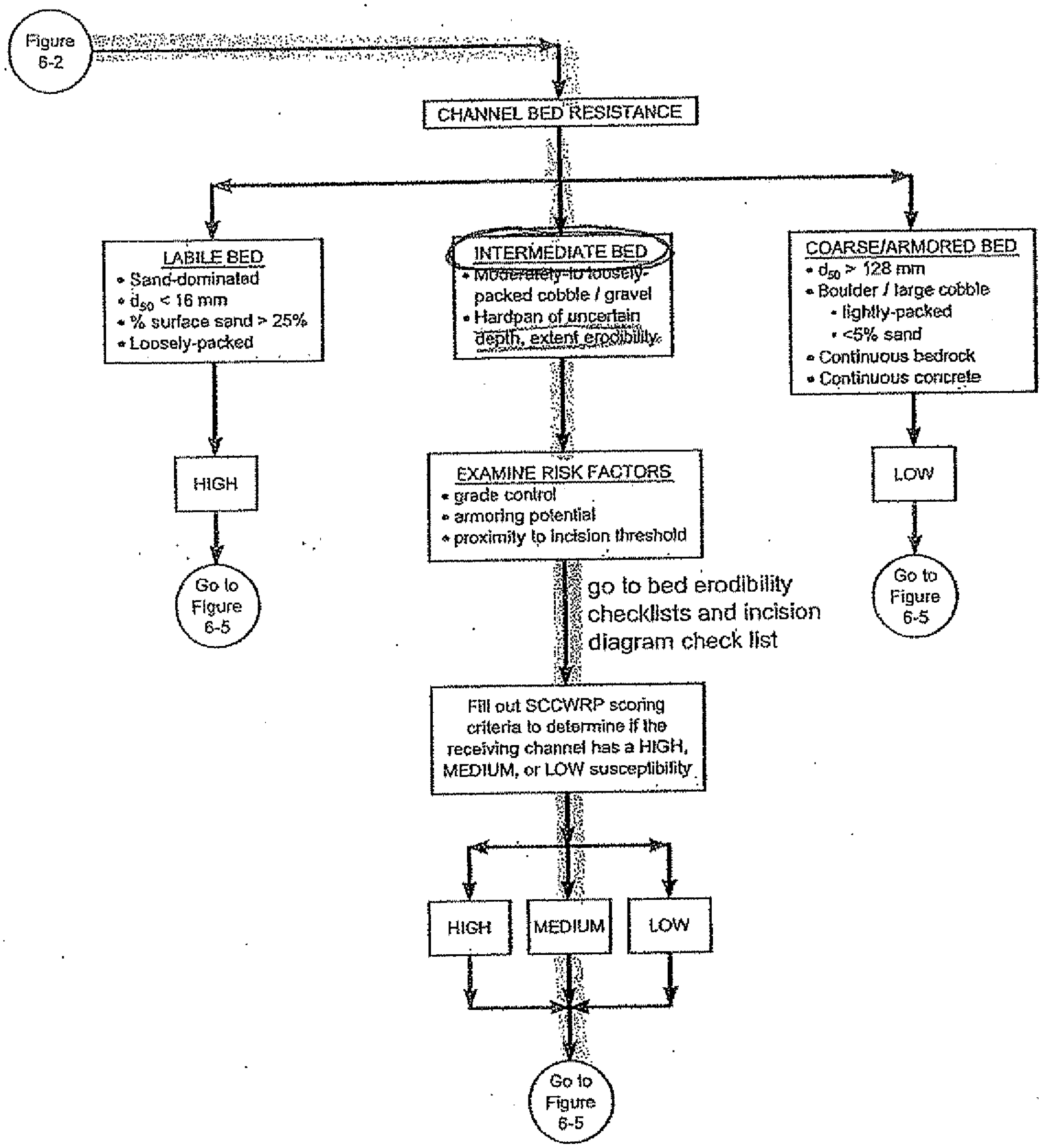


Figure 6-4. SCCWRP Vertical Susceptibility

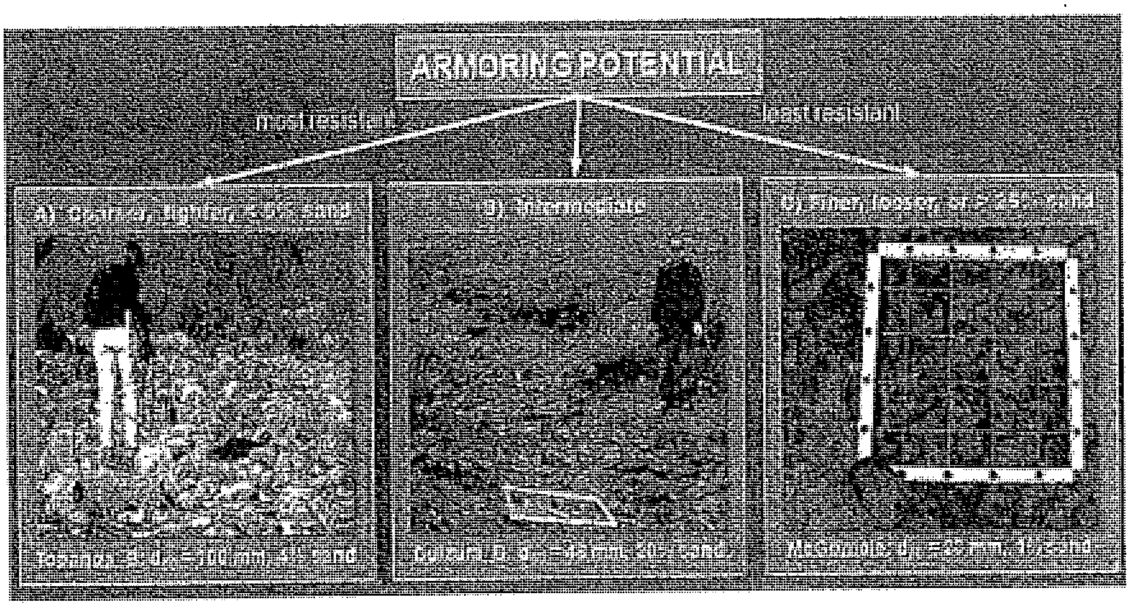
REACH 1

Form 3 Support Materials

Form 3 Checklists 1 and 2, along with information recording in Form 3 Table 1, are intended to support the decisions pathways illustrated in Form 3 Overall Vertical Rating for Intermediate/Transitional Bed.

Form 3 Checklist 1: Armoring Potential

☐	A	A mix of coarse gravels and cobbles that are tightly packed with <5% surface material of diameter <2 mm
X	B	Intermediate to A and C or hardpan of unknown resistance, spatial extent (longitudinal and depth), or unknown armoring potential due to surface veneer covering gravel or coarser layer encountered with probe
☐	C	Gravels/cobbles that are loosely packed or >25% surface material of diameter <2 mm



Form 3 Figure 2. Armoring potential photographic supplement for assessing intermediate beds ($16 < d_{50} < 128$ mm) to be used in conjunction with Form 3 Checklist 1.

ARMORING POTENTIAL NUMERIC VALUE:
B = 6

(Sheet 2 of 4)

Figure 7. Continued

REACH 1

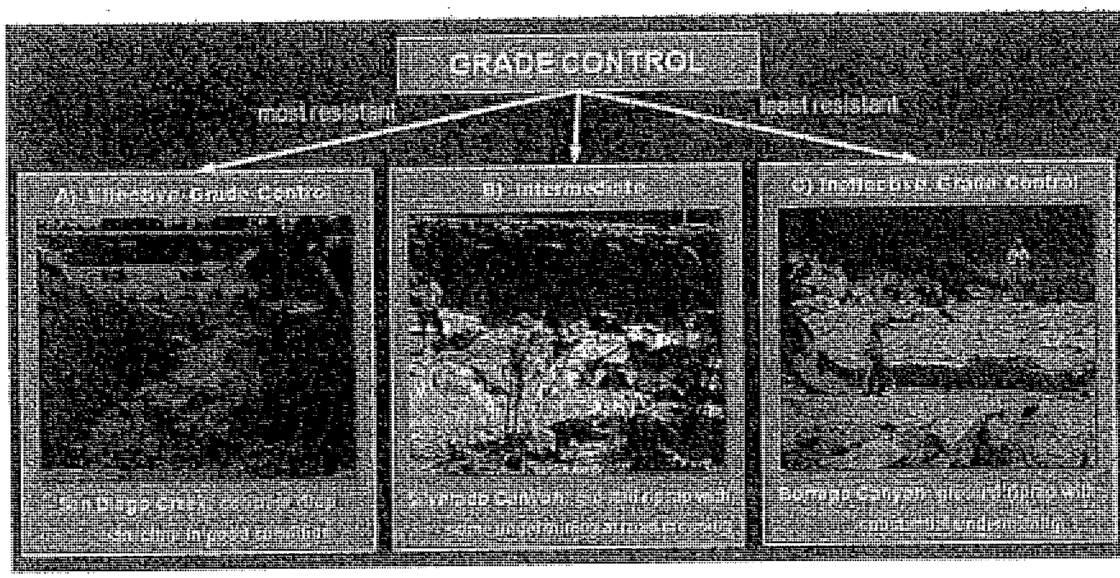
Form 3 Checklist 2: Grade Control

□ A Grade control is present with spacing <50 m or $2/S_v$ m

- No evidence of failure/ineffectiveness, e.g., no headcutting (>30 cm), no active mass wasting (analyst cannot say grade control sufficient if mass-wasting checklist indicates presence of bank failure), no exposed bridge pilings, no culverts/structures undermined
- Hard points in serviceable condition at decadal time scale, e.g., no apparent undermining, flanking, failing grout
- If geologic grade control, rock should be resistant igneous and/or metamorphic; For sedimentary/hardpan to be classified as 'grade control', it should be of demonstrable strength as indicated by field testing such as hammer test/borings and/or inspected by appropriate stakeholder

X B Intermediate to A and C – artificial or geologic grade control present but spaced 2/Sv m to 4/Sv m or potential evidence of failure or hardpan of uncertain resistance

□ C Grade control absent, spaced >100 m or $>4/S_v$ m, or clear evidence of ineffectiveness



Form 3 Figure 3. Grade-control (condition) photographic supplement for assessing intermediate beds (16 < d_{50} < 128 mm) to be used in conjunction with Form 3 Checklist 2.

(Sheet 3 of 4)

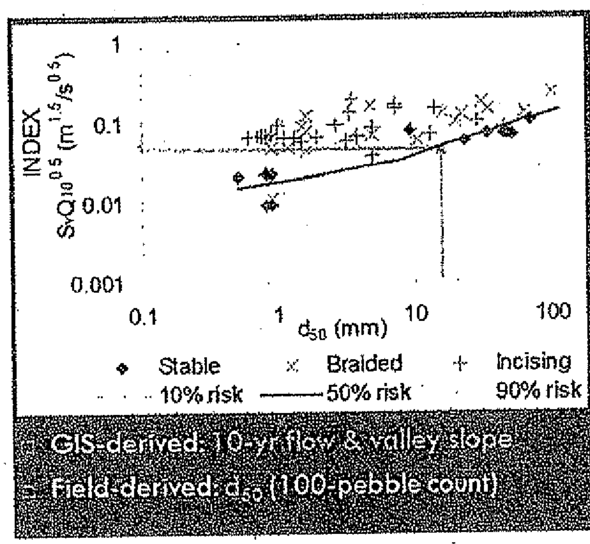
GRADE CONTROL NUMERIC VALUE : B = 6

Figure 7. Continued

Reach 1

Regionally-calibrated Screening Index Threshold for Incising/Braiding

For transitional bed channels (d_{50} between 16 and 128 mm) or labile beds (channel not incised past critical bank height), use Form 3 Figure 3 to determine Screening Index Score and complete Form 3 Table 1.



	[illegible]	[illegible]
Logistic Regression, $d_{50} \geq 16$ mm	128	0.145
	96	0.125
	80	0.114
	64	0.101
	48	0.087
	32	0.070
	16	0.049
	8	0.031
Logistic Reg. $d_{50} < 16$ mm	4	0.026
	2	0.022
	1	0.018
	0.5	0.015

Form 3 Figure 4. Probability of incising/braiding based on logistic regression of Screening Index and d_{50} to be used in conjunction with Form 3 Table 1.

Form 3 Table 1. Values for Screening Index Threshold (probability of incising/braiding) to be used in conjunction with Form 3 Figure 4 (above) to complete Form 3 Overall Vertical Rating for Intermediate/Transitional Bed (below). Screening Index Score: A = <50% probability of incision for current Q_{10}, valley slope, and d_{50}; B = Hardpan/d_{50} indeterminate; and C = ≥50% probability of incising/braiding for current Q_{10}, valley slope, and d_{50}.

d_{50} (mm) *From Form 2*	$S_v{}^*Q_{10}^{0.5}$ ($m^{1.5}/s^{0.5}$) *From Form 1*	$S_v{}^*Q_{10}^{0.5}$ ($m^{1.5}/s^{0.5}$) *50% risk of incising/braiding from table in Form 3 Figure 3 above*	Screening Index Score (A, (B), C)
			B = 6

Overall Vertical Rating for Intermediate/Transitional Bed

Calculate the overall Vertical Rating for Transitional Bed channels using the formula below. Numeric values for responses to Form 3 Checklists and Table 1 as follows: A = 3, B = 6, C = 9.

$$Vertical\ Rating = \sqrt{\{(\sqrt{armoring \times grade\ control}) \times screening\ index\ score\}}$$

Vertical Susceptibility based on Vertical Rating: <4.5 = LOW; 4.5 to 7 = MEDIUM; and >7 = HIGH.

(Sheet 4 of 4)

Figure 7. Continued Vertical Rating = ...

= 6

∴ Vertical Susceptibility Medium

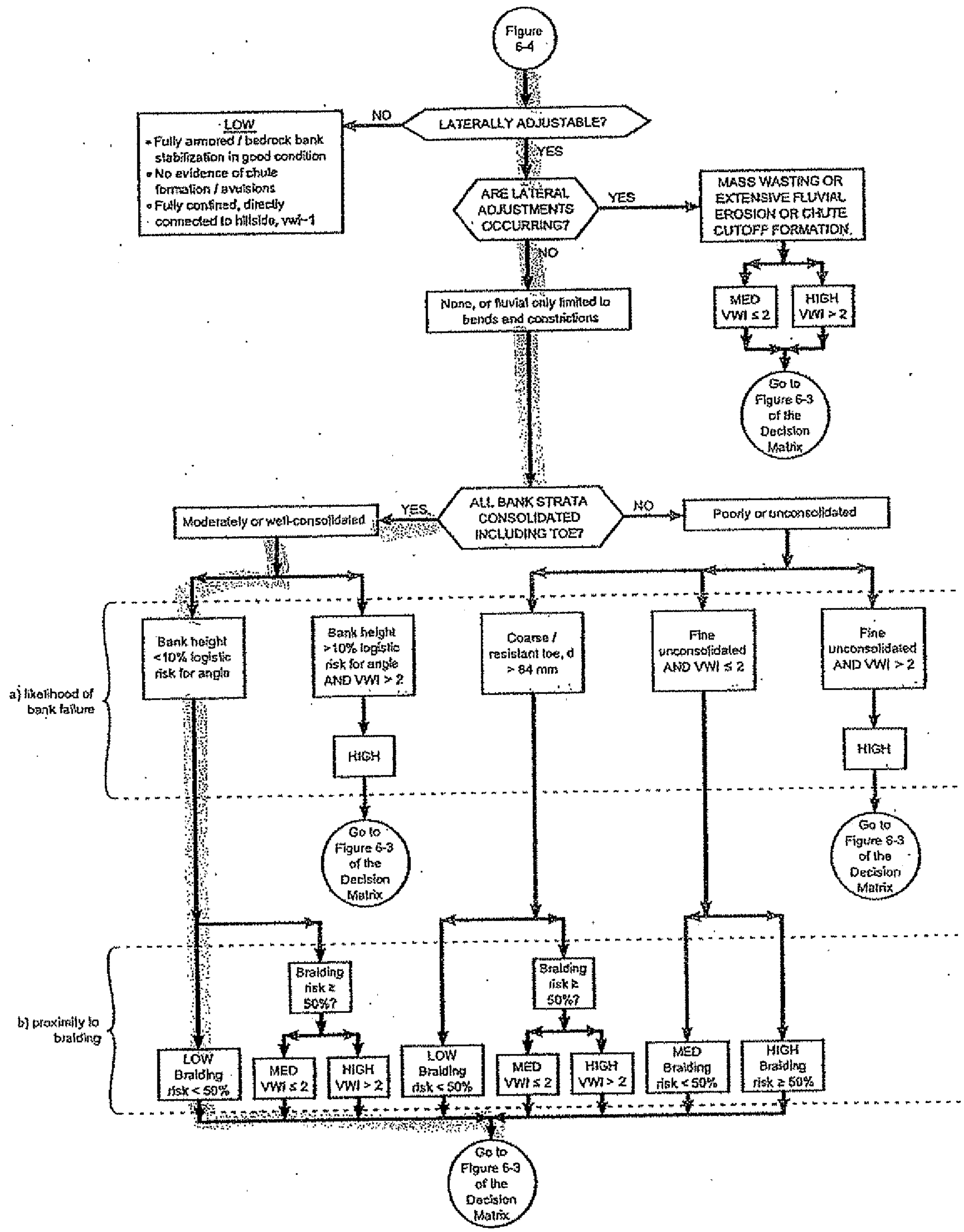
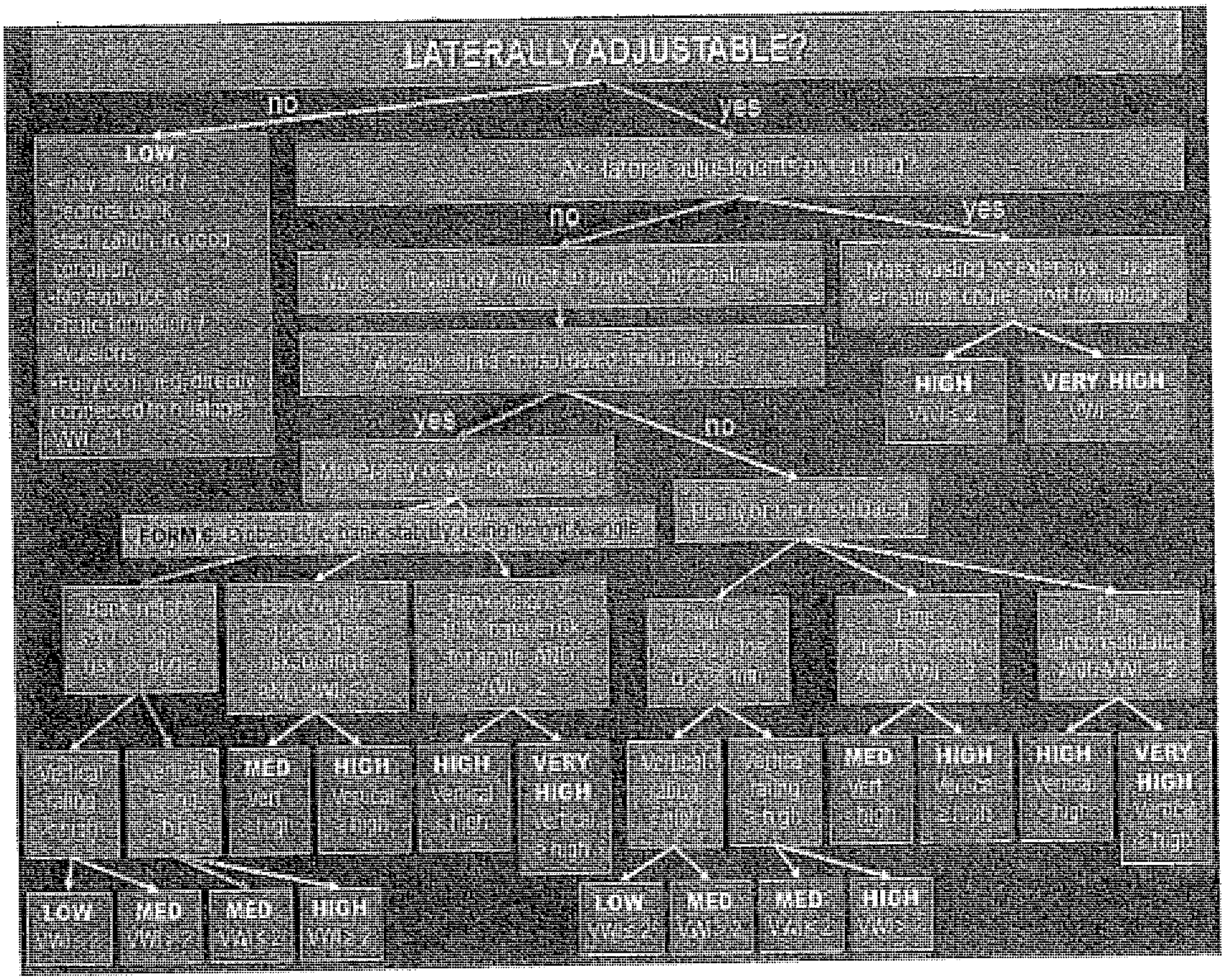


Figure 6-5. Lateral Channel Susceptibility

FORM 4: LATERAL SUSCEPTIBILTY FIELD SHEET

Circle appropriate nodes/pathway for proposed site
OR use sequence of questions provided in Form 5.



(Sheet 1 of 1)

Figure 12. Form 4: Lateral Susceptibility Field Sheet. Complete set of assessment forms in Appendix B.

Reach 1

FORM 5: SEQUENCE OF LATERAL SUSCEPTIBILITY QUESTIONS OPTION

Enter Lateral Susceptibility (Very High, High, Medium, Low) in shaded column.
Mass wasting and bank instability from Form 6, VWI from Form 4, and Vertical Rating from Form 3.

			Lateral Susceptibility
[illegible]	If YES: [illegible] LOW		
If NO: Is there [illegible] mass wasting [illegible]	If YES: VWI ≤ 2 = HIGH; VWI > 2 = VERY HIGH		
If NO: Are both banks [illegible]	If YES: How many risk factors present? Risk Factors: Bank instability [illegible]; VWI > 2; Vertical rating ≥ High	• All three = VERY HIGH • Two of three = HIGH • One of three = MEDIUM • None = LOW	LOW
If NO: Are banks either consolidated or unconsolidated with coarse [illegible]	If YES: How many risk factors present? Risk Factors: VWI [illegible]; Vertical rating ≥ High	• Two = HIGH • One = MEDIUM • None = LOW	
If NO: At least one bank is unconsolidated with [illegible] < 64 mm	How many risk factors present? Risk Factors: VWI > 2; Vertical rating ≥ High	• Two = VERY HIGH • One = HIGH • None = MEDIUM	

(Sheet 1 of 1)

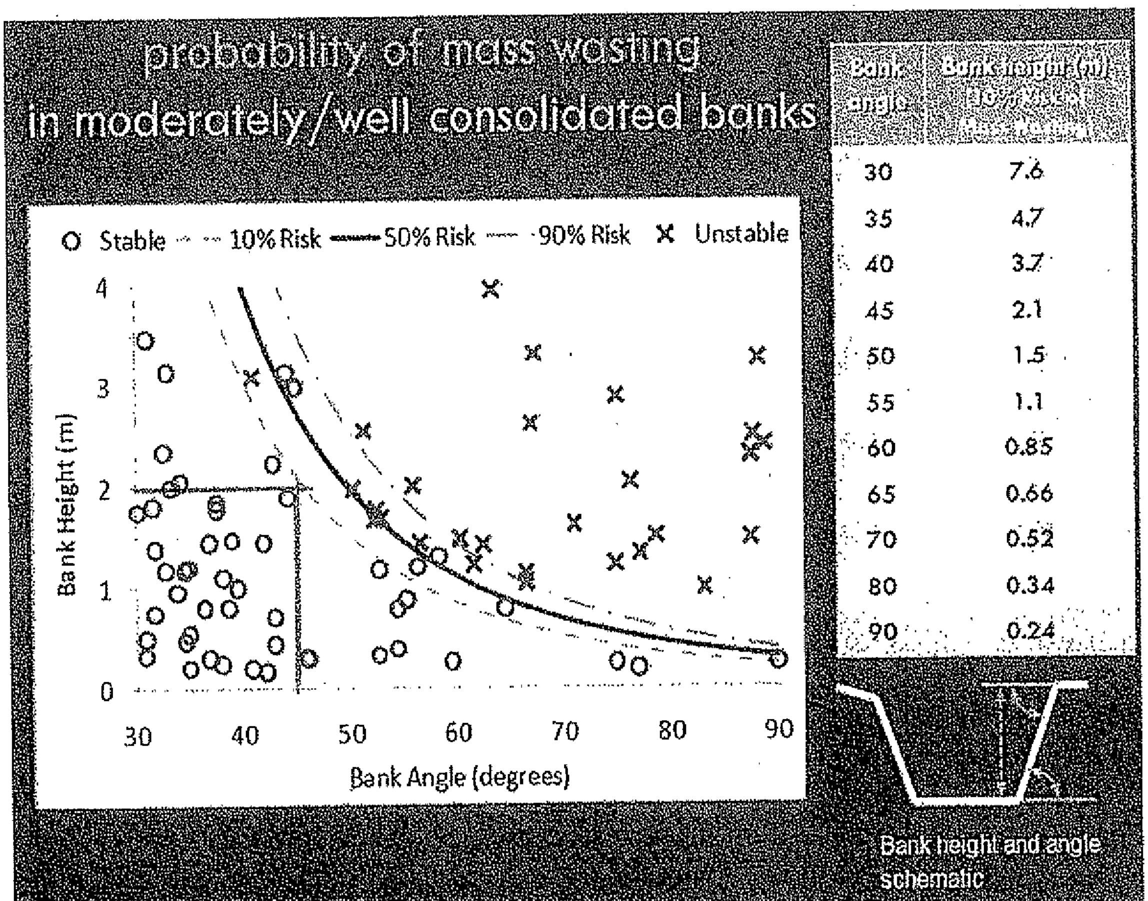
Figure 13. Form 5: Sequence of Lateral Questions Option for lateral susceptibility assessment. Complete set of assessment forms in Appendix B.

REACH 1

FORM 6: PROBABILITY OF MASS WASTING BANK FAILURE

If mass wasting is not currently extensive and the banks are moderately- to well-consolidated, measure bank height and angle at several locations (i.e., at least three locations that capture the range of conditions present in the study reach) to estimate representative values for the reach. Use Form 6 Figure 1 below to determine if risk of bank failure is >10% and complete Form 6 Table 1. Support your results with photographs that include a protractor/rod/tape/person for scale.

	Bank Angle (degrees) *(from Field)*	**Bank Height (m)** *(from Field)*	**Corresponding Bank Height for 10% Risk of Mass Wasting (m)** *(from Form 6 Figure 1 below)*	**Bank Failure Risk** *(<10% Risk)* *(>10% Risk)*
Left Bank	45°	2.0	2.1	<10%
Right Bank	45°	2.0	2.1	<10%



Bank angle	Bank height (m) [illegible]
30	7.6
35	4.7
40	3.7
45	2.1
50	1.5
55	1.1
60	0.85
65	0.66
70	0.52
80	0.34
90	0.24

Form 6 Figure 1. Probability Mass Wasting diagram, Bank Angle:Height/% Risk table, and Band Height:Angle schematic.

(Sheet 1 of 1)

Figure 14. Form 6: Probability of Mass Wasting Bank Failure for lateral susceptibility assessment. Complete set of assessment forms in Appendix B.

S.CA Hydromodification Screening Tool version 1.0

user: edelval@rickengineering.com

stream: Reach 2 - Channel Downstream of Point of Connection 1

latitude (decimal degrees): 32.9980

longitude (decimal degrees): -117.112

FORM 1: INITIAL DESKTOP ANALYSIS

GIS metrics and screening indices (for detailed instructions/examples see 'Field Screening Companion Document')

Symbol	Variable	units	Value	Description & Source
A	Drainage Area	mi^2	1.045	contributing drainage area to screening location via *published HUCs and/or 30-m (or better) National Elevation Data (NED), USGS seamless server*
P	Mean annual precipitation	inches	13.24	area-weighted annual precipitation via *USGS delineated polygons using records from 1900 to 1960 (which was more significant in hydrologic models than polygons delineated from shorter record lengths)*
S_v	Valley slope	m/m	0.028	valley slope at site *via NED, measured over a relatively homogeneous valley segment as indicated by slope, hillslope coupling/confinement, valley alignment, confluences, etc., over a distance of up to ~500 meters or 10% of the main-channel length (whatever is smaller)*
W_v	Valley width	meters	24.7	valley bottom width at site *between natural valley walls as dictated by clear breaks in hillslope on NED raster, irrespective of potential armoring from floodplain encroachement, levees, etc. (imprecise measurements have negligible effect on rating in wide valleys where VWI >>2, as defined in lateral decision tree)*
Q_{10cfs}	10-year peak flow, US units	ft^3/s	138	$Q_{10cfs} = 18.2 * A^{0.87} * P^{0.77}$ *(Hawley and Bledsoe, in review)*
Q_{10}	10-year peak flow	m^3/s	3.91	$Q_{10} = 0.0283 * Q_{10cfs}$
INDEX	10-year mobility index	$m^{1.5}/s^{0.5}$	0.055	$INDEX = S_v * Q_{10}^{0.5}$
W_{ref}	Reference width	meters	12.70	$W_{ref} = 6.99 * Q_{10}^{0.438}$
VWI	Valley width index	m/m	1.94	$VWI = W_v / W_{ref}$

user: edelval@rickengineering.com

stream: Reach 2: Channel Downstream of Point of Connection 1

latitude: 32.9980

longitude: -117.112

FORM 3: PEBBLE COUNT & MOBILITY INDEX THRESHOLD

Pebble Count

Count	Station	d (mm)
1	0	2
2	1	2
3	2	2
4	3	2
5	4	2
6	5	2
7	6	2
8	7	2
9	8	2
10	9	2
11	9	2
12	8	2
13	7	2
14	6	2
15	5	2
16	4	2
17	3	2
18	2	2
19	1	2
20	0	2
21	0	2
22	1	2
23	2	2
24	3	2
25	4	2
26	5	2
27	6	2
28	7	2
29	8	2
30	9	2
31	9	2
32	8	2
33	7	2
34	6	2
35	5	2
36	4	2
37	3	2
38	2	2
39	1	2
40	0	2
41	0	2
42	1	2
43	2	2
44	3	2
45	4	2
46	5	2
47	6	2
48	7	2
49	8	2
50	9	2
51	9	2

If it is necessary to estimate d50, perform a pebble count using a minimum of 100 particles with a standard phi template or by measuring along the intermediate axis of each pebble. Use a grid and tape for systematic/complete transects across riffle sections (i.e. if the 100th particle is in the middle of a transect, complete the full transect before stopping the count). If fines (sand/silt) are less than ½-inch thick (~ one finger width) at point of sample, it is appropriate to sample the coarser buried substrate; otherwise record an observation of fines (i.e. ≤2 mm, recorded in spreadsheet as 2 mm). Take photographs to support the results.

total particles	d_{50} (mm)	%sand
100	2	100%

mobility index $S_v Q_{10}^{0.5}$ ($m^{1.5}/s^{0.5}$)	mobility index corresponding to 50% risk for d_{50}	Incision/ Braiding Risk
0.0554	0.022	>50%

Pebble count data in the table on the left are example data for illustrative purposes only. You must replace these data with actual pebble count data from your field site. Once populated the pebble count results will be used to automatically populate fields on Form 2 and Form 4.

52	8	2
53	7	2
54	6	2
55	5	2
56	4	2
57	3	2
58	2	2
59	1	2
60	0	2
61	0	2
62	1	2
63	2	2
64	3	2
65	4	2
66	5	2
67	6	2
68	7	2
69	8	2
70	9	2
71	9	2
72	8	2
73	7	2
74	6	2
75	5	2
76	4	2
77	3	2
78	2	2
79	1	2
80	0	2
81	0	2
82	1	2
83	2	2
84	3	2
85	4	2
86	5	2
87	6	2
88	7	2
89	8	2
90	9	2
91	9	2
92	8	2
93	7	2
94	6	2
95	5	2
96	4	2
97	3	2
98	2	2
99	1	2
100	0	2
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Reach 2

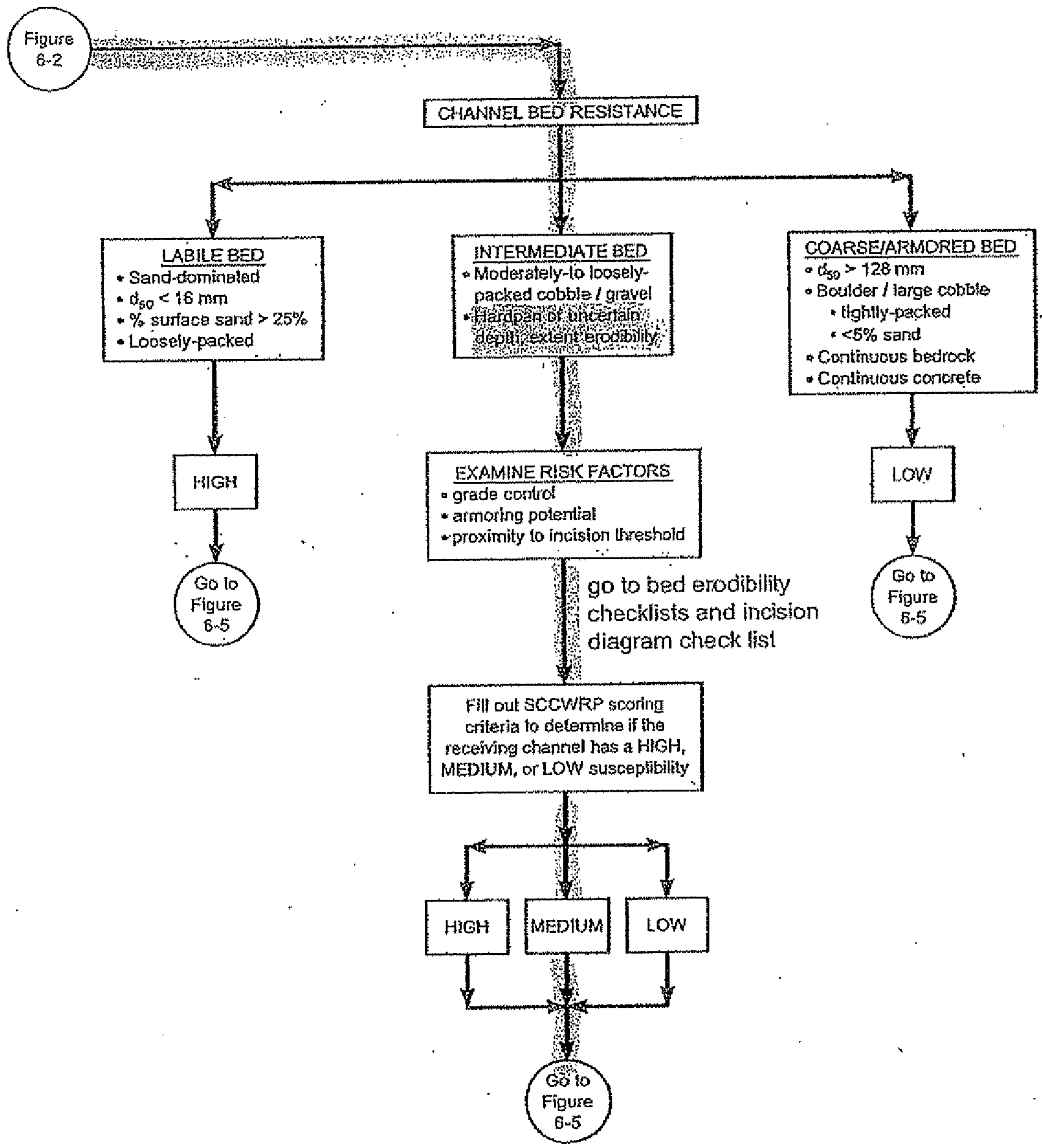


Figure 6-4. SCCWRP Vertical Susceptibility

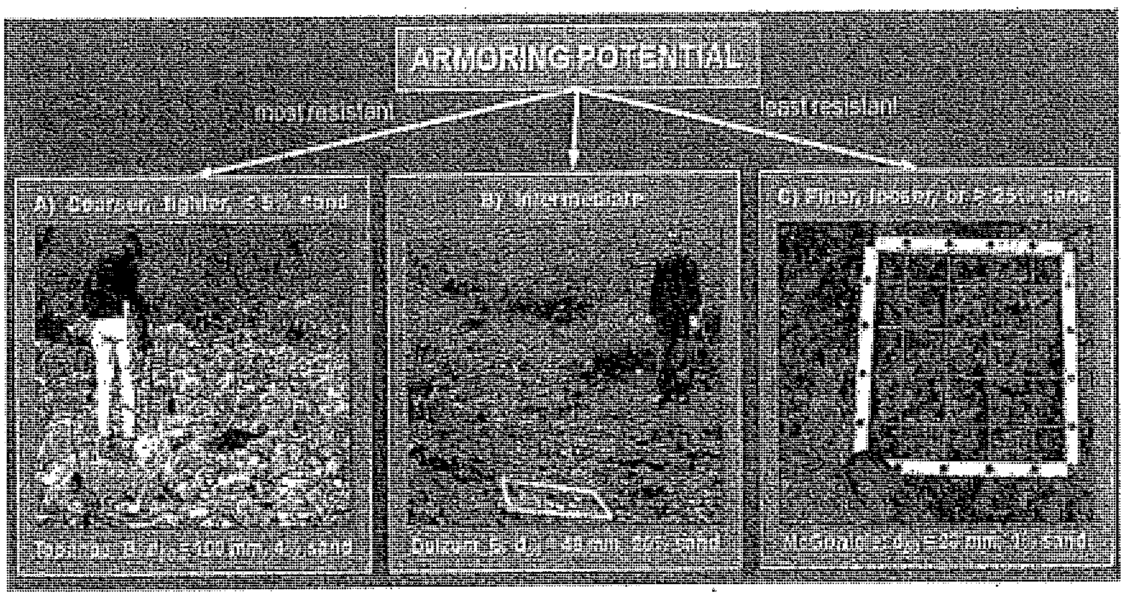
Reach 2

Form 3 Support Materials

Form 3 Checklists 1 and 2, along with information recording in Form 3 Table 1, are intended to support the decisions pathways illustrated in Form 3 Overall Vertical Rating for Intermediate/Transitional Bed.

Form 3 Checklist 1: Armoring Potential

☐	A	A mix of coarse gravels and cobbles that are tightly packed with <5% surface material of diameter <2 mm
☑	B	Intermediate to A and C or hardpan of unknown resistance, spatial extent (longitudinal and depth), or unknown armoring potential due to surface veneer covering gravel or coarser layer encountered with probe
☐	C	Gravels/cobbles that are loosely packed or >25% surface material of diameter <2 mm



Form 3 Figure 2. Armoring potential photographic supplement for assessing intermediate beds ($16 < d_{50} < 128$ mm) to be used in conjunction with Form 3 Checklist 1.

Armoring Potential Numeric Value ?

B = 6

(Sheet 2 of 4)

Figure 7. Continued

Reach 2

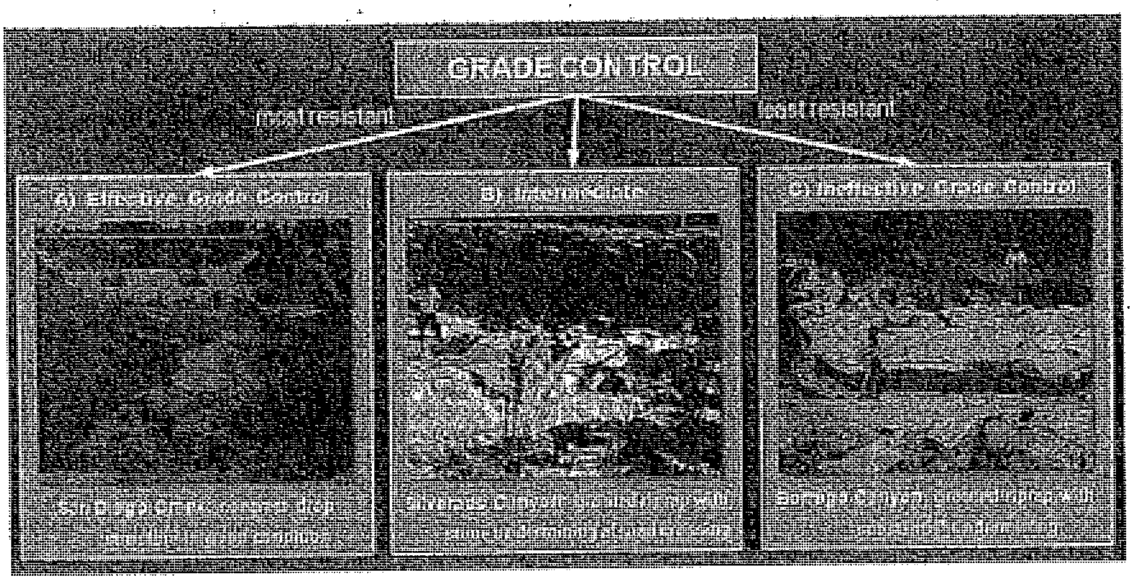
Form 3 Checklist 2: Grade Control

☐ A — Grade control is present with spacing <50 m or $2/S_v$ m

- No evidence of failure/ineffectiveness, e.g., no headcutting (>30 cm), no active mass wasting (analyst cannot say grade control sufficient if mass-wasting checklist indicates presence of bank failure), no exposed bridge pilings, no culverts/structures undermined
- Hard points in serviceable condition at decadal time scale, e.g., no apparent undermining, flanking, failing grout
- If geologic grade control, rock should be resistant igneous and/or metamorphic; For sedimentary/hardpan to be classified as 'grade control', it should be of demonstrable strength as indicated by field testing such as hammer test/borings and/or inspected by appropriate stakeholder

☒ B — Intermediate to A and C – artificial or geologic grade control present but spaced 2/Sv m to 4/Sv m or potential evidence of failure or hardpan of uncertain resistance

☐ C — Grade control absent, spaced >100 m or $>4/S_v$ m, or clear evidence of ineffectiveness



Form 3 Figure 3. Grade-control (condition) photographic supplement for assessing intermediate beds ($16 < d_{50} < 128$ mm) to be used in conjunction with Form 3 Checklist 2.

(Sheet 3 of 4)

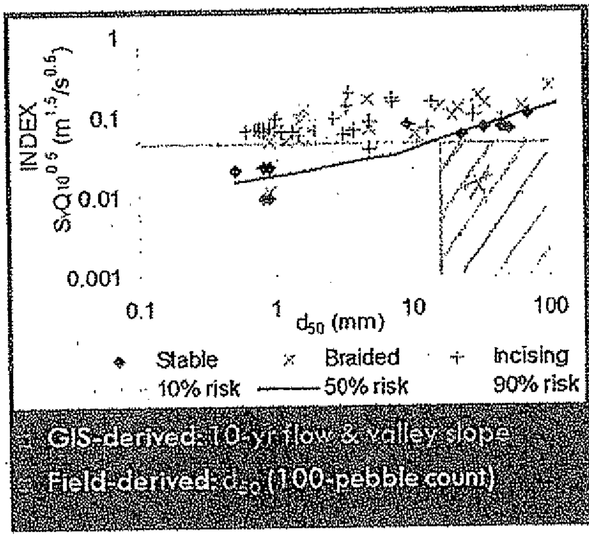
Figure 7. Continued

Grade Control: B = 6

* During the field inspection, the bed of channel reach 3 was determined to consist of hardpan of unknown depth. Therefore, the d_{50} should be considered between [illegible] and [illegible], as seen for an intermediate bed. ∴ Incision/Braiding value = B

Regionally-calibrated Screening Index Threshold for Incising/Braiding

For transitional bed channels (d_{50} between 16 and 128 mm) or labile beds (channel not incised past critical bank height), use Form 3 Figure 3 to determine Screening Index Score and complete Form 3 Table 1.



Logistic Regression d_{50} ≥ 16 mm	128	0.145
	96	0.125
	80	0.114
	64	0.101
	48	0.087
	32	0.070
	16	0.049
Logistic Reg. d_{50} < 16 mm	8	0.031
	4	0.026
	2	0.022
	1	0.018
	0.5	0.015

Form 3 Figure 4. Probability of incising/braiding based on logistic regression of Screening Index and d_{50} to be used in conjunction with Form 3 Table 1.

Form 3 Table 1. Values for Screening Index Threshold (probability of incising/braiding) to be used in conjunction with Form 3 Figure 4 (above) to complete Form 3 Overall Vertical Rating for Intermediate/Transitional Bed (below).. Screening Index Score: A = <50% probability of incision for current Q_{10}, valley slope, and d_{50}; B = Hardpan/d_{50} indeterminate; and C = ≥50% probability of incising/braiding for current Q_{10}, valley slope, and d_{50}.

d_{50} (mm) *From Form 2*	$S_v{}^*Q_{10}^{0.5}$ ($m^{1.5}/s^{0.5}$) *From Form 1*	$S_v{}^*Q_{10}^{0.5}$ ($m^{1.5}/s^{0.5}$) *50% risk of incising/braiding from table in Form 3 Figure 3 above*	Screening Index Score (A, B, C)

Overall Vertical Rating for Intermediate/Transitional Bed

Calculate the overall Vertical Rating for Transitional Bed channels using the formula below. Numeric values for responses to Form 3 Checklists and Table 1 as follows: A = 3, B = 6, C = 9.

$$Vertical\ Rating = \sqrt{\left\{\left(\sqrt{armoring \times grade\ control}\right) \times screening\ index\ score\right\}}$$

Vertical Susceptibility based on Vertical Rating: <4.5 = LOW; 4.5 to 7 = MEDIUM; and >7 = HIGH.

(Sheet 4 of 4)

Figure 7. Continued VR $\sqrt{((3 \times 6) \times 6)}$ ≈ 6

∴ Medium

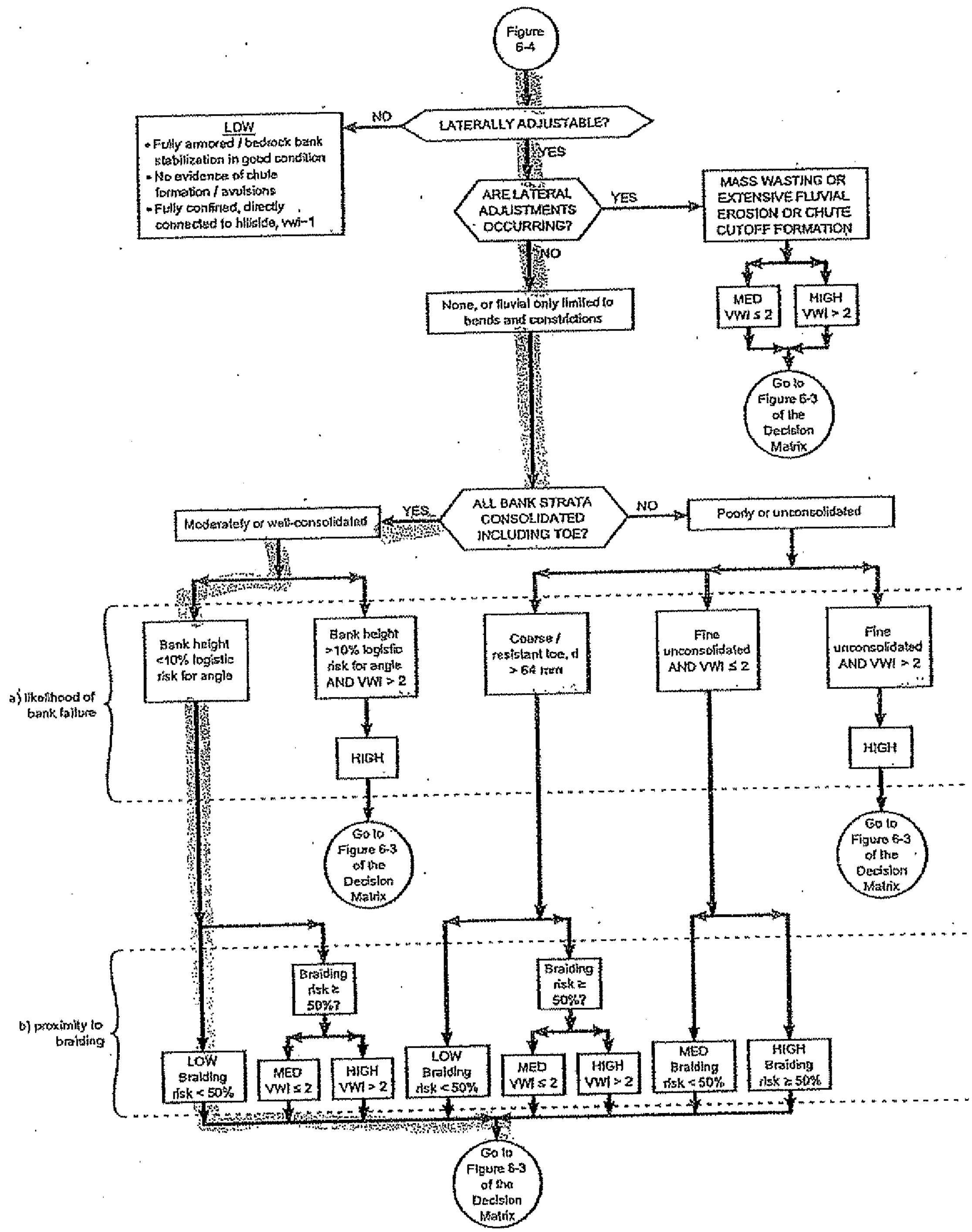
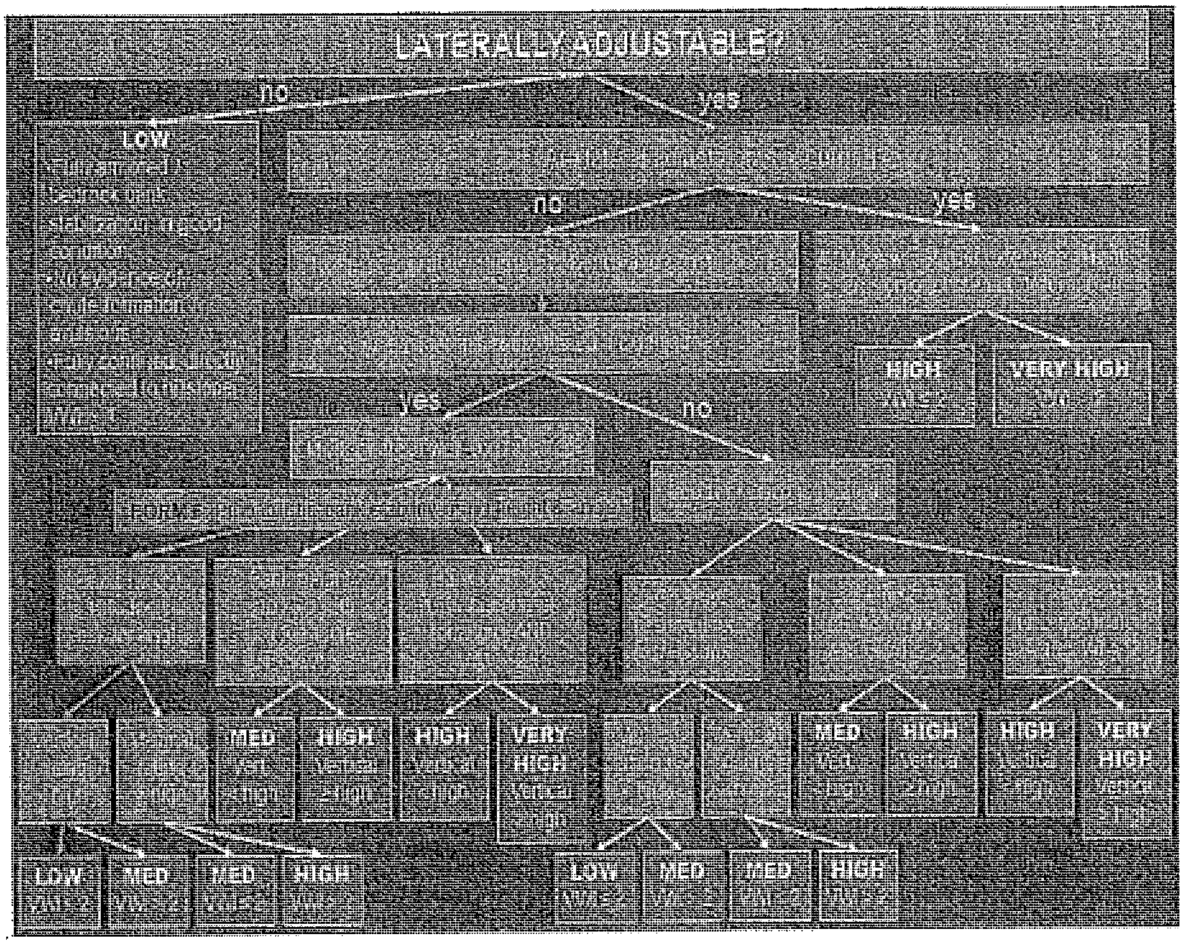


Figure 6-5. Lateral Channel Susceptibility

Reach 2

FORM 4: LATERAL SUSCEPTIBILTY FIELD SHEET

Circle appropriate nodes/pathway for proposed site
OR use sequence of questions provided in Form 5.



(Sheet 1 of 1)

Figure 12. Form 4: Lateral Susceptibility Field Sheet. Complete set of assessment forms in Appendix B.

KEACH

FORM 5: SEQUENCE OF LATERAL SUSCEPTIBILITY QUESTIONS OPTION

Enter Lateral Susceptibility (Very High, High, Medium, Low) in shaded column.
Mass wasting and bank instability from Form 6, VWI from Form 4, and Vertical Rating from Form 3.

			Lateral Susceptibility
[illegible]	If YES, then Low		
If NO, is there active mass wasting [illegible]	If YES, VWI < 2 = HIGH; VWI > 2 = VERY HIGH		
If NO, [illegible]	If YES, How many risk factors present? Risk Factors: o Bank instability [illegible]; o VWI > 2; o Vertical rating = High	• All three = VERY HIGH • Two of three = HIGH • One of three = MEDIUM • None = LOW	[illegible]
If NO, [illegible]	If YES, How many risk factors present? Risk Factors: o VWI > 2; o Vertical rating = High	• Two = HIGH • One = MEDIUM • None = LOW	
If NO, At least one bank is unconsolidated with d_{50} < 64 mm	How many risk factors present? Risk Factors: o VWI > 2; o Vertical rating = High	• Two = VERY HIGH • One = HIGH • None = MEDIUM	

(Sheet 1 of 1)

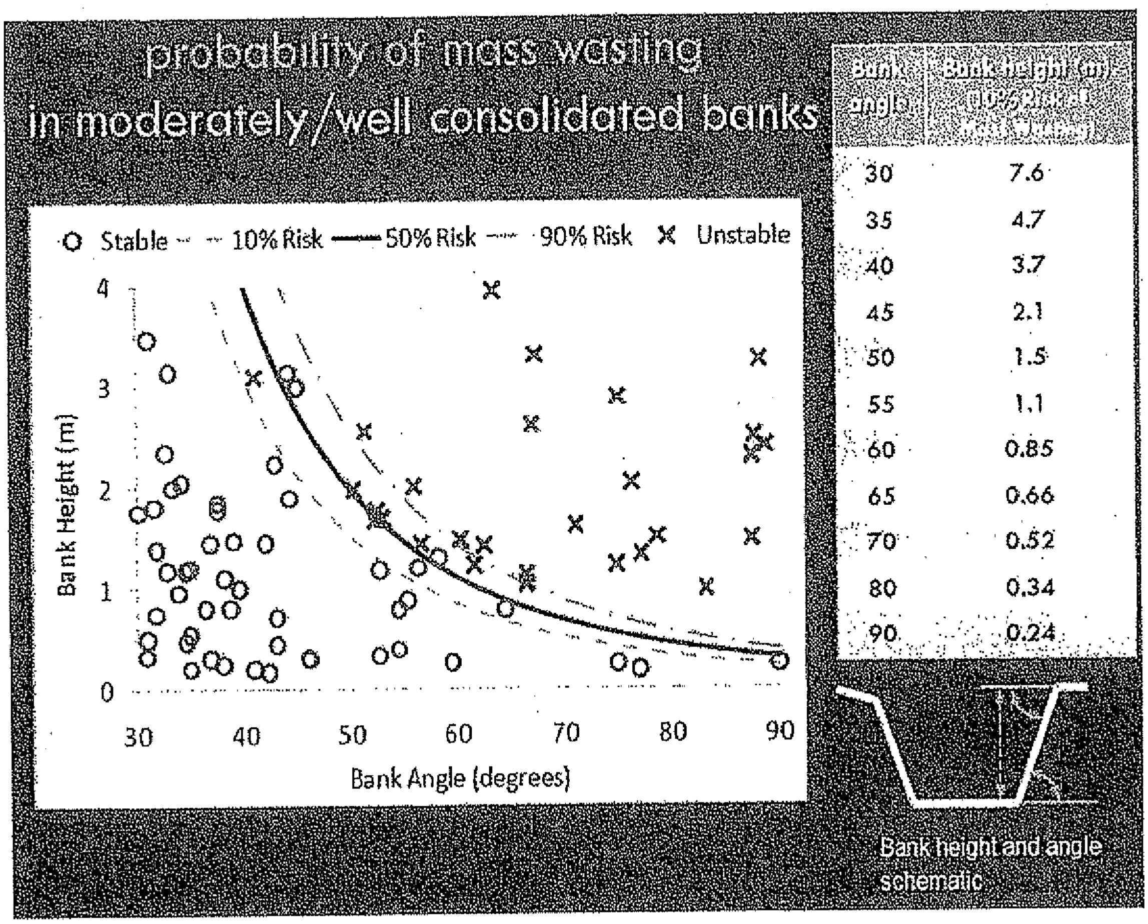
Figure 13. Form 5: Sequence of Lateral Questions Option for lateral susceptibility assessment. Complete set of assessment forms in Appendix B.

Reach 2

FORM 6: PROBABILITY OF MASS WASTING BANK FAILURE

If mass wasting is not currently extensive and the banks are moderately- to well-consolidated, measure bank height and angle at several locations (i.e., at least three locations that capture the range of conditions present in the study reach) to estimate representative values for the reach. Use Form 6 Figure 1 below to determine if risk of bank failure is >10% and complete Form 6 Table 1. Support your results with photographs that include a protractor/rod/tape/person for scale.

	Bank Angle (degrees) *(from Field)*	**Bank Height (m)** *(from Field)*	**Corresponding Bank Height for 10% Risk of Mass Wasting (m)** *(from Form 6 Figure 1 below)*	**Bank Failure Risk** *(<10% Risk)* *(>10% Risk)*
Left Bank	30°	0.76	7.6	<10%
Right Bank	30°	0.76	7.6	<10%



Bank angle	Bank height (m) 10% Risk of Mass Wasting
30	7.6
35	4.7
40	3.7
45	2.1
50	1.5
55	1.1
60	0.85
65	0.66
70	0.52
80	0.34
90	0.24

Form 6 Figure 1. Probability Mass Wasting diagram, Bank Angle:Height/% Risk table, and Band Height:Angle schematic.

(Sheet 1 of 1)

Figure 14. Form 6: Probability of Mass Wasting Bank Failure for lateral susceptibility assessment. Complete set of assessment forms in Appendix B.

S.CA Hydromodification Screening Tool version 1.0

user: edelvai@rickengineering.com

stream: Reach 3 - Downstream of Point of Connection 2

latitude (decimal degrees): 33.0000

longitude (decimal degrees): -117.112

FORM 1: INITIAL DESKTOP ANALYSIS

GIS metrics and screening indices (for detailed instructions/examples see 'Field Screening Companion Document')

Symbol	Variable	units	Value	Description & Source
A	Drainage Area	mi^2	1.06	contributing drainage area to screening location via *published HUCs and/or 30-m (or better) National Elevation Data (NED), USGS seamless server*
P	Mean annual precipitation	inches	13.24	area-weighted annual precipitation via *USGS delineated polygons using records from 1900 to 1960 (which was more significant in hydrologic models than polygons delineated from shorter record lengths)*
S_v	Valley slope	m/m	0.026	valley slope at site *via NED, measured over a relatively homogeneous valley segment as indicated by slope, hillslope coupling/confinement, valley alignment, confluences, etc., over a distance of up to ~500 meters or 10% of the main-channel length (whatever is smaller)*
W_v	Valley width	meters	19.9	valley bottom width at site *between natural valley walls as dictated by clear breaks in hillslope on NED raster, irrespective of potential armoring from floodplain encroachement, levees, etc. (Imprecise measurements have negligible effect on rating in wide valleys where VWI >>2, as defined in lateral decision tree)*
Q_{10cfs}	10-year peak flow, US units	ft^3/s	140	$Q_{10cfs} = 18.2 * A^{0.87} * P^{0.77}$ *(Hawley and Bledsoe, In review)*
Q_{10}	10-year peak flow	m^3/s	3.96	$Q_{10} = 0.0283 * Q_{10cfs}$
INDEX	10-year mobility index	$m^{1.5}/s^{0.5}$	0.052	$INDEX = S_v * Q_{10}^{0.5}$
W_{ref}	Reference width	meters	12.77	$W_{ref} = 6.99 * Q_{10}^{0.438}$
VWI	Valley width index	m/m	1.56	$VWI = W_v / W_{ref}$

user: edelva@rickengineering.com *stream:* Reach 3 - Downstream of Point of Connection 2

latitude: 33.0000

longitude: -117.112

FORM 3: PEBBLE COUNT & MOBILITY INDEX THRESHOLD

Pebble Count

Count	Station	d (mm)
1	0	32
2	1	11
3	2	11
4	3	11
5	4	1
6	5	32
7	6	16
8	7	32
9	8	45
10	9	22.6
11	9	16
12	8	32
13	7	2
14	6	2
15	5	2
16	4	2
17	3	2
18	2	2
19	1	2
20	0	2
21	0	2
22	1	2
23	2	2
24	3	2
25	4	2
26	5	2
27	6	2
28	7	2
29	8	2
30	9	2
31	9	2
32	8	2
33	7	2
34	6	2
35	5	2
36	4	2
37	3	2
38	2	2
39	1	2
40	0	2
41	0	2
42	1	2
43	2	2
44	3	2
45	4	2
46	5	2
47	6	2
48	7	2
49	8	2
50	9	2
51	9	2

If it is necessary to estimate d50, perform a pebble count using a minimum of 100 particles with a standard phi template or by measuring along the intermediate axis of each pebble. Use a grid and tape for systematic/complete transects across riffle sections (i.e. if the 100th particle is in the middle of a transect, complete the full transect before stopping the count). If fines (sand/silt) are less than ½-inch thick (~ one finger width) at point of sample, it is appropriate to sample the coarser buried substrate; otherwise record an observation of fines (i.e. ≤2 mm, recorded in spreadsheet as 2 mm). Take photographs to support the results.

total particles	d_{50} (mm)	%sand
100	2	51%

mobility index $S_v Q_{10}^{0.5}$ ($m^{1.5}/s^{0.5}$)	mobility index corresponding to 50% risk for d_{50}	Incision/ Braiding Risk
0.0517	0.022	>50%

Pebble count data in the table on the left are example data for illustrative purposes only. You must replace these data with actual pebble count data from your field site. Once populated the pebble count results will be used to automatically populate fields on Form 2 and Form 4.

52	8	2
53	7	2
54	6	2
55	5	2
56	4	2
57	3	2
58	2	2
59	1	2
60	0	2
61	0	2
62	1	2
63	2	2
64	3	22.6
65	4	22.6
66	5	22.6
67	6	45
68	7	64
69	8	45
70	9	22.6
71	9	45
72	8	90
73	7	45
74	6	32
75	5	22.6
76	4	45
77	3	32
78	2	16
79	1	22.6
80	0	32
81	0	32
82	1	16
83	2	16
84	3	32
85	4	45
86	5	45
87	6	16
88	7	32
89	8	22.6
90	9	64
91	9	32
92	8	22.6
93	7	11
94	6	16
95	5	22.6
96	4	22.6
97	3	11
98	2	32
99	1	16
100	0	22.6
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REACH 3

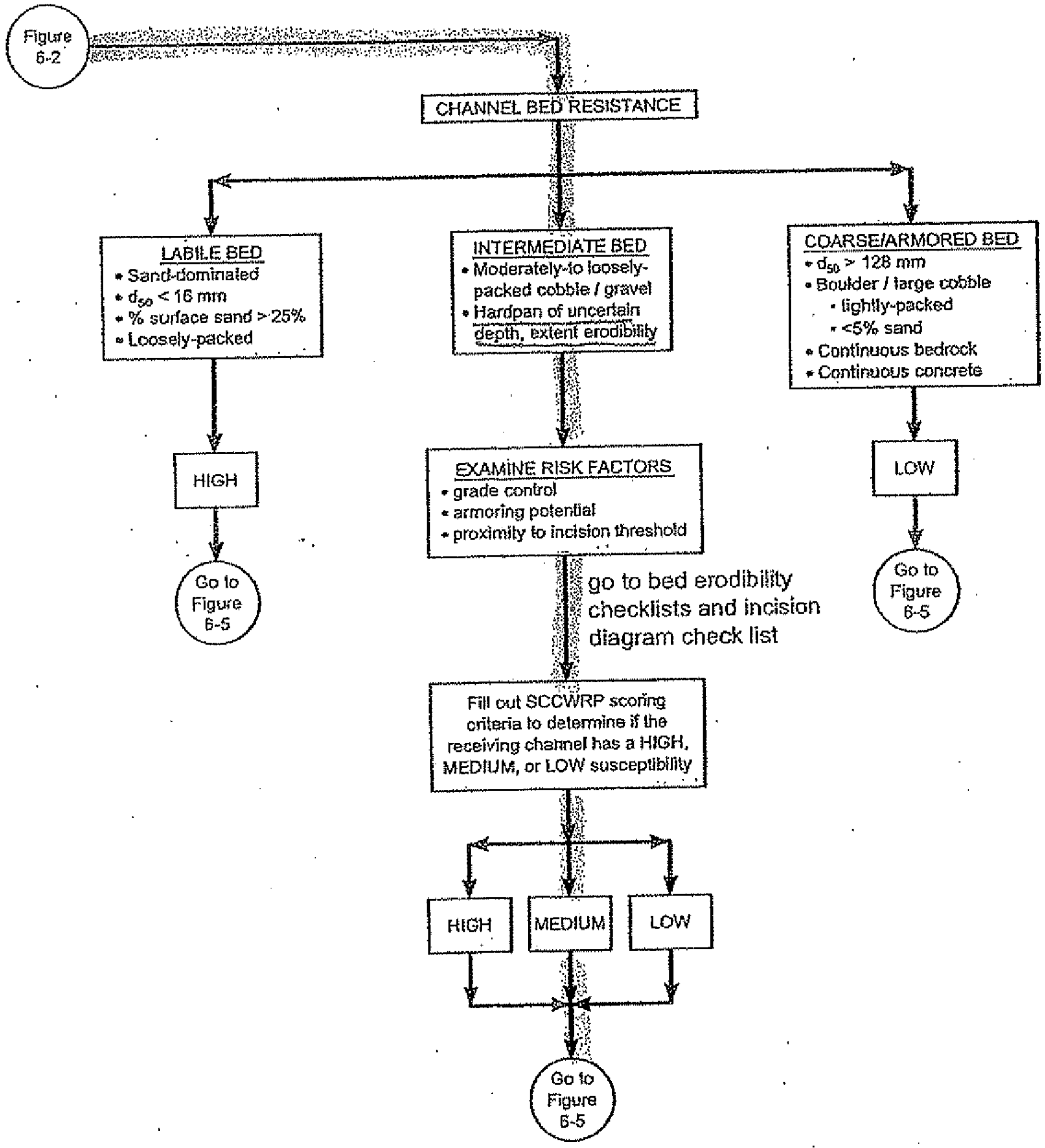


Figure 6-4. SCCWRP Vertical Susceptibility

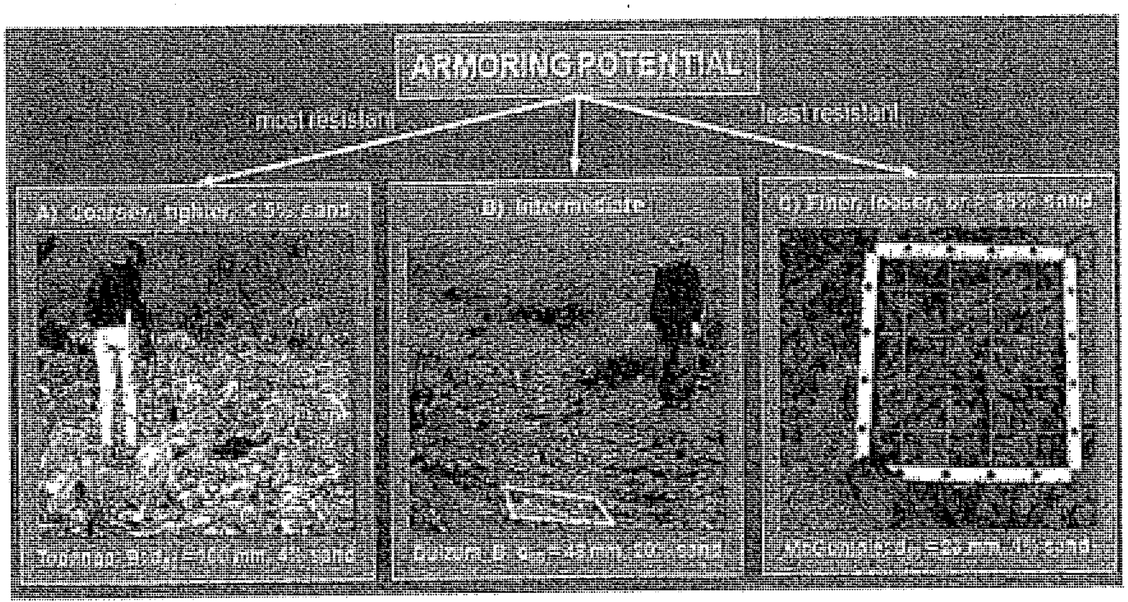
Reach 3

Form 3 Support Materials

Form 3 Checklists 1 and 2, along with information recording in Form 3 Table 1, are intended to support the decisions pathways illustrated in Form 3 Overall Vertical Rating for Intermediate/Transitional Bed.

Form 3 Checklist 1: Armoring Potential

☐	A	A mix of coarse gravels and cobbles that are tightly packed with <5% surface material of diameter <2 mm
☒	B	Intermediate to A and C or hardpan of unknown resistance, spatial extent (longitudinal and depth), or unknown armoring potential due to surface veneer covering gravel or coarser layer encountered with probe
☐	C	Gravels/cobbles that are loosely packed or >25% surface material of diameter <2 mm



Form 3 Figure 2. Armoring potential photographic supplement for assessing intermediate beds ($16 < d_{50} < 128$ mm) to be used in conjunction with **Form 3 Checklist 1.**

ARMORING POTENTIAL NUMERIC VALUE :
B=6

(Sheet 2 of 4)

Figure 7. Continued

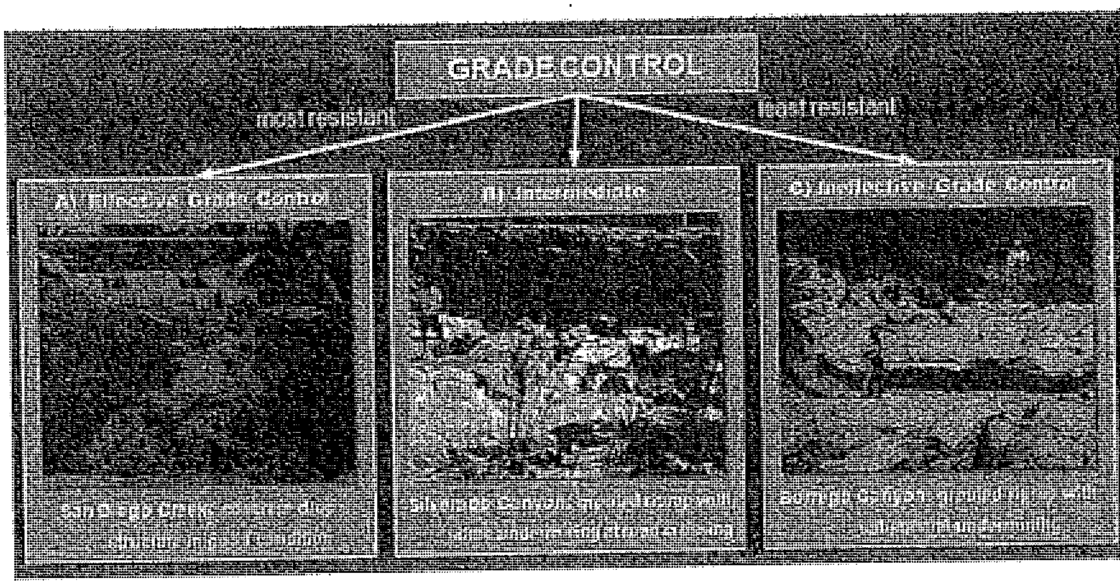
Form 3 Checklist 2: Grade Control

☐ **A** — Grade control is present with spacing <50 m or $2/S_v$ m

- No evidence of failure/ineffectiveness, e.g., no headcutting (>30 cm), no active mass wasting (analyst cannot say grade control sufficient if mass-wasting checklist indicates presence of bank failure), no exposed bridge pilings, no culverts/structures undermined
- Hard points in serviceable condition at decadal time scale, e.g., no apparent undermining, flanking, failing grout
- If geologic grade control, rock should be resistant igneous and/or metamorphic; For sedimentary/hardpan to be classified as 'grade control', it should be of demonstrable strength as indicated by field testing such as hammer test/borings and/or inspected by appropriate stakeholder

☒ **B** — Intermediate to A and C – artificial or geologic grade control present but spaced 2/Sv m to 4/Sv m or potential evidence of failure or hardpan of uncertain resistance

☐ **C** — Grade control absent, spaced >100 m or >$4/S_v$ m, or clear evidence of ineffectiveness



Form 3 Figure 3. Grade-control (condition) photographic supplement for assessing intermediate beds (16 < d_{50} < 128 mm) to be used in conjunction with Form 3 Checklist 2.

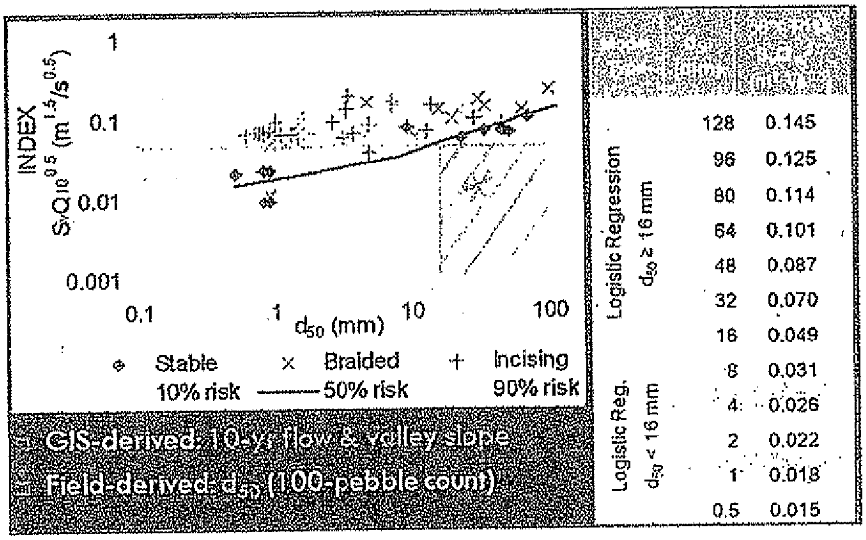
(Sheet 3 of 4)

Figure 7. Continued

GRADE CONTROL NUMERIC VALUE: B = 6

Regionally-calibrated Screening Index Threshold for Incising/Braiding

For transitional bed channels (d_{50} between 16 and 128 mm) or labile beds (channel not incised past critical bank height), use Form 3 Figure 3 to determine Screening Index Score and complete Form 3 Table 1.



Form 3 Figure 4. Probability of incising/braiding based on logistic regression of Screening Index and d_{50} to be used in conjunction with Form 3 Table 1.

Form 3 Table 1. Values for Screening Index Threshold (probability of incising/braiding) to be used in conjunction with Form 3 Figure 4 (above) to complete Form 3 Overall Vertical Rating for Intermediate/Transitional Bed (below). Screening Index Score: A = <50% probability of incision for current Q_{10}, valley slope, and d_{50}; B = Hardpan/d_{50} indeterminate; and C = ≥50% probability of incising/braiding for current Q_{10}, valley slope, and d_{50}.

d_{50} (mm) *From Form 2*	$S_v*Q_{10}^{0.5}$ ($m^{1.5}/s^{0.5}$) *From Form 1*	$S_v*Q_{10}^{0.5}$ ($m^{1.5}/s^{0.5}$) *50% risk of incising/braiding from table in Form 3 Figure 3 above*	Screening Index Score (A, B, C)

Overall Vertical Rating for Intermediate/Transitional Bed

Calculate the overall Vertical Rating for Transitional Bed channels using the formula below. Numeric values for responses to Form 3 Checklists and Table 1 as follows: A = 3, B = 6, C = 9.

$$Vertical\ Rating = \sqrt{\left\{\left(\sqrt{armoring \times grade\ control}\right) \times screening\ index\ score\right\}}$$

Vertical Susceptibility based on Vertical Rating: <4.5 = LOW; 4.5 to 7 = MEDIUM; and >7 = HIGH.

(Sheet 4 of 4)

Figure 7. Continued

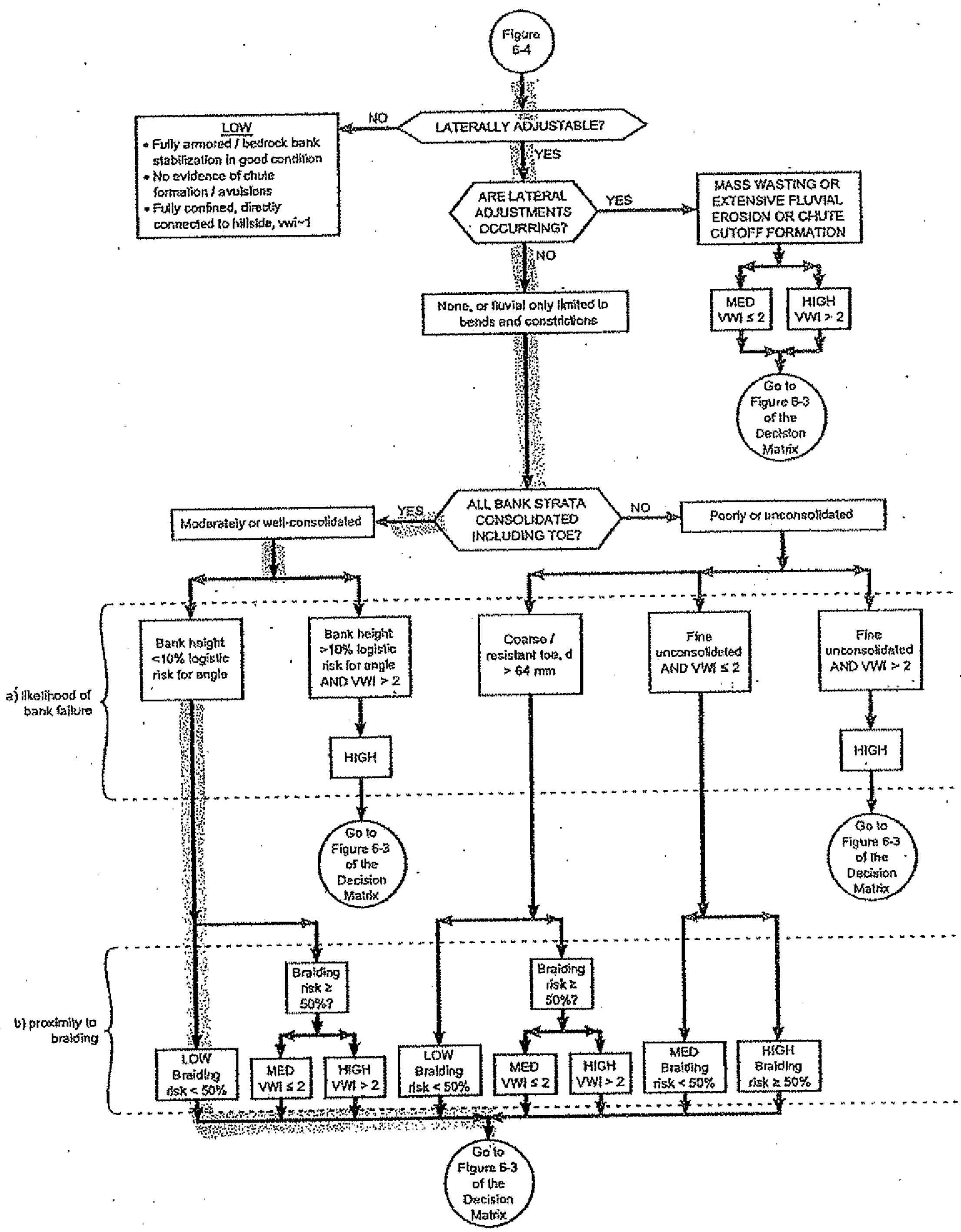
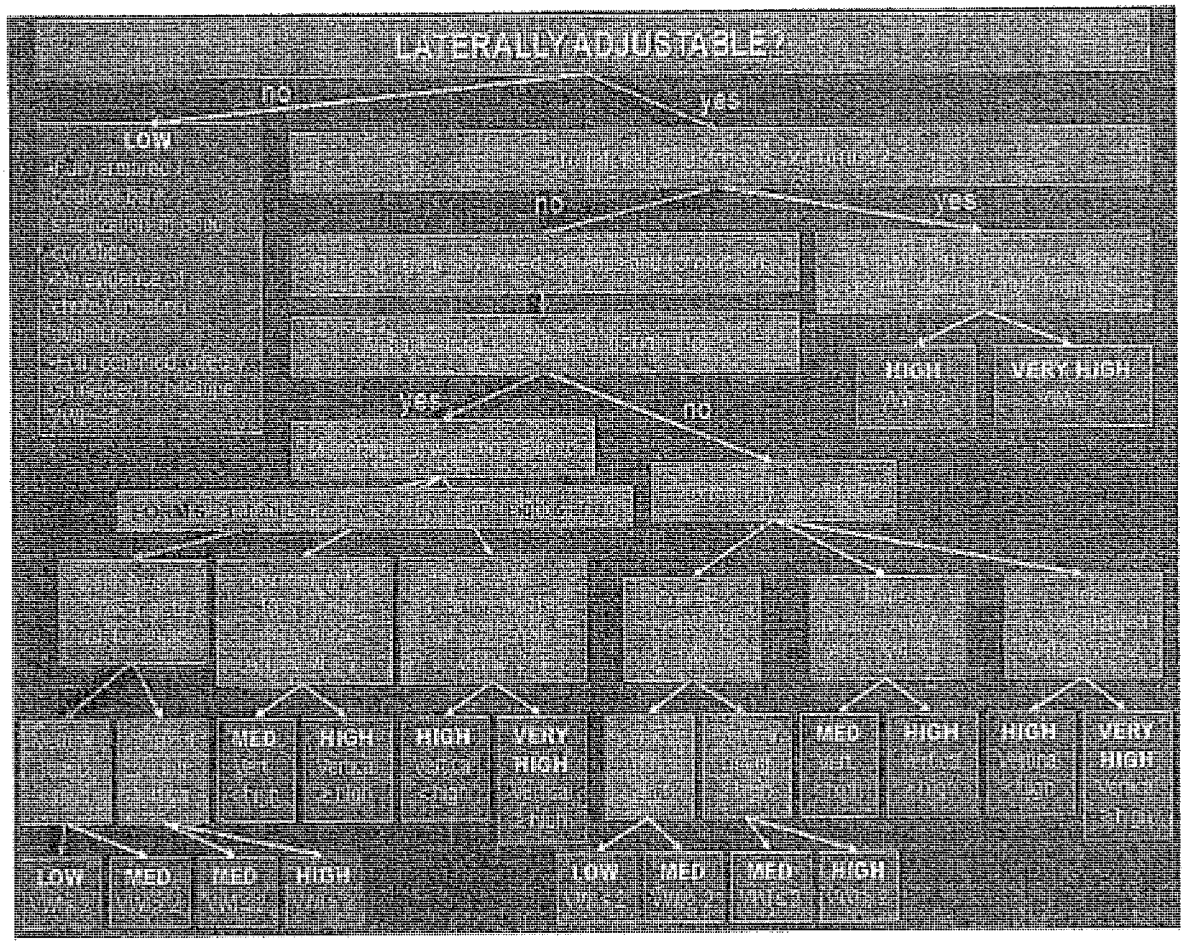


Figure 6-5. Lateral Channel Susceptibility

Reach 3

FORM 4: LATERAL SUSCEPTIBILTY FIELD SHEET

Circle appropriate nodes/pathway for proposed site
OR use sequence of questions provided in Form 5.



(Sheet 1 of 1)

Figure 12. Form 4: Lateral Susceptibility Field Sheet. Complete set of assessment forms in Appendix B.

FORM 5: SEQUENCE OF LATERAL SUSCEPTIBILITY QUESTIONS OPTION

Enter Lateral Susceptibility (Very High, High, Medium, Low) in shaded column.
Mass wasting and bank instability from Form 6, VWI from Form 4, and Vertical Rating from Form 3.

				Lateral Susceptibility
[illegible]	If YES [illegible] then LOW			
If NO [illegible] mass wasting [illegible]	If YES: VWI [illegible] 2 = HIGH; VWI [illegible] 2 = VERY HIGH			
If NO [illegible]	If YES: How many risk factors present? Risk Factors: Bank instability [illegible] 10%; VWI [illegible] 2; Vertical rating ≥ High	• Three = VERY HIGH • Two of three = HIGH • One of three = MEDIUM • None = LOW		
If NO [illegible]	If YES: How many risk factors present? Risk Factors: VWI [illegible] 2; Vertical rating ≥ High	• Two = HIGH • One = MEDIUM • None = LOW		
If NO: At least one bank is unconsolidated with toe of [illegible]	How many risk factors present? Risk Factors: VWI [illegible] 2; Vertical rating ≥ High	• Two = VERY HIGH • One = HIGH • None = MEDIUM		

(Sheet 1 of 1)

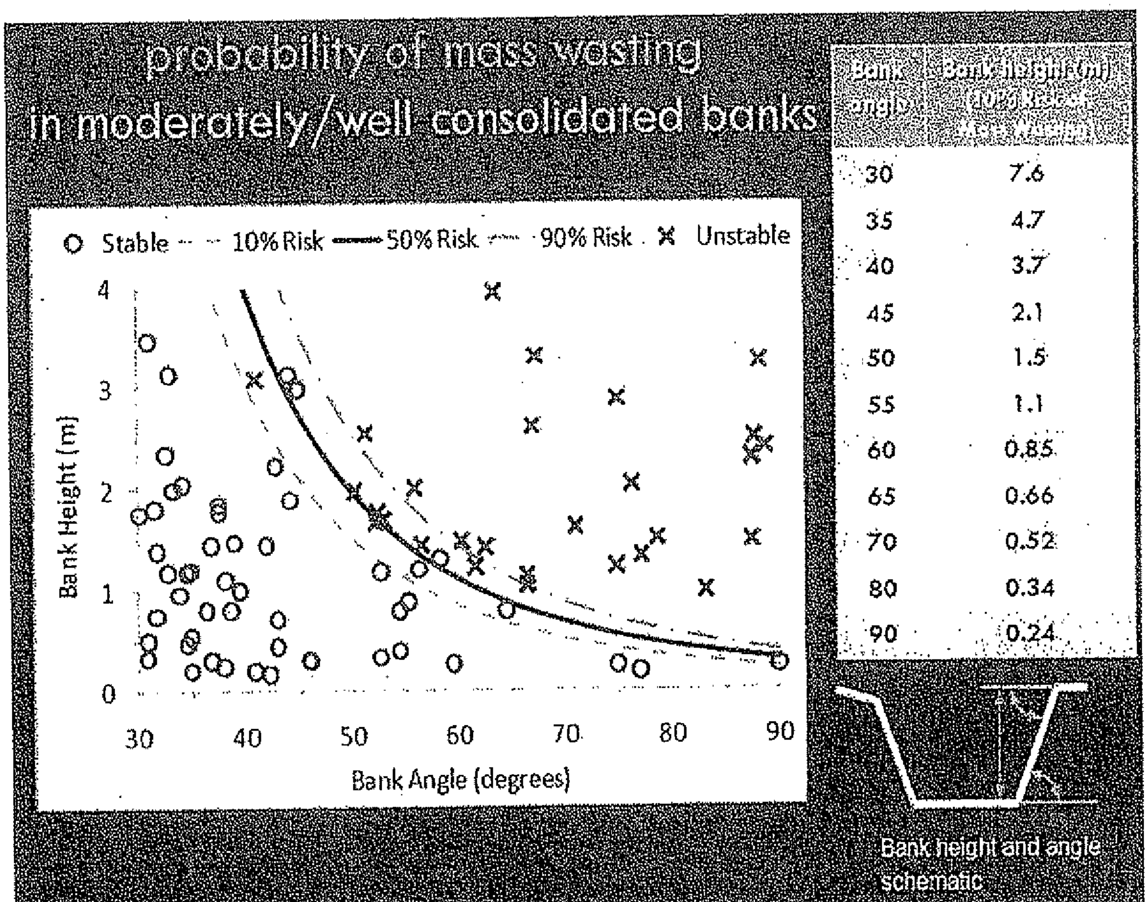
Figure 13. Form 5: Sequence of Lateral Questions Option for lateral susceptibility assessment. Complete set of assessment forms in Appendix B.

Reach 3

FORM 6: PROBABILITY OF MASS WASTING BANK FAILURE

If mass wasting is not currently extensive and the banks are moderately- to well-consolidated, measure bank height and angle at several locations (i.e., at least three locations that capture the range of conditions present in the study reach) to estimate representative values for the reach. Use Form 6 Figure 1 below to determine if risk of bank failure is >10% and complete Form 6 Table 1. Support your results with photographs that include a protractor/rod/tape/person for scale.

	Bank Angle (degrees) *(from Field)*	**Bank Height (m)** *(from Field)*	**Corresponding Bank Height for 10% Risk of Mass Wasting (m)** *(from Form 6 Figure 1 below)*	**Bank Failure Risk** *(<10% Risk)* *(>10% Risk)*
Left Bank	45°	0.91	2.1	< 10%
Right Bank	45°	0.91	2.1	< 10%



Bank angle	Bank Height (m) (10% Risk of Mass Wasting)
30	7.6
35	4.7
40	3.7
45	2.1
50	1.5
55	1.1
60	0.85
65	0.66
70	0.52
80	0.34
90	0.24

Form 6 Figure 1. Probability Mass Wasting diagram, Bank Angle:Height/% Risk table, and Band Height:Angle schematic.

(Sheet 1 of 1)

Figure 14. Form 6: Probability of Mass Wasting Bank Failure for lateral susceptibility assessment. Complete set of assessment forms in Appendix B.

user: edelval@rickengineering.com

stream: Reach 4 - Downstream of Grade-Control Point 2

latitude (decimal degrees): 33.0000

longitude (decimal degrees): -117.112

FORM 1: INITIAL DESKTOP ANALYSIS

GIS metrics and screening indices (for detailed instructions/examples see '<u>Field Screening Companion Document</u>')

Symbol	Variable	units	Value	Description & Source
A	Drainage Area	mi^2	1.067	contributing drainage area to screening location via *published HUCs and/or 30-m (or better) National Elevation Data (NED), USGS seamless server*
P	Mean annual precipitation	inches	13.24	area-weighted annual precipitation via *USGS delineated polygons using records from 1900 to 1960 (which was more significant in hydrologic models than polygons delineated from shorter record lengths)*
S_v	Valley slope	m/m	0.027	valley slope at site *via NED, measured over a relatively homogeneous valley segment as indicated by slope, hillslope coupling/confinement, valley alignment, confluences, etc., over a distance of up to ~500 meters or 10% of the main-channel length (whatever is smaller)*
W_v	Valley width	meters	22.9	valley bottom width at site *between natural valley walls as dictated by clear breaks in hillslope on NED raster, irrespective of potential armoring from floodplain encroachement, levees, etc. (imprecise measurements have negligible effect on rating in wide valleys where VWI >>2, as defined in lateral decision tree)*
Q_{10cfs}	10-year peak flow, US units	ft^3/s	141	$Q_{10cfs} = 18.2 * A^{0.87} * P^{0.77}$ *(Hawley and Bledsoe, In review)*
Q_{10}	10-year peak flow	m^3/s	3.98	$Q_{10} = 0.0283 * Q_{10cfs}$
INDEX	10-year mobility index	$m^{1.5}/s^{0.5}$	0.054	$INDEX = S_v * Q_{10}^{0.5}$
W_{ref}	Reference width	meters	12.80	$W_{ref} = 6.99 * Q_{10}^{0.438}$
VWI	Valley width index	m/m	1.79	$VWI = W_v / W_{ref}$

S.CA Hydromodification Screening Tool version 1.0

user: edelval@rickengineering.com *stream:* Reach 4 - Downstream of Grade Control Point 2

latitude: 33.0000

longitude: -117.112

FORM 3: PEBBLE COUNT & MOBILITY INDEX THRESHOLD

Pebble Count

Count	Station	d (mm)
1	0	2
2	1	2
3	2	2
4	3	2
5	4	2
6	5	2
7	6	2
8	7	2
9	8	2
10	9	2
11	9	2
12	8	2
13	7	2
14	6	2
15	5	2
16	4	2
17	3	2
18	2	2
19	1	2
20	0	2
21	0	2
22	1	2
23	2	2
24	3	2
25	4	2
26	5	2
27	6	2
28	7	2
29	8	2
30	9	2
31	9	2
32	8	2
33	7	2
34	6	2
35	5	2
36	4	2
37	3	2
38	2	2
39	1	2
40	0	2
41	0	2
42	1	2
43	2	2
44	3	2
45	4	2
46	5	2
47	6	2
48	7	2
49	8	2
50	9	2
51	9	2

If it is necessary to estimate d50, perform a pebble count using a minimum of 100 particles with a standard phi template or by measuring along the intermediate axis of each pebble. Use a grid and tape for systematic/complete transects across riffle sections (i.e. if the 100th particle is in the middle of a transect, complete the full transect before stopping the count). If fines (sand/silt) are less than ½-inch thick (~ one finger width) at point of sample, it is appropriate to sample the coarser buried substrate; otherwise record an observation of fines (i.e. ≤2 mm, recorded in spreadsheet as 2 mm). Take photographs to support the results.

total particles	d_{50} (mm)	%sand
100	2	100%

mobility index $S_v Q_{10}^{0.5}$ ($m^{1.5}/s^{0.5}$)	mobility index corresponding to 50% risk for d_{50}	Incision/ Braiding Risk
0.0539	0.022	>50%

Pebble count data in the table on the left are example data for illustrative purposes only. You must replace these data with actual pebble count data from your field site. Once populated the pebble count results will be used to automatically populate fields on Form 2 and Form 4.

52	8	2
53	7	2
54	6	2
55	5	2
56	4	2
57	3	2
58	2	2
59	1	2
60	0	2
61	0	2
62	1	2
63	2	2
64	3	2
65	4	2
66	5	2
67	6	2
68	7	2
69	8	2
70	9	2
71	9	2
72	8	2
73	7	2
74	6	2
75	5	2
76	4	2
77	3	2
78	2	2
79	1	2
80	0	2
81	0	2
82	1	2
83	2	2
84	3	2
85	4	2
86	5	2
87	6	2
88	7	2
89	8	2
90	9	2
91	9	2
92	8	2
93	7	2
94	6	2
95	5	2
96	4	2
97	3	2
98	2	2
99	1	2
100	0	2
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Reach 4

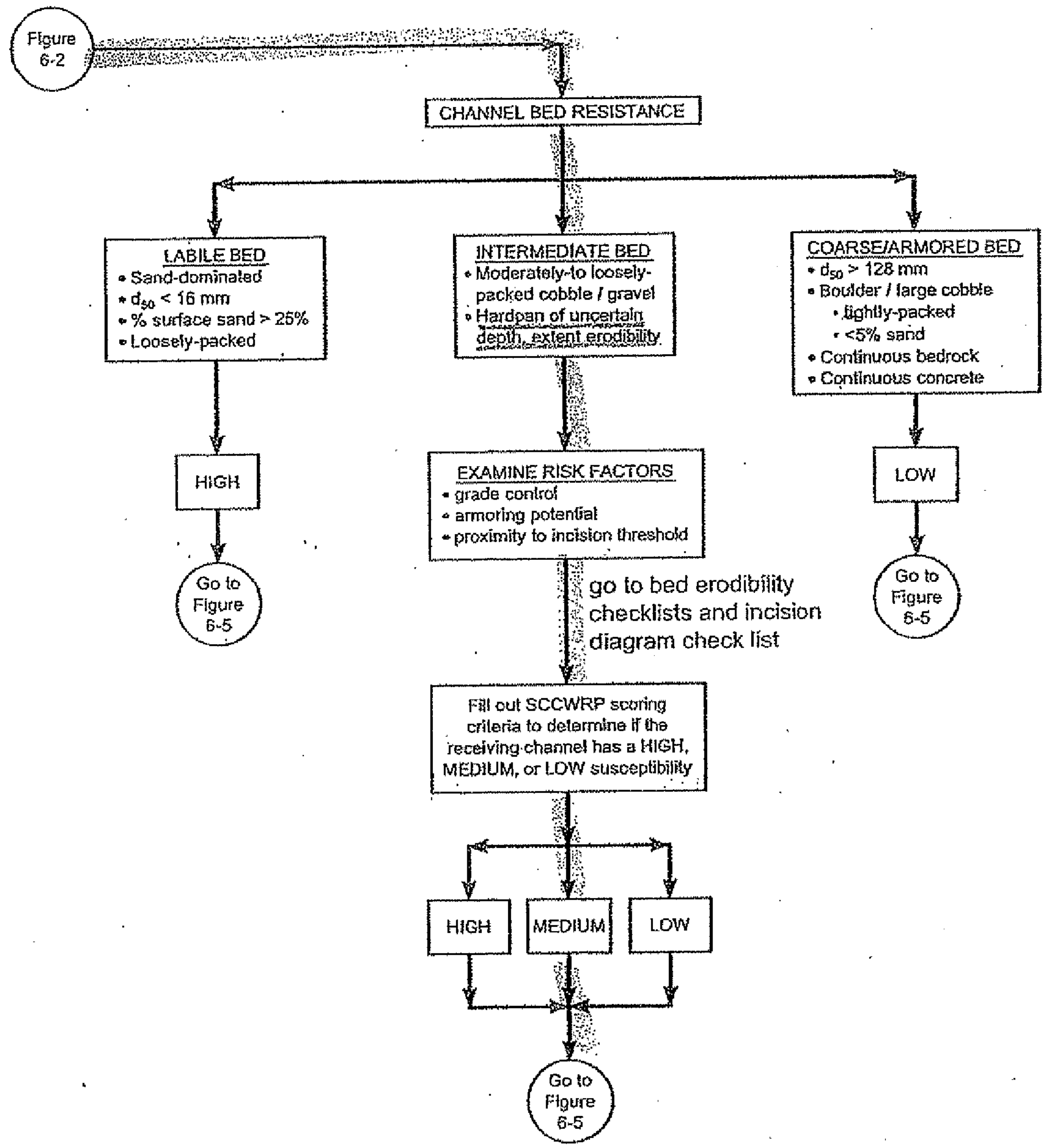


Figure 6-4. SCCWRP Vertical Susceptibility

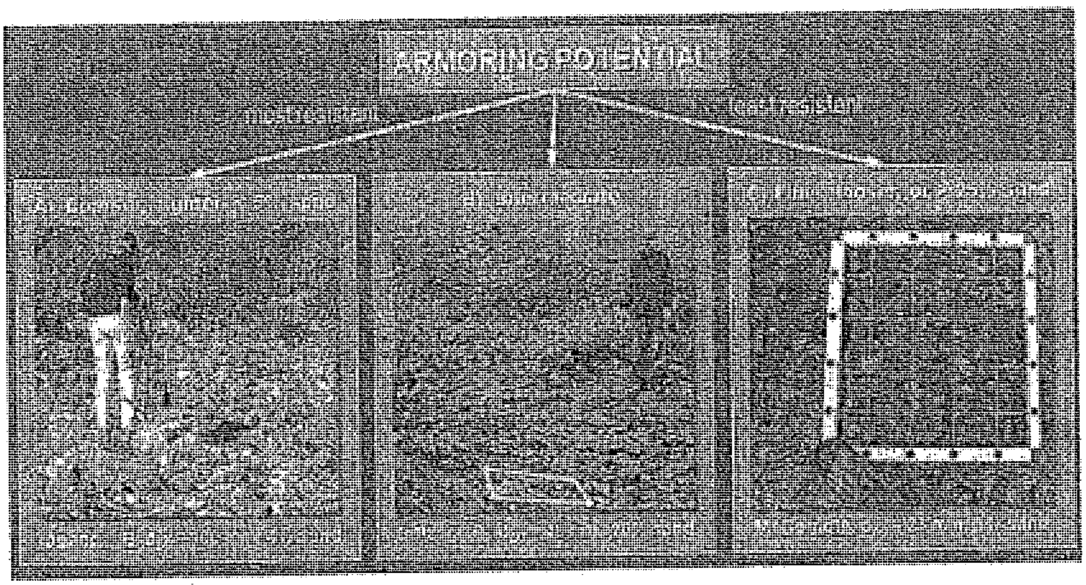
Reach 4

Form 3 Support Materials

Form 3 Checklists 1 and 2, along with information recording in Form 3 Table 1, are intended to support the decisions pathways illustrated in Form 3 Overall Vertical Rating for Intermediate/Transitional Bed.

Form 3 Checklist 1: Armoring Potential

☐	A	A mix of coarse gravels and cobbles that are tightly packed with <5% surface material of diameter <2 mm
X	B	Intermediate to A and C or hardpan of unknown resistance, spatial extent (longitudinal and depth), or unknown armoring potential due to surface veneer covering gravel or coarser layer encountered with probe
☐	C	Gravels/cobbles that are loosely packed or >25% surface material of diameter <2 mm



Form 3 Figure 2. Armoring potential photographic supplement for assessing intermediate beds ($16 < d_{50} < 128$ mm) to be used in conjunction with Form 3 Checklist 1.

ARMORING POTENTIAL NUMERIC VALUE
B = 6

(Sheet 2 of 4)

Figure 7. Continued

REACH 4

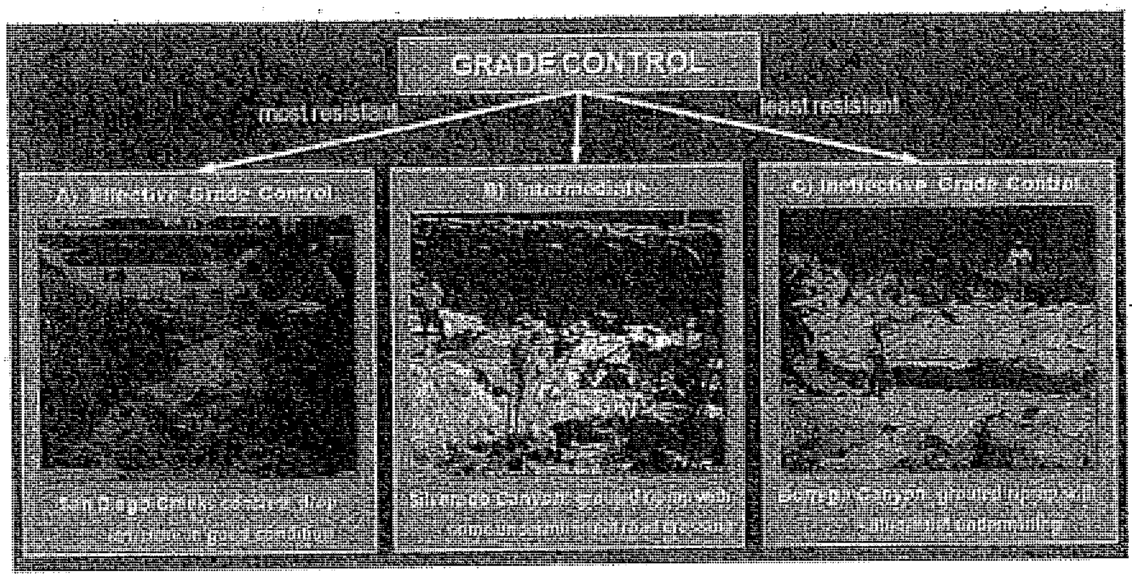
Form 3 Checklist 2: Grade Control

☐ A Grade control is present with spacing <50 m or $2/S_v$ m

- No evidence of failure/ineffectiveness, e.g., no headcutting (>30 cm), no active mass wasting (analyst cannot say grade control sufficient if mass-wasting checklist indicates presence of bank failure), no exposed bridge pilings, no culverts/structures undermined
- Hard points in serviceable condition at decadal time scale, e.g., no apparent undermining, flanking, failing grout
- If geologic grade control, rock should be resistant igneous and/or metamorphic; For sedimentary/hardpan to be classified as 'grade control', it should be of demonstrable strength as indicated by field testing such as hammer test/borings and/or inspected by appropriate stakeholder

X B Intermediate to A and C – artificial or geologic grade control present but spaced 2/Sv m to 4/Sv m or potential evidence of failure or hardpan of uncertain resistance

☐ C Grade control absent, spaced >100 m or $>4/S_v$ m, or clear evidence of ineffectiveness



Form 3 Figure 3. Grade-control (condition) photographic supplement for assessing intermediate beds (16 < d_{50} < 128 mm) to be used in conjunction with Form 3 Checklist 2.

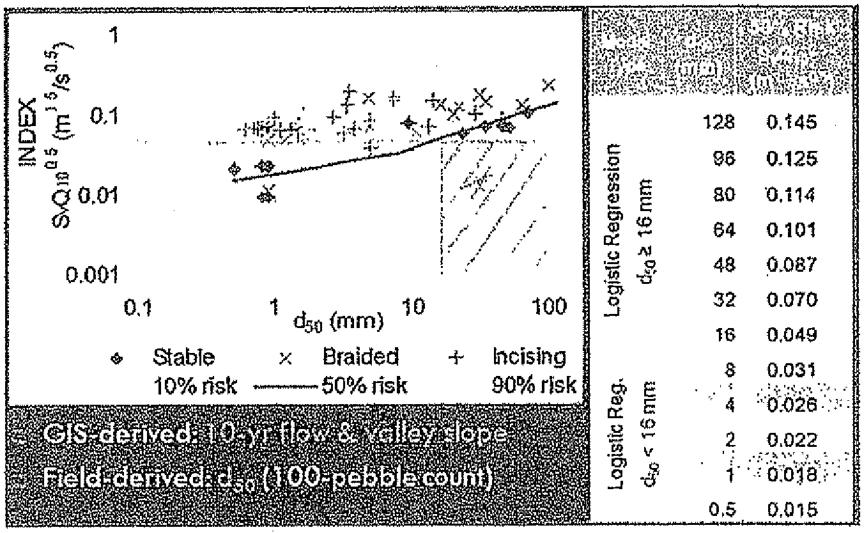
(Sheet 3 of 4)

Figure 7. Continued

GRADE CONTROL NUMERIC VALUE : B = 6

Regionally-calibrated Screening Index Threshold for Incising/Braiding

For transitional bed channels (d_{50} between 16 and 128 mm) or labile beds (channel not incised past critical bank height), use Form 3 Figure 3 to determine Screening Index Score and complete Form 3 Table 1.



Form 3 Figure 4. Probability of incising/braiding based on logistic regression of Screening Index and d_{50} to be used in conjunction with Form 3 Table 1.

Form 3 Table 1. Values for Screening Index Threshold (probability of incising/braiding) to be used in conjunction with Form 3 Figure 4 (above) to complete Form 3 Overall Vertical Rating for Intermediate/Transitional Bed (below).. Screening Index Score: A = <50% probability of incision for current Q_{10}, valley slope, and d_{50}; B = Hardpan/d_{50} indeterminate; and C = ≥50% probability of incising/braiding for current Q_{10}, valley slope, and d_{50}.

d_{50} (mm) *From Form 2*	$S_v{}^*Q_{10}^{0.5}$ ($m^{1.5}/s^{0.5}$) *From Form 1*	$S_v{}^*Q_{10}^{0.5}$ ($m^{1.5}/s^{0.5}$) *50% risk of incising/braiding from table in Form 3 Figure 3 above*	Screening Index Score (A, B, C)

Overall Vertical Rating for Intermediate/Transitional Bed

Calculate the overall Vertical Rating for Transitional Bed channels using the formula below. Numeric values for responses to Form 3 Checklists and Table 1 as follows: A = 3, B = 6, C = 9.

$$Vertical\ Rating = \sqrt{\left(\left(\sqrt{armoring * grade\ control}\right) \times screening\ index\ score\right)}$$

Vertical Susceptibility based on Vertical Rating: <4.5 = LOW; 4.5 to 7 = MEDIUM; and >7 = HIGH.

(Sheet 4 of 4)

Figure 7. Continued = 6

Medium

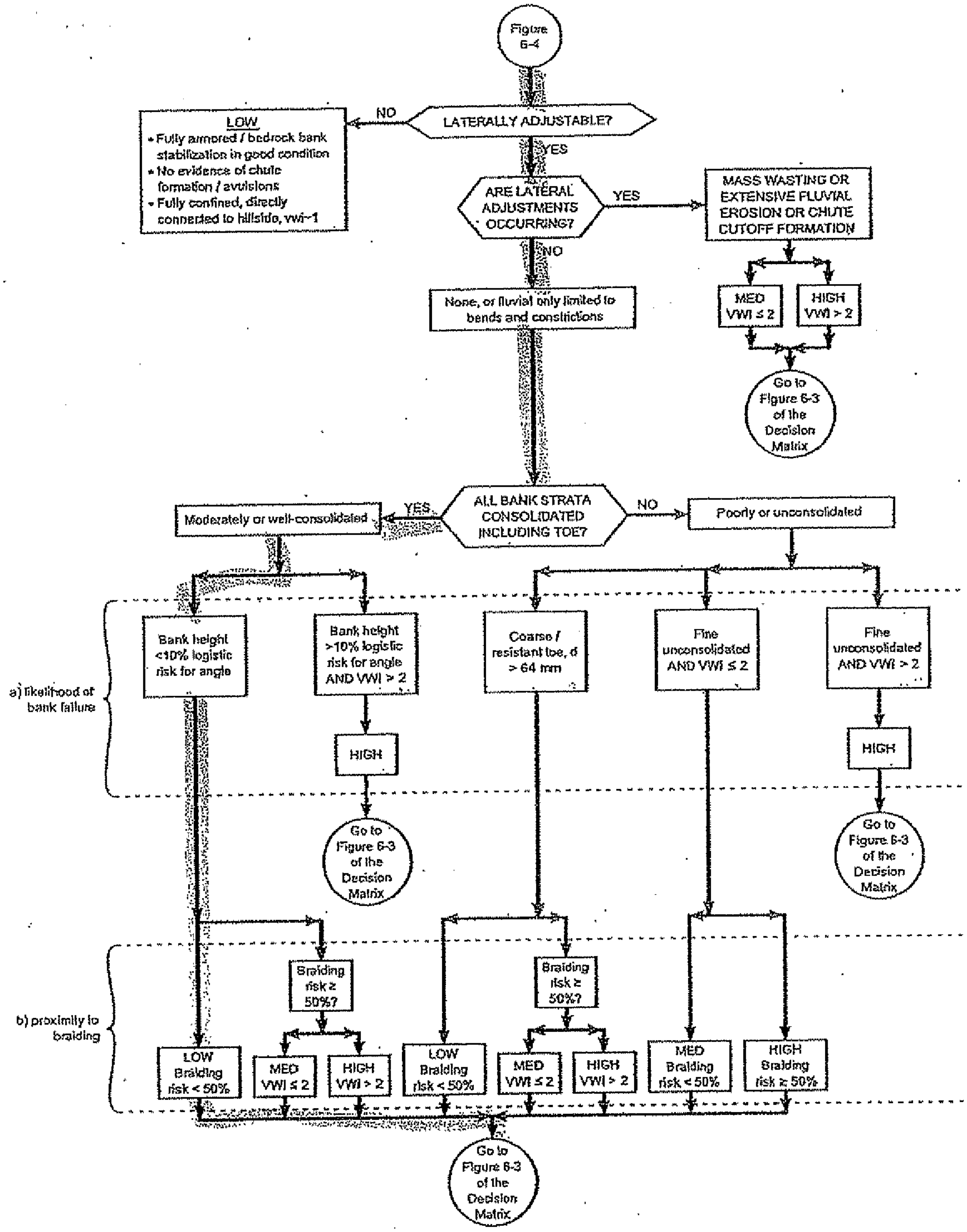
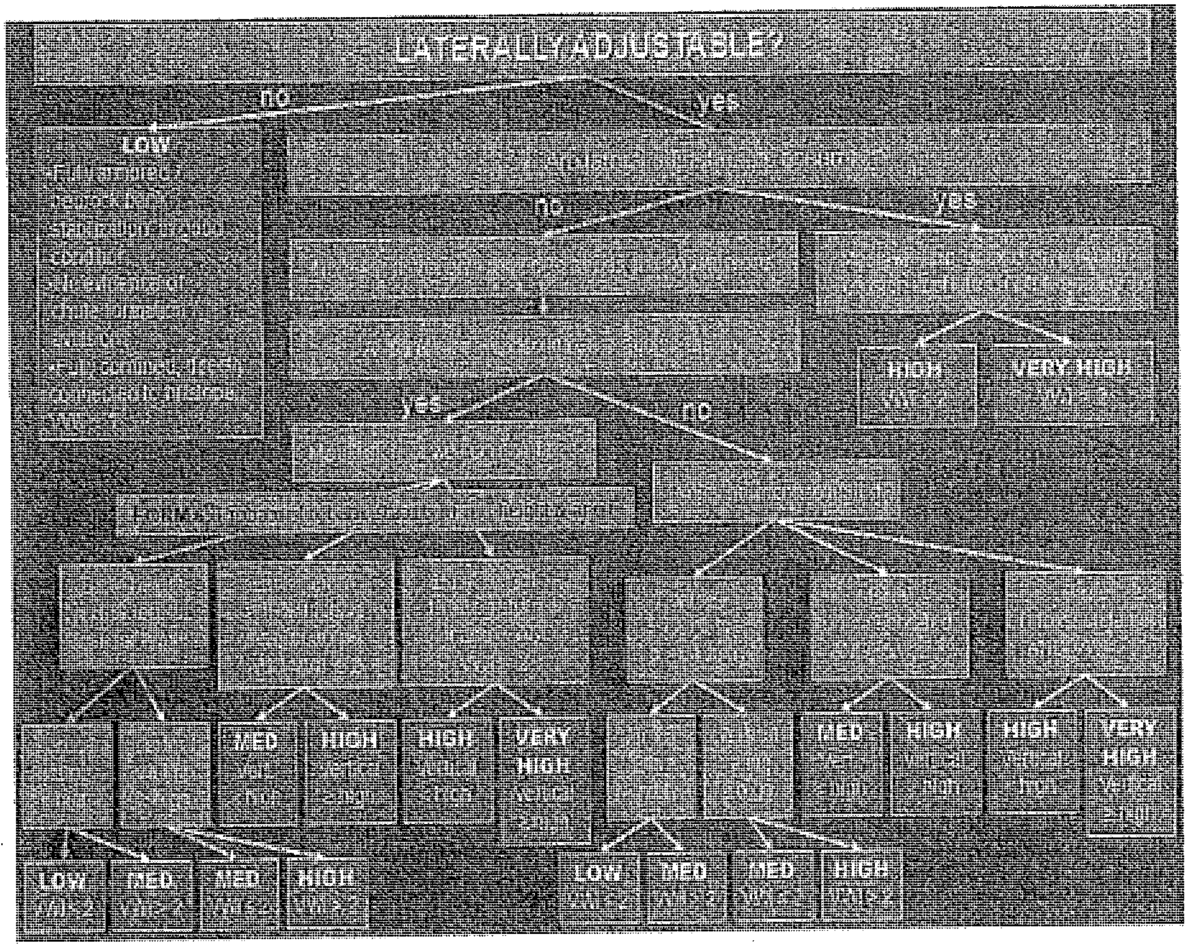


Figure 6-5. Lateral Channel Susceptibility

Reach 4

FORM 4: LATERAL SUSCEPTIBILTY FIELD SHEET

Circle appropriate nodes/pathway for proposed site OR use sequence of questions provided in Form 5.



(Sheet 1 of 1)

Figure 12. Form 4: Lateral Susceptibility Field Sheet. Complete set of assessment forms in Appendix B.

Reach 4

FORM 5: SEQUENCE OF LATERAL SUSCEPTIBILITY QUESTIONS OPTION

Enter Lateral Susceptibility (Very High, High, Medium, Low) in shaded column.
Mass wasting and bank instability from Form 6, VWI from Form 4, and Vertical Rating from Form 3.

Question	Response	Rating	Lateral Susceptibility
[illegible]	If YES, then LOW		
If NO: Is there active mass wasting [illegible]	If YES: VWI ≤ 2 = HIGH; VWI > 2 = VERY HIGH		
If NO: At [illegible]	If YES: How many risk factors present? Risk Factors: Bank instability ≥ 10%; VWI > 2; Vertical rating ≥ High	• All three = VERY HIGH • Two of three = HIGH • One of three = MEDIUM • None = LOW	
If NO: Are banks [illegible] consolidated [illegible] with [illegible]	If YES: How many risk factors present? Risk Factors: VWI > 2; Vertical rating ≥ High	• Two = HIGH • One = MEDIUM • None = LOW	
If NO: At least one bank is unconsolidated with toe of [illegible] ≤ 64 mm	How many risk factors present? Risk Factors: VWI > 2; Vertical rating ≥ High	• Two = VERY HIGH • One = HIGH • None = MEDIUM	

(Sheet 1 of 1)

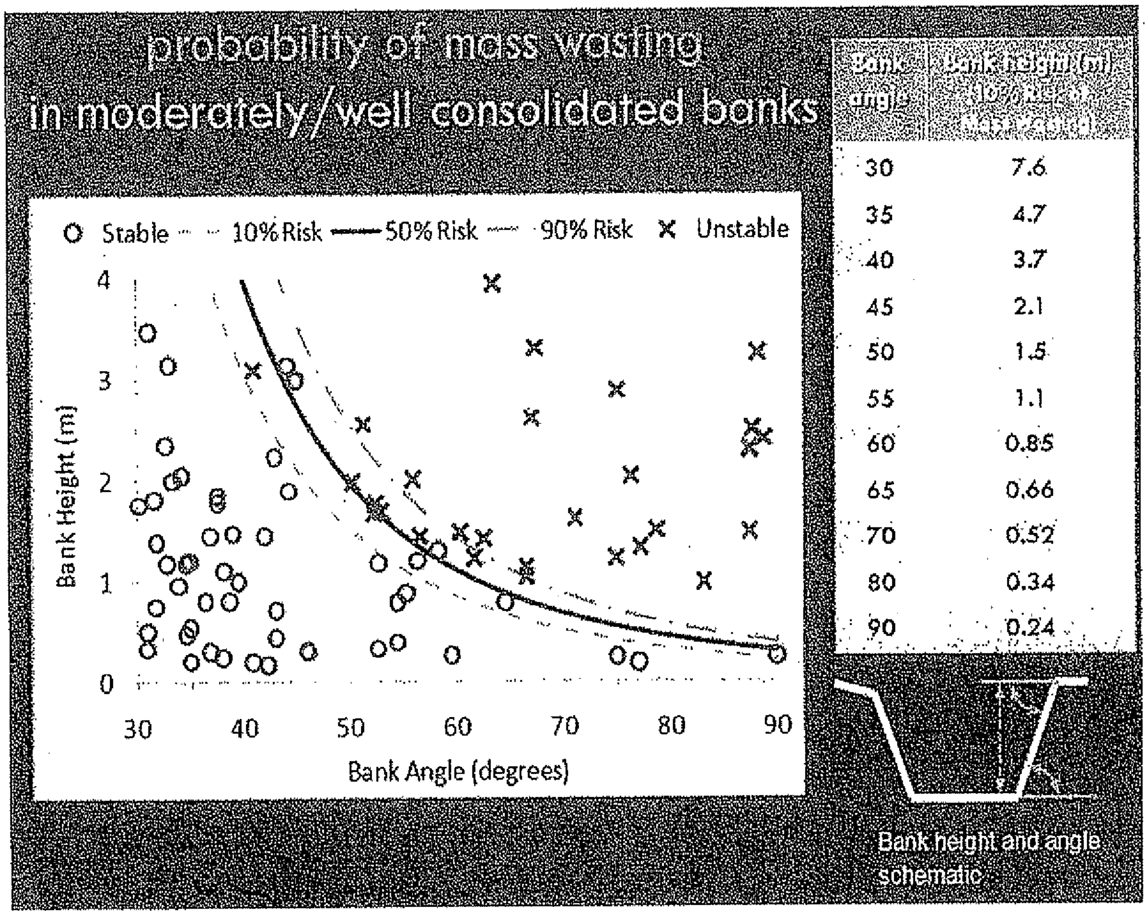
Figure 13. Form 5: Sequence of Lateral Questions Option for lateral susceptibility assessment. Complete set of assessment forms in Appendix B.

Reach 4

FORM 6: PROBABILITY OF MASS WASTING BANK FAILURE

If mass wasting is not currently extensive and the banks are moderately- to well-consolidated, measure bank height and angle at several locations (i.e., at least three locations that capture the range of conditions present in the study reach) to estimate representative values for the reach. Use Form 6 Figure 1 below to determine if risk of bank failure is >10% and complete Form 6 Table 1. Support your results with photographs that include a protractor/rod/tape/person for scale.

	Bank Angle (degrees) *(from Field)*	**Bank Height (m)** *(from Field)*	**Corresponding Bank Height for 10% Risk of Mass Wasting (m)** *(from Form 6 Figure 1 below)*	**Bank Failure Risk** *(<10% Risk)* *(>10% Risk)*
Left Bank	45°	0.6	2.1	<10%
Right Bank	45°	0.6	2.1	<10%



Form 6 Figure 1. Probability Mass Wasting diagram, Bank Angle:Height/% Risk table, and Band Height:Angle schematic.

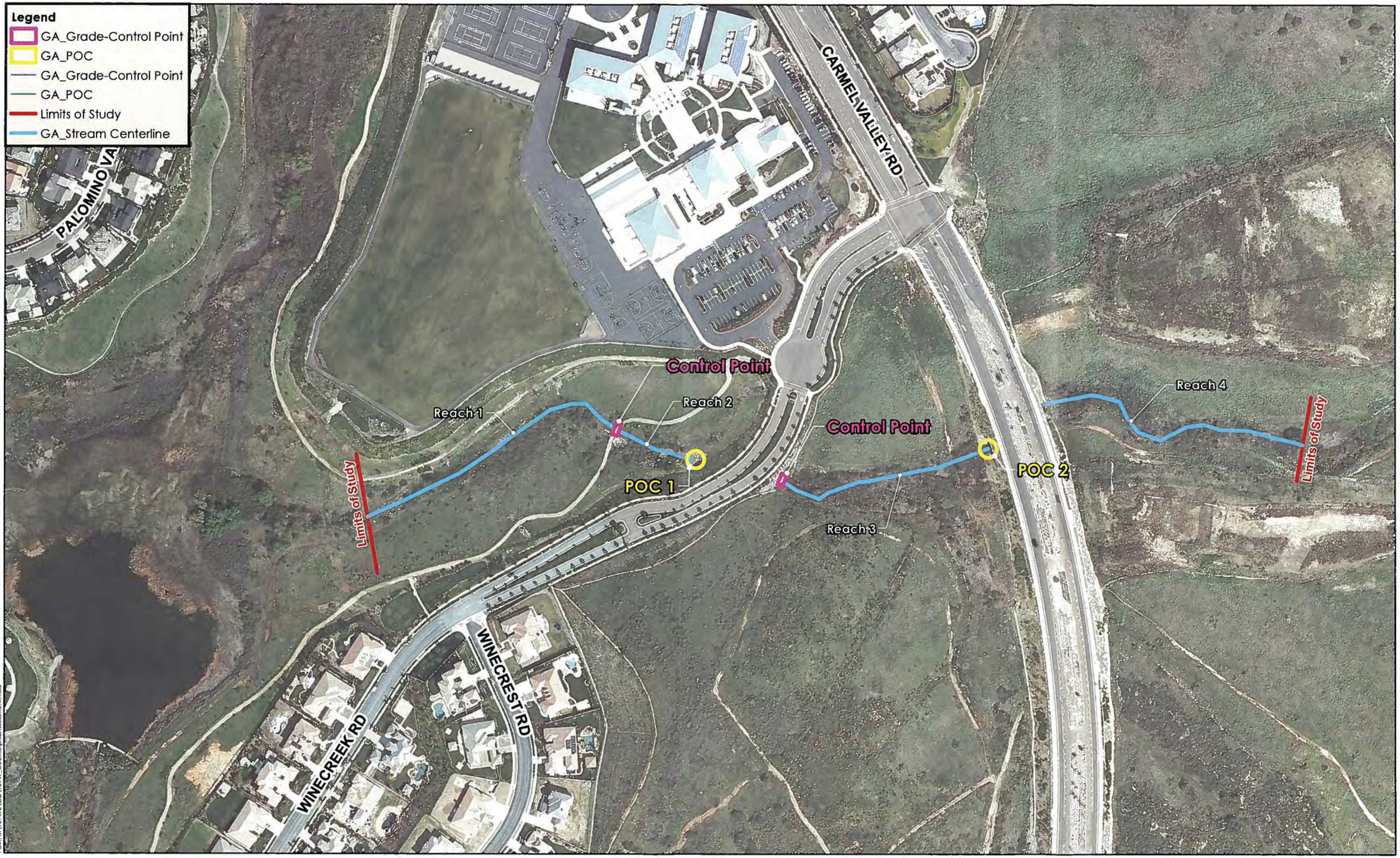
(Sheet 1 of 1)

Figure 14. Form 6: Probability of Mass Wasting Bank Failure for lateral susceptibility assessment. Complete set of assessment forms in Appendix B.

SECTION E-2

Geomorphic Assessment Exhibits

- **Reach 1, 2, 3, and 4**
- **Overall Watershed**



RICK ENGINEERING COMPANY

Scale in Feet
0 200 400

North

Date of Exhibit: 05.16.2013
Eagle Aerial Image: 03.2009

Black Mountain Ranch East Clusters - Unit 3

Geomorphic Assessment

J-15149B

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Path: R:\15149B\GIS\15149 GeomorphicAssessment Watershed.mxd

RICK ENGINEERING COMPANY

Scale in Feet
0 800 1,600

North

Date of Exhibit: 05.16.2013
Eagle Aerial Image: 03.2009

Black Mountain Ranch East Clusters - Unit 3

Geomorphic Assessment - Watersheds Map

J-15149B

SECTION E-3

Field Photographs

Figure 1: Basin 900 Reach 1 – Standing Along Left Bank Looking Downstream

Figure 2: Basin 900 Reach 1 – Standing Along Left Bank Looking Upstream

Figure 3: Basin 900 Reach 1 - Gravelometer on Channel Bed

Figure 4: Basin 900 Reach 2 – Upstream Boundary of Reach 2

Figure 5: Basin 900 Reach 2 - Gravelometer on Channel Bed

Figure 6: Basin 900 Reach 3 – Standing Along Right Bank Looking Upstream

Figure 7: Basin 900/1000 Reach 3 – Upstream End of Reach

Figure 8: Basin 900/1000 Reach 3 – Standing in Channel, Looking Downstream

Figure 9: Basin 900/1000 Reach 3 – Channel Bed

Figure 10: Basin 1000 Reach 4 – Standing Along Right Bank Looking Downstream

Figure 11: Basin 1000 Reach 4 Gravelometer on Channel Bed

Figure 12: Basin 1000 Reach 4 – Standing Along Right Bank Looking Downstream

APPENDIX F

Storm Water Management and Discharge Control Maintenance Agreement (SWMDCMA)

FOR FINAL, SIGNED, AND NOTARIZED COPY,
PLEASE SEE THE RECORDED MAINTENANCE AGREEMENT,
UPON ITS COMPLETION

THE CITY OF SAN DIEGO

RECORDING REQUESTED BY:
THE CITY OF SAN DIEGO
AND WHEN RECORDED MAIL TO:

Black Mountain Ranch, LLC

16010 Camino Del Sur

SAN DIEGO, CA 92127

(THIS SPACE IS FOR RECORDER'S USE ONLY)

STORM WATER MANAGEMENT AND DISCHARGE CONTROL MAINTENANCE AGREEMENT

APPROVAL NUMBER:	ASSESSORS PARCEL NUMBER:	PROJECT NUMBER:
	312-160-05 & 06	363074

This agreement is made by and between the City of San Diego, a municipal corporation [City] and Black Mountain Ranch,

the owner or duly authorized representative of the owner [Property Owner] of property located at south of the intersection of Carmel Valley Road and Winecreek Road
(PROPERTY ADDRESS)

and more particularly described as: Parcels 1, 2 & B of Parcel Map 18504
(LEGAL DESCRIPTION OF PROPERTY)

in the City of San Diego, County of San Diego, State of California.

Property Owner is required pursuant to the City of San Diego Municipal Code, Chapter 4, Article 3, Division 3, Chapter 14, Article 2, Division 2, and the Land Development Manual, Storm Water Standards to enter into a Storm Water Management and Discharge Control Maintenance Agreement [Maintenance Agreement] for the installation and maintenance of Permanent Storm Water Best Management Practices [Permanent Storm Water BMP's] prior to the issuance of construction permits. The Maintenance Agreement is intended to ensure the establishment and maintenance of Permanent Storm Water BMP's onsite, as described in the attached exhibit(s), the project's Water Quality Technical Report [WQTR] and Grading and/or Improvement Plan Drawing No(s), or Building Plan Project No(s): 38042-1-D.

Property Owner wishes to obtain a building or engineering permit according to the Grading and/or Improvement Plan Drawing No(s) or Building Plan Project No(s): 38042-1-D.

Continued on Page 2

NOW, THEREFORE, the parties agree as follows:

1. Property Owner shall have prepared, or if qualified, shall prepare an Operation and Maintenance Procedure [OMP] for Permanent Storm Water BMP's, satisfactory to the City, according to the attached exhibit(s), consistent with the Grading and/or Improvement Plan Drawing No(s), or Building Plan Project No(s): 38042-1-D.

2. Property Owner shall install, maintain and repair or replace all Permanent Storm Water BMP's within their property, according to the OMP guidelines as described in the attached exhibit(s), the project's WQTR and Grading and/or Improvement Plan Drawing No(s), or Building Plan Project No(s) 38042-1-D.

3. Property Owner shall maintain operation and maintenance records for at least five (5) years. These records shall be made available to the City for inspection upon request at any time.

This Maintenance Agreement shall commence upon execution of this document by all parties named hereon, and shall run with the land.

Executed by the City of San Diego and by Property Owner in San Diego, California.

See Attached Exhibit(s): A, B, C.1, C.2, D.1, D.2

____
(Owner Signature)

____
(Print Name and Title)

____
(Company/Organization Name)

____
(Date)

THE CITY OF SAN DIEGO

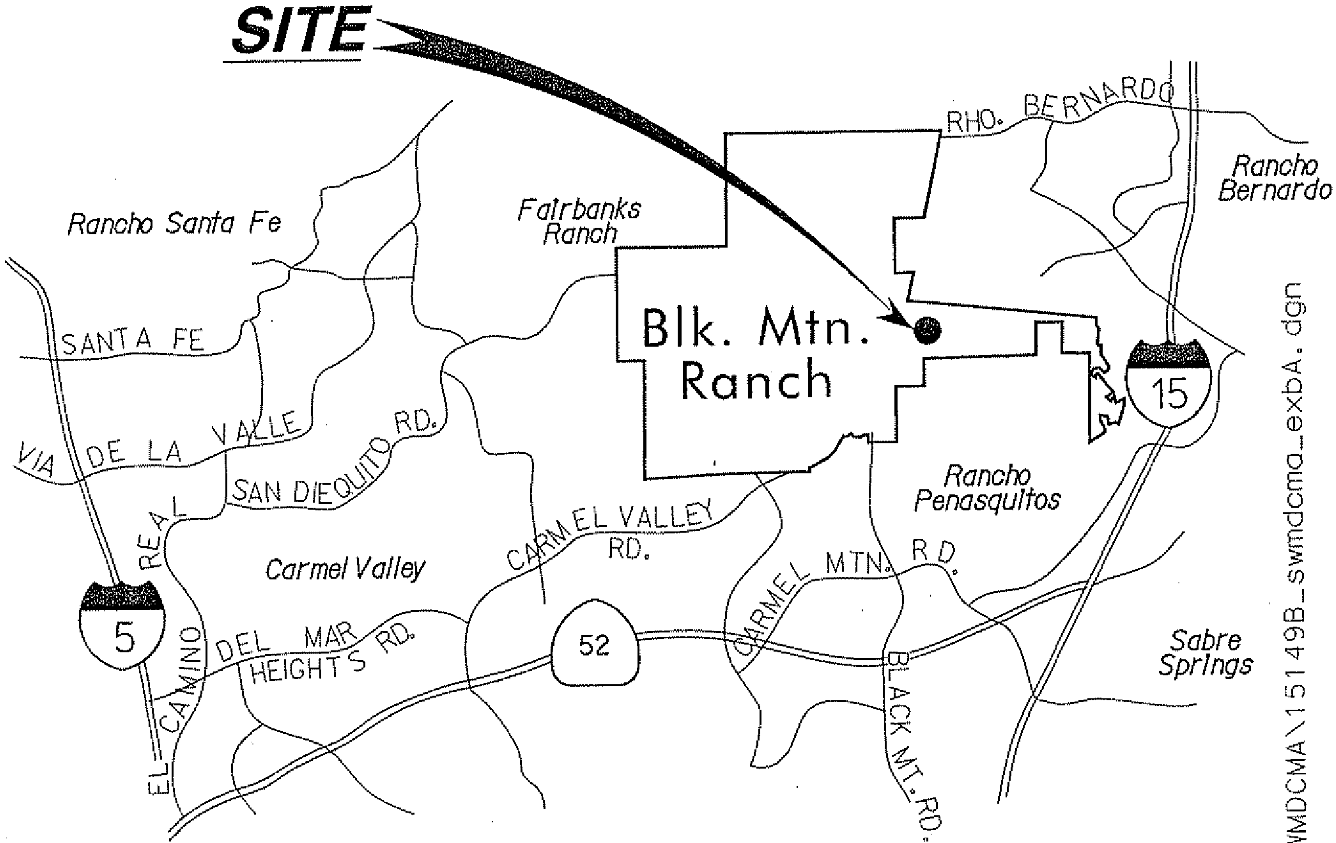
APPROVED:

____
(City Control Engineer Signature)

____
(Print Name)

____
(Date)

NOTE: ALL SIGNATURES MUST INCLUDE NOTARY ACKNOWLEDGMENTS PER CIVIL CODE SEC. 1180 ET.SEQ.



VICINITY MAP

NO SCALE

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30-JUL-2014 11:30

J-15149B DATE: 7/31/14

1 OF 1

RICK ENGINEERING COMPANY
5620 FRIARS ROAD
SAN DIEGO, CA 92110
619.291.0707
(FAX)619.291.4165

EXHIBIT "A"
BLACK MOUNTAIN RANCH
EAST CLUSTERS UNIT 3
STORM WATER MANAGEMENT AND DISCHARGE CONTROL MAINTENANCE AGREEMENT

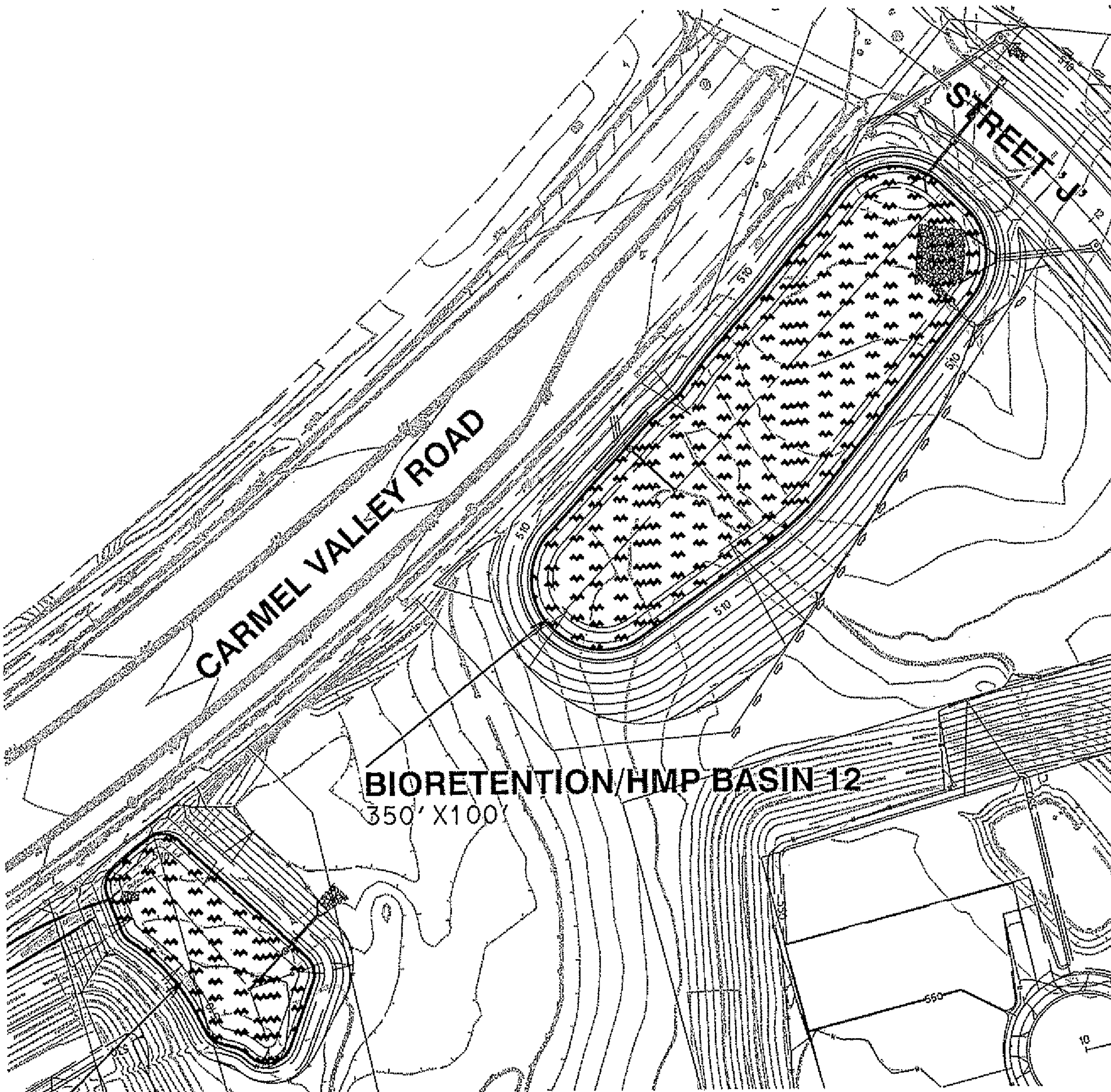
BMP DESCRIPTION		POST-CONSTRUCTION PERMANENT BMP OPERATION & MAINTENANCE PROCEDURE DETAILS[1] O&M RESPONSIBLE PARTY DESIGNEE: PROPERTY OWNER		
		INSPECTION FREQUENCY	MAINTENANCE FREQUENCY	MAINTENANCE METHOD
SITE DESIGN	LANDSCAPED AREAS	MONTHLY (NOTE: INSPECTOR SHALL CHECK FOR THE FOLLOWING MAINTENANCE INDICATORS: EROSION IN THE FORM OF RILLS OR GULLIES, PONDING WATER, BARE AREAS, ANIMAL BURROWS, HOLDS, MOUNDS, AND TRASH.)	1. AS DETERMINED BY INSPECTION; AND 2. ON OR BEFORE SEPTEMBER 30TH.	1. FILL AND COMPACT AREAS OF RUTS, RILLS, OR GULLIES; 2. RE-SEED AND/OR PLANT SLOPES AND AREAS OF EXPOSED SOILS; AND 3. ROUTINE MOWING AND TRIMMING AND TRASH REMOVAL.
	OUTLET PROTECTION	1. MONTHLY; 2. WITHIN 24 HOURS AFTER EACH "SIGNIFICANT RAIN EVENT" [2] AND 3. WITHIN 24 HOURS FOLLOWING CONSTRUCTION IN IMMEDIATE AREA OF OUTLET PROTECTION	1. AS DETERMINED BY INSPECTION; 2. WHEN DISTURBED OR MISSING ROCKS (RIP RAP), OR SOIL EROSION BELOW AND/OR ADJACENT TO OUTLET PROTECTION ARE OBSERVED.	1. REMOVE TRASH, DEBRIS AND LEAVES. REPAIR ANY DAMAGE TO ROOF DRAINS; 2. IMMEDIATELY REPOSITION ALL DISPLACED ENERGY DISSIPATER; AND 3. IF SOIL EROSION IS FOUND, EXTEND ENERGY DISSIPATER (I.E. LANDSCAPE ROCKS AND/OR SPLASH PADS); REPOSITION OR INCREASE LIMITS OF ENERGY DISSIPATER TO FULLY COVER ERODED AREA.
SOURCE CONTROL	INTEGRATED PEST MANAGEMENT	TWICE A YEAR (ON OR BEFORE SEPTEMBER 30TH AND FOLLOWING THE RAINING SEASON AFTER MAY 1ST.)	WHEN THE PEST OR PESTS, OBSERVED IN GREATEST ABUNDANCE OR CAUSE THE MOST OBSERVED SYMPTOMS, ARE IDENTIFIED.	CHECK FREQUENTLY FOR PESTS, AND TREAT WITH A PESTICIDE ONLY WHEN A PEST IS PRESENT, ETC.

BMP DESCRIPTION		POST-CONSTRUCTION PERMANENT BMP OPERATION & MAINTENANCE PROCEDURE DETAILS[1] O&M RESPONSIBLE PARTY DESIGNEE: PROPERTY OWNER		
		INSPECTION FREQUENCY	MAINTENANCE FREQUENCY	MAINTENANCE METHOD
SOURCE CONTROL	EFFECTIVE IRRIGATION SYSTEM	MONTHLY	WHEN BROKEN SPRINKLER HEADS, RAIN SHUTOFF DEVICES, AND FLOW REDUCERS ARE OBSERVED; OR RUNNING SPRINKLERS IN RAIN ARE OBSERVED.	REPAIR OR REPLACE THE BROKEN AND/OR MALFUNCTIONING PARTS OF IRRIGATION SYSTEM.
	TRASH STORAGE AREAS	WEEKLY	1. AS DETERMINED BY INSPECTION; 2. STANDING WATER IN TRASH STORAGE AREA. 3. LOOSE TRASH OR DEBRIS. 4. LEAKED OR SPILLED MATERIALS. 5. COMPROMISED FENCE, SCREEN, GATE, WALL, BIN. LID OR ROOF AWNING (WHERE APPLICABLE). 6. CRACKED OR OTHERWISE COMPROMISED PAVING OR OTHER FLAWED FLOOR SURFACE (AS APPLICABLE).	1. IF STANDING WATER IS OBSERVED IN THE AREA, DETERMINE THE WATER SOURCE AND REMOVE THE SOURCE. ALLOW STANDING WATER TO EVAPORATE. IF WATER DOES NOT EVAPORATE IN 48 HOURS, REDISTRIBUTE THE WATER TO LANDSCAPED AREA(S). DO NOT DRAIN WATER TO STORM DRAIN SYSTEM. 2. REMOVE AND PROPERLY DISPOSE LOOSE TRASH, DEBRIS, AND LEAKED OR SPILLED MATERIALS. USE APPROPRIATE SPILL CLEANUP MATERIAL AS NECESSARY TO REMOVE ALL LEAKED AND SPILLED MATERIALS INCLUDING MATERIALS ADHERED TO PAVEMENT. IDENTIFY AND REMOVE OR REPAIR THE SOURCE OF ANY LEAKED OR SPILLED MATERIALS. 3. REPAIR THE FOLLOWING AS APPLICABLE: COMPROMISED FENCE, SCREEN, GATE, WALL, BIN, LID OR ROOF AWNING (WHERE APPLICABLE), CRACKED OR COMPROMISED PAVING OR OTHER FLOOR SURFACE (AS APPLICABLE).

BMP DESCRIPTION		POST-CONSTRUCTION PERMANENT BMP OPERATION & MAINTENANCE PROCEDURE DETAILS[1] O&M RESPONSIBLE PARTY DESIGNEE: PROPERTY OWNER		
		INSPECTION FREQUENCY	MAINTENANCE FREQUENCY	MAINTENANCE METHOD
SOURCE CONTROL	PREVENTIVE STENCILING AND SIGNAGE	ANNUALLY	WHEN FULLY OR PARTIALLY ERASED SIGNS ARE OBSERVED; WHEN DUMPING OF TRASH ARE OBSERVED AT PUBLIC ACCESS POINTS, BUILDING ENTRANCES, PUBLIC PARKS, ETC.	1. REPLACE OR REPAINT THE STENCILS AND SIGNAGE SO THAT THEY ARE LEGIBLE; AND 2. MAKE SURE THAT THEY ARE PLACED AT ALL REQUIRED LOCATIONS (I.E.- ALL INLETS).
TREATMENT CONTROL	BIORETENTION FACILITIES	TWICE A YEAR AND AFTER MAJOR STORM EVENTS (NOTE: INSPECTOR SHALL CHECK FOR THE FOLLOWING MAINTENANCE INIDICATORS: EROSION IN THE FORM OF RILLS OR GULLIES, PONDING WATER, BARE AREAS, ANIMAL BURROWS, HOLES, MOUNDS, AND TRASH)	1. AS DETERMINED BY INSPECTION; AND 2. ON OR BEFORE SEPTEMBER 30TH AND FOLLOWING THE RAINY SEASON AFTER MAY 1ST.	1. REPLACE MULCH IN AREAS OF RUTS, RILLS, OR GULLIES; 2. RE-SEED AND/OR PLANT SLOPES AND AREAS OF EXPOSED SOILS; AND 3. ROUTINE MAINTENANCE TO REMOVE ACCUMULATED MATERIALS SUCH AS TRASH AND DEBRIS. 4. NON-ROUTINE MAINTENANCE WILL BE REQUIRED TO BACKWASH AND CLEAR UNDERDRAINS IF INSPECTION INDICATES UNDERDRAINS ARE CLOGGED. 5. DEPENDING ON POLLUTANT LOADS, SOILS MAY NEED TO BE REPLACED EVERY 5 TO 10 YEARS.

BMP DESCRIPTION		POST-CONSTRUCTION PERMANENT BMP OPERATION & MAINTENANCE PROCEDURE DETAILS[1] O&M RESPONSIBLE PARTY DESIGNEE: PROPERTY OWNER		
		INSPECTION FREQUENCY	**MAINTENANCE FREQUENCY**	**MAINTENANCE METHOD**
OTHER STRUCTURAL BMPs	HMP BASINS (12 & 13)	1. TWICE A YEAR (ON OR BEFORE SEPTEMBER 30TH AND FOLLOWING THE RAINY SEASON AFTER MAY 1ST); AND 2. AFTER EACH "SIGNIFICANT RAIN EVENT"[2]	1. TWICE A YEAR (ON OR BEFORE SEPTEMBER 30TH AND FOLLOWING THE RAINY SEASON AFTER MAY 1ST); AND 2. AFTER EACH "SIGNIFICANT RAIN EVENT"[2]	1. REMOVE ACCUMULATED MATERIALS SUCH AS TRASH AND DEBRIS; 2. THE RISER STRUCTURE SHOULD BE MAINTAINED TO AVOID CLOGGING AND ANY LEAKAGE THROUGH BOLTHOLES; 3. TRIM VEGETATION AT THE BEGINNING AND END OF WET SEASON AND INSPECT MONTHLY TO PREVENT ESTABLISHMENT OF WOODY VEGETATION AND FOR AESTHETIC AND VECTOR REASONS; AND 4. REMOVE ACCUMULATED SEDIMENT AND REGRADE ABOUT EVERY 10 YEARS OR WHEN THE ACCUMULATED SEDIMENT VOLUME EXCEEDS 10 PERCENT OF THE BASIN VOLUME.

NOTE:
1. REFER TO THE WATER QUALITY TECHNICAL REPORT (WQTR) FOR MORE SPECIFIC INFORMATION.
2. A SIGNIFICANT RAIN EVENT CONSIDERED WHENEVER THE NATIONAL WEATHER SERVICE REPORTS 0.50" OF RAIN IN 48 HOURS FOR THE LOCAL COMMUNITY.



BIORETENTION/HMP BASIN 13
140'X60'

NO SCALE

LIMITS OF BIORETENTION AREA WITHIN BIORETENTION/HMP BASIN 12 IS APPROXIMATELY 350 FEET BY 100 FEET AND BASIN 13 IS 140 FEET BY 60 FEET

N

LEGEND

BIORETENTION/HMP BASIN

PROPOSED STORM DRAIN

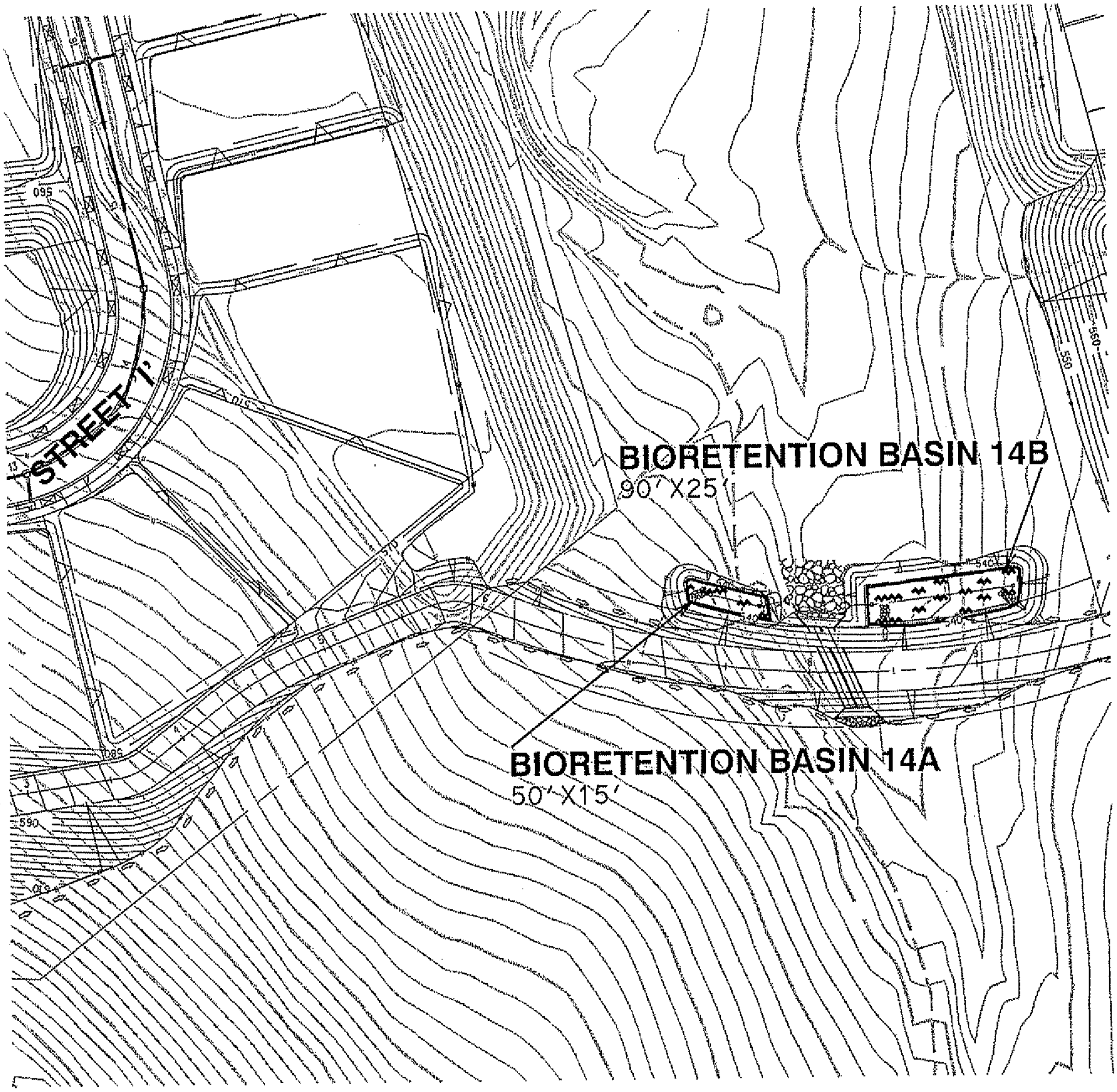
ENERGY DISSIPATION

R:\15149B\Hydro\WaterQuality\SWMDCMA\15149B_swmdcma_exbC.dgn
30-JUL-2014 13:55

J-15149B DATE: 7/31/14

EXHIBIT "C.1"
BLACK MOUNTAIN RANCH
EAST CLUSTERS UNIT 3
STORM WATER MANAGEMENT AND DISCHARGE CONTROL MAINTENANCE AGREEMENT

RICK ENGINEERING COMPANY
5620 FRIARS ROAD
SAN DIEGO, CA 92110
619.291.0707
(FAX)619.291.4165



NO SCALE

LIMITS OF BIORETENTION AREA WITHIN BIORETENTION BASIN 14A IS APPROXIMATELY 50 FEET BY 15 FEET AND BASIN 14B IS 90 FEET BY 25 FEET

N

R:\15149B\Hydro\WaterQuality\SWMDCMA\15149B_swmdcma_exbC2.dgn
30-JUL-2014 15:04

LEGEND

BIORETENTION/HMP BASIN

PROPOSED STORM DRAIN

ENERGY DISSIPATION

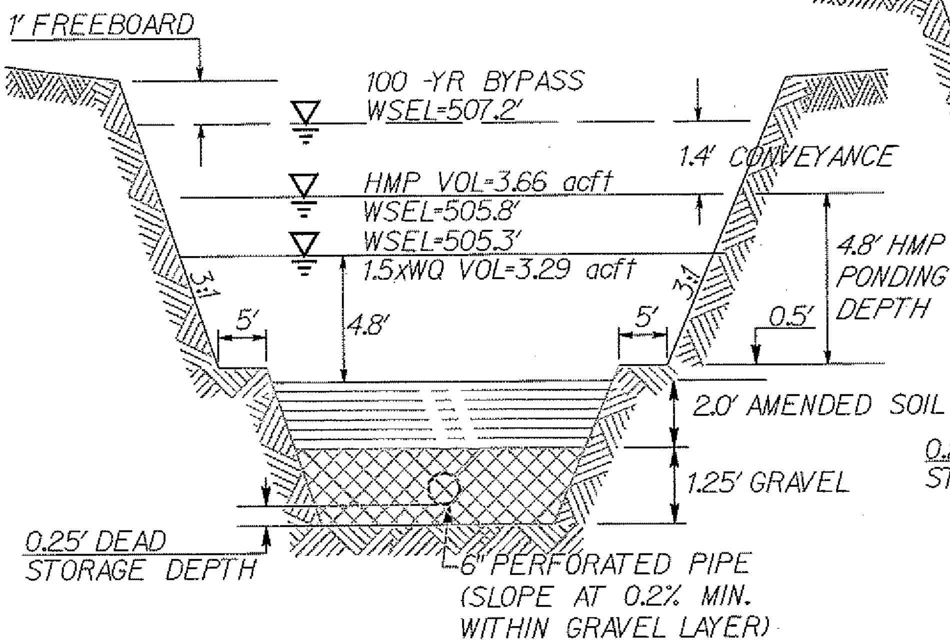
J-15149B DATE: 7/31/14

2 OF 2

EXHIBIT "C.2"
BLACK MOUNTAIN RANCH
EAST CLUSTERS UNIT 3
STORM WATER MANAGEMENT AND DISCHARGE CONTROL MAINTENANCE AGREEMENT

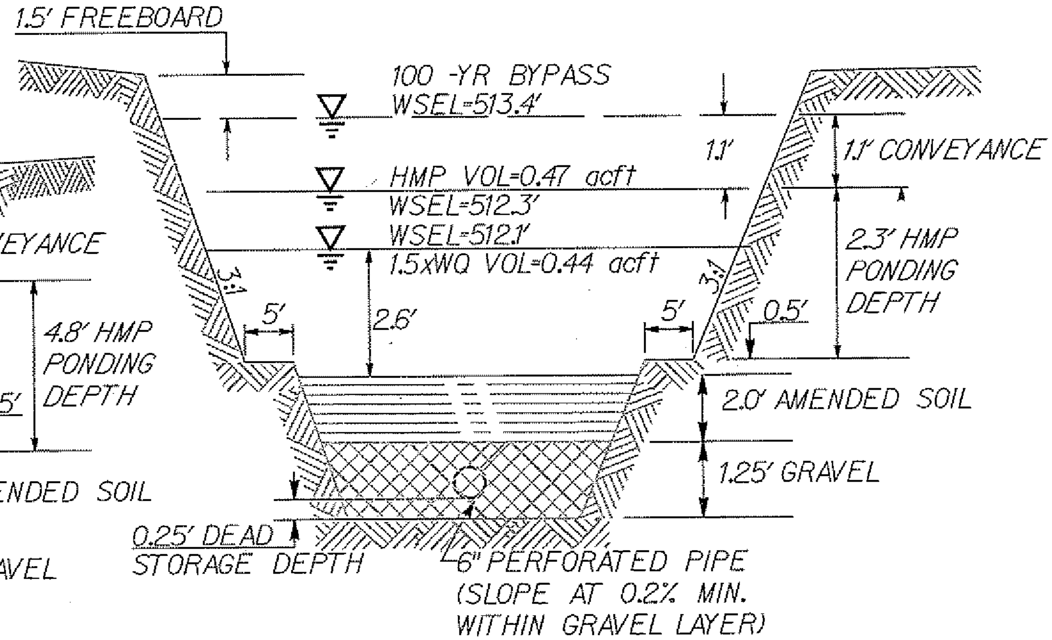
RICK ENGINEERING COMPANY
5620 FRIARS ROAD
SAN DIEGO, CA 92110
619.291.0707
(FAX)619.291.4165

NOTE: 30-MIL PVC LINER, OR EQUIVALENT TO BE INSTALLED ALONG SIDES & BOTTOM. SEAMS AND PENETRATIONS SHOULD BE PROPERLY SEALED IN ACCORDANCE WITH THE MANUFACTURES RECOMMENDATIONS.



BIORETENTION BASIN (BMP-12)

NOT TO SCALE



BIORETENTION BASIN (BMP-13)

NOT TO SCALE

R:\15149B\Hydro\WaterQuality\SWMDCMA\15149B_swmdcma_exbD1.dgn
08-AUG-2014 11:55

J-15149B DATE: 7/31/14

RICK ENGINEERING COMPANY
5620 FRIARS ROAD
SAN DIEGO, CA 92110
619.291.0707
(FAX)619.291.4165

EXHIBIT "D.1"
BLACK MOUNTAIN RANCH
EAST CLUSTERS UNIT 3
STORM WATER MANAGEMENT AND DISCHARGE CONTROL MAINTENANCE AGREEMENT

BIORETENTION SOIL

BIORETENTION SOIL SHALL ACHIEVE AN INITIAL INFILTRATION RATE OF AT LEAST 8 INCH PER HOUR OR MORE THAN 20 INCHES PER HOUR "IN SITU" AND A LONG-TERM, IN-PLACE INFILTRATION RATE OF AT LEAST 5 INCHES PER HOUR. BIORETENTION SOIL SHALL ALSO SUPPORT VIGOROUS PLANT GROWTH. BIORETENTION SOIL SHALL BE A MIXTURE OF FINE SAND AND COMPOST, MEASURED ON A VOLUME BASIS:

65% SAND, 20% SANDY LOAM, 15% COMPOST

GRAVEL LAYER (FILTER MATERIALS)

A. GRAVEL STONE SHALL BE "CLASS 2 PERMEABLE MATERIAL" PER CALTRANS SPECIFICATION 68-2.02F(3).
B. PEA GRAVEL (IF APPLICABLE) SHALL BE CLEAN AND GRADED, WASH RIVER-RUN GRAVEL MEETING ASTM C33, SIZE 7 (3/4 INCH).
C. FILTER FABRIC (IF APPLICABLE) SHALL BE GEOTEXTILE FILTER FABRIC WHICH MEETS AASHTO M288-96 FOR SPECIFICATIONS FOR STABILIZATION AND SEPARATION - CLASS 3, MIRAFI 140N OR APPROVED EQUAL. A TWO INCH LAYER OF BARK MULCH PER SECTION 02900 LANDSCAPE PLANTING SHALL BE INSTALLED ON THE SURFACE OF THE BIORETENTION SOIL IF PLANTING OF CONTAINER STOCK AND NO HYDROSEEDING IS TO BE INSTALLED TO PREVENT FOOT COMPACTION OF THE BIORETENTION SOIL.

NOTE: REFER TO SHEET 7 OF GRADING PLANS FOR MORE INFORMATION.

BIORETENTION BASIN
SOIL AND GRAVEL LAYER SPECIFICATION

R:\15149B\Hydro\WaterQuality\SWMDCMA\15149B_swmdcma_exbD2.dgn
08-AUG-2014 11:59

J-15149B *DATE: 7/31/14*

RICK ENGINEERING COMPANY
5620 FRIARS ROAD
SAN DIEGO, CA 92110
619.291.0707
(FAX)619.291.4165

EXHIBIT "D.2"
BLACK MOUNTAIN RANCH
EAST CLUSTERS UNIT 3
STORM WATER MANAGEMENT AND DISCHARGE CONTROL MAINTENANCE AGREEMENT

APPENDIX G

City of San Diego Permanent BMP Construction Certification

(A blank copy is provided)

FINAL SIGNED AND STAMPED CERTIFICATION
TO BE PROVIDED AT COMPLETION OF CONSTRUCTION
UNDER SEPARATE COVER

Note: This certification is subject to change prior to its use, as ongoing discussions between the City of San Diego and industry professionals is expected to result in modification to the language.

City of San Diego
Development Services
1222 First Ave., MS-501
San Diego, CA 92101
(619) 236-5500

THE CITY OF SAN DIEGO

Permanent BMP Construction
Self Certification Form

FORM
DS-563
FEBRUARY 2013

Date Prepared:	Project No.:
Project Applicant:	Phone:
Project Address:	
Project Engineer:	Phone:

The purpose of this form is to verify that the site improvements for the project, identified above, have been constructed in conformance with the approved Standard Urban Storm Water Mitigation Plan (SUSMP) documents and drawings.

This form must be completed by the engineer and submitted prior to final inspection of the construction permit. Completion and submittal of this form is required for all new development and redevelopment projects in order to comply with the City's Storm Water ordinances and NDPES Permit Order No. R9-2007-0001. Final inspection for occupancy and/or release of grading or public improvement bonds may be delayed if this form is not submitted and approved by the City of San Diego.

CERTIFICATION:
As the professional in responsible charge for the design of the above project, I certify that I have inspected all constructed Low Impact Development (LID) site design, source control and treatment control BMP's required per the approved SUSMP and Construction Permit No. ______________________; and that said BMP's have been constructed in compliance with the approved plans and all applicable specifications, permits, ordinances and Order No. R9-2007-0001 of the San Diego Regional Water Quality Control Board.

I understand that this BMP certification statement does not constitute an operation and maintenance verification.

Signature: ______________________________

Date of Signature: ______________________________

Printed Name: ______________________________

Title: ______________________________

Phone No. ______________________________

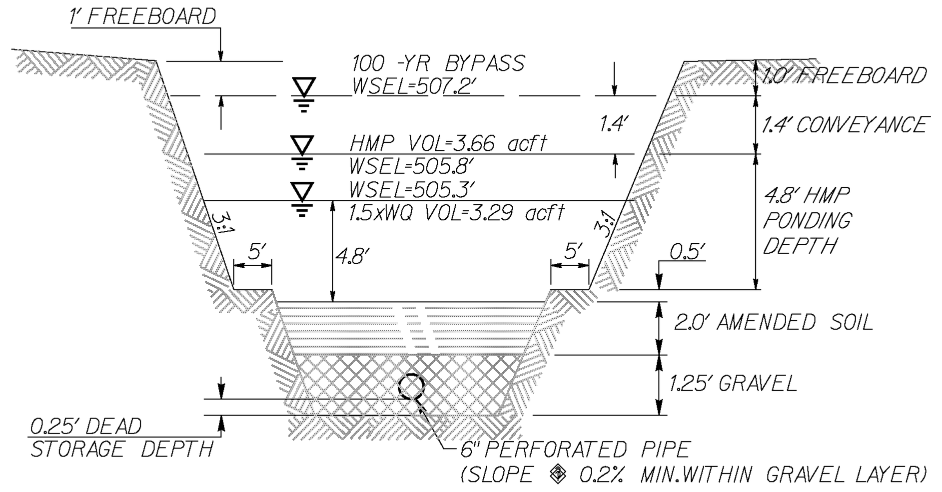
Engineer's Stamp

COMPACT DISC (CD):

Electronic Files for San Diego Hydrology Model (SDHM)

MAP POCKET 1

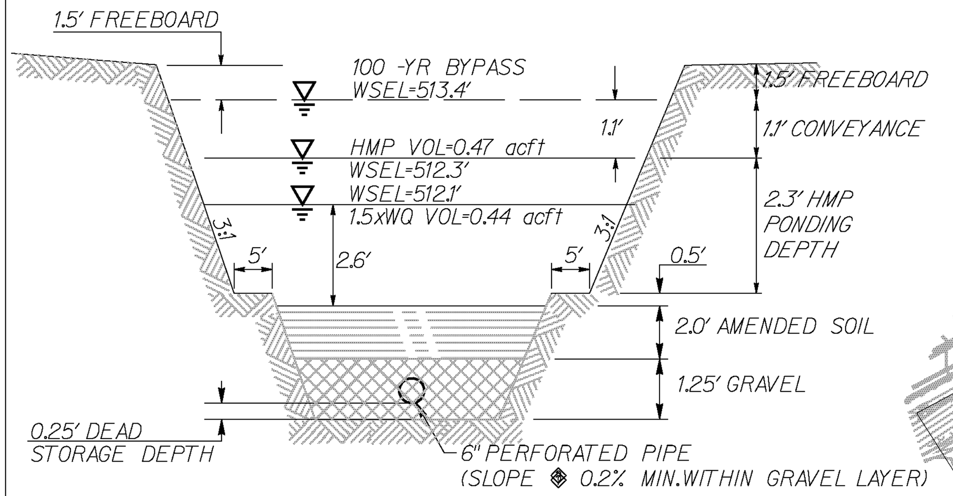
Water Quality Technical Report Exhibit
and
Hydromodification Management Plan
Exhibit for
BMR East Clusters Unit 3



BIORETENTION BASIN
(BMP-12)

NOT TO SCALE

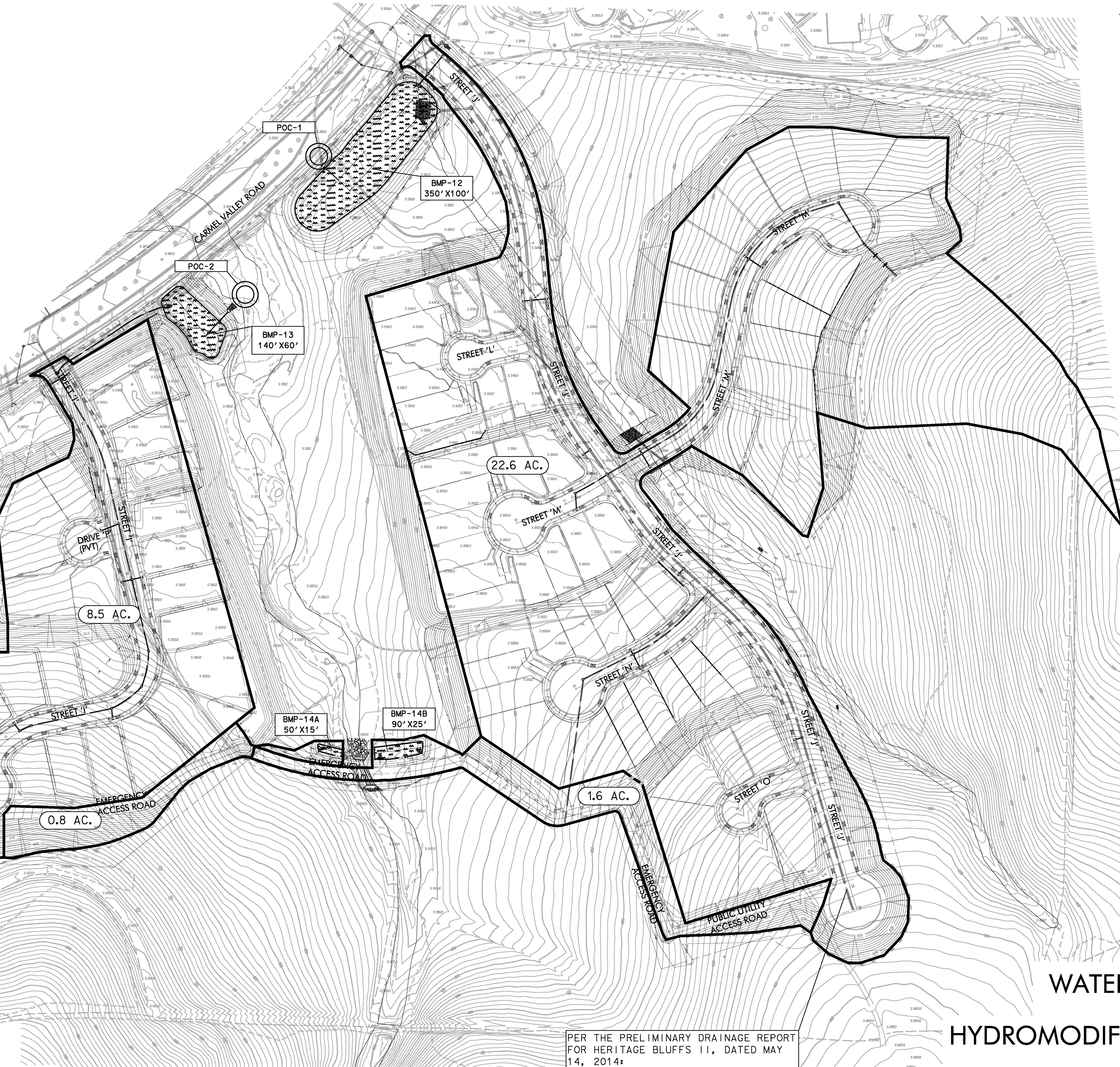
NOTE: 30-MIL PVC LINER, OR EQUIVALENT TO BE INSTALLED ALONG SIDES & BOTTOM. SEAMS AND PENETRATIONS SHOULD BE PROPERLY SEALED IN ACCORDANCE WITH THE MANUFACTURES RECOMMENDATIONS.



BIORETENTION BASIN
(BMP-13)

NOT TO SCALE

NOTE: 30-MIL PVC LINER, OR EQUIVALENT TO BE INSTALLED ALONG SIDES & BOTTOM. SEAMS AND PENETRATIONS SHOULD BE PROPERLY SEALED IN ACCORDANCE WITH THE MANUFACTURES RECOMMENDATIONS.



PER THE PRELIMINARY DRAINAGE REPORT FOR HERITAGE BLUFFS II, DATED MAY 14, 2014:

AREA = 39.6 ACRES

NOTE

1. THE PROPOSED BIORETENTION BASINS WILL SERVE AS THE TREATMENT CONTROL BEST MANAGEMENT PRACTICE (TC-BMP) FOR THE OVERALL PROJECT. THE BIORETENTION SYSTEM WITHIN THE BASIN IS COMPRISED OF AN AMENDED SOIL MIX AND GRAVEL LAYER. EXCESS RUNOFF WILL BE DIRECTED TO THE STORM DRAIN SYSTEM IN THE NORTHEAST CORNER OF THE PROJECT.

2. PLEASE REFER TO THE LANDSCAPE PLANTING SHEET FOR THE PLANT MATERIAL SPECIFICATIONS. IN GENERAL, IT IS IMPORTANT TO NOTE THAT THE SELECTED PLANT MATERIAL IS UNIQUE AND SUITABLE FOR THE BIORETENTION BASIN (I.E. - A LOW WATER-USE / DROUGHT TOLERANT PLANT PALETTE)

BIORETENTION SOIL

BIORETENTION SOIL SHALL ACHIEVE AN INITIAL INFILTRATION RATE OF AT LEAST 8 INCH PER HOUR OR MORE THAN 20 INCHES PER HOUR 'IN SITU' AND A LONG-TERM, IN-PLACE INFILTRATION RATE OF AT LEAST 5 INCHES PER HOUR. BIORETENTION SOIL SHALL ALSO SUPPORT VIGOROUS PLANT GROWTH. BIORETENTION SOIL SHALL BE A MIXTURE OF FINE SAND AND COMPOST, MEASURED ON A VOLUME BASIS:

65% SAND, 20% SANDY LOAM, 15% COMPOST

GRAVEL LAYER (FILTER MATERIALS)

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NOTE: REFER TO SHEET 7 OF GRADING PLANS FOR MORE INFORMATION.

INPUT DATA FOR HMP SIZING

- LOW-FLOW THRESHOLD: 0.3Q2
- RAINFALL GAUGE: POWAY
- POINT OF COMPLIANCE (POC): VARIES; SEE EXHIBIT
- DRAINAGE SOIL (HYDROLOGIC SOIL TYPE): D
- POST SURFACE: VARIES (SEE EXHIBIT)
- PRE PROJECT COVER: PERVIOUS
- POST-PROJECT SLOPE: FLAT (0-10%) / MODERATE (5-10%)
- PRE-PROJECT SLOPE: MODERATE (5-10%) / STEEP (>10%)

DRAINAGE MANAGEMENT AREA LEGEND

- LOCATION OF PROPOSED BIORETENTION BASIN (BASIN EAST, BASIN WEST, BASIN 10 AND BASIN 20)
- DMA BOUNDARY TO TREATMENT CONTROL BMP
- (XX.X AC.) DRAINAGE MANAGEMENT AREA TO TREATMENT CONTROL BMP
- POINT OF COMPLIANCE (POC) FOR HMP

WATER QUALITY TECHNICALREPORT AND HYDROMODIFICATION MANAGEMENT PLAN EXHIBIT FOR EAST CLUSTERS UNIT 3 (FINAL ENGINEERING)

J-15149-B

Date: January 31, 2014
Revised: August 7, 2014

RICK ENGINEERING COMPANY
San Diego
5620 FRIARS ROAD
SAN DIEGO, CA 92110
619.291.0707
(FAX)619.291.4165
rickengineering.com
Riverside · Orange · San Luis Obispo · Bakersfield · Sacramento · Phoenix · Tucson

J-15149-B

NOT FOR CONSTRUCTION - EXHIBIT FOR WATER QUALITY TECHNICAL REPORT ONLY

APPENDIX C
Thread-leaved Brodiaea Habitat Management Plan

THREAD-LEAVED BRODIAEA HABITAT MANAGEMENT PLAN

FOR THE

Heritage Brodiaea Preserve

Heritage Bluffs II and East Clusters Unit 3 Projects
City Project No's. 319435; SAP 24004059 and VTM 99-1054: Units 2 & 3
City of San Diego

PREPARED FOR

William M. Dumka
SPIC Del Sur, LLC
16010 Camino Del Sur
San Diego, California 92127

PREPARED BY

Vincent N. Scheidt
Biological Consultant
3158 Occidental Street
San Diego California 92122

Revised December 2015

Vincent N. Scheidt, MA
Certified Biological Consultant

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Glossary of Acronyms

BMP ....Best Management Practices

CCR ....Conditions, Covenants and Restrictions

CDFW... California Department of Fish and Wildlife

CESA...California Endangered Species Act

CNDDB.. California Natural Diversity Data Base

CRPR .... California Rare Plant Rank

DSD ....Development Services Department

DPR... Department of Parks and Recreation

FESA ....Federal Endangered Species Act

FMP ....Framework Management Plan

HMP .... Habitat Management Plan

MHCP...Multi-habitat Planning Area

MOU .... Memorandum of Understanding

MSCP .... Multiple Species Conservation Program

USFWS ....United States Fish and Wildlife Service

Glossary of Standard Terms

Adaptive Management: A systematic process for continually improving management policies and practices by learning from the outcomes of operational programs.

California Department of Fish and Wildlife (**CDFW):** a department of the California Resources Agency.

California Natural Diversity Data Base (CNDDB): A state program that inventories the status and locations of rare plants and animals in California.

Conservation Easement: A legal agreement between a landowner and a land trust or government agency, such as the CDFW, that permanently limits uses of the land in order to protect its conservation values (California Government Code Section 27255).

Dedication: The turning over by an owner or developer of private land for public use, and the acceptance of land for such use by the governmental agency having jurisdiction over the public function for which it will be used. Dedications for roads, parks, school sites, or other public uses often are made conditions for approval of a development by a city or county.

Easement: Usually the right to use property owned by another for specific purposes or to gain access to another property. For example, utility companies often have easements on the private property of individuals to be able to install and maintain utility facilities.

Exotic Species: A species of plant or animal that is not indigenous, native, or naturalized to the area where it is found.

GLOSSARY OF STANDARD TERMS

Habitat: The combination of environmental conditions of a specific place providing for the needs of a species or a population of such species.

Habitat Management Plan (HMP): An activity plan for wildlife resources for a specific geographical area of land. It identifies wildlife habitat and related objectives, establishes the sequence of actions for achieving objectives, and outlines procedures for evaluating accomplishments.

Habitat Requirements: A specific set of physical and biological conditions that surround a single species, group of species, or community of species upon which the species or associations are dependent for their existence. In wildlife management the major components of habitat are considered to be food, water, cover and living space.

Listed Species: A taxon that is protected under the FESA or CESA. Listing categories include: Threatened, Endangered, Species of Special Concern, State Protected Species, Federally Proposed Threatened or Endangered, and Federally Petitioned Threatened or Endangered.

MSCP: A Subregional Plan. Also refers to the City of San Diego's Multiple Species Conservation Program Subarea Plan.

Monitoring: The timed collection of information to determine the effects of resource management and to identify changing resource conditions or needs.

Native (Indigenous) Species: A species of plant or animal that naturally occurs in an area and that was not introduced by humans.

Narrow Endemic Species: A rare species that is confined to a specific geographic region, soil type, and/or habitat.

Plant Community: Assemblage of plant populations in a defined area or physical habitat; an aggregation of plants similar in species composition and structure, occupying similar habitats over the landscape.

Sensitive Species: Plant or animal species listed as endangered, threatened, candidate, or sensitive by federal, state, or local governments.

Take: Under FESA and CESA: to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or attempt to engage in any such conduct relative to a Listed Species.

United States Fish and Wildlife Service (FWS/USFWS): An agency of the United States Department of the Interior.

Vegetative Community: Refers to the species or various combinations of species which dominate or appear to dominate an area of habitat (see plant community).

Wildlife Agencies: The USFWS and CDFW, collectively.

1.0 INTRODUCTION

1.1 Purpose of Habitat Management Plan

The purpose of this Habitat Management Plan (HMP) is to identify specific requirements for the maintenance and monitoring, in perpetuity, of the plant communities and plant and animal species naturally occurring in the Heritage Brodiaea Preserve (HBP) site, with special attention to the resident population of Thread-leaved Brodiaea *(Brodiaea filifolia)* a FESA-list Threatened, CESA-listed Endangered Species, and City of San Diego "Narrow Endemic Species". The HBP is being proposed for the conservation, preservation, and enhancement of these natural resources as partial mitigation for impacts associated with development of the Heritage Bluffs II development project site. The HBP will preserve a portion of a regionally-significant population of Thread-leaved Brodiaea in a Conservation Easement (CE) dedicated for that purpose. This new occurrence represents the southern-most known major population of Thread-leaved Brodiaea and one of only two in the City of San Diego. The other occurrence, which is substantially smaller, is located a short distance away on the other side of Black Mountain.

As part of the responsibilities of management, the biological features of the site will be protected and monitored in perpetuity. This document establishes a program of baseline assessments, management, monitoring, and reporting that will help to protect and maintain these biological resources. A Project Analysis Record (PAR) will be prepared to fully document the specific tasks, fees and contingencies associated with these activities. Additionally, this HMP provides an overview of the operation, maintenance, administrative, and personnel requirements necessary to implement management goals. The applicant is required to prepare this HMP and have it reviewed and approved by the California Department of Fish and Wildlife (CDFW) and the U.S. Fish and Wildlife Service (USFWS), hereafter referred to as the Wildlife Agencies, as well as the City of San Diego.

1.2 Agency Review and Coordination

The City's Development Services Department (DSD) in concert with the Wildlife Agencies, as third party beneficiaries, must approve this HMP, the associated PAR, and all activities associated with it. If the proposed CE is granted to an agency or organization other than a member of the Wildlife Agencies, review and approval by that other agency or organization shall be required.

2.0 THE HERITAGE BRODIAEA PRESERVE

2.1 Preserve Description and Location

The HBP is located in the northern part of the City of San Diego County, California (Figure 1). The Preserve consists of 14.1 acres of the Heritage Bluffs II and portions of the adjacent Parcel 3 of PM 18504 (portions of APNs 312-010-15 and 312-160-07) generally situated between the East Clusters Unit 3 and Heritage Bluffs II development project sites. The HBP will be protected within a conservation easement supporting a diversity of habitats and species.

2.2 Current Environmental Setting

The HBP is located in the northern part of the City of San Diego (Figure 1 and 2). The HBP is situated in a broad valley below the north slopes of Black Mountain, a well-known local land feature. The East Clusters Unit 3 and Heritage Bluffs II development projects abut the HBP to the immediate northwest and southeast, respectively. Black Mountain Open Space Park generally surrounds the East Clusters Unit 3 and Heritage Bluffs II development project sites. The HBP area appears to have been used in the past for grazing and extensive agriculture, some evidence of which remains on the site today. However, the land has been fallow for many decades.

The HBP is undeveloped, supporting 100 percent open grassland vegetation with significant numbers of both native and non-native elements. Minor ephemeral drainages are found to the northeast and southwest. These effectively "box-in" the HPB and surrounding grasslands, forming the limits of the large clay lens that sits in this location. Slopes within the HBP are mostly gentle, and elevations range between approximately 605 feet and 690 feet MSL. Regional soil mapping (USDA 1973, 2014) indicates that the HBP site is underlain by the Auld Clay Series. Auld Clays typically consists of poorly drained materials that are underlain by metavolcanic rock. Based on differences between the mapped Auld series and soil profiles examined during geotechnical research, the site soils may belong to a different series. The USDA (1973) soils mapping on similar parent material in the region suggests that the site soils appear to be better associated with the Diablo Clay Series, or Diablo-Olivehain Complex Series (USDA 1973), which are also mapped in the vicinity. However, both of the aforementioned soils series fall into hydrologic soil "Group D," have very low infiltration rates, and high runoff potential (USDA 1973). These clays remain hydrated at shallow depth (12-18") for much of the year due to their water-holding capacity. The degree of soil saturation, generally evaluated between depths of 4 to 29 inches, typically ranges from 52 percent to approximately 73 percent with depth.

The HBP and surrounding undeveloped lands function as part of this significant, large-scale, regional wildlife and habitat linkage. Preservation of the site is intended to contribute to the habitat connectivity in this regional linkage in perpetuity.

The Parcel 3 segment of the HBP acreage was previously designated as a part of the City of San Diego's Multiple Species Conservation Program (MSCP) Subarea Plan's Multi-habitat Planning Area (MHPA). The Heritage Bluffs II segment was not. However, after the discovery of Thread-leaved Brodiaea on this site, the City and the Wildlife Agencies have agreed to include all of the HPB acreage in the MHPA.

2.2.1 Plant Communities

The HBP supports a single, highly variable plant community, or habitat-type. This was classified by the project biologist as Non-native Grassland, although it was acknowledged that it contained significant elements of both Native Grassland and some Coastal Sage Scrub species at the periphery. This is defined and described in detail in the site's Final Biological Technical Report (Affinis, 2015).

2.2.2 Flora and Fauna

The HBP site supports a diversity of native and non-native species of plants and animals. The plant and animal species observed typify the diversity normally found in stabilized native and non-native grassland plant communities in this part of the City of San Diego. Comprehensive lists of the plants and animals detected or expected within the HBP will be assembled during the first year of biological monitoring.

2.2.3 Sensitive Species

The HBP site likely supports a number of sensitive species of plants and animals. Sensitive plants might include various ephemeral grassland annuals, such as Small-flowered Morning-glory *(Convolvulus simulans)* and Small-flowered Microseris *(Microseris douglasii* ssp. *platycarpha)*. Sensitive animal species expected to utilize the HBP would include various wide-ranging raptors and bats, such Black-shouldered Kite *(Elanus axillaris)*, Northern Harrier (*Circus cyaneus)*, Townsend's Big-eared Bat *(Corynorhinus townsendii),* Red Bat *(Lasiurus blossevillii),* and many others. .

2.2.4 Thread-leaved Brodiaea

The main purpose of establishing the HBP is to conserve and manage, in perpetuity, all of the natural resources within the HBP boundaries. The most significant species is Thread-leaved Brodiaea, a FESA-listed Threatened and CESA-listed Endangered Species.

Thread-leaved Brodiaea is a late spring-flowering member of the Liliaceae (lily family) sometimes assigned to Amaryllidaceae, Alliaceae, or Themidaceae (Dahlgren et al. 1985; Keator 1993; Fay and Chase 1996; Smith 1997). This is one of 15 species within the genus *Brodiaea*, a group of cormiferous geophytes that occur from southwestern Oregon to northwestern Baja California, Mexico (Niehaus 1971; Keator 1993), mostly in cismontane areas. Thread-leaved Brodiaea is endemic to southwestern California, occurring in a spotty distribution from Glendora in Los Angeles County, east to Arrowhead Hot Springs in San Bernardino County, and south through eastern Orange and western Riverside counties to the slopes of Black Mountain in the northern part of the City of San Diego (Keator 1993; CNDDB 1995a, 1998, 2003, 2012).

Thread-leaved Brodiaea was listed as a California Endangered Species in January of 1982. In October of 1998, it was listed as Threatened under the Federal Endangered Species Act (USFWS 1998). The California Native Plant Society (CNPS) first listed this species in 1980 under the Rarity, Endangerment, Distribution coding system as a “3-3-3” species (CNPS 1980), which equates to the current CRPR listing (2014) as a 1B.1 species. This is the highest ranking (in terms of endangerment status and other factors) afforded any species listed by the CNPS.

At the time of Federal listing, 48 occurrences of Thread-leaved Brodiaea had been reported throughout the species’ range, with at least nine known to have been extirpated, most in northern San Diego County. Populations of Thread-leaved Brodiaea are generally reported as small, with only six populations known from 1998 to exceed 5,000 flowering scapes (Roberts and Vanderwier 1997; CNDDB 1998; USFWS 1998). Many occurrences are reported to consist of less than 500 specimens. In contrast, the CNDDB lists one occurrence, EO 10, on a 40-acre parcel in San Marcos in northern San Diego County as supporting approximately 342,000 flowering specimens (extrapolated) in 1993 (CNDDB 1995a, b). Because each flowering scape detectable during a normal rainfall year represents at least 8–10 separate subterranean corms (CNDDB 1995b), the projected population density at EO 10 would be between 2.7 and 3.4 million plants. In extreme or exceptional drought years, the corms are able to remain in innate dormancy and not produce flowers or even foliage, rendering counts on the basis of flowering scapes extremely unreliable. One study in San Marcos found only 20 flowering plants where

8,000+ corms were later located during salvage and transplantation (Taylor and Burkhart 1992). Another reported that 14,373 vegetative plants were counted within three research plots at the Rancho La Costa reserve in Carlsbad, but none flowered. Even in a wet year, only 2 to 26 percent of the plants within these plots flowered. Year-to-year variation in the number of flowering scapes within known populations thus ranges from thousands to none, depending on precipitation (CNDDB 1995b).

Thread-leaved Brodiaea was first discovered on the Heritage Bluffs II development site in 2011 by biologist Marcia Adams of Affinis. Affinis conducted focused surveys for this species in 2011 and again in 2012. Follow-up foliage surveys were completed in January and February of 2015 during the period of maximum detectability for this species. All surveys were completed by walking the site at 10 foot intervals. All observed occurrences were mapped with a Garmin GPS unit. In 2012, the site was first resurveyed by Affinis with consulting biologist Vince Scheidt, to search for Thread-leaved Brodiaea foliage. All previously identified GPS points (from 2011) were relocated in 2012, and transects were again walked to search for new occurrences. All additional occurrences were also mapped with the GPS unit. Biologists Scheidt and Adams, along with Affinis Research Assistant Nicole Sivba were present for the final field visit in 2012 which also included city and wildlife agency staff. This survey had been conducted after a wet winter and many additional flowering scapes were visible (in addition to those detected in 2011), including flowering scapes on the adjoining East Clusters Unit 3 development site, allowing new GPS points to be added to the inventory. All GPS data was given to PDC for digital map preparation. During the surveys conducted in 2011 and 2012, specimens were found in disjunct patches that ranged from one to several hundred flowering scapes. This is discussed in more detail in the Biological Technical Report for that project (Affinis, 2015). As discussed above, the numbers of observed flowering scapes observed does not in any way accurately reflect the HBP's population size or carrying capacity, however, because (1) the 2011 and 2012 surveys were unavoidably conducted in the midst of 3-years of extreme drought, and (2) Thread-leaved Brodiaea often produces foliage without producing flowers. Therefore, it was predicted that the total number of specimens in the HBP and on the adjoining development sites could range from thousands to hundreds of thousands or more individual corms of all age classes.

The aforementioned, most recent field surveys, completed in January and February of 2015 under the same survey protocols, revealed the presence of no less than 10,423 individually-counted specimens, with the total occurrence population estimated to be between 95,000 and 185,000 individuals of all age classes.

2.3 Restoration and Enhancement Opportunities

The HBP is currently subject to regular disturbance along two dirt tracks. These have impacted the habitat directly, and they also provide access to allow illegal dumping, littering, trampling, etc. Opportunities for habitat creation, restoration. and enhancement exist in the HBP within and adjacent to these tracks, which total approximately 0.23 acres of disturbed/degraded land. Old graded areas will be recontoured to natural grades, and the subsequent termination of pedestrian, equestrian, vehicular and bicycle access through the HBP, followed by planting with indigenous native grassland species, will result in an increase in the biological resource value of the overall HBP habitat and mitigation for project impacts to Native Perennial Grassland vegetation. All restoration or enhancement activities, such as eliminating the dirt tracks, etc. are subject to the requirements of this Plan. Enhancement activities involving the use of Thread-leaved Brodiaea are further subject to the salvage and translocation requirements of the Plan.

Because of the natural growth form of *B. filifolia,* it is possible to augment the existing population that occurs within the HBP with specimens salvaged from the Heritage Bluff II development project site. Adequate room is present to move many tens to hundreds of thousands of specimens without any crowding. *B. filifolia* often occurs in very dense stands, each containing many thousands of ramets. For this reason, there is adequate room within the HBP area to support all specimens needing translocation.

One of the proposed mitigation measures associated with the Heritage Bluff II project's environmental review is the restoration of a small area of Native Grassland vegetation, a Tier I habitat-type. Specifically, the project's *Final Biological Technical Report* (Affinis, 2015) indicates that the proposed project would directly impact approximately 0.15 acre of "native perennial grassland". According to the Affinis (2015) report, the City’s biology guidelines require 2:1 mitigation if impacts and mitigation for Tier I habitats both occur within the MHPA. Mitigation is 1:1 if impacts to Tier I habitat occur outside the MHPA and mitigation occurs inside the MHPA. Mitigating cumulative impacts to Native Grassland also require a minimum of 1:1 "creation" of new Native Perennial Grassland in addition to that required for direct impacts. In order to accomplish adequate mitigation for direct impacts, areas within the HBP richest in native species will be enhanced by following most of the techniques that will be used to manage *B. filifolia*. Specifically, this would consist of the mechanical removal of noxious invasives (*Cynara* and *Foeniculum*), as described above, along with thatch thinning and removal (if necessary). Areas where noxious invasives are removed will planted with native grassland species salvaged from the development site or from seeds collected from the site in order to augment the native elements of the habitat. To mitigate cumulative impacts, the site's two dirt tracks, which currently support 0.23 acre of Disturbed

Habitat, will be regraded and planted with Native Perennial Grassland species intended to "create" new grassland within the former track roadbed (Figure 6). This is discussed further in the project's Biological Technical Report (Affinis, 2015).

Table 1. Potential Species for Native Perennial Grassland Plantings - the HBP Preserve

Common Name	**Scientific Name**	**Source**
Gumplant	*Grindelia camporum*	project site-collected seeds
Purple Stipa	*Stipa pulchra*	rose pots/ project site-salvaged specimens + seeds
Blue-eyed Grass	*Sisyrinchium bellum*	rose pots/ project site-salvaged specimens + seeds
Small-flowered Morning Glory	*Convolvulus simulans*	project site-collected seeds
Blue Dicks	*Dichelostemma capitatum*	project site-salvaged corms or seeds
Early Onion	*Allium praecox*	project site-salvaged bulbs or seeds
Thread-leaved Brodiaea	*Brodiaea filifolia*	project site-salvaged corms
Star Lily	*Zigadenus fremontii*	project site-salvaged bulbs or seeds
Johnny Jump-up Violet	*Viola pedunculata*	project site-salvaged bulbs or seeds
Common Goldenstar	*Bloomeria crocea*	project site-salvaged corms or seeds

Table 2. Performance Standards:
Native Perennial Grassland Creation Area within the HBP Preserve

	Year 1	**Year 2**	**Year 3**	**Year 4**	**Year 5**
Minimum Number of Native Species Established	4	5	6	6	6
Minimum Percentage of Cover with Native Species	5	10	15	15	20
Maximum Percentage of Cover with Invasives	0	0	0	0	0

2.4 Easements or Rights

No existing easements or right-of-ways are known to be present within the HBP.

3.0 ADMINISTRATIVE STRUCTURE AND FUNDING MECHANISM

3.1 Responsible Parties

The following organizations and individuals will be involved in the fulfillment of this HMP. All obligations of the SPIC Del Sur, LLC described below shall be transferred to any future applicant, developer, or land owner:

- SPIC Del Sur, LLC, the Applicant/Developer, shall be responsible for granting a Conservation Easement over the HBP to [--*TBD*--]. Fee Title to the HBP shall be held by the current or future Applicant/Developer. Any transfer of fee Title shall require consultation with the Wildlife Agencies.

- SPIC Del Sur, LLC, the Applicant/Developer, shall retain the services of a PROJECT BIOLOGIST as approved by the Wildlife Agencies who shall be responsible for the implementation of all interim site preparation activities as described herein, including activities associated with the salvage and translocation of any specimens of Thread-leaved Brodiaea detected during grading activities on the adjoining lands. The Project Biologist shall have a B.S., B.A., or higher degree in ecology, botany, or biology, a minimum of five years of demonstrated experience in field biology working directly with Thread-leaved Brodiaea in San Diego County, and be approved by the Wildlife Agencies to work with this species. The interim site preparation is anticipated to take approximately 60 months.

- SPIC Del Sur, LLC, the Applicant/Developer, shall retain the services of a HABITAT MANAGER as approved by the Wildlife Agencies who shall be responsible for the implementation of all long-term maintenance, management, and monitoring activities associated with this HMP. Long-term habitat management shall begin as soon as interim site preparation is completed and approved.

- The WILDLIFE AGENCIES and the DSD will be the approving agencies with respect to the HBP. The Wildlife Agencies and the DSD will not be responsible for implementation of the HMP, but will have authority to enforce its terms and conditions.

- The CONSERVATION EASEMENT HOLDER [--*TBD*--] will also have authority to enforce the terms and conditions of the Conservation Easements which, among other things, requires compliance with this HMP.

Applicant/Developer Responsibilities

The Applicant/Developer shall perform the following tasks prior to certification of the HBP and in conjunction with dedication of Conservation Easements to [--*TBD*--].

- Pay all recording and related costs.

- Complete a thorough clean-up of the HBP, removing debris (old fences, pipes, tires, etc.) and all other items as deemed necessary by (and to the satisfaction of) the Project Biologist. The initial site clean-up activities shall be overseen by the Project Biologist and be done in such a manner so as to not adversely impact biological resources within the HBP.

- Install the necessary fences, signs, and access gate(s). A fencing plan and map are attached (Attachment A).

- Initiate and fund all interim site preparation activities, including habitat enhancement and salvage/translocation activities, identified in this HMP, including horticultural propagation, and fund all activities as necessary. Funding shall pay for activities including exotics eradication and planting, maintenance and biological monitoring for five years as deemed necessary by (and to the satisfaction of) the Project Biologist.

- Supply the Project Biologist and the Habitat Manager with copies of all relevant reports prepared for the project (e.g., biology reports, cultural reports, soils reports, landscape plans, revegetation plans, monitoring reports, etc).

3.2 Designation of a Habitat Manager

The Applicant/Developer shall be responsible for designating a Habitat Manager to provide long-term management of the HBP. The Habitat Manager must be approved by the Wildlife Agencies, and the Habitat Manager shall have the following qualifications:

- The Habitat Manager shall have at least one staff member or contact worker who possesses a B.S., B.A., or higher degree in ecology, zoology, botany, or biology or retain a qualified biologist with such a degree. This individual must have a minimum of five years of demonstrated experience in field biology working directly with Thread-leaved Brodiaea in San Diego County.

- Fiscal stability, including preparation of an operational budget (using an appropriate analysis technique) for the management of this HMP.

- Demonstrated biological stewardship experience with other projects requiring similar skills in San Diego County.

- The ability to carry out habitat monitoring or mitigation activities.

At this time, [--*TBD*--] has been identified as the Habitat Manager responsible for implementation of the specified requirements of this HMP.

3.3 Easement Dedication

SPIC Del Sur, LLC will execute and record a perpetual biological Conservation Easement(s) ("Easement") over the HBP site in favor of the Conservation Easement holder. A draft Easement will been submitted to the Wildlife Agencies for review and approval. The Easement holder will submit the final easement and evidence of its recordation to the Wildlife Agencies within 60 days of recordation of the Easement. Prior to dedication of any Easement, SPIC Del Sur, LLC will complete an initial site clean-up, including the removal of any trash, old fencing, etc.

3.4 Financial Responsibility and Funding Mechanism

The applicant will prepare and implement a perpetual management, maintenance and monitoring plan for the HBP. The applicant will also establish a non-wasting endowment or similar instrument, such as a Landscape Maintenance District, which is tied to the property, for an amount approved by the Wildlife Agencies based on a PAR or similar cost estimation method to secure the ongoing funding for the perpetual management, maintenance and monitoring of the biological conservation easement area by an agency, non-profit organization, or other entity approved by the Wildlife Agencies. The applicant will submit a draft plan to the Wildlife Agencies that shall include: 1) a description of perpetual management, maintenance and monitoring actions and the PAR or other cost estimation results for the non-wasting endowment; 2) proposed land manager's name, qualifications, business address, and contact information, to the Wildlife Agencies for approval at least [--*TBD*--] days prior to initiating project impacts. The applicant will submit the final plan to the Wildlife Agencies and a contract with the approved land manager, as well as transfer the funds for the non-wasting endowment to a non-profit entity, within 60 days of receiving approval of the draft plan. During the 60-month interim period, the funding source for all site preparation activities shall be borne by the Applicant/ Developer. It is anticipated that one or more project biologists will be retained to supervise or directly conduct all activities described in Table 3. Anticipated budget expenditures include consulting fees, fees for materials, and fees for review/oversight by the City and the Wildlife Agencies.

4.0 HABITAT MANAGEMENT

4.1 Habitat Manager Responsibilities

The Habitat Manager's primary responsibilities shall be to maintain the integrity of the conserved habitats in the HBP and to ensure that the conserved populations of Thread-leaved Brodiaea are protected in perpetuity. In order to fulfill that responsibility, the Habitat Manager shall:

- Be familiar with the ecology of and have demonstrated experience working with Thread-leaved Brodiaea in the field.
- Be familiar with this HMP and all supporting documentation.
- Be responsible for all matters noted in this HMP that are required of the Habitat Manager.
- Maintain all documents transferred by the Applicant/Developer and his contractors, including the Project Biologist, and be knowledgeable of the resources and their locations addressed in these reports.
- Be responsive to any community concerns or problems regarding the HBP.
- Document all field visits, notify the HBP contacts in a timely manner of any concerns or problems, and identify potential solutions.
- Carry out all long-term habitat management and monitoring tasks as described in Sections 4.0 and 5.0 of this report.

4.2 Long-term Management Objectives

Invasive Species

Task 1. Monitoring

The Habitat Manager shall be responsible for assessing the occurrence of noxious invasive or exotic plant species in the HBP on an ongoing basis. This shall include semiannual monitoring of the HBP by the Habitat Manager for the occurrence of noxious and exotic plants. An exotics control section will be included in the annual report. In addition, measures shall be undertaken to prevent the introduction of new invasive species into the HBP.

Task 2. Eradication

Noxious invasive species detected in the HBP during semiannual site visits shall be immediately and completely removed under the direct supervision of the Habitat Manager. Perennial and noxious invasive exotic plants shall be removed by cutting their stems at or below ground level or pulling seedlings manually. Annual weeds shall be manually pulled or otherwise killed prior to producing mature seed. All weeds shall be exported from the HBP and disposed of properly. The use of herbicides/pesticides for weed/vector control shall be avoided and shall be implemented only if authorized by the Habitat Manager who will use EPA approved herbicides and pesticides designed to combat and control invasive species.

Noxious invasives that must be removed from the HBP, whenever found, include Artichoke Thistle *(Cynara cardunculus)* and Fennel *(Foeniculum vulgare).* These species are known to occur in the Preserve in large numbers. Also, Hottentot Fig *(Carpobrotus edule)*, Giant Wild Reed (*Arundo donax*), Castor Bean (*Ricinus communis*), Mexican Fan Palm (*Washingtonia robusta*), Salt Cedar (*Tamarix* sp.), Pampas Grass *(Cortaderia* sp.*),* Sahara Mustard *(Brassica tournefortii),* Yellow Starthistle *(Centaurea solstitialis),* English Ivy *(Hedera* sp.*)* Perennial Pepperweed *(Lepidium latifolium),* and all others listed as “high” priority by The California Invasive Plant Council (Cal-IPC, 2006) or subsequent publications.

Certain non-native but naturalized species, including most Eurasian annual grasses, such as Slender Wild Oat *(Avena barbata)*, Red Brome (*Bromus rubens),* Ripgut Brome *(B. diandrus)*, and Purple False-brome *(Brachypodium distachyon)* along with various annual forbs, such as Filaree *(Erodium* spp.*)* and others are long-established non-native elements of southern California’s Non-native Grassland plant communities. The attempts to control these naturalized species are ineffective and can create more problems than they solve. Assuming that the HBP's hydrology is stable and unchanging, these annuals will not be a problem for Thread-leaved Brodiaea, and will not be actively managed. However, as part of the adaptive management strategy, measures may be provided to control and/or dethatch areas of the HBP currently known to support Thread-leaved Brodiaea. This would come into play should a deep thatch develop or should any of the above species become noxious or truly invasive.

