The City of San Diego

PRIORITY DEVELOPMENT PROJECT (PDP) STORM WATER QUALITY MANAGEMENT PLAN (SWQMP) FOR

Southview East
Project # 371807
Tentative Map Internal Order 24004729

ENGINEER OF WORK:

REGISTERED PROFESSIONAL ENGINEER
ALLEN L. BUTCHER
No. 47107
12/31/17
CIVIL
STATE OF CALIFORNIA

Allen L Butcher, PE C47107
Provide Wet Signature and Stamp Above Line

PREPARED FOR:

Southview Development Partners, LLC
4365 Executive Drive, Suite 600
San Diego, CA 92121
(858) 458-9700

PREPARED BY:

SB&O INC.
PLANNING ENGINEERING SURVEYING

SB&O, Inc.
3990 RUFFIN ROAD, SUITE 120
SAN DIEGO, CA 92123
858-560-1141 JN 70910.11

DATE:
August 11, 2016

Approved by: City of San Diego Date

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Project Name: Southview East

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ACRONYMS

APN	Assessor's Parcel Number
ASBS	Area of Special Biological Significance
BMP	Best Management Practice
CEQA	California Environmental Quality Act
CGP	Construction General Permit
DCV	Design Capture Volume
DMA	Drainage Management Areas
ESA	Environmentally Sensitive Area
GLU	Geomorphic Landscape Unit
GW	Ground Water
HMP	Hydromodification Management Plan
HSG	Hydrologic Soil Group
HU	Harvest and Use
INF	Infiltration
LID	Low Impact Development
LUP	Linear Underground/Overhead Projects
MS4	Municipal Separate Storm Sewer System
N/A	Not Applicable
NPDES	National Pollutant Discharge Elimination System
NRCS	Natural Resources Conservation Service
PDP	Priority Development Project
PE	Professional Engineer
POC	Pollutant of Concern
SC	Source Control
SD	Site Design
SDRWQCB	San Diego Regional Water Quality Control Board
SIC	Standard Industrial Classification
SWPPP	Stormwater Pollutant Protection Plan
SWQMP	Storm Water Quality Management Plan
TMDL	Total Maximum Daily Load
WMAA	Watershed Management Area Analysis
WPCP	Water Pollution Control Program
WQIP	Water Quality Improvement Plan

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CERTIFICATION PAGE

Project Name: Southview East
Permit Application Number: 371807

I hereby declare that I am the Engineer in Responsible Charge of design of storm water BMPs for this project, and that I have exercised responsible charge over the design of the project as defined in Section 6703 of the Business and Professions Code, and that the design is consistent with the requirements of the Storm Water Standards, which is based on the requirements of SDRWQCB Order No. R9-2013-0001 as amended by R9-2015-0001 and R9-2015-0100 (MS4 Permit).

I have read and understand that the City Engineer has adopted minimum requirements for managing urban runoff, including storm water, from land development activities, as described in the Storm Water Standards. I certify that this PDP SWQMP has been completed to the best of my ability and accurately reflects the project being proposed and the applicable source control and site design BMPs proposed to minimize the potentially negative impacts of this project's land development activities on water quality. I understand and acknowledge that the plan check review of this PDP SWQMP by the City Engineer is confined to a review and does not relieve me, as the Engineer in Responsible Charge of design of storm water BMPs for this project, of my responsibilities for project design.

Engineer of Work's Signature, PE Number & Expiration Date

Allen L Butcher, PE C47017 Exp 12-31-2017
Print Name

SB&O, Inc.
Company

August 11, 2016
Date

Engineer's Stamp

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Project Name: Southview East

SUBMITTAL RECORD

Use this Table to keep a record of submittals of this PDP SWQMP. Each time the PDP SWQMP is re-submitted, provide the date and status of the project. In last column indicate changes that have been made or indicate if response to plancheck comments is included. When applicable, insert response to plancheck comments.

Submittal Number	Date	Project Status	Changes
1	12/11/15	◉ Preliminary Design/Planning/CEQA ○ Final Design	Initial Submittal
2	5/6/16	◉ Preliminary Design/Planning/CEQA ○ Final Design	Initial Submittal - New Template
3	6/30/16	◉ Preliminary Design/Planning/CEQA ○ Final Design	Second Submittal
4	8/11/16	◉ Preliminary Design/Planning/CEQA ○ Final Design	Third Submittal

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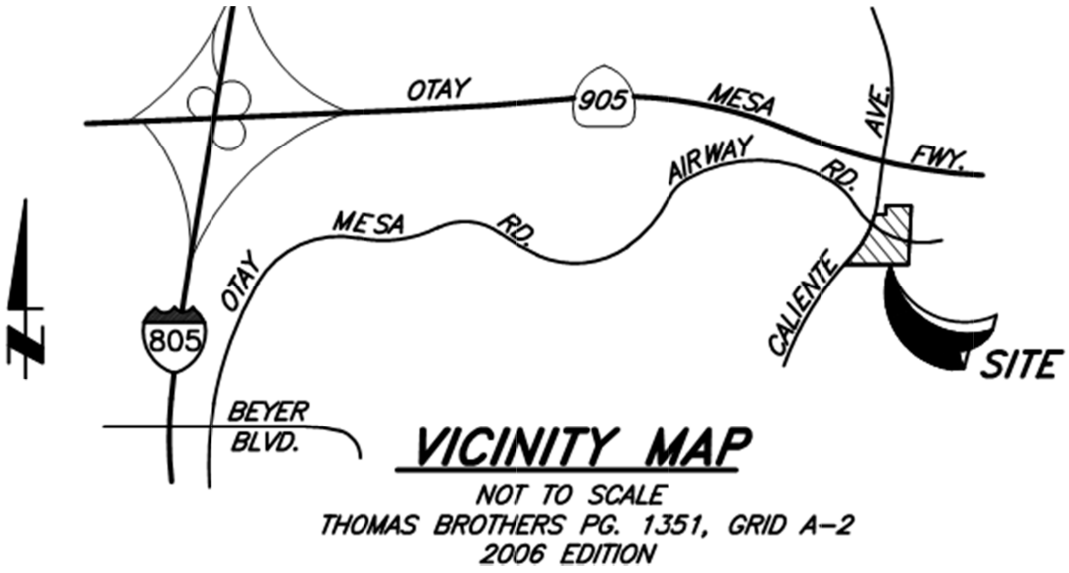
PROJECT VICINITY MAP

Project Name: Southview East
Permit Application Number: 371807



VICINITY MAP
NOT TO SCALE
THOMAS BROTHERS PG. 1351, GRID A–2
2006 EDITION

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Project Name: Southview East

THE CITY OF SAN DIEGO	City of San Diego **Development Services** 1222 First Ave., MD-302 San Diego, CA 92101 (619