Task 3. Predator Control

Exotic animal control is not anticipated to represent a major issue in the management of the HBP. However, both domestic and feral dogs and cats can be major predators of native species. The Habitat Manager shall ensure that dogs, cats, and other non-native animals are not occurring in the HBP. Trapping may be necessary, although the relatively open nature of the HBP means that few pets or feral animals would be residing in the habitat.

Exotic animal control shall be initiated on a case-by-case basis, as follows:

- Predator/pest control shall only be implemented to address a specific, identified problem situation.

- The trapping of non-native predators/pests shall be limited to strategic locations where determined most feasible to accomplish the goal of removing these animals from the HBP. All predator/pest control shall be considered a temporary, short-term activity.

- Predator/pest control methods shall be humane. Adequate shade shall be provided, and all traps, when activated, shall be checked twice daily. Any domestic animals trapped during predator/pest control shall be returned to their owners or taken to the nearest animal shelter.

- The Habitat Manager shall report to the County Animal Control Officers if persistent and chronic problems occur with respect to particular uncontrolled pets or feral animals being found in the HBP.

Task 4. Habitat Restoration, Salvage, and Translocation

The Habitat Manager may allow seed collecting from plants in the HBP for the express purpose of revegetating degraded HBP areas. Any such seed collecting shall be performed under the direct supervision of the Habitat Manager, during the dry season, and under a written agreement specifying the amounts and locations of collectible materials. The collecting of seed stock shall be limited to the minimum necessary for the revegetation effort and shall not seriously deplete the existing vegetation.

The salvage of all specimens of Thread-leaved Brodiaea in harm's way is a requirement of the issuance of development permits for portions of the adjoining East Clusters Unit 3 development project and all of the Heritage Bluffs II development project. Any specimens detected prior to or during grading shall be salvaged. Most specimens must be relocated into the HBP. See Attachment B for more information about this process.

Task 5. Trash/Graffiti Removal and Vandalism Repair

The Habitat Manager shall be responsible for the general condition of the HBP by directing the removal of any illegally dumped materials, the clean-up of any litter, and the removal of any vandalism. Any vandalism resulting in damage to the fences, signs, or resources within the HBP must be remediated immediately. These tasks shall occur during the semi-annual monitoring visits or as often as necessary and approved by the Habitat Manager. All maintenance activities within the HBP shall be performed under the direct supervision of the Habitat Manager.

Task 6. Removal of Hazardous Materials

When identified, any hazardous materials must be removed per County-approved procedures. The Habitat Manager shall contact the County's Environmental Health Services Department for guidance in the event that hazardous materials are identified.

Task 7. Removal of Encampments and Unauthorized Encroachments

The Habitat Manager shall survey the site for encampments during monitoring visits and report them to the Sheriff's Department. Any encampments shall be removed from the HBP upon vacation of the property by the unauthorized persons. Improper or illegal encroachments must be removed as soon as possible, on an as needed basis.

Task 8. Installation/Repair/Replacement of Fencing, Gates, and Signs

The HBP shall be protected by a professionally-installed, equestrian (ranch rail), or similarly well-constructed "wildlife friendly" fence designed to be of maximum durability. Equestrian rail fencing is recommended to allow wildlife passage and provide a clear visual barrier to discourage pedestrian entry. The fence shall surround the HBP where the Project Biologist determines it is needed for site security or to protect the habitat (Attachment A). The fence will be installed immediately following approval of the HBP. The fence will have a minimum five-foot height with locked entry gates where needed. The purpose of the perimeter fencing will be to prevent intrusion into the HBP and to avoid an attractive nuisance. The installation of this fence will be monitored to completion by the Project Biologist.

Evidence that permanent fencing and signage have been properly installed shall consist of a signed statement from the Project Biologist verifying that the permanent fence has been put in place around the perimeter of the HBP, as appropriate. Photographs and a brief description of design and materials used shall be submitted along with the statement from the Project Biologist. The specific construction materials and fence designs are subject to approval by the Project Biologist and the Wildlife Agencies.

Permanent, high-visibility signs shall be installed at three (3) signs per mile along the permanent fence. These signs shall read the equivalent of:

NO TRESPASSING ***Sensitive Environmental Resources*** ***Disturbance Beyond this Point is Restricted by Easement*** *Information:* *Contact:* [--*TBD*--] *Tel.* ________________ *Penal Code 602*

Signs must be in good condition at all times and must be replaced, repaired, and/or cleaned as often as necessary. The Applicant/Developer shall be responsible for the installation of the permanent fencing, signs, and gates. The Project Biologist shall be responsible to supervise the installation of the permanent fencing, signs, and gates, and for providing five years of fence, signage and gate maintenance and monitoring. The Habitat Manager shall assume responsibility for the long-term maintenance and repair of the fencing, signs, and gates at the end of the five-year interim management period.

Task 9. Access

The Applicant/Developer shall be responsible for providing permanent access to the HBP for the Project Biologist and Habitat Manager. The HBP's access gates and locks must be maintained in working order at all times to prevent unauthorized entry into the HBP. Under normal circumstances, only the Project Biologist, Habitat Manager, and other authorized agents will be allowed into the actual HBP site. Exceptions to this shall be in an emergency or as otherwise specified by the Project Biologist or Habitat Manager in consultation with the WILDLIFE AGENCIES. Access to the HBP (other than for biological monitoring) shall primarily occur during the dry season to avoid potential damage to sensitive biological resources.

Task 10. Coordination with Adjacent Land Managers and Neighbors

The Habitat Manager shall coordinate with land managers of nearby preserved lands on management practices and tasks related to the preservation and maintenance of the sub-regional open space system. This shall include activities such as continuous removal of exotic and pest species and ensuring compatibility with the goals of the overall open space management plan to be prepared for the City as part of the MSCP Plan.

Task 11. Coordination with Other Agencies

The Habitat Manager shall coordinate with relevant local agencies on an as-needed basis, including, but not limited to:

- Coordination with County's Environmental Health Services Department for vector control and herbicide use, although the use of herbicides/pesticides for weed/vector control shall be avoided to the extent possible. Any and all pesticide use shall be implemented only if deemed necessary and authorized in writing by the Habitat Manager.

- Coordination with law enforcement, including the City of San Diego Police Department or County Sheriff's Department.

- Coordination with emergency services, such as the City of San Diego Fire Department's local fire station personnel.

4.3 Prohibited Activities

Within the HBP, the following shall be prohibited:

- Grading, excavation, or the placement or movement of any soil, sand, rock, gravel, or any other material, except for approved habitat restoration and/or enhancement activities or other habitat or species restoration efforts determined to be necessary as a result of adaptive management, undertaken as part of an approved restoration plan.

- The clearing or thinning of any vegetation, except for the removal of exotic plant species as determined by the Project Biologist or Habitat Manager to be necessary, and the selective thinning of vegetation by hand in Zone 2 Brush Management associated with the adjoining homes to the extent required by written order of the fire authorities for the express purpose of reducing an identified fire hazard. While clearing for brush management is not anticipated with the creation of this easement, such clearing may be deemed necessary in the future for the safety of lives and property. All fire clearing shall be pursuant to the Consolidated Fire Code and the Memorandum of Understanding dated February 26, 1997 between the Wildlife Agencies and the fire districts and any subsequent amendments thereto.

- The watering, pruning, or fertilizing of any native species, unless determined by the Project Biologist or Habitat Manager to be necessary.

- The construction, erection, or placement of any building or structure, with the exception of the required permanent fence.

- Use of off-road vehicles and the use of any other motorized vehicles, except when necessary in conjunction with authorized habitat management activities. The Project Biologist or Habitat Manager will ensure that any vehicular use for authorized habitat management purposes is limited to the minimum necessary for the allowed purpose.

- Dumping of any kind, including the dumping of landscape materials, trash, hazardous waste, or any other materials.

- Planting of any vegetation except as pursuant to habitat enhancement as described in this HMP.

- Use for any purpose other than those specifically designated in this HMP.

- The disturbing of any natural resources (plants, animals, minerals, etc.) including hunting, collecting, etc.

Anyone attempting such activities shall be informed of the restrictions by the Project Biologist or Habitat Manager in a non-confrontational manner. The Habitat Manager shall report any serious confrontational situations and any chronic offenders to the Wildlife Agencies and the San Diego Police Department.

The Project Biologist or Habitat Manager, in consultation with the City DSD and the Wildlife Agencies, shall determine the appropriateness of any proposed uses not specifically designated in this HMP. All activities authorized by the Project Biologist or Habitat Manager must be consistent with the goals and objectives of this HMP and must be approved by the Wildlife Agencies. To limit impacts to sensitive biological resources, activities within the HBP are forever restricted to:

- Biological surveys conducted as part of the ongoing biological monitoring process.

- Weeding, trash removal, or other maintenance activities (described in detail in this HMP).

- Habitat restoration and/or enhancement activities or other habitat or species restoration as described in this Plan.

- Emergency response by the Project Biologist or Habitat Manager and the appropriate agencies in case of fires, floods, earthquakes, or other natural disasters.

- Other activities deemed by the Habitat Manager to be appropriate and necessary to ensure the long-term viability of the HBP. The Wildlife Agencies will have the right to disallow "other activities" approved by the Habitat Manager if Wildlife Agencies determine that such uses are not appropriate or necessary to the purposes of the HMP.

4.4 Adaptive Management

This HMP has been developed to facilitate an adaptive management strategy. The overall goal of an adaptive management strategy is to improve the quality of management decisions, based on the best available information. Monitoring will be used to assess the success of adaptive management. If monitoring indicates that the biological resource management goals are not being met, it may be necessary to modify this HMP between regularly scheduled updates. If changes to the HMP are determined to be necessary, the proposed changes shall be submitted to the Wildlife Agencies for approval, as required.

5.0 PRESERVE MONITORING

5.1 Monitoring Tasks

5.1.1 Interim Site Preparation and Monitoring

The 60 month interim site preparation and monitoring activities shall consist of the following, as described in this report:

- General site clean-up, removing old fences, trash, and old dumped materials
- Monitoring of grading in all areas adjoining or near the HBP to ensure that encroachment does not take place
- Inspection and certification of required fencing and signage
- Supervision of invasives removal
- Verification that all noxious invasives have been effectively eradicated
- Evaluation as to whether a need exists to remove any accumulation of excess thatch from areas supporting Thread-leaved Brodiaea
- Salvage and translocation of any specimens of Thread-leaved Brodiaea found during grading in all area adjoining or near the HBP
- Supervision and biological monitoring of site preparation and installation of NPG
- Biological monitoring of the NPG restoration for 60 months, including a 120-day plant establishment period (PEP)
- Establishment and maintenance of a managed reserve (assurance) population in horticulture for future reintroduction to the HBP

Additional tasks, such as detailed vegetation mapping, baseline species inventorying, other management activities, and annual reporting shall also be performed or overseen by the Project Biologist until such time as the long-term Habitat Manager is funded and in place.

5.1.2 Long-term Habitat Monitoring

Long-term biological management and monitoring shall begin once the Applicant/Developer meets all obligations required prior to the initiation of this activity, including implementation of all interim site preparation tasks identified in the this Plan, and the long-term management is funded.

The Habitat Manager shall conduct basic qualitative and quantitative monitoring on a semiannual basis. Because of the gradual nature of changes experienced by climax plant association lands, this is consistent with the regional planning efforts for this area. During site visits, to be conducted during periods to maximize detection of Thread-leaved Brodiaea (typically in December/January and again in May/June) or as determined necessary by the Habitat Manager, the HBP shall be visually inspected for changes, including new occurrences of exotic species, changes in vegetative growth patterns, changes in floristic composition or diversity, and other factors relating to habitat viability. Quantitative monitoring shall consist of visual counts within one-meter quadrats at permanent monitoring stations established during the first year of monitoring. The first count shall be of the number of foliage-producing corms and the second of flowering scapes. During both semiannual monitoring surveys, an estimate of weedy cover and percentage of thatch shall be made. The Habitat Manager shall recognize the survey's limitations and shall adopt methodologies to maximize the detection of changes to the structure of the habitat, as appropriate. All plant and animal species observed shall be recorded during each site survey, and any new occurrences of Thread-leaved Brodiaea within the HBP, beyond the limits of previously recorded specimens, shall be noted and reported to the Wildlife Agencies via CNDDB form submitted to the CDFW. In extreme drought years, funds that would be normally allocated towards surveying for Thread-leaved Brodiaea shall be redirected towards other habitat management considerations as determined by the Habitat Manager in consultation with the Wildlife Agencies.

Any measurable changes within the HBP that could affect the existing biological resources shall be monitored over time. Information obtained from tracking changes within the HBP shall be used by the Habitat Manager to determine specific remediation, as needed. All remediation/recovery activities shall be discussed with the Wildlife Agencies prior to implementation.

Baseline Inventory and Vegetation Mapping

The quality and quantity of the habitat-types present within the HBP shall be documented by the Project Biologist during the first year of interim biological monitoring. In addition, a detailed vegetation map showing conditions at the time of HMP approval shall be produced for the HBP during the first year of interim biological monitoring. The locations of all known sensitive plants or animals detected shall be noted on the vegetation map, where practicable. The vegetation map shall be updated every five years, initially by the Project Biologist once at HMP approval and again at the end of the first year of biological monitoring, and then by the Habitat Manager on the same yearly schedule, in perpetuity.

A baseline species inventory shall also be compiled by the Project Biologist during the first year of interim biological monitoring. This shall consist of a complete list of all plant and animal species observed (either directly or indirectly by scats, tracks, etc.) during the periodic field surveys. The baseline species inventory shall be updated with any new species detected onsite during subsequent field surveys of the HBP by the Habitat Manager in perpetuity.

The updated vegetation map and baseline species inventory shall be included in the first annual monitoring report prepared by the Project Biologist. An updated species list will be included in the subsequent annual reports that follow and an updated vegetation map will be included every five years. This information shall be used as a baseline to measure habitat changes resulting from both natural causes and edge effects, as well as to evaluate the success of the management effort in the years that follow.

Sensitive Species Surveys

During the interim and long-term management periods, the Project Biologist and the Habitat Manager, respectively, shall be responsible for evaluating the status of the sensitive species in the HBP biennially and for implementing protective measures, if necessary. Monitoring of sensitive species shall include the use of specific survey protocols and methodologies, fixed monitoring locations or transects, and species-specific data collection and analysis. All of the sensitive species that are recorded from the HBP site shall be monitored. Any additional sensitive species detected in the HBP during the regular monitoring periods shall be incorporated into future monitoring reports as additional data and be forwarded to the CNDDB.

The status of all occurrences of Thread-leaved Brodiaea onsite shall be assessed semiannually (2x per year). Surveys for any other sensitive species known or expected to occur within the HBP shall be included during the semiannual Thread-leaved Brodiaea surveys, if appropriate. The Habitat Manager shall be responsible for evaluating the status of the onsite populations of all sensitive species and any edge effects or other issues that may reduce the perpetual viability of these populations. All plant and animal species observed during sensitive species surveys shall be recorded and included in the annual report.

Review of HMP

The Habitat Manager shall meet with the Wildlife Agencies on an "as needed" basis to discuss whether changes in management of the HBP are needed. Any necessary changes in management will be reflected in updates of this HMP. Updates shall be based on findings and determinations made during the ongoing biological monitoring of the HBP, changes in site conditions, and recommended modifications to maintenance efforts. During annual review of implement of this HMP, all parties shall cooperatively develop a list of habitat or population triggers and potential remedial actions should conditions deteriorate to a point where additional action is required. This list shall be based on observations made during the prior year of biological monitoring.

5.2 Annual Reports

Annual reports shall be submitted to the Wildlife Agencies by the first of August of each year. Annual reports shall discuss the previous year’s management and monitoring, as well as work plan that outlines specific management and monitoring activities that will be undertaken in the coming year. The annual report shall provide a concise but complete summary of management and monitoring methods, identify any new management issues, and address the success or failure of management approaches (based on monitoring). The report shall address any changes resulting from previous monitoring results and provide a methodology for measuring the success of any adaptive management. The annual report shall summarize the status of the endowment and funds generated, itemize the costs of management actions, and estimated costs for the coming year. In addition, the annual report shall provide a general habitat assessment and a summary of the status of Thread-leaved Brodiaea and any other sensitive species occurring on the property and provide specific recommendations, as necessary, to remediate any problems. If any habitats or sensitive species’ populations appear to be declining, the annual report shall outline a plan for the remediation of the resource(s).

Site photographs from fixed photo-documentation points shall be provided in the annual report. These shall be established by the Project Biologist during the first year of monitoring. The photographs shall clearly depict the height and cover of the native vegetation, condition of the fences and signs, and any problems not needing an emergency response. The annual report shall also include photo documentation of any problem areas that would require significant management action, such as vandalism, fire damage, and trash dumping. The annual report shall summarize remediation required during the previous reporting period and make specific recommendations for future maintenance and monitoring. The report shall include copies of CNDDB forms as submitted to the CDFW for any occurrences of Thread-leaved Brodiaea and new sensitive species observations or significant changes to species occurrences or habitats previously reported. The report shall also include copies of invasive plant species forms submitted to the CDFW and/or other regulatory authorities, if applicable.

6.0 LIST OF PREPARERS

- Vincent N. Scheidt, Biologist
- Brandon D. Myers, Associate Biologist

7.0 CERTIFICATION

I hereby certify that the information contained in this document is complete and accurate to the best of my knowledge as of November 24, 2015.

Vincent N. Scheidt, MA
Biological Consultant

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Figure 1. Regional Location – Heritage Brodiaea Preserve

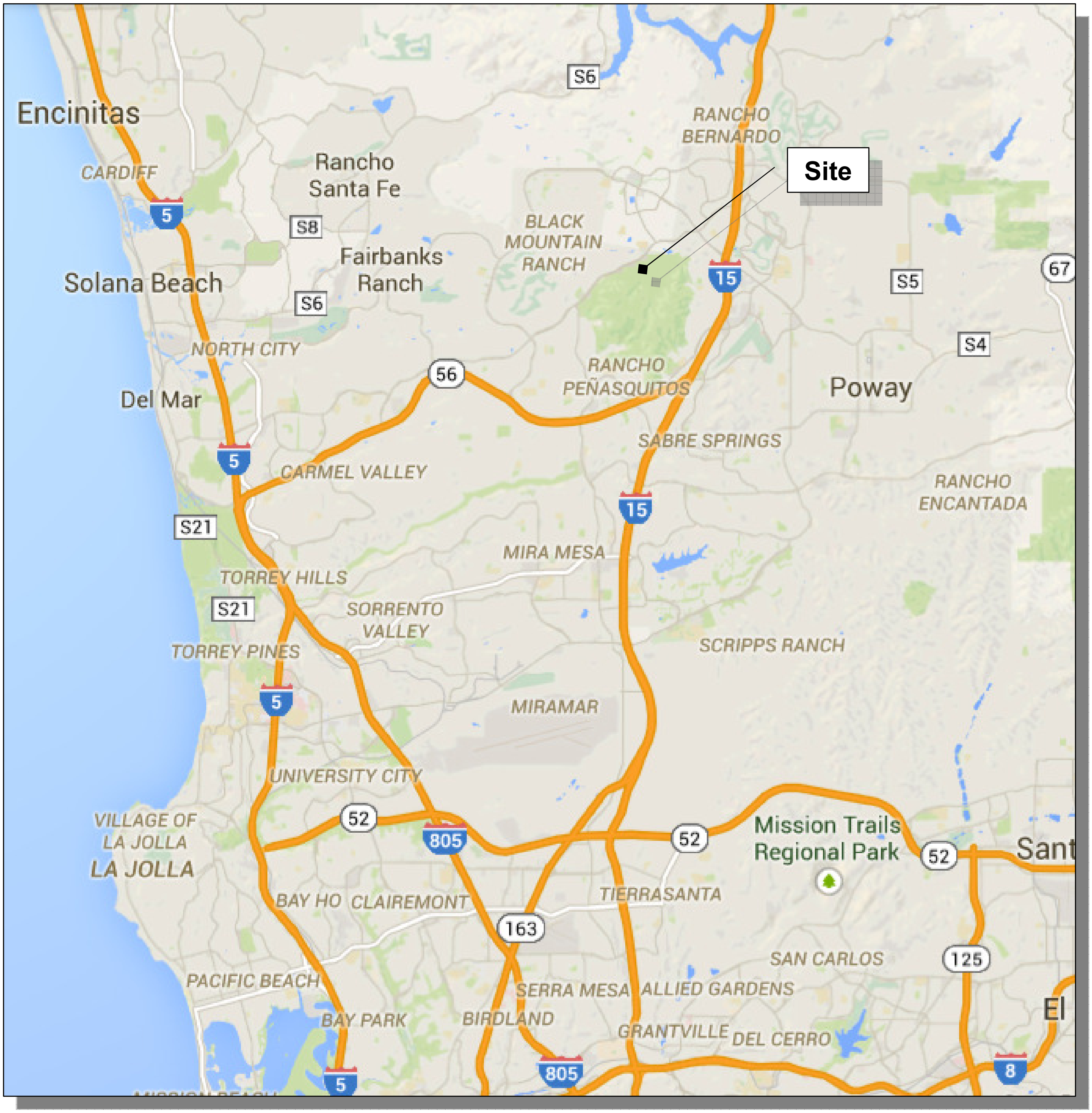


Figure 2. Topography – Heritage Brodiaea Preserve
Portion of U.S.G.S. "Poway, California" 7.5' Quadrangle

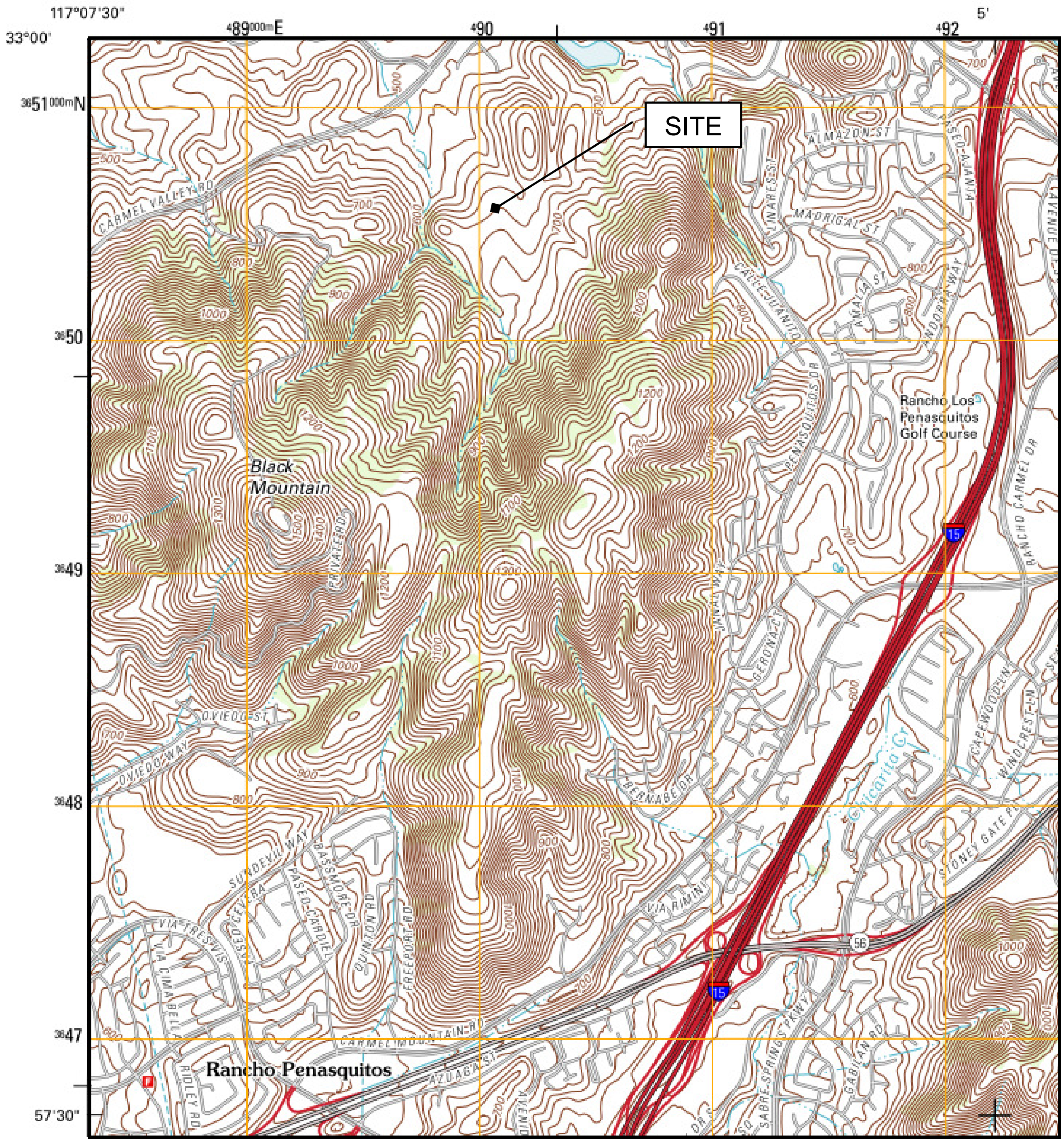


Figure 3. Heritage Brodiaea Preserve

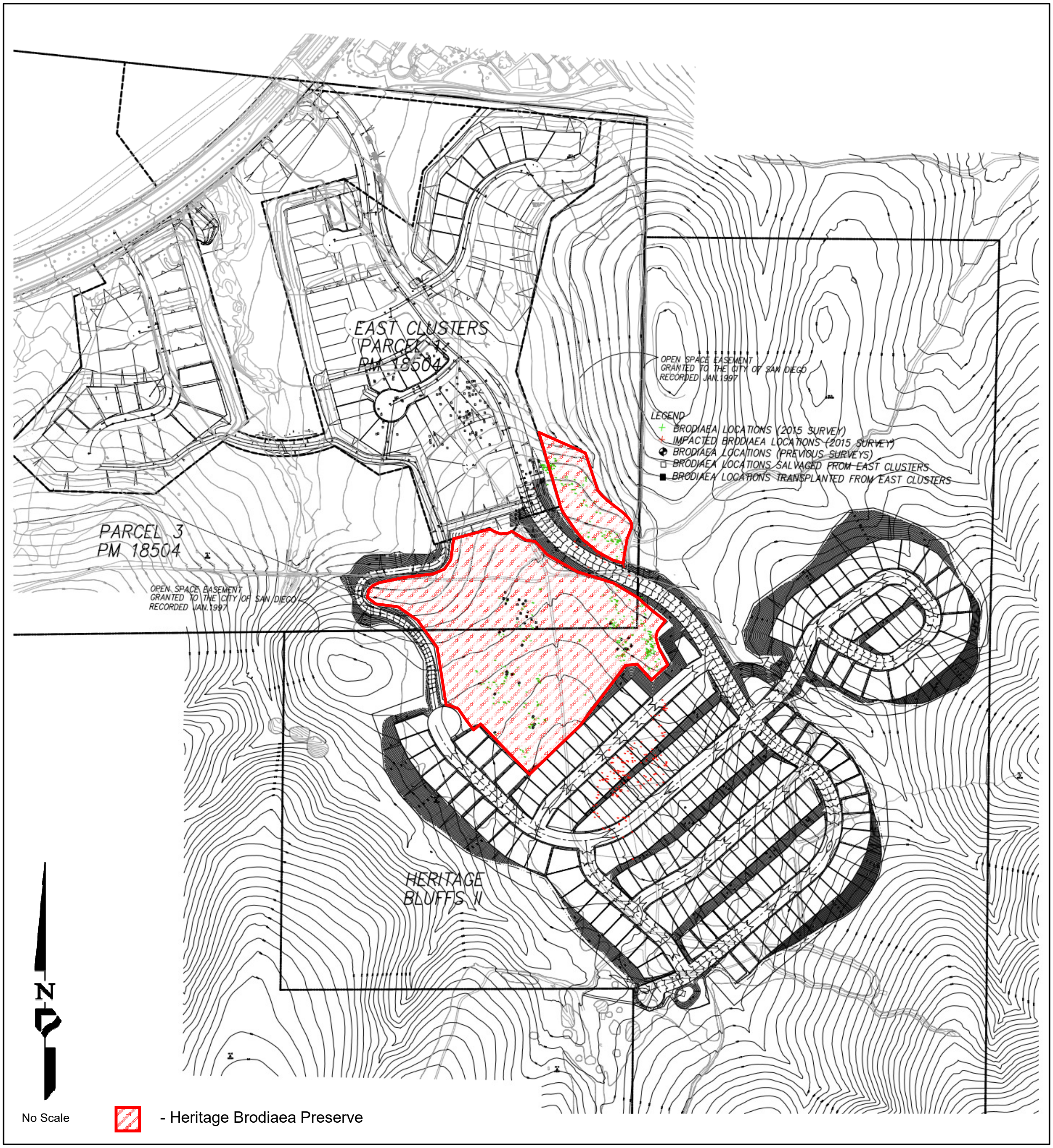
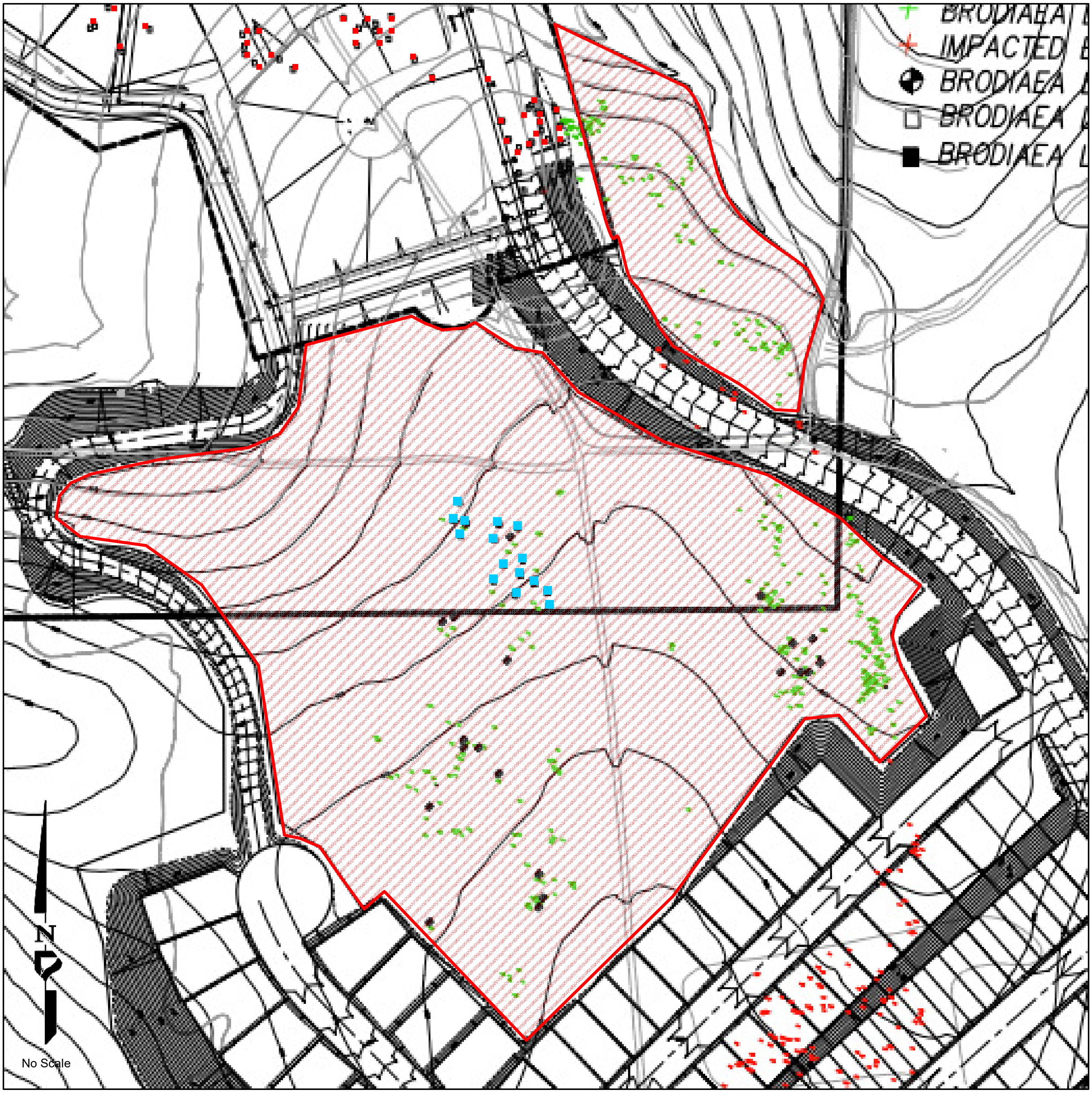


Figure 4. Detail - Heritage Brodiaea Preserve with Brodiaea Occurrences



- Heritage Brodiaea Preserve

- Known Thread-leaved Brodiaea Occurrence - Translocated Thread-leaved Brodiaea Occurrence

- Impacted Thread-leaved Brodiaea Occurrence

Figure 5. Recent Aerial Photograph Showing the Heritage Brodiaea Preserve

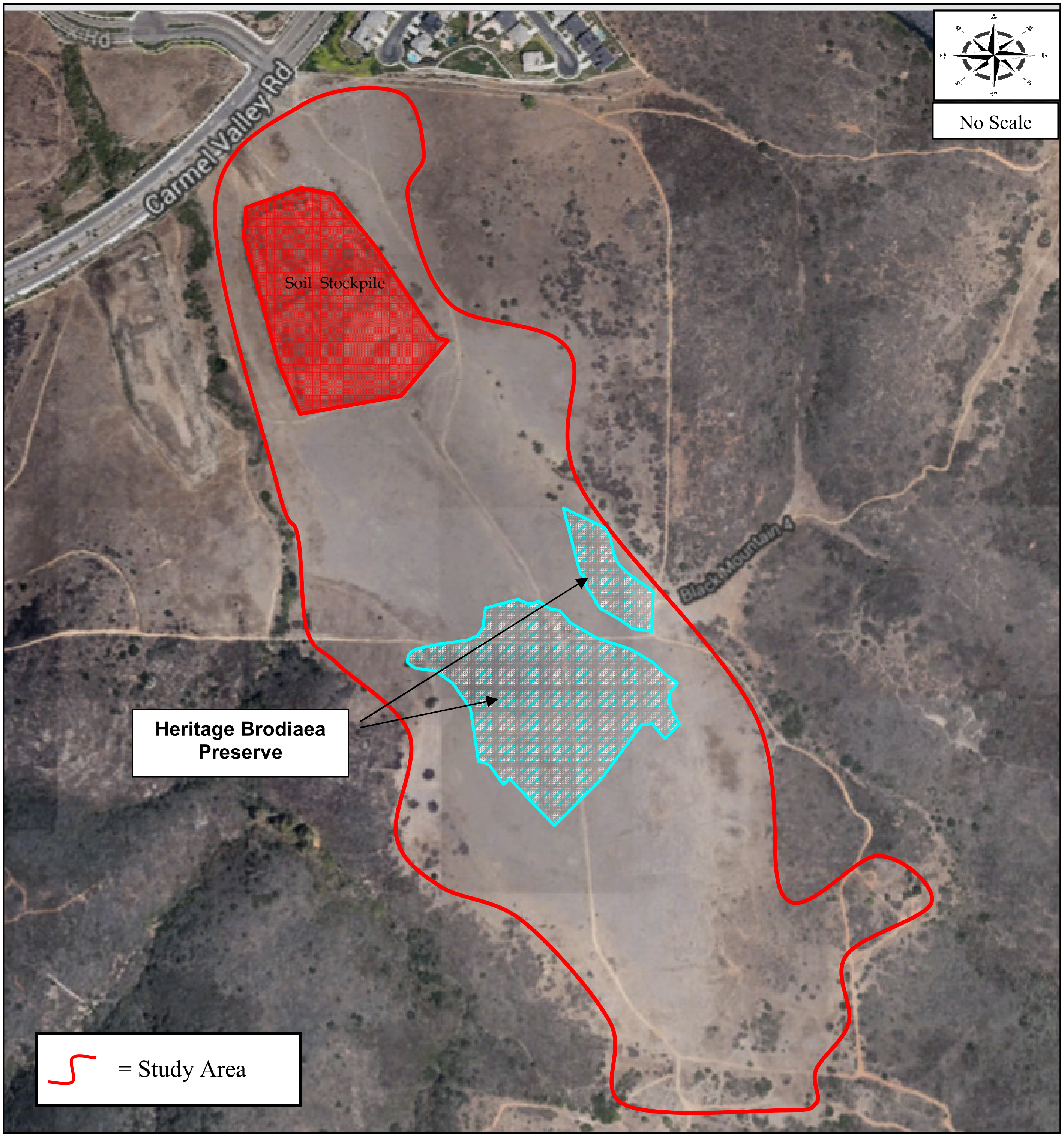


Figure 6. Native Perennial Grassland Creation Areas within the Heritage Brodiaea Preserve

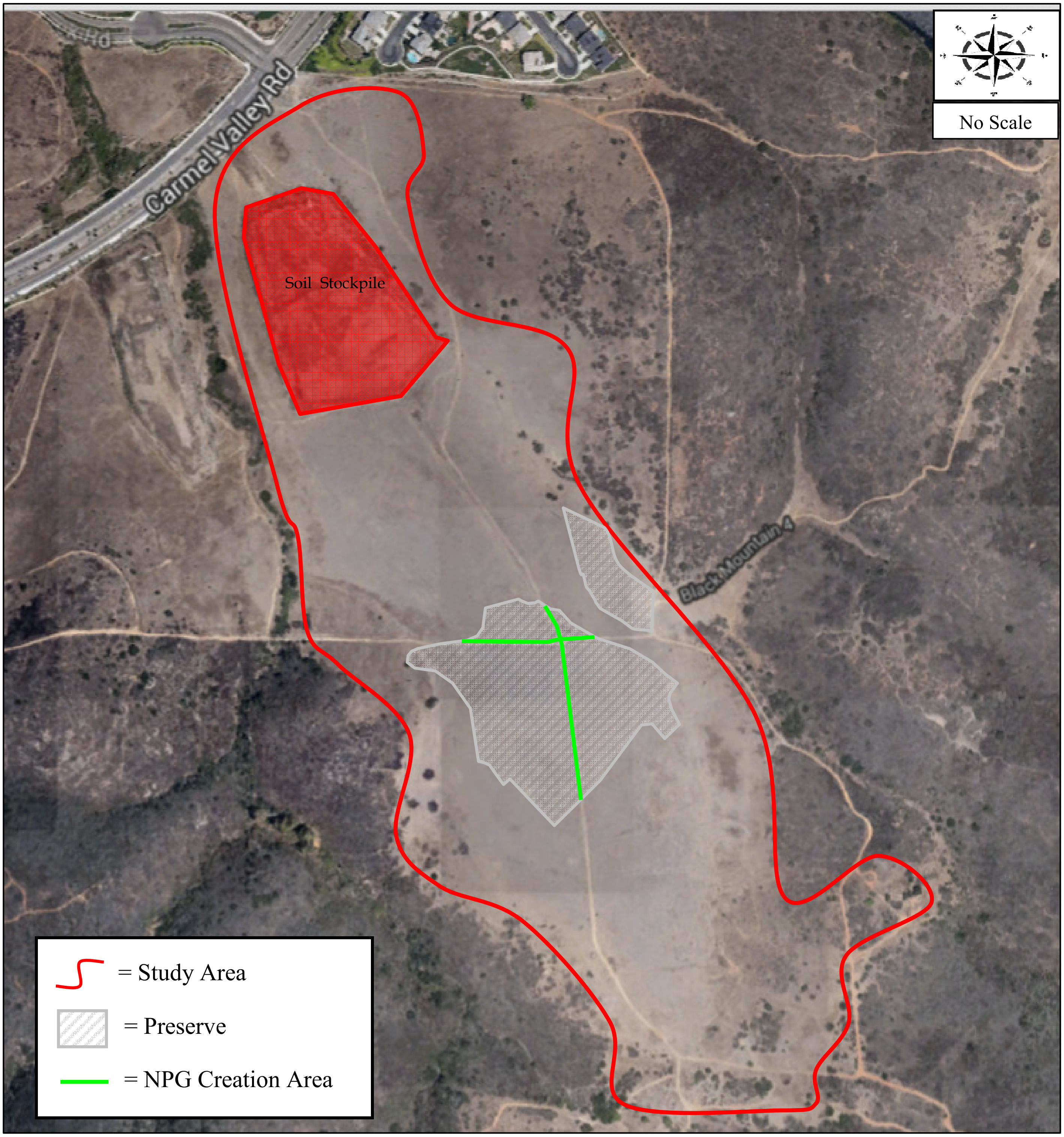


Table 3. 60-month Interim Site Preparation and Monitoring Schedule: HBP

Task	Responsible Party/Staff	Funding Source	Report Deadline	Frequency/Season of Implementation	Report To
Site clean-up	Applicant/Developer/ Project Biologist	Applicant/ Developer	Prior to recordation of CE	One time	City
Biological monitoring of grading	Project Biologist	Applicant/ Developer	Part of annual monitoring report	Continuous Until Grading is Complete	Wildlife Agencies and City
Certification of permanent installation - fencing/gates	Applicant/Developer/ Project Biologist	Applicant/ Developer	Following Installation	One time	City
Biological monitoring of site preparation and installation of NPG	Project Biologist	Applicant/ Developer	Part of annual monitoring report	Continuous during installation	Wildlife Agencies and City
Biological monitoring of NPG during 120-day PEP	Project Biologist	Applicant/ Developer	Part of annual monitoring report	Monthly through end of 120-day PEP	Wildlife Agencies and City
Biological monitoring of Brodiaea salvage and translocation	Project Biologist	Applicant/ Developer	Part of annual monitoring report	Continuous Until Grading is Complete, then Winter and late Spring	Wildlife Agencies and City
Biological monitoring: Years 1-3	Project Biologist	Applicant/ Developer	Part of annual monitoring report	Monthly	Wildlife Agencies and City
Biological monitoring: Years 4-5	Project Biologist	Applicant/ Developer	Part of annual monitoring report	Quarterly	Wildlife Agencies and City
Establish Assurance Population of Thread-leaved Brodiaea in Horticulture	Project Biologist	Applicant/ Developer	Part of annual monitoring report	One time/Winter	Wildlife Agencies
Monitor Assurance Population of Thread-leaved Brodiaea and documentation	Project Biologist	Applicant/ Developer	Part of annual monitoring report	Annually/Winter	Wildlife Agencies
Monitoring of Invasives removal and documentation	Project Biologist	Applicant/ Developer	Part of annual monitoring report	Continuous Until Grading is Complete, then Semi-annually	Wildlife Agencies and City
Detailed vegetation mapping	Project Biologist	Applicant/ Developer	Upon approval of HBP	Annually/Fall	Wildlife Agencies and City
Baseline species inventory	Project Biologist	Applicant/ Developer	Part of annual monitoring report	Annually/Spring	Wildlife Agencies and City
General biological monitoring	Project Biologist	Applicant/ Developer	Part of annual monitoring report	Semi-annually/Spring & Fall	City
Other management activities (fence and signage inspection)	Project Biologist	Applicant/ Developer	Part of annual monitoring report	Ongoing	Wildlife Agencies and City
Annual monitoring report	Project Biologist	Applicant/ Developer	August 1 of each year	Submitted annually	Wildlife Agencies and City

Table 4. Long-term Management and Monitoring Schedule: HBP

Task	Responsible Party	Report Deadline	Frequency	Report To
Inspection of permanent fencing/gates	Habitat Manager	Upon acceptance of maintenance/monitoring responsibilities	Ongoing in perpetuity	City
Patrolling	Habitat Manager	Part of annual report	Monthly in perpetuity	City
General biological monitoring	Habitat Manager	Part of annual report	Semi-annually in perpetuity/Spring/Fall	City
Invasives monitoring and removal	Habitat Manager	Part of annual report	Semi-annually in perpetuity/Spring/Fall	Wildlife Agencies and City
Thread-leaved Brodiaea surveys	Habitat Manager	Part of annual report	Semi-annually in perpetuity/Winter/ late Spring	Wildlife Agencies and City
Other sensitive species surveys	Habitat Manager	Part of annual report	Every three years in perpetuity/Spring/Fall	Wildlife Agencies and City
Update vegetation mapping	Habitat Manager	Part of annual report	Every five years in perpetuity or as needed/Fall	Wildlife Agencies and City
Review and, if necessary, update HMP	Habitat Manager	Part of annual report	Every five years in perpetuity	Wildlife Agencies and City
Other management activities	Habitat Manager	Part of annual report	Annually or as needed in perpetuity	City
Annual report	Habitat Manager	March 1 of each year	Annually in perpetuity	Wildlife Agencies and City

Attachment A

FENCING PLAN

(to be provided)

Attachment B

SALVAGE AND TRANSLOCATION PROTOCOLS

Thread-leaved Brodiaea Salvage and Translocation Requirements for the Heritage Bluffs II and East Clusters Unit 3 Project, San Diego

Thread-leaved Brodiaea *(Brodiaea filifolia)* is a State Endangered and Federally Threatened native plant species that is known to occur on portions of the Heritage Bluffs II and East Clusters Unit 3 Project in the City of San Diego. Specimens are known to occur in areas that will be subject to grading and development, hence the need to salvage and translocated all individuals that will be in harm's way. The salvage effort shall utilize the most current protocols, which may differ from those presented herein, to maximize success.

Transplantation programs involving Thread-leaved Brodiaea have had a nearly forty-year history of failure, with numerous failed efforts since at least 1977 (Hall, 1986; Scheidt, 2009). The standard method of salvage and translocation involves removing corms from the soil (corm separation) during the summer, when the corms are dormant, and immediately replanting them in a designated location, with hopes that the plants will emerge and flower in the late spring when growing conditions are optimal (Scheidt, 2009; Recon Environmental, 2015). This does not work, as the corms are an extremely attractive food source to burrowing herbivores, which forage widely in search of food during the dry months. Over the last few years, however, new translocation techniques have been developed that retain the corms within the hydrated substrate. Using this technique, the entire block of corm-bearing clay soil is moved in manageable sections during the winter months when the ground is very wet. This minimizes herbivory losses due to the difficulty herbivores have penetrating the saturated and heavy clay soils. The corms are able to settle into the dense substrate when many herbivores are dormant, being protected by a surrounding matrix of heavy clay which is sealed up by winter rains.

<u>Salvage and Translocation</u>

The most important consideration with respect to the viability of translocation is the selection of a suitable receptor or replanting area. To maximize the chances for successful salvage and transplanting, several critical transplantation parameters have been identified. These must be matched between the salvage site(s) and the replanting site(s) prior to salvage and replanting. The factors are as follows:

a. Proximity

In order to maintain the genetic integrity of the salvaged population and avoiding gene contamination of nearby, undisturbed populations, it is critical that specimens be moved the shortest distance possible from the salvage site. Potential replanting areas must be identified and located within the Heritage Brodiaea Preserve (HBP). In most cases, this is within a several hundred meter radius of the known and potential occurrences that will be affected by grading and development. Each potential replanting area must be carefully examined and considered. The final candidate transplantation area must be subject to rigorous evaluation, focusing on the five factors below.

b. Slope

The transplanting area within the HBP must be consist of a gentle slope (<15% grade), with a cover of native and non-native grasses. This will minimize chances for slope-related problems, such as general erosion, slope stability, slumping, etc. The presence of other geophytes, such as Golden Star (*Bloomeria)* and Blue Dicks (*Dichelostemma)* is highly desirable.

c. Aspect

In this part of San Diego County, Thread-leaved Brodiaea usually occurs on gentle north-facing slopes, with some populations reported to occur on flat land, or lands with west- facing or east-facing aspects. The salvage areas within the Heritage Bluffs II Project and East Clusters Unit 3 site generally sloped to the north. Matching aspect between the salvage site(s) and the replanting site(s) has been determined to be critical because it would presumably provide a match between these areas with regards to overall site dryness.

d. Drainage

The salvage site(s) are all essentially undrained, or drained via very limited sheet flow. It is highly unlikely that Thread-leaved Brodiaea occurs at the bottoms of rills, swales, or other drainage or erosional features. For this reason, the replanting site must match the drainage patterns of the salvage site to the maximum extent feasible. This will further ensure that erosion-related problems will be minimized.

e. Soil types

The salvage site(s) all likely contain Diablo-series or Auld-series heavy clay deposits underlain by metavolcanic rock. In San Diego County, the distribution of Thread-leaved Brodiaea is highly correlated with specific clay soil series (USFWS 1998). The Diablo-series or Auld-series deposits form discrete lenses containing what appeared to be dense ramets (asexually produced, genetically identical specimens) of Thread-leaved Brodiaea. Although the clay lenses within the HBP also support substantial numbers of Thread-leaved Brodiaea, these numbers form spotty occurrences, primarily taking advantage of the differences in the soil profiles within the Preserve. The potential to support stable depositions of this extremely dense clay material is critical to the success of the program. The replanting site(s) must support dense clay lenses, but not in the precise location where the salvaged specimens would be placed. Rather, these lenses must be located upslope and downslope of the transplantation area, indicating that if the salvaged materials are successfully translocated into the area between these heavy clay deposits, the potential for long-term transplantation viability will be increased.

f. Presence of target taxon with significant interstices

In order to ensure that growing conditions at the selected replanting site(s) will be viable in perpetuity, the presence of extant and robust occurrences of Thread-leaved Brodiaea with significant interstices is important. This indicates that the replanting site(s) are in all ways suitable and it assumes that factors beyond those listed above, such as microclimate, pollinators, mycorrhizal fungi or other associate species will be generally matched. By placing the salvaged materials into the interstices (while protecting the extant specimens), as many unmeasured variables as possible will be matched, maximizing the chances for success.

Two other factors are considered critical to the long-term success of the salvage and transplantation program:

g. Timing

The excavation technique used in this plan is critically time-dependent. There is a limited window of time available each year to salvage and translocate the plants *in situ*. This is because the corm-supporting clay lens needs to be moved when fully hydrated so as to minimize chances for lens disintegration and corm separation. The very best time to salvage corms is after the cessation of winter rains when soil conditions are ideal for excavation. During the summer or fall, the soil forms dry clods that break up during excavation, resulting in corm separation and/or damage. Other Thread-leaved Brodiaea transplantation programs that were designed to separate the corms from the surrounding clay matrix have historically failed (Scheidt, 2009). Disintegration of the lens allowed corm herbivory primarily by pocket gophers (*Thomomys*), as well as excessive desiccation of the corms and rhizomes, and invasion by weedy species that are opportunistic on the broken clay soils.

If salvage must occur during the summer or fall, depending on the timing of grading, all salvaged corms must be maintained in horticulture until such time as the receptor soils are fully saturated by winter rainfall. Any corms salvaged outside of the winter rainy season must be stored in a cool, dry location for transplanting the following year. Transplanting planting of corms other than in the winter is not permitted.

h. Long-term Protection

The selected transplantation site will be afforded protection in perpetuity. The HBP will be managed and monitored per the requirements of the *Thread-leaved Brodiaea Habitat Management Plan (HMP) for the Heritage Brodiaea Preserve.* This ensures that the replanted specimens will be conserved as part of the recovery of the species.

Propagation and Management in Horticulture

In order to establish and maintain an *ex situ* reserve (assurance) population, no more than twenty-five percent of all salvaged specimens shall be retained for horticultural propagation purposes. These specimens shall be maintained in cultivation in a facility approved by the Wildlife Agencies until such time as field augmentation is desirable, or when the number of cultivated specimens exceeds 500 percent of the stockpiled specimens. No less than 100 percent of the specimens designated for propagation must be maintained in cultivation in perpetuity.

Summary

The translocation of Thread-leaved Brodiaea out of harm’s way appears to be technically feasible assuming that several critical requirements are met:

- Salvage must occur in the winter when the soil is fully hydrated.
- The substrate must not be separated from the corms to the extent practicable.
- The replanting area(s) within the HBP must conform to the salvage site with respect to proximity, slope, aspect, drainage, and soil type.
- Thread-leaved Brodiaea occurrences must be present in areas immediately adjoining the replanting area, but not in the specific location where the transplanted materials are established. Adequate space is present to translocate

all specimens within the development area, but great care must be taken when planting to ensure that no extant specimens are affected in any way.

The published literature contains a number of inaccuracies with respect to the biology of Thread-leaved Brodiaea. This geophyte does not produce bulbs, as is frequently stated, but it probably does reproduce primarily asexually via the production of daughter corms at the end of long, thin rhizomes that radiate out from the mother corm (Smith 1997). Numbers of specimens reported from known occurrences are most likely gross underestimates. In any case, sexual reproduction is critical to the long-term survival of *B. filifolia*, as is the support of native pollinators. Niehaus (1971) found that a broad spectrum of insects visit Brodiaea flowers, but only tumbling flower beetles (Mordellidae) and sweat bees (Helictidae) were found to transport pollen between flowers. Bell reported that native bees were faithful to specific species of *Brodiaea* on the Santa Rosa Plateau, Riverside County, CA), but the European honeybee *(Apis mellifera)* was not (G. Bell, the Nature Conservancy, pers. comm. 1997, cited in USFWS 1998). The presence of Thread-leaved Brodiaea pollinators at the HBP will ultimately depend on the success of maintaining and expanding occurrences in the Preserve.

One significant problem relating to the transplantation of Thread-leaved Brodiaea concerns the difficulty in estimating the total number of individuals within a population. As discussed previously, the number of corms producing flowers varies in response to the timing and amount of rainfall, as well as temperature patterns. Typically, in any given year, only a fraction of the plants will develop to the point of flowering, thus any transplantation effort must anticipate encountering large numbers of mature and immature corms.

In the case of the this project, this is precisely what happened. Field surveys completed in the winter of 2015, during the time between the approval of the draft of this Plan (January 2015) and this revised, final version (November 2015), additional field surveys were completed. A total of 10,423 individual specimens were detected and counted, and the total population is estimated to be between a low of 95,000 specimens and a high of 185,000 individual specimens.

APPENDIX D
Thread-leaved Brodiaea Foliage Survey for East Clusters Unit 3 and Heritage Bluffs II Project Sites

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Standard Pacific Homes, San Diego
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~~February 27, 2015~~
Revised September 18, 2015

RE: Results: Thread-leaved Brodiaea Foliage Survey for East Clusters Unit 3 and Heritage Bluffs II Project Sites, City of San Diego

Dear Mr. Dumka:

Per your request, we have recently completed a directed field survey for Thread-leaved Brodiaea *(Brodiaea filifolia)* on the portions of the East Clusters Unit 3, Parcel 3 of PM 18504, and the Heritage Bluffs II properties in the City of San Diego (APNs 312-160-05, 312-160-07, and 312-010-15). All areas that supported suitable grassland habitat (Figure 1) were carefully searched for foliage which is characteristic of this species in compliance with current Wildlife Agency (CDFW, USFWS) standards, which require a directed search for seasonally-limited rare plants during the season of greatest detectability.

Methods

Field surveys of the site were completed by Brandon D. Myers, Associate Biologist and me on the dates and in the areas presented below. Biologists Marcia Adams, Lee BenVau, Allison Sharpe, and Catherine MacGregor assisted with surveying for part of the day on February 4, 2015.

Date	General Location of Area Surveyed	*B. filifolia* Counts; 2015
January 22, 2015	Southern and southwestern-most edge portions of site	No *B. filifolia* detected
January 26, 2015	Southern portion, east of N-S dirt haul road	Approximately 400 *B. filifolia* detected
January 28, 2015	Central portion of site, east of N-S dirt haul road	Approximately 3,472 *B. filifolia* detected
January 30, 2015	Central portion of site, west of N-S dirt haul	Approximately 1,370 *B. filifolia* detected
February 2, 2015	Northern portion of site, east of N-S dirt haul road	Approximately 976 *B. filifolia* detected
February 4, 2015	Northern-central potion of site, west of N-S dirt haul road	Approximately 424 *B. filifolia* detected
February 11, 2015	Central portion of site, west of N-S dirt haul road	No *B. filifolia* detected
February 13, 2015	Northern-central potion of site, west of N-S dirt haul road	Approximately 605 *B. filifolia* detected
February 18, 2015	Central portion of site, east of N-S dirt haul road	Approximately 2,072 *B. filifolia* detected
February 20, 2015	Southern portion, east of N-S dirt haul road	Approximately 401 *B. filifolia* detected
February 23, 2015	Central portion of site, west of N-S dirt haul road	Approximately 703 *B. filifolia* detected
Total	--	**Approximately 10,423 *B. filifolia* detected**

Surveying involved slowly walking linear transects across the entire area of potential habitat at 10 foot intervals. Plants encountered were flagged in the field and GPS points were established for each observation. An estimate of the number of plants at each point of observation was made by visually counting emerging specimens.

Results

The number of *B. filifolia* specimens counted at any flagged location during the surveys varied between one and many dozen specimens, with the number of specimens counted in the field totaling 10,423 individuals. This number reflects visible, mature specimens only, as immature specimens and seedlings produce foliage that is effectively impossible to locate and verify as originating from *B. filifolia* corms. Also, it is easy to miss specimens during field surveys as the surrounding vegetation, particularly dense stands of the noxious Artichoke Thistle *(Cynara cardunculus)*, which is abundant on this site, effectively block a view of the ground's surface in many areas where *B. filifolia* foliage could be emerging. It is generally accepted that the number of plants counted *in situ* represents approximately 11 percent of the total number of corms of this species buried within the substrate. This reconciles with Recon Environmental's pre-grading salvage of approximately 10,902 mature corms from the East Clusters Unit 3 site in the spring of 2015, where approximately 3,207 foliage-producing (mature) specimens had been counted just three months prior (see Attachment A). Thus, we estimate that the study area supports a low of approximately 95,000 to a high of 185,000 individual specimens based on the results of the 2015 foliage survey. The attached exhibits illustrate the 2015 survey polygons covering all potentially-suitable habitat areas for this species (Figure 1) and the location of specimens detected on the study area covering portions of the East Clusters Unit 3, Parcel 3 of PM 18504, and Heritage Bluffs II properties in the City of San Diego (Figure 2).

Impacts and Mitigation

As currently designed, the proposed preserve associated with the Heritage Bluffs II project ("Heritage Brodiaea Preserve") would cover approximately 14.1 acres of Parcel 3 of PM 18504 and the adjoining Heritage Bluffs II properties. The Heritage Brodiaea Preserve will conserve *in situ* approximately 3.75 acres of the acreage mapped as supporting *B. filifolia*, with the balance - 2.43 acres - considered impacted by the Heritage Bluffs II development project. These 2.43 acres will be subject to *Brodiaea* corm salvage and translocation into the Heritage Brodiaea Preserve.

In terms of numbers of individual specimens counted and mapped between 2011-2015, the Heritage Brodiaea Preserve will protect approximately 5,401 counted plants on the Heritage Bluffs II project site, with the balance - 5,022 counted plants - either salvaged and translocated into the Preserve or stockpiled for propagation. An additional approximately 10,902 specimens were subject to emergency salvaged from the adjoining East Clusters Unit 3 project site (see Attachment A) in July of 2015. although these numbers do not reconcile readily with the counted plant occurrences from January/February of 2015. The total numbers of counted specimens conserved (via either *in situ* preservation or translocation to the HBP) to 10,423 counted plants. As noted previously, this represents approximately 11 percent of the total corms anticipated to occur onsite. Therefore, a total of approximately 49,149 corms are anticipated to be preserved *in situ*, with 45,700 to be ultimately salvaged and translocated to either propagation or to the HBP. These numbers do not directly reflect the salvaged corms associated with Attachment A.

The details of this proposed salvage and translocation, along with required management and monitoring tasks, are presented in the *Thread-leaved Brodiaea Salvage and Translocation Plan for the Heritage Brodiaea Preserve* dated August 2015. The details of emergency salvage from the East Clusters Unit 3 are presented in Attachment A

Discussion

This new occurrence of *B. filifolia* represents the southern-most known major population, with a single, substantially smaller occurrence on the other side of Black Mountain. These are the only two known occurrences of *B. filifolia* in the City of San Diego. The City received "coverage" for this species under their MSCP permit in 1997, even though *B. filifolia* was not known to occur in the City at that time. This allows the City to authorize the "take" of this species under the assumption that specific avoidance measures are in place, and that significant populations are protected to the maximum extent practicable.

B. filifolia is an MSCP-designated Narrow Endemic Species and a “covered” special status species. In accordance with the City's "take permit, the MSCP Narrow Endemic Policy must be applied to any populations of this species, including those already known and any found in the future. This is discussed in more detail in the *Final Biological Technical Report Heritage Bluffs II, San Diego, California* dated February 2015 (Affinis Job Number 2538).

Sincerely,

Vincent N. Scheidt
Certified Biological Consultant
TE 7881333-5

Figures and Attachments:

Table 1. *Brodiaea filifolia* - Acreage and Numbers Conserved *In Situ* and Numbers Translocated
Figure 1. 2015 Survey Polygons Showing Areas and Dates Surveyed
Figure 2. Occurrence Polygons - Heritage Bluffs II and East Clusters Unit 3 Project Site (Not Showing Translocated Specimens)
Figure 3. All Known Brodiaea Locations Through February 2015, Potentially Impacted Brodiaea Locations, Salvaged Brodiaea Locations (East Clusters Unit 3), and Translocated Brodiaea Locations (Entitled East Clusters Unit 3) Through July 2015
Attachment A. Letter-report from Recon Environmental: *Entitled East Clusters Unit 3 - Brodiaea Salvage/Translocation (RECON Number 3159-4)*
CNDDB form

Table 1. *Brodiaea filifolia* - Acreage and Numbers Conserved *In Situ* and Numbers Translocated

Site/Parcel	*Brodiaea* Acres Conserved *In Situ*	*Brodiaea* Acres Impacted	Total [1] Counted Specimens	Counted Specimens Conserved *In Situ*	Counted Specimens Impacted	Estimated Specimen Salvage Numbers [2] and Translocation
East Clusters Unit 3 312-160-05	n/a	n/a	3,341	n/a	3,341	Approx. 30,403 corms (~10,902 corms already salvaged) [3]
Parcel 3 of PM 18504 312-160-07	1.69 acres	0.32 acres	2,982	2,853	129	Approx. 1,174 corms to be salvaged
Heritage Bluffs II 312-010-15	2.06 acres	2.11 acres	4,100	2,548	1,552	Approx 14,123 corms to be salvaged
TOTAL	**3.75 acres**	**2.43 acres**	**10,423**	5,401	**5,022**	**Approx. 45,700 corms salvaged or to be salvaged**

[1] Specimen numbers above represent the actual number of plants counted in the field through February of 2015.
[2] Estimated salvage numbers are based on an 11 percent foliage count accuracy, with each counted specimen representing 9.1 additional specimens within the substrate (uncounted).
[3] See Attachment A for details. A known total of approximately 10,902 corms were salvaged from the East Clusters Unit 3 project site in July 2015.

Figure 1. 2015 Survey Polygons Showing Dates and Areas Surveyed

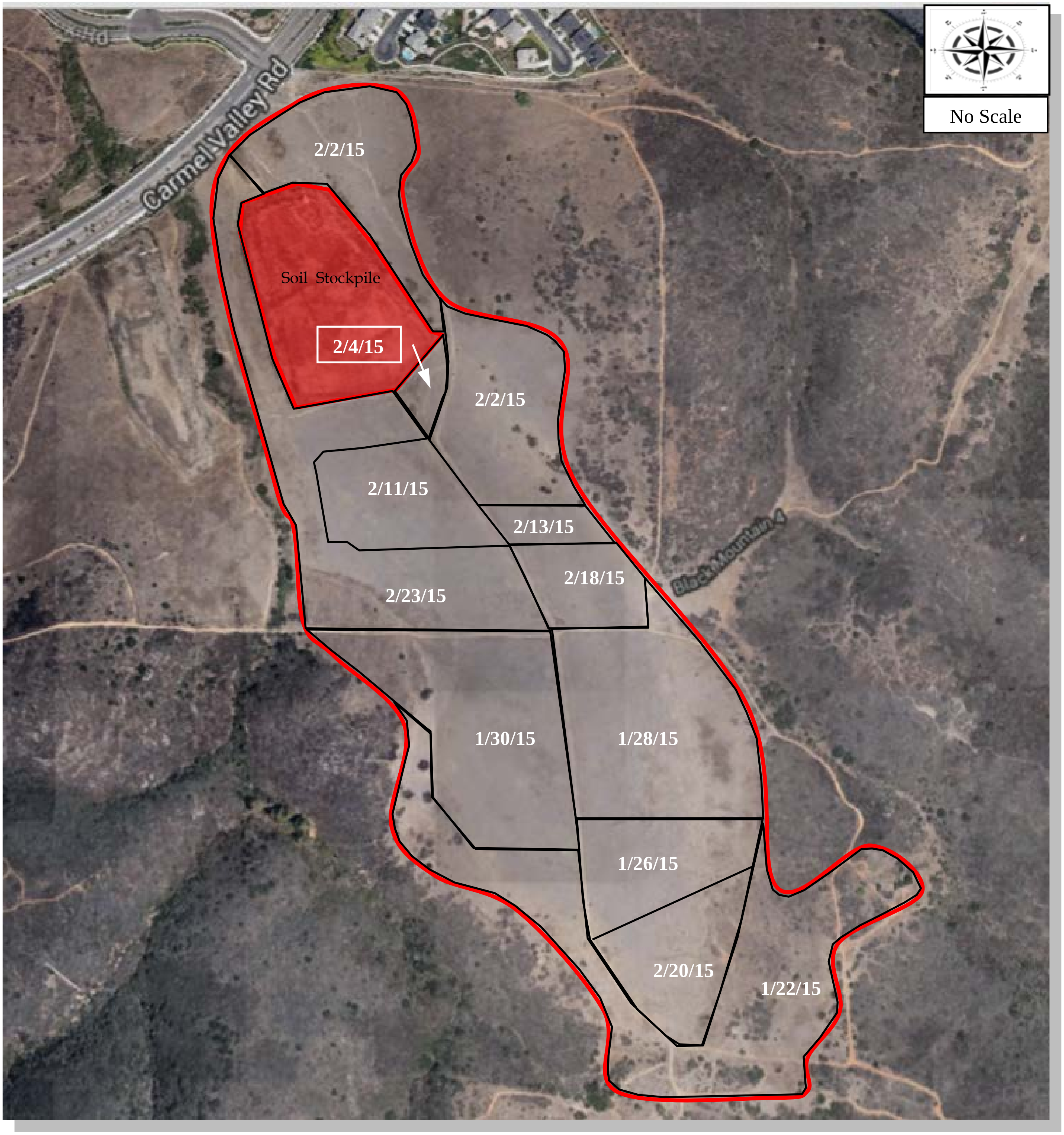
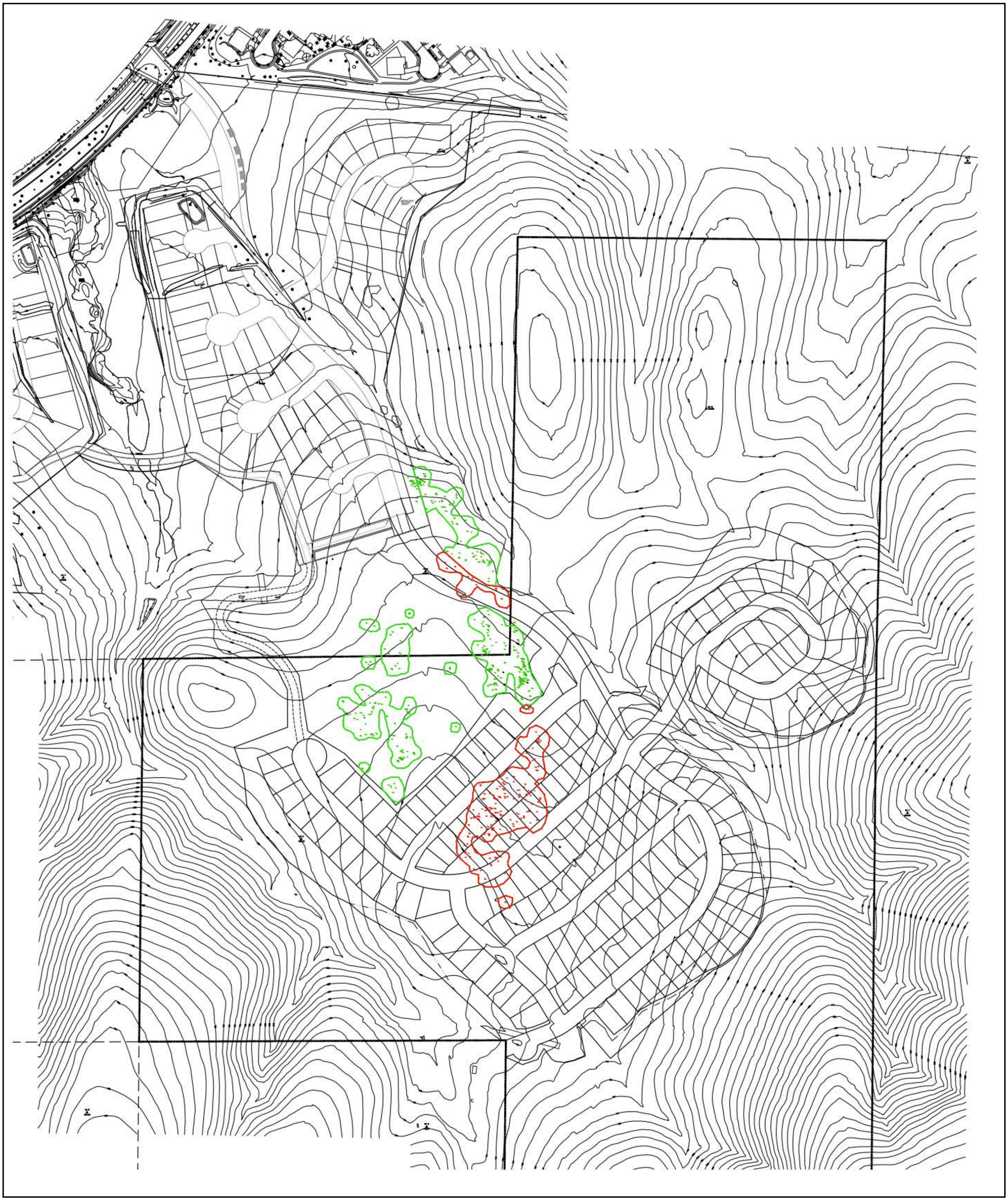
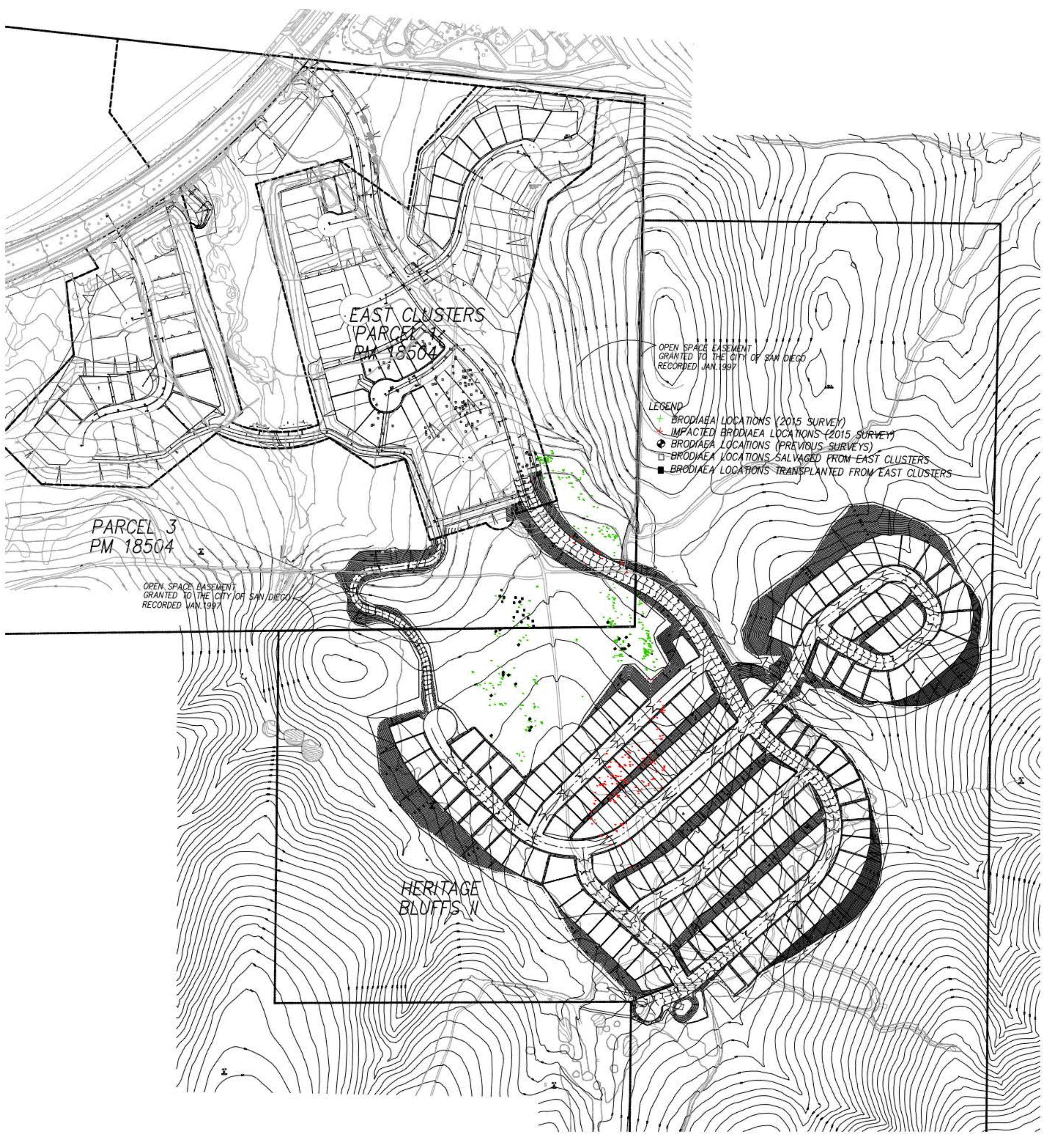


Figure 2. Occurrence Polygons - Heritage Bluffs II and Parcel 3 of PM 18504[4]



[4] *Not showing East Clusters specimens salvaged and translocated by Recon Environmental in the Spring of 2015*

Figure 3. ~~East Clusters~~Entitled East Clusters Unit 3 , Parcel 3 of PM 18504, and Heritage Bluffs II Project Sites - Known *Brodiaea* Locations Through February 2015, Potentially Impacted *Brodiaea* Locations, Salvaged *Brodiaea* Locations (~~East Clusters~~Entitled East Clusters Unit 3), and Translocated *Brodiaea* Locations (~~East Clusters~~Entitled East Clusters Unit 3) Through July 2015.



Attachment A

Letter-report from RECON Environmental:
East Clusters Unit 3 - Brodiaea Salvage/Translocation (RECON Number 3159-4)

Insert RECON report here

Mail to:
California Natural Diversity Database
Department of Fish and Game
1807 13th Street, Suite 202
Sacramento, CA 95814
Fax: (916) 324-0475 *email: CNDDB@dfg.ca.gov*

For Office Use Only

Source Code ____ Quad Code ____
Elm Code ____ Occ. No. ____
EO Index No. ____ Map Index No. ____

Date of Field Work (mm/dd/yyyy): 02/04/2015

Reset

California Native Species Field Survey Form

Send Form

Scientific Name: *Brodiaea filifolia*

Common Name: Thread-leaved Brodiaea

Species Found? ☑ Yes ☐ No ____ If not, why?

Total No. Individuals ~10,423 Subsequent Visit? ☐ yes ☑ no

Is this an existing NDDB occurrence? ____ Yes, Occ. # ☑ no ☐ unk.

Collection? If yes: ____ Number ____ Museum / Herbarium

Reporter: Vince Scheidt
Address: 3158 Occidental Street
San Diego CA 92122
E-mail Address: vince.scheidt@gmail.com
Phone: (858) 457-3873

Plant Information

Phenology: 100 % vegetative ____ % flowering ____ % fruiting

Animal Information

____ # adults ____ # juveniles ____ # larvae ____ # egg masses ____ # unknown

☐ breeding ☐ wintering ☐ burrow site ☐ rookery ☐ nesting ☐ other

Location Description ***(please attach map AND/OR fill out your choice of coordinates, below)***

Attached USGS 7.5' Quadrangle

County: San Diego Landowner / Mgr.: Private

Quad Name: Poway, CA Elevation: ~700'

T____ R____ Sec ____, ____ ¼ of ____ ¼, Meridian: H☐ M☐ S☐ Source of Coordinates (GPS, topo. map & type): GPS

T____ R____ Sec ____, ____ ¼ of ____ ¼, Meridian: H☐ M☐ S☐ GPS Make & Model Iphone 4s

DATUM: NAD27 ☐ NAD83 ☐ WGS84 ☐ Horizontal Accuracy ____ meters/feet

Coordinate System: UTM Zone 10 ☐ UTM Zone 11 ☐ ***OR*** Geographic (Latitude & Longitude) ☑

Coordinates: Center of study area: 32.993121, -117.106380

Habitat Description *(plant communities, dominants, associates, substrates/soils, aspects/slope):*

Native and Non-native Grassland habitat on heavy clay soils. Associates include Stipa pulchra, Sisyrinchium bellum, various other native geophytes, and non-natives, including Cynara cardunculus, Foeniculum vulgare, and Eurasian grasses. Specimens observed primarily on gentle north-facing slopes in various areas of site, mostly in small occurrences. Surrounding area in non-native grassland and partiall developed. Site mostly flat.

Other rare taxa seen at THIS site on THIS date: Polioptila california in adjoining Coastal Sage Scrub vegetation
(separate form preferred)

Site Information Overall site/occurrence quality/viability (site + population): ☑ Excellent ☐ Good ☐ Fair ☐ Poor

Immediate AND surrounding land use:

Visible disturbances:

Threats:

Comments: Presence of large numbers of Cynara makes accurate counts difficult.

Determination: *(check one or more, and fill in blanks)*

☑ Keyed (cite reference): Jepson
☐ Compared with specimen housed at: ____
☐ Compared with photo / drawing in: ____
☐ By another person (name): ____
☐ Other: ____

Photographs: *(check one or more)*

	Slide	Print	Digital
Plant / animal	☐	☐	☑
Habitat	☐	☐	☑
Diagnostic feature	☐	☐	☑

May we obtain duplicates at our expense? yes ☐ no ☐

APPENDIX E
Biological Technical Report

FINAL BIOLOGICAL TECHNICAL REPORT
HERITAGE BLUFFS II
SAN DIEGO, CALIFORNIA
Project No. 319435; SAP No. 24004059
(Affinis Job No. 2538)

Prepared For:
William M. Dumka
Standard Pacific Homes, San Diego
16010 Camino Del Sur
San Diego, California 92127

Prepared By:
Affinis
810 Jamacha Road, Suite 206
El Cajon, California 92019
(619) 441-0144

And:

REC Consultants
2442 Second Avenue
San Diego, CA 92101

Submitted to:
City of San Diego
Land Development Review Division
1222 First Ave MS501
San Diego, CA 92101-4165

Marcia Adams, Biologist **Michael Busdosh, Biologist**

December 2015

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EXECUTIVE SUMMARY

Introduction and Project Description

This biological resources report has been prepared to assess the impacts associated with development of a portion of a 169.85-acre parcel within the City of San Diego. It is within Sections 32 and 5 of Township 13 and 14 South, Range 2 West of the USGS 7.5' Poway Quadrangle; and it includes Assessor Parcel Numbers 312-010-15 and 312-160-02. The site is designated as one of the "Southwest Perimeter Properties" in the Black Mountain Ranch Subarea Plan, and portions of the site are located within the City's Multiple Species Conservation Program (MSCP) Multi-Habitat Planning Area (MHPA).

The Subarea Plan designates approximately 43 acres of the property as Low Density Residential (2-5 dwelling units per acre) and the remainder of the site as part of MHPA. The Subarea Plan also identifies the property as Areas A and B intended for development of 25 dwelling units and 195 dwelling units respectively, or a total of 220 dwelling units. The Subarea Plan also requires that 35 dwellings of the 220 total dwellings be affordable units.

The proposed Heritage Bluffs II project consists of a Vesting Tentative Map, a Planned Development Permit for deviations to underlying zone setback requirements, a Site Development Permit for Environmentally Sensitive Lands, and Re-zonings from AR-1 to RS-1-14 and RX-1-1. In addition, a Boundary Line Adjustment (BLA) to the City's Multi-Habitat Planning Area (MHPA) is required.

On-site the project proposes to develop a total of 171 residential units on approximately 43 acres and includes two different product types. A total of 119 single-family residential lots are proposed in the 4,500 to 6,000 square-foot range under the RX-1-1 zone and 52 lots are proposed to be in the over 6000 square foot range under the RS-1-14 zone. The balance of the 220 dwellings allocated to the property in the Black Mountain Ranch Subarea Plan would be transferred to the Black Mountain Ranch North Village. This transfer of 49 dwellings to the North Village would include the 35 affordable dwellings required by the Subarea Plan. The project would include an annexation to the Olivenhain Municipal Water District for sewer service.

Access to the project site would be provided by extending access from the proposed development to the north per the East Clusters VTM. A second paved emergency access road/utility easement would be provided from the East Clusters VTM.

Biological Resources

Seven habitats/vegetative associations occur on the property. They include coastal sage scrub (102.45 acres), southern mixed chaparral (34.83 acres), non-native grassland (31.80 acres), native perennial grassland (0.15 acre), freshwater marsh (0.03 acre), mulefat scrub (0.18 acre), and riparian forest (0.41 acre). The riparian forest, freshwater marsh, and mulefat scrub areas are considered wetland habitats under the City's Biology Guidelines 2002 and Environmentally Sensitive Lands (ESL) Regulation. Any impacts to these areas would require preparation of Findings to allow deviations from ESL regulations and mitigation for significant impacts would be required. Additionally, these areas may be considered jurisdictional by state and federal agencies.

Thirty-one species of birds, four mammals, and three reptile species were observed or detected on-site. One raptor, a red-tailed hawk (*Buteo jamaicensis*), was observed flying over the site. A red-tailed hawk nest is present in the riparian forest along the western property boundary. This nest may be active, but this could not be confirmed due to the timing of the 2013 surveys. Two sensitive bird species, coastal California gnatcatcher (*Poliptila californica californica*) and rufous-crowned sparrow (*Aimophila ruficeps*), were observed on-site.

Thread-leaved Brodiaea (*Brodiaea filifolia*) was found in a portion of the non-native grassland on-site. Approximately 10,423 individual plants were observed and counted during the 2015 survey: 3,341 on the East Clusters site, 2,982 on Parcel 3 of PM No. 18504, and 4,100 on the project site. Thread-leaved Brodiaea is a state-listed Endangered and federal-listed Threatened species. It is an MSCP covered species and is also considered a narrow endemic species per the City's MSCP. It should be noted that the areas supporting the thread-leaved Brodiaea are also heavily infested with artichoke thistle.

Project Impacts

The project would result in the loss of 24.29 acres of coastal sage scrub (Tier II), 25.71 acres of non-native grassland (Tier IIIB), and 0.15 acre of native perennial grassland (Tier I), for a total of 50.15 acres. These impacts include all project grading limits as well as Brush Management Zone 1. With the proposed Boundary Line Adjustment (BLA), all impacts would be outside the MHPA and mitigated within the MHPA.

The project would preserve enough habitat in biological open space to offset the impacts to coastal sage scrub (a surplus of 52.97 acres).

On-and off-site impacts to non-native grassland would require 12.85 acres of mitigation (0.5:1 ratio). Approximately 5.87 acres of non-native grassland would be preserved on-site, and the project is proposing off-site mitigation in two areas. One area totaling 7 acres is along Lusardi Creek, and the other area totaling 0.84 acre on the Santaluz project to the north. With the proposed on- and off-site mitigation for non-native grassland (13.71 acres), there would be a surplus of 0.86 acre.

Impacts to 0.15 acre of native perennial grassland are significant and cumulatively significant. Direct impacts to this habitat type are mitigated via Tier I per the City's Biology Guidelines, which further stipulate that cumulative impacts may be mitigated "only via creation at a 1:1 ratio or greater with the feasibility of creation to be evaluated on a case-by-case basis." A total of 0.15

acre has been delineated for native grassland creation and an additional 0.30 acre would be enhanced with native grassland in compliance with the guidelines. Monitoring requirements and success criteria are provided in the Habitat Management Plan (HMP) prepared for the project.

The project would result in both on- and off-site impacts to thread-leaved Brodiaea, which would be significant. The project has been redesigned to avoid the majority of the thread-leaved Brodiaea, and impacted plants would be translocated into the proposed Heritage Brodiaea Preserve as detailed in the HMP. Approximately 10,902 plants were excavated and salvaged located off-site within the East Clusters project area (under construction at the time of public review of the Project's SEIR).

No impacts are expected to occur to the freshwater marsh, mulefat scrub, or riparian forest habitats. These habitats are located outside the development footprint, and buffers consisting of at least 100 feet wide between the edge of development and these ESL wetlands have been incorporated into the project design. While post-development runoff may slightly increase or decrease in some areas, the overall site drainage would remain the same (steep slopes and stream beds would remain unaltered) and no adverse impacts to these habitats are expected.

A stormwater basin is proposed on a portion of a disturbed segment of one non-wetland tributary. Impacts would be approximately 726 square feet, approximately 0.02 acre, under both federal and state jurisdiction. A culverted road crossing is proposed over another drainage impacting approximately 1167 square feet (0.03 acre) to waters under federal jurisdiction, and approximately 1843 square feet (0.05 acre) to waters under state jurisdiction. Mitigation for the loss of non-wetland jurisdictional waters would be negotiated with ACOE and CDFW as part of the permitting process. Mitigation ratios would be determined at that time and may consist of habitat restoration, creation, or enhancement.

In order to develop the site, a Boundary Line Adjustment (BLA) is required, primarily to avoid impacts to sensitive biological resources. This would result in the removal of 20.47 acres from the MHPA (16.42 acres of coastal sage scrub; and 4.05 acres of non-native grassland, including 1.34 acres on-site and 2.71 acres off-site). The proposed replacement includes 13.5 acres currently on-site (6.58 acres of coastal sage scrub, 5.87 acres of non-native grassland, 0.18 acre of mulefat scrub; and 0.03 acre of freshwater marsh), as well as approximately 0.84 acre of off-site non-native grassland just north of the site boundary. The project would also place approximately 7 acres of off-site non-native grassland adjacent to Lusardi Creek into the MHPA. Thus the overall give area would be 20.5 acres, including the on-and off-site replacement areas. Findings have been prepared in accordance with Section 5.4.2 of the *Final MSCP Plan* (August, 1998) to address the required equivalency analysis.

Mitigation Measures

The following mitigation measures have been made conditions of project approval:

a. Preservation of MHPA Open Space.

Prior to the issuance of a Notice to Proceed for a subdivision, or any construction permits, such as Demolition, Grading or Building, or beginning any construction-related activity, upland project upland impacts shall be mitigated in accordance with the City's LDC Biology Guidelines, as based on all impacts occurring outside of the MHPA and all mitigation occurring within the MHPA per the MHPA boundary line adjustment. With approval of the MHPA boundary line adjustment, mitigation for the impacts to sensitive vegetation communities would be achieved through the on-site and off-site preservation of habitat Mitigation land shall be dedicated in fee title to the City of San Diego as part of the MHPA.

Prior to the issuance of any construction permits, the Owner/Permittee shall preserve Lots O and P (on-site) and off-site parcels (as indicated on Sheets 18 and 19 of the Vesting Tentative Map) to the City's MSCP preserve via a covenant of easement or temporary covenant of easement and an Irrevocable Offer of Dedication in fee title to the City.

A covenant of easement (COE) shall be placed over ungraded portions of HOA Zone 2 Brush Management Lots and conveyed to the City's MHPA preserve. Parcels, or portions thereof, subject to the COE shall include: on-site Lots A, F, G and J and off-site Parcels A and F.

b. Heritage Brodiaea Preserve

Prior to issuance of any construction permit or notice to proceed, the *Thread-Leaved Brodiaea Habitat Management Plan for the Heritage Brodiaea Preserve, Heritage Bluffs II and East Clusters Project* shall be reviewed and approved by the City and Wildlife Agencies. The Habitat Management Plan (HMP) outlines specific requirements for the maintenance and monitoring, in perpetuity, of the plant communities and plant and animal species naturally occurring in the 14.1-acre Heritage Brodiaea Preserve (HBP). The emphasis is on the resident population of thread-leaved Brodiaea on the project site as well as a portion of the East Clusters project area to the north.

Prior to the issuance of any construction permits, the Owner/Permittee shall dedicate the Heritage Brodiaea Preserve [Lot Q (on-site) and Parcels C and D (off-site)] as indicated on Sheet 19 of the Vesting Tentative Map to a conservancy in fee title. Said offer of fee-title shall be accepted by the Conservancy upon completion of the project grading and construction.

A covenant of easement (COE) shall be placed over portions of HOA Zone 2 Brush Management Lots and dedicated to the conservancy. Parcels, or portions thereof, subject to the COE shall include: on-site Lot Q and off-site Parcels C and D.

c. MHPA Adjacency Guidelines

Projects can result in "edge effects" on adjacent habitats because of the potential introduction of plants, animals, noise, drainage, and access that can affect adjacent habitats and wildlife species. For the proposed project, edge effects would be minimized to the extent practicable by adherence to the MHPA Adjacency Guidelines regarding drainage, lighting, noise, barriers, and invasives. Additionally, detailed soils and drainage studies were prepared for the project to insure that no adverse indirect effects would occur in the areas set aside for the thread-leaved Brodiaea.

d. Area Specific Management Directives

Area Specific Management Directives (ASMDs) are not mitigation measures, per se, but are implemented through compliance with the MSCP Adjacency Guidelines. The project incorporates all feasible mitigation and design measures to address the ASMDs set forth in the City's MSCP for the coastal California gnatcatcher. While the he MSCP document also calls for ASMDs related to the Southern California rufous-crowned sparrow, until such time controlled burns might be allowed for such maintenance, this directive is not considered feasible.

Per the request of the WA, project-specific ASMDs were developed for the long-term protection of the thread-leaved Brodiaea populations on Heritage Bluffs. These include a conservation goal level of 100% of the known populations which have been mapped on-site and off-site land immediately to the north; species-specific monitoring; removal of exotic species; hand-clearing in BMZ2 areas supporting the plants; no grading in areas supporting the plants; no public access/motorized vehicles; installation of fencing and signage; reparation of any erosion damage, and other contingency measures.

A. INTRODUCTION AND PROJECT DESCRIPTION

This biological resources report has been prepared to assess the impacts associated with development of a portion of a parcel within the City of San Diego (Figures 1-3). It is within Sections 32 and 5 of Township 13 and 14 South, Range 2 West of the USGS 7.5' Poway Quadrangle (Figure 2); and it includes Assessor Parcel Numbers 312-010-15 and 312-160-02. The site is designated as one of the “Southwest Perimeter Properties” in the Black Mountain Ranch Subarea Plan, and portions of the site are located within the City’s Multiple Species Conservation Program (MSCP) Multi-Habitat Planning Area (MHPA).

The project site consists of approximately 169.85 acres. The Subarea Plan designates approximately 43 acres of the property as Low Density Residential (2-5 dwelling units per acre) and the remainder of the site as part of the City’s Multiple Habitat Planning Area (MHPA). The Subarea Plan also identifies the property as Areas A and B intended for development of 25 dwelling units and 195 dwelling units respectively, or a total of 220 dwelling units. The Subarea Plan also requires that 35 dwellings of the 220 total dwellings be affordable units.

The proposed Heritage Bluffs II project consists of a Vesting Tentative Map, a Planned Development Permit for deviations to underlying zone setback requirements, a Site Development Permit for Environmentally Sensitive Lands, and Re-zonings from AR-1 to RS-1-14 and RX-1-1. In addition, a boundary line adjustment to the City’s Multi-Habitat Planning Area (MHPA) is required.

On-site the project proposes to develop a total of 171 residential units on approximately 43 acres and includes two different product types. A total of 119 single-family residential lots are proposed in the 4,500 to 6,000 square-foot range under the RX-1-1 zone and 52 lots are proposed to be in the over 6000 square foot range under the RS-1-14 zone. The balance of the 220 dwellings allocated to the property in the Black Mountain Ranch Subarea Plan would be transferred to the Black Mountain Ranch North Village. This transfer of 49 dwellings to the North Village would include the 35 affordable dwellings required by the Subarea Plan. The project would include an annexation to the Olivenhain Municipal Water District for sewer service.

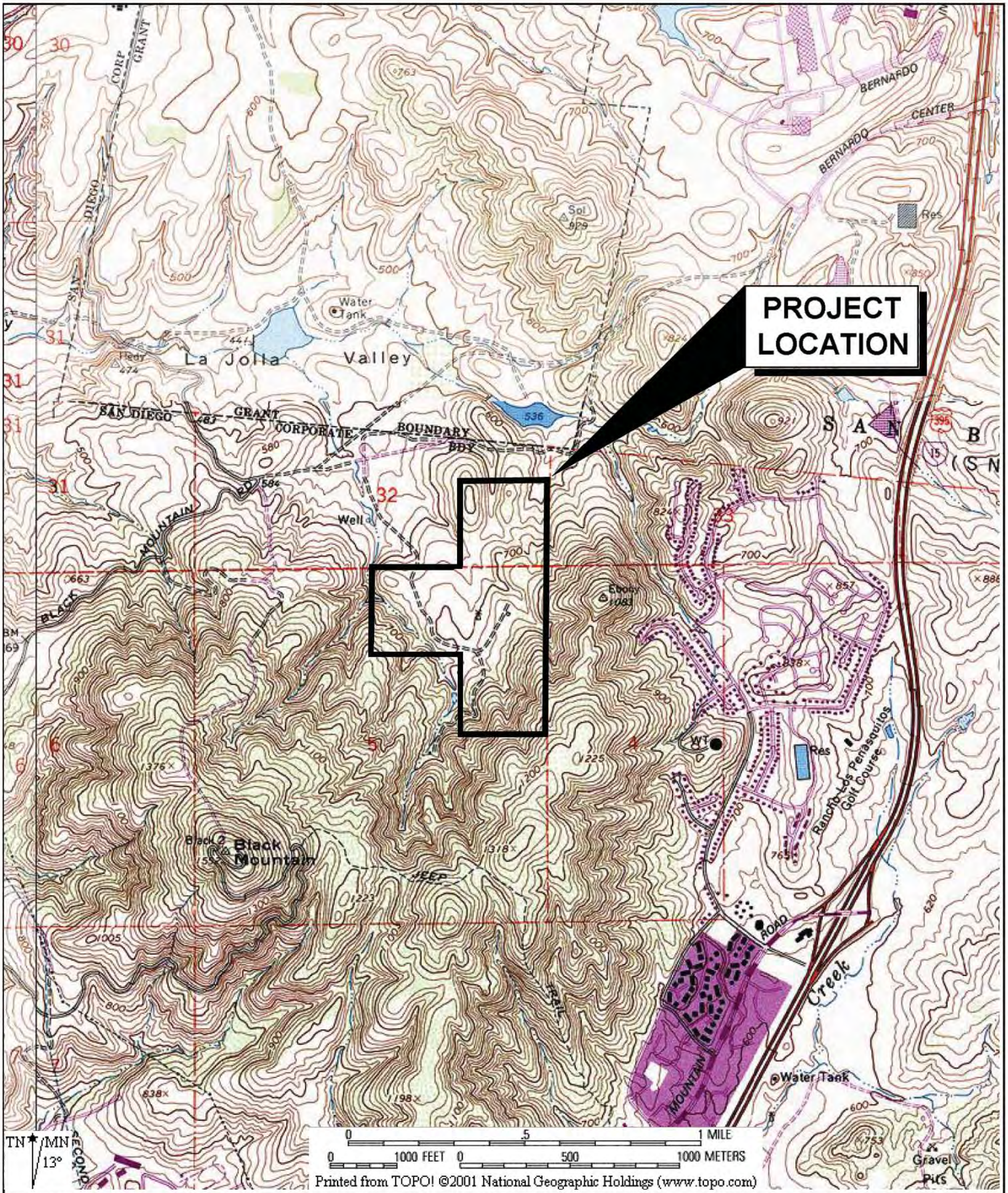
Access to the project site would be provided by extending access from the proposed development to the north per the East Clusters (Santaluz) VTM. A second paved emergency access road/utility easement would be provided from the Santaluz VTM. The majority of the remaining surrounding land is designated as open space in the Subarea Plan and is part of the MHPA.

Affinis

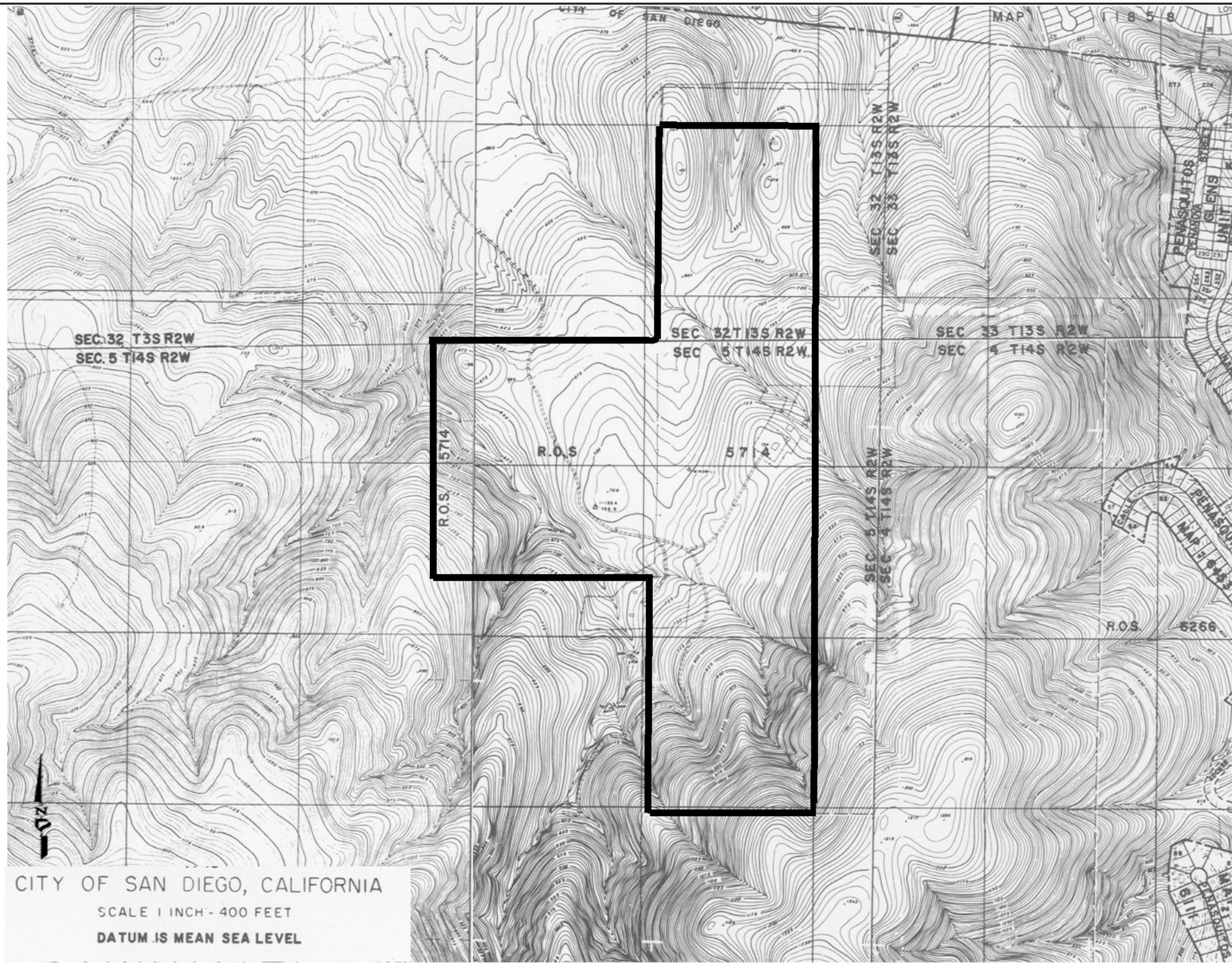
810 Jamacha Road
Suite 206
El Cajon, CA 92019

REGIONAL LOCATION IN SAN DIEGO COUNTY

FIGURE 1



Affinis 810 Jamacha Road Suite 206 El Cajon, CA 92019	**PROJECT LOCATION ON USGS 7.5' POWAY AND ESCONDIDO QUADRANGLES**	**FIGURE 2**



Affinis
810 Jamacha Road
Suite 206
El Cajon, CA 92019

PROJECT LOCATION ON CITY ENGINEERING MAP

FIGURE 3

B. METHODS AND SURVEY LIMITATIONS

The California Department of Fish and Wildlife's Natural Diversity Database (NDDB) program was accessed to determine if there were any sensitive species which have been reported on site or in the vicinity. Additionally, a survey report prepared by Recon in 2004 for a portion of the site was also reviewed.

Affinis initially surveyed the property in 2006. Updated protocol gnatcatcher surveys and habitat mapping were done in 2013, and delineations of jurisdictional waters were done as well.

Focused surveys were initially conducted in 2011 and 2012 to determine presence/absence of thread-leaf Brodiaea (*Brodiaea filifolia*). As summarized in Table 1, the 2011 surveys were conducted by Affinis' biologists Marcia Adams and Michael Busdosh, and Affinis Research Assistant Nicole Sivba, to search for flowering specimens. The non-native and native grassland areas were slowly walked at 10 meter intervals, and all occurrences were mapped by Ms. Sivba with a Garmin 60 GPS unit. In 2012, the site was re-surveyed by Ms. Sivba and Ms. Adams with consulting biologist Vince Scheidt, to search for Brodiaea foliage. Initially, the previously identified GPS points were relocated but transects were again walked to identify new occurrences. These were also mapped with the GPS unit. Mr. Scheidt, Ms. Adams, and Ms. Sivba were present for a field visit in 2012 which also included City and Wildlife Agency (WA) staff. This survey was conducted after a wet winter and many flowering individuals were visible, allowing a few new GPS points to be added to the inventory. All GPS data was given to PDC for digital map preparation. Subsequent surveys were conducted by Mr. Scheidt in 2015; results of those surveys are detailed in Appendix 11.

For jurisdictional waters, a steel tape was used to measure several widths along the segments of the ephemeral streams to be impacted. Widths were measured between the Ordinary High Water Marks (OHWM), as defined by the Army Corps' Regulatory Guidance Letter (U.S. Army Corps of Engineers, 2005) and the Corps' recent delineation field guide (Lichvar & McColley, 2008 Widths were measured from top-of-bank to top-of-bank for jurisdiction under the California Department of Fish and Wildlife. Where no clear top-of-bank was present, widths were measured between the points at which a clear break in vegetation types and/or density was evident. The length of the stream to be impacted was measured from scaled project maps. Data sheets for OHWM determination per the original Corps manual and Regulatory Guidance Letter, and data sheets per the Lichvar/McColley guide are in Appendix 8.

Table 1 provides details regarding the dates and times of the surveys. All surveys and analyses were conducted in accordance with the City's Guidelines for Conducting Biology Surveys (1998, Revised 2002) and the City's Land Development Code Biology Guidelines (Adopted 1999, Amended 2012).

Habitats were mapped on a base topographic map, using the prior habitat mapping, updated color aerial photography (including 2014), and field observations. All plant and animal species observed were recorded. Nomenclature for plant species is according to Hickman (2012); and for animals is according to the National Geographic Society (1983), American Ornithologists Union (DeBenedictis, 1989), Jameson and Peeters (1988), and Stebbens (1985). Plant community classification is according to Holland (1986).

Table 1. Dates, Times, and Weather Conditions during Field Surveys

DATE	TIME	WEATHER	PERSONNEL, ACTIVITY
05/20/11	11:00-02:00	70s, partly cloudy	Brodiaea survey (Adams, Busdosh, Sivba)
02/12/12	10:00-12:00	60s, overcast	Brodiaea foliage survey (Scheidt, Adams, Sivba)
05/22/12	01:00-03:00	70s, clear, light breeze	Field visit to observe Brodiaea with City Staff and Wildlife Agencies (Adams, Sivba, Scheidt)
07/04/13	06:00-11:30	Overcast, calm, 65° to clear, west breeze 5 mph, 74°	Gnatcatcher survey (Clark)
07/14/13	06:45-11:15	Partly cloudy, calm, 65°; to partly cloudy, calm, 71°	Gnatcatcher survey (Clark)
07/21/13	06:00-11:30	Overcast, calm, 63°; to partly cloudy, east breeze 3 mph, 72°	Gnatcatcher survey (Clark)
08/16/13	09:30-12:30	70s, 80s, clear, west wind 5-8 mph	Jurisdictional waters delineation, habitat mapping (Busdosh, Adams)
09/13/13	10:00-11:00	80s, clear, calm	Evaluation of off-site impacts for emergency access (Busdosh, Adams)

Thread-leaf Brodiaea (*Brodiaea filifiolia*) was found on-site in 2011 and 2012. An additional winter survey was conducted in 2015 to search for emergent foliage. Survey dates, times, and results are included in Appendix 11 to this report. Due to the presence of thread-leaf Brodiaea on-site, a detailed soils analysis was conducted by GeoSoils, Inc., in 2014. The report evaluated the geomorphic, soils, and hydrogeologic conditions in favorable vs. unfavorable areas for Brodiaea to determine how site development could indirectly impact areas proposed for protection of the on-site populations. The full report has been submitted under separate cover.

C. SURVEY RESULTS

1. Physical Characteristics

The property includes the northern slopes of Black Mountain and a series of small drainages surrounding a flat, disturbed field adjacent to remnant foundations of former structures. Elevations range from approximately 570 feet above mean sea level (amsl) at the northeastern corner to approximately 1180 feet amsl at the southern boundary. The site is undeveloped, although a series of dirt roads and trails traverse portions. Residential development is partially completed immediately north of the property, and Black Mountain Open Space Park is immediately south of the site.

Soils mapped on-site by the U.S. Soil Conservation Service are primarily San Miguel-Exchequer rocky silt loams, 9-70% slopes; with Escondido very fine sandy loam on the extreme northern portion and Auld clay in the flatter areas (Bowman, 1973). Based on sampling done by GeoSoils in the clay soils, however, it was determined that the on-site soils are better associated with the Diablo Clay Series, or Diablo-Olivenhein Complex Series derived from the Lusardi Formation. It should be noted that thread-leaf Brodiaea does occur regionally in both Diablo and Auld clays.

2. Biological Resources

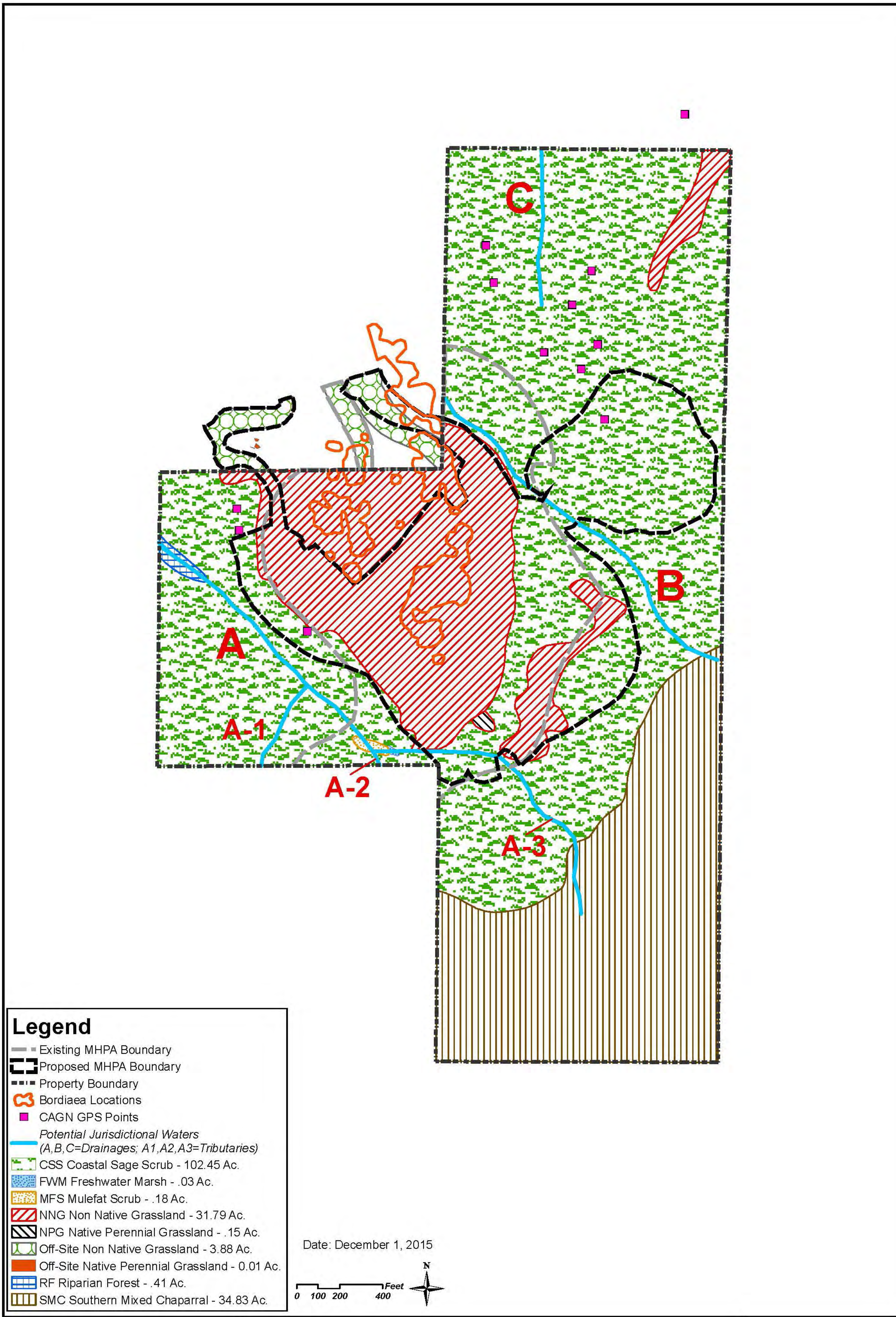
a. Botanical Resources - Flora

Seven habitats/vegetative associations occur on the property (Figure 4). They include:

<u>Coastal sage scrub</u> (Tier II, 102.45 acres). Coastal sage scrub occurs on the lower elevations of the property, largely on southern- and western-facing slopes. This vegetation type is dominated by coast monkey flower (*Mimulus aurantiacus*), coastal sagebrush (*Artemisia californica*), laurel sumac (*Malosma laurina*), and lemonade berry (*Rhus integrifolia*). Other species found in this habitat included California everlasting (*Gnaphalium californicum*), California encelia (*Encelia californica*), deerweed (*Lotus scoparius*), and spiny redberry (*Rhamnus crocea*).

<u>Southern mixed chaparral</u> (Tier IIIA, 34.83 acres). This habitat occurs on the steeper slopes in the southern portion of the site, largely on northern- and eastern-facing slopes, and is dominated by mission manzanita (*Xylococcus bicolor*), chamise (*Adenostoma fasciculatum*), Ramona lilac (*Ceanothus tomentosus*), and toyon (*Heteromeles arbutifolia*). Other species found here included manroot (*Marah macrocarpus*), white-flowered currant (*Ribes indecorum*), and fuschia-flowered gooseberry (*Ribes speciosum*).

<u>Non-native grassland</u> (Tier IIIB, 31.80 acres). The majority of the flatter areas on the property contained non-native grassland. This habitat occurs primarily in the central portion of the property as well as in a small finger in the extreme northeastern corner of the site. It was



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HABITAT MAP

FIGURE 4

dominated by thick stands of purple falsebrome (*Brachypodium distachyon*) and artichoke thistle (*Cynara cardunculus*). Other non-native species included ryegrass (*Lolium* sp.), and ripgut brome (*Bromus diandrus*), as well as bindweed (*Convolvulus simulans*). Also found in this habitat were occasional natives such as blue-eyed grass (*Sisyrinchium bellum*), hedge-nettle (*Stachys bullata*), and blue-dicks (*Dichelostemma capitatum*).

Native perennial grassland (Tier I, 0.15 acre). This area had a similar species composition to the non-native grassland, but had a higher prevalence of foothill needlegrass (*Nassella lepida*), and did not contain artichoke thistle.

Freshwater marsh (0.03 acre) was found in a modified drainage that contained cattail (*Typha* sp.) and bulrush (*Scirpus* sp.) as well as adjacent arroyo willow (*Salix lasiolepis*) and black willow (*Salix gooddingii*).

Mulefat scrub (0.18 acre) occurs in a small patch adjacent to the freshwater marsh and is dominated by mulefat (*Baccharis salicifolia*).

Riparian forest (0.41 acres). The largest drainage contains occasional willow trees, and in one area supports riparian forest with arroyo willow and western sycamore trees (*Platanus racemosa*) predominant.

A complete list of vascular plants observed during the surveys is included as Appendix 1.

b. Zoological Resources-Fauna

Thirty-one species of birds, four mammals, and three reptile species were observed or detected on-site (Appendices 2 and 3). One raptor, red-tailed hawk (*Buteo jamaicensis*), was observed flying over the site. A red-tailed hawk nest is present in the riparian forest along the western property boundary. This nest may be active, but this could not be confirmed due to the timing of the 2013 surveys. Two sensitive bird species were observed and are discussed below.

c. Rare, Threatened, Endangered, Endemic and/or Sensitive Species or MSCP Covered Species

Plants. During surveys conducted in 2011 and 2012, thread-leaf Brodiaea (*Brodiaea filifolia*) was found in a portion of the non-native grassland on-site. Individual populations ranged from a few plants to several hundred. During the 2015 surveys, approximately 10,423 individual plants were observed and counted: 3,341 on the East Clusters site, 2,982 on Parcel 3 of PM No. 18504, and 4,100 on the project site (refer to Appendix 11). Thread-leaf Brodiaea is a state-listed Endangered and federal-listed Threatened species, and it is identified as a narrow endemic in the MSCP Subregional Plan. However, specific conservation measures for this plant were not identified for the City's MSCP Subarea Plan because it was not known to occur in the City at the time the permits were issued by CDFW and USFWS (hereafter jointly referred to as the Wildlife Agencies, WA).

Numerous biological surveys have been conducted on the site dating back to 2006. In 2011, a series of multi-year focused surveys for thread-leaf Brodiaea (*Brodiaea filifolia*) was initiated as recommended by the WA due to a discovery of this species elsewhere in the broader vicinity. It was found on the HBII site, on Parcel 3 of PM No. 18504 between the Heritage Bluffs II site and the East Clusters project area and on the East Clusters site. Qualified Biologists completed a directed field survey for thread-leaved Brodiaea (Thread-leaved Brodiaea Foliage Survey for East Clusters and Heritage II project Sites, San Diego; November, 2015) on the East Clusters, Heritage Bluffs II property and Parcel 3 of PM No. 18504 in the City of San Diego (APN 312-010-15 and 312-160-12). All areas supporting suitable grassland and/or deeply fissured clay-soil habitat were carefully searched for foliage characteristic of this species. Thread-leaved Brodiaea was subsequently found on the HBII site, on the East Clusters site, and on Parcel 3 of PM No. 18504; however, the number of individuals and overall distribution was masked by prevailing drought conditions in the initial focused survey efforts. Following a more normal winter/spring rainy season in 2014-15, surveys conducted in 2015 revealed that the study area may support a low of approximately 95,000 to a high of 185,000 thread-leaved Brodiaea individuals. Approximately 10,902 plants were excavated and salvaged off-site within the East Clusters project area. It should be noted that the areas supporting the Brodiaea are also heavily infested with artichoke thistle.
While suitable habitat is also present in the clay soils for San Diego thornmint (*Acanthomintha ilicifolia*), it was not detected during any of the field surveys, including those dating back to 2006. San Diego thornmint has the same status as thread-leaf Brodiaea.

No additional sensitive plant species were observed or are expected to occur within the survey area (see Appendix 4).

<u>Animals</u>. The coastal California gnatcatcher (*Polioptila californica californica*) is a federal-listed Threatened species and is considered a Covered species under the City of San Diego's Multiple Species Conservation Plan (MSCP). As detailed in Appendix 7, a single territorial male gnatcatcher was detected during all three protocol surveys conducted on-site. A juvenile was observed at the northeastern boundary of the property during the last survey. Figures 4 and 7 show the locations of the gnatcatcher points.

The rufous-crowned sparrow (*Aimophila ruficeps*) is not state- or federal-listed, but is a CDFW Species of Concern and is also an MSCP Covered species. It was also noted in the coastal sage scrub habitat.

While not observed on-site, suitable habitat is present for several sensitive reptile species (San Diego horned lizard, orange-throated whiptail, red-diamond rattlesnake). These are not state- or federal-listed species and are all MSCP Covered species, so should their occurrence on-site become known, they would not be expected to pose any significant constraints to site development. These and other potentially-occurring sensitive animal species are listed in Appendix 5.

Upland Habitat. The City of San Diego ranks upland habitats by tiers, with Tier I being the most sensitive and Tier IV the least. All of the upland habitats occurring on-site are considered sensitive. Native perennial grassland is a Tier I habitat (rare uplands); coastal sage scrub is a Tier II habitat (uncommon uplands). Southern mixed chaparral is a Tier IIIA habitat, and non-native grassland is Tier IIIB (both common uplands). Impacts to any of these habitats would be considered significant and would require mitigation.

Wetland Habitat. The riparian forest, freshwater marsh, and mulefat scrub areas would be considered wetland habitats under the City's Biology Guidelines 2002 and Environmentally Sensitive Lands (ESL) Regulation. Any impacts to these areas would require preparation of Findings to allow deviations from ESL regulations and mitigation for significant impacts would be required. Additionally, these areas may be considered jurisdictional by state and federal agencies (see discussion below).

Four jurisdictions can have authority over activities affecting the water resources:

- The U.S. Army Corps of Engineers (federal Clean Water Act Section 404).
- The Regional Water Quality Control Board (RWQCB) (Clean Water Act Section 401; Porter-Cologne Act).
- The California Department of Fish and Wildlife (state Streambed Alteration Agreement Resources Code Section 1602).
- The City of San Diego (local land use agency).

Federal Clean Water Act

Section 404 of the Clean Water Act requires a permit from the Army Corps of Engineers for work placing fill within Waters of the United States. Waters of the United States potentially pertinent to this property include:

> "All other waters such as intrastate lakes, rivers, streams (including intermittent streams), mudflats, sandflats, wetlands, sloughs, prairie potholes, wet meadows, playa lakes, or natural ponds...: [33 CFR 328.3 (a)(3)]

Wetlands. The Army Corps has defined wetlands as:

> "Those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas." (42 Fed. Reg. 37, 125-26, 37128-29; July 19, 1977).

Under the federal methodology, an area is a jurisdictional wetland if it is under normal conditions and manifests all of the following: prevalence of hydrophytic vegetation, hydric soils, and wetland hydrology. Clean Water Act permitting has abandoned the 1989 methodology, and has returned to the 1987 methodology --"Corps of Engineers Wetlands Manual" (Waterways Experiment Station Technical Report Y-87-1, January, 1987). It also uses definitions of 33 CFR 328.3(a).

Streams. Streams are a category parallel with wetlands -- both are types of Waters of the U.S. Streams are jurisdictional areas below the Ordinary High Water Mark (OHWM), defined at 33 CFR 328.3(e):

> "The term *ordinary high water mark* means that line on the shore established by the fluctuations of water and indicated by physical characteristics such as a clear, natural line impressed on the bank, shelving, changes in the character of soil, destruction of terrestrial vegetation, the presence of litter and other debris, or other appropriate means that consider the characteristics of the surrounding areas."

Regulatory Guidance Letter No. 05-05, "Ordinary High Water Mark Identification" December 7, 2005, discussed these physical characteristics to be considered in making an OHWM determination. Additionally, paragraph 3d noted:

> "When making OHWM determinations, districts should be careful to look at characteristics associated with ordinary high water events, which occur on a regular or frequent basis. Evidence resulting from extraordinary events, including major flooding and storm surges, is not indicative of the OHWM..."

In August, 2008, the Army Corps published a Field Guide to aid the identification of the OHWM in the arid west (Lichvar and McColley, 2008). This work addresses "...the identification of the OHWM in low-gradient, alluvial ephemeral/intermittent channel forms in the Arid West for use in the delineation of non-wetland streams." The Army Corps is also considering the development of a uniform methodology to determine the OHWM (Water Policy Report, September 23, 2013).

In June of 2006 the Supreme Court ruled in the combined *Rapanos* and *Carabel* case (*Rapanos et ux., et al. v. United States*), generally referred to as *Rapanos*. Four justices limited jurisdiction on streams to "relatively permanent, standing or continuously flowing" waters. Justice Kennedy did not agree, and instead called for a "significant nexus" between regulated water and navigable-in-fact waters. The former is commonly referred to as "the Scalia test" and the latter as "the Kennedy test" with various courts accepting one or the other.

Federal jurisdictional determination interpretation is in a state of flux at this time, with various lawsuits active. EPA and the Army Corps have variously discussed a rulemaking and guidance for determination of jurisdiction under the Clean Water Act. At this time these agencies have submitted a draft proposed rule for interagency review, and have not released an interim guidance

(Water Policy Report, September 23, 2013).

Section 401 of the federal Clean Water Act requires certification or a waiver that a project will not degrade water quality. In California, the certifying agency is the Regional Water Quality Control Board (RWQCB). The Army Corps cannot issue a permit under Section 404 without Section 401 certification.

California Streambed Alteration Agreement

Under Code Section 1602 of the California Department of Fish and Wildlife, an Agreement is necessary for alteration to a waterway:

> "Fish and Wildlife Code section 1602 requires any person, state or local governmental agency, or public utility to notify the Department before beginning any activity that will do one or more of the following:
>
> 1) Substantially obstruct or divert the natural flow of a river, stream, or lake;
>
> 2) substantially change or use any material from the bed, channel,
> or bank of a river, stream, or lake; or
>
> 3) deposit or dispose of debris, waste, or other material containing crumbled, flaked, or ground pavement where it can pass into a river, stream, or lake.

Fish and Wildlife Code section 1602 applies to all perennial, intermittent, and ephemeral rivers, streams, and lakes in the state" (www.dfg.ca.gov/1600/qa.html#qa3).

The California Department of Fish and Wildlife has no officially adopted regulations or statutes pertaining to wetlands (http://ceres.ca.gov/wetlands/agencies/dfg.html).

City of San Diego Environmentally Sensitive Lands

The San Diego Municipal Code, Chapter 11: Land Development Procedures, defines wetlands as "...areas which are characterized by any of the following conditions:

2. All areas persistently or periodically containing naturally occurring *wetland* vegetation communities characteristically dominated by hydrophytic vegetation, including but not limited to salt marsh, brackish marsh, freshwater marsh, riparian forest, oak riparian forest, riparian woodlands, riparian scrub, and vernal pools;

3. Areas that have hydric soils or *wetland* hydrology and lack naturally occurring *wetland* vegetation communities because human activities have removed the historic *wetland*

vegetation or catastrophic or recurring natural events or processes have acted to preclude the establishment of *wetland* vegetation as in the case of salt pannes and mudflats;

4. Areas lacking *wetland* vegetation communities, hydric soils and *wetland* hydrology due to non-permitted filling of previously existing *wetlands*;

5. Areas mapped as *wetlands* on Map No. C-173 as shown in Chapter 13, Article 2, Division 6 (Sensitive Coastal Overlay Zone)."

Overall drainage is to the north to Lusardi Creek, which flows west to the San Dieguito River (Figure 2). Confluence with the river is approximately two miles downstream. At least one in-stream reservoir is on Lusardi Creek. There are three distinct drainages on the property (Figure 4).

Drainage A includes the southern and southwestern portions of the property, and is made up of three tributaries and the mainstem. The mainstem A has a distinct channel, flows generally southeast-to-northwest, and exits the property along the western border. Drainage A flows generally northwards off of the property; Bernardo Center Drive crosses the drainage with a bridge. Drainage A shows as a broken blue line on the USGS topo map (Figure 2).

Tributary A-1 is largely off-site, and has a distinct channel throughout all or most of its length. Tributary A-2 is also largely off-site, with a distinct channel upstream of the property, but through the old ranch area the drainage has been disturbed, and is more swale-like in stretches. Tributary A-3 is the most disturbed, with a distinct channel only in segments within the old ranch area. It does have a distinct flow channel upstream of the old ranch area. There is a large earthen structure just upstream of its confluence with A-2, a berm approximately eight feet in height. The berm is aligned roughly parallel to the tributary, and may have served to keep flows in A-3 away from the old ranch area. The structure seems overly large for such a purpose. The berm is very close to the property line, and may have been erected as a barrier to vehicles.

All three tributaries of A and the mainstem have distinct channels and banks outside of the overall old ranch area. Within the old ranch area the drainages have been modified, with remnants of old dams and ponded areas. A remnant freshwater marsh and mulefat area were mapped on Drainage A just downstream of the confluence of A-2 and A-3. These habitats were likely created by dam(s) on the drainage, which are now removed or breached.

Drainage B runs southeast-to-northwest, crossing the central portion of the property in its northeast corner (Figure 4). Drainage B has also been disturbed over time, probably from ranching or farming activities. It has a distinct channel and banks upstream of the disturbed areas and over most of its length on the property. Drainage B flows generally north off the property to a large riprap area and culvert under Bernardo Center Drive.

Drainage C is a small drainage in the northernmost part of the site, running south-to-north, and exiting the property along the northern border. It has a distinct channel along its length on the property.

Several low areas were observed in the grassland in the central portion of the property. These do not appear to be natural depressions such as vernal pools, but may be artifacts of prior farming activities on the property, which were graded or scraped in past years. No wetland or vernal pool plant indicators were observed, and none of the areas had any standing water.

D. PROJECT IMPACT ANALYSIS

1. Direct Impacts

Upland Impacts. The TM for the proposed project is shown in Figures 5 and 6; the development overlay, including Zone 1 and 2 Brush Management, is depicted on Figure 7. As detailed on the TM, the Brush Management Plan would require a Zone One width of 35 feet, and a Zone Two width of 65 feet, with certain lots using a BMZ1 of 40 feet and BMZ2 of 57.5 feet. Zone One would be would be adjacent to the structure, and would consist of pavement and permanently irrigated ornamental planting. Zone 1 impacts are factored into the project's total impacts. Zone Two would then extend from the edge of Zone One to the undisturbed native vegetation, and would be selectively thinned and pruned to include only low-fuel volume native species. Zone Two is considered "impact neutral" and is not included in the acreage to be preserved within the MHPA.

For the health and safety of protecting the residences in urban wildfire interface areas, Zone 1 will be an irrigated landscape to assure a low combustible vegetated buffer between the habitable structure and Zone 2. Based on the graded design for the individual lots, the irrigated back yards will swale around the habitable structure and drain to the street. With the flow of any water (including irrigation) toward the street, Zone 1 will be able to provide a wildfire buffer for the residences while not altering the existing natural water flow toward the Brodiaea preserve.

As detailed in Table 2, the project would result in the loss of 24.29 acres of coastal sage scrub (Tier II), 25.71 acres of non-native grassland (Tier IIIB)) including 2.71 acres of off-site impacts), and 0.15 acre of native perennial grassland (Tier I) or a total of 50.150 acres..

The project would preserve enough habitat in biological open space to offset the impacts to coastal sage scrub (a surplus of 51.93 acres). With the proposed on-site mitigation (5.87 acres) and off-site mitigation (7.84) for non-native grassland, there would be a surplus of 0.86 acre. The proposed 7.84 acre of off-site mitigation is discussed further below, under the MHPA Boundary Line Adjustment Equivalency Analysis.

Per the City's CEQA thresholds, "direct impacts to perennial native grasslands that are greater than 0.1 acre are significant and cumulatively significant. Direct impacts to this habitat type are mitigated via Tier I per Biology Guidelines. Cumulative impacts may be mitigated only via creation at a 1:1 ratio or greater with the feasibility of creation to be evaluated on a case-by-case basis." As shown in Figure 8 and Table 2, 0.23 acre within the 14.1-acre preserve has been delineated for native grassland creation. Additional areas would be enhanced with native grassland in compliance with the guidelines. Monitoring requirements and success criteria are provided in the Draft HMP.

Wetland Impacts. No impacts are expected to occur to the freshwater marsh, mulefat scrub, or riparian forest habitats. As shown in Figure 7, these habitats are located outside the development footprint and buffers consisting of at least 100 feet wide between the edge of development and these ESL wetlands have been incorporated into the project design. While post-development runoff may slightly increase or decrease in some areas, the overall site drainage would remain the same (steep slopes and stream beds would remain unaltered) and no adverse impacts to these habitats are expected.

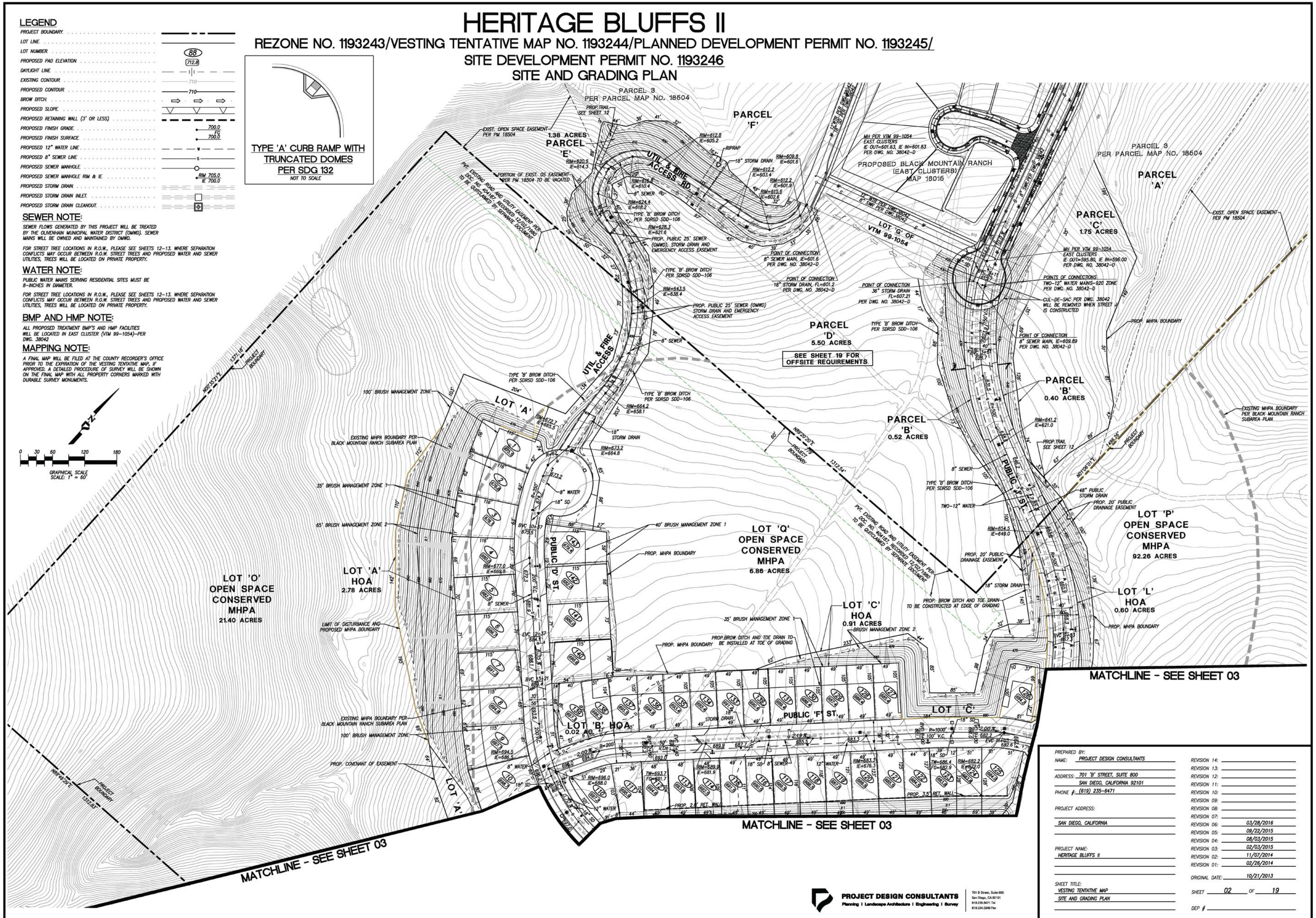
Non-Wetland Waters Impacts. A stormwater basin is proposed on a portion of a disturbed segment of Tributary A-3, in the old ranch area. This will drain through a culvert under the road required as access to the adjacent property and under the southwest corner of the project, and then empty back into the drainage. This allows stormwater from the undeveloped area to the south to not be comingled with project runoff. As noted above, a distinct channel for Tributary A-3 is not presently continuous, probably due to past disturbances of ranching. As can be seen in the photos of Figure 1 in Appendix 8, a channel is discernible upstream of the area to be impacted, but in the project area it is largely flow between shrubs. Tributary A-3 does have a distinct upstream channel, and a distinct downstream channel. Impacts to non-wetland waters would be approximately 726 square feet, approximately 0.02 acre, under both federal and state jurisdiction.

A culverted road crossing is proposed over Drainage B (Figure 5). This would result in impacts of approximately 1167 square feet (0.03 acre) to waters under federal jurisdiction, and approximately 1843 square feet (0.05 acre) to waters under state jurisdiction. Tributary B has a defined channel in its upper reaches, becoming more swale-like downstream (Figure 2, Appendix 8).

The California Department of Fish and Wildlife can require a Streambed Alteration Agreement on an ephemeral stream such as either of these, and would make that decision following review of a Notification Packet. Under the federal Clean Water Act, filling of this ephemeral stream segment would require a permit from the U.S. Army Corps of Engineers. It is likely this project could use Nationwide Permit #43 Stormwater Management Facilities, and Nationwide Permit #29 Residential Projects, for this work. There are currently discussions of changes in the Clean Water Act and/or in the methodology used to determine jurisdiction under the Act. The amount of impact included here was calculated assuming maximum area of jurisdiction under the present conditions or with any of the discussed changes. Mitigation for the loss of 0.03 acre of non-wetland jurisdictional waters would be negotiated with ACOE and CDFW as part of the permitting process. Mitigation ratios would be determined at that time and may consist of habitat restoration, creation, or enhancement.

FIGURE 5

PROPOSED TENTATIVE MAP, SHEET 1



Source: PDC, 2016

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HERITAGE BLUFFS II

REZONE NO. 1193243/VESTING TENTATIVE MAP NO. 1193244/PLANNED DEVELOPMENT PERMIT NO. 1193245/ SITE DEVELOPMENT PERMIT NO. 1193246

SENSITIVE BIOLOGICAL RESOURCES

SYMBOL	DESCRIPTION	PROJECT AREA (ACRES)	SITE DISTURBANCE DIRECT IMPACT AREA (ACRES)	OFFSITE DISTURBANCE
	CSS Coastal Sage Scrub	102.45	24.29	–
	SMC Southern Mixed Chaparral	34.83	–	–
	NNG Non Native Grassland	31.80	23.00	2.71
	NPG Native Perennial Grassland	0.15	0.15	0.002
	FWM Freshwater Marsh	0.03	–	–
	MFS Mulefat Scrub	0.18	–	–
	RF Riparian Forest	0.41	–	–
	TOTAL	169.85	47.4	2.712

TOPO WAS OBTAINED FROM GIS SOURCES. ACCURACY TO BE VERIFIED. PROPOSED BOUNDARY LIMITS WILL VARY SLIGHTLY ONCE FLOWN TOPOGRAPHY IS USED TO VALIDATE GRADING.

THE HABITAT BOUNDARIES ARE FROM AFFINIS MAP FIGURE 7 BIOLOGICAL RESOURCES DATED JULY 2015.

LEGEND

- PROJECT BOUNDARY
- SITE DISTURBANCE DIRECT IMPACT AREA
- BRUSH MANAGEMENT ZONE 1
- BRUSH MANAGEMENT ZONE 2
- EXISTING MHPA
- BRODIAEA LOCATION

PREPARED BY:
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PHONE #: (619) 235-6471

PROJECT ADDRESS:
SAN DIEGO, CALIFORNIA

PROJECT NAME:
HERITAGE BLUFFS II

SHEET TITLE:
SENSITIVE BIOLOGICAL RESOURCES

REVISION 14:
REVISION 13:
REVISION 12:
REVISION 11:
REVISION 10:
REVISION 09:
REVISION 08:
REVISION 07:
REVISION 06:
REVISION 05: 09/22/2015
REVISION 04: 08/03/2015
REVISION 03: 02/03/2015
REVISION 02: 11/07/2014
REVISION 01: 02/26/2014
ORIGINAL DATE: 10/21/2013
SHEET 10 OF 19
DEP #

PROJECT DESIGN CONSULTANTS
Planning | Landscape Architecture | Engineering | Survey

Source: PDC, 2015

FIGURE 6

PROPOSED TENTATIVE MAP, SHEET 2

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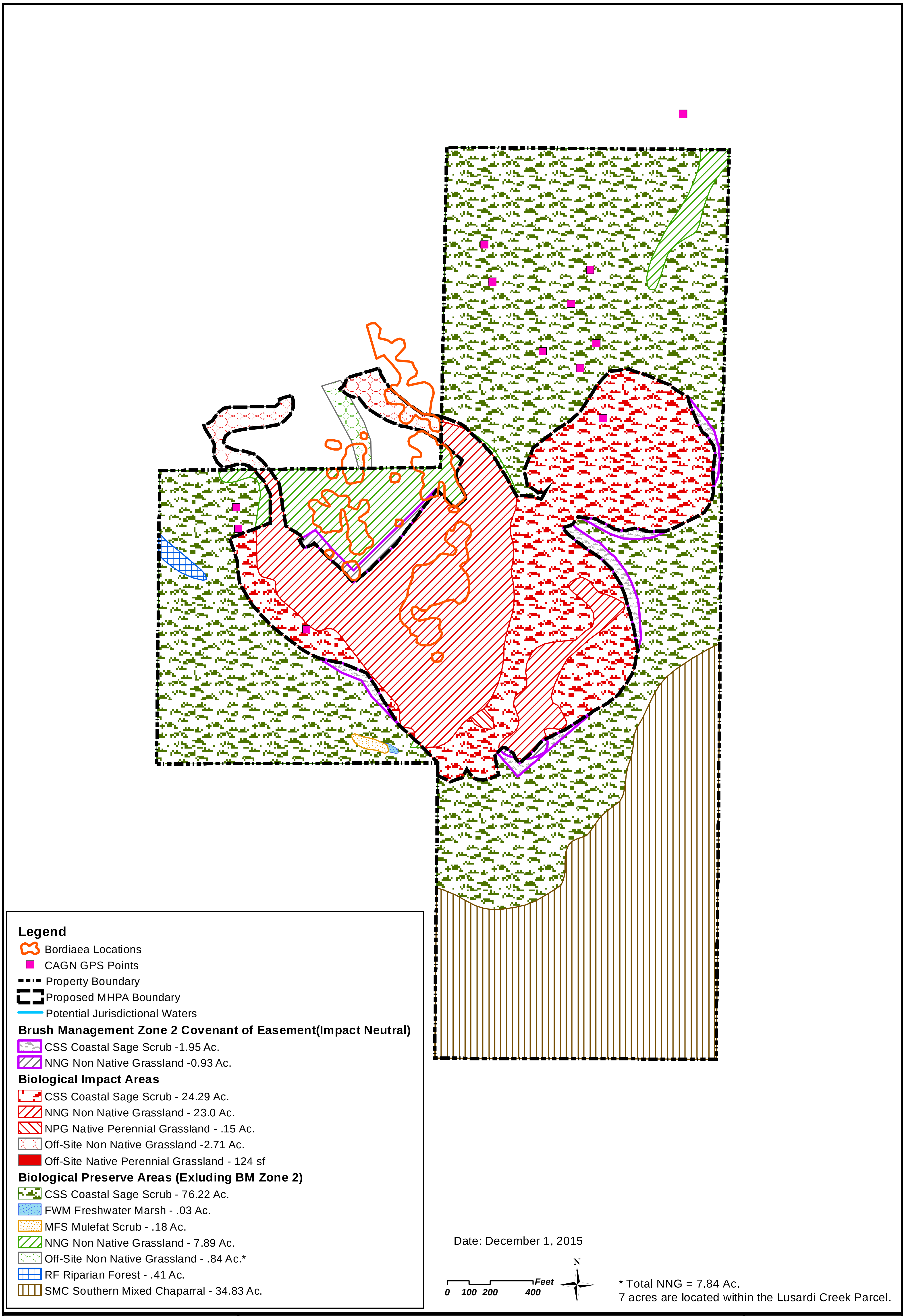


Affinis Shadow Valley Center 847 Jamacha Road El Cajon, CA 92019	**PROJECT IMPACTS**	**FIGURE 7**

Table 2. Project Impacts and Mitigation Requirements

HABITAT TYPE	TIER	TOTAL AC ON-SITE	ON-SITE IMPACTS	OFFSITE IMPACTS	TOTAL AC. IMPACTED[1]	MITIGATION RATIO	MITIGATION AC. REQUIRED	ACREAGE TO BE PRESERVED IN OPEN SPACE
Native perennial grassland	I	0.15	0.15	0.003	0.15	2:1, 1:1	0.45[2]	0.45
Coastal sage scrub	II	102.45	24.29		24.29	1:1	24.29	76.22[3]
Southern mixed chaparral	IIIA	34.83	0.00		0.00	0.5:1	0.00	34.83
Non-native grassland	IIIB	31.80	23.0	2.71	25.71	0.5:1	12.85	15.28[3]
TOTAL UPLAND		169.23		2.71	50.15		37.59	119.03[4]
Freshwater marsh	N/A	0.03	0.00		0.00	N/A	0.00	0.03
Mulefat scrub	N/A	0.18	0.00		0.00	N/A	0.00	0.18
Riparian forest	N/A	0.41	0.00		0.00	N/A	0.00	0.41
TOTAL WETLAND		0.62	0.00		0.00		0.00	0.62

1 With the proposed boundary adjustment, all impacts would be outside the MHPA, and mitigation would be inside the MHPA.

2 Mitigation for the loss of NPG will occur within the proposed 14.1-acre Heritage Brodiaea Preserve. Creation is required at a 1:1 ratio for cumulative impacts to NPG and would be achieved by NPG creation within abandoned roadbeds (0.15 acre, Figure 8). An additional 0.30 acre of native grassland enhancement is proposed with the overall thread-leaved Brodiaea preserve to meet the total of 0.45 acre of necessary mitigation.

3 Excludes impacts to 1.95 acres of CSS and 0.93 acre of NNG within BMZ 2 which are impact neutral but cannot be counted toward mitigation, as well as 0.45 acre to be converted to NPG. Off-site addition includes 7.acres of NNG adjacent to Lusardi Creek and 0.84 acre of NNG on vacated area on the Santaluz parcel to the MHPA. This acreage would be placed in a Covenant of Easement and maintained by the HOA.

4 Does not reflect a mathematical total of this column; refer to prior footnotes for explanations.

Off-site Impacts. Off-site impacts to 2.71 acres of non-native grassland would occur to the north where the project access road would be extended to meet with the approved East Clusters (Santaluz) project (City of San Diego, 2006), and for a secondary paved emergency access/utility easement. The roadway's slopes would be planted with native species, and drainage would be collected and treated downstream within the proposed regional water quality basin to satisfy RWQCB. The secondary road would impact a very small amount (0.0034) acre of native perennial grassland off-site to the north. The locations of these roads and utilities have been modified in consultation with City staff and the Wildlife Agencies (WA) to minimize impacts to the MHPA, per Section 1.4.2 of the *MSCP Subarea Plan* (Roads and Utilities). Further, the locations would maximize the area that would be preserved for protection of thread-leaf Brodiaea (additional discussion follows in Chapter E).

Impacts to Rare Plants. The project would result in both on- and off-site impacts to thread-leaved Brodiaea, which would be significant. After the thread-leaf Brodiaea was found on-site, the applicant met with the WAs to discuss measures to avoid and/or minimize project effects. The project design was subsequently revised to completely avoid the non-native grassland areas supporting the Brodiaea known to occur on-site at that time. During a BLA Meeting with City staff and the project biologist on September 18, 2012, the agencies stated that an increase in impacts to coastal sage scrub within the preserve could be approved due to the importance of preserving the Brodiaea in place. The project has further been redesigned to avoid the majority of the thread-leaved Brodiaea, and impacted plants would be translocated into the proposed Heritage Brodiaea Preserve. Further details are provided below in the MHPA Boundary Line Adjustment Equivalency Analysis, and Chapter E (Mitigation) regarding the proposed Heritage Brodiaea Preserve Habitat Management Plan (HMP).
As noted above, numerous surveys have been conducted on-site dating back to 2006. Focused surveys for thread-leaved Brodiaea were conducted in 2015 resulting in a count of over 10,000 plants and the potential occurrence of 95,000 to 185,000 additional plants. The overall number of individual corms is speculative because the majority of the plant exists underground and is not readily observable particularly when in an immature state or hidden within patches of weedy vegetation. A total of 7,082 plants were observed and counted within the project area, 4,100 were counted on-site, and the remainder (2,982) was counted off-site to the north of the project boundary within Parcels C and D. The project would impact 1,691 of the counted specimens (1,552 on-site and 139 off-site in conjunction with the construction of Street J). The project would preserve a total of 5,391 counted specimens in place within the HBP. The remainder (impacted specimens) would be translocated to the HBP. In accordance with a provision in the HMP, corms within the development footprint of the previously entitled Santaluz project were relocated into the proposed 14.1-acre preserve area, which is discussed in further detail below.

Two existing dirt roads, one running north-to-south on-site and another running east-to west just north of the property line, are largely within the proposed HMP area for protection of the thread-leaved Brodiaea populations. These roads will be abandoned and restored to native perennial grassland as detailed in the HMP. No public trails are currently proposed, but if trails are desired in the future, they would be addressed on a regional basis.

Indirect Impacts

Projects can result in "edge effects" on adjacent habitats because of the potential introduction of plants, animals, noise, drainage, and access that can affect adjacent habitats and wildlife species. For the proposed project, edge effects would be minimized to the extent practicable by adherence to the MHPA Adjacency Guidelines regarding drainage, lighting, noise, barriers, and invasives. These are detailed in Chapter E (Mitigation).

In order to evaluate potential indirect effects to thread-;leaved Brodiaea, detailed soils studies, including soil sampling, were conducted by GeoSoils in 2014 (Appendix 9). It was determined that the "pedons," (soil profiles) supporting thread-leaved Brodiaea on-site are limited to soils formed on the Lusardi Formation, and not on other soil deposits/formations or bedrock in the area. The report further concluded the following:

- Thread-leaved Brodiaea is limited to soils with a greater overall pedon thickness, minimal sand/gravels/cobble fraction, a slope gradient of about 5 – 10 percent.

- It appears to favor thicker pedons extending below the species' range of corm depth (approximately 6 – 18 inches)

- It appears to be confined to areas with clay contents more than about 50%.

- The areas proposed for grading would not pose a significant change in potential precipitation for runoff (overland flow) and infiltration for thread-leaved Brodiaea.

- Within the pedon favorable for the plant, the capacity to transmit water is low, given the clay content.

- Depth to groundwater is likely more than 50 feet below ground surface. Due to the hardness/firmness of the Lusardi Formation, crystalline nature of the bedrock, and clay content of the colluvium, transmission of groundwater within or near the area supporting corms would not be expected to occur.

- On-site, thread-leaved Brodiaea occurs in areas of non-native grasses and artichoke thistle, but not in areas where non-native fennel is dominant. Both thistle and fennel can have adverse effects the range of the on-site populations.

- Site topography ranges from relatively flat areas to steeply-sloping land. Based on the distribution of the thread-leaved Brodiaea on this site, it appears to favor slope gradients between 6.5 and 8.5 percent. Flat areas and drainage swales do not appear to be favorable.

- No evidence of lateral migration of subsurface water was found in any of the pedons. It appears that stormwater enters the surface locally and saturates the looser surficial soils, filling the open desiccation cracks in the upper 12 to 13 inches. The clay then expands, sealing the cracks and keeping soils relatively moist during the rainy season into spring/early summer. Should additional infiltration of stormwater periodically occur, it would be a very small volume.

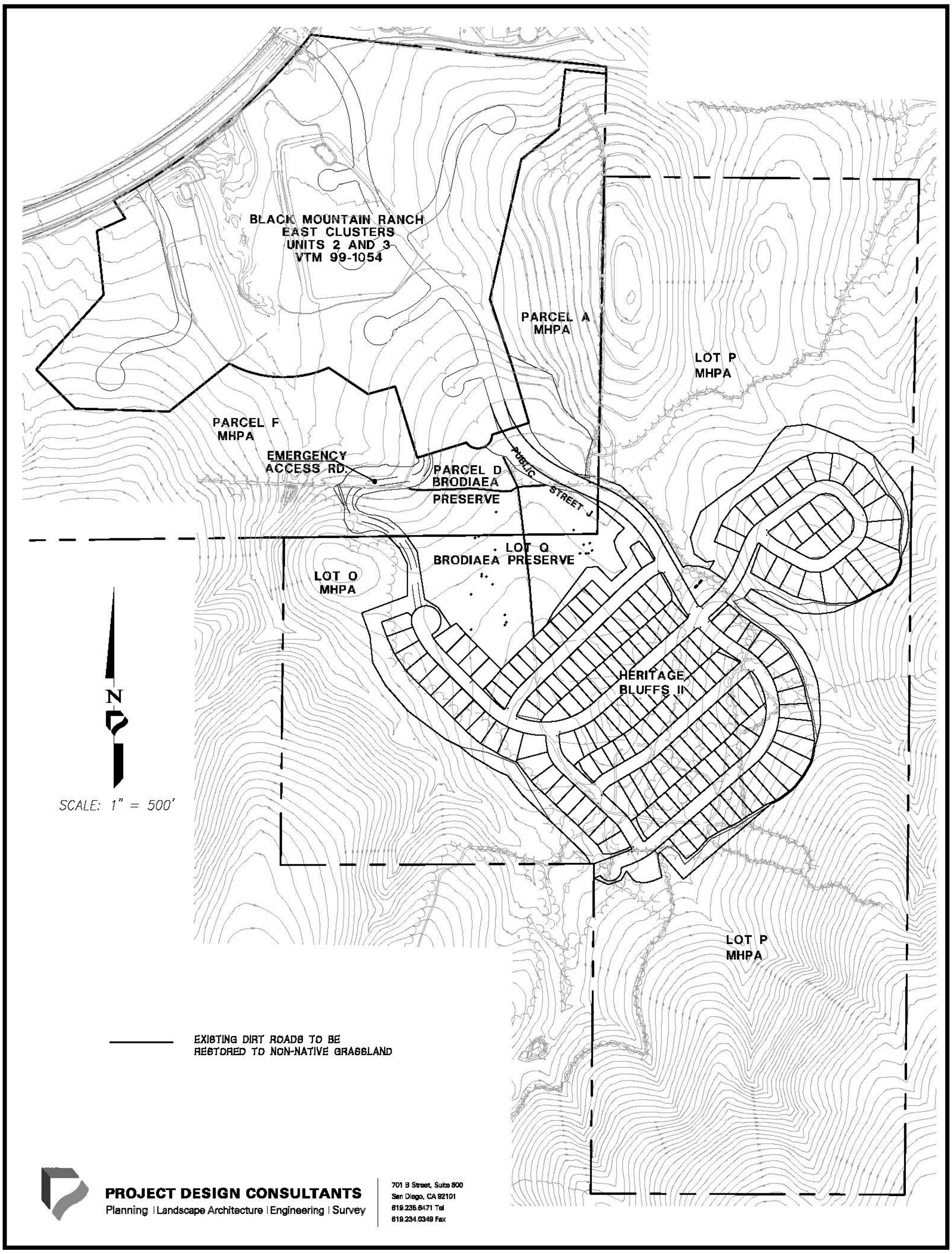
- Based on the basin divides and localized subdivides, project grading would have little effect on overland flow. Further effects on infiltration rates would also be limited by expansion and sealing of surface soil cracks.

While no adverse indirect impacts are expected to occur to the area proposed for preservation of thread-leaved Brodiaea, the soils study includes measures to further protect the preserve area. These are detailed in Chapter E (Mitigation) below.

MHPA Boundary Adjustment Equivalency Analysis

In order to develop the site, a Boundary Line Adjustment (BLA) is required, primarily to avoid impacts to sensitive biological resources. As illustrated in Figure 9, the proposed BLA would avoid impacts to the majority of the non-wetland drainages, would maintain a 100-foot wide setback from the blueline stream, and avoid impacts to the mulefat scrub and freshwater habitats currently outside the MHPA boundary. The project is proposing a compact development footprint, providing greater separation from gnatcatchers using the northern portion of the site, and reducing overall edge effects (see Figure 7).

Site development would result in the removal of 20.47 acres from the MHPA (16.42 acres of coastal sage scrub; and 4.05 acres of non-native grassland (including 1.34 acres on-site and 2.71 acres off-site). The proposed MHPA replacement would consist of 13.5 acres currently outside the MHPA (6.58acres of coastal sage scrub, 5.87 acres of non-native grassland, 0.18 acre of mulefat scrub; and 0.03 acre of freshwater marsh), as well as 0.84 acre of non-native grassland is an existing encumbrance alignment that was previously anticipated as an access point but is no longer needed on the Santaluz TM site. In addition, the project will place approximately 7 acres of off-site non-native grassland into the MHPA. This parcel is adjacent to Lusardi Creek, and is discussed further below (Figures 10 and 11). Thus, the total MHPA on- and off-site replacement areas total 20.5 acres.



Source: PDC, 2016

Affinis Shadow Valley Center 847 Jamacha Road El Cajon, CA 92019	**PROPOSED HERITAGE BRODIAEA PRESERVE AND NPG CREATION AREA**	**FIGURE 8**

The applicant has also agreed to add a portion of APN 267-150-35 adjacent to Lusardi Creek that totals approximately 72 acres to the MHPA. The 7.25-acre portion of Parcel 3 Parcel Map No. 18504 and approximately 72 acres of APN 267-150-35 would be dedicated to the City or placed in a covenant of easement as a condition of project approval.

The 7.25 –acre portion of Parcel 3 of Parcel Map No. 18504 will be included in the overall Heritage Brodiaea Preserve, and managed, monitored, and funded in perpetuity according to a plan approved by the City and the WA.

Section 5.4.2 of the *Final MSCP Plan* (August, 1998) states that "adjustments to the MHPA and/or preserve boundaries can be made without the need to amend the MSCP Plan or subarea plan if the adjustment will result in the same or higher biological value of the preserve." In order for the City and WA to determine the biological value of the proposed change, the following factors must be considered:

- Effects on significantly and sufficiently conserved habitats (i.e., the exchange maintains or improves the conservation, configuration, or status of significantly or sufficiently conserved habitats, as defined in Section 4.2.4).

Nearly half (23.0 acres) of the total development would be confined to the least environmentally sensitive area (non-native grassland not supporting thread-leaved Brodiaea, a Tier IIIB habitat). While 16.42 acres of coastal sage scrub (Tier II) would be removed, 13.72 acres would be added (6.58 acres of coastal sage scrub and 7.14 acres of on- and off-site non-native grassland supporting thread-leaf Brodiaea). The addition of this long-term conservation of habitat for a Threatened species is considered to be of high biological value, off-setting the net loss of 9.8 acres of the more common Tier II coastal sage scrub habitat in the preserve. Additionally, wetland habitats including 0.18 acre of mulefat scrub and 0.03 acre of freshwater marsh would be added to the preserve. The on-site exchange would also include more areas of the drainages on-site than are previously within the MHPA boundaries.

- Effects to covered species (i.e., the exchange maintains or increases the conservation of covered species)

The proposed exchange would potentially impact habitat being utilized by the gnatcatcher, although it would maintain the majority of coastal sage scrub (76.26 acres, in permanent open space. The majority of the 6.72 acres of on-site non-native grassland added to the MHPA supports most of the thread-leaved Brodiaea on-site, adding protection to this MSCP-covered and narrow endemic species. The additional off-site 0.84 acre on Santaluz also supports thread-leaved Brodiaea, which would be included in the proposed preserve area.

- Effects on habitat linkages and function of preserve areas (i.e., the exchange maintains or improves a habitat linkage or wildlife corridor)

As noted above, the addition of the on-site MHPA land (Lots O and P) would include more of the drainages than previously mapped within the preserve boundaries (see Figures 5, 6, and 9). These drainages serve as natural corridors for movement of wildlife. The exchange would maintain a connection to Black Mountain Open Space Park to the south as well as the La Jolla Valley to the north and ultimately the San Dieguito River valley to the north and west.

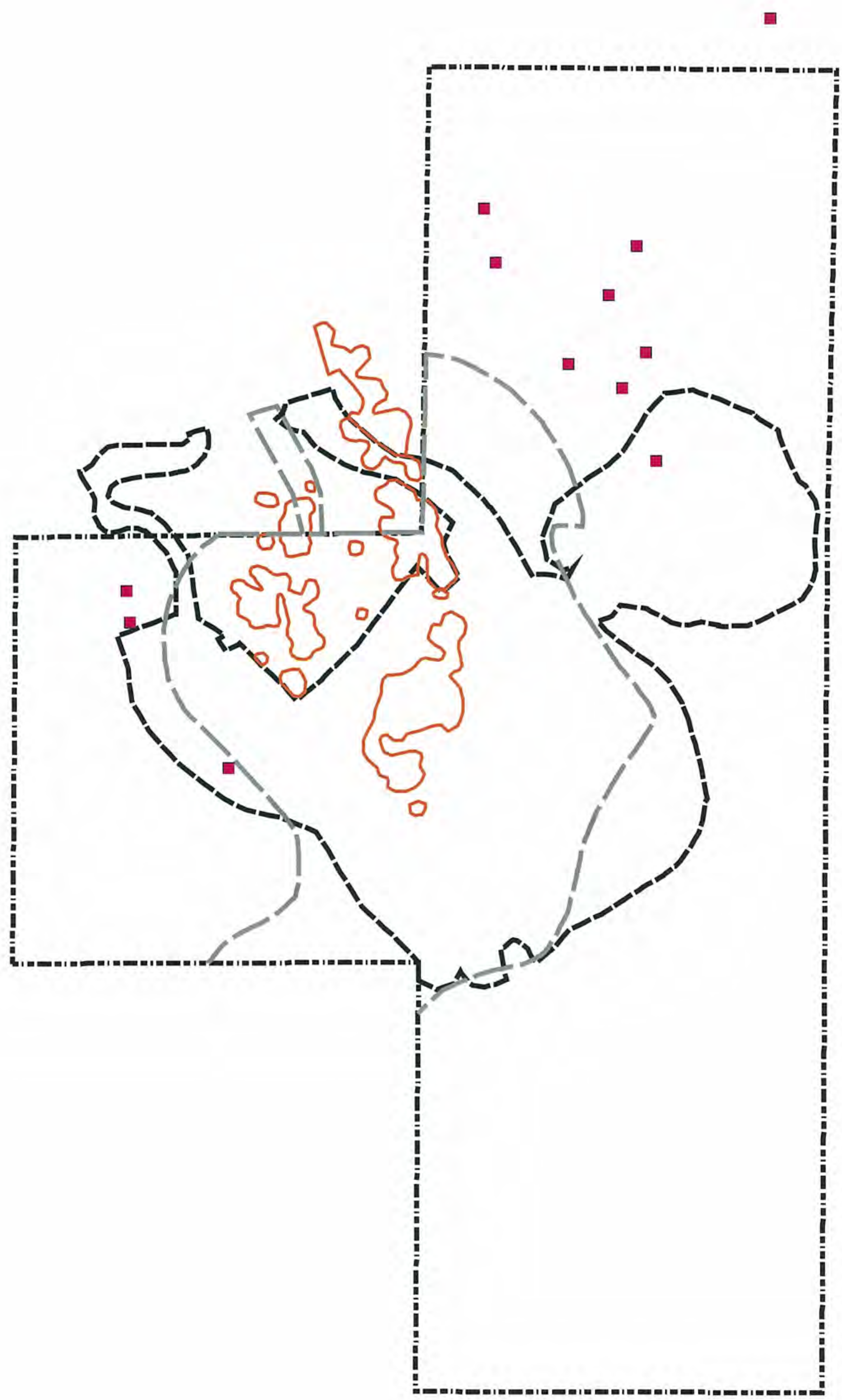
The 7 acres of off-site non-native grassland to be added to the MHPA (Lusardi parcel) supports a tributary to Lusardi Creek. The habitat to be added would provide an additional buffer to the creek, which is identified as the Lusardi Creek Corridor in the City's recently-adopted *Black Mountain Open Space Park Natural Resource Management Plan.* This corridor is one of three connecting to the park, providing a direct linkage to San Dieguito and Lake Hodges. Thus, it would improve this habitat linkage/corridor. Further, the addition of this parcel to the MHPA is consistent with the *MSCP Subarea Plan* (Section 1.58, Black Mountain Ranch Priority #1), which calls for restoration and preservation of the Lusardi Creek regional wildlife corridor.

- Effects on preserve configuration and management (i.e., the exchange results in similar or improved management efficiency and/or protection for biological resources).

The proposed exchange involves encroachment into the MHPA on the west and east, but replaces land on the north and south. Overall, the project footprint is more concise than the approved development boundaries. The exchange would be consistent with the requirement of the *Black Mountain Subarea Plan* as the configuration and amount of land within the MHPA for the project is substantially as designated in the plan. While the project would remove 20.47 acres and add 13.72 acres on-site, the 7-acre off-site mitigation area along Lusardi Creek and Santaluz parcel would add an additional protected buffer and tributary to the creek. A Habitat Management Plan (HMP) has been prepared for the proposed Heritage Brodiaea Preserve, which will improve management efficiency and protection of sensitive biological resources. The plan, provided in Appendix 10, is summarized in Chapter E, below.

As discussed above, the location of the primary and secondary access roads has been determined in consultation with the City and WA. The secondary access road, which also serves as a utility corridor, would only be used during an emergency such as a wildfire, and occasionally for utility maintenance. Due to the steep gradient, this roadway would be paved with a standard road surface (concrete or asphalt concrete) in compliance with the Fire Prevention Bureau Policy A-08-9. Potential adverse effects due to drainage modifications have been minimized by project design (e.g., planting of slopes with native vegetation and collecting and treating runoff). The placement of the roadways would maximize the area proposed for thread-leaved Brodiaea protection, and minimize adverse effects to significant cultural resources on-site.

- Effects on ecotones or other conditions affecting species diversity (i.e., the exchange maintains topographic and structural diversity and habitat interfaces of the preserve)



Give Take	Biology	Acres
GIVE	CSS	6.58
GIVE	FWM	0.03
GIVE	MFS	0.18
GIVE	NNG	5.87
GIVE	OFF SITE NNG	0.85
TAKE	CSS	16.42
TAKE	NNG	1.34
TAKE	OFF SITE NNG	2.71
TAKE	OFF SITE NPG	0

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MHPA BOUNDARY LINE ADJUSTMENT EXHIBIT

FIGURE 9

The habitat interfaces of the preserve would not be substantially changed. The exchange would include more of the on-site drainages, improving topographic diversity. The structural diversity would be maintained by the preservation of most of the on-site coastal sage scrub, and improved by the addition of all thread-leaved Brodiaea populations, drainage courses, the mulefat scrub, and freshwater marsh areas currently outside the preserve boundaries. Preservation of lots Q and off-site Parcel D would bring the thread-leaved Brodiaea populations into the preserve. These lots would also interface with the previously approved open space lots on the Santaluz project to the north. Finally, the off-site MHPA replacement land would improve the Lusardi Creek Corridor interface which is a major component of the Black Mountain Open Space Park.

- Effects to species of concern not on the covered species list (i.e., the exchange does not significantly increase the likelihood that an uncovered species will meet the criteria for listing under either the federal or state Endangered Species Acts)

The project site does not support any uncovered species which are rare or at risk of meeting the criteria for listing under the federal or state Endangered Species Acts. The exchange would result in an increase in the protection of sensitive species in an area more likely to retain biological value. The on-site exchange of the project MHPA land would not increase the likelihood that an uncovered species will meet the criteria for listing under either the federal or state Endangered Species Act; it would decrease the likelihood of uncovered species needing protection under the Acts.

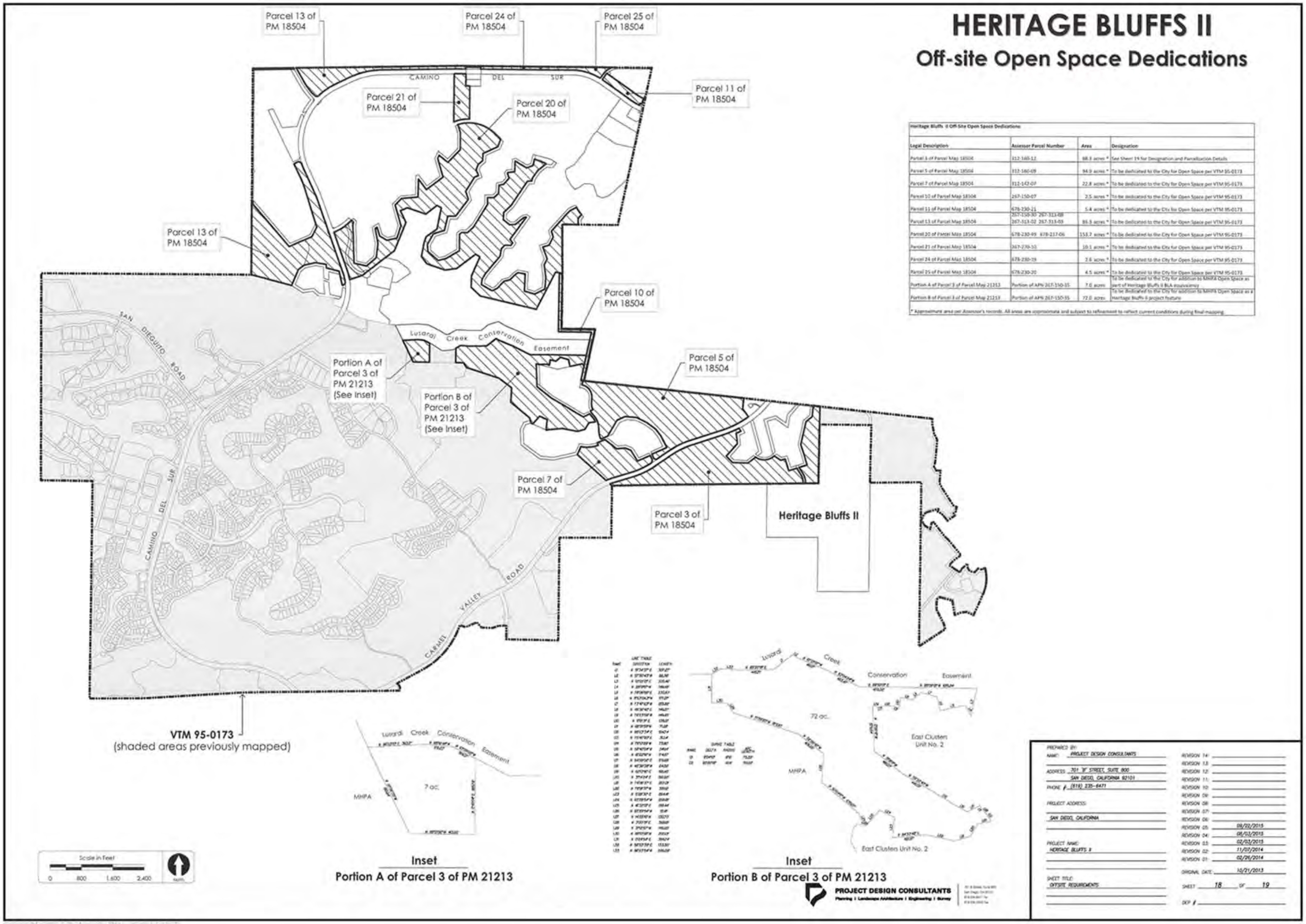
E. MITIGATION AND MONITORING REQUIREMENTS

1. Mitigation Element

a. Preservation of MHPA Open Space.

As detailed in Table 2, to mitigate the loss of 24.29 acres of coastal sage scrub, 0.15 acre of native perennial grassland and 25.71 acres of non-native grassland, prior to issuance of any construction permit or notice to proceed, the following shall occur:

i. Prior to the issuance of a Notice to Proceed for a subdivision, or any construction permits, such as Demolition, Grading or Building, or beginning any construction-related activity, upland project impacts shall be mitigated in accordance with the City's LDC Biology Guidelines, as specified in Table 2, based on all impacts occurring outside of the MHPA and all mitigation occurring within the MHPA per the MHPA boundary line adjustment. With approval of the MHPA boundary line adjustment, mitigation for the impacts to sensitive vegetation communities would be achieved through the on-site and off-site preservation of habitat as indicated in Table 2. Mitigation land shall be dedicated to the City of San Diego as part of the MHPA.



Heritage Bluffs II Off-Site Open Space Dedications			
Legal Description	Assessor Parcel Number	Area	Designation
Parcel 3 of Parcel Map 18504	312-160-12	68.3 acres *	See Sheet 19 for Designation and Parcellization Details
Parcel 5 of Parcel Map 18504	312-160-09	94.9 acres *	To be dedicated to the City for Open Space per VTM 95-0173
Parcel 7 of Parcel Map 18504	312-142-07	22.8 acres *	To be dedicated to the City for Open Space per VTM 95-0173
Parcel 10 of Parcel Map 18504	267-150-07	2.5 acres *	To be dedicated to the City for Open Space per VTM 95-0173
Parcel 11 of Parcel Map 18504	678-230-21	5.4 acres *	To be dedicated to the City for Open Space per VTM 95-0173
Parcel 13 of Parcel Map 18504	267-150-30 267-313-08 267-313-02 267-313-03	86.3 acres *	To be dedicated to the City for Open Space per VTM 95-0173
Parcel 20 of Parcel Map 18504	678-230-49 678-217-06	153.7 acres *	To be dedicated to the City for Open Space per VTM 95-0173
Parcel 21 of Parcel Map 18504	267-270-33	10.1 acres *	To be dedicated to the City for Open Space per VTM 95-0173
Parcel 24 of Parcel Map 18504	678-230-19	2.6 acres *	To be dedicated to the City for Open Space per VTM 95-0173
Parcel 25 of Parcel Map 18504	678-230-20	4.5 acres *	To be dedicated to the City for Open Space per VTM 95-0173
Portion A of Parcel 3 of Parcel Map 21213	Portion of APN 267-150-35	7.0 acres	To be dedicated to the City for addition to MHPA Open Space as part of Heritage Bluffs II BLA equivalency
Portion B of Parcel 3 of Parcel Map 21213	Portion of APN 267-150-35	72.0 acres	To be dedicated to the City for addition to MHPA Open Space as a Heritage Bluffs II project feature

* Approximate area per Assessor's records. All areas are approximate and subject to refinement to reflect current conditions during final mapping.

Source: PDC, 2015

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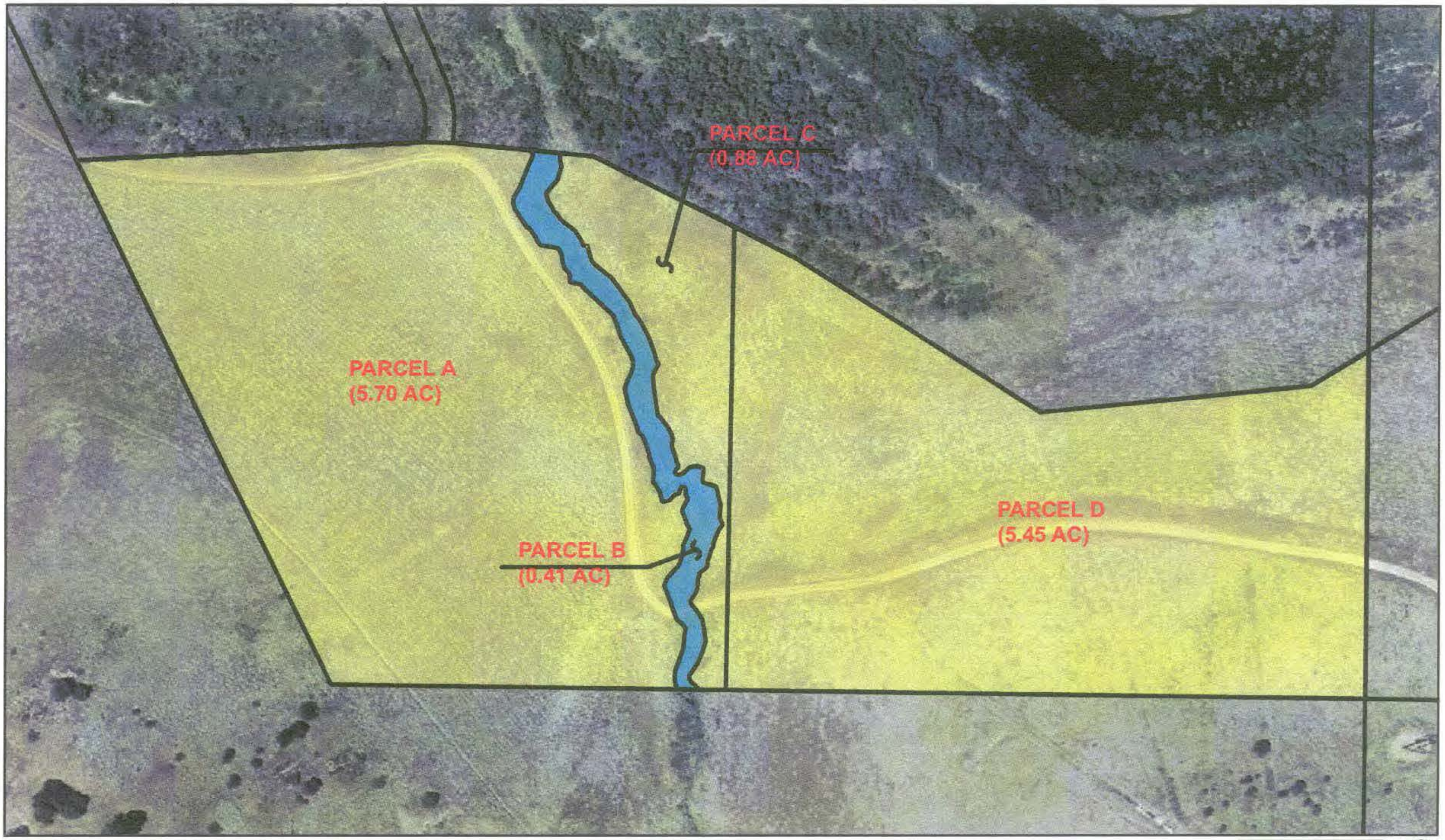
OFF-SITE OPEN SPACE DEDICATIONS

FIGURE 10



Vegetation Classification and Land Cover Type

Non-native Grassland

Natural Flood Channel

Parcel Lines

0 Feet 150

RECON

M:\JOBS\3159-1\common_gis\fig3_biomn9.mxd 5/9/2014 sab

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LUISARDI PARCEL VEGETATION MAP

FIGURE 11

ii.Prior to the issuance of any construction permits, the Owner/Permittee shall preserve Lots O and P (on-site) and off-site parcels (as indicated on Sheets 18 and 19 of the Vesting Tentative Map) to the City's MSCP preserve via a covenant of easement or temporary covenant of easement and an Irrevocable Offer of Dedication – in fee title to the City.

iii.A covenant of easement (COE) shall be placed over ungraded portions of HOA Zone 2 Brush Management Lots and conveyed to the City's MHPA preserve. Parcels, or portions thereof, subject to the COE shall include: on-site Lots A, F, G and J and off-site Parcels A and F.

b. Heritage Brodiaea Preserve

i. Prior to the issuance of any construction permits, the Owner/Permittee shall dedicate the Heritage Brodiaea Preserve [Lot Q (on-site) and Parcels C and D (off-site)] as indicated on Sheet 19 of the Vesting Tentative Map to a conservancy in fee title. Said offer of fee-title shall be accepted by the Conservancy upon completion of the project grading and construction.

ii. A covenant of easement (COE) shall be placed over portions of HOA Zone 2 Brush Management Lots and dedicated to the conservancy. Parcels, or portions thereof, subject to the COE shall include: on-site Lot Q and off-site Parcels C and D.

iii.Prior to issuance of any construction permit or notice to proceed, the *Thread-Leaved Brodiaea Habitat Management Plan for the Heritage Brodiaea Preserve, Heritage Bluffs II and East Clusters Project* was prepared by Vincent N. Scheidt in 2015 (Appendix 11) shall be reviewed and approved by the City and Wildlife Agencies. The purpose of the HMP is to identify specific requirements for the maintenance and monitoring, in perpetuity, of the plant communities and plant and animal species naturally occurring in the Heritage Brodiaea Preserve (HBP) site. The emphasis is on the resident population of Thread-leaved Brodiaea on the project site as well as a portion of the East Clusters/Santaluz project area to the north.

The HMP shall include the creation of 0.15 acre of native perennial grassland as shown on Figure 8 and provide mechanisms for its monitoring and maintenance. The HMP shall also address the native grassland restoration (minimum of 0.30 acre) located within the HBP. These areas shall be dedicated in fee to a conservancy (an agency, non-profit organization, or other entity approved by the wildlife agencies).

The HMP contains the following elements:

- An administrative structure and funding mechanism, which defines responsible parties, designation of a Habitat Manager, easement dedication, and financial responsibilities.

The applicant, Cal Atlantic Homes, will be responsible for retaining the services of a Project Biologist and Habitat Manager to implement the HMP. The applicant will be responsible for all funding, either by providing a non-wasting endowment or similar mechanism, to cover all monitoring and maintenance, based on a Property Analysis Record (PAR) prepared for the preserve.

- Habitat management criteria, including habitat manager responsibilities, long-term management objectives, prohibited activities, and adaptive management techniques.

A qualified Habitat Manager will oversee the long-term management objectives including the monitoring and eradication of invasive species; predator control; and any necessary habitat restoration, salvage, and translocation of any thread-leaved Brodiaea corms which might be found adjacent to the preserve during project grading. Additional tasks will include trash/graffiti removal and vandalism repair; removal of hazardous materials; removal of encampments and unauthorized encroachments; installation/repair/ replacement of fencing, gates and signs; access; and coordination with adjacent land managers/ neighbors.

Within the HBP, prohibited activities include grading and excavation, clearing and thinning of vegetation (except invasive species), landscape maintenance (watering, pruning, fertilizing), construction of structures (except fencing), use of off-road or motorized vehicles, dumping, planting of non-native species, and disturbance of natural resources.

In the event that management goals are not being met, the HMP may be modified to include adaptive management techniques as determined by the Habitat Manger and WA.

- Preserve monitoring, including monitoring tasks and reporting requirements

Monitoring tasks include interim site preparation and monitoring as well as long-term habitat monitoring. Tasks include baseline inventorying and vegetation mapping, sensitive species surveys, and five-year interval reviews of the HMP with the WA. Annual reports shall also be submitted to the WA as specified in the HMP.

b. MHPA Adjacency Guidelines

In addition, the project shall incorporate all measures required by the City's MHPA Adjacency Guidelines to avoid or reduce impacts to adjacent MHPA lands related to drainage, lighting, noise, barriers, and invasive species:

<u>Drainage</u>. Proposed surface runoff from the developed portions of the site would be collected and drained into the Santaluz project to the north via a storm drain pipe in the main access street, where it would be discharged into a detention basin before being released. The drainage calculations and facilities planned with the development for that project would accommodate the stormwater drainage flows from Heritage Bluffs. In addition, the project will incorporate the

following measures:

- Hydroseeding and landscaping of any cut/fill slopes disturbed or built during the construction phase of the project, with appropriate ground cover vegetation shall be performed within 30 days of completion of grading activities.

- Areas of native vegetation on adjoining slopes to be avoided during grading activities shall be delineated to minimize disturbance to existing vegetation and slopes.

- Artificial ground cover, hay bales, and catch basins to retard the rate of runoff from manufactured slopes shall be installed if grading occurs during the wet weather season, November 1 through April 1.

- Fine particulates in geologic materials used to construct the surficial layers of manufactured slopes shall not be specified unless a suitable alternative is not available.

- Temporary sedimentation and desilting basins between graded areas and streams shall be provided during grading.

Additional measures recommended by the soils study for thread-leaved protection have been included in the project's TM (Figures 5 and 6):

- Provide a self-cleaning concrete drainage ditch along the toe of any adjacent graded slope descending to the area supporting thread-leaved Brodiaea to avoid/minimize any additional runoff.

- Provide a "toe" drain to intercept subsurface water resulting from irrigation of graded slopes, to avoid/minimize any additional subsurface flow.

<u>Lighting</u>. All night lighting from residential development adjoining the MHPA shall be set back, directed downward and shielded from the MHPA in accordance with the MHPA adjacency guidelines. The intensity of exterior lighting shall be kept to a minimum (in accordance with accepted safety standards) to promote a rural character and limit impacts to wildlife within the preserve area.

<u>Noise</u>. The project will require grading which will result in short-term noise impacts. Grading would be prohibited during the gnatcatcher breeding season (March 1 to August 15), unless it can be demonstrated that noise levels in the preserve can be reduced to below 60 decibels dB LEQ or existing ambient noise levels. This would require a noise study to first determine ambient levels. With this as a threshold (or using 60 dB if the ambient level is below 60 dB), the study will define measures that would reduce the noise levels within occupied habitat to below this threshold.

As noted above, a raptor nest was observed on-site. Prior to construction, an additional survey should also determine the nest is still active and if so, grading/grubbing should also be avoided along the eastern development footprint during raptor breeding season (December 1 to May 31), unless it can be demonstrated that noise levels in the preserve can be reduced to below 60 decibels dB LEQ or existing ambient noise levels. The City requires that development inside the MHPA must include various impact avoidance areas depending upon what nesting raptors may occur (e.g. 300 feet from any nesting site of Cooper's hawk, 900 feet from any nesting site of northern harriers, 4000 feet from any nesting sites of golden eagles, or 300 feet from any occupied burrow of burrowing owls.). In order to avoid impacts to nesting avian species covered by the International Migratory Bird Treaty Act, construction and removal of vegetation shall also be avoided from February 1 to September 15, unless a pre-construction survey is conducted to confirm that no nesting species are present.

Barriers. The property is designated in the Black Mountain Subarea Plan as one with "limited access" to the preserve area. The MHPA Guidelines require that developments should provide barriers such as fencing to prevent encroachment into the preserve. The project is proposing to incorporate both a 5-foot high perimeter wall and tubular fencing to discourage predation by domestic pets and human intrusion. Signs will be placed at periodic intervals stating "Sensitive Biological Habitat - Access Limited." This would also be consistent with the *MSCP Subarea Plan* (Section 1.5.8, Black Mountain Ranch Priority #7) restricting public and pet access to the MHPA.

Invasives. The proposed landscape concept plan has been revised as shown in Figures 12-14. All perimeter planting adjacent to the preserve area would consist of native species. Both coast live oak and scrub oak are proposed, along with shrubs such as California adolphia, coast sagebrush, lemonade berry, monkeyflower and white sage. Also included are a number of wildflower and grass species. None of the proposed interior accent trees, shrubs, or groundcovers are listed as "prohibited" plants per Appendix B of the *Black Mountain Ranch Subarea Plan.*

Standard construction practices such as orange construction fencing along sensitive habitat and silt fencing along grading areas would be required that would avoid additional indirect impacts to the adjacent habitat. Use of any toxic materials would be restricted by City code.

c. Area Specific Management Directives

Area Specific Management Directives (ASMDs) are not mitigation measures, per se, but are implemented through compliance with the MSCP Adjacency Guidelines. The project incorporates all feasible mitigation and design measures to address the ASMDs set forth in the City's MSCP for the coastal California gnatcatcher. These "must include measures to reduce edge effects and minimize disturbance during the nesting period, fire protection measures to reduce the potential for habitat degradation due to unplanned fire, and management measures to maintain or improve habitat quality including vegetation structure. No clearing of occupied habitat within the City's MHPA...may occur between March 1 and August 15" (City of San Diego, 1997).

The MSCP document also calls for ASMDs related to the Southern California rufous-crowned sparrow to "include maintenance of dynamic processes, such as fire, to perpetuate some open phases of coastal sage scrub with herbaceous components." Until such time as controlled burns might be allowed for such maintenance, this directive is not considered feasible.

Per the request of the WA, the following project-specific ASMDs have been developed for the long-term protection of the thread-leaved Brodiaea populations on Heritage Bluffs:

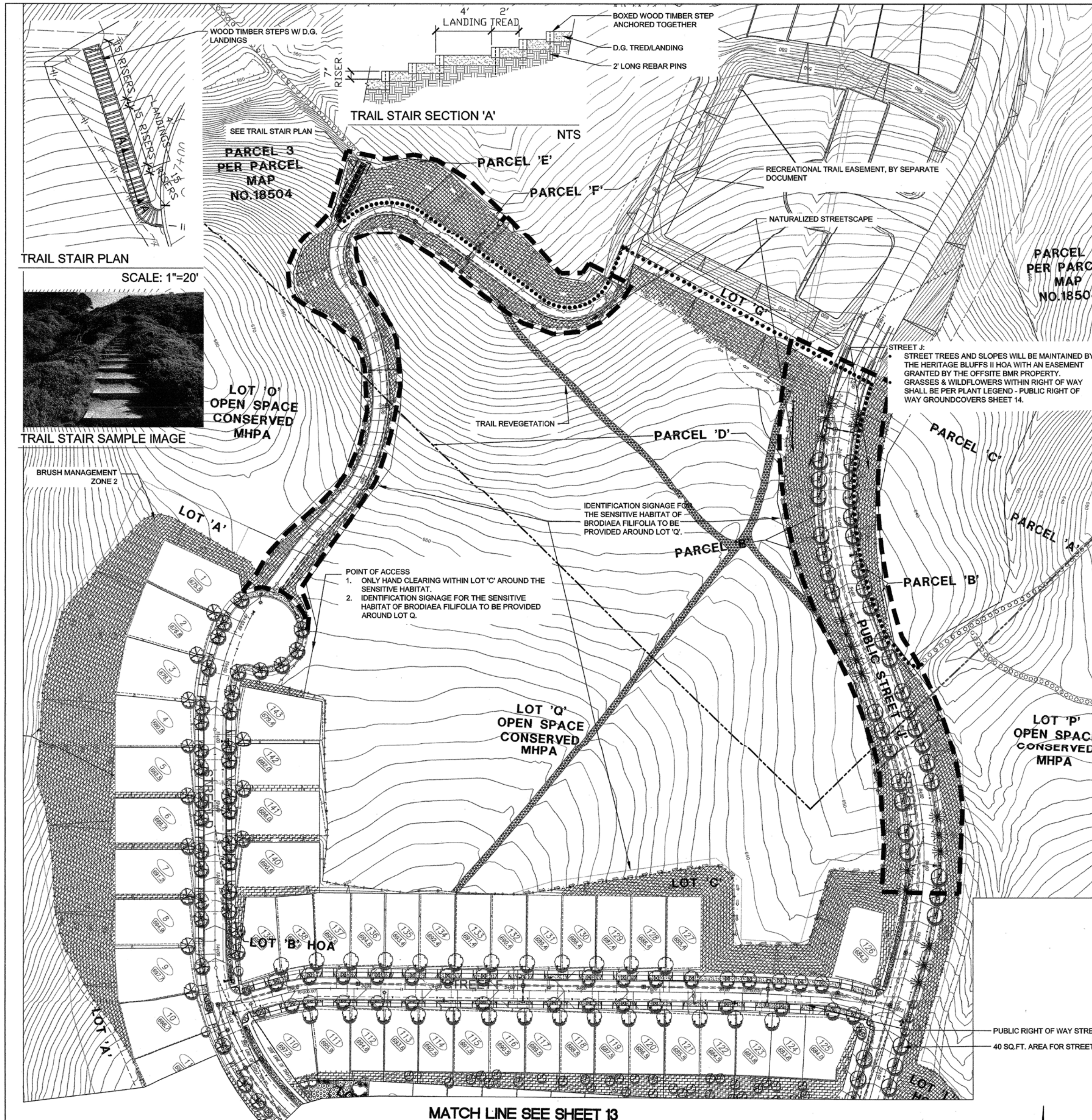
Thread-leaved Brodiaea (*Brodiaea filifolia*) is an MSCP-designated Narrow Endemic Species and a "covered" special status species. This state-listed Endangered and federal-listed Threatened plant is endemic to and restricted to heavy clay soils in non-native and native grasslands. The MSCP Narrow Endemic Policy must be applied to any populations of this species, including those already known and any found in the future.

On Heritage Bluffs, all *B. filifolia* populations shall be placed in a Covenant of Easement as the proposed "Heritage Brodiaea Preserve" that shall be managed and maintained by a Third Party Entity approved by the City and the WA.

The following management actions are based on Chapter 3.5.2 (Available Management Actions) of the *Final MHCP* Volume III, Appendix C-7 of the City of Carlsbad's *Habitat Management Plan*, the *Final Oceanside Subarea Plan*, and the *San Marcos Unified School District Future Elementary School #2, Thread-Leaved Brodiaea Transplantation and Long-Term Management Plan*. Based on these documents, the following Area Specific Management Directives (ASMDs) are proposed as components of an adaptive management strategy which will also provide a flexible resource management plan:

- Major populations and critical locations of thread-leaved Brodiaea shall be conserved at a goal level of 100% of known populations which have been mapped on-site and off-site land immediately to the north.
- Species-specific monitoring shall be conducted according to the most recently required methodologies specified in the HMP. At a minimum, this will include reconnaissance-level plant surveys to detect and monitor the presence of thread-leaved Brodiaea. Weather permitting, surveys shall be conducted during the winter months (e.g. January-February) to look for foliage, and during the spring/summer season (May/June) for flowering individuals. The frequency and duration of monitoring is detailed in the HMP (Appendix 10).

- Maintenance of *B. filifolia* habitat on Heritage Bluffs shall include removal of exotic species (particularly artichoke thistle and sweet fennel) or other noxious species as determined by the habitat manager. As a part of the adaptive management strategy presented in the HMP, if needed, measures such as dethatching non-native grasses may be implemented to enable better seed establishment to increase the on-site population. This would be consistent with the *MSCP Subarea Plan* (Section 1.58 Black Mountain Ranch Priority #6) regarding areas with a history of invasive species, as well as the *Black Mountain Open Space Park Natural Resource Management Plan.* A potential schedule is presented in the HMP. This shall be done by hand and shall be conducted by individuals trained to distinguish weedy species from native species. Trash removal shall also be done on a regular and ongoing basis.



REFER TO SHEET 14 FOR PLANTING LEGEND.
REFER TO SHEET 13 FOR PLANTING DETAILS.
REFER TO SHEET 15 TO 16 FOR BRUSH MANAGEMENT PLAN AND NOTES.

DESIGN STATEMENT:

THE PRIMARY GOAL OF THE LANDSCAPE DESIGN IS TO BLEND AND COMPLIMENT THE EXISTING NATIVE PLANTING IN THE AREA. NATIVE LOW FUEL VOLUME SPECIES WILL BE USE TO RE-VEGETATE THE GRADED SLOPES. THE TREATMENT FOR THE INTERIOR SHALL PRIMARILY BE PARKWAY STREET TREES AND GROUNDCOVER, ORNAMENTAL IN NATURE, FIRE-RESISTENT, AND COMPLIMENT THE BUILDING ARCHITECTURE. THE RECREATION AREA WILL BE MIX OF ORNAMENTAL AND NATURALIZED MATERIAL AND LOW MAINTENANCE.

LANDSCAPE DESIGN OBJECTIVES:

1. PLANT MATERIALS SPECIFIED FOR USE ON THIS PROJECT WILL BE FROM THE PALETTE OF PLANTS KNOWN TO PERFORM WELL IN THIS CLIMATIC ZONE AND AMENDED SOIL TYPE.
2. THE PALETTE OF LANDSCAPE PLANT MATERIALS WILL PROVIDE VARIATIONS OF FOLIAGE, BARK, AND FLOWER FORM, TEXTURE, AND COLOR. THESE VARIATIONS WILL BE USED TO BLEND IN WITH EXISTING SURROUNDING LANDSCAPE TREATMENTS ESPECIALLY AT PERIMETER SLOPES.
3. LANDSCAPE PLANTING AREAS WILL BE GRADED TO ASSURE POSITIVE SURFACE DRAINAGE.
4. ONSITE SOILS WILL BE AMENDED TO COMPLY WITH THE RECOMMENDATION OF A CERTIFIED SOILS TESTING LABORATORY.
5. ALL SLOPE ASPECTS 2:1 OR STEEPER SHALL RECEIVE JUTE MATTING (OR PER THE RECOMENDATION BY THE GEO-TECHNICAL ENGINEER).

GRADING NOTES:

1. PERMANENT REVEGETATION - ALL GRADED, DISTURBED, OR ERODED AREAS THAT WILL NOT BE PERMANENTLY PAVED OR COVERED BY STRUCTURES SHALL BE PERMANENTLY REVEGETATED AND IRRIGATED AS SHOWN IN TABLE 142-04F AND IN ACCORDANCE WITH THE STANDARDS IN THE LAND DEVELOPMENT MANUAL

2. TEMPORARY REVEGETATION - GRADED, DISTURBED, OR ERODED AREAS THAT WILL NOT BE PERMANENTLY PAVED, COVERED BY STRUCTURE, OR PLANTED FOR A PERIOD OVER 90 CALENDAR DAYS SHALL BE TEMPORARILY REVEGETATED WITH A NON-IRRIGATED HYDROSEED MIX, GROUND COVER, OR EQUIVALENT MATERIAL. TEMPORARY IRRIGATION SYSTEMS MAY BE USED TO ESTABLISH THE VEGETATION.

3. ALL REQUIRED REVEGETATION AND EROSION CONTROL SHALL BE COMPLETED WITHIN 90 CALENDAR DAYS OF THE COMPLETION OF GRADING OR DISTURBANCE.

4. INTERIM BINDER NOTE: GRADED, DISTURBED OR ERODED AREAS TO BE TREATED WITH A NON-IRRIGATED HYDROSEED MIX AND INTERIM BINDER / TACKIFIER AS NEEDED BETWEEN APRIL 2ND AND AUGUST 31ST FOR DUST-EROSION CONTROL WITH SUBSEQUENT APPLICATION OF HYDROSEED MIX DURING THE RAINY SEASON BETWEEN OCTOBER 1ST AND APRIL 1ST.

MAINTENANCE NOTE:

ALL REQUIRED COMMON LANDSCAPE AREAS SHALL BE MAINTAINED BY THE HOMEOWNERS ASSOCIATION. THE LANDSCAPE AREAS SHALL BE MAINTAINED FREE OF DEBRIS AND LITTER AND ALL PLANT MATERIAL SHALL BE MAINTAINED IN A HEALTHY GROWING CONDITION. DISEASED OR DEAD PLANT MATERIAL SHALL BE SATISFACTORILY TREATED OR REPLACED PER THE CONDITIONS OF THE PERMIT.

MINIMUM TREE SEPARATION DISTANCE:

TRAFFIC SIGNAL, STOP SIGN	20 FEET
UDERGROUND UTILITY LINES	5 FEET
ABOVE GROUND UTILITY STRUCTURES	10 FEET
DRIVEWAYS	10 FEET
INTERSECTIONS	25 FEET
SEWERS	10 FEET

STREET TREES:

STREET TREES SHALL HAVE A 40 S.F. ROOT ZONE AREA(10' FROM UNDERGROUND SEWER & 5' FROM UNDERGROUND WATER UTILITIES) OR IF CONFLICTS ARISE THE TREES SHALL BE LOCATED ON THE RESIDENTIAL LOT.

IRRIGATION:

ORNAMENTAL LANDSCAPE AREAS WILL BE SERVED BY A PERMANENT, AUTOMATIC MULTIPLE- VALVE IRRIGATION SYSTEM. THIS SYSTEM WILL USE LOW PRECIPITATION HEADS, SEGREGATED BASED ON PLANT MATERIAL TYPE AND ASPECT, AND BE DESIGNED TO MINIMIZE OVERSPRAY ONTO ANY NATIVE AREAS, HARDSCAPE SURFACE. RECYCLED WATER MAY BE USED, IF AVAILABLE.
PERMANENT IRRIGATION WILL BE PROVIDED FOR THE REQUIRED STREET TREES AND INTERIOR SLOPES PER THE PLANT LEGEND ON SHEET 14.
TEMPORARY IRRIGATION WILL BE PROVIDED FOR THE PERIMETER SLOPES TO REVEGETATE AND STABILIZE THE SLOPES FOR EROSION CONTROL.
PROPOSED IRRIGATION SYSTEMS WILL USE AN APPROVED RAIN SENSOR SHUTOFF DEVICE..

NOTES:

1. ALL LANDSCAPE AND IRRIGATION SHALL CONFORM TO THE CITY OF SAN DIEGO LANDSCAPE REGULATIONS AND CITY OF SAN DIEGO LAND DEVELOPMENT MANUAL LANDSCAPE STANDARDS AND ALL REGIONAL STANDARDS FOR LANDSCAPE INSTALLATION AND MAINTENANCE.
2. NO IMPROVEMENTS, INCLUDING ENHANCED PAVING, IRRIGATION AND LANDSCAPING, SHALL BE INSTALLED IN OR OVER ANY EASEMENT PRIOR TO THE APPLICANT OBTAINING AN ENCROACHMENT MAINTENANCE AND REMOVAL AGREEMENT.
3. PERMANENT MONUMENT SIGNAGE MAYBE PROPOSED BY THE DEVELOPER.
4. MINIMUM 24-INCH BOX SIZE STREET TREES SHALL BE INSTALLED IN THE PUBLIC RIGHT-OF-WAY. TREE PLANTING AREAS SHALL HAVE A MINIMUM 40 SQUARE FEET OF AIR-AND-WATER, PERMEABLE AREA.
5. INSTALL ALL APPROVED LANDSCAPE AND OBTAIN ALL REQUIRED LANDSCAPE INSPECTION FORMS. COPIES OF THESE APPROVED DOCUMENTS MUST BE SUBMITTED TO THE CITY.
6. IMPROVEMENTS SUCH AS DRIVEWAYS, UTILITIES, DRAINS, AND WATER/SEWER LATERALS SHALL BE DESIGNED SO AS NOT TO PROHIBIT THE PLACEMENT OF STREET TREES, ALL TO THE SATISFACTION OF THE CITY.
7. TREE ROOT BARRIERS SHALL BE INSTALLED WHERE TREES ARE PLACED WITHIN 5 FEET OF PUBLIC IMPROVEMENTS INCLUDING WALKS, CURBS, OR STREET PAVEMENT OR WHERE NEW PUBLIC IMPROVEMENTS ARE PLACED ADJACENT TO EXISTING TREES. ROOT BARRIERS WHICH WRAP AROUND THE ROOT BALL ARE NOT PERMITTED
8. MULCH: ALL REQUIRED PLANTING AREAS SHALL BE COVERED WITH MULCH TO A MINIMUM DEPTH OF 2 INCHES, EXCLUDING SLOPES REQUIRING REVEGETATION AND AREAS PLANTED WITH GROUND COVER. ALL EXPOSED SOIL AREAS WITHOUT VEGETATION SHALL ALSO BE MULCHED TO THIS MINIMUM DEPTH.
9. NO TREES OR SHRUBS EXCEEDING THREE FEET IN HEIGHT AT MATURITY MAY BE LOCATED WITHIN TEN FEET OF ANY SEWER FACILITIES.

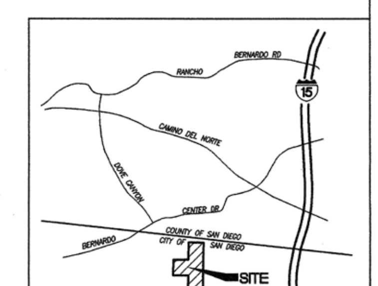
DEVELOPER INSTALLED LANDSCAPE AREAS

SLOPED AREAS	10.6 AC
PARKWAY AREAS	2.3 AC
RECREATION AREA	0.25 AC
MINI-PARK	<0.07 AC

TRAIL

○○○●● EXISTING & RE-ALIGNED BLACK MOUNTAIN OPEN SPACE TRAIL

NOTE:
ALL TRAILS SHALL BE CONSTRUCTED TO CITY STANDARDS AS IDENTIFIED IN THE CITY OF SAN DIEGO CONSULTANT'S GUIDE TO PARK DESIGN AND DEVELOPMENT.



VICINITY MAP
NOT TO SCALE

EXPIRES 7/31/17

ARCHITECT OF WORK
PROJECT DESIGN CONSULTANTS
701 "B" STREET, SUITE 800
SAN DIEGO, CA 92101
TELEPHONE (619) 235-6471

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REGISTRATION EXPIRES 7/31/17

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PHONE #: (619) 235-6471
PROJECT ADDRESS:
SAN DIEGO, CALIFORNIA
PROJECT NAME:
HERITAGE BLUFFS II
SHEET TITLE:
LANDSCAPE CONCEPT PLAN–
Street Trees/Revegetation/Erosion Control

REVISION 14:	
REVISION 13:	
REVISION 12:	
REVISION 11:	
REVISION 10:	
REVISION 09:	
REVISION 08:	
REVISION 07:	
REVISION 06:	
REVISION 05:	09/22/2015
REVISION 04:	08/04/2015
REVISION 03:	02/03/2015 03/12/2015
REVISION 02:	11/07/2014
REVISION 01:	02/26/2014
ORIGINAL DATE:	08/30/2013

SHEET 12 OF 19

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Source: PDC, 2015

FIGURE 12

LANDSCAPE PLAN (1 OF 3)

Affinis
Shadow Valley Center
847 Jamacha Road
El Cajon, CA 92019

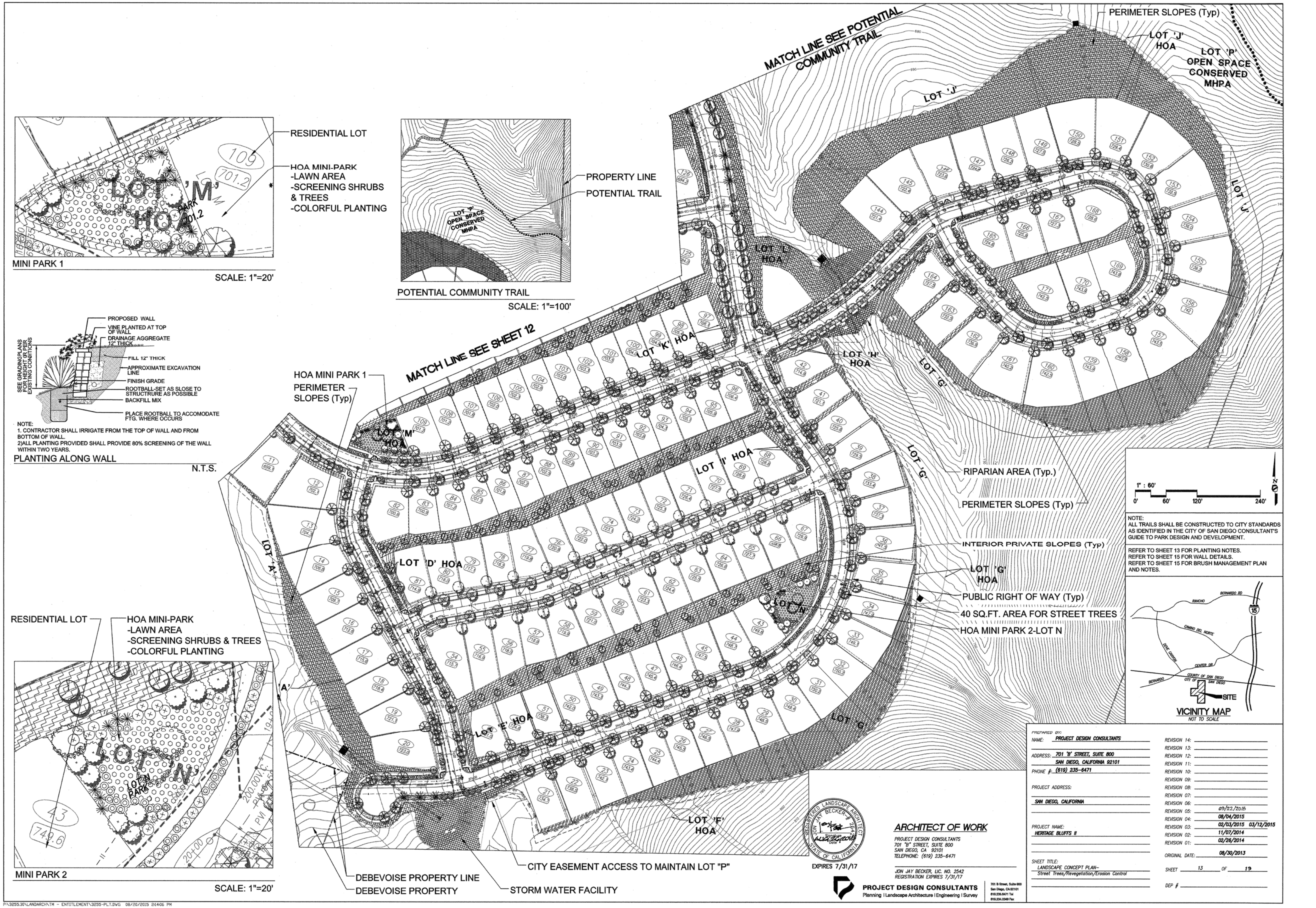


FIGURE 13

LANDSCAPE PLAN (2 OF 3)

Affinis
Shadow Valley Center
847 Jamacha Road
El Cajon, CA 92019

Source: PDC, 2015

REVEGETATION PLANTING LEGEND

NATURALIZED AND TRANSITIONAL AREAS (ENHANCED AND NEW COASTAL SAGE, GRASSLAND, AND CHAPARRAL HABITAT)
THE FOLLOWING PALETTE IS CONSISTENT WITH APPENDIX "B", TABLE 2 (REVEGETATION PLANT PALETTE) OF THE BLACK MOUNTAIN RANCH SUB AREA PLAN.
REVEGETATION SHALL BE SELECTED FROM THIS PALETTE OR APPROVED EQUAL.

NATURALIZED STREETSCAPE- PUBLIC RIGHT OF WAY -M.A.D. OR H.O.A. MAINTAINED(PERMENANT IRRIGATION)

THE NATURALIZED STREETSCAPE AREAS ARE TO BE PLANTED WITH NATIVE OR NATURALIZED SPECIES TO BE SUSTAINABLE WITH MINIMAL SUPPLIMENTAL WATER. SELECTION TO BE IN CONFORMANCE WITH THE LANDSCAPE STREET TREE ORDINANCE AND STREET TREE SELECTION GUIDE.

NATURALIZED STREET TREES, EVERGREEN, ROUND HEAD, SHADE TREE - 75% 24" BOX OR LARGER, 25% 15 GAL

PLANT MATERIAL		MATURE HT. & SPRD.
ARBUTUS MARINA	MARINA MADRONE	35' x 30'
CASSIA LEPTOPHYLLA	GOLD MEDALLION TREE	30' x 25'
CERCIS OCCIDENTALIS	WESTERN REDBUD	30' x 30'
ERIOBOTRYA DEFLEXA	BRONZE LOQUAT	20' x 20'
JACARANDA MIMOSIFOLIA	JACARANDA	40' x 40'
METROSIDEROS EXCELSUS	NEW ZEALAND XMAS TREE	20' x 20'
PINUS TORREYANA	TORREY PINE	50' x 50'
PISTACIA CHINENSIS	CHINESE PISTACHE	40' x 40'
QUERCUS ILEX	HOLLY OAK	50' x 50'
QUERCUS SUBER	CORK OAK	40' x 40'
RHUS LANCEA	AFRICAN SUMAC	30' x 25'
SAMBUSCUS MEXICANA	ELDERBERRY	25' x 40'

PERIMETER SLOPES (TEMPORARILY IRRIGATION)

THE PERIMETER SLOPE AREAS ARE TO BE PLANTED WITH CONTAINER MATERIAL IN CONFORMANCE WITH THE GRADING ORDINANCE AND BRUSH MANAGEMENT GUIDELINES AND HYDROSEEDED WITH A MIX OF NATIVE PLANT MATERIAL FOR SOIL EROSION PURPOSES. 50% OF SEED MIX TO BE PLANT MATERIAL THAT IS 24" OR LESS.

OPEN SPACE ADJACENT FILL SLOPES-50% 1 GAL., 50% 5 GAL. (TEMP. IRRIGATION)

PLANT MATERIAL	COMMON NAME	FORM FUNCTION	MATURE HEIGHT & SPREAD
ADOLPHIA CALIFORNICA	SPINESHRUB	FRAGRENT FLOWERS, EROSION CONRTOL	4' HT. x 6' SPRD
COMAROSTAPHYLIS DIVERSIFOLIA	SUMMER HOLLY	EVERGREEN, WHITE ACCENT FLOWERS	6-10' HT. x 8' SPRD
ENCELIA CALIFORNICA	COAST SUNFLOWER	YELLOW ACCENT FLOWERS, FAST GROWER	1-3' HT. x 4' SPRD
ERIODICTYON TRICHOCALYX	SMOOTH LEAF YERBA SANTA	EVERGREEN, WHITE ACCENT FLOWERS	3-5' HT. x 3-6' SPRD
ERIOPHYLLUM CONFERTIFLORUM	GOLDEN-YARROW	SUB-SHRUB, ORANGE-YELLOW FLOWERS	1-3' HT. x 1.5' SPRD
ESCHSCHOLZIA CALIFORNICA	CALIFORNIA POPPY	SUB-SHRUB, ORANGE-YELLOW FLOWERS	1-3' HT. x 3' SPRD
GNAPHALIUM CALIFORNICUM	CALIFORNIA PEARLY EVERLASTING	FRAGRANT EVERGREEN, WHITE FLOWERS	3' HT. x 3' SPRD
HAZARDIA SQUARROSA	COMMON HAZARDIA	SHRUB, YELLOW FLOWERS	1-2' HT. x 2-3' SPRD
HETEROMELES ARBUTIFOLIA	TOYON	LARGE EVERGREEN SHRUB, SHOWY RED BERRIES	8-15 HT. x 15' SPRD
LOTUS SCOPARIUS	DEER WEED	FAST GROWING PERENNIAL, YELLOW FLOWERS	2-3' HT. x 3' SPRD
MALOSMA LAURINA	LAURAL SUMAC	EVERGREEN SHRUB, RAPID GROWTH	8-15' HT. x 12'+ SPRD
MIMULUS AURANTIACUS PUNICEUS	RED MONKEYFLOWER	SUBSHRUB, CRIMSON TO BRICK-RED FLOWERS	2' HT. x 3' SPRD
NEMOPHILA MENZIESII	BABY BLUE EYES	ANNUAL, BLUE FLOWERS	1' HT. x 1.5' SPRD
QUERCUS AGRIFOLIA	COAST LIVE OAK	EVERGREEN TREE, SPREADING CROWN	20-40' HT. x 35'+ SPRD
QUERCUS DUMOSA	NUTTALL'S SCRUB OAK	LARGE EVERGREEN SHRUB, GOOD SOIL BINDER	3-10' HT. x 15' SPRD
RHUS INTEGRIFOLIA	LEMONADE BERRY	EVERGREEN SHRUB, SLOPE STABILIZER	5-15' HT. x 10'+ SPRD
SALVIA APIANA	WHITE SAGE	SUB SHRUB, AROMATIC WHITE LEAVES & FLOWERS	3-5' HT. x 5' SPRD
SALVIA LEUCOPHYLLA	PURPLE SAGE	MEDIUM SHRUB, PINKISH PURPLE FLOWERS	3-4' HT. x 4-6' SPRD

OPEN SPACE ADJACENT CUT SLOPES-75% 1 GAL., 25% 5 GAL. (TEMP. IRRIGATION)

PLANT MATERIAL	COMMON NAME	FORM FUNCTION	MATURE HEIGHT & SPREAD
ADOLPHIA CALIFORNICA	SPINESHRUB	FRAGRENT FLOWERS, EROSION CONRTOL	4' HT. x 6' SPRD
COMAROSTAPHYLIS DIVERSIFOLIA	SUMMER HOLLY	EVERGREEN, WHITE ACCENT FLOWERS	6-10' HT. x 8' SPRD
ENCELIA CALIFORNICA	COAST SUNFLOWER	YELLOW ACCENT FLOWERS, FAST GROWER	1-3' HT. x 4' SPRD
ERIODICTYON TRICHOCALYX	SMOOTH LEAF YERBA SANTA	EVERGREEN, WHITE ACCENT FLOWERS	3-5' HT. x 3-6' SPRD
ERIOPHYLLUM CONFERTIFLORUM	GOLDEN-YARROW	SUB-SHRUB, ORANGE-YELLOW FLOWERS	1-3' HT. x 1.5' SPRD
ESCHSHOLZIA CALIFORNICA	CALIFORNIA POPPY	SUB-SHRUB, ORANGE-YELLOW FLOWERS	1-3' HT. x 3' SPRD
GNAPHALIUM CALIFORNICUM	CALIFORNIA PEARLY EVERLASTING	FRAGRANT EVERGREEN, WHITE FLOWERS	3' HT. x 3' SPRD
HAZARDIA SQUARROSA	COMMON HAZARDIA	SHRUB, YELLOW FLOWERS	1-2' HT. x 2-3' SPRD
HETEROMELES ARBUTIFOLIA	TOYON	LARGE EVERGREEN SHRUB, SHOWY RED BERRIES	8-15 HT. x 15' SPRD
LOTUS SCOPARIUS	DEER WEED	FAST GROWING PERENNIAL, YELLOW FLOWERS	2-3' HT. x 3' SPRD
MALOSMA LAURINA	LAURAL SUMAC	EVERGREEN SHRUB, RAPID GROWTH	8-15' HT. x 12'+ SPRD
MIMULUS AURANTIACUS PUNICEUS	RED MONKEYFLOWER	SUBSHRUB, CRIMSON TO BRICK-RED FLOWERS	2' HT. x 3' SPRD
NEMOPHILA MENZIESII	BABY BLUE EYES	ANNUAL, BLUE FLOWERS	1' HT. x 1.5' SPRD
QUERCUS AGRIFOLIA	COAST LIVE OAK	EVERGREEN TREE, SPREADING CROWN	20-40' HT. x 35'+ SPRD
QUERCUS DUMOSA	NUTTALL'S SCRUB OAK	LARGE EVERGREEN SHRUB, GOOD SOIL BINDER	3-10' HT. x 15' SPRD
RHUS INTEGRIFOLIA	LEMONADE BERRY	EVERGREEN SHRUB, SLOPE STABILIZER	5-15' HT. x 10'+ SPRD
SALVIA APIANA	WHITE SAGE	SUB SHRUB, AROMATIC WHITE LEAVES & FLOWERS	3-5' HT. x 5' SPRD
SALVIA LEUCOPHYLLA	PURPLE SAGE	MEDIUM SHRUB, PINKISH PURPLE FLOWERS	3-4' HT. x 4-6' SPRD

NOTE: CONTAINER STOCK ARE TO BE PLACED AT A MINIMUM RATE OF ONE PLANT PER 100 S.F. OF DISTURBED AREA.

OPEN SPACE ADJACENT RIPARIAN CORRIDOR & DETENTION SLOPES (TEMPORARY IRRIGATION)

TREES - 25% 24" BOX, 75% 15 GALLON

PLANT MATERIAL	COMMON NAME	FORM FUNCTION	MATURE HEIGHT & SPREAD
POPULUS FREMONTII	WESTERN COTTON WOOD	DECIDUOUS, HEAT-DROUGHT TOLERANT	50' HT. x 20' SPRD
PLATANUS RACEMOSA	CALIFORNIA SYCAMORE	DECIDUOUS, MOTTLED WHITE BARK	70' HT. x 40' SPRD
QUERCUS AGRFOLIA	COAST LIVE OAK	EVERGREEN TREE, SPREADING CROWN	50' HT. x 50' SPRD
SALIX SPECIES	WILLOW	DECIDUOUS TREE	30' HT. x 30' SPRD
SAMBUCUS MEXICANA	MEXICAN ELDERBERRY	DECIDUOUS SHRUB TO SMALL TREE,CREAMY FLOWERS	25' HT. x 25' SPRD

SHRUBS-75% 1 GAL. , 25% 5 GAL.

ARTEMESIA DOUGLASIANA	DOUGLAS MUGWORT	HERBACEOUS SUBSHRUB, AROMATIC LEAVES, REVEGETATION	2-3' HT. x 3' SPRD
ARTEMESIA PALMERI	SAN DIEGO SAGEWORT	UPRIGHT PERENNIAL, REVEGETATION	2-3' HT. x 3' SPRD
BACCHARIS SALICIFOLIA	MULE FAT	SEMI-DECIDUOUS SHRUB, REVEGETATION	4-10' HT. x 8' SPRD
CAREX SPISSA	SAN DIEGO SEDGE	CLUMPING PERENNIAL, FLOWERS RESEMBLE CATTAILS	3-4' HT. x 2-3' SPRD
IVA HAYSIANA	SAN DIEGO MARSH ELDER	PERENNIAL, EROSION CONTROL, FAST GROWING	1-3' HT. x 5' SPRD
JUNCUS ACUTUS	SPINY RUSH	CLUMPING PERENNIAL, SPIKED DARK GREEN BLADES	2' HT. x 2'+ SPRD
JUNCUS MEXICANUS	MEXICAN RUSH	CREEPING PERENNIAL, SLENDER DARK GREEN BLADES	2' HT. x 2'+ SPRD
MIMULUS GUTTATUS	GOLDEN MONKEYFLOWER	SMALL PERENNIAL, YELLOW FLOWERS, MOIST PLACES	1-3' HT. x 3' SPRD
OENOTHERA ELATA HOOKERI	YELLOW EVENING PRIMROSE	BIENNIAL, LARGE PALE YELLOW FLOWERS	1-4' HT. x 1' SPRD
PLUCHEA ODORATA	SWEETSCENT	ERECT ANNUAL, PINK-LAVENDER FLOWER CLUSTERS	1-3' HT. x 1-3' SPRD
ROSA CALIFORNICA	CALIFORNIA WILD ROSE	MOUNDING SEMI-DECIDOUS SHRUB, FRAGRANT PINK FLOWERS	3-6' HT. x 5'+ SPRD
RUBUS URSINUS	CALIFORNIA BLACKBERRY	MOUNDING SHRUB/VINE, WHITE FLOWER, FAST, REVEGETATION	2-5' HT. x 6'+ SPRD
SAMBUCUS MEXICANA	MEXICAN ELDERBERRY	DECIDUOUS SHRUB/SMALL TREE, CREAMY FLOWERS	6-20' HT. x 15'+ SPRD
SCIRPUS ROBUSTUS*	BULL TULE	PERENNIAL SHRUB, BROWN FLOWER, WETLANDS	3-5" HT. x 4' SPRD
SCIRPUS ACUTUS*	HARD-STEM BULRUSH	PERENNIAL SHRUB, BROWN FLOWER, WETLANDS	2-3' HT. x 3' SPRD
SCIRPUS PUNGENS*	COMMON THREESQUARE	PERENNIAL SHRUB, BROWN FLOWER, WETLANDS	4-6' HT. x 4' SPRD
RIBES SPECIOSUM	FUCHSIA FLOWERING GOOSEBERRY	DECIDUOUS SHRUB, MAROON-RED FLOWERS, ATTRACTS BIRDS	4-10' HT. x 7' SPRD
RIBES VIBURNIFOLIUM	EVERGREEN CURRANT	LOW EVERGREEN SHRUB, AROMATIC, UNDER OAKS	3-4' HT. x 6' SPRD
TYPHA LATIFOLIA*	BROAD-LEAVED CATTAIL	ERECT RHIZOMATOUS PERENNIAL, RED-BROWN FLOWERS	6'+ HT. x 3'+ SPRD

* PLANTS FOR DETENTION BASIN AREAS. GROUND WATER & SURFACE RUN-OFF ARE PROPOSED TO PROVIDE MOISTURE FOR PLANT SUSTAINABILITY.

SLOPES (TEMPORARILY IRRIGATED) HYDROSEED MIX

THE SLOPE AREAS TO BE HYDROSEEDED WITH A MIX OF NATIVE PLANT MATERIAL FOR SOIL EROSION PURPOSES. 50% OF SEED MIX TO BE PLANT MATERIAL THAT IS 24" OR LESS TO MEET BRUSH MANAGEMENT GUIDELINES.

COASTAL SAGE SCRUB HYDROSEED MIX

PLANT MATERIAL	COMMON NAME	FORM FUNCTION	MATURE HEIGHT & SPREAD	LB/AC	% PURITY/ GERMINATION RECOMMENDED
ARTEMESIA CALIFORNICA	COASTAL SAGEBRUSH	AROMATIC SHRUB, EROSION CONTROL, FAST GROWING	3-4' HT. x 2-3' SPRD	2	15 / 50
ENCELIA CALIFORNICA	COAST SUNFLOWER	SUB-SHRUB, YELLOW FLOWERS, FAST GROWER	3' HT. x 4' SPRD	4	40 / 60
ERIOGONUM FASCICULATUM	CALIFORNIA BUCKWHEAT	PERENNIAL, PINK-WHITE FLOWERS, FAST GROWER	3-4' HT. x 4"+ SPRD	6	10 / 65
ERIOPHYLLUM CONFERTIFLORUM	GOLDEN YARROW	HERBACEOUS SUB-SHRUB, ORANGE-YELLOW FLOWERS	2' HT. x 3' SPRD	3	30 / 60
ESCHSCHOLZIA CALIFORNICA	CALIFORNIA POPPY	SUB-SHRUB, YELLOW FLOWERS, FAST GROWER	3' HT. x 3' SPRD	1	98 / 75
LOTUS SCOPARIUS	DEERWEED	PERENNIAL, NUMEROUS YELLOW FLOWERS, FAST GROWER	2-3' HT. x 3' SPRD	6	90 / 60
LUPINUS BICOLOR	PYGMY-LEAF LUPINE	SMALL ANNUAL, BLUE FLOWER, REVEGETATION	1' HT. x 1.5' SPRD	4	98 / 80
LUPINUS NANUS	SKY LUPINE	SMALL ANNUAL, BLUE FLOWER, GROUNDCOVER	1.5' HT. x 3' SPRD	4	98 / 85
MIMULUS AURANTIACUS PUNICEUS	RED MONKEYFLOWER	SUB-SHRUB, CRIMSON TO BRICK-RED FLOWERS	2' HT. x 3' SPRD	2	2 / 55
SALVIA MELLIFERA	BLACK SAGE	SUB-SHRUB, AROMATIC, FLOWERS BLUE, LILAC OR WHITE	3-5' HT. x 6'+ SPRD	1	70 / 50
NASSELLA PULCHRA	PURPLE NEEDLE GRASS	PERENNIAL BUNCHGRASS, PURPLE SEED HEADS	2' HT. x 2' SPRD	8	90 / 60

NOTE: CONTAINER STOCK ARE TO BE PLACED AT A MINIMUM RATE OF ONE PLANT PER 100 S.F. OF DISTURBED AREA.

PLANTING LEGEND-PUBLIC RIGHT OF WAY & RECREATION AREAS H.O.A. MAINTAINED (PERMENANTLY IRRIGATED)

THE STREET RIGHT OF WAY AND RECREATIONAL AREAS ARE TO BE PLANTED WITH A MIX OF EVERGREEN AND SEASONALLY CHANGING SHADE TREES. ACCENT TREE ARE LOCATED AT INTERSECTIONS AND RECREATION AREAS WITH COLORFUL SHRUBS PROVIDING INTEREST AT A PEDESTRIAN SCALE. TRANSITIONAL EDGES TO OPEN SPACE SHOULD HAVE DROUGHT TOLERANT, AND ORNAMENTAL MATERIALS OF TREES, SHRUBS, AND NATURALIZED DROUGHT TOLERANT GRASSES)

PLANT MATERIAL		MATURE HEIGHT & SPREAD	QTY.
STREET TREES EVERGREEN ROUND HEAD, SHADE TREE - 100% 24" BOX OR LARGER			131
ARBUTUS MARINA	MARINA MADRONE	35' x 30'	
ERIOBOTRYA DEFLXA	BRONZE LOQUAT	20' x 20'	
METROSIDEROS EXCELSA	NEW ZEALAND CHRISTMAS TREE	20' x 20'	
QUERCUS ILEX	HOLLY OAK	40' x 40'	
RHUS LANCEA	AFRICAN SUMAC	30' x 25'	
TRISTANIA LAURINA	ELEGANT BRISBANE	25' x 25'	
STREET TREES DECIDUOUS ROUND HEAD, SHADE TREE - 100% 24" BOX OR LARGER			276
ALBIZIA JULIBRISSIN	SILK TREE (MIMOSA)	40' x 80'	
ARBUTUS MARINA	MARINA STRAWBERRY	40'X 25'	
JACARANDA MIMOSIFOLIA	JACARANDA	30' x 25'	
KOELREUTERIA PANICULATA	GOLDEN RAIN TREE	30' x 40'	
PLATANUS ACERIFOLIA 'BLOODGOOD'	LONDON PLANE TREE	70' x 35'	
PYRUS CALLERYANA	ORNAMENTAL PEAR	50' x 50'	
UPRIGHT VERTICAL ACCENT TREES - 100%			38
BRACHYCHITON ACERIFOLIUS	FLAME TREE	40' x 15'	
HYMENO SPORUM FLAUM	SWEET SHADE	25' x 20'	
PEDESTRIAN SCALE ACCENT TREE - 100% 24" BOX			76
PYRUS CALLERYANA	FLOWERING PEAR	40' x 25'	
CALODENDRUM CAPENSE	CAPE CHESTNUT	40' x 25'	
CERCIS OCCIDENTALIS	WESTERN REDBUD	12' x 25'	
METROSIDEROS EXCELSA	NEW ZEALAND X MAS TREE	18' x 18'	
TABEBUIA IPE	TABEBUIA	25' x 35'	
LARGE SCALE DECIDUOUS ACCENT TREE - 100% 24" BOX			5
JACARANDA MIMOSIFOLIA	JACARANDA	25' x 25'	
PISTACIA CHINENSIS	CHINESE PISTACHE	40' x 25'	
ROBINIA X 'PURPLE ROBE'	PINK FLOWERING LOCUST	40' x 25'	
LARGE / MEDIUM EVERGREEN SHRUB - 80% 1-GALLON, 20% 5 GALLON-3'-5' o.c. ONLY SHRUBS OF 3' IN HEIGHT OR LESS WILL BE USED IN THE PARKWAY VISIBILITY TRIANGLE			13
CISTUS PURPUREUS	ORCHID ROCKROSE	3' x 3'	
DIETES VEGATA	FORTNIGHT LILY	2' x 3'	
LEPTOSPERMUM SCOPARIUM	NEW ZEALAND TEA TREE	4' x 4'	
PHORMIUM TENAX 'MAORI QUEEN'	FLAX	3' x 3'	
LIGUSTRUM JAPONICUM 'TEXANUM'	PRIVET	5' x 4'	
XYLOSMA CONGESTUM	SHINEY XYLOSMA	6' x 6'	
SMALL / MEDIUM EVERGREEN FLOWERING SHRUB - 80% 1-GALLON, 20% 5 GALLON-3'-5' o.c. ONLY SHRUBS OF 3' IN HEIGHT OR LESS WILL BE USED IN THE PARKWAY VISIBILITY TRIANGLE			16
ABELIA GRANDIFLORA	GLOSSY ABELIA	4' x 4'	
CEANOTHUS SP.	WILD LILAC	3' x 3'	
HEMEROCALLIS HYBRIDA	DAYLILY	1.5' x 1.5'	
LEUCOPHYLLUM FRUITICOSUM	TEXAS RANGER	3' x 2'	
RAPHIOLEPSIS INDICA 'BALLERINA'	BALLERINA INDIAN HAWTHORN	2' x 2'	
GROUNDCOVERS - 65% 1-GALLON, 35% FLATS-3'-5' o.c.			
ACACIA REDOLENS 'LOW BOW'	PROSTRATE ACACIA	2.5' x 5'	
BACCHARIS PILULARIS 'TWIN PEAKS'	TWIN PEAKS BACCHARIS	3' x 7'	
CEANOTHUS GRISEUS HORIZONTALIS 'YANKEE POINT'	SPREADING LILAC	1.5' x 7'	
COTONEASTER HORIZONTALIS	COTONEASTER	2' x 3'	
ESCALLONIA 'NEWPORT DWARF'	ESCALLONIA	3' x 3'	
ESCHSHOLZIA CALIFORNICA	CALIFORNIA POPPY	2' x 1'	
GREVILLEA SPP.	GREVILLEA	2' x 2'	
HAZARDIA SQUARROSA	YELLOW SQUIRREL COVER	2' x 2'	
LANTANA MONTEVIDENSIS	LANTANA	2' x 5'	
LOTUS SCOPARIUS	DEERWEED	1.5' x 1.5'	
NEMOPHILA MENZIESII	BABY BLUE EYES		
PUBLIC RIGHT-OF-WAY GROUNDCOVERS - 100% 1-GALLON-3'-5' o.c.			
CEANOTHUS SPP.	LILAC	3' x 3'	
CISTUS PURPUREUS	ROCK ROSE	2.5' x 2.5'	
COTONEASTER SPP.	COTONEASTER	2' x 3'	
LANTANA MONTEVIDENSIS	LANTANA	2' x 5'	
RAPHIOLEPSIS INDICA 'CLARA'	INDIAN HAWTHORNE	4' x 3'	

GRASSES & WILD FLOWERS (SEEDED) UNMANICURED GRASSES PERMENANTLY IRRIGATED TO BE WITHIN THE RIGHT OF WAY. WITHIN OPEN SPACE AREAS

	WILDFLOWERS (SEEDED)
BROMUS CARINATUS	CLARKIA AMOENA
ERIOPHYLLUM CONFERTIFLORUM	COLLINSIA HETEROPHYLLA
HORDEUM BRACHYANTHERUM	LAYIA PLATYGLOSSA
LASTHENIA CHRYSOSTOMA	LINANTHUS GRANDIFLONRIS
LUPINUS BICOLOR	LUPINUS NANUS
LUPINUS NANUS	ORTHOCARPUS PURPURASCENS
NEMOPHILA MENZIESSI	PHACELIA CAMPANULARIA
SISYRINCHIUM BELLUM	
NASSELLA PULCHRA	

DROUGHT RESISTANT, SLOW GROWING TURF - SOD

FESTUCA SPP.
FESCUE (MARATHON III OR EQUAL) LAWN

PLANTING NOTE

ALL INVASIVE PLANT SPECIES FOUND ON-SITE SHALL BE REMOVED PRIOR TO THE INSTALLATION OF NEW PLANT MATERIALS. REFER TO APPENDIX 'B', TABLE 1, OF THE BLACK MOUNTAIN RANCH SUBAREA PLAN FOR A 'PROHIBITED PLANT PALETTE' LIST

TRAIL

○○○●● EXISTING & RE-ALIGNED BLACK MOUNTAIN OPEN SPACE TRAIL

NOTE:
ALL TRAILS SHALL BE CONSTRUCTED TO CITY STANDARDS AS IDENTIFIED IN THE CITY OF SAN DIEGO CONSULTANT'S GUIDE TO PARK DESIGN AND DEVELOPMENT.

NATIVE GRASS SEED FOR BRODIAEA AREA MAINTAINED BY CONSERVANCY

NATIVE GRASSES FOR REVEGETATION OF EXISTING PATHS.

NO IRRIGATION TO BE PROVIDED TO BE BROADCAST PRIOR TO THE RAINY SEASON:
STIPA PULCHRA
SISYRIMBIUM BELLUM

INTERIOR SLOPES-PRIVATELY MAINTAINED (PERMENANT IRRIGATION)

THE INTERIOR SLOPE AREAS ARE TO BE PLANTED WITH COLORFUL CONTAINER MATERIAL WITH DEEP ROOTING CHARACTERISTICS IN CONFORMANCE WITH THE GRADING ORDINANCE. DROUGHT TOLERANT NATIVE AND NATURALIZED SPECIES ARE USED PLANTED IN AN INFORMAL PATTERN. SEASONAL MAINTENANCE ONCE ESTABLISHED.

			QTY.
SLOPE TREES - 25% 24" BOX, 75% 15 GALLON			
QUERCUS AGRIFOLIA	COAST LIVE OAK	50' x 50'	177
PLATANUS RACEMOSA	CALIFORNIA SYCAMORE	70' x 40'	
SAMBUCUS MEXICANA	BLUE ELDERBERRY	30' x 20'	
SMALL TREES/LARGE SHRUBS- 50% 15 GAL, 50% 5GAL-10'-15' o .c.	STRAWBERRY TREE	10' X 10'	
ARBUTUS UNEDO	SUMMER LEAF HOLLY	8' X 8'	
COMAROSTAPHYLIS DIVERSIFOLIA	LOQUAT	12' X 18'	
ERIOBOTRYA DEFLEXA	GUAVA	10' X 10'	
FEIJOA SELLOWIANA	TOYON	10' X 10'	
HETEROMELES ARBUTIFOLIA	SANTA CRUZ IRONWOOD	20' X 15'	
LYONOTHAMNUS FLORIBUNDUS SPP. ASPLENIFOLIUS	CATALINA CHERRY	15' X 10'	
PRUNUS ILLICIFOLIA	AFRICAN SUMAC	25' X 25'	
RHUS LANCEA	CAPE HONEYSUCKLE	5' X 8'	
TECOMARIA CAPENSIS			
LARGE/ MEDIUM SHRUBS-50% 1 GAL. , 50% 5 GAL.-3'- 4' o.c.	SPINE SHRUB		
ADOLPHIA CALIFORNICA	SILVERBERRY	2' x 1.5'	
ELAEAGNUS PUNGENS	LEMONADE BERRY	4' x 3'	
RHUS INTEGRIFOLIA	EVERGREEN CURRENT	1.5' x 7'	
RIBES VIBURNIFOLIUM	FUCHSIA-FLOWERED GOOSEBERRY	2' x 3'	
RIBES SPECIOSUM	WHITE SAGE	2' x 4'	
SALVIA APIANA	PURPLE SAGE	2.5' x 2.5'	
SALVIA LEUCOPHYLLA	ORCHID ROCKROSE	2.5' x 2.5'	
CISTUS PURPUREUS	FORTNIGHT LILY	2' x 2'	
DIETES VEGATA	NEW ZEALAND TEA TREE	2' x 1.5'	
LEPTOSPERMUM SCOPARIUM	FLAX	4' x 3'	
PHORMIUM TENAX 'MAORI QUEEN'	PRIVET	3' x 3'	
LIGUSTRUM JAPONICUM 'TEXANUM'	SHINEY XYLOSMA	3' x 4'	
XYLOSMA CONGESTUM		3' x 5'	
SMALL/MEDIUM SHRUBS 80% 1 GAL. , 20% 5 GAL 2.5'-3' o.c.			
ABELIA GRANDIFLORA	GLOSSY ABELIA	4' x4'	
CEANOTHUS SP.	WILD LILAC	3' x 3'	
HEMEROCALLIS HYBRID	DAYLILY	1.5' x 1.5'	
LEUCOPHYLLUM FRUITICOSUM	TEXAS RANGER	3' x2'	
RAPHIOLEPSIS INDICA 'BALLERINA'	BALLERINA INDIAN HAWTHORN	2' x 2'	
ENCELIA CALIFORNICA	COAST SUNFLOWER		
LOTUS SCOPARIUS	DEERWEED	25' x12.5'	
MIMULUS PUNICEUS	RED MONKEY FLOWER	1.5' x 1.5'	
		1.5' x1.5'	
GROUND COVERS-75% 1 GAL, 25% 5 GAL-6' o.c.			
BACCHARIS PILUARIS 'TWIN PEAKS'	DWARF COYOTE BRUSH	3' x 7'	
CEANOTHUS GRIS. HORIZ. YANKEE PT.	YANKEE POINT LILAC	1.5' x 7'	
ESCHSHOLZIA CALIFORNICA	CALIFORNIA POPPY	2' x13'	
LANTANA SPP.	LANTANA	2' x 5'	
ROSMARINUS OFFICINALIS	ROSEMARY	2.5' x 4	
SANTOLINA CHAMAECYPARISSUS	LAVENDER COTTON	1.5' x 4'	

WATER EFFICIENT LANDSCAPE WORKSHEET

A	B	C	D	E	F	G	H	I	J
Areas	Hyrdozone #	Valve Circuit #	Irrigation Method (Code)	Plant Factor (average) (PF)	Hyrdozone Area (sf) (HA)	% of Total Landscaped Area	PF x HA	IE	PF x HA / IE
1	Exterior Slopes	xxx	Rotator	0.4	266,768	56.8%	106,707.2	0.75	142,276.3
2	Interior Slopes	xxx	Rotator	0.5	111,116	23.7%	55,558.0	0.75	74,077.3
3	Parkways	xxx	Rotator	0.5	75,431	16.1%	37,715.5	0.75	50,287.3
4	Street Trees	xxx	Bubbler	0.5	616	0.1%	308.0	0.8	385.0
5	HOA Maintained Parks	xxx	Rotator	0.7	15,496	3.3%	10,847.2	0.75	14,462.9
				SLA	0	0.0%		1.0	0.0
				TOTAL	469,427	100.0%			281,488.9

Maximum Applied Water Allowance (MAWA)

MAWA Formula: (Eto)(0.62)[(0.7 x LA) + (0.3 x SLA)]

Maximum Applied Water Allowance = 9,453,133.2 gallons per year

Estimated Total Water Use (ETWU)

ETWU Formula: (Eto)(0.62)(Total of Column J)

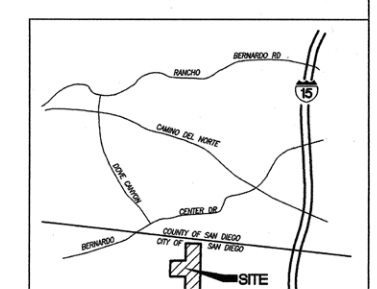
Estimated total Water Use = 8,097,871.7 gallons per year

Eto =	46.4
LA =	469,427.0
SLA =	0.0

Percentage Allowance Used: 85.66%

MAWA - ETWU = 1,355,261.4

Efficiency= 0.75



VICINITY MAP
NOT TO SCALE

REGISTERED LANDSCAPE ARCHITECT
JON JAY BECKER # 2542
Signature
Date
STATE OF CALIFORNIA
EXPIRES 7/31/17

ARCHITECT OF WORK

PROJECT DESIGN CONSULTANTS
701 "B" STREET, SUITE 800
SAN DIEGO, CA 92101
TELEPHONE: (619) 235-6471

JON JAY BECKER, LIC. NO. 2542
REGISTRATION EXPIRES 7/31/17

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PREPARED BY:
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PROJECT ADDRESS:
SAN DIEGO, CALIFORNIA

PROJECT NAME:
HERITAGE BLUFFS II

SHEET TITLE:
LANDSCAPE CONCEPT PLAN–Legend

REVISION 14:
REVISION 13:
REVISION 12:
REVISION 11:
REVISION 10:
REVISION 09:
REVISION 08:
REVISION 07:
REVISION 06:
REVISION 05: 09/22/2015
REVISION 04: 08/04/2015
REVISION 03: 02/03/2015 03/12/2015
REVISION 02: 11/07/2014
REVISION 01: 02/26/2014
ORIGINAL DATE: 08/30/2013
SHEET 14 OF 19
DEP #

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Source: PDC, 2015

FIGURE 14

LANDSCAPE PLAN (3 OF 3)

Affinis
Shadow Valley Center
847 Jamacha Road
El Cajon, CA 92019

- Zone 2 Brush management/clearing shall be done by hand where these zones overlap with mapped *B. filifolia* populations. Zone 1 Brush Management shall not be established in areas supporting *B. filifolia*.

- No grading will be permitted in the areas supporting the *B. filifolia*, and the hydrologic regime shall be preserved as outlined in the project's Stormwater Management Plan and GeoSoils' 2014 Memorandum (*Evaluation and Discussion of Soil Properties and Potential Impact of Development on an occurrence of Brodiaea filifolia, Adjacent to Lots 124-134, VTM No. 1193244, Proposed Heritage Bluffs II, Rancho Bernardo area, San Diego, California*) to ensure that existing drainage patterns and soils hydrology will be maintained to avoid adverse effects on the preserved populations.

- No public access points are proposed. No motor vehicles shall be permitted, and patrols for illegal uses shall be performed on a regular and ongoing basis.

- Fencing and signage shall be installed and trails shall be closed or redirected to protect habitat or species populations from trampling or other adverse direct or indirect impacts.

- Any unnatural erosion, caused by direct or indirect human activity or adjacent off-site disturbance shall immediately be repaired and the cause identified and addressed. No re-seeding or transplanting is proposed at this time.

- Contingency measures shall be implemented in the event that the long-term management is not implemented as outlined in the HMP. Any management deficiencies shall be evaluated by the WA and discussed with the habitat manager, to develop contingency measures for remedial correction, if needed. Yearly performance will be evaluated by the City and the WA upon review of annual reports from the habitat manager.

- The HMP shall be approved by the City and the WA prior to issuance of the project's grading permit. The proposed preserve shall be staked and flagged prior to grading and grubbing. A biological monitor shall be on-site during all ground disturbing activities adjacent to the preserve. The proposed short- and long-term monitoring and reporting schedule is detailed in the HMP.

d. Jurisdictional Waters/Resource Agency Permitting

Mitigation for the loss of 0.03 acre of jurisdictional waters would be negotiated with the CDFW and Army Corps as part of the permitting process. On-site mitigation could be achieved by creation/ enhancement of habitat associated with the ephemeral stream, either upstream of the proposed disturbance area or downstream, in the area associated with the wetlands to be preserved onsite, or possibly on the Lusardi Creek MHPA replacement parcel. Prior to the commencement of any construction-related activities on-site, the applicant shall provide evidence of the following (as applicable) to the Assistant Deputy Director (ADD) environmental designee of the City's Land Development Review Division:

- Compliance with the United States Army Corps of Engineers (ACOE) Section 404 Nationwide Permit;
- Compliance with the Regional Water Quality control Board Section 401 Water Quality Certification; and
- Compliance with CDFG (sic) Section 1601/1603 Streambed Alteration Agreement.

2. Protection, Notice, and Management Element

a. Prior to issuance of any grading permits, the on-site MHPA (Lots O and P) and off-site parcels (as indicated on Sheets 18 and 19 of the Vesting Tentative Map) shall be deeded in fee title to the City's MSCP preserve and maintained by the City's Park and Recreation Department Open Space Division.

b. The proposed Heritage Brodiaea Preserve (Lot Q onsite and off-site Parcels C and D) shall be dedicated in fee title to a Third Party conservancy with *Brodiaea filifolia* expertise.

c. Parcels B, C, and E (detention basins or other stormwater control facilities, brush management areas, landscape/revegetation areas, and graded slopes) shall be owned and maintained by the HOA.

d. A covenant of easement (COE) shall be placed over ungraded portions of HOA Zone 2 Brush Management Lots and dedicated to the City. Parcels, or portions thereof, subject to the COE shall include: on-site Lots A, F, G and J and off-site Parcels A and F. These lots will be included as part of the MHPA.

e. A covenant of easement (COE) shall be placed over portions of HOA Zone 2 Brush Management Lots and dedicated to the conservancy. Parcels, or portions thereof, subject to the COE shall include: on-site Lot Q and off-site Parcels C and D. These lots are within the HBP and are subject to the conditions for HMP.

f. Street J is a public street that will be maintained by the City.

g. The 7.84-acre Lusardi Creek/Santaluz MHPA Exchange/Mitigation parcels shall also be deeded to and managed by the City as part of the corridor system identified in the Black Mountain Open Space Park RMP.

h. The applicant has prepared a management, maintenance, and monitoring plan for all on- or off-site biological conservation easement areas, including a non-wasting endowment for an amount approved by the Agencies based on a Property Analysis Record (PAR) (Center for

Natural Lands Management ©1998) or similar cost estimation method to secure the ongoing funding for the perpetual management, maintenance and monitoring of the biological conservation easement area by an agency, non-profit organization, or other entity approved by the Agencies. The applicant will submit a draft plan including: 1) a description of perpetual management, maintenance and monitoring actions and the PAR or other cost estimation results for the non-wasting endowment; 2) proposed land manager's name, qualifications, business address, and contact information, to the Agencies for approval prior to issuance of the first grading permit. The applicant will submit the final plan to the Agencies and a contract with the approved land manager, as well as transfer the funds for the non-wasting endowment to a non-profit conservation entity, within 60 days of receiving approval of the draft plan.

The following are potential Conditions of Approval for the Vesting Tentative Map (VTM):

1. Prior to recordation of the first final map and/or issuance of any grading permits, the on-site MHPA shall be conveyed to the City's MSCP preserve through either fee title to the City, [or] covenant of easement granted in favor of the City and WA.

2. Conveyance of any land in fee to the City shall require approval from the Park and Recreation Department Open Space Division Deputy Director and shall exclude detention basins or other stormwater control facilities, brush management areas, landscape/ revegetation areas, and graded slopes. To facilitate MHPA conveyance, any non-fee areas shall have covenant of easements for MHPA lands placed over them if located in the MHPA, and be maintained in perpetuity by the owner/Permittee/ Applicant unless otherwise agreed to by the City for acceptance of dedicated land in fee title.

3. The issuance of this permit by the City of San Diego does not authorize the Permittee for this permit to violate any Federal, State, or City laws, ordinances, regulations, or policies including, but not limited to, the Endangered Species Act of 1973 (EAS) and any amendments thereto (16 U.S.C Section 1531 et seq.).

4. Third Party-Part II. In accordance with authorization granted to the City of San Diego from the USFWS pursuant to Sec. 10(a) of the ESA and by the CDFG (sic) pursuant to Fish and Game Code sec. 2835 as part of the Multiple Species Conservation Program (MSCP), the City of San Diego through the issuance of this Permit hereby confers upon Permittee the status of Third Party Beneficiary as provided for in Section 17 of the City of San Diego Implementing Agreement (IA), executed on July 17, 1997 and on File in the Office of the City Clerk as Document No. 00-18394.

5. Third Party – Part III. Third Party Beneficiary status is conferred upon Permittee by the City: (1) to grant Permittee the legal standing and legal right to utilize the take authorizations granted to the City pursuant to the MSCP within the context of those limitations imposed under this permit and the IA, and (2) to assure Permittee in the future

by the City of San Diego, USFWS or CDFG (sic), except in the limited circumstances described in Section 9.6 and 9.7 of the IA.

F. REFERENCES

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APPENDIX 1

PLANT SPECIES OBSERVED

Appendix 1. Plant Species Observed, Heritage Bluffs

	Habitat
SELAGINELLACEAE - Spike Moss Family	
Selaginella cinerascens Maxon Mesa Mossfern	CSS
POLYPODIACEAE - Fern Family	
Adiantum jordani C. mueller California Maidenhair	SMC
Pellaea mucronata (Eaton d. Eaton) var. mucronata Bird's foot Fern	SMC
Pentagramma triangularis G. Yatskievych, M.D. Windham & E. Wollenweber var. *triangularis* Goldenback Fern	SMC
CUPRESSACEAE - Cypress Family	
* *Juniper* sp.	NNG
PINACEAE	
Pinus sp. Pine	NNG
<u>DICOTYLEDONES</u>	
ADOXACEAE	
Sambucus mexicana C. Presl. Mexican Elderberry (Blue Elderberry)	RF,CSS
AMARANTHACEAE - Amaranth Family	
* *Atriplex semibaccata* R. Br. Australian Saltbush	NNG
* *Chenopodium ambrosoides* L. Mexican Tea	NNG
* *Salsola tragus* L. Russian Thistle	NNG

Appendix 1. Continued

ANACARDIACEAE - Sumac Family

Malosma laurina (Nutt.) Abrams
Laurel Sumac — CSS

Rhus integrifolia (Nutt.) Brewer & Watson
Lemonade Berry — CSS, SMC

* *Schinus molle* L.
Peruvian Pepper Tree — NNG

Toxicodendron diversilobum (Torrey & A. Gray) E. Greene
Western Poison Oak — RF

APIACEAE - Carrot Family

Apiastrum angustifolium Nutt. in T. & G.
Mock parsley — CSS

Daucus pusillus Michaux.
Rattlesnake Weed — CSS

* *Foeniculum vulgare* Miller
Fennel — NNG

Sanicula sp.
Sanicle — NNG, CSS

APOCYNACEAE - Dogbane Family

Asclepias fascicularis Decne. in A. DC.
Narrow-leaf Milkweed — NNG, MFS

ASTERACEAE - Sunflower Family

Acourtia mirocephala (DC.)
Sacapellote — CSS

Ambrosia psilostachya DC.
Western Ragweed — SMC, NNG

Artemisia californica Less.
California Sagebrush — CSS

Baccharis salicifolia (Ruiz Lopez & Pavon)
Mule Fat — MFS

Baccharis pilularis D.C.
Coyote Brush — CSS

Baccharis sarothroides A. Gray.
Broom Baccharis — CSS, MFS

Appendix 1. Continued

* *Chamomilla suaveolens* (Pursh) Rydb. Pineapple Weed	CSS
Carduus pycnocephalus L. Italian Thistle	NNG
* *Centaurea melitensis* L. Tocalote	CSS
Chaenactis artemisiifolia (A. Gray) A. Gray Artemisia Pincushion	CSS
* *Chrysanthemum coronarium* L. Garland Chrysanthemum	NNG
* *Conyza canadensis* (L.) Cronq. Horseweed	NNG
* *Cynara carduluncus* L. Artichoke thistle, Cardoon	NNG
Deinandra fasciculata Fascicled Tarweed	NNG
Eriophyllum confertiflorum (DC.) A. Gray Golden Yarrow	CSS
Encelia californica Nutt. California Encelia	CSS
Filago californica Nutt. California Filago	SMC, CSS
* *Filago gallica* L. Narrow-Leaf Filago	CSS
* *Gazania linearus* (Thunb.) Druce	NNG
Gnaphalium californicum DC. California Everlasting	CSS
* *Gnaphalium luteo-album* L.	MFS
Gnaphalium palustre Nutt.	CSS
Grindelia camporum E. Greene var. *bracteosum* (J. Howell)M.A. Lane Big Gumplant	NNG
Hazardia squarrosa (Hook & Arn.) Saw-toothed Goldenbush	CSS
* *Hedypnois cretica* (L.) Dum.-Cours. Crete hedypnois	NNG
Heterotheca grandiflora Nutt. Telegraph Weed	CSS
Holocarpha virgata (A. Gray)Keck ssp. elongata Curving Tarweed	NNG

Appendix 1. Continued

Hypochoeris glabra L. Smooth Cat's Ear	CSS
Isocoma menziesii (Hook. & Arn.) G. Nesom Goldenbush	CSS
Lasthenia coronaria (Nutt.)Ornd. Southern Goldfields	SMC
Lessingia filaginifolia (Hook & Arn)M.A. Lane California Aster	CSS, NNG
* *Picris echioides* L. Bristly Ox-tongue	CSS, NNG
* *Sonchus* sp. Sow Thistle	NNG
Stephanomeria virgata Benth. Wreath plant or Mule Weed	CSS
Stylocline gnaphaloides Nutt. Everlasting nest straw	SMC
**Taraxacum* sp.	NNG
* *Xanthium spinosum* L. Spiny Cocklebur	MFS

BORAGINACEAE - Borage Family

Amsinckia menziesii (Lehm.) Nelson and J.F. Macbr. Rancher's Fiddleneck	CSS
Cryptantha sp. Cryptantha	CSS
Heliotropium curassavicum L. Salt Heliotrope	NNG
Pectocarya sp.	CSS
Plagiobothrys sp. Popcorn Flower	SMC
Pholistoma racemosum (Nutt.) Constance Field Nyctelea	CSS

BRASSICACEAE - Mustard Family

* *Hirschfeldia incana* (L.) Lagr.-Fossat Shortpod or Perennial Mustard	NNG, CSS

* *Raphanus sativus* L.
Wild Radish — CSS

CAPRIFOLIACEAE - Honeysuckle Family

Lonicera subspicata Hook. & Arn.
San Diego Honeysuckle — SMC

CARYOPHYLLACEAE - Pink Family

* Cerastium sp.
Chickweed — CSS

Silene gallica L.
Windmill Pink — CSS

CISTACEAE - Rock-Rose Family

Helianthemum scoparium Nutt.
Sun-Rose, Rock Rose — SMC

CONVOLVULACEAE - Morning-Glory Family

Calystegia macrostegia (E. Greene) Brummitt
Morning Glory — CSS

* Convolvulus arvensis L.
Common Bindweed — NNG

CRASSULACEAE - Stonecrop Family

Crassula connata (Ruiz Lopez & & Paven) A. Berger
Pygmy-Weed — CSS

CUCURBITACEAE - Gourd Family

Marah macrocarpus (E. Greene) E. Greene
Wild-cucumber — SMC

ERICACEAE - Heath Family

Xylococcus bicolor Nutt.
Mission Manzanita — SMC

EUPHORBIACEAE - Spurge Family

Eremocarpus setigerus (Hook.) Benth.
Turkey-Mullein or Dove Weed — NNG

Appendix 1. Continued

Euphorbia sp. Daryl L. Koutnik
Spurge NNG

FABACEAE - Pea Family

* *Acacia* sp.
Acacia NNG

Acmispon glaber (Vogel) Broullet
Deerweed CSS

Acmispon strigosus (Nutt.Broullet
Strigose Lotus CSS

Lathyrus laetiflorus Greene ssp. *alefeldii* (White)Brads. NNG
San Diego Sweetpea

Lupinus sp.
Lupine CSS

* *Medicago polymorpha* L.
California Bur Clover NNG

* *Melilotus indica* (L.) All.
Indian Sweet Clover NNG

GERANIACEAE - Geranium Family

* *Erodium circutarium* (L.) L'Hér.
Red Stem Filaree NNG

* *Erodium moschatum* (L.) L'Hér. NNG
Filaree

* *Geranium* sp.
Cranesbill CSS

GROSSULARIACEAE - Gooseberry Family

Ribes indecorum Eastw.
Winter Currant SMC

Ribes speciosum Pursh.
Fuchsia-flowered Gooseberry CSS

LAMIACEAE - Mint Family

* *Marrubium vulgare* L.
Horehound NNG, CSS

Salvia apiana Jepson
White Sage CSS

Appendix 1. Continued

Salvia mellifera E. Greene Black Sage	CSS, SMC
Stachys ajugoides Benth. var. *rigida* Jepson & Hoover Hedge Nettle	NNG

LYTHRACEAE - Loosestrife Family

* *Lythrum hyssopifolium* L. Loosestrife	NNG

MALVACEAE - Mallow Family

Malacothamnus fasciculatus (Torrey & A. Gray Mesa Bushmallow	SMC
Sidalcea malvaeflora (D.C.) Benth. ssp. *sparsifolia* C. Hitchc. Checker Bloom or wild hollyhock	CSS, NNG

MYRTACEAE - Myrtle Family

* *Eucalyptus* sp. Eucalyptus	NNG

NYCTAGINACEAE - Four O'Clock Family

Mirabilis californica A. Gray Wishbone Bush	CSS

OLEACEAE - Olive Family

* *Olea europaea* L. Olive	NNG

ONAGRACEAE - Evening Primrose Family

Clarkia purpurea (Curtis) Nelson & J.F. Macbr.	CSS

OXALIDACEAE - Wood-Sorrel Family

Oxalis albicans Kunth ssp. *californica* (Abrams) Eiten California Oxalis	CSS

PAEONIACEAE - Peony Family

Paeonia californica Torrey & A. Gray California Peony	CSS

Appendix 1. Continued

PHRYMACEAE

Mimulus aurantiacus Curtis
Monkey-Flower — CSS

PLATANACEAE - Sycamore Family

Platanus racemosa Nutt.
Sycamore — RF

PLUMBAGINACEAE - Leadwort Family

**Limonium sinuatum* (L.) Miller — NNGSea Lavender

POLEMONIACEAE - Phlox Family

Gilia angelensis . Grant — CSS Gilia

Navarretia hamata ssp. *hamata* Greene
Hooked Skunkweed — SMC

POLYGONACEAE - Buckwheat Family

Eriogonum fasciculatum Benth. ssp. *fasciculatum*
California Buckwheat — CSS

Pterostegia drymarioides F. & M.
Granny's Hairnet — CSS

* *Rumex conglomeratus* Murr.
Whorled Dock — NNG, MFS

* *Rumex crispus* L.
Curly Dock — NNG

PORTULACACEAE - Purslane Family

Claytonia perfoliata Willd var. *perfoliata*
Miner's Lettuce — SMC

PRIMULACEAE - Primrose Family

* *Anagallis arvensis* L.
Scarlet Pimpernel — NNG

RANUNCULACEAE - Crowfoot Family

Thalictrum fendleri A. Gray var. *polycarpum* Torrey
Meadow Rue — CSS

Ranuculus californicus Benth.
California buttercup — NNG

Appendix 1. Continued

RHAMNACEAE - Buckthorn Family

Ceanothus tomentosus C. Parry Wooly-leaved Ceanothus	SMC
Rhamnus crocea Nutt. Buckthorn or Redberry	CSS, SMC

ROSACEAE - Rose Family

Adenostoma fasciculatum Hook & Arn. Chamise	SMC
Heteromeles arbutifolia (Lindley) Roemer Toyon	SMC, CSS

RUBIACEAE - Madder Family

Galium sp Bedstraw	CSS

SALICACEAE - Willow Family

Salix gooddingii C. Ball Gooding's Black Willow	MFS, RF
Salix lasiolepis Benth. Arroyo willow	FWM, RF, MFS

SCROPHULARIACEAE - Figwort Family

Scrophularia californica Cham. & Schldl. ssp. *floribunda* (E. Greene) California Bee Plant	SMC, CSS

SOLANACEAE - Nightshade Family

Solanum parishii A. A. Heller Parish's Nightshade	CSS

TAMARICACEAE - Tamarisk Family

* *Tamarix parviflora* DC. Small-Flowered Tamarisk	CSS, MFS

VERBENACEAE - Vervain Family

Verbena lasiostachys Link. Western Vervain	NNG

Appendix 1. Continued

VERONICACEAE OR PLANTAGINACEAE - Veronica or Plantain Family

Antirrhinum nuttallianum Benth. Nuttall's snapdragon	CSS
* *Plantago major* L. Common Plantain	NNG

VIOLACEAE - Violet Family

Viola pedunculata Torrey & Gray Yellow Johnny Jump-Up	NNG, CSS

VISCACEAE - Mistletoe Family

Phoradendron macrophyllum (Engelm.) Big Leaf Mistletoe	RF

<u>MONOCOTYLEDONES</u>

AGAVACEAE - Agave Family

Chlorogalum parviflorum S. Watson Soap Plant	CSS
* *Yucca* sp. Yucca	NNG

CYPERACEAE - Sedge Family

Carex spissa L. Bailey San Diego Sedge	CSS
Eleocharis sp. Spike Rush	FWM

IRIDACEAE - Iris Family

Sisyrinchium bellum S. Watson Blue-eyed Grass	NNG, CSS

LILIACEAE - Lily Family

Calochortus sp.	CSS

MELANTHACEAE

Zigadenus fremontii (Torrey) S. Watson
Star Lily — CSS

THEMIDACEAE

Brodiaea filifolia S. Watson
Thread leaf Brodiaea — NNG

Dichelostemma capitatum Alph. Wood ssp. *capitatum*
Blue Dicks or Wild Hyacinth — CSS, NNG

POACEAE - Grass Family

Agrostis sp. — CSS

* *Avena* sp.
Wild Oat — NNG

* *Brachypodium distachyon* (L.) Beauv. — NNG, CSS
False Brome

* *Bromus diandrus* Roth.
Ripgut Grass — NNG

* *Bromus hordeaceus* L.
Soft Chess — NNG

**Cortaderia* ssp. — CSS
Pampas grass

Elymus glaucus Buckley.
Blue Wildrye — SMC

* *Lolium multiflorum* Lam.
Italian Ryegrass — NNG

Melica imperfecta Trin.
Coast Range Melic — CSS

Muhlenbergia rigens (Benth.) A. Hitchc.
California Deergrass — SMC

Nassella lepida (A. Hitchc.) Barkworth
Foothill Stipa or needlegrass — PNG, NNG

TYPHACEAE - Cat-Tail Family

Typha sp.
Cat-Tail — FWM

KEY:

CSS	=	Coastal Sage Scrub
NNG	=	Non-Native Grassland
MC	=	Mixed Chaparral
NPG	=	Native Perennial Grassland
MFS	=	Mulefat Scrub
FWM	=	Freshwater Marsh
RF	=	Riparian Forest
*	=	Non-native taxa

Nomenclature is according to Baldwin et. al, (2000)

APPENDIX 2

AVIAN SPECIES DETECTED

Appendix 2. Avian Species Detected, Heritage Bluffs II

Red tailed hawk	*Buteo jamaicensis*
Mourning dove	*Zenaida macroura*
Barn owl	*Tyto alba*
California quail	*Callipepla californica*
Allen’s hummingbird	*Selasphorus alleni*
Anna’s hummingbird	*Calypte anna*
Northern flicker	*Colaptes auratus*
Nuttall’s woodpecker	*Picoides nuttallii*
Pacific-slope flycatcher	*Empidonax difficilis*
Ash-throated flycatcher	*Myiarchus cinerascens*
Black phoebe	*Sayornis nigricans*
Say’s phoebe	*Sayornis saya*
Cassin’s kingbird	*Tyrannus vociferans*
Western kingbird	*Tyrannus verticalis*
Scrub jay	*Aphelocoma californica*
Cliff swallow	*Petrochelidon pyrrhonota*
Canyon wren	*Catherpes mexicanus*
Bewick’s wren	*Thryomanes bewickii*
Bushtit	*Psaltriparus minimus*
Northern mockingbird	*Mimus polyglottos*
California thrasher	*Toxostoma redivivum*
Wrentit	*Chamaea fasciata*
Blue-gray gnatcatcher	*Polioptila caerulea*
California gnatcatcher	*Polioptila californica*
Spotted towhee	*Pipilo maculatus*

Appendix 2. Continued

California towhee	*Melozone crissalis*
Black-headed grosbeak	*Pheucticus melanocephalus*
Rufous-crowned sparrow	*Aimophila ruficeps*
Bullocks' oriole	*Icterus bullockii*
House finch	*Carpodacus mexicanus*
Lesser goldfinch	*Spinus psaltria*

APPENDIX 3

MAMMALS AND REPTILES OBSERVED

Appendix 3. Mammals and Reptiles Observed, Heritage

COMMON NAME	SCIENTIFIC NAME	METHOD
Coyote	*Canis latrans*	scat
Wood rat	*Neotoma* sp.	houses
Desert Cottontail	*Sylvilagus auduboni*	pellets
Botta's Pocket Gopher	*Thomomys bottae*	mounds
Alligator Lizard	*Gerrhonotus multicarinatus*	sighted
Western Fence Lizard	*Sceloporus occidentalis*	sighted
California Kingsnake	*Lampropeltis getulus californiae*	sighted

APPENDIX 4

SENSITIVE PLANT SPECIES POTENTIALLY OCCURRING ON-SITE

APPENDIX 4. SENSITIVE PLANT SPECIES POTENTIALLY OCCURRING ON-SITE

SPECIES	STATUS	HABITAT	OPTIMUM TIME FOR SURVEY	COMMENTS
Acanthomintha ilicifolia (Gray) Gray San Diego thorn mint	CNPS: 2-3-2, List 1B Fed: T Cal: E MSCP: NE, C	Chaparral, coastal scrub, valley and foothill grassland, 10-935 m	April - June	Searched for but not detected on-site.
Adolphia californica Wats. California adolphia	CNPS: 1-3-1, List 2 Fed: -- Cal: --	Coastal sage scrub, chaparral, foothill grassland, 45-300 m	Anytime; blooms Dec - May	Not observed on-site.
Ambrosia pumila (Nutt.) Gray San Diego ambrosia	CNPS: 3-2-2, List 1B Fed: PE Cal: -- MSCP: NE, C	Coastal scrub, valley and foothill grassland	May - October	Not observed on-site.
Baccharis vanessae Encinitas baccharis	CNPS: 2-3-3, List 1B Fed: T Cal: E MSCP: NE, C	Chaparral (maritime, sandstone), 60-720 m	Anytime; blooms August - November	Not observed on-site.
Brodiaea filifolia Thread-leaf brodiaea	CNPS: Fed: T Cal: E MSCP: NE, C	Annual and non-native grassland	February for foliage, May – June for flowers	Several hundred plants occur on site.
Ceanothus verrucosus Nutt. in T. & G. Wart-stemmed ceanothus	CNPS: 2-2-1, List 2 Fed: -- Cal: -- MSCP: C	Chaparral, below 1 - 380 m	Anytime; blooms Dec - April	Not observed on-site.
Centromadia parryi (Greene) Greene ssp. *australis* (Keck) B.G. Baldwin Southern tarplant	CNPS: 3-3-2, List 1B Fed: -- Cal: --	Marshes and swamps (margins), valley & foothill grassland (vernally mesic), vernal pools; 0-425 m	May - November	Not observed on-site.
Centromadia pungens (H. & A.) Greene ssp. *laevis* (Keck) B.G. Baldwin Smooth tarplant	CNPS: 2-3-3, List 1B Fed: -- Cal: --	Chenopod scrub, meadows and seeps, playas, riparian woodland, valley & foothill grassland/alkaline; elevation 0-480 m	April - September	Not observed on-site.

Clarkia delicata (Abrams) Nels. & Macbr. Delicate clarkia	CNPS: 2-2-2, List 1B Fed: -- Cal: --	Chaparral, cismontane woodland; 235-1000 m	April - June	Not observed on-site.
Comarostaphylos diversifolia (Parry) Greene ssp. *diversifolia* Summer holly	CNPS: 2-2-2, List 1B Fed: -- Cal: --	Chaparral, 30-550 m	Anytime; blooms April - June	Not observed on-site.
Dudleya variegata Variegated dudleya	CNPS: 2-2-2, List 1B Fed: -- Cal: -- MSCP: NE, C	Chaparral, cismontane woodland, coastal scrub, valley & foothill grassland, vernal pools/clay; 3-550 m	May - June	Not observed on-site.
Ericamera palmeri (Gray) Hall ssp. *palmeri* Palmer's goldenbush	CNPS: 3-2-1, List 2 Fed: -- Cal: -- MSCP: NE, C	Chaparral, coastal scrub/mesic; 30-600 m	Anytime; blooms July - November	Not observed on-site.
Ferocactus viridescens (T. & G.) Britt. & Rose Coast barrel cactus	CNPS: 1-3-1, List 2 Fed: -- Cal: -- MSCP: C	Rocky slopes in coastal sage scrub, chaparral below 5000'	Anytime	Not observed on-site.
Iva hayesiana Gray San Diego marsh elder	CNPS: 2-2-1, List 2 Fed: -- Cal: --	Marshes and swamps, playas; 10-500 m	Anytime; blooms April - September	Not observed on-site.
Muilla clevelandii (Wats.) Hoover San Diego goldenstar	CNPS: 2-3-2, List 1B Fed: -- Cal: -- MSCP: C	Chaparral, coastal scrub, grassland, vernal pools, 50-465 m	March - May	Not observed on-site.

SEE APPENDIX 6 FOR EXPLANATION OF STATUS CODES

APPENDIX 5

SENSITIVE ANIMAL SPECIES POTENTIALLY OCCURRING ON-SITE

APPENDIX 5. SENSITIVE ANIMAL SPECIES POTENTIALLY OCCURRING ON-SITE

SPECIES	STATUS	HABITAT	OPTIMUM TIME FOR SURVEY	POTENTIAL ON-SITE
AMPHIBIANS AND REPTILES				
Clemmys marmorata pallida Western pond turtle	Fed: SC Cal: -- CDFG: CSC, Protected MSCP: NE,C	Aquatic/riparian. Inhabits permanent or nearly permanent bodies of water in many habitat types, below 6000 ft MSL. Requires basking sites such as partially submerged logs, vegetation mats, or open mud banks.	Breeding period	No suitable habitat on-site.
Aspidoscelis (=Cnemidophorus) hyperythrus beldingi Orange-throated whiptail	Fed: -- Cal: -- CDFG: CSC, Protected MSCP: C	Inhabits coastal sage scrub, chaparral, and valley-foothill hardwood at low elevations. Prefers washes and other sandy areas with patches of brush and rocks.	April - September	Not observed, but expected to occur on-site.
Aspidoscelis (=Cnemidophorus) tigris multiscutatus Coastal western whiptail	Fed: -- Cal: -- CDFG: CSC	Inhabits coastal sage scrub, chaparral, and valley-foothill hardwood at low elevations. Prefers washes and other sandy areas with patches of brush and rocks.	April - September	Not observed, but expected to occur on-site.
Crotalus ruber ruber Northern red-diamond rattlesnake	Fed: SC Cal: -- CDFG: CSC	Rocky brushlands, grassland, and cultivated areas.	Spring - Fall	Not observed; moderate potential for occurrence.
Eumeces skiltonianus interparietalis Western (Coronado) skink	Fed: SC Cal: -- CDFG: CSC	Grassland, chaparral, pinyon-juniper & juniper sage woodland, pine-oak and pine forests in coast ranges of So. Cal. Prefers early successional stages or open areas. Found in rocky areas close to streams and on dry hillsides, under surface litter, inside rotten logs.	April - September	Not observed; moderate potential for occurrence
Lichanura tirvirgata rosafusca Coastal rosy boa	Fed: SC Cal: --	Desert, arid scrub, rocky chaparral-covered foothills, particularly along streams, springs, and canyon floors	Spring - summer	Not observed; moderate potential for occurrence
Phrynosoma coronatum blainvillei San Diego horned lizard	Fed: -- Cal: -- CDFG: CSC, Protected MSCP: C	Coastal sage scrub and chaparral. Prefers friable, rocky, or shallow sandy soils.	April - September	Not observed; moderate potential for occurrence

SPECIES	STATUS	HABITAT	OPTIMUM TIME FOR SURVEY	POTENTIAL ON-SITE
Scaphiopus hammondi Western spadefoot	Fed: SC Cal: -- CDFG: CSC, Protected	Primarily in grassland habitats, but can be found in valley-foothill hardwood woodlands. Vernal pools are essential for breeding and egg laying.	Spring - early summer	No suitable habitat on-site.
BIRDS				
Aimophila ruficeps canescens Southern Rufous-crowned sparrow	Fed: SC Cal: -- CDFG: CSC MSCP: C	Coastal sage scrub & sparse mixed chaparral; steep, rocky terrain. Seeks scattered bunches of grasses.	Anytime	Observed on-site.
Campylorhynchus brunneicapillus Coastal cactus wren	Fed: -- Cal: -- CDFG: CSC MSCP: NE, C	Coastal sage scrub, cactus patches	Anytime; nests April - June	Not observed; low potential for occurrence due to lack of suitable habitat (dense cactus patches)
Icteria virens Yellow-breasted chat	Fed: -- Cal: -- CDFG: CSC	Summer resident. Inhabits riparian thickets of willow & other brushy tangles near watercourses. Nests in low, dense riparian consisting of willow, blackberry, wild grape. Forages & nests within 10 ft of ground.	April - September	Not observed; low potential due to sparseness of suitable habitat on-site.
Plegadis chihi White-faced ibis	Fed: SC Cal: -- CDFG: CSC MSCP: C	Rookery sites in shallow fres-water marsh; dense tule thickets for nesting interspersed with areas of shallow water for foraging	Winter	Not observed; low potential due to sparseness of suitable habitat on-site
Polioptila californica californica California gnatcatcher	Fed: T Cal: -- CDFG: CSC NAS: E MSCP: C	Coastal sage scrub with *Artemisia californica* a major component.	Anytime; nests mid-February to mid-August	Observed on-site.
Vireo bellii pusillus Least Bells vireo	Fed: E Cal: E MSCP: NE,C	Early successional willow riparian, with dense shrub cover; high degree of understory	March - September	Not observed; low potential due to sparseness of suitable habitat on-site
Lepus californicus bennettii San Diego black-tailed jackrabbit	Fed: SC Cal: -- CDFG: CSC	From the coast to Cuyamaca Peak at 6,000 feet. Generally associated with coastal sage scrub, chaparral, grasslands, croplands, and open, disturbed areas with some scrub cover.	Anytime	Not observed; low potential on-site.

SPECIES	STATUS	HABITAT	OPTIMUM TIME FOR SURVEY	POTENTIAL ON-SITE
Neotoma lepida intermedia San Diego desert woodrat	Fed: -- Cal: -- CDFG: CSC	Southern coastal bluff scrub with an open, sandy substrate. Moderate to dense canopies preferred. Rock outcrops, rocky cliffs and slopes	Anytime	Wood rat houses observed; trapping would be required to determine species presence.
Nyctinomops macrotis Big free-tailed bat	Fed: -- Cal: -- CDFG: CSC	Low-lying arid areas in southern California. Need high cliffs or rocky outcrops; sometimes found in man-made structures.	Anytime	Not observed; low potential on-site due to lack of suitable habitat.

Sources: CDF & G's Natural Diversity Database (2003), S.D. County Sensitive Birds, Mammals, and Herptiles lists; MSCP Target Species List (1/25/93), National Audubon Society (NAS, 1990), Williams, Mies, and Stokes (2002).

SEE APPENDIX 6 FOR EXPLANATION OF STATUS CODES.

APPENDIX 6

EXPLANATION OF STATUS CODES

APPENDIX 6. EXPLANATION OF STATUS CODES

The CNPS R-E-D Code

R (Rarity)

1 Rare, but found in sufficient numbers and distributed widely enough that the potential for extinction is low at this time
2 Distributed in a limited number of occurrences, occasionally more if each occurrence is small
3 Distributed in one to several highly restricted occurrences, or present in such small numbers that it is seldom reported

E (Endangerment)

1 Not endangered
2 Endangered in a portion of its range
3 Endangered throughout its range

D (Distribution)

1 More or less widespread outside California
2 Rare outside California
3 Endemic to California

The CNPS Lists

List 1A Plants that are Presumed Extinct in California
List 1B Plants Rare, Threatened, or Endangered in California and Elsewhere
List 2 Plants Rare, Threatened, or Endangered in California, But More Common Elsewhere
List 3 Plants About Which We Need More Information - A Review List
List 4 Plants of Limited Distribution - A Watch List

State-Listed Plants and Animals

CE State-listed, endangered
CT State-listed, threatened
CR State-listed, rare
CC Candidate for State listing
CSSC Species of Special Concern
P Protected

Federal-Listed Plants and Animals

FE Federal-listed, Endangered
FT Federal-listed, Threatened
PE Federal-proposed, Endangered
PT Federal-proposed, Threatened
R Federal-listed, Rare
C Candidate species for federal-listing
SC Species of Concern

MSCP = Target Species of Multiple Species Conservation Program

NE Narrow Endemic
C Covered Under the MSCP
NC Not Covered Under the MSCP

SOURCE: Tibor (2001), City of San Diego (1997), County of San Diego (1997), USFWS (1996)

APPENDIX 7

GNATCATCHER SURVEY REPORT

Clark Biological Services

7558 Northrup Drive
San Diego, CA 92126

Phone: (858) 271-1669
Fax: (858) 271-1669
kevin.b.clark@sbcglobal.net

October 4, 2013

Susie Tharratt
Recovery Permit Coordinator
U.S. Fish and Wildlife Service
2177 Salk Avenue, Suite 250
Carlsbad, California 92008

RE: 45-day report on the results of 2013 surveys for the coastal California gnatcatcher (***Polioptila californica californica***) at a 210 acre property near Black Mountain in San Diego County.

Dear Ms. Tharratt,

This report is to notify you of the results of surveys conducted for the coastal California gnatcatcher (***Polioptila californica californica***) near Black Mountain in Rancho Bernardo, San Diego County, California. The surveys were conducted on a 210 acre property northeast of Black Mountain, west of Interstate 15, and south of Bernardo Center Drive (Figure 1).

The surveys were conducted in accordance with established protocols pursuant to my Federal 10(a)(1)(A) Recovery Permit (TE-117947-3).

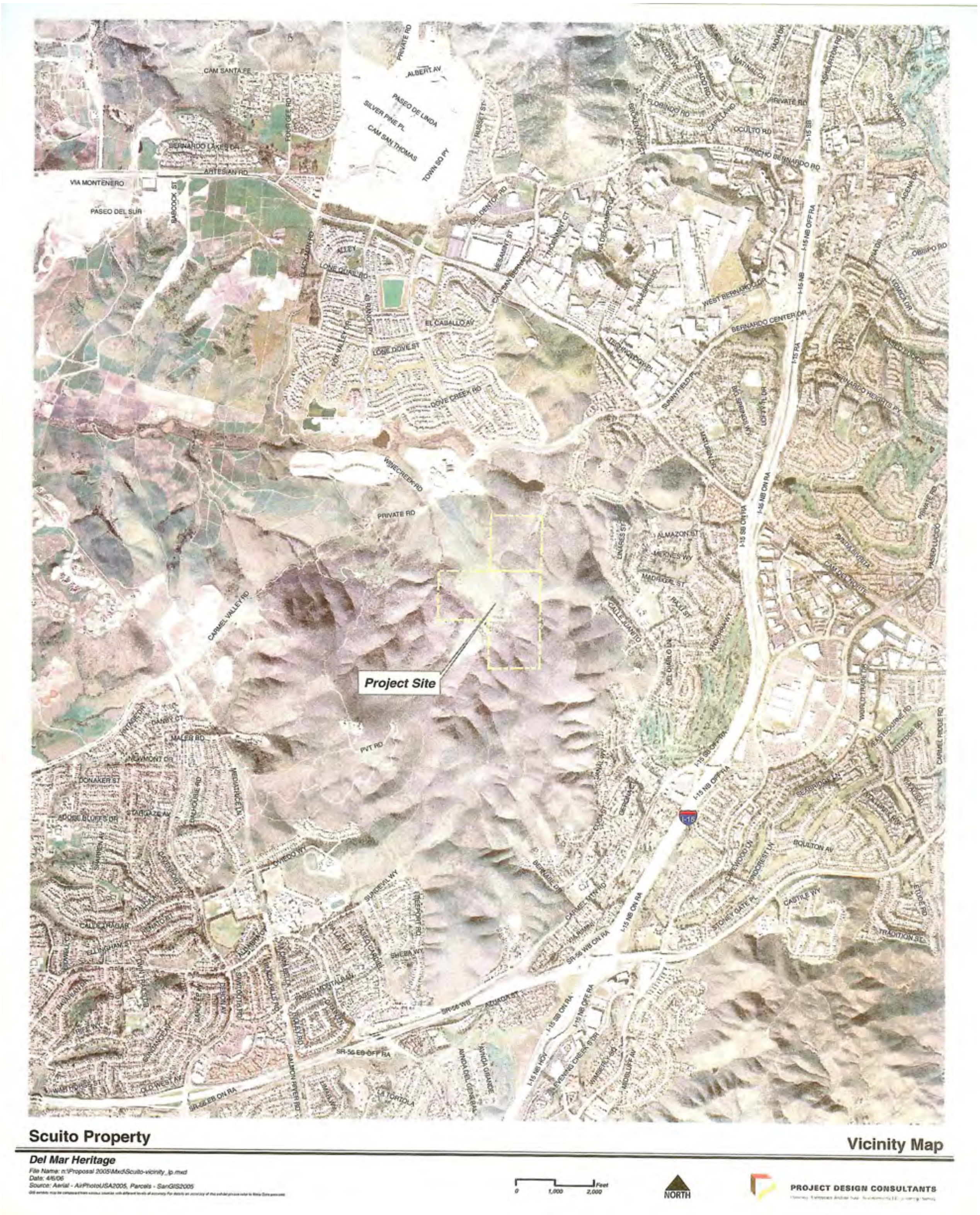
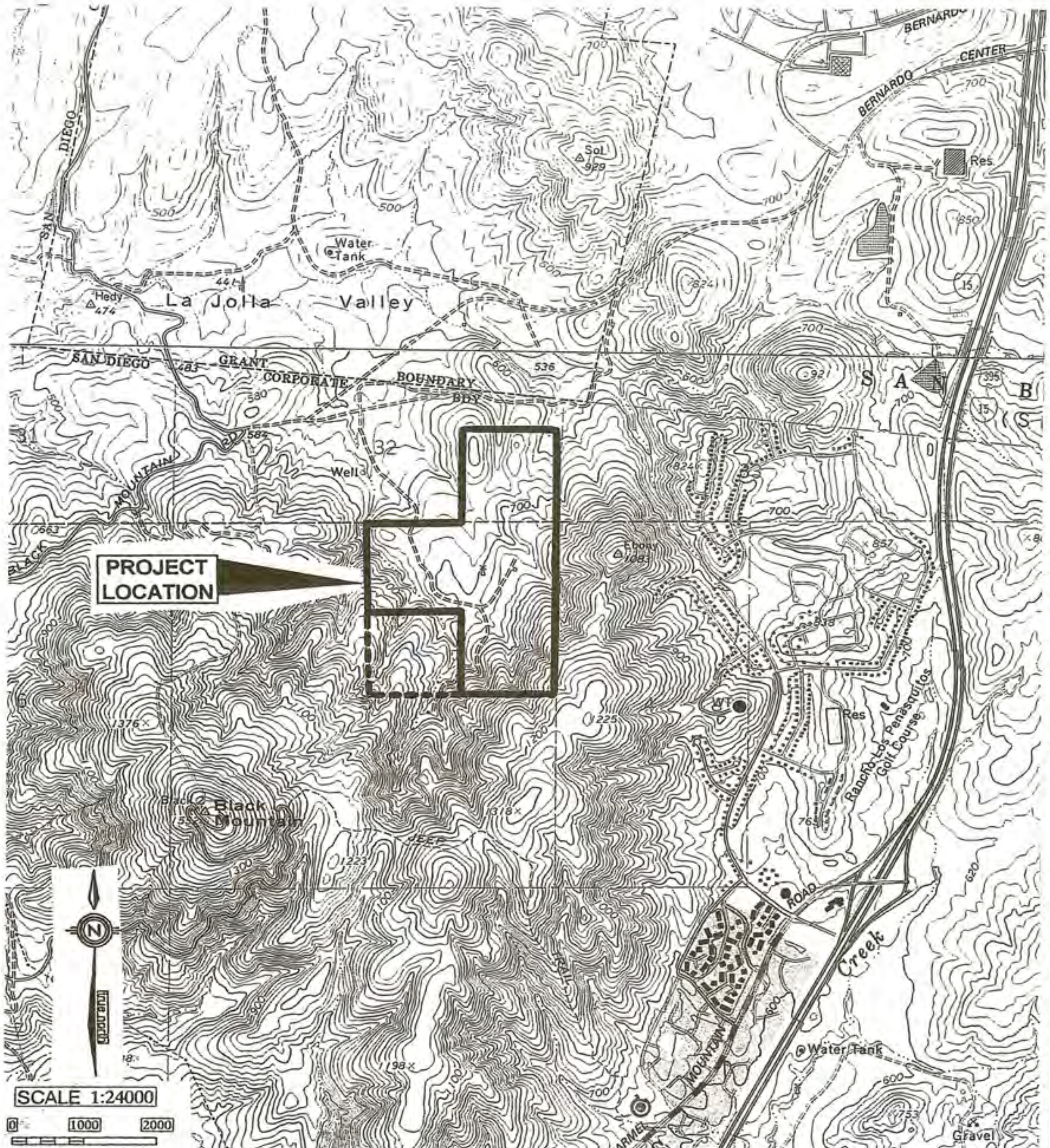

Project Site
Scuito Property
Vicinity Map
Del Mar Heritage
File Name: n:\Proposal 2005\Mxd\Scuito-vicinity_lp.mxd
Date: 4/6/06
Source: Aerial - AirPhotoUSA2005, Parcels - SanGIS2005
NORTH
PROJECT DESIGN CONSULTANTS

Figure 1.

Surveys were conducted following the most recent U.S. Fish and Wildlife Service protocol (USFWS 1997). During each visit that a gnatcatcher was detected, its location was recorded. If an individual moved a significant distance during the observation period, additional locations were recorded, resulting in more mapped locations than the number of days an individual or pair was detected in some instances. All avian species detected during the surveys were recorded. A complete list of avian species detected during the surveys is in Table 1.

The property consists of the northern slopes of Black Mountain and a series of small drainages surrounding a flat disturbed field adjacent to remnant foundations of former structures. Elevations on the property range from approximately 570 feet above mean sea level at the northeastern corner to 1180 feet at the southern boundary (Figure 2). The property is predominately covered with mixed chaparral and coastal sage scrub surrounding the central grassy field. The majority of the coastal sage scrub in the survey area is high quality and dominated by black sage (***Salvia mellifera***), monkey flower (***Mimulus aurantiacus***), coastal sagebrush (***Artemisia californica***), and laurel sumac (***Malosma laurina***) (Photos 1 and 2). Also present were flat-topped buckwheat (***Eriogonum fasciculatum***), deerweed (***Lotus scoparius***), broom baccharis (***Baccharis sarathroides***), and spiny redberry (***Rhamnus crocea***). Some portions of the property, especially near habitat edges, had higher percentages of invasive species such as mustards (***Brassica*** spp.) and tocalote (***Centaurea melitensis***).



Affinis
Shadow Valley Center
847 Jamacha Road
El Cajon, CA 92019

PROJECT LOCATION ON USGS 7.5' POWAY AND ESCONDIDO QUADRANGLES

FIGURE 2

Photo 1. Coastal sage scrub habitat on north facing slopes at the Black Mountain property. Habitat is dominated by black sage, lemonadeberry, and monkeyflower. Photo taken July 14, 2013 by Kevin B. Clark.

Survey Schedule:

July 4, 2013: 0600 - 1130; start weather: overcast, calm, 65^{o}F; end: clear, west breeze 5 mph, 74^{o}

July 14, 2013: 0645 - 1115; start weather: partly cloudy, calm, 65^{o}; end: partly cloudy, calm, 71^{o}

July 21, 2013: 0600 - 1130; start weather: overcast, calm, 63^{o}; end: partly cloudy, east breeze 3 mph, 72^{o}

Photo 2. Coastal sage scrub habitat on an east facing slope. Habitat dominated by black sage, laurel sumac, and broom baccharis. Photo taken July 14, 2013 by Kevin B. Clark.

Results

On each visit a single territorial male gnatcatcher was observed in the northeastern section of the property (CAGN A in Figure 3). This male was never seen with another bird and was consistently found foraging and vocalizing.

On the last survey on July 21, a juvenile was observed at the northeastern boundary of the property (CAGN B in Figure 3). The individual responded briefly to a vocalization playback,

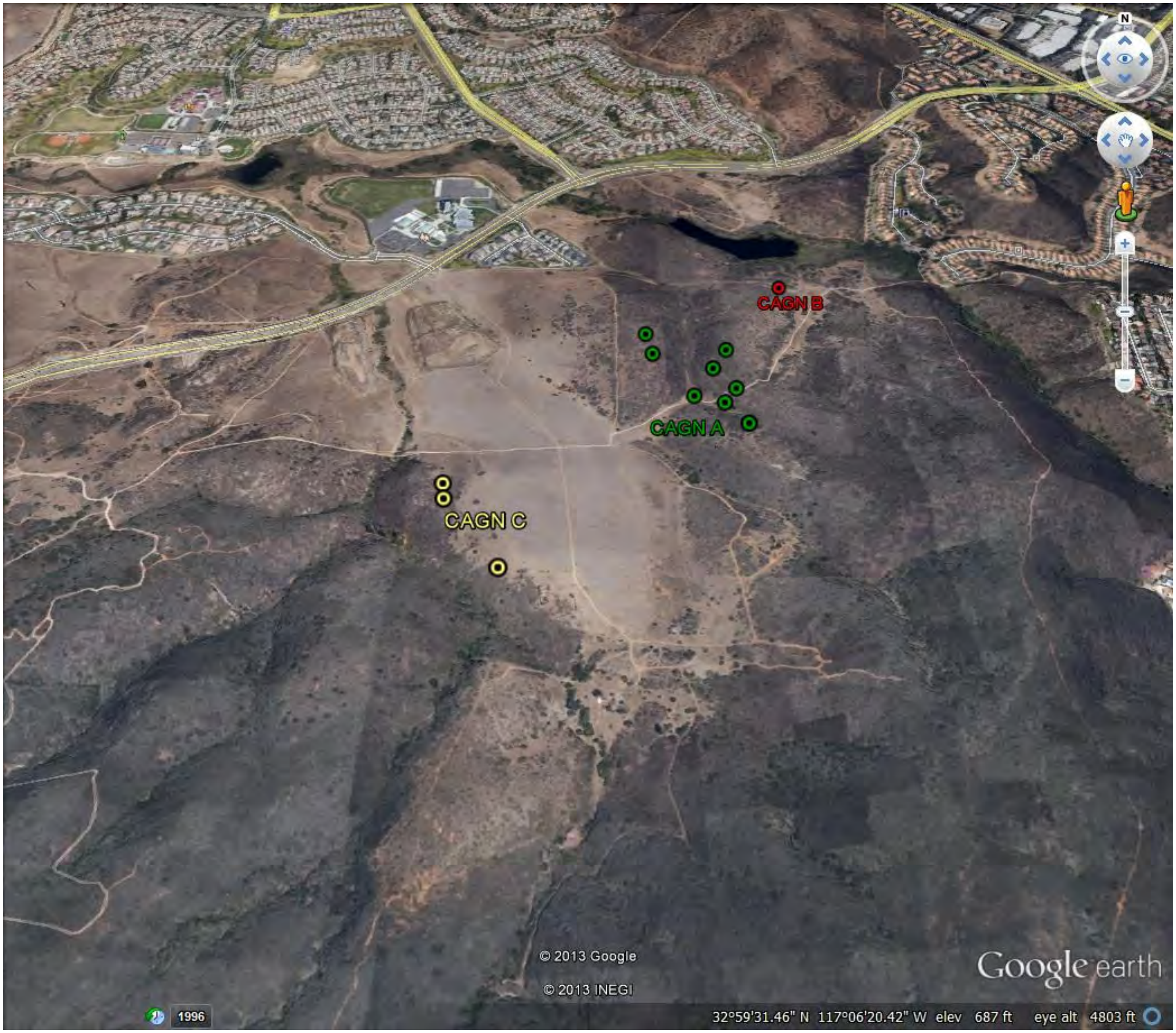


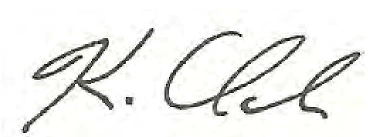
Figure 3. Map showing California Gnatcatchers found on the property. CAGN A and CAGN C include multiple locations depicting movement during observation periods.

and then went quiet. Approximately three hours later, presumably the same bird was heard and seen just off site to the east. It is likely this individual is a dispersing juvenile and will continue moving through the area.

On the last survey on July 21, a group of at least three juveniles was observed foraging and calling frequently near the northwestern boundary of the property (CAGN C in Figure 3). These were very vocal and clearly had just moved onto the property, likely from the high quality coastal sage scrub off site to the west and northwest. One juvenile was a male with a slight eyebrow stripe just appearing. These birds called frequently and moved around widely while being observed.

A list of all birds detected is provided in Table 1. No Brown-headed cowbirds (***Molothrus ater***) were detected during the surveys. If you have any questions about this report please feel free to contact me.

Sincerely,



Kevin B. Clark
Clark Biological Services
7558 Northrup Drive
San Diego, CA 92126-5115
ph/fx (858) 271-1669
kevin.b.clark@sbcglobal.net

Certification Statement

I certify that the information in this survey report fully and accurately represents my work.

October 4, 2013

Kevin Clark (TE-117947-3)

<u>**References**</u>

Atwood J. L., and D.R. Bontrager. 2001. California Gnatcatcher (***Polioptila californica***). In A. Poole and F. Gill (***eds***.) The Birds of North America No. 574. Philadelphia.

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U.S. Fish and Wildlife Service. 1997. Coastal California Gnatcatcher (***Polioptila californica californica***) Presence/Absence Survey Protocol. July 28, 1997, Carlsbad, California.

Unitt, P. 2004. San Diego County Bird Atlas. Proceedings of the San Diego Society of Natural History, No 39, 31 Oct. 2004. Ibis Publishing Co. 645 pp.

Table 1. Avian species detected during Black Mountain surveys July 4 – July 21, 2013.

Species	
Red-tailed Hawk	***Buteo jamaicensis***
Mourning Dove	***Zenaida macroura***
Barn Owl	***Tyto alba***
California Quail	***Callipepla californica***
Allen's Hummingbird	***Selasphorus alleni***
Anna's Hummingbird	***Calypte anna***
Northern Flicker	***Colaptes auratus***
Nuttall's Woodpecker	***Picoides nuttallii***
Pacific-slope Flycatcher	***Empidonax difficilis***
Ash-throated Flycatcher	***Myiarchus cinerascens***
Black Phoebe	***Sayornis nigricans***
Say's Phoebe	***Sayornis saya***
Cassin's Kingbird	***Tyrannus vociferans***
Western Kingbird	***Tyrannus verticalis***
Scrub Jay	***Aphelocoma californica***
Cliff Swallow	***Petrochelidon pyrrhonota***
Canyon Wren	***Catherpes mexicanus***
Bewick's Wren	***Thryomanes bewickii***
Bushtit	***Psaltriparus minimus***
Northern Mockingbird	***Mimus polyglottos***
California Thrasher	***Toxostoma redivivum***
Wrentit	***Chamaea fasciata***
Blue-gray Gnatcatcher	***Polioptila caerulea***
California Gnatcatcher	***Polioptila californica***
Spotted Towhee	***Pipilo maculatus***
California Towhee	***Melozone crissalis***
Black-headed Grosbeak	***Pheucticus melanocephalus***
Rufous-crowned Sparrow	***Aimophila ruficeps***
Bullock's Oriole	***Icterus bullockii***
House Finch	***Carpodacus mexicanus***
Lesser Goldfinch	***Spinus psaltria***

Appendix 8

Jurisdictional Waters

Calculations of Areas Impacted

Field Measurements

Arid Lands Data Sheets

Photos

8-16-13

Project Heritage Bluffs II #2538

Drainage A-3

Stream type ephemeral

Length Source scaled project map

Mean Width Source field measurements

Measurements 10 foot intervals. 30 total
19 measurements, 11 were swale

Army Corps

L	x	$\overline{W}$	= ft²	≈ acres
220'		3.3'	726	0.16 ≃ 0.02

CA F&G

L	x	$\overline{W}$	= ft²	≈ acres
		Same		

Additional Areas

No indication of banks at 11 measuring points
Stream is disturbed from ranching, has areas
of concrete and asphalt rubble. (riprap?)

8/16/13 N. Bluffs

9³⁰ Am 79° clear
W Wind steady 5-8 mph

#2538

A-3

10' intervals

Southern Dr. - Meas 10' from mid road upstream 400'

1	3'	21	4.5 pathway, photo w/ track
2	Conc. rubble riprap 2'	22	3.0 path
3	1.5	23	3.0?
4	1.5	24	4.5
5	3.0	25	3.0 definite channel
6	3.5 conc rubble	26	5.5 rocks, def. channel
7	Swale	27	3.5 rocks, " , photo
8	3.0	28	3.0 def channel
9	Swale	29	3.5
10	Swale	30	3.5 [illegible] photo ?
11	Swale	31	
12	Swale/road	32	
13	Swale	33	
14	2.5	34	
15	Swale	35	
16	Swale	36	
17	Swale	37	
18	4.5	38	
19	Swale	39	
20	Swale	40	

photo of swale downstream from road

Project: Heritage Bluffs II
Project Number: 2538
Stream: A-3
Investigator(s): Adams, Busdosh

Date: 9-13-13 **Time:** 9 am
Town: **State:**
Photo begin file# **Photo end file#**

Y ☐ / N ☑ Do normal circumstances exist on the site?

Y ☑ / N ■ Is the site significantly disturbed?

Location Details: Trib A-3 southern portion
Projection: **Datum:**
Coordinates:

Notes: Disturbed by past ranching or farming and roads. Asphalt & concrete piles, dirt piles.

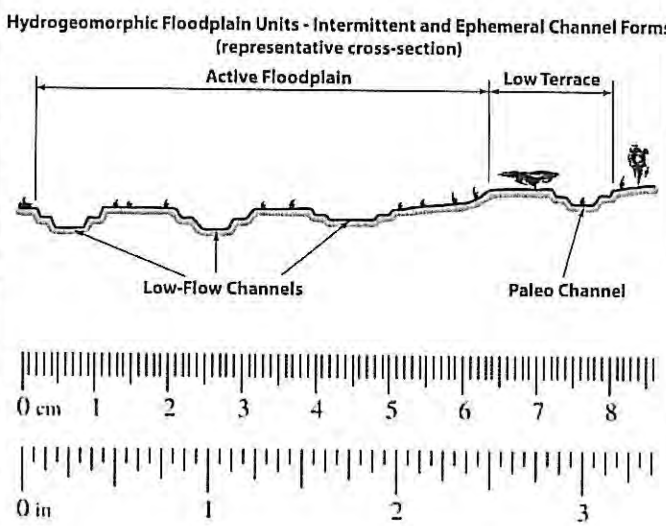
Brief site description:
Ephemeral stream, indistinct in many segments, running through chaparral

Checklist of resources (if available):

- ☑ Aerial photography
  Dates:
- ☑ Topographic maps
  Scale: 1:24 000
- ☐ Geologic maps
- ☑ Vegetation maps
- ☑ Soils maps
- ☐ Rainfall/precipitation maps
- ☐ Existing delineation(s) for site
- ☐ Global positioning system (GPS)
- ☐ Other studies
- ☐ Stream gage data
  Gage number:
  Period of record:
  - ☐ Clinometer / level
  - ☐ History of recent effective discharges
  - ☐ Results of flood frequency analysis
  - ☐ Most recent shift-adjusted rating
  - ☐ Gage heights for 2-, 5-, 10-, and 25-year events and the most recent event exceeding a 5-year event

The dominant Wentworth size class that imparts a characteristic texture to each zone of a channel cross-section is recorded in the average sediment texture field under the characteristics section for the zone of interest.

Inches (in)	Millimeters (mm)	Wentworth size class	
		Boulder	Gravel
10.08	256		
		Cobble	Gravel
2.56	64		
		Pebble	Gravel
0.157	4		
		Granule	Gravel
0.079	2.00		
		Very coarse sand	Sand
0.039	1.00		
		Coarse sand	Sand
0.020	0.50		
		Medium sand	Sand
1/2 0.0098	0.25		
		Fine sand	Sand
1/4 0.005	0.125		
		Very fine sand	Sand
1/8 0.0025	0.0625		
		Coarse silt	Silt
1/16 0.0012	0.031		
		Medium silt	Silt
1/32 0.00061	0.0156		
		Fine silt	Silt
1/64 0.00031	0.0078		
		Very fine silt	Silt
1/128 0.00015	0.0039		
		Clay	Mud



A-3
(1)

☑	**Walk the channel and floodplain within the study area to get an impression of the vegetation and geomorphology present at the site. Record any potential anthropogenic influences on the channel system in "Notes" above.**
☑	**Locate the low-flow channel (lowest part of the channel). Record observations.** Characteristics of the low-flow channel: Average sediment texture: sandy Total veg cover: ____ % Tree: 1 % Shrub: ____ % Herb: 50 % Community successional stage: ☑ NA ☐ Mid (herbaceous, shrubs, saplings) ☐ Early (herbaceous & seedlings) ☐ Late (herbaceous, shrubs, mature trees) Dominant species present: Brome grasses Other: ☑ prickly ox-tongue ☐ ☐ ☐
☑	**Walk away from the low-flow channel along cross-section. Record characteristics of the low-flow/active floodplain boundary.** Characteristics used to delineate the low-flow/active floodplain boundary: ☑ Change in total veg cover ☐ Tree ☑ Shrub ☐ Herb ☑ Change in overall vegetation maturity ☑ Change in dominant species present → buckwheat, laurel sumac, deer weed ☐ Other ☑ Presence of bed and bank - intermittent ☑ Drift and/or debris ☐ Other: ____ ☐ Other: ____
☑	**Continue walking the channel cross-section. Record observations below.** Characteristics of the active floodplain: Average sediment texture: ____ Total veg cover: ____ % Tree: ____ % Shrub: ____ % Herb: ____ % Community successional stage: ☑ NA ☐ Mid (herbaceous, shrubs, saplings) ☐ Early (herbaceous & seedlings) ☐ Late (herbaceous, shrubs, mature trees) Dominant species present: ____ Other: ☐ ☐ ☐ ☐

☑	**Continue walking the channel cross-section. Record indicators of the active floodplain/low terrace boundary.** Characteristics used to delineate the active floodplain/ low terrace boundary: ☐ Change in average sediment texture ☐ Change in total veg cover ☐ Tree ☐ Shrub ☐ Herb ☑ Change in overall vegetation maturity ☑ Change in dominant species present ☐ Other ☐ Presence of bed and bank ☐ Drift and/or debris ☐ Other: ________ ☐ Other: ________
☑	**Walk the active floodplain/low terrace boundary both upstream and downstream of the cross-section to verify that the indicators used to identify the transition are consistently associated the transition in both directions.** Consistency of indicators used to delineate the active floodplain/low terrace boundary: Y ☐ N ☐ Change in average sediment texture Y ☐ N ☐ Change in total veg cover ☐ Tree ☐ Shrub ☐ Herb Y ☐ N ☐ Change in overall vegetation maturity Y ☐ N ☐ Change in dominant species present Y ☐ N ☐ Other: Y ☐ N ☐ Presence of bed and bank Y ☐ N ☐ Drift and/or debris Y ☐ N ☐ Other: ________ Y ☐ N ☐ Other: ________ No low terrace
☐	**If the characteristics used to delineate the active floodplain/low terrace boundary were NOT consistently associated with the transition in both the upstream and downstream directions, repeat all steps above.**
☐	**Continue walking the channel cross-section. Record characteristics of the low terrace.** Characteristics of the low terrace: Average sediment texture: ________ Total veg cover: ____ % Tree: ____ % Shrub: ____ % Herb: ____ % Community successional stage: ☐ NA ☐ Mid (herbaceous, shrubs, saplings) ☐ Early (herbaceous & seedlings) ☐ Late (herbaceous, shrubs, mature trees) Dominant species present: ________ Other: ☐ ________ ☐ ________ ☐ ________ ☐ ________
☐	**If characteristics used to delineate the active floodplain/low terrace boundary were deemed reliable, acquire boundary.** Active floodplain/low terrace boundary acquired via: ☐ Mapping on aerial photograph ☐ GPS ☐ Digitized on computer ☐ Other: ________

8-16-13

Project Heritage Bluffs II #2538

Drainage B

Stream type ephemeral

Length Source scaled project map

Mean Width Source field measurements

Measurements ≈ 10' intervals 24 total
21 measured + 3 not accessible

Army Corps

L	x	$\overline{W}$	= ft²	≈ acres
200'		5.83'	1167	.026 = 0.03

CA F+G

L	x	$\overline{W}$	= ft²	≈ acres
200'		9.3'	1843	.042 = 0.05

Additional Areas

3 points not accessible - boulders or dense brush

end 1:30 76°

#2538

B E Drainage 10' Intervals (CSS Halo)

	ACOE	CDFS	
1	4.5	8.0	
2	4.0	7.5	
3	8.5	8.5	
4	4.0	5.0	photo upstream (#3)
5	6.5	8.0	
6	10.5	10.5	
7	4.5	6.5	
8	3.0	4.0	
9	8.5	8.5	
10	Impenetrable	—	fern berry thicket 50'
11	8.5	13.0	
12	9.0	12.0	
13	8.0	12.5	
14	12.5	15.0	
15	9.0	11.0	
16	6.5	9.5 approx	
17	5.0	11.5	
18	Boulders	- impen.	
19	"	"	
20	5.5	10.0	small rocks
21	5.5	8.0	
22	3.0	7.0	
23	5.5	8.0	~~piles~~ piles of rocks } packrat nests
24	6.5	6.5	photo up & downstr. }

Project: Heritage Bluff II
Project Number: 2538
Stream: B
Investigator(s): Adams, Busdosh

Date: 9-13-13
Town:
Photo begin file#

Time: 10:30
State:
Photo end file#

Y ☑ / N ☐ Do normal circumstances exist on the site?

Y ☐ / N ☑ Is the site significantly disturbed?

Location Details: Trib B eastern portion of site
Projection: **Datum:**
Coordinates:

Notes: Largely normal circumstances. Some dumped rock, some junk

Brief site description:
Ephemeral drainage through chaparral. Distinct

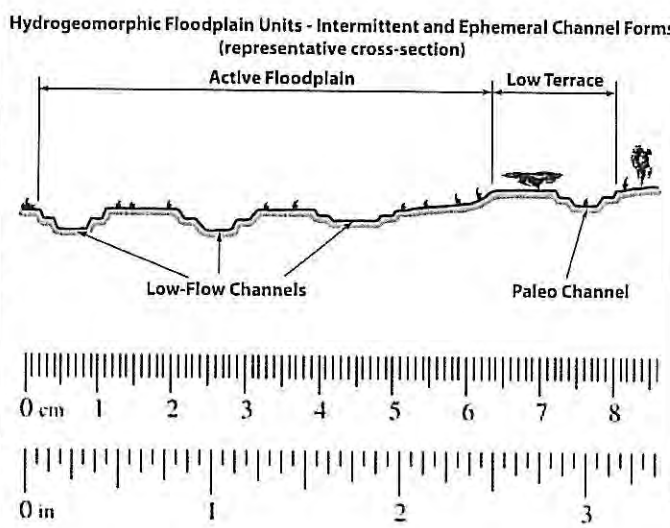
Checklist of resources (if available):

- ☑ Aerial photography
  Dates:
- ☑ Topographic maps
  Scale: 1:24000
- ☐ Geologic maps
- ☑ Vegetation maps
- ☑ Soils maps
- ☐ Rainfall/precipitation maps
- ☐ Existing delineation(s) for site
- ☐ Global positioning system (GPS)
- ☐ Other studies

- ☐ Stream gage data
  Gage number:
  Period of record:
  - ☐ Clinometer / level
  - ☐ History of recent effective discharges
  - ☐ Results of flood frequency analysis
  - ☐ Most recent shift-adjusted rating
  - ☐ Gage heights for 2-, 5-, 10-, and 25-year events and the most recent event exceeding a 5-year event

The dominant Wentworth size class that imparts a characteristic texture to each zone of a channel cross-section is recorded in the average sediment texture field under the characteristics section for the zone of interest.

Inches (in)		Millimeters (mm)	Wentworth size class	
			Boulder	Gravel
	10.08	256		
			Cobble	Gravel
	2.56	64		
			Pebble	Gravel
	0.157	4		
			Granule	Gravel
	0.079	2.00		
			Very coarse sand	Sand
	0.039	1.00		
			Coarse sand	Sand
	0.020	0.50		
			Medium sand	Sand
1/2	0.0098	0.25		
			Fine sand	Sand
1/4	0.005	0.125		
			Very fine sand	Sand
1/8	0.0025	0.0625		
			Coarse silt	Silt
1/16	0.0012	0.031		
			Medium silt	Silt
1/32	0.00061	0.0156		
			Fine silt	Silt
1/64	0.00031	0.0078		
			Very fine silt	Silt
1/128	0.00015	0.0039		
			Clay	Mud



B ①

☑	**Walk the channel and floodplain within the study area to get an impression of the vegetation and geomorphology present at the site. Record any potential anthropogenic influences on the channel system in "Notes" above.**
☑	**Locate the low-flow channel (lowest part of the channel). Record observations.** Characteristics of the low-flow channel: Average sediment texture: sandy, silty Total veg cover: 80 % Tree: ___ % Shrub: ___ % Herb: 80 % Community successional stage: ☑ NA ☐ Mid (herbaceous, shrubs, saplings) ☐ Early (herbaceous & seedlings) ☐ Late (herbaceous, shrubs, mature trees) Dominant species present: Brome grass, wild oat Other: ☑ yellow star thistle ☑ prickly sow thistle ☐ ☐
☑	**Walk away from the low-flow channel along cross-section. Record characteristics of the low-flow/active floodplain boundary.** Characteristics used to delineate the low-flow/active floodplain boundary: ☑ Change in total veg cover ☐ Tree ☑ Shrub ☐ Herb ☑ Change in overall vegetation maturity ☑ Change in dominant species present ☐ Other ☑ Presence of bed and bank ☑ Drift and/or debris ☐ Other: ___ ☐ Other: ___
☐	**Continue walking the channel cross-section. Record observations below.** Characteristics of the active floodplain: Average sediment texture: ___ Total veg cover: ___ % Tree: ___ % Shrub: ___ % Herb: ___ % Community successional stage: ☐ NA ☐ Mid (herbaceous, shrubs, saplings) ☐ Early (herbaceous & seedlings) ☐ Late (herbaceous, shrubs, mature trees) Dominant species present: ___ Other: ☐ ☐ ☐ ☐

B

☑	**Continue walking the channel cross-section. Record indicators of the active floodplain/low terrace boundary.** Characteristics used to delineate the active floodplain/ low terrace boundary: ☐ Change in average sediment texture ☐ Change in total veg cover ☐ Tree ☐ Shrub ☐ Herb ☐ Change in overall vegetation maturity ☑ Change in dominant species present laurel sumac, black sage, Artemesia buckwheat lemonade berry ☐ Other ☑ Presence of bed and bank ☐ Drift and/or debris ☐ Other: ________ ☐ Other: ________
☑	**Walk the active floodplain/low terrace boundary both upstream and downstream of the cross-section to verify that the indicators used to identify the transition are consistently associated the transition in both directions.** Consistency of indicators used to delineate the active floodplain/low terrace boundary: Y ☐ N ☑ Change in average sediment texture Y ☑ N ☐ Change in total veg cover ☐ Tree ☑ Shrub ☐ Herb Y ☑ N ☐ Change in overall vegetation maturity Y ☑ N ☐ Change in dominant species present Y ☐ N ☐ Other: Y ☑ N ☐ Presence of bed and bank Y ☐ N ☐ Drift and/or debris Y ☐ N ☐ Other: ________ Y ☐ N ☐ Other: ________
☐	**If the characteristics used to delineate the active floodplain/low terrace boundary were NOT consistently associated with the transition in both the upstream and downstream directions, repeat all steps above.**
☐	**Continue walking the channel cross-section. Record characteristics of the low terrace.** Characteristics of the low terrace: Average sediment texture: ________ Total veg cover: ____ % Tree: ____ % Shrub: ____ % Herb: ____ % Community successional stage: ☐ NA ☐ Mid (herbaceous, shrubs, saplings) ☐ Early (herbaceous & seedlings) ☐ Late (herbaceous, shrubs, mature trees) Dominant species present: ________ Other: ☐ ________ ☐ ________ ☐ ________ ☐ ________
☐	**If characteristics used to delineate the active floodplain/low terrace boundary were deemed reliable, acquire boundary.** Active floodplain/low terrace boundary acquired via: ☐ Mapping on aerial photograph ☐ GPS ☐ Digitized on computer ☐ Other: ________

APPENDIX 9

GEOSOILS STUDY

EVALUATION OF SOIL PROPERTIES AND POTENTIAL IMPACT OF PROPOSED DEVELOPMENT ON AN OCCURRENCE OF *BRODIAEA FILIFOLIA* ADJACENT TO LOTS 127-134, VTN NO. 1193244 PROPOSED HERITAGE BLUFFS II, RANCHO BERNARDO AREA SAN DIEGO, CALIFORNIA

FOR

STANDARD PACIFIC HOMES, SAN DIEGO
16010 CAMINO DEL SUR
SAN DIEGO, CALIFORNIA 92127

W.O. 6747-A-SC JULY 31, 2014

GeoSoils, Inc.

Geotechnical • Geologic • Coastal • Environmental

5741 Palmer Way • Carlsbad, California 92010 • (760) 438-3155 • FAX (760) 931-0915 • www.geosoilsinc.com

July 31, 2014

W.O. 6747-A-SC

Standard Pacific Homes, San Diego
16010 Camino Del Sur
San Diego, California 92127

Attention: Mr. William M. Dumka, Vice-President of Forward Planning

Subject: Evaluation of Soil Properties and Potential Impact of Proposed Development on an Occurrence of *Brodiaea Filifolia*, Adjacent to Lots 127-134, VTM No. 1193244 Proposed Heritage Bluffs II, Rancho Bernardo Area, San Diego, California.

Dear Mr. Dumka:

In accordance with your request, GeoSoils, Inc. (GSI) has prepared this report of soil conditions and potential impacts of the proposed development on an occurrence of *Brodiaea Filifolia* at the subject site. The scope of our services has included a review of the referenced documents (see Appendix A), field exploration, laboratory testing of representative samples collected, analysis of data, and preparation of this report. Four (4) test pits excavations were completed at various locations, identified by the project botanical consultant, in order to expose and evaluate geomorphic conditions, soil stratigraphy and soil (pedon) profiles in what appears to be both favorable, and unfavorable areas for *B. filifolia* occurrence onsite (as presented by the project botanical consultant).

Based on our review of the plans and documents provided, GSI understands that the proposed development will potentially include a fill slope that descends from Lots 127 through 134 to the edge of the *B. filifolia* occurrence area. The resource agencies have expressed concern that development around the *B. filifolia* occurrence will result in changes to the conditions conducive to plant preservation, or may be otherwise detrimental to the plant. The purpose of this report was to evaluate the geomorphic, soils, and hydrogeologic conditions in the favorable vs. unfavorable areas for *B. filifolia*, in light of the agency concern.

PREVIOUS WORK

A preliminary geotechnical evaluation was performed for the site by Geocon, Inc. ([GI], 2007). This evaluation included subsurface exploration, laboratory testing of representative soil samples, and the presentation of findings, conclusions, and recommendations regarding the development of the proposed residential construction, from a geotechnical viewpoint. That report was reviewed for geologic information pertinent to this current study. GI (2007) identified site soils consisting of colluvium/topsoil overlying surficial alluvium, Cretaceous fanglomerate, and metavolcanic rock belonging to the Santiago Peak Volcanics.

FIELD STUDIES

Site-specific field studies were conducted by GSI on June 25, and June 27, 2014, consisting of reconnaissance geologic mapping and the excavation of four (4) exploratory test pit excavations with hand equipment, for an evaluation of near-surface soil and geologic conditions onsite. The test pits were logged by an engineering geologist from GSI, who collected representative bulk and undisturbed soil samples for appropriate laboratory testing. The logs of the test pits are presented in Appendix B. The approximate location of the test pits are presented on the Geologic Map (see plate 1), which uses a topographic/grading plan provided by Project Design Consultants (PDS), as a base.

SOIL AND GEOLOGIC CONDITIONS

Site Geology

Current literature regarding the general geology of the site is variable. A review of Kennedy and Tan (2005, 2008), and Kennedy (1975) indicates that bedrock underlying the site consists of Eocene-age bedrock, belonging to the Friars formation. A review of the USDA Soil Survey (USDA; 1973, 2014) indicates that the underlying "parent material," or bedrock, consists of Jurassic-age metavolcanic bedrock, belonging to the Santiago Peak Volcanics. GI (2007, 2014a) describes bedrock in the area as both the Santiago Peak Volcanics Formation, and Cretaceous-age fanglomerate/fanglomerate deposits.

Based on our evaluation, including a review of the aforementioned regional documents and onsite work by GI (2007, 2014a) and GSI, it is our opinion that the fanglomerate of GI (2007, 2014a), are sediments that belong to the Cretaceous-age Lusardi Formation, which is described as a "Cretaceous fanglomerate" in current regional mapping (Todd, 2004; Kennedy and Tan, 2005, 2008). Furthermore, the mapped contact between the Friars Formation and the overlying Eocene-age Stadium conglomerate generally occurs at elevations less than approximately 500 feet mean sea level (MSL), north of Bernardo Center/Carmel Valley Roads (Kennedy and Tan, 2008), with regional mapping indicating a gentle westward dip on the order of 2 degrees. Where the site is located to the south of Bernardo Center/Carmel Valley Roads, the elevations of the Lusardi deposits are generally greater than 600 feet MSL. This topographic discontinuity does not lend to the extension of the Friars deposits south of the aforementioned roadways, based on stratigraphic position and known structure. It should be noted that local faulting, which would explain the difference in elevation, was not noted, nor mapped in the nearby area or vicinity. Bedrock underlying the surficial deposits (discussed below), and the Lusardi Formation, both at depth and discontinuously at the surface, is the Santiago Peak Volcanics, now termed undivided Metasedimentary and metavolcanic rocks of Mesozoic-age, by Kennedy and Tan (2005, 2008).

As a result of weathering over geologic time, colluvium (sometimes termed topsoil) is developed on the exposed Lusardi Formation and Santiago Peak Volcanics, imprinting a soil profile mantle on those rocks, extending over most of the study area. Other surficial deposits of undifferentiated colluvium/alluvium and colluvium/slope wash are present onsite, but *B. filifolia* does not occur there.

Groundwater

Our review of GI (2007) indicates that groundwater was not encountered to the depths explored (i.e., 22 feet below surface grades). The site occurs at a relatively high topographic position in the area (i.e., 600 to 700 feet MSL), relative to the adjacent, major drainage, located down slope at elevations less than approximately 500 feet MSL. Seasonal, perched water conditions may develop within the adjacent drainages, however, the apparent range of *B. filifolia* in the area appears to be well above any adjacent drainage.

Groundwater was not encountered, nor observed as seeps/springs in the immediate vicinity by GSI. It should be noted that the potential for wet soils and seepage discussed in GI (2007) is related to the potential infiltration of storm water and the creation of seasonal "perched" groundwater conditions within adjacent drainages, and not due to a pervasive groundwater occurrence at shallow depths. Furthermore, as discussed herein, calcium carbonate deposits (commonly referred to as "caliche"), were not observed in the soil profile within the *B. filifolia* occurrence area, and thus there were no indications of a semi-static shallow groundwater table, or infiltration from the surface, under current climatic conditions. Furthermore, there were no signs of a gaining stream in the drainages, also indicative of relative deep groundwater conditions.

Soil Profiles/Pedons

Regional Mapping

An evaluation of regional soil mapping (USDA; 1973, 2014) indicates that the site is underlain by the Auld Clay Series. The Auld series typically consists of well drained clays that are underlain by metavolcanic rock," and "in a representative profile, the surface layer is reddish brown,... and about 37 inches thick." However, the Auld series soils typically display reddish "hues," brighter "values" and stronger "chromas," such as 5YR, 4/4 (Munsell, 1988), relative to actual site soils, observed to display more yellowish hues, darker values, and weaker chromas, such as 10YR, 2/2 (Munsell, 1988). Furthermore, parent materials (bedrock) noted for the Auld series are described as metavolcanic rock, which differs from the fanglomerate deposits underlying most of the study area.

Based on general dissimilarities between the mapped Auld series and the soil profiles, or "pedons" observed onsite, site soils more likely belong to a different "soil series." Based on a review of USDA (1973), including soils mapped on similar parent material in the region, site soils appear to be better associated with the Diablo Clay Series, or Diablo-Olivehain Complex Series (USDA, 1973), which are also mapped in the vicinity. All of the aforementioned soils series fall into hydrologic soil "Group D," have very low infiltration rates, and high runoff potential (USDA, 1973). That is to say, while overland flow may be present, it largely does not infiltrate into these soils, and thus, would contribute little, if any, to the availability of water for *B. filifolia*.

Parent Material

All soil profiles, or "pedons" evaluated appear to share similar parent material (i.e., Cretaceous-age Fanglomerate [herein termed Lusardi Formation], or Santiago Peak Volcanics), consisting of a clay with sand and variable amounts of gravel/cobble (see Figure 1). A review of site geology (see the attached Plate 1) indicates that *B. filifolia* occurrence in the study area appears to prefer soils formed on the Lusardi Formation, and not on the other soil deposits/formations or bedrock in the area.

Pedon Thickness

Pedon thickness generally ranges from 20 to 34 inches (see Figure 2). *B. filifolia* appears to favor a thicker pedon which extends below the species' range of corm depth, as noted by the project botanical consultant, to normally be between approximately 6 and 18 inches below the surface.

Texture

All pedons appear to be high in clay content, with clay contents ranging from approximately 45 percent to 62 percent. *B. filifolia* appears to prefer clay contents in excess of about 50 percent. Conversely, pedons with a relatively higher percentage of sand and gravel do not appear to support *B. filifolia*.

Pedons contain variable amounts of gravel- to cobble-size rock fragments within the upper 12 to 18 inches from surface grades, and *B. filifolia* appears to favor less rock material. In general, the occurrence of rock material, as evidenced by the greater percentage of gravel to boulder size surface "float," appears greater within the upper, more gently (flatter) sloping portions of the study area, including areas located near the crest of a ridge line, as the ridge line descends out of the study area to the north (see Figure 3). Plate 1 shows the approximate distribution of relatively "rocky" near surface soils where *B. filifolia* does not occur. Gradation analysis and Atterberg limits of selected soil samples are presented in Appendix C.

Figure 1
Soil pedon with parent material “fanglomerate” exposed at botton. Note: rounded cobbles near bottom of image. (Test Pit TP-4 West Side)

Figure 2
Pedon Thickness of approximately 34 inches, as observed in Test Pit TP-2.

GeoSoils, Inc.

SITE PHOTOGRAPHS

DATE 07/2014

W.O. NO. 6747-A-SC

Geotechnical · Geologic · Coastal · Environmental

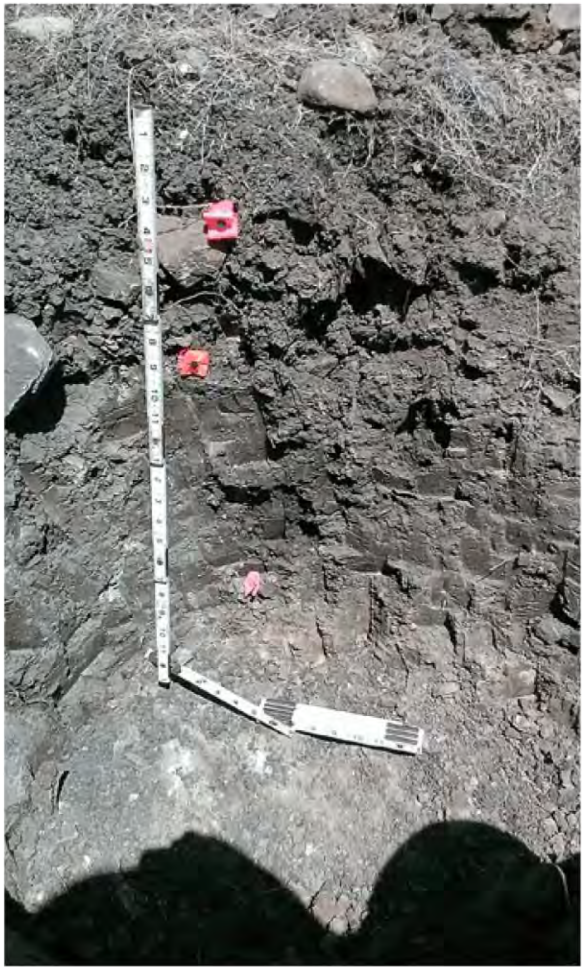


Figure 3
Gravel to cobble size rock fragments exposed in Test Pit TP-3. The transition for dessicated, granular to medium subangular, and underlying “massive” structure is indicated at approximately 9 inches on the scale. Please note that this transition is deeper on the opposite side of the pit, as indicated on the log for TP-3.

Figure 4
Gravel to cobble size rock fragments exposed in Test Pit TP-4.

GeoSoils, Inc.

SITE PHOTOGRAPHS

DATE 07/2014

W.O. NO. 6747-A-SC

Geotechnical · Geologic · Coastal · Environmental

Structure

The upper 0 to 5 inches of all pedons are coarse granular, becoming medium sub-angular blocky to approximate depths of 10 to 13 inches below surface grades. The upper zone is also desiccated, with common open dessication cracks to the surface. Below the 10 to 13 inch depth, soils are generally massive, which appears to correlate with a greater soil moisture content at depth (see Figure 4).

Soil Moisture

The upper 10 to 13 inches of all pedons are relatively dry and desiccated, becoming moist with depth. Open cracks to the surface are common. Moisture profiles generally range from relatively dry/damp (5 percent to 13 percent moisture) within the desiccated zone, becoming moist to wet (moisture contents ranging from approximately 14 percent to 18 percent) with depth. Soil has a finite capacity to absorb water, and this appears to be the case below the dessication zone. Soil moisture and field density evaluation for selected samples are presented on the Test Pit Logs in Appendix B. The degree of saturation, generally evaluated between depths of 4 to 29 inches typically ranges from 52 percent, up to approximately 73 percent with depth (see Appendix B).

Geobotany

As discussed previously, *B. filifolia* appears to prefer clayey soils formed on the Lusardi Formation, relative to other soil deposits/formations or bedrock in the area (see Plate 1). A review of soil profile/pedon information (Appendix B), and consultations with the project botanical consultant also suggest that *B. filifolia* prefer soils with relatively less rock material within the near surface (i.e., upper 18 inches) portion of the pedon. Geobotanical mapping by this office (see Plate 1) shows the general distribution of soils with an apparent "rocky" near surface soil component (i.e., soils containing a relatively greater percentage of gravel to boulder size rock fragments) in the study area, relative to the observed locations of *B. filifolia*. As can be seen from Plate 1, *B. filifolia* growth does not appear to be supported on these "rocky" soils.

The study area generally appears to support a growth of grasses, fennel, artichoke thistle, and stunted shrubs. Based on our observations, vigorous shrub growth generally appears to be confined within the upper portion of the site, in areas underlain with metavolcanic bedrock and generally outside areas where clay rich soils have developed. Smaller shrubs were also noted within areas of "rocky" near surface soil zones formed on the Lusardi formation, but not within areas of clayey soil, with few rocks (i.e., *B. filifolia* areas). Thistle is relatively ubiquitous throughout the study area, and is known for out competing native vegetation and can exclude shrubs, herbaceous plants and grasses at high densities (California Invasive Plant Council, 2014).

Topography

The study area is an active geomorphic surface. Soils developed on low gradient slopes typically exhibit a cumulic profile. Slope gradients in the area range from relatively flat lying to steeply sloping. Based on the distribution of *B. filifolia* shown on plan (attached Plate 1), This species appears to favor slope gradients on the order of 5 to 10 percent (per PDS Slope Analysis [July 30, 2014). The flatter, upper elevations of the site, and the broad, low gradient swales in the area do not appear favorable to *B. filifolia*.

Hydrology-Hydrogeology

An examination of the topography (see Plate 1) in the area, indicates that the local gradient associated with the *B. filifolia* occurrence, has little, if any, potential to contribute to overland flow, since these internal basins are terminated up-gradient by divides, which are also shown on Plate 1. Evidence of the lateral migration of subsurface water (i.e., seeps, oxidized seams, etc.) were not noted in any of the pedons. Evidence of significant surface runoff (overland flow) within the mapped *B. filifolia* occurrence area, such as rills, gullies, particle/grain translocation, or other significant mass movement of earth material, was not observed.

Based on our evaluation, it appears that precipitation enters the surface locally, and saturates loose surficial soils, fills the near-surface open dessication cracks within the upper 12 to 13 inches, until the clay expands and the cracks become sealed, where the growing area is then kept relatively moist through the rainy season and additional near vertical infiltration of storm water can periodically occur, but only close to the surface. Below the dessication zone, the moisture content is relatively constant in the soil profile. There was no evidence to support significant infiltration deeper than the dessication cracks in the colluvium, under current climatic conditions.

PDS (2014) has provided an exhibit that shows the tributary drainage that is removed for one stand of *B. filifolia* that might possibly be affected by the proposed grading. This area is depicted on Plate 1, and shows that 0.03 acres of tributary drainage is potentially affecting this stand. The “Q” value for the 100-year event (± 4 inches/hr.), has been provided by PDS as 0.12 cubic feet per second (cfs) for this particular area.

In a recent study in southern California, the USGS estimated that approximately 5 to 30% of applied water passes through the root zone (Hanson, et al., 2003). Burrows (1995) indicated that infiltration is about 15% of precipitation. Considering that the soil profile is clay, and more properly termed an aquiclude, it is reasonably assumed that precipitation that arrives via overland flow (runoff) that will be available to the root zone through infiltration is 10%. Thus, in a 100 year event, only 10% of the 0.12 cfs would conceivably be available for infiltration, and therefore potentially removed for this stand of *B. filifolia*. This is equivalent to 0.012 cfs, or a volume of about 43.6 cubic feet of water in an hour (±326 gallons) in the area potentially removed by the proposed grading. Of course, this assumes that there is some communication or transmission in the subsurface between topographically up-gradient areas and the stand of *B. filifolia*; considering the field evidence and the capacity to transmit water is low, perhaps on the order of 0.06 inches per hour, this is not significant. We note that for smaller amounts of precipitation, this value of 43.6 cubic feet would be even lower, and even more insignificant.

Estimated Age of Pedons

Owing to the soil development and general lack of rubification/oxidation, and presence on an active geomorphic surface, similar soils have been estimated to range from 1,000 to perhaps as much as 4,000 years old (Birkeland, 1999). Significantly, the lack of even Stage 1 development of calcium carbonate accumulation (similar to hard water deposits), attests to the lack of surface water infiltration in the soil profile in the study area, also indicating climatic conditions of a young age, similar to the present. In contrast, where locally present, some of the calcium carbonate deposits in the Lusardi Formation and Santiago Peak Volcanics attest to a deeper weathering zone, indicative of a past climate that was wetter than the semi-arid conditions of today.

Other

Soils/pedons are normally locally heavily burrowed by burrowing animals, such as pocket gophers (Thomomys) at the surface. Evidence of burrowing activity within any of the test pits was not noted.

CONCLUSIONS

Based on our review, field exploration, laboratory testing, and analyses, GSI concludes that the proposed grading has little, if any, potential to affect the soils or hydrology in a way that would be detrimental to the *B. filifolia* occurrence in the study area, from a geologic and hydrogeologic viewpoint, provided our recommendations are properly implemented. Specifically, the following conclusions are presented:

- The project botanical consultant has indicated that, based on his experience, soils exposed within Test Pit TP-2 appear to be the most favorable for *B. filifolia*. Test Pit TP-2 was also in closest physical proximity to know strands of *B. filifolia*. Significant differences between Test Pit TP-2, contrasted to the other test pits, or areas that do not appear to support *B. filifolia*, appear to be: (1) a greater overall pedon thickness; (2) minimal sand/gravels/cobble fraction; (3) underlying parent material (Lusardi Formation); and, (4) a slope gradient typically of about 5 to 10 percent.

- Pedon thickness generally ranges from 20 to 34 inches, and *B. filifolia* appears to favor a thicker pedon which extends below the species range of corm depth, noted as between approximately 6 to 18 inches.

- All pedons appear to be high in clay content, with clay contents ranging from approximately 45 percent to 62 percent. *B. filifolia* appears to prefer clay contents in excess of about 50 percent. Conversely, pedons with a relatively higher percentage of sand and gravel do not appear favorable for this species.

- The amount of potential precipitation available for runoff (overland flow) and subsequent infiltration for *B. filifolia* nourishment, that would be modified by the proposed grading, is insignificant.

- USDA mapping of soils indicates that the capacity to transmit water is low, 0.06 to 0.2 inches/hour, in the pedon favorable for *B. filifolia* growth. Given the clay content, the lower number appears more realistic. This is supported by the lack of calcium carbonate accumulation in the soil profiles evaluated by GSI.

- Regional groundwater is deep, probably more than 50 feet from the surface. There was no evidence of groundwater occurring in the Lusardi Formation or joints/fractures of the bedrock. The indurated nature of the Lusard Formation, crystalline nature of the bedrock, and clay content of the colluvium are not conducive to the transmission of groundwater within or near the zone in the soil profile know to support *B. filifolia* corms.

- *B. filifolia* appears to prefer pedons formed on parent material belonging to the Lusardi Formation. All pedons formed on the Lusardi Formation (Map symbol Kl) were evaluated to have similar clay contents. The pedon within TP-1 (outside of the mapped occurrence of *B. filifolia*), is formed on parent material belonging to the Santiago Peak Volcanics (map symbol - Jsp), and exhibits the relatively lowest clay content.

- Geobotanical mapping indicates that *B. filifolia* generally appear to coexist with grasses and non-native thistles, but appear to not occur in areas supporting non-native fennel. Both thistle and fennel in the study area are non-native, invasive plant species that can adversely affect *B. filifolia* range in the study area.

- Slope gradients in the area range from relatively flay lying to steeply sloping. Based on the distribution of *B. filifolia* shown on plan (attached Plate 1), this species appears to favor slope gradients on the order of 6½ to 8½ percent. Conversely, flat areas of the site, or drainage swales do not appear favorable.

- Evidence of the lateral migration of subsurface water (i.e., seeps, oxidized seams, etc.) was not noted in any of the pedons, and evidence of significant surface runoff (such as rills, gullies, particle/grain translocation, etc.) was not noted. As such, it appears that storm water enters the surface locally, and saturates loose surficial soils, fills the near-surface open dessication cracks within the upper 12 to 13 inches, until the clay expands and the cracks become sealed, where the growing area is then kept relatively moist through the rainy season and into the spring/early summer. Additional near-vertical infiltration of storm water can periodically occur during this period, but the volume of water is very small.

- The proposed grading has little, if any, affect on local overland flow to influence the *B. filifolia* occurrence in the study area, based on basin divides and localized subdivides, as shown on Plate 1. Furthermore, after the dessication cracks have initially expanded, and sealed, overland flow has little, if any, effect on infiltration into the soil profile.

RECOMMENDATIONS

In order to mitigate potential impacts from the proposed development, the following preliminary recommendations are provided:

- Provide a self-cleaning concrete drainage ditch along the toe of any adjacent graded slope descending to the area supporting *B. filifolia* in order to mitigate the influx of any additional runoff into the area.

- Provide a "toe" drain to intercept subsurface water generated from the irrigation of graded slopes in order to mitigate the influx of any additional subsurface flow into the area.

- The planned "preservation" area(s), to be determined by others, should not be altered. Irrigation, adverse foot traffic, or equipment storage/operation (which could result in the excessive saturation and/or compaction of surficial soils) should not be permitted.

- Invasive, non-native thistle and fennel species in the study area can adversely affect *B. filifolia* range, as well as other native plants. Consideration should be given to an appropriate non-native plant eradication program.

- Since *B. filifolia* is generally considered as a food source for rodents, ground squirrels, etc., consideration should be given to establishing a rodent control program to keep densities low in areas adjoining the preserve.

CLOSURE

Inasmuch as our limited study is based upon our review and engineering analyses, the conclusions and recommendations are professional opinions. These opinions have been derived in accordance with current standards of practice, and no warranty, either express or implied, is given. Standards of practice are subject to change with time. This report brings to completion our scope of services.

The opportunity to be of service is sincerely appreciated. If you should have any questions, please do not hesitate to contact our office.

Respectfully submitted,

GeoSoils, Inc.

Robert G. Crisman
Engineering Geologist, CEG 1934

John P. Franklin
Engineering Geologist, CEG 1340
Certified HydroGeologist, CHG 532

RGC/JPF/jh

Attachment: Appendix A - References
Appendix B - Test Pit Logs
Appendix C - Laboratory Data
Plate 1 - Geologic Map

Distribution: (4) Addressee

<u>APPENDIX A</u>

REFERENCES

APPENDIX A

REFERENCES

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APPENDIX B

TEST EXCAVATION LOGS

UNIFIED SOIL CLASSIFICATION SYSTEM				
Major Divisions			Group Symbols	Typical Names
Coarse-Grained Soils More than 50% retained on No. 200 sieve	Gravels 50% or more of coarse fraction retained on No. 4 sieve	Clean Gravels	GW	Well-graded gravels and gravel-sand mixtures, little or no fines
			GP	Poorly graded gravels and gravel-sand mixtures, little or no fines
		Gravel with	GM	Silty gravels gravel-sand-silt mixtures
			GC	Clayey gravels, gravel-sand-clay mixtures
	Sands more than 50% of coarse fraction passes No. 4 sieve	Clean Sands	SW	Well-graded sands and gravelly sands, little or no fines
			SP	Poorly graded sands and gravelly sands, little or no fines
		Sands with Fines	SM	Silty sands, sand-silt mixtures
			SC	Clayey sands, sand-clay mixtures
Fine-Grained Soils 50% or more passes No. 200 sieve	Silts and Clays Liquid limit 50% or less		ML	Inorganic silts, very fine sands, rock flour, silty or clayey fine sands
			CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays
			OL	Organic silts and organic silty clays of low plasticity
	Silts and Clays Liquid limit greater than 50%		MH	Inorganic silts, micaceous or diatomaceous fine sands or silts, elastic silts
			CH	Inorganic clays of high plasticity, fat clays
			OH	Organic clays of medium to high plasticity
Highly Organic Soils			PT	Peat, mucic, and other highly organic soils

CONSISTENCY OR RELATIVE DENSITY

CRITERIA

Standard Penetration Test

Penetration Resistance N (blows/ft)	Relative Density
0 - 4	Very loose
4 - 10	Loose
10 - 30	Medium
30 - 50	Dense
> 50	Very dense

Standard Penetration Test

Penetration Resistance N (blows/ft)	Consistency	Unconfined Compressive Strength (tons/ft^2)
<2	Very Soft	<0.25
2 - 4	Soft	0.25 - .050
4 - 8	Medium	0.50 - 1.00
8 - 15	Stiff	1.00 - 2.00
15 - 30	Very Stiff	2.00 - 4.00
>30	Hard	>4.00

		3"	3/4"	#4	#10	#40	#200 U.S. Standard Sieve
Unified Soil Classification	Cobbles	Gravel		Sand			Silt or Clay
		coarse	fine	coarse	medium	fine	

MOISTURE CONDITIONS

Dry	Absence of moisture: dusty, dry to the touch
Slightly Moist	Below optimum moisture content for compaction
Moist	Near optimum moisture content
Very Moist	Above optimum moisture content
Wet	Visible free water; below water table

MATERIAL QUANTITY

trace	0 - 5 %
few	5 - 10 %
little	10 - 25 %
some	25 - 45 %

OTHER SYMBOLS

C	Core Sample
S	SPT Sample
B	Bulk Sample
–	Groundwater
Qp	Pocket Penetrometer

BASIC LOG FORMAT:
Group name, Group symbol, (grain size), color, moisture, consistency or relative density. Additional comments: odor, presence of roots, mica, gypsum, coarse grained particles, etc.

EXAMPLE:
Sand (SP), fine to medium grained, brown, moist, loose, trace silt, little fine gravel, few cobbles up to 4" in size, some hair roots and rootlets.

GeoSoils, Inc.

W.O. 6747-A
Standard Pacific
Heritage II
Logged By: RGC
June 27, 2014

LOG OF EXPLORATORY TEST PITS

TEST PIT NO.	ELEV. (ft.)	DEPTH (in.)	GROUP SYMBOL	SAMPLE DEPTH (in.)	MOISTURE (%)	FIELD DRY DENSITY (pcf)	DEGREE SATURATION (%)	DESCRIPTION
TP-1	704	0-5	CL/CH (Soil "A" Horizon)	0-5	7.7	--		CLAY with SAND, dark gray (10YR, 4/1), dry slightly sticky, slightly plastic, weak medium to coarse granular, abrupt smooth contact, sand dessicated, pinhole porosity, many roots.
		5-20	CH (Soil "B" Horizon)	5-20	12.2	--		CLAY with gravel, very dark gray brown (10YR, 3/2), dry to damp, sticky, plastic, strong medium sub angular blocky, abrupt smooth contact, many sub angular to sub rounded gravels of metavolcanic rock, few roots, pressure faces on peds.
		@ 20	Rock					Refusal on hard rock (boulder?) across entire test pit bottom, noted several small to large boulders of metavolcanic rock at the surface in the vicinity.
								Total Depth = 20" Slope = 3½% No Groundwater/Caving Encountered Backfilled 6/27/14

GeoSoils, Inc.

W.O. 6747-A
Standard Pacific
Heritage II
Logged By: RGC
June 27, 2014

LOG OF EXPLORATORY TEST PITS

TEST PIT NO.	ELEV. (ft.)	DEPTH (in.)	GROUP SYMBOL	SAMPLE DEPTH (in.)	MOISTURE (%)	FIELD DRY DENSITY (pcf)	DEGREE SATURATION (%)	DESCRIPTION
TP-2	660	0-4	CL/CH (Soil "A" Horizon)	0-4	6.8			CLAY with SAND, dark gray (10YR, 4/1), dry, slightly sticky, slightly plastic, weak medium to coarse grained granular, abrupt smooth contact, dessicated, pinhole porosity, TRACE sub angular gravel, many roots.
		4-10	CH (Soil "Bh" Horizon)	4-10	7.8	118.8	52.5	CLAY with SAND, very dark gray (10YR, 3/1) to black (10YR, 2/1), damp, sticky, plastic, strong medium sub angular blocky, gradual smooth contact, few visible SILT films, dessicated, very few sub angular to sub rounded gravels on metavolcanic rock, some roots. Pressure faces on peds.
		10-29	CH (Soil "B" Horizon)	12-24 24-26	13.8 16.5	109.4 --	71.2 --	CLAY, very dark brown (10, 2/2) to black (10YR, 2/1), moist, sticky, plastic, massive, gradual smooth contact, some sub rounded to sub angular gravels, trace roots.
		29-34	CH (Soil "BC" Horizon)					CLAY with SAND, dark brown (10YR, 4/2), moist, sticky, plastic, massive, gradual smooth contact.
		34-36	SC/CL (Soil "C" Horizon)	34-36	18.4			SANDY CLAY, dark yellowish brown (10YR, 4/4), damp to moist, sticky, slightly plastic, many (10%) sub angular coarse gravels .
								Total Depth = 36" Slope = 8½% No Groundwater/Caving Encountered Backfilled 6/27/14

GeoSoils, Inc.

W.O. 6747-A
Standard Pacific
Heritage II
Logged By: RGC
June 27, 2014

LOG OF EXPLORATORY TEST PITS

TEST PIT NO.	ELEV. (ft.)	DEPTH (in.)	GROUP SYMBOL	SAMPLE DEPTH (in.)	MOISTURE (%)	FIELD DRY DENSITY (pcf)	DEGREE SATURATION (%)	DESCRIPTION
TP-3	661	0-4	CL/CH (Soil "A" Horizon)	0-4	5.0			CLAY with SAND, dark grayish brown, dry (10YR, 4/2), slightly sticky, slightly plastic, weak medium to coarse granular, no CLAY films, abrupt smooth contact, dessicated, pinhole porosity, many roots.
		4-13	CH (Soil "Bw" Horizon)	4-12	12.5	108.5	63.1	CLAY with SAND and COBBLES, dark brown (7.5YR, 3/2), to very dark grayish brown (10YR, 3/2), dry, slightly sticky, slightly plastic/plastic, strong medium sub angular, blocky, few thin films on clasts, abrupt wavy contact, dessicated 20% sub angular to sub round gravel and cobble of metavolcanic rock, few roots.
		13-24	CH (Soil "B" Horizon)	16-18	15.3	102.0	65.2	CLAY, very dark grayish brown (10YR, 3/2), moist, sticky, plastic, massive, TRACE round gravels, slightly moist to moist, no visible porosity, trace fine roots.
		24-30	SC/CL (Soil "C" Horizon)	24-26	18.4			SANDY CLAY, mottled dark yellowish brown (10YR, 4/6), to brown (10YR, 4/3), and olive brown (2.5Y, 4/4), moist, sticky, slightly plastic, massive, few sub rounded cobble and gravels Of metavolcanic rock.
								Total Depth = 30" Slope = 10% No Groundwater/Caving Encountered Backfilled 6/27/14

GeoSoils, Inc.

W.O. 6747-A
Standard Pacific
Heritage II
Logged By: RGC
June 27, 2014

LOG OF EXPLORATORY TEST PITS

TEST PIT NO.	ELEV. (ft.)	DEPTH (in.)	GROUP SYMBOL	SAMPLE DEPTH (in.)	MOISTURE (%)	FIELD DRY DENSITY (pcf)	DEGREE SATURATION (%)	DESCRIPTION
TP-4	685	0-4	CL/CH (Soil “A” Horizon)		--	--	--	CLAY with SAND, dark grayish brown (10 YR, 4/2), dry, slightly sticky, slightly plastic, weak medium to coarse granular, abrupt smooth contact, dessicated, pinhole porosity, many roots.
		4-13	CL/CH (Soil “Bh” Horizon)	4-13	13.0	108.1	64.8	CLAY, very dark brown (10 YR, 2/2), dry-damp, sticky, plastic, strong medium sub angular blocky, no CLAY films, weak SILT caps, abrupt smooth contact, dessicated, few sub rounded gravels, few roots. Pressure faces on peds.
		13-28	CH (Soil “B” Horizon)	13-28	14.6	108.4	73.3	CLAY, very dark brown (10 YR, 3/3), moist, sticky, plastic massive, gradual smooth contact.
		28-36	SC/CL (Soil “C” Horizon)	28-36	15.2	--	--	SANDY CLAY, mottled dark brown (10 YR, 3/3) to dark brown/strong brown (7.5 YR, 4/5), moist, massive, few sub rounded to sub angular gravel and cobbles.
								Total Depth = 36" Slope = 7% No Groundwater/Caving Encountered Backfilled 6/27/14

APPENDIX C

LABORATORY TESTING

APPENDIX C

LABORATORY TESTING

Laboratory tests were performed on representative samples of site earth materials collected during our subsurface exploration in order to evaluate their physical characteristics. Test procedures used and results obtained are presented below.

Classification

Soils were visually classified with respect to the Unified Soil Classification System (U.S.C.S.) in general accordance with ASTM D 2487 and D 2488. The soil classifications of the onsite soils are provided on the Test Pit Logs in Appendix B.

Moisture-Density Relations

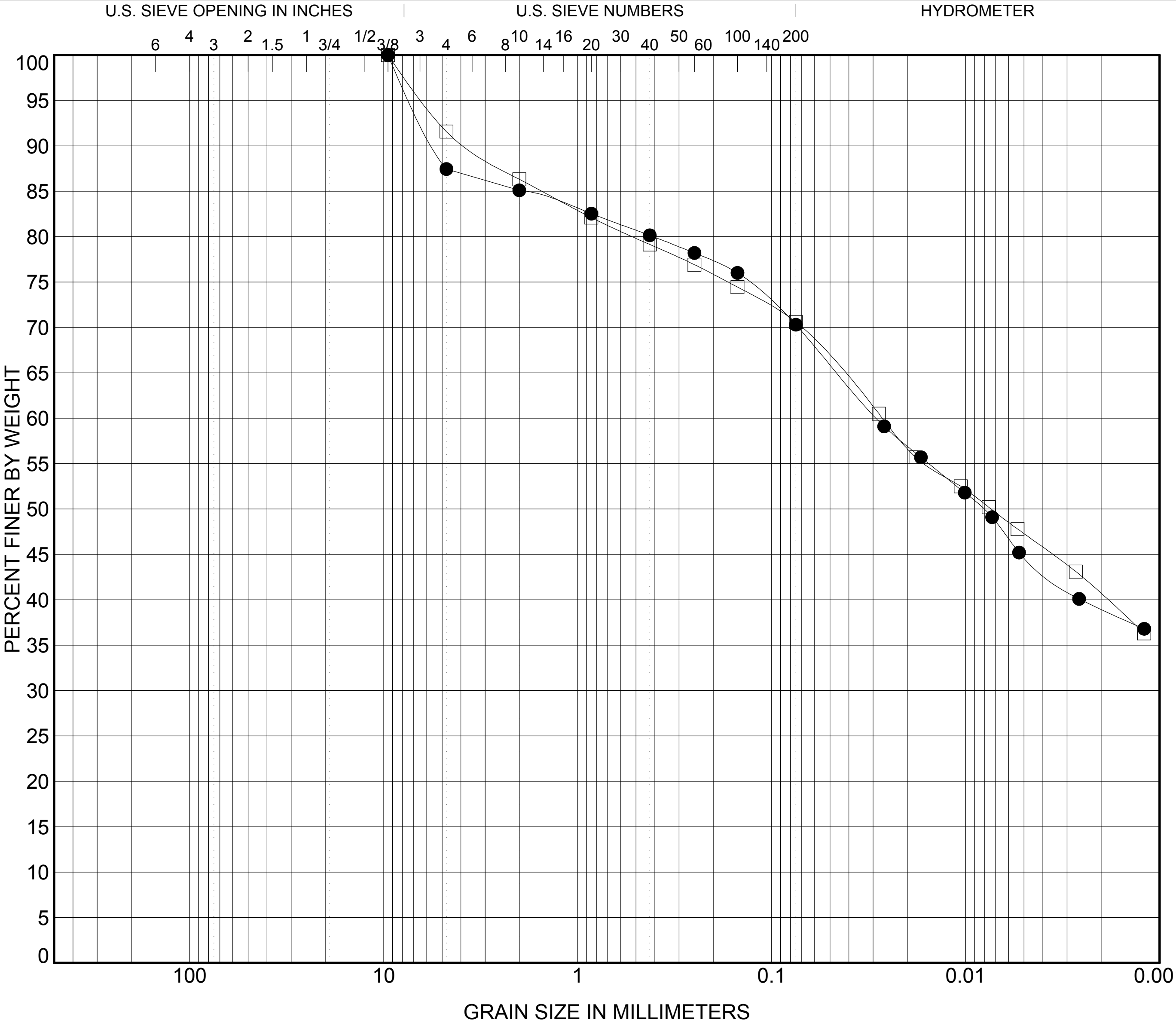
The field moisture contents and dry unit weights were determined for selected samples in the laboratory. Testing was performed in general accordance with ASTM D 2937 and ASTM D 2216. The dry unit weight was determined in pounds per cubic foot (pcf), and the field moisture content was determined as a percentage of the dry weight. The results of these tests are shown on the Test Pit Logs in Appendix B.

Grain-Size Distribution

An evaluation was performed on a selected representative soil sample in general accordance with ASTM D 422. The grain-size distribution curves and ternary plots for the representative samples are presented on Plates C-1 through C-8.

Atterberg Limits

Tests were performed on a representative fine-grained soil sample to evaluate its liquid limit, plastic limit, and plasticity index (P.I.) in general accordance with ASTM D 4318-4318. The test results are presented on Plate C-9.



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Sample	Depth	Range	Visual Classification/USCS CLASSIFICATION	LL	PL	PI	Cc	Cu
●	TP-1	0.0	0"-5"	Clay w/ Sand					
□	TP-1	5.0	5"-20"	Clay w/ Sand					

	Sample	Depth	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	TP-1	0.0	9.5	0.029			12.6	17.1	25.5	44.8
□	TP-1	5.0	9.5	0.027			8.4	21.0	23.3	47.3

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GRAIN SIZE DISTRIBUTION

Project: STANDARD PACIFIC

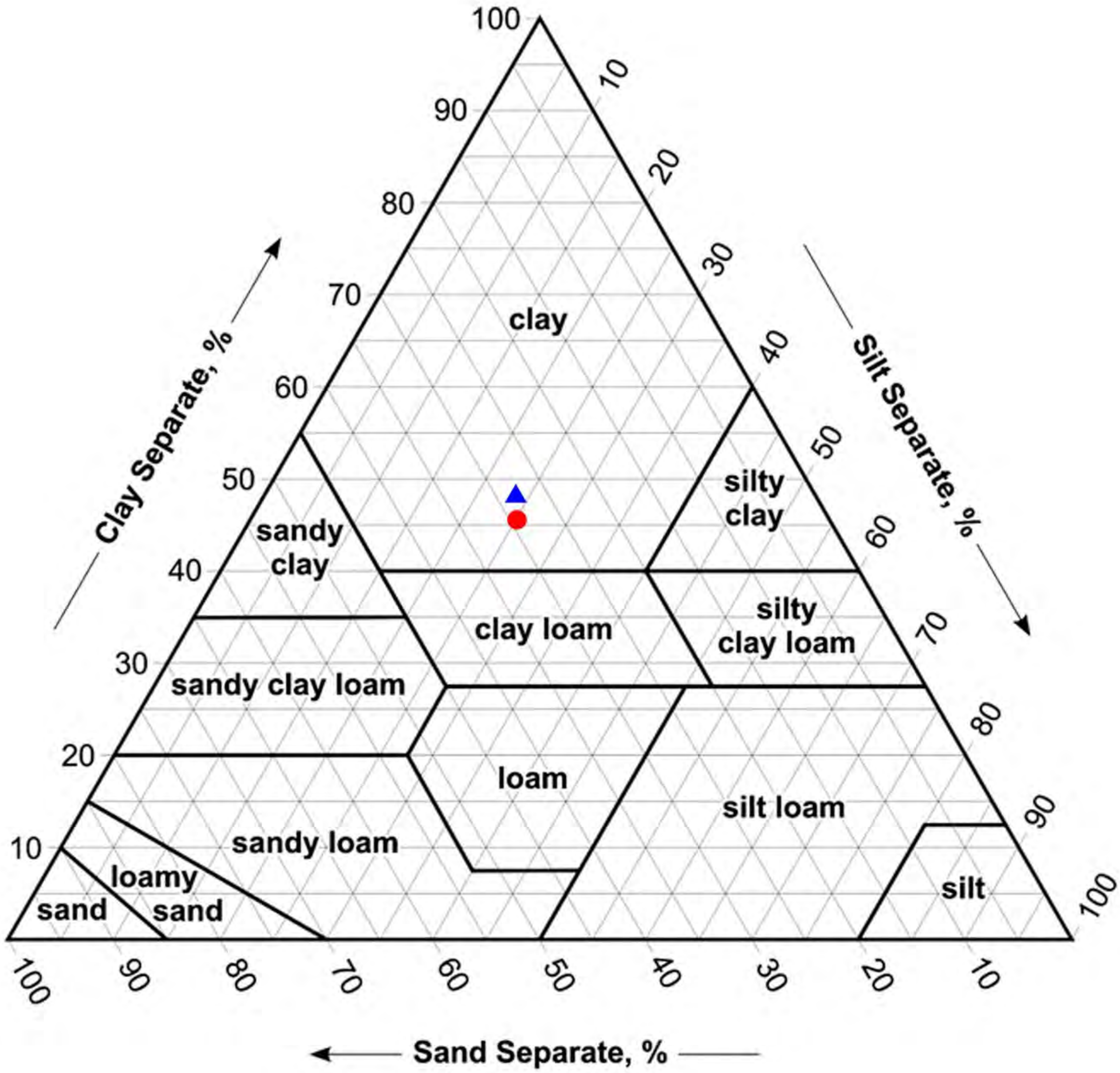
Number: 6747-A-SC

Date: July 2014

Plate: C - 1

US_GRAIN_SIZE 6747.GPJ US_LAB.GDT 7/15/14

Soil Textural Triangle



Source: USDA

EXPLANATION

● 0-5" (Depth)

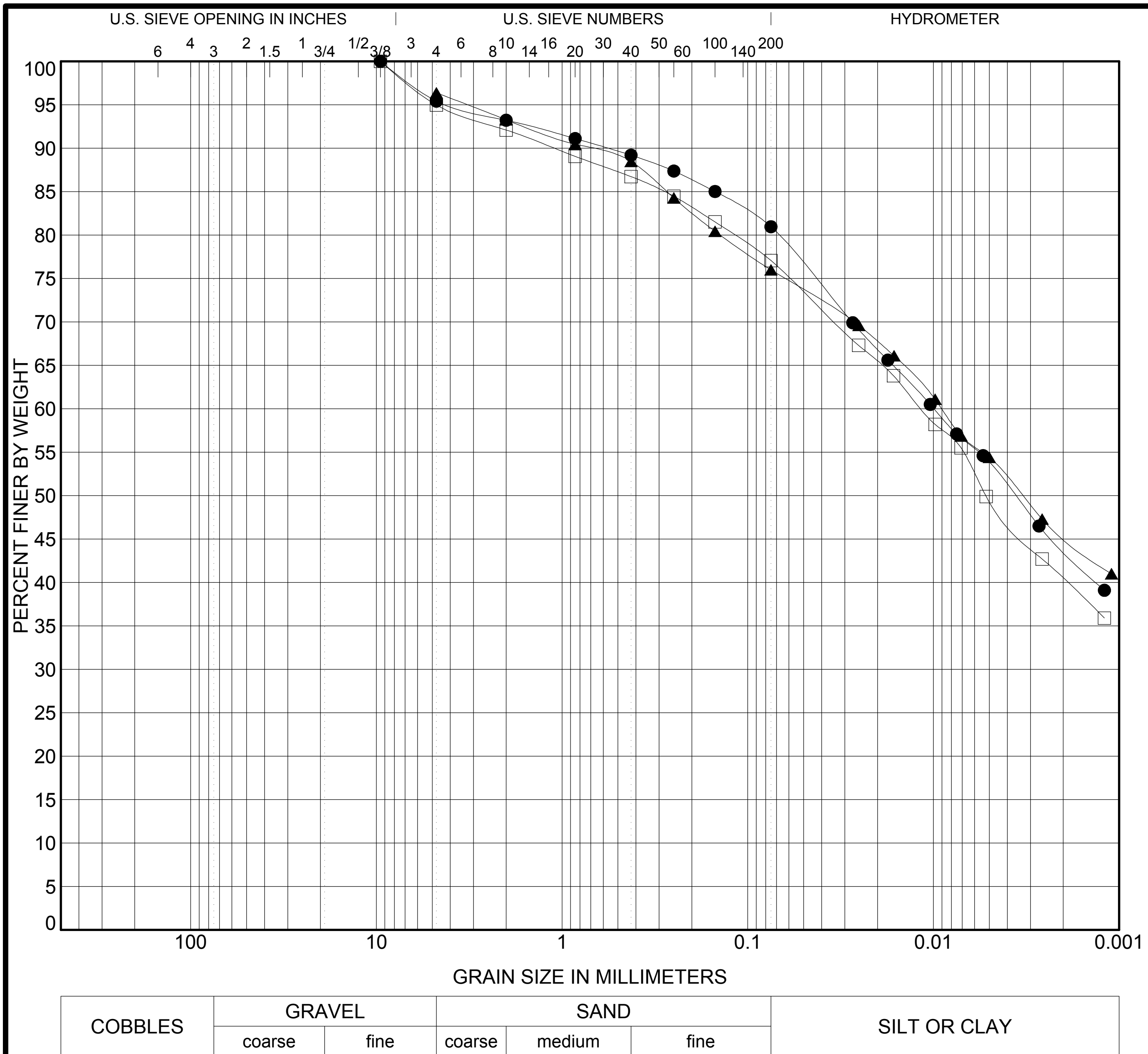
▲ 5-20" (Depth)

GeoSoils, Inc.

SOIL TEXTURAL TRIANGLE

Test Pit TP-1 **Plate C-2**

W.O. 6747-A-SC	DATE 07/14	SCALE: None



	Sample	Depth	Range	Visual Classification/USCS CLASSIFICATION	LL	PL	PI	Cc	Cu
●	TP-2	0.0	0"-4"	Clay w/ Sand					
□	TP-2	4.0	4"-10"	FAT CLAY with SAND(CH)	61	20	41		
▲	TP-2	12.0	12"-24"	FAT CLAY with SAND(CH)	59	20	39		

	Sample	Depth	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	TP-2	0.0	9.5	0.01			4.6	14.5	27.3	53.7
□	TP-2	4.0	9.5	0.012			5.0	17.9	27.6	49.5
▲	TP-2	12.0	4.75	0.009			0.0	20.4	21.6	54.4

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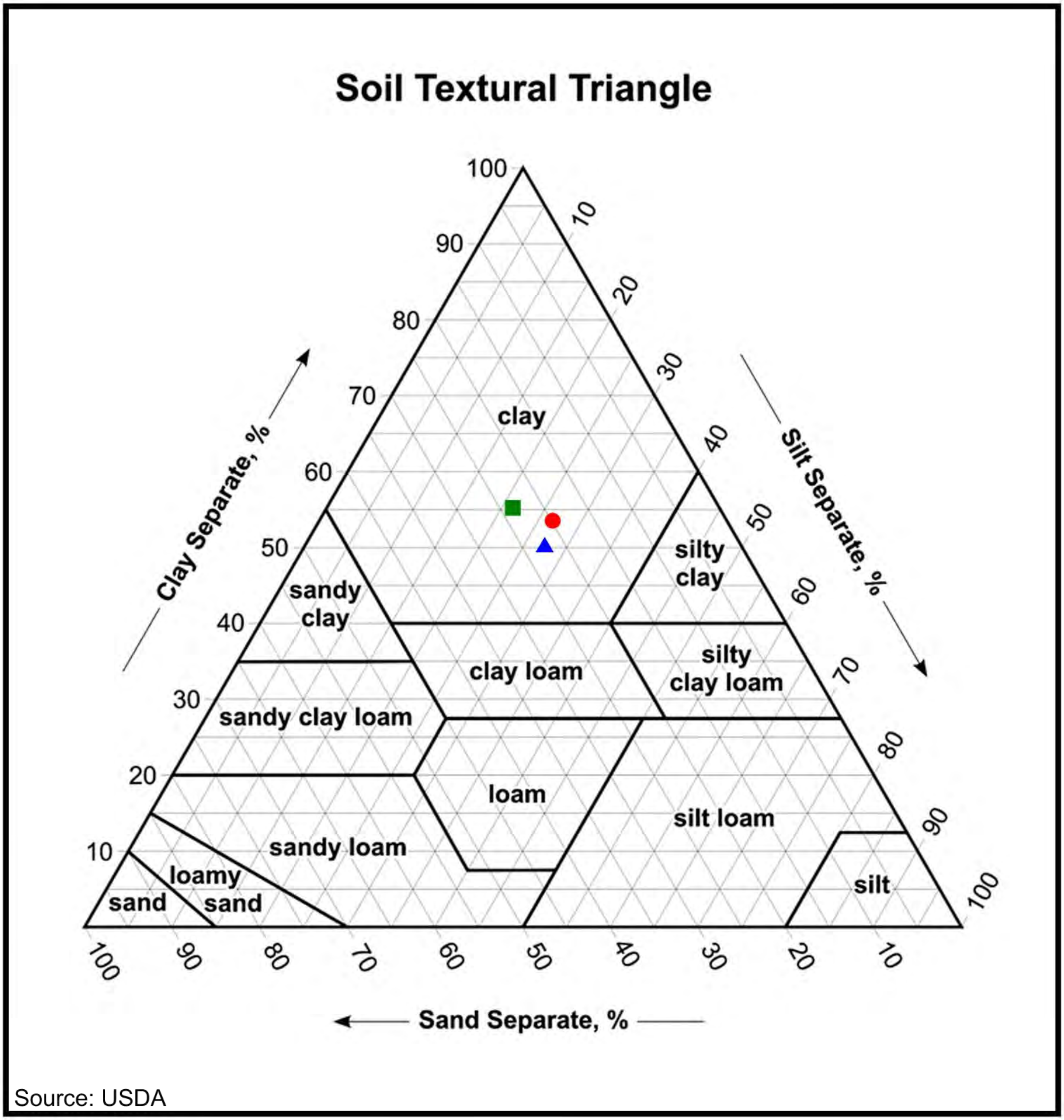
GRAIN SIZE DISTRIBUTION

Project: STANDARD PACIFIC

Number: 6747-A-SC

Date: July 2014

Plate: C - 3



EXPLANATION

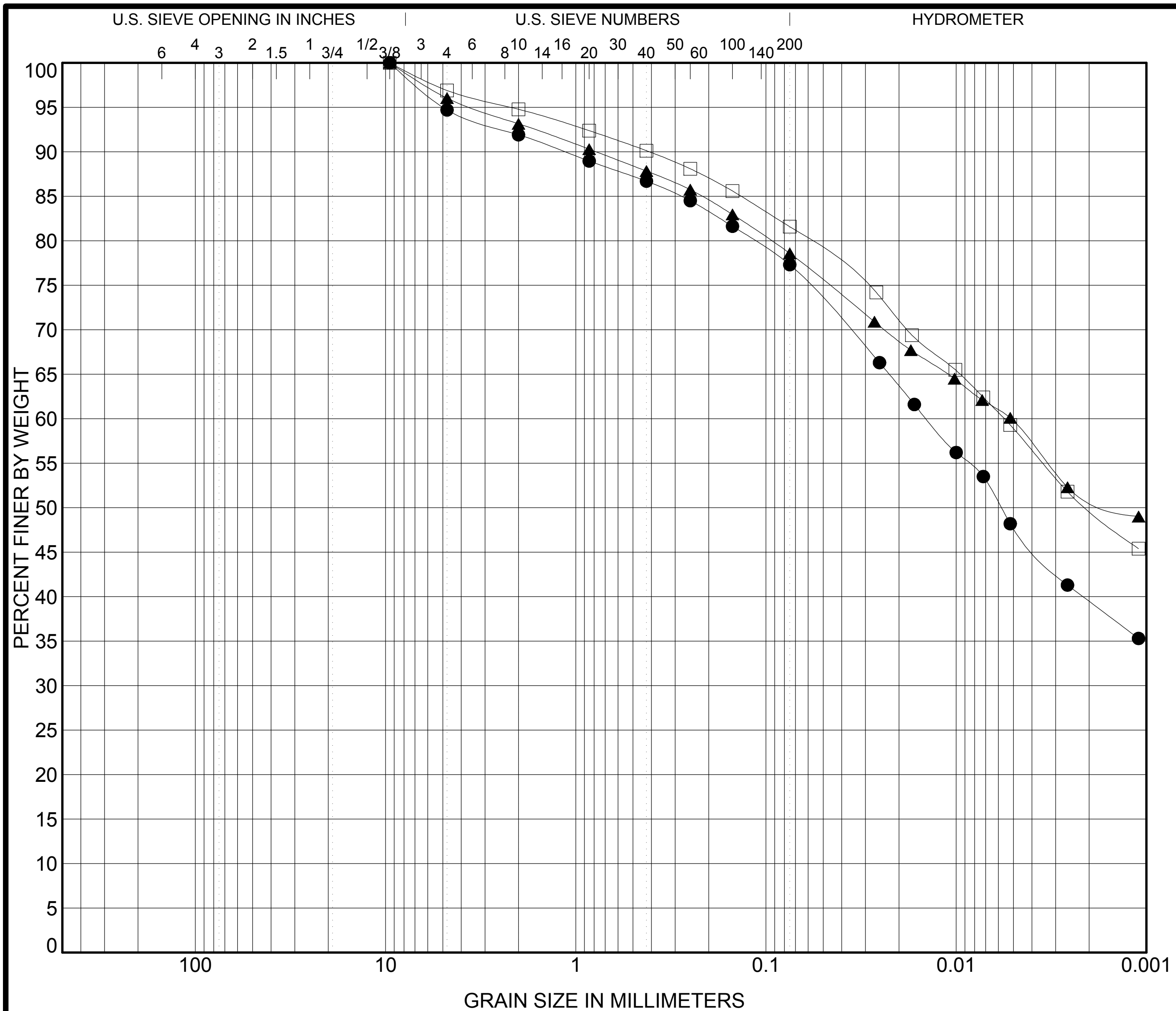
- 0-4" (Depth)
- 4-10" (Depth)
- 12-24" (Depth)

GeoSoils, Inc.

SOIL TEXTURAL TRIANGLE

Test Pit TP-2 Plate C-4

W.O. 6747-A-SC	DATE 07/14	SCALE: None



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Sample	Depth	Range	Visual Classification/USCS CLASSIFICATION	LL	PL	PI	Cc	Cu
●	TP-3	0.0	0"-4"	Clay w/ Sand					
□	TP-3	4.0	4"-12"	Clay w/ Sand					
▲	TP-3	16.0	16"-18"	FAT CLAY with SAND(CH)	88	24	64		

	Sample	Depth	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	TP-3	0.0	9.5	0.014			5.3	17.4	29.5	47.8
□	TP-3	4.0	9.5	0.006			3.1	15.3	22.7	58.9
▲	TP-3	16.0	9.5	0.005			4.0	17.4	18.9	59.7

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GRAIN SIZE DISTRIBUTION

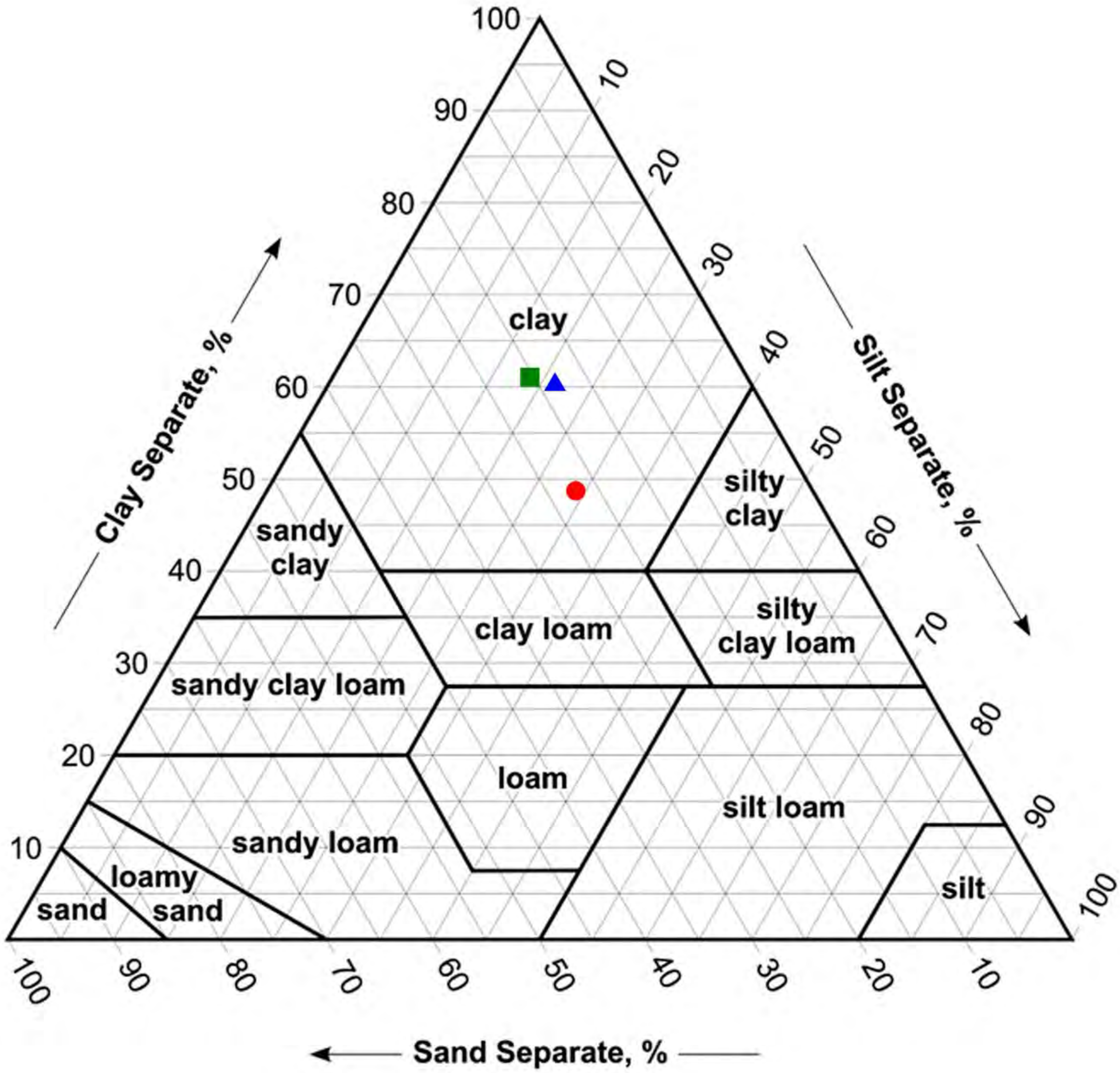
Project: STANDARD PACIFIC

Number: 6747-A-SC

Date: July 2014

Plate: C - 5

Soil Textural Triangle



Source: USDA

EXPLANATION

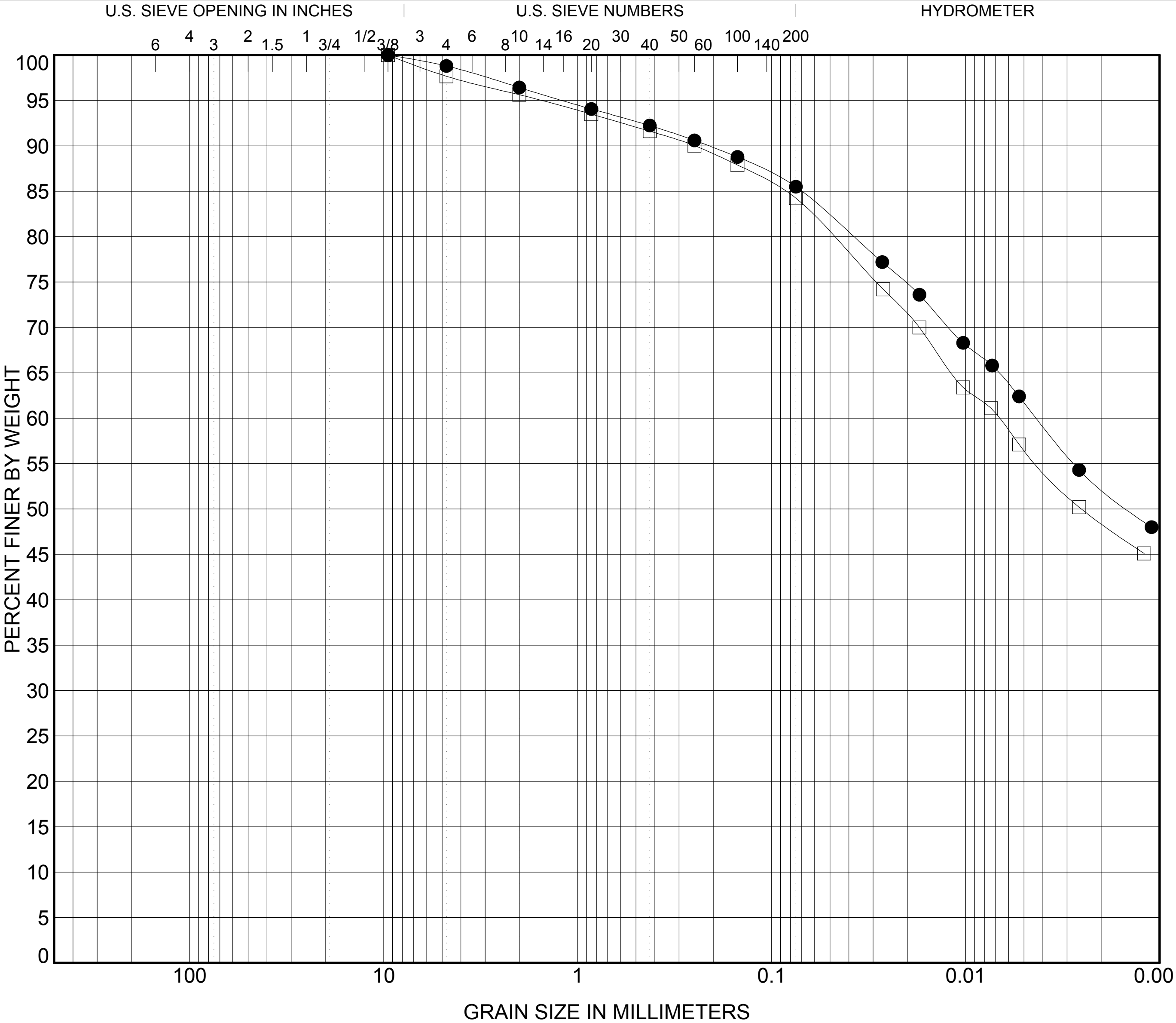
- ● 0-4" (Depth)
- ▲ 4-12" (Depth)
- ■ 16-18" (Depth)

GeoSoils, Inc.

SOIL TEXTURAL TRIANGLE

Test Pit TP-3 Plate C-6

W.O. 6747-A-SC	DATE 07/14	SCALE: None



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Sample	Depth	Range	Visual Classification/USCS CLASSIFICATION	LL	PL	PI	Cc	Cu
●	TP-4	4.0	4"-13"	FAT CLAY(CH)	61	21	40		
□	TP-4	13.0	13"-29"	FAT CLAY with SAND(CH)	74	21	53		

	Sample	Depth	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	TP-4	4.0	9.5	0.004			1.2	13.3	23.8	61.7
□	TP-4	13.0	9.5	0.007			2.3	13.4	27.7	56.5

US_GRAIN_SIZE 6747.GPJ US_LAB.GDT 7/15/14

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GRAIN SIZE DISTRIBUTION

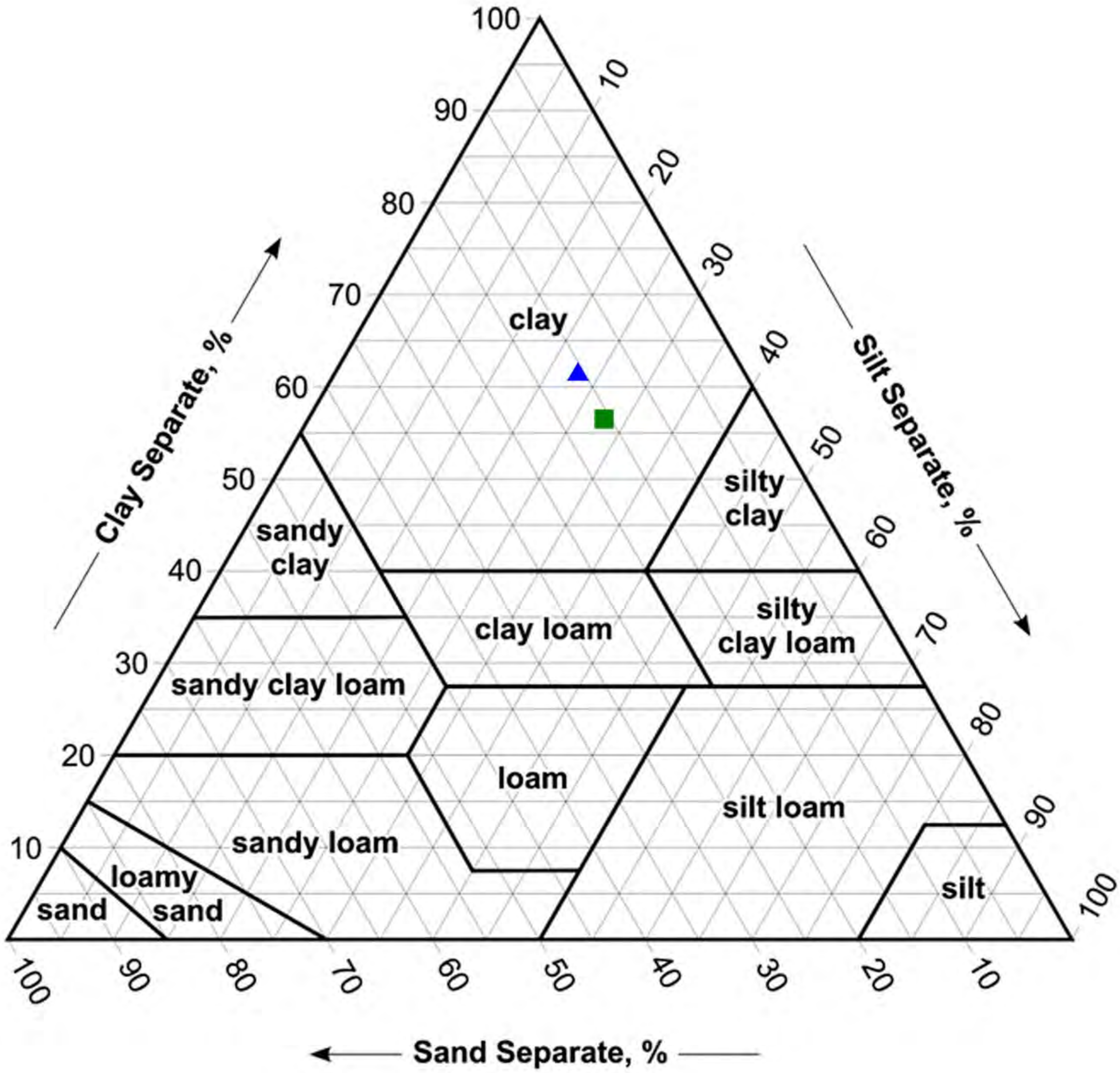
Project: STANDARD PACIFIC

Number: 6747-A-SC

Date: July 2014

Plate: C - 7

Soil Textural Triangle



Source: USDA

EXPLANATION

▲ 4-13" (Depth)

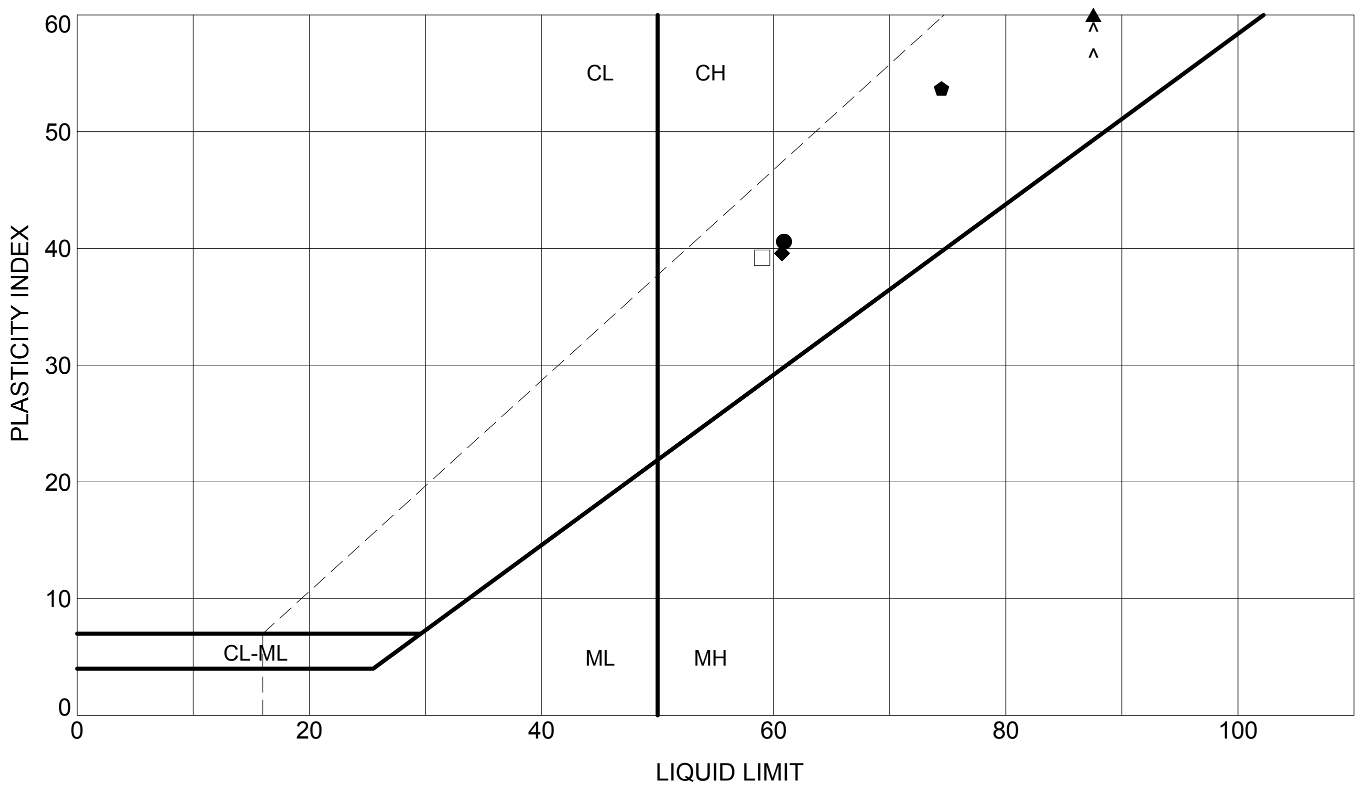
■ 13-29" (Depth)

GeoSoils, Inc.

SOIL TEXTURAL TRIANGLE

Test Pit TP-4 | Plate C-8

W.O. 6747-A-SC	DATE 07/14	SCALE: None



	Sample	Depth/El.	LL	PL	PI	Fines	USCS CLASSIFICATION
●	TP-2	4.0	61	20	41	77	FAT CLAY with SAND(CH)
□	TP-2	12.0	59	20	39	76	FAT CLAY with SAND(CH)
▲	TP-3	16.0	88	24	64	79	FAT CLAY with SAND(CH)
◆	TP-4	4.0	61	21	40	85	FAT CLAY(CH)
⬟	TP-4	13.0	74	21	53	84	FAT CLAY with SAND(CH)

US_ATTERBERG_LIMITS 6747.GPJ US_LAB.GDT 7/15/14

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ATTERBERG LIMITS' RESULTS

Project: STANDARD PACIFIC

Number: 6747-A-SC

Date: July 2014

Plate: C - 9


Qal
Qcol/Qal
Qcol/Qsw
Kl
Jsp
T-2
T-3
T-4
T-5
T-9
T-10
T-11
T-16
T-17
T-18
T-19
TP-1
TP-2
TP-3
TP-4
5%
8%
11%
7%
6%
3.5%
EXISTING CONDITIONS TRIBUTARY DRAINAGE AREA (0.12 ACRES)
TRIBUTARY DRAINAGE AREA REMOVED UNDER PROPOSED CONDITIONS (0.03 ACRES)
27.90 Ac.
GSI LEGEND
Qal — QUATERNARY ALLUVIUM
Qcol/Qal — QUATERNARY UNDIFFERENTIATED COLLUVIUM AND ALLUVIUM
Qcol/Qsw — QUATERNARY UNDIFFERENTIATED COLLUVIUM AND SLOPE WASH
Kl — CRETEACOUS LUSARDI FORMATION
Jsp — JURASSIC, SANTIAGO PEAK VOLCANICS, CIRCLED WHERE BURIED
— APPROXIMATE LOCATION OF GEOLOGIC CONTACT (QUERIED WHERE UNCERTAIN)
— APPROXIMATE AREAL EXTENT OF NEAR SURFACE SOIL WITH A RELATIVELY HIGH PERCENTAGE OF GRAVEL TO BOULDER SIZE ROCK FRAGMENTS, QUERIED WHERE UNCERTAIN
— SURFACE PILES OF COBBLE TO BOULDER SIZE ROCK FRAGMENTS
F — APPROXIMATE AREAL EXTENT OF INVASIVE, NON-NATIVE FENNEL
T-19 — APPROXIMATE LOCATION OF EXPLORATORY TEST PIT BY GEOCON (2007)
TP-4 — APPROXIMATE LOCATION OF EXPLORATORY TEST PIT (THIS STUDY)
— SURVEYED LOCATION OF "B. filifolia" BY OTHERS
11% — APPROXIMATE SLOPE GRADIENT IN PERCENT
— DRAINAGE DIVIDE PER PDS
— DRAINAGE SUBDIVIDE PER GSI
— AREAS CONTAINING OBSERVED SPECIMENS OF Brodiaea filifolia
BASE MAP PREPARED BY: PROJECT DESIGN CONSULTANTS
N
GRAPHIC SCALE
80 0 40 80 160 320
1" = 80'
ALL LOCATIONS ARE APPROXIMATE
This document or efile is not a part of the Construction Documents and should not be relied upon as being an accurate depiction of design.
GeoSoils, Inc.
GEOLOGIC MAP
Plate 1
W.O. 6747-A-SC
DATE: 07/14
SCALE: 1" = 80'

RESPONSE TO REVIEW ENTITLED
"PROPOSED HERITAGE BLUFFS II RESIDENTIAL DEVELOPMENT
AND POTENTIAL IMPLICATIONS FOR *BRODIAEA FILIFOLIA*
RANCHO BERNARDO AREA, SAN DIEGO, SAN DIEGO COUNTY"
BY CALIFORNIA DEPARTMENT OF FISH AND WILDLIFE,
DATED AUGUST 13, 2014

FOR

STANDARD PACIFIC HOMES, SAN DIEGO
16010 CAMINO DEL SUR
SAN DIEGO, CALIFORNIA 92127

W.O. 6747-A1-SC AUGUST 25, 2014

GeoSoils, Inc.

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August 25, 2014

W.O. 6747-A1-SC

Standard Pacific Homes, San Diego
16010 Camino Del Sur
San Diego, California 92127

Attention: Mr. William M. Dumka, Vice-President of Forward Planning

Subject: Response to Review entitled "Proposed Heritage Bluffs II residential development and potential implications for *Brodiaea filifolia*, Rancho Bernardo Area, San Diego, San Diego County," by California Department of Fish and Wildlife, dated August 13, 2014.

Dear Mr. Dumka:

In accordance with your authorization, GeoSoils, Inc. (GSI) has prepared this response to the subject review of the GSI report dated July 27, 2014 (see Appendix A). The scope of our services has included attending a conference with representative of the US Fish and Wildlife Service, the California Department of Fish and Wildlife, representatives of the City of San Diego, and you and your consultants; a review of selected references (Appendix A); analyses of data; and preparation of this summary response. Unless specifically superceded herein, the conclusions and recommendations contained in GSI (2014), remain pertinent and applicable, and should be appropriately implemented during planning, design, and construction.

GSI REVIEW RESPONSE

A copy of the reviewers' comments is included as Appendix B, following the text of this response. For convenience, pertinent portions of the reviewers comments are repeated below in *italics*, followed by GSI's response.

Comment No. 1 (Stage I Calcium Carbonate Deposits).

A conclusion that the absence of pedogenic calcium carbonate indicates the absence of surface water infiltration ignores the role of carbonate supply, climate, and the relative age of the soil.

Response No. 1.

The process of formation of pedogenic carbonates provided by the reviewer is far from complete and settled. More specifically, in addition to the carbonate supply, climate and relative age, other factors include temperature, relief, surficial run-off and $HC0_3$ ions (either inherited or incorporated from dust), and $C0_2$ release by root and rhizomicrobial respiration (Gocke, et al., 2012). Most soils of arid and semiarid regions (such as is the site), contain carbonate accumulations, which can form as rapidly as within 300 to 1,700 years in cohesive soils (Gocke, et al., 2012), and this reasonably correlates with the age range for site soils provided by GSI (2014). Gocke, et al. (2012), also indicate that the formation of carbonates is consistent with humid conditions. The fact that Stage I of carbonate development is lacking in the soil profile at this site is not surprising based on the field data obtained by GSI, including the lack of evidence for carbonate formation and infiltration, as well as vertical hydraulic conductivity (0.0001 [10^{-4}] to 0.0000001 [10^{-7}] meters/day) for a typical clay (Freeze and Cherry, 1979), that site soils are at field capacity immediately below the zone of desiccation (top 13 inches), and the soils are on an active geomorphic surface. Neuendorf, et al. (2005), define field capacity as "The quantity of water held by soil or rock against the pull of gravity." That is, as pointed out in Fetter (1988), when the soil-moisture content reaches the point at which the force of gravity acting on the water equals the surface tension, gravity drainage ceases (i.e., no infiltration). Not only is there no evidence of vertical infiltration in the field capacity zone, there cannot be any significant vertical infiltration under these identified site specific field conditions.

Comment No. 2 (Soil Characteristics).

...a meaningful evaluation of the significance of surface runoff to the soil-water-plant relations has not been provided.

Response No. 2.

As pointed out by Fredlund, et al. (2010), the increased hydraulic conductivity of the soil profile only occurs in the desiccated (cracked) zone (in this case the top 13 inches), and the hydraulic conductivity in the underlying intact (uncracked) clay is not impacted. Furthermore, Novak, et al. (2000), note that the infiltration contribution by cracked fine-textured soils is lateral, not vertical. Further, Novak, et al. (2002), indicate that soil cracks usually change their dimensions during the infiltration process, meaning that the soil swells and the cracks ultimately seal. Once sealed, the contribution from lateral infiltration would necessarily stop. It has been our personal local experience that this sealing process can occur after one significant storm event, lasting beyond several hours.

GSI notes that the Novak, et al. (2000 and 2002) assume that infiltration through cracks only commences after a surface layer of water with a critical thickness has formed (i.e., such as occurs on relatively **level** irrigated ground). The site is not level, and is generally characterized as an active geomorphic surface. Given the site topography, it is doubtful that a surface layer of water would be present under most precipitation events, thick enough to attain the critical thickness of Novak, et al. (2000 and 2002).

Regardless of the above, the contribution from lateral infiltration is limited to the desiccated zone, where *B. filifolia* occurs. Thus, after the desiccation cracks have initially expanded, and sealed, overland flow has little, if any, effect on infiltration in the formerly desiccated zone, and no effect in the field capacity zone of the soil profile.

Comment No. 3 (Evidence of Surface Runnoff [overland flow]).

*As noted below in the section on the **Loss of Ephemeral Stream Channel Area**, runoff-related erosion of the type described by GSI does occur on the coarser clay soils upslope of the westernmost stand of B. filifolia. The channel ends at the transition in slope between the topographically steeper coarse clay unit and the lower gradient finer clay soils. The **B. filifolia** stand occurs at the end of the channel. GSI describes the **B. filifolia** landscape as "internal basins" (page 8, paragraph 2). This description and the location of the channel end suggest rather than erosion that evidence of ponding might be a more appropriate indicator of surface runoff in these locations. See the section on **Topography** that follows.*

Recommendation: I recommend that GSI be asked to consider these points and to revisit their evidence and conclusions accordingly.

Response No. 3.

B. filifolia does not occur in a channel. In fact, there are no channels topographically up-gradient from *B. filifolia* on this site. Neuendorf, et al. (2005) define four contexts for using the word "basin(s)," one of which is drainage basin. The term "internal basins" used by GSI is in reference to basin area (boundaries of drainage divides), rather than a topographic depression, as the reviewer has apparently assumed. A simple review of the topography shown on Plate 1 of GSI (2014), clearly shows no topographic basins in the study area. The only place where ponding would potentially occur on this site, would be on a relatively stable geomorphic surface or flat area. A small relatively stable geomorphic surface occurs within Lot 17; however, even if ponding were to occur here locally, given that the soil profile below the desiccated zone is an intact (unfractured) clay at field capacity, no significant vertical infiltration would occur, owing to field capacity conditions, typical vertical infiltration rates, and small areal extent of the relatively stable geomorphic surface or flat area. Lateral infiltration, if any, would trend down topographic gradient, and would not impact the westernmost stand of *B. filifolia*. As indicated in GSI (2014), there is no evidence to support significant infiltration deeper than the dessication cracks in the colluvium, under current climatic conditions, and there are no channels that would contribute moisture to *B. filifolia*, since the soil profile below the desiccation zone is at field capacity.

Comment No. 4 (Topography).

*GSI ignores or assumes that there is no surface runoff from the extensive area of sandy, gravelly clay soils that occur within the same drainage divides and upslope of the **B. filifolia** stands. However the westernmost stand of **B. filifolia** is associated with the downstream end of an ephemeral stream channel that originates in the sandy, gravelly clay unit and is* *evidence that surface runoff from this soil unit does indeed occur. Moreover, under the right conditions the volume and erosive potential of the otherwise diffuse surface runoff is apparently great enough to initiate channel formation and to result in channelized flow that is delivered to the* ***B. filifolia*** *landscape. GSI does not discuss why surface runoff occurs on these soils at this location but not on the same soils upslope of the* ***B. filifolia*** *stands at the other locations. Given the evidence of surface runoff from the upslope clay unit, it seems reasonable to assume that some amount of ponding of this runoff occurs in the* ***B. filifolia*** *areas that GSI describes topographically as "basins" GSI should provide meaningful evidence to the contrary, or be advised of the need to rectify the conflict between the onsite evidence of surface runoff, to refine their conclusion that surface runoff does not occur, and that it plays no role in sustaining downslope populations of* ***B. filifolia****.*

Response No. 4.

The reviewer mis-states our opinion and direct observations. Nowhere in GSI (2014) do we describe the site topographically as a basin. As indicated in GSI (2014), evidence of significant surface runoff was not noted. With regard to the "ephemeral stream channel," the reviewer has mis-interpreted the data and ignored topography shown on the Geologic Map (Plate 1 of GSI [2014]). There is no ephemeral stream channel at this location, nor within the area occupied by *B. filifolia*. It appears that the reviewer has confused tributary drainage area with an ephemeral stream channel. GSI (2014) discusses where surface runoff enters into the desiccation cracks where *B. filifolia* grows. After the desiccation cracks are sealed, the growing area is then kept relatively moist through the rainy season and into the spring/early summer. There is no evidence of groundwater communication between drainage boundaries of basin areas, owing to topographic gradient (lateral movement in the desiccated zone), and field capacity of the soil profile below the desiccated zone on an active geomorphic surface.

Comment No. 5 (Loss of Ephemeral Stream Channel Area).

GSI does not state whether or not the data used for their calculations accounted for the influence of soil cracks on infiltration rates, and absent this information the values extrapolated have little meaning.

The sub-watershed divide in the area adjacent to the ephemeral stream channel appears too small to generate the surface runoff necessary to develop a channel of the size shown within the divide. This suggests to me that the source area basin that supplies water to the stream extends some as yet to defined distance upslope of the channel head. Source area contributions are critical to stream function and must be accounted for in the impact evaluations of the loss of stream flow to ***B. filifolia****.*

Response No. 5.

Since soil cracks only occur within the upper 10 to 13 inches, and as noted previously, the infiltration contribution by cracked fine-textured soils is lateral. The infiltration rates provided by GSI were for hypothetical vertical infiltration, to show the insignificance of this amount of infiltration volume, for illustrative purposes.

With regard to the "ephemeral stream channel," the reviewer has again mis-interpreted the data and ignored the topography shown on Plate 1 (GSI, 2014). There is no ephemeral stream channel at this location, nor within the area occupied by *B. filifolia*. It appears that the reviewer has again confused tributary drainage area with an ephemeral stream channel.

Comment No. 6 (Lateral Connectivity of Soil Cracks).

Field experiments in cracked clays have found that the hydraulic conductivity was controlled by flow through the cracks, and that the measured horizontal hydraulic conductivity values can be several orders of magnitude greater than the mean value for the uncracked clay soil, and greatly increase the potential for the lateral migration water or other solutes (McKay, et al 1993). As noted above in the section on Topography, if ponding of runoff occurs in the B. filifolia areas that GSI describes topographically as "basins" then it would be prudent to assume that with the saturation of the soil by water-filled cracks and the positive pressures associated with such ponding that these conditions would almost certainly result in the lateral movement of water through the horizontal cracks in these areas. I recommend that GSI be asked to consider these points and to revisit their evidence and conclusions accordingly.

Response No. 6.

Desiccation polygon cracking was noted by GSI at the site. The desiccation polygons typically had three to five sides, the cracks were on the order of 6 to 12 inches long, and were not noted to be connected to other dessication polygons. GSI would like to again point out the site soils are at field capacity immediately below the zone of desiccation (top 10 to13 inches), and the soils are present on what is characterized as an active geomorphic surface. Further, below that surficial zone of desiccation, the clay is intact (uncracked). As discussed previously, ponding would occur on this site on a relatively stable geomorphic surface or flat area, not an active geomorphic surface.

Once again, the reviewer mis-states our opinion and direct observations. Nowhere in GSI (2014) do we describe the site topographically as a basin. Again, the term "basin" used by GSI is in reference to basin area (boundaries of drainage divides). The referenced paper (McKay, et al., 1993) is based on fractured clay-rich glacial till that is 1.5 to 5.5 meters (±5 to 18 feet) thick at the surface, and that is where the author performed the measurements for horizontal hydraulic conductivity. Further, site conditions are dissimilar to the field conditions of McKay, et al. (1993), and in our opinion, utilizing this paper for a model of site conditions is not valid, since the site soils had dessication cracks only in the top 10 to 13 inches. Based on the site specific data, GSI does not agree that it would be prudent to assume that with the saturation of the soil by water-filled cracks and the positive pressures associated with such ponding that these conditions would almost certainly result in the lateral movement of water through the horizontal cracks in these areas." GSI found no soil or geomorphic evidence of ponding on the site. Site specific data refutes the conjecture by the reviewer.

<u>SUMMARY</u>

The reviewer has mis-stated our opinions, ignored site specific data and topography, and cites technical papers written for specific conditions (level ground, irrigation, thick glacial till, fractured clays covered by concrete slabs, etc.), that are not applicable to the subject site. Many of these flaws could have been avoided by a simple review of the topography shown on Plate 1 of GSI (2014). GSI finds no technical reason to change our previous opinion.

CLOSURE

The opportunity to be of service is sincerely appreciated. If you should have any questions, please do not hesitate to contact our office.

Respectfully submitted,

GeoSoils, Inc.

Robert G. Crisman
Engineering Geologist, CEG 1934

John P. Franklin
Engineering Geologist, CEG 1340
Certified HydroGeologist, CHG 532

RGC/JPF/jh

Attachment: Appendix A - References
Appendix B - Interoffice Technical Comments, dated August 13, 2014

Distribution: (4) Addressee

APPENDIX A

SELECTED REFERENCES

APPENDIX A

SELECTED REFERENCES

California Department of Fish and Wildlife, South Coast Region, Habitat Conservation Planning, 2014, Interoffice Technical Memorandum, Proposed Heritage Bluffs II residential developpment and potential implications for *Brodiaea filifolia*, Rancho Bernardo Area, San Diego, San Diego County, by K. Vyverberg, dated August 13.

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APPENDIX B

INTEROFFICE TECHNICAL MEMORANDUM
AUGUST 13, 2014

Interoffice
TECHNICAL
MEMORANDUM

To: Paul Schlitt
Senior Environmental Scientist – Specialist
South Coast Region

From: Kris Vyverberg
Senior Engineering Geologist

Date: 13 August 2014

Subject: Proposed Heritage Bluffs II residential development and potential implications for *Brodiaea filifolia*, Rancho Bernardo Area, San Diego, San Diego County

Paul,

It is my understanding that South Coast Region staff has raised concerns that the current Heritage Bluffs II development design in the area above where *Brodiaea filifolia* occurs could result in detrimental changes to the conditions that currently support and sustain this plant, a State-listed endangered species and federally-listed threatened species.

In response to these concerns the geomorphic, soils, and hydrogeologic conditions in the areas favorable and unfavorable for *Brodiaea filifolia* were evaluated by GeoSoils (hereafter GSI), a consultant to the project (*GeoSoils Inc. 2014: Evaluation of Soil Properties and Potential Impact of Proposed Development on an Occurrence of Brodiaea filifolia, Adjacent to Lots 127-134, VTM No. 1193244 Proposed Heritage Bluffs II, Rancho Bernardo Area, San Diego, Ca.*).

As you requested, I reviewed the GeoSoils report, the focus of which was on the soil conditions and behavior of surface and subsurface water movement around and downslope of building lots 121 through 138 to where the *Brodiaea filifolia* stands occur (GSI Plate 1, attached). I found a number of the report findings and conclusions worthy of concern and further discussion, and offer the following comments and recommendations for your consideration.

Comments and Recommendations

1. **Stage I Calcium Carbonate Deposits:** GIS notes that no pedogenic calcium carbonate deposits were observed in the soil profile within the *B. filifolia* occurrence area, and interpreted the absence of these deposits as evidence that surface water infiltration into the soil profile does not occur in the study area (page 3, paragraph 4; page 9, paragraph 2).

   Comment: In non-carbonate parent materials soils accumulate pedogenic calcium carbonate from the solution, movement and subsequent precipitation of $CaCo_3$. A change in soil morphology occurs as calcium carbonate accumulates with time. Stage I begins with accumulation of calcium carbonate as filaments in fine-grained sediment and discontinuous carbonate coatings on undersides of gravels and cobbles in coarser-grained soils. Water is certainly an active driver in the development of these deposits but the process is also strongly controlled by the availability of carbonate, climate, and the passage of time. A conclusion that the absence of pedogenic calcium carbonate indicates the absence of surface water infiltration ignores the role of carbonate supply, climate, and the relative age of the soil.

Recommendation: It may be that the GSI statement represents an oversimplification that inadvertently slipped through the editing process as this conclusion is at odds with the extensive literature on this topic (amongst many others, see for example: Gile et al 1966; Machette 1985; Bull 1991; McFadden 1988; Parsons and Abrahams 2009; Birkeland 1999; Thomas 2000; Goudie 2004; Laity 2008; Brock and Buck 2009). Be that as it may, I suggest that GSI be asked to provide for our review the background materials used in support of this conclusion.

2. **Soil Characteristics:** GSI identified the soils as having very low infiltration rates and high runoff potential, and concluded that while overland flow may be present, it largely does not infiltrate into these soils, thus contributes little, if at all, to the availability of water necessary to sustain *B. filifolia.* GSI contends that *B. filifolia* is sustained not by surface water runoff but rather direct precipitation alone. Elsewhere in the report, GSI states that *"…after the desiccation cracks have…sealed, overland flow has little, if any, effect on infiltration into the soil profile…"* (page 11, paragraph 2).

Comment: (1) I agree that data provided from the soil samples are consistent with the *"…very low infiltration rates, and high runoff potential…"* part of the GSI characterization. However, while GSI notes the cracking tendencies of the soils neither the laboratory analyses nor the report narrative address the role of the cracks in rates of surface water infiltration.

(2) GSI concludes that the *B. filifolia* stands are sustained by direct precipitation alone, but then implies that even should this prove to be wrong and surface runoff does indeed play a role in sustaining the plants it largely ceases to do so after the cracks are sealed. I agree with the latter part of this conclusion in concept given the low infiltration rates and high runoff potential of the intact or resealed clay soil with no desiccation cracks. However, the conclusion that the role of surface runoff is insignificant also requires consideration of the physical process of crack closure, which includes swelling of the clay as wells as infilling by small particles such as sands, silt, and organic particles. Do the cracks seal upon the first rainfall runoff event regardless of intensity and duration, and in which case would not even that single occurrence be significant from the perspective of the plant? Or do crack dimensions change incrementally in response to a series of runoff events until the cracks seal and flow no longer occurs, in which case would not this extended period of runoff also be considered significant?

(3) Absent the presence of soil cracks, the infiltration of water into such low-permeability soils is normally very slow and frequently accompanied by surface runoff. However, the behavioral physical processes of hydraulic conductivity and the water storage and movement associated with a cracked soil are notably different from those of an intact soil. Fractures (cracks) in a soil mass dramatically change the

mechanical and hydrological behavior of the soil. The fractures reduce shear strength, greatly increase the hydraulic conductivity of the soil, and provide preferential flow paths for the vertical as well as lateral movement of water (Snow 1965; Mitchell and van Genuchten 1993; Novak et al. 2000; Liu et al. 2004, Vogel et al 2004, Fredlund et al 2010).

Ignoring the infiltration of water via cracks in the soil matrix tends to lead to (1) severely underestimated infiltration rates, (2) a tendency to overestimate surface runoff but then to underestimate its contribution to surface water infiltration, (3) a failure to account for the movement of water or other less-desirable solutes laterally through the crack system, and (4) to unrealistic descriptions of the soil-water-regime in general and the ecohydrological relations in particular.

Recommendation: Absent these considerations a meaningful evaluation of the significance of surface runoff to the soil-water-plant relations has not been provided. GSI should be advised of the need to revisit this evaluation taking into consideration the points outlined here.

3. **Evidence of Surface Runoff (overland flow):** no rills, gullies, particle/grain translocation, or other significant mass movement of earth material was observed in the *B. filifolia* areas (page 8, paragraph 2).

Comment: (1) Whether surface runoff generated over the gentle slopes of a grassland-dominated landscape underlain by clayey soils is accompanied by soil erosion of the type described depends on the intensity and duration of rainfall, and the physical response of the soil as accumulated water in excess of infiltration flows into the cracks. Surface runoff can also leave behind much more subtle, seasonally ephemeral indicators of occurrence – such as grasses forced down in the direction of flow, or small accumulations of waterborne organic debris trapped by vegetation – evidence that might have been obscured or destroyed by the time of the June/July survey period or simply not observed because it was not being looked for.

(2) As noted below in the section on the **Loss of Ephemeral Stream Channel Area**, runoff-related erosion of the type described by GSI does occur on the coarser clay soils upslope of the westernmost stand of *B. filifolia*. The channel ends at the transition in slope between the topographically steeper coarse clay unit and the lower gradient finer clay soils. The *B. filifolia* stand occurs at the end of the channel. GSI describes the *B. filifolia* landscape as *"internal basins"* (page 8, paragraph 2). This description and the location of the channel end suggest rather than erosion that evidence of ponding might be a more appropriate indicator of surface runoff in these locations. See the section on **Topography** that follows.

Recommendation: I recommend that GSI be asked to consider these points and to revisit their evidence and conclusions accordingly.

4. **Topography:** the local gradient of 6½ to 8½ percent associated with the *B. filifolia* landscape is interpreted to have little, if any, potential to contribute to overland flow, since these *"internal basins"* are terminated up-gradient by divides (page 8, paragraph 2). .

Comment: (1) GSI ignores or assumes that there is no surface runoff from the extensive area of sandy, gravelly clay soils that occur within the same drainage divides and upslope of the *B. filifolia* stands.

However the westernmost stand of *B. filifolia* is associated with the downstream end of an ephemeral stream channel that originates in the sandy, gravelly clay unit and is evidence that surface runoff from this soil unit does indeed occur. Moreover, under the right conditions the volume and erosive potential of the otherwise diffuse surface runoff is apparently great enough to initiate channel formation and to result in channelized flow that is delivered to the *B. filifolia* landscape. GSI does not discuss why surface runoff occurs on these soils at this location but not on the same soils upslope of the *B. filifolia* stands at the other locations.

(2) Given the evidence of surface runoff from the upslope clay unit, it seems reasonable to assume that some amount of ponding of this runoff occurs in the *B. filifolia* areas that GSI describes topographically as *"basins".*

Recommendation: GSI should provide meaningful evidence to the contrary, or be advised of the need to rectify the conflict between the onsite evidence of surface runoff, to refine their conclusion that surface runoff does not occur, and that it plays no role in sustaining downslope populations of *B. filifolia*.

5. **Loss of Ephemeral Stream Channel Area:** 0.03 acres, or 25%, of a 0.12 acre ephemeral stream would be removed by the proposed grading. Based on extrapolations of the lowest range of shallow groundwater and soils data developed by USGS and USDA studies of the area, GSI determined that if any precipitation were to be delivered as runoff to the *B. filifolia* stands 10% or less would be available to the root zone through infiltration. GSI also determined that under their best case scenario the stream area lost to grading and fill would be responsible for only 10% or 0.012 cubic feet per second of the runoff generated by the 100-year precipitation event (identified as ± 4 inches of rainfall/hour). This seemingly tiny loss of runoff from the altered stream channel was deemed by GSI to represent an insignificant contribution to the downstream stand of *B. filifolia.*

   Comment: (1) GSI does not state whether or not the data used for their calculations accounted for the influence of soil cracks on infiltration rates, and absent this information the values extrapolated have little meaning. See the **Soil Characteristics** discussion above.

   (2) The sub-watershed divide in the area adjacent to the ephemeral stream channel appears too small to generate the surface runoff necessary to develop a channel of the size shown within the divide. This suggests to me that the source area basin that supplies water to the stream extends some as yet to defined distance upslope of the channel head. Source area contributions are critical to stream function and must be accounted for in the impact evaluations of the loss of stream flow to *B. filifolia.*

   Recommendation: I recommend that GSI be asked to consider these points and to revisit their evidence and conclusions accordingly.

6. **Lateral Connectivity of Soil Cracks:** GSI emphasizes the validity of their conclusions about water movement (see **Soil Characterization** above) by noting that actual infiltration values are probably lower than and even less significant to survival of *B. filifolia* than the extrapolations suggest because the data assume there is some communication or transmission of water in the subsurface between

topographically up-gradient areas and the stands of *B. filifolia* (page 9, paragraph 1), which GSI clearly does not believe to be the case.

Comments: (1) Field experiments in cracked clays have found that the hydraulic conductivity was controlled by flow through the cracks, and that the measured horizontal hydraulic conductivity values can be several orders of magnitude greater than the mean value for the uncracked clay soil, and greatly increase the potential for the lateral migration water or other solutes (McKay et al 1993).

(2) As noted above in the section on **Topography**, if ponding of runoff occurs in the *B. filifolia* areas that GSI describes topographically as *"basins"* then it would be prudent to assume that with the saturation of the soil by water-filled cracks and the positive pressures associated with such ponding that these conditions would almost certainly result in the lateral movement of water through the horizontal cracks in these areas.

Recommendation: I recommend that GSI be asked to consider these points and to revisit their evidence and conclusions accordingly.

I am confident that the project can be refined to afford *Brodiaea filifolia* the protection required. However this will require that the project design be informed by a meaningful evaluation of the pre-development soil conditions and behavior of surface and subsurface water movement that currently sustains *B. filifolia.* In my opinion the GSI report does not satisfy this requirement.

Call if you would like to discuss any of the above in greater detail, and please consider me available to provide technical support as the plans for this project continue to evolve.

Regards,

KA Vyverberg

Senior Engineering Geologist
Conservation Engineering
Ecosystem Conservation Division
Department of Fish and Wildlife
1812 Ninth Street
Sacramento, CA 95811

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Attachment

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CLARIFICATION LETTER PERTAINING TO
"EVALUATION OF SOIL PROPERTIES AND POTENTIAL IMPACT
OF PROPOSED DEVELOPMENT ON AN OCCURRENCE OF *BRODIAEA FILIFOLIA*
ADJACENT TO LOTS 127-134, VTM NO. 1193244
PROPOSED HERITAGE BLUFFS II
RANCHO BERNARDO AREA, SAN DIEGO, CALIFORNIA"
W.O. 6747-A-SC, DATED JULY 31, 2014, BY GEOSOILS, INC.

FOR

STANDARD PACIFIC HOMES, SAN DIEGO
16010 CAMINO DEL SUR
SAN DIEGO, CALIFORNIA 92127

W.O. 6747-A1-SC OCTOBER 29, 2014

GeoSoils, Inc.

Geotechnical • Geologic • Coastal • Environmental

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October 29, 2014

W.O. 6747-A1-SC

Standard Pacific Homes, San Diego
16010 Camino Del Sur
San Diego, California 92127

Attention: Mr. William M. Dumka, Vice-President of Forward Planning

Subject: Clarification Letter Pertaining to "Evaluation of Soil Properties and Potential Impact of Proposed Development on an Occurrence of *Brodiaea Filifolia*, Adjacent to Lots 127-134, VTM No. 1193244 Proposed Heritage Bluffs II, Rancho Bernardo Area, San Diego, California," W.O. 6747-A-SC, dated July 31, 2014, by GeoSoils, Inc

References:

1. "Response to Review entitled 'Proposed Heritage Bluffs II residential development and potential implications for *Brodiaea filifolia*, Rancho Bernardo Area, San Diego, San Diego County,' by California Department of Fish and Wildlife, dated August 13, 2014," W.O. 6747-A1-SC, response dated August 25, 2014, by GeoSoils, Inc.

2. "Proposed Heritage Bluffs II residential development and potential implications for *Brodiaea filifolia*, Rancho Bernardo Area, San Diego, San Diego County," dated August 13, 2014, by California Department of Fish and Wildlife.

3. "Evaluation of Soil Properties and Potential Impact of Proposed Development on an Occurrence of *Brodiaea Filifolia*, Adjacent to Lots 127-134, VTM No. 1193244 Proposed Heritage Bluffs II, Rancho Bernardo Area, San Diego, California," W.O. 6747-A-SC, dated July 31, 2014, by GeoSoils, Inc.

Dear Mr. Dumka:

In accordance with your authorization, and as discussed during our teleconference on Wednesday October 8, 2014, GeoSoils, Inc. (GSI) has prepared this clarification letter and attachment, to respond to requests by the California Department of Fish and Wildlife. The scope of our services has included attending the teleconference with representatives of the California Department of Fish and Wildlife (CDFW), representatives of the City of San Diego, and you and your consultants, reviewing the referenced documents, analysis of data, revising the Geologic Map for the site (See Plate 1), and preparation of this summary letter. Unless specifically superceded herein, the conclusions and recommendations contained in the referenced GSI documents remain pertinent and applicable, and should be appropriately implemented during planning, design, and construction.

GSI CLARIFICATION

During the teleconference discussed previously, representative of the CDFW requested that in order to avoid confusion, the Geologic Map be revised to rename: drainage divide to basin divide; drainage subdivide to basin subdivide; and, tributary drainage area to plant population specific basin sub-subdivide. These changes have been made and incorporated into the revised Geologic Map, Plate 1, following the text of this summary letter.

In addition, CDFW requested that GSI revisit our original report (Reference No. 3), regarding the phrase "no infiltration." While we did not use those exact words, we found two instances where "no infiltration" may have been interpreted by the reviewer. On page 4, first paragraph, the last sentence reads:

"That is to say, while overland flow may be present, it largely does not infiltrate into these soils, and thus, would contribute little, if any, to the availability of water for *B. filifolia*."

That sentence should be modified to read as follows:

That is to say, while overland flow may be present, it largely does not infiltrate into these soils, and thus, would contribute little to the availability of water for *B. filifolia*.

On page 11, first complete paragraph, the last sentence reads:

"Furthermore, after the dessication cracks have initially expanded, and sealed, overland flow has little, if any, effect on infiltration into the soil profile."

That sentence should be modified to read as follows:

Furthermore, after the dessication cracks have initially expanded, and sealed, overland flow has little effect on infiltration into the soil profile.

CLOSURE

The opportunity to be of service is sincerely appreciated. If you should have any questions, please do not hesitate to contact our office.

Respectfully submitted,

GeoSoils, Inc.

Robert G. Crisman
Engineering Geologist, CEG 1934

John P. Franklin
Engineering Geologist, CEG 1340
Certified HydroGeologist, CHG 532

RGC/JPF/jh

Attachment: Plate 1 - Revised Geologic Map

Distribution: (4) Addressee


27.90 Ac.
22.84 Ac.
2.88 Ac.
Qal
Qcol/Qal
Qcol/Qsw
Kl
Jsp
STREET C
STREET D
STREET E
STREET G
STREET J
T-2
T-3
T-4
T-9
T-10
T-11
T-16
T-17
T-18
T-19
TP-1
TP-2
TP-3
TP-4
5%
6%
7%
8%
11%
3.5%
EXISTING CONDITIONS PLANT POPULATION SPECIFIC BASIN SUB-SUBDIVIDE AREA (0.12 ACRES)
PLANT POPULATION SPECIFIC BASIN SUB-SUBDIVIDE AREA REMOVED UNDER PROPOSED CONDITIONS (0.03 ACRES)
GSI LEGEND
Qal — QUATERNARY ALLUVIUM
Qcol/Qal — QUATERNARY UNDIFFERENTIATED COLLUVIUM AND ALLUVIUM
Qcol/Qsw — QUATERNARY UNDIFFERENTIATED COLLUVIUM AND SLOPE WASH
Kl — CRETEACOUS LUSARDI FORMATION
Jsp — JURASSIC, SANTIAGO PEAK VOLCANICS, CIRCLED WHERE BURIED
— APPROXIMATE LOCATION OF GEOLOGIC CONTACT (QUERIED WHERE UNCERTAIN)
— APPROXIMATE AREAL EXTENT OF NEAR SURFACE SOIL WITH A RELATIVELY HIGH PERCENTAGE OF GRAVEL TO BOULDER SIZE ROCK FRAGMENTS, QUERIED WHERE UNCERTAIN
— SURFACE PILES OF COBBLE TO BOULDER SIZE ROCK FRAGMENTS
F — APPROXIMATE AREAL EXTENT OF INVASIVE, NON-NATIVE FENNEL
T-19 — APPROXIMATE LOCATION OF EXPLORATORY TEST PIT BY GEOCON (2007)
TP-4 — APPROXIMATE LOCATION OF EXPLORATORY TEST PIT (THIS STUDY)
— SURVEYED LOCATION OF "B. filifolia" BY OTHERS
11% — APPROXIMATE SLOPE GRADIENT IN PERCENT
— BASIN DIVIDE PER PDS
— BASIN SUBDIVIDE PER GSI
— AREAS CONTAINING OBSERVED SPECIMENS OF *Brodiaea filifolia*
BASE MAP PREPARED BY: PROJECT DESIGN CONSULTANTS
N
GRAPHIC SCALE
80 0 40 80 160 320
1" = 80'
ALL LOCATIONS ARE APPROXIMATE
This document or efile is not a part of the Construction Documents and should not be relied upon as being an accurate depiction of design.
GeoSoils, Inc.
REVISED
GEOLOGIC MAP
Plate 1
W.O. 6747-A-SC
DATE: 10/29/14
SCALE: 1" = 80'

APPENDIX 10

DRAFT HABITAT MANAGEMENT PLAN

THREAD-LEAVED BRODIAEA HABITAT MANAGEMENT PLAN

FOR THE

Heritage Brodiaea Preserve

Heritage Bluffs II and East Clusters Unit 3 Projects
City Project No's. 319435; SAP 24004059 and VTM 99-1054: Units 2 & 3
City of San Diego

PREPARED FOR

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Revised December 2015

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GLOSSARY OF ACRONYMS

BMP	Best Management Practices
CCR	Conditions, Covenants and Restrictions
CDFW	California Department of Fish and Wildlife
CESA	California Endangered Species Act
CNDDB	California Natural Diversity Data Base
CRPR	California Rare Plant Rank
DSD	Development Services Department
DPR	Department of Parks and Recreation
FESA	Federal Endangered Species Act
FMP	Framework Management Plan
HMP	Habitat Management Plan
MHCP	Multi-habitat Planning Area
MOU	Memorandum of Understanding
MSCP	Multiple Species Conservation Program
USFWS	United States Fish and Wildlife Service

GLOSSARY OF STANDARD TERMS

Adaptive Management: A systematic process for continually improving management policies and practices by learning from the outcomes of operational programs.

California Department of Fish and Wildlife (**CDFW):** a department of the California Resources Agency.

California Natural Diversity Data Base (CNDDB): A state program that inventories the status and locations of rare plants and animals in California.

Conservation Easement: A legal agreement between a landowner and a land trust or government agency, such as the CDFW, that permanently limits uses of the land in order to protect its conservation values (California Government Code Section 27255).

Dedication: The turning over by an owner or developer of private land for public use, and the acceptance of land for such use by the governmental agency having jurisdiction over the public function for which it will be used. Dedications for roads, parks, school sites, or other public uses often are made conditions for approval of a development by a city or county.

Easement: Usually the right to use property owned by another for specific purposes or to gain access to another property. For example, utility companies often have easements on the private property of individuals to be able to install and maintain utility facilities.

Exotic Species: A species of plant or animal that is not indigenous, native, or naturalized to the area where it is found.

GLOSSARY OF STANDARD TERMS

Habitat: The combination of environmental conditions of a specific place providing for the needs of a species or a population of such species.

Habitat Management Plan (HMP): An activity plan for wildlife resources for a specific geographical area of land. It identifies wildlife habitat and related objectives, establishes the sequence of actions for achieving objectives, and outlines procedures for evaluating accomplishments.

Habitat Requirements: A specific set of physical and biological conditions that surround a single species, group of species, or community of species upon which the species or associations are dependent for their existence. In wildlife management the major components of habitat are considered to be food, water, cover and living space.

Listed Species: A taxon that is protected under the FESA or CESA. Listing categories include: Threatened, Endangered, Species of Special Concern, State Protected Species, Federally Proposed Threatened or Endangered, and Federally Petitioned Threatened or Endangered.

MSCP: A Subregional Plan. Also refers to the City of San Diego's Multiple Species Conservation Program Subarea Plan.

Monitoring: The timed collection of information to determine the effects of resource management and to identify changing resource conditions or needs.

Native (Indigenous) Species: A species of plant or animal that naturally occurs in an area and that was not introduced by humans.

Narrow Endemic Species: A rare species that is confined to a specific geographic region, soil type, and/or habitat.

Plant Community: Assemblage of plant populations in a defined area or physical habitat; an aggregation of plants similar in species composition and structure, occupying similar habitats over the landscape.

Sensitive Species: Plant or animal species listed as endangered, threatened, candidate, or sensitive by federal, state, or local governments.

Take: Under FESA and CESA: to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or attempt to engage in any such conduct relative to a Listed Species.

United States Fish and Wildlife Service (FWS/USFWS): An agency of the United States Department of the Interior.

Vegetative Community: Refers to the species or various combinations of species which dominate or appear to dominate an area of habitat (see plant community).

Wildlife Agencies: The USFWS and CDFW, collectively.

1.0 INTRODUCTION

1.1 Purpose of Habitat Management Plan

The purpose of this Habitat Management Plan (HMP) is to identify specific requirements for the maintenance and monitoring, in perpetuity, of the plant communities and plant and animal species naturally occurring in the Heritage Brodiaea Preserve (HBP) site, with special attention to the resident population of Thread-leaved Brodiaea *(Brodiaea filifolia)* a FESA-list Threatened, CESA-listed Endangered Species, and City of San Diego "Narrow Endemic Species". The HBP is being proposed for the conservation, preservation, and enhancement of these natural resources as partial mitigation for impacts associated with development of the Heritage Bluffs II development project site. The HBP will preserve a portion of a regionally-significant population of Thread-leaved Brodiaea in a Conservation Easement (CE) dedicated for that purpose. This new occurrence represents the southern-most known major population of Thread-leaved Brodiaea and one of only two in the City of San Diego. The other occurrence, which is substantially smaller, is located a short distance away on the other side of Black Mountain.

As part of the responsibilities of management, the biological features of the site will be protected and monitored in perpetuity. This document establishes a program of baseline assessments, management, monitoring, and reporting that will help to protect and maintain these biological resources. A Project Analysis Record (PAR) will be prepared to fully document the specific tasks, fees and contingencies associated with these activities. Additionally, this HMP provides an overview of the operation, maintenance, administrative, and personnel requirements necessary to implement management goals. The applicant is required to prepare this HMP and have it reviewed and approved by the California Department of Fish and Wildlife (CDFW) and the U.S. Fish and Wildlife Service (USFWS), hereafter referred to as the Wildlife Agencies, as well as the City of San Diego.

1.2 Agency Review and Coordination

The City's Development Services Department (DSD) in concert with the Wildlife Agencies, as third party beneficiaries, must approve this HMP, the associated PAR, and all activities associated with it. If the proposed CE is granted to an agency or organization other than a member of the Wildlife Agencies, review and approval by that other agency or organization shall be required.

2.0 THE HERITAGE BRODIAEA PRESERVE

2.1 Preserve Description and Location

The HBP is located in the northern part of the City of San Diego County, California (Figure 1). The Preserve consists of 14.1 acres of the Heritage Bluffs II and portions of the adjacent Parcel 3 of PM 18504 (portions of APNs 312-010-15 and 312-160-07) generally situated between the East Clusters Unit 3 and Heritage Bluffs II development project sites. The HBP will be protected within a conservation easement supporting a diversity of habitats and species.

2.2 Current Environmental Setting

The HBP is located in the northern part of the City of San Diego (Figure 1 and 2). The HBP is situated in a broad valley below the north slopes of Black Mountain, a well-known local land feature. The East Clusters Unit 3 and Heritage Bluffs II development projects abut the HBP to the immediate northwest and southeast, respectively. Black Mountain Open Space Park generally surrounds the East Clusters Unit 3 and Heritage Bluffs II development project sites. The HBP area appears to have been used in the past for grazing and extensive agriculture, some evidence of which remains on the site today. However, the land has been fallow for many decades.

The HBP is undeveloped, supporting 100 percent open grassland vegetation with significant numbers of both native and non-native elements. Minor ephemeral drainages are found to the northeast and southwest. These effectively “box-in” the HPB and surrounding grasslands, forming the limits of the large clay lens that sits in this location. Slopes within the HBP are mostly gentle, and elevations range between approximately 605 feet and 690 feet MSL. Regional soil mapping (USDA 1973, 2014) indicates that the HBP site is underlain by the Auld Clay Series. Auld Clays typically consists of poorly drained materials that are underlain by metavolcanic rock. Based on differences between the mapped Auld series and soil profiles examined during geotechnical research, the site soils may belong to a different series. The USDA (1973) soils mapping on similar parent material in the region suggests that the site soils appear to be better associated with the Diablo Clay Series, or Diablo-Olivehain Complex Series (USDA 1973), which are also mapped in the vicinity. However, both of the aforementioned soils series fall into hydrologic soil “Group D,” have very low infiltration rates, and high runoff potential (USDA 1973). These clays remain hydrated at shallow depth (12-18”) for much of the year due to their water-holding capacity. The degree of soil saturation, generally evaluated between depths of 4 to 29 inches, typically ranges from 52 percent to approximately 73 percent with depth.

The HBP and surrounding undeveloped lands function as part of this significant, large-scale, regional wildlife and habitat linkage. Preservation of the site is intended to contribute to the habitat connectivity in this regional linkage in perpetuity.

The Parcel 3 segment of the HBP acreage was previously designated as a part of the City of San Diego's Multiple Species Conservation Program (MSCP) Subarea Plan's Multi-habitat Planning Area (MHPA). The Heritage Bluffs II segment was not. However, after the discovery of Thread-leaved Brodiaea on this site, the City and the Wildlife Agencies have agreed to include all of the HPB acreage in the MHPA.

2.2.1 Plant Communities

The HBP supports a single, highly variable plant community, or habitat-type. This was classified by the project biologist as Non-native Grassland, although it was acknowledged that it contained significant elements of both Native Grassland and some Coastal Sage Scrub species at the periphery. This is defined and described in detail in the site's Final Biological Technical Report (Affinis, 2015).

2.2.2 Flora and Fauna

The HBP site supports a diversity of native and non-native species of plants and animals. The plant and animal species observed typify the diversity normally found in stabilized native and non-native grassland plant communities in this part of the City of San Diego. Comprehensive lists of the plants and animals detected or expected within the HBP will be assembled during the first year of biological monitoring.

2.2.3 Sensitive Species

The HBP site likely supports a number of sensitive species of plants and animals. Sensitive plants might include various ephemeral grassland annuals, such as Small-flowered Morning-glory *(Convolvulus simulans)* and Small-flowered Microseris *(Microseris douglasii* ssp. *platycarpha)*. Sensitive animal species expected to utilize the HBP would include various wide-ranging raptors and bats, such Black-shouldered Kite *(Elanus axillaris)*, Northern Harrier (*Circus cyaneus)*, Townsend's Big-eared Bat *(Corynorhinus townsendii),* Red Bat *(Lasiurus blossevillii),* and many others. .

2.2.4 Thread-leaved Brodiaea

The main purpose of establishing the HBP is to conserve and manage, in perpetuity, all of the natural resources within the HBP boundaries. The most significant species is Thread-leaved Brodiaea, a FESA-listed Threatened and CESA-listed Endangered Species.

Thread-leaved Brodiaea is a late spring-flowering member of the Liliaceae (lily family) sometimes assigned to Amaryllidaceae, Alliaceae, or Themidaceae (Dahlgren et al. 1985; Keator 1993; Fay and Chase 1996; Smith 1997). This is one of 15 species within the genus *Brodiaea*, a group of cormiferous geophytes that occur from southwestern Oregon to northwestern Baja California, Mexico (Niehaus 1971; Keator 1993), mostly in cismontane areas. Thread-leaved Brodiaea is endemic to southwestern California, occurring in a spotty distribution from Glendora in Los Angeles County, east to Arrowhead Hot Springs in San Bernardino County, and south through eastern Orange and western Riverside counties to the slopes of Black Mountain in the northern part of the City of San Diego (Keator 1993; CNDDB 1995a, 1998, 2003, 2012).

Thread-leaved Brodiaea was listed as a California Endangered Species in January of 1982. In October of 1998, it was listed as Threatened under the Federal Endangered Species Act (USFWS 1998). The California Native Plant Society (CNPS) first listed this species in 1980 under the Rarity, Endangerment, Distribution coding system as a “3-3-3” species (CNPS 1980), which equates to the current CRPR listing (2014) as a 1B.1 species. This is the highest ranking (in terms of endangerment status and other factors) afforded any species listed by the CNPS.

At the time of Federal listing, 48 occurrences of Thread-leaved Brodiaea had been reported throughout the species’ range, with at least nine known to have been extirpated, most in northern San Diego County. Populations of Thread-leaved Brodiaea are generally reported as small, with only six populations known from 1998 to exceed 5,000 flowering scapes (Roberts and Vanderwier 1997; CNDDB 1998; USFWS 1998). Many occurrences are reported to consist of less than 500 specimens. In contrast, the CNDDB lists one occurrence, EO 10, on a 40-acre parcel in San Marcos in northern San Diego County as supporting approximately 342,000 flowering specimens (extrapolated) in 1993 (CNDDB 1995a, b). Because each flowering scape detectable during a normal rainfall year represents at least 8–10 separate subterranean corms (CNDDB 1995b), the projected population density at EO 10 would be between 2.7 and 3.4 million plants. In extreme or exceptional drought years, the corms are able to remain in innate dormancy and not produce flowers or even foliage, rendering counts on the basis of flowering scapes extremely unreliable. One study in San Marcos found only 20 flowering plants where

8,000+ corms were later located during salvage and transplantation (Taylor and Burkhart 1992). Another reported that 14,373 vegetative plants were counted within three research plots at the Rancho La Costa reserve in Carlsbad, but none flowered. Even in a wet year, only 2 to 26 percent of the plants within these plots flowered. Year-to-year variation in the number of flowering scapes within known populations thus ranges from thousands to none, depending on precipitation (CNDDB 1995b).

Thread-leaved Brodiaea was first discovered on the Heritage Bluffs II development site in 2011 by biologist Marcia Adams of Affinis. Affinis conducted focused surveys for this species in 2011 and again in 2012. Follow-up foliage surveys were completed in January and February of 2015 during the period of maximum detectability for this species. All surveys were completed by walking the site at 10 foot intervals. All observed occurrences were mapped with a Garmin GPS unit. In 2012, the site was first resurveyed by Affinis with consulting biologist Vince Scheidt, to search for Thread-leaved Brodiaea foliage. All previously identified GPS points (from 2011) were relocated in 2012, and transects were again walked to search for new occurrences. All additional occurrences were also mapped with the GPS unit. Biologists Scheidt and Adams, along with Affinis Research Assistant Nicole Sivba were present for the final field visit in 2012 which also included city and wildlife agency staff. This survey had been conducted after a wet winter and many additional flowering scapes were visible (in addition to those detected in 2011), including flowering scapes on the adjoining East Clusters Unit 3 development site, allowing new GPS points to be added to the inventory. All GPS data was given to PDC for digital map preparation. During the surveys conducted in 2011 and 2012, specimens were found in disjunct patches that ranged from one to several hundred flowering scapes. This is discussed in more detail in the Biological Technical Report for that project (Affinis, 2015). As discussed above, the numbers of observed flowering scapes observed does not in any way accurately reflect the HBP's population size or carrying capacity, however, because (1) the 2011 and 2012 surveys were unavoidably conducted in the midst of 3-years of extreme drought, and (2) Thread-leaved Brodiaea often produces foliage without producing flowers. Therefore, it was predicted that the total number of specimens in the HBP and on the adjoining development sites could range from thousands to hundreds of thousands or more individual corms of all age classes.

The aforementioned, most recent field surveys, completed in January and February of 2015 under the same survey protocols, revealed the presence of no less than 10,423 individually-counted specimens, with the total occurrence population estimated to be between 95,000 and 185,000 individuals of all age classes.

2.3 Restoration and Enhancement Opportunities

The HBP is currently subject to regular disturbance along two dirt tracks. These have impacted the habitat directly, and they also provide access to allow illegal dumping, littering, trampling, etc. Opportunities for habitat creation, restoration. and enhancement exist in the HBP within and adjacent to these tracks, which total approximately 0.23 acres of disturbed/degraded land. Old graded areas will be recontoured to natural grades, and the subsequent termination of pedestrian, equestrian, vehicular and bicycle access through the HBP, followed by planting with indigenous native grassland species, will result in an increase in the biological resource value of the overall HBP habitat and mitigation for project impacts to Native Perennial Grassland vegetation. All restoration or enhancement activities, such as eliminating the dirt tracks, etc. are subject to the requirements of this Plan. Enhancement activities involving the use of Thread-leaved Brodiaea are further subject to the salvage and translocation requirements of the Plan.

Because of the natural growth form of *B. filifolia,* it is possible to augment the existing population that occurs within the HBP with specimens salvaged from the Heritage Bluff II development project site. Adequate room is present to move many tens to hundreds of thousands of specimens without any crowding. *B. filifolia* often occurs in very dense stands, each containing many thousands of ramets. For this reason, there is adequate room within the HBP area to support all specimens needing translocation.

One of the proposed mitigation measures associated with the Heritage Bluff II project's environmental review is the restoration of a small area of Native Grassland vegetation, a Tier I habitat-type. Specifically, the project's *Final Biological Technical Report* (Affinis, 2015) indicates that the proposed project would directly impact approximately 0.15 acre of "native perennial grassland". According to the Affinis (2015) report, the City’s biology guidelines require 2:1 mitigation if impacts and mitigation for Tier I habitats both occur within the MHPA. Mitigation is 1:1 if impacts to Tier I habitat occur outside the MHPA and mitigation occurs inside the MHPA. Mitigating cumulative impacts to Native Grassland also require a minimum of 1:1 "creation" of new Native Perennial Grassland in addition to that required for direct impacts. In order to accomplish adequate mitigation for direct impacts, areas within the HBP richest in native species will be enhanced by following most of the techniques that will be used to manage *B. filifolia*. Specifically, this would consist of the mechanical removal of noxious invasives (*Cynara* and *Foeniculum*), as described above, along with thatch thinning and removal (if necessary). Areas where noxious invasives are removed will planted with native grassland species salvaged from the development site or from seeds collected from the site in order to augment the native elements of the habitat. To mitigate cumulative impacts, the site's two dirt tracks, which currently support 0.23 acre of Disturbed

Habitat, will be regraded and planted with Native Perennial Grassland species intended to "create" new grassland within the former track roadbed (Figure 6). This is discussed further in the project's Biological Technical Report (Affinis, 2015).

Table 1. Potential Species for Native Perennial Grassland Plantings - the HBP Preserve

Common Name	Scientific Name	Source
Gumplant	*Grindelia camporum*	project site-collected seeds
Purple Stipa	*Stipa pulchra*	rose pots/ project site-salvaged specimens + seeds
Blue-eyed Grass	*Sisyrinchium bellum*	rose pots/ project site-salvaged specimens + seeds
Small-flowered Morning Glory	*Convolvulus simulans*	project site-collected seeds
Blue Dicks	*Dichelostemma capitatum*	project site-salvaged corms or seeds
Early Onion	*Allium praecox*	project site-salvaged bulbs or seeds
Thread-leaved Brodiaea	*Brodiaea filifolia*	project site-salvaged corms
Star Lily	*Zigadenus fremontii*	project site-salvaged bulbs or seeds
Johnny Jump-up Violet	*Viola pedunculata*	project site-salvaged bulbs or seeds
Common Goldenstar	*Bloomeria crocea*	project site-salvaged corms or seeds

Table 2. Performance Standards:
Native Perennial Grassland Creation Area within the HBP Preserve

	Year 1	Year 2	Year 3	Year 4	Year 5
Minimum Number of Native Species Established	4	5	6	6	6
Minimum Percentage of Cover with Native Species	5	10	15	15	20
Maximum Percentage of Cover with Invasives	0	0	0	0	0

2.4 Easements or Rights

No existing easements or right-of-ways are known to be present within the HBP.

3.0 ADMINISTRATIVE STRUCTURE AND FUNDING MECHANISM

3.1 Responsible Parties

The following organizations and individuals will be involved in the fulfillment of this HMP. All obligations of the SPIC Del Sur, LLC described below shall be transferred to any future applicant, developer, or land owner:

- SPIC Del Sur, LLC, the Applicant/Developer, shall be responsible for granting a Conservation Easement over the HBP to [--*TBD*--]. Fee Title to the HBP shall be held by the current or future Applicant/Developer. Any transfer of fee Title shall require consultation with the Wildlife Agencies.

- SPIC Del Sur, LLC, the Applicant/Developer, shall retain the services of a PROJECT BIOLOGIST as approved by the Wildlife Agencies who shall be responsible for the implementation of all interim site preparation activities as described herein, including activities associated with the salvage and translocation of any specimens of Thread-leaved Brodiaea detected during grading activities on the adjoining lands. The Project Biologist shall have a B.S., B.A., or higher degree in ecology, botany, or biology, a minimum of five years of demonstrated experience in field biology working directly with Thread-leaved Brodiaea in San Diego County, and be approved by the Wildlife Agencies to work with this species. The interim site preparation is anticipated to take approximately 60 months.

- SPIC Del Sur, LLC, the Applicant/Developer, shall retain the services of a HABITAT MANAGER as approved by the Wildlife Agencies who shall be responsible for the implementation of all long-term maintenance, management, and monitoring activities associated with this HMP. Long-term habitat management shall begin as soon as interim site preparation is completed and approved.

- The WILDLIFE AGENCIES and the DSD will be the approving agencies with respect to the HBP. The Wildlife Agencies and the DSD will not be responsible for implementation of the HMP, but will have authority to enforce its terms and conditions.

- The CONSERVATION EASEMENT HOLDER [--*TBD*--] will also have authority to enforce the terms and conditions of the Conservation Easements which, among other things, requires compliance with this HMP.

<u>Applicant/Developer Responsibilities</u>

The Applicant/Developer shall perform the following tasks prior to certification of the HBP and in conjunction with dedication of Conservation Easements to [--*TBD*--].

- Pay all recording and related costs.

- Complete a thorough clean-up of the HBP, removing debris (old fences, pipes, tires, etc.) and all other items as deemed necessary by (and to the satisfaction of) the Project Biologist. The initial site clean-up activities shall be overseen by the Project Biologist and be done in such a manner so as to not adversely impact biological resources within the HBP.

- Install the necessary fences, signs, and access gate(s). A fencing plan and map are attached (Attachment A).

- Initiate and fund all interim site preparation activities, including habitat enhancement and salvage/translocation activities, identified in this HMP, including horticultural propagation, and fund all activities as necessary. Funding shall pay for activities including exotics eradication and planting, maintenance and biological monitoring for five years as deemed necessary by (and to the satisfaction of) the Project Biologist.

- Supply the Project Biologist and the Habitat Manager with copies of all relevant reports prepared for the project (e.g., biology reports, cultural reports, soils reports, landscape plans, revegetation plans, monitoring reports, etc).

3.2 Designation of a Habitat Manager

The Applicant/Developer shall be responsible for designating a Habitat Manager to provide long-term management of the HBP. The Habitat Manager must be approved by the Wildlife Agencies, and the Habitat Manager shall have the following qualifications:

- The Habitat Manager shall have at least one staff member or contact worker who possesses a B.S., B.A., or higher degree in ecology, zoology, botany, or biology or retain a qualified biologist with such a degree. This individual must have a minimum of five years of demonstrated experience in field biology working directly with Thread-leaved Brodiaea in San Diego County.

- Fiscal stability, including preparation of an operational budget (using an appropriate analysis technique) for the management of this HMP.

- Demonstrated biological stewardship experience with other projects requiring similar skills in San Diego County.

- The ability to carry out habitat monitoring or mitigation activities.

At this time, [--*TBD*--] has been identified as the Habitat Manager responsible for implementation of the specified requirements of this HMP.

3.3 Easement Dedication

SPIC Del Sur, LLC will execute and record a perpetual biological Conservation Easement(s) (“Easement”) over the HBP site in favor of the Conservation Easement holder. A draft Easement will been submitted to the Wildlife Agencies for review and approval. The Easement holder will submit the final easement and evidence of its recordation to the Wildlife Agencies within 60 days of recordation of the Easement. Prior to dedication of any Easement, SPIC Del Sur, LLC will complete an initial site clean-up, including the removal of any trash, old fencing, etc.

3.4 Financial Responsibility and Funding Mechanism

The applicant will prepare and implement a perpetual management, maintenance and monitoring plan for the HBP. The applicant will also establish a non-wasting endowment or similar instrument, such as a Landscape Maintenance District, which is tied to the property, for an amount approved by the Wildlife Agencies based on a PAR or similar cost estimation method to secure the ongoing funding for the perpetual management, maintenance and monitoring of the biological conservation easement area by an agency, non-profit organization, or other entity approved by the Wildlife Agencies. The applicant will submit a draft plan to the Wildlife Agencies that shall include: 1) a description of perpetual management, maintenance and monitoring actions and the PAR or other cost estimation results for the non-wasting endowment; 2) proposed land manager’s name, qualifications, business address, and contact information, to the Wildlife Agencies for approval at least [--*TBD*--] days prior to initiating project impacts. The applicant will submit the final plan to the Wildlife Agencies and a contract with the approved land manager, as well as transfer the funds for the non-wasting endowment to a non-profit entity, within 60 days of receiving approval of the draft plan. During the 60-month interim period, the funding source for all site preparation activities shall be borne by the Applicant/ Developer. It is anticipated that one or more project biologists will be retained to supervise or directly conduct all activities described in Table 3. Anticipated budget expenditures include consulting fees, fees for materials, and fees for review/oversight by the City and the Wildlife Agencies.

4.0 HABITAT MANAGEMENT

4.1 Habitat Manager Responsibilities

The Habitat Manager's primary responsibilities shall be to maintain the integrity of the conserved habitats in the HBP and to ensure that the conserved populations of Thread-leaved Brodiaea are protected in perpetuity. In order to fulfill that responsibility, the Habitat Manager shall:

- Be familiar with the ecology of and have demonstrated experience working with Thread-leaved Brodiaea in the field.
- Be familiar with this HMP and all supporting documentation.
- Be responsible for all matters noted in this HMP that are required of the Habitat Manager.
- Maintain all documents transferred by the Applicant/Developer and his contractors, including the Project Biologist, and be knowledgeable of the resources and their locations addressed in these reports.
- Be responsive to any community concerns or problems regarding the HBP.
- Document all field visits, notify the HBP contacts in a timely manner of any concerns or problems, and identify potential solutions.
- Carry out all long-term habitat management and monitoring tasks as described in Sections 4.0 and 5.0 of this report.

4.2 Long-term Management Objectives

Invasive Species

Task 1. Monitoring

The Habitat Manager shall be responsible for assessing the occurrence of noxious invasive or exotic plant species in the HBP on an ongoing basis. This shall include semiannual monitoring of the HBP by the Habitat Manager for the occurrence of noxious and exotic plants. An exotics control section will be included in the annual report. In addition, measures shall be undertaken to prevent the introduction of new invasive species into the HBP.

Task 2. Eradication

Noxious invasive species detected in the HBP during semiannual site visits shall be immediately and completely removed under the direct supervision of the Habitat Manager. Perennial and noxious invasive exotic plants shall be removed by cutting their stems at or below ground level or pulling seedlings manually. Annual weeds shall be manually pulled or otherwise killed prior to producing mature seed. All weeds shall be exported from the HBP and disposed of properly. The use of herbicides/pesticides for weed/vector control shall be avoided and shall be implemented only if authorized by the Habitat Manager who will use EPA approved herbicides and pesticides designed to combat and control invasive species.

Noxious invasives that must be removed from the HBP, whenever found, include Artichoke Thistle *(Cynara cardunculus)* and Fennel *(Foeniculum vulgare).* These species are known to occur in the Preserve in large numbers. Also, Hottentot Fig *(Carpobrotus edule)*, Giant Wild Reed (*Arundo donax*), Castor Bean (*Ricinus communis*), Mexican Fan Palm (*Washingtonia robusta*), Salt Cedar (*Tamarix* sp.), Pampas Grass *(Cortaderia* sp.*),* Sahara Mustard *(Brassica tournefortii),* Yellow Starthistle *(Centaurea solstitialis),* English Ivy *(Hedera* sp.*)* Perennial Pepperweed *(Lepidium latifolium),* and all others listed as “high” priority by The California Invasive Plant Council (Cal-IPC, 2006) or subsequent publications.

Certain non-native but naturalized species, including most Eurasian annual grasses, such as Slender Wild Oat *(Avena barbata)*, Red Brome (*Bromus rubens),* Ripgut Brome *(B. diandrus)*, and Purple False-brome *(Brachypodium distachyon)* along with various annual forbs, such as Filaree *(Erodium* spp.*)* and others are long-established non-native elements of southern California’s Non-native Grassland plant communities. The attempts to control these naturalized species are ineffective and can create more problems than they solve. Assuming that the HBP's hydrology is stable and unchanging, these annuals will not be a problem for Thread-leaved Brodiaea, and will not be actively managed. However, as part of the adaptive management strategy, measures may be provided to control and/or dethatch areas of the HBP currently known to support Thread-leaved Brodiaea. This would come into play should a deep thatch develop or should any of the above species become noxious or truly invasive.

Task 3. Predator Control

Exotic animal control is not anticipated to represent a major issue in the management of the HBP. However, both domestic and feral dogs and cats can be major predators of native species. The Habitat Manager shall ensure that dogs, cats, and other non-native animals are not occurring in the HBP. Trapping may be necessary, although the relatively open nature of the HBP means that few pets or feral animals would be residing in the habitat.

Exotic animal control shall be initiated on a case-by-case basis, as follows:

- Predator/pest control shall only be implemented to address a specific, identified problem situation.

- The trapping of non-native predators/pests shall be limited to strategic locations where determined most feasible to accomplish the goal of removing these animals from the HBP. All predator/pest control shall be considered a temporary, short-term activity.

- Predator/pest control methods shall be humane. Adequate shade shall be provided, and all traps, when activated, shall be checked twice daily. Any domestic animals trapped during predator/pest control shall be returned to their owners or taken to the nearest animal shelter.

- The Habitat Manager shall report to the County Animal Control Officers if persistent and chronic problems occur with respect to particular uncontrolled pets or feral animals being found in the HBP.

Task 4. Habitat Restoration, Salvage, and Translocation

The Habitat Manager may allow seed collecting from plants in the HBP for the express purpose of revegetating degraded HBP areas. Any such seed collecting shall be performed under the direct supervision of the Habitat Manager, during the dry season, and under a written agreement specifying the amounts and locations of collectible materials. The collecting of seed stock shall be limited to the minimum necessary for the revegetation effort and shall not seriously deplete the existing vegetation.

The salvage of all specimens of Thread-leaved Brodiaea in harm's way is a requirement of the issuance of development permits for portions of the adjoining East Clusters Unit 3 development project and all of the Heritage Bluffs II development project. Any specimens detected prior to or during grading shall be salvaged. Most specimens must be relocated into the HBP. See Attachment B for more information about this process.

Task 5. Trash/Graffiti Removal and Vandalism Repair

The Habitat Manager shall be responsible for the general condition of the HBP by directing the removal of any illegally dumped materials, the clean-up of any litter, and the removal of any vandalism. Any vandalism resulting in damage to the fences, signs, or resources within the HBP must be remediated immediately. These tasks shall occur during the semi-annual monitoring visits or as often as necessary and approved by the Habitat Manager. All maintenance activities within the HBP shall be performed under the direct supervision of the Habitat Manager.

Task 6. Removal of Hazardous Materials

When identified, any hazardous materials must be removed per County-approved procedures. The Habitat Manager shall contact the County's Environmental Health Services Department for guidance in the event that hazardous materials are identified.

Task 7. Removal of Encampments and Unauthorized Encroachments

The Habitat Manager shall survey the site for encampments during monitoring visits and report them to the Sheriff's Department. Any encampments shall be removed from the HBP upon vacation of the property by the unauthorized persons. Improper or illegal encroachments must be removed as soon as possible, on an as needed basis.

Task 8. Installation/Repair/Replacement of Fencing, Gates, and Signs

The HBP shall be protected by a professionally-installed, equestrian (ranch rail), or similarly well-constructed “wildlife friendly” fence designed to be of maximum durability. Equestrian rail fencing is recommended to allow wildlife passage and provide a clear visual barrier to discourage pedestrian entry. The fence shall surround the HBP where the Project Biologist determines it is needed for site security or to protect the habitat (Attachment A). The fence will be installed immediately following approval of the HBP. The fence will have a minimum five-foot height with locked entry gates where needed. The purpose of the perimeter fencing will be to prevent intrusion into the HBP and to avoid an attractive nuisance. The installation of this fence will be monitored to completion by the Project Biologist.

Evidence that permanent fencing and signage have been properly installed shall consist of a signed statement from the Project Biologist verifying that the permanent fence has been put in place around the perimeter of the HBP, as appropriate. Photographs and a brief description of design and materials used shall be submitted along with the statement from the Project Biologist. The specific construction materials and fence designs are subject to approval by the Project Biologist and the Wildlife Agencies.

Permanent, high-visibility signs shall be installed at three (3) signs per mile along the permanent fence. These signs shall read the equivalent of:

NO TRESPASSING
Sensitive Environmental Resources
Disturbance Beyond this Point is Restricted
by Easement

Information:
Contact: [--*TBD*--]
Tel. ________________
Penal Code 602

Signs must be in good condition at all times and must be replaced, repaired, and/or cleaned as often as necessary. The Applicant/Developer shall be responsible for the installation of the permanent fencing, signs, and gates. The Project Biologist shall be responsible to supervise the installation of the permanent fencing, signs, and gates, and for providing five years of fence, signage and gate maintenance and monitoring. The Habitat Manager shall assume responsibility for the long-term maintenance and repair of the fencing, signs, and gates at the end of the five-year interim management period.

Task 9. Access

The Applicant/Developer shall be responsible for providing permanent access to the HBP for the Project Biologist and Habitat Manager. The HBP's access gates and locks must be maintained in working order at all times to prevent unauthorized entry into the HBP. Under normal circumstances, only the Project Biologist, Habitat Manager, and other authorized agents will be allowed into the actual HBP site. Exceptions to this shall be in an emergency or as otherwise specified by the Project Biologist or Habitat Manager in consultation with the WILDLIFE AGENCIES. Access to the HBP (other than for biological monitoring) shall primarily occur during the dry season to avoid potential damage to sensitive biological resources.

Task 10. Coordination with Adjacent Land Managers and Neighbors

The Habitat Manager shall coordinate with land managers of nearby preserved lands on management practices and tasks related to the preservation and maintenance of the sub-regional open space system. This shall include activities such as continuous removal of exotic and pest species and ensuring compatibility with the goals of the overall open space management plan to be prepared for the City as part of the MSCP Plan.

Task 11. Coordination with Other Agencies

The Habitat Manager shall coordinate with relevant local agencies on an as-needed basis, including, but not limited to:

- Coordination with County's Environmental Health Services Department for vector control and herbicide use, although the use of herbicides/pesticides for weed/vector control shall be avoided to the extent possible. Any and all pesticide use shall be implemented only if deemed necessary and authorized in writing by the Habitat Manager.

- Coordination with law enforcement, including the City of San Diego Police Department or County Sheriff's Department.

- Coordination with emergency services, such as the City of San Diego Fire Department's local fire station personnel.

4.3 Prohibited Activities

Within the HBP, the following shall be prohibited:

- Grading, excavation, or the placement or movement of any soil, sand, rock, gravel, or any other material, except for approved habitat restoration and/or enhancement activities or other habitat or species restoration efforts determined to be necessary as a result of adaptive management, undertaken as part of an approved restoration plan.

- The clearing or thinning of any vegetation, except for the removal of exotic plant species as determined by the Project Biologist or Habitat Manager to be necessary, and the selective thinning of vegetation by hand in Zone 2 Brush Management associated with the adjoining homes to the extent required by written order of the fire authorities for the express purpose of reducing an identified fire hazard. While clearing for brush management is not anticipated with the creation of this easement, such clearing may be deemed necessary in the future for the safety of lives and property. All fire clearing shall be pursuant to the Consolidated Fire Code and the Memorandum of Understanding dated February 26, 1997 between the Wildlife Agencies and the fire districts and any subsequent amendments thereto.

- The watering, pruning, or fertilizing of any native species, unless determined by the Project Biologist or Habitat Manager to be necessary.

- The construction, erection, or placement of any building or structure, with the exception of the required permanent fence.

- Use of off-road vehicles and the use of any other motorized vehicles, except when necessary in conjunction with authorized habitat management activities. The Project Biologist or Habitat Manager will ensure that any vehicular use for authorized habitat management purposes is limited to the minimum necessary for the allowed purpose.

- Dumping of any kind, including the dumping of landscape materials, trash, hazardous waste, or any other materials.

- Planting of any vegetation except as pursuant to habitat enhancement as described in this HMP.

- Use for any purpose other than those specifically designated in this HMP.

- The disturbing of any natural resources (plants, animals, minerals, etc.) including hunting, collecting, etc.

Anyone attempting such activities shall be informed of the restrictions by the Project Biologist or Habitat Manager in a non-confrontational manner. The Habitat Manager shall report any serious confrontational situations and any chronic offenders to the Wildlife Agencies and the San Diego Police Department.

The Project Biologist or Habitat Manager, in consultation with the City DSD and the Wildlife Agencies, shall determine the appropriateness of any proposed uses not specifically designated in this HMP. All activities authorized by the Project Biologist or Habitat Manager must be consistent with the goals and objectives of this HMP and must be approved by the Wildlife Agencies. To limit impacts to sensitive biological resources, activities within the HBP are forever restricted to:

- Biological surveys conducted as part of the ongoing biological monitoring process.

- Weeding, trash removal, or other maintenance activities (described in detail in this HMP).

- Habitat restoration and/or enhancement activities or other habitat or species restoration as described in this Plan.

- Emergency response by the Project Biologist or Habitat Manager and the appropriate agencies in case of fires, floods, earthquakes, or other natural disasters.

- Other activities deemed by the Habitat Manager to be appropriate and necessary to ensure the long-term viability of the HBP. The Wildlife Agencies will have the right to disallow “other activities” approved by the Habitat Manager if Wildlife Agencies determine that such uses are not appropriate or necessary to the purposes of the HMP.

4.4 Adaptive Management

This HMP has been developed to facilitate an adaptive management strategy. The overall goal of an adaptive management strategy is to improve the quality of management decisions, based on the best available information. Monitoring will be used to assess the success of adaptive management. If monitoring indicates that the biological resource management goals are not being met, it may be necessary to modify this HMP between regularly scheduled updates. If changes to the HMP are determined to be necessary, the proposed changes shall be submitted to the Wildlife Agencies for approval, as required.

5.0 PRESERVE MONITORING

5.1 Monitoring Tasks

5.1.1 Interim Site Preparation and Monitoring

The 60 month interim site preparation and monitoring activities shall consist of the following, as described in this report:

- General site clean-up, removing old fences, trash, and old dumped materials
- Monitoring of grading in all areas adjoining or near the HBP to ensure that encroachment does not take place
- Inspection and certification of required fencing and signage
- Supervision of invasives removal
- Verification that all noxious invasives have been effectively eradicated
- Evaluation as to whether a need exists to remove any accumulation of excess thatch from areas supporting Thread-leaved Brodiaea
- Salvage and translocation of any specimens of Thread-leaved Brodiaea found during grading in all area adjoining or near the HBP
- Supervision and biological monitoring of site preparation and installation of NPG
- Biological monitoring of the NPG restoration for 60 months, including a 120-day plant establishment period (PEP)
- Establishment and maintenance of a managed reserve (assurance) population in horticulture for future reintroduction to the HBP

Additional tasks, such as detailed vegetation mapping, baseline species inventorying, other management activities, and annual reporting shall also be performed or overseen by the Project Biologist until such time as the long-term Habitat Manager is funded and in place.

5.1.2 Long-term Habitat Monitoring

Long-term biological management and monitoring shall begin once the Applicant/Developer meets all obligations required prior to the initiation of this activity, including implementation of all interim site preparation tasks identified in the this Plan, and the long-term management is funded.

The Habitat Manager shall conduct basic qualitative and quantitative monitoring on a semiannual basis. Because of the gradual nature of changes experienced by climax plant association lands, this is consistent with the regional planning efforts for this area. During site visits, to be conducted during periods to maximize detection of Thread-leaved Brodiaea (typically in December/January and again in May/June) or as determined necessary by the Habitat Manager, the HBP shall be visually inspected for changes, including new occurrences of exotic species, changes in vegetative growth patterns, changes in floristic composition or diversity, and other factors relating to habitat viability. Quantitative monitoring shall consist of visual counts within one-meter quadrats at permanent monitoring stations established during the first year of monitoring. The first count shall be of the number of foliage-producing corms and the second of flowering scapes. During both semiannual monitoring surveys, an estimate of weedy cover and percentage of thatch shall be made. The Habitat Manager shall recognize the survey's limitations and shall adopt methodologies to maximize the detection of changes to the structure of the habitat, as appropriate. All plant and animal species observed shall be recorded during each site survey, and any new occurrences of Thread-leaved Brodiaea within the HBP, beyond the limits of previously recorded specimens, shall be noted and reported to the Wildlife Agencies via CNDDB form submitted to the CDFW. In extreme drought years, funds that would be normally allocated towards surveying for Thread-leaved Brodiaea shall be redirected towards other habitat management considerations as determined by the Habitat Manager in consultation with the Wildlife Agencies.

Any measurable changes within the HBP that could affect the existing biological resources shall be monitored over time. Information obtained from tracking changes within the HBP shall be used by the Habitat Manager to determine specific remediation, as needed. All remediation/recovery activities shall be discussed with the Wildlife Agencies prior to implementation.

Baseline Inventory and Vegetation Mapping

The quality and quantity of the habitat-types present within the HBP shall be documented by the Project Biologist during the first year of interim biological monitoring. In addition, a detailed vegetation map showing conditions at the time of HMP approval shall be produced for the HBP during the first year of interim biological monitoring. The locations of all known sensitive plants or animals detected shall be noted on the vegetation map, where practicable. The vegetation map shall be updated every five years, initially by the Project Biologist once at HMP approval and again at the end of the first year of biological monitoring, and then by the Habitat Manager on the same yearly schedule, in perpetuity.

A baseline species inventory shall also be compiled by the Project Biologist during the first year of interim biological monitoring. This shall consist of a complete list of all plant and animal species observed (either directly or indirectly by scats, tracks, etc.) during the periodic field surveys. The baseline species inventory shall be updated with any new species detected onsite during subsequent field surveys of the HBP by the Habitat Manager in perpetuity.

The updated vegetation map and baseline species inventory shall be included in the first annual monitoring report prepared by the Project Biologist. An updated species list will be included in the subsequent annual reports that follow and an updated vegetation map will be included every five years. This information shall be used as a baseline to measure habitat changes resulting from both natural causes and edge effects, as well as to evaluate the success of the management effort in the years that follow.

<u>Sensitive Species Surveys</u>

During the interim and long-term management periods, the Project Biologist and the Habitat Manager, respectively, shall be responsible for evaluating the status of the sensitive species in the HBP biennially and for implementing protective measures, if necessary. Monitoring of sensitive species shall include the use of specific survey protocols and methodologies, fixed monitoring locations or transects, and species-specific data collection and analysis. All of the sensitive species that are recorded from the HBP site shall be monitored. Any additional sensitive species detected in the HBP during the regular monitoring periods shall be incorporated into future monitoring reports as additional data and be forwarded to the CNDDB.

The status of all occurrences of Thread-leaved Brodiaea onsite shall be assessed semiannually (2x per year). Surveys for any other sensitive species known or expected to occur within the HBP shall be included during the semiannual Thread-leaved Brodiaea surveys, if appropriate. The Habitat Manager shall be responsible for evaluating the status of the onsite populations of all sensitive species and any edge effects or other issues that may reduce the perpetual viability of these populations. All plant and animal species observed during sensitive species surveys shall be recorded and included in the annual report.

Review of HMP

The Habitat Manager shall meet with the Wildlife Agencies on an "as needed" basis to discuss whether changes in management of the HBP are needed. Any necessary changes in management will be reflected in updates of this HMP. Updates shall be based on findings and determinations made during the ongoing biological monitoring of the HBP, changes in site conditions, and recommended modifications to maintenance efforts. During annual review of implement of this HMP, all parties shall cooperatively develop a list of habitat or population triggers and potential remedial actions should conditions deteriorate to a point where additional action is required. This list shall be based on observations made during the prior year of biological monitoring.

5.2 Annual Reports

Annual reports shall be submitted to the Wildlife Agencies by the first of August of each year. Annual reports shall discuss the previous year’s management and monitoring, as well as work plan that outlines specific management and monitoring activities that will be undertaken in the coming year. The annual report shall provide a concise but complete summary of management and monitoring methods, identify any new management issues, and address the success or failure of management approaches (based on monitoring). The report shall address any changes resulting from previous monitoring results and provide a methodology for measuring the success of any adaptive management. The annual report shall summarize the status of the endowment and funds generated, itemize the costs of management actions, and estimated costs for the coming year. In addition, the annual report shall provide a general habitat assessment and a summary of the status of Thread-leaved Brodiaea and any other sensitive species occurring on the property and provide specific recommendations, as necessary, to remediate any problems. If any habitats or sensitive species’ populations appear to be declining, the annual report shall outline a plan for the remediation of the resource(s).

Site photographs from fixed photo-documentation points shall be provided in the annual report. These shall be established by the Project Biologist during the first year of monitoring. The photographs shall clearly depict the height and cover of the native vegetation, condition of the fences and signs, and any problems not needing an emergency response. The annual report shall also include photo documentation of any problem areas that would require significant management action, such as vandalism, fire damage, and trash dumping. The annual report shall summarize remediation required during the previous reporting period and make specific recommendations for future maintenance and monitoring. The report shall include copies of CNDDB forms as submitted to the CDFW for any occurrences of Thread-leaved Brodiaea and new sensitive species observations or significant changes to species occurrences or habitats previously reported. The report shall also include copies of invasive plant species forms submitted to the CDFW and/or other regulatory authorities, if applicable.

6.0 LIST OF PREPARERS

- Vincent N. Scheidt, Biologist
- Brandon D. Myers, Associate Biologist

7.0 CERTIFICATION

I hereby certify that the information contained in this document is complete and accurate to the best of my knowledge as of November 24, 2015.

Vincent N. Scheidt, MA
Biological Consultant

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Figure 1. Regional Location – Heritage Brodiaea Preserve

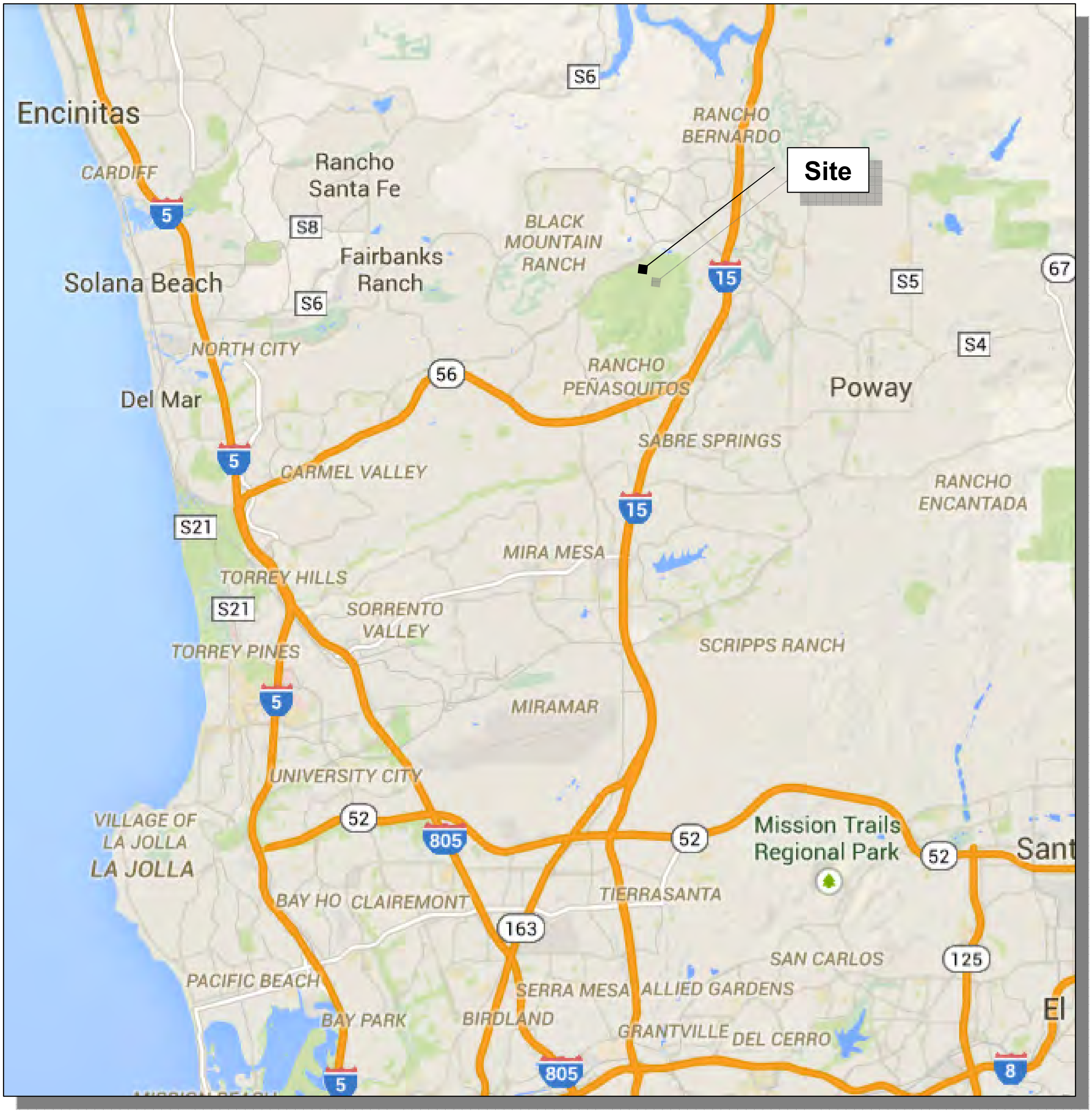


Figure 2. Topography – Heritage Brodiaea Preserve
Portion of U.S.G.S. "Poway, California" 7.5' Quadrangle

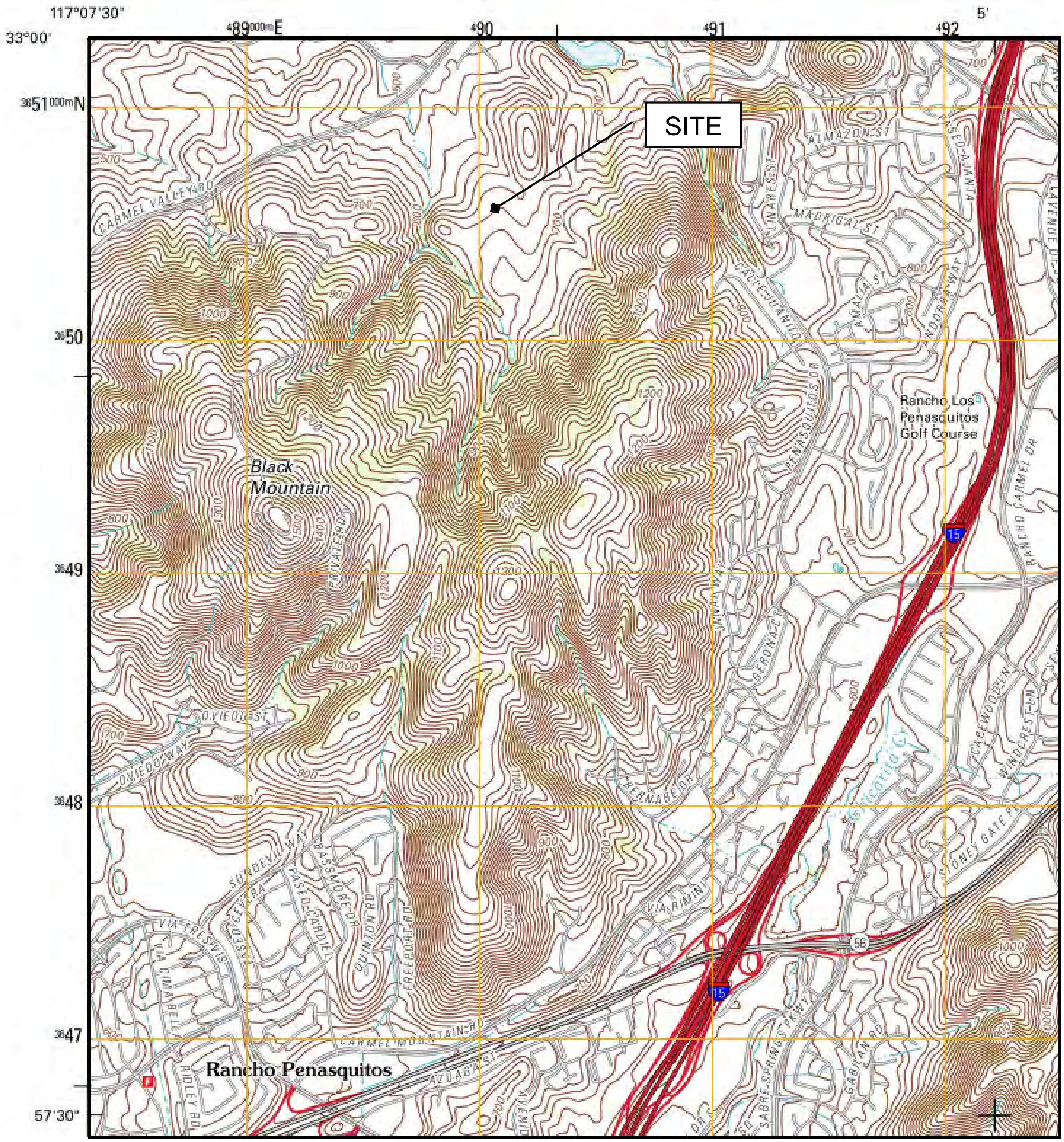


Figure 3. Heritage Brodiaea Preserve

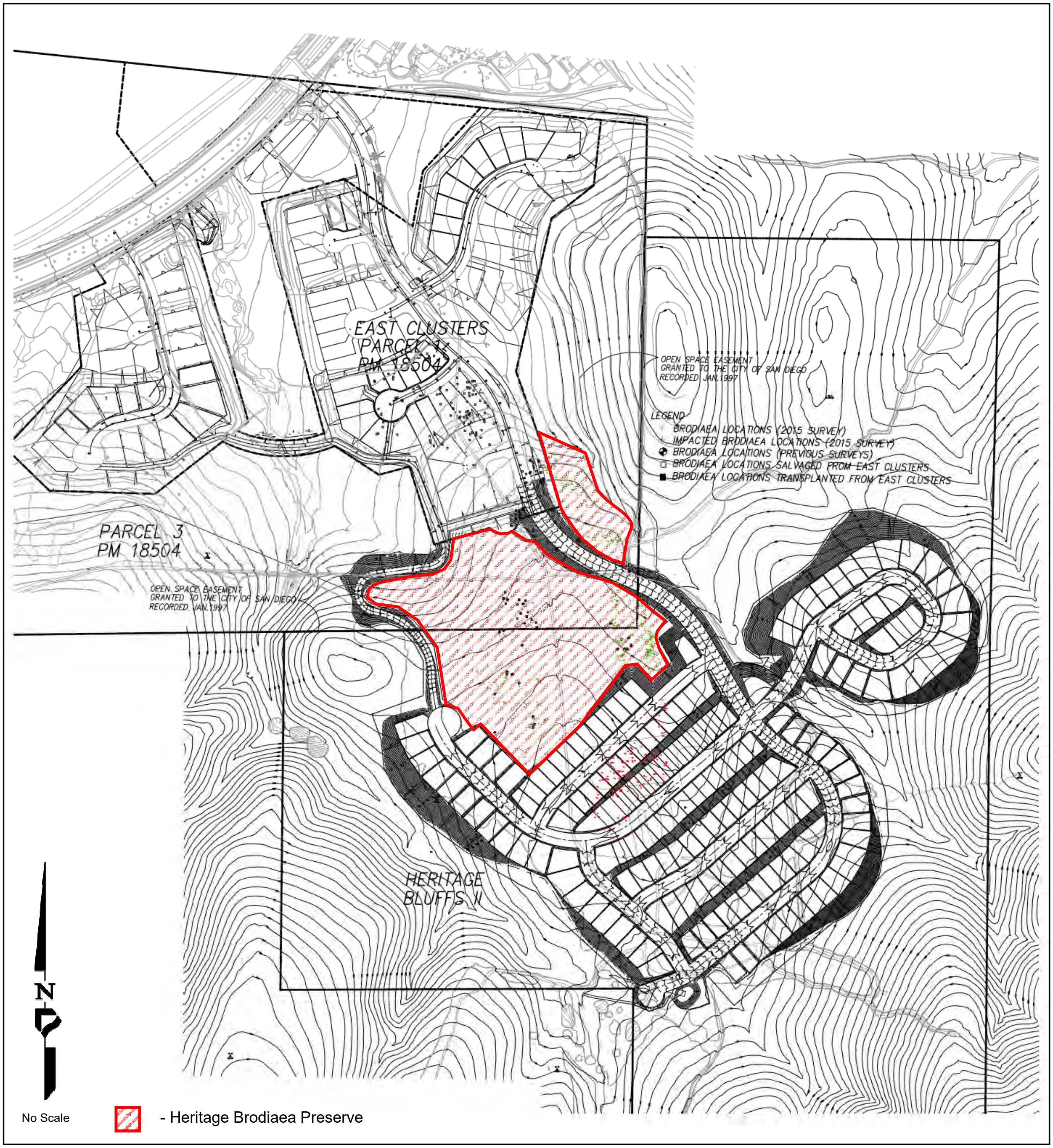
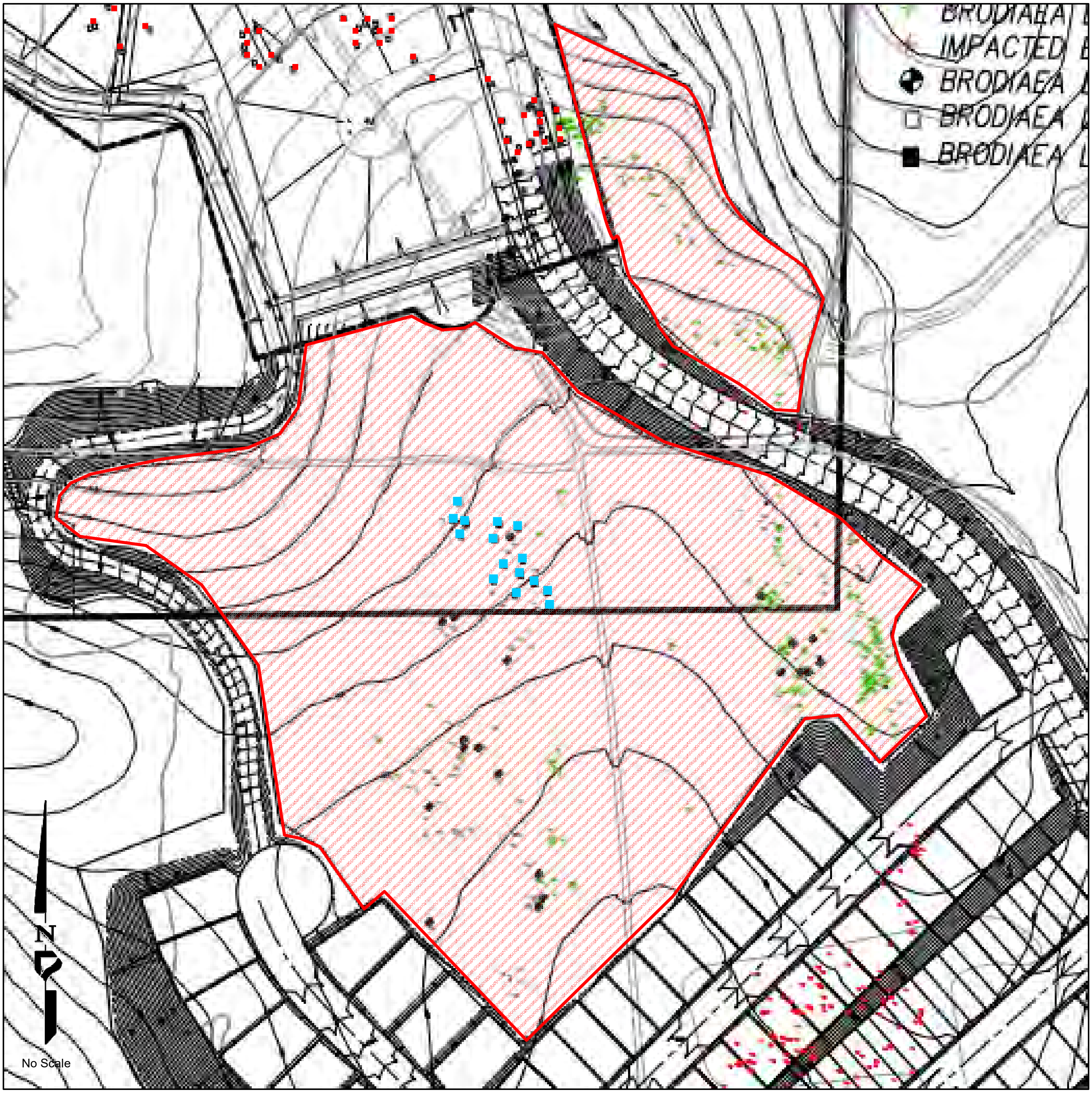


Figure 4. Detail - Heritage Brodiaea Preserve with Brodiaea Occurrences



- Heritage Brodiaea Preserve

- Known Thread-leaved Brodiaea Occurrence - Translocated Thread-leaved Brodiaea Occurrence

- Impacted Thread-leaved Brodiaea Occurrence

Figure 5. Recent Aerial Photograph Showing the Heritage Brodiaea Preserve

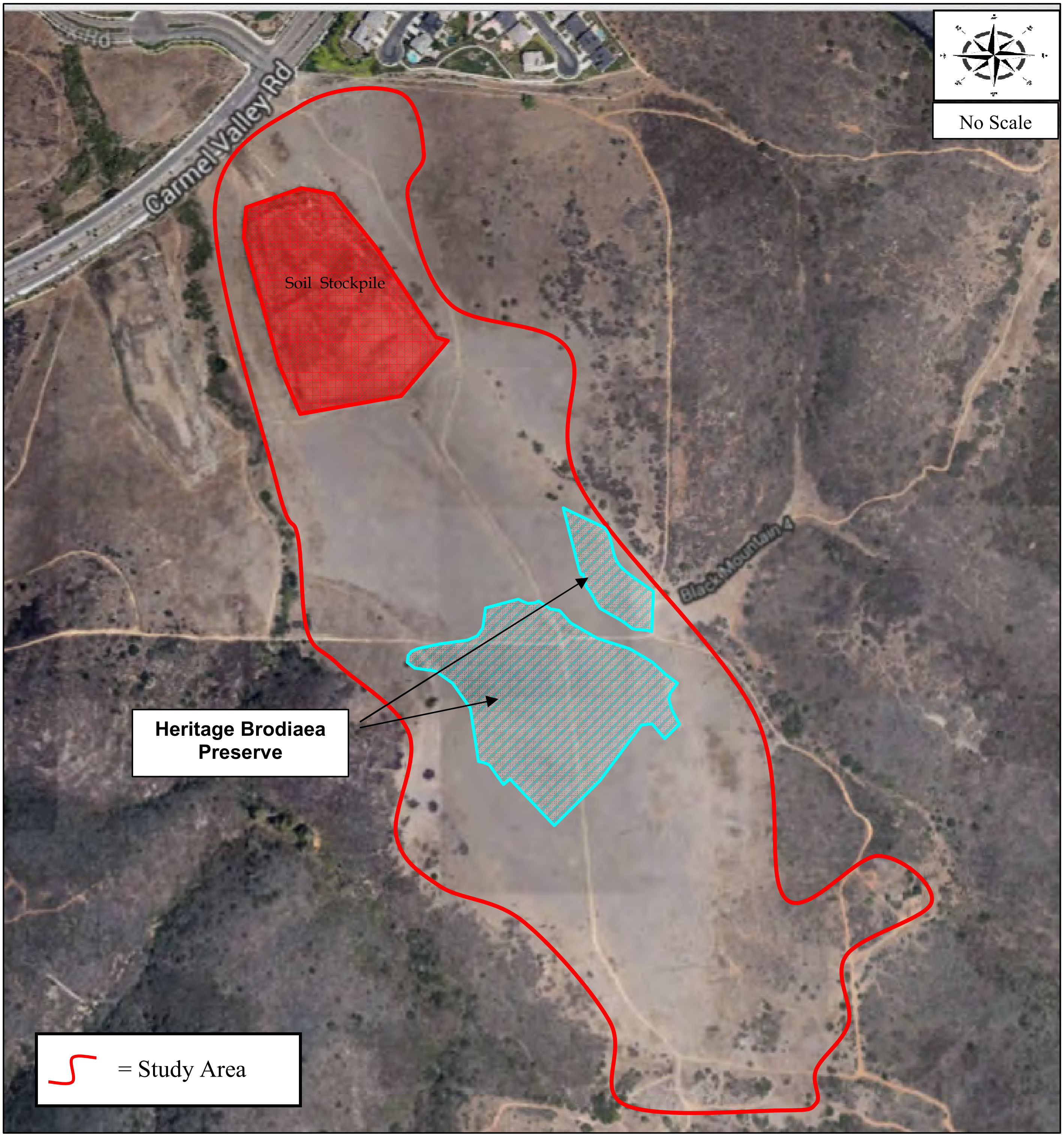


Figure 6. Native Perennial Grassland Creation Areas within the Heritage Brodiaea Preserve

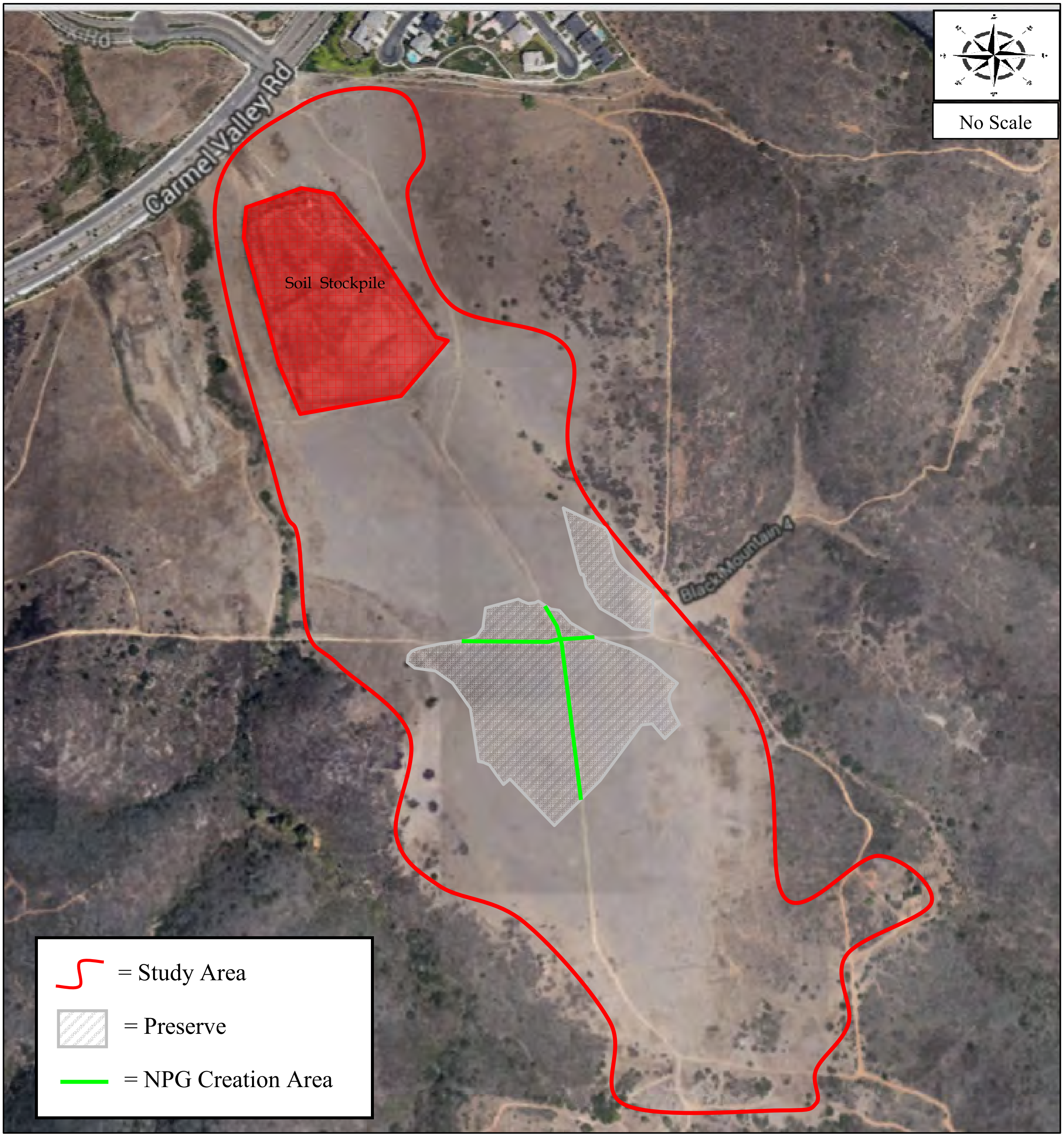


Table 3. 60-month Interim Site Preparation and Monitoring Schedule: HBP

Task	Responsible Party/Staff	Funding Source	Report Deadline	Frequency/Season of Implementation	Report To
Site clean-up	Applicant/Developer/ Project Biologist	Applicant/ Developer	Prior to recordation of CE	One time	City
Biological monitoring of grading	Project Biologist	Applicant/ Developer	Part of annual monitoring report	Continuous Until Grading is Complete	Wildlife Agencies and City
Certification of permanent installation - fencing/gates	Applicant/Developer/ Project Biologist	Applicant/ Developer	Following Installation	One time	City
Biological monitoring of site preparation and installation of NPG	Project Biologist	Applicant/ Developer	Part of annual monitoring report	Continuous during installation	Wildlife Agencies and City
Biological monitoring of NPG during 120-day PEP	Project Biologist	Applicant/ Developer	Part of annual monitoring report	Monthly through end of 120-day PEP	Wildlife Agencies and City
Biological monitoring of Brodiaea salvage and translocation	Project Biologist	Applicant/ Developer	Part of annual monitoring report	Continuous Until Grading is Complete, then Winter and late Spring	Wildlife Agencies and City
Biological monitoring: Years 1-3	Project Biologist	Applicant/ Developer	Part of annual monitoring report	Monthly	Wildlife Agencies and City
Biological monitoring: Years 4-5	Project Biologist	Applicant/ Developer	Part of annual monitoring report	Quarterly	Wildlife Agencies and City
Establish Assurance Population of Thread-leaved Brodiaea in Horticulture	Project Biologist	Applicant/ Developer	Part of annual monitoring report	One time/Winter	Wildlife Agencies
Monitor Assurance Population of Thread-leaved Brodiaea and documentation	Project Biologist	Applicant/ Developer	Part of annual monitoring report	Annually/Winter	Wildlife Agencies
Monitoring of Invasives removal and documentation	Project Biologist	Applicant/ Developer	Part of annual monitoring report	Continuous Until Grading is Complete, then Semi-annually	Wildlife Agencies and City
Detailed vegetation mapping	Project Biologist	Applicant/ Developer	Upon approval of HBP	Annually/Fall	Wildlife Agencies and City
Baseline species inventory	Project Biologist	Applicant/ Developer	Part of annual monitoring report	Annually/Spring	Wildlife Agencies and City
General biological monitoring	Project Biologist	Applicant/ Developer	Part of annual monitoring report	Semi-annually/Spring & Fall	City
Other management activities (fence and signage inspection)	Project Biologist	Applicant/ Developer	Part of annual monitoring report	Ongoing	Wildlife Agencies and City
Annual monitoring report	Project Biologist	Applicant/ Developer	August 1 of each year	Submitted annually	Wildlife Agencies and City

Table 4. Long-term Management and Monitoring Schedule: HBP

Task	Responsible Party	Report Deadline	Frequency	Report To
Inspection of permanent fencing/gates	Habitat Manager	Upon acceptance of maintenance/monitoring responsibilities	Ongoing in perpetuity	City
Patrolling	Habitat Manager	Part of annual report	Monthly in perpetuity	City
General biological monitoring	Habitat Manager	Part of annual report	Semi-annually in perpetuity/Spring/Fall	City
Invasives monitoring and removal	Habitat Manager	Part of annual report	Semi-annually in perpetuity/Spring/Fall	Wildlife Agencies and City
Thread-leaved Brodiaea surveys	Habitat Manager	Part of annual report	Semi-annually in perpetuity/Winter/ late Spring	Wildlife Agencies and City
Other sensitive species surveys	Habitat Manager	Part of annual report	Every three years in perpetuity/Spring/Fall	Wildlife Agencies and City
Update vegetation mapping	Habitat Manager	Part of annual report	Every five years in perpetuity or as needed/Fall	Wildlife Agencies and City
Review and, if necessary, update HMP	Habitat Manager	Part of annual report	Every five years in perpetuity	Wildlife Agencies and City
Other management activities	Habitat Manager	Part of annual report	Annually or as needed in perpetuity	City
Annual report	Habitat Manager	March 1 of each year	Annually in perpetuity	Wildlife Agencies and City

Attachment A

FENCING PLAN

(to be provided)

Attachment B

SALVAGE AND TRANSLOCATION PROTOCOLS

Thread-leaved Brodiaea Salvage and Translocation Requirements for the Heritage Bluffs II and East Clusters Unit 3 Project, San Diego

Thread-leaved Brodiaea *(Brodiaea filifolia)* is a State Endangered and Federally Threatened native plant species that is known to occur on portions of the Heritage Bluffs II and East Clusters Unit 3 Project in the City of San Diego. Specimens are known to occur in areas that will be subject to grading and development, hence the need to salvage and translocated all individuals that will be in harm's way. The salvage effort shall utilize the most current protocols, which may differ from those presented herein, to maximize success.

Transplantation programs involving Thread-leaved Brodiaea have had a nearly forty-year history of failure, with numerous failed efforts since at least 1977 (Hall, 1986; Scheidt, 2009). The standard method of salvage and translocation involves removing corms from the soil (corm separation) during the summer, when the corms are dormant, and immediately replanting them in a designated location, with hopes that the plants will emerge and flower in the late spring when growing conditions are optimal (Scheidt, 2009; Recon Environmental, 2015). This does not work, as the corms are an extremely attractive food source to burrowing herbivores, which forage widely in search of food during the dry months. Over the last few years, however, new translocation techniques have been developed that retain the corms within the hydrated substrate. Using this technique, the entire block of corm-bearing clay soil is moved in manageable sections during the winter months when the ground is very wet. This minimizes herbivory losses due to the difficulty herbivores have penetrating the saturated and heavy clay soils. The corms are able to settle into the dense substrate when many herbivores are dormant, being protected by a surrounding matrix of heavy clay which is sealed up by winter rains.

<u>Salvage and Translocation</u>

The most important consideration with respect to the viability of translocation is the selection of a suitable receptor or replanting area. To maximize the chances for successful salvage and transplanting, several critical transplantation parameters have been identified. These must be matched between the salvage site(s) and the replanting site(s) prior to salvage and replanting. The factors are as follows:

a. Proximity

In order to maintain the genetic integrity of the salvaged population and avoiding gene contamination of nearby, undisturbed populations, it is critical that specimens be moved the shortest distance possible from the salvage site. Potential replanting areas must be identified and located within the Heritage Brodiaea Preserve (HBP). In most cases, this is within a several hundred meter radius of the known and potential occurrences that will be affected by grading and development. Each potential replanting area must be carefully examined and considered. The final candidate transplantation area must be subject to rigorous evaluation, focusing on the five factors below.

b. Slope

The transplanting area within the HBP must be consist of a gentle slope (<15% grade), with a cover of native and non-native grasses. This will minimize chances for slope-related problems, such as general erosion, slope stability, slumping, etc. The presence of other geophytes, such as Golden Star (*Bloomeria)* and Blue Dicks (*Dichelostemma)* is highly desirable.

c. Aspect

In this part of San Diego County, Thread-leaved Brodiaea usually occurs on gentle north-facing slopes, with some populations reported to occur on flat land, or lands with west- facing or east-facing aspects. The salvage areas within the Heritage Bluffs II Project and East Clusters Unit 3 site generally sloped to the north. Matching aspect between the salvage site(s) and the replanting site(s) has been determined to be critical because it would presumably provide a match between these areas with regards to overall site dryness.

d. Drainage

The salvage site(s) are all essentially undrained, or drained via very limited sheet flow. It is highly unlikely that Thread-leaved Brodiaea occurs at the bottoms of rills, swales, or other drainage or erosional features. For this reason, the replanting site must match the drainage patterns of the salvage site to the maximum extent feasible. This will further ensure that erosion-related problems will be minimized.

e. Soil types

The salvage site(s) all likely contain Diablo-series or Auld-series heavy clay deposits underlain by metavolcanic rock. In San Diego County, the distribution of Thread-leaved Brodiaea is highly correlated with specific clay soil series (USFWS 1998). The Diablo-series or Auld-series deposits form discrete lenses containing what appeared to be dense ramets (asexually produced, genetically identical specimens) of Thread-leaved Brodiaea. Although the clay lenses within the HBP also support substantial numbers of Thread-leaved Brodiaea, these numbers form spotty occurrences, primarily taking advantage of the differences in the soil profiles within the Preserve. The potential to support stable depositions of this extremely dense clay material is critical to the success of the program. The replanting site(s) must support dense clay lenses, but not in the precise location where the salvaged specimens would be placed. Rather, these lenses must be located upslope and downslope of the transplantation area, indicating that if the salvaged materials are successfully translocated into the area between these heavy clay deposits, the potential for long-term transplantation viability will be increased.

f. Presence of target taxon with significant interstices

In order to ensure that growing conditions at the selected replanting site(s) will be viable in perpetuity, the presence of extant and robust occurrences of Thread-leaved Brodiaea with significant interstices is important. This indicates that the replanting site(s) are in all ways suitable and it assumes that factors beyond those listed above, such as microclimate, pollinators, mycorrhizal fungi or other associate species will be generally matched. By placing the salvaged materials into the interstices (while protecting the extant specimens), as many unmeasured variables as possible will be matched, maximizing the chances for success.

Two other factors are considered critical to the long-term success of the salvage and transplantation program:

g. Timing

The excavation technique used in this plan is critically time-dependent. There is a limited window of time available each year to salvage and translocate the plants *in situ*. This is because the corm-supporting clay lens needs to be moved when fully hydrated so as to minimize chances for lens disintegration and corm separation. The very best time to salvage corms is after the cessation of winter rains when soil conditions are ideal for excavation. During the summer or fall, the soil forms dry clods that break up during excavation, resulting in corm separation and/or damage. Other Thread-leaved Brodiaea transplantation programs that were designed to separate the corms from the surrounding clay matrix have historically failed (Scheidt, 2009). Disintegration of the lens allowed corm herbivory primarily by pocket gophers (*Thomomys*), as well as excessive desiccation of the corms and rhizomes, and invasion by weedy species that are opportunistic on the broken clay soils.

If salvage must occur during the summer or fall, depending on the timing of grading, all salvaged corms must be maintained in horticulture until such time as the receptor soils are fully saturated by winter rainfall. Any corms salvaged outside of the winter rainy season must be stored in a cool, dry location for transplanting the following year. Transplanting planting of corms other than in the winter is not permitted.

h. Long-term Protection

The selected transplantation site will be afforded protection in perpetuity. The HBP will be managed and monitored per the requirements of the *Thread-leaved Brodiaea Habitat Management Plan (HMP) for the Heritage Brodiaea Preserve.* This ensures that the replanted specimens will be conserved as part of the recovery of the species.

Propagation and Management in Horticulture

In order to establish and maintain an *ex situ* reserve (assurance) population, no more than twenty-five percent of all salvaged specimens shall be retained for horticultural propagation purposes. These specimens shall be maintained in cultivation in a facility approved by the Wildlife Agencies until such time as field augmentation is desirable, or when the number of cultivated specimens exceeds 500 percent of the stockpiled specimens. No less than 100 percent of the specimens designated for propagation must be maintained in cultivation in perpetuity.

Summary

The translocation of Thread-leaved Brodiaea out of harm's way appears to be technically feasible assuming that several critical requirements are met:

- Salvage must occur in the winter when the soil is fully hydrated.
- The substrate must not be separated from the corms to the extent practicable.
- The replanting area(s) within the HBP must conform to the salvage site with respect to proximity, slope, aspect, drainage, and soil type.
- Thread-leaved Brodiaea occurrences must be present in areas immediately adjoining the replanting area, but not in the specific location where the transplanted materials are established. Adequate space is present to translocate

all specimens within the development area, but great care must be taken when planting to ensure that no extant specimens are affected in any way.

The published literature contains a number of inaccuracies with respect to the biology of Thread-leaved Brodiaea. This geophyte does not produce bulbs, as is frequently stated, but it probably does reproduce primarily asexually via the production of daughter corms at the end of long, thin rhizomes that radiate out from the mother corm (Smith 1997). Numbers of specimens reported from known occurrences are most likely gross underestimates. In any case, sexual reproduction is critical to the long-term survival of *B. filifolia*, as is the support of native pollinators. Niehaus (1971) found that a broad spectrum of insects visit Brodiaea flowers, but only tumbling flower beetles (Mordellidae) and sweat bees (Helictidae) were found to transport pollen between flowers. Bell reported that native bees were faithful to specific species of *Brodiaea* on the Santa Rosa Plateau, Riverside County, CA), but the European honeybee *(Apis mellifera)* was not (G. Bell, the Nature Conservancy, pers. comm. 1997, cited in USFWS 1998). The presence of Thread-leaved Brodiaea pollinators at the HBP will ultimately depend on the success of maintaining and expanding occurrences in the Preserve.

One significant problem relating to the transplantation of Thread-leaved Brodiaea concerns the difficulty in estimating the total number of individuals within a population. As discussed previously, the number of corms producing flowers varies in response to the timing and amount of rainfall, as well as temperature patterns. Typically, in any given year, only a fraction of the plants will develop to the point of flowering, thus any transplantation effort must anticipate encountering large numbers of mature and immature corms.

In the case of the this project, this is precisely what happened. Field surveys completed in the winter of 2015, during the time between the approval of the draft of this Plan (January 2015) and this revised, final version (November 2015), additional field surveys were completed. A total of 10,423 individual specimens were detected and counted, and the total population is estimated to be between a low of 95,000 specimens and a high of 185,000 individual specimens.

APPENDIX 11

THREAD-LEAVED BRODIAEA SURVEY REPORT

VINCENT N. SCHEIDT
Biological Consultant

3158 Occidental Street • San Diego, CA • 92122-3205 • 858-457-3873 • 858-336-7106 cell • email: vince.scheidt@gmail.com

William M. Dumka
Vice-President of Forward Planning
Standard Pacific Homes, San Diego
16010 Camino Del Sur
San Diego, California 92127

~~February 27, 2015~~
~~Revised September 18, 2015~~
Second Revision November 24, 2015

RE: Results: Thread-leaved Brodiaea Foliage Survey for East Clusters Unit 3 and Heritage Bluffs II Project Sites, City of San Diego

Dear Mr. Dumka:

Per your request, we have recently completed a directed field survey for Thread-leaved Brodiaea *(Brodiaea filifolia)* on portions of the East Clusters Unit 3, Parcel 3 of PM 18504, and the Heritage Bluffs II properties in the City of San Diego (APNs 312-160-05, 312-160-07, and 312-010-15). All areas that supported suitable grassland habitat (Figure 1) were carefully searched for foliage which is characteristic of this species in compliance with current Wildlife Agency (CDFW, USFWS) standards, which require a directed search for seasonally-limited rare plants during the season of greatest detectability.

Methods

Field surveys of the site were completed by Brandon D. Myers, Associate Biologist and me on the dates and in the areas presented below. Biologists Marcia Adams, Lee BenVau, Allison Sharpe, and Catherine MacGregor assisted with surveying for part of the day on February 4, 2015.

Date	General Location of Area Surveyed	***B. filifolia*** **Counts; 2015**
January 22, 2015	Southern and southwestern-most edge portions of site	No *B. filifolia* detected
January 26, 2015	Southern portion, east of N-S dirt haul road	Approximately 400 *B. filifolia* detected
January 28, 2015	Central portion of site, east of N-S dirt haul road	Approximately 3,472 *B. filifolia* detected
January 30, 2015	Central portion of site, west of N-S dirt haul	Approximately 1,370 *B. filifolia* detected
February 2, 2015	Northern portion of site, east of N-S dirt haul road	Approximately 976 *B. filifolia* detected
February 4, 2015	Northern-central potion of site, west of N-S dirt haul road	Approximately 424 *B. filifolia* detected
February 11, 2015	Central portion of site, west of N-S dirt haul road	No *B. filifolia* detected
February 13, 2015	Northern-central potion of site, west of N-S dirt haul road	Approximately 605 *B. filifolia* detected
February 18, 2015	Central portion of site, east of N-S dirt haul road	Approximately 2,072 *B. filifolia* detected
February 20, 2015	Southern portion, east of N-S dirt haul road	Approximately 401 *B. filifolia* detected
February 23, 2015	Central portion of site, west of N-S dirt haul road	Approximately 703 *B. filifolia* detected
Total	--	**Approximately 10,423 *B. filifolia* detected**

Surveying involved slowly walking linear transects across the entire area of potential habitat at 10 foot intervals. Plant groupings encountered were flagged in the field and GPS points were established for each observation point. An estimate of the number of plants emerging at each point of observation point was made by visually counting mature specimens to the extent possible.

Results

The number of *B. filifolia* specimens actually counted at any observation point (flagged location) during the surveys varied between one and many dozen plants, with the number of specimens counted in the field totaling 10,423 individuals. This number reflects visible, mature specimens only, as immature specimens and seedlings produce foliage that is effectively impossible to locate and verify as originating from *B. filifolia* corms. Also, it is easy to miss specimens during field surveys as the surrounding vegetation, particularly dense stands of the noxious Artichoke Thistle *(Cynara cardunculus)*, which is abundant on this site, effectively block a view of the ground's surface in many areas where *B. filifolia* foliage could be emerging. It is generally accepted that the number of plants counted *in situ* represents approximately 11 percent of the total number of corms of this species buried within the substrate. This reconciles with Recon Environmental's pre-grading salvage of approximately 10,902 mature corms from the East Clusters Unit 3 site in the summer of 2015, where approximately 3,207 foliage-producing (mature) specimens had been counted just three months prior (see Attachment A). Thus, we estimate that the study area supports a low of approximately 95,000 to a high of 185,000 individual specimens based on the results of the 2015 foliage survey. The attached exhibits illustrate the 2015 survey polygons covering all potentially-suitable habitat areas for this species (Figure 1) and the location of specimens detected on the study area covering portions of the East Clusters Unit 3, Parcel 3 of PM 18504, and Heritage Bluffs II properties in the City of San Diego (Figure 2).

Salvage and Translocation

As currently designed, the proposed habitat preserve associated with the Heritage Bluffs II project ("Heritage Brodiaea Preserve") would cover approximately 14.1 acres of Parcel 3 of PM 18504 and the adjoining Heritage Bluffs II properties. The Heritage Brodiaea Preserve will conserve *in situ* approximately 3.75 acres of the acreage mapped as supporting *B. filifolia*, with the balance - 2.43 acres - considered impacted by the Heritage Bluffs II development project. These 2.43 acres will be subject to *Brodiaea* corm salvage and translocation into the Heritage Brodiaea Preserve.

In terms of numbers of individual specimens counted and mapped within the study area between 2011-2015, the Heritage Brodiaea Preserve will protect approximately 5,401 counted plants on the Heritage Bluffs II project site, with the balance - 5,022 counted plants - either salvaged and translocated into the Preserve or stockpiled for future propagation. As mentioned, approximately 10,902 specimens were subject to emergency salvage from the adjoining East Clusters Unit 3 project site (see Attachment A) by RECON Environmental in July of 2015, although these numbers do not readily reconcile with the counted plant occurrence points from January/February of 2015 with the total numbers of counted specimen occurrences conserved (via either *in situ* preservation or translocation to the HBP): 10,423 counted plants. As noted previously, this represents approximately 11 percent of the total corms anticipated to occur onsite. Therefore, a total of approximately 49,149 corms are anticipated to be preserved *in situ*, with 45,700 to be ultimately salvaged and translocated to either propagation or to the HBP. The 10,902 specimens salvaged by RECON represent the order of magnitude larger number of specimens actually present in the habitat, most of which were uncounted during the survey.

The details of this proposed salvage and translocation, along with required management and monitoring tasks, are presented in the *Thread-leaved Brodiaea Salvage and Translocation Plan for the Heritage Brodiaea Preserve* dated August 2015. The details of emergency salvage from the East Clusters Unit 3 are presented in Attachment A

Discussion

This new occurrence of *B. filifolia* represents the southern-most known major population, with a single, substantially smaller occurrence on the other side of Black Mountain. These are the only two known occurrences of *B. filifolia* in the City of San Diego. The City received "coverage" for this species under their MSCP permit in 1997, even though *B. filifolia* was not known to occur in the City at that time. This allows the City to authorize the "take" of this species under the assumption that specific avoidance measures are in place, and that significant populations are protected to the maximum extent practicable.

B. filifolia is an MSCP-designated Narrow Endemic Species and a “covered” special status species. In accordance with the City's "take permit, the MSCP Narrow Endemic Policy must be applied to any populations of this species, including those already known and any found in the future. This is discussed in more detail in the *Final Biological Technical Report Heritage Bluffs II, San Diego, California* dated November 2015 (Affinis Job Number 2538).

Sincerely,

Vincent N. Scheidt
Certified Biological Consultant
TE 7881333-5

Figures and Attachments:

Table 1. *Brodiaea filifolia* - Acreage and Numbers Conserved *In Situ* and Numbers Translocated
Figure 1. 2015 Survey Polygons Showing Areas and Dates Surveyed
Figure 2. Occurrence Polygons - Heritage Bluffs II and East Clusters Unit 3 Project Site (Not Showing Translocated Specimens)
Figure 3. All Known Brodiaea Locations Through February 2015, Potentially Impacted Brodiaea Locations, Salvaged Brodiaea Locations (East Clusters Unit 3), and Translocated Brodiaea Locations (Entitled East Clusters Unit 3) Through July 2015
Attachment A. Letter-report from Recon Environmental: *Entitled East Clusters Unit 3 - Brodiaea Salvage/Translocation (RECON Number 3159-4)*
CNDDB form

Table 1. *Brodiaea filifolia* - Acreage and Numbers Conserved *In Situ* and Numbers Translocated

Site/Parcel	***Brodiaea*** **Acres Conserved *In Situ***	***Brodiaea*** **Acres Impacted**	**Total [1] Counted Specimens**	**Counted Specimens Conserved *In Situ***	**Counted Specimens Impacted**	**Estimated Specimen Salvage Numbers [2] and Translocation**
East Clusters Unit 3 312-160-05	n/a	n/a	3,341	n/a	3,341	Approx. 30,403 corms (~10,902 corms already salvaged) [3]
Parcel 3 of PM 18504 312-160-07	1.69 acres	0.32 acres	2,982	2,853	129	Approx. 1,174 corms to be salvaged
Heritage Bluffs II 312-010-15	2.06 acres	2.11 acres	4,100	2,548	1,552	Approx 14,123 corms to be salvaged
TOTAL	**3.75 acres**	**2.43 acres**	**10,423**	5,401	**5,022**	**Approx. 45,700 corms salvaged or to be salvaged**

[1] *Specimen numbers above represent the actual number of plants counted in the field through February of 2015.*
[2] *Estimated salvage numbers are based on an 11 percent foliage count accuracy, with each counted specimen representing 9.1 additional specimens within the substrate (uncounted).*
[3] *See Attachment A for details. A known total of approximately 10,902 corms were salvaged from the East Clusters Unit 3 project site in July 2015.*

Figure 1. 2015 Survey Polygons Showing Dates and Areas Surveyed

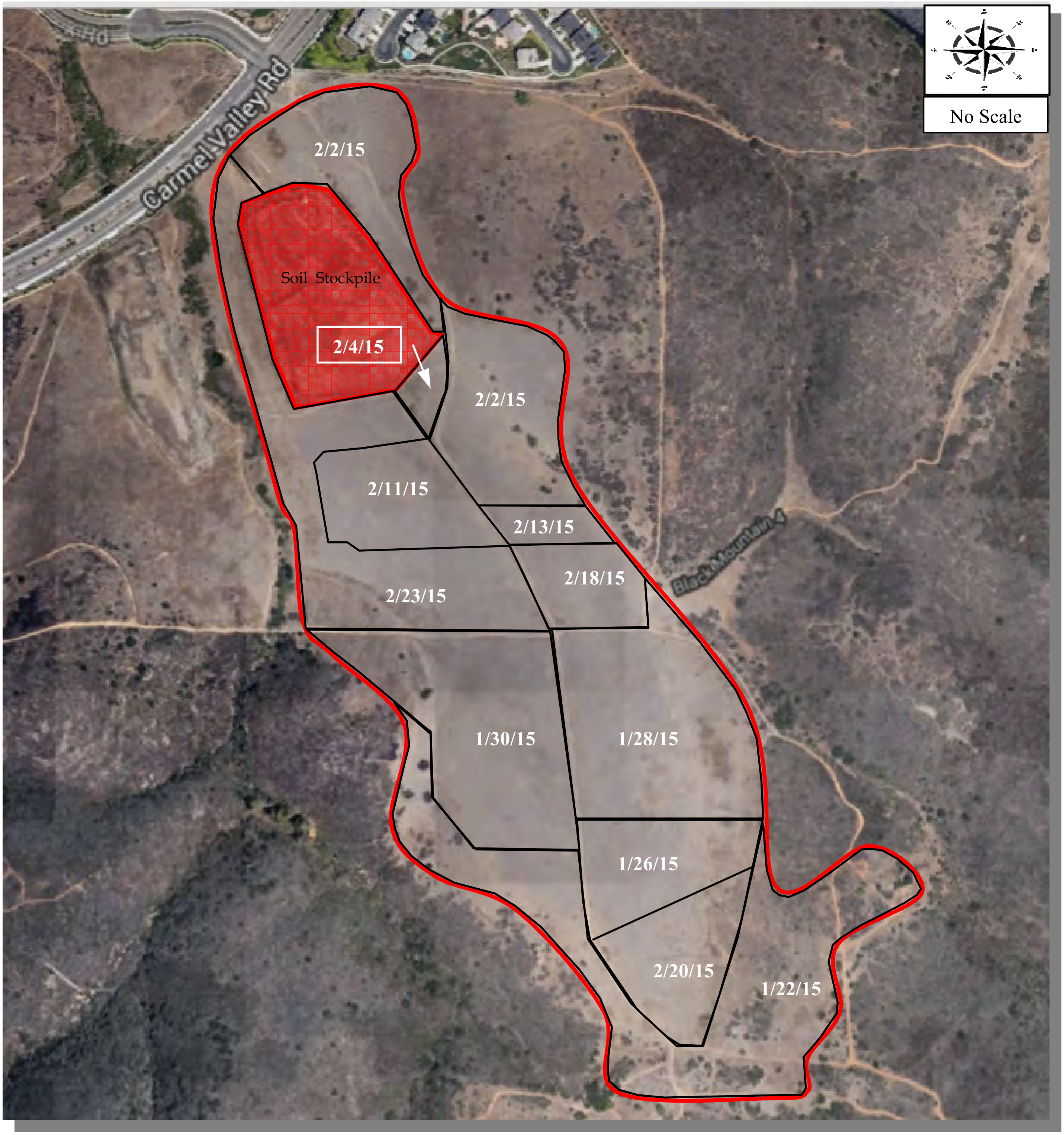
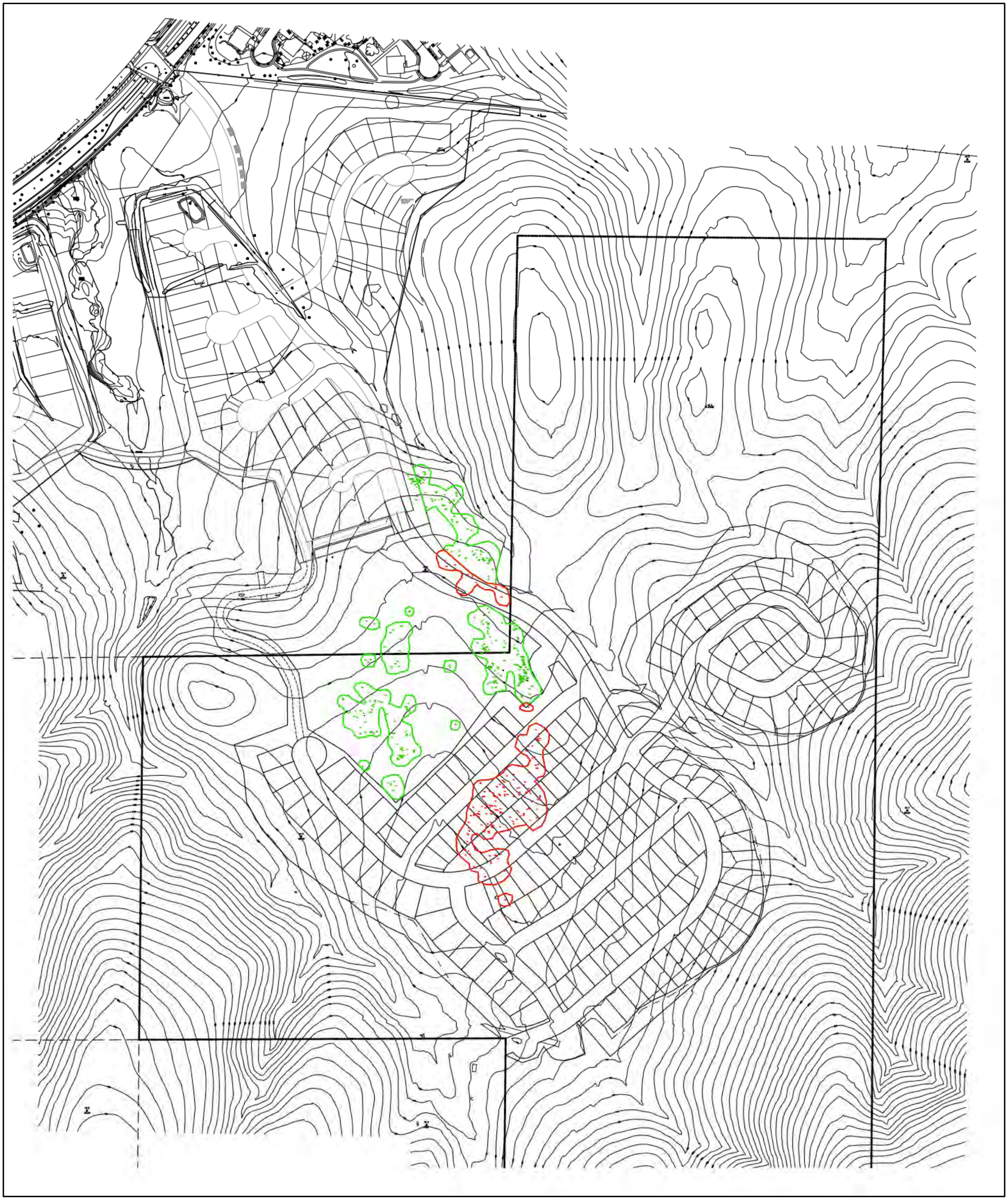
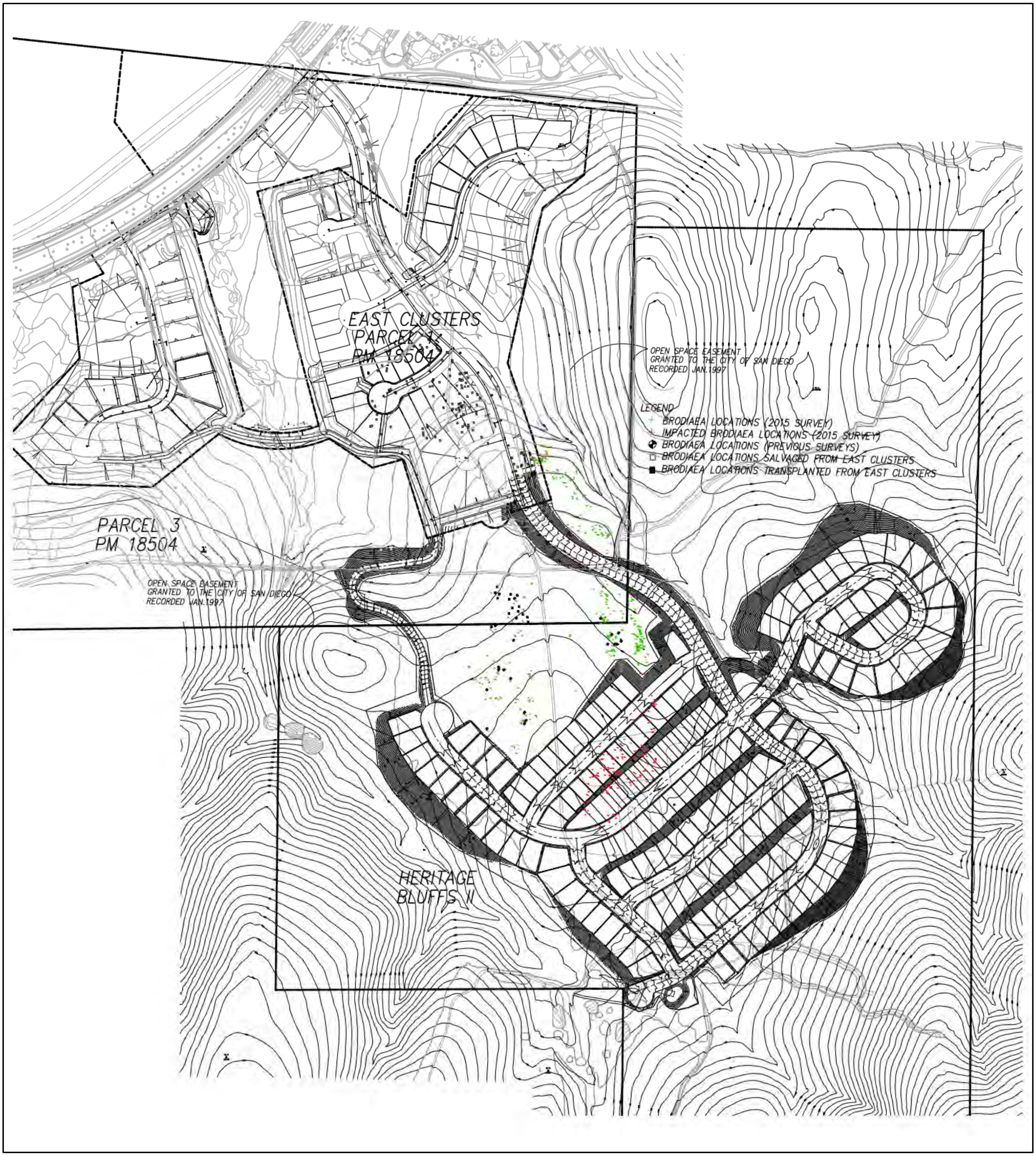


Figure 2. Occurrence Polygons - Heritage Bluffs II and Parcel 3 of PM 18504[4]



[4] *Not showing East Clusters specimens salvaged and translocated by RECON Environmental in the Summer of 2015*

Figure 3. Entitled East Clusters Unit 3, Parcel 3 of PM 18504, and Heritage Bluffs II Project Sites - Known *Brodiaea* Locations Through February 2015, Potentially Impacted *Brodiaea* Locations, Salvaged *Brodiaea* Locations (Entitled East Clusters Unit 3), and Translocated *Brodiaea* Locations (Entitled East Clusters Unit 3) Through July 2015.



Attachment A

Letter-report from RECON Environmental:
East Clusters Unit 3 - Brodiaea Salvage/Translocation (RECON Number 3159-4)

Insert RECON report here

Mail to:
California Natural Diversity Database
Department of Fish and Game
1807 13th Street, Suite 202
Sacramento, CA 95814
Fax: (916) 324-0475 email: CNDDB@dfg.ca.gov

Date of Field Work (mm/dd/yyyy): 02/04/2015

For Office Use Only
Source Code ______ Quad Code ______
Elm Code ______ Occ. No. ______
EO Index No. ______ Map Index No. ______

Reset

California Native Species Field Survey Form

Send Form

Scientific Name: *Brodiaea filifolia*

Common Name: Thread-leaved Brodiaea

Species Found? ☑ Yes ☐ No ______ If not, why?

Total No. Individuals ~10,423 Subsequent Visit? ☐ yes ☑ no

Is this an existing NDDB occurrence? ______ Yes, Occ. # ☑ no ☐ unk.

Collection? If yes: ______ Number ______ Museum / Herbarium

Reporter: Vince Scheidt
Address: 3158 Occidental Street
San Diego CA 92122
E-mail Address: vince.scheidt@gmail.com
Phone: (858) 457-3873

Plant Information

Phenology: 100 % vegetative ____% flowering ____% fruiting

Animal Information

____ # adults ____ # juveniles ____ # larvae ____ # egg masses ____ # unknown

☐ breeding ☐ wintering ☐ burrow site ☐ rookery ☐ nesting ☐ other

Location Description ***(please attach map AND/OR fill out your choice of coordinates, below)***

Attached USGS 7.5' Quadrangle

County: San Diego Landowner / Mgr.: Private

Quad Name: Poway, CA Elevation: ~700'

T____ R____ Sec ____, ____ ¼ of ____ ¼, Meridian: H☐ M☐ S☐ Source of Coordinates (GPS, topo. map & type): GPS

T____ R____ Sec ____, ____ ¼ of ____ ¼, Meridian: H☐ M☐ S☐ GPS Make & Model Iphone 4s

DATUM: NAD27 ☐ NAD83 ☐ WGS84 ☐ Horizontal Accuracy ______ meters/feet

Coordinate System: UTM Zone 10 ☐ UTM Zone 11 ☐ ***OR*** Geographic (Latitude & Longitude) ☑

Coordinates: Center of study area: 32.993121, -117.106380

Habitat Description *(plant communities, dominants, associates, substrates/soils, aspects/slope):*

Native and Non-native Grassland habitat on heavy clay soils. Associates include Stipa pulchra, Sisyrinchium bellum, various other native geophytes, and non-natives, including Cynara cardunculus, Foeniculum vulgare, and Eurasian grasses. Specimens observed primarily on gentle north-facing slopes in various areas of site, mostly in small occurrences. Surrounding area in non-native grassland and partiall developed. Site mostly flat.

Other rare taxa seen at THIS site on THIS date: Polioptila california in adjoining Coastal Sage Scrub vegetation
(separate form preferred)

Site Information Overall site/occurrence quality/viability (site + population): ☑ Excellent ☐ Good ☐ Fair ☐ Poor

Immediate AND surrounding land use:

Visible disturbances:

Threats:

Comments: Presence of large numbers of Cynara makes accurate counts difficult.

Determination: *(check one or more, and fill in blanks)*

- ☑ Keyed (cite reference): Jepson
- ☐ Compared with specimen housed at: ______
- ☐ Compared with photo / drawing in: ______
- ☐ By another person (name): ______
- ☐ Other: ______

Photographs: *(check one or more)*

	Slide	Print	Digital
Plant / animal	☐	☐	☑
Habitat	☐	☐	☑
Diagnostic feature	☐	☐	☑

May we obtain duplicates at our expense? yes ☐ no ☐

APPENDIX F
Archaeological Resources Survey and Assessment

NATIONAL ARCHAEOLOGICAL DATA BASE INFORMATION

Authors:	Mary Robbins-Wade
Consulting firm:	Affinis, 810 Jamacha Road, Suite 206, El Cajon, California 92019 (619) 441-0144. Contact: Mary Robbins-Wade, HELIX Environmental Planning, (619) 462-1515
Report Date:	January 2008; Revised March 2009; Revised July 2009; Revised February 2010; Revised January 2014; Revised November 2014; Revised February 2015
Report Title:	Archaeological Resources Survey and Assessment, Heritage Bluffs II, San Diego California. Project No. 147683
Submitted to:	City of San Diego, Planning and Development Review Department, 1222 First Avenue, San Diego, California 92101 (619) 236-6460
Submitted by:	Project Design Consultants, 701 B Street, Suite 800, San Diego, California 92101 (619) 235-6471
Contract number:	Affinis Job No. 2239/2572
USGS quadrangle:	Poway (7.5' series)
Acreage:	170 acres
Keywords:	San Diego County, City of San Diego, Black Mountain Ranch; archaeological survey; archaeological evaluation; lithic scatter (not significant), habitation site (significant); CA-SDI-11,039, CA-SDI-18,504; T14S, R2W, Section 5; T13S, R2W, Section 32

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CONFIDENTIAL APPENDICES

A Records Search Maps
B Locations of Cultural Resources; Site Maps
C Site Records
D Native American Correspondence

LIST OF ACRONYMS

CEQA	California Environmental Quality Act
HRG	Historic Resources Guide
KCRC	Kumeyaay Cultural and Repatriation Committee
LDC	Land Development Code
MHPA	Multiple Habitat Planning Area
MMRP	Mitigation Monitoring and Reporting Program
NAHC	Native American Heritage Commission
STP	Shovel Test Pit
VTM	Vesting Tentative Map

MANAGEMENT SUMMARY

The Heritage Bluffs II project is located in the Black Mountain Ranch Subarea of the City of San Diego, in western San Diego County. The property is south of Bernardo Center Drive/ Carmel Valley Road and west of Interstate 15. The project site consists of approximately 169.85 acres, and the project proposes to develop a total of 171 residential units on approximately 43 acres of the site.

One archaeological site was previously recorded within the Heritage Bluffs project area. CA-SDI-11,039 had been described as a scatter of flakes and pottery with a possible rock room feature. No testing had been undertaken to assess the site's significance.

Affinis conducted a survey of the Heritage Bluffs project area in July 2007. Two archaeological sites were identified within the property: CA-SDI-11,039 and CA-SDI-18,504. A testing program was conducted in August and September 2007 to assess the significance of the two sites and evaluate the significance of project impacts. At CA-SDI-11,039, the testing program included mapping and collection of surface artifacts and excavation of 10 shovel test pits and 12 test units (1 m by 1 m). One test unit was excavated at CA-SDI-18,504.

CA-SDI-11,039 was found to be much larger than previously recorded: 175 m (575 ft) by 110 m (365 ft), covering an area of 15,120 m^2 (3.7 acres). Site boundaries were based on surface artifacts and topography. A rock feature was documented in the northwestern portion of the site; it is assumed to be the same feature noted on the previous surveys. A hearth feature was found in a subsurface context, and cremated human remains were encountered in two units. These remains and associated grave goods were repatriated to the Kumeyaay Cultural Repatriation Committee (KCRC).

While much of the subsurface deposit at CA-SDI-11,039 was only about 30 cm deep, there were pockets of midden soil. The maximum depth of cultural material was 80 cm. Almost 10,000 artifacts were collected at the site, including debitage, cores, numerous projectile points and bifaces, flaked stone tools, manos, metates, hammers, and over 500 Tizon Brown Ware sherds. A small amount of marine shell and animal bone was also recovered. Non-local lithic material included obsidian and Piedra de Lumbre chert.

CA-SDI-11,039 is a Late Prehistoric site, apparently representing a habitation location. Activities conducted at the site include food processing/preparation and consumption, lithic tool manufacture or finishing and resharpening, and possibly hunting. The site was used during the Late Prehistoric period and shows no evidence of use during an earlier time period or following European contact. The site possesses the potential to address a variety of research questions. The site is of cultural significance, due to the presence of human remains, as well as its archaeological significance. It is a significant resource under the California Environmental Quality Act (CEQA) and is considered to be an Important Archaeological Site, as defined in the Historical Resources Guidelines of the City of San Diego and the Historical Resources Regulations of the City of San Diego Municipal Code.

Using more precise digitized mapping, the overall site area was calculated to be 3.623 acres, with the area of concentration (the significant portion of the site) covering 2.033 acres or 56.1 percent of the site, and the less significant portion of the site covering 1.590 acres or 43.9 percent.

CA-SDI-11,039 was designated by the City of San Diego Historical Resources Board on July 23, 2009 as a historical resource under Criterion A for its archaeological and cultural signficance. It is listed on the City's Register as HRB #916. As such, the proposed project would normally be subject to Sections 143.0251, 143.0252, and 143.0253 of the City's Land Development Code. However, because encroachment into the site is less than 25 percent (23.2 percent overall; 0.839 acres) and there is no encroachment into the significant portion of the site, the project is exempt from the requirements for a Site Development Permit under Section 143.0220. The majority of CA-SDI-11,039, including the portion of the site that contains significant deposits, would be preserved in place. The portion of the site that would be subject to direct impacts contains no subsurface deposits and does not constitute a significant resource. Therefore, impacts to the site as proposed would not constitute significant effects.

Avoidance of impacts to significant archaeological resources is always preferred. If avoidance is not feasible, other measures must be developed and implemented to mitigate impacts to below a level of significance. At CA-SDI-11,039, the majority of the site, including the entirety of the significant portion of the site, would be preserved in an open space easement, and a monitoring program would be conducted during all ground disturbing activity. These mitigation measures are described in detail in the report.

CA-SDI-18,504 is a lithic scatter representing lithic processing activity. The site, which was first identified during the 2007 survey, covers an area of about 50 m by 30 m (1180 m^2) and is located entirely within the Multiple Habitat Planning Area (MHPA). Twenty-five flakes and angular debris were noted on the surface; these were not collected. One 1 m by 1 m test unit was excavated in the area of the greatest concentration of material. All cultural material recovered is debitage (flakes and angular debris): a total of 65 items. Cultural material was recovered to a depth of 30 cm.

CA-SDI-18,504 is a relatively small lithic scatter site with limited research potential. It does not meet the criteria for listing on the California Register of Historical Resources. Therefore, CA-SDI-18,504 is not a historical resource under CEQA, and impacts to it would not constitute significant effects. CA-SDI-18,504 is within the MHPA and would be left in open space under the proposed development plan. The project would have no effects on this site, and no mitigation measures are necessary for it.

I. INTRODUCTION

PROJECT LOCATION

The Heritage Bluffs project is located in the Black Mountain Ranch Subarea of the City of San Diego, in western San Diego County (Figure 1). The property is south of Bernardo Center Drive/Carmel Valley Road and west of Interstate 15 (I-15) (Figures 2 and 3). The parcel is a very short distance (less than 500 ft) south of the historic San Bernardo land grant. The property lies within in Township 14 South, Range 2 West, Section 5 and Township 13 South, Range 2 West, Section 32, on the USGS 7.5' Poway quadrangle.

PROJECT DESCRIPTION

The project site consists of approximately 169.85 acres and includes Assessor Parcel Numbers 312-010-15 and 312-160-02. The property is located in the southeast perimeter properties of the Black Mountain Ranch Subarea. The Subarea Plan designates approximately 43 acres of the property as Low Density Residential (2-5 dwelling units per acre) and the remainder of the site as part of the City's Multiple Habitat Planning Area (MHPA). The Subarea Plan also identifies the property as Areas A and B intended for development of 25 dwelling units and 195 dwelling units respectively, or a total of 220 dwelling units. The Subarea Plan also requires that 35 dwellings of the 220 total dwellings be affordable units.

The proposed Heritage Bluffs II project consists of a Vesting Tentative Map, a Planned Development Permit for deviations to underlying zone setback requirements, a Site Development Permit for Environmentally Sensitive Lands, and Re-zonings from AR-1 to RS-1-14 and RX-1-1. In addition, a boundary adjustment to the City's Multiple Habitat Planning Area (MHPA) is required.

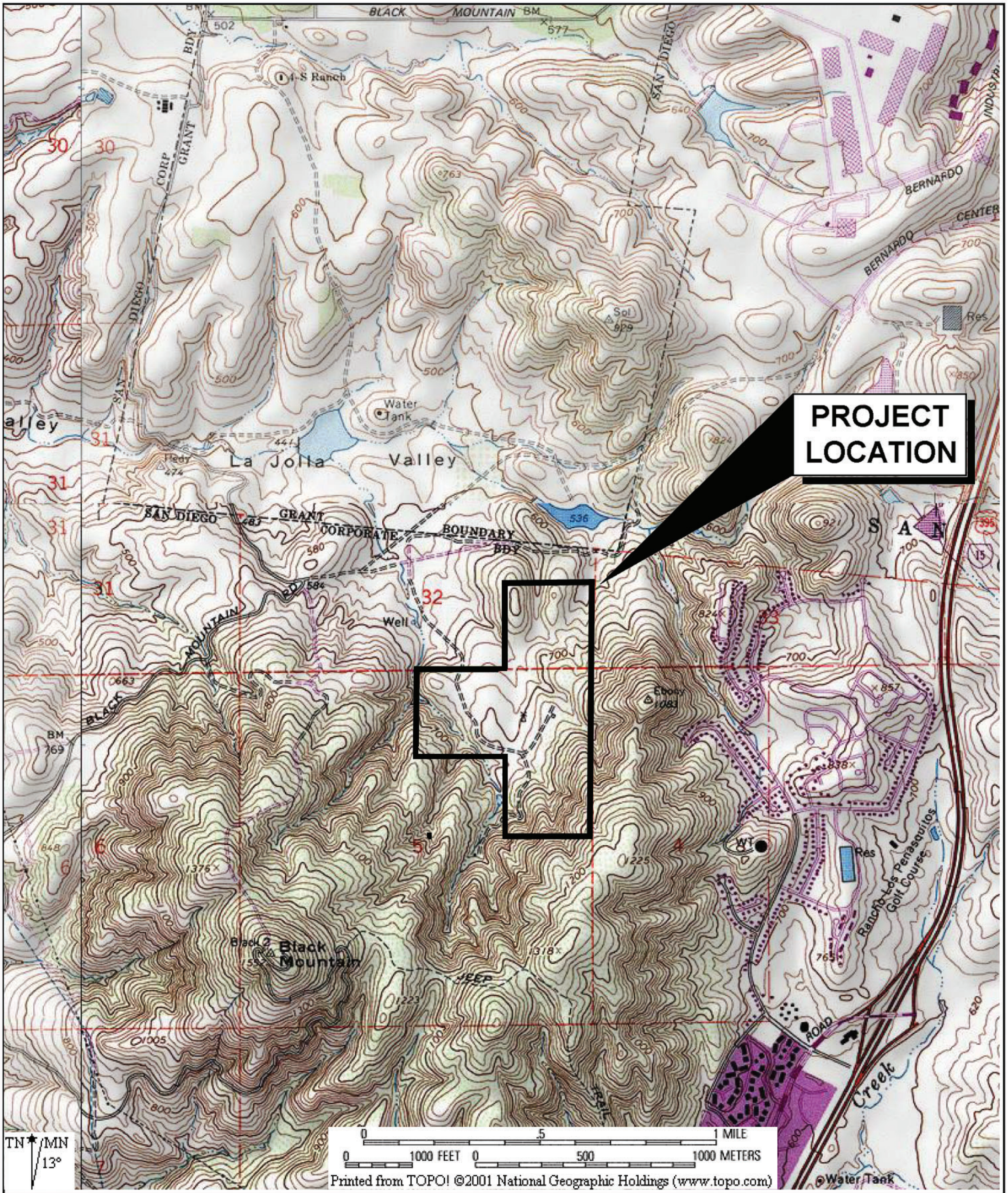
On-site the project proposes to develop a total of 171 residential units on approximately 43 acres and includes two different product types. A total of 119 single-family residential lots are proposed in the 4,500 to 6,000 square-foot range under the RX-1-1 zone and 52 lots are proposed to be in the over 6000 square foot range under the RS-1-14 zone. The balance of the 220 dwellings allocated to the property in the Black Mountain Ranch Subarea Plan will be transferred to the Black Mountain Ranch North Village. This transfer of 49 dwellings to the North Village will include the 35 affordable dwellings required by the Subarea Plan.

The archaeological project consisted of a survey and assessment program to evaluate the presence and significance of cultural resources within the project area. Mary Robbins-Wade served as the project manager/project archaeologist. Matt Sivba was the field director. This report addresses the methods and results of the survey and evaluation program.

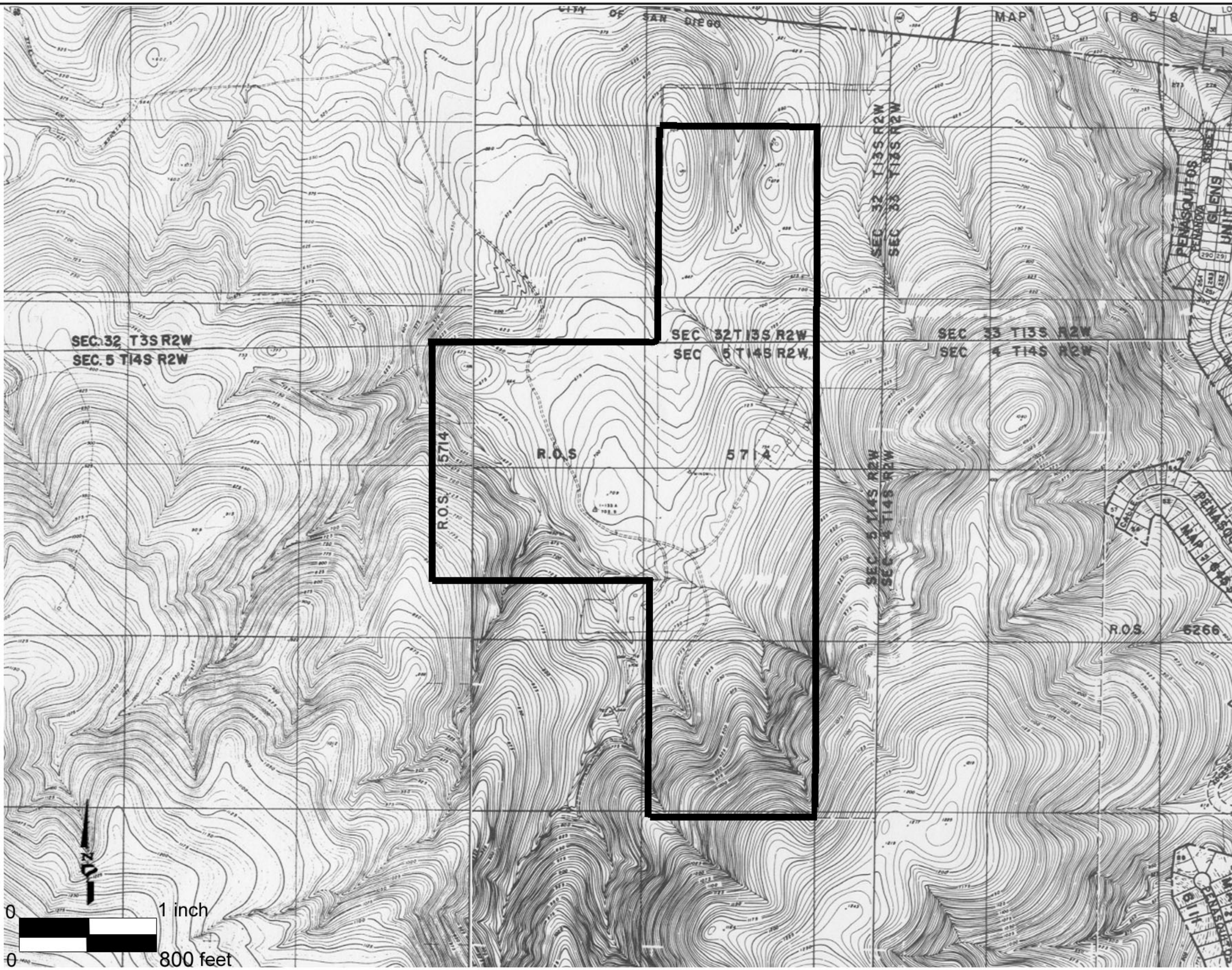
Affinis
810 Jamacha Road
Suite 206
El Cajon, CA 92019

Regional location in San Diego County

Figure 1



Affinis 810 Jamacha Road Suite 206 El Cajon, CA 92019	Project location on USGS 7.5' Poway and Escondido quadrangles	Figure 2



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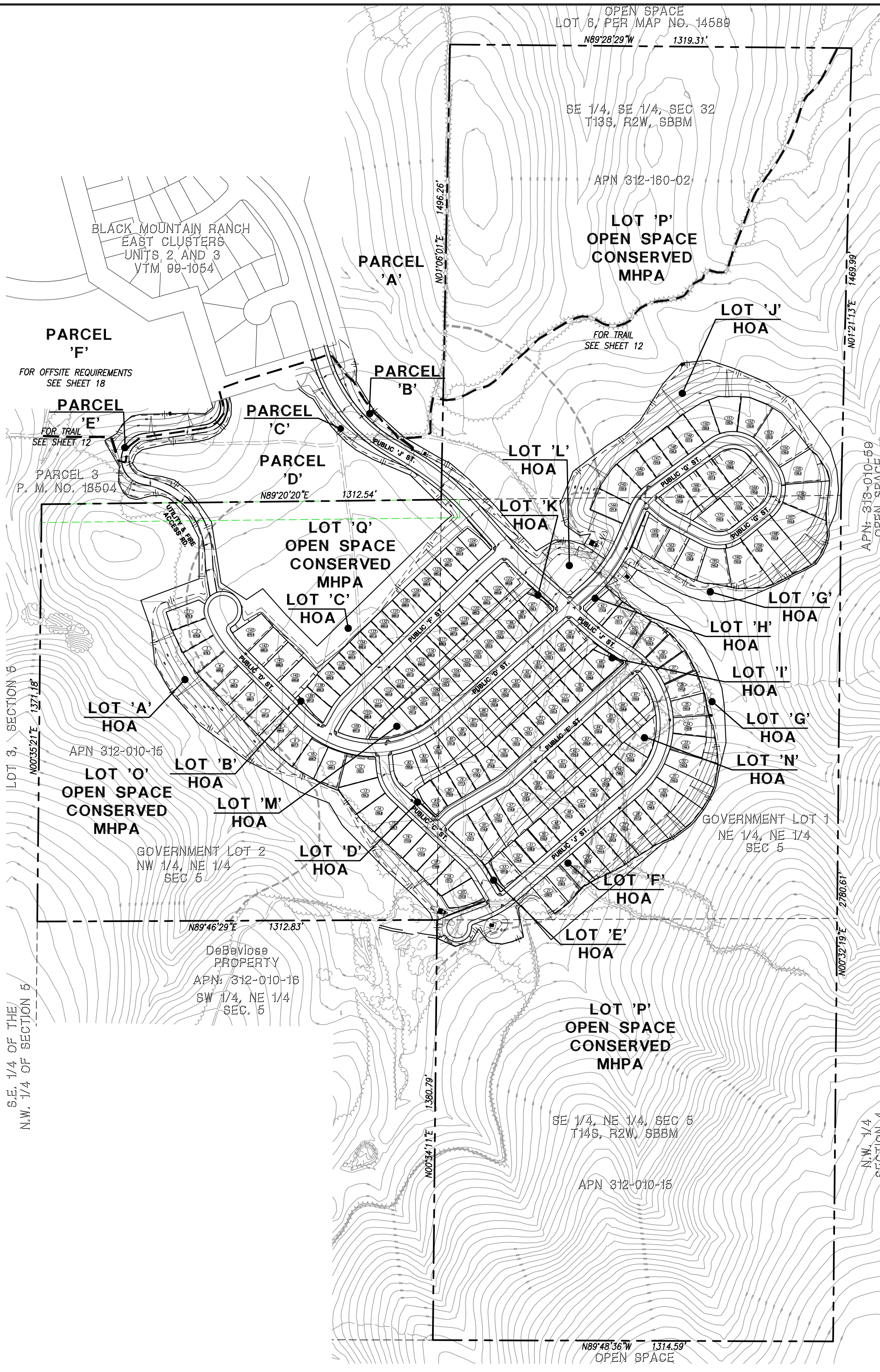
Project location on City Engineering Map

Figure 3



Affinis 810 Jamacha Road Suite 206 El Cajon, CA 92019	Site Plan	Figure 4

II. ENVIRONMENTAL SETTING

PHYSICAL AND BIOLOGICAL ENVIRONMENT

The project area is at the juncture of the coastal plains and foothills of western San Diego. The climate of the coastal plains area is characterized as semi-arid, cool, and the climate of the foothills is characterized as Mediterranean hot summer (Griner and Pryde 1976:Figure 3.4). Average annual temperatures in the area of the project range from a January low of about 44^{o} F to a July high of about 80^{o} F, and annual rainfall averages around 10 inches (Griner and Pryde 1976).

The project area is on the northeastern flanks of Black Mountain, overlooking La Jolla Valley (Figure 2). Black Mountain is north of Los Peñasquitos Canyon and south of the San Dieguito River. The property is underlain by the Jurassic Santiago Peak Volcanics, with a tongue of the Tertiary Friars formation in the north-central portion (Kennedy and Peterson 1975). The Santiago Peak Volcanics, also known as Black Mountain Volcanics, contain a great deal of lithic raw material that was preferred by native populations for stone tool manufacture. The material fractures in a predictable manner, making it easier to use than more coarse-grained material that does not fracture as easily or as predictably. In addition, Kennedy and Peterson (1975) noted, “Included in the Santiago Peak Volcanics are a number of small plutons of mildly metamorphosed gabbro” (Kennedy and Peterson 1975:45). These plutonic outcrops provided surfaces for bedrock milling features and rock art panels.

The soil mapped for the majority of the project area is San Miguel-Exchequer rocky silty loams, 9 to 70 percent slopes. Other soil types mapped for the project area are Auld clay, 9 to 15 percent slopes; and Escondido very fine sandy loams, 9 to 15 percent slopes, eroded (Bowman 1973). Native vegetation supported by these soils types includes California sagebrush, chamise, ceanothus, sumac, black sagebrush, flattop buckwheat, scattered oaks, and annual grasses and forbs (Bowman 1973).

Approximately two-thirds of the project area currently support coastal sage scrub vegetation, mainly occurring on the lower elevations of the property. This vegetation type is dominated by coast monkey flower (*Mimulus aurantiacus*), coastal sagebrush (*Artemisia californica*), laurel sumac (*Malosma laurina*), and lemonade berry (*Rhus integrifolia*). Other species found in this habitat included California everlasting (*Gnaphalium californicum*), California encelia (*Encelia californica*), deerweed (*Lotus scoparius*), and spiny redberry (*Rhamnus crocea*). Southern mixed chaparral accounts for over one-tenth of the property. This habitat is dominated by mission manzanita (*Xylococcus bicolor*), chamise (*Adenostoma fasciculatum*), Ramona lilac (*Ceanothus tomentosus*), and toyon (*Heteromeles arbutifolia*). Other species found here included manroot (*Marah macrocarpus*), white-flowered currant (*Ribes indecorum*), and fuschia-flowered gooseberry (*Ribes speciosum*) (Gross 2007).

The majority of the flatter areas on the property contain non-native grassland. This habitat occurs primarily in the central portion of the property, as well as in a small finger in the extreme northeastern corner of the site. A small portion of the property was mapped as native perennial grassland. The non-native grassland may have been perennial grassland during prehistoric times. Native species found in both grassland areas of the property include blue-eyed grass (*Sisyrinchium bellum*), hedge-nettle (*Stachys bullata*), and blue-dicks (*Dichelostemma capitatum*). The native grassland area has a higher prevalence of foothill needlegrass (*Nassella lepida*) (Gross 2007).

A small freshwater marsh was found in a modified drainage that contained cattail (*Typha* sp.) and bulrush (*Scirpus* sp.), as well as adjacent arroyo willow (*Salix lasiolepis*) and black willow (*Salix gooddingii*). Adjacent to this area was a small patch of mulefat scrub dominated by mulefat (*Baccharis salicifolia*). The largest drainage contained occasional willow trees, and in one area formed 0.5 acre of riparian forest with arroyo willow and western sycamore trees (*Platanus racemosa*) predominant (Gross 2007).

All these vegetation communities would have provided a number of plant species known to have been used by the Kumeyaay and Luiseño people for food, medicine, tools, shelter, ceremonial and other uses (Bean and Shipek 1978; Christenson 1990; Hedges and Beresford 1986; Luomala 1978; Sparkman 1908; White 1963). Many of the animal species found in these communities would have been used by native populations as well. Rabbits were an important food source, as were deer, numerous small mammals, and birds. Fish and shellfish were obtained from open coast and lagoon environments; such environments are found located about 10 miles to the west of the current project area.

A large drainage in the northwestern portion of the property flows north, ultimately into Lusardi Creek in La Jolla Valley (Figure 2). Water would have been available in this drainage, as well as others in the vicinity (Figure 2).

CULTURAL ENVIRONMENT

General Culture History

Several summaries discuss the prehistory of San Diego County and provide a background for understanding the archaeology of the general area surrounding the project. Moratto's (1984) review of the archaeology of California contains important discussions of Southern California, including the San Diego area. Bull (1983, 1987), Carrico (1987), Gallegos (1987), and Warren (1985, 1987) provide summaries of relatively recent work and interpretations. The following is a brief discussion of the culture history of the San Diego region.

Carter (1957, 1978, 1980), Minshall (1976) and others (e.g., Childers 1974; Davis 1968, 1973) have long argued for the presence of Pleistocene humans in California, including the San Diego area. The sites identified as "early man" are all controversial. Carter and

Minshall are best known for their discoveries at Texas Street and Buchanan Canyon. The material from these sites is generally considered nonartifactual, and the investigative methodology is often questioned (Moratto 1984).

The earliest accepted archaeological manifestation of Native Americans in the San Diego area is the San Dieguito complex, dating to approximately 10,000 years ago (Warren 1967). The San Dieguito complex was originally defined by Rogers (1939), and Warren published a clear synthesis of the complex in 1967. The material culture of the San Dieguito complex consists primarily of scrapers, scraper planes, choppers, large blades, and large projectile points. Rogers considered crescentic stones to be characteristic of the San Dieguito complex as well. Tools and debitage made of fine-grained green metavolcanic material, locally known as felsite, were found at many sites which Rogers identified as San Dieguito. Often these artifacts were heavily patinated. Felsite tools, especially patinated felsite, came to be seen as an indicator of the San Dieguito complex. Until relatively recently, many archaeologists felt that the San Dieguito culture lacked milling technology and saw this as an important difference between the San Dieguito and La Jolla complexes. Sleeping circles, trail shrines, and rock alignments have also been associated with early San Dieguito sites. The San Dieguito complex is chronologically equivalent to other Paleoindian complexes across North America. San Dieguito material underlies La Jolla complex strata at the C. W. Harris site in San Dieguito Valley (Warren, ed. 1966).

The traditional view of San Diego prehistory has the San Dieguito complex followed by the La Jolla complex at least 7000 years ago, possibly as long as 9000 years ago (Rogers 1966). The La Jolla complex is part of the Encinitas tradition and equates with Wallace's (1955) Millingstone Horizon. The Encinitas tradition is generally "recognized by millingstone assemblages in shell middens, often near sloughs and lagoons" (Moratto 1984:147). "Crude" cobble tools, especially choppers and scrapers, characterize the La Jolla complex (Moriarty 1966). Basin metates, manos, discoidals, a small number of Pinto series and Elko series points, and flexed burials are also characteristic.

Warren et al. (1961) proposed that the La Jolla complex developed with the arrival of a desert people on the coast who quickly adapted to their new environment. Moriarty (1966) and Kaldenberg (1976) have suggested an in situ development of the La Jolla people from the San Dieguito. Moriarty has since proposed a Pleistocene migration of an ancestral stage of the La Jolla people to the San Diego coast. He suggested this Pre-La Jolla complex is represented at Texas Street, Buchanan Canyon, and the Brown site (Moriarty 1987).

Since the 1980s, archaeologists in the region have begun to question the traditional definition of San Dieguito people simply as makers of finely crafted felsite projectile points, domed scrapers, and discoidal cores, who lacked milling technology. The traditional defining criteria for La Jolla sites (manos, metates, "crude" cobble tools, and reliance on lagoonal resources) have also been questioned (Bull 1987; Cárdenas and Robbins-Wade 1985; Robbins-Wade 1986). There is speculation that differences between artifact assemblages of "San Dieguito" and "La Jolla" sites reflect functional differences rather than temporal or cultural variability (Bull 1987; Gallegos 1987). Gallegos (1987) has proposed that the San Dieguito, La Jolla, and Pauma complexes are manifestations of the same culture, with differing site types "explained by site location, resources exploited, influence, innovation and adaptation to a rich coastal region over a long period of time" (Gallegos 1987:30). The classic "La Jolla" assemblage is one adapted to life on the coast and appears to continue through time (Robbins-Wade 1986; Winterrowd and Cárdenas 1987). Inland sites adapted to hunting contain a different tool kit, regardless of temporal period (Cárdenas and Van Wormer 1984).

Several archaeologists in San Diego, however, do not subscribe to the Early Prehistoric/Late Prehistoric chronology (see Cook 1985; Gross and Hildebrand 1998; Gross and Robbins-Wade 1989; Shackley 1988; Warren 1998). They feel that an apparent overlap among assemblages identified as "La Jolla," "Pauma," or "San Dieguito" does not preclude the existence of an Early Milling period culture in the San Diego region, whatever name is used to identify it, separate from an earlier culture. One problem these archaeologists perceive is that many site reports in the San Diego region present conclusions based on interpretations of stratigraphic profiles from sites at which stratigraphy cannot validly be used to address chronology or changes through time. Archaeology emphasizes stratigraphy as a tool, but many of the sites known in the San Diego region are not in depositional situations. In contexts where natural sources of sediment or anthropogenic sources of debris to bury archaeological materials are lacking, other factors must be responsible for the subsurface occurrence of cultural materials. The subsurface deposits at numerous sites are the result of such agencies as rodent burrowing and insect activity. Recent work has emphasized the importance of bioturbative factors in producing the stratigraphic profiles observed at archaeological sites (see Gross 1992). Different classes of artifacts move through the soil in different ways (Bocek 1986; Erlandson 1984; Johnson 1989), creating vertical patterning (Johnson 1989) that is not culturally relevant. Many sites which have been used to help define the culture sequence of the San Diego region are the result of just such nondepositional stratigraphy.

The Late Prehistoric period is represented by the San Luis Rey complex in northern San Diego County and the Cuyamaca complex in the southern portion of the county. The San Luis Rey complex is the archaeological manifestation of the Shoshonean predecessors of the ethnohistoric Luiseño (named for the San Luis Rey Mission). The Cuyamaca complex represents the Yuman forebears of the Kumeyaay (Diegueño, named for the San Diego Mission). Agua Hedionda is traditionally considered to be the point of separation between Luiseño and Northern Diegueño territories.

Elements of the San Luis Rey complex include small, pressure-flaked projectile points (Cottonwood and Desert Side-notched series); milling implements, including mortars and pestles; *Olivella* shell beads; ceramic vessels; and pictographs (True et al. 1974). Of these elements, mortars and pestles, ceramics, and pictographs are not associated with earlier sites. True noted a greater number of quartz projectile points at San Luis Rey sites than at Cuyamaca complex sites, which he interpreted as a cultural preference for quartz (True

1966). He considered ceramics to be a late development among the Luiseño, probably learned from the Diegueño. The general mortuary pattern at San Luis Rey sites is ungathered cremations.

The Cuyamaca complex, reported by True (1970), is similar to the San Luis Rey complex, differing in the following points:

1. Defined cemeteries away from living areas;
2. Use of grave markers;
3. Cremations placed in urns;
4. Use of specially made mortuary offerings;
5. Cultural preference for side-notched points;
6. Substantial numbers of scrapers, scraper planes, etc., in contrast to small numbers of these implements in San Luis Rey sites;
7. Emphasis placed on use of ceramics; wide range of forms and several specialized items;
8. Steatite industry;
9. Substantially higher frequency of milling stone elements compared with San Luis Rey;
10. Clay-lined hearths (True 1970:53-54).

Both the San Luis Rey and Cuyamaca complexes were defined on the basis of village sites in the foothills and mountains. Coastal manifestations of both Luiseño and Kumeyaay differ from their inland counterparts. Fewer projectile points are found on the coast, and there tends to be a greater number of scrapers and scraper planes at coastal sites (Robbins-Wade 1986, 1988). Cobble-based tools, originally defined as "La Jolla", are characteristic of coastal sites of the Late Prehistoric period, as well (Cárdenas and Robbins-Wade 1985:117; Winterrowd and Cárdenas 1987:56).

History

While Juan Rodriguez Cabrillo visited San Diego briefly in 1542, the beginning of the historic period in the San Diego area is generally given as 1769. It was that year that the Royal Presidio and the first Mission San Diego were founded on a hill overlooking Mission Valley. The existing Mission San Diego de Alcala was constructed later. The Spanish Colonial period lasted until 1820 and was characterized by religious and military institutions bringing Spanish culture to the area and attempting to convert the Native American population to Christianity. Mission San Diego was the first mission founded in Southern California, followed by Mission San Juan Capistrano in 1776. Mission San Luis Rey, in Oceanside, was founded in 1798.

The Mexican period lasted from 1820 to 1846. Following secularization of the missions in 1834, mission lands were given as large land grants as rewards for service to the Mexican government. The society made a transition from one dominated by the church and the military to a more civilian population, with people living on ranchos or in pueblos.

The American period began in 1846, and California became a state in 1850. Metropolitan San Diego began to develop in 1850, but boomed in the 1880s. While the 1880s were a period of alternating boom and bust, by the 1890s, the city entered a time of steady growth. Subdivisions such as Golden Hill, Sherman Heights, Logan Heights, Banker's Hill, and University Heights began in the 1890s. As the city continued to grow in the early 20th century, the downtown's residential character changed. Streetcars and the introduction of the automobile allowed people to live farther from their downtown jobs. New suburbs were developed in Hillcrest, North Park, Mission Hills, and Normal Heights, as well as Point Loma, Ocean Beach, Pacific Beach, and Mission Beach. In the post-World War II years, San Diego grew significantly, with new jobs created in the aircraft industry, shipbuilding, fishing, and other enterprises.

During the late 19th and early 20th centuries, rural areas of San Diego, such as La Jolla Valley, developed small agricultural communities centered on one-room school houses. Such rural farming communities consisted of individuals and families tied together through geographical boundaries, a common schoolhouse, and a church. Farmers living in small rural communities were instrumental in the development of San Diego County. They fed the growing urban population and provided business for local markets. Rural farm school districts represented the most common type of community in the county from 1870 to 1930 (Van Wormer 1986).

Project Vicinity

The Heritage Bluffs property is in an area that is close to the boundary between Kumeyaay and Luiseño territories. There is a relatively large number of pictographs in the Rancho Bernardo area, and it has been suggested that some of these rock art sites may have been territorial markers. The La Jolla Valley and 4S Ranch areas, just north of the Heritage Bluffs project are rich in cultural resources, including sites of the Early Archaic (La Jolla), Late Prehistoric, and Historic periods. To the southeast is the Sabre Springs area, including the culturally and archaeologically significant Sabre Springs site (CA-SDI-6669/SDM-W-230). Los Peñasquitos Canyon, to the south of Black Mountain is also rich in Native American and historic period resources. To the northeast of the Heritage Bluffs area, on the south side of Lake Hodges, is the Westwood Valley complex, which includes Early Archaic and Late Prehistoric habitation sites. Although the Late Prehistoric sites in Westwood Valley are associated with a Kumeyaay occupation, there is evidence of Luiseño influence as well (Carrico and Kyle 1987). "The native settlement of San Bernardo (possibly Sinyau-Pichkaka) . . . was generally located on both sides of the San Dieguito River between Highland Valley and Lake Hodges" and may have included the Westwood Valley sites (Carrico and Kyle 1987:2-9).

The Heritage Bluffs project area is located a short distance (less than 500 ft) south of the boundary of the historic land grant Rancho San Bernardo (Figure 2), which was used for grazing livestock owned by the Mission San Diego de Alcala. In 1837, an attack was made by individuals from the Kumeyaay settlement on several Europeans tending livestock at San Bernardo. This attack may have been in retaliation for earlier murders of Indians or it may have been part of an overall attempt to drive out the Mexican settlers in the San Diego area (Carrico and Kyle 1987:2-9).

During the 1840s, an English sea captain, Joseph F. Snook, was granted a major portion of the San Bernardo land grant. Snook had married Maria Antonia Alvarado in 1833 and changed his name to Jose Francisco Snook. Snook was a successful rancher-trader until his death in 1852 (Kyle and Carrico 1987). Later in the 19^{th} century, the white settlement of Bernardo was established along the banks of the San Dieguito River. The settlement was inundated by the rising water level following the construction of the dam and the creation of Lake Hodges.

La Jolla Valley, just north of the project area, was first settled by Peter and Francisco Lusardi in the late 1860s. "Francisco Lusardi took up a homestead of 160 acres, a timber culture of 160 acres, and a preemption of 160 acres. Peter Lusardi accumulated 3,000 acres. This accumulation of land was accomplished through various government programs and by having their Basque shepherds file land claims and then sell them to the Lusardis" (Forstadt et al. 1992:2-5).

By the 1890s, Lusardi was recognized as an established community, with a schoolhouse and a post office. The schoolhouse was located a few miles west of the Heritage Bluffs project area.

III. PREVIOUS RESEARCH

Records searches were obtained from the South Coastal Information Center and the San Diego Museum of Man for the project area and a one-mile radius (Confidential Appendix A). The Black Mountain Ranch property covers approximately 5000 acres in proximity to the current Heritage Bluffs project area, including acreage adjacent to the property, on the north. A number of archaeological surveys have been conducted within the Black Mountain Ranch property, beginning in the mid-1970s (Eckhardt 1978; Kinney 1976; May 1974a; Ritz and Wade 1990a, 1990b, 1990c; Walker et al. 1981). A total of 64 archaeological sites have been recorded within that property, 26 of which were destroyed prior to a 1992 testing program to evaluate significance (Forstadt et al. 1992). The 1992 testing program identified 27 sites as not significant under the California Environmental Quality Act (CEQA), 7 sites as significant cultural resources, and 4 sites as destroyed (Forstadt et al. 1992). Additional site testing was conducted by Wade (1992).

A 1993 survey of 514 acres adjacent to Black Mountain Ranch, in four separate parcels, covered the current Heritage Bluffs project area (Cheever 1993). One previously recorded site was found (as addressed below), but no other sites were identified as a result of that survey.

In addition, the 4S Ranch property is located a short distance north of the current project area. Approximately 70 archaeological sites have been recorded within the 3000-acre 4S Ranch. The Westwood Valley project, with 10 recorded archaeological sites, is located just 2 miles north-northeast of the Heritage Bluffs project area.

One archaeological site was previously recorded within the Heritage Bluffs project area. CA-SDI-11,039 was recorded in 1988 during a survey of the adjacent Black Mountain Open Space Preserve. The site record described the site as follows:

> The site consists of a scatter of artifacts, with possible midden present in some areas, and a possible rock feature. The possible feature is covered with vegetation, but appears similar to rock rooms found on the Westwood property by WESTEC. These features are enclosures on prominent ridges and hills; some contain artifacts. Confirmation of the possible feature at BMP-1 [CA-SDI-11,039] will only be possible through clearing of the natural vegetation covering it [site record, on file at South Coastal Information Center].

The possible rock room, made of metavolcanic boulders, was noted as being 5 m by 5 m. The overall size was given as 30 m by 30 m. The site record also noted, “the artifacts are scattered on the eastern side of the hill, while the possible rock feature is on the west side” (site record, on file at South Coastal Information Center). Artifacts noted were flakes and potsherds.

The 1993 survey of Black Mountain Ranch perimeter properties, which covered the current project area, noted:

> The site location was revisited during the current survey with no obvious changes in the conditions as reported on the site record form. There is a heavy vegetation cover which makes ground surface observations difficult. The stone feature appears as described, although the plant growth prevented all but a cursory investigation [Cheever 1993:20].

IV. RESEARCH METHODS

by Matt Sivba and Mary Robbins-Wade

Although the Heritage Bluffs project area had been surveyed for cultural resources in the past, that survey was over 10 years old, and ground visibility at the time of that survey was quite poor (Cheever 1993). Therefore, a new archaeological survey was conducted by Affinis staff and a monitor from Red Tail Monitoring and Research in July 2007. To the extent feasible, the property was walked using parallel transects spaced 10 m apart. In some areas, steep topography or dense vegetation required different transect spacing or forays into areas of dense brush. An effort was made to examine exposed bedrock outcrops for evidence of milling features, pictographs, or quarrying. Two archaeological sites were identified during the survey: CA-SDI-11,039 and CA-SDI-18,504.

Affinis archaeologists conducted a testing program at site CA-SDI-11,039 in August and September of 2007. The survey conducted in July revealed the site boundaries to be larger than previously recorded As a result, the site was divided into two temporary and unofficial loci to facilitate the management of the testing process. One locus consisted of the knoll top and its slopes. This area, called Locus A, is covered with dense native vegetation, outcrops of metavolcanic stone, and rocky soil. The other locus consisted of the flat valley continuing from the eastern slope of the knoll top. This area, called Locus B, is covered in low lying grass and contains soil that is more claylike in nature. The entire site was resurveyed in transects spaced 1 to 2 m (3 to 6.5 ft) apart, in order to identify surface cultural material and determine the surface extent of the site. Cultural material observed was flagged and was later mapped and collected. The crew continued surveying as long as cultural material was found on the surface.

Twelve 1 m by 1 m test units were excavated at CA-SDI-11,039, six at each locus. A series of shovel test pits (STPs) was excavated at Locus B to determine the extent and nature of any subsurface deposits and also to provide information on where to place the test units for maximum recovery. After the STPs were excavated, four 1 m by 1 m test units were placed in areas with surface artifacts and good recovery in the STPs. The other two test units required for Locus B were placed in areas where the potential for subsurface artifacts appeared high but lacked STPs or surface artifacts.

Six 1 m by 1 m test units and one STP were excavated at Locus A. Portions of Locus A are within the MHPA and in planned open spaces, which limited the area where test units could be placed. In addition, the archaeologists and Native American monitors attempted to minimize the impacts to areas that will remain relatively undisturbed by the proposed project. For this reason, the majority (four) of the test units at Locus A were placed on the eastern slope of the knoll, since this portion falls within the development footprint. Only two test units were placed at the top of the knoll to determine any significance in this portion of the site. All the test units at Locus A were placed in areas naturally cleared of vegetation, since minimizing the impact to the native vegetation was a priority.

There were two rock features discovered within the site boundaries of CA-SDI-11,039. One feature was a subsurface hearth found during the excavation of Unit 4; the other feature was located above ground on the northwest corner of the knoll top. Both features were photographed and drawn to scale. Artifacts were collected from each feature to be analyzed and cataloged at the Affinis lab.

A previously unrecorded site, CA-SDI-18,504, was discovered within the Heritage Bluffs project area during the survey conducted in July 2007. During the survey, three metavolcanic flakes were found, which required one 1 m by 1 m test unit to be excavated in this area. During the unit excavation, crew members resurveyed the area and discovered more surface artifacts which enlarged the site boundaries. Only artifacts found during the unit excavation were retained. Surface artifacts were not collected or mapped on this site.

STPs measured 50 cm north-south by 30 cm east-west. Excavation units measured 1 m on a side. Test units and STPs were oriented to true north and were excavated in 10-cm contour levels. Soils were passed through 1/8-in mesh rocker screens. Standard record forms were completed for each unit and level, recording artifact recovery, soil characteristics, and other information about the unit.

A Native American monitor from Red Tail Monitoring and Research was on-site throughout the testing program.

The archaeological sites were mapped on the project topographic map (Confidential Appendix B), and updated site records were submitted to the South Coastal Information Center and the San Diego Museum of Man (Confidential Appendix C).

All cultural material found during the testing program (other than human remains) was taken to the Affinis lab, where it was washed, sorted, and cataloged. Standard catalog forms were completed for the collection that recorded provenience, artifact type, and material. The artifact catalogs are included as Appendix A of this report.

The senior archaeologist reviewed historic maps and aerial photographs to determine the potential for historic archaeological resources. The results of this review are presented below under Results.

Before beginning field work, the senior archaeologist contacted the State Native American Heritage Commission for a search of the Sacred Lands Files. Contacts with the Native American community throughout the project were handled through the Native American representative, Clint Linton, of Red Tail Monitoring and Research. Native American correspondence is included as Confidential Appendix D.

V. RESULTS

Two archaeological sites were identified within the Heritage Bluffs project area during the 2007 survey (Figure 5, Confidential Appendix B). CA-SDI-11,039 had been previously recorded, as addressed under Previous Research. The site boundaries were greatly increased as the result of the Affinis survey, and the amount and range of cultural material was found to be much greater than previously noted. As addressed below, CA-SDI-11,039 is a habitation site that includes a wide range of cultural material, as well as a large hearth feature and cremated human remains. A second, previously unknown site, was also recorded during the Affinis survey. CA-SDI-18,504 is a lithic scatter that appears to be the result of quarrying and lithic processing activity.

CA-SDI-11,039

As addressed under Previous Research, CA-SDI-11,039 was recorded in 1988 as a scatter of flakes and pottery, with a possible midden deposit present in some areas, and a possible rock room feature, obscured by vegetation. The possible rock room, made of metavolcanic boulders, was noted as being 5 m by 5 m. The overall site size was given as 30 m by 30 m. “The artifacts are scattered on the eastern side of the hill, while the possible rock feature is on the west side” (site record, on file at South Coastal Information Center). A 1993 survey indicated, “no obvious changes in the conditions as reported on the site record form” (Cheever 1993:20). The rock feature was noted essentially as previously recorded, although it was obscured by vegetative cover (Cheever 1993).

During the 2007 survey by Affinis, the site was found to be much larger than previously recorded: 175 m (575 ft) by 110 m (365 ft), covering an area of 15,120 m^2 (3.7 acres). Site boundaries were based on surface artifacts and topography. A rock feature was documented in the northwestern portion of the site (Figure 5); it is assumed to be the same feature noted on the previous surveys. This feature is discussed in more detail below. Cremated human remains were encountered in two units. These remains were repatriated to the Kumeyaay Cultural Repatriation Committee (KCRC), as addressed below under Burials.

Using more precise digitized maps, the overall site area was calculated to be 3.623 acres, with the area of concentration (the significant portion of the site) covering 2.033 acres or 56.1 percent of the site, and the less significant portion of the site covering 1.590 acres or 43.9 percent.

During the testing program, over 700 surface artifacts were collected from 67 surface shots. Ten STPs and 12 test units were excavated at the site, yielding over 9000 artifacts. Artifact recovery for the entire site is summarized in Table 1. Faunal material (animal bone and shell) is summarized in Table 2. As shown in Table 1, over 90 percent of the artifact collection consists of debitage, but only six cores were collected. Forty-two projectile points and 27 other bifaces were recovered, but only 10 other formal flaked stone tools were found. Twenty retouched/utilized flakes were recovered. The site yielded 16 manos

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Affinis 810 Jamacha Road, Suite 206 El Cajon, CA 92019	Locations of cultural resources	Figure 5

Table 1. CA-SDI-11,039 summary of total artifact recovery

Class	Item	Count	% Count	Weight (g)	Weight %
Flaked Stone	Debitage	9326	93.28%	23673.6	20.93%
Flaked Stone	Core	6	0.10%	2741.3	2.42%
Flaked Stone	Cottonwood concave base point	10	0.10%	6.8	0.01%
Flaked Stone	Cottonwood series point	25	0.25%	7.6	0.01%
Flaked Stone	Cottonwood straight base point	5	0.05%	6.0	0.01%
Flaked Stone	Desert Side-Notched concave base point	2	0.02%	1.2	0.00%
Flaked Stone	Large biface/preform	13	0.13%	317.0	0.28%
Flaked Stone	Small biface/preform	13	0.13%	33.9	0.03%
Flaked Stone	Other biface/point	1	0.01%	4.8	0.00%
Flaked Stone	Scraper	3	0.03%	393.2	0.35%
Flaked Stone	Chopper	6	0.06%	2668.6	2.36%
Flaked Stone	Hammer	1	0.01%	506.0	0.45%
Flaked Stone	Rejuvenation flake	6	0.06%	769.5	0.68%
Flaked Stone	Retouched/utilized flake	20	0.20%	1215.8	1.08%
Ground Stone	Mano	16	0.16%	8546.5	7.56%
Ground Stone	Metate	16	0.16%	69016.3	61.03%
Other Stone	Hammerstone, angular	2	0.02%	622.7	0.55%
Other Stone	Hammerstone, spherical	2	0.02%	474.1	0.42%
Other Stone	Hammerstone, unclassified	1	0.01%	216.2	0.19%
Native American Ceramics	Pipe, unclassified	1	0.01%	1.2	0.00%
Native American Ceramics	Rim sherd	13	0.13%	128.6	0.11%
Native American Ceramics	Body sherd	509	5.09%	1726.4	1.53%
Glass	Clear	1	0.01%	7.8	0.01%
Total		9998	100.04%	113085.1	100.00%

and mano fragments, as well as 16 metates and metate fragments (12 of which fit together as part of a single metate). Five non-flaked hammerstones were collected. Over 500 pottery sherds were recovered (509 body sherds and 13 rim sherds), as well as one ceramic pipe fragment. A small amount of marine shell was found (6.2 g), as well as almost 400 pieces of animal bone (33.7 g). Cultural material is discussed below by artifact type, and recovery is addressed by provenience type (surface collection, STPs, units).

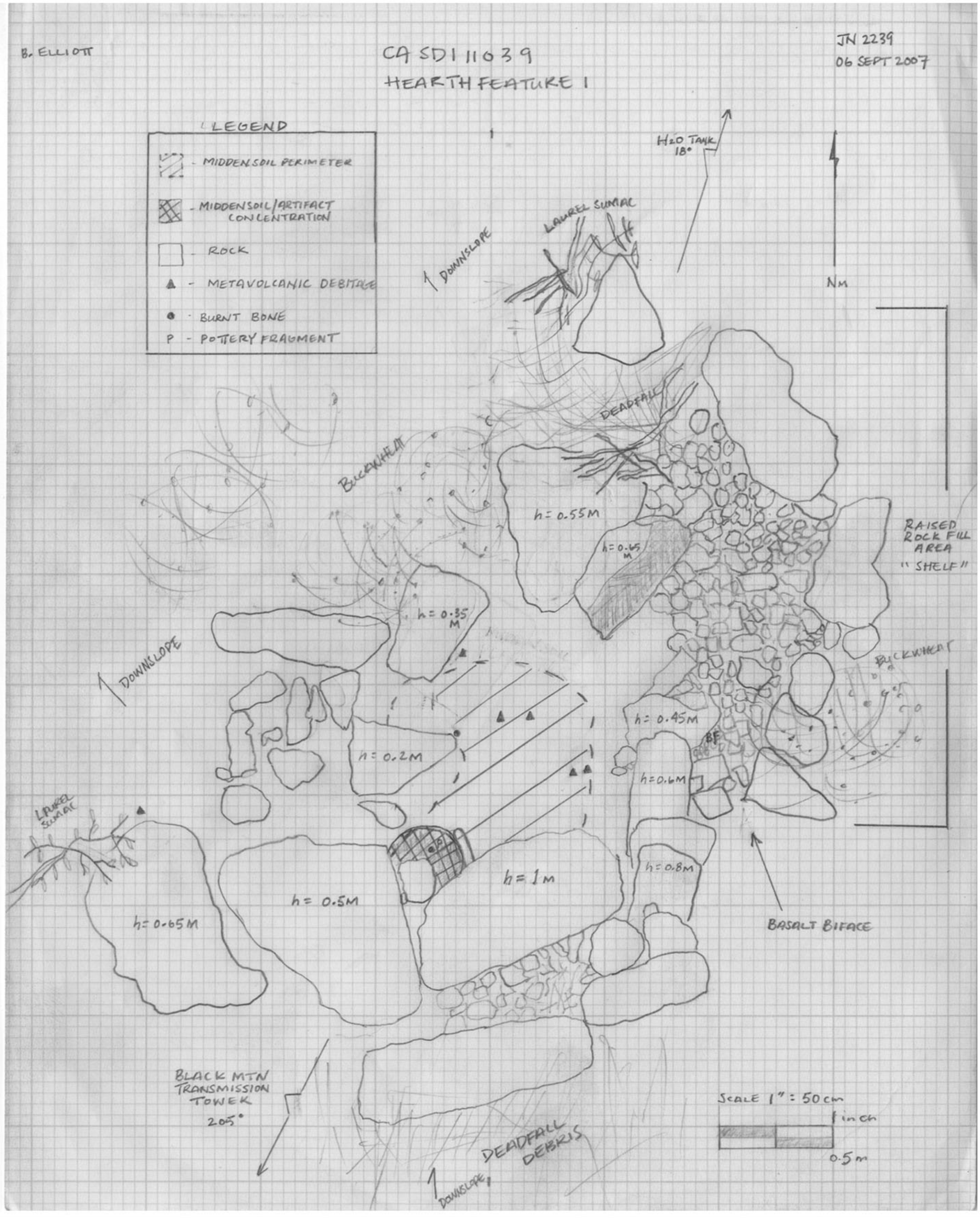
Table 2. CA-SDI-11,039, summary of total faunal material recovery

Class	Item	Count	Percent by Count	Weight (g)	Percent by Weight
Bone, non-human	Bulk, unmodified	393	96.1%	33.7	84.5%
Shell	Bulk, unmodified	16	3.9%	6.2	15.5%
Total		409	100.0%	39.9	100.0%

Rock Feature

As previously addressed, the original site record noted a possible rock room, measuring about 5 m by 5 m. Due to thick vegetation cover, it was not certain this feature was genuine, and brush clearing was recommended. During the current study, a number of concentrations of rock were examined, in an effort to identify this possible rock room. All of these areas of rock are located within proposed open space, within the City's Multi-Habitat Planning Area (MHPA), so the brush was not cleared. A rock feature was documented in the northwestern portion of the site (Figure 5), which is assumed to be the previously noted feature.

The rock feature consists of boulders in place and other large stones arranged with them to form a somewhat circular shape. These large stones are augmented with smaller rocks that are stacked to form the remainder of the circle (Figures 6 and 7). The interior walls exhibit fire-blackening, as if the feature were used as a hearth or oven. The exterior dimensions of the feature are approximately 3.75 m by 3.25 m, while the interior measures approximately 1 m in diameter (Figure 6). Artifacts noted within the feature included metavolcanic debitage, pottery, and one piece of burnt animal bone (Table 3). An additional piece of debitage was noted on an outer edge of the feature. A sample of artifacts was collected: a chopper, two pieces of debitage, two pottery sherds, and one piece of burnt bone. As shown in Figure 5, the rock feature is at the edge of the knoll, just before the slope drops away steeply.



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CA-SDI-11,039, rock feature

Figure 6

View of rock feature, looking east 07-10:6

View of interior of rock feature, looking south 07-10:05

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Rock rings are not uncommon in the San Diego region and are generally thought to date to the Late Prehistoric period. Some rock features are thought to be native structures from the Historic period, and others have been associated with ranching activities. DuBois (1908) described stone enclosures near Ramona as dwellings, citing Venegas' descriptions from the 18th century of stone houses used by the Indians of Baja California.

Table 3. CA-SDI-11,039, summary of artifact recovery from the rock feature

Class	Item	Count	Percent by Count	Weight (g)	Percent by Weight
Flaked Stone	Debitage	2	40.0%	31.5	11.5%
Flaked Stone	Chopper	1	20.0%	236.2	86.3%
Native American Ceramics	Body sherd	2	40.0%	6.0	2.2%
Total		5	100.0%	273.7	100.0%

At the Westwood Valley site complex in Rancho Bernardo, numerous rock circles and other rock features were recorded. One large, complex feature included walls, granary bases, and single rock rooms. The features, which were part of the Late Prehistoric portion of the rancheria, were described in detail by Carrico (1988) and Van Wormer and Carrico (1987). Minor (1975) surveyed current literature in a study of stone enclosures at a site complex in the El Cajon area and used this variability to explain differing functions for the features. Other studies of stone circle structures include May (1974b) and Cárdenas and Robbins-Wade (1986).

While the rock features at the Westwood Valley sites are found in proximity to one another and appear to be in association with each other, the rock feature at CA-SDI-11,039 occurs in relative isolation – there are no other rock circles or bedrock milling features at the site. While clusters of rock rings have been noted elsewhere, single rock rings are not uncommon either (cf. Cárdenas and Robbins-Wade 1986; Robbins-Wade 2007).

Surface Collection

As summarized in Table 4, over 700 surface artifacts were collected at CA-SDI-11,039. Almost 85 percent of these were debitage, and over 10 percent were pottery sherds. Six bifaces and two projectile points were also collected, as were six manos and mano fragments (Table 4). Four small pieces of animal bone (0.8 g) were also collected. Locations of surface collection points are shown in Figure 8. At each surface collection point, all cultural material within a 2 m radius was collected. It would be impossible to collect all surface artifacts under any circumstances, and ground visibility was relatively poor over much of the site. However, an effort was made to collect all visible surface artifacts in order to provide a representative sample of cultural material present on the surface of the site.

Table 4. CA-SDI-11,039, artifact recovery from surface collection

Class	Item	Count	% Count	Weight (g)	% Weight
Flaked Stone	Debitage	590	83.9%	4381.7	14.1%
Flaked Stone	Core	2	0.3%	1112.6	3.6%
Flaked Stone	Cottonwood Concave Base	1	0.1%	0.9	0.0%
Flaked Stone	Cottonwood Straight Base p	1	0.1%	1.3	0.0%
Flaked Stone	Large biface/perform	3	0.4%	117.5	0.4%
Flaked Stone	Small biface/preform	3	0.4%	12.2	0.0%
Flaked Stone	Scraper	1	0.1%	173.9	0.6%
Flaked Stone	Chopper	3	0.4%	1156.3	3.7%
Flaked Stone	Rejuvenation flake	2	0.3%	167.1	0.5%
Flaked Stone	Retouched/utilized flake	6	0.9%	230.1	0.7%
Ground Stone	Mano	6	0.9%	6097.6	19.6%
Ground Stone	Metate	2	0.3%	17000	54.7%
Other Stone	Hammerstone, angular	1	0.1%	308.4	1.0%
Native American Ceramics	Rim sherd	1	0.1%	5.5	0.0%
Native American Ceramics	Body sherd	81	11.5%	317.3	1.0%
Total		703	100.0%	31082.4	100.0%

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Affinis 810 Jamacha Road, Suite 206 El Cajon, CA 92019	CA-SDI-11,039, surface collection map	Figure 8

STPs

Ten STPs were excavated at CA-SDI-11,039 to determine the extent of subsurface cultural material. STPs were only placed on the flat portion of the site, where steep slopes and rock outcrops were not impediments, as they were on the knolltop portion of the site. As shown in Figure 9, the site boundary is well beyond the extent of subsurface cultural material (positive STPs and test units). This is based on the presence of surface artifacts (discussed above).

Five of the 10 STPs were positive, yielding a total of 151 artifacts (Table 5), and one fragment of marine shell (0.1 g). As summarized in Table 6, STP 8 was by far the most prolific STP, accounting for over half of the material recovered in the STPs. Cultural material was found to a depth of 70 cm in STP 8, at which point excavation was halted, as it became too difficult to dig beyond that point in the confined space of an STP. Unit 1 was placed adjacent to STP 8 in order to further explore this area. STP 1 yielded about one-fourth of the cultural material collected in the STPs (38 artifacts), and STP 10 accounted for an additional 15 percent (23 artifacts). The other three positive STPs yielded between one and seven artifacts, all of it debitage except one pottery sherd from STP 3. Only STP 8 was excavated to a depth greater than 50 cm.

Table 5. CA-SDI-11,039, summary of artifact recovery from STPs

Class	Item	Count	Percent by Count	Weight (g)	Percent by Weight
Flaked stone	Debitage	129	85.4%	262.8	19.9%
Flaked stone	Cottonwood series point	2	1.3%	0.7	0.1%
Flaked stone	Large biface/ preform	2	1.3%	77.4	5.9%
Flaked stone	Small biface/ preform	1	0.7%	1.3	0.1%
Ground stone	Mano	1	0.7%	928.6	70.5%
Native American ceramics	Body sherd	16	10.6%	46.9	3.6%
Total		151	100.0%	1,317.7	100.0%

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Affinis 810 Jamacha Road, Suite 206 El Cajon, CA 92019	CA-SDI-11,039, locations of units and STPs	Figure 9

As summarized in Table 7, about 60 percent of the material collected in the STPs was from the upper two levels (0-10 cm and 10-20 cm). The 20-30 cm level still accounted for almost 20 percent of the STP assemblage. Artifact recovery decreased somewhat with each subsequent level, except the 60-70 cm level of Unit 8, which yielded more debitage than the 50-60 cm level (Table 7). A whole mano in the 50-60 cm level and a single small fragment of marine shell (0.1 g) from the 40-50 cm level were the only items other than debitage found below 30 cm in the STPs. Both of these items were from STP 8.

Table 6. CA-SDI-11,039, summary of artifact recovery by STP

Unit	STP 1		STP 2		STP 3		STP 4		STP 8		STP 10		Total	
	Count	Percent*	Count	Percent*	Count	Percent*	Count	Percent*	Count	Percent*	Count	Percent*	Count	Percent*
Debitage	35	27.1%	7	5.4%	3	2.3%	1	0.8%	64	49.6%	19	14.7%	129	85.3%
Cottonwood series point	0	0.0%	0	0.0%	0	0.0%	0	0.0%	2	100.0%	0	0.0%	2	100.0%
Large biface/perform	2	100.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	2	100.0%
Small biface/preform	0	0.0%	0	0.0%	0	0.0%	0	0.0%	1	100.0%	0	0.0%	1	100.0%
Mano	0	0.0%	0	0.0%	0	0.0%	0	0.0%	1	100.0%	0	0.0%	1	100.0%
Body sherd	1	6.3%	0	0.0%	1	6.3%	0	0.0%	10	62.5%	4	25.0%	16	100.0%
Total	38	25.2%	7	4.6%	4	2.6%	1	0.7%	78	51.7%	23	15.2%	151	100.0%
	* percent of total artifacts from STPs													

Table 7. CA-SDI-11,039, Summary of Artifact Recovery from STPs, by Level

	Debitage		Cottonwood series		Large Biface		Small Biface		Mano		Body Sherd		Total	
Level	Count	Percent	Count	Percent	Count	Percent	Count	Percent	Count	Percent	Count	Percent	Count	Percent
0-10	42	32.6%	0	0.0%	0	0.0%	1	100.0%	0	0.0%	5	31.2%	48	31.8%
10-2	36	27.9%	2	100.0%	1	50.0%	0	0.0%	0	0.0%	4	25.0%	43	28.5%
20-3	21	16.3%	0	0.0%	1	50.0%	0	0.0%	0	0.0%	7	43.8%	29	19.2%
30-4	11	8.5%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	11	7.3%
40-5	9	7.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	9	6.0%
50-6	3	2.3%	0	0.0%	0	0.0%	0	0.0%	1	100.0%	0	0.0%	4	2.6%
60-7	7	5.4%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	7	4.6%
Total	129	100.0%	2	100.0%	2	100.0%	1	100.0%	1	100.0%	16	100.0%	151	100.0%

Units

Twelve 1 m by 1 m test units were excavated during the testing program at CA-SDI-11,039 (Figure 9). As summarized in Table 8, over 9100 artifacts were collected in the units. Almost 400 pieces of animal bone (32.3 g) and 15 fragments of marine shell (6.1 g) were also recovered in the units (Table 9).

Table 8. CA-SDI-11,039, summary of artifact recovery from units

Class	Item	Count	% Count	Weight (g)	% Weight
Flaked Stone	Debitage	8605	94.17%	18,998.0	23.63%
Flaked Stone	Core	4	0.04%	1,628.7	2.03%
Flaked Stone	Cottonwood concave base point	9	0.10%	5.9	0.01%
Flaked Stone	Cottonwood series point	23	0.25%	6.9	0.01%
Flaked Stone	Cottonwood straight base point	4	0.04%	4.7	0.01%
Flaked Stone	Desert side-notched concave base point	2	0.02%	1.2	0.00%
Flaked Stone	Large biface/ preform	8	0.09%	122.1	0.15%
Flaked Stone	Small biface/ preform	9	0.10%	20.4	0.03%
Flaked Stone	Other biface/ preform	1	0.01%	4.8	0.01%
Flaked Stone	Scraper	2	0.02%	219.3	0.27%
Flaked Stone	Chopper	2	0.02%	1,276.1	1.59%
Flaked Stone	Hammer	1	0.01%	506.0	0.63%
Flaked Stone	Rejuvenation flake	4	0.04%	602.4	0.75%
Flaked Stone	Retouched/ utilized flake	14	0.15%	985.7	1.23%
Ground Stone	Mano	9	0.10%	1,520.3	1.89%
Ground Stone	Metate	14	0.15%	52,016.3	64.69%
Other Stone	Hammerstone, angular	1	0.01%	314.3	0.39%
Other Stone	Hammerstone, spherical	2	0.02%	474.1	0.59%
Other Stone	Hammerstone, unclassified	1	0.01%	216.2	0.27%
Ceramics	Pipe, unclassified	1	0.01%	1.2	0.00%
Ceramics	Rim sherd	12	0.13%	123.1	0.15%
Ceramics	Body sherd	410	4.49%	1,356.2	1.69%
Total		9,138	100.00%	80,403.9	100.00%

Table 9. CA-SDI-11,039, summary of faunal material recovery from units

Class	Item	Count	Percent by Count	Weight (g)	Percent by Weight
Bone, non-human	Bulk, unmodified	388	96.3%	32.3	84.1%
Shell	Bulk, unmodified	15	3.7%	6.1	15.9%
Total		403	100.0%	38.4	100.0%

Cremated human remains were encountered in Units 8 and 9. The human remains and sherds of a large ceramic pot from Unit 9 were repatriated to KCRC, as addressed below under Burials.

Table 10 summarizes artifact recovery by unit. Table 11 summarizes artifact recovery from the units, by level. As summarized in Table 10, Unit 9 accounted for over 40 percent of all the cultural material collected in the units. Unit 9 yielded almost half of the ceramics from the units (45 percent of the body sherds, 75 percent of the rim sherds, and the single pipe fragment), as well as 46 percent of the bifaces and projectile points. Twelve of the 14 metates or metate fragments collected in the units came from Unit 9 and refit to form an almost complete metate (one piece is missing). (The other two metates came from the hearth feature in Unit 4.) Another rich and varied unit was Unit 7, which accounted for approximately 12 percent of the total unit assemblage. The units are described individually below.

Unit 1
The location of Unit 1 was chosen because STP 8 produced cultural material to a depth of 70 cm. Unit 1 was placed in order to further explore this area. This unit yielded cultural material to a depth of 80 cm (Table 11). Unit 1 produced 10 percent of the debitage from the 12 units. Other artifacts recovered included four Cottonwood series projectile points (one of them a concave base point), a small biface/preform, two rejuvenation flakes, three retouched/utilized flakes, and three manos (one-third of the manos recovered from the units). Seventy-six ceramic sherds were also collected in Unit 1, two of them rim sherds (Table 10). Unit 1 also yielded 6.3 g (43 pieces) of animal bone.

Unit 2
Unit 2 was placed in proximity to STP 1, also a relatively rich STP, which yielded cultural material to its maximum depth of 50 cm. Unit 2 bottomed out in clay at 40 cm. The only cultural material recovered from this unit was 148 pieces of debitage, 1 mano, and 1 ceramic body sherd (Table 10).

Table 10. CA-SDI-11,039, summary of artifact recovery by unit

Unit	Unit 1		Unit 2		Unit 3		Unit 4		Unit 5		Unit 6		Unit 7		Unit 8		Unit 9		Unit 10		Unit 11		Unit 12		Total	
	Count	Percent*	Count	Percent*	Count	Percent*	Count	Percent*	Count	Percent*	Count	Percent*	Count	Percent*	Count	Percent*	Count	Percent*	Count	Percent*	Count	Percent*	Count	Percent*	Count	Percent*
Debitage	886	10.3%	148	1.7%	268	3.1%	375	4.4%	529	6.1%	97	1.1%	1048	12.2%	270	3.1%	3653	42.5%	692	8.0%	234	2.7%	405	4.7%	8605	100.0%
Core	0	0.0%	0	0.0%	0	0.0%	2	50.0%	0	0.0%	0	0.0%	1	25.0%	0	0.0%	1	25.0%	0	0.0%	0	0.0%	0	0.0%	4	100.0%
Cottonwood Concave Base point	1	11.1%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	2	22.2%	0	0.0%	6	66.7%	0	0.0%	0	0.0%	0	0.0%	9	100.0%
Cottonwood Series point	3	13.0%	0	0.0%	0	0.0%	0	0.0%	5	21.7%	0	0.0%	4	17.4%	1	4.3%	9	39.1%	0	0.0%	0	0.0%	1	4.3%	23	100.0%
Cottonwood Straight Base point	0	0.0%	0	0.0%	0	0.0%	0	0.0%	1	25.0%	0	0.0%	0	0.0%	0	0.0%	3	75.0%	0	0.0%	0	0.0%	0	0.0%	4	100.0%
Desert Side-Notched Concave Base point	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	1	50.0%	1	50.0%	0	0.0%	0	0.0%	2	100.0%
Large biface/ perform	0	0.0%	0	0.0%	1	12.5%	0	0.0%	2	25.0%	0	0.0%	4	50.0%	0	0.0%	1	12.5%	0	0.0%	0	0.0%	0	0.0%	8	100.0%
Small biface/ preform	1	11.1%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	2	22.2%	0	0.0%	5	55.6%	1	11.1%	0	0.0%	0	0.0%	9	100.0%
Other biface/ point	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	1	100.0%	0	0.0%	0	0.0%	0	0.0%	1	100.0%
Scraper	0	0.0%	0	0.0%	1	50.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	1	50.0%	0	0.0%	0	0.0%	0	0.0%	2	100.0%
Chopper	0	0.0%	0	0.0%	0	0.0%	2	100.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	2	100.0%
Hammer	0	0.0%	0	0.0%	0	0.0%	1	100.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	1	100.0%
Rejuvenation flake	2	40.0%	0	0.0%	0	0.0%	2	40.0%	0	0.0%	0	0.0%	1	20.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	5	100.0%
Retouched/ utilized flake	3	23.1%	0	0.0%	1	7.7%	2	15.4%	1	7.7%	0	0.0%	0	0.0%	1	7.7%	2	15.4%	1	7.7%	0	0.0%	2	15.4%	13	100.0%
Mano	3	33.3%	1	11.1%	0	0.0%	1	11.1%	2	22.2%	0	0.0%	0	0.0%	0	0.0%	2	22.2%	0	0.0%	0	0.0%	0	0.0%	9	100.0%
Metate	0	0.0%	0	0.0%	0	0.0%	2	14.3%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	12	85.7%	0	0.0%	0	0.0%	0	0.0%	14	100.0%
Hammerstone, angular	0	0.0%	0	0.0%	0	0.0%	1	100.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	1	100.0%
Hammerstone, spherical	0	0.0%	0	0.0%	0	0.0%	2	100.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	2	100.0%
Hammerstone, unclassified	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	1	100.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	1	100.0%
Pipe, unclassified	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	1	100.0%	0	0.0%	0	0.0%	0	0.0%	1	100.0%
Rim sherd	2	16.7%	0	0.0%	0	0.0%	1	8.3%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	9	75.0%	0	0.0%	0	0.0%	0	0.0%	12	100.0%
Body sherd	74	18.0%	1	0.2%	2	0.5%	16	3.9%	25	6.1%	0	0.0%	28	6.8%	23	5.6%	184	44.9%	11	2.7%	5	1.2%	41	10.0%	410	100.0%
Total	975	10.7%	150	1.6%	273	3.0%	407	4.5%	565	6.2%	97	1.1%	1091	11.9%	295	3.2%	3891	42.6%	706	7.7%	239	2.6%	449	4.9%	9138	100.0%

* percent of total artifacts from unit

Table 11. CA-SDI-11,039, summary of artifact recovery from units, by level

	0-10 cm		10-20 cm		20-30 cm		30-40 cm		40-50 cm		50-60 cm		60-70 cm		70-80 cm		Total	
	Count	Percent	Count	Percent	Count	Percent	Count	Percent	Count	Percent	Count	Percent	Count	Percent	Count	Percent	Count	Percent
Debitage	4076	47.4%	2600	30.2%	1369	15.9%	247	2.9%	168	2.0%	76	0.9%	45	0.5%	24	0.3%	8605	100.0%
Core	0	0.0%	1	25.0%	1	25.0%	0	0.0%	1	25.0%	0	0.0%	1	25.0%	0	0.0%	4	100.0%
Cottonwood Concave Base point	6	66.7%	2	22.2%	1	11.1%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	9	100.0%
Cottonwood series point	12	52.2%	6	26.1%	5	21.7%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	23	100.0%
Cottonwood Straight Base point	0	0.0%	2	50.0%	2	50.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	4	100.0%
Desert Side-Notched Concave base point	2	100.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	2	100.0%
Large biface/perform	2	25.0%	5	62.5%	0	0.0%	1	12.5%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	8	100.0%
Small biface/preform	3	33.3%	5	55.6%	0	0.0%	0	0.0%	0	0.0%	1	11.1%	0	0.0%	0	0.0%	9	100.0%
Other biface/point	0	0.0%	1	100.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	1	100.0%
Scraper	0	0.0%	0	0.0%	1	50.0%	1	50.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	2	100.0%
Chopper	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	1	50.0%	1	50.0%	2	100.0%
Hammer	1	100.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	1	100.0%
Rejuvenation flake	0	0.0%	2	50.0%	0	0.0%	0	0.0%	1	25.0%	0	0.0%	1	25.0%	0	0.0%	4	100.0%
Retouched/utilized flake	9	64.3%	1	7.1%	1	7.1%	1	7.1%	0	0.0%	1	7.1%	1	7.1%	0	0.0%	14	100.0%
Mano	4	44.4%	1	11.1%	1	11.1%	0	0.0%	0	0.0%	0	0.0%	2	22.2%	1	11.1%	9	100.0%
Metate	4	28.6%	5	35.7%	3	21.4%	0	0.0%	0	0.0%	1	7.1%	1	7.1%	0	0.0%	14	100.0%
Hammerstone, angular	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	1	100.0%	0	0.0%	1	100.0%
Hammerstone, spherical	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	1	50.0%	1	50.0%	2	100.0%
Hammerstone, unclassified	0	0.0%	1	100.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	1	100.0%
Pipe, unclassified	0	0.0%	1	100.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	1	100.0%
Rim sherd	8	66.7%	2	16.7%	1	8.3%	0	0.0%	1	8.3%	0	0.0%	0	0.0%	0	0.0%	12	100.0%
Body sherd	224	54.6%	136	33.2%	33	8.0%	6	1.5%	9	2.2%	2	0.5%	0	0.0%	0	0.0%	410	100.0%
Total	4351	47.6%	2771	30.3%	1418	15.5%	256	2.8%	180	2.0%	81	0.9%	54	0.6%	27	0.3%	9138	100.0%

Unit 3
Unit 3, located midway between Units 1 and 2 also bottomed out in clay, at 50 cm. The unit produced debitage (268 pieces), a large biface/preform, a scraper (one of only three recovered at the site), a retouched/utilized flake, and two ceramic sherds (Table 10).

Unit 4
Unit 4 was placed in the large flat area of the site, in an effort to explore the eastern portion of the site. The STPs to the east of this area had been sterile, but the soil in the area of Unit 4 was darker and more organic. A large hearth feature was encountered in the 50 cm level and continued to the depth of the unit, at 80 cm. An abrupt soil change was encountered at 80 cm, as well as bedrock covering over half the unit floor, and excavation was halted. Cultural material collected in Unit 4 included 375 pieces of debitage, 2 cores (of only 6 recovered at the site), 2 choppers, 1 hammer (the only flaked stone hammer collected at the site), 2 rejuvenation flakes, 2 retouched/utilized flakes, 1 mano, 2 metates, 3 hammerstones, 1 rim sherd, 16 body sherds, and 1 shell fragment (Table 10). Both metates were whole and were in the hearth feature. Over 300 pieces of fire-affected rock were found in the hearth feature; these were not collected. The hearth feature, illustrated in Figure 10, extends for an unknown distance outside the unit, apparently in all directions. The fire-affected rock appears to extend to the west of Unit 4, and charcoal was found in the eastern part of the unit, appearing to continue to the east.

Unit 5
Unit 5, located southwest of Unit 1, produced cultural material to a depth of 50 cm, at which the clay level was encountered, and excavation was halted. This unit yielded only about 6 percent of the debitage from the 12 units, but the unit produced 6 projectile points and 2 large biface/preforms. The six points were all Cottonwood series, one of them a Cottonwood straight base point. Other cultural material collected in Unit 5 included 1 retouched/utilized flake, 2 manos, 25 ceramic body sherds, 2.4 g of animal bone (9 pieces), and 1 shell fragment (0.1 g) (Table 9).

Unit 6
Unit 6, located near the northern project boundary, was the least productive of the 12 units. While cultural material was found to a depth of 60 cm, at which point the clay layer was encountered, only 97 pieces of debitage were recovered (Table 10).

Unit 7
Unit 7 was the second most productive of the 12 units excavated, accounting for almost 12 percent of the artifacts collected in the units. In addition to 1048 pieces of debitage, cultural material collected included 1 core, 6 projectile points, 6 biface/preforms (4 large and 2 small), 1 retouched/utilized flake, 1 hammerstone, 28 body sherds, and 0.1 g of bone (2 pieces) (Table 10). The projectile points are all Cottonwood series, two of them concave base points. Unit 7 produced cultural material only to a depth of 30 cm (Table 11), at which point it bottomed out on clay and rock.

Unit 4 hearth feature
50-60cm

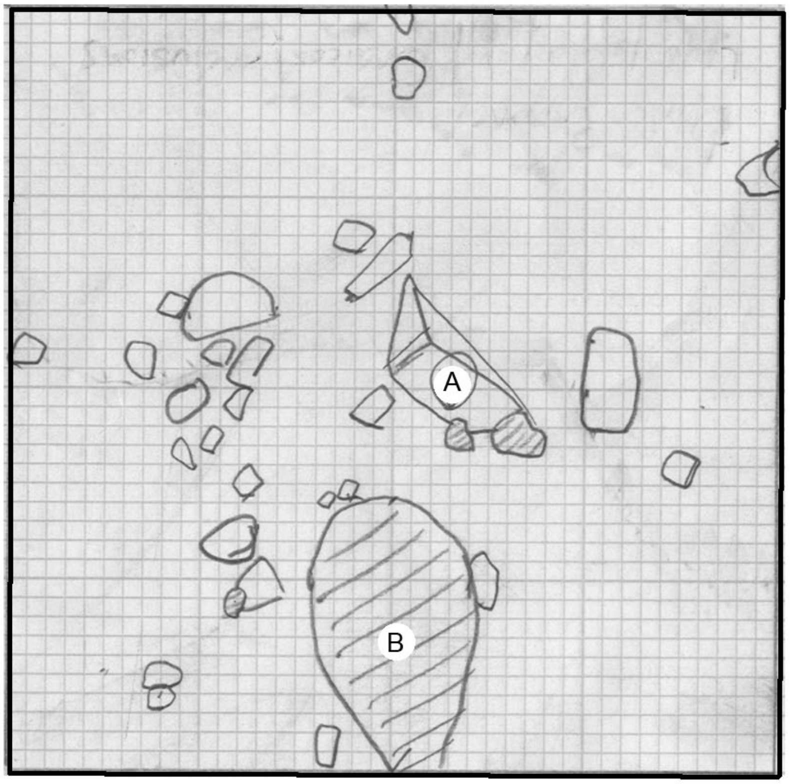
KEY

= Rock in 40-50cm level

= Rock in 50-60cm level

(A) = Metate

(B) = Upside down Metate



Soil Type

Dark brown
Clay and loam mixture
with charcoal

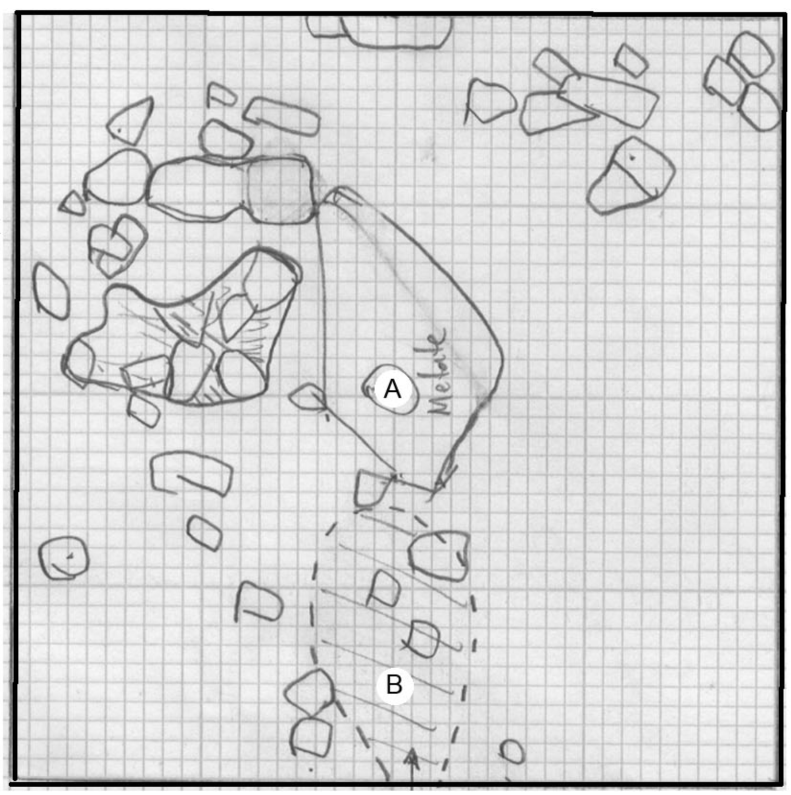
Unit 4 hearth feature
60-70cm

KEY

= Fire Affected Rock

(A) = Metate

(B) = Metate from 50-60cm



Soil Type

Dark brown
Clay and loam mixture
with charcoal

N

Scale: 1cm = 10cm

0 1 2 3 cm

0 10 20 30 cm

Affinis 810 Jamacha Road Suite 206 El Cajon, CA 92019	CA-SDI-11,039, hearth feature in Unit 4	Figure 10

Unit 8

Unit 8 did not yield a great deal of artifactual material (295 items, 3.2 percent of the total from all units), but human remains were recovered from this unit. Artifacts collected from Unit 8 included debitage, a Cottonwood series projectile point, a retouched/utilized flake, 23 ceramic body sherds, and 3 pieces of animal bone (less than 0.1 g) (Table 10). Unit 8 was located near the top of the knoll, and the soil in the unit was generally the clayey soil found in the bottom levels of the other units. By 20 cm, the clay and rock made excavation too difficult and unproductive to continue further.

When possible human remains were identified early in the excavation of Unit 8, digging was halted while the burned bone was taken to Rose Tyson of the San Diego Museum of Man and then to Dr. Arion Mayes of San Diego State University for identification. The burned bones were determined to be human. Native American representative, Clint Linton, asked that excavation of this unit be completed, so that if other human remains were found, all the remains could be kept together for reburial. All the human remains from Unit 8, as well as those from Unit 9, were repatriated to the Kumeyaay Cultural Repatriation Committee (KCRC) for reburial.

Unit 9

Unit 9 was located on the knolltop, up slope from Unit 8. This unit was by far the richest of all 12 units excavated, accounting for over 40 percent of the cultural material collected in the units. The 19 projectile points recovered in Unit 9 make up half of the 38 points collected from the units. Seven bifaces were recovered (one large biface/preform, five small biface/preforms, and one "other" biface/preform). These account for almost 40 percent of all the bifaces collected in the units (eight large biface/preforms, nine small biface/preforms, and one "other" biface/preform). The ceramic pipe fragment came from this unit, as well as 9 rim sherds (75 percent of all the rim sherds from the units) and 184 body sherds (45 percent of body sherds from the units). As addressed below, under the discussion of ceramics, two of the rim sherds were incised. Twelve metate fragments from this unit refit to form a metate with one piece missing. Other cultural material collected from Unit 9 included a scraper, 2 manos, 23.4 g of animal bone (330 pieces), and 5.3 g of shell (13 fragments) (Table 10). Unit 9 produced cultural material to a depth of 40 cm. The unit bottomed out on clay and rocks.

Human remains were encountered in Unit 9, in the form of cremated bone fragments. These were identified by Dr. Arion Mayes of San Diego State University. The human bone, the refit metate, and a number of ceramic sherds that appear to be from one large olla (including the incised rim sherds) were repatriated to KCRC, as addressed below under Burials.

Unit 10
Unit 10 was downslope from Unit 9, near the base of the knoll (Figure 9). Cultural material was found to a depth of 30 cm. In addition to 692 pieces of debitage, the unit produced a Desert side notched concave base point, a small biface/preform, a retouched/utilized flake, and 11 body sherds (Table 10).

Unit 11
Unit 11 was placed so as to explore the southern base of the knoll, the southwestern portion of the site (Figure 9). This unit was south of Unit 10 and northwest of Unit 5. It was excavated to 40 cm and yielded only debitage (234 pieces) and 5 body sherds (Table 10).

Unit 12
Unit 12 also was located along the base of the knoll, between Unit 10 to the south and Unit 7 to the north (Figure 9). This unit bottomed out on clay and rocks at only 20 cm, but it produced 405 pieces of debitage, 1 Cottonwood series point, 2 retouched/utilized flakes, 5 body sherds, and 0.1 g of animal bone (1 piece).

Artifacts

Artifact catalogs are included as Appendix A of this report. Provenience information and artifact attributes are given for each item in the catalogs.

Debitage
Debitage accounts for over 90 percent of the artifact assemblage from CA-SDI-11,039, a total of 9326 items (Table 1). No debitage analysis was undertaken as part of the current testing program, but analysis of debitage from the site should be done as part of further research. As summarized in Table 12, 90 percent of the debitage assemblage consists of metavolcanic material (86.8 percent is medium- to coarse-grained metavolcanic, 3.6 percent is fine-grained). Quartz is the next most frequently occurring material type, at 5.5 percent of the debitage collection. Piedra de Lumbre chert accounts for 2.5 percent of the debitage. The source for this material is in the Camp Pendleton area; it is not locally available (see Pigniolo 1994). Fifty-one pieces of obsidian debitage were collected. While this accounts for only 0.5 percent of the total debitage assemblage, it is a large amount considering that it is not a locally available material. Obsidian sources are found in the Salton Sea area, in the eastern Sierra Nevada, and in Baja California. The Obsidian Butte source, near the Salton Sea, is the most frequently represented in Late Prehistoric Kumeyaay sites. Chert and quartzite each make up a similar proportion of the assemblage as does obsidian.

Table 12.	CA-SDI-11,039, summary of debitage material types

Material	Count	Percent by Count	Weight (g)	Percent by Weight
Medium- to coarse-grained metavolcanic	8096	86.8%	22,350.5	94.4%
Fine-grained metavolcanic	332	3.6%	210.7	0.9%
Quartzite	34	0.4%	625.4	2.6%
Quartz	515	5.5%	268.5	1.1%
Obsidian	51	0.5%	6.3	0.0%
Chert	63	0.7%	47.3	0.2%
Granitic	1	0.0%	0.8	0.0%
Chalcedony	1	0.0%	0.4	0.0%
Piedra de Lumbre Chert	233	2.5%	163.7	0.7%
Total	9326	100.0%	23,673.6	100.0%

Cores
Only six cores were recovered at CA-SDI-11,039, accounting for 0.1 percent of the total assemblage. Four of the cores were collected in units (Unit 4, Unit 7, and Unit 9); the other two came from the surface collection. All of the cores are whole. Five of the six cores are multidirectional; one is bidirectional. The bidirectional core is quartzite; the others are all medium- to coarse-grained metavolcanic material. The steepest edge angle on the cores ranges from 96 degrees to 120 degrees. Narrowest edge angle ranges from 65 degrees to 85 degrees. At CA-ORA-910A, Shackley (1989:65) suggested that acute edge angles around 60 degrees to 70 degrees may represent attempts to produce cutting or scraping edges, which may have been abandoned for a variety of reasons.

Projectile Points
Forty-two projectile points were collected during the testing at CA-SDI-11,039: 2 from the surface collection, 2 from the STPs, and 38 from the units. Figure 11 illustrates the distribution of projectile points and bifaces. All but two of the projectile points are Cottonwood series, including 10 Cottonwood concave base, 5 Cottonwood straight base, and 25 classified simply as Cottonwood series. The other two points are Desert side-notched concave base.

SENSITIVE MATERIAL – IN CONFIDENTIAL APPENDIX B

Affinis 810 Jamacha Road, Suite 206 El Cajon, CA 92019	CA-SDI-11,039, distribution of points and bifaces	Figure 11

As summarized in Table 13, almost two-thirds of the projectile points are made from metavolcanic material, probably locally available raw material. The six quartz points account for almost 15 percent of the total, and five Piedra de Lumbre chert points comprise over 10 percent of the point assemblage. Obsidian accounts for almost 10 percent as well; there are four obsidian projectile points. A single chert point was found.

Table 13. CA-SDI-11,039, summary of projectile point material types

Material	Count	Percent by Count	Weight (g)	Percent by Weight
Medium- to coarse-grained metavolcanic	24	57.1%	14.0	64.8%
Fine-grained metavolcanic	2	4.8%	2.0	9.3%
Quartz	6	14.3%	1.9	8.8%
Obsidian	4	9.5%	1.3	6.0%
Chert	1	2.4%	0.8	3.7%
Piedra de Lumbre Chert	5	11.9%	1.6	7.4%
Total	42	100.0%	21.6	100.0%

Bifaces/Preforms

In addition to projectile points, 27 other bifaces were recovered at CA-SDI-11,039. These include 13 large bifaces, 13 small bifaces, and 1 biface classified as “other”. The biface classified as “other” is the base of what appears to be a large, parallel-sided biface. Two-thirds of the bifaces (18) were recovered in units (Table 8); seven of them from Unit 9 and another six from Unit 7 (Table 10). Six bifaces were found on the surface (Table 5), and three came from STPs (STP 1 and STP 8) (Table 6). This distribution is illustrated in Figure 11.

Attributes of bifaces/preforms are summarized in Table 14. As seen in this table, about 60 percent of the bifaces are early stage preforms; another 30 percent are late stage preforms. One specimen is finished, and two are unknown as to stage. Almost half of the bifaces/preforms are complete. Almost one-fourth exhibit end-shock, and about 15 percent have perverse fractures. Both of these fracture types tend to be the result of breaks during manufacture. A little over 10 percent have longitudinal fractures, which probably occurred as a result of use.

Table 14. CA-SDI-11,039, summary of biface/preform attributes

Variable	Value	Count	Percent
Production Stage	Unknown	2	7.4%
	Finished	1	3.7%
	Early Stage Preform	16	59.3%
	Late Stage Preform	8	29.6%
Condition	Complete	13	48.1%
	Tip	0	0.0%
	Mid-section	0	0.0%
	Tip missing	1	3.7%
	Base	2	7.4%
	Base missing	1	3.7%
	Essentially complete	0	0.0%
	Incomplete	10	37.0%
	Other	0	0.0%
Fracture	N/A	13	48.1%
	End shock	6	22.2%
	Perverse	4	14.8%
	Longitudinal	3	11.1%
	Split-feather	0	0.0%
	Other	1	3.7%
Edge Shape	N/A	1	3.7%
	Straight	16	59.3%
	Convex	9	33.3%
	Concave	0	0.0%
	Serrated (fine)	0	0.0%
	Serrated	0	0.0%
	Other	1	3.7%
	Angular debris	1	5.0%
Patinated	No	3	11.1%
	Yes	24	88.9%
Material			
	Medium- to coarse-grained metavolcanic	18	66.7%
	Fine-grained metavolcanic	1	3.7%
	Quartz	4	14.8%
	Chert	1	3.7%
	Chalcedony	1	3.7%
	Piedra de Lumbre chert	1	3.7%
	Undetermined	1	3.7%

Two-thirds of the bifaces are made from metavolcanic material, probably the locally available Santiago Peak Volcanics. This matches the percentage of metavolcanic material in the projectile point assemblage, although a greater proportion of the points are fine-grained metavolcanic than seen in the biface assemblage. As with the projectile point collection, almost 15 percent of the bifaces are quartz. Chert, chalcedony, Piedra de Lumbre chert, and an undetermined lithic material each account for a single specimen. No obsidian bifaces were recovered, although obsidian accounts for almost one-tenth of the projectile points.

Flaked Stone Tools

In addition to projectile points and bifaces, several other formal flaked stone tools were recovered: three scrapers, six choppers, and one core hammer (Table 1). For convenience, artifacts have been given commonly used names, based on morphology and other attributes. Although these names suggest function (e.g., chopper, scraper), it is by no means certain what the various uses of all these artifacts were. The labels are used for ease of discussion, rather than to indicate that "scrapers" were all used for scraping or "choppers" were used for chopping.

Six types of edge wear are recognized in the cataloging; these are summarized in Table 15. Edge angle was measured for all artifacts and recorded as one of 10 classes: 0) not applicable, 1) 25 degrees or less, 2) 26 to 35 degrees, 3) 36 to 45 degrees, 4) 46 to 55 degrees, 5) 56 to 65 degrees, 6) 66 to 75 degrees, 7) 76 to 85 degrees, 8) 86 to 95 degrees, or 9) greater than 95 degrees. Edge angle and edge damage/use wear are measured on up to three edges on each artifact. The catalog also records production base -- 0) unclassified, 1) flake, 2) core, or 3)cobble -- and retouch -- 0) none, 1) unifacial, or 2) bifacial.

Table 15. CA-SDI-11,039, edge wear types used in cataloging (based on Cook and Bull 1978:45-52).

Code	Type	Description
0	No wear	No evidence of wear visible on the observed edge.
1	Faceting	Accumulation of step and hinge fractures. The fractures are longer and wider than micro-step fractures. The presence of discrete flake scars and the absence of crushed crystals distinguish faceting from edge crushing. This type of wear is assumed to result from heavy work on hard materials such as stone.
2	Crushing	This type of edge wear includes the dulling of flaked edges on prepared tools and the creation of overlapping conchoidal fractures on the edges of unmodified cobbles. This type of damage generally results from light percussion.
3	Abrasion	This includes rasping, grinding, and polishing as defined by Semenov (1964). For flaked lithic tools this type of wear is characterized by an angular smoothing of the edge that follows the curvature of the edge.
4	Micro-step fractures	This is a series of small superimposed step fractures. Step flake scars terminate at a right angle to the axis of the scar, and in this type of edge damage, a number of such scars is present. Scalar flaking is also included in this category. Scalar flakes scars are small flake scars that terminate in a feathered or finely-tapering fashion, but that remove portions of the working edge, resulting is a scalloped effect. Scalar flaking is produced by working hard materials.
5	Rounding	As the name suggests, this is a localized blunting of the edge of a tool. This type of wear may cover and obliterate other types of wear. Rounding results from friction between the tool and the worked material.
6	Nibbling	This wear type consists of small, irregularly spaced flake scars that have a feather termination (a finely tapering distal margin to the flake scar). Such scars do not remove any of the working edge of the tool, distinguishing them from scalar scars. Cook and Bull (1978:52) suggest that these may be a result of either the tool's material type or an indication of the type of material worked and the nature of the work performed.

All of the tools recovered at CA-SDI-11,039 are made from medium- to coarse-grained metavolcanic material, apparently the locally available raw material. Two of the three scrapers are core-based, and one is flake-based; all are unifacial. Each of the three scrapers exhibits retouch and use wear on two edges. Edge angle varies from an acute edge of 36 to 45 degrees to a steep edge of 66 to 75 degrees. Types of use wear noted on the scrapers are crushing (on two edges), micro-step flaking (on three edges), and nibbling (on one edge). Edge shape for five of the retouched/utilized edges is straight, with one edge noted as convex.

Six choppers were collected, one of which is broken. One chopper is flake-based; the other five are core-based. One of the choppers is bifacial, the others are all unifacial. While three of the choppers exhibit retouch and use wear on a single edge, two have two retouched edges, and one has retouch on three edges. Edge angle varies from an acute edge of 36 to 45 degrees to a steep edge of 86 to 95 degrees. This steepest angle is present on three of the retouched edges; another three edges have an angle of 66 to 75 degrees. Crushing is the most frequently occurring type of use wear, with micro-step flaking also noted. The most frequently noted edge shape is convex, but several edges are straight.

A single core hammer was found at the site, in Unit 4. The hammer exhibits no retouch, just the flaking associated with its initial function as a core, as well as the use wear as a hammer. Micro-step flaking was noted on at least three edges, all of them with edge angles greater than 95 degrees. One of the edges is straight, the others are convex.

Retouched/utilized flakes

Twenty retouched/utilized flakes were collected during the testing at CA-SDI-11,039. These tools are not formally shaped, rather they are expedient tools, which are useful but do not require a great deal of time to make. The attributes of the retouched/utilized flakes are summarized in Table 16. The attribute analysis for retouched/ utilized is based on an analysis system developed by Shackley (1989). As shown in this table, 85 percent of these items exhibit retouch, not merely utilization. Bifacial retouch is evident on three of the artifacts; the remainder show unifacial retouch. Only one-fourth of the retouched/utilized flakes exhibit use wear or retouch on more than one edge, however. While the majority of the retouched/ utilized flakes have relatively sharp angles, suggesting use as scraping and cutting tools, four of the tools have primary edges greater than 55 degrees, and three have secondary edges greater than 55 degrees. Edge rounding was the most common type of use wear noted, followed by crushing and micro-step flaking. One item is retouched but shows no use wear. Straight and convex are the two prevalent edge shapes, with two items having concave edges. The vast majority of the retouched/utilized flakes are made on divergent flakes; that is, flakes that are larger at the distal end than the platform. One of the items is a linear flake, one is converging in shape, and one is angular debris. Only one of the retouched/utilized flakes is not metavolcanic; it is quartz. Eighty-five percent of these tools are medium- to coarse-grained metavolcanic; the remainder are fine-grained metavolcanic. While only 30 percent of the retouched/ utilized flakes have no cortex at all, over half have cortex over 1 to 30 percent of their dorsal surface. The remaining 15 percent exhibit cortex over 31 to 90 percent of their surface.

Table 16. CA-SDI-11,039, summary of retouched/utilized flakes attributes

Variable	Value	Count	Percent
Retouch	None	3	15.0%
	Unifacial	14	70.0%
	Bifacial	3	15.0%
Primary Edge Angle	N/A	0	0.0%
	<26 degrees	0	0.0%
	26-35 degrees	6	30.0%
	36-45 degrees	5	25.0%
	46-55 degrees	5	25.0%
	56-65 degrees	2	10.0%
	66-75 degrees	2	10.0%
Secondary Edge Angle	N/A	15	75.0%
	<26 degrees	0	0.0%
	26-35 degrees	0	0.0%
	36-45 degrees	1	5.0%
	46-55 degrees	1	5.0%
	56-65 degrees	1	5.0%
	66-75 degrees	2	10.0%
Primary Edge Wear	No wear	1	5.0%
	Faceting	0	0.0%
	Crushing	6	30.0%
	Abrasion	0	0.0%
	Micro-step flaking	4	20.0%
	Rounding	9	45.0%
	Nibbling	0	0.0%
Secondary Edge Wear	No wear	16	80.0%
	Faceting	0	0.0%
	Crushing	1	5.0%
	Abrasion	0	0.0%
	Micro-step flaking	1	5.0%
	Rounding	2	10.0%
	Nibbling	0	0.0%

Variable	Value	Count	Percent
Primary Edge Shape	Straight	9	45.0%
	Convex	9	45.0%
	Concave	2	10.0%
	Notched	0	0.0%
	Sharply protruding	0	0.0%
	Serrated	0	0.0%
	Other	0	0.0%
Secondary Edge Shape	N/A	15	75.0%
	Straight	2	10.0%
	Convex	3	15.0%
	Concave	0	0.0%
	Notched	0	0.0%
	Sharply protruding	0	0.0%
	Serrated	0	0.0%
	Other	0	0.0%
Morphology	Linear	1	5.0%
	Diverging	17	85.0%
	Converging	1	5.0%
	Other	0	0.0%
	Angular debris	1	5.0%
Cortex	None	6	30.0%
	1-30%	11	55.0%
	31-90%	3	15.0%
	91-99%	0	0.0%
	100%	0	0.0%
Material	Medium- to coarse-grained metavolcanic	17	85.0%
	Fine-grained metavolcanic	2	10.0%
	Quartz	1	5.0%

Rejuvenation Flakes
Six rejuvenation flakes were found at CA-SDI-11,039. These are flakes removed to rejuvenate a core by providing a better platform for removing additional flakes or to rejuvenate a tool by reworking the edge to make it more useable. Four of the six rejuvenation flakes appear to have been taken off to renew cores; the other two are from scrapers. While three of the items exhibit no retouch, two have bifacial retouch, and one has unifacial retouch. All six of the flakes are metavolcanic; five of them are medium- to coarse-grained, and one is fine-grained.

Ground Stone
Thirty-two ground stone artifacts were recovered: 16 manos and 16 metates or metate fragments. Twelve metate fragments came from Unit 9 and refit to form an almost complete metate (one piece is missing). In this discussion, the pieces from Unit 9 will be addressed as a single item, bringing the total number of metates to five. Two whole metates came from the hearth feature in Unit 4. One complete metate and one fragment were collected from the surface. The distribution of ground stone artifacts is illustrated in Figure 12.

The attributes of the metates collected are summarized in Table 17. All five exhibit medium to heavy use, and all are moderately-shaped to well-shaped in terms of manufacturing input. Two of the items show thermal alteration. Two of the metates are granitic; the other three are medium- to coarse-grained metavolcanic. The three complete metates (the two found in the hearth feature in Unit 4 and surface collection shot 68) are smaller but thicker than the metate from Unit 9. The basin from Unit 4 is 38.0 cm by 18.5 cm by 16.0 cm, and the slab from Unit 4 is 38.5 cm by 28.0 cm by 14.0 cm. The slab metate collected from the surface measures 45.0 cm by 14.5 cm by 10.5 cm. The metate from Unit 9 is triangular in shape with maximum dimensions of approximately 65 cm by 50 cm. Thickness varies from 4.5 to 7.0 cm (Figure 13). The other surface collection piece is a fragment of a basin metate.

Sixteen manos were collected at the site; attributes are summarized in Table 18. Unlike metates, which were mainly found whole, three-fourths of the manos collected are fragments. Bifacial manos are the most common, with almost as many multiple-surface manos as unifacial ones. Less than one-third of the manos were noted as shaped, four of them shouldered. Of the shaped manos, three were minimally shaped and two were moderately shaped. Almost two-thirds of the mano assemblage exhibits battering, but only about one-third shows thermal alteration. Intensity of use ranges from light to heavy, with two items exhibiting variable use. All but one of the manos is granitic. The single exception is quartzite.

Cook (1978) suggested that in an archaeological context, we would expect to find the majority of manos (and other milling implements) to be broken; tools that were still in good condition would be cached at the site or carried away for use at another site (cf. Cuero 1970; Lee 1989). Such tools would only be discarded when they could no longer be used.

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Affinis 810 Jamacha Road, Suite 206 El Cajon, CA 92019	CA-SDI-11,039, distribution of ground stone	Figure 12

Table 17. CA-SDI-11,039, summary of metate attributes

Variable	Value	Count	Percent
Surface morphology	Single surface	5	100.0%
	Double surface	0	0.0%
	Multiple surface	0	0.0%
Shaped	No	0	0.0%
	Yes	5	100.0%
Battered	No	4	80.0%
	Yes	1	20.0%
Thermal Alteration	No	3	60.0%
	Yes	2	40.0%
Intensity of Use	Fragment	0	0.0%
	Light	0	0.0%
	Medium	3	60.0%
	Heavy	2	40.0%
	Variable	0	0.0%
Manufacturing Input	Unidentifiable	0	0.0%
	Unshaped item	0	0.0%
	Minimally shaped (<1/3)	0	0.0%
	Moderately shaped (>1/3, <2/3)	2	40.0%
	Well shaped (>2/3)	3	60.0%
Base	Unclassified	0	0.0%
	Slab	3	60.0%
	Basin	2	40.0%
Material	Medium- to coarse-grained metavolcanic	3	60.0%
	Granitic	2	40.0%

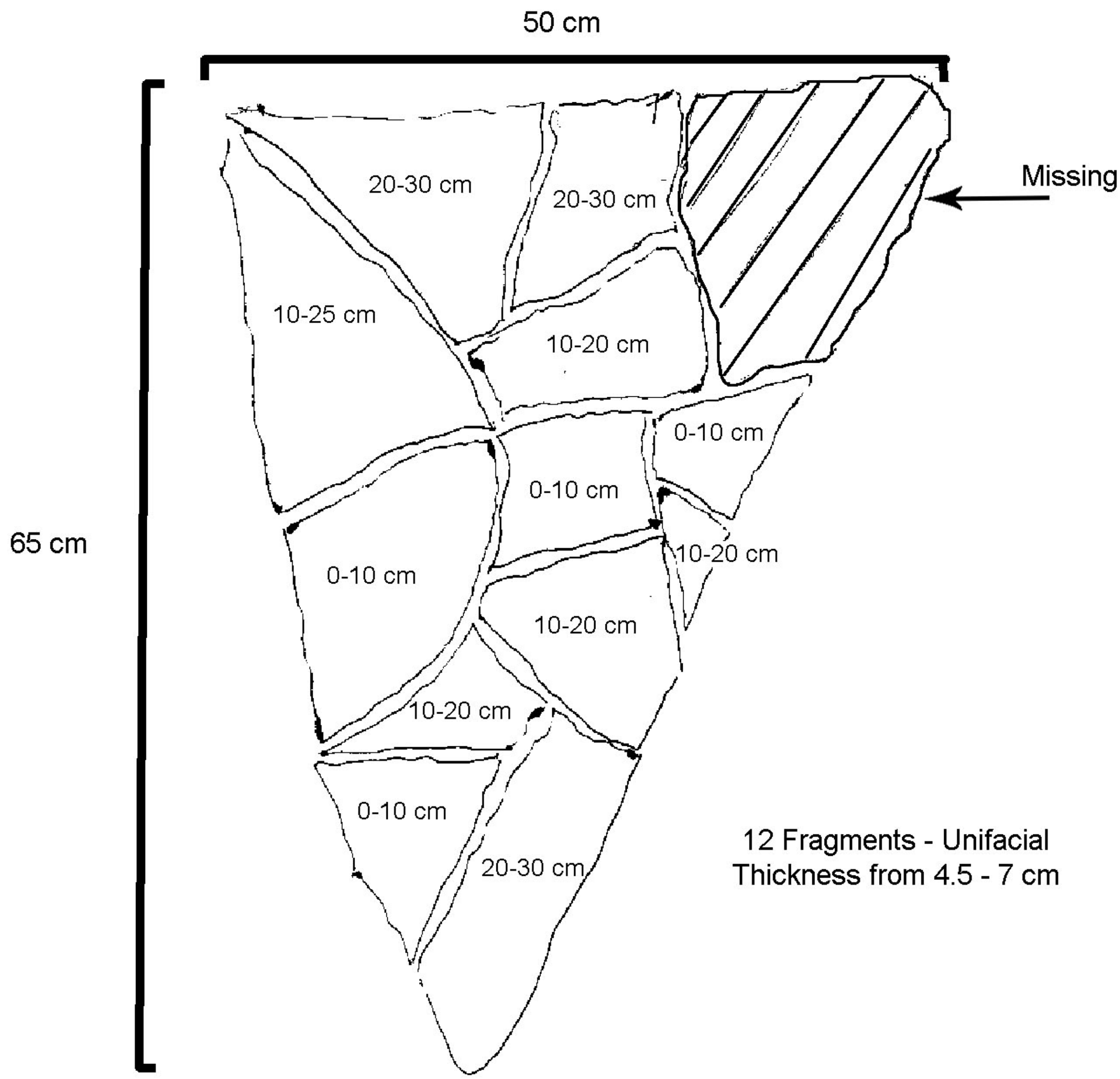
Note: 12 fragments in Unit 9 refit to form an almost complete metate, which is addressed as a single item in this table

Job # 2239

CA-SDI-11,039

Unit 9 Various levels

Metate



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CA-SDI-11,039, refit metate from Unit 9

Figure 13

Table 18. CA-SDI-11,039, summary of mano attributes

Variable	Value	Count	Percent
Surface morphology	Unidentifiable	2	12.5%
	Single surface	4	25.0%
	Double surface	7	43.8%
	Multiple surface	3	18.8%
Shaped	No	11	68.8%
	Yes	5	31.3%
Battered	No	6	37.5%
	Yes	10	62.5%
Thermal Alteration	No	11	68.8%
	Yes	5	31.3%
Shouldering	No	12	75.0%
	Yes	4	25.0%
Intensity of Use	Fragment	2	12.5%
	Light	5	31.3%
	Medium	4	25.0%
	Heavy	3	18.8%
	Variable	2	12.5%
Manufacturing Input	Unidentifiable	10	62.5%
	Unshaped item	1	6.3%
	Minimally shaped (<1/3)	3	18.8%
	Moderately shaped (>1/3, <2/3)	2	12.5%
	Well shaped (>2/3)	0	0.0%
Material	Quartzite	1	6.3%
	Granitic	15	93.8%
Condition	Whole	12	75.0%
	Broken	4	25.0%

Cook's suggestion is borne out by the fact that 75 percent of the manos from the testing are fragmentary. Three whole metates were found, but these may have been left at the site in anticipation of later use. Or they may have been discarded for another reason (two of the whole metates were in the hearth feature in Unit 4.

Other Stone – Hammerstones

Other stone hammerstones are unmodified field stones that have been used as hammerstones. While the uses of these tools are the same as flaked stone hammers, these artifacts have not been modified prior to use. Flaked stone hammers have either been manufactured for that purpose or are flaked stone tools (or cores) that were later used as hammers as well. Five other stone hammerstones were collected during testing at CA-SDI-11,039: one from the surface collection and four from units (one from Unit 7 and three from Unit 4). The hammerstones include two angular, two spherical, and one unclassified. The two angular hammerstones both exhibit no finger polish and are both of medium- to coarse-grained metavolcanic material. One has a single used edge, which is straight, and is battered over 5 percent of its surface. The other angular hammerstone has two used edges, both convex, and exhibits battering over 10 percent of its surface. Both angular hammerstones are fragments. The two spherical hammerstones are both granitic. Each has a single used edge, convex in shape, and each has battering over 5 percent of its surface. One shows finger polish; this one is complete, the other is a fragment. One unclassified hammerstone was collected in Unit 7. It is a medium- to coarse-grained metavolcanic piece with a single used edge, straight. This artifact is whole and has battering over 5 percent of its surface. It shows no finger polish.

Native American Ceramics

Over 500 ceramic sherds were collected during the testing at CA-SDI-11,039, including 509 body sherds, 13 rim sherds, and one fragment of a ceramic pipe. All of the ceramics are Tizon Brown Ware. One rim sherd and 81 body sherds were collected on the surface. Another 16 body sherds were found in STPs. The remainder of the ceramics (80 percent) came from units. The pipe, three-fourths of the rim sherds, and almost half of the body sherds all came from Unit 9 (Table 10), apparently associated with the human remains found there. About 20 percent of the ceramics collected from the units were from Unit 1. No other unit yielded a concentration of ceramics.

A number of the ceramic sherds were burned; carbon-caking was noted on three sherds. Two of the rim sherds from Unit 9 have rounded lips; both of these are incised. One rim sherd found in the surface collection has a flattened lip. Unit 12 yielded three body sherds that are incised. The pipe fragment was burned and had been burnished.

As illustrated in Figure 14, several of the large sherds from Unit 9 refit. Figure 14 shows the sherds that appear to be from a single olla and were repatriated to KCRC for reburial. Figure 15 illustrates a rim sherd from Unit 9 that is incised. This piece was also included in the material in Figure 14 that was repatriated.

Ceramic sherds from Unit 9 that fit together, repatriated to KCRC

Ceramic sherds from Unit 9, repatriated to KCRC

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Incised rim sherd from Unit 9

Figure 15

Faunal Material
by G. Timothy Gross

The bone collection from the excavation at CA-SDI-11,039 is composed primarily of unburned small mammal bone, most of which is probably from jack rabbits (*Lepus californicus*). The taxonomic composition of the collection is summarized in Table 19, and the elements recovered are presented in Table 20.

The collection may well represent animals that died naturally in the area and not the results of cultural activities. The lack of general burning and the absence of evidence of butchering marks argues against a cultural origin for most of the bone. The exception to this is large mammal long bone fragments that have what appear to have spiral fractures, suggesting the bone was broken when it was relatively fresh. This may indicate marrow extraction, where the bone is broken and peeled off the marrow that lies inside. The marrow can be eaten as it is or can be boiled up into a soup.

A concentration of bone occurs in Unit 9 in the upper levels (0-10 cm to 20-30 cm). Much of this bone is small mammal and appears to be jack rabbit (*Lepus californicus*). This bone could all be the result of a single animal dying in its burrow.

Although the bone does not appear to provide a lot of information about the past lifeways at the site, it does suggest hunting of deer with possible use of marrow. Jack rabbits may have been used, as well. It is also noteworthy that no fish bones were recovered. Analysis of a larger sample from a data recovery excavation would most likely provide more interesting results.

Shell was not particularly abundant at the site, and most of it was fragmentary and difficult to identify. Of interest is a single chiton plate. Chitons are not common on inland archaeological sites, but they are occasionally found.

Table 19. CA-SDI-11,039, bone taxa identified

Taxa	NISP
cf Aves	28
Micromammal (mouse/gopher size)	6
Small mammal	227
Medium mammal	4
Large mammal	30
Mammal, not identifiable further	3
Total	298

Table 20. CA-SDI-11,039, bone elements identified

Taxa	Element	NISP
cf Aves	long bone shaft fragments	28
Micromammal (mouse/gopher size)	maxilla	1
	femur	1
	tibia	1
	humerus	1
	metatarsal/metacarpal	1
	indeterminate long bone	1
Small mammal	cranial elements/maxilla	11
	mandible	9
	incisor	5
	rib	4
	scapula	4
	molar	1
	innominate	1
	femur	1
	tibia	2
	metatarsal/metacarpal	4
	talus	1
	long bone shaft fragment	180
	indeterminate element	4
Medium mammal	talus	1
	long bone shaft fragment	3
Large mammal	long bone shaft fragment	30
Mammal, not identifiable further	vertebra	1
	indeterminate element	2

Burials
As previously addressed, fragments of cremated human remains were encountered in Units 8 and 9. The bone was examined by Rose Tyson of the San Diego Museum of Man and was positively identified as human by Dr. Arion T. Mayes of San Diego State University. The bone was in the care of Native American representative Clint Linton of Red Tail Monitoring and Research. Following identification of the remains as human, the Medical Examiner's office was notified, as required by law. Also as required by law, the Medical Examiner's office notified the NAHC, who contacted KCRC, as the Most Likely Descendent. The human remains, as well as associated grave goods (the metate, the pipe, and ceramic sherds that appear to be from a single olla), were repatriated to KCRC through Mr. Linton. The area in which the human remains were found is within the MHPA, and a conservation easement will be placed over the area to ensure that it will remain in permanent open space, as addressed under Mitigation Measures.

CA-SDI-18,504

CA-SDI-18,504 is a lithic scatter representing lithic processing activity. The site, which was first identified during the 2007 survey, covers an area of about 50 m by 30 m (1180 m^2) (Figure 16) and is located entirely within the MHPA. Twenty-five flakes and angular debris were noted on the surface; these were not collected. One 1 m by 1 m test unit was excavated in the area of the greatest concentration of material. All cultural material recovered is debitage (flakes and angular debris): a total of 65 items. As summarized in Table 21, cultural material was recovered to a depth of 30 cm. (The 30-40 cm level was sterile.)

Table 21. CA-SDI-18,504, summary of artifact recovery by level

Level	Count	Percent by Count	Weight (g)	Percent by Weight
0-10 cm	33	50.8%	91.6	59.2%
10-20 cm	22	33.9%	55.5	35.9%
20-30 cm	10	15.4%	7.6	4.9%
Total	65	100.0%	154.7	100.0%

As summarized in Table 22, only two pieces of debitage from CA-SDI-18,504 were quartz. The remainder of the material recovered was metavolcanic material, apparently the local material from the Santiago Peak Volcanics formation, which underlies the project and surrounding area. Attributes of the debitage assemblage from CA-SDI-18,504 are summarized in Table 23.

Table 22. CA-SDI-18,504, summary of debitage material types

Material	Count	Percent by Count	Weight (g)	Percent by Weight
Medium- to coarse-grained metavolcanic	62	95.4%	154.1	99.6%
Fine-grained metavolcanic	1	1.5%	0.2	0.1%
Quartz	2	3.1%	0.4	0.3%
Total	65	100.0%	154.7	100.0%

As summarized in Table 23, almost two-thirds of the debitage collected at CA-SDI-18,504 is angular debris. Almost 20 percent consists of microflakes, debitage that is less than 1 cm in size. For angular debris and for microflakes, due to their small size, the only attributes measured were degree of cortex, cortex type, and patination.

As summarized in Table 23, “diverging” is the most common flake shape other than angular debris and microflakes, accounting for 13.8 percent of the overall assemblage. In these flakes, the body of the flake diverges from the platform, being wider at the bottom than the top. Converging flakes, in which the flake is larger near the platform than at the bottom, make up only 1.5 percent of the assemblage. Two linear flakes account for 3.1 percent of the debitage. Platform preparation was noted on about 40 percent of the flakes, with flaking being the most common type of platform preparation (microflakes were not inspected for platform preparation, due to their small size). Plain platforms, with no cortex or visible preparation account for another 40 percent the flakes, with one additional flake having a cortex platform, and one with no platform.

Over 90 percent of the debitage collection has no cortex, with two items exhibiting cortex over less than 30 percent of the dorsal surface, and three pieces with cortex over 31 to 90 percent of the dorsal surface (Table 23). Cortex type for the five pieces of debitage that have cortex is tabular/nodule. All of the debitage exhibits patination.

Almost half of the flakes (when angular debris is removed from the assemblage) are microflakes, less than 1 cm in size. Another one-fourth of the flake collection is 2.0 to 2.9 cm in greatest dimension. The other size categories (1.0 to 1.9 cm, 3.0 to 3.9 cm, and greater than 3.9 cm) each account for less than 10 percent of the flake assemblage (Table 23). Dorsal scar count (not noted for angular debris and microflakes) ranges from a minimum of 2 dorsal scars to a maximum of 6, with 3.75 as the mean count. Four dorsal scars is the median count and the mode.

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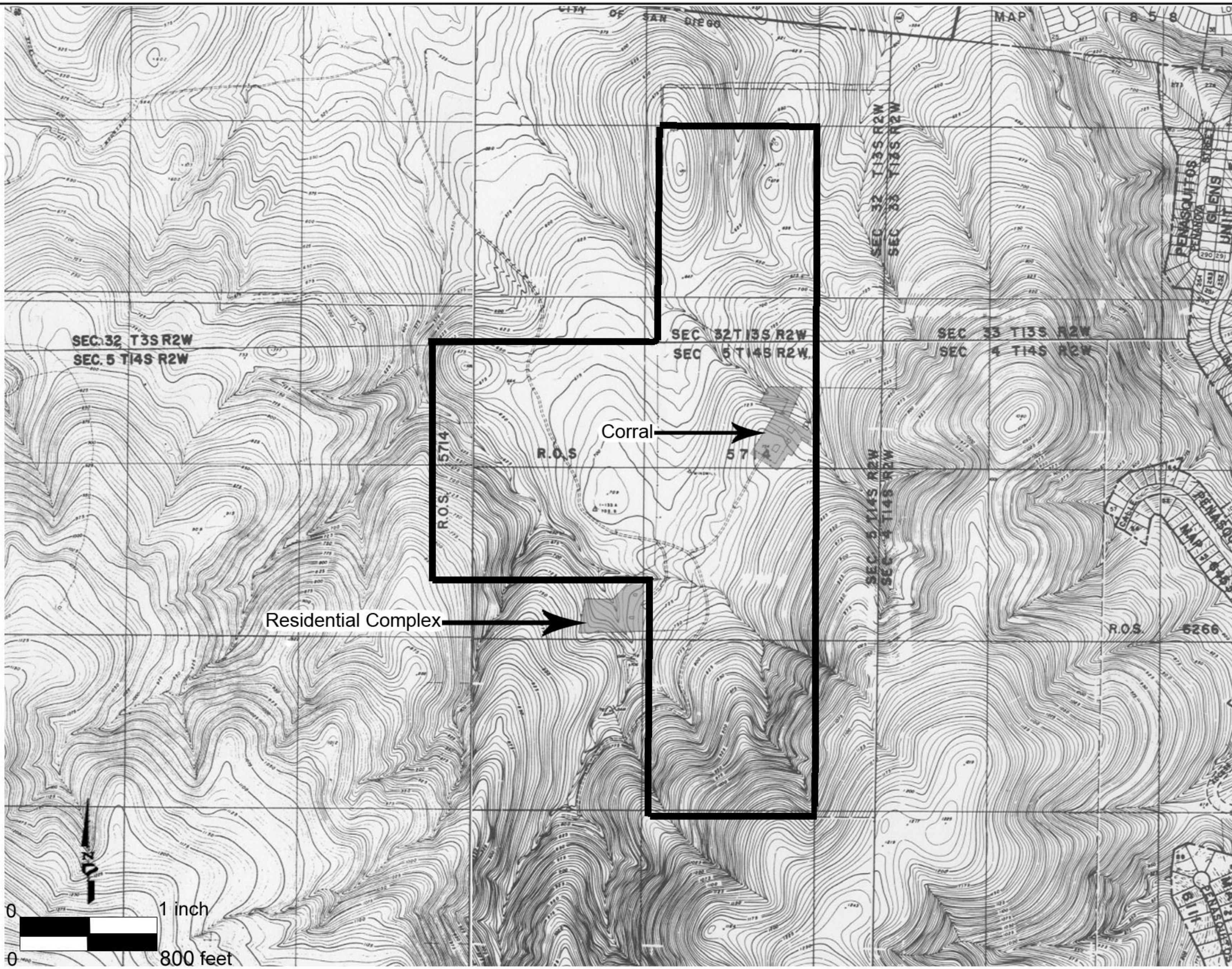
Table 23. CA-SDI-18,504, summary of debitage attributes

Variable	Value	Count	Percent
Morphology	Linear	2	3.1%
	Diverging	9	13.8%
	Converging	1	1.5%
	Other	0	0.0%
	Angular debris	42	64.6%
	Microflake	11	16.9%
Cortex	None	60	92.3%
	1-30%	2	3.1%
	31-90%	3	4.6%
	91-99%	0	0.0%
	100%	0	0.0%
Cortex type	No cortex	60	92.3%
	Tabular/nodular	5	7.7%
	Cobble	0	0.0%
	Indeterminate	0	0.0%
Platform preparation (does not include angular debris and microflakes)	Not applicable, no platform	1	8.3%
	Cortex, no preparation	1	8.3%
	Grinding visible	0	0.0%
	Flaking visible	3	25.0%
	Plain, no cortex or flaking	5	41.7%
	Step platform	0	0.0%
	Central beak	1	8.3%
	Chapeau de gendarme	1	8.3%
Flake termination (does not include angular debris and microflakes)	Indeterminate	0	0.0%
	Feather	5	41.7%
	Step	6	50.0%
	Hinge	0	0.0%
	Overshot	1	8.3%
Patination	Unpatinated	0	0.0%
	Patinated	65	100.0%
Flake size, maximum dimension (does not include angular debris)	< 1 cm	11	47.8%
	1-1.9 cm	2	8.7%
	2-2.9 cm	6	26.1%
	3-3.9 cm	2	8.7%
	>3.9 cm	2	8.7%

Several of the debitage attributes, such as the lack of cortex, the generally small flake size, and the relative abundance of microflakes indicate that, despite the presence of lithic raw material at the site, CA-SDI-18,504 was not a quarry and primary manufacturing location. Although the debitage assemblage consists of locally available lithic material, the flake attributes suggest that secondary tool manufacture and perhaps tool rejuvenation were conducted at this site.

HISTORIC MATERIAL

As previously noted, the property has been subject to a great deal of disturbance from agricultural uses and graded dirt roads, as well as a motocross track. The 1993 survey report noted "an active residential complex with considerable scraping and grading of the adjoining property" (Cheever 1993:19). The house and associated outbuildings of this rural residential complex were no longer standing at the time of the 2007 survey. The remnants of the house and associated features were located just off-site (Figure 17), but a series of corrals is located within the east-central portion of the project area (Figure 17). Although the La Jolla Valley, just north of the project area, was in agricultural uses as far back as the 1880s, no structures are shown within or adjacent to the Heritage Bluffs project area on 1928 aerial photographs (tax factor aerials, on file at the South Coastal Information Center). A road to the house location is shown on the 1930 15' La Jolla quadrangle topographic map, although this road is not visible on the 1928 aerial photographs. The house first appears on the 1952 7.5' Poway quadrangle, based on information from 1950. Aerial photographs taken in 1958 show a well-developed residential complex with a number of trees around it. The corral area is also visible in the 1958 aerial photograph, apparently with a few buildings (barns?) visible as well. This aerial (as well as the 1952 topographic map) also shows a graded road continuing south beyond the house complex to another smaller house/cabin to the south. Remnants of this cabin are still standing, but it is well beyond the Heritage Bluffs project area and was not inspected during the current survey. The current USGS map (Figure 2) shows the corral area with the symbol used for "ruins", although no buildings were shown in this area on previous USGS maps. The house of the residential complex, as well as the more southerly cabin, are both shown on the current USGS map (Figure 2). Given the relatively recent age of the residential complex, the potential for historic archaeological material associated with it is considered to be low.



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Location of Former Residentail Complex

Figure 17

VI. DISCUSSION

CA-SDI-11,039 is a significant site that includes human remains, midden deposits, a subsurface hearth feature, a surface rock feature, and a range of artifact types. Non-local lithic materials, such as obsidian and Piedra de Lumbre chert, were recovered at the site. This section is a synthesis and discussion of the cultural material from the site.

CHRONOLOGY

The assessment of chronologic placement of CA-SDI-11,039 is based on diagnostic artifacts, as no chronometric analyses have been undertaken at the site as yet. Forty-two projectile points were collected at the site during the testing program. All of these points are diagnostic of the Late Prehistoric period. All but one of the points are Cottonwood series; the single exception is a Desert side-notched point.

The other temporally diagnostic artifact type is ceramics. Over 500 ceramic sherds were collected during the testing program. Ceramic technology did not develop (or was not introduced) until the Late Prehistoric period in Southern California. Therefore, the presence of ceramics indicates use of the site during that time period.

Cremated human remains were also encountered at the site. Cremation came into use during the Late Prehistoric period; inhumation was the burial method in earlier times.

Chronometric analyses that could be undertaken using material from CA-SDI-11,039 include radiocarbon dating and obsidian hydration. While little faunal material was recovered at the site, there was some, which could be used for radiocarbon analysis. In addition, charcoal from Unit 4, where the hearth feature was found, could be used for dating. Some of the soil in Unit 4 contains a relatively large amount of charcoal mixed in; this could be submitted as a soil sample for radiocarbon analysis. Carbon caking was noted on a few of the ceramic sherds. Accelerator mass spectrometry (AMS) dating could possibly be conducted using this carbon. AMS dating requires much smaller samples than conventional radiocarbon analysis.

Obsidian hydration combined with source analysis is often used as a relative dating technique for archaeological material. Over 50 pieces of obsidian were recovered during the testing. Although many of these were quite small, some are undoubtedly large enough to be used for source and hydration analysis. Radiocarbon dating and obsidian hydration should be undertaken as part of the next phase of study at CA-SDI-11,039.

SITE USE

The large amount of debitage at CA-SDI-11,039 suggests that stone tool manufacture and/or resharpening took place at the site. The fact that only six cores were found argues against primary tool manufacture as an important task at the site, although the vast majority of the lithic material found is the metavolcanic lithic raw material available in the immediate vicinity of the site. No debitage analysis was undertaken as part of the testing program; however, anecdotally, the crew noted a large number of microflakes and other flakes of small size. This suggests that tool finishing and resharpening were conducted at the site. Several rejuvenation flakes were found, also indicating tool resharpening.

It is interesting to note that large edge angles, approaching 90 degrees, are useful on hammers used in flintknapping, and more acute edge angles may have been used for pecking grinding surfaces to resharpen them (cf. Shackley 1989). The single core hammer has edge angles greater than 95 degrees, suggesting its use in flintknapping.

The presence of manos and metates is indicative of grinding/milling uses, such as food preparation. Milling activities were an important element of the subsistence system of Native Americans throughout California. Based on ethnohistoric and archaeological evidence, the most important food sources for the Late Prehistoric inhabitants of the San Diego region were lagomorphs (rabbits and jackrabbits), acorns, grass seeds, chia, and chenopodium (Christenson 1990; Luomala 1978). Other preferred vegetal resources included elderberries, agave hearts, and cactus fruits (Christenson 1990; Cuero 1970; Hedges and Beresford 1986). Small mammals, deer, reptiles, fish, and birds were also consumed by local Native American populations. Milling implements were used to process grasses, grass seeds (and other types of seeds), and acorns. Small mammals were also processed by crushing in mortars (Christenson 1987; Cuero 1970).

While most ethnographic and ethnohistoric accounts speak of grinding acorn in mortars, little mention is made of differences in mortar types or of other, non-mortar milling stones -- slab and basin metates. Hedges and Beresford (1986) spoke of mortars as being used in acorn processing and metates used in preparing wild oats, as anvils for cracking acorns, and for grinding pottery clay (Hedges and Beresford 1986:8). Wild oats (*Avena fatua*; a non-native species used ethnohistorically) were hulled on a metate, and mesquite beans may be ground on a metate (or pounded in a mortar) (Hedges and Beresford 1986: 15, 32). Seeds of white sage (*Salvia apiana*) were noted by Hedges and Beresford (1986) as being ground, but no mention was made of the implement used. Thistle sage (*Salvia carduaceae*) and chia (*Salvia columbariae*) were noted as having similar uses to white sage, but grinding of these seeds was not mentioned (Hedges and Beresford 1986: 39-41). Although no specific grinding implement was noted for the processing of these seeds, the authors used the word "ground", as opposed to the word "pounded". Throughout the text, ground was used to refer to processing with a metate, and pounded or pulverized was used when speaking of processing in a mortar (Hedges and Beresford 1986). This suggests that wild oats, seeds of several sages, and sometimes mesquite beans are processed using a metate, while acorns, seeds of holly-leafed cherry, and sometimes mesquite beans are processed using a mortar (Hedges and Beresford 1986).

Replicative experiments conducted by Satterthwait compared different milling surfaces (slabs, basin metates, and mortars) to determine their effectiveness for processing various resources. Basin metates were found to be most effective in processing most small seeds. Satterthwait found size and hardness of the item being processed the most important factor in selecting which grinding implement to use (Satterthwait 1971, cited in Hector 1984). "Larger, harder items were ground finest in a mortar, while smaller, harder seeds were processed better with a mano and metate" (Hector 1984:121). This statement suggests that grass seeds are best processed using a basin metate, while acorns are ground in a mortar.

There is not enough ethnographic data from the San Diego area to adequately assess what different resources were processed using the various types of milling implements. The ethnographic and ethnohistoric literature often alludes to mortars for acorn processing, and the importance of acorn to the Kumeyaay and other native groups is frequently addressed (cf. Cuero 1970; DuBois 1908; Luomala 1978; Sparkman 1908). However, the differential uses of slicks, basins, and mortars are seldom, if ever, mentioned. Both basin and slick metates were found at CA-SDI-11,039. No mortars were recovered, and no bedrock milling features were found.

Cook suggested that due to differential amounts of effort required to manufacture the various types of milling elements, simply quantifying elements cannot be used to infer differential proportions of milling activities or contributions of resources to the diet.

> The manufacturer's decision as to overall necessity of a slick as opposed to a mortar per se is somewhat mitigated by the energy expenditure differential. (This possibly implies that the proportion of slicks to basins to mortars is not equivalent to a proportional amount of the different milling activity types.) (Cook 1978:83).

Unfortunately, due to the general lack of ethnographic and replicative studies of grinding activities, the time and effort required to make and maintain the various milling surfaces is not known.

As noted above, small mammals were also ground for use as food (cf. Michelsen 1967). However, if there is a differentiation between grinding surfaces used for plant resources and those used for small mammals, the attributes that distinguish the two types are not known. Therefore, differential contributions of small mammals and plants to the diet cannot be addressed through analysis of milling features.

Hammers are sometimes thought to be associated with plant processing, as well as with lithic reduction. If pounding or pulverizing activities were important at the site, we would expect to see a great deal of battering on the ends of manos, in addition to the presence of hammers. Ten of the 16 manos collected (over 60 percent) showed evidence of battering. This suggests that pounding/pulverizing may have been an important element of the food processing and preparation that occurred at the site.

Ceramics at the site also suggest food processing and storage. While some of the sherds are associated with the human remains, ceramics were abundant at the site and were not concentrated in a single area.

Crabtree and Davis (1968) found that scraping wood by drawing the scraper toward the operator resulted in the removal of small, step fracture use flakes. Similarly, Shackley (1989) noted that scraping hard materials, such as wood, antler, and bone, produced scalar flake removals along the tool edge. Scalar edge damage is not differentiated from micro-step flaking in the analysis system used for this report. Such micro-step flaking was noted on several of the scrapers and choppers from CA-SDI-11,039, suggesting that these artifacts may have been used in woodworking. "It was determined that no use-flakes are pressed off when leather or hide is scraped" (Crabtree and Davis 1968:428). Shackley (1989) noted that use on soft substances would probably leave damage that is only visible under the electron microscope.

The number of projectile points found at CA-SDI-11,039 is four times greater than the number of other formal tools. Bifaces/preforms were also found in much greater numbers than other flaked stone tools. This, combined with the large mammal bone found during the excavation, suggests that hunting may have been one of the activities undertaken at the site. The rock feature in the northwestern portion of the site may have been used as a hunting blind, which is one suggested of other rock ring/rock room features (see Minor 1975).

The amount of faunal material recovered at the site is less than would be expected at a habitation site, but there is evidence of consumption of large mammal (long bones with spiral fractures) and shellfish. Another factor that suggests longer term use of the site is the presence of a relatively large amount of non-local lithic material, such as obsidian and Piedra de Lumbre chert. This is material that would have to be obtained from a long distance, either by trade or by sending out gathering parties on a trip of many days. Such exotic materials tend to be found at habitation sites, rather than short-term camps or processing locations.

Rock rooms, similar in appearance to the rock feature at CA-SDI-11,039, have sometimes been suggested as living areas. Indeed, at some sites, this seems to be the case (see Carrico 1988; Van Wormer and Carrico 1987). The rock feature at this site is in a very steep area, however, and does not appear to have been used for this purpose. As mentioned above, it is in such a position that it may have been a hunting blind. The interior of the feature shows evidence of burning and may have been used as a hearth or oven.

SUMMARY

CA-SDI-11,039 is a Late Prehistoric site, apparently representing a habitation location. Activities conducted at the site include food processing/preparation and consumption, lithic tool manufacture or finishing and resharpening, and possibly hunting. The site was used during the Late Prehistoric period and shows no evidence of use during an earlier time period or following European contact. The site possesses the potential to address a variety of research questions. The site is of cultural significance, due to the presence of human remains, as well as its archaeological signficance.

VII. PROJECT EFFECTS AND MITIGATION MEASURES

SIGNIFICANCE CRITERIA

The archaeological resources were evaluated using the significance criteria of the California Environmental Quality Act (CEQA), the City of San Diego's Historical Resource Guidelines, the City of San Diego Historical Resources Board criteria for local designation, the City's Signficance Determination Thresholds, and the Historical Resources Regulations of the City of San Diego Municipal Code.

Under CEQA, any object, building, structure, site, area, place, record, or manuscript which a lead agency determines to be historically significant or significant in the architectural, engineering, scientific, economic, agricultural, educational, social, political, military, or cultural annals of California may be considered to be a historical resource, provided the lead agency's determination is supported by substantial evidence in light of the whole record. Generally, a resource shall be considered by the lead agency to be "historically significant" if the resource meets the criteria for listing on the California Register of Historical Resources (Pub. Res. Code §5024.1, Title 14 CCR Section 4852) including the following:

- Is associated with events that have made a significant contribution to the broad patterns of California's history and cultural heritage;

- Is associated with the lives of persons important in our past;

- Embodies the distinctive characteristics of a type, period, region, or method of construction, or represents the work of an important creative individual, or possesses high artistic values, or:

- Has yielded or may be likely to yield information important in prehistory or history.

The California Register includes resources listed in or formally determined eligible for listing in the National Register of Historic Places, as well as some California State Landmarks and Points of Historical Interest. Properties of local significance that have been designated under a local preservation ordinance (local landmarks or landmark districts) or that have been identified in a local historical resources inventory may be eligible for listing in the California Register and are presumed to be significant resources for purposes of CEQA, unless a preponderance of evidence indicates otherwise (Public Resource Code § 5024.1, 14 CCR § 4850).

The CEQA Guidelines direct that lead agencies should first evaluate an archaeological site to determine if it meets the criteria for listing in the California Register. If an archaeological site is a historical resource (i.e., listed or eligible for listing in the California Register) potential adverse impacts to it must be considered (Public Resource Code 21084.1 and

21083.2(l)). If an archaeological site is not a historical resource, the effects of the project on the resource shall not be considered a significant effect on the environment.

The City of San Diego has established the following criteria to be used in the determination of significance under CEQA:

> An archaeological site must consist of at least three associated artifacts/ ecofacts (within a 50 square meter area) or a single feature and must be at least 45 years of age. Archaeological sites containing only a surface component are generally considered not significant unless demonstrated otherwise. Such site types may include isolated finds, bedrock milling stations, sparse lithic scatters, and shellfish processing stations. All other archaeological sites are considered potentially significant. The determination of significance is based on a number of factors specific to a particular site including site size, type, and integrity; presence or absence of a subsurface deposit, soil stratigraphy, features, diagnostics, and dateable material; artifact and ecofact density; assemblage complexity; cultural affiliation; association with an important person or event; and ethnic importance.
>
> The determination of significance for historic buildings, structures, objects and landscapes is based on age, location, context, association with an important person or event, uniqueness, and integrity.
>
> A site will be considered to possess ethnic significance if it is associated with a burial or cemetery; religious social or traditional activities of a discrete ethnic population; an important person or event as defined by a discrete ethnic population; or the mythology of a discrete ethnic population [City of San Diego 2001:15-16].

Any improvement, building, structure, sign, interior element and fixture, feature, site, place, district, area, or object may be designated as historic by the City of San Diego Historical Resources Board if it meets any of the following criteria:

a. Exemplifies or reflects special elements of the City's, a community's or a neighborhood's historical, archaeological, cultural, social, economic, political, aesthetic, engineering, landscaping or architectural development;
b. Is identified with persons or events significant in local, state or national history;
c. Embodies distinctive characteristics of a style, type, period or method of construction or is a valuable example of the use of indigenous materials or craftsmanship;
d. Is representative of the notable work of a master builder, designer, architect, engineer, landscape architect, interior designer, artist or craftsman;
e. Is listed or has been determined eligible by the National Park Service for listing on the National Register of Historic Places or is listed or has been determined eligible

by the California State Office of Historic Preservation for listing on the California Register of Historical Resources;

f. Is a finite group of resources related to one another in a clearly distinguishable way or is a geographically definable area or neighborhood containing improvements which have a special character, historical interest or aesthetic value or which represent one or more architectural periods or styles in the history and development of the City [City of San Diego 2001:14-15].

The City's Municipal Code includes Historical Resources Regulations. "The purpose of these regulations is to protect, preserve, and where damaged, restore the historical resources of San Diego, which include historical buildings, historical structures or historical objects, important archaeological sites, historical districts, historical landscapes, and traditional cultural properties" (City of San Diego 2008:1).

Due to the designation of CA-SDI-11,039 as a historical resource by the City of San Diego Historical Resources Board, the proposed project would normally be subject to Sections 143.0251, 143.0252, and 143.0253 of the Land Development Code: Section 143.0251 – Development Regulations for Designated Historical Resources and Historical Districts; Section 143.0252 – Development Regulations for Traditional Cultural Properties; and Section 143.0253 – Development Regulations for Important Archaeological Sites. However, City staff has determined that the project is exempt from the requirement to obtain a Site Development Permit under Section 143.0220 – Development Exempted from the Requirement to Obtain a Development Permit for Historical Resources – as the project would result in a minor alteration to the resource.

The majority of the important archaeological site CA-SDI-11,039 will be preserved in open space under a conservation easement. Encroachment into the overall site area would be approximately 23.2 percent (0.839 acres); this includes all disturbance from brush management and other ground-disturbing activities. There would be no encroachment into the significant portion of the site. Because the encroachment is minor (less than 25 percent), the project is an exempt project under Section 143.0220 and not a Discretionary Action for Historical Resources. The portion of CA-SDI-11,039 that would be subject to impacts from the project has no subsurface deposit. A total of four artifacts were recovered from one STP in this portion of the site; the other STPs in this area of the site yielded no cultural material.

SIGNIFICANCE OF IMPACTS

Two archaeological sites have been identified within the Heritage Bluffs project area: CA-SDI-11,039 and CA-SDI-18,504. No archaeological resources have been identified within the proposed off-site road connection. CA-SDI-18,504 is a relatively small lithic scatter site with limited research potential. It does not meet the criteria for listing on the California Register of Historical Resources. Therefore, CA-SDI-18,504 is not a historical resource under CEQA, and impacts to it would not constitute significant effects. CA-SDI-18,504 is within the MHPA and would be left in open space under the proposed development plan. The project would have no effects on this site.

CA-SDI-11,039 is a significant site, both archaeologically and culturally. The site includes cultural features and areas of midden deposit that contain materials possessing information with the potential to address important scientific research questions. Human remains were encountered at the site, and additional human remains may still exist on-site. Therefore, CA-SDI-11,039 is of cultural importance to the Kumeyaay people. Impacts to this site would constitute significant effects under CEQA and City of San Diego Guidelines. Portions of the site containing midden deposits are within the MHPA and are proposed to be left in open space, but other parts of the site are within the proposed development footprint (Figure 18). The portion of the site that would be subject to direct impacts is 0.839 acres, 23.2 percent of the overall site. The area of concentration, the significant portion of the resource, is entirely within the conservation easement and would not be subject to direct impacts (see Figure 18).

CA-SDI-11,039 was designated by the City of San Diego Historical Resources Board on July 23, 2009 as a historical resource under Criterion A for its archaeological and cultural signficance. It is listed on the City's Register as HRB #916. The majority of CA-SDI-11,039 would be preserved in place, including the significant portion of the site. The portion of CA-SDI-11,039 that would be subject to direct impacts contains no subsurface deposits and has limited research potential. Therefore, the project would have no significant impacts to cultural resources.

It must be noted that the project has been redesigned since earlier submittals of the cultural resources report. Under previous project designs, although most of CA-SDI-11,039 was to be preserved in open space, there still would have been impacts to the portion of the site containing significant deposits. Under the current project plan, there would be no direct impacts to this significant area of the site. Therefore, the data recovery plan previously proposed for this site would no longer need to be implemented, as the significant portion of the site will be preserved in a conservation easement.

MITIGATION MEASURES

Avoidance of impacts to significant archaeological resources is always preferred. If avoidance is not feasible, other measures must be developed and implemented to mitigate impacts to below a level of significance. Such measures may include preservation of portions of a site by means such as capping, use of interpretative displays or signage, as well as implementation of a data recovery program. At CA-SDI-11,039, the portion of the site containing significant deposits will be preserved in an open space easement, and a monitoring program will be conducted during any ground disturbing activity.

SENSITIVE MATERIAL – IN CONFIDENTIAL APPENDIX B

Affinis 810 Jamacha Road, Suite 206 El Cajon, CA 92019	Locations of cultural resources in relation to project plans	Figure 18

Preservation Easement

As shown in Figure 18, almost three-fourths of CA-SDI-11,039 is within a conservation easement that includes the MHPA and would be left in open space under the proposed development. The MHPA Guidelines require that developments should provide barriers such as fencing to prevent encroachment into the preserve. The project is proposing to incorporate a 5-foot high perimeter wall or tubular fencing to discourage human intrusion. Signs will be posted at period intervals stating “Sensitive Biological Habitat – Access Limited”. This will serve to keep residents and visitors out of the sensitive archaeological site. The area where the human remains were found is within this proposed open space area. In order to assure that no future impacts occur in this sensitive area, a preservation easement shall be placed over this portion of the archaeological site in perpetuity. The language of the preservation easement will be agreed upon by City of San Diego staff, the applicant, and the appropriate representatives of the Kumeyaay community.

Monitoring

Due to the significance of CA-SDI-11,039 and the potential for encountering additional culturally sensitive material in the site area, a construction monitoring program shall be implemented. The monitoring program shall include both archaeological and Native American monitors. Following is a summary of key components of the monitoring program. The detailed Mitigation Monitoring and Reporting Program can be found in the project environmental document.

VIII. INDIVIDUALS AND AGENCIES CONSULTED

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Myra Herrmann	City of San Diego, Development Services Department
Clint Linton	Red Tail Monitoring and Research
Rose Tyson	San Diego Museum of Man
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APPENDIX A

ARTIFACT CATALOGS

CA-SDI-11,039	48	1 x 1 m excavation unit	1	0	10	Flaked stone	Cottonwood series point	Medium to coarse grained metavolcanic	1	0.6
CA-SDI-11,039	49	1 x 1 m excavation unit	1	0	10	Native American ceramics	Body sherd	Tizon Brown Ware	13	20.2
CA-SDI-11,039	50	1 x 1 m excavation unit	1	0	10	Native American ceramics	Rim sherd	Tizon Brown Ware	2	6.1
CA-SDI-11,039	51	1 x 1 m excavation unit	1	10	20	Flaked stone	Debitage	Medium to coarse grained metavolcanic	283	462.8
CA-SDI-11,039	52	1 x 1 m excavation unit	1	10	20	Flaked stone	Debitage	Fine grained metavolcanic	3	0.6
CA-SDI-11,039	53	1 x 1 m excavation unit	1	10	20	Flaked stone	Debitage	Quartzite	1	0.2
CA-SDI-11,039	54	1 x 1 m excavation unit	1	10	20	Flaked stone	Debitage	Quartz	6	4
CA-SDI-11,039	55	1 x 1 m excavation unit	1	10	20	Flaked stone	Debitage	Chert	1	0.6
CA-SDI-11,039	56	1 x 1 m excavation unit	1	10	20	Flaked stone	Debitage	Piedra de Lumbre	4	3.1
CA-SDI-11,039	57	1 x 1 m excavation unit	1	10	20	Flaked stone	Rejuvenation flake	Medium to coarse grained metavolcanic	1	73.2
CA-SDI-11,039	58	1 x 1 m excavation unit	1	10	20	Flaked stone	Rejuvenation flake	Fine grained metavolcanic	1	49.8
CA-SDI-11,039	59	1 x 1 m excavation unit	1	10	20	Flaked stone	Cottonwood series point	Medium to coarse grained metavolcanic	2	0.8
CA-SDI-11,039	60	1 x 1 m excavation unit	1	10	20	Bone, nonhuman	Bulk unmodified	Unclassifed Bone	3	0.5
CA-SDI-11,039	61	1 x 1 m excavation unit	1	10	20	Bone, nonhuman	Bulk unmodified	Unclassifed Bone	1	0.1
CA-SDI-11,039	62	1 x 1 m excavation unit	1	10	20	Native American ceramics	Body sherd	Tizon Brown Ware	36	65.5
CA-SDI-11,039	63	1 x 1 m excavation unit	1	20	30	Flaked stone	Debitage	Medium to coarse grained metavolcanic	165	321.8
CA-SDI-11,039	64	1 x 1 m excavation unit	1	20	30	Flaked stone	Debitage	Fine grained metavolcanic	6	3.9
CA-SDI-11,039	65	1 x 1 m excavation unit	1	20	30	Flaked stone	Debitage	Quartz	2	2.9
CA-SDI-11,039	66	1 x 1 m excavation unit	1	20	30	Flaked stone	Debitage	Chert	5	0.8
CA-SDI-11,039	67	1 x 1 m excavation unit	1	20	30	Flaked stone	Debitage	Piedra de Lumbre	1	0.1
CA-SDI-11,039	68	1 x 1 m excavation unit	1	20	30	Groundstone	Mano	Granitic	1	42.1
CA-SDI-11,039	69	1 x 1 m excavation unit	1	20	30	Bone, nonhuman	Bulk unmodified	Unclassifed Bone	27	4.4
CA-SDI-11,039	70	1 x 1 m excavation unit	1	20	30	Bone, nonhuman	Bulk unmodified	Unclassifed Bone	1	0.1
CA-SDI-11,039	71	1 x 1 m excavation unit	1	20	30	Bone, nonhuman	Bulk unmodified	Unclassifed Bone	2	0.1
CA-SDI-11,039	72	1 x 1 m excavation unit	1	20	30	Native American ceramics	Body sherd	Tizon Brown Ware	18	47.9
CA-SDI-11,039	73	1 x 1 m excavation unit	1	30	40	Flaked stone	Debitage	Medium to coarse grained metavolcanic	82	171.5
CA-SDI-11,039	74	1 x 1 m excavation unit	1	30	40	Flaked stone	Debitage	Quartzite	2	77.6
CA-SDI-11,039	75	1 x 1 m excavation unit	1	30	40	Bone, nonhuman	Bulk unmodified	Unclassifed Bone	8	1
CA-SDI-11,039	76	1 x 1 m excavation unit	1	30	40	Native American ceramics	Body sherd	Tizon Brown Ware	3	12.2
CA-SDI-11,039	77	1 x 1 m excavation unit	1	40	50	Flaked stone	Debitage	Medium to coarse grained metavolcanic	93	511.9
CA-SDI-11,039	78	1 x 1 m excavation unit	1	40	50	Flaked stone	Debitage	Quartzite	1	1.3
CA-SDI-11,039	79	1 x 1 m excavation unit	1	40	50	Flaked stone	Debitage	Quartz	1	0.7
CA-SDI-11,039	80	1 x 1 m excavation unit	1	40	50	Flaked stone	Debitage	Chert	1	0.4
CA-SDI-11,039	81	1 x 1 m excavation unit	1	40	50	Flaked stone	Debitage	Piedra de Lumbre	1	0.8
CA-SDI-11,039	82	1 x 1 m excavation unit	1	40	50	Bone, nonhuman	Bulk unmodified	Unclassifed Bone	1	0.1
CA-SDI-11,039	83	1 x 1 m excavation unit	1	40	50	Native American ceramics	Body sherd	Tizon Brown Ware	4	6.1
CA-SDI-11,039	84	1 x 1 m excavation unit	1	50	60	Flaked stone	Retouched/utilized flake	Medium to coarse grained metavolcanic	1	216.4
CA-SDI-11,039	85	1 x 1 m excavation unit	1	50	60	Flaked stone	Debitage	Medium to coarse grained metavolcanic	29	64.2
CA-SDI-11,039	86	1 x 1 m excavation unit	1	50	60	Flaked stone	Debitage	Chert	1	0.1
CA-SDI-11,039	87	1 x 1 m excavation unit	1	50	60	Flaked stone	Small biface/prefrom	Chalcedony	1	0.1
CA-SDI-11,039	88	1 x 1 m excavation unit	1	60	70	Flaked stone	Debitage	Medium to coarse grained metavolcanic	31	193.6
CA-SDI-11,039	89	1 x 1 m excavation unit	1	60	70	Flaked stone	Debitage	Quartzite	1	46.6
CA-SDI-11,039	90	1 x 1 m excavation unit	1	60	70	Flaked stone	Debitage	Quartz	1	0.3
CA-SDI-11,039	91	1 x 1 m excavation unit	1	60	70	Flaked stone	Debitage	Chert	1	0.6
CA-SDI-11,039	92	1 x 1 m excavation unit	1	60	70	Groundstone	Mano	Quartzite	1	65.2
CA-SDI-11,039	93	1 x 1 m excavation unit	1	60	70	Groundstone	Mano	Granitic	1	241.5
CA-SDI-11,039	94	1 x 1 m excavation unit	1	70	80	Flaked stone	Debitage	Medium to coarse grained metavolcanic	18	23.5
CA-SDI-11,039	95	1 x 1 m excavation unit	2	0	10	Groundstone	Mano	Granitic	1	195.8
CA-SDI-11,039	96	1 x 1 m excavation unit	2	0	10	Flaked stone	Debitage	Medium to coarse grained metavolcanic	44	102
CA-SDI-11,039	97	1 x 1 m excavation unit	2	0	10	Flaked stone	Debitage	Fine grained metavolcanic	10	4.1
CA-SDI-11,039	98	1 x 1 m excavation unit	2	0	10	Flaked stone	Debitage	Quartz	7	1.4
CA-SDI-11,039	99	1 x 1 m excavation unit	2	10	20	Flaked stone	Debitage	Medium to coarse grained metavolcanic	29	120.8

CA-SDI-11,039	100	1 x 1 m excavation unit	2	10	20	Flaked stone	Debitage	Fine grained metavolcanic	3	0.5
CA-SDI-11,039	101	1 x 1 m excavation unit	2	10	20	Flaked stone	Debitage	Quartzite	1	10
CA-SDI-11,039	102	1 x 1 m excavation unit	2	10	20	Flaked stone	Debitage	Quartz	5	1.3
CA-SDI-11,039	103	1 x 1 m excavation unit	2	10	20	Native American ceramics	Body sherd	Tizon Brown Ware	1	4.5
CA-SDI-11,039	104	1 x 1 m excavation unit	2	20	30	Flaked stone	Debitage	Medium to coarse grained metavolcanic	28	28.3
CA-SDI-11,039	105	1 x 1 m excavation unit	2	20	30	Flaked stone	Debitage	Fine grained metavolcanic	5	2.7
CA-SDI-11,039	106	1 x 1 m excavation unit	2	20	30	Flaked stone	Debitage	Quartz	1	0.4
CA-SDI-11,039	107	1 x 1 m excavation unit	2	30	40	Flaked stone	Debitage	Medium to coarse grained metavolcanic	14	54.9
CA-SDI-11,039	108	1 x 1 m excavation unit	2	30	40	Flaked stone	Debitage	Fine grained metavolcanic	1	0.1
CA-SDI-11,039	109	1 x 1 m excavation unit	3	0	10	Flaked stone	Debitage	Medium to coarse grained metavolcanic	69	439.1
CA-SDI-11,039	110	1 x 1 m excavation unit	3	0	10	Flaked stone	Debitage	Fine grained metavolcanic	1	1.9
CA-SDI-11,039	111	1 x 1 m excavation unit	3	0	10	Native American ceramics	Body sherd	Tizon Brown Ware	2	5.2
CA-SDI-11,039	112	1 x 1 m excavation unit	3	10	20	Flaked stone	Debitage	Medium to coarse grained metavolcanic	108	239.4
CA-SDI-11,039	113	1 x 1 m excavation unit	3	10	20	Flaked stone	Retouched/utilized flake	Medium to coarse grained metavolcanic	1	132.4
CA-SDI-11,039	114	1 x 1 m excavation unit	3	20	30	Flaked stone	Debitage	Medium to coarse grained metavolcanic	40	223.1
CA-SDI-11,039	115	1 x 1 m excavation unit	3	30	40	Flaked stone	Debitage	Medium to coarse grained metavolcanic	29	101.5
CA-SDI-11,039	116	1 x 1 m excavation unit	3	30	40	Flaked stone	Debitage	Quartzite	1	19.8
CA-SDI-11,039	117	1 x 1 m excavation unit	3	30	40	Flaked stone	Large biface/perform	Medium to coarse grained metavolcanic	1	32.7
CA-SDI-11,039	118	1 x 1 m excavation unit	3	30	40	Flaked stone	Scraper	Medium to coarse grained metavolcanic	1	171.3
CA-SDI-11,039	119	1 x 1 m excavation unit	3	40	50	Flaked stone	Debitage	Medium to coarse grained metavolcanic	20	47.7
CA-SDI-11,039	120	1 x 1 m excavation unit	4	0	10	Flaked stone	Debitage	Medium to coarse grained metavolcanic	116	230.8
CA-SDI-11,039	121	1 x 1 m excavation unit	4	0	10	Flaked stone	Debitage	Quartzite	1	1.4
CA-SDI-11,039	122	1 x 1 m excavation unit	4	0	10	Flaked stone	Debitage	Quartz	6	2.4
CA-SDI-11,039	123	1 x 1 m excavation unit	4	0	10	Flaked stone	Debitage	Chert	3	2.8
CA-SDI-11,039	124	1 x 1 m excavation unit	4	0	10	Flaked stone	Debitage	Piedra de Lumbre	2	2.4
CA-SDI-11,039	125	1 x 1 m excavation unit	4	0	10	Flaked stone	Hammer	Medium to coarse grained metavolcanic	1	506
CA-SDI-11,039	126	1 x 1 m excavation unit	4	0	10	Native American ceramics	Body sherd	Tizon Brown Ware	5	10.4
CA-SDI-11,039	127	1 x 1 m excavation unit	4	10	20	Flaked stone	Debitage	Medium to coarse grained metavolcanic	47	209.8
CA-SDI-11,039	128	1 x 1 m excavation unit	4	10	20	Flaked stone	Debitage	Quartzite	2	0.5
CA-SDI-11,039	129	1 x 1 m excavation unit	4	10	20	Flaked stone	Debitage	Quartz	5	0.5
CA-SDI-11,039	130	1 x 1 m excavation unit	4	10	20	Flaked stone	Debitage	Chert	1	0.1
CA-SDI-11,039	131	1 x 1 m excavation unit	4	10	20	Native American ceramics	Body sherd	Tizon Brown Ware	2	4.6
CA-SDI-11,039	132	1 x 1 m excavation unit	4	20	30	Flaked stone	Debitage	Medium to coarse grained metavolcanic	61	92.2
CA-SDI-11,039	133	1 x 1 m excavation unit	4	20	30	Flaked stone	Debitage	Quartz	4	2.3
CA-SDI-11,039	134	1 x 1 m excavation unit	4	20	30	Flaked stone	Debitage	Piedra de Lumbre	2	0.2
CA-SDI-11,039	135	1 x 1 m excavation unit	4	20	30	Native American ceramics	Body sherd	Tizon Brown Ware	2	4.6
CA-SDI-11,039	136	1 x 1 m excavation unit	4	30	40	Flaked stone	Debitage	Medium to coarse grained metavolcanic	40	175.7
CA-SDI-11,039	137	1 x 1 m excavation unit	4	30	40	Flaked stone	Debitage	Fine grained metavolcanic	1	0.6
CA-SDI-11,039	138	1 x 1 m excavation unit	4	30	40	Flaked stone	Debitage	Quartz	1	0.6
CA-SDI-11,039	139	1 x 1 m excavation unit	4	30	40	Flaked stone	Retouched/utilized flake	Medium to coarse grained metavolcanic	1	13.8
CA-SDI-11,039	140	1 x 1 m excavation unit	4	40	50	Flaked stone	Debitage	Medium to coarse grained metavolcanic	23	87.7
CA-SDI-11,039	141	1 x 1 m excavation unit	4	40	50	Flaked stone	Debitage	Quartz	1	0.6
CA-SDI-11,039	142	1 x 1 m excavation unit	4	40	50	Flaked stone	Rejuvenation flake	Medium to coarse grained metavolcanic	1	151.3
CA-SDI-11,039	143	1 x 1 m excavation unit	4	40	50	Flaked stone	Core	Medium to coarse grained metavolcanic	1	152.8
CA-SDI-11,039	144	1 x 1 m excavation unit	4	40	50	Shell	Bulk unmodified	Chione	1	0.7
CA-SDI-11,039	145	1 x 1 m excavation unit	4	40	50	Native American ceramics	Body sherd	Tizon Brown Ware	5	8.6
CA-SDI-11,039	146	1 x 1 m excavation unit	4	40	50	Native American ceramics	Rim sherd	Tizon Brown Ware	1	1.7
CA-SDI-11,039	147	1 x 1 m excavation unit	4	50	60	Flaked stone	Debitage	Medium to coarse grained metavolcanic	39	78.6
CA-SDI-11,039	148	1 x 1 m excavation unit	4	50	60	Flaked stone	Debitage	Quartz	3	1.1
CA-SDI-11,039	149	1 x 1 m excavation unit	4	50	60	Native American ceramics	Body sherd	Tizon Brown Ware	2	4.9
CA-SDI-11,039	150	1 x 1 m excavation unit	4	50	60	Sample	Soil, general level	Undetermined	0	69.8
CA-SDI-11,039	151	1 x 1 m excavation unit	4	50	60	Groundstone	Metate	Medium to coarse grained metavolcanic	1	19731.27

CA-SDI-11,039	152	1 x 1 m excavation unit	4	60	70	Flaked stone	Debitage	Medium to coarse grained metavolcanic	10	20
CA-SDI-11,039	153	1 x 1 m excavation unit	4	60	70	Flaked stone	Debitage	Quartzite	1	106.7
CA-SDI-11,039	154	1 x 1 m excavation unit	4	60	70	Flaked stone	Rejuvenation flake	Medium to coarse grained metavolcanic	1	328.1
CA-SDI-11,039	155	1 x 1 m excavation unit	4	60	70	Flaked stone	Retouched/utilized flake	Fine grained metavolcanic	1	36.3
CA-SDI-11,039	156	1 x 1 m excavation unit	4	60	70	Flaked stone	Core	Medium to coarse grained metavolcanic	1	131.8
CA-SDI-11,039	157	1 x 1 m excavation unit	4	60	70	Flaked stone	Chopper	Medium to coarse grained metavolcanic	1	126.1
CA-SDI-11,039	158	1 x 1 m excavation unit	4	60	70	Other stone	Hammerstone, angular	Medium to coarse grained metavolcanic	1	314.3
CA-SDI-11,039	159	1 x 1 m excavation unit	4	60	70	Other stone	Hammerstone, spherical	Granitic	1	234.5
CA-SDI-11,039	160	1 x 1 m excavation unit	4	60	70	Groundstone	Metate	Medium to coarse grained metavolcanic	1	15785.01
CA-SDI-11,039	161	1 x 1 m excavation unit	4	70	80	Flaked stone	Debitage	Medium to coarse grained metavolcanic	6	291.7
CA-SDI-11,039	162	1 x 1 m excavation unit	4	70	80	Flaked stone	Chopper	Medium to coarse grained metavolcanic	1	1150
CA-SDI-11,039	163	1 x 1 m excavation unit	4	70	80	Other stone	Hammerstone, spherical	Granitic	1	239.6
CA-SDI-11,039	164	1 x 1 m excavation unit	4	70	80	Groundstone	Mano	Granitic	1	379.4
CA-SDI-11,039	165	1 x 1 m excavation unit	5	0	10	Flaked stone	Debitage	Medium to coarse grained metavolcanic	177	1691.6
CA-SDI-11,039	166	1 x 1 m excavation unit	5	0	10	Flaked stone	Debitage	Fine grained metavolcanic	68	37.5
CA-SDI-11,039	167	1 x 1 m excavation unit	5	0	10	Flaked stone	Debitage	Quartzite	1	1.2
CA-SDI-11,039	168	1 x 1 m excavation unit	5	0	10	Flaked stone	Debitage	Quartz	6	4
CA-SDI-11,039	169	1 x 1 m excavation unit	5	0	10	Flaked stone	Debitage	Chert	2	1.4
CA-SDI-11,039	170	1 x 1 m excavation unit	5	0	10	Flaked stone	Debitage	Obsidian	1	0.2
CA-SDI-11,039	171	1 x 1 m excavation unit	5	0	10	Flaked stone	Debitage	Piedra de Lumbre	3	1.1
CA-SDI-11,039	172	1 x 1 m excavation unit	5	0	10	Flaked stone	Large biface/perform	Medium to coarse grained metavolcanic	1	22.2
CA-SDI-11,039	173	1 x 1 m excavation unit	5	0	10	Flaked stone	Cottonwood series point	Medium to coarse grained metavolcanic	1	0.6
CA-SDI-11,039	174	1 x 1 m excavation unit	5	0	10	Flaked stone	Cottonwood series point	Medium to coarse grained metavolcanic	1	0.8
CA-SDI-11,039	175	1 x 1 m excavation unit	5	0	10	Flaked stone	Cottonwood series point	Medium to coarse grained metavolcanic	1	0.1
CA-SDI-11,039	176	1 x 1 m excavation unit	5	0	10	Flaked stone	Cottonwood series point	Quartz	1	0.1
CA-SDI-11,039	177	1 x 1 m excavation unit	5	0	10	Groundstone	Mano	Granitic	1	41.8
CA-SDI-11,039	178	1 x 1 m excavation unit	5	0	10	Native American ceramics	Body sherd	Tizon Brown Ware	14	71.9
CA-SDI-11,039	179	1 x 1 m excavation unit	5	10	20	Flaked stone	Debitage	Medium to coarse grained metavolcanic	147	533.7
CA-SDI-11,039	180	1 x 1 m excavation unit	5	10	20	Flaked stone	Debitage	Fine grained metavolcanic	27	30.7
CA-SDI-11,039	181	1 x 1 m excavation unit	5	10	20	Flaked stone	Debitage	Quartz	3	0.3
CA-SDI-11,039	182	1 x 1 m excavation unit	5	10	20	Flaked stone	Debitage	Quartzite	1	202.8
CA-SDI-11,039	183	1 x 1 m excavation unit	5	10	20	Flaked stone	Debitage	Obsidian	1	1.6
CA-SDI-11,039	184	1 x 1 m excavation unit	5	10	20	Flaked stone	Large biface/perform	Fine grained metavolcanic	1	4
CA-SDI-11,039	185	1 x 1 m excavation unit	5	10	20	Flaked stone	Cottonwood Straight Base po	Medium to coarse grained metavolcanic	1	1.7
CA-SDI-11,039	186	1 x 1 m excavation unit	5	10	20	Groundstone	Mano	Granitic	1	410.4
CA-SDI-11,039	187	1 x 1 m excavation unit	5	10	20	Bone, nonhuman	Bulk unmodified	Unclassifed Bone	3	2
CA-SDI-11,039	188	1 x 1 m excavation unit	5	10	20	Shell	Bulk unmodified	Unidentifiable	1	0.1
CA-SDI-11,039	189	1 x 1 m excavation unit	5	10	20	Native American ceramics	Body sherd	Tizon Brown Ware	10	66
CA-SDI-11,039	190	1 x 1 m excavation unit	5	20	30	Flaked stone	Debitage	Medium to coarse grained metavolcanic	56	236.4
CA-SDI-11,039	191	1 x 1 m excavation unit	5	20	30	Flaked stone	Debitage	Fine grained metavolcanic	3	1.1
CA-SDI-11,039	192	1 x 1 m excavation unit	5	20	30	Flaked stone	Retouched/utilized flake	Medium to coarse grained metavolcanic	1	88
CA-SDI-11,039	193	1 x 1 m excavation unit	5	20	30	Flaked stone	Cottonwood series point	Medium to coarse grained metavolcanic	1	0.2
CA-SDI-11,039	194	1 x 1 m excavation unit	5	20	30	Bone, nonhuman	Bulk unmodified	Unclassifed Bone	6	0.4
CA-SDI-11,039	195	1 x 1 m excavation unit	5	20	30	Native American ceramics	Body sherd	Tizon Brown Ware	1	6.2
CA-SDI-11,039	196	1 x 1 m excavation unit	5	30	40	Flaked stone	Debitage	Medium to coarse grained metavolcanic	21	38.4
CA-SDI-11,039	197	1 x 1 m excavation unit	5	30	40	Flaked stone	Debitage	Fine grained metavolcanic	1	0.4
CA-SDI-11,039	198	1 x 1 m excavation unit	5	40	50	Flaked stone	Debitage	Medium to coarse grained metavolcanic	10	9.1
CA-SDI-11,039	199	1 x 1 m excavation unit	5	40	50	Flaked stone	Debitage	Fine grained metavolcanic	1	0.3
CA-SDI-11,039	200	1 x 1 m excavation unit	6	0	10	Flaked stone	Debitage	Medium to coarse grained metavolcanic	9	13.3
CA-SDI-11,039	201	1 x 1 m excavation unit	6	10	20	Flaked stone	Debitage	Medium to coarse grained metavolcanic	38	70.4
CA-SDI-11,039	202	1 x 1 m excavation unit	6	20	30	Flaked stone	Debitage	Medium to coarse grained metavolcanic	17	14.1
CA-SDI-11,039	203	1 x 1 m excavation unit	6	30	40	Flaked stone	Debitage	Medium to coarse grained metavolcanic	13	66.8

CA-SDI-11,039	204	1 x 1 m excavation unit	6	40	50	Flaked stone	Debitage	Medium to coarse grained metavolcanic	16	23.2
CA-SDI-11,039	205	1 x 1 m excavation unit	6	50	60	Flaked stone	Debitage	Medium to coarse grained metavolcanic	4	10.4
CA-SDI-11,039	206	1 x 1 m excavation unit	7	0	10	Flaked stone	Debitage	Medium to coarse grained metavolcanic	410	494.4
CA-SDI-11,039	207	1 x 1 m excavation unit	7	0	10	Flaked stone	Debitage	Fine grained metavolcanic	5	0.6
CA-SDI-11,039	208	1 x 1 m excavation unit	7	0	10	Flaked stone	Debitage	Quartz	21	8.6
CA-SDI-11,039	209	1 x 1 m excavation unit	7	0	10	Flaked stone	Debitage	Chert	5	0.1
CA-SDI-11,039	210	1 x 1 m excavation unit	7	0	10	Flaked stone	Debitage	Piedra de Lumbre	17	7.6
CA-SDI-11,039	211	1 x 1 m excavation unit	7	0	10	Flaked stone	Retouched/utilized flake	Medium to coarse grained metavolcanic	1	10.8
CA-SDI-11,039	212	1 x 1 m excavation unit	7	0	10	Flaked stone	Large biface/perform	Medium to coarse grained metavolcanic	1	4.7
CA-SDI-11,039	213	1 x 1 m excavation unit	7	0	10	Flaked stone	Cottonwood series point	Medium to coarse grained metavolcanic	1	0.2
CA-SDI-11,039	214	1 x 1 m excavation unit	7	0	10	Flaked stone	Cottonwood Concave Base p	Medium to coarse grained metavolcanic	1	1.8
CA-SDI-11,039	215	1 x 1 m excavation unit	7	0	10	Flaked stone	Cottonwood series point	Piedra de Lumbre	1	0.5
CA-SDI-11,039	216	1 x 1 m excavation unit	7	0	10	Native American ceramics	Body sherd	Tizon Brown Ware	1	0.6
CA-SDI-11,039	217	1 x 1 m excavation unit	7	10	20	Flaked stone	Debitage	Medium to coarse grained metavolcanic	470	2483.4
CA-SDI-11,039	218	1 x 1 m excavation unit	7	10	20	Flaked stone	Debitage	Fine grained metavolcanic	6	1.2
CA-SDI-11,039	219	1 x 1 m excavation unit	7	10	20	Flaked stone	Debitage	Quartz	33	30.3
CA-SDI-11,039	220	1 x 1 m excavation unit	7	10	20	Flaked stone	Debitage	Obsidian	1	0.1
CA-SDI-11,039	221	1 x 1 m excavation unit	7	10	20	Flaked stone	Debitage	Chert	11	2.1
CA-SDI-11,039	222	1 x 1 m excavation unit	7	10	20	Flaked stone	Debitage	Piedra de Lumbre	29	25.3
CA-SDI-11,039	223	1 x 1 m excavation unit	7	10	20	Flaked stone	Core	Medium to coarse grained metavolcanic	1	656.9
CA-SDI-11,039	224	1 x 1 m excavation unit	7	10	20	Flaked stone	Large biface/perform	Medium to coarse grained metavolcanic	1	13.4
CA-SDI-11,039	225	1 x 1 m excavation unit	7	10	20	Flaked stone	Large biface/perform	Medium to coarse grained metavolcanic	1	26.3
CA-SDI-11,039	226	1 x 1 m excavation unit	7	10	20	Flaked stone	Large biface/perform	Undetermined	1	13.1
CA-SDI-11,039	227	1 x 1 m excavation unit	7	10	20	Flaked stone	Small biface/prefrom	Medium to coarse grained metavolcanic	1	3
CA-SDI-11,039	228	1 x 1 m excavation unit	7	10	20	Flaked stone	Small biface/prefrom	Medium to coarse grained metavolcanic	1	5.5
CA-SDI-11,039	229	1 x 1 m excavation unit	7	10	20	Flaked stone	Cottonwood series point	Medium to coarse grained metavolcanic	1	0.2
CA-SDI-11,039	230	1 x 1 m excavation unit	7	10	20	Flaked stone	Cottonwood series point	Medium to coarse grained metavolcanic	1	0.1
CA-SDI-11,039	231	1 x 1 m excavation unit	7	10	20	Flaked stone	Cottonwood Concave Base p	Quartz	1	0.5
CA-SDI-11,039	232	1 x 1 m excavation unit	7	10	20	Other stone	Hammerstone, unclassified	Medium to coarse grained metavolcanic	1	216.2
CA-SDI-11,039	233	1 x 1 m excavation unit	7	10	20	Native American ceramics	Body sherd	Tizon Brown Ware	25	69.7
CA-SDI-11,039	234	1 x 1 m excavation unit	7	10	20	Bone, nonhuman	Bulk unmodified	Unclassifed Bone	2	0.1
CA-SDI-11,039	235	1 x 1 m excavation unit	7	20	30	Flaked stone	Debitage	Medium to coarse grained metavolcanic	32	369.3
CA-SDI-11,039	236	1 x 1 m excavation unit	7	20	30	Flaked stone	Debitage	Quartz	3	1.5
CA-SDI-11,039	237	1 x 1 m excavation unit	7	20	30	Flaked stone	Debitage	Obsidian	1	0.1
CA-SDI-11,039	238	1 x 1 m excavation unit	7	20	30	Flaked stone	Debitage	Piedra de Lumbre	4	48.2
CA-SDI-11,039	239	1 x 1 m excavation unit	7	20	30	Native American ceramics	Body sherd	Tizon Brown Ware	2	1.2
CA-SDI-11,039	240	1 x 1 m excavation unit	8	0	10	Flaked stone	Debitage	Medium to coarse grained metavolcanic	157	882
CA-SDI-11,039	241	1 x 1 m excavation unit	8	0	10	Flaked stone	Debitage	Fine grained metavolcanic	2	0.9
CA-SDI-11,039	242	1 x 1 m excavation unit	8	0	10	Flaked stone	Debitage	Quartzite	2	30.6
CA-SDI-11,039	243	1 x 1 m excavation unit	8	0	10	Flaked stone	Debitage	Quartz	15	7
CA-SDI-11,039	244	1 x 1 m excavation unit	8	0	10	Flaked stone	Retouched/utilized flake	Medium to coarse grained metavolcanic	1	199.5
CA-SDI-11,039	245	1 x 1 m excavation unit	8	0	10	Flaked stone	Cottonwood series point	Obsidian	1	0.1
CA-SDI-11,039	246	1 x 1 m excavation unit	8	0	10	Native American ceramics	Body sherd	Tizon Brown Ware	20	51.1
CA-SDI-11,039	247	1 x 1 m excavation unit	8	0	10	Bone, nonhuman	Bulk unmodified	Unclassifed Bone	3	0
CA-SDI-11,039	248	1 x 1 m excavation unit	8	10	20	Flaked stone	Debitage	Medium to coarse grained metavolcanic	85	93.4
CA-SDI-11,039	249	1 x 1 m excavation unit	8	10	20	Flaked stone	Debitage	Quartzite	1	0.1
CA-SDI-11,039	250	1 x 1 m excavation unit	8	10	20	Flaked stone	Debitage	Quartz	5	0.8
CA-SDI-11,039	251	1 x 1 m excavation unit	8	10	20	Flaked stone	Debitage	Obsidian	2	0.1
CA-SDI-11,039	252	1 x 1 m excavation unit	8	10	20	Flaked stone	Debitage	Piedra de Lumbre	1	0.1
CA-SDI-11,039	253	1 x 1 m excavation unit	8	10	20	Native American ceramics	Body sherd	Tizon Brown Ware	3	4.4
CA-SDI-11,039	254	1 x 1 m excavation unit	9	0	10	Flaked stone	Debitage	Medium to coarse grained metavolcanic	1481	1345.3
CA-SDI-11,039	255	1 x 1 m excavation unit	9	0	10	Flaked stone	Debitage	Fine grained metavolcanic	46	13.1

CA-SDI-11,039	256	1 x 1 m excavation unit	9	0	10	Flaked stone	Debitage	Quartzite	2	66.6
CA-SDI-11,039	257	1 x 1 m excavation unit	9	0	10	Flaked stone	Debitage	Quartz	141	40.6
CA-SDI-11,039	258	1 x 1 m excavation unit	9	0	10	Flaked stone	Debitage	Obsidian	18	2
CA-SDI-11,039	259	1 x 1 m excavation unit	9	0	10	Flaked stone	Debitage	Chert	5	3.7
CA-SDI-11,039	260	1 x 1 m excavation unit	9	0	10	Flaked stone	Debitage	Piedra de Lumbre	91	40.6
CA-SDI-11,039	261	1 x 1 m excavation unit	9	0	10	Flaked stone	Retouched/utilized flake	Medium to coarse grained metavolcanic	1	1.3
CA-SDI-11,039	262	1 x 1 m excavation unit	9	0	10	Flaked stone	Retouched/utilized flake	Fine grained metavolcanic	1	4.4
CA-SDI-11,039	263	1 x 1 m excavation unit	9	0	10	Flaked stone	Small biface/prefrom	Medium to coarse grained metavolcanic	1	2.6
CA-SDI-11,039	264	1 x 1 m excavation unit	9	0	10	Flaked stone	Small biface/prefrom	Quartz	1	0.9
CA-SDI-11,039	265	1 x 1 m excavation unit	9	0	10	Flaked stone	Cottonwood Concave Base p	Piedra de Lumbre	1	0.6
CA-SDI-11,039	266	1 x 1 m excavation unit	9	0	10	Flaked stone	Cottonwood Concave Base p	Medium to coarse grained metavolcanic	1	0.5
CA-SDI-11,039	267	1 x 1 m excavation unit	9	0	10	Flaked stone	Cottonwood Concave Base p	Medium to coarse grained metavolcanic	1	0.4
CA-SDI-11,039	268	1 x 1 m excavation unit	9	0	10	Flaked stone	Cottonwood Concave Base p	Quartz	1	0.5
CA-SDI-11,039	269	1 x 1 m excavation unit	9	0	10	Flaked stone	Cottonwood series point	Quartz	1	0.3
CA-SDI-11,039	270	1 x 1 m excavation unit	9	0	10	Flaked stone	Cottonwood series point	Quartz	1	0.2
CA-SDI-11,039	271	1 x 1 m excavation unit	9	0	10	Flaked stone	Cottonwood series point	Medium to coarse grained metavolcanic	1	0.8
CA-SDI-11,039	272	1 x 1 m excavation unit	9	0	10	Flaked stone	Desert Side-Notched Concav	Chert	1	0.8
CA-SDI-11,039	273	1 x 1 m excavation unit	9	0	10	Groundstone	Mano	Granitic	1	27.3
CA-SDI-11,039	274	1 x 1 m excavation unit	9	0	10	Groundstone	Mano	Granitic	1	116.8
CA-SDI-11,039	275	1 x 1 m excavation unit	9	0	10	Bone, nonhuman	Bulk unmodified	Unclassifed Bone	50	4.7
CA-SDI-11,039	276	1 x 1 m excavation unit	9	0	10	Bone, nonhuman	Bulk unmodified	Unclassifed Bone	31	1.7
CA-SDI-11,039	277	1 x 1 m excavation unit	9	0	10	Shell	Bulk unmodified	Chione	3	0.5
CA-SDI-11,039	278	1 x 1 m excavation unit	9	0	10	Shell	Bulk unmodified	Pecten	2	0.2
CA-SDI-11,039	279	1 x 1 m excavation unit	9	0	10	Shell	Bulk unmodified	Unidentifiable	1	3.5
CA-SDI-11,039	280	1 x 1 m excavation unit	9	0	10	Native American ceramics	Body sherd	Tizon Brown Ware	14	9.2
CA-SDI-11,039	281	1 x 1 m excavation unit	9	0	10	Native American ceramics	Body sherd	Tizon Brown Ware	95	336
CA-SDI-11,039	282	1 x 1 m excavation unit	9	0	10	Native American ceramics	Rim sherd	Tizon Brown Ware	5	11.3
CA-SDI-11,039	283	1 x 1 m excavation unit	9	0	10	Groundstone	Metate	Granitic	4	5100
CA-SDI-11,039	284	1 x 1 m excavation unit	9	10	20	Flaked stone	Debitage	Medium to coarse grained metavolcanic	767	764.6
CA-SDI-11,039	285	1 x 1 m excavation unit	9	10	20	Flaked stone	Debitage	Fine grained metavolcanic	61	24.5
CA-SDI-11,039	286	1 x 1 m excavation unit	9	10	20	Flaked stone	Debitage	Quartz	85	21.9
CA-SDI-11,039	287	1 x 1 m excavation unit	9	10	20	Flaked stone	Debitage	Obsidian	13	1.4
CA-SDI-11,039	288	1 x 1 m excavation unit	9	10	20	Flaked stone	Debitage	Chert	5	3
CA-SDI-11,039	289	1 x 1 m excavation unit	9	10	20	Flaked stone	Debitage	Piedra de Lumbre	33	13.3
CA-SDI-11,039	290	1 x 1 m excavation unit	9	10	20	Flaked stone	Small biface/prefrom	Medium to coarse grained metavolcanic	1	2.7
CA-SDI-11,039	291	1 x 1 m excavation unit	9	10	20	Flaked stone	Cottonwood Straight Base po	Medium to coarse grained metavolcanic	1	1.5
CA-SDI-11,039	292	1 x 1 m excavation unit	9	10	20	Flaked stone	Cottonwood series point	Medium to coarse grained metavolcanic	1	0.1
CA-SDI-11,039	293	1 x 1 m excavation unit	9	10	20	Flaked stone	Large biface/perform	Quartz	1	5.7
CA-SDI-11,039	294	1 x 1 m excavation unit	9	10	20	Flaked stone	Small biface/prefrom	Quartz	1	1.4
CA-SDI-11,039	295	1 x 1 m excavation unit	9	10	20	Flaked stone	Small biface/prefrom	Quartz	1	3.6
CA-SDI-11,039	296	1 x 1 m excavation unit	9	10	20	Flaked stone	Cottonwood Concave Base p	Obsidian	1	0.2
CA-SDI-11,039	297	1 x 1 m excavation unit	9	10	20	Flaked stone	Cottonwood series point	Piedra de Lumbre	1	0.1
CA-SDI-11,039	298	1 x 1 m excavation unit	9	10	20	Flaked stone	Other biface/point	Piedra de Lumbre	1	4.8
CA-SDI-11,039	299	1 x 1 m excavation unit	9	10	20	Bone, nonhuman	Bulk unmodified	Unclassifed Bone	70	4.8
CA-SDI-11,039	300	1 x 1 m excavation unit	9	10	20	Bone, nonhuman	Bulk unmodified	Unclassifed Bone	27	1.3
CA-SDI-11,039	301	1 x 1 m excavation unit	9	10	20	Shell	Bulk unmodified	Unidentifiable	2	0.5
CA-SDI-11,039	302	1 x 1 m excavation unit	9	10	20	Native American ceramics	Body sherd	Tizon Brown Ware	52	336
CA-SDI-11,039	303	1 x 1 m excavation unit	9	10	20	Native American ceramics	Body sherd	Tizon Brown Ware	5	1.8
CA-SDI-11,039	304	1 x 1 m excavation unit	9	10	20	Native American ceramics	Rim sherd	Tizon Brown Ware	2	2.7
CA-SDI-11,039	305	1 x 1 m excavation unit	9	10	20	Native American ceramics	Pipe, unclassified	Tizon Brown Ware	1	1.2
CA-SDI-11,039	306	1 x 1 m excavation unit	9	10	20	Groundstone	Metate	Granitic	5	5950
CA-SDI-11,039	307	1 x 1 m excavation unit	9	20	30	Flaked stone	Debitage	Medium to coarse grained metavolcanic	677	1665

CA-SDI-11,039	308	1 x 1 m excavation unit	9	20	30	Flaked stone	Debitage	Fine grained metavolcanic	35	12.5
CA-SDI-11,039	309	1 x 1 m excavation unit	9	20	30	Flaked stone	Debitage	Quartzite	5	30.2
CA-SDI-11,039	310	1 x 1 m excavation unit	9	20	30	Flaked stone	Debitage	Quartz	86	20.7
CA-SDI-11,039	311	1 x 1 m excavation unit	9	20	30	Flaked stone	Debitage	Obsidian	13	0.7
CA-SDI-11,039	312	1 x 1 m excavation unit	9	20	30	Flaked stone	Debitage	Chert	8	2.8
CA-SDI-11,039	313	1 x 1 m excavation unit	9	20	30	Flaked stone	Debitage	Chalcedony	1	0.4
CA-SDI-11,039	314	1 x 1 m excavation unit	9	20	30	Flaked stone	Debitage	Piedra de Lumbre	41	10.8
CA-SDI-11,039	315	1 x 1 m excavation unit	9	20	30	Flaked stone	Core	Medium to coarse grained metavolcanic	1	687.2
CA-SDI-11,039	316	1 x 1 m excavation unit	9	20	30	Flaked stone	Scraper	Medium to coarse grained metavolcanic	1	48
CA-SDI-11,039	317	1 x 1 m excavation unit	9	20	30	Flaked stone	Cottonwood series point	Medium to coarse grained metavolcanic	1	0.1
CA-SDI-11,039	318	1 x 1 m excavation unit	9	20	30	Flaked stone	Cottonwood series point	Medium to coarse grained metavolcanic	1	0.4
CA-SDI-11,039	319	1 x 1 m excavation unit	9	20	30	Flaked stone	Cottonwood Straight Base po	Fine grained metavolcanic	1	1.2
CA-SDI-11,039	320	1 x 1 m excavation unit	9	20	30	Flaked stone	Cottonwood Straight Base po	Quartz	1	0.3
CA-SDI-11,039	321	1 x 1 m excavation unit	9	20	30	Flaked stone	Cottonwood Concave Base p	Obsidian	1	0.6
CA-SDI-11,039	322	1 x 1 m excavation unit	9	20	30	Flaked stone	Cottonwood series point	Piedra de Lumbre	2	0.4
CA-SDI-11,039	323	1 x 1 m excavation unit	9	20	30	Bone, nonhuman	Bulk unmodified	Unclassifed Bone	93	7.4
CA-SDI-11,039	324	1 x 1 m excavation unit	9	20	30	Bone, nonhuman	Bulk unmodified	Unclassifed Bone	50	3
CA-SDI-11,039	325	1 x 1 m excavation unit	9	20	30	Shell	Bulk unmodified	Pecten	2	0.1
CA-SDI-11,039	326	1 x 1 m excavation unit	9	20	30	Shell	Bulk unmodified	Unidentifiable	2	0.1
CA-SDI-11,039	327	1 x 1 m excavation unit	9	20	30	Shell	Bulk unmodified	Chiton	1	0.4
CA-SDI-11,039	328	1 x 1 m excavation unit	9	20	30	Native American ceramics	Body sherd	Tizon Brown Ware	1	0.1
CA-SDI-11,039	329	1 x 1 m excavation unit	9	20	30	Sample	Radiocarbon,	Undetermined	0	0.8
CA-SDI-11,039	330	1 x 1 m excavation unit	9	20	30	Native American ceramics	Body sherd	Tizon Brown Ware	9	87.4
CA-SDI-11,039	331	1 x 1 m excavation unit	9	20	30	Native American ceramics	Rim sherd	Tizon Brown Ware	1	79
CA-SDI-11,039	332	1 x 1 m excavation unit	9	20	30	Groundstone	Metate	Granitic	3	5450
CA-SDI-11,039	333	1 x 1 m excavation unit	9	20	30	Bone, nonhuman	Bulk unmodified	Unclassifed Bone	1	0.1
CA-SDI-11,039	334	1 x 1 m excavation unit	9	30	40	Flaked stone	Debitage	Medium to coarse grained metavolcanic	33	17
CA-SDI-11,039	335	1 x 1 m excavation unit	9	30	40	Flaked stone	Debitage	Fine grained metavolcanic	2	0.3
CA-SDI-11,039	336	1 x 1 m excavation unit	9	30	40	Flaked stone	Debitage	Quartz	4	1
CA-SDI-11,039	337	1 x 1 m excavation unit	9	30	40	Bone, nonhuman	Bulk unmodified	Unclassifed Bone	6	0.3
CA-SDI-11,039	338	1 x 1 m excavation unit	9	30	40	Bone, nonhuman	Bulk unmodified	Unclassifed Bone	2	0.1
CA-SDI-11,039	339	1 x 1 m excavation unit	9	30	40	Native American ceramics	Body sherd	Tizon Brown Ware	3	7.2
CA-SDI-11,039	340	1 x 1 m excavation unit	10	0	10	Flaked stone	Debitage	Medium to coarse grained metavolcanic	433	822.2
CA-SDI-11,039	341	1 x 1 m excavation unit	10	0	10	Flaked stone	Debitage	Fine grained metavolcanic	1	0.1
CA-SDI-11,039	342	1 x 1 m excavation unit	10	0	10	Flaked stone	Debitage	Quartzite	1	1.5
CA-SDI-11,039	343	1 x 1 m excavation unit	10	0	10	Flaked stone	Debitage	Quartz	3	1.2
CA-SDI-11,039	344	1 x 1 m excavation unit	10	0	10	Flaked stone	Debitage	Chert	7	0.8
CA-SDI-11,039	345	1 x 1 m excavation unit	10	0	10	Flaked stone	Retouched/utilized flake	Medium to coarse grained metavolcanic	1	4.7
CA-SDI-11,039	346	1 x 1 m excavation unit	10	0	10	Flaked stone	Small biface/prefrom	Chert	1	0.6
CA-SDI-11,039	347	1 x 1 m excavation unit	10	0	10	Flaked stone	Desert Side-Notched Concav	Obsidian	1	0.4
CA-SDI-11,039	348	1 x 1 m excavation unit	10	0	10	Native American ceramics	Body sherd	Tizon Brown Ware	11	37.7
CA-SDI-11,039	349	1 x 1 m excavation unit	10	10	20	Flaked stone	Debitage	Medium to coarse grained metavolcanic	185	481.7
CA-SDI-11,039	350	1 x 1 m excavation unit	10	10	20	Flaked stone	Debitage	Quartz	1	0.1
CA-SDI-11,039	351	1 x 1 m excavation unit	10	10	20	Flaked stone	Debitage	Chert	3	0.4
CA-SDI-11,039	352	1 x 1 m excavation unit	10	20	30	Flaked stone	Debitage	Medium to coarse grained metavolcanic	57	104.7
CA-SDI-11,039	353	1 x 1 m excavation unit	10	20	30	Flaked stone	Debitage	Fine grained metavolcanic	1	0.1
CA-SDI-11,039	354	1 x 1 m excavation unit	11	0	10	Flaked stone	Debitage	Medium to coarse grained metavolcanic	152	395.8
CA-SDI-11,039	355	1 x 1 m excavation unit	11	0	10	Flaked stone	Debitage	Fine grained metavolcanic	1	0.2
CA-SDI-11,039	356	1 x 1 m excavation unit	11	0	10	Flaked stone	Debitage	Quartzite	1	1.4
CA-SDI-11,039	357	1 x 1 m excavation unit	11	0	10	Flaked stone	Debitage	Chert	1	24.6
CA-SDI-11,039	358	1 x 1 m excavation unit	11	0	10	Native American ceramics	Body sherd	Tizon Brown Ware	5	17.4
CA-SDI-11,039	359	1 x 1 m excavation unit	11	10	20	Flaked stone	Debitage	Medium to coarse grained metavolcanic	66	184.5

CA-SDI-11,039	360	1 x 1 m excavation unit	11	10	20	Flaked stone	Debitage	Fine grained metavolcanic	1	0.1
CA-SDI-11,039	361	1 x 1 m excavation unit	11	10	20	Flaked stone	Debitage	Obsidian	1	0.1
CA-SDI-11,039	362	1 x 1 m excavation unit	11	20	30	Flaked stone	Debitage	Medium to coarse grained metavolcanic	9	11
CA-SDI-11,039	363	1 x 1 m excavation unit	11	30	40	Flaked stone	Debitage	Medium to coarse grained metavolcanic	2	0.2
CA-SDI-11,039	364	1 x 1 m excavation unit	12	0	10	Flaked stone	Debitage	Medium to coarse grained metavolcanic	353	419
CA-SDI-11,039	365	1 x 1 m excavation unit	12	0	10	Flaked stone	Debitage	Fine grained metavolcanic	8	6.4
CA-SDI-11,039	366	1 x 1 m excavation unit	12	0	10	Flaked stone	Debitage	Quartzite	3	1
CA-SDI-11,039	367	1 x 1 m excavation unit	12	0	10	Flaked stone	Debitage	Quartz	22	12.4
CA-SDI-11,039	368	1 x 1 m excavation unit	12	0	10	Flaked stone	Retouched/utilized flake	Medium to coarse grained metavolcanic	1	53
CA-SDI-11,039	369	1 x 1 m excavation unit	12	0	10	Flaked stone	Retouched/utilized flake	Medium to coarse grained metavolcanic	1	202.9
CA-SDI-11,039	370	1 x 1 m excavation unit	12	0	10	Flaked stone	Cottonwood series point	Medium to coarse grained metavolcanic	1	0.2
CA-SDI-11,039	371	1 x 1 m excavation unit	12	0	10	Bone, nonhuman	Bulk unmodified	Unclassifed Bone	1	0.1
CA-SDI-11,039	372	1 x 1 m excavation unit	12	0	10	Native American ceramics	Body sherd	Tizon Brown Ware	36	34.4
CA-SDI-11,039	373	1 x 1 m excavation unit	12	0	10	Native American ceramics	Body sherd	Tizon Brown Ware	3	2
CA-SDI-11,039	374	1 x 1 m excavation unit	12	10	20	Flaked stone	Debitage	Medium to coarse grained metavolcanic	18	4.6
CA-SDI-11,039	375	1 x 1 m excavation unit	12	10	20	Flaked stone	Debitage	Quartz	1	1.8
CA-SDI-11,039	376	1 x 1 m excavation unit	12	10	20	Native American ceramics	Body sherd	Tizon Brown Ware	2	1.4
CA-SDI-11,039	377	General surface	0	0	0	Flaked stone	Debitage	Medium to coarse grained metavolcanic	11	61.3
CA-SDI-11,039	378	General surface	0	0	0	Flaked stone	Debitage	Quartz	1	0.4
CA-SDI-11,039	379	General surface	0	0	0	Native American ceramics	Body sherd	Tizon Brown Ware	5	7.7
CA-SDI-11,039	380	General surface	0	0	0	Flaked stone	Debitage	Medium to coarse grained metavolcanic	6	32.8
CA-SDI-11,039	381	General surface	0	0	0	Flaked stone	Retouched/utilized flake	Medium to coarse grained metavolcanic	1	89.1
CA-SDI-11,039	382	General surface	0	0	0	Flaked stone	Small biface/prefrom	Medium to coarse grained metavolcanic	1	3.2
CA-SDI-11,039	383	General surface	0	0	0	Native American ceramics	Body sherd	Tizon Brown Ware	5	11.4
CA-SDI-11,039	384	General surface	0	0	0	Flaked stone	Debitage	Medium to coarse grained metavolcanic	3	15.1
CA-SDI-11,039	385	General surface	0	0	0	Native American ceramics	Body sherd	Tizon Brown Ware	2	9.8
CA-SDI-11,039	386	General surface	0	0	0	Flaked stone	Debitage	Medium to coarse grained metavolcanic	3	7.4
CA-SDI-11,039	387	General surface	0	0	0	Flaked stone	Retouched/utilized flake	Medium to coarse grained metavolcanic	1	40.6
CA-SDI-11,039	388	General surface	0	0	0	Flaked stone	Small biface/prefrom	Medium to coarse grained metavolcanic	1	4
CA-SDI-11,039	389	General surface	0	0	0	Native American ceramics	Body sherd	Tizon Brown Ware	1	2.4
CA-SDI-11,039	390	General surface	0	0	0	Flaked stone	Debitage	Medium to coarse grained metavolcanic	4	23.4
CA-SDI-11,039	391	General surface	0	0	0	Flaked stone	Large biface/perform	Medium to coarse grained metavolcanic	1	53.1
CA-SDI-11,039	392	General surface	0	0	0	Native American ceramics	Body sherd	Tizon Brown Ware	1	2.4
CA-SDI-11,039	393	General surface	0	0	0	Native American ceramics	Body sherd	Tizon Brown Ware	1	5
CA-SDI-11,039	394	General surface	0	0	0	Flaked stone	Debitage	Medium to coarse grained metavolcanic	1	21.5
CA-SDI-11,039	395	General surface	0	0	0	Native American ceramics	Rim sherd	Tizon Brown Ware	1	5.5
CA-SDI-11,039	396	General surface	0	0	0	Flaked stone	Debitage	Medium to coarse grained metavolcanic	5	23.4
CA-SDI-11,039	397	General surface	0	0	0	Native American ceramics	Body sherd	Tizon Brown Ware	1	10.7
CA-SDI-11,039	398	General surface	0	0	0	Native American ceramics	Body sherd	Tizon Brown Ware	1	15.2
CA-SDI-11,039	399	General surface	0	0	0	Flaked stone	Debitage	Medium to coarse grained metavolcanic	1	3
CA-SDI-11,039	400	General surface	0	0	0	Native American ceramics	Body sherd	Tizon Brown Ware	2	15.6
CA-SDI-11,039	401	General surface	0	0	0	Flaked stone	Rejuvenation flake	Medium to coarse grained metavolcanic	1	103.1
CA-SDI-11,039	402	General surface	0	0	0	Flaked stone	Debitage	Medium to coarse grained metavolcanic	6	57.5
CA-SDI-11,039	403	General surface	0	0	0	Flaked stone	Large biface/perform	Medium to coarse grained metavolcanic	1	22.2
CA-SDI-11,039	404	General surface	0	0	0	Flaked stone	Debitage	Medium to coarse grained metavolcanic	1	4.7
CA-SDI-11,039	405	General surface	0	0	0	Native American ceramics	Body sherd	Tizon Brown Ware	1	2.3
CA-SDI-11,039	406	General surface	0	0	0	Flaked stone	Debitage	Medium to coarse grained metavolcanic	1	59.1
CA-SDI-11,039	407	General surface	0	0	0	Flaked stone	Debitage	Fine grained metavolcanic	1	19.6
CA-SDI-11,039	408	General surface	0	0	0	Native American ceramics	Body sherd	Tizon Brown Ware	1	2.7
CA-SDI-11,039	409	General surface	0	0	0	Flaked stone	Debitage	Medium to coarse grained metavolcanic	2	31
CA-SDI-11,039	410	General surface	0	0	0	Native American ceramics	Body sherd	Tizon Brown Ware	2	7.2
CA-SDI-11,039	411	General surface	0	0	0	Flaked stone	Retouched/utilized flake	Quartz	1	19.2

CA-SDI-11,039	412	General surface	0	0	0	Flaked stone	Debitage	Medium to coarse grained metavolcanic	12	121.3
CA-SDI-11,039	413	General surface	0	0	0	Flaked stone	Debitage	Quartz	1	4.1
CA-SDI-11,039	414	General surface	0	0	0	Native American ceramics	Body sherd	Tizon Brown Ware	2	18.5
CA-SDI-11,039	415	General surface	0	0	0	Flaked stone	Debitage	Medium to coarse grained metavolcanic	3	50.5
CA-SDI-11,039	416	General surface	0	0	0	Flaked stone	Debitage	Fine grained metavolcanic	2	0.4
CA-SDI-11,039	417	General surface	0	0	0	Native American ceramics	Body sherd	Tizon Brown Ware	1	3.6
CA-SDI-11,039	418	General surface	0	0	0	Flaked stone	Debitage	Medium to coarse grained metavolcanic	7	23
CA-SDI-11,039	419	General surface	0	0	0	Native American ceramics	Body sherd	Tizon Brown Ware	1	6.6
CA-SDI-11,039	420	General surface	0	0	0	Flaked stone	Debitage	Medium to coarse grained metavolcanic	5	50
CA-SDI-11,039	421	General surface	0	0	0	Flaked stone	Debitage	Fine grained metavolcanic	1	2.5
CA-SDI-11,039	422	General surface	0	0	0	Flaked stone	Debitage	Quartz	1	2.3
CA-SDI-11,039	423	General surface	0	0	0	Flaked stone	Debitage	Medium to coarse grained metavolcanic	2	22.6
CA-SDI-11,039	424	General surface	0	0	0	Flaked stone	Debitage	Medium to coarse grained metavolcanic	8	81.4
CA-SDI-11,039	425	General surface	0	0	0	Flaked stone	Scraper	Medium to coarse grained metavolcanic	1	173.9
CA-SDI-11,039	426	General surface	0	0	0	Flaked stone	Debitage	Medium to coarse grained metavolcanic	4	36
CA-SDI-11,039	427	General surface	0	0	0	Flaked stone	Debitage	Medium to coarse grained metavolcanic	1	17.6
CA-SDI-11,039	428	General surface	0	0	0	Flaked stone	Chopper	Medium to coarse grained metavolcanic	1	437
CA-SDI-11,039	429	General surface	0	0	0	Flaked stone	Debitage	Medium to coarse grained metavolcanic	1	11.5
CA-SDI-11,039	430	General surface	0	0	0	Native American ceramics	Body sherd	Tizon Brown Ware	1	10
CA-SDI-11,039	431	General surface	0	0	0	Flaked stone	Debitage	Medium to coarse grained metavolcanic	2	11
CA-SDI-11,039	432	General surface	0	0	0	Flaked stone	Debitage	Medium to coarse grained metavolcanic	9	117
CA-SDI-11,039	433	General surface	0	0	0	Native American ceramics	Body sherd	Tizon Brown Ware	3	8.9
CA-SDI-11,039	434	General surface	0	0	0	Flaked stone	Debitage	Medium to coarse grained metavolcanic	5	12.3
CA-SDI-11,039	435	General surface	0	0	0	Flaked stone	Debitage	Fine grained metavolcanic	1	0.8
CA-SDI-11,039	436	General surface	0	0	0	Flaked stone	Debitage	Medium to coarse grained metavolcanic	7	49.5
CA-SDI-11,039	437	General surface	0	0	0	Flaked stone	Debitage	Fine grained metavolcanic	2	6.8
CA-SDI-11,039	438	General surface	0	0	0	Flaked stone	Retouched/utilized flake	Medium to coarse grained metavolcanic	1	16.5
CA-SDI-11,039	439	General surface	0	0	0	Flaked stone	Chopper	Medium to coarse grained metavolcanic	1	333
CA-SDI-11,039	440	General surface	0	0	0	Groundstone	Mano	Granitic	1	561.7
CA-SDI-11,039	441	General surface	0	0	0	Native American ceramics	Body sherd	Tizon Brown Ware	2	16.7
CA-SDI-11,039	442	General surface	0	0	0	Flaked stone	Debitage	Medium to coarse grained metavolcanic	11	136.1
CA-SDI-11,039	443	General surface	0	0	0	Flaked stone	Debitage	Fine grained metavolcanic	1	1
CA-SDI-11,039	444	General surface	0	0	0	Flaked stone	Core	Quartzite	1	134.1
CA-SDI-11,039	445	General surface	0	0	0	Flaked stone	Debitage	Medium to coarse grained metavolcanic	16	116.4
CA-SDI-11,039	446	General surface	0	0	0	Native American ceramics	Body sherd	Tizon Brown Ware	1	1.2
CA-SDI-11,039	447	General surface	0	0	0	Glass	Clear	Undetermined	1	7.8
CA-SDI-11,039	448	General surface	0	0	0	Flaked stone	Debitage	Medium to coarse grained metavolcanic	1	4
CA-SDI-11,039	449	General surface	0	0	0	Flaked stone	Debitage	Medium to coarse grained metavolcanic	6	17.3
CA-SDI-11,039	450	General surface	0	0	0	Flaked stone	Debitage	Fine grained metavolcanic	1	1.2
CA-SDI-11,039	451	General surface	0	0	0	Flaked stone	Debitage	Chert	1	1.7
CA-SDI-11,039	452	General surface	0	0	0	Flaked stone	Retouched/utilized flake	Medium to coarse grained metavolcanic	1	23.9
CA-SDI-11,039	453	General surface	0	0	0	Flaked stone	Debitage	Medium to coarse grained metavolcanic	33	1156.4
CA-SDI-11,039	454	General surface	0	0	0	Flaked stone	Debitage	Fine grained metavolcanic	2	3
CA-SDI-11,039	455	General surface	0	0	0	Other stone	Hammerstone, angular	Medium to coarse grained metavolcanic	1	308.4
CA-SDI-11,039	456	General surface	0	0	0	Flaked stone	Debitage	Medium to coarse grained metavolcanic	32	398.6
CA-SDI-11,039	457	General surface	0	0	0	Flaked stone	Retouched/utilized flake	Medium to coarse grained metavolcanic	1	40.8
CA-SDI-11,039	458	General surface	0	0	0	Flaked stone	Chopper	Medium to coarse grained metavolcanic	1	386.3
CA-SDI-11,039	459	General surface	0	0	0	Groundstone	Mano	Granitic	1	536
CA-SDI-11,039	460	General surface	0	0	0	Flaked stone	Debitage	Medium to coarse grained metavolcanic	8	25.3
CA-SDI-11,039	461	General surface	0	0	0	Flaked stone	Debitage	Quartz	1	0.1
CA-SDI-11,039	462	General surface	0	0	0	Flaked stone	Debitage	Medium to coarse grained metavolcanic	4	35.7
CA-SDI-11,039	463	General surface	0	0	0	Flaked stone	Debitage	Fine grained metavolcanic	1	0.1

CA-SDI-11,039	464	General surface	0	0	0	Native American ceramics	Body sherd	Tizon Brown Ware	3	2
CA-SDI-11,039	465	General surface	0	0	0	Flaked stone	Debitage	Medium to coarse grained metavolcanic	9	11.8
CA-SDI-11,039	466	General surface	0	0	0	Flaked stone	Debitage	Quartz	2	0.5
CA-SDI-11,039	467	General surface	0	0	0	Flaked stone	Cottonwood Straight Base pc	Medium to coarse grained metavolcanic	1	1.3
CA-SDI-11,039	468	General surface	0	0	0	Native American ceramics	Body sherd	Tizon Brown Ware	3	15.9
CA-SDI-11,039	469	General surface	0	0	0	Bone, nonhuman	Bulk unmodified	Unclassifed Bone	1	0.4
CA-SDI-11,039	470	General surface	0	0	0	Flaked stone	Debitage	Medium to coarse grained metavolcanic	12	28.2
CA-SDI-11,039	471	General surface	0	0	0	Flaked stone	Debitage	Fine grained metavolcanic	1	0.4
CA-SDI-11,039	472	General surface	0	0	0	Flaked stone	Debitage	Quartz	1	3
CA-SDI-11,039	473	General surface	0	0	0	Native American ceramics	Body sherd	Tizon Brown Ware	2	8.8
CA-SDI-11,039	474	General surface	0	0	0	Groundstone	Mano	Granitic	1	773.4
CA-SDI-11,039	475	General surface	0	0	0	Flaked stone	Debitage	Medium to coarse grained metavolcanic	12	95.3
CA-SDI-11,039	476	General surface	0	0	0	Flaked stone	Debitage	Quartz	6	61
CA-SDI-11,039	477	General surface	0	0	0	Native American ceramics	Body sherd	Tizon Brown Ware	5	4.5
CA-SDI-11,039	478	General surface	0	0	0	Groundstone	Mano	Granitic	1	539
CA-SDI-11,039	479	General surface	0	0	0	Groundstone	Metate	Granitic	1	1900
CA-SDI-11,039	480	General surface	0	0	0	Flaked stone	Debitage	Medium to coarse grained metavolcanic	17	81.2
CA-SDI-11,039	481	General surface	0	0	0	Flaked stone	Debitage	Fine grained metavolcanic	1	0.3
CA-SDI-11,039	482	General surface	0	0	0	Flaked stone	Debitage	Quartz	9	2.6
CA-SDI-11,039	483	General surface	0	0	0	Native American ceramics	Body sherd	Tizon Brown Ware	4	5.6
CA-SDI-11,039	484	General surface	0	0	0	Bone, nonhuman	Bulk unmodified	Unclassifed Bone	1	0.1
CA-SDI-11,039	485	General surface	0	0	0	Bone, nonhuman	Bulk unmodified	Unclassifed Bone	2	0.3
CA-SDI-11,039	486	General surface	0	0	0	Groundstone	Mano	Granitic	1	662.5
CA-SDI-11,039	487	General surface	0	0	0	Flaked stone	Debitage	Medium to coarse grained metavolcanic	1	33.9
CA-SDI-11,039	488	General surface	0	0	0	Flaked stone	Debitage	Medium to coarse grained metavolcanic	7	17.2
CA-SDI-11,039	489	General surface	0	0	0	Flaked stone	Debitage	Quartz	3	5.5
CA-SDI-11,039	490	General surface	0	0	0	Native American ceramics	Body sherd	Tizon Brown Ware	2	10.9
CA-SDI-11,039	491	General surface	0	0	0	Flaked stone	Debitage	Medium to coarse grained metavolcanic	6	18.4
CA-SDI-11,039	492	General surface	0	0	0	Flaked stone	Debitage	Medium to coarse grained metavolcanic	1	23.2
CA-SDI-11,039	493	General surface	0	0	0	Flaked stone	Debitage	Medium to coarse grained metavolcanic	36	224.1
CA-SDI-11,039	494	General surface	0	0	0	Flaked stone	Debitage	Quartz	2	5.1
CA-SDI-11,039	495	General surface	0	0	0	Flaked stone	Rejuvenation flake	Medium to coarse grained metavolcanic	1	64
CA-SDI-11,039	496	General surface	0	0	0	Flaked stone	Debitage	Medium to coarse grained metavolcanic	8	12.5
CA-SDI-11,039	497	General surface	0	0	0	Flaked stone	Debitage	Quartz	1	0.9
CA-SDI-11,039	498	General surface	0	0	0	Native American ceramics	Body sherd	Tizon Brown Ware	2	1.6
CA-SDI-11,039	499	General surface	0	0	0	Flaked stone	Debitage	Medium to coarse grained metavolcanic	15	27.9
CA-SDI-11,039	500	General surface	0	0	0	Flaked stone	Debitage	Fine grained metavolcanic	5	8.8
CA-SDI-11,039	501	General surface	0	0	0	Flaked stone	Debitage	Quartz	2	0.1
CA-SDI-11,039	502	General surface	0	0	0	Flaked stone	Debitage	Piedra de Lumbre	1	7.4
CA-SDI-11,039	503	General surface	0	0	0	Native American ceramics	Body sherd	Tizon Brown Ware	4	11.5
CA-SDI-11,039	504	General surface	0	0	0	Flaked stone	Debitage	Medium to coarse grained metavolcanic	6	18.7
CA-SDI-11,039	505	General surface	0	0	0	Flaked stone	Debitage	Quartz	1	1.6
CA-SDI-11,039	506	General surface	0	0	0	Flaked stone	Debitage	Medium to coarse grained metavolcanic	1	0.2
CA-SDI-11,039	507	General surface	0	0	0	Native American ceramics	Body sherd	Tizon Brown Ware	1	3.9
CA-SDI-11,039	508	General surface	0	0	0	Flaked stone	Debitage	Medium to coarse grained metavolcanic	4	21.2
CA-SDI-11,039	509	General surface	0	0	0	Flaked stone	Debitage	Medium to coarse grained metavolcanic	27	28.5
CA-SDI-11,039	510	General surface	0	0	0	Flaked stone	Debitage	Fine grained metavolcanic	1	3.4
CA-SDI-11,039	511	General surface	0	0	0	Flaked stone	Debitage	Quartz	2	4.3
CA-SDI-11,039	512	General surface	0	0	0	Flaked stone	Debitage	Piedra de Lumbre	2	1
CA-SDI-11,039	513	General surface	0	0	0	Flaked stone	Debitage	Medium to coarse grained metavolcanic	5	17.1
CA-SDI-11,039	514	General surface	0	0	0	Flaked stone	Debitage	Medium to coarse grained metavolcanic	4	31.1
CA-SDI-11,039	515	General surface	0	0	0	Flaked stone	Debitage	Medium to coarse grained metavolcanic	5	2.4

CA-SDI-11,039	516	General surface	0	0	0	Native American ceramics	Body sherd	Tizon Brown Ware	3	9.9
CA-SDI-11,039	517	General surface	0	0	0	Flaked stone	Debitage	Medium to coarse grained metavolcanic	4	64
CA-SDI-11,039	518	General surface	0	0	0	Flaked stone	Core	Medium to coarse grained metavolcanic	1	978.5
CA-SDI-11,039	519	General surface	0	0	0	Flaked stone	Debitage	Medium to coarse grained metavolcanic	10	7.8
CA-SDI-11,039	520	General surface	0	0	0	Flaked stone	Debitage	Piedra de Lumbre	1	1.7
CA-SDI-11,039	521	General surface	0	0	0	Native American ceramics	Body sherd	Tizon Brown Ware	1	1.8
CA-SDI-11,039	522	General surface	0	0	0	Flaked stone	Debitage	Medium to coarse grained metavolcanic	8	34.4
CA-SDI-11,039	523	General surface	0	0	0	Native American ceramics	Body sherd	Tizon Brown Ware	5	43.2
CA-SDI-11,039	524	General surface	0	0	0	Flaked stone	Debitage	Medium to coarse grained metavolcanic	16	66.6
CA-SDI-11,039	525	General surface	0	0	0	Flaked stone	Debitage	Fine grained metavolcanic	1	1.1
CA-SDI-11,039	526	General surface	0	0	0	Flaked stone	Debitage	Quartz	1	0.1
CA-SDI-11,039	527	General surface	0	0	0	Native American ceramics	Body sherd	Tizon Brown Ware	1	3.8
CA-SDI-11,039	528	General surface	0	0	0	Flaked stone	Debitage	Medium to coarse grained metavolcanic	1	2.3
CA-SDI-11,039	529	General surface	0	0	0	Flaked stone	Debitage	Quartz	1	0.1
CA-SDI-11,039	530	General surface	0	0	0	Native American ceramics	Body sherd	Tizon Brown Ware	1	2.6
CA-SDI-11,039	531	General surface	0	0	0	Flaked stone	Debitage	Medium to coarse grained metavolcanic	5	12.2
CA-SDI-11,039	532	General surface	0	0	0	Flaked stone	Debitage	Medium to coarse grained metavolcanic	10	206.8
CA-SDI-11,039	533	General surface	0	0	0	Flaked stone	Debitage	Fine grained metavolcanic	1	0.1
CA-SDI-11,039	534	General surface	0	0	0	Flaked stone	Debitage	Medium to coarse grained metavolcanic	2	16.1
CA-SDI-11,039	535	General surface	0	0	0	Native American ceramics	Body sherd	Tizon Brown Ware	1	1.3
CA-SDI-11,039	536	General surface	0	0	0	Flaked stone	Debitage	Medium to coarse grained metavolcanic	34	54.6
CA-SDI-11,039	537	General surface	0	0	0	Flaked stone	Debitage	Fine grained metavolcanic	5	2.3
CA-SDI-11,039	538	General surface	0	0	0	Flaked stone	Debitage	Quartzite	2	0.7
CA-SDI-11,039	539	General surface	0	0	0	Flaked stone	Debitage	Quartz	2	1
CA-SDI-11,039	540	General surface	0	0	0	Flaked stone	Cottonwood Concave Base p	Medium to coarse grained metavolcanic	1	0.9
CA-SDI-11,039	541	General surface	0	0	0	Native American ceramics	Body sherd	Tizon Brown Ware	5	7.5
CA-SDI-11,039	542	General surface	0	0	0	Flaked stone	Debitage	Medium to coarse grained metavolcanic	6	40.2
CA-SDI-11,039	543	General surface	0	0	0	Flaked stone	Debitage	Fine grained metavolcanic	1	3
CA-SDI-11,039	544	General surface	0	0	0	Flaked stone	Debitage	Quartz	1	3
CA-SDI-11,039	545	General surface	0	0	0	Native American ceramics	Body sherd	Tizon Brown Ware	2	8.7
CA-SDI-11,039	546	General surface	0	0	0	Flaked stone	Debitage	Medium to coarse grained metavolcanic	14	97
CA-SDI-11,039	547	General surface	0	0	0	Flaked stone	Debitage	Fine grained metavolcanic	2	4.8
CA-SDI-11,039	548	General surface	0	0	0	Flaked stone	Debitage	Quartz	1	0.4
CA-SDI-11,039	549	General surface	0	0	0	Flaked stone	Small biface/prefrom	Medium to coarse grained metavolcanic	1	5
CA-SDI-11,039	550	General surface	0	0	0	Native American ceramics	Body sherd	Tizon Brown Ware	1	9.2
CA-SDI-11,039	551	General surface	0	0	0	Flaked stone	Debitage	Medium to coarse grained metavolcanic	7	84.9
CA-SDI-11,039	552	General surface	0	0	0	Flaked stone	Large biface/perform	Medium to coarse grained metavolcanic	1	42.2
CA-SDI-11,039	553	General surface	0	0	0	Native American ceramics	Body sherd	Tizon Brown Ware	1	6.7
CA-SDI-11,039	554	General surface	0	0	0	Groundstone	Metate	Medium to coarse grained metavolcanic	1	15100
CA-SDI-11,039	555	General surface	0	0	0	Groundstone	Mano	Granitic	1	3025
CA-SDI-11,039	556	Other	0	0	0	Flaked stone	Debitage	Medium to coarse grained metavolcanic	2	31.5
CA-SDI-11,039	557	Other	0	0	0	Flaked stone	Chopper	Medium to coarse grained metavolcanic	1	236.2
CA-SDI-11,039	558	Other	0	0	0	Native American ceramics	Body sherd	Tizon Brown Ware	2	6
CA-SDI-11,039	559	Other	0	0	0	Bone, nonhuman	Bulk unmodified	Unclassifed Bone	1	0.6
CA-SDI-11,039	560	1 x 1 m excavation unit	9	0	0	Native American ceramics	Body sherd	Tizon Brown Ware	6	19.8
CA-SDI-11,039	561	1 x 1 m excavation unit	9	0	0	Native American ceramics	Rim sherd	Tizon Brown Ware	1	22.3

CA-SDI-18,504A Artifact Summary

SITE	ARTNUM	Unit type	Unit number	Upper depth	Lower depth	Class	Item	Material	CNT	WT
CA-SDI-18504 A	1	1 x 1 m excavation unit	1	0	10	Flaked stone	Debitage	Medium to coarse grained metavolcanic	2	0.2
CA-SDI-18504 A	2	1 x 1 m excavation unit	1	0	10	Flaked stone	Debitage	Medium to coarse grained metavolcanic	1	18.9
CA-SDI-18504 A	3	1 x 1 m excavation unit	1	0	10	Flaked stone	Debitage	Medium to coarse grained metavolcanic	1	2.5
CA-SDI-18504 A	4	1 x 1 m excavation unit	1	0	10	Flaked stone	Debitage	Medium to coarse grained metavolcanic	1	2
CA-SDI-18504 A	5	1 x 1 m excavation unit	1	0	10	Flaked stone	Debitage	Medium to coarse grained metavolcanic	1	0.8
CA-SDI-18504 A	6	1 x 1 m excavation unit	1	0	10	Flaked stone	Debitage	Medium to coarse grained metavolcanic	1	1
CA-SDI-18504 A	7	1 x 1 m excavation unit	1	0	10	Flaked stone	Debitage	Medium to coarse grained metavolcanic	1	2.8
CA-SDI-18504 A	8	1 x 1 m excavation unit	1	0	10	Flaked stone	Debitage	Medium to coarse grained metavolcanic	1	14.5
CA-SDI-18504 A	9	1 x 1 m excavation unit	1	0	10	Flaked stone	Debitage	Medium to coarse grained metavolcanic	1	7.5
CA-SDI-18504 A	10	1 x 1 m excavation unit	1	0	10	Flaked stone	Debitage	Medium to coarse grained metavolcanic	23	31.6
CA-SDI-18504 A	11	1 x 1 m excavation unit	1	10	20	Flaked stone	Debitage	Medium to coarse grained metavolcanic	17	52.4
CA-SDI-18504 A	12	1 x 1 m excavation unit	1	10	20	Flaked stone	Debitage	Medium to coarse grained metavolcanic	1	1.5
CA-SDI-18504 A	13	1 x 1 m excavation unit	1	10	20	Flaked stone	Debitage	Medium to coarse grained metavolcanic	1	0.8
CA-SDI-18504 A	14	1 x 1 m excavation unit	1	10	20	Flaked stone	Debitage	Medium to coarse grained metavolcanic	3	1
CA-SDI-18504 A	15	1 x 1 m excavation unit	1	20	30	Flaked stone	Debitage	Medium to coarse grained metavolcanic	5	3.2
CA-SDI-18504 A	16	1 x 1 m excavation unit	1	20	30	Flaked stone	Debitage	Medium to coarse grained metavolcanic	1	1.6
CA-SDI-18504 A	17	1 x 1 m excavation unit	1	20	30	Flaked stone	Debitage	Medium to coarse grained metavolcanic	1	0.9
CA-SDI-18504 A	18	1 x 1 m excavation unit	1	20	30	Flaked stone	Debitage	Fine grained metavolcanic	1	0.2
CA-SDI-18504 A	19	1 x 1 m excavation unit	1	20	30	Flaked stone	Debitage	Quartz	2	0.4

APPENDIX G-1
Air Quality Technical Report

Heritage Bluffs II

AIR QUALITY IMPACT ANALYSIS

CITY OF SAN DIEGO

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LIST OF ABBREVIATED TERMS

(1)	Reference
µg/m3	Microgram per Cubic Meter
AADT	Annual Average Daily Trips
AQIA	Air Quality Impact Analysis
AQMP	Air Quality Management Plan
ARB	California Air Resources Board
BACM	Best Available Control Measures
BMPs	Best Management Practices
CAA	Federal Clean Air Act
CAAQS	California Ambient Air Quality Standards
CalEEMod	California Emissions Estimator Model
Caltrans	California Department of Transportation
CAPCOA	California Air Pollution Control Officers Association
CARB	California Air Resources Board
CCR	California Code of Regulations
CEQA	California Environmental Quality Act
CFR	Code of Federal Regulations
CO	Carbon Monoxide
DPM	Diesel Particulate Matter
EPA	Environmental Protection Agency
LST	Localized Significance Threshold
NAAQS	National Ambient Air Quality Standards
NO2	Nitrogen Dioxide
NOx	Oxides of Nitrogen
Pb	Lead
PM10	Particulate Matter 10 microns in diameter or less
PM2.5	Particulate Matter 2.5 microns in diameter or less
PPM	Parts Per Million
Project	Heritage Bluffs II
RAQS	Regional Air Quality Strategy
ROG	Reactive Organic Gases
SANDAG	San Diego Association of Governments
SDAB	San Diego Air Basin
SDAPCD	San Diego Air Pollution Control District
SIPs	State Implementation Plans
TAC	Toxic Air Contaminant

TIA	Traffic Impact Analysis
TOG	Total Organic Gases
VMT	Vehicle Miles Traveled
VOC	Volatile Organic Compounds

1 INTRODUCTION

This report presents the results of the air quality impact analysis (AQIA) prepared by Urban Crossroads, Inc., for the Heritage Bluffs Project (referred to as "Project"), which is located south of Carmel Valley Road on Winecreek Road in the City of San Diego

The purpose of this AQIA is to evaluate the potential impacts to air quality associated with construction and operation of the proposed Project, and recommend measures to mitigate impacts considered potentially significant in comparison to established regulatory thresholds.

1.1 PROJECT OVERVIEW

The project site consists of approximately 169.85 acres and includes Assessor Parcel Numbers 312-010-15 and 312-160-02. The property is located in the southeast perimeter properties of the Black Mountain Ranch Subarea. The Subarea Plan designates approximately 43 acres of the property as Low Density Residential (2-5 dwelling units per acre) and the remainder of the site as part of the City's Multiple Habitat Planning Area (MHPA). The Subarea Plan also identifies the property as Areas A and B intended for development of 25 dwelling units and 195 dwelling units respectively, or a total of 220 dwelling units. The Subarea Plan also requires that 35 dwellings of the 220 total dwellings be affordable units.

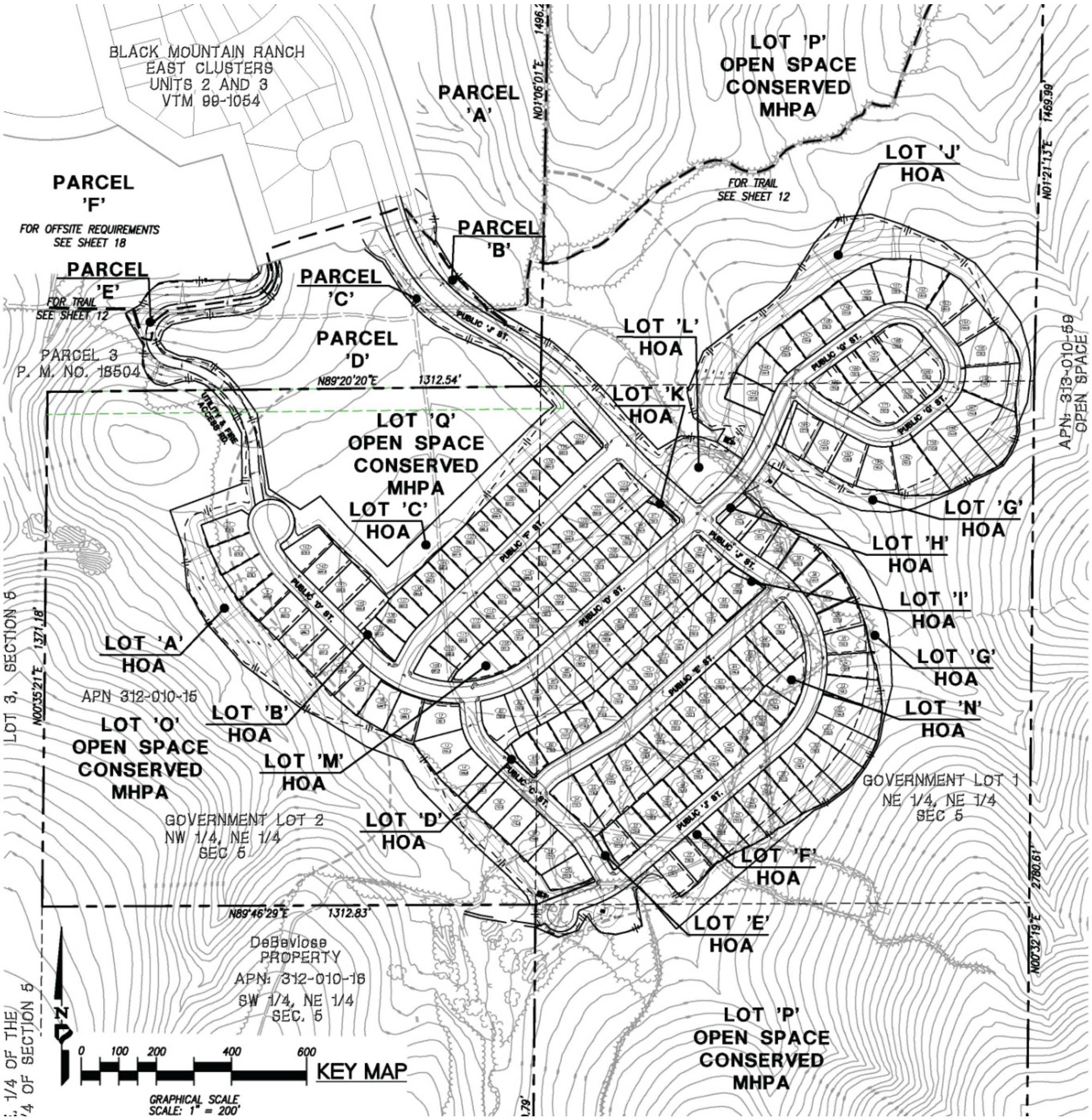
The proposed Heritage Bluffs II project consists of a Vesting Tentative Map, a Planned Development Permit for deviations to underlying zone setback requirements, a Site Development Permit for Environmentally Sensitive Lands, and Re-zonings from AR-1 to RS-1-14 and RX-1-1. In addition, a boundary adjustment to the City's Multiple Habitat Planning Area (MHPA) is required.

On-site the project proposes to develop a total of 171 residential units on approximately 43 acres and includes two different product types as shown on Exhibit 1-A. A total of 119 single-family residential lots are proposed in the 4,500 to 6,000 square-foot range under the RX-1-1 zone and 52 lots are proposed to be in the over 6000 square foot range under the RS-1-14 zone. The balance of the 220 dwellings allocated to the property in the Black Mountain Ranch Subarea Plan will be transferred to the Black Mountain Ranch North Village. This transfer of 49 dwellings to the North Village will include the 35 affordable dwellings required by the Subarea Plan. For the purposes of this AQIA, it is assumed that the Project will be constructed and at full occupancy by 2016.

1.2 EXISTING LAND USES

The Project site is currently vacant, undeveloped and not generating quantifiable emissions.

EXHIBIT 1-A: PRELIMINARY SITE PLAN



1.3 SUMMARY OF FINDINGS

Short-Term Construction

For regional emissions, the Project would not exceed the numerical thresholds of significance established by the San Diego Air Pollution Control District (SDAPCD). Although not required, best available control measures (BACM AQ-1 and BACM AQ-2) are recommended to further reduce potential impacts. A less than significant impact will occur during the Project's construction activity. Additionally, Project construction-source emissions would not conflict with the applicable Regional Air Quality Strategy (RAQS

Established requirements addressing construction equipment operations, and construction material use, storage, and disposal requirements act to minimize odor impacts that may result from construction activities. Moreover, construction-source odor emissions would be temporary, short-term, and intermittent in nature and would not result in persistent impacts that would affect substantial numbers of people. Potential construction-source odor impacts are therefore considered less-than-significant.

Long-Term Operational

For regional emissions, the Project would not exceed the numerical thresholds of significance established by the SDAPCD. Thus a less than significant impact would occur for Project-related operational-source emissions

The proposed Project would not result in a significant CO "hotspot" as a result of Project related traffic during ongoing operations, nor would the Project result in a significant adverse health impact as discussed in Section 3.6, thus a less than significant impact to sensitive receptors during operational activity is expected. Project operational-source emissions would not conflict with the RAQS.

Substantial odor-generating sources include land uses such as agricultural activities, feedlots, wastewater treatment facilities, landfills or various heavy industrial uses. The Project does not propose any such uses or activities that would result in potentially significant operational-source odor impacts. Potential sources of operational odors generated by the Project would disposal of miscellaneous residential refuse. Consistent with the City's requirements, all Project-generated refuse would be stored in covered containers and removed at regular intervals in compliance with solid waste regulations. Potential operational-source odor impacts are therefore considered less-than-significant.

1.4 STANDARD REGULATORY REQUIREMENTS/BEST AVAILABLE CONTROL MEASURES (BACMS)

Measures listed below (or equivalent language) shall appear on all Project grading plans, construction specifications and bid documents, and the City shall ensure such language is incorporated prior to issuance of any development permits. City monitoring of construction activities shall be conducted to ensure mitigation compliance.

SDAPCD Rules that are currently applicable during construction activity for this Project include but are not limited to: Rule 67 (Architectural Coatings) (1); Rule 62 (Low Sulfur Fuels) (2); Rule

55 (Fugitive Dust) (3). In order to facilitate monitoring and compliance, applicable SDAPCD regulatory requirements are summarized below.

BACM AQ-1

The following measures shall be incorporated into Project plans and specifications as implementation of Rule 55 (3):

- The contractor shall ensure that all disturbed unpaved roads and disturbed areas within the Project are watered at least two times daily during dry weather. Watering, with complete coverage of disturbed areas, shall occur at least three times a day, preferably in the mid-morning, afternoon, and after work is done for the day.

1.5 CONSTRUCTION-SOURCE AIR QUALITY IMPACT MITIGATION MEASURES

No significant impacts were identified and no mitigation measures are required

1.6 OPERATIONAL-SOURCE MITIGATION MEASURES

No significant impacts were identified and no mitigation measures are required

2 AIR QUALITY SETTING

This section provides an overview of the existing air quality conditions in the Project area and region.

2.1 SAN DIEGO AIR BASIN

The project site is located in the San Diego Air Basin (SDAB)(4). The SDAB lies in the southwest corner of California and comprises the entire San Diego region. However, population and emissions are concentrated mainly in the western portion of the county. The air basin covers 4,260 square miles, includes about eight percent of the state's population, and produces about seven percent of the state's criteria pollutant emissions. The City of San Diego covers approximately 330 square miles, or eight percent, of the SDAB.

Air quality in the SDAB is impacted not only by local emissions, but also by pollutants transported from other areas, in particular, ozone and ozone precursor emissions transported from the South Coast Air Basin and the Republic of Mexico. Although the impact of transport is particularly important on days with high ozone concentrations, transported pollutants and emissions cannot be blamed entirely for the ozone problem in the San Diego area. Studies show that emissions from the SDAB are sufficient, on their own, to cause ozone violations.

2.2 REGIONAL CLIMATE

The climate of coastal Southern California is determined largely by high pressure that is almost always present off the west coast of North America. High-pressure systems are characterized by an upper layer of dry air that warms as it descends. This warm, dry air acts as a lid, restricting cool air located near the surface creating an inversion of typical temperature conditions.

During the summer and fall, emissions generated in the region combine with abundant sunshine under the influences of topography and an inversion to create conditions that are conducive to the formation of photochemical pollutants, such as ozone, and secondary particulates, such as sulfates and nitrates. As a result, air quality in the SDAB is often the poorest during the warmer summer and fall months.

Average summer high temperatures in the project vicinity are approximately 77 degrees Fahrenheit (˚F). Average winter low temperatures are approximately 50˚F. The average rainfall in the project vicinity is approximately 2 inches annually (5)

2.3 WIND PATTERNS AND PROJECT LOCATION

The interaction of ocean, land, and the Pacific High Pressure Zone maintains clear skies for much of the year and drives the prevailing winds. Local terrain is often the dominant factor inland, and winds in inland mountainous areas tend to blow through the valleys during the day and down the hills and valleys at night.

In conjunction with the two characteristic onshore/offshore wind patterns, there are two types of temperature inversions (reversals of the normal decrease of temperature with height) which occur within the region that affect atmospheric dispersive capability and that act to degrade local air quality. In the summer, an inversion at about 1,100 to 2,500 feet is formed over the entire coastal plain when the warm air mass over land is undercut by a shallow layer of cool marine air flowing offshore. The prevailing sunny days in this region further exacerbate the smog problem by inducing additional adverse photochemical reactions. During the winter, a nightly shallow inversion layer (usually at about 800 feet) forms between the cooled air at the ground and the warmer air above, which can trap vehicular pollutants. The days of highest CO concentrations occur during the winter months.

The predominant onshore/offshore wind pattern is sometimes interrupted by so-called Santa Ana conditions, when high pressure over the Nevada-Utah area overcomes the prevailing westerly winds, sending strong, steady, hot and dry winds from the east over the mountains and out to sea. Strong Santa Ana winds tend to blow pollutants out over the ocean, producing clear days. However, at the onset or breakdown of these conditions or if the Santa Ana is weak, prevailing northwesterly winds reassert themselves and send a cloud of contamination from the Los Angeles Basin ashore in the SDAB.

2.4 EXISTING AIR QUALITY

Existing air quality is measured based upon ambient air quality standards. These standards are the levels of air quality that are considered safe, with an adequate margin of safety, to protect the public health and welfare. National Ambient Air Quality Standards (NAAQS) and California Ambient Air Quality Standards (CAAQS) currently in effect, as well health effects of each pollutant regulated under these standards are shown in Table 2-1 (6)(7).

The determination of whether a region's air quality is healthful or unhealthful is determined by comparing contaminant levels in ambient air samples to the state and federal standards presented in Table 2-1. The air quality in a region is considered to be in attainment by the state if the measured ambient air pollutant levels for O3, CO, SO2, NO2, PM10, and PM2.5 are not equaled or exceeded at any time in any consecutive three-year period; and the federal standards (other than O3, PM10, PM2.5, and those based on annual averages or arithmetic mean) are not exceeded more than once per year. The O3 standard is attained when the fourth highest eight-hour concentration in a year, averaged over three years, is equal to or less than the standard. For PM10, the 24 hour standard is attained when 99 percent of the daily concentrations, averaged over three years, are equal to or less than the standard.

TABLE 2-1: AMBIENT AIR QUALITY STANDARDS

Pollutant	Averaging Time	California Standards [1]		National Standards [2]		
		Concentration [3]	Method [4]	Primary [3,5]	Secondary [3,6]	Method [7]
Ozone (O_3)	1 Hour	0.09 ppm (180 μg/m³)	Ultraviolet Photometry	—	Same as Primary Standard	Ultraviolet Photometry
	8 Hour	0.070 ppm (137 μg/m³)		0.075 ppm (147 μg/m³)		
Respirable Particulate Matter (PM10)[8]	24 Hour	50 μg/m³	Gravimetric or Beta Attenuation	150 μg/m³	Same as Primary Standard	Inertial Separation and Gravimetric Analysis
	Annual Arithmetic Mean	20 μg/m³		—		
Fine Particulate Matter (PM2.5)[8]	24 Hour	—	—	35 μg/m³	Same as Primary Standard	Inertial Separation and Gravimetric Analysis
	Annual Arithmetic Mean	12 μg/m³	Gravimetric or Beta Attenuation	12.0 μg/m³	15 μg/m³	
Carbon Monoxide (CO)	1 Hour	20 ppm (23 mg/m³)	Non-Dispersive Infrared Photometry (NDIR)	35 ppm (40 mg/m³)	—	Non-Dispersive Infrared Photometry (NDIR)
	8 Hour	9.0 ppm (10 mg/m³)		9 ppm (10 mg/m³)	—	
	8 Hour (Lake Tahoe)	6 ppm (7 mg/m³)		—	—	
Nitrogen Dioxide (NO_2)[9]	1 Hour	0.18 ppm (339 μg/m³)	Gas Phase Chemiluminescence	100 ppb (188 μg/m³)	—	Gas Phase Chemiluminescence
	Annual Arithmetic Mean	0.030 ppm (57 μg/m³)		0.053 ppm (100 μg/m³)	Same as Primary Standard	
Sulfur Dioxide (SO_2)[10]	1 Hour	0.25 ppm (655 μg/m³)	Ultraviolet Fluorescence	75 ppb (196 μg/m³)	—	Ultraviolet Flourescence; Spectrophotometry (Pararosaniline Method)
	3 Hour	—		—	0.5 ppm (1300 μg/m³)	
	24 Hour	0.04 ppm (105 μg/m³)		0.14 ppm (for certain areas)[10]	—	
	Annual Arithmetic Mean	—		0.030 ppm (for certain areas)[10]	—	
Lead[11,12]	30 Day Average	1.5 μg/m³	Atomic Absorption	—	—	High Volume Sampler and Atomic Absorption
	Calendar Quarter	—		1.5 μg/m³ (for certain areas)[12]	Same as Primary Standard	
	Rolling 3-Month Average	—		0.15 μg/m³		
Visibility Reducing Particles[13]	8 Hour	See footnote 13	Beta Attenuation and Transmittance through Filter Tape	No National Standards		
Sulfates	24 Hour	25 μg/m³	Ion Chromatography			
Hydrogen Sulfide	1 Hour	0.03 ppm (42 μg/m³)	Ultraviolet Fluorescence			
Vinyl Chloride[11]	24 Hour	0.01 ppm (26 μg/m³)	Gas Chromatography			

See footnotes at: http://www.arb.ca.gov/research/aaqs/aaqs2.pdf

For more information please call ARB-PIO at (916) 322-2990 **California Air Resources Board (6/4/13)**

2.5 REGIONAL AIR QUALITY

SDAPCD monitors levels of various criteria pollutants at monitoring stations throughout the air district. In 2012, the federal and state ambient air quality standards (NAAQS and CAAQS) were exceeded on one or more days for ozone, PM10, and PM2.5 at most monitoring locations (8). No areas of the SCAB exceeded federal or state standards for NO2, SO2, CO, sulfates or lead. See Table 2-2 for attainment designations for the SCAB (9).

2.6 LOCAL AIR QUALITY

Relative to the Project site, the nearest long-term air quality monitoring site for Ozone (O_3), is the San Diego County Air Pollution Control District Del Mar – Winston School monitoring station, located approximately 9.71 miles southwest of the Project site in Del Mar (10). Relative to the Project site, the nearest long-term air quality monitoring site for Carbon Monoxide (CO), Nitrogen Dioxide (NO_2), Inhalable Particulates (PM_{10}), and Ultra-Fine Particulates ($PM_{2.5}$) is the San Diego County Air Pollution Control District Escondido – E. Valley Parkway monitoring station, located approximately 8.86 miles northeast of the Project site in Escondido.

The most recent three (3) years of data available is shown on Table 2-3 and identifies the number of days ambient air quality standards were exceeded for the study area, which is was considered to be representative of the local air quality at the Project site (8) (11). Additionally, data for SO2 has been omitted as attainment is regularly met in the San Diego Air Basin and few monitoring stations measure SO2 concentrations.

Criteria pollutants are pollutants that are regulated through the development of human health based and/or environmentally based criteria for setting permissible levels. Criteria pollutants, their typical sources, and effects are identified below:

- Carbon Monoxide (CO): Is a colorless, odorless gas produced by the incomplete combustion of carbon-containing fuels, such as gasoline or wood. CO concentrations tend to be the highest during the winter morning, when little to no wind and surface-based inversions trap the pollutant at ground levels. Because CO is emitted directly from internal combustion engines, unlike ozone, motor vehicles operating at slow speeds are the primary source of CO in the Basin. The highest ambient CO concentrations are generally found near congested transportation corridors and intersections.
- Sulfur Dioxide (SO2): Is a colorless, extremely irritating gas or liquid. It enters the atmosphere as a pollutant mainly as a result of burning high sulfur-content fuel oils and coal and from chemical processes occurring at chemical plants and refineries. When SO2 oxidizes in the atmosphere, it forms sulfates (SO4). Collectively, these pollutants are referred to as sulfur oxides (SOX).

  Nitrogen Oxides (Oxides of Nitrogen, or NOx): Nitrogen oxides (NOx) consist of nitric oxide (NO), nitrogen dioxide (NO2) and nitrous oxide (N2O) and are formed when nitrogen (N2) combines with oxygen (O2). Their lifespan in the atmosphere ranges from one to seven days for nitric oxide and nitrogen dioxide, to 170 years for nitrous oxide. Nitrogen oxides are typically created during combustion processes, and are major contributors to smog formation and acid deposition. NO2 is a criteria air pollutant, and may result in numerous adverse health effects; it absorbs blue light, resulting in a brownish-red cast to the atmosphere and reduced visibility. Of the seven types of nitrogen oxide compounds, NO2 is the most abundant in the atmosphere. As ambient concentrations of NO_2 are related to traffic density, commuters in heavy traffic may be exposed to higher concentrations of NO_2 than those indicated by regional monitors.

- Ozone (O_3): Is a highly reactive and unstable gas that is formed when volatile organic compounds (VOCs) and nitrogen oxides (NO_X), both byproducts of internal combustion engine exhaust, undergo slow photochemical reactions in the presence of sunlight. Ozone concentrations are generally highest during the summer months when direct sunlight, light wind, and warm temperature conditions are favorable to the formation of this pollutant.
- PM_{10} (Particulate Matter less than 10 microns): A major air pollutant consisting of tiny solid or liquid particles of soot, dust, smoke, fumes, and aerosols. The size of the particles (10 microns or smaller, about 0.0004 inches or less) allows them to easily enter the lungs where they may be deposited, resulting in adverse health effects. PM_{10} also causes visibility reduction and is a criteria air pollutant.
- $PM_{2.5}$ (Particulate Matter less than 2.5 microns): A similar air pollutant consisting of tiny solid or liquid particles which are 2.5 microns or smaller (which is often referred to as fine particles). These particles are formed in the atmosphere from primary gaseous emissions that include sulfates formed from SO_2 release from power plants and industrial facilities and nitrates that are formed from NO_X release from power plants, automobiles and other types of combustion sources. The chemical composition of fine particles highly depends on location, time of year, and weather conditions. $PM_{2.5}$ is a criteria air pollutant.
- Volatile Organic Compounds (VOC): Volatile organic compounds are hydrocarbon compounds (any compound containing various combinations of hydrogen and carbon atoms) that exist in the ambient air. VOCs contribute to the formation of smog through atmospheric photochemical reactions and/or may be toxic. Compounds of carbon (also known as organic compounds) have different levels of reactivity; that is, they do not react at the same speed or do not form ozone to the same extent when exposed to photochemical processes. VOCs often have an odor, and some examples include gasoline, alcohol, and the solvents used in paints. Exceptions to the VOC designation include: carbon monoxide, carbon dioxide, carbonic acid, metallic carbides or carbonates, and ammonium carbonate. VOCs are a criteria pollutant since they are a precursor to O_3, which is a criteria pollutant. The SDAPCD uses the terms VOC and ROG (see below) interchangeably.
- Reactive Organic Gases (ROG): Similar to VOC, Reactive Organic Gases (ROG) are also precursors in forming ozone and consist of compounds containing methane, ethane, propane, butane, and longer chain hydrocarbons, which are typically the result of some type of combustion/decomposition process. Smog is formed when ROG and nitrogen oxides react in the presence of sunlight. ROGs are a criteria pollutant since they are a precursor to O_3, which is a criteria pollutant. The SDAPCD uses the terms ROG and VOC (see previous) interchangeably.
- Lead (Pb): Lead is a heavy metal that is highly persistent in the environment. In the past, the primary source of lead in the air was emissions from vehicles burning leaded gasoline. As a result of the removal of lead from gasoline, emissions of lead are largely limited to stationary sources such as lead smelters. It should be noted that the Project is not anticipated to generate a quantifiable amount of lead emissions. Lead is a criteria air pollutant.

TABLE 2-2: ATTAINMENT STATUS OF CRITERIA POLLUTANTS IN THE SAN DIEGO AIR BASIN (SDAB)

Criteria Pollutant	State Designation	Federal Designation
Ozone - 1hour standard	Nonattainment	Attainment
Ozone - 8 hour standard	Nonattainment	Nonattainment
PM_{10}	Nonattainment	Unclassified
Carbon Monoxide	Attainment	Attainment
Nitrogen Dioxide	Attainment	Attainment
Sulfur Dioxide	Attainment	Attainment
Sulfates	Attainment	No Federal Standard
Hydrogen Sulfide	Unclassified	No Federal Standard
Lead	Attainment	Attainment
Visibility	Unclassified	No Federal Standard

TABLE 2-3: PROJECT AREA AIR QUALITY MONITORING SUMMARY 2010-2012

POLLUTANT	STANDARD	YEAR		
		2010	2011	2012
Ozone (O_3)				
Maximum 1-Hour Concentration (ppm)		0.085	0.080	0.080
Maximum 8-Hour Concentration (ppm)		0.072	0.074	0.079
Number of Days Exceeding State 1-Hour Standard	> 0.09 ppm	0	0	0
Number of Days Exceeding State 8-Hour Standard	> 0.07 ppm	2	1	2
Number of Days Exceeding Federal 1-Hour Standard	> 0.12 ppm	0	0	0
Number of Days Exceeding Federal 8-Hour Standard	> 0.075 ppm	0	0	2
Number of Days Exceeding Health Advisory	≥ 0.15 ppm	0	0	0
Carbon Monoxide (CO)				
Maximum 1-Hour Concentration (ppm)		3.9	3.5	4.4
Maximum 8-Hour Concentration (ppm)		2.5	2.3	3.8
Number of Days Exceeding State 1-Hour Standard	> 20 ppm	0	0	0
Number of Days Exceeding Federal / State 8-Hour Standard	> 9.0 ppm	0	0	0
Number of Days Exceeding Federal 1-Hour Standard	> 35 ppm	0	0	0
Nitrogen Dioxide (NO_2)				
Maximum 1-Hour Concentration (ppm)		0.064	.052	0.062
Annual Arithmetic Mean Concentration (ppm)		--	--	--
Number of Days Exceeding State 1-Hour Standard	> 0.18 ppm	0	0	0
Particulate Matter ≤ 10 Microns (PM10)				
Maximum 24-Hour Concentration (μg/m3)		43	40	33
Number of Samples		59	60	60
Number of Samples Exceeding State Standard	> 50 μg/m3	0	0	0
Number of Samples Exceeding Federal Standard	> 150 μg/m3	0	0	0
Particulate Matter ≤ 2.5 Microns (PM2.5)				
Maximum 24-Hour Concentration (μg/m3)		48.4	69.8	70.7
Annual Arithmetic Mean (μg/m3)		12.7	13.2	10.8
Number of Samples Exceeding Federal 24-Hour Standard	> 35 μg/m3	2	3	1

Source: http://www.epa.gov/airdata/
http://www.arb.ca.gov/adam/select8/sc8start.php

Health Effects of Air Pollutants

Ozone

Individuals exercising outdoors, children, and people with preexisting lung disease, such as asthma and chronic pulmonary lung disease, are considered to be the most susceptible sub-groups for ozone effects. Short-term exposure (lasting for a few hours) to ozone at levels typically observed in Southern California can result in breathing pattern changes, reduction of breathing capacity, increased susceptibility to infections, inflammation of the lung tissue, and some immunological changes. Elevated ozone levels are associated with increased school absences. In recent years, a correlation between elevated ambient ozone levels and increases in daily hospital admission rates, as well as mortality, has also been reported. An increased risk for asthma has been found in children who participate in multiple sports and live in communities with high ozone levels.

Ozone exposure under exercising conditions is known to increase the severity of the responses described above. Animal studies suggest that exposure to a combination of pollutants that includes ozone may be more toxic than exposure to ozone alone. Although lung volume and resistance changes observed after a single exposure diminish with repeated exposures, biochemical and cellular changes appear to persist, which can lead to subsequent lung structural changes.

Carbon Monoxide

Individuals with a deficient blood supply to the heart are the most susceptible to the adverse effects of CO exposure. The effects observed include earlier onset of chest pain with exercise, and electrocardiograph changes indicative of decreased oxygen supply to the heart. Inhaled CO has no direct toxic effect on the lungs, but exerts its effect on tissues by interfering with oxygen transport and competing with oxygen to combine with hemoglobin present in the blood to form carboxyhemoglobin (COHb). Hence, conditions with an increased demand for oxygen supply can be adversely affected by exposure to CO. Individuals most at risk include fetuses, patients with diseases involving heart and blood vessels, and patients with chronic hypoxemia (oxygen deficiency) as seen at high altitudes.

Reduction in birth weight and impaired neurobehavioral development have been observed in animals chronically exposed to CO, resulting in COHb levels similar to those observed in smokers. Recent studies have found increased risks for adverse birth outcomes with exposure to elevated CO levels; these include pre-term births and heart abnormalities.

Particulate Matter

A consistent correlation between elevated ambient fine particulate matter (PM10 and PM2.5) levels and an increase in mortality rates, respiratory infections, number and severity of asthma attacks and the number of hospital admissions has been observed in different parts of the United States and various areas around the world. In recent years, some studies have reported an association between long-term exposure to air pollution dominated by fine particles and increased mortality, reduction in life-span, and an increased mortality from lung cancer.

Daily fluctuations in PM2.5 concentration levels have also been related to hospital admissions for acute respiratory conditions in children, to school and kindergarten absences, to a decrease in respiratory lung volumes in normal children, and to increased medication use in children and adults with asthma. Recent studies show lung function growth in children is reduced with longterm exposure to particulate matter.

The elderly, people with pre-existing respiratory or cardiovascular disease, and children appear to be more susceptible to the effects of high levels of PM10 and PM2.5.

Nitrogen Dioxide

Population-based studies suggest that an increase in acute respiratory illness, including infections and respiratory symptoms in children (not infants), is associated with long-term exposure to NO2 at levels found in homes with gas stoves, which are higher than ambient levels found in Southern California. Increase in resistance to air flow and airway contraction is observed after short-term exposure to NO2 in healthy subjects. Larger decreases in lung functions are observed in individuals with asthma or chronic obstructive pulmonary disease (e.g., chronic bronchitis, emphysema) than in healthy individuals, indicating a greater susceptibility of these sub-groups.

In animals, exposure to levels of NO2 considerably higher than ambient concentrations results in increased susceptibility to infections, possibly due to the observed changes in cells involved in maintaining immune functions. The severity of lung tissue damage associated with high levels of ozone exposure increases when animals are exposed to a combination of ozone and NO2.

Sulfur Dioxide

A few minutes of exposure to low levels of SO2 can result in airway constriction in some asthmatics, all of whom are sensitive to its effects. In asthmatics, increase in resistance to air flow, as well as reduction in breathing capacity leading to severe breathing difficulties, are observed after acute exposure to SO2. In contrast, healthy individuals do not exhibit similar acute responses even after exposure to higher concentrations of SO2.

Animal studies suggest that despite SO2 being a respiratory irritant, it does not cause substantial lung injury at ambient concentrations. However, very high levels of exposure can cause lung edema (fluid accumulation), lung tissue damage, and sloughing off of cells lining the respiratory tract.

Some population-based studies indicate that the mortality and morbidity effects associated with fine particles show a similar association with ambient SO2 levels. In these studies, efforts to separate the effects of SO2 from those of fine particles have not been successful. It is not clear whether the two pollutants act synergistically or one pollutant alone is the predominant factor.

Lead

Fetuses, infants, and children are more sensitive than others to the adverse effects of Pb exposure. Exposure to low levels of Pb can adversely affect the development and function of the central nervous system, leading to learning disorders, distractibility, inability to follow simple commands, and lower intelligence quotient. In adults, increased Pb levels are associated with increased blood pressure.

Pb poisoning can cause anemia, lethargy, seizures, and death; although it appears that there are no direct effects of Pb on the respiratory system. Pb can be stored in the bone from early age environmental exposure, and elevated blood Pb levels can occur due to breakdown of bone tissue during pregnancy, hyperthyroidism (increased secretion of hormones from the thyroid gland) and osteoporosis (breakdown of bony tissue). Fetuses and breast-fed babies can be exposed to higher levels of Pb because of previous environmental Pb exposure of their mothers.

Odors

The science of odor as a health concern is still new. Merely identifying the hundreds of VOCs that cause odors poses a big challenge. Offensive odors can potentially affect human health in several ways. First, odorant compounds can irritate the eye, nose, and throat, which can reduce respiratory volume. Second, studies have shown that the VOCs that cause odors can stimulate sensory nerves to cause neurochemical changes that might influence health, for instance, by compromising the immune system. Finally, unpleasant odors can trigger memories or attitudes linked to unpleasant odors, causing cognitive and emotional effects such as stress.

2.7 REGULATORY BACKGROUND

2.7.1 FEDERAL REGULATIONS

The U.S. EPA is responsible for setting and enforcing the NAAQS for O3, CO, NOx, SO2, PM10, and lead (6). The U.S. EPA has jurisdiction over emissions sources that are under the authority of the federal government including aircraft, locomotives, and emissions sources outside state waters (Outer Continental Shelf). The U.S. EPA also establishes emission standards for vehicles sold in states other than California. Automobiles sold in California must meet the stricter emission requirements of the CARB.

The Federal Clean Air Act (CAA) was first enacted in 1955, and has been amended numerous times in subsequent years (1963, 1965, 1967, 1970, 1977, and 1990). The CAA establishes the federal air quality standards, the NAAQS, and specifies future dates for achieving compliance (12). The CAA also mandates that states submit and implement State Implementation Plans (SIPs) for local areas not meeting these standards. These plans must include pollution control measures that demonstrate how the standards will be met.

The 1990 amendments to the CAA that identify specific emission reduction goals for areas not meeting the NAAQS require a demonstration of reasonable further progress toward attainment and incorporate additional sanctions for failure to attain or to meet interim milestones. The sections of the CAA most directly applicable to the development of the Project site include Title I (Non-Attainment Provisions) and Title II (Mobile Source Provisions). Title I provisions were established with the goal of attaining the NAAQS for the following criteria pollutants O3, NO2, SO2, PM10, CO, PM2.5, and lead. The NAAQS were amended in July 1997 to include an additional standard for O3 and to adopt a NAAQS for PM2.5. Table 3-1 (previously presented) provides the NAAQS within the basin.

Mobile source emissions are regulated in accordance with Title II provisions. These provisions require the use of cleaner burning gasoline and other cleaner burning fuels such as methanol and natural gas. Automobile manufacturers are also required to reduce tailpipe emissions of hydrocarbons and nitrogen oxides (NOx). NOx is a collective term that includes all forms of nitrogen oxides (NO, NO2, NO3) which are emitted as byproducts of the combustion process.

2.7.2 California Regulations

The CARB, which became part of the California EPA in 1991, is responsible for ensuring implementation of the California Clean Air Act (AB 2595), responding to the federal CAA, and for regulating emissions from consumer products and motor vehicles. The California CAA mandates achievement of the maximum degree of emissions reductions possible from vehicular and other mobile sources in order to attain the state ambient air quality standards by the earliest practical date. The CARB established the CAAQS for all pollutants for which the federal government has NAAQS and, in addition, establishes standards for sulfates, visibility, hydrogen sulfide, and vinyl chloride. However at this time, hydrogen sulfide and vinyl chloride are not measured at any monitoring stations in the SCAB because they are not considered to be a regional air quality problem. Generally, the CAAQS are more stringent than the NAAQS (7)(6).

Local air quality management districts, such as the SDAPCD, regulate air emissions from commercial and light industrial facilities. All air pollution control districts have been formally designated as attainment or non-attainment for each CAAQS.

Serious non-attainment areas are required to prepare air quality management plans that include specified emission reduction strategies in an effort to meet clean air goals. These plans are required to include:

- Application of Best Available Retrofit Control Technology to existing sources;
- Developing control programs for area sources (e.g., architectural coatings and solvents) and indirect sources (e.g. motor vehicle use generated by residential and commercial development);
- A District permitting system designed to allow no net increase in emissions from any new or modified permitted sources of emissions;
- Implementing reasonably available transportation control measures and assuring a substantial reduction in growth rate of vehicle trips and miles traveled;
- Significant use of low emissions vehicles by fleet operators;
- Sufficient control strategies to achieve a five percent or more annual reduction in emissions or 15 percent or more in a period of three years for ROGs, NOx, CO and PM10. However, air basins may use alternative emission reduction strategy that achieves a reduction of less than five percent per year under certain circumstances.

2.7.3 Air Quality Management Planning

The SDAPCD and the San Diego Association of Governments (SANDAG) are responsible for developing and implementing the clean air plan for attainment and maintenance of the ambient air quality standards in the SDAB. The San Diego County Regional Air Quality Strategy (RAQS) was initially adopted in 1991, and is updated on a triennial basis. The RAQS was updated in 1995, 1998, 2001, 2004 and most recently in 2009 (13). The RAQS outlines the APCD's plans and control measures designed to attain the state air quality standard for O_3 . The SDAPCD has also developed the air basin's input to the SIP, which is required under the Federal Clean Air Act for areas that are out of attainment of air quality standards. The SIP includes the APCD's plans and control measures for attaining the O_3 NAAQS.

The RAQS relies on information from CARB and SANDAG, including mobile and area source emissions, as well as information regarding projected growth in the County in order to project future emissions and then determine from the results strategies that may be necessary for the reduction of emissions through regulatory controls. The ARB mobile source emission projections and SANDAG growth projections are based on population and vehicle trends and land use plans developed by the cities and by the County as part of the development of the County's General Plan. As such, projects that propose development that is consistent with the growth anticipated by the General Plans would be consistent with the RAQS. In the event that a project would propose a development that is less dense than that associated with the General Plan, the project would likewise be consistent with the RAQS. If a project, however, proposes a development that is denser than that assumed in the general plan, and SANDAG's growth projections, the project may be in conflict with the RAQS and SIP, and could therefore result in a significant impact on air quality.

The proposed Heritage Bluffs project is consistent with the Black Mountain Ranch Subarea and would be consistent with the growth, goals, and objectives of the RAQS and SIP, impacts to the implementation of the air quality plan would thus be less than significant.

The SIP relies on the same information from SANDAG to develop emission inventories and emission reduction strategies that are included in the attainment demonstration for the air basin. The SIP also includes rules and regulations that have been adopted by the APCD to control emissions from stationary sources. These SIP-approved rules may be used as a guideline to determine whether a project's emissions would have the potential to conflict with the SIP and subsequently hinder attainment of the NAAQS for O_3.

2.8 EXISTING PROJECT SITE AIR QUALITY CONDITIONS

The Project site is currently vacant, and therefore does not generate quantifiable emissions. Existing air quality conditions at the Project site would generally reflect ambient monitored conditions as presented previously at Table 2-3.

3 PROJECT AIR QUALITY IMPACT

3.1 INTRODUCTION

The Project has been evaluated to determine if it will violate an air quality standard or contribute to an existing or projected air quality violation. Additionally, the Project has been evaluated to determine if it will result in a cumulatively considerable net increase of a criteria pollutant for which the SCAB is non-attainment under an applicable federal or state ambient air quality standard. The significance of these potential impacts is described in the following section.

3.2 STANDARDS OF SIGNIFICANCE

The City of San Diego has approved thresholds of significance based on appendix G of the CEQA Guidelines. The City of San Diego published the document *California Environmental Quality Act Significance Determination Thresholds Development Services Department*(14), the document provides guidance on determining project-related air quality impacts. The guidance states that a project would have a significant air quality impact if it would result in:

1. A conflict with or obstruct implementation of the applicable air quality plan [San Diego Regional Air Quality Strategy (RAQS) or applicable portions of the State Implementation Plan (SIP)];
2. A violation of any air quality standard or contribute substantially to an existing or projected air quality violation;
3. Exposing sensitive receptors to substantial pollutant concentrations;
4. Create objectionable odors affecting a substantial number of people;
5. Exceeding 100 pounds per day of particulate matter (PM) (dust); or
6. Substantial alteration of air movement in the area of the project.

The following are the significance criteria SDAPCD and the City of San Diego have established to determine project impacts.

Construction Phase Significance Criteria

The proposed project would have a significant impact if:

- Daily construction emissions were to exceed construction emissions thresholds for VOC,
- NO_X, CO, SO_X, $PM_{2.5}$, PM_{10}. Significance thresholds for construction activities appear in Table 3-1;
- The proposed project would generate excessive emissions of TACs; or
- The proposed project would create objectionable odors affecting a substantial number of people.

Operations Phase Significance Criteria

The proposed project would have a significant impact if:

- Daily operational emissions were to exceed operational emissions thresholds for VOC, NO_X, CO, SO_X, $PM_{2.5}$, or PM_{10}. Significance thresholds for operational emissions appear in Table 3-1;
- Project-related traffic causes CO concentrations at study intersections to violate the CAAQS for either the one- or eight-hour period. The CAAQS for the one- and eight-hour periods are 20 ppm and 9.0 ppm, respectively;
- The proposed project would generate excess emissions of TACs;
- The proposed project would create objectionable odors affecting a substantial number of people; or
- The proposed project would conflict with or obstruct implementation of the Regional Air Quality Strategy.

TABLE 3-1: MAXIMUM DAILY EMISSIONS REGIONAL THRESHOLDS

Pollutant	Construction/Operations
NOx	250 lbs/day
VOC[a]	137 lbs/day
PM10	100 lbs/day
PM2.5[a]	55 lbs/day
SO_x[b]	250 lbs/day
CO	550 lbs/day
Lead	3.2 lbs/day

[a] The SDAPCD does not have a significance threshold for PM2.5. The PM2.5 threshold used in this analysis was obtained from the South Coast Air Quality Management District's Methodology to Calculate Particulate Matter (PM) 2.5 and PM 2.5 Significance Thresholds

[b] San Diego Air basin has been in attainment of SO_x standard due to sulfur-free natural gas for electricity generation and lack of heavy industrial/manufacturing uses in the region.

3.3 PROJECT-RELATED SOURCES OF POTENTIAL IMPACT

Land uses such as the Project affect air quality through construction-source and operational-source emissions.

On October 2, 2013, the SCAQMD in conjunction with the California Air Pollution Control Officers Association (CAPCOA) released the latest version of the California Emissions Estimator Model™ (CalEEMod™) v2013.2.2. The purpose of this model is to calculate construction-source and operational-source criteria pollutant (NO_x, VOC, PM_{10}, $PM_{2.5}$, SO_x, and CO) and greenhouse gas (GHG) emissions from direct and indirect sources; and quantify applicable air quality and GHG reductions achieved from mitigation measures (15). Accordingly, the latest version of CalEEMod™ has been used for this Project to determine construction and operational air quality emissions. Output from the model runs for both construction and operational activity are provided in Appendix 3.1.

3.4 CONSTRUCTION EMISSIONS

Construction activities associated with the Project will result in emissions of CO, VOCs, NOx, SOx, PM10, and PM2.5. Construction related emissions are expected from the following construction activities:

- Site Preparation
- Grading
- Building Construction
- Paving
- Painting (Architectural Coatings)
- Construction Workers Commuting

Construction is expected to commence in 2015 and will last through 2016, Table 3-2 shows the number of working days for each phase of construction activity. The duration of construction activity and associated equipment represents a reasonable approximation of the expected construction fleet as required per CEQA guidelines. Site specific construction fleet may vary due to specific project needs at the time of construction. The associated construction equipment was estimated based on the CalEEMod defaults and projects of similar size. Please refer to specific detailed modeling inputs/outputs contained in Appendix 3.1 of this Analysis. A detailed summary of construction equipment assumptions by phase is provided at Table 3-3. It should be noted that the emissions estimates provided at Table 3-3 represent a "worst-case" (i.e. overestimation) of actual emissions that will likely occur.

Dust is typically a major concern during rough grading activities. Because such emissions are not amenable to collection and discharge through a controlled source, they are called "fugitive emissions". Fugitive dust emissions rates vary as a function of many parameters (soil silt, soil moisture, wind speed, area disturbed, number of vehicles, depth of disturbance or excavation, etc.). The CalEEMod model was utilized to calculate fugitive dust emissions resulting from this phase of activity.

Construction emissions for construction worker vehicles traveling to and from the Project site, as well as vendor trips (construction materials delivered to the Project site) were estimated based on information CalEEMod model defaults.

TABLE 3-2: CONSTRUCTION DURATION

Phase	Duration (working days)
Site Preparation	40
Grading	30
Building Construction	300
Paving	30
Architectural Coatings	285

TABLE 3-3: CONSTRUCTION EQUIPMENT ASSUMPTIONS

Activity	Equipment	Number	Hours Per Day
Site Preparation	Rubber Tired Dozers	3	8
	Tractors/Loaders/Backhoes	4	8
Grading	Excavators	2	8
	Graders	2	8
	Water Trucks	1	8
	Rubber Tired Dozers	2	8
	Scrapers	4	8
	Tractors/Loaders/Backhoes	2	8
Building Construction	Cranes	1	8
	Forklifts	3	8
	Generator Sets	1	8
	Tractors/Loaders/Backhoes	3	8
	Welders	1	8
Paving	Pavers	2	8
	Paving Equipment	2	8
	Rollers	2	8
Architectural Coatings	Air Compressors	1	8

3.4.1 CONSTRUCTION EMISSIONS SUMMARY

The estimated maximum daily construction emissions are summarized on Table 3-4. Detailed construction model outputs are presented in Appendix 3.1. Under the assumed scenarios, emissions resulting from the Project construction will not exceed any criteria pollutant thresholds established by the SDAPCD.

TABLE 3-4: EMISSIONS SUMMARY OF OVERALL CONSTRUCTION (WITHOUT BACMS)

Year	VOC	NOx	CO	SOx	PM10	PM2.5
2015	78.71	150.40	94.75	0.12	24.58	13.67
2016	74.91	43.93	48.22	0.08	5.49	3.18
Maximum Daily Emissions	**78.71**	**150.40**	**94.75**	**0.12**	**24.58**	**13.67**
SDAPCD Regional Threshold	137	250	550	250	100	55
Threshold Exceeded?	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**

3.5 OPERATIONAL EMISSIONS

Operational activities associated with the proposed Project will result in emissions of ROG, NOX, CO, SOX, PM10, and PM2.5. Operational emissions would be expected from the following primary sources:

- Vehicles
- Fugitive dust related to vehicular travel
- Combustion Emissions Associated with Natural Gas and Electricity
- Landscape maintenance equipment
- Emissions from consumer products
- Architectural coatings

3.5.1 VEHICLES

Project operational (vehicular) impacts are dependent on both overall daily vehicle trip generation and the effect of the Project on peak hour traffic volumes and traffic operations in the vicinity of the Project. The Project related operational air quality impacts derive primarily from vehicle trips generated by the Project. Trip characteristics available from the report, Heritage Bluffs Traffic Impact Analysis (LLG Engineers) were utilized in this analysis (16). A mix consistent with the Caltrans ITS Transportation Project-Level Carbon Monoxide Protocol was used as shown in Table 3-5 (17)

TABLE 3-5: PROJECT FLEET MIX

Vehicle Type	Fleet Mix %
Light Duty Autos	69 %
Light Duty Trucks	19.4 %
Medium Duty Trucks	6.4 %
Heavy Duty Trucks	4.7 %
Motorcycles	0.5 %

3.5.2 FUGITIVE DUST RELATED TO VEHICULAR TRAVEL

Vehicles traveling on paved roads would be a source of fugitive emissions due to the generation of road dust inclusive of tire wear particulates. The emissions estimates for travel on paved roads were calculated using the CalEEMod model.

3.5.3 COMBUSTION EMISSIONS ASSOCIATED WITH NATURAL GAS AND ELECTRICITY

Electricity and natural gas are used by almost every project. Criteria pollutant emissions are emitted through the generation of electricity and consumption of natural gas. However, because electrical generating facilities for the Project area are located either outside the region (state) or offset through the use of pollution credits (RECLAIM) for generation within the SCAB, criteria pollutant emissions from offsite generation of electricity is generally excluded from the evaluation of significance and only natural gas use is considered. The emissions associated with natural gas use were calculated using the CalEEMod model.

3.5.4 LANDSCAPE MAINTENANCE EQUIPMENT

Landscape maintenance equipment would generate emissions from fuel combustion and evaporation of unburned fuel. Equipment in this category would include lawnmowers, shedders/grinders, blowers, trimmers, chain saws, and hedge trimmers used to maintain the landscaping of the Project. The emissions associated with landscape maintenance equipment were calculated based on assumptions provided in the CalEEMod model.

3.5.5 CONSUMER PRODUCTS

Consumer projects include, but are not limited to detergents, cleaning compounds, polishes, personal care products, and lawn and garden products. Many of these products contain organic compounds which when released in the atmosphere can react to form ozone and other photochemically reactive pollutants. The emissions associated with use of consumer products were calculated based on assumptions provided in the CalEEMod model.

3.5.6 ARCHITECTURAL COATINGS

Over a period of time the buildings that are part of this Project will be subject to emissions resulting from the evaporation of solvents contained in paints, varnishes, primers, and other surface coatings as part of Project maintenance. The emissions associated with architectural coatings were calculated using the CalEEMod model.

3.5.7 OPERATIONAL EMISSIONS SUMMARY

Impacts Without Mitigation

Operational-source emissions without implementation of mitigation measures are summarized on Table 3-6. Prior to implementation of appropriate mitigation measures, Project operational-source emissions would not exceed applicable SDAPCD regional thresholds of significance. Therefore, a less than significant impact would without the application of appropriate mitigation measures.

TABLE 3-6: SUMMARY OF PEAK OPERATIONAL EMISSIONS (WITHOUT MITIGATION)

Operational Activities – Summer Emissions	VOC	NO_x	CO	SO_x	PM_{10}	$PM_{2.5}$
Area Source Emissions	21.90	0.17	14.32	7.50e-4	0.31	0.30
Energy Source Emissions	0.17	1.46	0.62	9.31e-3	0.12	0.12
Mobile Emissions	12.09	38.55	124.62	0.26	18.42	5.33
Maximum Daily Emissions	**34.16**	**40.17**	**139.57**	**0.27**	**18.85**	**5.76**
SDAPCD Regional Threshold	137	250	550	250	100	55
Threshold Exceeded?	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**

Operational Activities – Winter Emissions	VOC	NO_x	CO	SO_x	PM_{10}	$PM_{2.5}$
Area Source Emissions	21.90	0.17	14.32	7.50e-4	0.31	0.30
Energy Source Emissions	0.17	1.46	0.62	9.31e-3	0.12	0.12
Mobile Emissions	13.08	40.20	136.47	0.25	18.43	5.34
Maximum Daily Emissions	**35.15**	**41.83**	**151.41**	**0.26**	**18.85**	**5.76**
SDAPCD Regional Threshold	137	250	550	250	100	55
Threshold Exceeded?	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**

3.6 CO "HOT SPOT" ANALYSIS

Air pollutant emissions related to project traffic have the potential to create new, or worsen existing, localized air quality. A CO impact analysis is required to assess the localized CO impacts on sensitive receptors that are situated adjacent to congested roadways and intersections.

It has long been recognized that adverse localized CO concentrations ("hot spots") are caused by vehicular emissions, primarily when idling at congested intersections. In response, vehicle emissions standards have become increasingly stringent in the last twenty years. Currently, the allowable CO emissions standard in California is a maximum of 3.4 grams/mile for passenger cars (there are requirements for certain vehicles that are more stringent). With the turnover of older vehicles, introduction of cleaner fuels, and implementation of increasingly sophisticated and efficient emissions control technologies, CO concentrations in the Project vicinity have steadily declined.

CO emissions are the result of the combustion process and therefore primarily associated with mobile source emissions (vehicles). CO concentrations tend to be higher in urban areas where there are many mobile-source emissions. CO "hotspots" or pockets where the CO concentration exceeds the NAAQS and/or CAAQS, have been found to occur only at signalized intersections that operate at or below level of service (LOS) E with peak-hour trips for that intersection exceeding 3,000 trips. Therefore, any project that would place receptors within 500 feet of a signalized intersection operating at or below LOS E (peak-hour trips exceeding 3,000 trips) must conduct a "hotspot" analysis for CO. Likewise, projects that will cause road intersections to operate at or below a LOS E (with intersection peak-hour trips exceeding 3,000) will also have to conduct a CO "hotspot" analysis.

Traffic volumes and LOS for the A.M. and P.M. peak hours for the near-term with project conditions were reviewed to determine the need for preparation of a CO hotspot analysis. This information was available from the report Heritage Bluffs Traffic Impact Analysis (LLG Engineers)(16). After careful review it was determined that none of the studied intersections experience a LOS E or worse and result in peak-hour trips exceeding 3,000. Thus impacts are expected to be less than significant and no additional analysis is required. Consequently, sensitive receptors would not be significantly affected by CO emissions generated by Project-related traffic.

3.7 REGIONAL AIR QUALITY STRATEGY

The San Diego County Air Pollution Control District (the "District") is responsible for RAQS development and implementation. The RAQS control measures focus on emission sources under the District's authority, specifically stationary emission sources and some area-wide sources. However, the emission inventories and emission projections in the RAQS reflect the impact of all emission sources and all control measures, including those under the jurisdiction of the California Air Resources Board (ARB) (e.g., on-road motor vehicles, off-road vehicles and equipment, and consumer products) and the U. S. Environmental Protection Agency (EPA) (e.g., aircraft, ships, trains, and pre-empted off-road equipment). Thus, while legal authority to control various pollution sources is divided among agencies, the District is responsible for reflecting federal, State, and local measures in a single plan to achieve State ozone standards in San Diego County. Achieving the standards requires a cooperative partnership of governmental agencies at the federal, State, and local levels. State law requires the RAQS, when implemented, to achieve a 5% average annual reduction in countywide emissions of ozone precursors or, if that is not achievable, it must include an expeditious schedule for adopting every feasible emission control measure under air district purview (H&SC §40914). This RAQS Revision reflects expeditious adoption of feasible control measures, since neither San Diego County nor any nonattainment air district in the State has demonstrated a sustained 5% average annual reduction in ozone precursor emissions.

This RAQS Revision reflects the District's projection of future regulatory activity for purposes of providing expeditious progress toward attaining State ozone standards. As planned activities, the control measures are initial proposals based on currently available information, and are subject to the rule development process and Board consideration prior to implementation.

The rule development process includes many steps, including review of control measures and adopted rules in other regions, consultation with affected parties, development of draft rules, workshops with affected and interested parties, development of technical support documentation, and rule consideration and adoption by the Board at a public hearing. During rule development, new information may become available regarding the availability of control technologies, emission reduction potential, costs of measures, and other factors. Consequently, the scheduling of rule adoption or the estimated emission benefits may ultimately differ from that identified in the RAQS Revision.

This RAQS Revision was prepared pursuant to ARB guidance and complies with all of the following applicable progress report and plan revision requirements of the CCAA:

- • **Air Quality Improvement**. Assess the extent of ozone air quality improvement achieved
- during the preceding three years (H&SC §40924(b)(1)) (Addressed in Section 2);
- • **Countywide Emission Reduction Rates**. Compare estimated rates of total countywide
- emission reductions over the preceding three years to the rates anticipated in the RAQS for
- that same period, and incorporate updated projections of population, industry, and vehiclerelated
- emissions growth (H&SC §40925(a)) (Addressed in Section 3.1, Table 4);

- • **Rule Adoption Dates**. Identify the proposed and actual dates for adopting and
- implementing each District control measure (H&SC §40924(a)) (Addressed in Section 4,
- Tables 7, 8, and 9);
- • **Control Measure Emission Reductions**. Compare the expected emission reductions for
- each control measure to a newly revised estimate (H&SC §40924(b)(2)) (Addressed in
- Section 4, Tables 7, 8, and 9);
- • **Control Measure Cost-Effectiveness**. Include an assessment of the cost-effectiveness of
- available and proposed control measures and contain a list which ranks the control measures
- from the least cost-effective to the most cost-effective (H&SC §40922(a)) (Addressed in
- Section 4, Tables 7 and 9);
- • **Updated Rule Adoption Schedule**. Include an updated schedule for expeditiously adopting
- every feasible control measure for emission sources under District purview (H&SC
- §40914(b)(2)) (Addressed in Section 4, Table 9); and
- • **Emission Offsets**. Determine whether the locally repealed State requirements for emission
- offsets should be reinstated to achieve and maintain State ozone standards by the earliest
- practicable date (H&SC §40918.6)

Construction Impacts

As evaluated as in Section 3.4 the Project's regional construction-source emissions will not exceed applicable thresholds, and a less than significant impact is expected.

Operational Impacts

Project operational-source emissions would not result in exceedances of applicable SDAPCD regional thresholds, and a less than significant impact is expected

RAQS Consistency Conclusion

The Project would not result in or cause NAAQS or CAAQS violations. The Project is consistent with the Black Mountain Ranch Subarea and would be consistent with the goals, and objectives of the RAQS and SIP, impacts to the implementation of the air quality plan would thus be less than significant.

3.8 POTENTIAL IMPACTS TO SENSITIVE RECEPTORS

The potential impact of Project-generated air pollutant emissions at sensitive receptors has also been considered. Sensitive receptors can include uses such as long term health care facilities, rehabilitation centers, and retirement homes. Residences, schools, playgrounds, child care centers, and athletic facilities can also be considered as sensitive receptors.

The nearest sensitive receptors in proximity to the proposed project site are existing residential units in the project vicinity. As discussed in previously results of the analysis indicate that the project will not exceed short-term construction and long-term operational activity emissions thresholds as established by the SDAPCD, as such a less than significant impact is expected.

TOXIC AIR CONTAMINANT IMPACTS

Health risk assessments are typically completed for substantial sources of diesel particulate emissions (e.g., truck stops and warehouse distribution facilities). The proposed project would develop residential land uses on the project site. The residential land uses are not anticipated to generate a substantial number of daily truck trips. The primary source of potential TACs associated with project operations is diesel particulates from delivery trucks (e.g., truck traffic on local streets and on-site truck idling). The number of delivery trucks accessing the project site on a daily basis would be minimal, and the trucks that do visit the site would not idle on-site for extended periods of time. Based on the limited activity of the TAC sources, the proposed project would not warrant the need for a health risk assessment associated with on-site activities.

Typical sources of acutely and chronically hazardous TACs include industrial manufacturing processes and automotive repair facilities. The proposed project would not include any of these potential sources, although minimal emissions may result from the use of consumer products (e.g., aerosol sprays). As such, the proposed project would not release substantial amounts of TACs, and no significant impact on human health would occur

3.9 ODORS

The potential for the Project to generate objectionable odors has also been considered. Land uses generally associated with odor complaints include:

- Agricultural uses (livestock and farming)
- Wastewater treatment plants
- Food processing plants
- Chemical plants
- Composting operations
- Refineries
- Landfills
- Dairies
- Fiberglass molding facilities

The Project does not contain land uses typically associated with emitting objectionable odors. Potential odor sources associated with the proposed Project may result from construction equipment exhaust and the application of asphalt and architectural coatings during construction activities and the temporary storage of typical solid waste (refuse) associated with the proposed Project's (long-term operational) uses. Standard construction requirements would minimize odor impacts from construction. The construction odor emissions would be temporary, short-term, and intermittent in nature and would cease upon completion of the respective phase of construction and is thus considered less than significant. It is expected that

Project-generated refuse would be stored in covered containers and removed at regular intervals in compliance with the city's solid waste regulations. Therefore, odors associated with the proposed Project construction and operations would be less than significant and no mitigation is required.

3.10 CUMULATIVE IMPACTS

The Project area is designated as a non-attainment area for ozone and for PM_{10}.

Construction Impacts

The Project-specific evaluation of emissions presented in the preceding analysis demonstrates that prior to application of appropriate mitigation measures, Project construction-source air pollutant emissions will not result in exceedances of regional thresholds. Therefore, project construction-source emission would be considered less than significant

Operational Impacts

Project operational-source emissions will not exceed applicable SDAPCD regional thresholds. Per SDAPCD significance guidance, these impacts at the Project level are also considered cumulatively less than significant impact persisting over the life of the Project.

Related projects could contribute to an existing or projected air quality exceedance because the Basin is currently nonattainment for ozone and PM10. With regard to determining the significance of the contribution from the Project, the SDAPCD recommends that any given project's potential contribution to cumulative impacts should be assessed using the same significance criteria as for project-specific impacts. Therefore, this analysis assumes that individual projects that do not generate operational or construction emissions that exceed the SDAPCD's recommended daily thresholds for project-specific impacts would also not cause a commutatively considerable increase in emissions for those pollutants for which the Basin is in nonattainment, and, therefore, would not be considered to have a significant, adverse air quality impact. Alternatively, individual project-related construction and operational emissions that exceed SDAPCD thresholds for project-specific impacts would be considered cumulatively considerable. As previously noted, the Project will not exceed the applicable SDAPCD regional threshold for construction and operational-source emissions. As such, the Project will result in a cumulatively less than significant impact.

4 REFERENCES

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13. **San Diego Air Pollution Control District.** *2009 Regional Air Quality Strategy Revision.* San Diego : s.n., 2009.

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16. **LLG Engineers.** *Heritage Bluffs Traffic Impact Analysis.* 2014.

17. **California Department of Transportation.** *Transportation Project-Level Carbon Monoxed Protocol.* 1997. UCD-ITS-RR-92-21.

5 CERTIFICATION

The contents of this air study report represent an accurate depiction of the environmental impacts associated with the proposed Heritage Bluffs II Project. The information contained in this air quality impact assessment report is based on the best available data at the time of preparation. If you have any questions, please contact me directly at (949) 660-1994 ext. 217.

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EDUCATION

Master of Science in Environmental Studies
California State University, Fullerton • May, 2010

Bachelor of Arts in Environmental Analysis and Design
University of California, Irvine • June, 2006

PROFESSIONAL AFFILIATIONS

AEP – Association of Environmental Planners
AWMA – Air and Waste Management Association
ASTM – American Society for Testing and Materials

PROFESSIONAL CERTIFICATIONS

Environmental Site Assessment – American Society for Testing and Materials • June, 2013
Planned Communities and Urban Infill – Urban Land Institute • June, 2011
Indoor Air Quality and Industrial Hygiene – EMSL Analytical • April, 2008
Principles of Ambient Air Monitoring – California Air Resources Board • August, 2007
AB2588 Regulatory Standards – Trinity Consultants • November, 2006
Air Dispersion Modeling – Lakes Environmental • June, 2006

APPENDIX 3.1:

CALEEMOD EMISSIONS MODEL OUTPUTS

Heritage Bluffs

San Diego County, Summer

1.0 Project Characteristics

1.1 Land Usage

Land Uses	Size	Metric	Lot Acreage	Floor Surface Area	Population
Other Asphalt Surfaces	9.84	Acre	9.84	428,630.40	0
Single Family Housing	171.00	Dwelling Unit	55.52	307,800.00	489

1.2 Other Project Characteristics

Urbanization Urban **Wind Speed (m/s)** 2.6 **Precipitation Freq (Days)** 40

Climate Zone 10 **Operational Year** 2016

Utility Company San Diego Gas & Electric

CO2 Intensity (lb/MWhr) 477.05 **CH4 Intensity (lb/MWhr)** 0.029 **N2O Intensity (lb/MWhr)** 0.006

1.3 User Entered Comments & Non-Default Data

Project Characteristics - CPUC GHG Calculator version 3c

Land Use - based on information provided by the applicant

Construction Phase - based on a 2016 opening year

Off-road Equipment - 8 hour work day

Off-road Equipment - 8 hour work day

Off-road Equipment - adjusted defaults to account for grading quantities

Off-road Equipment -

Off-road Equipment -

Grading -

Vehicle Trips - weekday TR based on the City of San diego Trip Generation Manual, May 2003

Woodstoves - no woodstoves. all natural gas fireplaces

Energy Use - based on a 2016 opening year

Construction Off-road Equipment Mitigation -

Vechicle Emission Factors - a mix consistent with the Caltrans ITS Transportation Project-Level Carbon Monoxide Protocol

Vechicle Emission Factors - a mix consistent with the Caltrans ITS Transportation Project-Level Carbon Monoxide Protocol

Vechicle Emission Factors - a mix consistent with the Caltrans ITS Transportation Project-Level Carbon Monoxide Protocol

Table Name	Column Name	Default Value	New Value
tblConstructionPhase	NumDays	75.00	285.00
tblConstructionPhase	NumDays	1,110.00	300.00
tblConstructionPhase	NumDays	110.00	30.00
tblConstructionPhase	NumDays	75.00	30.00
tblConstructionPhase	PhaseEndDate	8/15/2016	7/4/2016
tblConstructionPhase	PhaseEndDate	7/13/2016	7/13/2015
tblConstructionPhase	PhaseStartDate	7/14/2015	6/2/2015
tblConstructionPhase	PhaseStartDate	6/2/2016	6/2/2015
tblFireplaces	NumberGas	94.05	171.00
tblFireplaces	NumberNoFireplace	17.10	0.00

tblFireplaces	NumberWood	59.85	0.00
tblOffRoadEquipment	HorsePower	400.00	189.00
tblOffRoadEquipment	LoadFactor	0.38	0.50
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	1.00	2.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	1.00	2.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	2.00	4.00
tblOffRoadEquipment	UsageHours	6.00	8.00
tblOffRoadEquipment	UsageHours	7.00	8.00
tblOffRoadEquipment	UsageHours	7.00	8.00
tblProjectCharacteristics	CO2IntensityFactor	720.49	477.05
tblProjectCharacteristics	OperationalYear	2014	2016
tblVehicleEF	HHD	0.02	0.05
tblVehicleEF	HHD	0.02	0.05
tblVehicleEF	HHD	0.02	0.05
tblVehicleEF	LDA	0.51	0.69
tblVehicleEF	LDA	0.51	0.69
tblVehicleEF	LDA	0.51	0.69
tblVehicleEF	LDT1	0.07	0.19
tblVehicleEF	LDT1	0.07	0.19
tblVehicleEF	LDT1	0.07	0.19
tblVehicleEF	LDT2	0.19	0.00
tblVehicleEF	LDT2	0.19	0.00
tblVehicleEF	LDT2	0.19	0.00
tblVehicleEF	LHD1	0.04	0.00
tblVehicleEF	LHD1	0.04	0.00
tblVehicleEF	LHD1	0.04	0.00
tblVehicleEF	LHD2	5.2650e-003	0.00
tblVehicleEF	LHD2	5.2650e-003	0.00

tblVehicleEF	LHD2	5.2650e-003	0.00
tblVehicleEF	MCY	6.5480e-003	5.0000e-003
tblVehicleEF	MCY	6.5480e-003	5.0000e-003
tblVehicleEF	MCY	6.5480e-003	5.0000e-003
tblVehicleEF	MDV	0.13	0.00
tblVehicleEF	MDV	0.13	0.00
tblVehicleEF	MDV	0.13	0.00
tblVehicleEF	MH	3.4710e-003	0.00
tblVehicleEF	MH	3.4710e-003	0.00
tblVehicleEF	MH	3.4710e-003	0.00
tblVehicleEF	MHD	0.01	0.06
tblVehicleEF	MHD	0.01	0.06
tblVehicleEF	MHD	0.01	0.06
tblVehicleEF	OBUS	1.8470e-003	0.00
tblVehicleEF	OBUS	1.8470e-003	0.00
tblVehicleEF	OBUS	1.8470e-003	0.00
tblVehicleEF	SBUS	6.1000e-004	0.00
tblVehicleEF	SBUS	6.1000e-004	0.00
tblVehicleEF	SBUS	6.1000e-004	0.00
tblVehicleEF	UBUS	2.0830e-003	0.00
tblVehicleEF	UBUS	2.0830e-003	0.00
tblVehicleEF	UBUS	2.0830e-003	0.00
tblVehicleTrips	WD_TR	9.57	17.10
tblWoodstoves	NumberCatalytic	8.55	0.00
tblWoodstoves	NumberNoncatalytic	8.55	0.00

2.0 Emissions Summary

2.1 Overall Construction (Maximum Daily Emission)

Unmitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Year	lb/day										lb/day					
2015	78.4691	150.3859	94.7485	0.1182	18.2141	6.9669	24.5846	9.9699	6.4095	13.6744	0.0000	12,349.7660	12,349.7660	3.6138	0.0000	12,425.6562
2016	74.7009	43.5808	45.1709	0.0840	2.9730	2.5173	5.4904	0.8004	2.3753	3.1757	0.0000	7,881.3887	7,881.3887	0.9076	0.0000	7,900.4482
Total	**153.1700**	**193.9666**	**139.9194**	**0.2022**	**21.1871**	**9.4842**	**30.0750**	**10.7703**	**8.7848**	**16.8502**	**0.0000**	**20,231.1547**	**20,231.1547**	**4.5214**	**0.0000**	**20,326.1044**

Mitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Year	lb/day										lb/day					
2015	78.4691	150.3859	94.7485	0.1182	7.1937	6.9669	14.0032	3.9122	6.4095	9.2867	0.0000	12,349.7660	12,349.7660	3.6138	0.0000	12,425.6562
2016	74.7009	43.5808	45.1709	0.0840	2.9730	2.5173	5.4904	0.8004	2.3753	3.1757	0.0000	7,881.3887	7,881.3887	0.9076	0.0000	7,900.4482
Total	**153.1700**	**193.9666**	**139.9194**	**0.2022**	**10.1667**	**9.4842**	**19.4935**	**4.7126**	**8.7848**	**12.4624**	**0.0000**	**20,231.1547**	**20,231.1547**	**4.5214**	**0.0000**	**20,326.1044**

	ROG	**NOx**	**CO**	**SO2**	**Fugitive PM10**	**Exhaust PM10**	**PM10 Total**	**Fugitive PM2.5**	**Exhaust PM2.5**	**PM2.5 Total**	**Bio- CO2**	**NBio-CO2**	**Total CO2**	**CH4**	**N20**	**CO2e**
Percent Reduction	**0.00**	**0.00**	**0.00**	**0.00**	**52.01**	**0.00**	**35.18**	**56.24**	**0.00**	**26.04**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**

2.2 Overall Operational

Unmitigated Operational

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Area	21.9020	0.1674	14.3234	7.5000e-004		0.3065	0.3065		0.3041	0.3041	0.0000	3,646.5811	3,646.5811	0.0953	0.0664	3,669.1627
Energy	0.1706	1.4579	0.6204	9.3100e-003		0.1179	0.1179		0.1179	0.1179		1,861.1260	1,861.1260	0.0357	0.0341	1,872.4525
Mobile	12.0856	38.5463	124.6219	0.2583	17.8119	0.6113	18.4232	4.7715	0.5620	5.3335		22,603.7459	22,603.7459	0.8441		22,621.4710
Total	**34.1582**	**40.1715**	**139.5657**	**0.2683**	**17.8119**	**1.0357**	**18.8476**	**4.7715**	**0.9839**	**5.7554**	**0.0000**	**28,111.4530**	**28,111.4530**	**0.9750**	**0.1005**	**28,163.0862**

Mitigated Operational

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Area	21.9020	0.1674	14.3234	7.5000e-004		0.3065	0.3065		0.3041	0.3041	0.0000	3,646.5811	3,646.5811	0.0953	0.0664	3,669.1627
Energy	0.1706	1.4579	0.6204	9.3100e-003		0.1179	0.1179		0.1179	0.1179		1,861.1260	1,861.1260	0.0357	0.0341	1,872.4525
Mobile	12.0856	38.5463	124.6219	0.2583	17.8119	0.6113	18.4232	4.7715	0.5620	5.3335		22,603.7459	22,603.7459	0.8441		22,621.4710
Total	**34.1582**	**40.1715**	**139.5657**	**0.2683**	**17.8119**	**1.0357**	**18.8476**	**4.7715**	**0.9839**	**5.7554**	**0.0000**	**28,111.4530**	**28,111.4530**	**0.9750**	**0.1005**	**28,163.0862**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N20	CO2e
Percent Reduction	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

3.0 Construction Detail

Construction Phase

Phase Number	Phase Name	Phase Type	Start Date	End Date	Num Days Week	Num Days	Phase Description
1	Site Preparation	Site Preparation	1/1/2015	2/25/2015	5	40	
2	Grading	Grading	2/26/2015	4/8/2015	5	30	
3	Building Construction	Building Construction	4/9/2015	6/1/2016	5	300	
4	Paving	Paving	6/2/2015	7/13/2015	5	30	
5	Architectural Coating	Architectural Coating	6/2/2015	7/4/2016	5	285	

Acres of Grading (Site Preparation Phase): 0

Acres of Grading (Grading Phase): 150

Acres of Paving: 0

Residential Indoor: 623,295; Residential Outdoor: 207,765; Non-Residential Indoor: 642,946; Non-Residential Outdoor: 214,315 (Architectural Coating – sqft)

OffRoad Equipment

Phase Name	Offroad Equipment Type	Amount	Usage Hours	Horse Power	Load Factor
Site Preparation	Rubber Tired Dozers	3	8.00	255	0.40
Site Preparation	Tractors/Loaders/Backhoes	4	8.00	97	0.37
Grading	Excavators	2	8.00	162	0.38
Grading	Graders	2	8.00	174	0.41
Grading	Off-Highway Trucks	1	8.00	189	0.50
Grading	Rubber Tired Dozers	2	8.00	255	0.40
Grading	Scrapers	4	8.00	361	0.48
Grading	Tractors/Loaders/Backhoes	2	8.00	97	0.37
Building Construction	Cranes	1	8.00	226	0.29
Building Construction	Forklifts	3	8.00	89	0.20
Building Construction	Generator Sets	1	8.00	84	0.74
Building Construction	Tractors/Loaders/Backhoes	3	8.00	97	0.37
Building Construction	Welders	1	8.00	46	0.45
Paving	Pavers	2	8.00	125	0.42
Paving	Paving Equipment	2	8.00	130	0.36
Paving	Rollers	2	8.00	80	0.38
Architectural Coating	Air Compressors	1	8.00	78	0.48

Trips and VMT

Phase Name	Offroad Equipment Count	Worker Trip Number	Vendor Trip Number	Hauling Trip Number	Worker Trip Length	Vendor Trip Length	Hauling Trip Length	Worker Vehicle Class	Vendor Vehicle Class	Hauling Vehicle Class
Site Preparation	7	18.00	0.00	0.00	10.80	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Grading	13	33.00	0.00	0.00	10.80	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Building Construction	9	242.00	89.00	0.00	10.80	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Paving	6	15.00	0.00	0.00	10.80	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Architectural Coating	1	48.00	0.00	0.00	10.80	7.30	20.00	LD_Mix	HDT_Mix	HHDT

3.1 Mitigation Measures Construction

Water Exposed Area

3.2 Site Preparation - 2015

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Fugitive Dust					18.0663	0.0000	18.0663	9.9307	0.0000	9.9307			0.0000			0.0000
Off-Road	5.2609	56.8897	42.6318	0.0391		3.0883	3.0883		2.8412	2.8412		4,111.7444	4,111.7444	1.2275		4,137.5225
Total	**5.2609**	**56.8897**	**42.6318**	**0.0391**	**18.0663**	**3.0883**	**21.1545**	**9.9307**	**2.8412**	**12.7719**		**4,111.7444**	**4,111.7444**	**1.2275**		**4,137.5225**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0690	0.0814	0.8900	1.8700e-003	0.1479	1.1600e-003	0.1490	0.0392	1.0600e-003	0.0403		162.0015	162.0015	8.4900e-003		162.1798
Total	**0.0690**	**0.0814**	**0.8900**	**1.8700e-003**	**0.1479**	**1.1600e-003**	**0.1490**	**0.0392**	**1.0600e-003**	**0.0403**		**162.0015**	**162.0015**	**8.4900e-003**		**162.1798**

3.2 Site Preparation - 2015

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Fugitive Dust					7.0458	0.0000	7.0458	3.8730	0.0000	3.8730			0.0000			0.0000
Off-Road	5.2609	56.8897	42.6318	0.0391		3.0883	3.0883		2.8412	2.8412	0.0000	4,111.744 4	4,111.744 4	1.2275		4,137.522 4
Total	**5.2609**	**56.8897**	**42.6318**	**0.0391**	**7.0458**	**3.0883**	**10.1341**	**3.8730**	**2.8412**	**6.7142**	**0.0000**	**4,111.744 4**	**4,111.744 4**	**1.2275**		**4,137.522 4**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0690	0.0814	0.8900	1.8700e-003	0.1479	1.1600e-003	0.1490	0.0392	1.0600e-003	0.0403		162.0015	162.0015	8.4900e-003		162.1798
Total	**0.0690**	**0.0814**	**0.8900**	**1.8700e-003**	**0.1479**	**1.1600e-003**	**0.1490**	**0.0392**	**1.0600e-003**	**0.0403**		**162.0015**	**162.0015**	**8.4900e-003**		**162.1798**

3.3 Grading - 2015

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Fugitive Dust					17.3467	0.0000	17.3467	7.1930	0.0000	7.1930			0.0000			0.0000
Off-Road	12.7854	150.2367	93.1170	0.1147		6.9647	6.9647		6.4076	6.4076		12,052.7632	12,052.7632	3.5983		12,128.3265
Total	**12.7854**	**150.2367**	**93.1170**	**0.1147**	**17.3467**	**6.9647**	**24.3114**	**7.1930**	**6.4076**	**13.6006**		**12,052.7632**	**12,052.7632**	**3.5983**		**12,128.3265**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.1265	0.1492	1.6316	3.4400e-003	0.2711	2.1300e-003	0.2732	0.0719	1.9500e-003	0.0739		297.0028	297.0028	0.0156		297.3297
Total	**0.1265**	**0.1492**	**1.6316**	**3.4400e-003**	**0.2711**	**2.1300e-003**	**0.2732**	**0.0719**	**1.9500e-003**	**0.0739**		**297.0028**	**297.0028**	**0.0156**		**297.3297**

3.3 Grading - 2015

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Fugitive Dust					6.7652	0.0000	6.7652	2.8053	0.0000	2.8053			0.0000			0.0000
Off-Road	12.7854	150.2367	93.1170	0.1147		6.9647	6.9647		6.4076	6.4076	0.0000	12,052.7632	12,052.7632	3.5983		12,128.3265
Total	**12.7854**	**150.2367**	**93.1170**	**0.1147**	**6.7652**	**6.9647**	**13.7299**	**2.8053**	**6.4076**	**9.2128**	**0.0000**	**12,052.7632**	**12,052.7632**	**3.5983**		**12,128.3265**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.1265	0.1492	1.6316	3.4400e-003	0.2711	2.1300e-003	0.2732	0.0719	1.9500e-003	0.0739		297.0028	297.0028	0.0156		297.3297
Total	**0.1265**	**0.1492**	**1.6316**	**3.4400e-003**	**0.2711**	**2.1300e-003**	**0.2732**	**0.0719**	**1.9500e-003**	**0.0739**		**297.0028**	**297.0028**	**0.0156**		**297.3297**

3.4 Building Construction - 2015

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	3.8870	32.4182	20.0375	0.0287		2.2678	2.2678		2.1293	2.1293		2,886.4292	2,886.4292	0.7336		2,901.8345
Total	**3.8870**	**32.4182**	**20.0375**	**0.0287**		**2.2678**	**2.2678**		**2.1293**	**2.1293**		**2,886.4292**	**2,886.4292**	**0.7336**		**2,901.8345**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	1.0507	9.7076	10.8125	0.0212	0.5907	0.1591	0.7498	0.1685	0.1463	0.3148		2,148.7228	2,148.7228	0.0186		2,149.1135
Worker	0.9277	1.0941	11.9649	0.0252	1.9880	0.0156	2.0036	0.5273	0.0143	0.5416		2,178.0204	2,178.0204	0.1142		2,180.4177
Total	**1.9784**	**10.8017**	**22.7774**	**0.0464**	**2.5787**	**0.1747**	**2.7533**	**0.6958**	**0.1606**	**0.8564**		**4,326.7431**	**4,326.7431**	**0.1328**		**4,329.5312**

3.4 Building Construction - 2015

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	3.8870	32.4182	20.0375	0.0287		2.2678	2.2678		2.1293	2.1293	0.0000	2,886.4292	2,886.4292	0.7336		2,901.8345
Total	**3.8870**	**32.4182**	**20.0375**	**0.0287**		**2.2678**	**2.2678**		**2.1293**	**2.1293**	**0.0000**	**2,886.4292**	**2,886.4292**	**0.7336**		**2,901.8345**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	1.0507	9.7076	10.8125	0.0212	0.5907	0.1591	0.7498	0.1685	0.1463	0.3148		2,148.7228	2,148.7228	0.0186		2,149.1135
Worker	0.9277	1.0941	11.9649	0.0252	1.9880	0.0156	2.0036	0.5273	0.0143	0.5416		2,178.0204	2,178.0204	0.1142		2,180.4177
Total	**1.9784**	**10.8017**	**22.7774**	**0.0464**	**2.5787**	**0.1747**	**2.7533**	**0.6958**	**0.1606**	**0.8564**		**4,326.7431**	**4,326.7431**	**0.1328**		**4,329.5312**

3.4 Building Construction - 2016

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	3.6240	30.7934	19.7845	0.0287		2.1098	2.1098		1.9794	1.9794		2,863.944 7	2,863.944 7	0.7208		2,879.080 4
Total	**3.6240**	**30.7934**	**19.7845**	**0.0287**		**2.1098**	**2.1098**		**1.9794**	**1.9794**		**2,863.944 7**	**2,863.944 7**	**0.7208**		**2,879.080 4**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.9284	8.4348	9.9004	0.0212	0.5907	0.1276	0.7183	0.1685	0.1173	0.2858		2,123.437 2	2,123.437 2	0.0164		2,123.781 8
Worker	0.8459	0.9927	10.8266	0.0252	1.9880	0.0149	2.0029	0.5273	0.0137	0.5410		2,101.847 3	2,101.847 3	0.1053		2,104.058 8
Total	**1.7743**	**9.4275**	**20.7271**	**0.0464**	**2.5787**	**0.1425**	**2.7212**	**0.6958**	**0.1310**	**0.8268**		**4,225.284 6**	**4,225.284 6**	**0.1217**		**4,227.840 7**

3.4 Building Construction - 2016

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	3.6240	30.7934	19.7845	0.0287		2.1098	2.1098		1.9794	1.9794	0.0000	2,863.9447	2,863.9447	0.7208		2,879.0804
Total	**3.6240**	**30.7934**	**19.7845**	**0.0287**		**2.1098**	**2.1098**		**1.9794**	**1.9794**	**0.0000**	**2,863.9447**	**2,863.9447**	**0.7208**		**2,879.0804**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.9284	8.4348	9.9004	0.0212	0.5907	0.1276	0.7183	0.1685	0.1173	0.2858		2,123.4372	2,123.4372	0.0164		2,123.7818
Worker	0.8459	0.9927	10.8266	0.0252	1.9880	0.0149	2.0029	0.5273	0.0137	0.5410		2,101.8473	2,101.8473	0.1053		2,104.0588
Total	**1.7743**	**9.4275**	**20.7271**	**0.0464**	**2.5787**	**0.1425**	**2.7212**	**0.6958**	**0.1310**	**0.8268**		**4,225.2846**	**4,225.2846**	**0.1217**		**4,227.8407**

3.5 Paving - 2015

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	2.3172	25.1758	14.9781	0.0223		1.4148	1.4148		1.3016	1.3016		2,339.8984	2,339.8984	0.6986		2,354.5681
Paving	0.8594					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Total	**3.1766**	**25.1758**	**14.9781**	**0.0223**		**1.4148**	**1.4148**		**1.3016**	**1.3016**		**2,339.8984**	**2,339.8984**	**0.6986**		**2,354.5681**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0575	0.0678	0.7416	1.5600e-003	0.1232	9.7000e-004	0.1242	0.0327	8.9000e-004	0.0336		135.0013	135.0013	7.0800e-003		135.1499
Total	**0.0575**	**0.0678**	**0.7416**	**1.5600e-003**	**0.1232**	**9.7000e-004**	**0.1242**	**0.0327**	**8.9000e-004**	**0.0336**		**135.0013**	**135.0013**	**7.0800e-003**		**135.1499**

3.5 Paving - 2015

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	2.3172	25.1758	14.9781	0.0223		1.4148	1.4148		1.3016	1.3016	0.0000	2,339.8984	2,339.8984	0.6986		2,354.5681
Paving	0.8594					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Total	**3.1766**	**25.1758**	**14.9781**	**0.0223**		**1.4148**	**1.4148**		**1.3016**	**1.3016**	**0.0000**	**2,339.8984**	**2,339.8984**	**0.6986**		**2,354.5681**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0575	0.0678	0.7416	1.5600e-003	0.1232	9.7000e-004	0.1242	0.0327	8.9000e-004	0.0336		135.0013	135.0013	7.0800e-003		135.1499
Total	**0.0575**	**0.0678**	**0.7416**	**1.5600e-003**	**0.1232**	**9.7000e-004**	**0.1242**	**0.0327**	**8.9000e-004**	**0.0336**		**135.0013**	**135.0013**	**7.0800e-003**		**135.1499**

3.6 Architectural Coating - 2015

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Archit. Coating	68.6436					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Off-Road	0.5421	3.4271	2.5357	3.9600e-003		0.2945	0.2945		0.2945	0.2945		375.2641	375.2641	0.0489		376.2902
Total	**69.1857**	**3.4271**	**2.5357**	**3.9600e-003**		**0.2945**	**0.2945**		**0.2945**	**0.2945**		**375.2641**	**375.2641**	**0.0489**		**376.2902**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.1840	0.2170	2.3732	5.0000e-003	0.3943	3.1000e-003	0.3974	0.1046	2.8400e-003	0.1074		432.0040	432.0040	0.0226		432.4796
Total	**0.1840**	**0.2170**	**2.3732**	**5.0000e-003**	**0.3943**	**3.1000e-003**	**0.3974**	**0.1046**	**2.8400e-003**	**0.1074**		**432.0040**	**432.0040**	**0.0226**		**432.4796**

3.6 Architectural Coating - 2015

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Archit. Coating	68.6436					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Off-Road	0.5421	3.4271	2.5357	3.9600e-003		0.2945	0.2945		0.2945	0.2945	0.0000	375.2641	375.2641	0.0489		376.2902
Total	**69.1857**	**3.4271**	**2.5357**	**3.9600e-003**		**0.2945**	**0.2945**		**0.2945**	**0.2945**	**0.0000**	**375.2641**	**375.2641**	**0.0489**		**376.2902**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.1840	0.2170	2.3732	5.0000e-003	0.3943	3.1000e-003	0.3974	0.1046	2.8400e-003	0.1074		432.0040	432.0040	0.0226		432.4796
Total	**0.1840**	**0.2170**	**2.3732**	**5.0000e-003**	**0.3943**	**3.1000e-003**	**0.3974**	**0.1046**	**2.8400e-003**	**0.1074**		**432.0040**	**432.0040**	**0.0226**		**432.4796**

3.6 Architectural Coating - 2016

Unmitigated Construction On-Site

Category	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
	lb/day										lb/day					
Archit. Coating	68.6436					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Off-Road	0.4913	3.1630	2.5119	3.9600e-003		0.2622	0.2622		0.2622	0.2622		375.2641	375.2641	0.0442		376.1932
Total	**69.1349**	**3.1630**	**2.5119**	**3.9600e-003**		**0.2622**	**0.2622**		**0.2622**	**0.2622**		**375.2641**	**375.2641**	**0.0442**		**376.1932**

Unmitigated Construction Off-Site

Category	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.1678	0.1969	2.1474	5.0000e-003	0.3943	2.9600e-003	0.3973	0.1046	2.7200e-003	0.1073		416.8953	416.8953	0.0209		417.3340
Total	**0.1678**	**0.1969**	**2.1474**	**5.0000e-003**	**0.3943**	**2.9600e-003**	**0.3973**	**0.1046**	**2.7200e-003**	**0.1073**		**416.8953**	**416.8953**	**0.0209**		**417.3340**

3.6 Architectural Coating - 2016

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Archit. Coating	68.6436					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Off-Road	0.4913	3.1630	2.5119	3.9600e-003		0.2622	0.2622		0.2622	0.2622	0.0000	375.2641	375.2641	0.0442		376.1932
Total	**69.1349**	**3.1630**	**2.5119**	**3.9600e-003**		**0.2622**	**0.2622**		**0.2622**	**0.2622**	**0.0000**	**375.2641**	**375.2641**	**0.0442**		**376.1932**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.1678	0.1969	2.1474	5.0000e-003	0.3943	2.9600e-003	0.3973	0.1046	2.7200e-003	0.1073		416.8953	416.8953	0.0209		417.3340
Total	**0.1678**	**0.1969**	**2.1474**	**5.0000e-003**	**0.3943**	**2.9600e-003**	**0.3973**	**0.1046**	**2.7200e-003**	**0.1073**		**416.8953**	**416.8953**	**0.0209**		**417.3340**

4.0 Operational Detail - Mobile

4.1 Mitigation Measures Mobile

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Mitigated	12.0856	38.5463	124.6219	0.2583	17.8119	0.6113	18.4232	4.7715	0.5620	5.3335		22,603.7459	22,603.7459	0.8441		22,621.4710
Unmitigated	12.0856	38.5463	124.6219	0.2583	17.8119	0.6113	18.4232	4.7715	0.5620	5.3335		22,603.7459	22,603.7459	0.8441		22,621.4710

4.2 Trip Summary Information

	Average Daily Trip Rate			Unmitigated	Mitigated
Land Use	Weekday	Saturday	Sunday	Annual VMT	Annual VMT
Other Asphalt Surfaces	0.00	0.00	0.00		
Single Family Housing	2,924.10	1,723.68	1499.67	7,278,515	7,278,515
Total	2,924.10	1,723.68	1,499.67	7,278,515	7,278,515

4.3 Trip Type Information

	Miles			Trip %			Trip Purpose %		
Land Use	H-W or C-W	H-S or C-C	H-O or C-NW	H-W or C-W	H-S or C-C	H-O or C-NW	Primary	Diverted	Pass-by
Other Asphalt Surfaces	9.50	7.30	7.30	0.00	0.00	0.00	0	0	0
Single Family Housing	10.80	7.30	7.50	41.60	18.80	39.60	86	11	3

LDA	LDT1	LDT2	MDV	LHD1	LHD2	MHD	HHD	OBUS	UBUS	MCY	SBUS	MH
0.690000	0.194000	0.000000	0.000000	0.000000	0.000000	0.064000	0.047000	0.000000	0.000000	0.005000	0.000000	0.000000

4.4 Fleet Mix

5.0 Energy Detail

Historical Energy Use: N

5.1 Mitigation Measures Energy

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
NaturalGas Mitigated	0.1706	1.4579	0.6204	9.3100e-003		0.1179	0.1179		0.1179	0.1179		1,861.1260	1,861.1260	0.0357	0.0341	1,872.4525
NaturalGas Unmitigated	0.1706	1.4579	0.6204	9.3100e-003		0.1179	0.1179		0.1179	0.1179		1,861.1260	1,861.1260	0.0357	0.0341	1,872.4525

5.2 Energy by Land Use - NaturalGas

Unmitigated

	NaturalGas Use	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Land Use	kBTU/yr	lb/day										lb/day					
Single Family Housing	15819.6	0.1706	1.4579	0.6204	9.3100e-003		0.1179	0.1179		0.1179	0.1179		1,861.1260	1,861.1260	0.0357	0.0341	1,872.4525
Other Asphalt Surfaces	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
Total		**0.1706**	**1.4579**	**0.6204**	**9.3100e-003**		**0.1179**	**0.1179**		**0.1179**	**0.1179**		**1,861.1260**	**1,861.1260**	**0.0357**	**0.0341**	**1,872.4525**

5.2 Energy by Land Use - NaturalGas

Mitigated

	NaturalGas Use	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Land Use	kBTU/yr	lb/day										lb/day					
Other Asphalt Surfaces	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
Single Family Housing	15.8196	0.1706	1.4579	0.6204	9.3100e-003		0.1179	0.1179		0.1179	0.1179		1,861.1260	1,861.1260	0.0357	0.0341	1,872.4525
Total		**0.1706**	**1.4579**	**0.6204**	**9.3100e-003**		**0.1179**	**0.1179**		**0.1179**	**0.1179**		**1,861.1260**	**1,861.1260**	**0.0357**	**0.0341**	**1,872.4525**

6.0 Area Detail

6.1 Mitigation Measures Area

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Mitigated	21.9020	0.1674	14.3234	7.5000e-004		0.3065	0.3065		0.3041	0.3041	0.0000	3,646.5811	3,646.5811	0.0953	0.0664	3,669.1627
Unmitigated	21.9020	0.1674	14.3234	7.5000e-004		0.3065	0.3065		0.3041	0.3041	0.0000	3,646.5811	3,646.5811	0.0953	0.0664	3,669.1627

6.2 Area by SubCategory

Unmitigated

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
SubCategory	lb/day										lb/day					
Architectural Coating	5.3598					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Consumer Products	15.7596					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Hearth	0.3319	2.0000e-005	0.0181	0.0000		0.2293	0.2293		0.2269	0.2269	0.0000	3,621.1765	3,621.1765	0.0694	0.0664	3,643.2144
Landscaping	0.4506	0.1674	14.3053	7.5000e-004		0.0772	0.0772		0.0772	0.0772		25.4046	25.4046	0.0259		25.9484
Total	**21.9020**	**0.1674**	**14.3234**	**7.5000e-004**		**0.3065**	**0.3065**		**0.3041**	**0.3041**	**0.0000**	**3,646.5811**	**3,646.5811**	**0.0953**	**0.0664**	**3,669.1627**

6.2 Area by SubCategory

Mitigated

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
SubCategory	lb/day										lb/day					
Architectural Coating	5.3598					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Consumer Products	15.7596					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Hearth	0.3319	2.0000e-005	0.0181	0.0000		0.2293	0.2293		0.2269	0.2269	0.0000	3,621.1765	3,621.1765	0.0694	0.0664	3,643.2144
Landscaping	0.4506	0.1674	14.3053	7.5000e-004		0.0772	0.0772		0.0772	0.0772		25.4046	25.4046	0.0259		25.9484
Total	**21.9020**	**0.1674**	**14.3234**	**7.5000e-004**		**0.3065**	**0.3065**		**0.3041**	**0.3041**	**0.0000**	**3,646.5811**	**3,646.5811**	**0.0953**	**0.0664**	**3,669.1627**

7.0 Water Detail

7.1 Mitigation Measures Water

8.0 Waste Detail

8.1 Mitigation Measures Waste

9.0 Operational Offroad

Equipment Type	Number	Hours/Day	Days/Year	Horse Power	Load Factor	Fuel Type

10.0 Vegetation

Heritage Bluffs

San Diego County, Winter

1.0 Project Characteristics

1.1 Land Usage

Land Uses	Size	Metric	Lot Acreage	Floor Surface Area	Population
Other Asphalt Surfaces	9.84	Acre	9.84	428,630.40	0
Single Family Housing	171.00	Dwelling Unit	55.52	307,800.00	489

1.2 Other Project Characteristics

Urbanization	Urban	**Wind Speed (m/s)**	2.6	**Precipitation Freq (Days)**	40
Climate Zone	10			**Operational Year**	2016
Utility Company	San Diego Gas & Electric				
CO2 Intensity (lb/MWhr)	477.05	**CH4 Intensity (lb/MWhr)**	0.029	**N2O Intensity (lb/MWhr)**	0.006

1.3 User Entered Comments & Non-Default Data

Project Characteristics - CPUC GHG Calculator version 3c

Land Use - based on information provided by the applicant

Construction Phase - based on a 2016 opening year

Off-road Equipment - 8 hour work day

Off-road Equipment - 8 hour work day

Off-road Equipment - adjusted defaults to account for grading quantities

Off-road Equipment -

Off-road Equipment -

Grading -

Vehicle Trips - weekday TR based on the City of San diego Trip Generation Manual, May 2003

Woodstoves - no woodstoves. all natural gas fireplaces

Energy Use - based on a 2016 opening year

Construction Off-road Equipment Mitigation -

Vechicle Emission Factors - a mix consistent with the Caltrans ITS Transportation Project-Level Carbon Monoxide Protocol

Vechicle Emission Factors - a mix consistent with the Caltrans ITS Transportation Project-Level Carbon Monoxide Protocol

Vechicle Emission Factors - a mix consistent with the Caltrans ITS Transportation Project-Level Carbon Monoxide Protocol

Table Name	Column Name	Default Value	New Value
tblConstructionPhase	NumDays	75.00	285.00
tblConstructionPhase	NumDays	1,110.00	300.00
tblConstructionPhase	NumDays	110.00	30.00
tblConstructionPhase	NumDays	75.00	30.00
tblConstructionPhase	PhaseEndDate	8/15/2016	7/4/2016
tblConstructionPhase	PhaseEndDate	7/13/2016	7/13/2015
tblConstructionPhase	PhaseStartDate	7/14/2015	6/2/2015
tblConstructionPhase	PhaseStartDate	6/2/2016	6/2/2015
tblFireplaces	NumberGas	94.05	171.00
tblFireplaces	NumberNoFireplace	17.10	0.00

tblFireplaces	NumberWood	59.85	0.00
tblOffRoadEquipment	HorsePower	400.00	189.00
tblOffRoadEquipment	LoadFactor	0.38	0.50
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	1.00	2.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	1.00	2.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	2.00	4.00
tblOffRoadEquipment	UsageHours	6.00	8.00
tblOffRoadEquipment	UsageHours	7.00	8.00
tblOffRoadEquipment	UsageHours	7.00	8.00
tblProjectCharacteristics	CO2IntensityFactor	720.49	477.05
tblProjectCharacteristics	OperationalYear	2014	2016
tblVehicleEF	HHD	0.02	0.05
tblVehicleEF	HHD	0.02	0.05
tblVehicleEF	HHD	0.02	0.05
tblVehicleEF	LDA	0.51	0.69
tblVehicleEF	LDA	0.51	0.69
tblVehicleEF	LDA	0.51	0.69
tblVehicleEF	LDT1	0.07	0.19
tblVehicleEF	LDT1	0.07	0.19
tblVehicleEF	LDT1	0.07	0.19
tblVehicleEF	LDT2	0.19	0.00
tblVehicleEF	LDT2	0.19	0.00
tblVehicleEF	LDT2	0.19	0.00
tblVehicleEF	LHD1	0.04	0.00
tblVehicleEF	LHD1	0.04	0.00
tblVehicleEF	LHD1	0.04	0.00
tblVehicleEF	LHD2	5.2650e-003	0.00
tblVehicleEF	LHD2	5.2650e-003	0.00

tblVehicleEF	LHD2	5.2650e-003	0.00
tblVehicleEF	MCY	6.5480e-003	5.0000e-003
tblVehicleEF	MCY	6.5480e-003	5.0000e-003
tblVehicleEF	MCY	6.5480e-003	5.0000e-003
tblVehicleEF	MDV	0.13	0.00
tblVehicleEF	MDV	0.13	0.00
tblVehicleEF	MDV	0.13	0.00
tblVehicleEF	MH	3.4710e-003	0.00
tblVehicleEF	MH	3.4710e-003	0.00
tblVehicleEF	MH	3.4710e-003	0.00
tblVehicleEF	MHD	0.01	0.06
tblVehicleEF	MHD	0.01	0.06
tblVehicleEF	MHD	0.01	0.06
tblVehicleEF	OBUS	1.8470e-003	0.00
tblVehicleEF	OBUS	1.8470e-003	0.00
tblVehicleEF	OBUS	1.8470e-003	0.00
tblVehicleEF	SBUS	6.1000e-004	0.00
tblVehicleEF	SBUS	6.1000e-004	0.00
tblVehicleEF	SBUS	6.1000e-004	0.00
tblVehicleEF	UBUS	2.0830e-003	0.00
tblVehicleEF	UBUS	2.0830e-003	0.00
tblVehicleEF	UBUS	2.0830e-003	0.00
tblVehicleTrips	WD_TR	9.57	17.10
tblWoodstoves	NumberCatalytic	8.55	0.00
tblWoodstoves	NumberNoncatalytic	8.55	0.00

2.0 Emissions Summary

2.1 Overall Construction (Maximum Daily Emission)

Unmitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Year	lb/day										lb/day					
2015	78.7093	150.4041	94.7087	0.1180	18.2141	6.9669	24.5846	9.9699	6.4095	13.6744	0.0000	12,331.7024	12,331.7024	3.6138	0.0000	12,407.5927
2016	74.9074	43.9304	48.2248	0.0821	2.9730	2.5187	5.4917	0.8004	2.3765	3.1770	0.0000	7,711.8129	7,711.8129	0.9080	0.0000	7,730.8810
Total	**153.6167**	**194.3344**	**142.9335**	**0.2000**	**21.1871**	**9.4855**	**30.0763**	**10.7703**	**8.7861**	**16.8514**	**0.0000**	**20,043.5153**	**20,043.5153**	**4.5218**	**0.0000**	**20,138.4737**

Mitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Year	lb/day										lb/day					
2015	78.7093	150.4041	94.7087	0.1180	7.1937	6.9669	14.0032	3.9122	6.4095	9.2867	0.0000	12,331.7024	12,331.7024	3.6138	0.0000	12,407.5927
2016	74.9074	43.9304	48.2248	0.0821	2.9730	2.5187	5.4917	0.8004	2.3765	3.1770	0.0000	7,711.8129	7,711.8129	0.9080	0.0000	7,730.8810
Total	**153.6167**	**194.3344**	**142.9335**	**0.2000**	**10.1667**	**9.4855**	**19.4948**	**4.7126**	**8.7861**	**12.4637**	**0.0000**	**20,043.5153**	**20,043.5153**	**4.5218**	**0.0000**	**20,138.4737**

	ROG	**NOx**	**CO**	**SO2**	**Fugitive PM10**	**Exhaust PM10**	**PM10 Total**	**Fugitive PM2.5**	**Exhaust PM2.5**	**PM2.5 Total**	**Bio- CO2**	**NBio-CO2**	**Total CO2**	**CH4**	**N20**	**CO2e**
Percent Reduction	**0.00**	**0.00**	**0.00**	**0.00**	**52.01**	**0.00**	**35.18**	**56.24**	**0.00**	**26.04**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**

2.2 Overall Operational

Unmitigated Operational

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Area	21.9020	0.1674	14.3234	7.5000e-004		0.3065	0.3065		0.3041	0.3041	0.0000	3,646.5811	3,646.5811	0.0953	0.0664	3,669.1627
Energy	0.1706	1.4579	0.6204	9.3100e-003		0.1179	0.1179		0.1179	0.1179		1,861.1260	1,861.1260	0.0357	0.0341	1,872.4525
Mobile	13.0798	40.2017	136.4702	0.2470	17.8119	0.6164	18.4282	4.7715	0.5666	5.3381		21,652.1916	21,652.1916	0.8454		21,669.9459
Total	**35.1524**	**41.8270**	**151.4140**	**0.2571**	**17.8119**	**1.0408**	**18.8526**	**4.7715**	**0.9886**	**5.7601**	**0.0000**	**27,159.8986**	**27,159.8986**	**0.9764**	**0.1005**	**27,211.5611**

Mitigated Operational

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Area	21.9020	0.1674	14.3234	7.5000e-004		0.3065	0.3065		0.3041	0.3041	0.0000	3,646.5811	3,646.5811	0.0953	0.0664	3,669.1627
Energy	0.1706	1.4579	0.6204	9.3100e-003		0.1179	0.1179		0.1179	0.1179		1,861.1260	1,861.1260	0.0357	0.0341	1,872.4525
Mobile	13.0798	40.2017	136.4702	0.2470	17.8119	0.6164	18.4282	4.7715	0.5666	5.3381		21,652.1916	21,652.1916	0.8454		21,669.9459
Total	**35.1524**	**41.8270**	**151.4140**	**0.2571**	**17.8119**	**1.0408**	**18.8526**	**4.7715**	**0.9886**	**5.7601**	**0.0000**	**27,159.8986**	**27,159.8986**	**0.9764**	**0.1005**	**27,211.5611**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N20	CO2e
Percent Reduction	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

3.0 Construction Detail

Construction Phase

Phase Number	Phase Name	Phase Type	Start Date	End Date	Num Days Week	Num Days	Phase Description
1	Site Preparation	Site Preparation	1/1/2015	2/25/2015	5	40	
2	Grading	Grading	2/26/2015	4/8/2015	5	30	
3	Building Construction	Building Construction	4/9/2015	6/1/2016	5	300	
4	Paving	Paving	6/2/2015	7/13/2015	5	30	
5	Architectural Coating	Architectural Coating	6/2/2015	7/4/2016	5	285	

Acres of Grading (Site Preparation Phase): 0

Acres of Grading (Grading Phase): 150

Acres of Paving: 0

Residential Indoor: 623,295; Residential Outdoor: 207,765; Non-Residential Indoor: 642,946; Non-Residential Outdoor: 214,315 (Architectural Coating – sqft)

OffRoad Equipment

Phase Name	Offroad Equipment Type	Amount	Usage Hours	Horse Power	Load Factor
Site Preparation	Rubber Tired Dozers	3	8.00	255	0.40
Site Preparation	Tractors/Loaders/Backhoes	4	8.00	97	0.37
Grading	Excavators	2	8.00	162	0.38
Grading	Graders	2	8.00	174	0.41
Grading	Off-Highway Trucks	1	8.00	189	0.50
Grading	Rubber Tired Dozers	2	8.00	255	0.40
Grading	Scrapers	4	8.00	361	0.48
Grading	Tractors/Loaders/Backhoes	2	8.00	97	0.37
Building Construction	Cranes	1	8.00	226	0.29
Building Construction	Forklifts	3	8.00	89	0.20
Building Construction	Generator Sets	1	8.00	84	0.74
Building Construction	Tractors/Loaders/Backhoes	3	8.00	97	0.37
Building Construction	Welders	1	8.00	46	0.45
Paving	Pavers	2	8.00	125	0.42
Paving	Paving Equipment	2	8.00	130	0.36
Paving	Rollers	2	8.00	80	0.38
Architectural Coating	Air Compressors	1	8.00	78	0.48

Trips and VMT

Phase Name	Offroad Equipment Count	Worker Trip Number	Vendor Trip Number	Hauling Trip Number	Worker Trip Length	Vendor Trip Length	Hauling Trip Length	Worker Vehicle Class	Vendor Vehicle Class	Hauling Vehicle Class
Site Preparation	7	18.00	0.00	0.00	10.80	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Grading	13	33.00	0.00	0.00	10.80	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Building Construction	9	242.00	89.00	0.00	10.80	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Paving	6	15.00	0.00	0.00	10.80	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Architectural Coating	1	48.00	0.00	0.00	10.80	7.30	20.00	LD_Mix	HDT_Mix	HHDT

3.1 Mitigation Measures Construction

Water Exposed Area

3.2 Site Preparation - 2015

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Fugitive Dust					18.0663	0.0000	18.0663	9.9307	0.0000	9.9307			0.0000			0.0000
Off-Road	5.2609	56.8897	42.6318	0.0391		3.0883	3.0883		2.8412	2.8412		4,111.744 4	4,111.744 4	1.2275		4,137.522 5
Total	**5.2609**	**56.8897**	**42.6318**	**0.0391**	**18.0663**	**3.0883**	**21.1545**	**9.9307**	**2.8412**	**12.7719**		**4,111.744 4**	**4,111.744 4**	**1.2275**		**4,137.522 5**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0734	0.0913	0.8682	1.7600e-003	0.1479	1.1600e-003	0.1490	0.0392	1.0600e-003	0.0403		152.1487	152.1487	8.4900e-003		152.3270
Total	**0.0734**	**0.0913**	**0.8682**	**1.7600e-003**	**0.1479**	**1.1600e-003**	**0.1490**	**0.0392**	**1.0600e-003**	**0.0403**		**152.1487**	**152.1487**	**8.4900e-003**		**152.3270**

3.2 Site Preparation - 2015

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Fugitive Dust					7.0458	0.0000	7.0458	3.8730	0.0000	3.8730			0.0000			0.0000
Off-Road	5.2609	56.8897	42.6318	0.0391		3.0883	3.0883		2.8412	2.8412	0.0000	4,111.744 4	4,111.744 4	1.2275		4,137.522 4
Total	**5.2609**	**56.8897**	**42.6318**	**0.0391**	**7.0458**	**3.0883**	**10.1341**	**3.8730**	**2.8412**	**6.7142**	**0.0000**	**4,111.744 4**	**4,111.744 4**	**1.2275**		**4,137.522 4**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0734	0.0913	0.8682	1.7600e-003	0.1479	1.1600e-003	0.1490	0.0392	1.0600e-003	0.0403		152.1487	152.1487	8.4900e-003		152.3270
Total	**0.0734**	**0.0913**	**0.8682**	**1.7600e-003**	**0.1479**	**1.1600e-003**	**0.1490**	**0.0392**	**1.0600e-003**	**0.0403**		**152.1487**	**152.1487**	**8.4900e-003**		**152.3270**

3.3 Grading - 2015

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Fugitive Dust					17.3467	0.0000	17.3467	7.1930	0.0000	7.1930			0.0000			0.0000
Off-Road	12.7854	150.2367	93.1170	0.1147		6.9647	6.9647		6.4076	6.4076		12,052.7632	12,052.7632	3.5983		12,128.3265
Total	**12.7854**	**150.2367**	**93.1170**	**0.1147**	**17.3467**	**6.9647**	**24.3114**	**7.1930**	**6.4076**	**13.6006**		**12,052.7632**	**12,052.7632**	**3.5983**		**12,128.3265**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.1345	0.1674	1.5917	3.2300e-003	0.2711	2.1300e-003	0.2732	0.0719	1.9500e-003	0.0739		278.9392	278.9392	0.0156		279.2661
Total	**0.1345**	**0.1674**	**1.5917**	**3.2300e-003**	**0.2711**	**2.1300e-003**	**0.2732**	**0.0719**	**1.9500e-003**	**0.0739**		**278.9392**	**278.9392**	**0.0156**		**279.2661**

3.3 Grading - 2015

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Fugitive Dust					6.7652	0.0000	6.7652	2.8053	0.0000	2.8053			0.0000			0.0000
Off-Road	12.7854	150.2367	93.1170	0.1147		6.9647	6.9647		6.4076	6.4076	0.0000	12,052.7632	12,052.7632	3.5983		12,128.3265
Total	**12.7854**	**150.2367**	**93.1170**	**0.1147**	**6.7652**	**6.9647**	**13.7299**	**2.8053**	**6.4076**	**9.2128**	**0.0000**	**12,052.7632**	**12,052.7632**	**3.5983**		**12,128.3265**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.1345	0.1674	1.5917	3.2300e-003	0.2711	2.1300e-003	0.2732	0.0719	1.9500e-003	0.0739		278.9392	278.9392	0.0156		279.2661
Total	**0.1345**	**0.1674**	**1.5917**	**3.2300e-003**	**0.2711**	**2.1300e-003**	**0.2732**	**0.0719**	**1.9500e-003**	**0.0739**		**278.9392**	**278.9392**	**0.0156**		**279.2661**

3.4 Building Construction - 2015

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	3.8870	32.4182	20.0375	0.0287		2.2678	2.2678		2.1293	2.1293		2,886.4292	2,886.4292	0.7336		2,901.8345
Total	**3.8870**	**32.4182**	**20.0375**	**0.0287**		**2.2678**	**2.2678**		**2.1293**	**2.1293**		**2,886.4292**	**2,886.4292**	**0.7336**		**2,901.8345**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	1.2171	9.9485	14.3447	0.0211	0.5907	0.1610	0.7517	0.1685	0.1480	0.3165		2,132.3362	2,132.3362	0.0190		2,132.7360
Worker	0.9863	1.2278	11.6727	0.0237	1.9880	0.0156	2.0036	0.5273	0.0143	0.5416		2,045.5542	2,045.5542	0.1142		2,047.9516
Total	**2.2033**	**11.1762**	**26.0174**	**0.0448**	**2.5787**	**0.1766**	**2.7552**	**0.6958**	**0.1623**	**0.8581**		**4,177.8904**	**4,177.8904**	**0.1332**		**4,180.6876**

3.4 Building Construction - 2015

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	3.8870	32.4182	20.0375	0.0287		2.2678	2.2678		2.1293	2.1293	0.0000	2,886.429 2	2,886.429 2	0.7336		2,901.834 5
Total	**3.8870**	**32.4182**	**20.0375**	**0.0287**		**2.2678**	**2.2678**		**2.1293**	**2.1293**	**0.0000**	**2,886.429 2**	**2,886.429 2**	**0.7336**		**2,901.834 5**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	1.2171	9.9485	14.3447	0.0211	0.5907	0.1610	0.7517	0.1685	0.1480	0.3165		2,132.336 2	2,132.336 2	0.0190		2,132.736 0
Worker	0.9863	1.2278	11.6727	0.0237	1.9880	0.0156	2.0036	0.5273	0.0143	0.5416		2,045.554 2	2,045.554 2	0.1142		2,047.951 6
Total	**2.2033**	**11.1762**	**26.0174**	**0.0448**	**2.5787**	**0.1766**	**2.7552**	**0.6958**	**0.1623**	**0.8581**		**4,177.890 4**	**4,177.890 4**	**0.1332**		**4,180.687 6**

3.4 Building Construction - 2016

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	3.6240	30.7934	19.7845	0.0287		2.1098	2.1098		1.9794	1.9794		2,863.9447	2,863.9447	0.7208		2,879.0804
Total	**3.6240**	**30.7934**	**19.7845**	**0.0287**		**2.1098**	**2.1098**		**1.9794**	**1.9794**		**2,863.9447**	**2,863.9447**	**0.7208**		**2,879.0804**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	1.0740	8.6391	13.3243	0.0211	0.5907	0.1289	0.7196	0.1685	0.1185	0.2871		2,107.1570	2,107.1570	0.0168		2,107.5103
Worker	0.8967	1.1139	10.5179	0.0237	1.9880	0.0149	2.0029	0.5273	0.0137	0.5410		1,973.9248	1,973.9248	0.1053		1,976.1363
Total	**1.9707**	**9.7530**	**23.8422**	**0.0447**	**2.5787**	**0.1438**	**2.7225**	**0.6958**	**0.1322**	**0.8281**		**4,081.0818**	**4,081.0818**	**0.1221**		**4,083.6466**

3.4 Building Construction - 2016

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	3.6240	30.7934	19.7845	0.0287		2.1098	2.1098		1.9794	1.9794	0.0000	2,863.9447	2,863.9447	0.7208		2,879.0804
Total	**3.6240**	**30.7934**	**19.7845**	**0.0287**		**2.1098**	**2.1098**		**1.9794**	**1.9794**	**0.0000**	**2,863.9447**	**2,863.9447**	**0.7208**		**2,879.0804**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	1.0740	8.6391	13.3243	0.0211	0.5907	0.1289	0.7196	0.1685	0.1185	0.2871		2,107.1570	2,107.1570	0.0168		2,107.5103
Worker	0.8967	1.1139	10.5179	0.0237	1.9880	0.0149	2.0029	0.5273	0.0137	0.5410		1,973.9248	1,973.9248	0.1053		1,976.1363
Total	**1.9707**	**9.7530**	**23.8422**	**0.0447**	**2.5787**	**0.1438**	**2.7225**	**0.6958**	**0.1322**	**0.8281**		**4,081.0818**	**4,081.0818**	**0.1221**		**4,083.6466**

3.5 Paving - 2015

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	2.3172	25.1758	14.9781	0.0223		1.4148	1.4148		1.3016	1.3016		2,339.898 4	2,339.898 4	0.6986		2,354.568 1
Paving	0.8594					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Total	**3.1766**	**25.1758**	**14.9781**	**0.0223**		**1.4148**	**1.4148**		**1.3016**	**1.3016**		**2,339.898 4**	**2,339.898 4**	**0.6986**		**2,354.568 1**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0611	0.0761	0.7235	1.4700e-003	0.1232	9.7000e-004	0.1242	0.0327	8.9000e-004	0.0336		126.7906	126.7906	7.0800e-003		126.9392
Total	**0.0611**	**0.0761**	**0.7235**	**1.4700e-003**	**0.1232**	**9.7000e-004**	**0.1242**	**0.0327**	**8.9000e-004**	**0.0336**		**126.7906**	**126.7906**	**7.0800e-003**		**126.9392**

3.5 Paving - 2015

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	2.3172	25.1758	14.9781	0.0223		1.4148	1.4148		1.3016	1.3016	0.0000	2,339.898 4	2,339.898 4	0.6986		2,354.568 1
Paving	0.8594					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Total	**3.1766**	**25.1758**	**14.9781**	**0.0223**		**1.4148**	**1.4148**		**1.3016**	**1.3016**	**0.0000**	**2,339.898 4**	**2,339.898 4**	**0.6986**		**2,354.568 1**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0611	0.0761	0.7235	1.4700e-003	0.1232	9.7000e-004	0.1242	0.0327	8.9000e-004	0.0336		126.7906	126.7906	7.0800e-003		126.9392
Total	**0.0611**	**0.0761**	**0.7235**	**1.4700e-003**	**0.1232**	**9.7000e-004**	**0.1242**	**0.0327**	**8.9000e-004**	**0.0336**		**126.7906**	**126.7906**	**7.0800e-003**		**126.9392**

3.6 Architectural Coating - 2015

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Archit. Coating	68.6436					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Off-Road	0.5421	3.4271	2.5357	3.9600e-003		0.2945	0.2945		0.2945	0.2945		375.2641	375.2641	0.0489		376.2902
Total	**69.1857**	**3.4271**	**2.5357**	**3.9600e-003**		**0.2945**	**0.2945**		**0.2945**	**0.2945**		**375.2641**	**375.2641**	**0.0489**		**376.2902**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.1956	0.2435	2.3153	4.6900e-003	0.3943	3.1000e-003	0.3974	0.1046	2.8400e-003	0.1074		405.7298	405.7298	0.0226		406.2053
Total	**0.1956**	**0.2435**	**2.3153**	**4.6900e-003**	**0.3943**	**3.1000e-003**	**0.3974**	**0.1046**	**2.8400e-003**	**0.1074**		**405.7298**	**405.7298**	**0.0226**		**406.2053**

3.6 Architectural Coating - 2015

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Archit. Coating	68.6436					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Off-Road	0.5421	3.4271	2.5357	3.9600e-003		0.2945	0.2945		0.2945	0.2945	0.0000	375.2641	375.2641	0.0489		376.2902
Total	**69.1857**	**3.4271**	**2.5357**	**3.9600e-003**		**0.2945**	**0.2945**		**0.2945**	**0.2945**	**0.0000**	**375.2641**	**375.2641**	**0.0489**		**376.2902**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.1956	0.2435	2.3153	4.6900e-003	0.3943	3.1000e-003	0.3974	0.1046	2.8400e-003	0.1074		405.7298	405.7298	0.0226		406.2053
Total	**0.1956**	**0.2435**	**2.3153**	**4.6900e-003**	**0.3943**	**3.1000e-003**	**0.3974**	**0.1046**	**2.8400e-003**	**0.1074**		**405.7298**	**405.7298**	**0.0226**		**406.2053**

3.6 Architectural Coating - 2016

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Archit. Coating	68.6436					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Off-Road	0.4913	3.1630	2.5119	3.9600e-003		0.2622	0.2622		0.2622	0.2622		375.2641	375.2641	0.0442		376.1932
Total	**69.1349**	**3.1630**	**2.5119**	**3.9600e-003**		**0.2622**	**0.2622**		**0.2622**	**0.2622**		**375.2641**	**375.2641**	**0.0442**		**376.1932**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.1779	0.2209	2.0862	4.6900e-003	0.3943	2.9600e-003	0.3973	0.1046	2.7200e-003	0.1073		391.5223	391.5223	0.0209		391.9609
Total	**0.1779**	**0.2209**	**2.0862**	**4.6900e-003**	**0.3943**	**2.9600e-003**	**0.3973**	**0.1046**	**2.7200e-003**	**0.1073**		**391.5223**	**391.5223**	**0.0209**		**391.9609**

3.6 Architectural Coating - 2016

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Archit. Coating	68.6436					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Off-Road	0.4913	3.1630	2.5119	3.9600e-003		0.2622	0.2622		0.2622	0.2622	0.0000	375.2641	375.2641	0.0442		376.1932
Total	**69.1349**	**3.1630**	**2.5119**	**3.9600e-003**		**0.2622**	**0.2622**		**0.2622**	**0.2622**	**0.0000**	**375.2641**	**375.2641**	**0.0442**		**376.1932**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.1779	0.2209	2.0862	4.6900e-003	0.3943	2.9600e-003	0.3973	0.1046	2.7200e-003	0.1073		391.5223	391.5223	0.0209		391.9609
Total	**0.1779**	**0.2209**	**2.0862**	**4.6900e-003**	**0.3943**	**2.9600e-003**	**0.3973**	**0.1046**	**2.7200e-003**	**0.1073**		**391.5223**	**391.5223**	**0.0209**		**391.9609**

4.0 Operational Detail - Mobile

4.1 Mitigation Measures Mobile

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Mitigated	13.0798	40.2017	136.4702	0.2470	17.8119	0.6164	18.4282	4.7715	0.5666	5.3381		21,652.19 16	21,652.19 16	0.8454		21,669.94 59
Unmitigated	13.0798	40.2017	136.4702	0.2470	17.8119	0.6164	18.4282	4.7715	0.5666	5.3381		21,652.19 16	21,652.19 16	0.8454		21,669.94 59

4.2 Trip Summary Information

	Average Daily Trip Rate			Unmitigated	Mitigated
Land Use	Weekday	Saturday	Sunday	Annual VMT	Annual VMT
Other Asphalt Surfaces	0.00	0.00	0.00		
Single Family Housing	2,924.10	1,723.68	1499.67	7,278,515	7,278,515
Total	2,924.10	1,723.68	1,499.67	7,278,515	7,278,515

4.3 Trip Type Information

	Miles			Trip %			Trip Purpose %		
Land Use	H-W or C-W	H-S or C-C	H-O or C-NW	H-W or C-W	H-S or C-C	H-O or C-NW	Primary	Diverted	Pass-by
Other Asphalt Surfaces	9.50	7.30	7.30	0.00	0.00	0.00	0	0	0
Single Family Housing	10.80	7.30	7.50	41.60	18.80	39.60	86	11	3

LDA	LDT1	LDT2	MDV	LHD1	LHD2	MHD	HHD	OBUS	UBUS	MCY	SBUS	MH
0.690000	0.194000	0.000000	0.000000	0.000000	0.000000	0.064000	0.047000	0.000000	0.000000	0.005000	0.000000	0.000000

4.4 Fleet Mix

5.0 Energy Detail

Historical Energy Use: N

5.1 Mitigation Measures Energy

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
NaturalGas Mitigated	0.1706	1.4579	0.6204	9.3100e-003		0.1179	0.1179		0.1179	0.1179		1,861.1260	1,861.1260	0.0357	0.0341	1,872.4525
NaturalGas Unmitigated	0.1706	1.4579	0.6204	9.3100e-003		0.1179	0.1179		0.1179	0.1179		1,861.1260	1,861.1260	0.0357	0.0341	1,872.4525

5.2 Energy by Land Use - NaturalGas

Unmitigated

	NaturalGas Use	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Land Use	kBTU/yr	lb/day										lb/day					
Single Family Housing	15819.6	0.1706	1.4579	0.6204	9.3100e-003		0.1179	0.1179		0.1179	0.1179		1,861.1260	1,861.1260	0.0357	0.0341	1,872.4525
Other Asphalt Surfaces	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
Total		**0.1706**	**1.4579**	**0.6204**	**9.3100e-003**		**0.1179**	**0.1179**		**0.1179**	**0.1179**		**1,861.1260**	**1,861.1260**	**0.0357**	**0.0341**	**1,872.4525**

5.2 Energy by Land Use - NaturalGas

Mitigated

	NaturalGas Use	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Land Use	kBTU/yr	lb/day										lb/day					
Other Asphalt Surfaces	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
Single Family Housing	15.8196	0.1706	1.4579	0.6204	9.3100e-003		0.1179	0.1179		0.1179	0.1179		1,861.1260	1,861.1260	0.0357	0.0341	1,872.4525
Total		**0.1706**	**1.4579**	**0.6204**	**9.3100e-003**		**0.1179**	**0.1179**		**0.1179**	**0.1179**		**1,861.1260**	**1,861.1260**	**0.0357**	**0.0341**	**1,872.4525**

6.0 Area Detail

6.1 Mitigation Measures Area

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Mitigated	21.9020	0.1674	14.3234	7.5000e-004		0.3065	0.3065		0.3041	0.3041	0.0000	3,646.5811	3,646.5811	0.0953	0.0664	3,669.1627
Unmitigated	21.9020	0.1674	14.3234	7.5000e-004		0.3065	0.3065		0.3041	0.3041	0.0000	3,646.5811	3,646.5811	0.0953	0.0664	3,669.1627

6.2 Area by SubCategory

Unmitigated

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
SubCategory	lb/day										lb/day					
Architectural Coating	5.3598					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Consumer Products	15.7596					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Hearth	0.3319	2.0000e-005	0.0181	0.0000		0.2293	0.2293		0.2269	0.2269	0.0000	3,621.1765	3,621.1765	0.0694	0.0664	3,643.2144
Landscaping	0.4506	0.1674	14.3053	7.5000e-004		0.0772	0.0772		0.0772	0.0772		25.4046	25.4046	0.0259		25.9484
Total	**21.9020**	**0.1674**	**14.3234**	**7.5000e-004**		**0.3065**	**0.3065**		**0.3041**	**0.3041**	**0.0000**	**3,646.5811**	**3,646.5811**	**0.0953**	**0.0664**	**3,669.1627**

6.2 Area by SubCategory

Mitigated

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
SubCategory	lb/day										lb/day					
Architectural Coating	5.3598					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Consumer Products	15.7596					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Hearth	0.3319	2.0000e-005	0.0181	0.0000		0.2293	0.2293		0.2269	0.2269	0.0000	3,621.1765	3,621.1765	0.0694	0.0664	3,643.2144
Landscaping	0.4506	0.1674	14.3053	7.5000e-004		0.0772	0.0772		0.0772	0.0772		25.4046	25.4046	0.0259		25.9484
Total	**21.9020**	**0.1674**	**14.3234**	**7.5000e-004**		**0.3065**	**0.3065**		**0.3041**	**0.3041**	**0.0000**	**3,646.5811**	**3,646.5811**	**0.0953**	**0.0664**	**3,669.1627**

7.0 Water Detail

7.1 Mitigation Measures Water

8.0 Waste Detail

8.1 Mitigation Measures Waste

9.0 Operational Offroad

Equipment Type	Number	Hours/Day	Days/Year	Horse Power	Load Factor	Fuel Type

10.0 Vegetation

APPENDIX G-2

Supplemental Construction Emissions Analysis

March 5, 2015

Ms. Camille Passon
Project Design Consultants
701 B Street, Suite 800
San Diego, CA 92101

SUBJECT: **HERITAGE BLUFFS II BLASTING/CRUSHING/CONSTRUCTION ACTIVITY**

Dear Ms. Camille Passon:

Urban Crossroads, Inc. is pleased to submit the following air quality quantification regarding potential air quality impacts regarding Project Blasting, Crushing, and Construction related activities in support of the *Heritage Bluffs II Project (Project)* which is located south of Carmel Valley Road on Winecreek Road in the City of San Diego.

CONSTRUCTION EMISSIONS

Construction activities associated with the Project will result in emissions of CO, VOCs, NOx, SOx, PM10, and PM2.5. Construction emissions were calculated using the latest version of the California Emissions Estimator Model™ (CalEEMod™) v2013.2.2. Outputs from the model runs for construction activity are provided in Appendix 3.1 Construction related emissions are expected from the following construction activities:

- Rock Crushing
- Reducing Oversize Material
- Site Preparation
- Blasting
- Drilling
- Import of Crushed Materials
- Grading
- Foundation/Utilities Excavation
- Foundation/Vertical Construction
- Paving
- Painting (Architectural Coatings)
- Construction Workers Commuting

Table 1 shows the number of working days for each phase of construction activity. The duration of construction activity and associated equipment represents a reasonable approximation of the expected construction fleet as required per CEQA guidelines. Site specific construction fleet may vary due to specific project needs at the time of construction. The associated construction schedule and equipment were estimated based on consultation with the applicant. Please refer to specific detailed modeling inputs/outputs contained in Appendix 3.1 of this Analysis. A detailed summary of construction equipment assumptions by phase is provided in Table 2.

Dust is typically a major concern during grading activities. Because such emissions are not amenable to collection and discharge through a controlled source, they are called "fugitive emissions". Fugitive dust emissions rates vary as a function of many parameters (soil silt, soil moisture, wind speed, area disturbed, number of vehicles, depth of disturbance or excavation, etc.). The CalEEMod model was utilized to calculate fugitive dust emissions resulting from this phase of activity. The Project site will require around 145,000 cubic yards of soil import in order to balance. Soil import will commence in June 2015 concurrent with the "Import of Crushed Materials" phase and will last for a duration of approximately 40 working days.

Construction emissions for construction worker vehicles traveling to and from the Project site, as well as vendor trips (construction materials delivered to the Project site) were estimated based on information CalEEMod model defaults.

It is estimated that 15,000 cubic yards per day of unsuitable rock (hard rock) would be blasted on-site for an approximate duration of 5 months or 110 days. An average of 5,000 square foot (SF) surface area for blasting per day is a reasonable working estimate for analytical purposes. Fugitive dust emissions during blasting activities were estimated using the US EPA AP-42 emission factor (Table 11.9, 1.9-5 from AP-42). Detailed blasting calculations are provided in Appendix 3.2 for review.

Additionally, fugitive dust emissions will also be generated through the crushing of rock on-site, the US EPA's AP-42 compilation of emission factors available in Chapter 11.19.2-2 were used to estimate fugitive dust from rock crushing activities. Additionally, it was estimated that approximately 24,000 tons per day would be processed during crushing activities for an approximate duration of 5 months or 110 working days. Detailed calculations are provided in Appendix 3.3 for review.

TABLE 1: CONSTRUCTION DURATION

Phase	Duration (working days)
Rock Crushing	110
Reducing Oversize Material	110
Site Preparation	40
Blasting	110
Drilling	110
Import of Crushed Materials	40
Grading	75
Foundation/Utilities Excavation	30
Foundation/Vertical Construction	300
Paving	30
Architectural Coatings	285

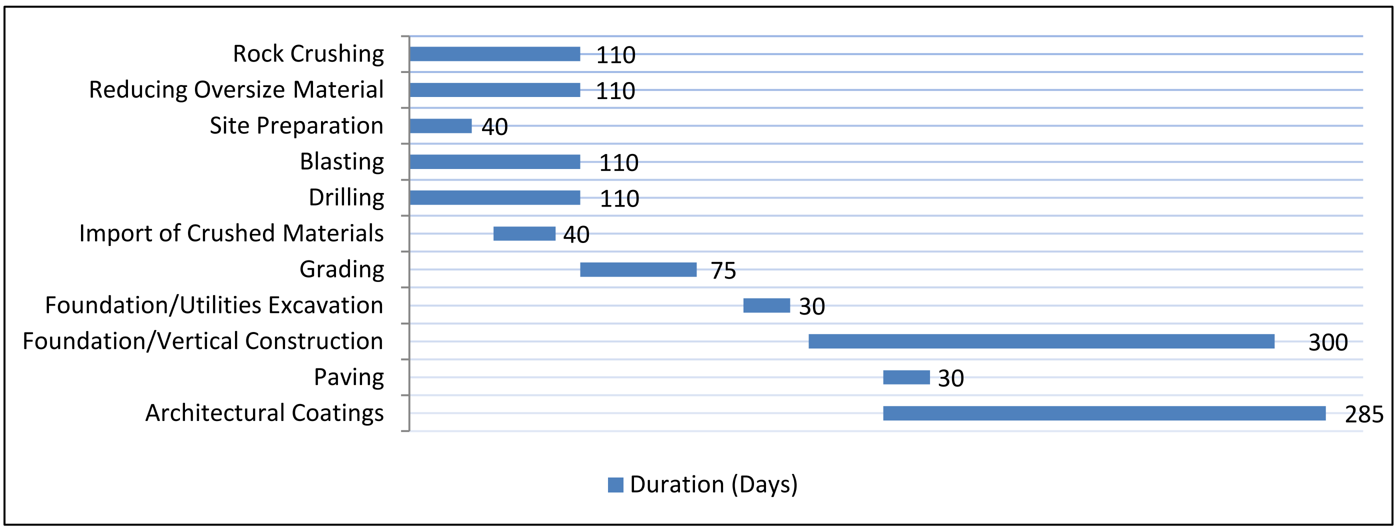
TABLE 2: CONSTRUCTION EQUIPMENT ASSUMPTIONS

Activity	Equipment	Number	Hours Per Day
Rock Crushing	Crushing/Proc. Equipment	1	8
	Generator Sets	1	8
	Water Trucks	1	8
Reducing Oversize Material	Concrete/Industrial Saws	1	8
	Dumpers/Tenders	1	8
	Tractors/Loaders/Backhoes	1	8
Site Preparation	Rubber Tired Dozers	3	8
	Tractors/Loaders/Backhoes	4	8
Blasting	Water Trucks	1	8
Drilling	Bore/Drill Rigs	3	8
Import of Crushed Material	Rubber Tired Dozers	1	8
	Tractors/Loaders/Backhoes	2	8
Grading	Excavators	2	8
	Graders	2	8
	Water Trucks	1	8
	Rubber Tired Dozers	2	8
	Scrapers	4	8
	Tractors/Loaders/Backhoes	2	8
Foundation/Utilities Excavation	Excavators	1	8
	Tractors/Loaders/Backhoes	1	8
	Trenchers	1	8
Foundation/Vertical Construction	Cement and Mortar Mixers	2	8
	Cranes	1	8
	Forklifts	3	8
	Generator Sets	1	8
	Tractors/Loaders/Backhoes	3	8
	Welders	1	8
Paving	Pavers	2	8
	Paving Equipment	2	8
	Rollers	2	8
Architectural Coatings	Air Compressors	1	8

OVERLAP OF CONSTRUCTION-RELATED ACTIVITIES

The Project is anticipated to have overlapping construction activities. Therefore, overlapping construction activities would affect the maximum peak daily construction emission levels for criteria pollutants. As shown in Table 3, the Import of Crushed Materials overlaps with Rock Crushing, Reducing Oversize Material, Blasting, and Drilling activities. These overlapping construction phases result in the maximum daily construction emissions for the criteria pollutants NO_x, CO, SO_x, PM_{10}, and $PM_{2.5}$. Additionally, as shown in Table 3, Architectural Coatings overlap with Foundation/Vertical Construction and Paving resulting in the maximum daily construction emission for VOCs

TABLE 3: SCHEDULE OF CONSTRUCTION ACTIVITIES



CONSTRUCTION EMISSIONS SUMMARY

The estimated maximum daily construction emissions are summarized on Table 4. Detailed construction model outputs are presented in Appendix 3.1. Under the assumed scenarios, emissions resulting from the Project construction will not exceed any criteria pollutant thresholds established by the SDAPCD.

TABLE 4: EMISSIONS SUMMARY OF OVERALL CONSTRUCTION

Year	VOC	NOx	CO	SOx	PM10	PM2.5
2015	19.14	233.24	173.50	0.43	71.72	19.10
2016	80.00	142.45	91.11	0.16	13.94	8.93
2017	76.26	49.83	68.53	0.13	12.29	4.84
Maximum Daily Emissions	**80.00**	**233.24**	**173.50**	**0.43**	**71.72**	**19.10**
SDAPCD Regional Threshold	137	250	550	250	100	55
Threshold Exceeded?	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**

STANDARD REGULATORY REQUIREMENTS/BEST AVAILABLE CONTROL MEASURES (BACMS)

Measures listed below (or equivalent language) shall appear on all Project grading plans, construction specifications and bid documents, and the City shall ensure such language is incorporated prior to issuance of any development permits. City monitoring of construction activities shall be conducted to ensure mitigation compliance.

SDAPCD Rules that are currently applicable during construction activity for this Project include but are not limited to: Rule 67 (Architectural Coatings) (1); Rule 62 (Low Sulfur Fuels) (2); Rule 55 (Fugitive Dust) (3). In order to facilitate monitoring and compliance, applicable SDAPCD regulatory requirements are summarized below.

BACM AQ-1

The following measures shall be incorporated into Project plans and specifications as implementation of Rule 55 (3):

- The contractor shall ensure that all disturbed unpaved roads and disturbed areas within the Project are watered at least two times daily during dry weather. Watering, with complete coverage of disturbed areas, shall occur at least three times a day, preferably in the mid-morning, afternoon, and after work is done for the day.

CONSTRUCTION-SOURCE AIR QUALITY IMPACT MITIGATION MEASURES

No significant impacts were identified and no mitigation measures are required

CONCLUSION

Results of the analysis indicate that the proposed Project's short-term construction emissions will not exceed the established regional significance thresholds. Therefore a less than significant impact will occur.

If you have any questions, please contact me directly at (949) 660-1994 x217.

Respectfully submitted,

URBAN CROSSROADS, INC.

Haseeb Qureshi,
Senior Associate

Appendix 3.1

CalEEMod Input/Output Files

Heritage Bluffs (construction)

San Diego County, Winter

1.0 Project Characteristics

1.1 Land Usage

Land Uses	Size	Metric	Lot Acreage	Floor Surface Area	Population
Other Asphalt Surfaces	9.84	Acre	9.84	428,630.40	0
Single Family Housing	171.00	Dwelling Unit	55.52	307,800.00	489

1.2 Other Project Characteristics

Urbanization Urban **Wind Speed (m/s)** 2.6 **Precipitation Freq (Days)** 40

Climate Zone 10 **Operational Year** 2016

Utility Company San Diego Gas & Electric

CO2 Intensity (lb/MWhr) 477.05 **CH4 Intensity (lb/MWhr)** 0.029 **N2O Intensity (lb/MWhr)** 0.006

1.3 User Entered Comments & Non-Default Data

Project Characteristics - CPUC GHG Calculator version 3c

Land Use - based on information provided by the applicant

Construction Phase - based on consultation with the applicant

Off-road Equipment - 8 hour work day

Off-road Equipment - based on past project experience

Off-road Equipment - 8 hour work day

Off-road Equipment - based on consultation with the applicant

Off-road Equipment - based on past project experience

Off-road Equipment - based on past project experience

Off-road Equipment - adjusted defaults to account for grading quantities

Off-road Equipment - based on past project experience

Off-road Equipment -

Off-road Equipment - based on past project experience

Off-road Equipment - based on consultation with the applicant

Off-road Equipment -

Grading -

Vehicle Trips - no operational emissions modeled

Vechicle Emission Factors - no operational emissions modeled

Vechicle Emission Factors - no operational emissions modeled

Vechicle Emission Factors - no operational emissions modeled

Woodstoves - no operational emissions modeled

Energy Use - no operational emissions modeled

Water And Wastewater - no operational emissions modeled

Solid Waste - no operational emissions modeled

Construction Off-road Equipment Mitigation -

Table Name	Column Name	Default Value	New Value
tblConstructionPhase	NumDays	75.00	285.00

tblConstructionPhase	NumDays	1,110.00	300.00
tblConstructionPhase	NumDays	110.00	40.00
tblConstructionPhase	NumDays	110.00	75.00
tblConstructionPhase	NumDays	75.00	30.00
tblConstructionPhase	NumDays	40.00	110.00
tblConstructionPhase	NumDays	40.00	110.00
tblConstructionPhase	PhaseEndDate	6/15/2017	5/4/2017
tblConstructionPhase	PhaseEndDate	12/25/2015	10/30/2015
tblConstructionPhase	PhaseEndDate	12/25/2015	9/18/2015
tblConstructionPhase	PhaseEndDate	5/19/2017	5/12/2016
tblConstructionPhase	PhaseEndDate	4/1/2016	10/30/2015
tblConstructionPhase	PhaseEndDate	12/25/2015	7/24/2015
tblConstructionPhase	PhaseEndDate	4/1/2016	10/30/2015
tblConstructionPhase	PhaseStartDate	5/13/2016	4/1/2016
tblConstructionPhase	PhaseStartDate	7/25/2015	6/1/2015
tblConstructionPhase	PhaseStartDate	10/31/2015	7/25/2015
tblConstructionPhase	PhaseStartDate	4/8/2017	4/1/2016
tblConstructionPhase	PhaseStartDate	10/31/2015	6/1/2015
tblConstructionPhase	PhaseStartDate	10/31/2015	6/1/2015
tblConstructionPhase	PhaseStartDate	10/31/2015	6/1/2015
tblEnergyUse	LightingElect	1,608.84	0.00
tblEnergyUse	NT24E	5,089.81	0.00
tblEnergyUse	NT24NG	5,950.14	0.00
tblEnergyUse	T24E	980.99	0.00
tblEnergyUse	T24NG	27,816.78	0.00
tblFireplaces	NumberGas	94.05	0.00
tblFireplaces	NumberNoFireplace	17.10	0.00
tblFireplaces	NumberWood	59.85	0.00

tblGrading	MaterialImported	0.00	145,000.00
tblOffRoadEquipment	HorsePower	205.00	265.00
tblOffRoadEquipment	HorsePower	122.00	189.00
tblOffRoadEquipment	HorsePower	400.00	189.00
tblOffRoadEquipment	HorsePower	400.00	189.00
tblOffRoadEquipment	LoadFactor	0.44	0.50
tblOffRoadEquipment	LoadFactor	0.38	0.50
tblOffRoadEquipment	LoadFactor	0.38	0.50
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	2.00	0.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	2.00	0.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	1.00	0.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	1.00	0.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	1.00	2.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	1.00	0.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	1.00	2.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	3.00	0.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	3.00	0.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	2.00	0.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	2.00	0.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	2.00	4.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	2.00	0.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	4.00	0.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	4.00	1.00
tblOffRoadEquipment	UsageHours	6.00	8.00
tblOffRoadEquipment	UsageHours	7.00	8.00
tblOffRoadEquipment	UsageHours	7.00	8.00
tblProjectCharacteristics	CO2IntensityFactor	720.49	477.05
tblProjectCharacteristics	OperationalYear	2014	2016

tblSolidWaste	SolidWasteGenerationRate	200.49	0.00
tblVehicleEF	HHD	0.02	0.00
tblVehicleEF	HHD	0.02	0.00
tblVehicleEF	HHD	0.02	0.00
tblVehicleEF	LDA	0.51	0.00
tblVehicleEF	LDA	0.51	0.00
tblVehicleEF	LDA	0.51	0.00
tblVehicleEF	LDT1	0.07	0.00
tblVehicleEF	LDT1	0.07	0.00
tblVehicleEF	LDT1	0.07	0.00
tblVehicleEF	LDT2	0.19	0.00
tblVehicleEF	LDT2	0.19	0.00
tblVehicleEF	LDT2	0.19	0.00
tblVehicleEF	LHD1	0.04	0.00
tblVehicleEF	LHD1	0.04	0.00
tblVehicleEF	LHD1	0.04	0.00
tblVehicleEF	LHD2	5.2650e-003	0.00
tblVehicleEF	LHD2	5.2650e-003	0.00
tblVehicleEF	LHD2	5.2650e-003	0.00
tblVehicleEF	MCY	6.5480e-003	0.00
tblVehicleEF	MCY	6.5480e-003	0.00
tblVehicleEF	MCY	6.5480e-003	0.00
tblVehicleEF	MDV	0.13	0.00
tblVehicleEF	MDV	0.13	0.00
tblVehicleEF	MDV	0.13	0.00
tblVehicleEF	MH	3.4710e-003	0.00
tblVehicleEF	MH	3.4710e-003	0.00
tblVehicleEF	MH	3.4710e-003	0.00

tblVehicleEF	MHD	0.01	0.00
tblVehicleEF	MHD	0.01	0.00
tblVehicleEF	MHD	0.01	0.00
tblVehicleEF	OBUS	1.8470e-003	0.00
tblVehicleEF	OBUS	1.8470e-003	0.00
tblVehicleEF	OBUS	1.8470e-003	0.00
tblVehicleEF	SBUS	6.1000e-004	0.00
tblVehicleEF	SBUS	6.1000e-004	0.00
tblVehicleEF	SBUS	6.1000e-004	0.00
tblVehicleEF	UBUS	2.0830e-003	0.00
tblVehicleEF	UBUS	2.0830e-003	0.00
tblVehicleEF	UBUS	2.0830e-003	0.00
tblVehicleTrips	ST_TR	10.08	0.00
tblVehicleTrips	SU_TR	8.77	0.00
tblVehicleTrips	WD_TR	9.57	0.00
tblWater	IndoorWaterUseRate	11,141,338.38	0.00
tblWater	OutdoorWaterUseRate	7,023,887.24	0.00
tblWoodstoves	NumberCatalytic	8.55	0.00
tblWoodstoves	NumberNoncatalytic	8.55	0.00

2.0 Emissions Summary

2.1 Overall Construction (Maximum Daily Emission)

Unmitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Year	lb/day										lb/day					
2015	19.1372	233.2394	173.5042	0.4312	20.7526	9.9100	27.7495	10.0287	9.2204	16.5442	0.0000	43,850.9159	43,850.9159	5.4935	0.0000	43,966.2799
2016	80.0005	142.4518	91.0666	0.1520	17.6178	6.5795	24.1972	7.2649	6.0531	13.3180	0.0000	14,332.6549	14,332.6549	3.6099	0.0000	14,408.4634
2017	76.2550	49.8272	68.5296	0.1281	9.8662	2.4258	12.2921	2.5553	2.2869	4.8422	0.0000	11,622.2931	11,622.2931	1.0045	0.0000	11,643.3884
Total	**175.3928**	**425.5184**	**333.1005**	**0.7112**	**48.2366**	**18.9153**	**64.2388**	**19.8489**	**17.5604**	**34.7043**	**0.0000**	**69,805.8639**	**69,805.8639**	**10.1080**	**0.0000**	**70,018.1317**

Mitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Year	lb/day										lb/day					
2015	19.1372	233.2394	173.5042	0.4312	13.0950	9.9100	19.5539	4.8545	9.2204	12.1564	0.0000	43,850.9159	43,850.9159	5.4935	0.0000	43,966.2799
2016	80.0005	142.4518	91.0666	0.1520	9.9894	6.5795	13.9434	2.8772	6.0531	8.9303	0.0000	14,332.6549	14,332.6549	3.6099	0.0000	14,408.4634
2017	76.2550	49.8272	68.5296	0.1281	9.8662	2.4258	12.2921	2.5553	2.2869	4.8422	0.0000	11,622.2931	11,622.2931	1.0045	0.0000	11,643.3884
Total	**175.3928**	**425.5184**	**333.1005**	**0.7112**	**32.9506**	**18.9153**	**45.7894**	**10.2870**	**17.5604**	**25.9289**	**0.0000**	**69,805.8639**	**69,805.8639**	**10.1080**	**0.0000**	**70,018.1317**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N20	CO2e
Percent Reduction	0.00	0.00	0.00	0.00	31.69	0.00	28.72	48.17	0.00	25.29	0.00	0.00	0.00	0.00	0.00	0.00

2.2 Overall Operational

Unmitigated Operational

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Area	21.5700	0.1674	14.3053	7.5000e-004		0.0772	0.0772		0.0772	0.0772	0.0000	25.4046	25.4046	0.0259	0.0000	25.9484
Energy	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
Mobile	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Total	**21.5700**	**0.1674**	**14.3053**	**7.5000e-004**	**0.0000**	**0.0772**	**0.0772**	**0.0000**	**0.0772**	**0.0772**	**0.0000**	**25.4046**	**25.4046**	**0.0259**	**0.0000**	**25.9484**

Mitigated Operational

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Area	21.5700	0.1674	14.3053	7.5000e-004		0.0772	0.0772		0.0772	0.0772	0.0000	25.4046	25.4046	0.0259	0.0000	25.9484
Energy	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
Mobile	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Total	**21.5700**	**0.1674**	**14.3053**	**7.5000e-004**	**0.0000**	**0.0772**	**0.0772**	**0.0000**	**0.0772**	**0.0772**	**0.0000**	**25.4046**	**25.4046**	**0.0259**	**0.0000**	**25.9484**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N20	CO2e
Percent Reduction	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

3.0 Construction Detail

Construction Phase

Phase Number	Phase Name	Phase Type	Start Date	End Date	Num Days Week	Num Days	Phase Description
1	Rock Crushing	Site Preparation	6/1/2015	10/30/2015	5	110	
2	Reducing Oversize Material	Site Preparation	6/1/2015	10/30/2015	5	110	
3	Site Preparation	Site Preparation	6/1/2015	7/24/2015	5	40	
4	Blasting	Grading	6/1/2015	10/30/2015	5	110	
5	Drilling	Trenching	6/1/2015	10/30/2015	5	110	
6	Import of Crushed Material	Grading	7/25/2015	9/18/2015	5	40	
7	Grading	Grading	9/19/2015	1/1/2016	5	75	
8	Foundation/Utilities Excavation	Trenching	1/2/2016	2/12/2016	5	30	
9	Foundation/Vertical Construction	Building Construction	2/13/2016	4/7/2017	5	300	
10	Paving	Paving	4/1/2016	5/12/2016	5	30	
11	Architectural Coating	Architectural Coating	4/1/2016	5/4/2017	5	285	

Acres of Grading (Site Preparation Phase): 0

Acres of Grading (Grading Phase): 375

Acres of Paving: 0

Residential Indoor: 623,295; Residential Outdoor: 207,765; Non-Residential Indoor: 642,946; Non-Residential Outdoor: 214,315 (Architectural Coating – sqft)

OffRoad Equipment

Phase Name	Offroad Equipment Type	Amount	Usage Hours	Horse Power	Load Factor
Rock Crushing	Crushing/Proc. Equipment	1	8.00	85	0.78
Rock Crushing	Generator Sets	1	8.00	84	0.74
Rock Crushing	Off-Highway Tractors	1	8.00	189	0.50
Rock Crushing	Rubber Tired Dozers	0	8.00	255	0.40
Rock Crushing	Tractors/Loaders/Backhoes	0	8.00	97	0.37
Reducing Oversize Material	Concrete/Industrial Saws	1	8.00	81	0.73
Reducing Oversize Material	Dumpers/Tenders	1	8.00	16	0.38
Reducing Oversize Material	Rubber Tired Dozers	0	8.00	255	0.40
Reducing Oversize Material	Tractors/Loaders/Backhoes	1	8.00	97	0.37
Site Preparation	Rubber Tired Dozers	3	8.00	255	0.40
Site Preparation	Tractors/Loaders/Backhoes	4	8.00	97	0.37
Blasting	Excavators	0	8.00	162	0.38
Blasting	Graders	0	8.00	174	0.41
Blasting	Off-Highway Trucks	1	8.00	189	0.50
Blasting	Rubber Tired Dozers	0	8.00	255	0.40
Blasting	Scrapers	0	8.00	361	0.48
Blasting	Tractors/Loaders/Backhoes	0	8.00	97	0.37
Drilling	Bore/Drill Rigs	3	8.00	265	0.50
Import of Crushed Material	Excavators	0	8.00	162	0.38
Import of Crushed Material	Graders	0	8.00	174	0.41
Import of Crushed Material	Rubber Tired Dozers	1	8.00	255	0.40
Import of Crushed Material	Scrapers	0	8.00	361	0.48
Import of Crushed Material	Tractors/Loaders/Backhoes	2	8.00	97	0.37
Grading	Excavators	2	8.00	162	0.38
Grading	Graders	2	8.00	174	0.41
Grading	Off-Highway Trucks	1	8.00	189	0.50
Grading	Rubber Tired Dozers	2	8.00	255	0.40

Grading	Scrapers	4	8.00	361	0.48
Grading	Tractors/Loaders/Backhoes	2	8.00	97	0.37
Foundation/Utilities Excavation	Excavators	1	8.00	162	0.38
Foundation/Utilities Excavation	Tractors/Loaders/Backhoes	1	8.00	97	0.37
Foundation/Utilities Excavation	Trenchers	1	8.00	80	0.50
Foundation/Vertical Construction	Cement and Mortar Mixers	2	8.00	9	0.56
Foundation/Vertical Construction	Cranes	1	8.00	226	0.29
Foundation/Vertical Construction	Forklifts	3	8.00	89	0.20
Foundation/Vertical Construction	Generator Sets	1	8.00	84	0.74
Foundation/Vertical Construction	Tractors/Loaders/Backhoes	3	8.00	97	0.37
Foundation/Vertical Construction	Welders	1	8.00	46	0.45
Paving	Pavers	2	8.00	125	0.42
Paving	Paving Equipment	2	8.00	130	0.36
Paving	Rollers	2	8.00	80	0.38
Architectural Coating	Air Compressors	1	8.00	78	0.48

Trips and VMT

Phase Name	Offroad Equipment Count	Worker Trip Number	Vendor Trip Number	Hauling Trip Number	Worker Trip Length	Vendor Trip Length	Hauling Trip Length	Worker Vehicle Class	Vendor Vehicle Class	Hauling Vehicle Class
Rock Crushing	3	8.00	0.00	0.00	10.80	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Reducing Oversize Material	3	8.00	0.00	0.00	10.80	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Site Preparation	7	18.00	0.00	0.00	10.80	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Blasting	1	3.00	0.00	0.00	10.80	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Drilling	3	8.00	0.00	0.00	10.80	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Import of Crushed Material	4	10.00	0.00	18,125.00	10.80	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Grading	13	33.00	0.00	0.00	10.80	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Foundation/Utilities Excavation	3	8.00	0.00	0.00	10.80	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Foundation/Vertical Construction	11	242.00	89.00	0.00	10.80	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Foundation/Vertical Construction	11	242.00	89.00	0.00	10.80	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Paving	6	15.00	0.00	0.00	10.80	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Architectural Coating	1	48.00	0.00	0.00	10.80	7.30	20.00	LD_Mix	HDT_Mix	HHDT

3.1 Mitigation Measures Construction

Water Exposed Area

3.2 Rock Crushing - 2015

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Fugitive Dust					0.0000	0.0000	0.0000	0.0000	0.0000	0.0000			0.0000			0.0000
Off-Road	2.3130	20.3348	11.0241	0.0217		1.2147	1.2147		1.1882	1.1882		2,136.228 3	2,136.228 3	0.4000		2,144.627 7
Total	**2.3130**	**20.3348**	**11.0241**	**0.0217**	**0.0000**	**1.2147**	**1.2147**	**0.0000**	**1.1882**	**1.1882**		**2,136.228 3**	**2,136.228 3**	**0.4000**		**2,144.627 7**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0326	0.0406	0.3859	7.8000e-004	0.0657	5.2000e-004	0.0662	0.0174	4.7000e-004	0.0179		67.6216	67.6216	3.7700e-003		67.7009
Total	**0.0326**	**0.0406**	**0.3859**	**7.8000e-004**	**0.0657**	**5.2000e-004**	**0.0662**	**0.0174**	**4.7000e-004**	**0.0179**		**67.6216**	**67.6216**	**3.7700e-003**		**67.7009**

3.2 Rock Crushing - 2015

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Fugitive Dust					0.0000	0.0000	0.0000	0.0000	0.0000	0.0000			0.0000			0.0000
Off-Road	2.3130	20.3348	11.0241	0.0217		1.2147	1.2147		1.1882	1.1882	0.0000	2,136.2283	2,136.2283	0.4000		2,144.6277
Total	**2.3130**	**20.3348**	**11.0241**	**0.0217**	**0.0000**	**1.2147**	**1.2147**	**0.0000**	**1.1882**	**1.1882**	**0.0000**	**2,136.2283**	**2,136.2283**	**0.4000**		**2,144.6277**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0326	0.0406	0.3859	7.8000e-004	0.0657	5.2000e-004	0.0662	0.0174	4.7000e-004	0.0179		67.6216	67.6216	3.7700e-003		67.7009
Total	**0.0326**	**0.0406**	**0.3859**	**7.8000e-004**	**0.0657**	**5.2000e-004**	**0.0662**	**0.0174**	**4.7000e-004**	**0.0179**		**67.6216**	**67.6216**	**3.7700e-003**		**67.7009**

3.3 Reducing Oversize Material - 2015

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Fugitive Dust					0.0000	0.0000	0.0000	0.0000	0.0000	0.0000			0.0000			0.0000
Off-Road	1.1473	8.8985	6.4810	0.0101		0.6766	0.6766		0.6552	0.6552		981.0937	981.0937	0.1680		984.6223
Total	**1.1473**	**8.8985**	**6.4810**	**0.0101**	**0.0000**	**0.6766**	**0.6766**	**0.0000**	**0.6552**	**0.6552**		**981.0937**	**981.0937**	**0.1680**		**984.6223**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0326	0.0406	0.3859	7.8000e-004	0.0657	5.2000e-004	0.0662	0.0174	4.7000e-004	0.0179		67.6216	67.6216	3.7700e-003		67.7009
Total	**0.0326**	**0.0406**	**0.3859**	**7.8000e-004**	**0.0657**	**5.2000e-004**	**0.0662**	**0.0174**	**4.7000e-004**	**0.0179**		**67.6216**	**67.6216**	**3.7700e-003**		**67.7009**

3.3 Reducing Oversize Material - 2015

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Fugitive Dust					0.0000	0.0000	0.0000	0.0000	0.0000	0.0000			0.0000			0.0000
Off-Road	1.1473	8.8985	6.4810	0.0101		0.6766	0.6766		0.6552	0.6552	0.0000	981.0937	981.0937	0.1680		984.6223
Total	**1.1473**	**8.8985**	**6.4810**	**0.0101**	**0.0000**	**0.6766**	**0.6766**	**0.0000**	**0.6552**	**0.6552**	**0.0000**	**981.0937**	**981.0937**	**0.1680**		**984.6223**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0326	0.0406	0.3859	7.8000e-004	0.0657	5.2000e-004	0.0662	0.0174	4.7000e-004	0.0179		67.6216	67.6216	3.7700e-003		67.7009
Total	**0.0326**	**0.0406**	**0.3859**	**7.8000e-004**	**0.0657**	**5.2000e-004**	**0.0662**	**0.0174**	**4.7000e-004**	**0.0179**		**67.6216**	**67.6216**	**3.7700e-003**		**67.7009**

3.4 Site Preparation - 2015

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Fugitive Dust					18.0663	0.0000	18.0663	9.9307	0.0000	9.9307			0.0000			0.0000
Off-Road	5.2609	56.8897	42.6318	0.0391		3.0883	3.0883		2.8412	2.8412		4,111.7444	4,111.7444	1.2275		4,137.5225
Total	**5.2609**	**56.8897**	**42.6318**	**0.0391**	**18.0663**	**3.0883**	**21.1545**	**9.9307**	**2.8412**	**12.7719**		**4,111.7444**	**4,111.7444**	**1.2275**		**4,137.5225**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0734	0.0913	0.8682	1.7600e-003	0.1479	1.1600e-003	0.1490	0.0392	1.0600e-003	0.0403		152.1487	152.1487	8.4900e-003		152.3270
Total	**0.0734**	**0.0913**	**0.8682**	**1.7600e-003**	**0.1479**	**1.1600e-003**	**0.1490**	**0.0392**	**1.0600e-003**	**0.0403**		**152.1487**	**152.1487**	**8.4900e-003**		**152.3270**

3.4 Site Preparation - 2015

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Fugitive Dust					7.0458	0.0000	7.0458	3.8730	0.0000	3.8730			0.0000			0.0000
Off-Road	5.2609	56.8897	42.6318	0.0391		3.0883	3.0883		2.8412	2.8412	0.0000	4,111.744 4	4,111.744 4	1.2275		4,137.522 4
Total	**5.2609**	**56.8897**	**42.6318**	**0.0391**	**7.0458**	**3.0883**	**10.1341**	**3.8730**	**2.8412**	**6.7142**	**0.0000**	**4,111.744 4**	**4,111.744 4**	**1.2275**		**4,137.522 4**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0734	0.0913	0.8682	1.7600e-003	0.1479	1.1600e-003	0.1490	0.0392	1.0600e-003	0.0403		152.1487	152.1487	8.4900e-003		152.3270
Total	**0.0734**	**0.0913**	**0.8682**	**1.7600e-003**	**0.1479**	**1.1600e-003**	**0.1490**	**0.0392**	**1.0600e-003**	**0.0403**		**152.1487**	**152.1487**	**8.4900e-003**		**152.3270**

3.5 Blasting - 2015

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Fugitive Dust					0.0000	0.0000	0.0000	0.0000	0.0000	0.0000			0.0000			0.0000
Off-Road	0.7890	8.7373	3.1666	8.0600e-003		0.3779	0.3779		0.3477	0.3477		846.3621	846.3621	0.2527		851.6682
Total	**0.7890**	**8.7373**	**3.1666**	**8.0600e-003**	**0.0000**	**0.3779**	**0.3779**	**0.0000**	**0.3477**	**0.3477**		**846.3621**	**846.3621**	**0.2527**		**851.6682**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0122	0.0152	0.1447	2.9000e-004	0.0246	1.9000e-004	0.0248	6.5400e-003	1.8000e-004	6.7100e-003		25.3581	25.3581	1.4200e-003		25.3878
Total	**0.0122**	**0.0152**	**0.1447**	**2.9000e-004**	**0.0246**	**1.9000e-004**	**0.0248**	**6.5400e-003**	**1.8000e-004**	**6.7100e-003**		**25.3581**	**25.3581**	**1.4200e-003**		**25.3878**

3.5 Blasting - 2015

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Fugitive Dust					0.0000	0.0000	0.0000	0.0000	0.0000	0.0000			0.0000			0.0000
Off-Road	0.7890	8.7373	3.1666	8.0600e-003		0.3779	0.3779		0.3477	0.3477	0.0000	846.3621	846.3621	0.2527		851.6682
Total	**0.7890**	**8.7373**	**3.1666**	**8.0600e-003**	**0.0000**	**0.3779**	**0.3779**	**0.0000**	**0.3477**	**0.3477**	**0.0000**	**846.3621**	**846.3621**	**0.2527**		**851.6682**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0122	0.0152	0.1447	2.9000e-004	0.0246	1.9000e-004	0.0248	6.5400e-003	1.8000e-004	6.7100e-003		25.3581	25.3581	1.4200e-003		25.3878
Total	**0.0122**	**0.0152**	**0.1447**	**2.9000e-004**	**0.0246**	**1.9000e-004**	**0.0248**	**6.5400e-003**	**1.8000e-004**	**6.7100e-003**		**25.3581**	**25.3581**	**1.4200e-003**		**25.3878**

3.6 Drilling - 2015

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	1.3967	21.0536	8.8029	0.0334		0.6721	0.6721		0.6183	0.6183		3,504.664 9	3,504.664 9	1.0463		3,526.637 0
Total	**1.3967**	**21.0536**	**8.8029**	**0.0334**		**0.6721**	**0.6721**		**0.6183**	**0.6183**		**3,504.664 9**	**3,504.664 9**	**1.0463**		**3,526.637 0**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0326	0.0406	0.3859	7.8000e-004	0.0657	5.2000e-004	0.0662	0.0174	4.7000e-004	0.0179		67.6216	67.6216	3.7700e-003		67.7009
Total	**0.0326**	**0.0406**	**0.3859**	**7.8000e-004**	**0.0657**	**5.2000e-004**	**0.0662**	**0.0174**	**4.7000e-004**	**0.0179**		**67.6216**	**67.6216**	**3.7700e-003**		**67.7009**

3.6 Drilling - 2015

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	1.3967	21.0536	8.8029	0.0334		0.6721	0.6721		0.6183	0.6183	0.0000	3,504.664 9	3,504.664 9	1.0463		3,526.636 9
Total	**1.3967**	**21.0536**	**8.8029**	**0.0334**		**0.6721**	**0.6721**		**0.6183**	**0.6183**	**0.0000**	**3,504.664 9**	**3,504.664 9**	**1.0463**		**3,526.636 9**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0326	0.0406	0.3859	7.8000e-004	0.0657	5.2000e-004	0.0662	0.0174	4.7000e-004	0.0179		67.6216	67.6216	3.7700e-003		67.7009
Total	**0.0326**	**0.0406**	**0.3859**	**7.8000e-004**	**0.0657**	**5.2000e-004**	**0.0662**	**0.0174**	**4.7000e-004**	**0.0179**		**67.6216**	**67.6216**	**3.7700e-003**		**67.7009**

3.7 Import of Crushed Material - 2015

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Fugitive Dust					12.5536	0.0000	12.5536	6.6976	0.0000	6.6976			0.0000			0.0000
Off-Road	1.9939	21.2513	15.8277	0.0151		1.2085	1.2085		1.1118	1.1118		1,588.906 6	1,588.906 6	0.4744		1,598.868 0
Total	**1.9939**	**21.2513**	**15.8277**	**0.0151**	**12.5536**	**1.2085**	**13.7621**	**6.6976**	**1.1118**	**7.8094**		**1,588.906 6**	**1,588.906 6**	**0.4744**		**1,598.868 0**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	11.3465	152.7762	126.4173	0.3392	7.8951	2.3067	10.2019	2.1618	2.1218	4.2836		34,480.91 05	34,480.91 05	0.2833		34,486.86 07
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0408	0.0507	0.4823	9.8000e-004	0.0822	6.4000e-004	0.0828	0.0218	5.9000e-004	0.0224		84.5270	84.5270	4.7200e-003		84.6261
Total	**11.3872**	**152.8269**	**126.8997**	**0.3401**	**7.9773**	**2.3074**	**10.2847**	**2.1836**	**2.1223**	**4.3059**		**34,565.43 75**	**34,565.43 75**	**0.2881**		**34,571.48 68**

3.7 Import of Crushed Material - 2015

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Fugitive Dust					4.8959	0.0000	4.8959	2.6121	0.0000	2.6121			0.0000			0.0000
Off-Road	1.9939	21.2513	15.8277	0.0151		1.2085	1.2085		1.1118	1.1118	0.0000	1,588.906 6	1,588.906 6	0.4744		1,598.868 0
Total	**1.9939**	**21.2513**	**15.8277**	**0.0151**	**4.8959**	**1.2085**	**6.1044**	**2.6121**	**1.1118**	**3.7239**	**0.0000**	**1,588.906 6**	**1,588.906 6**	**0.4744**		**1,598.868 0**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	11.3465	152.7762	126.4173	0.3392	7.8951	2.3067	10.2019	2.1618	2.1218	4.2836		34,480.91 05	34,480.91 05	0.2833		34,486.86 07
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0408	0.0507	0.4823	9.8000e-004	0.0822	6.4000e-004	0.0828	0.0218	5.9000e-004	0.0224		84.5270	84.5270	4.7200e-003		84.6261
Total	**11.3872**	**152.8269**	**126.8997**	**0.3401**	**7.9773**	**2.3074**	**10.2847**	**2.1836**	**2.1223**	**4.3059**		**34,565.43 75**	**34,565.43 75**	**0.2881**		**34,571.48 68**

3.8 Grading - 2015

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Fugitive Dust					17.3467	0.0000	17.3467	7.1930	0.0000	7.1930			0.0000			0.0000
Off-Road	12.7854	150.2367	93.1170	0.1147		6.9647	6.9647		6.4076	6.4076		12,052.7632	12,052.7632	3.5983		12,128.3265
Total	**12.7854**	**150.2367**	**93.1170**	**0.1147**	**17.3467**	**6.9647**	**24.3114**	**7.1930**	**6.4076**	**13.6006**		**12,052.7632**	**12,052.7632**	**3.5983**		**12,128.3265**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.1345	0.1674	1.5917	3.2300e-003	0.2711	2.1300e-003	0.2732	0.0719	1.9500e-003	0.0739		278.9392	278.9392	0.0156		279.2661
Total	**0.1345**	**0.1674**	**1.5917**	**3.2300e-003**	**0.2711**	**2.1300e-003**	**0.2732**	**0.0719**	**1.9500e-003**	**0.0739**		**278.9392**	**278.9392**	**0.0156**		**279.2661**

3.8 Grading - 2015

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Fugitive Dust					6.7652	0.0000	6.7652	2.8053	0.0000	2.8053			0.0000			0.0000
Off-Road	12.7854	150.2367	93.1170	0.1147		6.9647	6.9647		6.4076	6.4076	0.0000	12,052.7632	12,052.7632	3.5983		12,128.3265
Total	**12.7854**	**150.2367**	**93.1170**	**0.1147**	**6.7652**	**6.9647**	**13.7299**	**2.8053**	**6.4076**	**9.2128**	**0.0000**	**12,052.7632**	**12,052.7632**	**3.5983**		**12,128.3265**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.1345	0.1674	1.5917	3.2300e-003	0.2711	2.1300e-003	0.2732	0.0719	1.9500e-003	0.0739		278.9392	278.9392	0.0156		279.2661
Total	**0.1345**	**0.1674**	**1.5917**	**3.2300e-003**	**0.2711**	**2.1300e-003**	**0.2732**	**0.0719**	**1.9500e-003**	**0.0739**		**278.9392**	**278.9392**	**0.0156**		**279.2661**

3.8 Grading - 2016

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Fugitive Dust					17.3467	0.0000	17.3467	7.1930	0.0000	7.1930			0.0000			0.0000
Off-Road	12.2443	142.2999	89.6324	0.1147		6.5774	6.5774		6.0513	6.0513		11,920.2400	11,920.2400	3.5956		11,995.7470
Total	**12.2443**	**142.2999**	**89.6324**	**0.1147**	**17.3467**	**6.5774**	**23.9241**	**7.1930**	**6.0513**	**13.2443**		**11,920.2400**	**11,920.2400**	**3.5956**		**11,995.7470**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.1223	0.1519	1.4343	3.2200e-003	0.2711	2.0300e-003	0.2731	0.0719	1.8700e-003	0.0738		269.1716	269.1716	0.0144		269.4731
Total	**0.1223**	**0.1519**	**1.4343**	**3.2200e-003**	**0.2711**	**2.0300e-003**	**0.2731**	**0.0719**	**1.8700e-003**	**0.0738**		**269.1716**	**269.1716**	**0.0144**		**269.4731**

3.8 Grading - 2016

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Fugitive Dust					6.7652	0.0000	6.7652	2.8053	0.0000	2.8053			0.0000			0.0000
Off-Road	12.2443	142.2999	89.6324	0.1147		6.5774	6.5774		6.0513	6.0513	0.0000	11,920.2400	11,920.2400	3.5956		11,995.7469
Total	**12.2443**	**142.2999**	**89.6324**	**0.1147**	**6.7652**	**6.5774**	**13.3426**	**2.8053**	**6.0513**	**8.8565**	**0.0000**	**11,920.2400**	**11,920.2400**	**3.5956**		**11,995.7469**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.1223	0.1519	1.4343	3.2200e-003	0.2711	2.0300e-003	0.2731	0.0719	1.8700e-003	0.0738		269.1716	269.1716	0.0144		269.4731
Total	**0.1223**	**0.1519**	**1.4343**	**3.2200e-003**	**0.2711**	**2.0300e-003**	**0.2731**	**0.0719**	**1.8700e-003**	**0.0738**		**269.1716**	**269.1716**	**0.0144**		**269.4731**

3.9 Foundation/Utilities Excavation - 2016

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	1.2847	12.5552	8.6547	0.0119		0.8506	0.8506		0.7825	0.7825		1,233.3212	1,233.3212	0.3720		1,241.1334
Total	**1.2847**	**12.5552**	**8.6547**	**0.0119**		**0.8506**	**0.8506**		**0.7825**	**0.7825**		**1,233.3212**	**1,233.3212**	**0.3720**		**1,241.1334**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0296	0.0368	0.3477	7.8000e-004	0.0657	4.9000e-004	0.0662	0.0174	4.5000e-004	0.0179		65.2537	65.2537	3.4800e-003		65.3268
Total	**0.0296**	**0.0368**	**0.3477**	**7.8000e-004**	**0.0657**	**4.9000e-004**	**0.0662**	**0.0174**	**4.5000e-004**	**0.0179**		**65.2537**	**65.2537**	**3.4800e-003**		**65.3268**

3.9 Foundation/Utilities Excavation - 2016

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	1.2847	12.5552	8.6547	0.0119		0.8506	0.8506		0.7825	0.7825	0.0000	1,233.3212	1,233.3212	0.3720		1,241.1334
Total	**1.2847**	**12.5552**	**8.6547**	**0.0119**		**0.8506**	**0.8506**		**0.7825**	**0.7825**	**0.0000**	**1,233.3212**	**1,233.3212**	**0.3720**		**1,241.1334**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0296	0.0368	0.3477	7.8000e-004	0.0657	4.9000e-004	0.0662	0.0174	4.5000e-004	0.0179		65.2537	65.2537	3.4800e-003		65.3268
Total	**0.0296**	**0.0368**	**0.3477**	**7.8000e-004**	**0.0657**	**4.9000e-004**	**0.0662**	**0.0174**	**4.5000e-004**	**0.0179**		**65.2537**	**65.2537**	**3.4800e-003**		**65.3268**

3.10 Foundation/Vertical Construction - 2016

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	3.7416	31.5318	20.4012	0.0301		2.1395	2.1395		2.0091	2.0091		2,964.977 5	2,964.977 5	0.7312		2,980.333 5
Total	**3.7416**	**31.5318**	**20.4012**	**0.0301**		**2.1395**	**2.1395**		**2.0091**	**2.0091**		**2,964.977 5**	**2,964.977 5**	**0.7312**		**2,980.333 5**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	2.1481	17.2782	26.6487	0.0421	2.0404	0.2578	2.2982	0.5479	0.2370	0.7849		4,214.314 0	4,214.314 0	0.0337		4,215.020 5
Worker	1.7934	2.2278	21.0358	0.0473	7.4314	0.0298	7.4613	1.9028	0.0274	1.9302		3,947.849 7	3,947.849 7	0.2106		3,952.272 7
Total	**3.9415**	**19.5060**	**47.6845**	**0.0894**	**9.4719**	**0.2876**	**9.7594**	**2.4507**	**0.2645**	**2.7151**		**8,162.163 6**	**8,162.163 6**	**0.2443**		**8,167.293 2**

3.10 Foundation/Vertical Construction - 2016

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	3.7416	31.5318	20.4012	0.0301		2.1395	2.1395		2.0091	2.0091	0.0000	2,964.9775	2,964.9775	0.7312		2,980.3335
Total	**3.7416**	**31.5318**	**20.4012**	**0.0301**		**2.1395**	**2.1395**		**2.0091**	**2.0091**	**0.0000**	**2,964.9775**	**2,964.9775**	**0.7312**		**2,980.3335**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	2.1481	17.2782	26.6487	0.0421	2.0404	0.2578	2.2982	0.5479	0.2370	0.7849		4,214.3140	4,214.3140	0.0337		4,215.0205
Worker	1.7934	2.2278	21.0358	0.0473	7.4314	0.0298	7.4613	1.9028	0.0274	1.9302		3,947.8497	3,947.8497	0.2106		3,952.2727
Total	**3.9415**	**19.5060**	**47.6845**	**0.0894**	**9.4719**	**0.2876**	**9.7594**	**2.4507**	**0.2645**	**2.7151**		**8,162.1636**	**8,162.1636**	**0.2443**		**8,167.2932**

3.10 Foundation/Vertical Construction - 2017

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	3.4197	29.2456	19.9881	0.0301		1.9393	1.9393		1.8207	1.8207		2,932.3421	2,932.3421	0.7189		2,947.4382
Total	**3.4197**	**29.2456**	**19.9881**	**0.0301**		**1.9393**	**1.9393**		**1.8207**	**1.8207**		**2,932.3421**	**2,932.3421**	**0.7189**		**2,947.4382**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	1.9628	15.4428	25.2405	0.0421	2.0405	0.2237	2.2642	0.5479	0.2057	0.7537		4,143.0188	4,143.0188	0.0319		4,143.6878
Worker	1.6248	2.0246	18.9327	0.0473	7.4314	0.0289	7.4603	1.9028	0.0267	1.9294		3,795.2770	3,795.2770	0.1949		3,799.3693
Total	**3.5876**	**17.4674**	**44.1732**	**0.0893**	**9.4719**	**0.2526**	**9.7245**	**2.4507**	**0.2324**	**2.6831**		**7,938.2958**	**7,938.2958**	**0.2267**		**7,943.0571**

3.10 Foundation/Vertical Construction - 2017

Mitigated Construction On-Site

Category	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
	lb/day										lb/day					
Off-Road	3.4197	29.2456	19.9881	0.0301		1.9393	1.9393		1.8207	1.8207	0.0000	2,932.342 1	2,932.342 1	0.7189		2,947.438 2
Total	**3.4197**	**29.2456**	**19.9881**	**0.0301**		**1.9393**	**1.9393**		**1.8207**	**1.8207**	**0.0000**	**2,932.342 1**	**2,932.342 1**	**0.7189**		**2,947.438 2**

Mitigated Construction Off-Site

Category	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	1.9628	15.4428	25.2405	0.0421	2.0405	0.2237	2.2642	0.5479	0.2057	0.7537		4,143.018 8	4,143.018 8	0.0319		4,143.687 8
Worker	1.6248	2.0246	18.9327	0.0473	7.4314	0.0289	7.4603	1.9028	0.0267	1.9294		3,795.277 0	3,795.277 0	0.1949		3,799.369 3
Total	**3.5876**	**17.4674**	**44.1732**	**0.0893**	**9.4719**	**0.2526**	**9.7245**	**2.4507**	**0.2324**	**2.6831**		**7,938.295 8**	**7,938.295 8**	**0.2267**		**7,943.057 1**

3.11 Paving - 2016

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	2.0898	22.3859	14.8176	0.0223		1.2610	1.2610		1.1601	1.1601		2,316.3767	2,316.3767	0.6987		2,331.0495
Paving	0.8594					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Total	**2.9491**	**22.3859**	**14.8176**	**0.0223**		**1.2610**	**1.2610**		**1.1601**	**1.1601**		**2,316.3767**	**2,316.3767**	**0.6987**		**2,331.0495**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0556	0.0690	0.6519	1.4700e-003	0.1232	9.2000e-004	0.1242	0.0327	8.5000e-004	0.0335		122.3507	122.3507	6.5300e-003		122.4878
Total	**0.0556**	**0.0690**	**0.6519**	**1.4700e-003**	**0.1232**	**9.2000e-004**	**0.1242**	**0.0327**	**8.5000e-004**	**0.0335**		**122.3507**	**122.3507**	**6.5300e-003**		**122.4878**

3.11 Paving - 2016

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	2.0898	22.3859	14.8176	0.0223		1.2610	1.2610		1.1601	1.1601	0.0000	2,316.376 7	2,316.376 7	0.6987		2,331.049 5
Paving	0.8594					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Total	**2.9491**	**22.3859**	**14.8176**	**0.0223**		**1.2610**	**1.2610**		**1.1601**	**1.1601**	**0.0000**	**2,316.376 7**	**2,316.376 7**	**0.6987**		**2,331.049 5**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0556	0.0690	0.6519	1.4700e-003	0.1232	9.2000e-004	0.1242	0.0327	8.5000e-004	0.0335		122.3507	122.3507	6.5300e-003		122.4878
Total	**0.0556**	**0.0690**	**0.6519**	**1.4700e-003**	**0.1232**	**9.2000e-004**	**0.1242**	**0.0327**	**8.5000e-004**	**0.0335**		**122.3507**	**122.3507**	**6.5300e-003**		**122.4878**

3.12 Architectural Coating - 2016

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Archit. Coating	68.6436					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Off-Road	0.4913	3.1630	2.5119	3.9600e-003		0.2622	0.2622		0.2622	0.2622		375.2641	375.2641	0.0442		376.1932
Total	**69.1349**	**3.1630**	**2.5119**	**3.9600e-003**		**0.2622**	**0.2622**		**0.2622**	**0.2622**		**375.2641**	**375.2641**	**0.0442**		**376.1932**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.1779	0.2209	2.0862	4.6900e-003	0.3943	2.9600e-003	0.3973	0.1046	2.7200e-003	0.1073		391.5223	391.5223	0.0209		391.9609
Total	**0.1779**	**0.2209**	**2.0862**	**4.6900e-003**	**0.3943**	**2.9600e-003**	**0.3973**	**0.1046**	**2.7200e-003**	**0.1073**		**391.5223**	**391.5223**	**0.0209**		**391.9609**

3.12 Architectural Coating - 2016

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Archit. Coating	68.6436					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Off-Road	0.4913	3.1630	2.5119	3.9600e-003		0.2622	0.2622		0.2622	0.2622	0.0000	375.2641	375.2641	0.0442		376.1932
Total	**69.1349**	**3.1630**	**2.5119**	**3.9600e-003**		**0.2622**	**0.2622**		**0.2622**	**0.2622**	**0.0000**	**375.2641**	**375.2641**	**0.0442**		**376.1932**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.1779	0.2209	2.0862	4.6900e-003	0.3943	2.9600e-003	0.3973	0.1046	2.7200e-003	0.1073		391.5223	391.5223	0.0209		391.9609
Total	**0.1779**	**0.2209**	**2.0862**	**4.6900e-003**	**0.3943**	**2.9600e-003**	**0.3973**	**0.1046**	**2.7200e-003**	**0.1073**		**391.5223**	**391.5223**	**0.0209**		**391.9609**

3.12 Architectural Coating - 2017

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Archit. Coating	68.6436					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Off-Road	0.4431	2.9134	2.4908	3.9600e-003		0.2311	0.2311		0.2311	0.2311		375.2641	375.2641	0.0396		376.0961
Total	**69.0867**	**2.9134**	**2.4908**	**3.9600e-003**		**0.2311**	**0.2311**		**0.2311**	**0.2311**		**375.2641**	**375.2641**	**0.0396**		**376.0961**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.1611	0.2008	1.8776	4.6900e-003	0.3943	2.8700e-003	0.3972	0.1046	2.6400e-003	0.1072		376.3911	376.3911	0.0193		376.7970
Total	**0.1611**	**0.2008**	**1.8776**	**4.6900e-003**	**0.3943**	**2.8700e-003**	**0.3972**	**0.1046**	**2.6400e-003**	**0.1072**		**376.3911**	**376.3911**	**0.0193**		**376.7970**

3.12 Architectural Coating - 2017

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Archit. Coating	68.6436					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Off-Road	0.4431	2.9134	2.4908	3.9600e-003		0.2311	0.2311		0.2311	0.2311	0.0000	375.2641	375.2641	0.0396		376.0961
Total	**69.0867**	**2.9134**	**2.4908**	**3.9600e-003**		**0.2311**	**0.2311**		**0.2311**	**0.2311**	**0.0000**	**375.2641**	**375.2641**	**0.0396**		**376.0961**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.1611	0.2008	1.8776	4.6900e-003	0.3943	2.8700e-003	0.3972	0.1046	2.6400e-003	0.1072		376.3911	376.3911	0.0193		376.7970
Total	**0.1611**	**0.2008**	**1.8776**	**4.6900e-003**	**0.3943**	**2.8700e-003**	**0.3972**	**0.1046**	**2.6400e-003**	**0.1072**		**376.3911**	**376.3911**	**0.0193**		**376.7970**

4.0 Operational Detail - Mobile

4.1 Mitigation Measures Mobile

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Mitigated	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Unmitigated	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000

4.2 Trip Summary Information

	Average Daily Trip Rate			Unmitigated	Mitigated
Land Use	Weekday	Saturday	Sunday	Annual VMT	Annual VMT
Other Asphalt Surfaces	0.00	0.00	0.00		
Single Family Housing	0.00	0.00	0.00		
Total	0.00	0.00	0.00		

4.3 Trip Type Information

	Miles			Trip %			Trip Purpose %		
Land Use	H-W or C-W	H-S or C-C	H-O or C-NW	H-W or C-W	H-S or C-C	H-O or C-NW	Primary	Diverted	Pass-by
Other Asphalt Surfaces	9.50	7.30	7.30	0.00	0.00	0.00	0	0	0
Single Family Housing	10.80	7.30	7.50	41.60	18.80	39.60	86	11	3

LDA	LDT1	LDT2	MDV	LHD1	LHD2	MHD	HHD	OBUS	UBUS	MCY	SBUS	MH
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000

4.4 Fleet Mix

5.0 Energy Detail

Historical Energy Use: N

5.1 Mitigation Measures Energy

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
NaturalGas Mitigated	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
NaturalGas Unmitigated	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000

5.2 Energy by Land Use - NaturalGas

Unmitigated

	NaturalGas Use	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Land Use	kBTU/yr	lb/day										lb/day					
Single Family Housing	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
Other Asphalt Surfaces	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**		**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

5.2 Energy by Land Use - NaturalGas

Mitigated

	NaturalGas Use	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Land Use	kBTU/yr	lb/day										lb/day					
Single Family Housing	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
Other Asphalt Surfaces	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**		**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

6.0 Area Detail

6.1 Mitigation Measures Area

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Mitigated	21.5700	0.1674	14.3053	7.5000e-004		0.0772	0.0772		0.0772	0.0772	0.0000	25.4046	25.4046	0.0259	0.0000	25.9484
Unmitigated	21.5700	0.1674	14.3053	7.5000e-004		0.0772	0.0772		0.0772	0.0772	0.0000	25.4046	25.4046	0.0259	0.0000	25.9484

6.2 Area by SubCategory

Unmitigated

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
SubCategory	lb/day										lb/day					
Architectural Coating	5.3598					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Consumer Products	15.7596					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Hearth	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Landscaping	0.4506	0.1674	14.3053	7.5000e-004		0.0772	0.0772		0.0772	0.0772		25.4046	25.4046	0.0259		25.9484
Total	**21.5700**	**0.1674**	**14.3053**	**7.5000e-004**		**0.0772**	**0.0772**		**0.0772**	**0.0772**	**0.0000**	**25.4046**	**25.4046**	**0.0259**	**0.0000**	**25.9484**

6.2 Area by SubCategory

Mitigated

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
SubCategory	lb/day										lb/day					
Architectural Coating	5.3598					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Consumer Products	15.7596					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Hearth	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Landscaping	0.4506	0.1674	14.3053	7.5000e-004		0.0772	0.0772		0.0772	0.0772		25.4046	25.4046	0.0259		25.9484
Total	**21.5700**	**0.1674**	**14.3053**	**7.5000e-004**		**0.0772**	**0.0772**		**0.0772**	**0.0772**	**0.0000**	**25.4046**	**25.4046**	**0.0259**	**0.0000**	**25.9484**

7.0 Water Detail

7.1 Mitigation Measures Water

8.0 Waste Detail

8.1 Mitigation Measures Waste

9.0 Operational Offroad

Equipment Type	Number	Hours/Day	Days/Year	Horse Power	Load Factor	Fuel Type

10.0 Vegetation

Heritage Bluffs (construction)

San Diego County, Summer

1.0 Project Characteristics

1.1 Land Usage

Land Uses	Size	Metric	Lot Acreage	Floor Surface Area	Population
Other Asphalt Surfaces	9.84	Acre	9.84	428,630.40	0
Single Family Housing	171.00	Dwelling Unit	55.52	307,800.00	489

1.2 Other Project Characteristics

Urbanization	Urban	**Wind Speed (m/s)**	2.6	**Precipitation Freq (Days)**	40
Climate Zone	10			**Operational Year**	2016
Utility Company	San Diego Gas & Electric				
CO2 Intensity (lb/MWhr)	477.05	**CH4 Intensity (lb/MWhr)**	0.029	**N2O Intensity (lb/MWhr)**	0.006

1.3 User Entered Comments & Non-Default Data

Project Characteristics - CPUC GHG Calculator version 3c

Land Use - based on information provided by the applicant

Construction Phase - based on consultation with the applicant

Off-road Equipment - 8 hour work day

Off-road Equipment - based on past project experience

Off-road Equipment - 8 hour work day

Off-road Equipment - based on consultation with the applicant

Off-road Equipment - based on past project experience

Off-road Equipment - based on past project experience

Off-road Equipment - adjusted defaults to account for grading quantities

Off-road Equipment - based on past project experience

Off-road Equipment -

Off-road Equipment - based on past project experience

Off-road Equipment - based on consultation with the applicant

Off-road Equipment -

Grading -

Vehicle Trips - no operational emissions modeled

Vechicle Emission Factors - no operational emissions modeled

Vechicle Emission Factors - no operational emissions modeled

Vechicle Emission Factors - no operational emissions modeled

Woodstoves - no operational emissions modeled

Energy Use - no operational emissions modeled

Water And Wastewater - no operational emissions modeled

Solid Waste - no operational emissions modeled

Construction Off-road Equipment Mitigation -

Table Name	Column Name	Default Value	New Value
tblConstructionPhase	NumDays	75.00	285.00

tblConstructionPhase	NumDays	1,110.00	300.00
tblConstructionPhase	NumDays	110.00	40.00
tblConstructionPhase	NumDays	110.00	75.00
tblConstructionPhase	NumDays	75.00	30.00
tblConstructionPhase	NumDays	40.00	110.00
tblConstructionPhase	NumDays	40.00	110.00
tblConstructionPhase	PhaseEndDate	6/15/2017	5/4/2017
tblConstructionPhase	PhaseEndDate	12/25/2015	10/30/2015
tblConstructionPhase	PhaseEndDate	12/25/2015	9/18/2015
tblConstructionPhase	PhaseEndDate	5/19/2017	5/12/2016
tblConstructionPhase	PhaseEndDate	4/1/2016	10/30/2015
tblConstructionPhase	PhaseEndDate	12/25/2015	7/24/2015
tblConstructionPhase	PhaseEndDate	4/1/2016	10/30/2015
tblConstructionPhase	PhaseStartDate	5/13/2016	4/1/2016
tblConstructionPhase	PhaseStartDate	7/25/2015	6/1/2015
tblConstructionPhase	PhaseStartDate	10/31/2015	7/25/2015
tblConstructionPhase	PhaseStartDate	4/8/2017	4/1/2016
tblConstructionPhase	PhaseStartDate	10/31/2015	6/1/2015
tblConstructionPhase	PhaseStartDate	10/31/2015	6/1/2015
tblConstructionPhase	PhaseStartDate	10/31/2015	6/1/2015
tblEnergyUse	LightingElect	1,608.84	0.00
tblEnergyUse	NT24E	5,089.81	0.00
tblEnergyUse	NT24NG	5,950.14	0.00
tblEnergyUse	T24E	980.99	0.00
tblEnergyUse	T24NG	27,816.78	0.00
tblFireplaces	NumberGas	94.05	0.00
tblFireplaces	NumberNoFireplace	17.10	0.00
tblFireplaces	NumberWood	59.85	0.00

tblGrading	MaterialImported	0.00	145,000.00
tblOffRoadEquipment	HorsePower	205.00	265.00
tblOffRoadEquipment	HorsePower	122.00	189.00
tblOffRoadEquipment	HorsePower	400.00	189.00
tblOffRoadEquipment	HorsePower	400.00	189.00
tblOffRoadEquipment	LoadFactor	0.44	0.50
tblOffRoadEquipment	LoadFactor	0.38	0.50
tblOffRoadEquipment	LoadFactor	0.38	0.50
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	2.00	0.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	2.00	0.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	1.00	0.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	1.00	0.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	1.00	2.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	1.00	0.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	1.00	2.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	3.00	0.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	3.00	0.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	2.00	0.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	2.00	0.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	2.00	4.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	2.00	0.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	4.00	0.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	4.00	1.00
tblOffRoadEquipment	UsageHours	6.00	8.00
tblOffRoadEquipment	UsageHours	7.00	8.00
tblOffRoadEquipment	UsageHours	7.00	8.00
tblProjectCharacteristics	CO2IntensityFactor	720.49	477.05
tblProjectCharacteristics	OperationalYear	2014	2016

tblSolidWaste	SolidWasteGenerationRate	200.49	0.00
tblVehicleEF	HHD	0.02	0.00
tblVehicleEF	HHD	0.02	0.00
tblVehicleEF	HHD	0.02	0.00
tblVehicleEF	LDA	0.51	0.00
tblVehicleEF	LDA	0.51	0.00
tblVehicleEF	LDA	0.51	0.00
tblVehicleEF	LDT1	0.07	0.00
tblVehicleEF	LDT1	0.07	0.00
tblVehicleEF	LDT1	0.07	0.00
tblVehicleEF	LDT2	0.19	0.00
tblVehicleEF	LDT2	0.19	0.00
tblVehicleEF	LDT2	0.19	0.00
tblVehicleEF	LHD1	0.04	0.00
tblVehicleEF	LHD1	0.04	0.00
tblVehicleEF	LHD1	0.04	0.00
tblVehicleEF	LHD2	5.2650e-003	0.00
tblVehicleEF	LHD2	5.2650e-003	0.00
tblVehicleEF	LHD2	5.2650e-003	0.00
tblVehicleEF	MCY	6.5480e-003	0.00
tblVehicleEF	MCY	6.5480e-003	0.00
tblVehicleEF	MCY	6.5480e-003	0.00
tblVehicleEF	MDV	0.13	0.00
tblVehicleEF	MDV	0.13	0.00
tblVehicleEF	MDV	0.13	0.00
tblVehicleEF	MH	3.4710e-003	0.00
tblVehicleEF	MH	3.4710e-003	0.00
tblVehicleEF	MH	3.4710e-003	0.00

tblVehicleEF	MHD	0.01	0.00
tblVehicleEF	MHD	0.01	0.00
tblVehicleEF	MHD	0.01	0.00
tblVehicleEF	OBUS	1.8470e-003	0.00
tblVehicleEF	OBUS	1.8470e-003	0.00
tblVehicleEF	OBUS	1.8470e-003	0.00
tblVehicleEF	SBUS	6.1000e-004	0.00
tblVehicleEF	SBUS	6.1000e-004	0.00
tblVehicleEF	SBUS	6.1000e-004	0.00
tblVehicleEF	UBUS	2.0830e-003	0.00
tblVehicleEF	UBUS	2.0830e-003	0.00
tblVehicleEF	UBUS	2.0830e-003	0.00
tblVehicleTrips	ST_TR	10.08	0.00
tblVehicleTrips	SU_TR	8.77	0.00
tblVehicleTrips	WD_TR	9.57	0.00
tblWater	IndoorWaterUseRate	11,141,338.38	0.00
tblWater	OutdoorWaterUseRate	7,023,887.24	0.00
tblWoodstoves	NumberCatalytic	8.55	0.00
tblWoodstoves	NumberNoncatalytic	8.55	0.00

2.0 Emissions Summary

2.1 Overall Construction (Maximum Daily Emission)

Unmitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Year	lb/day										lb/day					
2015	18.6614	228.4410	146.4539	0.4318	20.7526	9.9100	27.7495	10.0287	9.2204	16.5442	0.0000	43,951.9154	43,951.9154	5.4935	0.0000	44,067.2794
2016	79.5945	142.4353	91.1087	0.1557	17.6178	6.5795	24.1972	7.2649	6.0531	13.3180	0.0000	14,654.3626	14,654.3626	3.6099	0.0000	14,730.1711
2017	75.8986	49.2279	62.5913	0.1317	9.8662	2.4236	12.2898	2.5553	2.2848	4.8401	0.0000	11,925.0293	11,925.0293	1.0037	0.0000	11,946.1070
Total	**174.1545**	**420.1042**	**300.1539**	**0.7192**	**48.2366**	**18.9130**	**64.2366**	**19.8489**	**17.5584**	**34.7023**	**0.0000**	**70,531.3072**	**70,531.3072**	**10.1072**	**0.0000**	**70,743.5574**

Mitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Year	lb/day										lb/day					
2015	18.6614	228.4410	146.4539	0.4318	13.0950	9.9100	19.5450	4.8545	9.2204	12.1564	0.0000	43,951.9153	43,951.9153	5.4935	0.0000	44,067.2793
2016	79.5945	142.4353	91.1087	0.1557	9.9894	6.5795	13.9408	2.8772	6.0531	8.9303	0.0000	14,654.3626	14,654.3626	3.6099	0.0000	14,730.1711
2017	75.8986	49.2279	62.5913	0.1317	9.8662	2.4236	12.2898	2.5553	2.2848	4.8401	0.0000	11,925.0293	11,925.0293	1.0037	0.0000	11,946.1070
Total	**174.1545**	**420.1042**	**300.1539**	**0.7192**	**32.9506**	**18.9130**	**45.7755**	**10.2870**	**17.5584**	**25.9268**	**0.0000**	**70,531.3072**	**70,531.3072**	**10.1072**	**0.0000**	**70,743.5574**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N20	CO2e
Percent Reduction	0.00	0.00	0.00	0.00	31.69	0.00	28.74	48.17	0.00	25.29	0.00	0.00	0.00	0.00	0.00	0.00

2.2 Overall Operational

Unmitigated Operational

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Area	21.5700	0.1674	14.3053	7.5000e-004		0.0772	0.0772		0.0772	0.0772	0.0000	25.4046	25.4046	0.0259	0.0000	25.9484
Energy	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
Mobile	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Total	**21.5700**	**0.1674**	**14.3053**	**7.5000e-004**	**0.0000**	**0.0772**	**0.0772**	**0.0000**	**0.0772**	**0.0772**	**0.0000**	**25.4046**	**25.4046**	**0.0259**	**0.0000**	**25.9484**

Mitigated Operational

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Area	21.5700	0.1674	14.3053	7.5000e-004		0.0772	0.0772		0.0772	0.0772	0.0000	25.4046	25.4046	0.0259	0.0000	25.9484
Energy	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
Mobile	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Total	**21.5700**	**0.1674**	**14.3053**	**7.5000e-004**	**0.0000**	**0.0772**	**0.0772**	**0.0000**	**0.0772**	**0.0772**	**0.0000**	**25.4046**	**25.4046**	**0.0259**	**0.0000**	**25.9484**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N20	CO2e
Percent Reduction	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

3.0 Construction Detail

Construction Phase

Phase Number	Phase Name	Phase Type	Start Date	End Date	Num Days Week	Num Days	Phase Description
1	Rock Crushing	Site Preparation	6/1/2015	10/30/2015	5	110	
2	Reducing Oversize Material	Site Preparation	6/1/2015	10/30/2015	5	110	
3	Site Preparation	Site Preparation	6/1/2015	7/24/2015	5	40	
4	Blasting	Grading	6/1/2015	10/30/2015	5	110	
5	Drilling	Trenching	6/1/2015	10/30/2015	5	110	
6	Import of Crushed Material	Grading	7/25/2015	9/18/2015	5	40	
7	Grading	Grading	9/19/2015	1/1/2016	5	75	
8	Foundation/Utilities Excavation	Trenching	1/2/2016	2/12/2016	5	30	
9	Foundation/Vertical Construction	Building Construction	2/13/2016	4/7/2017	5	300	
10	Paving	Paving	4/1/2016	5/12/2016	5	30	
11	Architectural Coating	Architectural Coating	4/1/2016	5/4/2017	5	285	

Acres of Grading (Site Preparation Phase): 0

Acres of Grading (Grading Phase): 375

Acres of Paving: 0

Residential Indoor: 623,295; Residential Outdoor: 207,765; Non-Residential Indoor: 642,946; Non-Residential Outdoor: 214,315 (Architectural Coating – sqft)

OffRoad Equipment

Phase Name	Offroad Equipment Type	Amount	Usage Hours	Horse Power	Load Factor
Rock Crushing	Crushing/Proc. Equipment	1	8.00	85	0.78
Rock Crushing	Generator Sets	1	8.00	84	0.74
Rock Crushing	Off-Highway Tractors	1	8.00	189	0.50
Rock Crushing	Rubber Tired Dozers	0	8.00	255	0.40
Rock Crushing	Tractors/Loaders/Backhoes	0	8.00	97	0.37
Reducing Oversize Material	Concrete/Industrial Saws	1	8.00	81	0.73
Reducing Oversize Material	Dumpers/Tenders	1	8.00	16	0.38
Reducing Oversize Material	Rubber Tired Dozers	0	8.00	255	0.40
Reducing Oversize Material	Tractors/Loaders/Backhoes	1	8.00	97	0.37
Site Preparation	Rubber Tired Dozers	3	8.00	255	0.40
Site Preparation	Tractors/Loaders/Backhoes	4	8.00	97	0.37
Blasting	Excavators	0	8.00	162	0.38
Blasting	Graders	0	8.00	174	0.41
Blasting	Off-Highway Trucks	1	8.00	189	0.50
Blasting	Rubber Tired Dozers	0	8.00	255	0.40
Blasting	Scrapers	0	8.00	361	0.48
Blasting	Tractors/Loaders/Backhoes	0	8.00	97	0.37
Drilling	Bore/Drill Rigs	3	8.00	265	0.50
Import of Crushed Material	Excavators	0	8.00	162	0.38
Import of Crushed Material	Graders	0	8.00	174	0.41
Import of Crushed Material	Rubber Tired Dozers	1	8.00	255	0.40
Import of Crushed Material	Scrapers	0	8.00	361	0.48
Import of Crushed Material	Tractors/Loaders/Backhoes	2	8.00	97	0.37
Grading	Excavators	2	8.00	162	0.38
Grading	Graders	2	8.00	174	0.41
Grading	Off-Highway Trucks	1	8.00	189	0.50
Grading	Rubber Tired Dozers	2	8.00	255	0.40

Grading	Scrapers	4	8.00	361	0.48
Grading	Tractors/Loaders/Backhoes	2	8.00	97	0.37
Foundation/Utilities Excavation	Excavators	1	8.00	162	0.38
Foundation/Utilities Excavation	Tractors/Loaders/Backhoes	1	8.00	97	0.37
Foundation/Utilities Excavation	Trenchers	1	8.00	80	0.50
Foundation/Vertical Construction	Cement and Mortar Mixers	2	8.00	9	0.56
Foundation/Vertical Construction	Cranes	1	8.00	226	0.29
Foundation/Vertical Construction	Forklifts	3	8.00	89	0.20
Foundation/Vertical Construction	Generator Sets	1	8.00	84	0.74
Foundation/Vertical Construction	Tractors/Loaders/Backhoes	3	8.00	97	0.37
Foundation/Vertical Construction	Welders	1	8.00	46	0.45
Paving	Pavers	2	8.00	125	0.42
Paving	Paving Equipment	2	8.00	130	0.36
Paving	Rollers	2	8.00	80	0.38
Architectural Coating	Air Compressors	1	8.00	78	0.48

Trips and VMT

Phase Name	Offroad Equipment Count	Worker Trip Number	Vendor Trip Number	Hauling Trip Number	Worker Trip Length	Vendor Trip Length	Hauling Trip Length	Worker Vehicle Class	Vendor Vehicle Class	Hauling Vehicle Class
Rock Crushing	3	8.00	0.00	0.00	10.80	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Reducing Oversize Material	3	8.00	0.00	0.00	10.80	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Site Preparation	7	18.00	0.00	0.00	10.80	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Blasting	1	3.00	0.00	0.00	10.80	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Drilling	3	8.00	0.00	0.00	10.80	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Import of Crushed Material	4	10.00	0.00	18,125.00	10.80	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Grading	13	33.00	0.00	0.00	10.80	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Foundation/Utilities Excavation	3	8.00	0.00	0.00	10.80	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Foundation/Vertical Construction	11	242.00	89.00	0.00	10.80	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Foundation/Vertical Construction	11	242.00	89.00	0.00	10.80	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Paving	6	15.00	0.00	0.00	10.80	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Architectural Coating	1	48.00	0.00	0.00	10.80	7.30	20.00	LD_Mix	HDT_Mix	HHDT

3.1 Mitigation Measures Construction

Water Exposed Area

3.2 Rock Crushing - 2015

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Fugitive Dust					0.0000	0.0000	0.0000	0.0000	0.0000	0.0000			0.0000			0.0000
Off-Road	2.3130	20.3348	11.0241	0.0217		1.2147	1.2147		1.1882	1.1882		2,136.228 3	2,136.228 3	0.4000		2,144.627 7
Total	**2.3130**	**20.3348**	**11.0241**	**0.0217**	**0.0000**	**1.2147**	**1.2147**	**0.0000**	**1.1882**	**1.1882**		**2,136.228 3**	**2,136.228 3**	**0.4000**		**2,144.627 7**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0307	0.0362	0.3955	8.3000e-004	0.0657	5.2000e-004	0.0662	0.0174	4.7000e-004	0.0179		72.0007	72.0007	3.7700e-003		72.0799
Total	**0.0307**	**0.0362**	**0.3955**	**8.3000e-004**	**0.0657**	**5.2000e-004**	**0.0662**	**0.0174**	**4.7000e-004**	**0.0179**		**72.0007**	**72.0007**	**3.7700e-003**		**72.0799**

3.2 Rock Crushing - 2015

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Fugitive Dust					0.0000	0.0000	0.0000	0.0000	0.0000	0.0000			0.0000			0.0000
Off-Road	2.3130	20.3348	11.0241	0.0217		1.2147	1.2147		1.1882	1.1882	0.0000	2,136.2283	2,136.2283	0.4000		2,144.6277
Total	**2.3130**	**20.3348**	**11.0241**	**0.0217**	**0.0000**	**1.2147**	**1.2147**	**0.0000**	**1.1882**	**1.1882**	**0.0000**	**2,136.2283**	**2,136.2283**	**0.4000**		**2,144.6277**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0307	0.0362	0.3955	8.3000e-004	0.0657	5.2000e-004	0.0662	0.0174	4.7000e-004	0.0179		72.0007	72.0007	3.7700e-003		72.0799
Total	**0.0307**	**0.0362**	**0.3955**	**8.3000e-004**	**0.0657**	**5.2000e-004**	**0.0662**	**0.0174**	**4.7000e-004**	**0.0179**		**72.0007**	**72.0007**	**3.7700e-003**		**72.0799**

3.3 Reducing Oversize Material - 2015

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Fugitive Dust					0.0000	0.0000	0.0000	0.0000	0.0000	0.0000			0.0000			0.0000
Off-Road	1.1473	8.8985	6.4810	0.0101		0.6766	0.6766		0.6552	0.6552		981.0937	981.0937	0.1680		984.6223
Total	**1.1473**	**8.8985**	**6.4810**	**0.0101**	**0.0000**	**0.6766**	**0.6766**	**0.0000**	**0.6552**	**0.6552**		**981.0937**	**981.0937**	**0.1680**		**984.6223**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0307	0.0362	0.3955	8.3000e-004	0.0657	5.2000e-004	0.0662	0.0174	4.7000e-004	0.0179		72.0007	72.0007	3.7700e-003		72.0799
Total	**0.0307**	**0.0362**	**0.3955**	**8.3000e-004**	**0.0657**	**5.2000e-004**	**0.0662**	**0.0174**	**4.7000e-004**	**0.0179**		**72.0007**	**72.0007**	**3.7700e-003**		**72.0799**

3.3 Reducing Oversize Material - 2015

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Fugitive Dust					0.0000	0.0000	0.0000	0.0000	0.0000	0.0000			0.0000			0.0000
Off-Road	1.1473	8.8985	6.4810	0.0101		0.6766	0.6766		0.6552	0.6552	0.0000	981.0937	981.0937	0.1680		984.6223
Total	**1.1473**	**8.8985**	**6.4810**	**0.0101**	**0.0000**	**0.6766**	**0.6766**	**0.0000**	**0.6552**	**0.6552**	**0.0000**	**981.0937**	**981.0937**	**0.1680**		**984.6223**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0307	0.0362	0.3955	8.3000e-004	0.0657	5.2000e-004	0.0662	0.0174	4.7000e-004	0.0179		72.0007	72.0007	3.7700e-003		72.0799
Total	**0.0307**	**0.0362**	**0.3955**	**8.3000e-004**	**0.0657**	**5.2000e-004**	**0.0662**	**0.0174**	**4.7000e-004**	**0.0179**		**72.0007**	**72.0007**	**3.7700e-003**		**72.0799**

3.4 Site Preparation - 2015

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Fugitive Dust					18.0663	0.0000	18.0663	9.9307	0.0000	9.9307			0.0000			0.0000
Off-Road	5.2609	56.8897	42.6318	0.0391		3.0883	3.0883		2.8412	2.8412		4,111.7444	4,111.7444	1.2275		4,137.5225
Total	**5.2609**	**56.8897**	**42.6318**	**0.0391**	**18.0663**	**3.0883**	**21.1545**	**9.9307**	**2.8412**	**12.7719**		**4,111.7444**	**4,111.7444**	**1.2275**		**4,137.5225**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0690	0.0814	0.8900	1.8700e-003	0.1479	1.1600e-003	0.1490	0.0392	1.0600e-003	0.0403		162.0015	162.0015	8.4900e-003		162.1798
Total	**0.0690**	**0.0814**	**0.8900**	**1.8700e-003**	**0.1479**	**1.1600e-003**	**0.1490**	**0.0392**	**1.0600e-003**	**0.0403**		**162.0015**	**162.0015**	**8.4900e-003**		**162.1798**

3.4 Site Preparation - 2015

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Fugitive Dust					7.0458	0.0000	7.0458	3.8730	0.0000	3.8730			0.0000			0.0000
Off-Road	5.2609	56.8897	42.6318	0.0391		3.0883	3.0883		2.8412	2.8412	0.0000	4,111.744 4	4,111.744 4	1.2275		4,137.522 4
Total	**5.2609**	**56.8897**	**42.6318**	**0.0391**	**7.0458**	**3.0883**	**10.1341**	**3.8730**	**2.8412**	**6.7142**	**0.0000**	**4,111.744 4**	**4,111.744 4**	**1.2275**		**4,137.522 4**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0690	0.0814	0.8900	1.8700e-003	0.1479	1.1600e-003	0.1490	0.0392	1.0600e-003	0.0403		162.0015	162.0015	8.4900e-003		162.1798
Total	**0.0690**	**0.0814**	**0.8900**	**1.8700e-003**	**0.1479**	**1.1600e-003**	**0.1490**	**0.0392**	**1.0600e-003**	**0.0403**		**162.0015**	**162.0015**	**8.4900e-003**		**162.1798**

3.5 Blasting - 2015

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Fugitive Dust					0.0000	0.0000	0.0000	0.0000	0.0000	0.0000			0.0000			0.0000
Off-Road	0.7890	8.7373	3.1666	8.0600e-003		0.3779	0.3779		0.3477	0.3477		846.3621	846.3621	0.2527		851.6682
Total	**0.7890**	**8.7373**	**3.1666**	**8.0600e-003**	**0.0000**	**0.3779**	**0.3779**	**0.0000**	**0.3477**	**0.3477**		**846.3621**	**846.3621**	**0.2527**		**851.6682**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0115	0.0136	0.1483	3.1000e-004	0.0246	1.9000e-004	0.0248	6.5400e-003	1.8000e-004	6.7100e-003		27.0003	27.0003	1.4200e-003		27.0300
Total	**0.0115**	**0.0136**	**0.1483**	**3.1000e-004**	**0.0246**	**1.9000e-004**	**0.0248**	**6.5400e-003**	**1.8000e-004**	**6.7100e-003**		**27.0003**	**27.0003**	**1.4200e-003**		**27.0300**

3.5 Blasting - 2015

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Fugitive Dust					0.0000	0.0000	0.0000	0.0000	0.0000	0.0000			0.0000			0.0000
Off-Road	0.7890	8.7373	3.1666	8.0600e-003		0.3779	0.3779		0.3477	0.3477	0.0000	846.3621	846.3621	0.2527		851.6682
Total	**0.7890**	**8.7373**	**3.1666**	**8.0600e-003**	**0.0000**	**0.3779**	**0.3779**	**0.0000**	**0.3477**	**0.3477**	**0.0000**	**846.3621**	**846.3621**	**0.2527**		**851.6682**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0115	0.0136	0.1483	3.1000e-004	0.0246	1.9000e-004	0.0248	6.5400e-003	1.8000e-004	6.7100e-003		27.0003	27.0003	1.4200e-003		27.0300
Total	**0.0115**	**0.0136**	**0.1483**	**3.1000e-004**	**0.0246**	**1.9000e-004**	**0.0248**	**6.5400e-003**	**1.8000e-004**	**6.7100e-003**		**27.0003**	**27.0003**	**1.4200e-003**		**27.0300**

3.6 Drilling - 2015

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	1.3967	21.0536	8.8029	0.0334		0.6721	0.6721		0.6183	0.6183		3,504.6649	3,504.6649	1.0463		3,526.6370
Total	**1.3967**	**21.0536**	**8.8029**	**0.0334**		**0.6721**	**0.6721**		**0.6183**	**0.6183**		**3,504.6649**	**3,504.6649**	**1.0463**		**3,526.6370**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0307	0.0362	0.3955	8.3000e-004	0.0657	5.2000e-004	0.0662	0.0174	4.7000e-004	0.0179		72.0007	72.0007	3.7700e-003		72.0799
Total	**0.0307**	**0.0362**	**0.3955**	**8.3000e-004**	**0.0657**	**5.2000e-004**	**0.0662**	**0.0174**	**4.7000e-004**	**0.0179**		**72.0007**	**72.0007**	**3.7700e-003**		**72.0799**

3.6 Drilling - 2015

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	1.3967	21.0536	8.8029	0.0334		0.6721	0.6721		0.6183	0.6183	0.0000	3,504.6649	3,504.6649	1.0463		3,526.6369
Total	**1.3967**	**21.0536**	**8.8029**	**0.0334**		**0.6721**	**0.6721**		**0.6183**	**0.6183**	**0.0000**	**3,504.6649**	**3,504.6649**	**1.0463**		**3,526.6369**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0307	0.0362	0.3955	8.3000e-004	0.0657	5.2000e-004	0.0662	0.0174	4.7000e-004	0.0179		72.0007	72.0007	3.7700e-003		72.0799
Total	**0.0307**	**0.0362**	**0.3955**	**8.3000e-004**	**0.0657**	**5.2000e-004**	**0.0662**	**0.0174**	**4.7000e-004**	**0.0179**		**72.0007**	**72.0007**	**3.7700e-003**		**72.0799**

3.7 Import of Crushed Material - 2015

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Fugitive Dust					12.5536	0.0000	12.5536	6.6976	0.0000	6.6976			0.0000			0.0000
Off-Road	1.9939	21.2513	15.8277	0.0151		1.2085	1.2085		1.1118	1.1118		1,588.906 6	1,588.906 6	0.4744		1,598.868 0
Total	**1.9939**	**21.2513**	**15.8277**	**0.0151**	**12.5536**	**1.2085**	**13.7621**	**6.6976**	**1.1118**	**7.8094**		**1,588.906 6**	**1,588.906 6**	**0.4744**		**1,598.868 0**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	10.1893	147.9983	99.3223	0.3395	7.8951	2.2978	10.1929	2.1618	2.1135	4.2753		34,561.65 68	34,561.65 68	0.2800		34,567.53 65
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0383	0.0452	0.4944	1.0400e-003	0.0822	6.4000e-004	0.0828	0.0218	5.9000e-004	0.0224		90.0008	90.0008	4.7200e-003		90.0999
Total	**10.2276**	**148.0435**	**99.8167**	**0.3406**	**7.9773**	**2.2984**	**10.2757**	**2.1836**	**2.1141**	**4.2977**		**34,651.65 77**	**34,651.65 77**	**0.2847**		**34,657.63 65**

3.7 Import of Crushed Material - 2015

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Fugitive Dust					4.8959	0.0000	4.8959	2.6121	0.0000	2.6121			0.0000			0.0000
Off-Road	1.9939	21.2513	15.8277	0.0151		1.2085	1.2085		1.1118	1.1118	0.0000	1,588.906 6	1,588.906 6	0.4744		1,598.868 0
Total	**1.9939**	**21.2513**	**15.8277**	**0.0151**	**4.8959**	**1.2085**	**6.1044**	**2.6121**	**1.1118**	**3.7239**	**0.0000**	**1,588.906 6**	**1,588.906 6**	**0.4744**		**1,598.868 0**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	10.1893	147.9983	99.3223	0.3395	7.8951	2.2978	10.1929	2.1618	2.1135	4.2753		34,561.65 68	34,561.65 68	0.2800		34,567.53 65
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0383	0.0452	0.4944	1.0400e-003	0.0822	6.4000e-004	0.0828	0.0218	5.9000e-004	0.0224		90.0008	90.0008	4.7200e-003		90.0999
Total	**10.2276**	**148.0435**	**99.8167**	**0.3406**	**7.9773**	**2.2984**	**10.2757**	**2.1836**	**2.1141**	**4.2977**		**34,651.65 77**	**34,651.65 77**	**0.2847**		**34,657.63 65**

3.8 Grading - 2015

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Fugitive Dust					17.3467	0.0000	17.3467	7.1930	0.0000	7.1930			0.0000			0.0000
Off-Road	12.7854	150.2367	93.1170	0.1147		6.9647	6.9647		6.4076	6.4076		12,052.7632	12,052.7632	3.5983		12,128.3265
Total	**12.7854**	**150.2367**	**93.1170**	**0.1147**	**17.3467**	**6.9647**	**24.3114**	**7.1930**	**6.4076**	**13.6006**		**12,052.7632**	**12,052.7632**	**3.5983**		**12,128.3265**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.1265	0.1492	1.6316	3.4400e-003	0.2711	2.1300e-003	0.2732	0.0719	1.9500e-003	0.0739		297.0028	297.0028	0.0156		297.3297
Total	**0.1265**	**0.1492**	**1.6316**	**3.4400e-003**	**0.2711**	**2.1300e-003**	**0.2732**	**0.0719**	**1.9500e-003**	**0.0739**		**297.0028**	**297.0028**	**0.0156**		**297.3297**

3.8 Grading - 2015

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Fugitive Dust					6.7652	0.0000	6.7652	2.8053	0.0000	2.8053			0.0000			0.0000
Off-Road	12.7854	150.2367	93.1170	0.1147		6.9647	6.9647		6.4076	6.4076	0.0000	12,052.7632	12,052.7632	3.5983		12,128.3265
Total	**12.7854**	**150.2367**	**93.1170**	**0.1147**	**6.7652**	**6.9647**	**13.7299**	**2.8053**	**6.4076**	**9.2128**	**0.0000**	**12,052.7632**	**12,052.7632**	**3.5983**		**12,128.3265**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.1265	0.1492	1.6316	3.4400e-003	0.2711	2.1300e-003	0.2732	0.0719	1.9500e-003	0.0739		297.0028	297.0028	0.0156		297.3297
Total	**0.1265**	**0.1492**	**1.6316**	**3.4400e-003**	**0.2711**	**2.1300e-003**	**0.2732**	**0.0719**	**1.9500e-003**	**0.0739**		**297.0028**	**297.0028**	**0.0156**		**297.3297**

3.8 Grading - 2016

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Fugitive Dust					17.3467	0.0000	17.3467	7.1930	0.0000	7.1930			0.0000			0.0000
Off-Road	12.2443	142.2999	89.6324	0.1147		6.5774	6.5774		6.0513	6.0513		11,920.2400	11,920.2400	3.5956		11,995.7470
Total	**12.2443**	**142.2999**	**89.6324**	**0.1147**	**17.3467**	**6.5774**	**23.9241**	**7.1930**	**6.0513**	**13.2443**		**11,920.2400**	**11,920.2400**	**3.5956**		**11,995.7470**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.1154	0.1354	1.4764	3.4300e-003	0.2711	2.0300e-003	0.2731	0.0719	1.8700e-003	0.0738		286.6156	286.6156	0.0144		286.9171
Total	**0.1154**	**0.1354**	**1.4764**	**3.4300e-003**	**0.2711**	**2.0300e-003**	**0.2731**	**0.0719**	**1.8700e-003**	**0.0738**		**286.6156**	**286.6156**	**0.0144**		**286.9171**

3.8 Grading - 2016

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Fugitive Dust					6.7652	0.0000	6.7652	2.8053	0.0000	2.8053			0.0000			0.0000
Off-Road	12.2443	142.2999	89.6324	0.1147		6.5774	6.5774		6.0513	6.0513	0.0000	11,920.2400	11,920.2400	3.5956		11,995.7469
Total	**12.2443**	**142.2999**	**89.6324**	**0.1147**	**6.7652**	**6.5774**	**13.3426**	**2.8053**	**6.0513**	**8.8565**	**0.0000**	**11,920.2400**	**11,920.2400**	**3.5956**		**11,995.7469**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.1154	0.1354	1.4764	3.4300e-003	0.2711	2.0300e-003	0.2731	0.0719	1.8700e-003	0.0738		286.6156	286.6156	0.0144		286.9171
Total	**0.1154**	**0.1354**	**1.4764**	**3.4300e-003**	**0.2711**	**2.0300e-003**	**0.2731**	**0.0719**	**1.8700e-003**	**0.0738**		**286.6156**	**286.6156**	**0.0144**		**286.9171**

3.9 Foundation/Utilities Excavation - 2016

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	1.2847	12.5552	8.6547	0.0119		0.8506	0.8506		0.7825	0.7825		1,233.3212	1,233.3212	0.3720		1,241.1334
Total	**1.2847**	**12.5552**	**8.6547**	**0.0119**		**0.8506**	**0.8506**		**0.7825**	**0.7825**		**1,233.3212**	**1,233.3212**	**0.3720**		**1,241.1334**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0280	0.0328	0.3579	8.3000e-004	0.0657	4.9000e-004	0.0662	0.0174	4.5000e-004	0.0179		69.4826	69.4826	3.4800e-003		69.5557
Total	**0.0280**	**0.0328**	**0.3579**	**8.3000e-004**	**0.0657**	**4.9000e-004**	**0.0662**	**0.0174**	**4.5000e-004**	**0.0179**		**69.4826**	**69.4826**	**3.4800e-003**		**69.5557**

3.9 Foundation/Utilities Excavation - 2016

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	1.2847	12.5552	8.6547	0.0119		0.8506	0.8506		0.7825	0.7825	0.0000	1,233.3212	1,233.3212	0.3720		1,241.1334
Total	**1.2847**	**12.5552**	**8.6547**	**0.0119**		**0.8506**	**0.8506**		**0.7825**	**0.7825**	**0.0000**	**1,233.3212**	**1,233.3212**	**0.3720**		**1,241.1334**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0280	0.0328	0.3579	8.3000e-004	0.0657	4.9000e-004	0.0662	0.0174	4.5000e-004	0.0179		69.4826	69.4826	3.4800e-003		69.5557
Total	**0.0280**	**0.0328**	**0.3579**	**8.3000e-004**	**0.0657**	**4.9000e-004**	**0.0662**	**0.0174**	**4.5000e-004**	**0.0179**		**69.4826**	**69.4826**	**3.4800e-003**		**69.5557**

3.10 Foundation/Vertical Construction - 2016

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	3.7416	31.5318	20.4012	0.0301		2.1395	2.1395		2.0091	2.0091		2,964.9775	2,964.9775	0.7312		2,980.3335
Total	**3.7416**	**31.5318**	**20.4012**	**0.0301**		**2.1395**	**2.1395**		**2.0091**	**2.0091**		**2,964.9775**	**2,964.9775**	**0.7312**		**2,980.3335**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	1.8568	16.8695	19.8009	0.0424	2.0404	0.2551	2.2955	0.5479	0.2346	0.7825		4,246.8744	4,246.8744	0.0328		4,247.5636
Worker	1.6919	1.9854	21.6533	0.0504	7.4314	0.0298	7.4613	1.9028	0.0274	1.9302		4,203.6947	4,203.6947	0.2106		4,208.1177
Total	**3.5486**	**18.8550**	**41.4541**	**0.0927**	**9.4719**	**0.2849**	**9.7568**	**2.4507**	**0.2620**	**2.7127**		**8,450.5691**	**8,450.5691**	**0.2434**		**8,455.6813**

3.10 Foundation/Vertical Construction - 2016

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	3.7416	31.5318	20.4012	0.0301		2.1395	2.1395		2.0091	2.0091	0.0000	2,964.977 5	2,964.977 5	0.7312		2,980.333 5
Total	**3.7416**	**31.5318**	**20.4012**	**0.0301**		**2.1395**	**2.1395**		**2.0091**	**2.0091**	**0.0000**	**2,964.977 5**	**2,964.977 5**	**0.7312**		**2,980.333 5**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	1.8568	16.8695	19.8009	0.0424	2.0404	0.2551	2.2955	0.5479	0.2346	0.7825		4,246.874 4	4,246.874 4	0.0328		4,247.563 6
Worker	1.6919	1.9854	21.6533	0.0504	7.4314	0.0298	7.4613	1.9028	0.0274	1.9302		4,203.694 7	4,203.694 7	0.2106		4,208.117 7
Total	**3.5486**	**18.8550**	**41.4541**	**0.0927**	**9.4719**	**0.2849**	**9.7568**	**2.4507**	**0.2620**	**2.7127**		**8,450.569 1**	**8,450.569 1**	**0.2434**		**8,455.681 3**

3.10 Foundation/Vertical Construction - 2017

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	3.4197	29.2456	19.9881	0.0301		1.9393	1.9393		1.8207	1.8207		2,932.3421	2,932.3421	0.7189		2,947.4382
Total	**3.4197**	**29.2456**	**19.9881**	**0.0301**		**1.9393**	**1.9393**		**1.8207**	**1.8207**		**2,932.3421**	**2,932.3421**	**0.7189**		**2,947.4382**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	1.7020	15.0855	18.5856	0.0423	2.0405	0.2214	2.2619	0.5479	0.2037	0.7516		4,175.1304	4,175.1304	0.0310		4,175.7818
Worker	1.5377	1.8044	19.5846	0.0504	7.4314	0.0289	7.4603	1.9028	0.0267	1.9294		4,041.4844	4,041.4844	0.1949		4,045.5767
Total	**3.2397**	**16.8899**	**38.1702**	**0.0927**	**9.4719**	**0.2504**	**9.7223**	**2.4507**	**0.2303**	**2.6810**		**8,216.6148**	**8,216.6148**	**0.2259**		**8,221.3584**

3.10 Foundation/Vertical Construction - 2017

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	3.4197	29.2456	19.9881	0.0301		1.9393	1.9393		1.8207	1.8207	0.0000	2,932.342 1	2,932.342 1	0.7189		2,947.438 2
Total	**3.4197**	**29.2456**	**19.9881**	**0.0301**		**1.9393**	**1.9393**		**1.8207**	**1.8207**	**0.0000**	**2,932.342 1**	**2,932.342 1**	**0.7189**		**2,947.438 2**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	1.7020	15.0855	18.5856	0.0423	2.0405	0.2214	2.2619	0.5479	0.2037	0.7516		4,175.130 4	4,175.130 4	0.0310		4,175.781 8
Worker	1.5377	1.8044	19.5846	0.0504	7.4314	0.0289	7.4603	1.9028	0.0267	1.9294		4,041.484 4	4,041.484 4	0.1949		4,045.576 7
Total	**3.2397**	**16.8899**	**38.1702**	**0.0927**	**9.4719**	**0.2504**	**9.7223**	**2.4507**	**0.2303**	**2.6810**		**8,216.614 8**	**8,216.614 8**	**0.2259**		**8,221.358 4**

3.11 Paving - 2016

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	2.0898	22.3859	14.8176	0.0223		1.2610	1.2610		1.1601	1.1601		2,316.3767	2,316.3767	0.6987		2,331.0495
Paving	0.8594					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Total	**2.9491**	**22.3859**	**14.8176**	**0.0223**		**1.2610**	**1.2610**		**1.1601**	**1.1601**		**2,316.3767**	**2,316.3767**	**0.6987**		**2,331.0495**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0524	0.0615	0.6711	1.5600e-003	0.1232	9.2000e-004	0.1242	0.0327	8.5000e-004	0.0335		130.2798	130.2798	6.5300e-003		130.4169
Total	**0.0524**	**0.0615**	**0.6711**	**1.5600e-003**	**0.1232**	**9.2000e-004**	**0.1242**	**0.0327**	**8.5000e-004**	**0.0335**		**130.2798**	**130.2798**	**6.5300e-003**		**130.4169**

3.11 Paving - 2016

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	2.0898	22.3859	14.8176	0.0223		1.2610	1.2610		1.1601	1.1601	0.0000	2,316.3767	2,316.3767	0.6987		2,331.0495
Paving	0.8594					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Total	**2.9491**	**22.3859**	**14.8176**	**0.0223**		**1.2610**	**1.2610**		**1.1601**	**1.1601**	**0.0000**	**2,316.3767**	**2,316.3767**	**0.6987**		**2,331.0495**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0524	0.0615	0.6711	1.5600e-003	0.1232	9.2000e-004	0.1242	0.0327	8.5000e-004	0.0335		130.2798	130.2798	6.5300e-003		130.4169
Total	**0.0524**	**0.0615**	**0.6711**	**1.5600e-003**	**0.1232**	**9.2000e-004**	**0.1242**	**0.0327**	**8.5000e-004**	**0.0335**		**130.2798**	**130.2798**	**6.5300e-003**		**130.4169**

3.12 Architectural Coating - 2016

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Archit. Coating	68.6436					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Off-Road	0.4913	3.1630	2.5119	3.9600e-003		0.2622	0.2622		0.2622	0.2622		375.2641	375.2641	0.0442		376.1932
Total	**69.1349**	**3.1630**	**2.5119**	**3.9600e-003**		**0.2622**	**0.2622**		**0.2622**	**0.2622**		**375.2641**	**375.2641**	**0.0442**		**376.1932**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.1678	0.1969	2.1474	5.0000e-003	0.3943	2.9600e-003	0.3973	0.1046	2.7200e-003	0.1073		416.8953	416.8953	0.0209		417.3340
Total	**0.1678**	**0.1969**	**2.1474**	**5.0000e-003**	**0.3943**	**2.9600e-003**	**0.3973**	**0.1046**	**2.7200e-003**	**0.1073**		**416.8953**	**416.8953**	**0.0209**		**417.3340**

3.12 Architectural Coating - 2016

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Archit. Coating	68.6436					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Off-Road	0.4913	3.1630	2.5119	3.9600e-003		0.2622	0.2622		0.2622	0.2622	0.0000	375.2641	375.2641	0.0442		376.1932
Total	**69.1349**	**3.1630**	**2.5119**	**3.9600e-003**		**0.2622**	**0.2622**		**0.2622**	**0.2622**	**0.0000**	**375.2641**	**375.2641**	**0.0442**		**376.1932**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.1678	0.1969	2.1474	5.0000e-003	0.3943	2.9600e-003	0.3973	0.1046	2.7200e-003	0.1073		416.8953	416.8953	0.0209		417.3340
Total	**0.1678**	**0.1969**	**2.1474**	**5.0000e-003**	**0.3943**	**2.9600e-003**	**0.3973**	**0.1046**	**2.7200e-003**	**0.1073**		**416.8953**	**416.8953**	**0.0209**		**417.3340**

3.12 Architectural Coating - 2017

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Archit. Coating	68.6436					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Off-Road	0.4431	2.9134	2.4908	3.9600e-003		0.2311	0.2311		0.2311	0.2311		375.2641	375.2641	0.0396		376.0961
Total	**69.0867**	**2.9134**	**2.4908**	**3.9600e-003**		**0.2311**	**0.2311**		**0.2311**	**0.2311**		**375.2641**	**375.2641**	**0.0396**		**376.0961**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.1525	0.1790	1.9423	5.0000e-003	0.3943	2.8700e-003	0.3972	0.1046	2.6400e-003	0.1072		400.8084	400.8084	0.0193		401.2142
Total	**0.1525**	**0.1790**	**1.9423**	**5.0000e-003**	**0.3943**	**2.8700e-003**	**0.3972**	**0.1046**	**2.6400e-003**	**0.1072**		**400.8084**	**400.8084**	**0.0193**		**401.2142**

3.12 Architectural Coating - 2017

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Archit. Coating	68.6436					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Off-Road	0.4431	2.9134	2.4908	3.9600e-003		0.2311	0.2311		0.2311	0.2311	0.0000	375.2641	375.2641	0.0396		376.0961
Total	**69.0867**	**2.9134**	**2.4908**	**3.9600e-003**		**0.2311**	**0.2311**		**0.2311**	**0.2311**	**0.0000**	**375.2641**	**375.2641**	**0.0396**		**376.0961**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.1525	0.1790	1.9423	5.0000e-003	0.3943	2.8700e-003	0.3972	0.1046	2.6400e-003	0.1072		400.8084	400.8084	0.0193		401.2142
Total	**0.1525**	**0.1790**	**1.9423**	**5.0000e-003**	**0.3943**	**2.8700e-003**	**0.3972**	**0.1046**	**2.6400e-003**	**0.1072**		**400.8084**	**400.8084**	**0.0193**		**401.2142**

4.0 Operational Detail - Mobile

4.1 Mitigation Measures Mobile

Category	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
	lb/day										lb/day					
Mitigated	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Unmitigated	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000

4.2 Trip Summary Information

	Average Daily Trip Rate			Unmitigated	Mitigated
Land Use	Weekday	Saturday	Sunday	Annual VMT	Annual VMT
Other Asphalt Surfaces	0.00	0.00	0.00		
Single Family Housing	0.00	0.00	0.00		
Total	0.00	0.00	0.00		

4.3 Trip Type Information

	Miles			Trip %			Trip Purpose %		
Land Use	H-W or C-W	H-S or C-C	H-O or C-NW	H-W or C-W	H-S or C-C	H-O or C-NW	Primary	Diverted	Pass-by
Other Asphalt Surfaces	9.50	7.30	7.30	0.00	0.00	0.00	0	0	0
Single Family Housing	10.80	7.30	7.50	41.60	18.80	39.60	86	11	3

LDA	LDT1	LDT2	MDV	LHD1	LHD2	MHD	HHD	OBUS	UBUS	MCY	SBUS	MH
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000

4.4 Fleet Mix

5.0 Energy Detail

Historical Energy Use: N

5.1 Mitigation Measures Energy

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
NaturalGas Mitigated	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
NaturalGas Unmitigated	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000

5.2 Energy by Land Use - NaturalGas

Unmitigated

	NaturalGas Use	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Land Use	kBTU/yr	lb/day										lb/day					
Single Family Housing	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
Other Asphalt Surfaces	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**		**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

5.2 Energy by Land Use - NaturalGas

Mitigated

	NaturalGas Use	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Land Use	kBTU/yr	lb/day										lb/day					
Other Asphalt Surfaces	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
Single Family Housing	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**		**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

6.0 Area Detail

6.1 Mitigation Measures Area

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Mitigated	21.5700	0.1674	14.3053	7.5000e-004		0.0772	0.0772		0.0772	0.0772	0.0000	25.4046	25.4046	0.0259	0.0000	25.9484
Unmitigated	21.5700	0.1674	14.3053	7.5000e-004		0.0772	0.0772		0.0772	0.0772	0.0000	25.4046	25.4046	0.0259	0.0000	25.9484

6.2 Area by SubCategory

Unmitigated

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
SubCategory	lb/day										lb/day					
Architectural Coating	5.3598					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Consumer Products	15.7596					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Hearth	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Landscaping	0.4506	0.1674	14.3053	7.5000e-004		0.0772	0.0772		0.0772	0.0772		25.4046	25.4046	0.0259		25.9484
Total	**21.5700**	**0.1674**	**14.3053**	**7.5000e-004**		**0.0772**	**0.0772**		**0.0772**	**0.0772**	**0.0000**	**25.4046**	**25.4046**	**0.0259**	**0.0000**	**25.9484**

6.2 Area by SubCategory

Mitigated

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
SubCategory	lb/day										lb/day					
Architectural Coating	5.3598					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Consumer Products	15.7596					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Hearth	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Landscaping	0.4506	0.1674	14.3053	7.5000e-004		0.0772	0.0772		0.0772	0.0772		25.4046	25.4046	0.0259		25.9484
Total	**21.5700**	**0.1674**	**14.3053**	**7.5000e-004**		**0.0772**	**0.0772**		**0.0772**	**0.0772**	**0.0000**	**25.4046**	**25.4046**	**0.0259**	**0.0000**	**25.9484**

7.0 Water Detail

7.1 Mitigation Measures Water

8.0 Waste Detail

8.1 Mitigation Measures Waste

9.0 Operational Offroad

Equipment Type	Number	Hours/Day	Days/Year	Horse Power	Load Factor	Fuel Type

10.0 Vegetation

Appendix 3.2

Rock Blasting Calculations

BLASTING

E= .000014(A)^1.5*.52 lbs PM10/lbs TSP

E=	PM10 emissions, lbs/total	
A=	Area to be blasted (SF)	
A(day)=	5,000	
E=	2.57	lbs PM10/day without watering
E=	0.54	lbs PM10/day without watering
CE=	50.00%	pre-wetting blasting areas and stabalizing soils once blasting is complete
E=	**1.29**	**lbs of PM10/day with watering**
E=	**0.270**	**lbs of PM2.5/day with watering**

.

Appendix 3.3

Rock Crushing Calculations

Phase 3 - Crushing Operations PM 10 & PM 2.5 Fugitive Dust Emissions

Crusher	Tons/day Processed	Controlled Emission Factor (lb/ton)[1]	Max Daily Emissions (lb/day)
PM 10	24000.00	0.00054	12.96
PM 2.5	24000.00	0.0001	2.4
Screen			
PM 10	24000.00	0.00074	17.76
PM 2.5	24000.00	0.00005	1.2
Main Conveyor Loading			
PM 10	24000.00	0.00042	10.08
PM 2.5	24000.00	0.000064	1.536
Main Conveyor Unloading			
PM 10	24000.00	0.00042	10.08
PM 2.5	24000.00	0.000064	1.536
Total			
PM 10			50.88
PM 2.5			6.672

Note: 24,000 tons/day Processed = (15,000 cy * 1.6 tons/cy)

[1]Controlled Emission Factor U.S. EPA AP 42 11.19.2-2

APPENDIX H-1
Noise Analysis

Heritage Bluffs

Acoustical Report

November 7, 2014

Prepared for:
Project Design Consultants
701 B Street, Suite 800
San Diego, CA 92101

Prepared by:
HELIX Environmental Planning, Inc.
7578 El Cajon Boulevard, Suite 200
La Mesa, CA 91942

ACOUSTICAL REPORT

Heritage Bluffs
Black Mountain Ranch Subarea
San Diego, California

Tentative Tract Map Permit
Assessor's Parcel Numbers 312-010-15 and 312-160-02

Prepared for:

Project Design Consultants
701 B Street, Suite 800
San Diego, CA 92101

Prepared by:

HELIX Environmental Planning, Inc.
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La Mesa, California 91942

November 7, 2014

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GLOSSARY OF TERMS AND ACRONYMS

A-Weighted Sound Levels	Decibels (referenced to 20 micro-Pascals) as measured with an A-weighting network of standard sound level meter, abbreviated dB(A).
ADT	average daily trips
ANSI	American National Standards Institute
APN	Assessor's Parcel Number
CAD	Computer Aided Design
CADNA	Computer Aided Noise Abatement
CEQA	California Environmental Quality Act
Caltrans	California Department of Transportation
City	City of San Diego
CNEL	Community Noise Equivalent Level
dB	decibel
dBA	A-weighted sound pressure level
Daytime	The period from 7:00 a.m. to 10:00 p.m.
Evening	The period from 7:00 p.m. to 10:00 p.m.
FHWA	Federal Highway Administration
HNL	Hourly Noise Level
HT	heavy truck
HVAC	Heating, ventilating, and air conditioning
Hz	hertz

GLOSSARY OF TERMS AND ACRONYMS (cont.)

L_{EQ}	The equivalent sound level, or the continuous sound level, that represents the same sound energy as the varying sound levels, over a specified monitoring period.
L_{EQ} A-Weighted	A "one-hour" equivalent sound level measurement
MHPA	Multi-Habitat Planning Area
MSHCP	Multiple Species Habitat Conservation Program
MT	medium truck
Nighttime	Periods other than daytime (as defined above), including legal holidays
Noise Level Measurements	Unless otherwise indicated, the use of A-weighted and "slow" response of instrument complying with at least Type 2 requirements of latest revision of American National Standard Institute (ANSI) S1.4. Specification for Sound Level Meters.
Noise-sensitive Location	A location where particular sensitivities to noise exist, such as residential areas, institutions, hospitals, parks, or other environmentally sensitive areas.
RCNM	Roadway Construction Noise Model
Sound Pressure Level (S_{PL})	The observable effect of acoustic energy radiation, quantifying sound level as perceivable by the receiver. When Sound Pressure is used to describe a noise source, the distance between source and receiver must be known in order to yield useful information about the power rating of the source.
Sound power level (S_{WL})	A specialized analytical metric used to fully quantify the acoustic energy emitted by a source and is complete without accompanying information on the position of measurement relative to the source. It may be used to calculate the sound pressure level at any desired distance.
TNM	Traffic Noise Model
USFWS	U.S. Fish and Wildlife Service

EXECUTIVE SUMMARY

The Heritage Bluffs Project (hereafter referred to as the "Project" or "Proposed Project") proposes to build a residential development.

This acoustical analysis report is submitted to satisfy the acoustical requirements of the City of San Diego (City) for a Tentative Tract Map Permit. Its purpose is to assess the potential for construction noise impacts to the adjacent City's Multi-Habitat Planning Area (MHPA) surrounding much of the Project site. It will also address noise impacts from nearby roadway traffic and identify Project features or requirements necessary to achieve exterior noise levels of 65 Community Noise Equivalent Level (CNEL) at proposed residential outdoor use areas, in compliance with the City's noise regulations.

This report will address the potential for noise impacts to proposed on-site uses and the surrounding community generated by the Project, as well as potential noise impacts from off-site and on-site noise sources to the Project's usable outdoor and indoor areas.

The Project site is located in the Black Mountain Ranch Subarea of the City of San Diego (northwest slope of Black Mountain) 1.4 miles west of the Camino Del Norte and Interstate 15 intersection. The Assessor's parcel numbers (APNs) for the property are 312-010-15 and 312-160-02. For more information regarding the location of the Proposed Project, please refer to Figures 1 and 2.

The Project site consists of approximately 169.85 acres and includes APNs 312-010-15 and 312-160-02. The property is located in the southeast perimeter properties of the Black Mountain Ranch Subarea. The Subarea Plan designates approximately 43 acres of the property as Low Density Residential (2-5 dwelling units per acre) and the remainder of the site as part of the City's MHPA. The Subarea Plan also identifies the property as Areas A and B intended for development of 25 dwelling units and 195 dwelling units respectively, for a total of 220 dwelling units. The Subarea Plan also requires that 35 of the 220 total dwelling units be affordable units.

The Project proposes to develop a total of 171 residential units on approximately 43 acres and includes two different product types. Specifically, a total of 119 single-family residential lots are proposed in the 4,500 to 6,000 square-foot range under the RX-1-1 zone, and 52 lots are proposed in the over 6,000 square-foot range under the RS-1-14 zone. The balance of the 220 dwelling units allocated to the property in the Black Mountain Ranch Subarea Plan will be transferred to the Black Mountain Ranch North Village. This transfer of 49 dwelling units to the North Village will include the 35 affordable dwelling units required by the Subarea Plan.

The dominant noise source in the vicinity of the Project site is associated with vehicular traffic on Carmel Valley Road/Bernardo Center Drive. No other significant sources of ambient noise were noted in the area.

The following summarizes the findings of this report by noise type and source:

Construction Noise

Off-site residential impacts

Construction noise at the surrounding property lines is anticipated to be in compliance with the City Noise Ordinance (construction) requirements governing construction noise, and impacts would be less than significant. Additionally, construction vibration impacts at the surrounding property lines are expected to be less than significant. Therefore, no noise attenuation measures are required, for construction noise or vibration.

MHPA

There is no barrier or shielding methodology that can be used to lower the impacts heavy equipment operations to 60 dBA L_{EQ} or less (at the edge of habitat) during initial site grading for the homes closest to the MHPA.

Therefore, Project-generated construction noise impacts in nearby off-site MHPA areas would be potentially significant.

Operational Noise

Stationary Source Noise

On-Site Heating, Ventilation, and Air Conditioning

The only noteworthy stationary noise source associated with the Proposed Project with the potential for noise impacts would be the heating, ventilation, and air conditioning (HVAC) equipment. Typical exterior noise impacts from one residence to the closest nearby residence on the Project site would be approximately 41.8 dBA from an adjacent unit. Therefore, stationary source noise impacts from on-site residence to on-site residence receptors would potentially significant.

Off-site HVAC Noise

The maximum calculated noise level for the HVAC systems at the closest adjacent areas of MHPA habitat were estimated to be 42.5 dBA when the adjacent and nearby units were all running continuously. This is less than the MHPA habitat limit of 60 dBA and is, therefore, considered less than significant.

Land Use Noise and Vibration Compatibility

As the Proposed Project is exclusively a residential development, proposed residential units would not be in close proximity to commercial uses that would have the potential to cause significant on-site noise impacts. Thus, proposed residences would not be exposed to noise generated by on-site stationary noise sources other than the previously discussed HVAC systems. No mitigation measures are required.

The only potential on-site to off-site vibration impact sources are the on-site HVAC systems, pool equipment (located near the center of the Project site), and on-site traffic. Given the small size and low horsepower associated with the proposed on-site equipment (related to HVAC systems and the pool), the ability of the equipment to introduce vibration energy into the ground would be limited; subsequently, none of these sources have the potential to create human-perceptible vibration beyond their immediate footprint (or the site boundary). Therefore, vibration impacts to off-site receptors would be less than significant.

Transportation Noise

Off-site Project Transportation Noise

Transportation noise generated in the Project vicinity is primarily from vehicular traffic noise; other off-site transportation noise sources have a negligible contribution to noise levels at nearby off-site or on-site residential uses. The maximum change in noise levels at off-site receivers between Near Term and Near Term plus Project traffic conditions was modeled to be less than 0.6 CNEL. In order for a significant impact to be identified, a 3 CNEL traffic noise increase must occur at these off-site receptors as a result of a project. A project would have to double the amount of daily traffic on a roadway maintaining full speed. Therefore, Project off-site traffic noise impacts would be less than significant.

On-site Project Transportation Noise

Exterior and interior traffic-related noise levels at all proposed residential units are also expected to be less than the noise thresholds of 65 CNEL (single family residential) for exterior locations, and 45 CNEL for interior locations. Therefore, Project on-site traffic noise impacts would be less than significant.

Mitigation

MHPA

There are no requirements for construction noise control outside the breeding season. Therefore, all Project-related construction may occur outside the breeding season. The use of any heavy equipment within 500 feet of the edge of habitat during the identified breeding season of February 1 to September 15 without noise control, however, will exceed the 60 dBA L_{EQ} limit. Furthermore, almost any construction (excluding light finish carpentry) directly adjacent the habitat will exceed the 60 dBA limit without noise control. Other light equipment may be utilized closer than 500 feet, depending on the equipment and level of hourly utilization.

The following is a construction scenario where parts of the construction may occur during the breeding season. This scenario requires partial construction of the row of homes closest to the habitat outside of the noted breeding season, with these structures to act as noise barriers for construction activities further from the habitat.

A. Initial Out of season work (September 16 to January 31):

   1. Rough grading for two rows of homes closest to any habitat areas
   2. Finish grading of the row of homes closet to the habitat
   3. Foundation, framing, shear walls and roofing for row of homes closest to the habitat

These framed and exterior shell completed homes would then provide noise shielding and much of the required noise control for work further from the MHPA.

B. In season work where the outer row of partially constructed homes provides noise shielding:

   1. Finish construction of outer row of homes
   2. Finish grading of Project interior home pads
   3. Framing shear walls and finish construction of interior rows of homes

Depending on the construction and equipment utilized, the row of partially finished homes will need to extend an adequate distance in each direction from the construction to block the line of site of the equipment from the habitat. The partially finished homes will have a gap between the structures, however, with a clear line of sight view from construction areas to off-site habitat. Accordingly, some additional shielding may be required to maintain compliance with the specified construction noise limit in applicable habitat areas.

In addition, any form of construction within approximately 500-feet of the adjacent MHPA habitat during the specified breeding season will require on-going noise monitoring to ensure compliance with the 60 dBA L_{EQ} sensitive habitat noise control limitation. If monitoring shows exceedances of the 60 dBA L_{EQ} sensitive habitat noise control limitation additional noise control will be implemented or construction halted until noise control can be implemented.

<u>On-site Residential HVAC</u>

A five-foot or taller residential property line fence will provide noise reduction to a less than significant noise level for all HVAC systems.

1.0 INTRODUCTION

The Heritage Bluffs Project (hereafter referred to as the "Project" or "Proposed Project") proposes to build a residential development.

This acoustical analysis report is submitted to satisfy the acoustical requirements of the City of San Diego (City) for a Tentative Tract Map Permit. Its purpose is to assess the potential for construction noise impacts to the adjacent City's Multi-Habitat Planning Area (MHPA) surrounding much of the Project site. It will also address noise impacts from nearby roadway traffic and identify Project features or requirements necessary to achieve exterior noise levels of 65 Community Noise Equivalent Level (CNEL) at proposed residential outdoor use areas, in compliance with the City's noise regulations.

This report will address the potential for noise impacts to proposed on-site uses and the surrounding community generated by the Project, as well as potential noise impacts from off-site and on-site noise sources to the Project's usable outdoor and indoor areas.

1.1 NOISE AND SOUND LEVEL DESCRIPTORS

All noise level or sound level values presented herein are expressed in terms of decibels (dB), with A-weighting to approximate the hearing sensitivity of humans. Time-averaged noise levels are expressed by the symbol L_{EQ} with a specified duration. The CNEL is a 24-hour average, where noise levels during the evening hours of 7:00 p.m. to 10:00 p.m. have an added 5 dB weighting, and sound levels during the nighttime hours of 10:00 p.m. to 7:00 a.m. have an added 10 dB weighting. This is similar to the Day-Night sound level, L_{DN}, which is a 24-hour average with an added 10 dB weighting on the same nighttime hours but no added weighting on the evening hours. Sound levels expressed in CNEL are always based on the A-weighted decibel. These metrics are used to express noise levels for both measurement and municipal regulations, for land use guidelines, and for enforcement of noise ordinances.

Some of the data also may be presented as octave-band-filtered and/or A-octave-band-filtered data, which are a series of sound spectra centered on each stated frequency, with half of the bandwidth above, and half of the bandwidth below, the stated frequency. These data are typically used for machinery noise analysis and barrier-effectiveness calculations.

Noise emission data are often provided based on the industry standard format of sound power (noted by S_{WL}), which is the total acoustic power radiated from a given sound source as related to a reference power level. Sound power differs from sound pressure (if notation is needed the sound pressure abbreviation is S_{PL}), which measures the fluctuations in air pressure caused by the presence of sound waves, and is generally the format that describes noise levels as heard by the receiver. Sound pressure is the actual noise experienced by a human or registered by a sound level instrument. When sound pressure is used to describe a noise source, it must specify the distance from the noise source to provide complete information. Sound power is a specialized analytical method to provide information without the distance requirement, but it may be used to calculate the sound pressure at any desired distance.

1.2 PROJECT LOCATION

The Project site is located in the Black Mountain Ranch Subarea of the City of San Diego (northwest slope of Black Mountain) 1.4 miles west of the Camino Del Norte and Interstate 15 intersection. The Assessor's parcel numbers (APNs) for the property are 312-010-15 and 312-160-02. For more information regarding the location of the Proposed Project please refer to Figures 1 and 2, *Regional Location Map* and *Aerial Photograph*, respectively.

1.3 PROJECT DESCRIPTION

The Project site consists of approximately 169.85 acres and includes APNs 312-010-15 and 312-160-02. The property is located in the southeast perimeter properties of the Black Mountain Ranch Subarea. The Subarea Plan designates approximately 43 acres of the property as Low Density Residential (2-5 dwelling units per acre) and the remainder of the site as part of the City's MHPA. The Subarea Plan also identifies the property as Areas A and B intended for development of 25 dwelling units and 195 dwelling units respectively, or a total of 220 dwelling units. The Subarea Plan also requires that 35 of the 220 total dwelling units be affordable units.

The proposed Heritage Bluffs Project consists of a Vesting Tentative Map, a Planned Development Permit for deviations to underlying zone setback requirements, a Site Development Permit for Environmentally Sensitive Lands, and Re-zonings from AR-1 to RS-1-14 and RX-1-1. In addition, a boundary adjustment to the City's MHPA is required.

The Project proposes to develop a total of 171 residential units on approximately 43 acres and includes two different product types. Specifically, a total of 119 single-family residential lots are proposed in the 4,500 to 6,000 square-foot range under the RX-1-1 zone, and 52 lots are proposed in the over 6000 square-foot range under the RS-1-14 zone. The balance of the 220 dwelling units allocated to the property in the Black Mountain Ranch Subarea Plan will be transferred to the Black Mountain Ranch North Village. This transfer of 49 dwelling units to the North Village will include the 35 affordable dwelling units required by the Subarea Plan. Please see Figures 3a and 3b, *Site Plan*.

1.4 SENSITIVE RECEPTORS

There are no nearby off-site residential land uses and, thus, only the new on-site residences are considered as sensitive.

As previously described, the entire Project site is surrounded by MHPA habitat, with the off-site sensitive receptor consisting of the portion of the MHPA habitat area adjacent (or in close proximity) to the Project site.

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Regional Location Map

HERITAGE BLUFFS II REVEGETATION PLAN

HELIX Environmental Planning

N 0 8 Miles

Figure 1

I:PROJECTS\P\PDC\PDC-14_HeritageBluffs\Map\ENV\Noise_2014_0226\Fig2_Aerial.mxd PDC-13 02/26/14 -DR

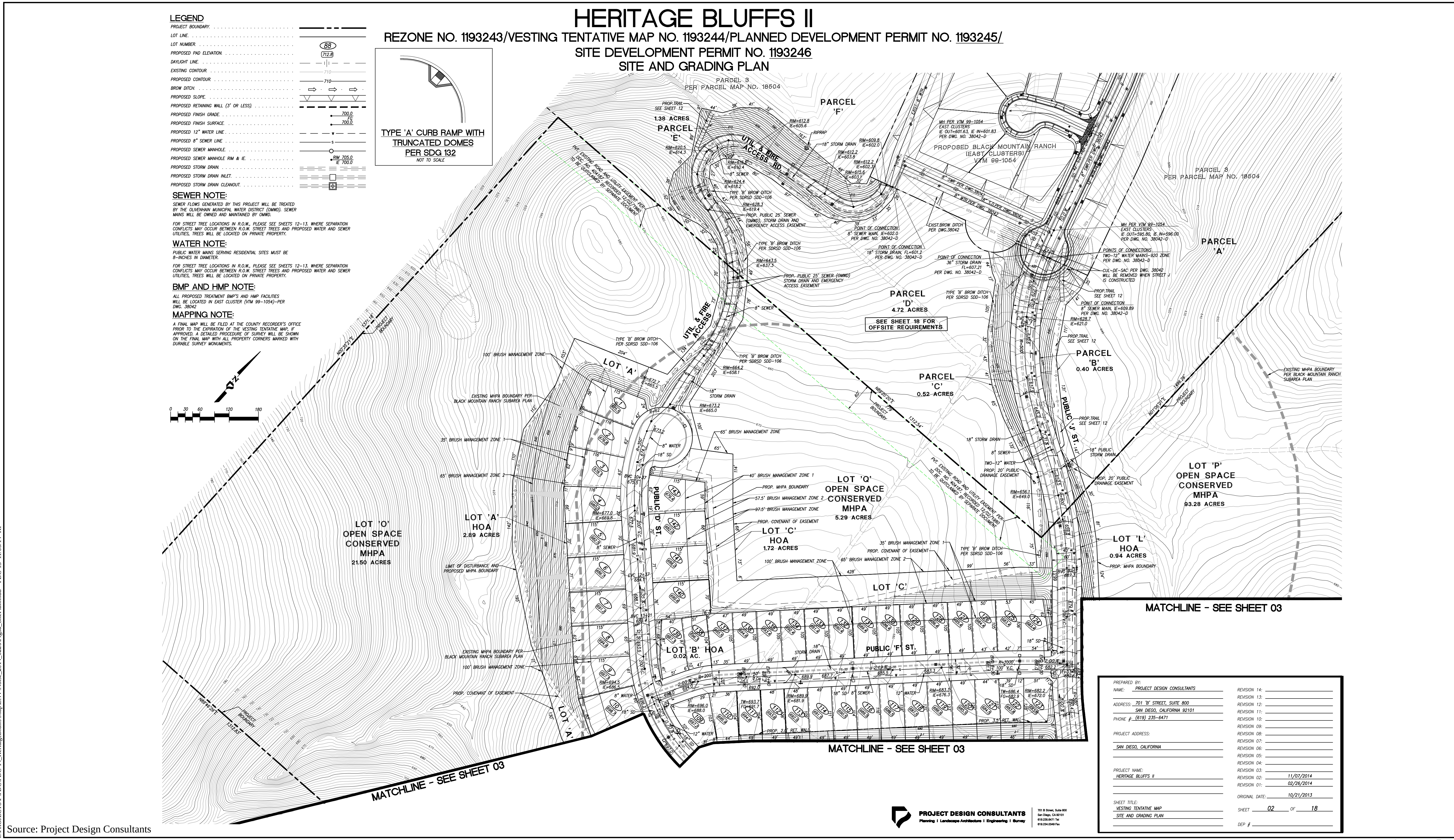
Aerial Photograph

HERITAGE BLUFFS II REVEGETATION PLAN

HELIX Environmental Planning

N 0 600 Feet

Figure 2



Source: Project Design Consultants

Site Plan

HERITAGE BLUFFS II REVEGETATION PLAN

Figure 3a

HELIX Environmental Planning

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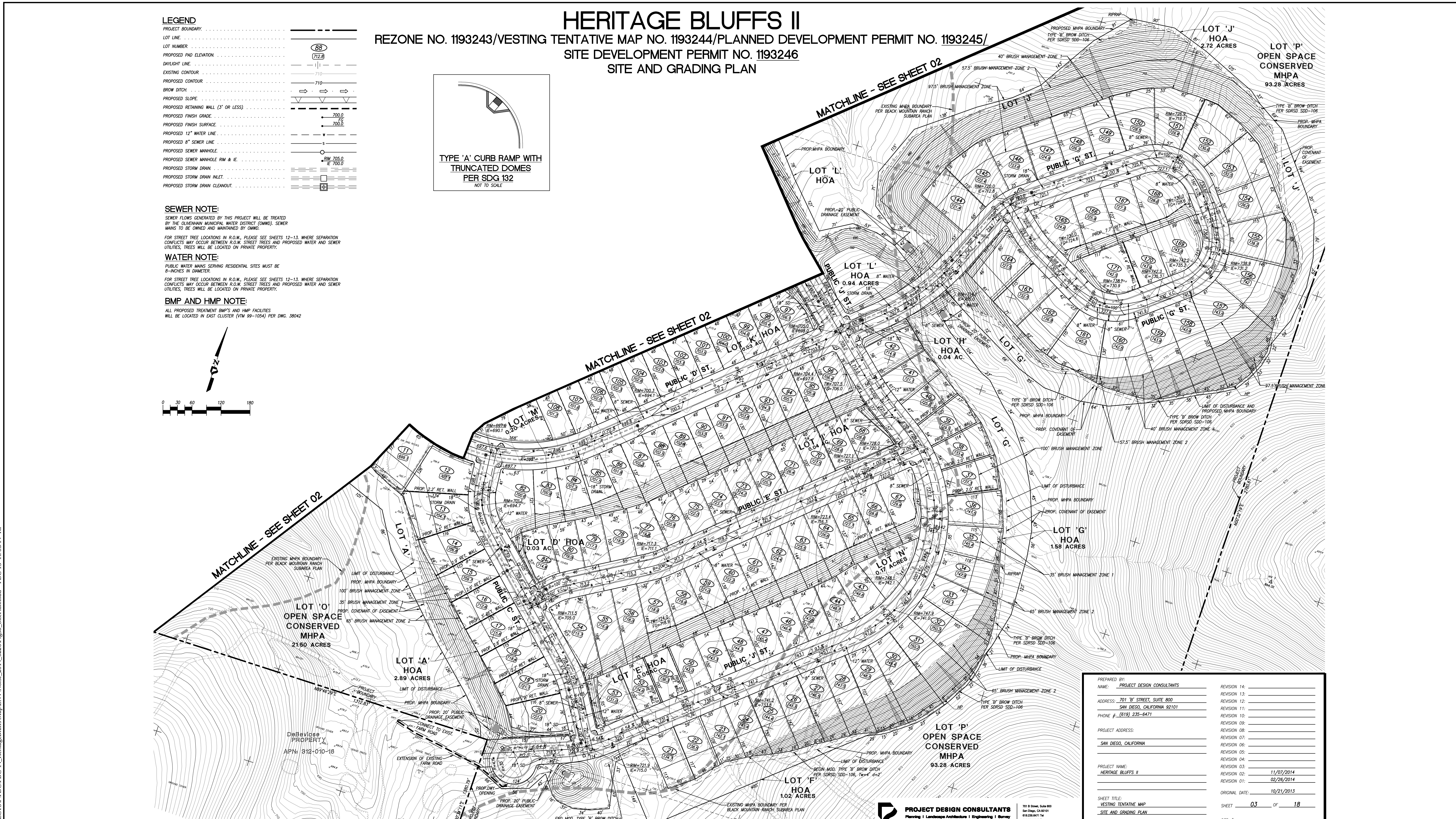


Source: Project Design Consultants

I:\PROJECTS\P\PDC\PDC-14_HeritageBluffs\Map\ENV\Noise_2014_0226\Fig3b_SitePlan.indd PDC-13 11/06/14 -KF

Site Plan

HERITAGE BLUFFS II REVEGETATION PLAN

Figure 3b

HELIX Environmental Planning

1.5 APPLICABLE NOISE AND VIBRATION REGULATIONS AND STANDARDS

Noise standards applicable to the Project are discussed below.

City of San Diego Municipal Code, Chapter 5, Article 9.5, Division 4, §59.5.0404 Construction Noise

(a) It shall be unlawful for any person, between the hours of 7:00 p.m. of any day and 7:00 a.m. of the following day, or on legal holidays as specified in Section 21.04 of the City of San Diego Municipal Code, with exception of Columbus Day and Washington's Birthday, or on Sundays, to erect, construct, demolish, excavate for, alter or repair any building or structure in such a manner as to create disturbing, excessive or offensive noise unless a permit has been applied for and granted beforehand by the Noise Abatement and Control Administrator. In granting such permit, the Administrator shall consider whether the construction noise in the vicinity of the proposed work site would be less objectionable at night than during the daytime because of different population densities or different neighboring activities; whether obstruction and interference with traffic particularly on streets of major importance, would be less objectionable at night than during the daytime; whether the type of work to be performed emits noise at such a low level as to not cause significant disturbances in the vicinity of the work site; the character and nature of the neighborhood of the proposed work site; whether great economic hardship would occur if the work were spread over a longer time; whether proposed night work is in the general public interest; and he shall prescribe such conditions, working times, types of construction equipment to be used, and permissible noise levels as he deems to be required in the public interest.

(b) Except as provided in subsection C. hereof, it shall be unlawful for any person, including the City of San Diego, to conduct any construction activity so as to cause, at or beyond the property lines of any property zoned residential, an average sound level greater than 75 decibels during the 12-hour period from 7:00 a.m. to 7:00 p.m.

(c) The provisions of subsection B. of this section shall not apply to construction equipment used in connection with emergency work, provided the Administrator is notified within 48 hours after commencement of work.

City of San Diego Municipal Code, Chapter 5, Article 9.5, Division 4, § 59.5.0401, Sound Level Limits

(a) It shall be unlawful for any person to cause noise by any means to the extent that the one-hour average sound level exceeds the applicable limit given in the following table (Table 1-1, *Applicable Noise Limits*), at any location in the City of San Diego on or beyond the boundaries of the property on which the noise is produced. The noise subject to these limits is that part of the total noise at the specified location that is due solely to the action of said person.

Table 1-1 APPLICABLE NOISE LIMITS		
Land Use Zone	**Time of Day**	**One-hour Average Sound Level (dB)**
Single Family Residential	7:00 a.m. to 7:00 p.m.	50
	7:00 p.m. to 10:00 p.m.	45
	10:00 p.m. to 7:00 a.m.	40
Multi-Family Residential (up to a maximum density of 1/2000)	7:00 a.m. to 7:00 p.m.	55
	7:00 p.m. to 10:00 p.m.	50
	10:00 p.m. to 7:00 a.m.	45
All other Residential	7:00 a.m. to 7:00 p.m.	60
	7:00 p.m. to 10:00 p.m.	55
	10:00 p.m. to 7:00 a.m.	50
Commercial	7:00 a.m. to 7:00 p.m.	65
	7:00 p.m. to 10:00 p.m.	60
	10:00 p.m. to 7:00 a.m.	60
Industrial or Agricultural	anytime	75

Source: City of San Diego Municipal Code, Chapter 5, Article 9.5, Division 4, § 59.5.0401, Sound Level Limits

(b) The sound level limit at a location on a boundary between two zoning districts is the arithmetic mean of the respective limits for the two districts. Permissible construction noise level limits shall be governed by Section 59.5.0404 of this article.

(c) Fixed-location public utility distribution or transmission facilities located on or adjacent to a property line shall be subject to the noise level limits of Part (a) of this section, measured at or beyond six feet from the boundary of the easement upon which the equipment is located.

City of San Diego General Plan Noise Element (March 2008)

The following policies were instated to ensure that the City would consider existing and future noise levels when making land use planning decisions to minimize people's exposure to excessive noise. More specifically, the Land Use-Noise Compatibility Guidelines were established for "evaluating land use noise compatibility when reviewing proposed land use development projects."

NE-A.1 Separate excessive noise-generating uses from residential and other noise-sensitive land uses with a sufficient spatial buffer of less sensitive uses.

NE-A.2 Assure the appropriateness of proposed developments relative to existing and future noise levels by consulting the guidelines for noise-compatible land use (shown on Table 1-2, *Land Use - Noise Compatibility Guidelines*, below) to minimize the effects on noise-sensitive land uses.

Table 1-2
LAND USE - NOISE COMPATIBILITY GUIDELINES

Land Use Category	**Exterior Noise Exposure (dBA CNEL)**				
	>60	60-65	65-70	70-75	75<
Open Space and Parks and Recreational					
Community & Neighborhood Parks; Passive Recreation					
Regional Parks; Outdoor Spectator Sports, Golf Courses; Athletic Fields; Outdoor, Spectator Sports, Water Recreational Facilities; Horse Stables; Park Maintenance Facilities					
Agricultural					
Crop Raising & Farming; Aquaculture, Dairies; Horticulture Nurseries & Greenhouses; Animal Raising, Maintain & Keeping; Commercial Stables					
Residential					
Single Units; Mobile Homes; Senior Housing		45			
Multiple Units; Mixed-Use Commercial/Residential; Live Work; Group Living Accommodations		45	45		
Institutional					
Hospitals; Nursing Facilities; Intermediate Care Facilities; Kindergarten through Grade 12 Educational Facilities; Libraries; Museums; Places of Worship; Child Care Facilities		45			
Vocational or Professional Educational Facilities; Higher Education Institution Facilities (Community or Junior Colleges, Colleges, or Universities)		45	45		
Cemeteries					
Sales					
Building Supplies/Equipment; Food, Beverages & Groceries; Pets & Pet Supplies; Sundries, Pharmaceutical, & Convenience Sales; Wearing Apparel & Accessories			50	50	

Table 1-2 (cont.)
LAND USE - NOISE COMPATIBILITY GUIDELINES

Land Use Category	Exterior Noise Exposure (dBA CNEL)				
	>60	60-65	65-70	70-75	75<
Commercial Services					
Building Services; Business Support; Eating & Drinking; Financial Institutions; Assembly & Entertainment; Radio & Television Studios; Golf Course Support			50	50	
Visitor Accommodations		45	45	45	
Offices					
Business & Professional; Government; Medical, Dental & Health Practitioner; Regional & Corporate Headquarters			50	50	
Vehicle and Vehicular Equipment Sales and Services Use					
Commercial or Personal Vehicle Repair & Maintenance; Commercial or Personal Vehicle Sales & Rentals; Vehicle Equipment & Supplies Sales & Rentals; Vehicle Parking					
Wholesale, Distribution, Storage Use Category					
Equipment & Materials Storage Yards; Moving & Storage Facilities; Warehouse; Wholesale Distribution					
Research & Development				50	

	Compatible	Indoor Uses	Standard construction methods should attenuate exterior noise to an acceptable indoor noise level.
		Outdoor Uses	Activities associated with the land use may be carried out.
	Conditionally Compatible	Indoor Uses	Building structure must attenuate exterior noise to the indoor noise level indicated by the number for occupied areas.
		Outdoor Uses	Feasible noise mitigate techniques should be analyzed and incorporated to make the outdoor activities acceptable.
	Incompatible	Indoor Uses	New construction should not be undertaken.
		Outdoor Uses	Severe noise interference makes outdoor activities unacceptable.

Source: City 2008

NE-A.3 Limit future residential and other noise-sensitive land uses in areas exposed to high levels of noise.

NE-A.4 Require an acoustical study consistent with Acoustical Study Guidelines for proposed developments in areas where the existing or future noise level exceeds or would exceed the "compatible" noise level thresholds as indicated on the Land Use – Noise Compatibility Guidelines, so that noise mitigation measures can be included in the project design to meet the noise guidelines.

NE-A.5 Prepare noise studies to address existing and future noise levels from noise sources that are specific to a community when updating community plans.

CEQA Significance Thresholds

This report addresses the applicable City's California Environmental Quality Act (CEQA) Significance Determination Thresholds 2011 revision, with related criteria summarized in Table 1-3, *Traffic Noise Significance Thresholds in CNEL*.

Table 1-3
TRAFFIC NOISE SIGNIFICANCE THRESHOLDS IN CNEL

Structure or Proposed Use that would be Impacted by Traffic Noise	Interior Space	Exterior Useable Space [1]	General Indication of Potential Significance
Single-family detached	45 dB	65 dB	Structure or outdoor useable area[2] is <50 feet from the center of the closest (outside) lane on a street with existing or future ADTs >7500
Multi-family, schools, libraries, hospitals, day care, hotels, motels, parks, convalescent homes	Development Services Department (DSD) ensures 45 dB pursuant to Title 24	65 dB	
Offices, Churches, Business, Professional Uses	50 dB*	70 dB	Structure or outdoor usable area is <50 feet from the center of the closest lane on a street with existing or future ADTs > 20,000
Commercial, Retail, Industrial, Outdoor Spectator Sports Uses	50 dB*	75 dB	Structure or outdoor usable area is <50 feet from the center of the closest lane on a street with existing or future ADTs >40,000

Source: City 2008 and City 2011

[1] If a project is currently at or exceeds the significance thresholds for traffic noise described above and noise levels would result in less than a 3 dB increase, then the impact is not considered significant.

* Based on the more restrictive City of San Diego 2008 Land Use-Noise Compatibility Guidelines.

The City of San Diego's Multiple Species Habitat Conservation Program (MSHCP) and MHPA requirements, as well as associated guidelines produced by the U.S. Fish and Wildlife Service (USFWS), require that noise be limited to a level not to exceed an hourly limit of 60 dBA L_{EQ} or the average ambient noise level, whichever is greater, at the edge of MHPA habitat during the identified sensitive species breeding season of February 1 to September 15.

2.0 ENVIRONMENTAL SETTING

2.1 SURROUNDING LAND USES

As previously described, all of the land immediately adjacent and near the Project site is MHPA habitat.

2.2 SURROUNDING ROADWAY DESCRIPTIONS

The primary noise sources in the vicinity of the Project site include automobile and truck traffic noise from Carmel Valley Road/Bernardo Center Drive. Interstate 15 is located east of the site but is across a ridgeline and at a significantly greater distance. Accordingly, the only source of roadway noise evaluated for this Project will be Carmel Valley Road/Bernardo Center Drive.

2.3 PROXIMITY TO AIRPORTS

The site is significantly beyond any airport noise contour maps and, while there are occasional overflights, it is well outside the normal Marine Corp Air Station Miramar to Camp Pendleton flight corridor. Accordingly, there will be no further discussion of aircraft noise.

2.4 EXISTING NOISE ENVIRONMENT

The dominant noise source in the vicinity of the Project site is associated with vehicular traffic on Carmel Valley Road/Bernardo Center Drive. No other significant sources of ambient noise were noted in the area.

2.5 FUTURE TRANSPORTATION NOISE ENVIRONMENT

Much of the immediate area is MHPA habitat, although there is still residential development occurring in the area and traffic volumes on Carmel Valley Road/Bernardo Center Drive will increase into the future (with an associated increase in area noise).

3.0 STUDY METHODS, EQUIPMENT, AND PROCEDURES

This section discusses the methods and procedures followed for the noise study, including the selection of noise measurement and receiver locations, noise measurement procedures, and noise impact evaluation.

3.1 METHODOLOGY

A "one-hour" equivalent sound level measurement (L_{EQ}, A-Weighted) was recorded near the Project site. During the on-site noise measurement, start and end times were recorded, vehicle counts were made for cars, medium trucks (double-tires/two axles), and heavy trucks (three or more axles) for the corresponding road segment(s).

For measurements of less than one hour in duration, the measurement time must be long enough for a representative traffic volume to occur and the noise level (L_{EQ}) to stabilize; 15 minutes is usually sufficient for this purpose. The vehicle counts are then converted to one-hour equivalent volumes by applying an appropriate factor. Other field data gathered included measuring or estimating distances, angles-of-view, slopes, elevations, roadway grades, and vehicle speeds. This information was subsequently verified using available maps and records.

3.2 EQUIPMENT

The following equipment was used to measure existing noise levels at the Project site:

- Larson Davis System LxT Integrating Sound Level Meter
- Larson Davis Model CA250 Calibrator
- Windscreen and tripod for the sound level meter
- Digital camera

The sound level meter was field-calibrated immediately prior to the noise measurements to ensure accuracy. All sound level measurements conducted and presented in this report were made with a sound level meter that conforms to the American National Standards Institute (ANSI) specifications for sound level meters (ANSI SI.4-1983 R2001). All instruments were maintained with National Bureau of Standards traceable calibration per the manufacturers' standards.

3.3 NOISE MODELING SOFTWARE

Modeling of the outdoor noise environment for this report was accomplished using two computer noise models: Computer Aided Noise Abatement version 3.6 (CADNA), and Traffic Noise Model (TNM) version 2.5. CADNA is a model-based computer program developed by *DataKustik* for predicting noise impacts in a wide variety of conditions. CADNA assists in the calculation, presentation, assessment, and mitigation of noise exposure. It allows for the input of project information, such as noise source data, barriers, structures, and topography, to create a detailed CADNA model and uses the most up-to-date calculation standards to predict outdoor noise impacts. CADNA traffic noise prediction is based on the data and methodology used in TNM. The TNM was released in February 2004 by the U.S. Department of Transportation, and calculates the daytime average Hourly Noise Level (HNL) from 3-dimensional model inputs and traffic data. The TNM used in this analysis was developed from Computer Aided Design (CAD) plans provided by the Project applicant. Input variables included road alignment, elevation, lane configuration, area topography, existing and planned noise control features, projected traffic volumes, estimated truck composition percentages, and vehicle speeds.

The model-calculated one-hour L_{EQ} noise output, with the use of 8 to 10 percent of the average daily traffic occurring during a peak hour, is the equivalent of the CNEL [Caltrans Technical Noise Supplement Nov, 2009] (6 to 8 percent traffic may be converted by adding two to the one-hour L_{EQ} for the equivalent CNEL).

4.0 EXISTING NOISE ENVIRONMENT

As described in Section 2.0 of this report, the dominant noise source at the Project site is the vehicular traffic on Carmel Valley Road/Bernardo Center Drive. An on-site inspection and traffic noise measurement were completed in December 2007 and a follow up visit was made on Thursday, January 16, 2014. While a "one-hour" equivalent measurement is typically made for roadway noise as previously noted, the subject roadway was not complete during either site visit and no measurements were feasible.

4.1 SITE NOISE MEASUREMENTS AND COMPARISON CALCULATIONS

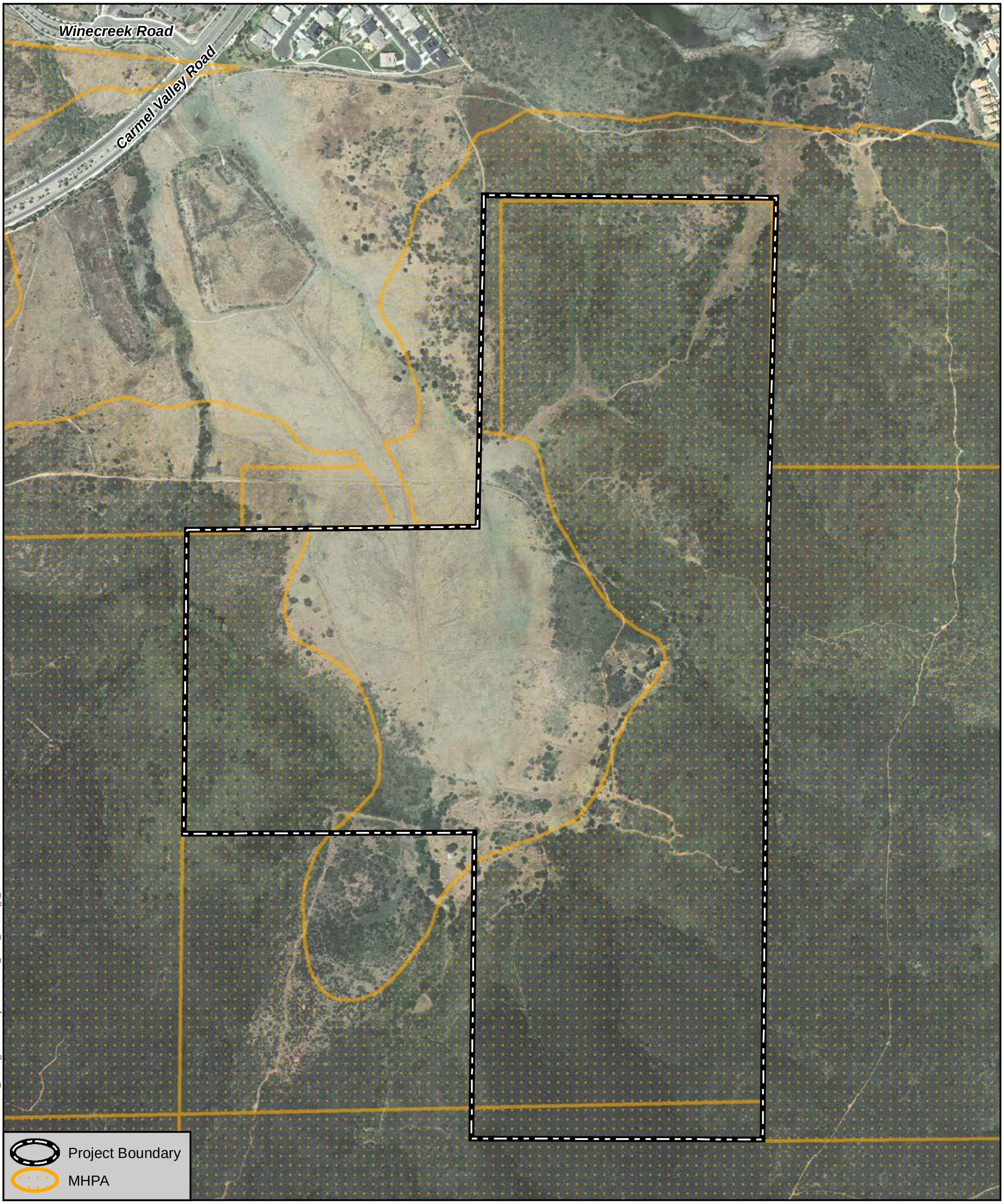
Based on the fact that the dominant off-site noise source at the Project site (Carmel Valley Road/Bernardo Center Drive) was not complete during field visits (as previously noted), no measurements or associated traffic counts were taken (or feasible).

5.0 IMPACTS

5.1 SIGNIFICANCE THRESHOLDS

5.1.1 Construction Noise

There are no residential locations within impact planning distance from the Project site, with Project-related construction noise therefore not an issue for off-site residential uses. As previously noted, however, the Project site is surrounded by occupied MHPA habitat, which is subject to an hourly limit of 60 dBA L_{EQ} or the average ambient noise level, whichever is greater, at the edge of habitat during the identified sensitive species breeding season of February 1 to September 15. Please see Figure 4, *MHPA*.



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MHPA

HERITAGE BLUFFS II REVEGETATION PLAN

HELIX Environmental Planning

N 0 600 Feet

Figure 4

5.1.2 Operational Noise

Stationary Source Noise

The City specifies a maximum operational exterior noise limit for residential uses of 50 dBA L_{EQ} during the daytime hours of 7:00 a.m. to 7:00 p.m., 45 dBA L_{EQ} during the evening hours of 7:00 p.m. to 10:00 p.m., and 40 dBA L_{EQ} during the nighttime hours of 10:00 p.m. to 7:00 a.m.

All planning is based on the nighttime 40 dBA L_{EQ} limit.

Transportation Noise

The City's Noise Element and CEQA Significance guidelines identify an exterior use area noise of greater than 65 CNEL and an interior use area noise of greater than 45 CNEL as significant. Planning assumes a minimum 15 CNEL reduction from outside to inside a structure, so interior noise levels for residential are assumed to be compatible with an exterior noise level of up to 60 CNEL

While no specific studies have been conducted to establish a level of noticeable change in the 24-hour weighted CNEL metric, the normal significance standard applied is an increase of 3 CNEL in existing versus existing plus Project.

5.2 CONSTRUCTION NOISE IMPACTS

5.2.1 Construction Noise Analysis Assumptions

Project construction would entail the use of equipment throughout the site for the full term of construction. Construction activities would be roughly divided into five phases. These phases may contain some overlap depending upon location and timing. The phases would include the following:

1. Grading
2. Foundation excavation
3. Utilities excavation and installation
4. Foundation construction
5. Vertical construction

Most construction equipment does not operate at full power (maximum noise) for a full hour, but rather is operated intermittently. As a result, the Federal Highway Administration (FHWA) guidelines analyze most equipment at an assumed 40 percent hourly operating time, with the FHWA assumption used for all equipment types in the following analysis.

5.2.2 Construction Noise Impacts

Rough grading activities are often the loudest noise that occurs during a construction of a project and will be the initial consideration for Project planning.

Other potential noise impacts to the MHPA could occur during final site preparation and vertical construction when a small excavator or backhoe and a loader would be utilized to dig the foundation for the Project, and for utility installation as well as lower noise impact general carpentry.

The FHWA Roadway Construction Noise Model (RCNM) Version 1.0 (February 2, 2006) lists the noise level of an excavator, a scraper, and a dozer all as 83 dBA at 50 feet. Excavation will occur throughout much of the site. The closest MHPA to the Project site is less than 25 feet, with associated noise impacts as high as 87 dBA L_{EQ} during rough grading.

There is no barrier or shielding methodology that can be used to lower the impacts of these types of heavy equipment operations to 60 dBA L_{EQ} or less (at the edge of habitat) when heavy construction is required for the homes closest to the MHPA.

Therefore, Project-generated construction noise impacts in nearby off-site MHPA areas would be potentially significant.

5.3 OPERATIONAL NOISE IMPACTS

5.3.1 Stationary Source Impacts

5.3.1.1 *Off-site Noise Impacts*

The only noteworthy stationary noise source associated with the Proposed Project with the potential for off-site noise impacts would be the heating, ventilation, and air conditioning (HVAC) equipment.

The HVAC systems will likely be ground-mounted (worst case for noise impact). Specific planning data (i.e., equipment details and locations) for the future HVAC systems is not available at this time. However, to estimate operational impacts from HVAC systems of the Project, the noise from a typical large residential exterior split systems condenser (*Carrier* 38HDR060) located in the area with the greatest potential for operational noise impacts to surrounding MHPA habitat was used as a basis for analysis. The Carrier exterior condenser noise data supplied by the manufacturer is shown below in Table 5-1, *HVAC Equipment Noise Levels.*

Table 5-1
HVAC EQUIPMENT NOISE LEVELS

Noise Levels in Decibels (DB)[1] Measured at Octave Frequencies in Hertz (HZ)							Overall Noise Level in A-Weighted Scale (DBA)
125 Hz	250 Hz	500 Hz	1,000 Hz	2,000 Hz	4,000 Hz	8,000 Hz	
63.0	61.5	64.0	66.5	66.0	64.5	55.5	72.0

[1] Sound Power Levels (S_{WL}).

The maximum calculated noise level for the HVAC systems at the closest adjacent areas of MHPA habitat were estimated to be 42.5 dBA when the adjacent and nearby units were all running continuously. This is less than the MHPA habitat limit of 60 dBA and is, therefore, considered less than significant.

5.3.1.2 *On-site Noise Impacts from On-site Sources*

The only noteworthy stationary noise source associated with the Proposed Project with the potential for on-site noise impacts would be the HVAC equipment as noted above for off-site impacts.

The maximum calculated noise levels for the HVAC systems at the closest adjacent exterior on-site buildings were estimated to be 41.8 dBA when the adjacent and nearby units were all running continuously. This is greater than the identified nighttime significance threshold of 40-dBA for residential uses. Therefore, stationary source noise impacts from HVAC systems to on-site residential receptors would be potentially significant.

5.3.2 Transportation Noise Impacts

5.3.2.1 *Off-site Transportation Noise Impacts*

A reasonable worst-case traffic noise impact planning will be based on a vehicle distribution of 96.5 percent automotive traffic, 2.5 percent Medium Truck (MT) traffic, and 1 percent Heavy Truck (HT) traffic.

Average Daily Trips (ADT), from Linscott, Law & Greenspan (LLG), Transportation Engineering figures dated Rev 2/17/2014, are shown in Table 5-2, *Average Daily Traffic Volumes*, below.

Table 5-2
AVERAGE DAILY TRAFFIC VOLUMES

Street Segment	Existing	Project	Near Term No-Project	Near Term with Project	Year 2035
Bernardo Center Drive					
Camino Del Norte to Dove Creek	11,600	1,111	11,400	12,511	24,211
Carmel Valley Road					
Dove Creek to Winecreek Road	17,020	1,436	17,900	19,336	29,571
Winecreek Road to Black Mountain Road	14,160	274	15,200	15,474	29,439

5.3.2.2 *On-site Transportation Noise Compatibility from Off-site Sources*

The site calculated site boundary noise impacts from off-site roadways for the worst case Year 2035 with project is provided in Table 5-3, *Calculated Receiver Noise Levels*, below

Table SS
CALCULATED RECEIVER NOISE LEVELS

Number	Name	Noise Level
1	Receiver 1	53.8 CNEL
2	Receiver 2	56.6 CNEL
3	Receiver 3	60.1 CNEL
4	Receiver 4	59.6 CNEL
5	Receiver 5	52.8 CNEL
6	Receiver 6	59.8 CNEL
7	Receiver 7	61.8 CNEL
8	Receiver 8	53.5 CNEL
9	Receiver 9	41.7 CNEL

The Year 2030 calculated on-site combined noise level is 60.1 CNEL at the northwest corner of parcel 312-160-02, and 61.8 CNEL at the north central corner of parcel 312-010-15. These two locations are the closest and highest roadway noise impact locations of the Project. Receiver locations are shown on Figure 5, *Noise Contours*.

No mitigation or future exterior to interior planning for roadway traffic noise is required for this site.

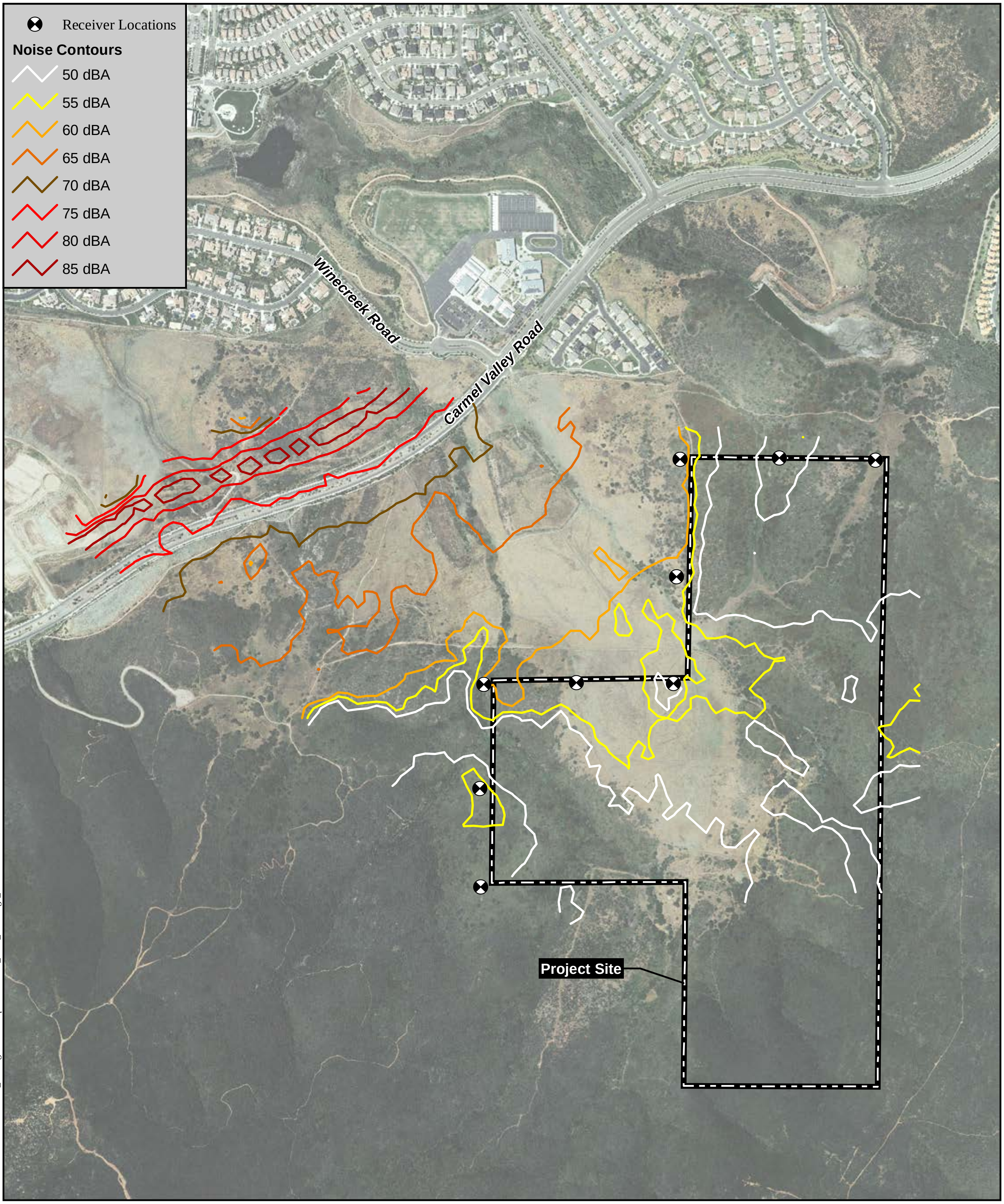
5.3.2.3 *On-site Transportation Noise Compatibility*

Exterior to interior analysis assumes a minimum 15 CNEL reduction from the outside to the inside a structure, assuming standard building construction methods. Therefore, interior noise levels (which are required to be less than 45 CNEL) for residential are assumed to be compatible with an exterior noise level up to 60 CNEL.

The exterior noise does not exceed the maximum threshold of 60 CNEL and, thus, no mitigation would be required for this outdoor use space.

5.3.2.4 *Off-site Transportation Noise Impacts*

Off-site traffic noise contour distances were developed for the Existing Conditions and Near Term No Project, Near-Term Plus Project as shown in Table 5-4, *Traffic Noise Levels for All Analyzed Conditions*.



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Noise Contours

HERITAGE BLUFFS II REVEGETATION PLAN

HELIX Environmental Planning

N 0 900 Feet

Figure 5

Table 5-4
TRAFFIC NOISE LEVELS FOR ALL ANALYZED CONDITIONS

Roadway / Segment	Existing Conditions (E)				Near-Term No Project (NT-P)					Near-Term + Project (NT+P)				
	CNEL @ 100 ft. (dBA)	70 CNEL (ft.)	65 CNEL (ft.)	60 CNEL (ft.)	CNEL @ 100 ft. (dBA)	CNE L E to NT-P	70 CNEL (ft.)	65 CNEL (ft.)	60 CNEL (ft.)	CNEL @ 100 ft. (dBA)	CNEL NT-P to NT+P	70 CNEL (ft.)	65 CNEL (ft.)	60 CNEL (ft.)
Bernardo Center Drive														
Camino Del Norte to Dove Creek	67.7	58	184	485	67.8	0.1	60	187	492	68.4	0.6	68	201	508
Carmel Valley Road														
Dove Creek to Winecreek Road	69.7	94	276	694	70	0.3	100	284	710	70.3	0.3	108	302	761
Winecreek Road to Black Mountain Road	68.9	78	235	650	69.3	0.4	84	242	661	69.4	0.1	85	256	645

In order for a significant three CNEL traffic noise increase to occur in areas over 65 CNEL as a result of a project, a project would have to double the amount of traffic on a roadway maintaining full speed (if speed is less than the existing speed, then noise would not reach the 3-dBA/CNEL increase). As shown in Table 5-4, traffic noise levels would not exceed 65 CNEL at exterior usable areas in the project vicinity. Project construction and operation would not double the amount of traffic on any roadway. Therefore, project off-site traffic noise impacts would be less than significant.

5.4 IMPACT SUMMARY

The following is a summary of potential Project noise impacts:

5.4.1 Less Than Significant Impacts

The following impacts would be less than significant, and are therefore not further discussed in this report:

1. On-site noise from off-site traffic would be less than the 65 CNEL exterior use noise levels allowed under the City Noise Ordinance for single-family residential developments.

2. On-site noise from off-site traffic would be less than the 60 CNEL exterior threshold (for all residential units), which would result in corresponding residential interior noise levels of less than 45 CNEL.

3. The Project's contribution to off-site transportation noise impacts would be less than significant.

4. There are no nearby residences, and Project-related construction noise at any occupied residential property line is anticipated to be in compliance with the City Noise Ordinance requirements governing construction noise. As a result, associated Project impacts would be less than significant.

5.4.2 Potential Significant Impacts

The following impacts would be potentially significant. Noise attenuation measures are discussed in Chapter 6, below.

1. Construction noise at the MHPA habitat surrounding the site may exceed the 60 dBA L_{EQ} limit during the identified February 1 to September 15 sensitive species breeding season.

6.0 MITIGATION

6.1 MHPA

There are no requirements for construction noise control outside the breeding season. Therefore, all Project-related construction may occur outside the breeding season. The use of any heavy equipment within 500-feet of the edge of habitat during the identified breeding season of February 1 to September 15 without noise control, however, will exceed the 60 dBA L_{EQ} limit. Furthermore, almost any construction (excluding light finish carpentry) directly adjacent the habitat will exceed the 60 dBA limit without noise control. Other light equipment may be utilized closer than 500-feet, depending on the equipment and level of hourly utilization.

The following is a construction scenario where parts of the construction may occur during the breeding season. This scenario requires partial construction of the row of homes closest to the habitat outside of the noted breeding season, with these structures to act as noise barriers for construction activities further from the habitat.

A. Initial Out of season work (September 16 to January 31):

1. Rough grading for two rows of homes closest to any habitat areas
2. Finish grading of the row of homes closet to the habitat
3. Foundation, framing, shear walls and roofing for row of homes closest to the habitat

These framed and exterior shell completed homes would then provide noise shielding and much of the required noise control for work further from the MHPA.

B. In season work where the outer row of partially constructed homes provides noise shielding:

1. Finish construction of outer row of homes
2. Finish grading of Project interior home pads
3. Framing shear walls and finish construction of interior rows of homes

Depending on the construction and equipment utilized, the row of partially finished homes will need to extend an adequate distance in each direction from the construction to block the line of site of the equipment from the habitat. The partially finished homes will have a gap between the structures, however, with a clear line of sight view from construction areas to off-site habitat. Accordingly, some additional shielding may be required to maintain compliance with the specified construction noise limit in applicable habitat areas.

In addition, any form of construction within approximately 500-feet of the adjacent MHPA habitat during the specified breeding season will require on-going noise monitoring to ensure compliance with the 60 dBA L_{EQ} sensitive habitat noise control limitation. If monitoring shows exceedances of the 60 dBA L_{EQ} sensitive habitat noise control limitation additional noise control will be implemented or construction halted until noise control can be implemented.

6.2 ON-SITE HVAC

A normal property division fence of 5-foot or higher will reduce HVAC noise to less than 37.5 dBA which is less than significant.

7.0 CONCLUSIONS

Noise mitigation for off-site transportation noise sources to on-site exterior use and interior residential living areas is not required.

- Construction outside the February 1 to September 15 breeding season is allowed without any noise control restrictions.

- No rough grading is feasible immediately adjacent the MHPA habitat during the breeding season. However, with the implementation of noise control barriers adjacent to the habitat in the form of completing the exterior shell of the future homes, much of the construction would potentially be feasible during the breeding season.

- Any form of construction within approximately 500-feet of the MHPA habitat during the specified breeding season will require on-going noise monitoring to ensure compliance with the 60 dBA L_{EQ} sensitive habitat noise control limitation.

- If monitoring shows exceedances of the 60 dBA L_{EQ} sensitive habitat noise control limitation additional noise control will be implemented or construction halted until noise control can be implemented.

8.0 CERTIFICATION

The findings and recommendations of this acoustical analysis report are based on the available information, and are a true and factual analysis of the potential acoustical issues associated with the Heritage Bluffs Project located in the City of San Diego, California. This report was prepared by Charles Terry.

Charles Terry
Acoustics and Noise Group Manager

9.0 REFERENCES

2001 California Building Code, Based on the 1997 Uniform Building Code, Appendix Chapter 12, Division II - Sound Transmission Control, Section 1208 - Sound Transmission Control.

2001 California Building Code, Based on the 1997 Uniform Building Code, Chapter 12, Section 1203.3 - Ventilation.

2001 California Noise Insulation Standards, effective 11/01/02, based on 1997 Uniform Building Code, California Code of Regulations, Title 24.

California Department of Transportation Environmental Program, Transportation- and Construction-Induced Vibration Guidance Manual. 2004.

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Linscott Law and Greenspan Engineers (LLG), Bernardo Shores Project Traffic Analysis. May 2013.

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Western Electro-Acoustic Laboratory, Inc. Sound Transmission Loss vs. Glazing Type, Window Size and Air Filtration. January 1985.

APPENDIX H-2

Supplemental Blasting Analysis

HELIX Environmental Planning, Inc.
7578 El Cajon Boulevard
Suite 200
La Mesa, CA 91942
619.462.1515 tel
619.462.0552 fax
www.**helixepi**.com

March 3, 2015 PDC-13

Project Design Consultants
Attention: Marina Wurst
701 B Street, Suite 800
San Diego, CA 92101

Subject: Addendum to the November 2014 Acoustical Analysis Report for Heritage Bluffs, Black Mountain Ranch Subarea, Assessor's Parcel Numbers 312-010-15 and 312-160-02

Dear Ms. Wurst:

The Heritage Bluffs Project (hereafter referred to as the "Project" or "Proposed Project") proposes the construction of a residential development in the City of San Diego (City). An acoustical analysis report was prepared in November 2014 (HELIX 2014) to assess the potential for construction noise impacts on the City's Multi-Habitat Planning Area (MHPA) that surrounds much of the Project site. It addressed noise impacts from nearby roadway traffic and identified Project requirements necessary to achieve exterior noise levels of 65 Community Noise Equivalent Level (CNEL) at proposed residential outdoor use areas, in compliance with the City's noise regulations.

Subsequent to the original project planning was the additional requirement for on-site drilling, blasting, and materials handling, including breaking larger material and use of a rock crusher to reduce materials to a consistent size for on-site use. In addition to the on-site materials handling, materials would also be imported from another associated project (not a part of this analysis) approximately 2,000 feet northwest of the project site to the proposed Project site.

The Project site is surrounded by occupied MHPA habitat, and existing residences are located approximately 650 feet from the Project site. This Addendum addresses the potential noise impacts associated with the new construction activity on the adjacent sensitive habitat and potential vibration damage to surrounding residences. The information supplements the analysis found in the original November 2014 Acoustic Analysis Report. [1]

[1] HELIX 2014. Acoustical Report for Heritage Bluffs, Black Mountain Ranch Subarea, Assessor's Parcel Numbers 312-010-15 and 312-160-02. Prepared for Project Design Consultants. November 7.

GENERAL DESCRIPTION OF BLASTING ACTIVITY

Blasting has three separate types of potential impacts: flyrock, vibration, and airblast.

Flyrock: Flyrock is debris (smaller and potentially larger chunks of rock) ejected from the blast. Outside the immediate area of the blast itself, flyrock is potentially the most dangerous portion of blasting; it has the ability to damage structures, as well as maim or kill humans or other animals at great distances from the blast.

Flyrock cannot be allowed beyond the site, under any circumstances. This analysis assumes that proper blast planning would be used, that all flyrock would be controlled with blast mats or other flyrock control techniques, and proper stemming materials for the charge hole would be utilized. No further analysis will be provided.

Vibration: Both air and ground vibrations create waves that disturb the material in which they travel. When these waves encounter a structure, they cause it to shake and may cause structural damage. Ground vibrations enter the house through the foundation.

Airblast: Airblast is a pressure wave that creates a push (positive pressure) and pull (negative pressure) effect; it may be audible (noise) or inaudible (concussion). A blast occurring outside of a residence may be heard inside because of the audible noise; however, noise has little impact on the structure. The concussion wave causes the structure to shake and rattle and, at higher pressure levels, can break windows.

APPLICABLE BLASTING REGULATIONS AND STANDARDS

Blast Planning Maximum Allowable Vibration and Airblast

Blasting planning information originates with the United States Department of Interior, Office of Surface Mining Reclamation and Enforcement (OSM).

The following analysis is based on a general description of potential impacts that would be incurred by the Project as a result of blasting activities. The information is based on guidance provided by the OSM, including the document, *Controlling the Adverse Effects of Blasting* (OSM website http://www.osmre.gov/) for calculating the scaled distance in blasting.

Airblast Impacts

The airblast limits at any man-made structure shall not exceed the levels specified in Table 1, below.

Table 1
MAXIMUM ALLOWABLE AIRBLAST LIMITS

Lower frequency limit of measuring system (in Hz)	Maximum level (in ±3 dB)
0.1 Hz or lower	134 peak
2 Hz or lower	133 peak
6 Hz or lower	128 peak
C-weighted	105 dBC

Abbreviations: Hz = Hertz; dB = decibels; dBC = C-weighted decibels

CONSTRUCTION BLASTING NOISE AND VIBRATION ANALYSIS ASSUMPTIONS

Project construction would entail the use of equipment throughout the site for the full term of construction. Construction activities would be roughly divided into five phases. These phases may contain some overlap, depending on location and timing. The phases would include the following:

1. Site Preparation and Rough Grading

   In addition to normal grading activities, the site will require the following specific operations:

   a. Drilling and blasting
   b. Reducing oversize materials with a breaker
   c. Rock crushing
   d. Importing crushed material from a nearby project site
2. Foundation excavation
3. Utilities excavation and installation
4. Foundation construction
5. Vertical construction

Most construction equipment does not operate at full power (maximum noise) for a full hour, but rather is operated intermittently. As a result, the Federal Highway Administration (FHWA) guidelines analyze most equipment at an assumed 40 percent hourly operating time; the FHWA assumption will be used for all equipment types in the following analysis.

The following assumptions are applicable to the Project's planned Site Preparation and Rough Grading activities:

1. Rock crushing will utilize an electric-powered rock crusher (powered with a trailer-mounted diesel generator). Other rough grading operations will occur during the rock crushing.

2. Three diesel powered rock drills will be used during the preparation for a blast.
3. Normal site rough grading will occur in areas other than the blasting but will be continuous during the drilling operations and will only terminate for a brief time (1-hour or less) before and after a blast.
4. Blast planning will be based on the following information:
    a. The blast volume will be approximately 12,000 to 15,000 cubic yards and will require 1 pound of explosive per cubic yard of granite (for a total of 12,000 to -15,000 pounds of explosive).
    b. Water gel will be used for wet holes and ammonium nitrate fuel oil (ANFO) will be used for dry conditions.
    c. Holes will be 3.5 to 4 inches in diameter, drilled to a typical depth of 20 feet.
    d. The blast pattern will be 10 x 10 feet to 12 x 12 feet.
    e. Approximately 200 holes will be drilled per shot.

Rough grading activities are often the loudest noise that occurs during a construction of a project and will be the initial consideration for Project planning.

Other potential noise impacts to the MHPA could occur during final site preparation and vertical construction, when a small excavator or backhoe and a loader would be utilized to dig the foundation for the Project, and for utility installation. General carpentry will result in a lower noise impact.

The FHWA Roadway Construction Noise Model (RCNM) Version 1.0 (February 2, 2006) lists the noise level of an excavator, a scraper, and a dozer all as 83 dBA at 50 feet. Excavation will occur throughout much of the site. The closest MHPA habitat to the Project site is less than 25 feet, with associated noise impacts as high as 87 dBA L_{EQ} during rough grading.

SIGNIFICANCE THRESHOLDS

Construction and Blasting Noise

There are no residential locations within impact planning distance from the Project site; therefore, Project-related construction noise will not be an issue for off-site residential uses. As previously noted, however, the Project site is surrounded by occupied MHPA habitat, which is subject to an hourly limit of 60 dBA L_{EQ} or the average ambient noise level, whichever is greater, at the edge of habitat during the identified sensitive species breeding season of February 1 to September 15.

Blasting Vibration

The following graphic provides the allowable impact limitations for construction blasting vibration to a structure. Allowable impacts are frequency-dependent with lower acceptable limits at lower frequencies (0.11 peak particle velocity [PPV] at 1 Hz or below), increasing up to a maximum frequency of concern at 100 Hz. The allowable limit between the stated frequencies is a linear change as provided in Table 2.

Table 2
RESIDENTIAL BLASTING VIBRATION LIMITS

Hz	PPV (in/s)
1	0.11
4	0.75
10	0.75
30	2.00
100	2.00

IMPACT ANALYSIS

<u>Drilling and Blasting</u>

Noise from blasting, while loud, is of an extremely short duration. Analysis per the normal construction noise control planning requirements does not yield valid results. All noise impact planning should be conducted per the OSM standards and good blasting practices.

Noise Impacts

Three rock drills rated at 87.5 dBA L_{MAX} for 40 percent utilization would produce up to 88.3 dBA L_{EQ} if used within an approximate 50-foot distance to MHPA areas. Noise impacts from the drilling for the blasting on the site during rough grading would be potentially significant.

As with flyrock, controlling an airblast is dependent on the skill of the Blasting Supervisor, along with many factors, including but not limited to: the depth of the charge, the type of rock, the amount of fractures in the rock, and the length of correct stemming materials.

Due to the nature of blasting, it is difficult to quantify a 60 dBA L_{EQ} distance; however, it is conservatively assumed that blasting anywhere within the site may affect sensitive nesting species. Therefore, if blasting occurs during the breeding seasons for coastal California gnatcatcher (February 15 to August 31), a potentially significant impact could occur.

Vibration Impacts

As the blast charge size is increased, so is the allowable distance to prevent residential structural damage.

Final blasting calculations are typically done by the blasting company using a commercial calculator with the Ground Transmission Constant "K," which is developed at the site by monitoring smaller controlled blasts.

Based on an assumption of 0.5 pounds of explosive material required per ton of material removed, and a typical granite weight of 166.5 pounds per cubic foot, or 2.25 tons per cubic yard, a typical shot designed to break up 10 cubic yards of material (typical truck load) would require about 11.25 pounds of explosive charge. The charge would typically consist of a 0.5 pound or less of detonation charge per hole, and the remainder of the charge would be provided by TOVEX or other similar water gel explosive slurry.

The following planning material is based on a maximum charge weight analysis per 8-millisecond (ms) delay (that is, a single blast session may use multiple charges if the charges are timed to detonate at greater than an 8-ms delay between each successive charge ignition). Given the probable small size of any blasting at this site, it is assumed that a single blasting shot would occur in this period.

If a shock tube or detonating cord is used for the blast ignition, it must be covered with at least 8 inches of sand or soil.

The following scaled distance factors (Table 3) are based on the relationship between PPV and frequency in compliance with the Peak Particle Velocity Limits provided in the graphic above. An analysis by this methodology typically provides overly conservative blast planning and is only used as a starting value until site-specific blasting conditions can be accurately determined and planning is feasible based on the site specific conditions.

Table 3
SCALED DISTANCE FACTORS

Distance from the Blasting Site (feet)	Scaled Distance Factor
0 to 300	50
300 to 5,000	55
5,001 and beyond	65

The allowable charge weight is calculated by: $W = (D/D_S)^2$

W = Allowable charge weight in pounds
D = Distance to the nearest structure in feet
D_S = Value from table based on D

Airblast is regulated by the limits from the Code of Federal Regulations (30 CFR 816.61-68). The airblast limits at any man-made structure shall not exceed the levels specified in the Table 4, below.

Table 4 MAXIMUM ALLOWABLE AIRBLAST LIMITS	
Lower frequency limit of measuring system (in Hz)	**Maximum level (in ±3 dB)**
0.1 Hz or lower	134 peak
2 Hz or lower	133 peak
6 Hz or lower	128 peak
C-weighted	105 dBC

The closest location for blasting impacts are residences at approximately 650 feet (see attached Geologic Map with potential blasting areas in yellow).

At 650 feet, the allowable maximum charge weight (within an 8-ms delay) is 139.7 pounds of explosive to create vibration impacts less than those stated in Table 2 above. Based on the blasting assumptions of a typical blast charge weight of 12,000 to 15,000 pounds of explosives, this would be a potentially significant impact to the closest residences.

<u>Rock Crushing</u>

Noise Impacts

A typical rock crusher and ancillary equipment creates approximately 92 dBA at 50 feet; the level may vary by as much as 5 to 10 dBA depending on location materials in crusher and type of equipment. The closest that rock crushing would occur is 200 feet[2] to the nearest edge of the habitat. That location would result in an 80 dBA Leq impact at the habitat and would be considered potentially significant.

<u>Off-site Truck Import of Fill Materials</u>

Noise Impacts

The RCNM model lists noise levels from a dump truck operating 50 feet away from a receiver at 76.5 dBA; the level reflects the dump truck operating 40 percent of the time. This would be the equivalent of 72.5 dBA at 50 feet.

Noise impacts at the sensitive habitat from truck fill import would be potentially significant.

[2] Typical minimum drive around clearance distance for a crusher.

IMPACT SUMMARY

The following impacts would be potentially significant:

1. Construction noise, including noise from blasting, rock crushing, and off-site truck hauling, may exceed the 60 dBA L_{EQ} limit at the MHPA habitat surrounding the site during the identified February 1 to September 15 sensitive species breeding season.
2. Blasting vibration impacts at the closest residences may exceed the allowable OSM specifications.

This analysis is based on typical and normal requirements. The basic planning for blasting charge weight limits at distances greater than 200 feet from an off-site structure does not provide final project-specific analysis for allowable blasting charges, nor is it intended to limit the blasting company to a minimum distance or maximum or minimum charge weights. This planning analysis is provided as general guidance and is not intended to provide final blasting planning for any specific blast nor does it imply acceptance of any liability for the proper or improper planning of any blasting and/or responsibility for any damages caused by the blaster.

All blasting planning and impacts and/or damages that may occur are the sole responsibility of the owner and blasting planning company.

MITIGATION

Mitigation to address construction noise impacts to adjacent MHPA habitat are provided in Section 6, Mitigation, of the original Acoustic Analysis Report prepared for the Project (HELIX 2014).

All blasting must have a blasting management plan. All blast planning must be done by a San Diego County Sheriff-approved blaster, with the appropriate San Diego County Sheriff blasting permits, in compliance with all applicable local, state, and federal permits, licenses, and bonding. The blasting contractor or owner must conduct all notifications, inspections, monitoring, and major or minor blasting requirements planning with seismograph reports, as necessary.

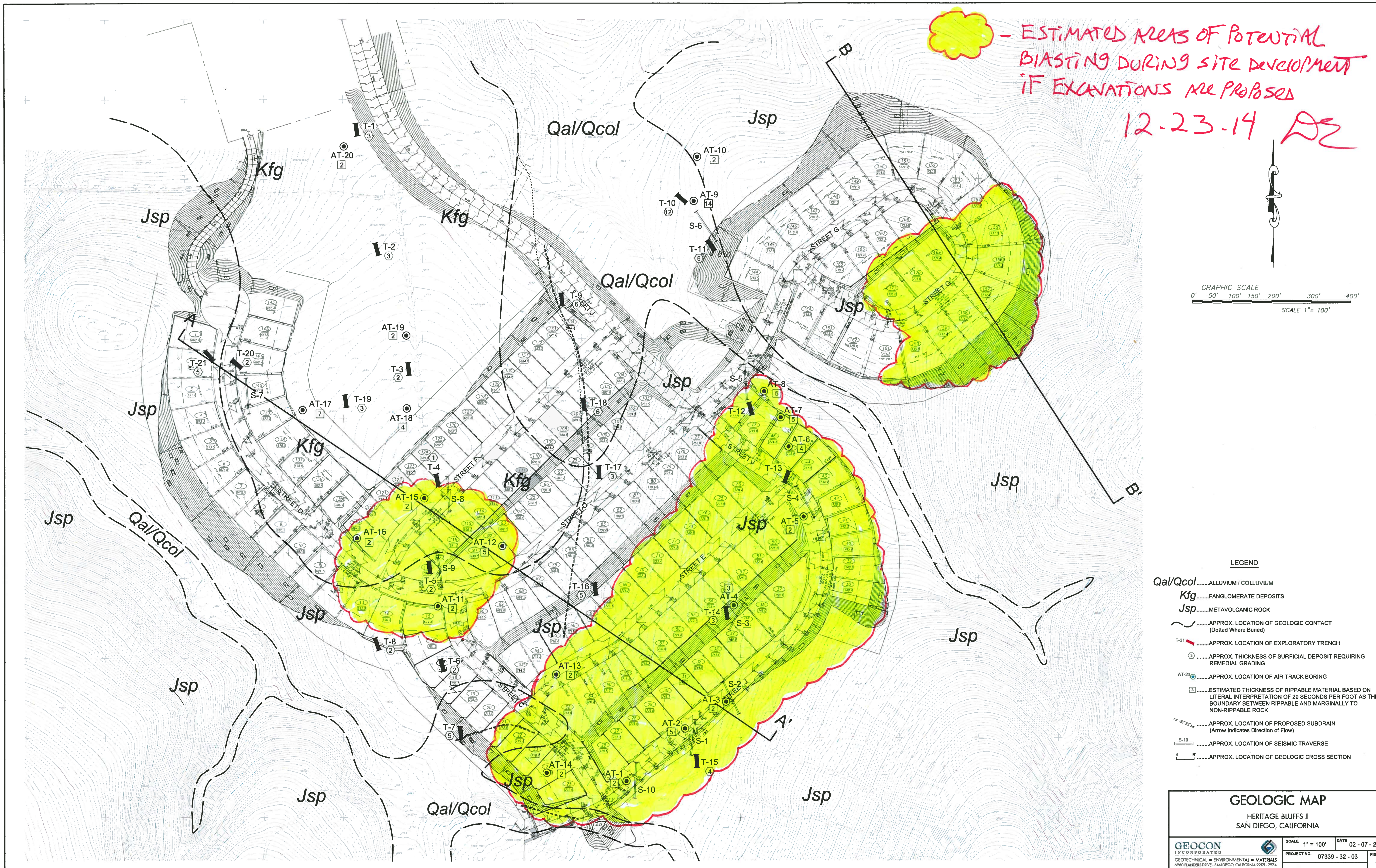
CERTIFICATION

The findings and recommendations of this acoustical analysis report are based on the available information, and are a true and factual analysis of the potential acoustical issues associated with Heritage Bluffs, Black Mountain Ranch Subarea, California. This addendum was prepared by Charles Terry.

Sincerely,

Charles Terry, Acoustics Senior Specialist

Attachment:
Geological Map of Blasting Impacts



- ESTIMATED AREAS OF POTENTIAL BLASTING DURING SITE DEVELOPMENT IF EXCAVATIONS ARE PROPOSED
12-23-14 DS
GRAPHIC SCALE
0' 50' 100' 150' 200' 300' 400'
SCALE 1" = 100'
Qal/Qcol
Jsp
Kfg
AT-20
T-1
AT-10
AT-9
T-10
S-6
T-11
T-2
AT-19
T-3
T-20
T-21
S-7
AT-17
T-19
AT-18
T-9
T-18
T-17
S-5
AT-8
T-12
AT-7
AT-6
T-13
S-4
AT-5
T-4
AT-15
S-8
AT-16
AT-12
S-9
T-5
AT-11
T-16
AT-4
T-14
S-3
T-8
T-6
AT-13
S-2
AT-3
AT-2
S-1
T-7
AT-14
AT-1
S-10
T-15
STREET C
STREET D
STREET E
STREET F
STREET G
STREET J
A
A'
B
B'
LEGEND
Qal/Qcol ....ALLUVIUM / COLLUVIUM
Kfg ........FANGLOMERATE DEPOSITS
Jsp ........METAVOLCANIC ROCK
........APPROX. LOCATION OF GEOLOGIC CONTACT (Dotted Where Buried)
T-21 ....APPROX. LOCATION OF EXPLORATORY TRENCH
........APPROX. THICKNESS OF SURFICIAL DEPOSIT REQUIRING REMEDIAL GRADING
AT-20 ....APPROX. LOCATION OF AIR TRACK BORING
........ESTIMATED THICKNESS OF RIPPABLE MATERIAL BASED ON LITERAL INTERPRETATION OF 20 SECONDS PER FOOT AS THE BOUNDARY BETWEEN RIPPABLE AND MARGINALLY TO NON-RIPPABLE ROCK
........APPROX. LOCATION OF PROPOSED SUBDRAIN (Arrow Indicates Direction of Flow)
S-10 ....APPROX. LOCATION OF SEISMIC TRAVERSE
B B' ....APPROX. LOCATION OF GEOLOGIC CROSS SECTION
GEOLOGIC MAP
HERITAGE BLUFFS II
SAN DIEGO, CALIFORNIA
GEOCON INCORPORATED
GEOTECHNICAL ■ ENVIRONMENTAL ■ MATERIALS
6960 FLANDERS DRIVE - SAN DIEGO, CALIFORNIA 92121 - 2974
PHONE 858 558-6900 - FAX 858 558-6159
SCALE 1" = 100'
DATE 02 - 07 - 2014
PROJECT NO. 07339 - 32 - 03
FIGURE 1
SHEET 1 OF 1

APPENDIX I-1
Update Geotechnical Investigation

UPDATE GEOTECHNICAL INVESTIGATION

HERITAGE BLUFFS II
SAN DIEGO, CALIFORNIA

GEOCON
INCORPORATED

GEOTECHNICAL
ENVIRONMENTAL
MATERIALS

PREPARED FOR

STANDARD PACIFIC HOMES
SAN DIEGO, CALIFORNIA

JANUARY 23, 2015
PROJECT NO. 07339-32-03

GEOCON
INCORPORATED
GEOTECHNICAL ■ ENVIRONMENTAL ■ MATERIALS

Project No. 07339-32-03
January 23, 2015

Standard Pacific Homes
16010 Camino Del Sur
San Diego, California 92127

Attention: Mr. Bill Dumka

Subject: UPDATE GEOTECHNICAL INVESTIGATION
HERITAGE BLUFFS II
SAN DIEGO, CALIFORNIA

Dear Mr. Dumka:

In accordance with your request, we have performed an update geotechnical investigation to address the revised vesting tentative map for the subject project. The results of our study indicate that the site can be developed as planned, provided the recommendations of this report are followed.

Should you have any questions regarding this update investigation, or if we may be of further service, please contact the undersigned at your convenience.

Very truly yours,

GEOCON INCORPORATED

Troy K. Reist
CEG 2408

Trevor E. Myers
RCE 63773

David B. Evans
CEG 1860

TKR:TEM:DBE:dmc

(2/del) Addressee
(4/del) Project Design Consultants
Attention: Ms. Marina Wurst

6960 Flanders Drive ■ San Diego, California 92121-2974 ■ Telephone 858.558.6900 ■ Fax 858.558.6159

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TABLE OF CONTENTS (Concluded)

UPDATE GEOTECHNICAL INVESTIGATION

1. PURPOSE AND SCOPE

The purpose of this update geotechnical investigation was to evaluate proposed grading for a 171 lot residential subdivision located in San Diego, California. This report provides recommendations relative to the geotechnical engineering aspects of developing the property as proposed based on the conditions encountered during this investigation and previous studies by Geocon Incorporated. In addition, this report is intended to update our previous report entitled *Update Geotechnical Report, Heritage Bluffs II, San Diego, California,* dated February 7, 2014 (Project No. 07339-32-03) and to address the revised plans entitled *Heritage Bluffs II, Rezone No. 1193243/Vesting Tentative Map No. 1193244/Planned Development Permit No. 1193245/Site Development Permit No. 1193246, Cover Sheet, PTS # 319435,* prepared by Project Design Consultants, revised November, 7, 2014.

The scope of our recent work consisted of the following:

- Reviewing aerial photographs and readily available published and unpublished geologic literature.
- Reviewing the referenced plans prepared by Project Design Consultants for the subject property.
- Performing twelve additional exploratory trenches using a track mounted backhoe to evaluate the general extent and condition of surficial deposits (see Appendix A, Figures A-22 through A-33).
- Coordinating and contracting with Southwest Geophysics to perform six additional seismic traverses to assess the apparent rippability of the underlying rock materials. (see Appendix C).
- Preparing this update report, geologic cross sections, geologic map and our conclusions and recommendations regarding the geotechnical aspects of developing the property as presently proposed. We have also compiled the recent and previous information pertinent to the site into this report.

The approximate locations of the subsurface information performed during the various studies for the site are shown on the *Geologic Map*, Figure 2. Cross-Sections A-A’ and B-B’ (Figure 3) represent our interpretation of the geologic conditions across the site. In addition, we have included our recent and previous information (i.e. seismic traverse data, trench and air track logs) and laboratory test results in Appendix A and B, respectfully.

2. SITE AND PROJECT DESCRIPTION

The property consists of approximately 170 acres of essentially unimproved land that is located to the south of the intersection of Winecreek Road and Carmel Valley Road situated within the northern limits of the City of San Diego (see *Vicinity Map,* Figure 1). The site is essentially undeveloped with the exception of several dirt roads that traverse across the property. It is our understanding that the project will be developed to create approximately 171 single-family residential lots and an approximate half acre HOA maintained park site. In addition, several retaining walls with a maximum height of 8½ feet are proposed throughout the project along with other associated improvements.

Topographically, the site is characterized by a broad gently rising canyon that ascends from the north to the south. Moderate to steep slopes comprised of metavolcanic rock surround the project on the west, east and south sides. Drainage for the property generally flows to the north and is collected by northerly and northwesterly trending canyons. The elevations within the proposed development consist of a topographic high of 804 feet Mean Sea Level (MSL) located in the northeast portion of the site and a low of approximately 640 feet MSL within the northern portion of the property. Vegetation consists of low lying natural grasses, wild artichoke, thistle, and chaparral.

Based on our review of the reference plans, grading will consists of approximately 630,000 cubic yards of cut, 775,000 cubic yards of fill with an estimated 145,000 cubic yards of import material. We understand that these estimates do not account for bulking and shrinking of the materials. Maximum cut and fill depths prior to remedial grading are on the order of 25 feet and 35 feet, respectively. Cut and fill slopes with maximum heights of approximately 69 feet and 62 feet, respectively, are planned. The majority of the slopes are designed at 2:1 (horizontal:vertical) or flatter, with the exception of the cut slopes behind Lots 25 through 35 and 155 through 161 that are designed at a 1.5:1 ratio.

3. PREVIOUS GEOTECHNICAL STUDIES

Several geotechnical studies have been performed on the site by Geocon Incorporated in July 2004 and April 2008. Portions of these studies extended beyond the boundaries of the current proposed grading limits. Collectively these studies consisted of the excavation of 27 exploratory trenches, 20 air track borings and 10 seismic traverses along with geologic field mapping and laboratory testing. The approximate location of the exploratory information has been included on our *Geologic Map*. In addition, the laboratory testing and other data (trench and air track logs, and seismic traverse data) has been included within Appendices A and B.

4. SOIL AND GEOLOGIC CONDITIONS

Three surficial soil types and two geologic formations were encountered during the field investigations. The surficial deposits consist of topsoil, alluvium and colluvium. The formational units include a Cretaceous-age unnamed fanglomerate and the Jurassic-age Santiago Peak Volcanics. Each of the surficial soil types and geologic units encountered is described below in order of increasing age. For purposes of this report, the alluvial and colluvial deposits have been undifferentiated. The approximate extent of the deposits, excluding topsoil, is shown on the *Geologic Map*.

4.1 Topsoil (Unmapped)

Topsoils blanket the majority of the site and vary in thickness from approximately ½ to 5 feet. The topsoils are characterized as predominately stiff to very stiff, moist, silty to gravely clays with some silty to clayey sands and silts. Topsoil deposits are considered unsuitable in their present condition and will require removal and compaction in areas planned to receive structural fill and/or settlement-sensitive structures. The topsoils typically exhibit a medium to high expansion potential and should be placed in deeper fill areas.

4.2 Alluvium/Colluvium (Qal/Col)

Alluvial and colluvial soils were found within and along the hillsides above the drainage channels present throughout the site. These deposits consist of silty to sandy clays and silty to clayey sands with varying amounts of gravel and cobble. These deposits are potentially compressible and will require remedial grading. The alluvial and colluvial deposits generally have a medium to high expansion potential and should be placed in deeper fill areas.

4.3 Fanglomerate (Kfg)

An unnamed, presumably Cretaceous-age, fanglomerate was encountered in the northern half of the project site. The deposit resembles an ancient debris flow with a convex surface, however it is difficult to determine the true mechanism of deposition. The fanglomerate is characterized as very stiff to hard gravelly clays and very dense clayey gravels with varying percentages of metavolcanic gravel, cobble and boulders up to 4½ feet in diameter. Based on our exploratory trenches and laboratory data, the deposit appears to be well consolidated and is considered suitable for the support of fill or structural loads in its present condition.

4.4 Santiago Peak Volcanics (Jsp)

The Santiago Peak Volcanics Formation was encountered throughout the majority of the property. This formation consists of weakly metamorphosed volcanic and sedimentary rocks that appear relatively dark-colored where exposed. The metavolcanic rock constitution ranges from rhyolite to basalt and commonly includes tuff, tuff-breccias, and andesites. Very fine-grained, silicified sandstones, slate, and other types of metasedimentary rocks can also be present.

The rippability characteristics of the Santiago Peak Volcanics are discussed in the *Rippability and Rock Considerations* section of this report. The Santiago Peak Volcanics generally exhibits adequate bearing and slope stability characteristics. Cut slopes excavated at an inclination of 1.5:1 (horizontal:vertical) should be stable to the proposed heights if free of adversely oriented joints or fractures. It should be anticipated that excavations within this unit will generate boulders and oversize materials (rocks greater than 12 inches in length) that will require special handling and placement procedures.

5. RIPPABILITY AND ROCK CONSIDERATIONS

To aid in evaluating the rippability characteristics of the rock in proposed cut areas, a subsurface exploration program consisting of 20 air-track borings and 16 seismic traverses were performed. Air-track borings utilizing an Ingersoll Rand ECM 370 equipped with a 4-inch bit were advanced in selected cut areas. Drill penetration rates were used to evaluate rock rippability and to estimate the depth at which difficult excavation will occur. Rock rippability is a function of natural weathering processes that can vary vertically and horizontally over short distances depending on jointing, fracturing, and/or mineralogic discontinuities within the bedrock.

A frequently used guideline to compare rock rippability to drill penetration rate is that a penetration rate of approximately 0 to 20 seconds per foot (spf) generally indicates rippable material, 20 to 30 spf indicates marginally to non-rippable material, and greater than 30 spf indicates non-rippable rock. These general guidelines are typically based on drill rates using a rotary percussion drill rig similar to an Ingersoll Rand ECM 360 with a 3½-inch drill bit. The penetration rates (recorded in seconds per foot) for each air-track boring are presented in Appendix A, Figures A-40 through A-59.

The estimated thickness of rippable material for each air track boring using 20 spf as the boundary between rippable and marginal to non-rippable rock is presented on the *Geologic Map*. The estimate is derived from a literal interpretation of the penetration rate from each boring log, based on the first occurrence where the penetration rate reaches 20 spf. Perspective contractors should use their own judgment to identify the penetration rate boundary between productive and non-productive ripping, and rippable and non-rippable rock.

The seismic traverses S-1 through S-10 were conducted with a Bison 1570B, 2-channel seismograph in July 2004 by Geocon. The traverses were 100 feet long and performed in both a forward and reverse direction. The results of this study are presented in Appendix A in Table A-1. In January 2015, Southwest Geophysics performed six additional seismic traverses (S-11 through S-16) to augment the existing information. Their report is presented in Appendix C.

Based on this study, it is expected that the majority of the significant excavations within the development will experience very difficult ripping and/or blasting as excavations are extended beyond the rippable weathered mantle. Based on an air track penetration rate of 20 spf, the thickness of the rippable rock mantle of the Santiago Peak Volcanics varies between 2 to 14 feet thick. Blasting techniques can be expected to generate oversized rock (rocks greater than 12-inches in dimension), which will necessitate typical hard rock handling and placement procedures during grading operations.

Estimates of the anticipated volume of hard rock materials generated from proposed excavations should be evaluated based on the information from each boring and drill penetration rate criteria acceptable to the contractor. Roadway/utility corridors and lot undercutting criteria should also be considered when calculating the volume of hard rock. Proposed cuts in hard rock areas can be expected to generate oversized fragments.

Earthwork construction should be carefully planned to efficiently utilize available rock placement areas. Oversize materials should be placed in accordance with rock placement procedures presented in Appendix D of this report and governing jurisdictions.

6. GROUNDWATER/SEEPAGE

No groundwater or seepage was observed in the excavations performed during the field studies. However, groundwater levels in drainage areas can be expected to fluctuate seasonally and may affect grading. In this regard, grading may encounter wet soils causing excavation and compaction difficulty, particularly if construction is planned during the winter months.

Subdrain systems will be necessary for the proposed development to intercept and convey seepage migrating along impervious strata. Subdrains should be planned for the main drainages and possibly where impervious layers daylight near the ultimate graded surface. The location of proposed underground improvements may result in modifications to the recommended subdrains shown on Figure 2.

7. GEOLOGIC HAZARDS

7.1 Faulting and Seismicity

Based on our previous observations during mass grading in adjacent areas, previous and recent geotechnical studies, and a review of published geologic maps and reports, the site is not located on any known “active,” “potentially active” or “inactive” fault traces as defined by the California Geological Survey (CGS).

The Rose Canyon Fault zone and the Newport-Inglewood Fault, located approximately 12 miles west of the site, are the closest known active faults. The CGS considers a fault seismically active when evidence suggests seismic activity within roughly the last 11,000 years. The CGS has included portions of the Rose Canyon Fault zone within an Alquist-Priolo Earthquake Fault Zone.

According to the computer program *EZ-FRISK (Version 7.62)*, 7 known active faults are located within a search radius of 50 miles from the property. We used the 2008 USGS fault database that provides several models and combinations of fault data to evaluate the fault information. The nearest active faults are the Newport-Inglewood and Rose Canyon Fault Zone, located approximately 12 miles west of the site and is the dominant source of potential ground motion. Earthquakes that might occur on the Newport-Inglewood and Rose Canyon Fault Zone or other faults within the southern California and northern Baja California area are potential generators of significant ground motion at the site. The estimated maximum earthquake magnitude and peak ground acceleration for the Newport-Inglewood Fault are 7.5 and 0.24g, respectively. Table 7.1.1 lists the estimated maximum earthquake magnitude and peak ground acceleration for the most dominant faults in relationship to the site location. We calculated peak ground acceleration (PGA) using Boore-Atkinson (2008) NGA USGS 2008, Campbell-Bozorgnia (2008) NGA USGS 2008, and Chiou-Youngs (2008) NGA acceleration-attenuation relationships.

TABLE 7.1.1
DETERMINISTIC SEISMIC SITE PARAMETERS

Fault Name	Distance from Site (miles)	Maximum Earthquake Magnitude (Mw)	Peak Ground Acceleration		
			Boore-Atkinson 2008 (g)	Campbell-Bozorgnia 2008 (g)	Chiou-Youngs 2008 (g)
Newport-Inglewood	12	7.5	0.22	0.18	0.23
Rose Canyon	12	6.9	0.18	0.16	0.17
Elsinore	25	7.85	0.16	0.11	0.15
Coronado Bank	26	7.4	0.13	0.10	0.11
Palos Verdes Connected	26	7.7	0.15	0.11	0.13
Earthquake Valley	33	6.8	0.08	0.06	0.05
San Jacinto	46	7.88	0.10	0.07	0.09

We performed a site-specific probabilistic seismic hazard analysis using the computer program *EZ-FRISK*. Geologic parameters not addressed in the deterministic analysis are included in this analysis. The program operates under the assumption that the occurrence rate of earthquakes on each mappable Quaternary fault is proportional to the faults slip rate. The program accounts for fault rupture length as a function of earthquake magnitude, and site acceleration estimates are made using the earthquake magnitude and distance from the site to the rupture zone. The program also accounts for uncertainty in each of following: (1) earthquake magnitude, (2) rupture length for a given magnitude, (3) location of the rupture zone, (4) maximum possible magnitude of a given earthquake, and (5) acceleration at the site from a given earthquake along each fault. By calculating the expected accelerations from considered earthquake sources, the program calculates the total average annual expected number of occurrences of site acceleration greater than a specified value. We utilized acceleration-attenuation relationships suggested by Boore-Atkinson (2008) NGA USGS 2008, Campbell-Bozorgnia (2008) NGA USGS 2008, and Chiou-Youngs (2008) NGA in the analysis. Table 7.1.2 presents the site-specific probabilistic seismic hazard parameters including acceleration-attenuation relationships and the probability of exceedence.

TABLE 7.1.2
PROBABILISTIC SEISMIC HAZARD PARAMETERS

Probability of Exceedence	Peak Ground Acceleration		
	Boore-Atkinson, 2008 (g)	Campbell-Bozorgnia, 2008 (g)	Chiou-Youngs, 2008 (g)
2% in a 50 Year Period	0.38	0.35	0.40
5% in a 50 Year Period	0.28	0.26	0.28
10% in a 50 Year Period	0.22	0.20	0.21

The California Geologic Survey (CGS) has a program that calculates the ground motion for a 10 percent of probability of exceedence in a 50-year period based on an average of several attenuation relationships. Table 7.1.3 presents the calculated results from the Probabilistic Seismic Hazards Mapping Ground Motion Page from the CGS website.

TABLE 7.1.3
PROBABILISTIC SITE PARAMETERS FOR SELECTED FAULTS
CALIFORNIA GEOLOGIC SURVEY

Calculated Acceleration (g) Firm Rock	Calculated Acceleration (g) Soft Rock	Calculated Acceleration (g) Alluvium
0.24	0.26	0.30

While listing peak accelerations is useful for comparison of potential effects of fault activity in a region, other considerations are important in seismic design, including the frequency and duration of motion and the soil conditions underlying the site. Seismic design of the structures should be evaluated in accordance with the California Building Code (CBC) guidelines currently adopted by the City of San Diego.

7.2 Liquefaction

Liquefaction typically occurs when a site is located in a zone with seismic activity, onsite soils are cohesionless, groundwater is encountered within 50 feet of the surface, and soil densities are less than about 70 percent of the maximum dry densities. If all four criteria are met, a seismic event could result in a rapid increase in pore water pressure from the earthquake-generated ground accelerations.

The potential for liquefaction at the site is considered to be negligible due to the dense formational material encountered, remedial grading recommended, and lack of a shallow groundwater condition.

7.3 Landslides

No evidence of ancient landslide deposits was encountered at the site during the geotechnical investigation.

7.4 Geologic Hazard Category

Based on our review of the 2008 City of San Diego Seismic Safety Study Map Sheets 43 and 44 the site is located within Geologic Hazard Categories 23 and 53. Category 23 indicates *Friars: neutral or favorable geologic structure*; and Category 53 indicates *level or sloping terrain, unfavorable geologic structure, low to moderate risk.* The Friars Formation was not encountered during the recent and previous studies and based on our experience with the surrounding area is not known to underlie the project area.

8. CONCLUSIONS AND RECOMMENDATIONS

8.1 General

8.1.1 No soil or geologic conditions were encountered that, in the opinion of Geocon Incorporated, would preclude the development of the property as proposed, provided the recommendations of this report are followed.

8.1.2 The site is underlain by surficial units that include topsoils, alluvial and colluvial deposits. These deposits are unsuitable in their present condition and will require remedial grading where improvements are planned.

8.1.3 The presence of hard rock within proposed cut areas will require special consideration during site development. It is anticipated that the majority of the proposed excavations will encounter moderate to heavy ripping with conventional heavy-duty equipment. Blasting is expected within the rock units exposed throughout the site. In addition, heavy ripping and blasting will generate oversize materials that will require special handling and fill placement procedures. Oversize materials should be placed in accordance with Appendix D of this report.

8.1.4 An earthwork analysis should be performed to determine if there is an adequate volume of fill area available to accommodate the anticipated volume of blasted/oversize materials. This study should consider the proposed grading, rippability information contained in this report, rock placement requirements and include proposed undercutting.

8.1.5 Cut slopes should be observed during grading by an engineering geologist to verify that the soil and geologic conditions do not differ significantly from those anticipated. Scaling of loose rock fragments from proposed cut slopes may also be necessary.

8.2 Soil and Excavation Characteristics

8.2.1 The soil conditions encountered consist of low expansive silty sands and medium to very high expansive clays. Figure 3 presents Geologic Cross Sections A-A' and B-B' that depicts our interpretation of the underlying geologic conditions across the site.

8.2.2 Excavation of the surficial deposits (topsoil, colluvium, and alluvium) should generally require light to moderate effort using conventional heavy-duty grading equipment.

8.2.3 Excavating within the volcanic rock materials will generally vary in difficulty with the depth of excavation depending on the degree of weathering. Blasting will likely be required for most portions of excavations in proposed, rock cut areas. Depending on the blasting pattern and overburden thickness, the generation of oversize rock could impact project development. In addition, excavations within the fanglomerate will encounter boulder size material. It is difficult to estimate the amount of oversize material that will be encountered within this deposit. Oversize rock should be placed in accordance with *Recommended Grading Specifications* (Appendix D) and the requirements of the City of San Diego. Oversize rock may require breakage to acceptable sizes or exportation from the property. Placement of oversize rock within the area of proposed underground utilities should not be permitted.

8.2.4 Surficial deposits (topsoil, colluvium, and alluvium) may be very moist to saturated during the winter or early spring depending on preceding precipitation. Overly wet soils will require drying or mixing with drier material prior to their use as compacted fill.

8.3 Corrosion

8.3.1 Selected samples were subjected to laboratory water soluble sulfate-content and pH and Resistivity testing to generally evaluate the corrosion potential to structures in contact with soil. The results of the laboratory tests are summarized in Appendix B.

8.3.2 Results from the laboratory water-soluble sulfate content tests indicate that the on-site materials at the locations tested possesses “Not Applicable” and “S0” sulfate exposure to concrete structures as defined by 2013 CBC Section 1904 and ACI 318-11 Sections 4.2 and 4.3. The presence of water-soluble sulfates is not a visually discernible characteristic; therefore, other soil samples from the site could yield different concentrations. Additionally, over time landscaping activities (i.e., addition of fertilizers and other soil nutrients) may affect the concentration. Table 8.3 presents a summary of concrete requirements set forth by 2013 CBC Section 1904 and ACI 318.

8.3.3 Laboratory chloride ion and pH and resistivity tests were performed on samples of on-site soil to evaluate whether the soils are potentially corrosive to buried metal. The results are summarized in Appendix B.

TABLE 8.3
REQUIREMENTS FOR CONCRETE EXPOSED TO SULFATE-CONTAINING SOLUTIONS

Sulfate Severity	Exposure Class	Water-Soluble Sulfate (SO_4) Percent by Weight	Cement Type (ASTM C 150)	Maximum Water to Cement Ratio by Weight	Minimum Compressive Strength (psi)
Not Applicable	S0	SO_4<0.10	--	--	2,500
Moderate	S1	0.10≤SO_4<0.20	II	0.50	4,000
Severe	S2	0.20≤SO_4≤2.00	V	0.45	4,500
Very Severe	S3	SO_4>2.00	V+Pozzolan or Slag	0.45	4,500

8.3.4 Geocon Incorporated does not practice in the field of corrosion engineering; therefore, if improvements that could be susceptible to corrosion are planned, it is recommended that further evaluation by a corrosion engineer be performed.

8.4 Slope Stability

8.4.1 Slope stability analyses for cut slopes within the fanglomerate and fill slopes were performed utilizing average drained direct shear strength parameters from the laboratory test results. These analyses indicate that the proposed 2:1 cut and fill slopes, constructed of on-site materials or fanglomerate material, should have calculated factors of safety of at least 1.5 under static conditions for both deep-seated failure and shallow sloughing conditions to heights of at least 20 feet and 62 feet, respectively. Generalized slope stability calculations for both deep-seated and surficial slope stability are presented on Figures 4 through 6, respectively.

8.4.2 Cut slopes in rock materials (Santiago Peak Volcanics) do not lend themselves to conventional slope stability analyses. Based on experience with similar rock conditions, 1.5:1 cut slopes to the planned heights of up to 69 feet should possess a factor of safety of at least 1.5 with respect to slope instability, if free of adversely oriented joints or fractures. However, to satisfy agency concerns we have performed an quantitative evaluation using strength parameters selected from the *American Geological Institute (AGI) Data Sheets for Geology in the Field, Laboratory and Office, Third Addition*, Data Sheet 78.2, Table 1 (Physical Engineering Properties of Rocks) compiled by Lawrence C. Wood, Stanford University. Based on the results of the analysis, the factor of safety for slopes excavated in metavolcanic rock to the design heights will possess a factor of safety greater than 1.5 for gross stability as shown on Figure 7.

8.4.3 Although rare, the most common mode of instability for rock slopes are shallow wedge failures from intersecting fault planes or clay filled joints/fractures dipping out of slope. In this regard, the structural measurements obtained during our studies did not reveal such conditions. It is recommended, however, that all slope excavations proposed on the site be observed during grading by an engineering geologist to confirm that geologic conditions do not differ significantly from those anticipated. In the event that adverse conditions are observed, stabilization recommendations can be provided.

8.4.4 Fill slopes should be compacted by backrolling with a loaded sheepsfoot roller at vertical intervals not to exceed 4 feet and should be track-walked at the completion of each slope such that the fill soils are uniformly compacted to at least 90 percent relative compaction to the face of the finished sloped. Alternatively, the fill slope may be over-built at least 3 feet and cut back to yield a properly compacted slope face.

8.4.5 Where fill slopes and fill-over-cut slopes are planned. Following removal of the surficial soils, a 15-foot-wide, 2-foot-deep, undrained keyway should be constructed prior to placing compacted fill. The keyway should be constructed with a minimum 5 percent inclination away from the toe of slope.

8.4.6 All slopes should be landscaped with drought-tolerant vegetation, having variable root depths and requiring minimal landscape irrigation. In addition, all slopes should be drained and properly maintained to reduce erosion.

8.5 Subdrains

8.5.1 The geologic units encountered on the site have permeability characteristics and/or fracture systems that could be susceptible under certain conditions to groundwater seepage. The use of canyon subdrains will be necessary to mitigate the potential for adverse impacts associated with seepage conditions. Figure 8 depicts a typical canyon subdrain detail and the proposed locations are shown on the *Geologic Map*. In general, subdrains should be extended to within approximately 10 feet of the ultimate ground surface.

8.5.2 Prior to outletting, the final segment of subdrain should consist of non-perforated drainpipe. At the non-perforated/perforated interface, a seepage cutoff wall should be constructed on the downslope side of the junction in accordance with Figure 9. Subdrains that discharge into a natural drainage course or open space area should be provided with a permanent headwall structure in accordance with Figure 10.

8.5.3 The final grading plans should show the location of all proposed subdrains. Upon completion of remedial excavations and subdrain installation, the project civil engineer should survey the drain locations and prepare an “as-built” map depicting the existing conditions.

8.6 Grading

8.6.1 All grading should be performed in accordance with the attached *Recommended Grading Specifications* (Appendix D). Where the recommendations of this section conflict with Appendix D, the recommendations of this section take precedence. All earthwork should be observed and all fills tested for proper compaction by Geocon Incorporated.

8.6.2 Prior to commencing grading, a preconstruction conference should be held at the site with the owner or developer, grading contractor, civil engineer, and geotechnical engineer in attendance. Special soil handling and/or the grading plans can be discussed at that time.

8.6.3 Site preparation should begin with the removal of all deleterious material and vegetation. The depth of removal should be such that material exposed in cut areas or soils to be used as fill are relatively free of organic matter. Material generated during stripping and/or site demolition should be exported from the site.

8.6.4 All compressible soil deposits, including topsoil, alluvium and colluvium within areas where structural improvements are planned or where discussed herein, should be removed to firm natural ground and properly compacted prior to placing additional fill and/or structural loads. Deeper than normal benching and/or stripping operations for sloping ground surfaces will be required where the thickness of potentially compressible surficial deposits exceeds 3 feet. The actual extent of unsuitable soil removals will be determined in the field during grading by the geotechnical engineer and/or engineering geologist.

8.6.5 After removal of unsuitable materials is performed, the site should then be brought to final subgrade elevations with structural fill compacted in layers. In general, soils native to the site are suitable for re-use as fill if free from vegetation, debris and other deleterious material. Layers of fill should be no thicker than will allow for adequate bonding and compaction. All fill, including backfill and scarified ground surfaces, should be compacted to at least 90 percent of maximum dry density at or above optimum moisture content, as determined in accordance with ASTM Test Procedure D1557. Fill materials below optimum moisture content will require additional moisture conditioning prior to placing additional fill.

8.6.6 Grading operations should be scheduled to permit the placement of oversize material and expansive soils in the deeper fill areas and to cap the building pads with granular materials having a “very low” to “low” expansive potential. Oversize material should be placed at least 10 feet below finish grade or 3 feet below the deepest utilities, whichever is greater.

8.6.7 To reduce the potential for differential settlement, it is recommended that the cut portion of cut/fill transition building pads be undercut at least 3 feet and replaced with properly compacted “very low” to “low” expansive fill soils. Where the thickness of the fill below the building pad exceeds 15 feet, the depth of the undercut should be increased to one-fifth of the maximum fill thickness. The base of the undercuts should be sloped towards the front of the lots.

8.6.8 Oversize material (defined as material greater than 12 inches in nominal dimension) may be generated during ripping of cemented formational materials. Placement of oversize material within fills should be conducted in accordance with the recommendations in Appendix D. Grading operations on the site should be scheduled such that oversize materials are placed in designated rock disposal areas and/or deeper fills.

8.6.9 Where practical, the upper 4 feet of all building pads (cut or fill) should be comprised of soil with a “very low” to “low” expansion potential. The more highly expansive fill soils should be placed in the deeper fill areas and properly compacted. “Very low” to “low” expansive soils are defined by the 2013 California Building Code (CBC) Section 1803.5.3 as those soils that have an Expansion Index of 50 or less. Cobbles, rock fragments, and concretions greater than 6 inches in maximum dimension should not be placed within 3 feet of finish grade in building pad areas.

8.6.10 Cut pads exposing metavolcanic rock or fanglomerate materials should be undercut at least 3 feet and replaced with properly compacted “very low” to “low” expansive soil. The base of the undercuts should be sloped towards the front of the lots.

8.6.11 Undercutting of street areas should be considered to facilitate the excavation of underground utilities where the streets are located in cut areas composed of marginally to non-rippable hard rock. If subsurface improvements or landscape zones are planned outside these areas, consideration should be given to undercutting these areas as well. This can be evaluated during grading operations.

8.6.12 Rock greater than 6 inches in maximum dimension should not be placed within 3 feet of finish grade in building pad areas or street subgrade. Rock greater than 12 inches in maximum dimension should not be placed within 10 feet of finish pad grade or within 2 feet of the deepest utility.

8.6.13 It is recommended that excavations be observed during grading by a representative of Geocon Incorporated to verify that soil and geologic conditions do not differ significantly from those anticipated.

8.6.14 It is the responsibility of the contractor to ensure that all excavations and trenches are properly shored and maintained in accordance with applicable OSHA rules and regulations in order to maintain safety and maintain the stability of adjacent existing improvements.

8.6.15 Import materials (if required), should consist of “very low” to “low” expansive (Expansion Index of 50 or less) soils. Prior to importing the material, samples from proposed borrow areas should be obtained and subjected to laboratory testing to determine whether the material conforms to the recommended criteria. At least 3 working days should be allowed for laboratory testing of the soil prior to its importation. Import materials should be free of oversize rock and construction debris.

8.7 Seismic Design Criteria

8.7.1 We used the computer program *U.S. Seismic Design Maps*, provided by the USGS. Table 8.7.1. summarizes site-specific design criteria obtained from the 2013 California Building Code (CBC; Based on the 2012 International Building Code [IBC] and ASCE 7-10), Chapter 16 Structural Design, Section 1613 Earthquake Loads. The short spectral response uses a period of 0.2 second. The building structure and improvements should be designed using a Site Class C. We evaluated the Site Class based on the discussion in Section 1613.3.2 of the 2013 CBC and Table 20.3-1 of ASCE 7-10. The values presented in Table 8.7.1 are for the risk-targeted maximum considered earthquake (MCE_R).

TABLE 8.7.1
2013 CBC SEISMIC DESIGN PARAMETERS

Parameter	Value	2013 CBC Reference
Site Class	C	Section 1613.3.2
MCE_R Ground Motion Spectral Response Acceleration – Class B (short), S_S	0.922g	Figure 1613.3.1(1)
MCE_R Ground Motion Spectral Response Acceleration – Class B (1 sec), S_1	0.361g	Figure 1613.3.1(2)
Site Coefficient, F_A	1.031	Table 1613.3.3(1)
Site Coefficient, F_V	1.439	Table 1613.3.3(2)
Site Class Modified MCE_R Spectral Response Acceleration (short), S_{MS}	0.951g	Section 1613.3.3 (Eqn 16-37)
Site Class Modified MCE_R Spectral Response Acceleration (1 sec), S_{M1}	0.520g	Section 1613.3.3 (Eqn 16-38)
5% Damped Design Spectral Response Acceleration (short), S_{DS}	0.634g	Section 1613.3.4 (Eqn 16-39)
5% Damped Design Spectral Response Acceleration (1 sec), S_{D1}	0.347g	Section 1613.3.4 (Eqn 16-40)

8.7.2 Table 8.7.2 presents additional seismic design parameters for projects located in Seismic Design Categories of D through F in accordance with ASCE 7-10 for the mapped maximum considered geometric mean (MCE_G).

TABLE 8.7.2
2013 CBC SITE ACCELERATION PARAMETERS

Parameter	Value	ASCE 7-10 Reference
Mapped MCE_G Peak Ground Acceleration, PGA	0.346g	Figure 22-7
Site Coefficient, F_{PGA}	1.054	Table 11.8-1
Site Class Modified MCE_G Peak Ground Acceleration, PGA_M	0.364g	Section 11.8.3 (Eqn 11.8-1)

8.7.3 Conformance to the criteria in Tables 8.7.1 and 8.7.2 for seismic design does not constitute any kind of guarantee or assurance that significant structural damage or ground failure will not occur if a large earthquake occurs. The primary goal of seismic design is to protect life, not to avoid all damage, since such design may be economically prohibitive.

8.8 Foundation and Concrete Slabs-On-Grade Recommendations

8.8.1 The following foundation recommendations are for proposed one- to three-story residential structures. The foundation recommendations have been separated into three categories based on either the maximum and differential fill thickness or Expansion Index. The foundation category criteria are presented in Table 8.8.1.

TABLE 8.8.1
FOUNDATION CATEGORY CRITERIA

Foundation Category	Maximum Fill Thickness, T (Feet)	Differential Fill Thickness, D (Feet)	Expansion Index (EI)
I	T<20	--	EI≤50
II	20≤T<50	10≤D<20	50<EI≤90
III	T≥50	D≥20	90<EI≤130

8.8.2 Final foundation categories for each building or lot will be provided after finish pad grades have been achieved and laboratory testing of the subgrade soil has been completed.

8.8.3 Table 8.8.2 presents minimum foundation and interior concrete slab design criteria for conventional foundation systems.

TABLE 8.8.2
CONVENTIONAL FOUNDATION RECOMMENDATIONS BY CATEGORY

Foundation Category	Minimum Footing Embedment Depth (inches)	Continuous Footing Reinforcement	Interior Slab Reinforcement
I	12	Two No. 4 bars, one top and one bottom	6 x 6 - 10/10 welded wire mesh at slab mid-point
II	18	Four No. 4 bars, two top and two bottom	No. 3 bars at 24 inches on center, both directions
III	24	Four No. 5 bars, two top and two bottom	No. 3 bars at 18 inches on center, both directions

8.8.4 The embedment depths presented in Table 8.8.2 should be measured from the lowest adjacent pad grade for both interior and exterior footings. The conventional foundations should have a minimum width of 12 inches and 24 inches for continuous and isolated footings, respectively. A typical wall/column footing detail is presented on Figure 11.

8.8.5 The concrete slabs-on-grade should be a minimum of 4 inches thick for Foundation Categories I and II and 5 inches thick for Foundation Category III. The concrete slabs-on-grade should be underlain by 4 inches and 3 inches of clean sand for 4-inch thick and 5-inch-thick slabs, respectively. Slabs expected to receive moisture sensitive floor coverings or used to store moisture sensitive materials should be underlain by a vapor inhibitor covered with at least 2 inches of clean sand or crushed rock. If crushed rock will be used, the thickness of the vapor inhibitor should be at least 10 mil to prevent possible puncturing.

8.8.6 As a substitute, the layer of clean sand (or crushed rock) beneath the vapor inhibitor recommended in the previous section can be omitted if a vapor inhibitor that meets or exceeds the requirements of ASTM E 1745-97 (Class A), and that exhibits permeance not greater than 0.012 perm (measured in accordance with ASTM E 96-95) is used. This vapor inhibitor may be placed directly on properly compacted fill or formational materials. The vapor inhibitor should be installed in general conformance with ASTM E 1643-98 and the manufacturer's recommendations. Two inches of clean sand should then be placed on top of the vapor inhibitor to reduce the potential for differential curing, slab curl, and cracking. Floor coverings should be installed in accordance with the manufacturer's recommendations.

8.8.7 As an alternative to the conventional foundation recommendations, consideration should be given to the use of post-tensioned concrete slab and foundation systems for the support of the proposed structures. The post-tensioned systems should be designed by a structural engineer experienced in post-tensioned slab design and design criteria of the Post-Tensioning Institute (PTI), Third Edition, as required by the 2013 California Building Code (CBC Section 1808.6). Although this procedure was developed for expansive soil conditions, it can also be used to reduce the potential for foundation distress due to differential fill settlement. The post-tensioned design should incorporate the geotechnical parameters presented on Table 8.8.3 for the particular Foundation Category designated. The parameters presented in Table 8.8.3 are based on the guidelines presented in the PTI, Third Edition design manual.

TABLE 8.8.3
POST-TENSIONED FOUNDATION SYSTEM DESIGN PARAMETERS

Post-Tensioning Institute (PTI), Third Edition Design Parameters	Foundation Category		
	I	II	III
Thornthwaite Index	-20	-20	-20
Equilibrium Suction	3.9	3.9	3.9
Edge Lift Moisture Variation Distance, e_M (feet)	5.3	5.1	4.9
Edge Lift, y_M (inches)	0.61	1.10	1.58
Center Lift Moisture Variation Distance, e_M (feet)	9.0	9.0	9.0
Center Lift, y_M (inches)	0.30	0.47	0.66

8.8.8 Foundation systems for the lots that possess a foundation Category I and a "very low" expansion potential (expansion index of 20 or less) can be designed using the method described in Section 1808 of the 2013 CBC. If post-tensioned foundations are planned, an alternative, commonly accepted design method (other than PTI Third Edition) can be used. However, the post-tensioned foundation system should be designed with a total and differential deflection of 1 inch. Geocon Incorporated should be contacted to review the plans and provide additional information, if necessary.

8.8.9 The foundations for the post-tensioned slabs should be embedded in accordance with the recommendations of the structural engineer. If a post-tensioned mat foundation system is planned, the slab should possess a thickened edge with a minimum width of 12 inches and extend below the clean sand or crushed rock layer.

8.8.10 If the structural engineer proposes a post-tensioned foundation design method other than PTI, Third Edition:

- The deflection criteria presented in Table 8.8.3 are still applicable.
- Interior stiffener beams should be used for Foundation Categories II and III.
- The width of the perimeter foundations should be at least 12 inches.
- The perimeter footing embedment depths should be at least 12 inches, 18 inches and 24 inches for foundation categories I, II, and III, respectively. The embedment depths should be measured from the lowest adjacent pad grade.

8.8.11 Our experience indicates post-tensioned slabs are susceptible to excessive edge lift, regardless of the underlying soil conditions. Placing reinforcing steel at the bottom of the perimeter footings and the interior stiffener beams may mitigate this potential. Current PTI design procedures primarily address the potential center lift of slabs but, because of the placement of the reinforcing tendons in the top of the slab, the resulting eccentricity after tensioning reduces the ability of the system to mitigate edge lift. The structural engineer should design the foundation system to reduce the potential of edge lift occurring for the proposed structures.

8.8.12 During the construction of the post-tension foundation system, the concrete should be placed monolithically. Under no circumstances should cold joints be allowed to form between the footings/grade beams and the slab during the construction of the post-tension foundation system.

8.8.13 Category I, II, or III foundations may be designed for an allowable soil bearing pressure of 2,000 pounds per square foot (psf) (dead plus live load). This bearing pressure may be increased by one-third for transient loads due to wind or seismic forces.

8.8.14 Isolated footings, if present, should have the minimum embedment depth and width recommended for conventional foundations for a particular foundation category. The use of isolated footings, which are located beyond the perimeter of the building and support structural elements connected to the building, are not recommended for Category III. Where this condition cannot be avoided, the isolated footings should be connected to the building foundation system with grade beams.

8.8.15 For Foundation Category III, consideration should be given to using interior stiffening beams and connecting isolated footings and/or increasing the slab thickness. In addition, consideration should be given to connecting patio slabs, which exceed 5 feet in width, to the building foundation to reduce the potential for future separation to occur.

8.8.16 Special subgrade presaturation is not deemed necessary prior to placing concrete; however, the exposed foundation and slab subgrade soil should be moisture conditioned, as necessary, to maintain a moist condition as would be expected in any such concrete placement.

8.8.17 Where buildings or other improvements are planned near the top of a slope steeper than 3:1 (horizontal:vertical), special foundations and/or design considerations are recommended due to the tendency for lateral soil movement to occur.

- For fill slopes less than 20 feet high, building footings should be deepened such that the bottom outside edge of the footing is at least 7 feet horizontally from the face of the slope.

- When located next to a descending 3:1 (horizontal:vertical) fill slope or steeper, the foundations should be extended to a depth where the minimum horizontal distance is equal to H/3 (where H equals the vertical distance from the top of the fill slope to the base of the fill soil) with a minimum of 7 feet but need not exceed 40 feet. The horizontal distance is measured from the outer, deepest edge of the footing to the face of the slope. An acceptable alternative to deepening the footings would be the use of a post-tensioned slab and foundation system or increased footing and slab reinforcement. Specific design parameters or recommendations for either of these alternatives can be provided once the building location and fill slope geometry have been determined.

- If swimming pools are planned, Geocon Incorporated should be contacted for a review of specific site conditions.

- Swimming pools located within 7 feet of the top of cut or fill slopes are not recommended. Where such a condition cannot be avoided, the portion of the swimming pool wall within 7 feet of the slope face be designed assuming that the adjacent soil provides no lateral support. This recommendation applies to fill slopes up to 30 feet in height, and cut slopes regardless of height. For swimming pools located near the top of fill slopes greater than 30 feet in height, additional recommendations may be required and Geocon Incorporated should be contacted for a review of specific site conditions.

- Although other improvements, which are relatively rigid or brittle, such as concrete flatwork or masonry walls, may experience some distress if located near the top of a slope, it is generally not economical to mitigate this potential. It may be possible, however, to incorporate design measures, which would permit some lateral soil movement without causing extensive distress. Geocon Incorporated should be consulted for specific recommendations.

8.8.18 The recommendations of this report are intended to reduce the potential for cracking of slabs due to expansive soil (if present), differential settlement of existing soil or soil with varying thicknesses. However, even with the incorporation of the recommendations presented herein, foundations, stucco walls, and slabs-on-grade placed on such conditions may still exhibit some cracking due to soil movement and/or shrinkage. The occurrence of concrete shrinkage cracks is independent of the supporting soil characteristics. Their occurrence may be reduced and/or controlled by limiting the slump of the concrete, proper concrete placement and curing, and by the placement of crack control joints at periodic intervals, in particular, where re-entrant slab corners occur.

8.8.19 Geocon Incorporated should be consulted to provide additional design parameters as required by the structural engineer.

8.9 Lateral Loading

8.9.1 To resist lateral loads, a passive pressure exerted by soil with an equivalent fluid weight of 300 pounds per cubic foot (pcf) should be used for the design of footings or shear keys poured neat against properly compacted granular fill soils. The allowable passive pressure assumes a horizontal surface extending at least 5 feet away from the base of the wall or three times the height of the surface generating the passive pressure, whichever is greater. The upper 12 inches of material in areas not protected by floor slabs or pavement should not be included in the design for passive resistance.

8.9.2 If friction is to be used to resist lateral loads, an allowable coefficient of friction between soil and concrete of 0.40 should be used for the design. This friction coefficient may be combined with the allowable passive earth pressure when determining resistance to lateral loads.

8.10 Retaining Walls

8.10.1 The structural engineer should determine the seismic design category for the project in accordance with Section 1613 of the CBC. If the project possesses a seismic design category of D, E, or F, retaining walls that support more than 6 feet of backfill should be designed with seismic lateral pressure in accordance with Section 1803.5.12 of the 2013 CBC. The seismic load is dependent on the retained height, where H is the retained height of the soil behind the wall, in feet, and the calculated loads result in pounds per square foot (psf) exerted at the base of the wall and zero at the top of the soil. A seismic load of 19H should be used for design. We used the peak ground acceleration adjusted for Site Class effects, PGA_M, of 0.364g calculated from ASCE 7-10 Section 11.8.3 and applied a pseudo-static coefficient of 0.33.

8.10.2 Retaining walls not restrained at the top and having a level backfill surface should be designed for an active soil pressure equivalent to the pressure exerted by a fluid with a density of 35 pounds per cubic foot (pcf). Where the backfill will be inclined at 2:1 (horizontal:vertical), an active soil pressure of 50 pcf, respectively, is recommended. These soil pressures assume that the backfill materials within an area bounded by the wall and a 1:1 plane extending upward from the base of the wall possess an Expansion Index of less than 50.

8.10.3 Unrestrained walls are those that are allowed to rotate more than 0.001H (where H equals the height of the retaining portion of the wall) at the top of the wall. Where walls are restrained from movement at the top, an additional uniform pressure of 7H psf should be added to the above active soil pressure. For retaining walls subject to vehicular loads within a horizontal distance equal to two-thirds the wall height, a surcharge equivalent to 2 feet of fill soil should be added.

8.10.4 The retaining walls may be designed using either the active and restrained (at-rest) loading condition or the active and seismic loading condition. Typically, it appears the design of the restrained condition for retaining wall loading may be adequate for the seismic design of the retaining walls. However, the active earth pressure combined with the seismic design load should be reviewed and also considered in the design of the retaining walls.

8.10.5 Retaining walls should be provided with a drainage system adequate to prevent the buildup of hydrostatic forces and waterproofed as required by the project architect. The use of drainage openings through the base of the wall (weep holes) is not recommended where the seepage could be a nuisance or otherwise adversely affect the property adjacent to the base of the wall. The above recommendations assume a properly compacted granular (EI less than 50) free-draining backfill material with no hydrostatic forces or imposed surcharge load. Figure 12 presents a typical retaining wall drainage detail.

8.10.6 Retaining wall footings should be at least 12 inches wide and 12 inches below lowest adjacent grade. An allowable bearing capacity for retaining wall footings can be taken as 2,000 psf.

8.10.7 Footings that must be placed within seven feet of the top of slopes should be extended in depth such that the outer bottom edge of the footing is at least seven feet horizontally inside the face of the slope.

8.10.8 If conditions different than those described are anticipated, or if specific drainage details are desired, Geocon Incorporated should be contacted for additional recommendations. If on-site highly expansive soils are used as retaining wall backfill, modifications to the design parameters provided above would be required.

8.10.9 The recommendations presented above are generally applicable to the design of rigid concrete or masonry retaining walls having a maximum height of 12 feet. In the event that walls higher than 12 feet or other types of walls are planned, Geocon Incorporated should be consulted for additional recommendations.

8.10.10 The wall parameters for the proposed retaining walls will be based on the available material to be used for backfill. Geocon can perform the necessary laboratory testing as required by the wall engineer for design purposes.

8.11 Slope Maintenance

8.11.1 Slopes that are steeper than 3:1 (horizontal:vertical) may, under conditions that are both difficult to prevent and predict, be susceptible to near-surface (surficial) slope instability. The instability is typically limited to the outer 3 feet of a portion of the slope and usually does not directly impact the improvements on the pad areas above or below the slope. The occurrence of surficial instability is more prevalent on fill slopes and is generally preceded by a period of heavy rainfall, excessive irrigation, or the migration of subsurface seepage. The disturbance and/or loosening of the surficial soils, as might result from root growth, soil expansion, or excavation for irrigation lines and slope planting, may also be a significant contributing factor to surficial instability. It is, therefore, recommended that, to the maximum extent practical: (a) disturbed/loosened surficial soils be either removed or properly recompacted, (b) irrigation systems be periodically inspected and maintained to eliminate leaks and excessive irrigation, and (c) surface drains on and adjacent to slopes be periodically maintained to preclude ponding or erosion. It should be noted that although the incorporation of the above recommendations should reduce the potential for surficial slope instability, it will not eliminate the possibility, and, therefore, it may be necessary to rebuild or repair a portion of the project's slopes in the future.

8.12 Storm Water Management

8.12.1 If low-impact development (LID) integrated management practices (IMP's) are being considered, Geocon should review the design and provide specific geotechnical recommendations to reduce the potential adverse impacts to both on and off-site properties.

8.12.2 If not property constructed, there is a potential for distress to improvements and properties located hydrologically down gradient or adjacent to these devices. Factors such as the amount of water to be detained, its residence time, and soil permeability have an important affect on seepage transmission and the potential adverse impacts that may occur if the storm water management features are not properly designed and constructed. Based on our experience with similar clayey soil and shallow bedrock conditions, infiltration IMP's are considered infeasible due to the poor percolation characteristics. We have not performed a hydrogeology study at the site. Down-gradient and adjacent properties may be subjected to seeps, springs, slope instability, raised groundwater, movement of foundations and slabs, or other impacts as a result of water infiltration.

8.12.3 Due to site soil and geologic conditions, a heavy duty, non-permeable liner is recommended beneath any hydro-modification areas or IMP's where water infiltration into the underlying soils is planned. If permeable pavers are planned, the design should include a subdrain to prevent subgrade saturation and pavement distress. The strength and thickness of the membrane, and construction method should be adequate to assure that the liner will not be compromised throughout the life of the system. In addition, civil engineering provisions should be implemented to assure that the capacity of the system is never exceeded resulting in over topping or malfunctioning of the device. The system should also include a long-term maintenance program or periodic cleaning to prevent clogging of the filter media or drain envelope. Geocon Incorporated has no opinion regarding the design of the filtration system or its effectiveness.

8.13 Site Drainage and Moisture Protection

8.13.1 Adequate site drainage is critical to reduce the potential for differential soil movement, erosion and subsurface seepage. Under no circumstances should water be allowed to pond adjacent to footings. The site should be graded and maintained such that surface drainage is directed away from structures in accordance with 2013 CBC 1804.3 or other applicable standards. In addition, surface drainage should be directed away from the top of slopes into swales or other controlled drainage devices. Roof and pavement drainage should be directed into conduits that carry runoff away from the proposed structure.

8.13.2 Underground utilities should be leak free. Utility and irrigation lines should be checked periodically for leaks, and detected leaks should be repaired promptly. Detrimental soil movement could occur if water is allowed to infiltrate the soil for prolonged periods of time.

8.14 Grading and Foundation Plan Review

8.14.1 Geocon Incorporated should review the grading plans and foundation plans for the project prior to final design submittal to evaluate whether additional analyses and/or recommendations are required.

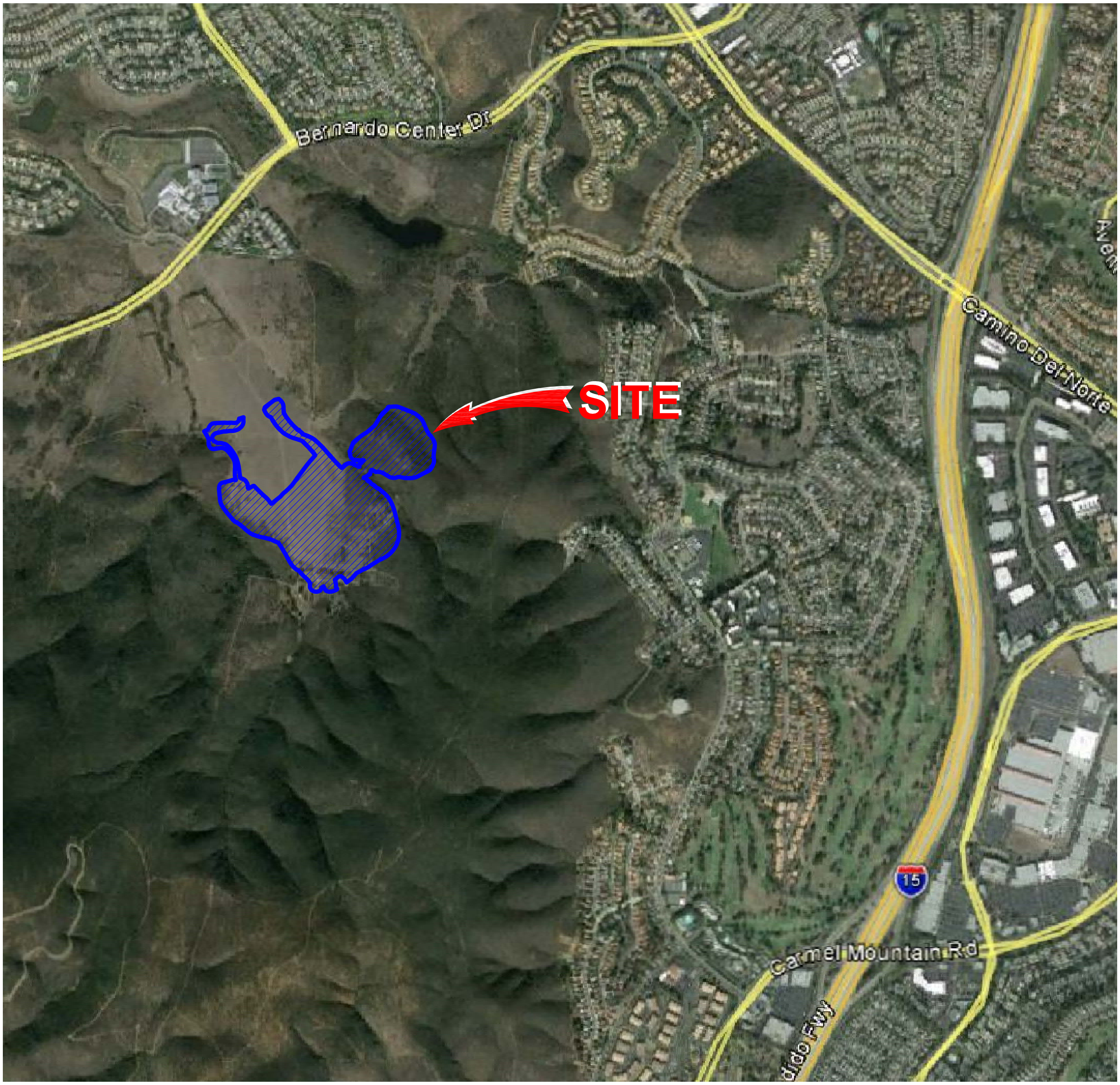
LIMITATIONS AND UNIFORMITY OF CONDITIONS

1. The firm that performed the geotechnical investigation for the project should be retained to provide testing and observation services during construction to provide continuity of geotechnical interpretation and to check that the recommendations presented for geotechnical aspects of site development are incorporated during site grading, construction of improvements, and excavation of foundations. If another geotechnical firm is selected to perform the testing and observation services during construction operations, that firm should prepare a letter indicating their intent to assume the responsibilities of project geotechnical engineer of record. A copy of the letter should be provided to the regulatory agency for their records. In addition, that firm should provide revised recommendations concerning the geotechnical aspects of the proposed development, or a written acknowledgement of their concurrence with the recommendations presented in our report. They should also perform additional analyses deemed necessary to assume the role of Geotechnical Engineer of Record.

2. The recommendations of this report pertain only to the site investigated and are based upon the assumption that the soil conditions do not deviate from those disclosed in the investigation. If any variations or undesirable conditions are encountered during construction, or if the proposed construction will differ from that anticipated herein, Geocon Incorporated should be notified so that supplemental recommendations can be given. The evaluation or identification of the potential presence of hazardous or corrosive materials was not part of the scope of services provided by Geocon Incorporated.

3. This report is issued with the understanding that it is the responsibility of the owner or his representative to ensure that the information and recommendations contained herein are brought to the attention of the architect and engineer for the project and incorporated into the plans, and the necessary steps are taken to see that the contractor and subcontractors carry out such recommendations in the field.

4. The findings of this report are valid as of the present date. However, changes in the conditions of a property can occur with the passage of time, whether they be due to natural processes or the works of man on this or adjacent properties. In addition, changes in applicable or appropriate standards may occur, whether they result from legislation or the broadening of knowledge. Accordingly, the findings of this report may be invalidated wholly or partially by changes outside our control. Therefore, this report is subject to review and should not be relied upon after a period of three years.



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N

NO SCALE

VICINITY MAP

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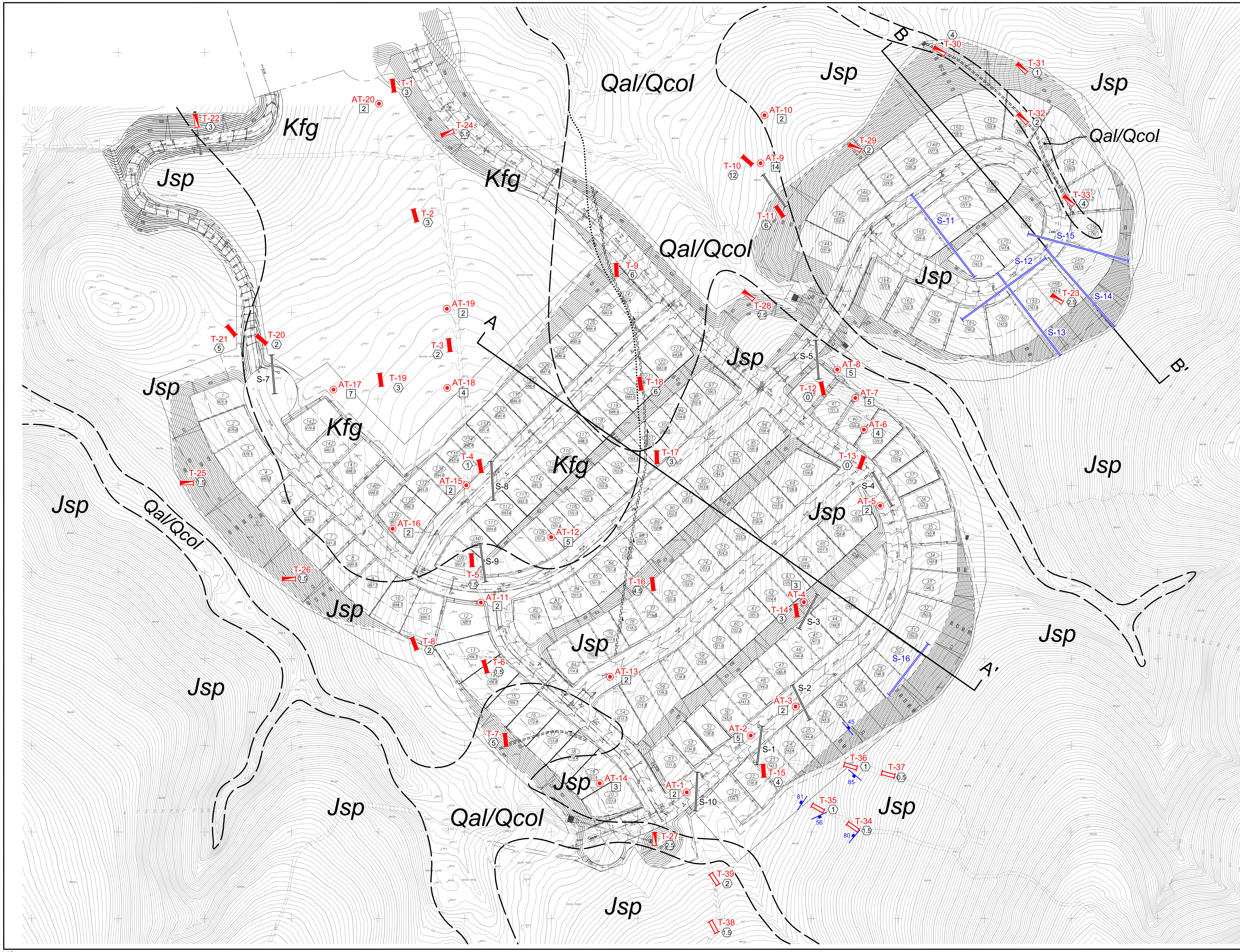
HERITAGE BLUFFS II

SAN DIEGO, CALIFORNIA

TR / AML		DSK/GTYPD	DATE 01 - 23 - 2015	PROJECT NO. 07339 - 32 - 03	FIG. 1



GRAPHIC SCALE

0' 50' 100' 150' 200' 300' 400'

SCALE 1" = 100'

GEOCON LEGEND

Qal/Qcol ....ALLUVIUM / COLLUVIUM

Kfg ........FANGLOMERATE DEPOSITS

Jsp ........METAVOLCANIC ROCK

........APPROX. LOCATION OF GEOLOGIC CONTACT (Dotted Where Buried)

T-21 ....APPROX. LOCATION OF EXPLORATORY TRENCH (Trenches T-1 through T-21 Performed in July 2004)

T-33 ....APPROX. LOCATION OF EXPLORATORY TRENCH (Trenches T-22 through T-33 Performed in January 2015)

T-39 ....APPROX. LOCATION OF EXPLORATORY TRENCH (Trenches T-34 through T-39 Performed in April 2008)

3 ....APPROX. THICKNESS OF SURFICIAL DEPOSIT REQUIRING REMEDIAL GRADING

AT-20 ....APPROX. LOCATION OF AIR TRACK BORING (Air Track Borings AT-1 through AT-20 Performed in July 2004)

3 ....ESTIMATED THICKNESS OF RIPPABLE MATERIAL BASED ON LITERAL INTERPRETATION OF 20 SECONDS PER FOOT AS THE BOUNDARY BETWEEN RIPPABLE AND MARGINALLY TO NON-RIPPABLE ROCK

........APPROX. LOCATION OF PROPOSED SUBDRAIN (Arrow Indicates Direction of Flow)

S-10 ....APPROX. LOCATION OF SEISMIC TRAVERSE (Seismic Traversed S-1 through S-10 Performed in July 2004)

S-16 ....APPROX. LOCATION OF SEISMIC TRAVERSE (Seismic Traversed S-11 through S-16 Performed in January 2015)

B B' ....APPROX. LOCATION OF GEOLOGIC CROSS SECTION

85 ....STRIKE AND DIP OF JOINT/FRACTURE

GEOLOGIC MAP

HERITAGE BLUFFS II
SAN DIEGO, CALIFORNIA

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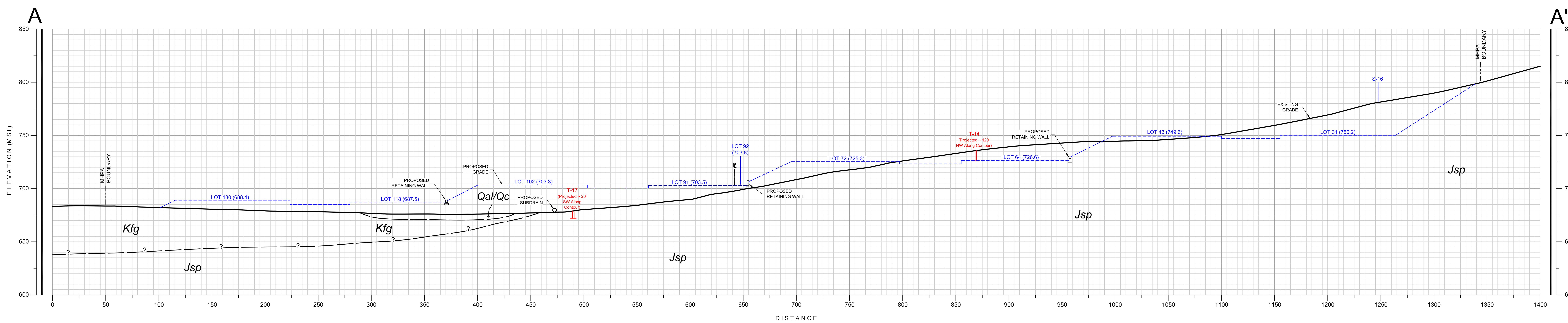
SCALE 1" = 100'	DATE 01 - 23 - 2015
PROJECT NO. 07339 - 32 - 03	FIGURE 2
SHEET 1 OF 1	

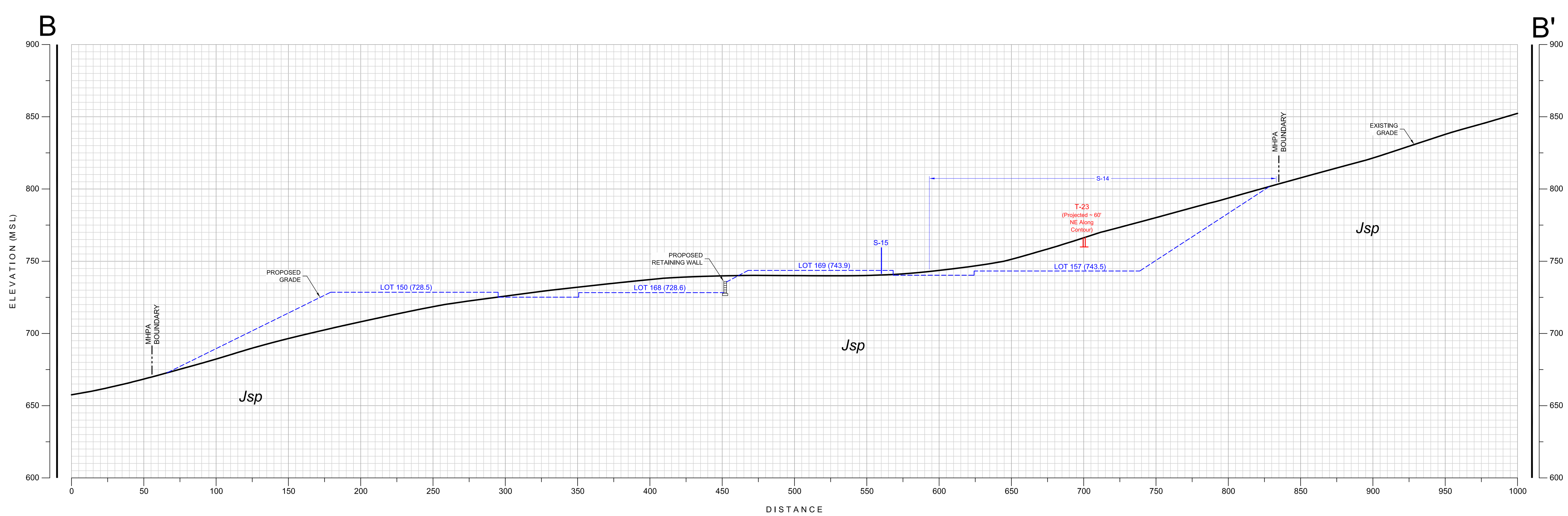
LadriBono

Plotted:01/20/2015 10:28AM | By:ALVIN LADRILLONO | File Location:Y:\PROJECTS\07339-32-03 (Heritage bluffs II)\SHEETS\07339-32-03 Geo Map (Upd 01-23-2015).dwg



GEOLOGIC CROSS-SECTION A-A'

SCALE: 1" = 50' (Vert. = Horiz.)



GEOLOGIC CROSS-SECTION B-B'

SCALE: 1" = 50' (Vert. = Horiz.)

GEOCON LEGEND

Qal/Qcol ....ALLUVIUM / COLLUVIUM

Kfg ........FANGLOMERATE DEPOSITS

Jsp ........METAVOLCANIC ROCK

........APPROX. LOCATION OF GEOLOGIC CONTACT (Queried Where Uncertain)

T-23 ....APPROX. LOCATION OF EXPLORATORY TRENCH (Trench Performed in July 2004)

S-15 ....APPROX. LOCATION OF SEISMIC TRAVERSE (Seismic Traversed Performed in January 2015)

GEOLOGIC CROSS SECTION

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SCALE 1" = 50'	DATE 01 - 23 - 2015
PROJECT NO. 07339 - 32 - 03	FIGURE 3
SHEET 1 OF 1	

LADRILLONO

ASSUMED CONDITIONS :

SLOPE HEIGHT	H	= 62 feet
SLOPE INCLINATION	2 : 1	(Horizontal : Vertical)
TOTAL UNIT WEIGHT OF SOIL	γ_t	= 130 pounds per cubic foot
ANGLE OF INTERNAL FRICTION	ϕ	= 26 degrees
APPARENT COHESION	C	= 350 pounds per square foot
NO SEEPAGE FORCES		

ANALYSIS :

$\gamma_{c\phi}$	=	$\frac{\gamma_t H \tan\phi}{C}$	EQUATION (3-3), REFERENCE 1
FS	=	$\frac{N_{cf} C}{\gamma_t H}$	EQUATION (3-2), REFERENCE 1
$\lambda_{c\phi}$	=	11.2	CALCULATED USING EQ. (3-3)
Ncf	=	35	DETERMINED USING FIGURE 10, REFERENCE 2
FS	=	1.5	FACTOR OF SAFETY CALCULATED USING EQ. (3-2)

REFERENCES :

1......Janbu, N., Stability Analysis of Slopes with Dimensionless Parameters, Harvard Soil Mechanics, Series No. 46, 1954

2......Janbu, N., Discussion of J.M. Bell, Dimensionless Parameters for Homogeneous Earth Slopes, Journal of Soil Mechanics and Foundation Design, No. SM6, November 1967.

SLOPE STABILITY ANALYSIS - 2:1 FILL SLOPES

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HERITAGE BLUFFS II
SAN DIEGO, CALIFORNIA

TR / AML		DSK/GTYPD	DATE 01 - 23 - 2015	PROJECT NO. 07339 - 32 - 03	FIG. 4

ASSUMED CONDITIONS :

SLOPE HEIGHT	H	= 20 feet
SLOPE INCLINATION	2 : 1	(Horizontal : Vertical)
TOTAL UNIT WEIGHT OF SOIL	γ_t	= 130 pounds per cubic foot
ANGLE OF INTERNAL FRICTION	ϕ	= 35 degrees
APPARENT COHESION	C	= 400 pounds per square foot
NO SEEPAGE FORCES		

ANALYSIS :

$\gamma_{c\phi} = \frac{\gamma_t H \tan\phi}{C}$		EQUATION (3-3), REFERENCE 1
$FS = \frac{N_{cf} C}{\gamma_t H}$		EQUATION (3-2), REFERENCE 1
$\lambda_{c\phi}$ =	4.6	CALCULATED USING EQ. (3-3)
Ncf =	18	DETERMINED USING FIGURE 10, REFERENCE 2
FS =	2.8	FACTOR OF SAFETY CALCULATED USING EQ. (3-2)

REFERENCES :

1......Janbu, N., Stability Analysis of Slopes with Dimensionless Parameters, Harvard Soil Mechanics, Series No. 46, 1954

2......Janbu, N., Discussion of J.M. Bell, Dimensionless Parameters for Homogeneous Earth Slopes, Journal of Soil Mechanics and Foundation Design, No. SM6, November 1967.

SLOPE STABILITY ANALYSIS - 2:1 CUT SLOPES IN FANGLOMERATE

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TR / AML		DSK/GTYPD	DATE 01 - 23 - 2015	PROJECT NO. 07339 - 32 - 03	FIG. 5

ASSUMED CONDITIONS :

SLOPE HEIGHT	H	= Infinite
DEPTH OF SATURATION	Z	= 3 feet
SLOPE INCLINATION	2 : 1	(Horizontal : Vertical)
SLOPE ANGLE	i	= 26.6 degrees
UNIT WEIGHT OF WATER	γ_w	= 62.4 pounds per cubic foot
TOTAL UNIT WEIGHT OF SOIL	γ_t	= 130 pounds per cubic foot
ANGLE OF INTERNAL FRICTION	ϕ	= 26 degrees
APPARENT COHESION	C	= 175 pounds per square foot

SLOPE SATURATED TO VERTICAL DEPTH Z BELOW SLOPE FACE

SEEPAGE FORCES PARALLEL TO SLOPE FACE

ANALYSIS :

$$FS = \frac{C + (\gamma_t - \gamma_w)\ Z \cos^2 i \tan \phi}{\gamma_t\ Z \sin i \cos i} = 1.6$$

REFERENCES :

1......Haefeli, R. *The Stability of Slopes Acted Upon by Parallel Seepage*, Proc. Second International Conference, SMFE, Rotterdam, 1948, 1, 57-62

2......Skempton, A. W., and F.A. Delory, *Stability of Natural Slopes in London Clay*, Proc. Fourth International Conference, SMFE, London, 1957, 2, 378-81

SURFICIAL SLOPE STABILITY ANALYSIS

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HERITAGE BLUFFS II
SAN DIEGO, CALIFORNIA

TR / AML		DSK/GTYPD	DATE 01 - 23 - 2015	PROJECT NO. 07339 - 32 - 03	FIG. 6

Heritage Bluffs II
Project No. 07339-32-03
Section B-B'
Name: BB-Case1.gsz
Date: 1/20/2015 Time: 8:06:07 AM

1.5:1 (H:V) Cut Slope in Jsp

Name: Santiago Peak Volcanics (Jsp) Unit Weight: 150 pcf Cohesion: 5.7e+005 psf Phi: 45 °

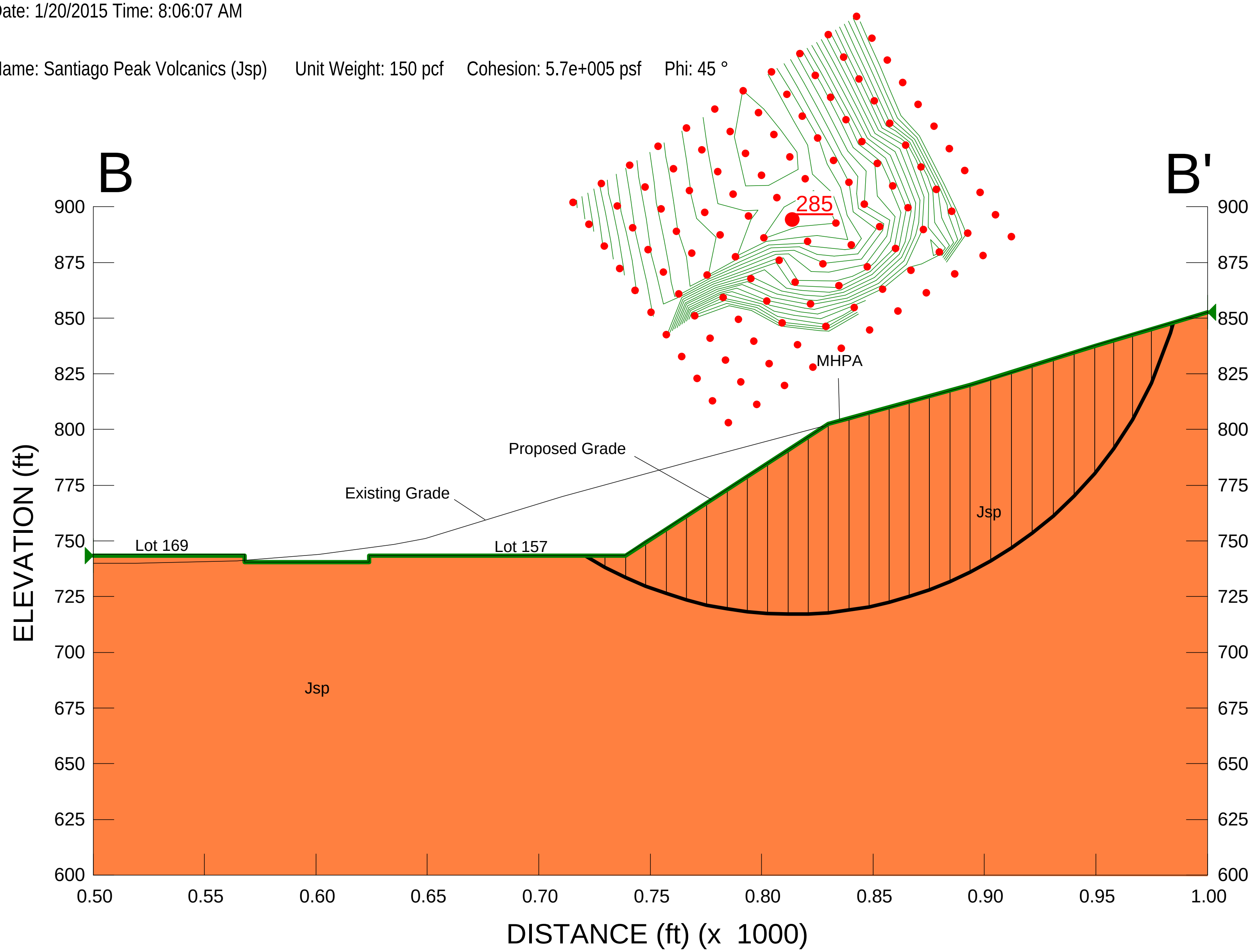
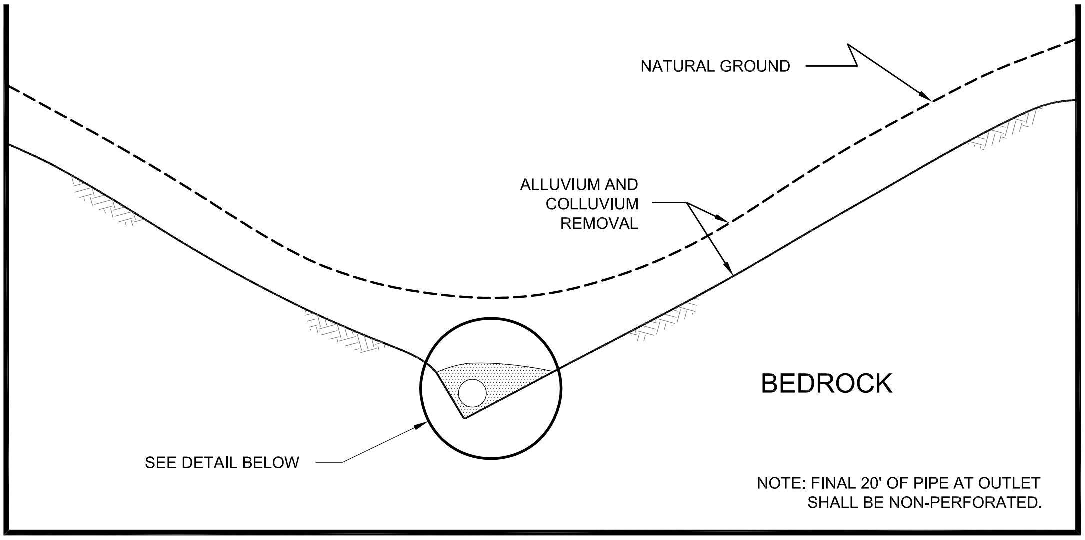
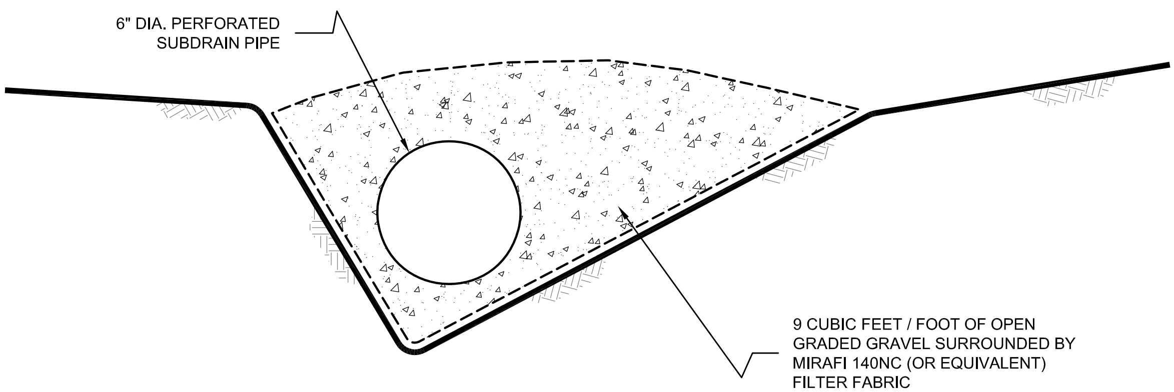


Figure 7

X:\Engineering and Geology\ENGINEER PROGRAMS, GUIDES, ETC\EngrgPrg\GEO-SLOPE2007\Projects\07339-32-03 Heritage Bluffs\





NOTES:

1......8-INCH DIAMETER, SCHEDULE 80 PVC PERFORATED PIPE FOR FILLS IN EXCESS OF 100-FEET IN DEPTH OR A PIPE LENGTH OF LONGER THAN 300 FEET.

2......6-INCH DIAMETER, SCHEDULE 40 PVC PERFORATED PIPE FOR FILLS LESS THAN 100-FEET IN DEPTH OR A PIPE LENGTH SHORTER THAN 300 FEET.

NO SCALE

TYPICAL CANYON SUBDRAIN DETAIL

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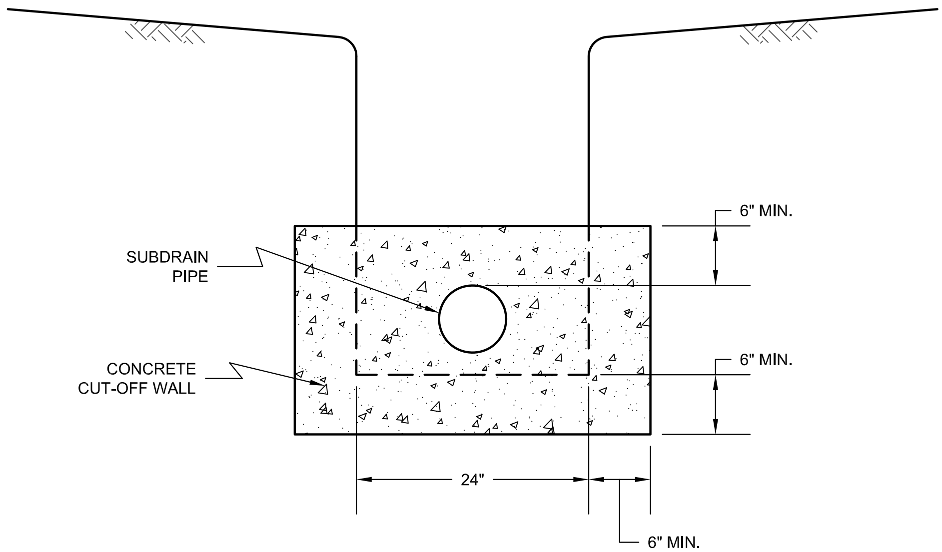
HERITAGE BLUFFS II
SAN DIEGO, CALIFORNIA

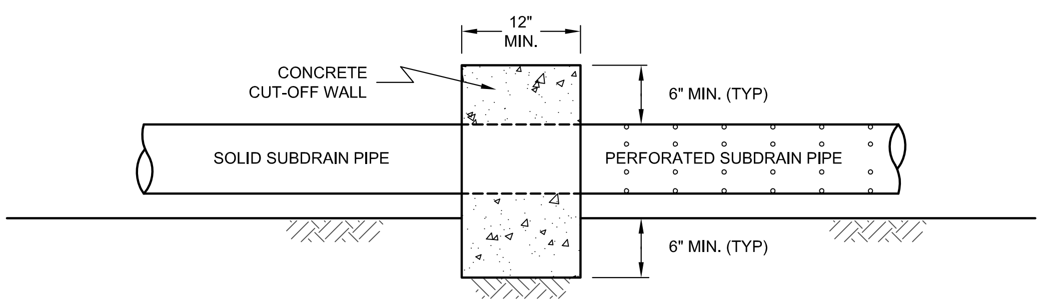
TR / AML		DSK/GTYPD	DATE 01 - 23 - 2015	PROJECT NO. 07339 - 32 - 03	FIG. 8

FRONT VIEW



NO SCALE

SIDE VIEW



NO SCALE

TYPICAL SUBDRAIN CUT-OFF WALL DETAIL

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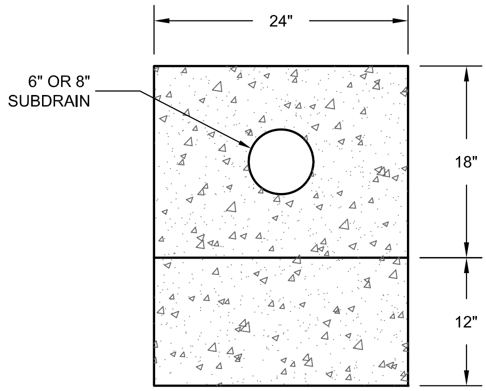
HERITAGE BLUFFS II
SAN DIEGO, CALIFORNIA

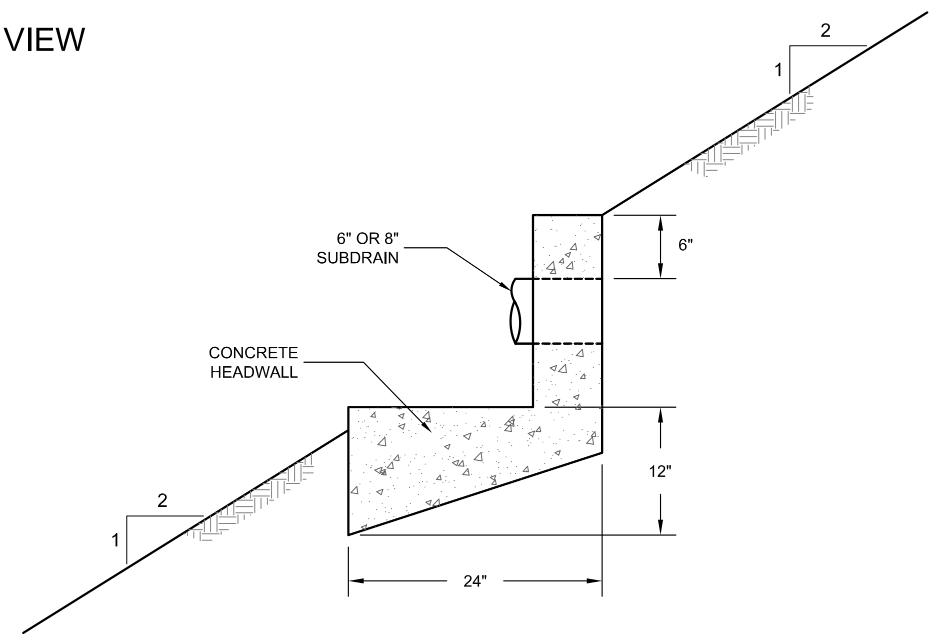
TR / AML		DSK/GTYPD	DATE 01 - 23 - 2015	PROJECT NO. 07339 - 32 - 03	FIG. 9

FRONT VIEW



NO SCALE

SIDE VIEW



NOTE: HEADWALL SHOULD OUTLET AT TOE OF FILL SLOPE
OR INTO CONTROLLED SURFACE DRAINAGE

NO SCALE

TYPICAL SUBDRAIN OUTLET HEADWALL DETAIL

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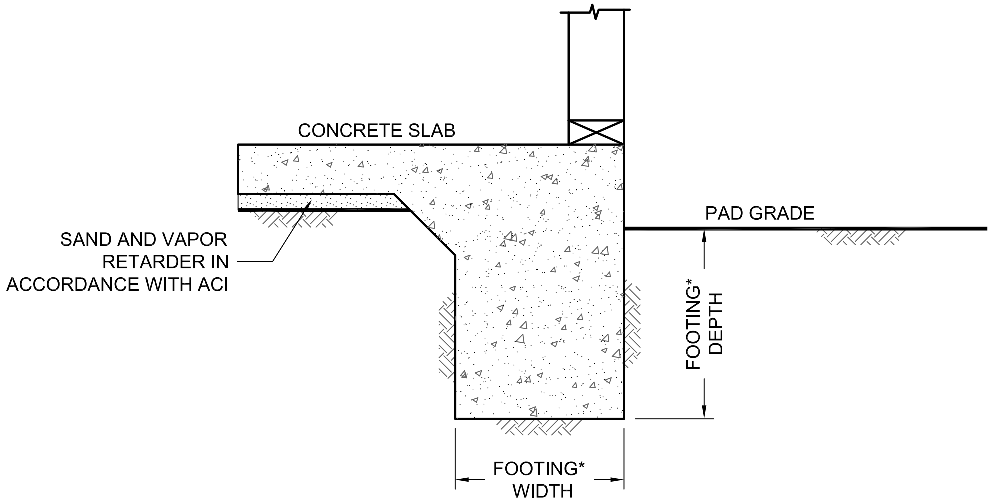
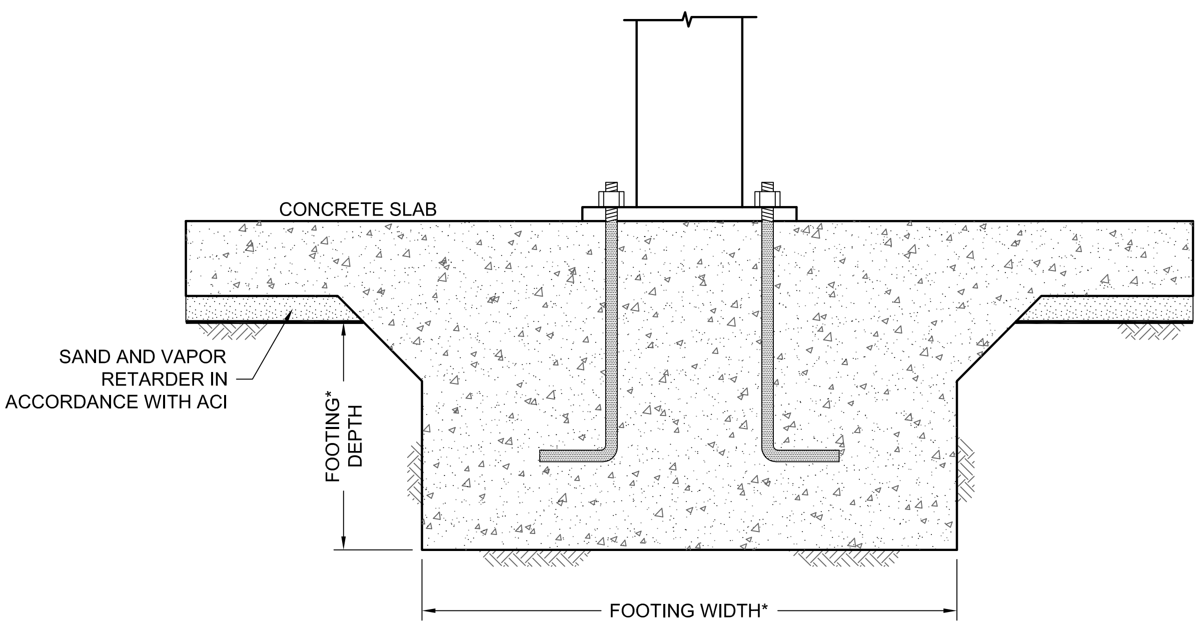
HERITAGE BLUFFS II
SAN DIEGO, CALIFORNIA

TR / AML		DSK/GTYPD	DATE 01 - 23 - 2015	PROJECT NO. 07339 - 32 - 03	FIG. 10

Plotted:01/20/2015 9:57AM | By:ALVIN LADRILLONO | File Location:Y:\PROJECTS\07339-32-03 (Heritage bluffs II)\DETAILS\Subdrain Headwall Detail (SOHD).dwg





*....SEE REPORT FOR FOUNDATION WIDTH AND DEPTH RECOMMENDATION

NO SCALE

WALL / COLUMN FOOTING DIMENSION DETAIL

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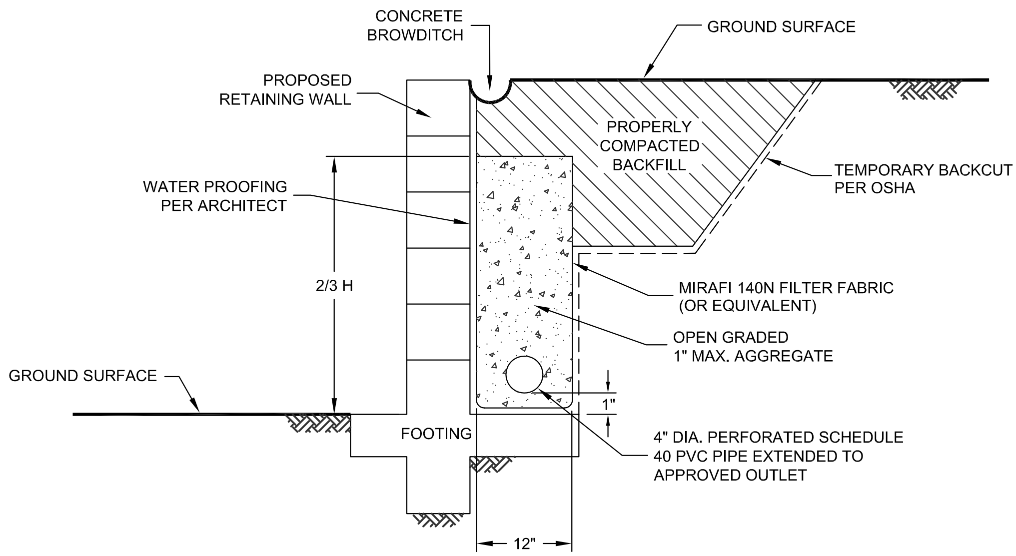
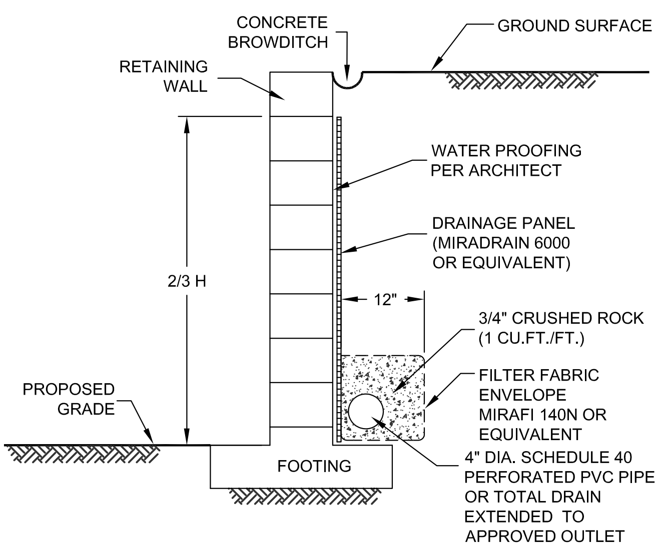
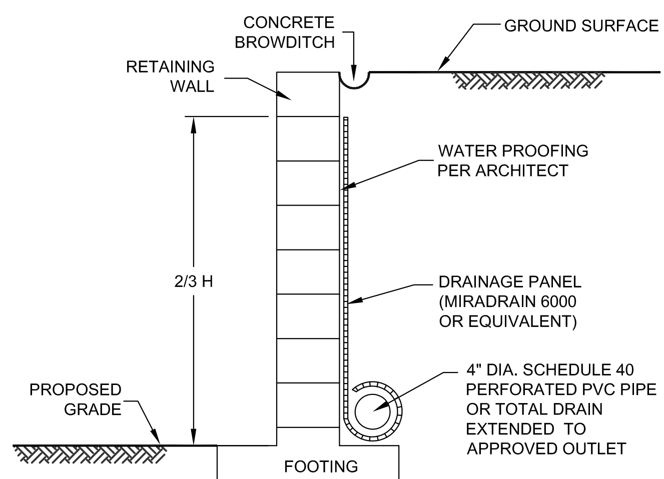
TR / AML		DSK/GTYPD	DATE 01 - 23 - 2015	PROJECT NO. 07339 - 32 - 03	FIG. 11







NOTE :

DRAIN SHOULD BE UNIFORMLY SLOPED TO GRAVITY OUTLET
OR TO A SUMP WHERE WATER CAN BE REMOVED BY PUMPING

NO SCALE

TYPICAL RETAINING WALL DRAIN DETAIL

GEOCON INCORPORATED

GEOTECHNICAL ■ ENVIRONMENTAL ■ MATERIALS
6960 FLANDERS DRIVE - SAN DIEGO, CALIFORNIA 92121 - 2974
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HERITAGE BLUFFS II
SAN DIEGO, CALIFORNIA

TR / AML		DSK/GTYPD	DATE 01 - 23 - 2015	PROJECT NO. 07339 - 32 - 03	FIG. 12

Plotted:01/20/2015 9:56AM | By:ALVIN LADRILLONO | File Location:Y:\PROJECTS\07339-32-03 (Heritage bluffs II)\DETAILS\Typical Retaining Wall Drainage Detail (RWDD7A).dwg

APPENDIX A

APPENDIX A

FIELD INVESTIGATION

Three field studies were performed on the site in July 2004, April 2008 and January 2015 that collectively consisted of a site reconnaissance, excavation of thirty nine exploratory trenches, twenty air track borings, and sixteen seismic traverses. The approximate locations of the subsurface information are shown on the *Geologic Map*, Figure 2.

Exploratory trenches T-1 through T-21 were advanced using a Caterpillar 345B track hoe, trenches T-22 through T-33 were excavated with a John Deere 555 track hoe, and trenches T-34 through T-39 were hand dug. The soils encountered were visually examined, classified and logged. Logs of the trenches depicting the soil and geologic conditions encountered are presented on Figures A-1 through A-39.

Twenty air-track borings were performed using an Ingersoll Rand ECM-370 with a 4-inch bit to evaluate the rock rippability of the underlying formational material. The penetration rates were recorded every foot in seconds using a stop watch as the drill bit was advanced through the subsurface. The air-track boring logs are presented as Figures A-40 through A-59.

The 100-foot-long seismic lines S-1 through S-10 were conducted with a Nimbus Geometrics 1570B-model, 2-channel seismograph unit in both a forward and reverse direction. The results of these seismic traverses are summarized on Table A-I. The six seismic traverses S-11 through S-16 performed by Southwest Geophysics is discussed in greater detail in their report presented in Appendix C.

TABLE A-I
SUMMARY OF SEISMIC TRAVERSE DATA FOR S-1 THROUGH S-10

Seismic Traverse No.	Average Velocity (ft./sec.)			Average Depth (feet)			Length of Traverse (feet)	Approximate Maximum Depth Explored (feet)
	V_1	V_2	V_3	D_1	D_2	D_3		
S-1	1500	3800	6200	4	9	>30	100	30
S-2	2300	4700	-	2	>30	-	100	30
S-3	2100	6200	-	5	>30	-	100	30
S-4	1700	6300	-	5	>30	-	100	30
S-5	1600	5100	-	2	>30	-	100	30
S-6	1400	1800	5900	1	9	>30	100	30
S-7	1300	2600	8900	3	5	>30	100	30
S-8	1400	2700	4500	4	6	>30	100	30
S-9	1700	4700	10400	7	18	>30	100	30
S-10	1500	5200	5900	3	15	>30	100	30

V_1 = Velocity in feet per second of first layer of materials
V_2 = Second layer velocities
V_3 = Third layer velocities
D_1 = Depth in feet to base of first layer
D_2 = Depth to base of second layer
D_3 = Depth to base of third layer

NOTE:

For mass grading, materials with velocities of less than 4500 fps are generally rippable with a D9 Caterpillar Tractor equipped with a single shank hydraulic ripper. Velocities of 4500 to 5500 fps indicate marginal ripping and blasting. Velocities greater than 5500 fps generally require pre-blasting. For trenching, materials with velocities less than 3800 fps are generally rippable depending upon the degree of fracturing and the presence or absence of boulders. Velocities between 3800 and 4300 fps generally indicate marginal ripping, and velocities greater than 4300 fps generally indicate non-rippable conditions. The above velocities are based on a Koehring 505.

The reported velocities represent average velocities over the length of each traverse, and should not generally be used for subsurface interpretation greater than 100 feet from a traverse.

PROJECT NO. 07339-32-03

TRENCH T 1

ELEV. (MSL.) **643'** DATE COMPLETED **07-08-2004**

EQUIPMENT **CAT 345B TRACK HOE** BY: **G. CANNON**

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0–3				CL	**TOPSOIL** Stiff to very stiff, moist, black CLAY			
3–15	T1-1 (10–11, disturbed or bag sample)			CL	**FANGLOMERATE DEPOSIT** Very stiff, moist to wet, olive CLAY			
15–22	T1-2 (17–18, chunk sample)			CL	Very stiff to hard, moist, olive and reddish brown, Gravelly CLAY with subrounded metavolcanic cobble		117.3	12.3
22					TRENCH TERMINATED AT 22 FEET Limit of machine			

Figure A-1,
Log of Trench T 1, Page 1 of 1

07339-32-03.GPJ

SAMPLE SYMBOLS			
	... SAMPLING UNSUCCESSFUL	... STANDARD PENETRATION TEST	... DRIVE SAMPLE (UNDISTURBED)
	... DISTURBED OR BAG SAMPLE	... CHUNK SAMPLE	... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

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PROJECT NO. 07339-32-03

TRENCH T 2

ELEV. (MSL.) 660' DATE COMPLETED 07-08-2004

EQUIPMENT CAT 345B TRACK HOE BY: G. CANNON

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0 – 3				CL	**TOPSOIL** Very stiff, moist, black CLAY			
3 – 18	T2-1 (approx. 5–6 ft)			GC	**FANGLOMERATE DEPOSIT** Dense to very dense, moist, olive, Clayey GRAVEL with subround to subangular metavolcanic cobble			
18					TRENCH TERMINATED AT 18 FEET			

Depth scale: 0, 2, 4, 6, 8, 10, 12, 14, 16, 18

Figure A-2,
Log of Trench T 2, Page 1 of 1

07339-32-03.GPJ

SAMPLE SYMBOLS
- ☐ ... SAMPLING UNSUCCESSFUL
- ⊠ ... DISTURBED OR BAG SAMPLE
- ◧ ... STANDARD PENETRATION TEST
- ◣ ... CHUNK SAMPLE
- ■ ... DRIVE SAMPLE (UNDISTURBED)
- ▼ ... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

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PROJECT NO. 07339-32-03

TRENCH T 3

ELEV. (MSL.) **683'** DATE COMPLETED **07-08-2004**

EQUIPMENT **CAT 345B TRACK HOE** BY: **G. CANNON**

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0 – 2				CL	**TOPSOIL** Very stiff, moist, black CLAY			
2 – 18	T3-1 (at 4)			GC/GM	**FANGLOMERATE DEPOSIT** Dense, moist, olive and reddish brown, Clayey/Sandy GRAVEL with subround to angular metavolcanic cobble -Very dense at 14 feet			
18 – 22				CL	Very stiff, moist, olive CLAY			
22					TRENCH TERMINATED AT 22 FEET Limit of machine			

Figure A-3,
Log of Trench T 3, Page 1 of 1

07339-32-03.GPJ

SAMPLE SYMBOLS
- ☐ ... SAMPLING UNSUCCESSFUL
- ... STANDARD PENETRATION TEST
- ... DRIVE SAMPLE (UNDISTURBED)
- ... DISTURBED OR BAG SAMPLE
- ... CHUNK SAMPLE
- ... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

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PROJECT NO. 07339-32-03

TRENCH T 4

ELEV. (MSL.) **697'** DATE COMPLETED **07-08-2004**

EQUIPMENT **CAT 345B TRACK HOE** BY: **G. CANNON**

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0				CL	**TOPSOIL** Stiff to very stiff, moist, dark brown, Gravelly CLAY			
2					**FANGLOMERATE DEPOSIT** Very dense, moist, olive and reddish brown, Clayey GRAVEL with subround to angular metavolcanic cobble and boulders (2.5 feet in diameter)			
4	T4-1							
6				GC				
8								
10								
12								
14					Very stiff to hard, moist, olive, Gravelly CLAY			
16	T4-2			CL				
	T4-3					1	119.4	17.3
18					-4.5 foot diameter boulder at 18 feet			
20								
					TRENCH TERMINATED AT 21 FEET Limit of machine			

Figure A-4,
Log of Trench T 4, Page 1 of 1

07339-32-03.GPJ

SAMPLE SYMBOLS			
	... SAMPLING UNSUCCESSFUL	... STANDARD PENETRATION TEST	... DRIVE SAMPLE (UNDISTURBED)
	... DISTURBED OR BAG SAMPLE	... CHUNK SAMPLE	... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

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PROJECT NO. 07339-32-03

TRENCH T 5

ELEV. (MSL.) **705'** DATE COMPLETED **07-08-2004**

EQUIPMENT **CAT 345B TRACK HOE** BY: **G. CANNON**

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0				CL	**TOPSOIL** Very stiff, moist, brown, fine, Sandy CLAY with trace cobbles and boulders			
2					**SANTIAGO PEAK VOLCANICS** Moderately to highly weathered, highly fractured METAVOLCANIC ROCK (excavates to clayey gravel with cobble and boulders)			
4								
6	T5-1							
8								
10								
12								
14					-Less weathered and fractured below 14 feet, difficult to excavate			
16					REFUSAL AT 16 FEET			

Figure A-5,
Log of Trench T 5, Page 1 of 1

07339-32-03.GPJ

SAMPLE SYMBOLS

- ... SAMPLING UNSUCCESSFUL
- ... STANDARD PENETRATION TEST
- ... DRIVE SAMPLE (UNDISTURBED)
- ... DISTURBED OR BAG SAMPLE
- ... CHUNK SAMPLE
- ... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

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TRENCH T 6

ELEV. (MSL.) 704' DATE COMPLETED 07-08-2004

EQUIPMENT CAT 345B TRACK HOE BY: G. CANNON

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0				CL	**TOPSOIL** Stiff, moist, brown, very fine, Sandy CLAY			
2					**SANTIAGO PEAK VOLCANICS** Completely weathered, yellowish brown, weak, METAVOLCANIC ROCK; (Saprolite) -Becomes moderately to highly weathered and highly fractured below 3 feet; excavates as yellowish brown, clayey gravel with cobble			
4								
6					-Becomes moderately weathered with less fracturing below 6 feet			
8					-Very difficult to excavate below 8 feet			
10					REFUSAL AT 10 FEET			

Figure A-6,
Log of Trench T 6, Page 1 of 1

07339-32-03.GPJ

SAMPLE SYMBOLS			
	... SAMPLING UNSUCCESSFUL	... STANDARD PENETRATION TEST	... DRIVE SAMPLE (UNDISTURBED)
	... DISTURBED OR BAG SAMPLE	... CHUNK SAMPLE	... WATER TABLE OR SEEPAGE

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PROJECT NO. 07339-32-03

TRENCH T 7

ELEV. (MSL.) **688** DATE COMPLETED **07-08-2004**

EQUIPMENT **CAT 345B TRACK HOE** BY: **G. CANNON**

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0					**ALLUVIUM** Stiff, moist, dark brown, very fine, Sandy CLAY			
	T7-1							
2	T7-2			CL			110.7	14.7
4								
					SANTIAGO PEAK VOLCANICS Completely weathered, yellow-brown, weak METAVOLCANIC ROCK (Saprolite)			
6	T7-3							
	T7-4							
8								
10					-Becomes highly to moderately weathered and highly fractured below 10 feet			
12								
					TRENCH TERMINATED AT 13 FEET			

Figure A-7,
Log of Trench T 7, Page 1 of 1

07339-32-03.GPJ

SAMPLE SYMBOLS			
	... SAMPLING UNSUCCESSFUL	... STANDARD PENETRATION TEST	... DRIVE SAMPLE (UNDISTURBED)
	... DISTURBED OR BAG SAMPLE	... CHUNK SAMPLE	... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

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PROJECT NO. 07339-32-03

TRENCH T 8

ELEV. (MSL.) **701'** DATE COMPLETED **07-08-2004**

EQUIPMENT **CAT 345B TRACK HOE** BY: **G. CANNON**

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0				CL	**TOPSOIL** Stiff, moist, dark brown CLAY with trace gravel			
2					**SANTIAGO PEAK VOLCANICS** Moderately to slightly weathered, highly fractured METAVOLCANIC ROCK			
4					REFUSAL AT 4 FEET			

Figure A-8,
Log of Trench T 8, Page 1 of 1

07339-32-03.GPJ

SAMPLE SYMBOLS			
	... SAMPLING UNSUCCESSFUL	... STANDARD PENETRATION TEST	... DRIVE SAMPLE (UNDISTURBED)
	... DISTURBED OR BAG SAMPLE	... CHUNK SAMPLE	... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

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PROJECT NO. 07339-32-03

TRENCH T 9

ELEV. (MSL.) **656'** DATE COMPLETED **07-08-2004**

EQUIPMENT **CAT 345B TRACK HOE** BY: **G. CANNON**

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0					**COLLUVIUM** Stiff, moist, black CLAY with gravel			
2	T9-1			CL				
4				CL	Stiff to very stiff, moist to wet, olive, Silty CLAY			
6					**SANTIAGO PEAK VOLCANICS** Completely weathered, olive, weak METAVOLCANIC ROCK; (Saprolite)			
8	T9-2							
10								
12					TRENCH TERMINATED AT 12 FEET			

Figure A-9,
Log of Trench T 9, Page 1 of 1

07339-32-03.GPJ

SAMPLE SYMBOLS			
	... SAMPLING UNSUCCESSFUL	... STANDARD PENETRATION TEST	... DRIVE SAMPLE (UNDISTURBED)
	... DISTURBED OR BAG SAMPLE	... CHUNK SAMPLE	... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

GEOCON

PROJECT NO. 07339-32-03

TRENCH T 10

ELEV. (MSL.) 670' DATE COMPLETED 07-08-2004

EQUIPMENT CAT 345B TRACK HOE BY: G. CANNON

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0					**COLLUVIUM** Medium dense, damp to moist, reddish brown, Silty SAND with angular gravel and cobble			
2								
4								
	T10-1			SM				
6								
8								
10								
12					**SANTIAGO PEAK VOLCANICS** Highly to moderately weathered, highly fractured METAVOLCANIC ROCK			
14					TRENCH TERMINATED AT 14 FEET			

Figure A-10,
Log of Trench T 10, Page 1 of 1

07339-32-03.GPJ

SAMPLE SYMBOLS
- ... SAMPLING UNSUCCESSFUL
- ... STANDARD PENETRATION TEST
- ... DRIVE SAMPLE (UNDISTURBED)
- ... DISTURBED OR BAG SAMPLE
- ... CHUNK SAMPLE
- ... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

GEOCON

TRENCH T 11

ELEV. (MSL.) **682'** DATE COMPLETED **07-08-2004**

EQUIPMENT **CAT 345B TRACK HOE** BY: **G. CANNON**

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0					**COLLUVIUM** Medium dense, damp to moist, reddish brown, Silty, fine to coarse SAND with clay and gravel			
2				SM				
4								
6					**SANTIAGO PEAK VOLCANICS** Completely weathered, dark olive, weak METAVOLCANIC ROCK; (Saprolite); with shinny parting surfaces			
8	T11-1							
10					-Becomes highly weathered and highly fractured below 10 feet			
12								
	T11-2							
14								
					-Very difficult digging			
16					PRACTICAL REFUSAL AT 16 FEET			

Figure A-11,
Log of Trench T 11, Page 1 of 1

07339-32-03.GPJ

SAMPLE SYMBOLS

- ... SAMPLING UNSUCCESSFUL
- ... STANDARD PENETRATION TEST
- ... DRIVE SAMPLE (UNDISTURBED)
- ... DISTURBED OR BAG SAMPLE
- ... CHUNK SAMPLE
- ... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

GEOCON

TRENCH T 12

ELEV. (MSL.) 723' DATE COMPLETED 07-08-2004

EQUIPMENT CAT 345B TRACK HOE BY: G. CANNON

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0					**SANTIAGO PEAK VOLCANICS** Moderately to slightly weathered, moderately fractured METAVOLCANIC ROCK			
2								
4					REFUSAL AT 4 FEET			

Figure A-12,
Log of Trench T 12, Page 1 of 1

07339-32-03.GPJ

SAMPLE SYMBOLS			
	... SAMPLING UNSUCCESSFUL	... STANDARD PENETRATION TEST	... DRIVE SAMPLE (UNDISTURBED)
	... DISTURBED OR BAG SAMPLE	... CHUNK SAMPLE	... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

GEOCON

TRENCH T 13

ELEV. (MSL.) **750'** DATE COMPLETED **07-08-2004**

EQUIPMENT **CAT 345B TRACK HOE** BY: **G. CANNON**

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0 – 5					**SANTIAGO PEAK VOLCANICS** Moderately to slightly weathered, dark gray, highly fractured METAVOLCANIC ROCK			
					REFUSAL AT 5 FEET			

Figure A-13,
Log of Trench T 13, Page 1 of 1

07339-32-03.GPJ

SAMPLE SYMBOLS			
	... SAMPLING UNSUCCESSFUL	... STANDARD PENETRATION TEST	... DRIVE SAMPLE (UNDISTURBED)
	... DISTURBED OR BAG SAMPLE	... CHUNK SAMPLE	... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

GEOCON

PROJECT NO. 07339-32-03

TRENCH T 14

ELEV. (MSL.) 736' DATE COMPLETED 07-08-2004

EQUIPMENT CAT 345B TRACK HOE BY: G. CANNON

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0				SM	**TOPSOIL** Medium dense, damp, reddish brown, Silty, fine SAND; numerous chips of highly weathered metavolcanic rock			
2	T14-1							
	T14-2				**SANTIAGO PEAK VOLCANICS** Highly to moderately weathered, dark gray, highly fractured METAVOLCANIC ROCK; becomes less weathered with depth		111.5	6.3
4								
6								
8								
10					REFUSAL AT 10 FEET			

Figure A-14,
Log of Trench T 14, Page 1 of 1

07339-32-03.GPJ

SAMPLE SYMBOLS
- ... SAMPLING UNSUCCESSFUL
- ... STANDARD PENETRATION TEST
- ... DRIVE SAMPLE (UNDISTURBED)
- ... DISTURBED OR BAG SAMPLE
- ... CHUNK SAMPLE
- ... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

PROJECT NO. 07339-32-03

TRENCH T 15

ELEV. (MSL.) **735'** DATE COMPLETED **07-08-2004**

EQUIPMENT **CAT 345B TRACK HOE** BY: **G. CANNON**

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0					**TOPSOIL** Very stiff, moist to very moist, reddish brown, Sandy CLAY with gravel			
2	T15-1			CL				
	T15-2						102.3	22.0
4					**SANTIAGO PEAK VOLCANICS** Highly to moderately weathered, dark gray, highly fractured METAVOLCANIC ROCK; becomes less weathered with depth			
6								
	T15-3							
8								
10								
12					REFUSAL AT 12 FEET			

Figure A-15,
Log of Trench T 15, Page 1 of 1

07339-32-03.GPJ

SAMPLE SYMBOLS

- ... SAMPLING UNSUCCESSFUL
- ... DISTURBED OR BAG SAMPLE
- ... STANDARD PENETRATION TEST
- ... CHUNK SAMPLE
- ... DRIVE SAMPLE (UNDISTURBED)
- ... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

GEOCON

TRENCH T 16

ELEV. (MSL.) **696'** DATE COMPLETED **07-08-2004**

EQUIPMENT **CAT 345B TRACK HOE** BY: **G. CANNON**

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0					**TOPSOIL** Very stiff to hard, moist to very moist, dark brown CLAY with caliche pockets			
2	T16-1			CL				
	T16-2						96.9	23.5
4					-Gradational contact			
					SANTIAGO PEAK VOLCANICS Completely weathered, olive and maroon oxidation, weak METAVOLCANIC ROCK; (Saprolite)			
6								
8								
10					-Becomes highly to moderately weathered and highly fractured at 10 feet			
					REFUSAL AT 11 FEET			

Figure A-16,
Log of Trench T 16, Page 1 of 1

07339-32-03.GPJ

SAMPLE SYMBOLS
... SAMPLING UNSUCCESSFUL
... STANDARD PENETRATION TEST
... DRIVE SAMPLE (UNDISTURBED)
... DISTURBED OR BAG SAMPLE
... CHUNK SAMPLE
... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

GEOCON

PROJECT NO. 07339-32-03

TRENCH T 17

ELEV. (MSL.) **679'** DATE COMPLETED **07-08-2004**

EQUIPMENT **CAT 345B TRACK HOE** BY: **G. CANNON**

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0	T17-1			CL	**TOPSOIL** Stiff to very stiff, moist to very moist, dark brown, very fine, Sandy CLAY			
2					-Gradational contact with caliche pods			
4					**SANTIAGO PEAK VOLCANICS** Completely to moderately weathered, dark gray, highly fractured METAVOLCANIC ROCK			
6								
					TRENCH TERMINATED AT 7 FEET			

Figure A-17,
Log of Trench T 17, Page 1 of 1

07339-32-03.GPJ

SAMPLE SYMBOLS			
	... SAMPLING UNSUCCESSFUL	... STANDARD PENETRATION TEST	... DRIVE SAMPLE (UNDISTURBED)
	... DISTURBED OR BAG SAMPLE	... CHUNK SAMPLE	... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

GEOCON

TRENCH T 18

ELEV. (MSL.) 669' DATE COMPLETED 07-08-2004

EQUIPMENT CAT 345B TRACK HOE BY: G. CANNON

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0					**COLLUVIUM** Very stiff to hard, moist to very moist, dark brown to black CLAY with trace gravel			
2	T18-1			CL				
4					-Becomes olive below 4 feet			
6					**SANTIAGO PEAK VOLCANICS** Completely to moderately weathered, gray, highly fractured METAVOLCANIC ROCK with veins of white caliche			
8								
10					TRENCH TERMINATED AT 10 FEET			

Figure A-18,
Log of Trench T 18, Page 1 of 1

07339-32-03.GPJ

SAMPLE SYMBOLS		
... SAMPLING UNSUCCESSFUL	... STANDARD PENETRATION TEST	... DRIVE SAMPLE (UNDISTURBED)
... DISTURBED OR BAG SAMPLE	... CHUNK SAMPLE	... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

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TRENCH T 19

ELEV. (MSL.) 680' DATE COMPLETED 07-08-2004

EQUIPMENT CAT 345B TRACK HOE BY: G. CANNON

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0 – 3				CL	**TOPSOIL** Very stiff, moist, dark brown to black, Silty CLAY with gravel			
3 – 14				GC	**FANGLOMERATE DEPOSIT** Very dense, moist, mottled olive, reddish brown and black, Clayey GRAVEL with angular cobble, boulders and abundant caliche			
14					TRENCH TERMINATED AT 14 FEET			

Figure A-19,
Log of Trench T 19, Page 1 of 1

07339-32-03.GPJ

SAMPLE SYMBOLS
- ... SAMPLING UNSUCCESSFUL
- ... STANDARD PENETRATION TEST
- ... DRIVE SAMPLE (UNDISTURBED)
- ... DISTURBED OR BAG SAMPLE
- ... CHUNK SAMPLE
- ... WATER TABLE OR SEEPAGE

PROJECT NO. 07339-32-03

TRENCH T 20

ELEV. (MSL.) **667'** DATE COMPLETED **07-08-2004**

EQUIPMENT **CAT 345B TRACK HOE** BY: **G. CANNON**

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0 – 2				CL	**TOPSOIL** Very stiff, moist, dark brown to black CLAY with gravel			
2 – 8				GC	**FANGLOMERATE DEPOSIT** Very dense, moist, mottled olive and reddish brown, Clayey GRAVEL with angular cobble and boulders			
8					REFUSAL AT 8 FEET			

Figure A-20,
Log of Trench T 20, Page 1 of 1

07339-32-03.GPJ

SAMPLE SYMBOLS
- ... SAMPLING UNSUCCESSFUL
- ... STANDARD PENETRATION TEST
- ... DRIVE SAMPLE (UNDISTURBED)
- ... DISTURBED OR BAG SAMPLE
- ... CHUNK SAMPLE
- ... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

GEOCON

PROJECT NO. 07339-32-03

TRENCH T 21

ELEV. (MSL.) **664'** DATE COMPLETED **07-08-2004**

EQUIPMENT **CAT 345B TRACK HOE** BY: **G. CANNON**

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0					**TOPSOIL** Very stiff, moist, dark brown to black CLAY with gravel			
2				CL				
4								
	T21-1				**SANTIAGO PEAK VOLCANICS** Completely weathered, light olive and orange-brown, weak METAVOLCANIC ROCK with caliche (Saprolite)			
6	T21-2						98.6	18.3
8								
10								
12								
					-Very hard digging			
14					TRENCH TERMINATED AT 14 FEET			

Figure A-21,
Log of Trench T 21, Page 1 of 1

07339-32-03.GPJ

SAMPLE SYMBOLS
- ... SAMPLING UNSUCCESSFUL
- ... STANDARD PENETRATION TEST
- ... DRIVE SAMPLE (UNDISTURBED)
- ... DISTURBED OR BAG SAMPLE
- ... CHUNK SAMPLE
- ... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

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TRENCH T 22

ELEV. (MSL.) **585'** DATE COMPLETED **01-06-2015**

EQUIPMENT **JD TRACKHOE** BY: **T. REIST**

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0 – 3				CL	**TOPSOIL** Stiff, moist, dark brown, Silty/Sandy CLAY			
3 – 6				CL	**FANGLOMERATE DEPOSIT** Hard, moist, mottled brown, dark brown and gray, Silty/Sandy CLAY with 10-15% gravel, cobble, and boulder size rock fragments up to 3 feet			
6					REFUSAL AT 6 FEET DUE TO BOULDER			

Figure A-22,
Log of Trench T 22, Page 1 of 1

07339-32-03.GPJ

SAMPLE SYMBOLS
- ... SAMPLING UNSUCCESSFUL
- ... STANDARD PENETRATION TEST
- ... DRIVE SAMPLE (UNDISTURBED)
- ... DISTURBED OR BAG SAMPLE
- ... CHUNK SAMPLE
- ... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

PROJECT NO. 07339-32-03

TRENCH T 23

ELEV. (MSL.) 766' DATE COMPLETED 01-06-2015

EQUIPMENT JD TRACKHOE BY: T. REIST

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0 – 2.5				CL	**TOPSOIL** Stiff, damp, dark brown, Silty/Sandy CLAY			
2.5 – 6					**SANTIAGO PEAK VOLCANICS** Highly to moderately weathered, gray with red oxidation, moderately weak to moderately strong METAVOLCANIC ROCK -Becomes moderately weathered and moderately strong below 5 feet			
6					TRENCH TERMINATED AT 6 FEET			

Figure A-23,
Log of Trench T 23, Page 1 of 1

07339-32-03.GPJ

SAMPLE SYMBOLS
- ... SAMPLING UNSUCCESSFUL
- ... STANDARD PENETRATION TEST
- ... DRIVE SAMPLE (UNDISTURBED)
- ... DISTURBED OR BAG SAMPLE
- ... CHUNK SAMPLE
- ... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

GEOCON

PROJECT NO. 07339-32-03

TRENCH T 24

ELEV. (MSL.) 653' DATE COMPLETED 01-06-2015

EQUIPMENT JD TRACKHOE BY: T. REIST

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0				CL	**COLLUVIUM** Stiff, moist, dark brown, Silty/Sandy CLAY			
2								
				CL	Very stiff, moist, gray-brown, CLAY			
4								
6				CL	**FANGLOMERATE DEPOSIT** Dense to very dense, damp, light brown, Silty/Sandy CLAY with 5-10% gravel, cobble, and boulder size rock fragments up to 24-inches			
8					PRACTICAL REFUSAL AT 8 FEET ON BOULDERS			

Figure A-24,
Log of Trench T 24, Page 1 of 1

07339-32-03.GPJ

SAMPLE SYMBOLS

- ... SAMPLING UNSUCCESSFUL
- ... STANDARD PENETRATION TEST
- ... DRIVE SAMPLE (UNDISTURBED)
- ... DISTURBED OR BAG SAMPLE
- ... CHUNK SAMPLE
- ... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

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PROJECT NO. 07339-32-03

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	TRENCH T 25 ELEV. (MSL.) 632' DATE COMPLETED 01-06-2015 EQUIPMENT JD TRACKHOE BY: T. REIST	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
					MATERIAL DESCRIPTION			
0				CL	**TOPSOIL** Soft, moist, dark brown, Sandy CLAY			
2					**SANTIAGO PEAK VOLCANICS** Moderately weathered, light gray, moderately weak to moderately strong METAVOLCANIC ROCK			
					TRENCH TERMINATED AT 3 FEET			

Figure A-25,
Log of Trench T 25, Page 1 of 1

07339-32-03.GPJ

SAMPLE SYMBOLS			
	... SAMPLING UNSUCCESSFUL	... STANDARD PENETRATION TEST	... DRIVE SAMPLE (UNDISTURBED)
	... DISTURBED OR BAG SAMPLE	... CHUNK SAMPLE	... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

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PROJECT NO. 07339-32-03

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	TRENCH T 26 ELEV. (MSL.) 655' DATE COMPLETED 01-06-2015 EQUIPMENT JD TRACKHOE BY: T. REIST	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
					MATERIAL DESCRIPTION			
0				CL	**TOPSOIL** Stiff, moist, dark brown to reddish brown, Sandy CLAY			
2					**SANTIAGO PEAK VOLCANICS** Moderately weathered, dark gray and light gray, moderately strong METAVOLCANIC ROCK			
					PRACTICAL REFUSAL AT 3 FEET			

Figure A-26,
Log of Trench T 26, Page 1 of 1

07339-32-03.GPJ

SAMPLE SYMBOLS			
	... SAMPLING UNSUCCESSFUL	... STANDARD PENETRATION TEST	... DRIVE SAMPLE (UNDISTURBED)
	... DISTURBED OR BAG SAMPLE	... CHUNK SAMPLE	... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

GEOCON

PROJECT NO. 07339-32-03

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	TRENCH T 27 ELEV. (MSL.) 720' DATE COMPLETED 01-06-2015 EQUIPMENT JD TRACKHOE BY: T. REIST	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
					MATERIAL DESCRIPTION			
0				CL	**ALLUVIUM** Stiff, moist, dark brown, Sandy CLAY with 10% boulder size rock fragments up to 10-inches			
2								
					SANTIAGO PEAK VOLCANICS Slightly weathered, dark gray, strong to very strong METAVOLCANIC ROCK			
					REFUSAL AT 3.5 FEET			

Figure A-27,
Log of Trench T 27, Page 1 of 1

07339-32-03.GPJ

SAMPLE SYMBOLS	... SAMPLING UNSUCCESSFUL	... STANDARD PENETRATION TEST	... DRIVE SAMPLE (UNDISTURBED)
	... DISTURBED OR BAG SAMPLE	... CHUNK SAMPLE	... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

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PROJECT NO. 07339-32-03

TRENCH T 28

ELEV. (MSL.) 680' DATE COMPLETED 01-06-2015

EQUIPMENT JD TRACKHOE BY: T. REIST

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0				CL	**TOPSOIL** Stiff, moist, dark brown, Sandy CLAY			
2								
					SANTIAGO PEAK VOLCANICS Moderately weathered, gray, moderately strong METAVOLCANIC ROCK			
4								
6					-Becomes strong below 6 feet			
					PRACTICAL REFUSAL AT 7 FEET			

Figure A-28,
Log of Trench T 28, Page 1 of 1

07339-32-03.GPJ

SAMPLE SYMBOLS			
	... SAMPLING UNSUCCESSFUL	... STANDARD PENETRATION TEST	... DRIVE SAMPLE (UNDISTURBED)
	... DISTURBED OR BAG SAMPLE	... CHUNK SAMPLE	... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

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DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	TRENCH T 29 ELEV. (MSL.) 704' DATE COMPLETED 01-06-2015 EQUIPMENT JD TRACKHOE BY: T. REIST	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
					MATERIAL DESCRIPTION			
0				CL	**TOPSOIL** Stiff, moist, dark brown to brown, Silty/Sandy CLAY			
2					**SANTIAGO PEAK VOLCANICS** Slightly weathered, gray, strong METAVOLCANIC ROCK			
					REFUSAL AT 3 FEET			

Figure A-29,
Log of Trench T 29, Page 1 of 1

07339-32-03.GPJ

SAMPLE SYMBOLS			
	... SAMPLING UNSUCCESSFUL	... STANDARD PENETRATION TEST	... DRIVE SAMPLE (UNDISTURBED)
	... DISTURBED OR BAG SAMPLE	... CHUNK SAMPLE	... WATER TABLE OR SEEPAGE

PROJECT NO. 07339-32-03

TRENCH T 30

ELEV. (MSL.) 666' DATE COMPLETED 01-06-2015

EQUIPMENT JD TRACKHOE BY: T. REIST

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0				SM/SC	**ALLUVIUM** Loose, damp, very dark brown, Silty/Clayey, fine to medium SAND			
2				GM	Loose, damp, dark gray, Silty/Sandy GRAVEL with 50-60% cobble and boulder size rock fragments up to 14-inches			
4					**SANTIAGO PEAK VOLCANICS** Moderately weathered, light brown to gray, moderately strong to strong METAVOLCANIC ROCK			
					TRENCH TERMINATED AT 5 FEET			

Figure A-30,
Log of Trench T 30, Page 1 of 1

07339-32-03.GPJ

SAMPLE SYMBOLS
- ... SAMPLING UNSUCCESSFUL
- ... STANDARD PENETRATION TEST
- ... DRIVE SAMPLE (UNDISTURBED)
- ... DISTURBED OR BAG SAMPLE
- ... CHUNK SAMPLE
- ... WATER TABLE OR SEEPAGE

PROJECT NO. 07339-32-03

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	TRENCH T 31 ELEV. (MSL.) 702' DATE COMPLETED 01-06-2015 EQUIPMENT JD TRACKHOE BY: T. REIST	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
					MATERIAL DESCRIPTION			
0				CL	**TOPSOIL** Stiff, moist, brown, Silty/Sandy CLAY			
2					**SANTIAGO PEAK VOLCANICS** Slightly weathered, gray, very strong METAVOLCANIC ROCK			
					REFUSAL AT 2.5 FEET			

Figure A-31,
Log of Trench T 31, Page 1 of 1

07339-32-03.GPJ

SAMPLE SYMBOLS			
	... SAMPLING UNSUCCESSFUL	... STANDARD PENETRATION TEST	... DRIVE SAMPLE (UNDISTURBED)
	... DISTURBED OR BAG SAMPLE	... CHUNK SAMPLE	... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

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TRENCH T 32

ELEV. (MSL.) **702'** DATE COMPLETED **01-06-2015**

EQUIPMENT **JD TRACKHOE** BY: **T. REIST**

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0				SM/SC	**ALLUVIUM** Loose, damp, brown, Silty/Clayey, fine to medium SAND			
2					**SANTIAGO PEAK VOLCANICS** Slightly weathered gray, strong METAVOLCANIC ROCK			
					PRACTICAL REFUSAL AT 3 FEET			

Figure A-32,
Log of Trench T 32, Page 1 of 1

07339-32-03.GPJ

SAMPLE SYMBOLS			
	... SAMPLING UNSUCCESSFUL	... STANDARD PENETRATION TEST	... DRIVE SAMPLE (UNDISTURBED)
	... DISTURBED OR BAG SAMPLE	... CHUNK SAMPLE	... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

TRENCH T 33

ELEV. (MSL.) 727' DATE COMPLETED 01-06-2015

EQUIPMENT JD TRACKHOE BY: T. REIST

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0				SM/SC	**ALLUVIUM** Loose, damp, dark brown, Silty/Clayey, fine to medium SAND			
2								
4					**SANTIAGO PEAK VOLCANICS** Slightly weathered, light gray, moderately strong to strong METAVOLCANIC ROCK			
6					TRENCH TERMINATED AT 6 FEET			

Figure A-33,
Log of Trench T 33, Page 1 of 1

07339-32-03.GPJ

SAMPLE SYMBOLS			
	... SAMPLING UNSUCCESSFUL	... STANDARD PENETRATION TEST	... DRIVE SAMPLE (UNDISTURBED)
	... DISTURBED OR BAG SAMPLE	... CHUNK SAMPLE	... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

GEOCON

PROJECT NO. 07339-32-03

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	TRENCH T 34 ELEV. (MSL.) 783' DATE COMPLETED 04-15-2008 EQUIPMENT HAND EXCAVATED PIT BY: T. REIST	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
					MATERIAL DESCRIPTION			
0				ML	**TOPSOIL** Loose, damp, reddish brown, Gravelly SILT with gravel and rock up to 8 inches			
2					**SANTIAGO PEAK VOLCANICS** Slightly weathered, dark gray to reddish brown, very strong, METAVOLCANIC ROCK; Joint/Fracture (N40E, 80NW)			
					REFUSAL AT 2 FEET			

Figure A-34,
Log of Trench T 34, Page 1 of 1

07339-32-03.GPJ

SAMPLE SYMBOLS			
	... SAMPLING UNSUCCESSFUL	... STANDARD PENETRATION TEST	... DRIVE SAMPLE (UNDISTURBED)
	... DISTURBED OR BAG SAMPLE	... CHUNK SAMPLE	... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

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TRENCH T 35

ELEV. (MSL.) 759' DATE COMPLETED 04-15-2008

EQUIPMENT HAND EXCAVATED PIT BY: T. REIST

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0				ML	**TOPSOIL** Loose, damp, reddish brown, Gravelly SILT with gravel and rock up to 6 inches			
2					**SANTIAGO PEAK VOLCANICS** Moderately weathered, reddish brown, very strong, METAVOLCANIC ROCK; Joint/Fracture (N65E, 56SE)			
					REFUSAL AT 2 FEET			

Figure A-35,
Log of Trench T 35, Page 1 of 1

07339-32-03.GPJ

SAMPLE SYMBOLS			
	☐ ... SAMPLING UNSUCCESSFUL	... STANDARD PENETRATION TEST	... DRIVE SAMPLE (UNDISTURBED)
	☒ ... DISTURBED OR BAG SAMPLE	... CHUNK SAMPLE	▼ ... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

GEOCON

PROJECT NO. 07339-32-03

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	TRENCH T 36 ELEV. (MSL.) **775'** DATE COMPLETED **04-15-2008** EQUIPMENT **HAND EXCAVATED PIT** BY: **T. REIST**	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
					MATERIAL DESCRIPTION			
0				ML	**TOPSOIL** Loose, damp, reddish brown, Gravelly SILT with gravel and rock up to 12 inches			
					SANTIAGO PEAK VOLCANICS Slightly weathered, gray, very strong, METAVOLCANIC ROCK; Joint/Fracture (N50W, 85SW)			
					REFUSAL AT 1.5 FEET			

Figure A-36,
Log of Trench T 36, Page 1 of 1

07339-32-03.GPJ

SAMPLE SYMBOLS			
	☐ ... SAMPLING UNSUCCESSFUL	◧ ... STANDARD PENETRATION TEST	■ ... DRIVE SAMPLE (UNDISTURBED)
	⊠ ... DISTURBED OR BAG SAMPLE	◣ ... CHUNK SAMPLE	▼ ... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

GEOCON

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	TRENCH T 37 ELEV. (MSL.) 765' DATE COMPLETED 04-15-2008 EQUIPMENT HAND EXCAVATED PIT BY: T. REIST	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
					MATERIAL DESCRIPTION			
0				ML	**TOPSOIL** Loose, dry to damp, reddish brown, Gravelly SILT with gravel and rock up to 6 inches			
					SANTIAGO PEAK VOLCANICS Slightly weathered, dark gray to reddish brown, very strong, METAVOLCANIC ROCK			
					REFUSAL AT 1 FOOT			

Figure A-37,
Log of Trench T 37, Page 1 of 1

07339-32-03.GPJ

SAMPLE SYMBOLS			
	... SAMPLING UNSUCCESSFUL	... STANDARD PENETRATION TEST	... DRIVE SAMPLE (UNDISTURBED)
	... DISTURBED OR BAG SAMPLE	... CHUNK SAMPLE	... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

GEOCON

PROJECT NO. 07339-32-03

TRENCH T 38

ELEV. (MSL.) **757'** DATE COMPLETED **04-15-2008**

EQUIPMENT **HAND EXCAVATED PIT** BY: **T. REIST**

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0				ML	**TOPSOIL** Loose, damp, reddish brown, Gravelly SILT with gravel up to 3 inches			
2					**SANTIAGO PEAK VOLCANICS** Moderately weathered, gray to light brown, moderately strong, METAVOLCANIC ROCK			
					REFUSAL AT 2.5 FEET			

Figure A-38,
Log of Trench T 38, Page 1 of 1

07339-32-03.GPJ

SAMPLE SYMBOLS

- ... SAMPLING UNSUCCESSFUL
- ... STANDARD PENETRATION TEST
- ... DRIVE SAMPLE (UNDISTURBED)
- ... DISTURBED OR BAG SAMPLE
- ... CHUNK SAMPLE
- ... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

GEOCON

PROJECT NO. 07339-32-03

TRENCH T 39

ELEV. (MSL.) **741'** DATE COMPLETED **04-15-2008**

EQUIPMENT **HAND EXCAVATED PIT** BY: **T. REIST**

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0				ML	**TOPSOIL** Loose, damp, reddish brown, Gravelly SILT with gravel up to 3 inches			
2					**SANTIAGO PEAK VOLCANICS** Moderately weathered, light brown, moderately strong, METAVOLCANIC ROCK			
					REFUSAL AT 2.5 FEET			

Figure A-39,
Log of Trench T 39, Page 1 of 1

07339-32-03.GPJ

SAMPLE SYMBOLS			
	... SAMPLING UNSUCCESSFUL	... STANDARD PENETRATION TEST	... DRIVE SAMPLE (UNDISTURBED)
	... DISTURBED OR BAG SAMPLE	... CHUNK SAMPLE	... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

GEOCON

APPENDIX B

APPENDIX B

LABORATORY TESTING

Laboratory tests were performed in accordance with generally accepted test methods of the American Society for Testing and Materials (ASTM) or other suggested procedures. Selected soil samples were tested for their in-place dry density, moisture content, maximum dry density and optimum moisture content, gradation, shear strength, pH/resistivity, soluble sulfate content, and expansion index. The results of our laboratory tests are summarized on Tables B-I through B-V and Figure B-1.

The results of our laboratory tests are presented in tabular and graphical forms hereinafter. The in-place density and moisture content is presented on the logs of the exploratory trenches.

TABLE B-I
SUMMARY OF LABORATORY MAXIMUM DRY DENSITY AND OPTIMUM MOISTURE CONTENT TEST RESULTS

Sample No.	Description	Maximum Dry Density (pcf)	Optimum Moisture Content (% dry wt.)
T3-1	Brown, fine to coarse, Sandy GRAVEL with some clay	122.5	13.0
T5-1	Olive brown, fine to coarse, Sandy GRAVEL with some clay	123.0	12.7
T15-3	Dark brown, fine to coarse, Sandy GRAVEL	127.0	11.3

TABLE B-II
SUMMARY OF LABORATORY EXPANSION INDEX TEST RESULTS

Sample No.	Moisture Content (%)		Dry Density (pcf)	Expansion Index
	Before Test	After Test		
T3-1	11.4	24.6	103.0	37
T5-1	13.8	30.3	100.9	67
T9-1	12.5	33.8	97.9	95
T15-3	10.9	21.4	102.6	6
T17-1	14.4	39.1	94.1	135

TABLE B-III
SUMMARY OF LABORATORY DIRECT SHEAR TEST RESULTS

Sample No.	Dry Density (pcf)	Moisture Content (%)	Unit Cohesion (psf)	Angle of Shear Resistance (degrees)
T3-1	109.1	14.2	460	44
T5-1	108.8	14.7	505	36
T15-3	114.0	11.7	735	43

Samples remolded to approximately 90 percent of maximum dry density at near optimum moisture content.

TABLE B-IV
SUMMARY OF LABORATORY WATER-SOLUBLE SULFATE TEST RESULTS

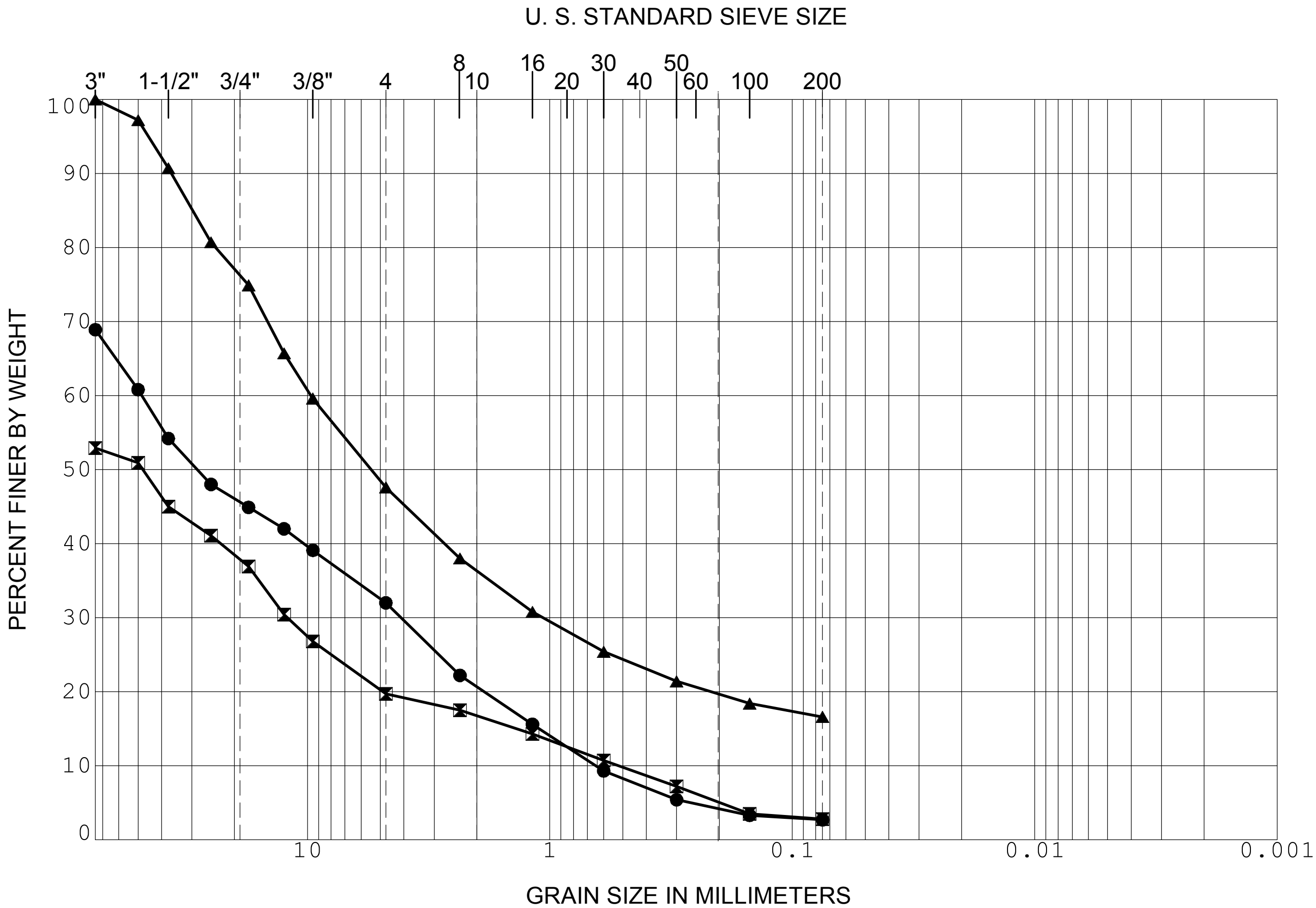
Sample No.	Water-Soluble Sulfate Content (%)	Exposure
T3-1	0.022	Not Applicable
T5-1	0.018	Not Applicable

TABLE B-V
SUMMARY OF LABORATORY POTENTIAL OF HYDROGEN (PH) AND RESISTIVITY TEST RESULTS

Sample No.	pH	Resistivity (ohm cms)
T3-1	6.7	310
T5-1	6.9	440

PROJECT NO. 07339-32-03

GRAVEL		SAND			SILT OR CLAY
COARSE	FINE	COARSE	MEDIUM	FINE	



	SAMPLE	DEPTH (ft)	CLASSIFICATION	NAT WC	LL	PL	PI
●	T3-1	5.0	GP-GC				
⧗	T5-1	6.0	GP-GC				
▲	T15-3	7.0	GC				

GRADATION CURVE

HERITAGE BLUFFS

SAN DIEGO, CALIFORNIA

07339-32-03.GPJ

Figure B-1

GEOCON

APPENDIX C

APPENDIX C

SEISMIC REFRACTION SURVEY REPORT

FOR

SEISMIC TRAVERSES S-11 THROUGH S-16
BY SOUTHWEST GEOPHYSICS

FOR

HERITAGE BLUFFS II
SAN DIEGO, CALIFORNIA

PROJECT NO. 07339-32-03

SEISMIC REFRACTION SURVEY
HERITAGE BLUFFS II
SAN DIEGO, CALIFORNIA

PREPARED FOR:
Geocon, Inc.
6960 Flanders Drive
San Diego, CA 92121

PREPARED BY:
Southwest Geophysics, Inc.
8057 Raytheon Road, Suite 9
San Diego, CA 92111

January 23, 2015
Project No. 115018

SOUTHWEST GEOPHYSICS, INC.
YOUR SUBSURFACE SOLUTION

January 23, 2015
Project No. 115018

Mr. Troy Reist
Geocon, Inc.
6960 Flanders Drive
San Diego, CA 92121

Subject: Seismic Refraction Survey
Heritage Bluffs II
San Diego, California

Dear Mr. Reist:

In accordance with your authorization, we have performed a seismic refraction survey pertaining to the subject project located in San Diego, California. Specifically, our survey consisted of performing six seismic refraction traverses at the project site. The purpose of our study was to develop subsurface velocity profiles of the areas surveyed, and to assess the apparent rippability of the subsurface materials. This data report presents our survey methodology, equipment used, analysis, and results.

We appreciate the opportunity to be of service on this project. Should you have any questions related to this report, please contact the undersigned at your convenience.

Sincerely,

SOUTHWEST GEOPHYSICS, INC.

Patrick F. Lehrmann, P.G., P.Gp.
Principal Geologist/Geophysicist

Hans van de Vrugt, C.E.G., P.Gp.
Principal Geologist/Geophysicist

REGISTERED GEOPHYSICIST
PATRICK F. LEHRMANN
No. 1043
Exp. 1/31/16
STATE OF CALIFORNIA

PFL/HV/hv

Distribution: (1) Addressee (electronic)

TABLE OF CONTENTS

1. INTRODUCTION

In accordance with your authorization, we have performed a seismic refraction survey pertaining to the subject project located in San Diego, California (Figure 1). Specifically, our survey consisted of performing six seismic refraction traverses at the project site. The purpose of our study was to develop subsurface velocity profiles of the areas surveyed, and to assess the apparent rippability of the subsurface materials. This data report presents our survey methodology, equipment used, analysis, and results.

2. SCOPE OF SERVICES

Our scope of services included:

- Performance of six seismic refraction lines (SL-11 through SL-16) at the project site.
- Compilation and analysis of the data collected.
- Preparation of this data report presenting our results and conclusions.

3. SITE AND PROJECT DESCRIPTION

The project site is generally located southeast of Carmel Valley Road and northeast of the Black Mountain Open Space Park in San Diego (see Figures 1 and 2). The site consists of mild to steep hills and associated drainages and valleys. Several unmaintained dirt roads and trails cross portions of the site. Vegetation in the area consists of heavy scrub brush and annual grass. Figures 2 and 3 depict the site conditions in the area of the seismic traverses.

Based on our discussions with you it is our understanding that the project involves the construction of single family residences and that site preparation will include cut and fill grading. Cuts up to 50 feet may be performed. It is also our understanding that a seismic refraction survey, which included lines SL-1 through SL-10, was previously conducted at the site by others.

4. SURVEY METHODOLOGY

A seismic P-wave (compression wave) refraction survey was conducted at the site to evaluate the rippability characteristics of the subsurface materials and to develop subsurface velocity profiles of the areas surveyed. The seismic refraction method uses first-arrival times of refracted seismic waves to estimate the thicknesses and seismic velocities of subsurface layers. Seismic P-waves generated at the surface, using a hammer and plate, are refracted at boundaries separating materials of contrasting velocities. These refracted seismic waves are then detected by a series of verti-vertical component geophones and recorded with a 24-channel Geometrics Geode seismograph. The travel times of the seismic P-waves are used in conjunction with the shot-to-geophone distances to obtain thickness and velocity information on the subsurface materials.

Six seismic lines (SL-11 through SL-16) were conducted in the study area. The general line locations were delineated by your office as well as the desired exploration depths. Seismic lines SL-11, through SL-15 were 240 feet long. Seismic line SL-16 was 170 feet long. Shot points (signal generation locations) were conducted near the ends, midpoint, and intermediate points between the ends and the midpoint. In general, the effective depth of evaluation for a seismic refraction traverse is approximately one-third to one-fifth the length of the traverse.

The refraction method requires that subsurface velocities increase with depth. A layer having a velocity lower than that of the layer above will not generally be detectable by the seismic refraction method and, therefore, could lead to errors in the depth calculations of subsequent layers. In addition, lateral variations in velocity, such as those caused by core stones or intrusions can also result in the misinterpretation of the subsurface conditions.

The rippability values presented in Table 1 are based on our experience with similar materials and assume that a Caterpillar D-9 dozer ripping with a single shank is used. We emphasize that the cutoffs in this classification scheme are approximate and that rock characteristics, such as fracture spacing and orientation, play a significant role in determining rock rippability. These characteristics may also vary with location and depth. For trenching operations**,** the rippability values should be scaled downward. For example, velocities as low as 3,500 feet/second may indicate difficult ripping during trenching operations. In addition, the presence of boulders, which can be troublesome in a narrow trench, should be anticipated.

Table 1 – Rippability Classification	
Seismic P-wave Velocity	**Rippability**
0 to 2,000 feet/second	Easy
2,000 to 4,000 feet/second	Moderate
4,000 to 5,500 feet/second	Difficult, Possible Blasting
5,500 to 7,000 feet/second	Very Difficult, Probable Blasting
Greater than 7,000 feet/second	Blasting Generally Required

It should be noted that the rippability cutoffs presented in Table 1 are slightly more conservative than those published in the Caterpillar Performance Handbook (Caterpillar, 2011). Accordingly, the above classification scheme should be used with discretion, and contractors should not be relieved of making their own independent evaluation of the rippability of the on-site materials prior to submitting their bids.

5. ANALYSIS

As previously indicated, six seismic traverses were conducted as part of our study. The collected data were processed using SIPwin (Rimrock Geophysics, 2003), a seismic interpretation program, and analyzed using SeisOpt Pro (Optim, 2008) which uses first arrival picks and elevation data to produce subsurface velocity models. SeisOpt Pro uses a nonlinear optimization technique called adaptive simulated annealing. The resulting velocity model provides a tomography image of the estimated geologic conditions. Both vertical and lateral velocity information is contained in the tomography model. Changes in layer velocity are revealed as gradients rather than discrete contacts, which typically are more representative of actual conditions. The data collected were generally of good quality.

6. RESULTS, CONCLUSIONS AND RECOMMENDATIONS

Figures 4a through 4f provide the velocity models calculated from SeisOpt Pro. Distinct vertical and lateral velocity variations are evident in the models. These inhomogeneities are likely related to the presence of remnant boulders, intrusions and differential weathering of the bedrock materials. It is also evident in the tomography models that the depth to bedrock is highly variable across the site.

Based on the refraction results, variability in the excavatability (including depth of rippability) of the subsurface materials should be expected across the project area. Furthermore, blasting may be required depending on the excavation depth, location, equipment used, and desired rate of production. In addition, oversized materials should be expected. A contractor with excavation experience in similar potentially difficult conditions should be consulted for expert advice on excavation methodology, equipment and production rate.

7. LIMITATIONS

The field evaluation and geophysical analyses presented in this report have been conducted in general accordance with current practice and the standard of care exercised by consultants performing similar tasks in the project area. No warranty, express or implied, is made regarding the conclusions, recommendations, and opinions presented in this report. There is no evaluation detailed enough to reveal every subsurface condition. Variations may exist and conditions not observed or described in this report may be present. Uncertainties relative to subsurface conditions can be reduced through additional subsurface exploration. Additional subsurface surveying will be performed upon request.

This document is intended to be used only in its entirety. No portion of the document, by itself, is designed to completely represent any aspect of the project described herein. Southwest Geophysics, Inc. should be contacted if the reader requires additional information or has questions regarding the content, interpretations presented, or completeness of this document. This report is intended exclusively for use by the client. Any use or reuse of the findings, conclusions, and/or recommendations of this report by parties other than the client is undertaken at said parties’ sole risk.

8. SELECTED REFERENCES

Caterpillar, Inc., 2011, Caterpillar Performance Handbook, Edition 41, Caterpillar, Inc., Peoria, Illinois.

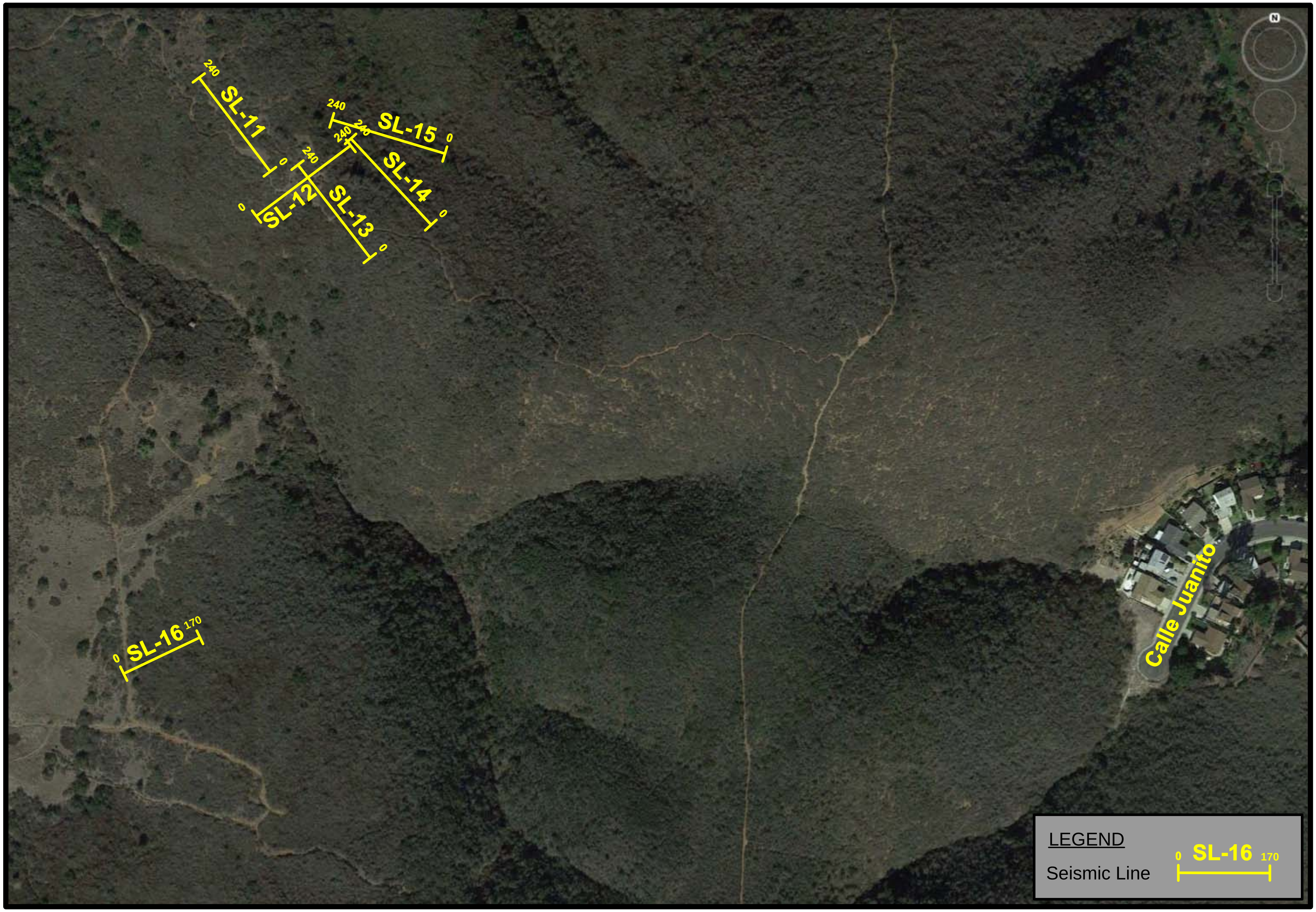
Mooney, H.M., 1976, Handbook of Engineering Geophysics, dated February.

Optim, Inc., 2008, SeisOpt Pro, V-5.0.

Rimrock Geophysics, 2003, Seismic Refraction Interpretation Program (SIPwin), V-2.76.

Telford, W.M., Geldart, L.P., Sheriff, R.E., and Keys, D.A., 1976, Applied Geophysics, Cambridge University Press.

SITE LOCATION MAP	N	Heritage Bluffs II San Diego, California		SOUTHWEST GEOPHYSICS INC. Figure 1
		Project No.: 115018	Date: 01/15	



LINE LOCATION MAP

N

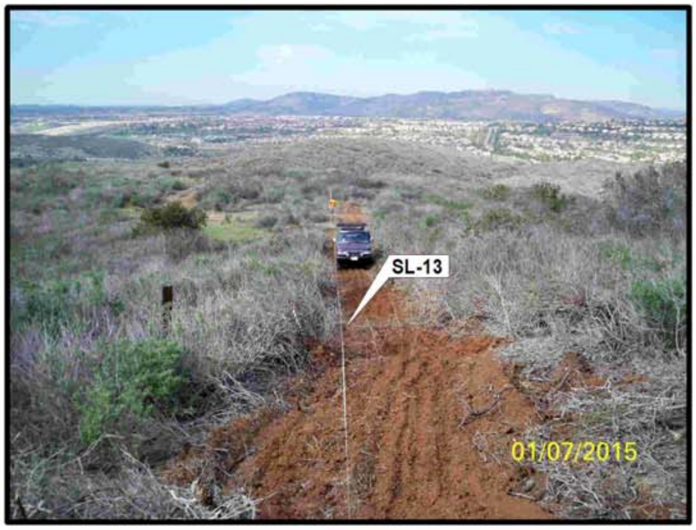
Heritage Bluffs II
San Diego, California

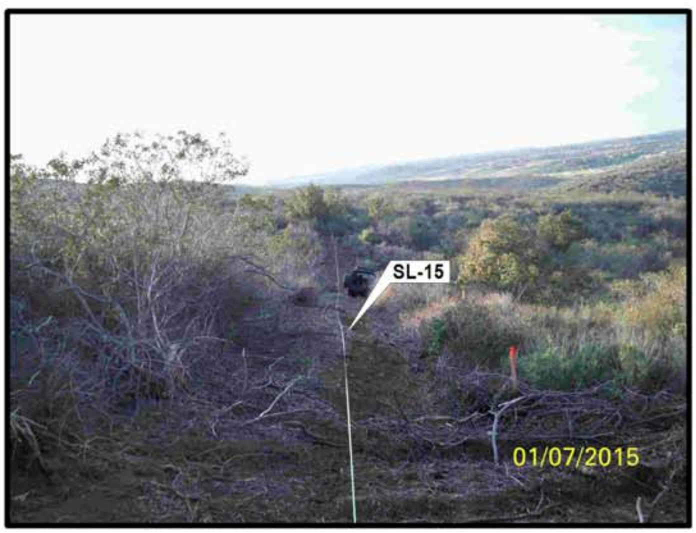
Project No.: 115018 | Date: 01/15

SOUTHWEST GEOPHYSICS INC.

Figure 2

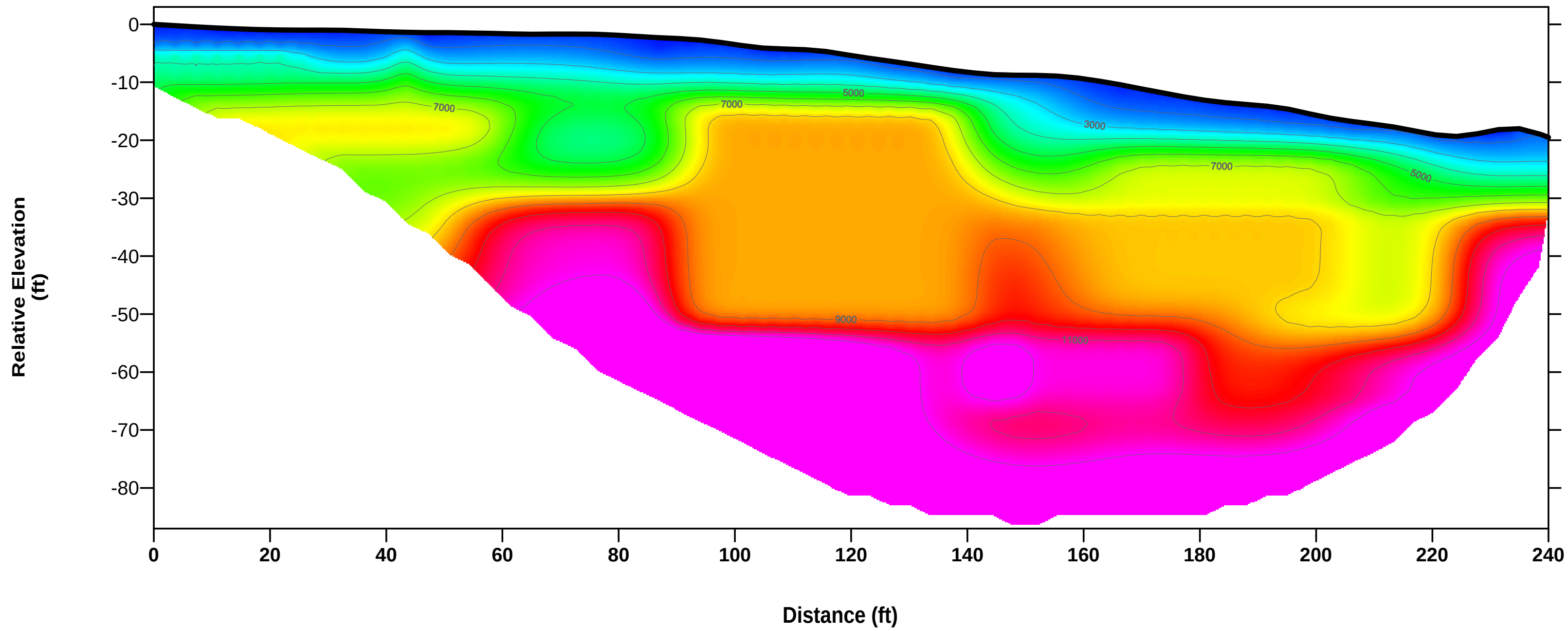
0 300 600
approximate scale in feet

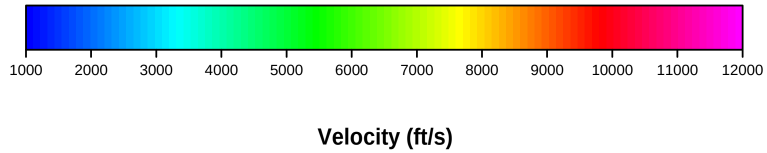




SITE PHOTOGRAPHS	Heritage Bluffs II San Diego, California Project No.: 115018 — Date: 01/15	SOUTHWEST GEOPHYSICS INC. Figure 3

TOMOGRAPHY MODEL

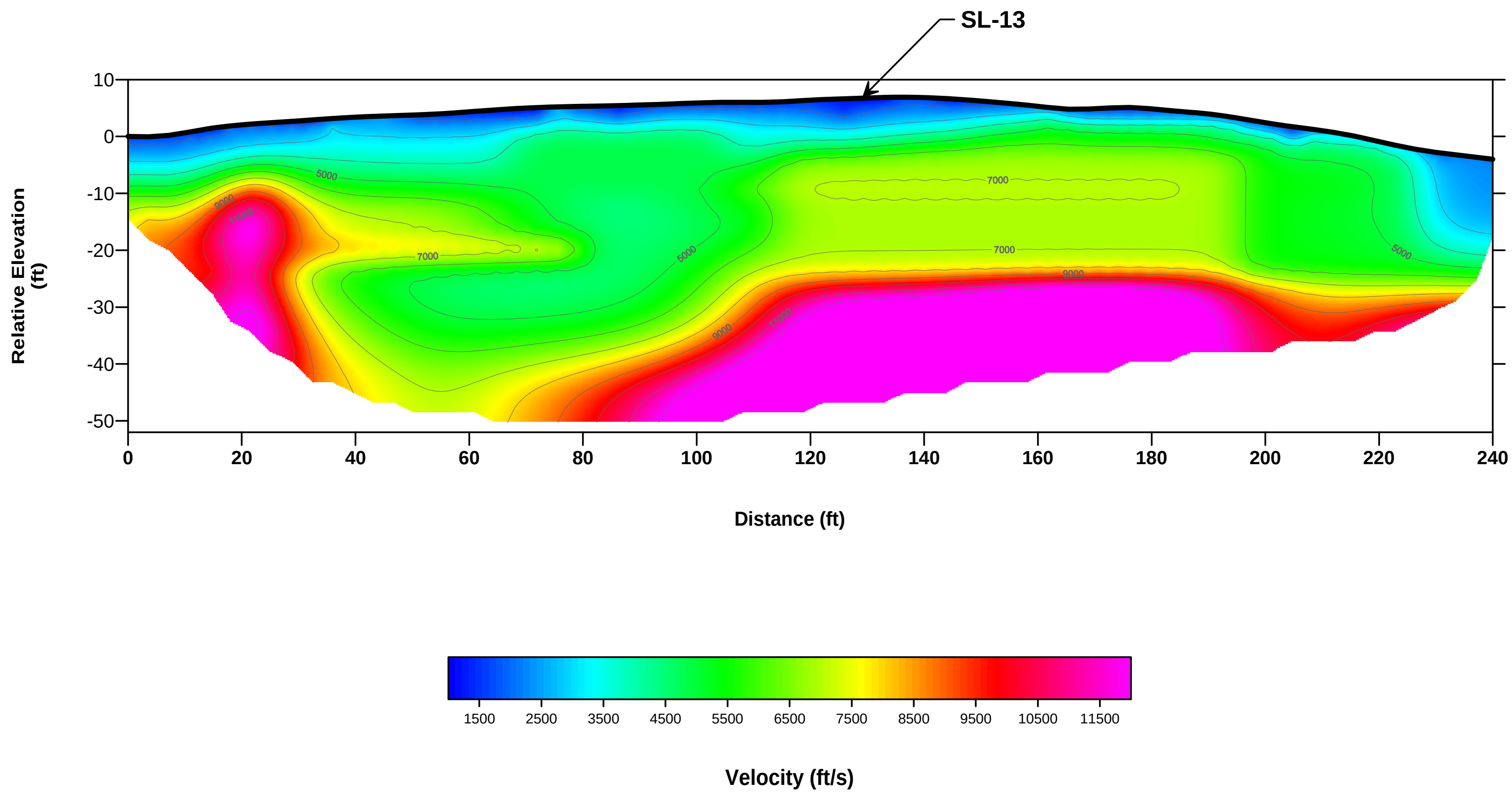




SEISMIC PROFILE SL-11	Heritage Bluffs II San Diego, California		SOUTHWEST GEOPHYSICS INC. Figure 4a
	Project No.: 115018	Date: 01/15	

Note: Contour Interval = 1,000 feet per second

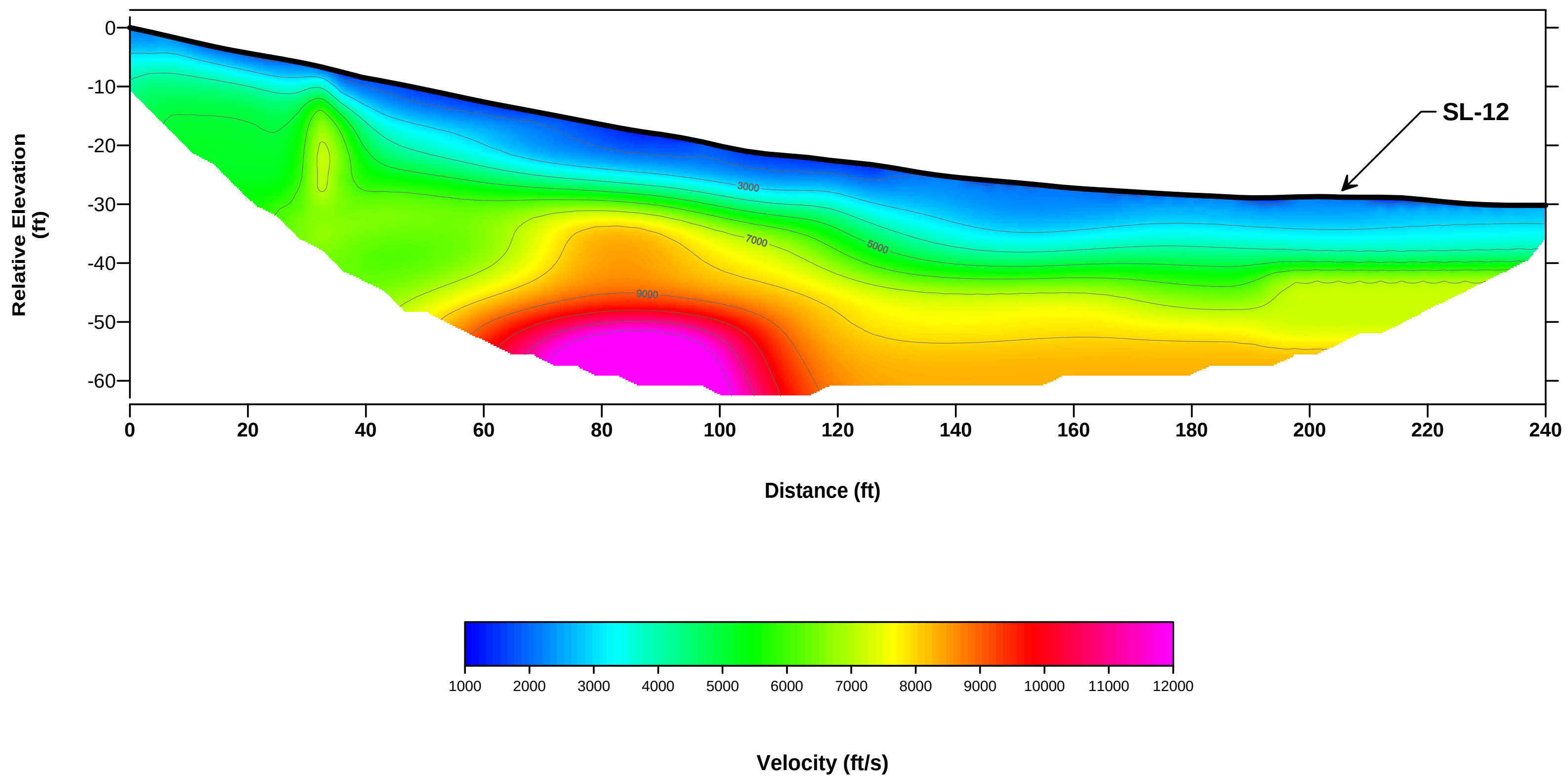
TOMOGRAPHY MODEL



SEISMIC PROFILE SL-12	Heritage Bluffs II San Diego, California Project No.: 115018 — Date: 01/15	SOUTHWEST GEOPHYSICS INC. Figure 4b

Note: Contour Interval = 1,000 feet per second

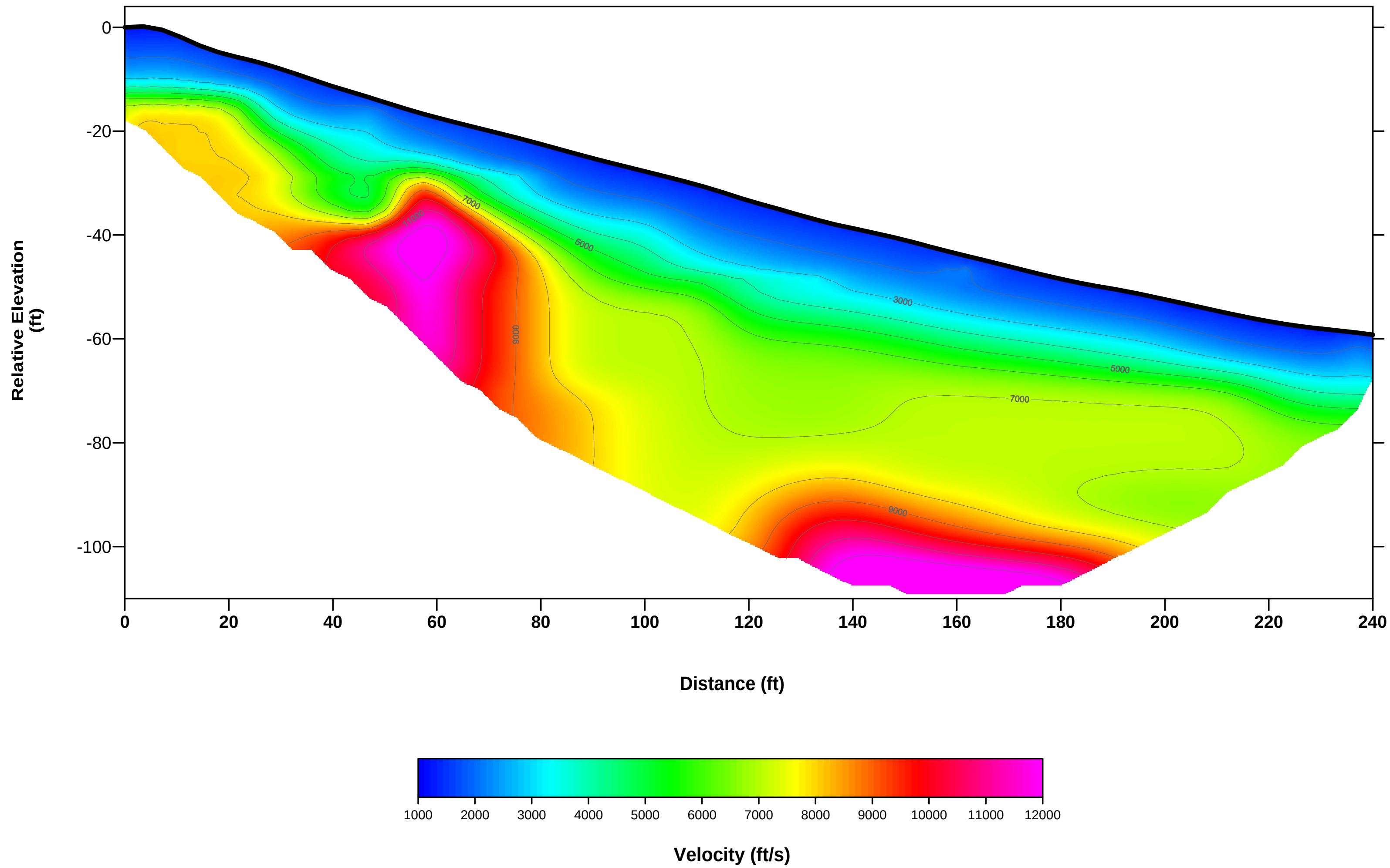
TOMOGRAPHY MODEL



SEISMIC PROFILE SL-13	Heritage Bluffs II San Diego, California		SOUTHWEST GEOPHYSICS INC. Figure 4c
	Project No.: 115018	Date: 01/15	

Note: Contour Interval = 1,000 feet per second

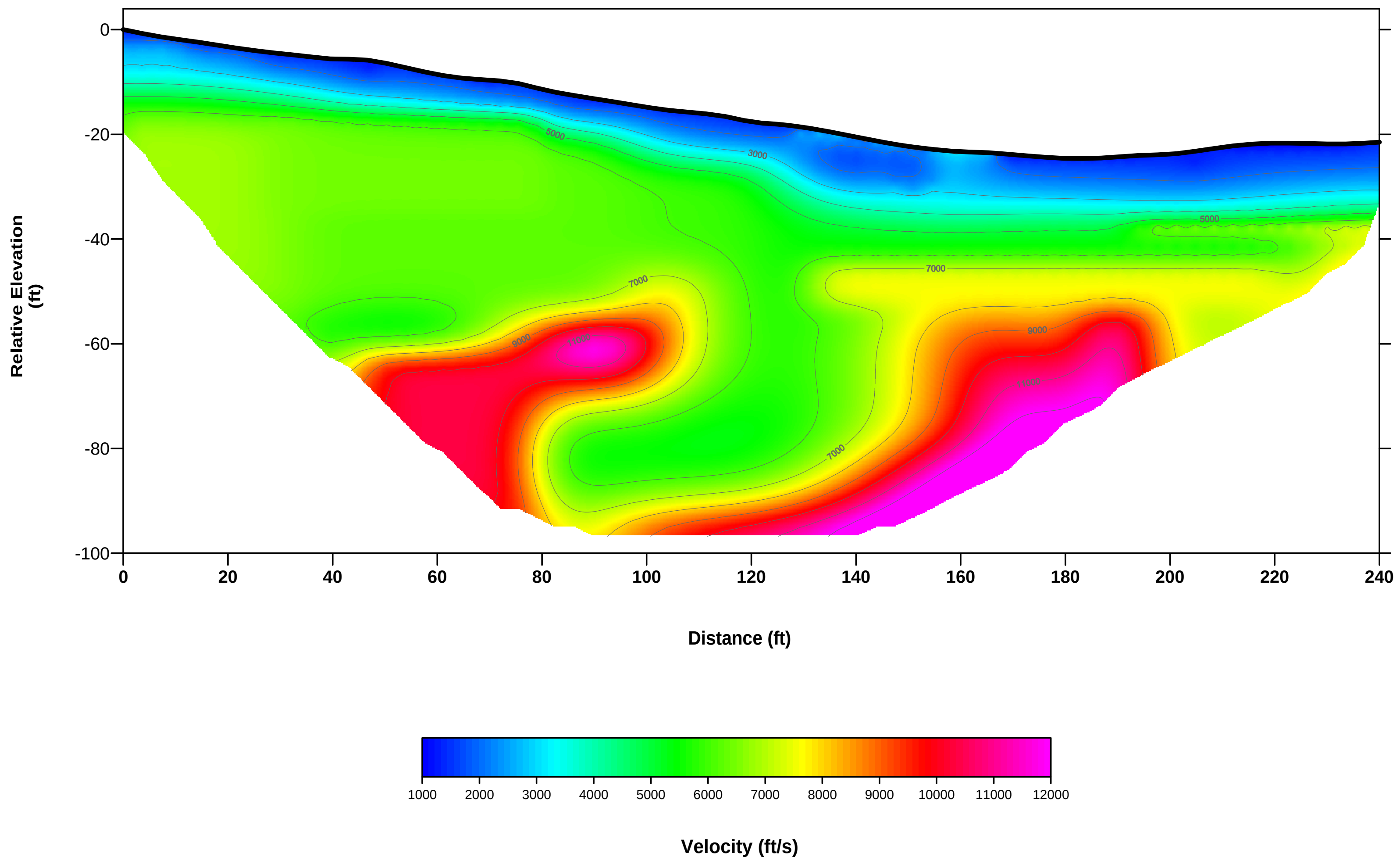
TOMOGRAPHY MODEL



SEISMIC PROFILE SL-14	Heritage Bluffs II San Diego, California		SOUTHWEST GEOPHYSICS INC. Figure 4d
	Project No.: 115018	Date: 01/15	

Note: Contour Interval = 1,000 feet per second

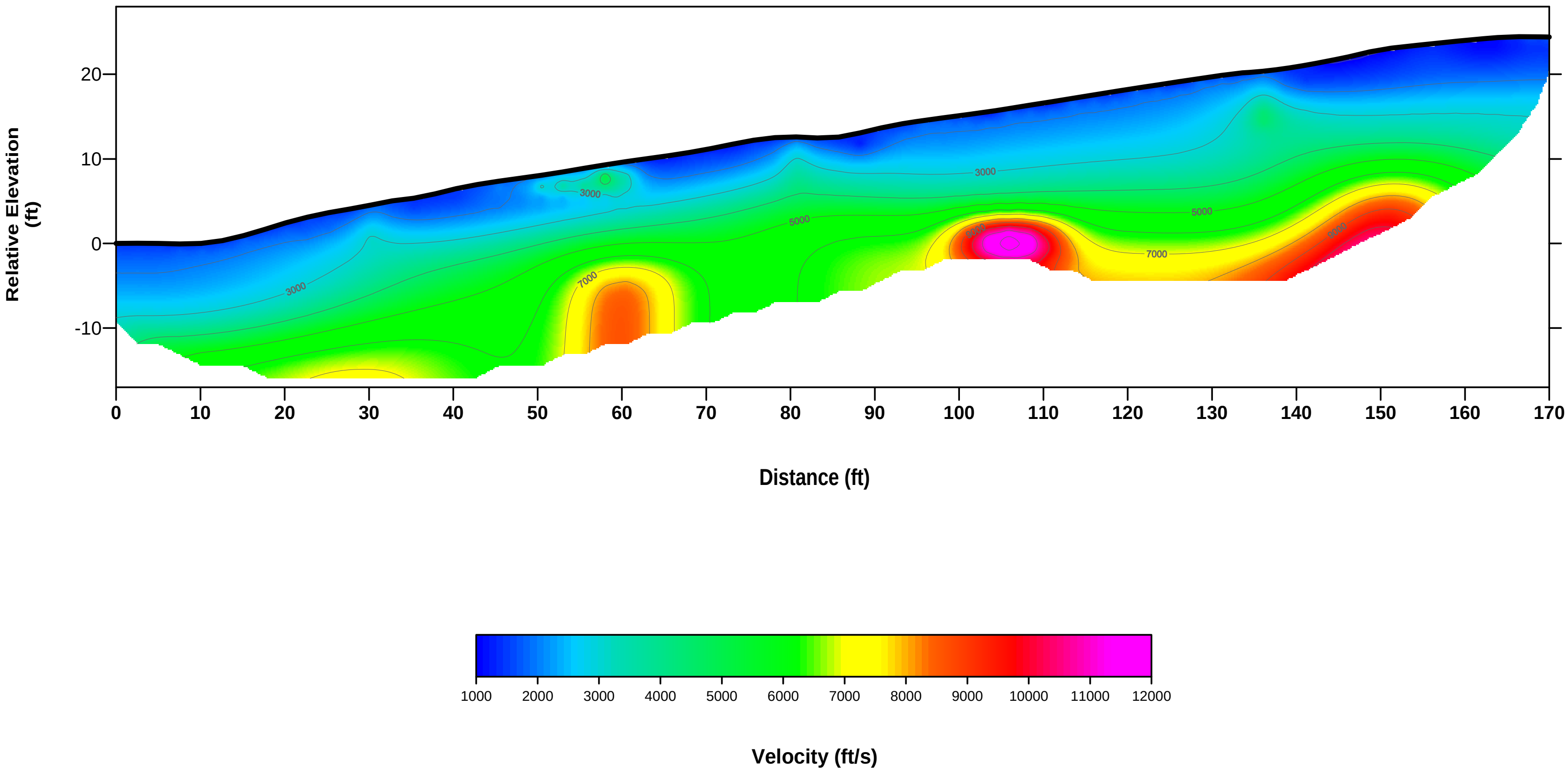
TOMOGRAPHY MODEL



SEISMIC PROFILE SL-15	Heritage Bluffs II San Diego, California Project No.: 115018 — Date: 01/15	SOUTHWEST GEOPHYSICS INC. Figure 4e

Note: Contour Interval = 1,000 feet per second

TOMOGRAPHY MODEL



SEISMIC PROFILE SL-16	Heritage Bluffs II San Diego, California Project No.: 115018 — Date: 01/15	SOUTHWEST GEOPHYSICS INC. Figure 4f

Note: Contour Interval = 1,000 feet per second

APPENDIX D

APPENDIX D

RECOMMENDED GRADING SPECIFICATIONS

FOR

HERITAGE BLUFFS II
SAN DIEGO, CALIFORNIA

PROJECT NO. 07339-32-03

RECOMMENDED GRADING SPECIFICATIONS

1. GENERAL

1.1 These Recommended Grading Specifications shall be used in conjunction with the Geotechnical Report for the project prepared by Geocon Incorporated. The recommendations contained in the text of the Geotechnical Report are a part of the earthwork and grading specifications and shall supersede the provisions contained hereinafter in the case of conflict.

1.2 Prior to the commencement of grading, a geotechnical consultant (Consultant) shall be employed for the purpose of observing earthwork procedures and testing the fills for substantial conformance with the recommendations of the Geotechnical Report and these specifications. The Consultant should provide adequate testing and observation services so that they may assess whether, in their opinion, the work was performed in substantial conformance with these specifications. It shall be the responsibility of the Contractor to assist the Consultant and keep them apprised of work schedules and changes so that personnel may be scheduled accordingly.

1.3 It shall be the sole responsibility of the Contractor to provide adequate equipment and methods to accomplish the work in accordance with applicable grading codes or agency ordinances, these specifications and the approved grading plans. If, in the opinion of the Consultant, unsatisfactory conditions such as questionable soil materials, poor moisture condition, inadequate compaction, adverse weather, result in a quality of work not in conformance with these specifications, the Consultant will be empowered to reject the work and recommend to the Owner that grading be stopped until the unacceptable conditions are corrected.

2. DEFINITIONS

2.1 **Owner** shall refer to the owner of the property or the entity on whose behalf the grading work is being performed and who has contracted with the Contractor to have grading performed.

2.2 **Contractor** shall refer to the Contractor performing the site grading work.

2.3 **Civil Engineer** or **Engineer of Work** shall refer to the California licensed Civil Engineer or consulting firm responsible for preparation of the grading plans, surveying and verifying as-graded topography.

2.4 **Consultant** shall refer to the soil engineering and engineering geology consulting firm retained to provide geotechnical services for the project.

2.5 **Soil Engineer** shall refer to a California licensed Civil Engineer retained by the Owner, who is experienced in the practice of geotechnical engineering. The Soil Engineer shall be responsible for having qualified representatives on-site to observe and test the Contractor's work for conformance with these specifications.

2.6 **Engineering Geologist** shall refer to a California licensed Engineering Geologist retained by the Owner to provide geologic observations and recommendations during the site grading.

2.7 **Geotechnical Report** shall refer to a soil report (including all addenda) which may include a geologic reconnaissance or geologic investigation that was prepared specifically for the development of the project for which these Recommended Grading Specifications are intended to apply.

3. MATERIALS

3.1 Materials for compacted fill shall consist of any soil excavated from the cut areas or imported to the site that, in the opinion of the Consultant, is suitable for use in construction of fills. In general, fill materials can be classified as *soil* fills, *soil-rock* fills or *rock* fills, as defined below.

3.1.1 **Soil fills** are defined as fills containing no rocks or hard lumps greater than 12 inches in maximum dimension and containing at least 40 percent by weight of material smaller than ¾ inch in size.

3.1.2 **Soil-rock fills** are defined as fills containing no rocks or hard lumps larger than 4 feet in maximum dimension and containing a sufficient matrix of soil fill to allow for proper compaction of soil fill around the rock fragments or hard lumps as specified in Paragraph 6.2. **Oversize rock** is defined as material greater than 12 inches.

3.1.3 **Rock fills** are defined as fills containing no rocks or hard lumps larger than 3 feet in maximum dimension and containing little or no fines. Fines are defined as material smaller than ¾ inch in maximum dimension. The quantity of fines shall be less than approximately 20 percent of the rock fill quantity.

3.2 Material of a perishable, spongy, or otherwise unsuitable nature as determined by the Consultant shall not be used in fills.

3.3 Materials used for fill, either imported or on-site, shall not contain hazardous materials as defined by the California Code of Regulations, Title 22, Division 4, Chapter 30, Articles 9 and 10; 40CFR; and any other applicable local, state or federal laws. The Consultant shall not be responsible for the identification or analysis of the potential presence of hazardous materials. However, if observations, odors or soil discoloration cause Consultant to suspect the presence of hazardous materials, the Consultant may request from the Owner the termination of grading operations within the affected area. Prior to resuming grading operations, the Owner shall provide a written report to the Consultant indicating that the suspected materials are not hazardous as defined by applicable laws and regulations.

3.4 The outer 15 feet of *soil-rock* fill slopes, measured horizontally, should be composed of properly compacted *soil* fill materials approved by the Consultant. *Rock* fill may extend to the slope face, provided that the slope is not steeper than 2:1 (horizontal:vertical) and a soil layer no thicker than 12 inches is track-walked onto the face for landscaping purposes. This procedure may be utilized provided it is acceptable to the governing agency, Owner and Consultant.

3.5 Samples of soil materials to be used for fill should be tested in the laboratory by the Consultant to determine the maximum density, optimum moisture content, and, where appropriate, shear strength, expansion, and gradation characteristics of the soil.

3.6 During grading, soil or groundwater conditions other than those identified in the Geotechnical Report may be encountered by the Contractor. The Consultant shall be notified immediately to evaluate the significance of the unanticipated condition

4. CLEARING AND PREPARING AREAS TO BE FILLED

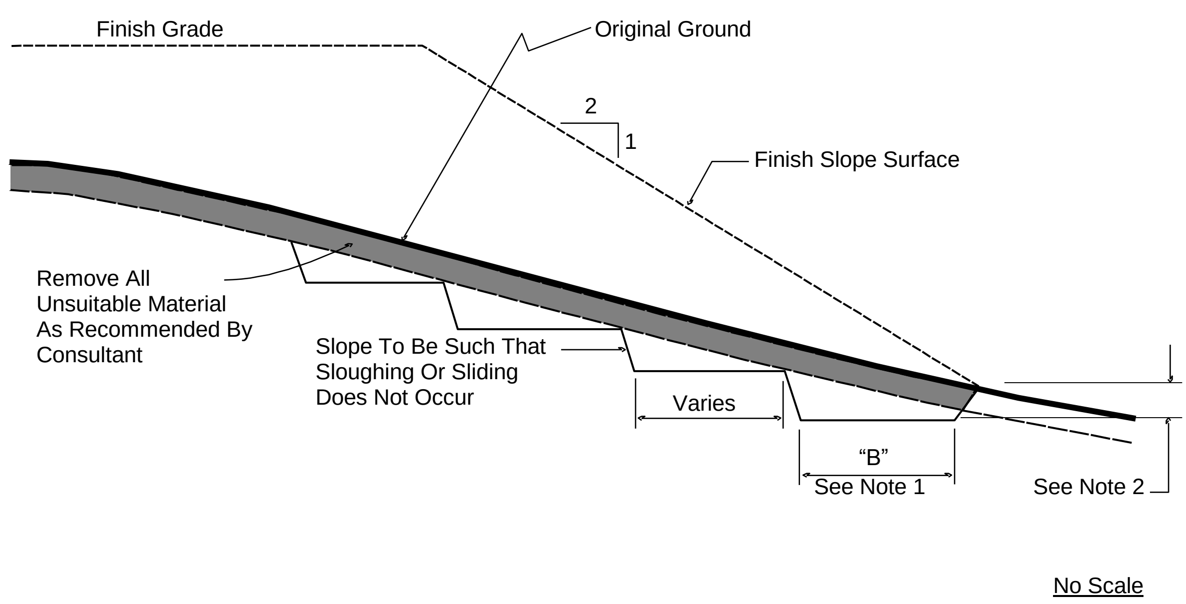
4.1 Areas to be excavated and filled shall be cleared and grubbed. Clearing shall consist of complete removal above the ground surface of trees, stumps, brush, vegetation, man-made structures, and similar debris. Grubbing shall consist of removal of stumps, roots, buried logs and other unsuitable material and shall be performed in areas to be graded. Roots and other projections exceeding 1½ inches in diameter shall be removed to a depth of 3 feet below the surface of the ground. Borrow areas shall be grubbed to the extent necessary to provide suitable fill materials.

4.2 Any asphalt pavement material removed during clearing operations should be properly disposed at an approved off-site facility. Concrete fragments that are free of reinforcing steel may be placed in fills, provided they are placed in accordance with Section 6.2 or 6.3 of this document.

4.3 After clearing and grubbing of organic matter and other unsuitable material, loose or porous soils shall be removed to the depth recommended in the Geotechnical Report. The depth of removal and compaction should be observed and approved by a representative of the Consultant. The exposed surface shall then be plowed or scarified to a minimum depth of 6 inches and until the surface is free from uneven features that would tend to prevent uniform compaction by the equipment to be used.

4.4 Where the slope ratio of the original ground is steeper than 5:1 (horizontal:vertical), or where recommended by the Consultant, the original ground should be benched in accordance with the following illustration.

TYPICAL BENCHING DETAIL



DETAIL NOTES: (1) Key width "B" should be a minimum of 10 feet, or sufficiently wide to permit complete coverage with the compaction equipment used. The base of the key should be graded horizontal, or inclined slightly into the natural slope.

(2) The outside of the key should be below the topsoil or unsuitable surficial material and at least 2 feet into dense formational material. Where hard rock is exposed in the bottom of the key, the depth and configuration of the key may be modified as approved by the Consultant.

4.5 After areas to receive fill have been cleared and scarified, the surface should be moisture conditioned to achieve the proper moisture content, and compacted as recommended in Section 6 of these specifications.

5. COMPACTION EQUIPMENT

5.1 Compaction of *soil* or *soil-rock* fill shall be accomplished by sheepsfoot or segmented-steel wheeled rollers, vibratory rollers, multiple-wheel pneumatic-tired rollers, or other types of acceptable compaction equipment. Equipment shall be of such a design that it will be capable of compacting the *soil* or *soil-rock* fill to the specified relative compaction at the specified moisture content.

5.2 Compaction of *rock* fills shall be performed in accordance with Section 6.3.

6. PLACING, SPREADING AND COMPACTION OF FILL MATERIAL

6.1 *Soil* fill, as defined in Paragraph 3.1.1, shall be placed by the Contractor in accordance with the following recommendations:

6.1.1 *Soil* fill shall be placed by the Contractor in layers that, when compacted, should generally not exceed 8 inches. Each layer shall be spread evenly and shall be thoroughly mixed during spreading to obtain uniformity of material and moisture in each layer. The entire fill shall be constructed as a unit in nearly level lifts. Rock materials greater than 12 inches in maximum dimension shall be placed in accordance with Section 6.2 or 6.3 of these specifications.

6.1.2 In general, the *soil* fill shall be compacted at a moisture content at or above the optimum moisture content as determined by ASTM D 1557-09.

6.1.3 When the moisture content of *soil* fill is below that specified by the Consultant, water shall be added by the Contractor until the moisture content is in the range specified.

6.1.4 When the moisture content of the *soil* fill is above the range specified by the Consultant or too wet to achieve proper compaction, the *soil* fill shall be aerated by the Contractor by blading/mixing, or other satisfactory methods until the moisture content is within the range specified.

6.1.5 After each layer has been placed, mixed, and spread evenly, it shall be thoroughly compacted by the Contractor to a relative compaction of at least 90 percent. Relative compaction is defined as the ratio (expressed in percent) of the in-place dry density of the compacted fill to the maximum laboratory dry density as determined in accordance with ASTM D 1557-09. Compaction shall be continuous over the entire area, and compaction equipment shall make sufficient passes so that the specified minimum relative compaction has been achieved throughout the entire fill.

6.1.6 Where practical, soils having an Expansion Index greater than 50 should be placed at least 3 feet below finish pad grade and should be compacted at a moisture content generally 2 to 4 percent greater than the optimum moisture content for the material.

6.1.7 Properly compacted *soil* fill shall extend to the design surface of fill slopes. To achieve proper compaction, it is recommended that fill slopes be over-built by at least 3 feet and then cut to the design grade. This procedure is considered preferable to track-walking of slopes, as described in the following paragraph.

6.1.8 As an alternative to over-building of slopes, slope faces may be back-rolled with a heavy-duty loaded sheepsfoot or vibratory roller at maximum 4-foot fill height intervals. Upon completion, slopes should then be track-walked with a D-8 dozer or similar equipment, such that a dozer track covers all slope surfaces at least twice.

6.2 *Soil-rock* fill, as defined in Paragraph 3.1.2, shall be placed by the Contractor in accordance with the following recommendations:

6.2.1 Rocks larger than 12 inches but less than 4 feet in maximum dimension may be incorporated into the compacted *soil* fill, but shall be limited to the area measured 15 feet minimum horizontally from the slope face and 5 feet below finish grade or 3 feet below the deepest utility, whichever is deeper.

6.2.2 Rocks or rock fragments up to 4 feet in maximum dimension may either be individually placed or placed in windrows. Under certain conditions, rocks or rock fragments up to 10 feet in maximum dimension may be placed using similar methods. The acceptability of placing rock materials greater than 4 feet in maximum dimension shall be evaluated during grading as specific cases arise and shall be approved by the Consultant prior to placement.

6.2.3 For individual placement, sufficient space shall be provided between rocks to allow for passage of compaction equipment.

6.2.4 For windrow placement, the rocks should be placed in trenches excavated in properly compacted *soil* fill. Trenches should be approximately 5 feet wide and 4 feet deep in maximum dimension. The voids around and beneath rocks should be filled with approved granular soil having a Sand Equivalent of 30 or greater and should be compacted by flooding. Windrows may also be placed utilizing an "open-face" method in lieu of the trench procedure, however, this method should first be approved by the Consultant.

6.2.5 Windrows should generally be parallel to each other and may be placed either parallel to or perpendicular to the face of the slope depending on the site geometry. The minimum horizontal spacing for windrows shall be 12 feet center-to-center with a 5-foot stagger or offset from lower courses to next overlying course. The minimum vertical spacing between windrow courses shall be 2 feet from the top of a lower windrow to the bottom of the next higher windrow.

6.2.6 Rock placement, fill placement and flooding of approved granular soil in the windrows should be continuously observed by the Consultant.

6.3 *Rock* fills, as defined in Section 3.1.3, shall be placed by the Contractor in accordance with the following recommendations:

6.3.1 The base of the *rock* fill shall be placed on a sloping surface (minimum slope of 2 percent). The surface shall slope toward suitable subdrainage outlet facilities. The *rock* fills shall be provided with subdrains during construction so that a hydrostatic pressure buildup does not develop. The subdrains shall be permanently connected to controlled drainage facilities to control post-construction infiltration of water.

6.3.2 *Rock* fills shall be placed in lifts not exceeding 3 feet. Placement shall be by rock trucks traversing previously placed lifts and dumping at the edge of the currently placed lift. Spreading of the *rock* fill shall be by dozer to facilitate *seating* of the rock. The *rock* fill shall be watered heavily during placement. Watering shall consist of water trucks traversing in front of the current rock lift face and spraying water continuously during rock placement. Compaction equipment with compactive energy comparable to or greater than that of a 20-ton steel vibratory roller or other compaction equipment providing suitable energy to achieve the required compaction or deflection as recommended in Paragraph 6.3.3 shall be utilized. The number of passes to be made should be determined as described in Paragraph 6.3.3. Once a *rock* fill lift has been covered with *soil* fill, no additional *rock* fill lifts will be permitted over the *soil* fill.

6.3.3 Plate bearing tests, in accordance with ASTM D 1196-09, may be performed in both the compacted *soil* fill and in the *rock* fill to aid in determining the required minimum number of passes of the compaction equipment. If performed, a minimum of three plate bearing tests should be performed in the properly compacted *soil* fill (minimum relative compaction of 90 percent). Plate bearing tests shall then be performed on areas of *rock* fill having two passes, four passes and six passes of the compaction equipment, respectively. The number of passes required for the *rock* fill shall be determined by comparing the results of the plate bearing tests for the *soil* fill and the *rock* fill and by evaluating the deflection variation with number of passes. The required number of passes of the compaction equipment will be performed as necessary until the plate bearing deflections are equal to or less than that determined for the properly compacted *soil* fill. In no case will the required number of passes be less than two.

6.3.4 A representative of the Consultant should be present during *rock* fill operations to observe that the minimum number of "passes" have been obtained, that water is being properly applied and that specified procedures are being followed. The actual number of plate bearing tests will be determined by the Consultant during grading.

6.3.5 Test pits shall be excavated by the Contractor so that the Consultant can state that, in their opinion, sufficient water is present and that voids between large rocks are properly filled with smaller rock material. In-place density testing will not be required in the *rock* fills.

6.3.6 To reduce the potential for "piping" of fines into the *rock* fill from overlying *soil* fill material, a 2-foot layer of graded filter material shall be placed above the uppermost lift of *rock* fill. The need to place graded filter material below the *rock* should be determined by the Consultant prior to commencing grading. The gradation of the graded filter material will be determined at the time the *rock* fill is being excavated. Materials typical of the *rock* fill should be submitted to the Consultant in a timely manner, to allow design of the graded filter prior to the commencement of *rock* fill placement.

6.3.7 *Rock* fill placement should be continuously observed during placement by the Consultant.

7. OBSERVATION AND TESTING

7.1 The Consultant shall be the Owner's representative to observe and perform tests during clearing, grubbing, filling, and compaction operations. In general, no more than 2 feet in vertical elevation of *soil* or *soil-rock* fill should be placed without at least one field density test being performed within that interval. In addition, a minimum of one field density test should be performed for every 2,000 cubic yards of *soil* or *soil-rock* fill placed and compacted.

7.2 The Consultant should perform a sufficient distribution of field density tests of the compacted *soil* or *soil-rock* fill to provide a basis for expressing an opinion whether the fill material is compacted as specified. Density tests shall be performed in the compacted materials below any disturbed surface. When these tests indicate that the density of any layer of fill or portion thereof is below that specified, the particular layer or areas represented by the test shall be reworked until the specified density has been achieved.

7.3 During placement of *rock* fill, the Consultant should observe that the minimum number of passes have been obtained per the criteria discussed in Section 6.3.3. The Consultant should request the excavation of observation pits and may perform plate bearing tests on the placed *rock* fills. The observation pits will be excavated to provide a basis for expressing an opinion as to whether the *rock* fill is properly seated and sufficient moisture has been applied to the material. When observations indicate that a layer of *rock* fill or any portion thereof is below that specified, the affected layer or area shall be reworked until the *rock* fill has been adequately seated and sufficient moisture applied.

7.4 A settlement monitoring program designed by the Consultant may be conducted in areas of *rock* fill placement. The specific design of the monitoring program shall be as recommended in the Conclusions and Recommendations section of the project Geotechnical Report or in the final report of testing and observation services performed during grading.

7.5 The Consultant should observe the placement of subdrains, to verify that the drainage devices have been placed and constructed in substantial conformance with project specifications.

7.6 Testing procedures shall conform to the following Standards as appropriate:

7.6.1 Soil and Soil-Rock Fills:

7.6.1.1 Field Density Test, ASTM D 1556-07, *Density of Soil In-Place By the Sand-Cone Method.*

7.6.1.2 Field Density Test, Nuclear Method, ASTM D 6938-08A, *Density of Soil and Soil-Aggregate In-Place by Nuclear Methods (Shallow Depth).*

7.6.1.3 Laboratory Compaction Test, ASTM D 1557-09, *Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 10-Pound Hammer and 18-Inch Drop.*

7.6.1.4. Expansion Index Test, ASTM D 4829-08A, *Expansion Index Test*.

7.6.2 Rock Fills

7.6.2.1 Field Plate Bearing Test, ASTM D 1196-09 (Reapproved 1997) *Standard Method for Nonreparative Static Plate Load Tests of Soils and Flexible Pavement Components, For Use in Evaluation and Design of Airport and Highway Pavements.*

8. PROTECTION OF WORK

8.1 During construction, the Contractor shall properly grade all excavated surfaces to provide positive drainage and prevent ponding of water. Drainage of surface water shall be controlled to avoid damage to adjoining properties or to finished work on the site. The Contractor shall take remedial measures to prevent erosion of freshly graded areas until such time as permanent drainage and erosion control features have been installed. Areas subjected to erosion or sedimentation shall be properly prepared in accordance with the Specifications prior to placing additional fill or structures.

8.2 After completion of grading as observed and tested by the Consultant, no further excavation or filling shall be conducted except in conjunction with the services of the Consultant.

9. CERTIFICATIONS AND FINAL REPORTS

9.1 Upon completion of the work, Contractor shall furnish Owner a certification by the Civil Engineer stating that the lots and/or building pads are graded to within 0.1 foot vertically of elevations shown on the grading plan and that all tops and toes of slopes are within 0.5 foot horizontally of the positions shown on the grading plans. After installation of a section of subdrain, the project Civil Engineer should survey its location and prepare an *as-built* plan of the subdrain location. The project Civil Engineer should verify the proper outlet for the subdrains and the Contractor should ensure that the drain system is free of obstructions.

9.2 The Owner is responsible for furnishing a final as-graded soil and geologic report satisfactory to the appropriate governing or accepting agencies. The as-graded report should be prepared and signed by a California licensed Civil Engineer experienced in geotechnical engineering and by a California Certified Engineering Geologist, indicating that the geotechnical aspects of the grading were performed in substantial conformance with the Specifications or approved changes to the Specifications.

LIST OF REFERENCES

1. Anderson, J. G., *Synthesis of Seismicity and Geologic Data in California*, U. S. Geologic Survey Open-File Report 84-424, 1984, pp. 1-186.

2. Boore, D. M., and G. M Atkinson (2008), *Ground-Motion Prediction for the Average Horizontal Component of PGA, PGV, and 5%-Damped PSA at Spectral Periods Between 0.01 and 10.0 S*, Earthquake Spectra, Volume 24, Issue 1, pages 99-138, February 2008.

3. California Department of Conservation, Division of Mines and Geology, *Probabilistic Seismic Hazard Assessment for the State of California*, Open File Report 96-08, 1996.

4. California Department of Water Resources, Water Data Library. http://www.water.ca.gov/waterdatalibrary.

5. California Geological Survey, *Seismic Shaking Hazards in California*, Based on the USGS/CGS Probabilistic Seismic Hazards Assessment (PSHA) Model, 2002 (revised April 2003). 10% probability of being exceeded in 50 years. http://redirect.conservation.ca.gov/cgs/rghm/pshamap/pshamain.html

6. Campbell, K. W. and Y. Bozorgnia, *NGA Ground Motion Model for the Geometric Mean Horizontal Component of PGA, PGV, PGD and 5% Damped Linear Elastic Response Spectra for Periods Ranging from 0.01 to 10 s*, Preprint of version submitted for publication in the NGA Special Volume of Earthquake Spectra, Volume 24, Issue 1, pages 139-171, February 2008.

7. Chiou, Brian S. J. and Robert R. Youngs, *A NGA Model for the Average Horizontal Component of Peak Ground Motion and Response Spectra*, preprint for article to be published in NGA Special Edition for Earthquake Spectra, Spring 2008.

8. City of San Diego, *Seismic Safety Study, Geologic Hazards and Faults*, 2008 edition, Map Sheets 43 and 44.

9. Geocon Incorporated, *Geotechnical Investigation, Heritage Bluffs, San Diego, California*, dated December 3, 2007 (Project No. 07339-32-02).

10. Geocon Incorporated, *Supplemental Geotechnical Investigation, Heritage Bluffs, San Diego, California*, dated May 5, 2008 (Project No. 07339-32-02).

11. Geocon Incorporated, Update Geotechnical Report, Heritage Bluffs II, San Diego, California, dated February 7, 2014 (Project No. 07339-32-03).

12. Jennings, C. W., 1994, California Division of Mines and Geology, *Fault Activity Map of California and Adjacent Areas*, California Geologic Data Map Series Map No. 6.

13. Kennedy, M. P. and S. S. Tan, *Geologic Map of the Oceanside 30'x60' Quadrangle, California*, USGS Regional Map Series, Scale 1:100,000, 2005.

14. Kennedy, M. P. and S. S. Tan, *Geologic Map of the San Diego 30'x60' Quadrangle, California*, USGS Regional Map Series Map No. 3, Scale 1:100,000, 2008.

LIST OF REFERENCES (Concluded)

15. Risk Engineering, *EZ-FRISK*, 2011.

16. Unpublished reports and maps on file with Geocon Incorporated.

17. USGS computer program, *Seismic Hazard Curves and Uniform Hazard Response Spectra*.

18. United States Department of Agriculture, *1953 Stereoscopic Aerial Photographs, Flight AXN-3M*, Photos Nos. 112 and 113 (scale 1:20,000).

APPENDIX I-2

Geotechnical Review of Environmental Impact Reports Memo

GEOCON
INCORPORATED
GEOTECHNICAL ■ ENVIRONMENTAL ■ MATERIALS

Project No. 07339-32-03
December 9, 2015

CalAtlantic Homes
16010 Camino Del Sur
San Diego, California 92127

Attention: Mr. Bill Dumka

Subject: GEOTECHNICAL REVIEW OF ENVIRONMENTAL IMPACT REPORTS
HERITAGE BLUFFS II
SAN DIEGO, CALIFORNIA

References:

1. *Update Geotechnical Investigation, Heritage Bluffs II, San Diego, California,* prepared by Geocon Incorporated, dated January 23, 2015.
2. *Final Environmental Impact Report for the Black Mountain Ranch Subarea I Plan (North City Future Urbanizing Area), City of San Diego; LDR No. 96-7902, SCH No. 97111070, Section H- Geology and Soils,* prepared by Recon Environmental, dated 1998.
3. *Draft Supplemental Environmental Impact Report for the Heritage Bluffs II Project, City of San Diego; Project No. 319435, SCH No. 1997111070, Section 9.0,* prepared by Recon Environmental, dated December 2015.

Dear Mr. Dumka:

In accordance with your request, we have reviewed References 2 and 3 in order to clarify the geotechnical differences between the 1998 and 2015 Environmental Impact Reports (EIR). To aid in preparing this correspondence, we have reviewed the reference reports and attended a review meeting at the City of San Diego on December 9, 2015.

The original EIR report (Reference No. 2) was based on several geotechnical reports performed between October 1989 and June 1995 that covered the overall Black Mountain Ranch Subarea. As such, several descriptions, discussions and mitigation measures contained within the 1998 EIR do not apply to the site-specific conditions as described in the present Supplemental 2015 EIR for the Heritage Bluffs II project (Reference No. 3).

In order to satisfy the City of San Diego reviewers concerns we have addressed the major geotechnical differences between the two EIR's in bullet form below.

- Nine geologic formations and five surficial deposits were described in the 1998 EIR, however, the geologic site conditions encountered during our study for Heritage Bluffs II consisted of three surficial soil types and two geologic formations. The surficial deposits consist of topsoil, alluvium and colluvium. The formational units include a Cretaceous-age unnamed fanglomerate and the Jurassic-age Santiago Peak Volcanics as discussed on pages 2 through 4, Section 4- *Soil and Geologic Conditions* in Reference No. 1.

- Groundwater-Seepage is discussed on page 292 of the 1998 EIR. Please see Section 6- *Groundwater/Seepage* on page 5 in Reference No. 1 for a discussion on groundwater and/or seepage for the subject site.

- Five potential geologic hazards were discussed in the 1998 EIR. The geologic hazards specific to the subject project are addressed in Section 7- *Geologic Hazards* on pages 5 through 8 in Reference No. 1.

- Five mitigation measures were included on pages 296 and 297 of 1998 EIR. Several of these measures are not applicable to the subject project or have been adequately addressed in Reference No. 1. Each of the five mitigation measures and our response is listed below.

Issue 1: *The presence of landslides, weak claystones, uncompacted fill soils, and potenitally compressible colluvial and alluvial deposits require special consideration where development is planned.*

Response: No landslides, weak claystones or uncompacted fill soils were identified on the subject site. Remediation of the colluvium and alluvium is discussed in Section 8.6.4 on page 13 in Reference No. 1.

Issue 2: *Very heavy ripping may be necessary within areas underlain by the Santiago Peak Volcanics, Lusardi Formation, and gabbro. Deep cuts in the Sanitago Peak Volcanics or gabbroic rocks would require blasting. Special handling of the excavated rock and placement of oversized materials would also be anticipated.*

Response: The Lusardi formation and gabbroic rock were not encountered during our field investigations for the subject site. See Section 5, Section 8.6 and Appendix D in Reference No. 1 for discussion and recommendations for rippability/blasting and placement of oversize materials.

Issue 3: *Highly expansive soils may be encountered with the Delmar, Mission Valley, and Friars formations and some of the topsoils. It is anticipated, however, that there would be sufficient low expanisve soils available on the site to mitigate the adverse impact of expansive soils where encountered.*

Response: The Delmar, Mission Valley, or Friars formations were not encountered during our field investigations. See Section 8.6.9, page 14 for recommendiations concerning expanisvie soils in Reference No. 1.

Issue 4: *Compressible alluvium and colluvium present along canyon alignments and on the lower flanks of the ridges would require at least partial removal and recompaction where settlement sensitive improvements are planned.*

Response: Remedial grading of the colluvium and alluvium is discussed in Section 8.6.4 on page 13 in Reference No. 1.

Issue 5: *Perched groundwater is anticipated to be present within the low-lying alluvial areas. Hence, remedial measures in the form of subdrains would be required where filling of the drainage courses is planned.*

Response: See Sections 6- *Groundwater/Seepage* and 8.5- *Subdrains* in Reference No. 1 for recommendations concerning groundwater/seepage and subdrains.

If there are any questions regarding this correspondence, or if we may be of further service, please contact the undersigned at your convenience.

Very truly yours,

GEOCON INCORPORATED

Troy K. Reist

Troy K. Reist
CEG 2408

PROFESSIONAL GEOLOGIST ★ STATE OF CALIFORNIA ★ TROY K. REIST No. 2408 CERTIFIED ENGINEERING GEOLOGIST

TKR:bl

(e-mail) Addressee
(e-mail) Recon Environmental
Attention: Ms. Stephanie Morgan Whitmore

APPENDIX J
Sewer Report

PRELIMINARY SEWER STUDY

HERITAGE BLUFFS II

November 2014

Prepared For:
Olivenhain Municipal Water District
1966 Olivenhain Road
Encinitas, California 92024

Client:
SPIC Del Sur LLC
c/o Black Mountain Ranch
16010 Camino Del Sur
San Diego, California 92127

Prepared By:

PROJECT DESIGN CONSULTANTS
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Job No. 3255.30

Greg Shields, RCE 42951		Prepared By: MW
Registration Expires 03/31/2016		Checked By: MW

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APPENDIX

ATTACHMENTS

SECTION 1

INTRODUCTION

The purpose of this report is to present the design of the onsite sanitary sewer facilities associated with Heritage Bluffs II project flows and demonstrate that the sewer discharge from the proposed project does not exceed the hydraulic capacity of the proposed downstream facilities.

The Heritage Bluffs ("HB") Project is within the City of San Diego, however, the project will be annexed into Olivenhain Municipal Water District ("OMWD") after tentative map approval and therefore the proposed sewer flows generated by the project will be conveyed to the downstream sewer treatment plant owned and operated by OMWD. The proposed sewer mains in the Heritage Bluffs II project will be owned and maintained by OMWD.

The proposed 8inch sewer mains in Heritage Bluffs II will have two proposed points of connections, one in Street J and the other at the connection of the access road, within the East Clusters Units 2 and 3 development. The plans for the sewer main points of connections have been designed by Rick Engineering and are currently being reviewed by OMWD. These facilities will be needed to be built prior to the development of Heritage Bluffs II.

SECTION 2

PROJECT DESCRIPTION

Heritage Bluffs is approximately 169.85 acres and located in the City of San Diego. The proposed project is west of I-15, south of Carmel Valley Road and Bernardo Center Drive, and north of Ted Williams Parkway (SR-56) as shown in Figure 1 on page 3.

The sewer report prepared by Dexter Wilson Engineering, Inc. titled *Amendment No. 4, Sewer System Analysis for Black Mountain Ranch North* dated July 2011 (see Appendix B) accounts for sewer discharge from the proposed project site. The approved Amendment was analyzed assuming 305 dwelling units would be coming from the Heritage Bluffs II project. The point of connection shown on the approved Amendment is located at Manhole No.8, per Exhibit A of the approved report.

The project now proposes to develop a total of 171 single family residential units. Sewage from within the project will be collected through a series of 8-inch collector lines, which ultimately connect to the proposed 8-inch sewer main, per *Black Mountain Ranch East Clusters* (VTM 99-1054), in Street J and the access road. Sewer flows will be treated by OMWD and all proposed sewer mains and facilities will be owned and maintained by OMWD. See Appendix C for supporting documentation regarding sewer annexation and OMWD's correspondences.

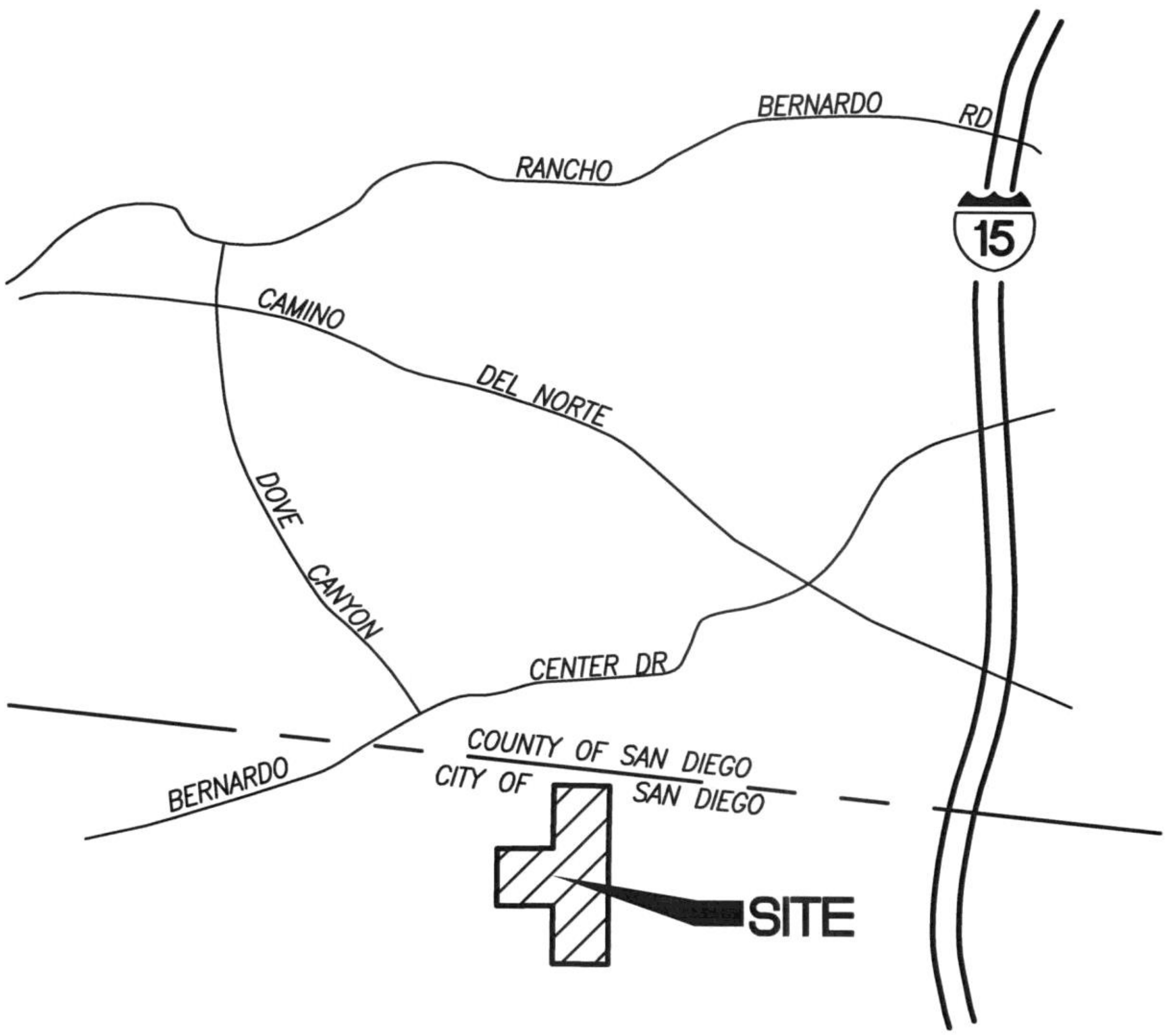


FIGURE 1

VICINITY MAP

SECTION 3

DESIGN CRITERIA

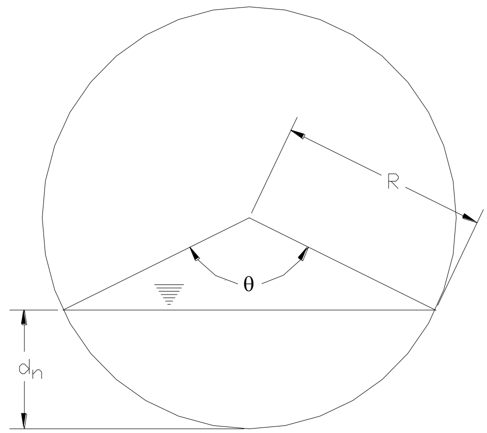
All sewer facilities have been designed in accordance with the following criteria:

- Residential flows are based on 80 gal/capita/day
- 8"PVC minimum diameters
- Minimum pipe slope = 0.5%, where slope is below 1.0%, pipe velocity must exceed 2.0FPS
- Sewer pipe material is to be polyvinyl chloride pipe (PVC) with Manning "N" value of 0.013
- 0.5 dn/D for pipes less than or equal to 15 inches
- 0.75 dn/D for pipes greater than 15 inches
- Peak Factor = 4.0 (per formula from City of San Diego Water and Sewer Design guide, Figure 1-1)
- GPD – Gallons per Day
- GPM – Gallons per Minute
- MGD – Million Gallons per Day
- DU – Dwelling Unit
- MH – Manhole

SECTION 4

FLOW CALCULATIONS AND EQUATIONS

Flow Velocities (V) and Normal Depths (d_n) are calculated using iterative solutions of the following equations:



Typical Cross Section

Q = Volumetric Flow = $V \times A$

where:

A = Cross-Sectional Area of Flow
V = Flow Velocity

$$A = (R)^2 \times [\theta/2 - \sin(\theta/2) \times \cos(\theta/2)]$$

where:

θ = $2 \times \text{ARCCOS}[(R - d_n)/(R)]$
d_n = Normal Depth

$$V = (1.486/n)R_h^{2/3}S^{1/2} \text{ (Manning Equation)}$$

where:

n = Manning Roughness Coefficient = 0.013
R_h = Hydraulic Radius = A/P_w
P_w = Wetted Perimeter = $\theta \times R$
S = Slope of Pipe

SECTION 5

CONCLUSION

This report analyzed the proposed design of the sanitary sewer facilities associated with Heritage Bluffs II. Based on the sewer calculations, the sewer discharge from this proposed project does not exceed the hydraulic capacity of the proposed downstream pipe. This report shows that the proposed system and the affected downstream pipes meet design criteria in accordance with the design standards of the Olivenhain Municipal Water District.

TABLES

Sewer Flow Calculations

PROJECT DESIGN CONSULTANTS
701 'B' STREET, SUITE 800
SAN DIEGO, CALIFORNIA 92101

PDC JOB # 3255.30
CITY W.O. #
DATE: 11/06/14

SEWER FLOW CALCULATIONS
HERITAGE BLUFFS

MH FROM	MH TO	POP PER D.U.	DU TOTAL	PEAK /AVE RATIO	PEAK DESIGN GAL/DAY	FLOW C.F.S.	LINE SIZE(D) (INCH.)	DESIGN SLOPE %	dn/D	VEL. F.P.S.
STREET 'D'										
MH # 42	MH # 41	3.5	9	4.00	2,880	0.004	8	4.99%	0.030	1.44
MH # 41	MH # 40	3.5	13	4.00	4,160	0.006	8	2.32%	0.040	1.37
MH # 40	MH # 39	3.5	13	4.00	4,160	0.006	8	1.00%	0.050	0.98
MH # 39	MH # 38	3.5	13	4.00	4,160	0.006	8	5.61%	0.036	1.69
MH # 38	MH # 37	3.5	13	4.00	4,160	0.006	8	11.34%	0.030	2.08
MH # 37	MH # 36	3.5	13	4.00	4,160	0.006	8	9.67%	0.030	2.08
MH # 36	MH # 35	3.5	13	4.00	4,160	0.006	8	6.73%	0.035	1.69
MH # 35	MH # 34	3.5	13	4.00	4,160	0.006	8	7.86%	0.036	1.69
MH # 34	MH # 33	3.5	13	4.00	4,160	0.006	8	7.86%	0.036	1.69
MH # 33	MH # 32	3.5	13	4.00	4,160	0.006	8	10.79%	0.030	2.08
MH # 32	MH # 31	3.5	13	4.00	4,160	0.006	8	1.00%	0.048	1.15
MH # 31	MH # 30	3.5	13	4.00	4,160	0.006	8	1.00%	0.048	1.15
MH # 30	MH # 29	3.5	13	4.00	4,160	0.006	8	1.00%	0.048	1.15
MH # 29	MH # 28	3.5	13	4.00	4,160	0.006	8	1.00%	0.048	1.15
MH # 28	TIE-IN	3.5	13	4.00	4,160	0.006	8	1.00%	0.048	1.15

STREET 'G'

MH # 27	MH # 26	3.5	4	4.00	1,280	0.002	8	3.87%	0.020	1.19
MH # 26	MH # 22	3.5	8	4.00	2,560	0.004	8	6.31%	0.025	1.77

MH		POP PER D.U.	DU TOTAL	PEAK /AVE RATIO	PEAK DESIGN GAL/DAY	FLOW C.F.S.	LINE SIZE(D) (INCH.)	DESIGN SLOPE %	dn/D	VEL. F.P.S.
FROM	TO									
STREET 'G'										
MH # 25	MH # 24	3.5	4	4.00	1,280	0.002	8	4.23%	0.020	1.19
MH # 24	MH # 23	3.5	8	4.00	2,560	0.004	8	5.01%	0.028	1.47
MH # 23	MH # 22	3.5	18	4.00	5,760	0.009	8	1.89%	0.048	1.59
MH # 22	MH # 21	3.5	28	4.00	8,960	0.014	8	3.94%	0.048	2.47
MH # 21	MH # 4	3.5	28	4.00	8,960	0.014	8	2.76%	0.058	1.67
STREET 'E'										
MH # 20	MH # 19	3.5	8	4.00	2,560	0.004	8	1.75%	0.040	0.84
MH # 19	MH # 18	3.5	19	4.00	6,080	0.009	8	2.01%	0.050	1.43
MH # 18	MH # 14	3.5	28	4.00	8,960	0.014	8	2.01%	0.060	1.61
STREET 'J'										
MH # 17	MH # 16	3.5	13	4.00	4,160	0.006	8	2.00%	0.045	1.15
MH # 16	MH # 15	3.5	22	4.00	7,040	0.011	8	5.40%	0.045	1.94
MH # 15	MH # 14	3.5	143	4.00	45,760	0.071	8	3.11%	0.125	2.87
MH # 14	MH # 13	3.5	175	4.00	56,000	0.087	8	4.54%	0.125	3.51
MH # 13	MH # 10	3.5	176	4.00	56,320	0.087	8	4.13%	0.130	3.24
STREET 'D'										
MH # 12	MH # 11	3.5	15	4.00	4,800	0.007	8	1.00%	0.060	0.86
MH # 11	MH # 10	3.5	27	4.00	8,640	0.013	8	1.00%	0.070	1.23
MH # 10	MH # 9	3.5	205	4.00	65,600	0.102	8	1.00%	0.180	2.35
MH # 9	MH # 8	3.5	216	4.00	69,120	0.107	8	2.00%	0.170	2.69
MH # 8	MH # 7	3.5	228	4.00	72,960	0.113	8	1.82%	0.180	2.62
MH # 7	MH # 3	3.5	236	4.00	75,520	0.117	8	1.61%	0.180	2.71
STREET 'J'										
MH # 6	MH # 5	3.5	7	4.00	2,240	0.003	8	6.93%	0.020	5.94
MH # 5	MH # 4	3.5	11	4.00	3,520	0.005	8	7.76%	0.025	4.86
MH # 4	MH # 3	3.5	39	4.00	12,480	0.019	8	9.17%	0.050	2.93
MH # 3	MH # 2	3.5	275	4.00	88,000	0.136	8	6.64%	0.140	4.54
MH # 2	MH # 1	3.5	275	4.00	88,000	0.136	8	7.49%	0.140	4.54
MH # 1	TIE-IN	3.5	275	4.00	88,000	0.136	8	8.61%	0.130	5.06

APPENDIX A

City of San Diego Sewer Design Guide Tables & Figures

Per Sewer Design Guide (2013)

TABLE 1-1
CITY OF SAN DIEGO SEWER DESIGN GUIDE
DENSITY CONVERSIONS

Zone	Maximum Density (DU/Net Ac)	Population per DU	Equivalent Population (Pop/Net Ac)
AR-1-1, RE-1-1	0.1	3.5	0.4
RE-1-2	0.2	3.5	0.7
AR-1-2, RE-1-3	1	3.5	3.5
RS-1-1, RS-1-8	1	3.5	3.5
RS-1-2, RS-1-9	2	3.5	7.0
RS-1-3, RS-1-10	3	3.5	10.5
RS-1-4, RS-1-11	4	3.5	14.0
RS-1-5, RS-1-12	5	3.5	17.5
RS-1-6, RS-1-13	7	3.5	24.5
RS-1-7, RS-1-14	9	3.5	31.5
RX-1-1	11	3.4	37.4
RT-1-1	12	3.3	39.6
RX-1-2, RT-1-2, RU-1-1	14	3.2	44.8
RT-1-3, RM-1-2	17	3.1	52.7
RT-1-4	20	3.0	60.0
RM-1-3	22	3.0	66.0
RM-2-4	25	3.0	75.0
RM-2-5	29	3.0	87.0
RM-2-6	35	2.8	98.0
RM-3-7, RM-5-12	43	2.6	111.8
RM-3-8	54	2.4	129.6
RM-3-9	73	2.2	160.6
RM-4-10	109	1.8	196.2
RM-4-11	218	1.5	327.0

TABLE 1-1
CITY OF SAN DIEGO SEWER DESIGN GUIDE
DENSITY CONVERSIONS (Continued)

Zone	Maximum Density (DU / Net Ac)	Population Per DU	Equivalent Population (Pop/Net Ac)
Schools/Public	8.9	3.5	31.2
Offices	10.9	3.5	38.2*
Commercial/Hotels	12.5	3.5	43.7*
Industrial	17.9	3.5	62.5*
Hospital	42.9	3.5	150.0*

Figures with asterisk (*) represent equivalent population per floor of the building.

Definitions:
DU = Dwelling Units
Ac = Acreage
Pop = Population

Net Acreage is the developable lot area excluding areas that are dedicated as public streets in acres. Gross Area is the entire area in acres of the drainage basin, including lots, streets, etc.

For undeveloped areas, assume Net Acreage = 0.8 x Gross Area in Acres

For developed areas, calculate actual Net Acreage.

Tabulated figures are for general case. The tabulated figures shall not be used if more accurate figures are available.

Population is based on actual equivalent dwelling units (EDU) or the maximum estimate obtained from zoning.

Conversion of Fixture Units to Equivalent Dwelling Units (EDU): The Water Meter Data Card, maintained by the Development Services Department, contains a table of plumbing fixtures that should be used for determining the equivalent dwelling units (EDU's) for the purpose of estimating the rate of wastewater generation in residential, commercial, or industrial areas. Currently, the basis for conversion is: 20 fixtures = 1 EDU and 1 EDU = 280 gallons of wastewater per day.

In high rise building areas, flow rates shall be based on the most current, adopted edition of the applicable Plumbing Code, assuming one lateral per area. The most conservative flow rate shall govern.

PUBLIC UTILITIES DEPARTMENT

PEAKING FACTOR FOR SEWER FLOWS
(Dry Weather)

Ratio of Peak to Average Flow*
Versus Tributary Population

Population	Ratio of Peak to Average Flow	Population	Ratio of Peak to Average Flow
200	4.00	4,800	2.01
500	3.00	5,000	2.00
800	2.75	5,200	1.99
900	2.60	5,500	1.97
1,000	2.50	6,000	1.95
1,100	2.47	6,200	1.94
1,200	2.45	6,400	1.93
1,300	2.43	6,900	1.91
1,400	2.40	7,300	1.90
1,500	2.38	7,500	1.89
1,600	2.36	8,100	1.87
1,700	2.34	8,400	1.86
1,750	2.33	9,100	1.84
1,800	2.32	9,600	1.83
1,850	2.31	10,000	1.82
1,900	2.30	11,500	1.80
2,000	2.29	13,000	1.78
2,150	2.27	14,500	1.76
2,225	2.25	15,000	1.75
2,300	2.24	16,000	1.74
2,375	2.23	16,700	1.73
2,425	2.22	17,400	1.72
2,500	2.21	18,000	1.71
2,600	2.20	18,900	1.70
2,625	2.19	19,800	1.69
2,675	2.18	21,500	1.68
2,775	2.17	22,600	1.67
2,850	2.16	25,000	1.65
3,000	2.14	26,500	1.64
3,100	2.13	28,000	1.63
3,200	2.12	32,000	1.61
3,500	2.10	36,000	1.59
3,600	2.09	38,000	1.58
3,700	2.08	42,000	1.57
3,800	2.07	49,000	1.55
3,900	2.06	54,000	1.54
4,000	2.05	60,000	1.53
4,200	2.04	70,000	1.52
4,400	2.03	90,000	1.51
4,600	2.02	100,000+	1.50

*Based on formula: Peak Factor = $6.2945 \times (\text{pop})^{-0.1342}$
(Holmes & Narver, 1960)

FIGURE 1-1

APPENDIX B

Amendment No. 4

Sewer System Analysis for Black Mountain Ranch North

Dated July 2011

AMENDMENT NO. 4
SEWER SYSTEM ANALYSIS FOR
BLACK MOUNTAIN RANCH NORTH

July 11, 2011

REGISTERED PROFESSIONAL ENGINEER
STEPHEN M. NIELSEN
No. 61070
Exp. 9/30/11
CIVIL
STATE OF CALIFORNIA

Prepared by:
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2234 Faraday Avenue
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Job No. 884-002

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July 11, 2011 884-002

Black Mountain Ranch, LLC
16010 Camino Del Sur
San Diego, CA 92127

Attention: Dale Greenhalgh, Project Manager

Subject: Black Mountain Ranch North Sewer System Analysis Amendment No. 4

Introduction

This letter-report provides an amendment (Amendment No. 4) to the Black Mountain Ranch North sewer system analysis. This study is prepared based on the most current land use plan for Vesting Tentative Map (VTM) 40-0528. Amendment No. 3 was prepared in February 2008 and was approved by the City of San Diego. The current land use plan does not include changes to the residential units or significant changes to the non-residential acreages that were presented in Amendment No. 3, but does propose changes to the lot layout and street and utility alignments. These changes primarily occur in the northeast corner of the study area. Thus, Amendment No. 4 is being prepared primarily to reflect the current street, lot, and utility locations.

Background

The Sewer System Analysis for Black Mountain Ranch North was dated January 2002. Amendment Number 1 to this analysis was dated April 2002 and was prepared based on minor land use changes in the northern portion of the study area. Amendment Number 2 was prepared in September 2003 and included a minor land use change in the northeast corner of the project. Amendment No. 3 was prepared in February 2008 to reflect land use changes in the northeast portion of the project. The original study and three amendments were approved by the City of San Diego. Amendment Number 3 contains the most current approved analysis for Black Mountain Ranch North and has been included in Appendix B for reference.

Purpose of Study

The developer of Black Mountain Ranch North has submitted plans for improvements in the northeast portion of the project. In response, the City has requested an amended sewer study to reflect the current street and utility layouts for the project. This study presents the current land use plan and updates the hydraulic analysis based on minor changes to gravity sewer alignments.

Projected Sewer Flows

Previous sewer studies identified three tributary areas for gravity flows within Black Mountain Ranch North as follows:

- East Area to County
- Lift Station B
- Pump Station 90

Development within the "East Area to County" is unaffected by the updated street and utility layouts and is, therefore, not considered further in the study. The majority of land use changes occur in the area tributary to Lift Station B, but flows to Lift Station 90 are also affected. Table 1 provides a summary of projected flows for these areas based on the current utility layout. Gross acreages were converted to net acreage by applying a factor of 0.8. Sewage generation factors for the current land use plan were based on the 2004 Sewer Design Guide, unless otherwise noted.

TABLE 1 PROJECTED SEWER FLOW SUMMARY				
Land Use	Current Land Use Plan			
	Net Area, Ac	Units	Sewage Generation Factor	Avg. Sewage Flow, gpd
Lift Station B				
MF Residential	--	375	240 gpd/unit[1]	90,000
Commercial/ Office	19.1	--	3,056 gpd/ac	58,370
Employment Center	18.3	--	3,056 gpd/ac	55,925
Middle School	17.4	--	2,496 gpd/ac	43,430
Hotel	--	300	100 gpd/ac[2]	30,000
Subtotal Lift Station B				**277,725**
Pump Station 90				
SF Residential	--	1,772	280 gpd/unit	496,160
Offsite Area "E" SF Residential	--	300	280 gpd/unit	84,000
MF Residential	--	823	240 gpd/unit[1]	197,520
Schools	8.2	--	2,496 gpd/ac	20,467
Parks	5.0	--	500 gpd/ac	2,500
Subtotal Pump Station 90				**800,648[3]**
TOTAL				**1,078,372**

[1] Based on average density of 20 Du/Ac.
[2] Based on Metcalf & Eddy Third Edition, assuming double occupancy.
[3] This gravity flow includes the development served by two private lift stations. In addition to this gravity flow, Pump Station 90 will receive flows from Lift Station B.

Recommended Sewer Facilities

Using the most current development plans for properties within Black Mountain Ranch North, sewer data tables were prepared to analyze the onsite sewer system. Where development plans were not detailed enough to provide information on the slope of a recommended sewer line, a minimum slope of 1.0 percent was assumed for local collector sewers and a 0.50 percent slope was assumed for trunk sewers. Appendix A provides the sewer data tables used to size onsite facilities. The sizing of these facilities should be verified once more detailed development plans and actual pipe slopes are available. Exhibit A in the Appendix A map pocket graphically shows the recommended onsite sewer facilities for Black Mountain Ranch North and provides the node diagram for the hydraulic analysis. Recommended gravity sewer lines range from 8-inch to 18-inches in size. For commercial areas, the minimum allowable gravity sewer line size is 10-inch per the 2004 Sewer Design Guide.

Lift Station B. From Table 1, the projected average sewage flow to Lift Station B is 0.278 mgd. By assuming an equivalent population of 80 gpd of sewage generation and using Figure 1-1 from the Sewer Design Guide, a peaking Factor of 2.10 was utilized. Thus, the peak projected flow to the station is 0.583 mgd (405 gpm). In accordance with the previously approved sewer study, a reserve capacity factor of 1.3 was assumed. Thus, the required firm pumping capacity for Lift Station B is 530 gpm. Dual 6-inch force mains are recommended to convey this flow. At 530 gpm, a force main velocity of 6.0 feet per second will be achieved in a 6-inch line.

Pump Station 90. Pump Station No. 90 will accept gravity flows as well as pumped flows from Lift Station B and two private lift stations. The methodology for sizing this station was to calculate 130 percent of the peak gravity flows and add the pumped flow rate from Lift Station B. The pumped flows from the private lift stations represent less than 10 percent of the total flow to Pump Station 90 and, therefore, the pump effect is not taken into account. The average projected gravity flow to Pump Station No. 90 is 0.801 mgd. Using 80 gpd per person and Figure 1-1 from the City of San Diego Design Guide, a peak factor of 1.82 was used. Thus, the peak gravity flow to the station is 1.46 mgd (1,012 gpm) and the design gravity flow is 1,315 gpm (1,012 x 1.3). By adding in pumped flows, the recommended design capacity of Pump Station 90 is 1,845 gpm (1,315 + 530).

Pump Station 90 was constructed in 2004 with a design capacity of 2,065 gpm. Based on the information presented above, Pump Station 90 has adequate capacity to meet the projected flows of the current development plan.

Conclusions and Recommendations

1. The current land use plan will result in approximately the same overall sewage flows for the project, but the collection of flows has changed slightly from previous studies with slightly less flow going to Lift Station B. The total sewage flow has also been reduced primarily due to the removal of the high school site that is being sewer by the Olivenhain Municipal Water District.

2. Exhibit A at the back of this report provides the recommended sewer system improvements for Black Mountain Ranch North project.

3. Since the exact location where the Camelot project will connect to the system is not yet known, we evaluated the connection of these flows at two locations. The hydraulic analysis for the proposed sewer system is provided in Appendix A.

4. Lift Station B is recommended to be designed for a firm pumping capacity of 530 gpm. This study confirms that Pump Station 90 was constructed with adequate capacity to serve the currently proposed development within Black Mountain Ranch North.

5. This study provides recommendations for serving Black Mountain Ranch North as a whole. It shall be the responsibility of the developer for each individual area to ensure that adequate sewer service is provided to their project based on the timing of surrounding developments.

6. Public sewer lift stations should be on a separate lot. Access road and lift station lot shall be designated in fee title to the City of San Diego. All proposed public sewer lift stations must be designed per the City's Design Guide Standards dated November 2004, or as revised.

7. For private sewer lift stations, all upstream gravity sewers and sewer force main piping shall also be private. A copy of the homeowner's association CC&R's will be required to show that the maintenance and operation of the private pump station, force mains, and any upstream gravity mains will be the responsibility of the homeowners. A letter of agreement to this effect must be recorded against all applicable lots.

Thank you for the opportunity to provide assistance on this project. If you have any questions on the information contained herein, please let us know.

Dexter Wilson Engineering, Inc.

Stephen M. Nielsen, P.E.

SMN:ck

APPENDIX A

SEWER SYSTEM
HYDRAULIC ANALYSIS

SEWER STUDY SUMMARY

DATE: 4/11/2011 FOR: Black Mountain Ranch North – Lift Station B Tributary Area SHT 1 OF 1

JOB NUMBER: 884-002 BY: Dexter Wilson Engineering REFER TO PLAN SHEET:

LINE	FROM	TO	POP. PER D.U.	IN-LINE EDUs	POPULATION SERVED		SEWAGE PER CAPITA/DAY (gpd)	AVG. DRY WEATHER FLOW (gpd)	DRY WEATHER PEAKING FACTOR	PEAK DRY WEATHER FLOW (gpd)	WET WEATHER PEAKING FACTOR	PEAK WET WEATHER FLOW (DESIGN FLOW)		LINE SIZE (inches)	DESIGN SLOPE (%)	DEPTH K'[1]	dn (feet)	dn/D[2]	C_2 for Velocity[3]	VELOCITY (f.p.s.)	Remarks
					IN-LINE	TOTAL						M.G.D.	C.F.S.								
	126	124	3.5	26.2	91.7	91.7	80	7,336	4.00	29,344	1.00	0.03	0.05	10	1.00	0.009598	0.08333	0.10	0.04	1.60	2.4 Net Ac Comm.
	124	116	3.5	229.4	802.9	894.6	80	71,568	2.60	186,077	1.00	0.19	0.29	10	1.00	0.060865	0.20000	0.24	0.14	2.86	204 MF Units + 5 Net ac E.C.
	122	118	3.5	30.9	108.2	108.2	80	8,652	4.00	34,608	1.00	0.03	0.05	8	1.00	0.020525	0.09333	0.14	0.07	1.79	36 MF Units
	120	118	3.5	49.7	174.0	174.0	80	13,916	4.00	55,664	1.00	0.06	0.09	8	1.00	0.033013	0.12000	0.18	0.10	2.02	58 MF Units
	118	116	3.5	58.3	204.1	378.0	80	30,240	3.40	102,816	1.00	0.10	0.16	10	1.00	0.033631	0.15000	0.18	0.10	2.41	32 MF Units + MH 122 Flow
	116	106	3.5	301.4	1054.9	1432.9	80	114,632	2.39	273,970	1.00	0.27	0.42	10	1.00	0.089615	0.25000	0.30	0.20	3.11	4.2 Net Ac E.C. + MH 124 Flow
	115	114	3.5	8.6	30.1	30.1	80	2,408	4.00	9,632	1.00	0.01	0.01	10	1.00	0.003151	0.05000	0.06	0.02	1.12	10 MF units
	114	112	3.5	95.0	332.5	362.6	80	25,008	3.45	100,078	1.00	0.10	0.15	10	1.00	0.032735	0.15000	0.18	0.10	2.32	4.8 Net ac com. hotel. 29 MF
	112	110	3.5	231.7	811.0	1173.6	80	93,884	2.45	230,016	1.00	0.23	0.36	10	1.00	0.075238	0.22500	0.27	0.17	3.00	School. 4.9 ac com. 6 MF hotel
	110	108	3.5	147.8	517.3	1690.9	80	135,268	2.34	316,527	1.00	0.32	0.49	10	1.00	0.103535	0.26667	0.32	0.22	3.25	7.0 net ac com. hotel
	108	106	3.5	99.3	347.6	2038.4	80	163,072	2.29	373,435	1.00	0.37	0.58	10	1.00	0.122150	0.29167	0.35	0.25	3.40	9.1 Net ac E.C.
	106	LS B	3.5	409.4	1432.9	3471.3	80	277,704	2.10	583,178	1.00	0.58	0.90	10	1.00	0.190757	0.37500	0.45	0.34	3.79	MH 116 Flow

[1] K' based on n = 0.013
[2] dn/D using K' in Brater King Table 7-14
[3] From Brater King Table 7-4 based on dn/D

SEWER STUDY SUMMARY

DATE: 4/11/2011 FOR: Black Mountain Ranch North – Pump Station 90 Tributary Area SHT 1 OF 2

JOB NUMBER: 884-002 BY: Dexter Wilson Engineering REFER TO PLAN SHEET:

LINE	FROM	TO	POP. PER D.U.	IN-LINE EDUs	POPULATION SERVED IN-LINE	POPULATION SERVED TOTAL	SEWAGE PER CAPITA/DAY (gpd)	AVG. DRY WEATHER FLOW (gpd)	DRY WEATHER PEAKING FACTOR	PEAK DRY WEATHER FLOW (gpd)	WET WEATHER PEAKING FACTOR	PEAK WET WEATHER FLOW (DESIGN FLOW) M.G.D.	PEAK WET WEATHER FLOW (DESIGN FLOW) C.F.S.	LINE SIZE (inches)	DESIGN SLOPE (%)	DEPTH K'[1]	dn (feet)	dn/D[2]	C_v for Velocity[3]	VELOCITY (f.p.s.)	Remarks
	292	282	3.5	66.0	231.0	231.0	80	18,480	3.83	70,778	1.00	0.07	0.11	8	4.21	0.020458	0.09333	0.14	0.07	3.65	66 SF Units
	291	290	3.5	76.4	267.4	267.4	80	21,392	3.67	78,509	1.00	0.08	0.12	8	2.00	0.032924	0.12000	0.18	0.10	2.84	75 SF Units + 0.8 ac park
	290	288	3.5	173.5	607.3	874.7	80	69,972	2.63	184,026	1.00	0.18	0.28	8	2.00	0.077174	0.18667	0.28	0.18	3.63	171 SF Units + 1.4 ac park
	288	286	3.5	84.5	295.8	1170.4	80	93,632	2.46	230,335	1.00	0.23	0.36	8	2.00	0.096594	0.20667	0.31	0.21	3.91	81 SF Units + 1.7 ac park
	286	284	3.5	33.0	115.5	1285.9	80	102,872	2.43	249,979	1.00	0.25	0.39	8	2.00	0.104832	0.21333	0.32	0.22	4.02	33 SF Units
	284	282	3.5	323.2	1131.2	2417.1	80	193,368	2.22	429,277	1.00	0.43	0.66	10	1.70	0.107694	0.27500	0.33	0.23	4.23	317 SF Units + 3.5 ac park
	282	280	3.5	66.0	231.0	2648.1	80	211,848	2.19	463,947	1.00	0.46	0.72	10	2.00	0.107308	0.27500	0.33	0.23	4.58	From MH 292
	280	258	3.5	58.0	203.0	2851.1	80	228,088	2.16	492,670	1.00	0.49	0.76	10	2.00	0.113951	0.28333	0.34	0.24	4.66	58 SF Units
	258	PS90	3.5	12.0	42.0	2893.1	80	231,448	2.16	499,928	1.00	0.50	0.77	10	2.00	0.115630	0.28333	0.34	0.24	4.72	12 SF Units
	272	270	3.5	109.8	384.3	384.3	80	30,744	3.45	106,067	1.00	0.11	0.16	8	1.00	0.062905	0.16667	0.25	0.15	2.41	48 SF + 70 MF Units + 1 ac park
	264	262	3.5	82.0	287.0	287.0	80	22,960	3.70	84,952	1.00	0.08	0.13	8	1.00	0.050382	0.14667	0.22	0.13	2.27	82 SF Units
	278	276	3.5	163.4	571.9	571.9	80	45,752	2.93	134,053	1.00	0.13	0.21	8	1.00	0.079503	0.18667	0.28	0.16	2.59	81 SF+School+Park
	276	270	3.5	83.1	290.9	862.8	80	69,020	2.67	184,283	1.00	0.18	0.29	8	1.00	0.109293	0.22000	0.33	0.23	2.84	36 SF + 55 MF Units
	270	268	3.5	56.0	196.0	1058.8	80	84,700	2.49	210,903	1.00	0.21	0.33	8	1.00	0.125080	0.24000	0.36	0.25	2.94	51 SF Units + 2.8 ac parks
	268	262	3.5	31.5	110.3	1169.0	80	93,520	2.46	230,059	1.00	0.23	0.36	8	1.00	0.136441	0.24667	0.37	0.26	3.05	29 SF Units + 1.4 ac park
	262	260	3.5	82.0	287.0	1456.0	80	116,480	2.39	278,387	1.00	0.28	0.43	8	1.00	0.165103	0.27333	0.41	0.30	3.20	From MH 264
	260	244	3.5	25.0	87.5	1543.5	80	123,480	2.37	292,648	1.00	0.29	0.45	8	1.00	0.173560	0.28000	0.42	0.31	3.27	25 SF Units
	244	240	3.5	344.8	1206.8	2750.3	80	220,024	2.17	477,452	1.00	1.24*	1.92*	15	0.50	0.194613	0.56250	0.45	0.34	3.57	From MH 246
	240	238	3.5	0.0	0.0	2750.3	80	220,024	2.17	477,452	1.00	1.24*	1.92*	15	0.50	0.194613	0.56250	0.45	0.34	3.57	
	256	254	3.5	0.0	0.0	0.0	80	0	4.00	0	1.00	0.76*	1.18*	12	1.00	0.153487	0.40000	0.40	0.29	4.04	Lift Station B
	254	252	3.5	65.8	230.3	230.3	80	18,424	3.90	71,854	1.00	0.84*	1.29*	12	1.00	0.167938	0.42000	0.42	0.31	4.13	73 MF Units + 1.8 ac park
	252	250	3.5	71.0	248.5	478.8	80	38,304	3.05	116,827	1.00	0.88*	1.36*	12	1.00	0.176982	0.43000	0.43	0.32	4.22	71 SF Units
	250	248	3.5	73.0	255.5	734.3	80	58,744	2.80	164,483	1.00	0.93*	1.44*	12	1.00	0.186566	0.44000	0.44	0.33	4.31	73 SF Units
	248	246	3.5	96.0	336.0	1070.3	80	85,624	2.48	212,348	1.00	0.98*	1.51*	15	0.50	0.153028	0.50000	0.40	0.29	3.31	96 SF Units
	246	244	3.5	39.0	136.5	1206.8	80	96,544	2.45	236,533	1.00	1.00*	1.55*	15	0.50	0.156822	0.50000	0.40	0.29	3.37	39 SF Units

* Includes 530 gpm from Lift Station B

[1] K' based on n = 0.013
[2] dn/D using K' in Brater King Table 7-14
[3] From Brater King Table 7-4 based on dn/D

SEWER STUDY SUMMARY

DATE: 7/7/2011 FOR: Black Mountain Ranch North - Pump Station 90 Tributary Area - Camelot Alt. I SHT 2A OF 2

JOB NUMBER: 884-002 BY: Dexter Wilson Engineering REFER TO PLAN SHEET:

LINE	FROM	TO	POP. PER D.U.	IN-LINE EDUs	POPULATION SERVED		SEWAGE PER CAPITA/DAY (gpd)	AVG. DRY WEATHER FLOW (gpd)	DRY WEATHER PEAKING FACTOR	PEAK DRY WEATHER FLOW (gpd)	WET WEATHER PEAKING FACTOR	PEAK WET WEATHER FLOW (DESIGN FLOW)		LINE SIZE (inches)	DESIGN SLOPE (%)	DEPTH K'[1]	dn (feet)	dn/D[2]	C_a for Velocity[3]	VELOCITY (f.p.s.)	Remarks
					IN-LINE	TOTAL						M.G.D.	C.F.S.								
	235	234	3.5	253.7	888.0	888.0	80	71,036	2.61	185,404	1.00	0.19	0.29	8	1.00	0.109957	0.22000	0.33	0.23	2.86	18 SF Units + 275 MF Units
	234	232	3.5	20.0	70.0	958.0	80	76,636	2.55	195,422	1.00	0.37**	0.57**	10	1.00	0.120418	0.29167	0.35	0.25	3.35	20 SF + Pvt. Pump Station(13)
	232	230	3.5	44.7	156.5	1114.4	80	89,152	2.47	220,205	1.00	0.39**	0.61**	10	1.00	0.128523	0.30000	0.36	0.25	3.44	42 SF Units + 1.5 ac park
	230	228	3.5	37.0	129.5	1243.9	80	99,512	2.44	242,809	1.00	0.42**	0.64**	10	1.00	0.135915	0.30833	0.37	0.26	3.50	37 SF Units
	228	206	3.5	21.0	73.5	1317.4	80	105,392	2.43	256,103	1.00	0.43**	0.66**	10	2.00	0.099181	0.25833	0.31	0.20	4.85	21 SF Units
	224	222	3.5	35.0	122.5	122.5	80	9,800	4.00	39,200	1.00	0.04	0.06	8	1.00	0.023248	0.10000	0.15	0.07	1.85	35 SF
	222	220	3.5	64.0	224.0	346.5	80	27,720	3.50	97,020	1.00	0.10	0.15	8	2.00	0.040687	0.13333	0.20	0.11	3.02	64 SF Units
	220	216	3.5	27.0	94.5	441.0	80	35,280	3.20	112,896	1.00	0.11	0.17	8	1.00	0.066955	0.17333	0.26	0.16	2.42	27 SF Units
	216	214	3.5	300.0	1050.0	1491.0	80	119,280	2.38	283,886	1.00	0.28	0.44	10	0.55	0.125211	0.30000	0.36	0.25	2.53	300 Offsite EDUs (Camelot)
	214	206	3.5	36.0	126.0	1617.0	80	129,360	2.36	305,290	1.00	0.48**	0.74**	12	0.55	0.129647	0.36000	0.36	0.25	2.90	36 SF + pvt. Pump
	206	204	3.5	376.4	1317.4	2934.4	80	234,752	2.15	504,717	1.00	0.85***	1.32***	15	0.55	0.127176	0.45000	0.36	0.25	3.31	From MH 228
	204	202	3.5	0.0	0.0	2934.4	80	234,752	2.15	504,717	1.00	0.85***	1.32***	15	0.55	0.127176	0.45000	0.36	0.25	3.31	
	202	238	3.5	0.0	0.0	2934.4	80	234,752	2.15	504,717	1.00	0.85***	1.32***	15	0.55	0.127176	0.32500	0.26	0.25	3.31	
	238	PS90	3.5	1,065.9	3730.7	6665.1	80	533,204	1.92	1,023,752	1.00	1.79*	2.76*	18	0.55	0.164357	0.61500	0.41	0.30	4.05	300 MF + From MH 240 + 23
																					SF lots from pvt pump sta areas.

[1] K' based on n = 0.013
[2] dn/D using K' in Brater King Table 7-14
[3] From Brater King Table 7-4 based on dn/D

* Includes 530 gpm from Lift Station B
** Includes 120 gpm from (1) private lift station
*** Includes 240 gpm from (2) private lift stations

SEWER STUDY SUMMARY

DATE: 7/7/2011 | FOR: Black Mountain Ranch North - Pump Station 90 Tributary Area - Camelot Alt. 2 | SHT 2B OF 2

JOB NUMBER: 884-002 | BY: Dexter Wilson Engineering | REFER TO PLAN SHEET:

LINE	FROM	TO	POP. PER D.U.	IN-LINE EDUs	POPULATION SERVED		SEWAGE PER CAPITA/DAY (gpd)	AVG. DRY WEATHER FLOW (gpd)	DRY WEATHER PEAKING FACTOR	PEAK DRY WEATHER FLOW (gpd)	WET WEATHER PEAKING FACTOR	PEAK WET WEATHER FLOW (DESIGN FLOW)		LINE SIZE (inches)	DESIGN SLOPE (%)	DEPTH K'[1]	dn (feet)	dn/D[2]	Ca for Velocity[3]	VELOCITY (f.p.s.)	Remarks
					IN-LINE	TOTAL						M.G.D.	C.F.S.								
	235	234	3.5	253.7	888.0	888.0	80	71,036	2.61	185,404	1.00	0.19	0.29	8	1.00	0.109957	0.22000	0.33	0.23	2.86	18 SF Units + 275 MF Units
	234	232	3.5	20.0	70.0	958.0	80	76,636	2.55	195,422	1.00	0.37**	0.57**	10	1.00	0.120418	0.29167	0.35	0.25	3.35	20 SF + Pvt. Pump Station(13)
	232	230	3.5	44.7	156.5	1114.4	80	89,152	2.47	220,205	1.00	0.39**	0.61**	10	1.00	0.128523	0.30000	0.36	0.25	3.44	42 SF Units + 1.5 ac park
	230	228	3.5	37.0	129.5	1243.9	80	99,512	2.44	242,809	1.00	0.42**	0.64**	10	1.00	0.135915	0.30833	0.37	0.26	3.50	37 SF Units
	228	206	3.5	21.0	73.5	1317.4	80	105,392	2.43	256,103	1.00	0.43**	0.66**	10	2.00	0.099181	0.25833	0.31	0.20	4.85	21 SF Units
	224	222	3.5	335.0	1172.5	1172.5	80	93,800	2.46	230,748	1.00	0.23	0.36	8	1.00	0.136849	0.24667	0.37	0.26	3.04	335 SF (Camelot)
	222	220	3.5	64.0	224.0	1396.5	80	111,720	2.40	268,128	1.00	0.27	0.41	8	2.00	0.112443	0.22667	0.34	0.24	3.96	64 SF Units
	220	216	3.5	27.0	94.5	1491.0	80	119,280	2.38	283,886	1.00	0.28	0.44	8	1.00	0.168364	0.28000	0.42	0.31	3.16	27 SF Units
	216	214	3.5	0.0	0.0	1491.0	80	119,280	2.38	283,886	1.00	0.28	0.44	10	0.55	0.125211	0.30000	0.36	0.25	2.53	
	214	206	3.5	36.0	126.0	1617.0	80	129,360	2.36	305,290	1.00	0.48**	0.74**	12	0.55	0.129647	0.36000	0.36	0.25	2.90	36 SF + pvt. Pump
	206	204	3.5	376.4	1317.4	2934.4	80	234,752	2.15	504,717	1.00	0.85***	1.32***	15	0.55	0.127176	0.45000	0.36	0.25	3.31	From MH 228
	204	202	3.5	0.0	0.0	2934.4	80	234,752	2.15	504,717	1.00	0.85***	1.32***	15	0.55	0.127176	0.45000	0.36	0.25	3.31	
	202	238	3.5	0.0	0.0	2934.4	80	234,752	2.15	504,717	1.00	0.85***	1.32***	15	0.55	0.127176	0.45000	0.36	0.25	3.31	
	238	PS90	3.5	1,065.9	3730.7	6665.1	80	533,204	1.92	1,023,752	1.00	1.79*	2.76*	18	0.55	0.164357	0.61500	0.41	0.30	4.05	300 MF + From MH 240 + 23 SF lots from pvt pump sta areas

[1] K' based on n = 0.013
[2] dn/D using K' in Brater King Table 7-14
[3] From Brater King Table 7-4 based on dn/D

* Includes 530 gpm from Lift Station B
** Includes 120 gpm from (1) private lift station
*** Includes 240 gpm from (2) private lift stations

APPENDIX B

BLACK MOUNTAIN RANCH NORTH
SEWER SYSTEM ANALYSIS
AMENDMENT NO. 3 (2/08)

AMENDMENT NO. 8
SEWER SYSTEM ANALYSIS FOR
BLACK MOUNTAIN RANCH NORTH

February 27, 2008

Prepared by:
Dexter Wilson Engineering, Inc.
703 Palomar Airport Road
Suite 300
Carlsbad, CA 92011

Job No. 884-001

DEXTER WILSON ENGINEERING, INC.

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February 27, 2008 884-001

Black Mountain Ranch, LLC
16010 Camino Del Sur
San Diego, CA 92127

Attention: Dale Greenhalgh, Project Manager

Subject: Black Mountain Ranch North Sewer System Analysis

Introduction

This letter-report provides an amendment to the Black Mountain Ranch North sewer system analysis. This study is prepared based on the most current land use plan for Vesting Tentative Map (VTM) 40-0528. The revisions to VTM 40-0528 are primarily concentrated in the commercial and multi-family residential areas in the northeast corner of the project. The land use plan for VTM 40-0528 has been included in a map pocket in Appendix A for reference.

Background

The Sewer System Analysis for Black Mountain Ranch North was dated January 2002. Amendment Number 1 to this analysis was dated April 2002 and was prepared based on minor land use changes in the northern portion of the study area. Amendment Number 2 was prepared in September 2003 and included a minor land use change in the northeast corner of the project. The original study and two amendments were approved by the City of San Diego. Amendment Number 2 contains the most current approved analysis for Black Mountain Ranch North and has been included in Appendix B for reference.

Purpose of Study

The developer of Black Mountain Ranch North has submitted revised VTM 40-0528 to the City for review. In response, the City has requested an amended sewer study to evaluate the impacts of the proposed land use revisions on the proposed sewer system. This study provides a comparison of the currently proposed land use plan to previous studies and provides the recommended sewer facilities to serve this development.

Projected Sewer Flows

One of the key components of this sewer study addendum is to provide a comparison of sewage flows from the September 2003 study to the current projections based on revised VTM 40-0528. Previous sewer studies identified three tributary areas for gravity flows within Black Mountain Ranch North as follows:

- East Area to County
- Lift Station B
- Pump Station 90

Development within the "East Area to County" is unaffected by the currently proposed revision to VTM 40-0528 and is, therefore, not considered further in the study. The majority of land use changes occur in the area tributary to Lift Station B, but flows to Lift Station 90 are also affected. Table 1 provides a summary of projected flows for these areas based on the September 2003 amendment and the current land use plan. Gross acreages were converted to net acreage by applying a factor of 0.8. Sewage generation factors for the current land use plan were updated based on the 2004 Sewer Design Guide, unless otherwise noted.

As shown in Table 1, the projected flows to Lift Station B increase, but flows to Pump Station 90 and the total projected flows decrease from previous estimates.

Recommended Sewer Facilities

Using the most current development plans for properties within Black Mountain Ranch North, sewer data tables were prepared to analyze the onsite sewer system. Where development plans were not detailed enough to provide information on the slope of a recommended sewer line, a minimum slope of 1.0 percent was assumed for local collector sewers and a 0.50 percent slope was assumed for trunk sewers. Appendix A provides the sewer data tables used to size onsite facilities. The sizing of these facilities should be verified once more detailed development plans and actual pipe slopes are available. Exhibit A in the Appendix A map pocket graphically shows the recommended onsite sewer facilities for Black Mountain Ranch North and provides the node diagram for the hydraulic analysis. Recommended gravity sewer lines range from 8-inch to 18-inches in size. For commercial areas, the minimum allowable gravity sewer line size is 10-inch per the 2004 Sewer Design Guide.

TABLE 1
PROJECTED SEWER FLOW SUMMARY

LAND USE	9/08 Study Amendment				Current Land Use Plan			
	Net Area Ac	Units	Sewage Generation Factor	Avg Sewage Flow gpd	Net Area Ac	Units	Sewage Generation Factor	Avg Sewage Flow gpd
Lift Station B								
MF Residential	---	490	256 gpd/unit	125,440	---	420	240 gpd/ac[1]	100,800
Commercial/ Office	3.1	---	2,500 gpd/ac	7,750	21.5	---	3,056 gpd/ac	65,704
Employment Center	18.5	---	2,500 gpd/ac	46,250	18.9	---	3,056 gpd/ac	57,758
Fire Station	1.9	---	2,500 gdp/ac	4,750	---	---	---	---
Middle School	17.7	---	2,500 gpd/ac	44,250	17.4	---	2,496 gpd/ac	43,430
Hotel	---	---	---	---	---	300	100 gpd/unit[2]	30,000
Subtotal Lift Station B				**228,440**				**297,692**
Pump Station 90								
SF Residential	---	1,920	280 gpd/unit	537,600	---	1,772	280 gpd/unit	496,160
Offsite Area "E" SF Residential	---	300	280 gpd/unit	84,000	---	300	280 gpd/unit	84,000
MF Residential	---	538	256 gpd/unit	137,720	---	778	240 gpd/unit[1]	186,720
Schools	50	---	2,500 gpd/ac	125,000	48.1	---	2,496 gpd/ac	120,058
Hotels	---	300	280 gpd/unit	84,000	---	---	---	---
Parks	12	---	500 gpd/ac	6,000	5.0	---	500 gpd/ac	2,500
Subtotal Pump Station 90				**974,320**[3]				**889,488**[3]
TOTAL				**1,202,760**				**1,187,180**

[1]Based on average density of 20 Du/Ac.

[2]Based on Metcalf & Eddy Third Edition, assuming double occupancy.

[3]This gravity flow includes the development served by two private lift stations. In addition to this gravity flow, Pump Station 90 will receive pumped flows from Lift Station B.

Lift Station B. From Table 1, the projected average sewage flow to Lift Station B is 0.298 mgd. By assuming an equivalent population of 80 gpd of sewage generation and using Figure 1-1 from the Sewer Design Guide, a peaking Factor of 2.08 was utilized. Thus, the peak projected flow to the station is 0.619 mgd (430 gpm). In accordance with the previously approved sewer study, a reserve capacity factor of 1.3 was assumed. Thus, the required firm pumping capacity for Lift Station B is 560 gpm. Dual 6-inch force mains are recommended to convey this flow. At 560 gpm, a force main velocity of 6.35 feet per second will be achieved in a 6-inch line.

Pump Station 90. Pump Station No. 90 will accept gravity flows as well as pumped flows from Lift Station B and two private lift stations. The methodology for sizing this station was to calculate 130 percent of the peak gravity flows and add the pumped flow rate from Lift Station B. The pumped flows from the private lift stations represent less than 10 percent of the total flow to Pump Station 90 and, therefore, the pump effect is not taken into account. The average projected gravity flow to Pump Station No. 90 is 0.889 mgd. Using 80 gpd per person and Figure 1-1 from the City of San Diego Design Guide, a peak factor of 1.80 was used. Thus, the peak gravity flow to the station is 1.60 mgd (1,112 gpm) and the design gravity flow is 1,446 gpm (1,112 x 1.3). By adding in pumped flows, the recommended design capacity of Pump Station 90 is 2,006 gpm (1,446 + 560).

Pump Station 90 was constructed in 2004 with a design capacity of 2,065 gpm. Based on the information presented above, Pump Station 90 has adequate capacity to meet the projected flows of the current development plan.

Conclusions and Recommendations

1. The current revision to VTM 40-0528 will result in lower overall sewage flows for the project, but flows will be higher in localized areas.
2. Exhibit A in Appendix A provides the recommended sewer system improvements for Black Mountain Ranch North project.
3. Lift Station B is recommended to be designed for a firm pumping capacity of 560 gpm. This study confirms that Pump Station 90 was constructed with adequate capacity to serve the currently proposed development within Black Mountain Ranch North.

4. This study provides recommendations for serving Black Mountain Ranch North as a whole. It shall be the responsibility of the developer for each individual area to ensure that adequate sewer service is provided to their project based on the timing of surrounding developments.

5. Public sewer lift stations should be on a separate lot. Access road and lift station lot shall be designated in fee title to the City of San Diego. All proposed public sewer lift stations must be designed per the City's Design Guide Standards dated November 2004, or as revised.

6. For private sewer lift stations, all upstream gravity sewers and sewer force main piping shall also be private. A copy of the homeowner's association CC&R's will be required to show that the maintenance and operation of the private pump station, force mains, and any upstream gravity mains will be the responsibility of the homeowners. A letter of agreement to this effect must be recorded against all applicable lots.

Thank you for the opportunity to provide assistance on this project. If you have any questions on the information contained herein, please let us know.

Dexter Wilson Engineering, Inc.

Stephen M. Nielsen, P.E.

SMN:hjs

APPENDIX A

SEWER SYSTEM HYDRAULIC ANALYSIS

SEWER STUDY SUMMARY

DATE: 2/22/2008 FOR: Black Mountain Ranch North - Lift Station B Tributary Area SHT 1 OF 1

JOB NUMBER: 884-001 BY: Dexter Wilson Engineering REFER TO PLAN SHEET:

LINE	FROM	TO	POP. PER D.U.	IN-LINE EDUs	POPULATION SERVED		SEWAGE PER CAPITA/DAY (gpd)	AVG. DRY WEATHER FLOW (gpd)	DRY WEATHER PEAKING FACTOR	PEAK DRY WEATHER FLOW (gpd)	WET WEATHER PEAKING FACTOR	PEAK WET WEATHER FLOW (DESIGN FLOW)		LINE SIZE (inches)	DESIGN SLOPE (%)	DEPTH K[1]	dn (feet)	dn/D[2]	C_s for Velocity[3]	VELOCITY (f.p.s.)	Remarks
					IN-LINE	TOTAL						M.G.D.	C.F.S.								
	126	124	3.5	26.2	91.7	91.7	80	7,336	4.00	29,344	1.00	0.03	0.05	10	1.00	0.009598	0.08333	0.10	0.04	1.60	2.4 Net Ac Comm.
	124	104	3.5	174.9	612.2	703.9	80	56,308	2.84	159,915	1.00	0.16	0.25	10	1.00	0.052308	0.19167	0.23	0.14	2.64	204 MF Units
	122	116	3.5	22.3	78.1	78.1	80	6,244	4.00	24,976	1.00	0.02	0.04	8	1.00	0.014812	0.08000	0.12	0.05	1.61	26 MF Units
	120	118	3.5	37.7	132.0	132.0	80	10,556	4.00	42,224	1.00	0.04	0.07	8	1.00	0.025042	0.10657	0.16	0.08	1.81	44 MF Units
	118	116	3.5	96.7	338.5	470.4	80	37,632	3.10	116,659	1.00	0.12	0.18	10	1.00	0.036159	0.15833	0.19	0.11	2.48	7.5 Net Ac E.C.+ 16 MF Units
	116	106	3.5	84.5	295.8	766.2	80	61,292	2.80	171,618	1.00	0.17	0.27	10	1.00	0.056136	0.20000	0.24	0.14	2.71	5.7 Net Ac E.C. + MH 122 Flow
	114	112	3.5	318.8	1115.8	1115.8	80	89,264	2.47	220,482	1.00	0.22	0.34	10	1.00	0.072119	0.22500	0.27	0.17	2.87	11.3 Net Ac Com. Hotel. 103 MF
	112	110	3.5	262.7	919.5	2035.3	80	162,820	2.29	372,858	1.00	0.37	0.58	10	1.00	0.121961	0.29167	0.35	0.25	3.39	School. 7.9 Net Ac Com. 25 MF
	110	108	3.5	0.0	0.0	2035.3	80	162,820	2.29	372,858	1.00	0.37	0.58	10	1.00	0.121961	0.29167	0.35	0.25	3.32	
	108	106	3.5	61.1	213.9	2249.1	80	179,928	2.25	404,838	1.00	0.40	0.63	10	1.00	0.132422	0.30833	0.37	0.26	3.47	5.6 Net Ac Emp Ctr
	106	104	3.5	218.9	766.2	3015.3	80	241,220	2.14	516,211	1.00	0.52	0.80	10	1.00	0.168852	0.35000	0.42	0.31	3.69	From MH 116
	104	LS B	3.5	201.1	703.9	3719.1	80	297,528	2.08	618,858	1.00	0.62	0.96	10	1.00	0.202427	0.38333	0.46	0.35	3.89	From MH 124

[1] K based on n = 0.013
[2] dn/D using K in Brater King Table 7-14
[3] From Brater King Table 7-4 based on dn/D

SEWER STUDY SUMMARY

DATE: 2/25/2008 FOR: Black Mountain Ranch North – Pump Station 90 Tributary Area SHT 1 OF 2

JOB NUMBER: 884-001 BY: Dexter Wilson Engineering REFER TO PLAN SHEET:

LINE	FROM	TO	POP. PER D.U.	IN-LINE EDUs	POPULATION SERVED		SEWAGE PER CAPITA/DAY (gpd)	AVG. DRY WEATHER FLOW (gpd)	DRY WEATHER PEAKING FACTOR	PEAK DRY WEATHER FLOW (gpd)	WET WEATHER PEAKING FACTOR	PEAK WET WEATHER FLOW (DESIGN FLOW)		LINE SIZE (inches)	DESIGN SLOPE (%)	DEPTH K'[1]	dn (feet)	dn/D[2]	C'v for Velocity[3]	VELOCITY (f.p.s.)	Remarks
					IN-LINE	TOTAL						M.G.D.	C.F.S.								
	292	282	3.5	66.0	231.0	231.0	80	18,480	3.83	70,778	1.00	0.07	0.11	8	4.21	0.020458	0.09333	0.14	0.07	3.65	66 SF Units
	291	290	3.5	75.0	262.5	262.5	80	21,000	3.67	77,070	1.00	0.08	0.12	8	2.00	0.032320	0.12000	0.18	0.10	2.79	75 SF Units
	290	288	3.5	171.0	598.5	861.0	80	68,880	2.66	183,221	1.00	0.18	0.28	8	2.00	0.076836	0.18667	0.28	0.18	3.61	171 SF Units
	288	286	3.5	81.0	283.5	1144.5	80	91,560	2.46	225,238	1.00	0.23	0.35	8	2.00	0.094456	0.20667	0.31	0.21	3.83	81 SF Units
	286	284	3.5	33.0	115.5	1260.0	80	100,800	2.44	245,952	1.00	0.25	0.38	8	2.00	0.103143	0.21333	0.32	0.22	3.95	33 SF Units
	284	282	3.5	272.0	952.0	2212.0	80	176,960	2.25	398,160	1.00	0.40	0.62	10	1.70	0.099888	0.25833	0.31	0.20	4.40	272 SF Units
	282	280	3.5	68.0	238.0	2450.0	80	196,000	2.22	435,120	1.00	0.44	0.67	10	2.00	0.100640	0.26667	0.32	0.21	4.52	From MH 292
	280	258	3.5	58.0	203.0	2653.0	80	212,240	2.18	462,683	1.00	0.46	0.72	10	2.00	0.107016	0.27500	0.33	0.23	4.58	58 SF Units
	258	PS90	3.5	12.0	42.0	2695.0	80	215,600	2.18	470,008	1.00	0.47	0.73	10	2.00	0.108710	0.27500	0.33	0.23	4.63	12 SF Units
	272	270	3.5	104.0	364.0	364.0	80	29,120	3.50	101,920	1.00	0.10	0.16	8	1.00	0.060446	0.16000	0.24	0.15	2.41	44 SF + 70 MF Units
	264	262	3.5	82.0	287.0	287.0	80	22,960	3.70	84,952	1.00	0.08	0.13	8	1.00	0.050382	0.14667	0.22	0.13	2.27	82 SF Units
	278	276	3.5	162.4	568.4	568.4	80	45,472	2.93	133,233	1.00	0.13	0.21	8	1.00	0.079016	0.18667	0.28	0.18	2.58	80 SF+School+Park
	276	270	3.5	83.1	290.9	859.3	80	68,740	2.67	183,536	1.00	0.18	0.28	8	1.00	0.108849	0.22000	0.33	0.23	2.83	36 SF + 55 MF Units
	270	268	3.5	51.0	178.5	1037.8	80	83,020	2.49	206,720	1.00	0.21	0.32	8	1.00	0.122599	0.23333	0.35	0.25	2.93	51 SF Units
	268	262	3.5	29.0	101.5	1139.3	80	91,140	2.46	224,204	1.00	0.22	0.35	8	1.00	0.132969	0.24667	0.37	0.26	2.97	29 SF Units
	262	260	3.5	82.0	287.0	1426.3	80	114,100	2.40	273,840	1.00	0.27	0.42	8	1.00	0.162406	0.27333	0.41	0.30	3.14	From MH 264
	260	244	3.5	20.0	70.0	1496.3	80	119,700	2.38	284,886	1.00	0.28	0.44	8	1.00	0.168957	0.28000	0.42	0.31	3.18	20 SF Units
	244	240	3.5	346.7	1213.5	2709.7	80	216,776	2.18	472,572	1.00	1.25*	1.93*	15	0.50	0.196106	0.56250	0.45	0.35	3.57	From MH 246
	240	238	3.5	0.0	0.0	2709.7	80	216,776	2.18	472,572	1.00	1.25*	1.93*	15	0.50	0.196106	0.56250	0.45	0.35	3.57	
	256	254	3.5	0.0	0.0	0.0	80	0	4.00	0	1.00	0.78*	1.20*	12	1.00	0.156383	0.40000	0.40	0.29	4.10	Lift Station B
	254	252	3.5	67.7	237.0	237.0	80	18,956	3.60	68,242	1.00	0.85*	1.31*	12	1.00	0.170107	0.42000	0.42	0.31	4.18	79 SF Units
	252	250	3.5	70.0	245.0	482.0	80	38,556	3.05	117,596	1.00	0.90*	1.38*	12	1.00	0.180033	0.43000	0.43	0.33	4.26	70 SF Units
	250	248	3.5	74.0	259.0	741.0	80	59,276	2.80	165,973	1.00	0.94*	1.46*	12	1.00	0.189762	0.45000	0.45	0.34	4.29	74 SF Units
	248	246	3.5	96.0	336.0	1077.0	80	86,156	2.48	213,667	1.00	0.99*	1.53*	15	0.50	0.155494	0.50000	0.40	0.29	3.36	96 SF Units
	246	244	3.5	39.0	136.5	1213.5	80	97,076	2.45	237,836	1.00	1.02*	1.57*	15	0.50	0.159265	0.50000	0.40	0.30	3.39	39 SF Units

* INCLUDES 540 GPM FROM LIFT STATION B

[1] K' based on n = 0.013

[2] dn/D using K' in Brater King Table 7-14

[3] From Brater King Table 7-4 based on dn/D

SEWER STUDY SUMMARY

DATE: 2/25/2008 FOR: Black Mountain Ranch North – Pump Station 90 Tributary Area SHT 2 OF 2

JOB NUMBER: 884-001 BY: Dexter Wilson Engineering REFER TO PLAN SHEET:

LINE	FROM	TO	POP. PER D.U.	IN-LINE EDUs.	POPULATION SERVED IN-LINE	POPULATION SERVED TOTAL	SEWAGE PER CAPITA/DAY (gpd)	AVG. DRY WEATHER FLOW (gpd)	DRY WEATHER PEAKING FACTOR	PEAK DRY WEATHER FLOW (gpd)	WET WEATHER PEAKING FACTOR	PEAK WET WEATHER FLOW (DESIGN FLOW) M.G.D.	PEAK WET WEATHER FLOW (DESIGN FLOW) C.F.S.	LINE SIZE (inches)	DESIGN SLOPE (%)	DEPTH K [1]	dn (feet)	dn/D [2]	Cv for Velocity [3]	VELOCITY (f.p.s.)	Remarks
	236	235	3.5	235.7	825.0	825.0	80	65,996	2.71	178,849	1.00	0.18	0.28	8	1.00	0.106070	0.22000	0.33	0.22	2.78	275 MF Units
	235	234	3.5	18.0	63.0	888.0	80	71,036	2.62	186,114	1.00	0.19	0.29	8	1.00	0.110379	0.22000	0.33	0.23	2.85	18 SF Units
	234	232	3.5	20.0	70.0	958.0	80	76,636	2.54	194,655	1.00	0.37 **	0.57 **	10	1.00	0.120168	0.29167	0.35	0.24	3.35	20 SF + Pvt. Pump Station
	232	230	3.5	44.0	154.0	1112.0	80	88,956	2.47	219,721	1.00	0.39 **	0.61 **	10	1.00	0.128365	0.30000	0.36	0.25	3.43	44 SF Units
	230	228	3.5	37.0	129.5	1241.5	80	99,316	2.44	242,331	1.00	0.42 **	0.64 **	10	1.00	0.135759	0.30833	0.37	0.26	3.50	37 SF Units
	228	206	3.5	21.0	73.5	1315.0	80	105,196	2.43	255,626	1.00	0.43 **	0.66 **	10	2.00	0.099071	0.25833	0.31	0.31	3.12	21 SF Units
	224	222	3.5	390.7	1367.5	1367.5	80	109,396	2.41	263,644	1.00	0.26	0.41	10	1.00	0.086238	0.24167	0.29	0.19	3.11	35 SF + High School
	222	220	3.5	61.0	213.5	1581.0	80	126,476	2.36	298,483	1.00	0.30	0.46	10	2.00	0.069037	0.21667	0.26	0.16	4.10	51 SF Units
	220	216	3.5	0.0	0.0	1581.0	80	126,476	2.36	298,483	1.00	0.30	0.46	10	1.00	0.097633	0.25833	0.31	0.21	3.21	
	216	214	3.5	300.0	1050.0	2631.0	80	210,476	2.19	460,942	1.00	0.46	0.71	12	0.55	0.125024	0.35000	0.35	0.25	2.86	300 Offsite EDUs.
	214	206	3.5	36.0	126.0	2757.0	80	220,556	2.17	478,607	1.00	0.65 **	1.01 **	12	0.55	0.176648	0.43000	0.43	0.32	3.13	36 SF + pvt. Pump
	206	204	3.5	375.7	1315.0	4071.9	80	325,752	2.05	667,792	1.00	1.01 ***	1.57 ***	15	0.55	0.151566	0.48750	0.39	0.29	3.51	From MH 228.
	204	202	3.5	0.0	0.0	4071.9	80	325,752	2.05	667,792	1.00	1.01 ***	1.57 ***	15	0.55	0.151566	0.48750	0.39	0.29	3.51	
	202	238	3.5	0.0	0.0	4071.9	80	325,752	2.05	667,792	1.00	1.01 ***	1.57 ***	15	0.55	0.151566	0.48750	0.39	0.29	3.51	
	238	PS90	3.5	1,031.3	3609.6	7681.5	80	614,516	1.89	1,161,435	1.00	1.94 *	3.00 *	18	0.55	0.178345	0.64500	0.43	0.32	4.13	300 MF + From MH 240

* INCLUDES 540 GPM FROM LIFT STATION 3

** INCLUDES 120 GPM FROM (1) PRIVATE LIFT STATION

*** INCLUDES 240 GPM FROM (2) PRIVATE LIFT STATIONS

[1] K based on n = 0.013

[2] dn/D using K in Brater King Table 7-14

[3] From Brater King Table 7-4 based on dn/D

APPENDIX C

PREVIOUS COMMENTS AND RESPONSES

The following summarizes the comments received from the City of San Diego in an e-mail dated June 8, 2011 and provides our responses to these comments:

1. **Comment:** Please remove the high school site from Node 224.

   Response: This change was made.

2. **Comment:** Add 300 EDUs from the Camelot project.

   Response: 300 offsite EDUs have always been included in the study. Per recent discussions and e-mails, the study has been revised to show the Camelot flows connected at two alternative locations.

3. **Comment:** Add the additional flow from the undeveloped area between Camelot and the high school.

   Response: This area is identified as a homeowner's association lot on the approved Black Mountain Ranch tentative map with no development assigned to it.

The following provides a summary of comments received from the City of San Diego in a letter dated March 3, 2011 and provides our responses to these comments:

4. **Comment:** Provide detailed hydraulic analysis for the area south of node 246 to the point of connection to pump station 90. The improvement plans show slopes that exceed our maximum of 10% up to 24% in some reaches of the above described area. However, you assume 1% or 0.5% slope in your calculations for the same reaches. Provide a detailed analysis necessary to determine the appropriate size of the mains to maintain a velocity of 3 fps to 5 fps where possible, according to the Sewer Design Guide, Section 1.3.31.

   Response: The detailed manhole to manhole analysis is provided in the Rick Engineering sewer study for Unit 14. The sewer slopes in this master sewer study are the minimum slopes for each section of piping.

5. **Comment:** Revise the exhibit and show manhole numbers for each reach. Also, provide a manhole summary calculation table. Manhole numbers should comply with the improvement plans produced by Rick Engineering.

Response: This information is provided in the Rick Engineering Unit 14 sewer study.

6. **Comment:** Provide the depth of all proposed manholes.

Response: This information is provided in the Rick Engineering Unit 14 sewer study.

7. **Comment:** For the proposed sewer mains south of Unit 14 and Unit 19, show the access road with the sewer in the center.

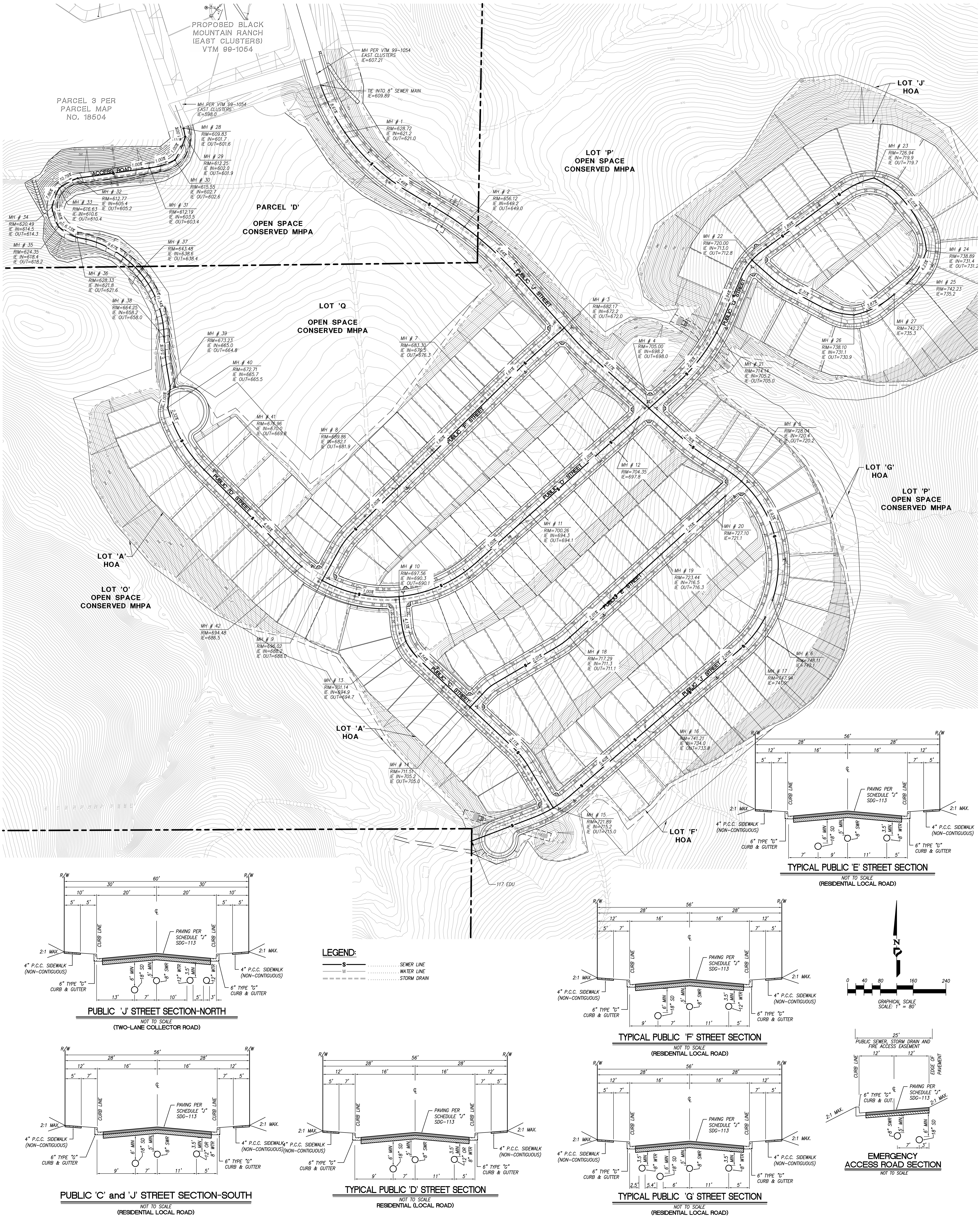
Response: This information will be provided in the Rick Engineering Unit 14 sewer study.

8. **Comment:** Reduce the amount of flow going to lift station B. Provide a detailed analysis in the north area. Show the manhole numbers in the sewer exhibit and provide the manhole to manhole summary calculation table for each proposed reach. The original sewer study for Unit 14 doesn't include the above calculations.

Response: The amount of sewage going to Lift Station B was reduced by gravity sewering Unit 12 to the south. This reduces the required capacity of Lift Station B to 530 gpm. The manhole to manhole analysis is to be provided in updated Rick Engineering sewer studies.

EXHIBIT A

Sewer Exhibit



NOTE: ALL SEWER MAINS WILL BE 8 INCHES

ALL PROPOSED SEWER MAINS WILL BE OWNED AND MAINTAINED BY OWMD

HERITAGE BLUFFS II

SEWER EXHIBIT

PROJECT DESIGN CONSULTANTS
Planning | Landscape Architecture | Engineering | Survey
701 B Street, Suite 800
San Diego, CA 92101
619.235.6471 Tel
619.234.0349 Fax

APPENDIX K
Waste Management Plan

Waste Management Plan for the Heritage Bluffs II Project, City of San Diego

Prepared for

Project Design Consultants
701 B Street, Suite 800
San Diego, CA 92101

Prepared by

RECON Environmental, Inc.
1927 Fifth Avenue
San Diego, CA 92101-2358
P 619.308.9333 F 619.308.9334

RECON Number 7108

March 18, 2015

Lance Unverzagt, Senior Project Manager

TABLE OF CONTENTS

FIGURES

TABLES

ATTACHMENTS

1.0 Introduction

The purpose of this Waste Management Plan (WMP) for the Heritage Bluffs II project is to identify the solid waste impacts that would be generated by construction and operation of the project and to identify measures to reduce those impacts. Figure 1 shows the regional location of the project site. Figure 2 shows an aerial photograph of the project site and vicinity. Figure 3 shows the proposed site plan.

The direct impact threshold of significance for projects in the City of San Diego (City) is 1,500 tons of waste per year, which would likely occur when developments are over 1 million square feet. Projects that generate more than 60 tons of waste per year would have a cumulative impact on solid waste services and are required to prepare a WMP to demonstrate how the project would reduce solid waste impacts to below a level of significance (City of San Diego 2011).

The WMP consists of three sections corresponding to the progress of site development, which are the Grading Phase, the Construction Phase, and the Occupancy (post-construction) Phase. Each phase addresses the amount of waste that would be generated by project activities, waste reduction goals, and the recommended techniques to achieve the waste reduction goals. More specifically, for each phase, the WMP includes:

- Tons of waste anticipated to be generated.
- Material/type and amount of waste anticipated to be diverted.
- Project features that would reduce the amount of waste generated.
- Project features that would divert or limit the generation of waste.
- Source separation techniques for waste generated.
- How materials shall be reused on-site.
- Name and location of recycling, reuse, or landfill facilities where waste shall be taken.

2.0 Background

In 1989, the California Legislature passed Assembly Bill (AB) 939, Integrated Waste Management Act, which, as modified by Senate Bill 1016, mandated that all local governments reduce waste be disposed of in landfills from generators within their borders by 50 percent by the year 2000 (State of California 1989). Approved in October 2011, AB 341 sets a policy goal of 75 percent waste diversion by the year 2020 (State of California 2011).

The City Environmental Services Department (ESD) developed the Source Reduction and Recycling Element, which describes waste management policies and programs.

The City's Recycling Ordinance, adopted November 2007, requires on-site recyclables collection for all single- and multi-family residential and commercial uses (City of San Diego 2007). The ordinance requires recycling of plastic and glass bottles and jars, paper, newspaper, metal containers, and cardboard. The focus of the ordinance is on education, with responsibility shared between the ESD, haulers, and building owners/managers. ESD is to provide on-site technical assistance, educational materials, templates, and service provider lists. Property owners/managers are to provide on-site recycling services and educational materials annually and to new tenants. Effective July 1, 2011, residents, commercial properties, and institutional properties must also recycle rigid plastics including clean food waste containers, jugs, tubs, trays, pots, buckets, and toys. On July 1, 2008, the Construction and Demolition (C&D) Debris Deposit Ordinance was adopted by the City (City of San Diego 2008). The ordinance requires that the majority of construction, demolition, and remodeling projects requiring building, combination, and demolition permits pay a refundable C&D Debris Recycling Deposit and divert at least 50 percent of their debris by recycling, reusing, or donating usable materials. The required diversion rate will increase to 75 percent under certain circumstances. The ordinance is designed to keep C&D materials out of local landfills and ensure they get diverted from disposal.

The City's Refuse and Recyclable Materials Storage Regulations (City of San Diego Municipal Code Sections 142.0801 through 142.0830) indicate the minimum exterior refuse and recyclable material storage areas. These are intended to provide permanent, adequate, and convenient space for the storage and collection of refuse and recyclable materials; encourage recycling of solid waste to reduce the amount of waste material entering landfills; and meet the recycling goals established by the City Council and mandated by the state of California. These regulations are discussed further in Section 6.3, Exterior Storage.

Project Location

RECON

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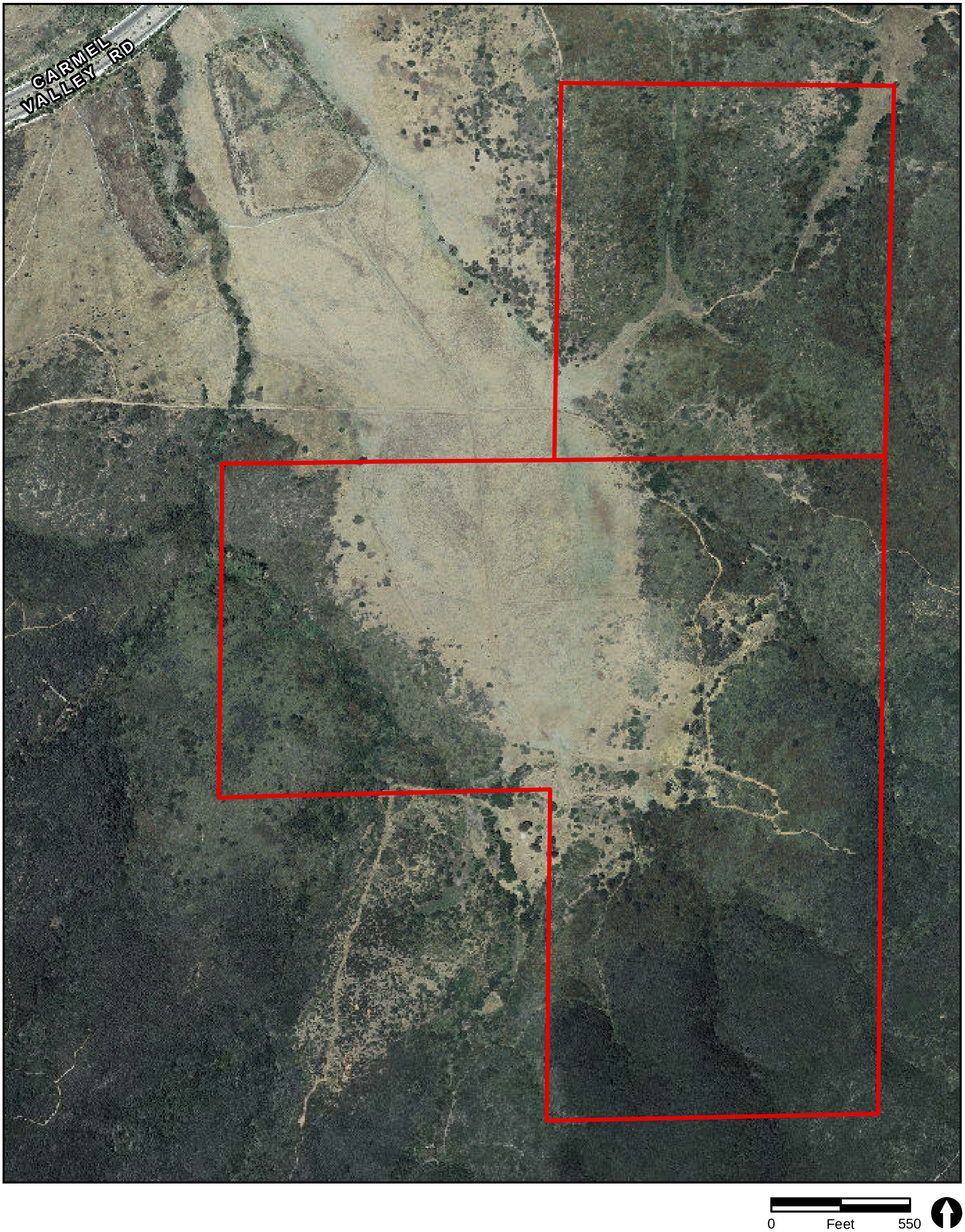
FIGURE 1

Regional Location



RECON

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FIGURE 2

Aerial Photograph

Map Source: Project Design Consultants

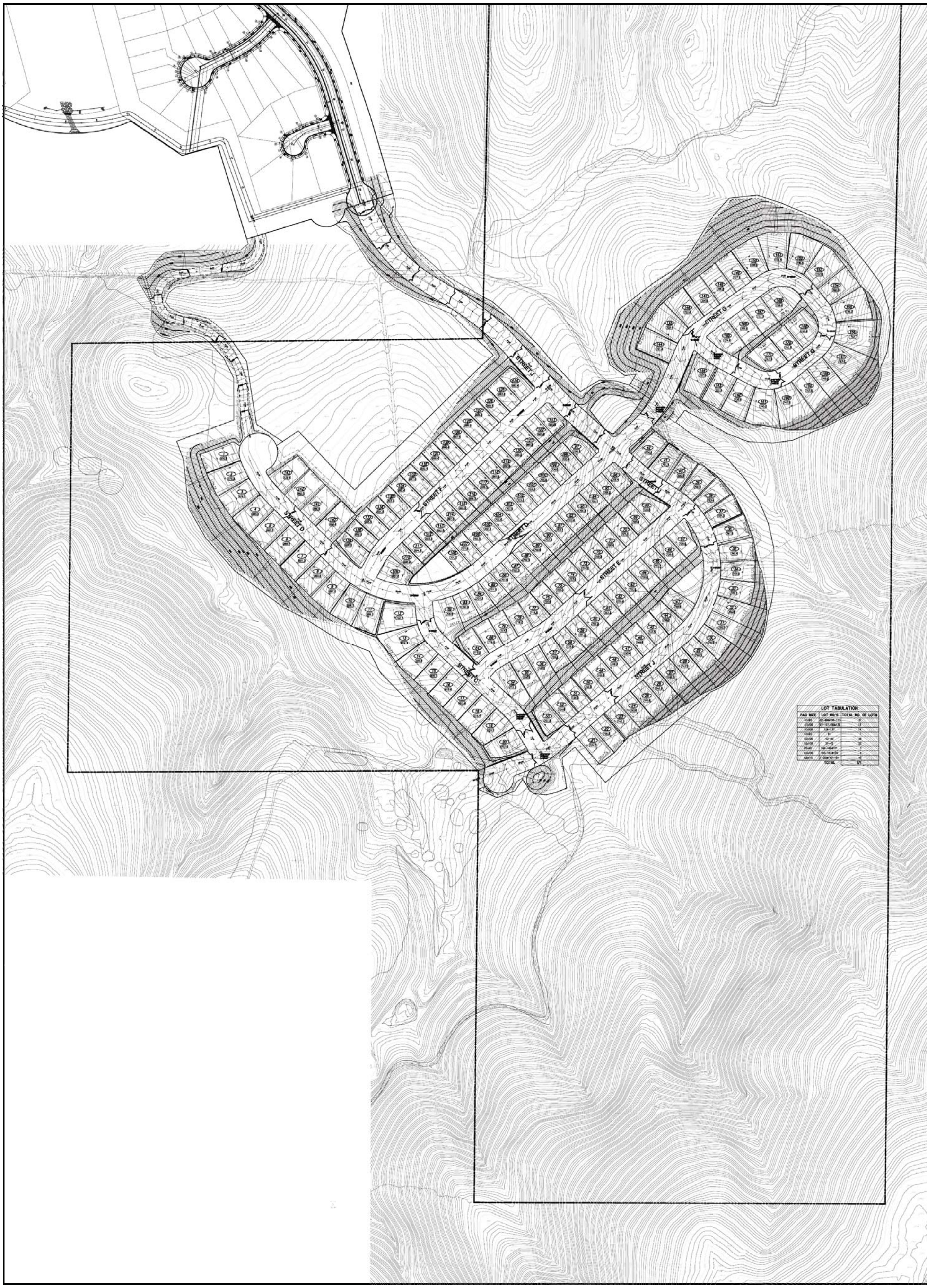

FIGURE 3
Site Plan

RECON

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3.0 Existing Conditions

The project site consists of approximately 169.8 acres and includes Assessor's Parcel Numbers 312-010-15 and 312-160-02. The property is located in the southeast perimeter properties of the Black Mountain Ranch Subarea. The *Black Mountain Ranch Subarea Plan* (Subarea Plan; City of San Diego 1998) designates approximately 43 acres of the property as Low Density Residential (2-5 dwelling units per acre) and the remainder of the site as part of the City's Multiple Habitat Planning Area. The Subarea Plan also identifies the property as Areas A and B, intended for development of 25 dwelling units and 195 dwelling units, respectively, for a total of 220 dwelling units. The Subarea Plan also requires that 35 dwellings of the 220 total dwellings be affordable units.

4.0 Proposed Conditions

The proposed Heritage Bluffs II project consists of a Vesting Tentative Map, a Planned Development Permit for deviations to underlying zone setback requirements, a Site Development Permit for Environmentally Sensitive Lands, and rezoning from AR-1 to RS-1-14 and RX-1-1. In addition, a boundary adjustment to the City's Multiple Habitat Planning Area is required.

The project proposes to develop a total of 171 residential units on approximately 43 acres, and includes two different product types. A total of 120 single-family residential lots are proposed in the 4,500- to 6,000-square-foot range under the RX-1-1 zone, and 51 lots are proposed to be in the over 6,000-square-foot range under the RS-1-14 zone. The balance of the 220 dwellings allocated to the property in the Subarea Plan will be transferred to the Black Mountain Ranch North Village. This transfer of 49 dwellings to the North Village will include the 35 affordable dwellings required by the Subarea Plan. At the time a Vesting Tentative Map is processed for these 49 transferred units, a separate WMP would be prepared.

Construction practices would comply with local, state, and federal regulations regarding the handling of building materials to ensure waste minimization goals and requirements are met.

5.0 Grading and Construction Phases

According to the *Waste Composition Study* prepared by the ESD (City of San Diego 2000), construction and demolition waste constituted the largest single component of disposed waste in San Diego in 2000. With almost 590,000 tons of waste being disposed of, construction/demolition waste composed 34 percent of the total mass of waste disposed of that year. AB 939 requires the diversion of 50 percent of all solid waste, including construction and demolition waste. Approved in October 2011, AB 341 sets a policy goal of 75 percent waste diversion by the year 2020.

Goals for all phases would be communicated to grading contractors through contract documents, the certified California Environmental Quality Act document and corresponding Mitigation Monitoring and Reporting Program, and the solid waste management coordinator (SWMC) for the project.

5.1 Grading Phase

Implementation of the project would require 630,000 cubic yards of cut, 775,000 cubic yards of fill, and a net import of 145,000 cubic yards. However, the 145,000 cubic yards of soil would be imported from the nearby East Clusters portion of Black Mountain Ranch. Therefore, no export of soil would occur from the project

Although no structures currently exist on the site, there is vegetation present. Therefore, during the grading phase, green waste would be generated and source separated, then recycled as green waste at the Miramar Greenery facility at 5180 Convoy Street. Goals for this phase will be communicated to grading contractors through contract documents, the certified California Environmental Quality Act document and corresponding Mitigation Monitoring and Reporting Program, and the SWMC for the project.

5.2 Construction Phase

According to the U.S. Environmental Protection Agency, residential construction projects typically generate 4.38 pounds of construction debris per square foot of building construction. It is estimated that the project would generate 1,505.8 tons of waste during the construction phase.

Black Mountain Development has an adopted Landfill Diversion Plan (July 2004; Attachment 1) and an existing agreement in place with Allied Waste Services. The agreement was made pursuant to the Black Mountain Ranch Construction Reuse and Recycling Project (CRRP; approved by the City in October 2005; Attachment 1). An existing construction waste separation and recycling facility is located within the Subarea south of Nicole Ridge, and has been used throughout the construction of projects within Black Mountain Ranch.

Specifically, the construction waste generated would be separated by category into piles or bins as follows:

- Asphalt/Concrete
- Drywall
- Inerts (roof tiles, bricks, stucco, etc.)
- Clean Wood
- Carpet/Carpet Padding
- Plastics
- Metals
- Cardboard
- Trash

These types of construction debris would be separated at the Black Mountain Ranch CRRP into material-specific containers to facilitate reuse and recycling. This type of waste diversion is referred to as “source separated” and achieves a nearly 100 percent diversion rate. Source separation of materials at the CRRP helps (1) ensure appropriate waste diversion rate, (2) minimize costs associated with transportation and disposal, and (3) facilitate compliance with the C&D ordinance.

Construction activities generate packaging materials and unpainted wood, including wood pallets and cardboard. The Black Mountain Ranch CRRP maintains a grinder on-site and 100 percent of the separated lumber that is not reused during the construction process would be ground and stockpiled on-site for use as mulch in project landscaping. All of the drywall waste generated by the construction phase would be ground into powder and used in the landscaping as a soil softener. Similarly, all inerts and concrete/asphalt waste would be ground and reused on-site for construction roads or Class 2 base for the private driveways.

All other construction waste would not be re-used on-site, but would be source separated and trucked to a City-certified facility which achieves a 100 percent diversion rate. (The C&D directory [2014] is included as Attachment 2 to this document.) As detailed in Table 1b, the categories that would be source separated on-site and trucked off-site to appropriate facilities include: metals, carpet/carpet padding, and cardboard.

5.3 Waste Diversion

As described above, on-site reuse of asphalt/concrete, inerts, clean wood, and drywall via the on-site CRRP is the primary diversion strategy for the project. The source-separation strategy is detailed further in the following section and would be the primary method implemented during project construction for the remaining categories. These materials (metals, carpet/carpet padding, and cardboard) would be source separated at the CRRP and then trucked to City-certified facilities that achieve almost a 100 percent diversion rate. However, the City recognizes that some types of C&D debris are difficult to source separate. Therefore, this plan conservatively estimates that 10 percent of the total tonnage would be unrecyclable (trash/garbage) and would go to the Miramar Landfill.

Therefore, ESD staff shall be invited by the applicant (or applicant's successor in interest) to attend any Development Services Department required preconstruction meetings. During the preconstruction meetings, strategies for waste diversion shall be discussed, and source separation (see Section 5.3.2 below) shall be utilized to the greatest extent feasible.

5.3.1 Source Separation Recycling

Source separation of construction waste at the project site would facilitate reuse and recycling of materials. Recycling, salvage, reuse, and disposal options would be determined before the job begins. As discussed above, this would be accomplished by source separating construction waste at the on-site CRRP which diverts approximately 90 percent of the waste from the landfill, after accounting for unrecyclable trash/garbage (Attachment 3).

More specifically, and in accordance with the 2005 CRRP, lumber, drywall, inerts (tile, concrete, stucco, etc.), clean wood, general recyclables (glass, plastic, paper, metals), and general trash would be source separated. General trash would be the only portion that goes to the landfill, and everything else would be re-used on-site, or diverted using the source-separating recycling method. As noted previously, after source separation, the lumber, drywall, inerts, and asphalt would be reused on-site while everything else would be trucked to certified facilities (see Table 1b). As shown in Table 1b, approximately 90 percent of construction waste would be diverted from landfills.

The contractors shall be responsible for evaluating the materials during the construction phase for reuse on-site. Materials that are determined not suitable for reuse shall be deposited into separate source bins to be taken to the appropriate facilities for recycling.

Based on providing segregation of these materials, the project would meet or exceed the 75 percent diversion of construction waste. To ensure this result, contractors will be required to comply with the following methods and procedures below:

1. Construction and Land-Clearing containers will be provided for waste that is to be recycled. Containers shall be clearly labeled with a list of acceptable and unacceptable materials. The list of acceptable materials must be the same as the materials recycled at the receiving material recovery facility or recycling processor.

2. The collection containers for recyclable Construction and Land-Clearing waste must contain no more than 10 percent non-recyclable materials, by volume.

3. Use detailed material estimates to reduce risk of unplanned and potentially wasteful material cuts.

4. Conduct daily visual inspections of dumpsters and recycling bins to remove contaminants.

5. Remove construction waste materials from the project site at least once every week to ensure no over-topping of waste bins. The accumulation and burning of on-site Construction and Land-Clearing waste materials will be prohibited.

Additionally, in an effort achieve the goal of diverting 90 percent of construction waste from the landfill, Allied Waste Services will provide the following equipment and services. In addition to achieving a 90 percent diversion goal, the equipment and services offered will also facilitate a safe, economical, and convenient waste removal program.

- On-site Supervisor
- Tractor with rotator forks
- 18-gallon curbside containers
- 3- to 4-yard color coded bins
- 20-yard roll-off containers
- Hauling of recyclable materials and trash
- Wood chipper and colorizer

Furthermore, the project will be required to meet the following state law and City Municipal Code requirements:

1. The City's C&D Debris Diversion Deposit Program, which requires a refundable deposit based on the tonnage and value of the expected recyclable waste materials as part of the building permit requirements.
2. The City's C&D Recycling Ordinance, which requires identification and sorting of Construction waste materials to be diverted to the appropriate recycling facility.
3. The City's Recycling Ordinance, which requires that collection of recyclable materials must be provided.
4. The City's Storage Ordinance, which requires that areas for recyclable material collection must be provided.
5. This WMP. The project construction manager will be responsible for compliance actions with the aforementioned guidelines and will make adjustments as needed to maintain conformance. The name and contact information of the waste contractor will be provided to ESD at least 10 days prior to the start of any work and updated within 5 days of any changes.

The U.S. Environmental Protection Agency (EPA) (1998) provides an average generation rate of 4.38 pounds of construction waste per square foot for residential types of uses, which includes the proposed project's 171 single-family residential units. Table 1a shows how much project construction waste (1,506 tons) would be generated by these two types of uses. Table 1b provides a breakdown of the 1,506 tons by types of material and also provides the most likely handling facility and diversion method. As shown in Table 1b, use of the source separation method for most of the materials types (where feasible) would result in the total diversion of approximately 1,356 tons; with only the 250 tons of trash/garbage being disposed of in the landfill.

TABLE 1a
CONSTRUCTION PHASE WASTE GENERATION AND DIVERSION

Land Use	Amount (square feet)	Generation Rate (pounds per square foot)	Tons Generated
Residential	687,600	4.38	1,506

Source: U.S. Environmental Protection Agency 1998.

TABLE 1b
CONSTRUCTION WASTE DIVERSION BY MATERIAL TYPE

Material Type	Estimated Waste Quantity (tons)	Handling Facility	Estimated Diversion (tons)	Estimated Disposal (tons)
Asphalt and Concrete	271	Black Mountain Ranch CRRP[1] (100% diversion)	271	0
Metals	90	Allan Company 6733 Consolidated Way (100% diversion)	90	0
Brick/Masonry/Tile	181	Black Mountain Ranch CRRP[1] (100% diversion)	181	0
Clean Wood	226	Black Mountain Ranch CRRP[2] (100% diversion)	226	0
Carpet, Carpet Padding	121	DFS Flooring 10178 Willow Creek Road (100% diversion)	121	0
Drywall	377	Black Mountain Ranch CRRP[3] (100% diversion)	377	0
Corrugated Cardboard	91	Allan Company 6733 Consolidated Way (100% diversion)	91	0
Trash/Garbage	151	Miramar Landfill 5480 Convoy Street San Diego, CA 92111 (0% diversion)	0	151
TOTAL	**1,506**		**1356 (90%)**	**151 (10%)**

[1] Ground up at the CRRP and used within Black Mountain Ranch for construction roads or Class 2 base for private driveways.
[2] Ground up at the CRRP and used within Black Mountain Ranch as mulch for project landscaping.
[3] Ground up at the CRRP and used in the landscaping as a soil softener.

Construction activities generate packaging materials and unpainted wood, including wood pallets and cardboard. The Black Mountain Ranch CRRP maintains a grinder on-site and 100 percent of the separated lumber that is not reused during the construction process would be ground and stockpiled on-site for use as mulch in project landscaping. All of the drywall waste generated by the construction phase would be ground into powder and used in the landscaping as a soil softener. Similarly, all inerts and concrete/asphalt waste would be ground and reused on-site for construction roads or Class 2 base for the private driveways.

5.3.2 Contractor Education and Responsibilities

Contractors would be educated regarding the solid waste management plan. Solid waste management plans would be distributed to all entities when they first begin work on-site and when training workers, subcontractors, and suppliers on proper waste management procedures applicable to the project. The WMP requirements shall be discussed at all pre-construction meetings.

5.3.3 Solid Waste Management Coordinator

A SWMC for the project shall be designated to ensure that the contractors and subcontractors are educated and that procedures for waste reduction and recycling efforts are implemented. Specific responsibilities of the SWMC include:

- Review the WMP, including the SWMC responsibilities.
- Work with the contractors to estimate the quantities of each type of material that would be salvaged, recycled, or disposed of as waste, then assist in documentation.
- Review and enforce procedures for materials separation and verify availability and signage of containers.
- Coordinate solid waste mitigation implementation with other requirements, such as storm water requirements, which may specify related measures, such as the placement of bins to minimize the possibility of runoff contamination.
- Review and enforce procedures for transportation of materials to recycling and disposal facilities.
- Return or reuse excess materials and packaging.

5.3.4 Total Diversion

The grading phase would not involve any soil export. All green waste would be recycled; thus, the project would achieve 100 percent diversion during grading.

The construction phase would generate approximately 1,506 tons of debris. Assuming 90 percent of the debris would be re-used on-site or source separated (with the exception of trash/garbage), the construction phase would divert about 1,356 tons. Therefore, because construction is the only phase of the project that would generate any waste, there would be a total of 90 percent reduction in solid waste, which would be diverted from the landfill. A SWMC would be designated and contractor education would occur to ensure that these methods would be carried out adequately.

6.0 Occupancy Phase

Unlike grading and construction, occupancy is an ongoing process. Therefore, it requires an ongoing plan to manage and reduce waste in order to meet the waste reduction goals established by local and state policy. All of the units (171 single-family residential) would be served by the City of San Diego during occupancy of the project.

6.1 Waste Generation

The expected annual waste to be generated during occupancy of the project was calculated using ESD waste generation factors. Table 2 summarizes the occupancy phase waste generation for the 171 single-family residential units; all of which would be served by the City of San Diego. As shown, the project would generate a total of about 273.6 tons of waste per year.

TABLE 2
OCCUPANCY PHASE ANNUAL WASTE GENERATION

Land Use	Amount	Generation Rate	Waste Generated	Percent Diverted	Tons Diverted	Tons Disposed
Residential	171	1.6 tons per year per unit	273.6 tons	40%	109.4	164.2

6.2 Waste Reduction Measures

The project will comply with City ordinances, including the City Recycling Ordinance and the Storage Ordinance. However, compliance with these laws achieves only an average 40 percent diversion rate (see Table 2) during the occupancy phase. As outlined in the

Black Mountain Development Landfill Diversion Plan (Allied Waste Services 2004), Allied Waste Services will plan and track diversion efforts throughout the project by either construction phases, builders, or both. The applicant (or applicant's successor in interest) shall be responsible for implementing a long-term WMP that shall ensure that the development meets or exceeds the requirements set forth in AB 939 and AB 341. This program shall include providing sufficient interior and exterior storage space for refuse and recyclable materials and a means of handling landscaping and green waste materials. Specific program measures are listed in Section 7.3 below.

- The applicant (or applicant's successor in interest) shall provide recycling services, which include all of the following provisions:

    1. Collection of recyclable materials required by and in accordance with applicable City Ordinances.

    2. Provide dedicated recycling collection and storage areas required by and in accordance with applicable City Ordinances.

    3. Provide signage required by and in accordance with applicable City Ordinances.

- The applicant (or applicant's successor in interest) shall educate residents about the recycling services as follows:

    1. Information, including the types of recyclable materials accepted, the location of recycling containers, and the residents' responsibility to recycle, shall be distributed to all residents annually.

    2. All new residents shall be given educational information on recycling programs and procedures and instructions upon occupancy.

    3. All residents shall be given information and instructions upon any change in recycling service to the facility.

6.3 Exterior Storage

This WMP follows the guidelines set by the City's Municipal Code (§142.0810–142.0830) designating on-site refuse and recyclable material storage space requirements. Table 3 shows exterior storage area requirements for residential developments pursuant to the City's guidelines.

TABLE 3
MINIMUM EXTERIOR REFUSE AND RECYCLABLE MATERIAL STORAGE AREAS FOR RESIDENTIAL DEVELOPMENT

Number of Dwelling Units per Development	Minimum Refuse Storage Area per Development (square feet)	Minimum Recyclable Material Storage Area per Development (square feet)	Total Minimum Storage Area per Development (square feet)
2–6	12	12	24
7–15	24	24	48
16–25	48	48	96
26–50	96	96	192
51–75	144	144	288
76–100	192	192	384
101–125	240	240	480
126–150	288	288	576
151–175	336	336	672
176–200	384	384	768
201+	384 plus 48 square feet for every 25 dwelling units above 201	384 plus 48 square feet for every 25 dwelling units above 201	768 plus 96 square feet for every 25 dwelling units above 201

SOURCE: City Municipal Code, Chapter 14, Article 2, Division 8: Refuse and Recyclable Material Storage Regulations, §142.0830, Table 142-08C; effective, January 1, 2000.

As seen in Table 3, because the project proposes a total of 171 dwelling units, the project is required to provide a minimum of 336 square feet of refuse storage area and a minimum of 336 square feet of recyclable material storage. This makes the total exterior refuse/recyclable material storage an area of approximately 672 square feet.

During occupancy, the expected annual waste to be generated from the proposed building would be approximately 273.6 tons, based on a residential waste generation rate of 1.6 tons per year per square foot (California Department of Resources Recycling and Recovery 2009). An ongoing plan to manage waste disposal in order to meet state/city certification waste reduction goals shall be implemented by the property manager through this WMP. Included in this program shall be the provision of a minimum of 336 square feet of exterior refuse storage area and 336 square feet of exterior recyclable material storage area, as required by the City's Municipal Code.

6.4 Landscaping and Green Waste Recycling

The project would require some landscaping and landscape maintenance. Drought-tolerant plants would be used to reduce the amount of green waste produced. Collection of green waste and disposal of it at recycling centers that accept green waste would help to further reduce the waste generated by the project during the occupancy phase.

Additionally, pursuant to the 2005 CRRP, lumber would be recycled by grinding it into mulch which would be reused for landscaping on-site (see Attachment 3). Likewise, drywall would be ground up and used as a soil additive, and inerts would be ground up and used as base material in private driveways and in utility trenches. Furthermore, post-consumer content in buildings would be limited to miscellaneous, off-the-shelf items.

7.0 Conclusion

7.1 Grading and Construction Phases

As discussed above, a total of approximately 1,506 tons of material would be generated and 1,356 tons of material would be diverted through on-site reuse and source separation strategies during the grading and construction phases. This amounts to a 90 percent reduction in solid waste, which would be diverted from the landfill. All green waste would be recycled at the Miramar Greenery facility (5180 Convoy Street); thus, the project would achieve a 100 percent diversion during grading.

7.2 Occupancy

The project proposes a total of up to 171 dwelling units. Therefore, the project is required to provide a minimum of 672 square feet of total exterior refuse/recyclable material storage area. In addition, as discussed in Section 6.0, the property manager shall implement measures to ensure that the operations phase of the project complies with the City's Recycling Ordinance.

In conclusion, the project would recycle 90 percent of the construction material generated, and would comply with all applicable City ordinances regarding construction debris. During occupancy, the WMP shall include provision of sufficient interior and exterior storage space for refuse and recyclable materials, and a means of handling and recycling landscaping and green waste materials. While the project is anticipated to achieve the City average of 40 percent diversion during occupancy, by incorporating the waste management strategies outlined in the Waste Management Plan, the project would mitigate impacts to below the level of significance.

7.3 Implementation

7.3.1 Source Separation during Construction

Based on providing segregation of these materials, the project would meet or exceed the 75 percent diversion of construction waste. To ensure this result, contractors will be required to comply with the following methods and procedures below:

1. Provide verification that dirt and grubbed material is being used on-site or transported to an appropriate facility for reuse/composting.

2. Construction and Land-Clearing containers will be provided for waste that is to be recycled. Containers shall be clearly labeled with a list of acceptable and unacceptable materials. The list of acceptable materials must be the same as the materials recycled at the receiving material recovery facility or recycling processor.

3. The collection containers for recyclable Construction and Land-Clearing waste must contain no more than 10 percent non-recyclable materials, by volume.

4. Use detailed material estimates to reduce risk of unplanned and potentially wasteful material cuts.

5. Prior to the start of construction, ensure that the C&D Ordinance deposit has been paid.

6. Conduct daily visual inspections of dumpsters and recycling bins to remove contaminants.

7. Remove construction waste materials from the project site at least once every week to ensure no over-topping of waste bins. The accumulation and burning of on-site Construction and Land-Clearing waste materials will be prohibited.

Additionally, in an effort to achieve the goal of diverting 90 percent of construction waste from the landfill, Allied Waste Services will provide the following equipment and services. In addition to achieving a 90 percent diversion goal, the equipment and services offered will also facilitate a safe, economical, and convenient waste removal program.

- On-site Supervisor
- Tractor with rotator forks
- 18-gallon curbside containers
- 3- to 4-yard color coded bins
- 20-yard roll-off containers
- Hauling of recyclable materials and trash
- Wood chipper and colorizer

 RECON

Furthermore, the SWMC for the project shall be designated to ensure that the contractors and subcontractors are educated and that procedures for waste reduction and recycling efforts are implemented. Specific responsibilities of the SWMC include:

- Review the WMP, including the SWMC responsibilities.
- Work with the contractors to estimate the quantities of each type of material that would be salvaged, recycled, or disposed of as waste, then assist in documentation.
- Review and enforce procedures for materials separation and verify availability and signage of containers.
- Coordinate solid waste mitigation implementation with other requirements, such as storm water requirements, which may specify related measures, such as the placement of bins to minimize the possibility of runoff contamination.
- Review and enforce procedures for transportation of materials to recycling and disposal facilities.
- Return or reuse excess materials and packaging.

7.3.2 Waste Reduction Measures during Occupancy

- The applicant (or applicant's successor in interest) shall provide recycling services, which include all of the following provisions:

  1. Collection of recyclable materials required by and in accordance with applicable City Ordinances.
  2. Provide dedicated recycling collection and storage areas required by and in accordance with applicable City Ordinances.
  3. Provide signage required by and in accordance with applicable City Ordinances.
  4. Ensure that a representative of ESD inspects and approves a storage area that has been provided consistent with the City's Storage Ordinance.
  5. Ensure that a hauler has been retained to provide recyclable materials collection as well as yard waste and/or food waste.

- The applicant (or applicant's successor in interest) shall educate residents about the recycling services as follows:

    1. Information, including the types of recyclable materials accepted, the location of recycling containers, and the residents' responsibility to recycle, shall be distributed to all residents annually.

    2. All new residents shall be given educational information on recycling programs and procedures and instructions upon occupancy.

    3. All residents shall be given information and instructions upon any change in recycling service to the facility.

8.0 References Cited

Allied Waste Services

2004 Black Mountain Development Landfill Diversion Plan.

California Department of Resources Recycling and Recovery

2009 Estimated Solid Waste Generation Rates for Residential Developments: http://www.calrecycle.ca.gov/wastechar/wastegenrates/Residential.htm. Last update December 30. Accessed online January 27, 2014.

California, State of

1989 Assembly Bill 939. Integrated Waste Management Act.

2011 Assembly Bill 341. Jobs and Recycling.

San Diego, City of

1998 Black Mountain Ranch Subarea Plan. July.

2000 *Waste Composition Study 1999-2000. Final Report*. San Diego Environmental Services Department. November.

2007 *Recycling Ordinance*. San Diego Municipal Code. Article 6, Division 7. November 13.

2008 Construction and Demolition Debris Diversion Deposit Program. San Diego Municipal Code. Article 6, Division 6.

2011 *Significance Determination Thresholds*. California Environmental Quality Act. January.

2014 2013 Certified Recycling Facility Directory, San Diego Environmental Services Department, November 30.

U.S. Environmental Protection Agency EPA

1998 Characterization of Building-Related Construction and Demolition Debris in the United States. Municipal and Industrial Solid Waste Division. Office of Solid Waste. Report No. EPA530-R-98-010. June.

ATTACHMENTS

ATTACHMENT 1

City Approval of Black Mountain Ranch Construction Reuse and Recycling Project (2005)

October 20, 2005

CERTIFIED MAIL 7005 0390 0006 5220 1521

Mike Mathias, District Recycling Manager
Allied Waste Services
881 Energy Way
Chula Vista, CA 91911

Dear Mr. Mathias:

Subject: Black Mountain Ranch Construction Reuse and Recycling Project

On October 11, 2005 the City of San Diego Solid Waste Local Enforcement Agency (LEA) received your letter on the above subject. This letter is in response to your description, dated September 20, 2005, of the proposed plan for recycling and reusing construction debris. Your letter describes how the metal, drywall, wood, recyclables and concrete debris and trash generated from the development of the 4,677 acre community in the City of San Diego would be either recycled or reused on site or shipped off site to a recycler or disposed of. Your description anticipates that 90% of the debris generated on site would be reused or recycled. Only debris generated onsite would be processed and all processing would occur only within the defined development project area. No unprocessed material would remain onsite after the completion of the six-year project. Any unprocessed material that remains on site after the completion of the project would be subject to California Code of Regulations, Title 14, Chapter 3, Article 5.9,(14 CCR) § 17381.1(ee) storage limitation and could be construed as disposal if not removed from the site.

The following equipment and services to recycle and reuse construction debris will be provided:

- On site Supervisor
- Tractor with Rotator Forks
- 18 Gallon Curbside Containers
- 3 to 4 Yard Color Coded bins
- 20 Yard Roll-off Containers
- Hauling of Recyclable Materials and Trash
- Wood Chipper and Colorizer

The description of the project meets the criteria of 14 CCR § 17380(g) and therefore is not subject to the construction and demolition and inert debris transfer/processing

Solid Waste Local Enforcement Agency (LEA) • Development Services
1010 Second Avenue, Suite 600, MS 606L • San Diego, CA 92101-4998
Tel (619) 533-3688 Fax (619) 533-3690

regulatory requirements. As long as only debris generated from on-site construction activity is processed or removed for recycling or disposal to a permitted location, the described activity will not be subject to these regulatory requirements.

14 CCR, § 17382(a)(4)(A) excludes chipping and grinding of lumber or other wood if the chipping and grinding activity handles materials derived from and applied to lands owned or leased by the same person, including a parent or subsidiary of a corporate owner. This exclusion would apply to the project described by your letter if the material is from and used only by Black Mountain Ranch LLC.

However, this letter does not as relieve any owner, or operator from obtaining all required permits, licenses, or other clearances and complying with all orders, laws, regulations, reports, or other requirements of the other regulatory or enforcement agencies, including, but not limited to, local health agencies, Regional Water Quality Control Boards, Department of Toxic Substances Control, air pollution control districts, local land use authorities, and fire authorities.

Additionally, 14 CCR, § 17382(b) states that the described recycling and reuse activity regulatory exclusion will not preclude the LEA from conducting inspections to verify that the activity is being conducted in a manner that qualifies as an excluded activity or from taking appropriate enforcement action. The burden of proof shall be on the owner and operator to demonstrate that the activities are excluded pursuant to this section.

Thank you for your early consultation regarding the proposed reuse and recycling activity at Black Mountain Ranch. If you have any questions regarding this letter you may call me at 619-533-3696.

Sincerely,

William E. Prinz, REHS, MPA
Solid Waste Inspector III

cc: Kelly Broughton, Deputy Land Development Review Director
Vicky Gallagher, LEA Program Manager
Adam Futo, Project Manager, Black Mountain, LLC
Tadese Gebre-Hawariat, Integrated Waste Management Specialist, California Integrated Waste Management Board

ATTACHMENT 2

2014 Certified Construction & Demolition Recycling Facility Directory

THE CITY OF SAN DIEGO

2014 Certified Construction & Demolition Recycling Facility Directory

These facilities are certified by the City of San Diego to accept materials listed in each category. Hazardous materials are not accepted. The diversion rate for these materials shall be considered 100%, except mixed C&D debris which updates quarterly. The City is not responsible for changes in facility information. Please call ahead to confirm details such as accepted materials, days and hours of operation, limitations on vehicle types, and cost. For more information visit: www.recyclingworks.com.

Please note: In order to receive recycling credit, Mixed C&D Facility and transfer station receipts must: *-be coded as construction & demolition (C&D) debris* *-have project address or permit number on receipt* **Make sure to notify weighmaster that your load is subject to the City of San Diego C&D Ordinance.* ***Note about landfills: Miramar Landfill and other landfills do not recycle mixed C&D debris.***	Mixed C&D Debris	Asphalt /Concrete	Brick/Block/Rock	Building Materials for Reuse	Cardboard	Carpet	Carpet Padding	Ceiling Tile	Ceramic Tile / Porcelain	Clean Fill Dirt	Clean Wood / Green Waste	Drywall	Industrial Plastics	Lamps / Light Fixtures	Metal	Mixed Inerts	Styrofoam Blocks
EDCO Recovery & Transfer 3660 Dalbergia St, San Diego, CA 92113 619-234-7774 | www.edcodisposal.com/public-disposal	65%											●					
EDCO Station Transfer Station & Buy Back Center 8184 Commercial St, La Mesa, CA 91942 619-466-3355 | www.edcodisposal.com/public-disposal	65%				●							●			●		
EDCO CDI Recycling & Buy Back Center 224 S. Las Posas Rd, San Marcos, CA 92078 760-744-2700 | www.edcodisposal.com/public-disposal	85%				●										●		
Escondido Resource Recovery 1044 W. Washington Ave, Escondido 760-745-3203 | www.edcodisposal.com/public-disposal	65%																
Fallbrook Transfer Station & Buy Back Center 550 W. Aviation Rd, Fallbrook, CA 92028 760-728-6114 | www.edcodisposal.com/public-disposal	65%				●										●		
Otay C&D/Inert Debris Processing Facility 1700 Maxwell Rd, Chula Vista, CA 91913 619-421-3773 | www.sd.disposal.com	66%																
Ramona Transfer Station & Buy Back Center 324 Maple St, Ramona, CA 92065 760-789-0516 | www.edcodisposal.com/public-disposal	65%				●										●		
SANCO Resource Recovery & Buy Back Center 6750 Federal Blvd, Lemon Grove, CA 91945 619-287-5696 | www.edcodisposal.com/public-disposal	65%				●										●		
All American Recycling 10805 Kenney St, Santee, CA 92071 619-508-1155 (Must call for appointment)						●											
Allan Company 6733 Consolidated Wy, San Diego, CA 92121 858-578-9300 | www.allancompany.com/facilities.htm					●										●		
Allan Company Miramar Recycling 5165 Convoy St, San Diego, CA 92111 858-268-8971 | www.allancompany.com/facilities.htm					●										●		
Allan Company 8514 Mast Blvd, Santee, CA 92701 619-448-4295 | www.allancompany.com/facilities.htm					●										●		
AMS 4674 Cardin St, San Diego, CA 92111 858-541-1977 | www.a-m-s.com								●									
AMS 1120 West Mission Ave, Escondido, CA 92025 858-541-1977 | www.a-m-s.com								●									
Armstrong World Industries, Inc. 300 S. Myrida St, Pensacola, FL 32505 877-276-7876 (Press 1, Then 8) www.armstrong.com/commceilingsna								●									
Cactus Recycling 8710 Avenida De La Fuente, San Diego, CA 92154 619-661-1283 | www.cactusrecycling.com					●								●		●		●

	Mixed C&D Debris	Asphalt /Concrete	Brick/Block/Rock	Building Materials for Reuse	Cardboard	Carpet	Carpet Padding	Ceiling Tile	Ceramic Tile / Porcelain	Clean Fill Dirt	Clean Wood / Green Waste	Drywall	Industrial Plastics	Lamps / Light Fixtures	Metal	Mixed Inerts	Styrofoam Blocks
DFS Flooring 10178 Willow Creek Road, San Diego, CA 92131 858-630-5200 | www.dfsflooring.com						●	●										
Enniss Incorporated 12421 Vigilante Rd, Lakeside, CA 92040 619-443-9024 | www.enniss.net		●	●						●	●							
Escondido Sand and Gravel 500 N. Tulip St, Escondido, CA 92025 760-432-4690 | www.weirasphalt.com/esg		●															
Habitat for Humanity ReStore 10222 San Diego Mission Rd, San Diego, CA 92108 619-516-5267 | www.sdhfh.org/restore.php				●													
Hanson Aggregates West – Lakeside Plant 12560 Highway 67, Lakeside, CA 92040 858-547-2141		●															
Hanson Aggregates West – Miramar 9229 Harris Plant Rd, San Diego, CA 92126 858-974-3849		●								●							
Hidden Valley Steel & Scrap, Inc. 1342 Simpson Wy, Escondido, CA 92029 760-747-6330															●		
HVAC Exchange 2675 Faivre St, Chula Vista, CA 91911 619-423-1855 | www.thehvacexchange.com															●		
IMS Recycling Services 2740 Boston Ave, San Diego, CA 92113 619-231-2521 | www.imsrecyclingservices.com					●								●				
IMS Recycling Services 2697 Main St, San Diego, CA 92113 619-231-2521 | www.imsrecyclingservices.com													●		●		
Inland Pacific Resource Recovery 12650 Slaughterhouse Canyon Rd, Lakeside, CA 92040 619-390-1418											●						
Lakeside Land Co., Inc. 10101 Riverford Rd, Lakeside, CA 92040 619-449-9083 | www.lakesideland.com		●														●	
Lamp Disposal Solutions 8248 Ronson Ct, San Diego, CA 92111 858-569-1807 | www.lampdisposalsolutions.com														●			
Lights Out Disposal 1097 Palm Ave, Ste 100, El Cajon, CA 92020 619-438-1093 | www.lightsoutdisposal.com														●			
Los Angeles Fiber Company 4920 S. Boyle Ave, Vernon, CA 90058 323-589-5637 | www.lafiber.com						●	●										
Miramar Greenery, City of San Diego 5180 Convoy St, San Diego, CA 92111 858-694-7000 | www.sandiego.gov/environmental-services/miramar/greenery.shtml											●						
Moody's 3210 Oceanside Blvd., Oceanside, CA 92056 760-433-3316		●								●						●	
Otay Valley Rock, LLC 2041 Heritage Rd, Chula Vista, CA 91913 619-591-4717 | www.otayrock.com		●															
Pacific Steel, Inc. 1700 Cleveland Ave, National City, CA 91950 619-474-7081															●		
Reclaimed Aggregates Chula Vista 855 Energy Wy, Chula Vista, CA 91913 619-656-1836		●														●	

	Mixed C&D Debris	Asphalt /Concrete	Brick/Block/Rock	Building Materials for Reuse	Cardboard	Carpet	Carpet Padding	Ceiling Tile	Ceramic Tile / Porcelain	Clean Fill Dirt	Clean Wood / Green Waste	Drywall	Industrial Plastics	Lamps / Light Fixtures	Metal	Mixed Inerts	Styrofoam Blocks
Reconstruction Warehouse 3341 Hancock St., San Diego, CA 92110 619-795-7326 | www.recowarehouse.com				●													
Robertson's Ready Mix 2094 Willow Glen Dr, El Cajon, CA 92019 619-593-1856		●								●						●	
Romero General Construction Corp. 8354 Nelson Wy, Escondido, CA 92026 760-749-9312 | www.romerogc.com/crushing/nelsonway.htm		●															
SA Recycling 3055 Commercial St., San Diego, CA 92113 619-238-6740 | www.sarecycling.com															●		
SA Recycling 1211 S. 32nd St., San Diego, CA 92113 619-234-6691 | www.sarecycling.com															●		
Vulcan Carol Canyon Landfill and Recycle Site 10051 Black Mountain Rd, San Diego, CA 92126 858-530-9465 | www.vulcanmaterials.com/carrollcanyon		●	●							●						●	

ATTACHMENT 3

Black Mountain Development Landfill Diversion Plan (2004)

Black Mountain Development
Landfill Diversion Plan

In Partnership with
Allied Waste Services
July 2004

Table of Contents

Equipment and Services

In an effort to assist Black Mountain Development in their goal of diverting 90% of construction waste from the landfill, Allied Waste Services would like to offer the following equipment and services. In addition to achieving a 90% diversion goal, we believe that the equipment and services offered will also facilitate a safe, economical and convenient waste removal program.

- On Site Supervisor
- Tractor with Rotator Forks
- 18 Gallon Curbside Containers
- 3 to 4 Yard Color Coded Bins
- 20 Yard Roll-Off Containers
- Hauling of Recyclable Materials and Trash
- Wood Chipper and Colorizer

On Site Supervisor – This person will be stationed on site to oversee Allied Waste Services' portion of the diversion program. We believe this will be key in maximizing and documenting your diversion efforts. The on-site supervisors will be responsible for the following, which will ensure fluidity in managing the waste generated:

- Tracking diversion and disposal services provided by Allied Waste Services including metal, single stream (cardboard, mixed paper, aluminum and steel cans, glass and plastic containers), wood, drywall and trash
- Reporting monthly diversion and disposal tonnages to Black Mountain Development
- Monitor and provide empty containers as needed
- Staging full bins for collection or emptying them in the appropriate staging areas
- Coordinating the servicing of Pacific Waste Services' 3 yard and roll-off containers
- Ensuring that there are an adequate number of collection containers provided and that the containers are labeled properly
- Educating contractors and subcontractors through tailgate meetings and on-site visits on how to use the containers provided to maximize diversion by segregating recyclable material from unrecyclable material

Tractor with Rotator Forks – The tractor will be used by the on-site supervisor to exchange full bins with empty ones and stage the full bins for service. A rotator feature will be included on the forks to allow the on-site supervisor to empty the bins. For example the wood and drywall bins will be emptied at a staging area on-site.

18 Gallon Curbside Containers – The contractors and subcontractors will use these small containers to collect and segregate unwanted material at the point of generation. For example an electrical contractor would place metal scraps in one container and trash in a second container. Once a container is full he will empty it into the appropriate color coded bin. Containers with metal will be transported to the metal roll-off container and emptied by the on-site supervisor.

3 Yard Color Coded Bins – Each bin will be color coded and identified for specific materials using and labeled in English and Spanish. The bins will be placed in front of every 1 to 5 homes depending on the volume of material generated. Additional bins will be placed in a staging area and will be used to exchange with full bins. The on-site supervisor will exchange full bins for empty ones. Each of the following materials will be collected in the bins.

- Single Stream (cardboard, mixed paper, aluminum and steel cans, food and beverage containers) – Light Blue
- Trash – Dark Blue
- Wood - Green
- Drywall – White
- Metal - Gray

Full single stream and trash bins will be placed in a staging area away from the immediate construction area by the on-site supervisor. The on-site supervisor will coordinate the emptying of the bins. Once emptied the on-site supervisor will place the empty bins at the bin staging area

Full wood and drywall bins will be emptied by the on-site supervisor at an on-site staging area.

20 Yard Labeled Roll-Off Containers – One container will be used to store mixed metals that are intended to be hauled off site for recycling. The on-site supervisor will coordinate the servicing of the roll-off container. An additional container(s) will be provided for concrete washout.

Hauling and Reporting of Recyclable Material and Trash – As an experienced hauler, Allied Waste Services can safely and efficiently manage scrap material on site and haul unwanted material off site to an appropriate recycle processor for recycling or a landfill for disposal. Additionally, as the hauler Allied Waste Services will provide detailed reports to assist in the tracking of materials diverted from the landfill. This ability to track diversion will be key in verifying the diversion goal of 90%.

Wood Chipper and Colorizer – Allied Waste Services will provide and operate a wood chipper and colorizer to mulch scrap wood that has been collected and stockpiled. The mulch will then be made available for use throughout the project.

Waste Management Plan

The table below will be used to plan and track diversion efforts throughout the project. Initially the table will be filled out to plan and estimate diversion potential. As the project progresses additional tables will be filled out with actual weights to track progress. This format provides the flexibility to track diversion efforts by construction phases, builders or both.

Material Type	Quantity in Pounds	Total Diverted	Total Disposed	Facility Used	Method of Transport
Asphalt					
Brick					
Roof Tiles					
Concrete					
Dirt/Clean Fill					
Lumber					
Single Stream					
Metal					
Drywall					
Other Materials					
Total Tons					

Total Tons Diverted ____________

Total Tons Disposed ____________

Diversion Rate ____________

Conversion Table

Material Type	Pounds/Cubic Yard
Asphalt	1380
Brick	3024
Roof Tiles	418
Concrete	1855
Dirt/Clean Fill	2000
Lumber	330
Single Stream	50
Metal	906
Drywall	394

Key Management and Technical Support

Pacific Waste Services has a vast pool of experience and expertise to apply to the development, implementation and execution of solid waste and recyclables services Black Mountain Development is requesting. Additionally, we monitor and share information nationwide to make certain we are providing our customers with up to date operational programs. The following are the individuals that will be responsible for serving Black Mountain Development. A brief biography and job description has been included for your review.

At Pacific Waste, Division personnel, organized and directed by the General Manager provide operational services. Directing the operation of a Division requires leadership, exceptional managerial skills, and an intense desire to succeed.

General Managers are local managers of semi-autonomous operating companies, usually operating out of single locations. Divisions are self-supporting with their own profit and loss statements. General Managers also perform functions associated with human resources, productivity, maintenance, sales, accounting, customer service, and public relations.

General Manager: Mr. Jerry Schnitzius, our San Diego Market General Manager has over 34 years experience in the solid waste industry. Mr. Schnitzius was born and educated in Indianapolis Indiana and is a United States Navy Submarine Veteran. Following discharge from the Navy, Mr. Schnitzius entered the waste hauling business with a private firm in Indianapolis. Through hands on experience he gained knowledge in all facets of the industry including helper, driver, operations manager and general manager. In 1981 through an acquisition, Mr. Schnitzius joined Waste Management, Inc. During this time he worked in Florida as general manager and division president and in 1995 he transferred to Michigan as district manager. In 2000 Mr. Schnitzius joined Allied Waste and moved to San Diego to manage Pacific Waste Services.

Mr. Schnitzius is very involved in many civic activities. He has served on three Chambers of Commerce Board of Directors, has served as President of the Salvation Army Board and Private Industry Council. He was the recipient of the Florida Public Relations Professionalism Award. As manager his divisions have won several awards, these include Outstanding Company of the Year, National Environmental Award and three Safety Awards.

Operations Manager: Division Operations Managers are responsible for productivity, labor control, disposal minimization, safety and customer service, and resolving and minimizing customer complaints. Other responsibilities include routing, driver development, vehicle assignment and vehicle care monitoring.

Mr. James Gehman is an Operations Supervisor. Mr. Gehman was born in San Diego, California, but moved to Washington State where he completed his degree at Western Washington University. Mr. Gehman entered the trash industry in 1989 with a small local company. He has been involved in all facets of Operations and Safety including helper, driver, dispatcher, Operations Supervisor and Safety Supervisor. He supervises all the roll-off compactor routes and commercial business routes.
Mr. Jim Gehman is our Operations Manager. Mr. Koman obtained a degree from San Diego State University and has been in the waste industry for 14 years - starting as an Accounts Receivable analyst. In his second year with the company Mr. Koman transferred to the Operations Department where he continued to develop his industry experience in positions as Route Auditor, Dispatcher, Operations Analyst and Project Analyst, assisting in budgeting and analytical projects to maximize productivity and profitability. Mr. Koman then served as Operations Supervisor and in August of 2001 was promoted to Operations Manager, with direct responsibility for the entire fleet.

Safety Manager: Safety Managers are responsible for loss control programs, training of drivers, health hygiene, claims, monitoring and vendor insurance requirements. Safety Managers may also be responsible for many human resource programs, specifically DOT qualifications and screening. All Safety Managers undergo a professional development program which is jointly sponsored by the National Safety Council and Allied Waste/Pacific Waste Services.

Mr. Saul J. Robles has a total of 3 years in Safety and 12 years in the hauling and transportation industry. He holds numerous safety professional certifications and is a member of various professional organizations.

Mr. Robles started working for an independent trash company in San Diego in 1990. In 1991 he started as a dispatcher in our San Diego facility transferring to a Route Supervisor Position working in both of our Hauling Divisions, in 2000 he started focusing in the Safety area. In 2003 he was appointed District Safety Manager for the San Diego District.

Sales Manager: The Division Sales Manager is responsible for the direction and development of all commercial and industrial sales activities and results within the division. They promote communication between sales, operations, and accounting to better assist with customer needs.

Kelli Rayzor currently holds the position of Sales Manager at Pacific Waste Services. She was born in Salem, Oregon. At the age of three, she moved with her family to San Diego, California, where she completed her education. She joined Pacific Waste Services in 1990 as an Accounts Receivable Analyst. In 1992 she was promoted to Customer Service and in 1993, she was promoted to the Lead Customer Service position. In 1997 Ms. Rayzor was promoted to the Sales Department as the Sales Supervisor where she oversees 10 representatives and is responsible for all facets of Sales. In 2001 Ms. Rayzor was promoted to Sales Manager.

District Recycling Manager: The District Recycling Manager is a resource for our customers and assists the Division with AB939 landfill diversion plan development and implementation, contract compliance, marketing recyclable materials, public education and government affairs.

Mr. Mike Mathias has over 7 years experience working in the recycling and waste reduction field. He received his AA in Business Administration and Environmental Management Certificate from Southwestern College. He has worked for the City of Chula Vista, as a used oil recycling intern managing the South Bay Regional Used Oil Recycling Program. He also worked for the City of Imperial Beach, as an Environmental Programs Specialist, managing compliance programs for AB939 and Municipal Storm Water Permit Regulations. Mr. Mathias has been at Pacific Waste Services for 2 years. During this time he has maintained recycling programs for the San Diego Airport and City of Chula Vista, implemented new recycling programs at the University of California San Diego (UCSD) and the Chula Vista Elementary School District. Recently he completed a pilot project to improve Multi-Family recycling in Chula Vista.

Operations Supervisors: Operations Supervisors directly manage the day to day collection operations of the Division. Pacific Waste Services has three Operations Supervisors who are in the field daily to ensure the drivers have the support and the assistance they need to provide our customers with high quality service.

Mr. Ricardo Fierro currently holds the position of Operations Supervisor at Pacific Waste Services. He was born in Mexicali, Baja California and was educated in Los Angeles California. In 1995, Mr. Fierro joined California Radio Group where he started as a driver and promoted through the ranks to Operations Manager. In 2000, Mr. Fierro joined the Pacific Waster Services team as a Route Supervisor. He is learning all facets of the waste industry and is responsible for supervising a portion of our commercial business and recycling collection routes.

APPENDIX L
Conservation of Thread-Leaved Brodiaea by the Heritage Bluffs II Project and Compliance with the City of San Diego MSCP Subarea Plan (City of San Diego)

THE CITY OF SAN DIEGO

September 24, 2015

Ms. Karen A. Goebel, Assistant Field Supervisor
U.S. Fish and Wildlife Service
Carlsbad Field Office
2177 Salk Avenue
Carlsbad, CA 92008

Ms. Gail K. Sevrens, Environmental Program Manager
California Department of Fish and Wildlife
3883 Ruffin Road
San Diego, CA 92123

Subject: Conservation of Thread-Leaved Brodiaea (*Brodiaea filifolia*) by the Heritage Bluffs II (HBII) Project and Compliance with the City of San Diego Multiple Species Conservation Program (MSCP) Subarea Plan

Dear Ms. Goebel and Ms. Sevrens:

This letter has been prepared to provide formal concurrence between the City of San Diego, California Department of Fish and Wildlife (CDFW), and U.S. Fish and Wildlife Service (USFWS) regarding the proposed conservation for thread-leaved brodiaea (*Brodiaea filifolia*) by the Heritage Bluffs II (HBII) project. Thread-leaved brodiaea is a state-listed Endangered and federal-listed Threatened species, and is identified as a narrow endemic species in the MSCP Subregional Plan; however, specific conservation measures for this plant were not identified in the City's MSCP Subarea Plan because it was not known to occur in the City at the time the permits were issued by CDFW and USFWS (hereafter jointly referred to as the Wildlife Agencies).

Numerous biological surveys have been conducted on the site dating back to 2006. In 2011, a series of multi-year focused surveys for thread-leaf Brodiaea (*Brodiaea filifolia*) was initiated as recommended by the Wildlife Agencies due to a discovery of this species elsewhere in the broader vicinity. This state-listed Endangered and federal-listed Threatened species, also considered a narrow endemic, was found on the HBII site, on Parcel 3 of PM No. 18504 between the Heritage Bluffs II site and the East Clusters project area and on the East Clusters site. Qualified Biologists completed a directed field survey for Thread-leaved Brodiaea (*Brodiaea filifolia*) (Thread-leaved Brodiaea Foliage Survey for East Clusters and Heritage II project Sites, San Diego; Feburary 27, 2015) on the East Clusters, Heritage Bluffs II property and Parcel 3 of PM No. 18504 in the City of San Diego (APN APN 312-010-15 and 312-160-12).

All areas supporting suitable grassland and/or deeply fissured clay-soil habitat were carefully searched for foliage characteristic of this species. Thread-leaved brodiaea was subsequently found on the HBII site, on the East Clusters site, and on Parcel 3 of PM No. 18504; however, the number of individuals and overall distribution was masked by prevailing drought conditions in the initial focused survey efforts. Following a more normal winter/spring rainy season in 2014-15, surveys conducted in 2015 revealed that the study area supports a low of approximately 95,000 to a high of 185,000 thread-leaved brodiaea individuals.

The 7.25-acre portion of Parcel 3 of PM No. 18504 where *Brodiaea filifolia* is proposed to be preserved as a part of The Heritage Brodiaea Preserve, is included in the Black Mountain Ranch Vesting Tentative Map 95-0173 and subject to conservation obligations stated in USFWS/CDFW Interim Loss Permit (1996). However, the portion of Parcel 3 of Parcel Map No. 18504 which will not be developed has not been dedicated to the City or placed in a covenant of easement, and is therefore not considered conserved. To allow this area to be counted as conservation for the HBII project, the applicant has agreed to add a portion of APN 267-150-35 adjacent to the Lusardi Creek that totals 72 acres to the MHPA (Attachment 1). The 7.25-acre portion of Parcel 3 of Parcel Map No. 18504 and 72 acres of APN 267-150-35 would be dedicated to the City or placed in a covenant of easement as a condition of HBII project approval. The 7.25-acre portion of Parcel 3 of Parcel Map No. 18504 will be included in the overall Heritage Brodiaea Preserve, and managed, monitored, and funded in perpetuity according to a plan approved by the City and the Wildlife Agencies.

During review of the HBII project, it became apparent that not all of the 1,766-acre conservation obligation stated in the USFWS/CDFW Interim Loss Permit (1996) for Black Mountain Ranch has been dedicated to the City or placed in a conservation easement (Attachment 2). The City commits to require all remaining areas subject to conservation obligations as stated in USFWS/CDFW Interim Loss Permit (1996), be dedicated to the City or placed in a covenant of easement as a condition of HBII project approval. The City would provide documentation of completion of these actions in the City of San Diego MSCP Subarea Plan Annual Report at the time of grading permit issuance for HBII.

We greatly appreciate the assistance of your agencies and staff. If you have any questions regarding this request for concurrence, please contact Kristy Forburger at (619) 236-6583.

Sincerely,

Tom Tomlinson

Tom Tomlinson
City of San Diego
Interim Planning Director
Planning Department

Attachments: 1. Black Mountain Ranch MHPA Proposed Modification
2. HBII Off-Site Open Space/MHPA Dedications

CC:
David Mayer, CDFW
Paul Schlitt, CDFW
Pat Gower, USFWS
David Zoutendyk, USFWS
Kristen Forburger, City MSCP
John Fisher, City DSD
Kerry Santoro, City DSD
Elizabeth Shearer-Nguyen, City EAS/DSD
William Dumka, Standard Pacific
William Ostrem, Standard Pacific

APPENDIX M
Conservation of Thread-Leaved Brodiaea by the Heritage Bluffs II Project and Compliance with the City of San Diego MSCP Subarea Plan (USFWS and CDFW)

U.S. Fish and Wildlife Service
Carlsbad Fish and Wildlife Office
2177 Salk Avenue, Suite 250
Carlsbad, California 92008
760-431-9440
FAX 760-431-9624

California Department of Fish and Wildlife
South Coast Region
3883 Ruffin Road
San Diego, California 92123
858-467-4201
FAX 858-467-4299

In Reply Refer To:
FWS/CDFW-SDG-10B0678-15TA0758

OCT 29 2015

Tom Tomlinson
City of San Diego
Interim Planning Director
Planning Department
1222 First Avenue, MS-501
San Diego, California 92101

Subject: Conservation of Thread-Leaved Brodiaea (*Brodiaea filifolia*) by the Heritage Bluffs II (HBII) Project and Compliance with the City of San Diego Multiple Species Conservation Program (MSCP) Subarea Plan

Dear Mr. Tomlinson:

The U.S. Fish and Wildlife Service (Service) and the California Department of Fish and Wildlife (Department), collectively the Wildlife Agencies, are providing the following comments to your September 24, 2015, letter that was based on our discussions on September 4, 2015, regarding the conservation of thread-leaved brodiaea (*Brodiaea filifolia*) for the HBII project and compliance with the Service/Department Interim Habitat Loss Permit (HLP, 1996) for Black Mountain Ranch and the City of San Diego's (City) MSCP Subarea Plan (SAP).

The proposed mitigation for impacts to thread-leaved brodiaea from the HBII project includes conserving and managing in perpetuity a 7.25-acre portion of Parcel 3 of PM No. 18504. Although this portion of Parcel 3 was previously identified for conservation per conditions of the HLP and reported in Habitrak as a gain, it was neither dedicated in fee title to the City nor placed in a covenant of easement. To allow the use of this portion of Parcel 3 for the HBII project, a 72-acre portion of APN 267-150-35 in Black Mountain Ranch adjacent to the Lusardi Creek will be conserved and added to the MHPA. Consequently, the 7.25-acre portion of Parcel 3 and 72 acres of APN 267-150-35 will be dedicated to the City or placed in a covenant of easement as a condition of approval of the HBII project.

The Black Mountain Ranch HLP required preservation of 1,766 acres of open space area prior to the recordation of the final map. However, as stated in your letter, not all of this area has been conserved and the City commits to require all remaining areas to be dedicated to the City or placed in a covenant of easement as a condition of HBII project approval. The Wildlife Agencies have concerns about linking completion of the remaining conservation obligations of the Black Mountain Ranch HLP solely to HBII project approval. Therefore, we request that the City commit to complete these long outstanding obligations by the end of 2016 if the HBII project approval is not completed by then.

In addition, we note that Sheet 18 referenced in the attachments to your September 24, 2015, letter was not included with the letter and the attachments are not labeled and differ regarding the location of the road between East Clusters and HBII and the areas already conserved and to be conserved with easements or dedication. Therefore, we request you provide revised attachments for our files.

We appreciate your efforts to conserve thread-leaved brodiaea on the HBII site, and to ensure compliance with the City's SAP and the Black Mountain Ranch HLP. If you have questions regarding this letter, please contact Paul Schlitt of the Department at 858-467-4234 or Patrick Gower of the Service at 760-431-9440, extension 352.

Sincerely,

Karen A. Goebel
Assistant Field Supervisor
U.S. Fish and Wildlife Service

Gail K. Sevrens
Environmental Program Manager
California Department of Fish and Wildlife

cc:
Kristen Forburger, City MSCP
John Fisher, City DSD
Kerry Santoro, City DSD
William Dumka, Standard Pacific
William Ostrem, Standard Pacific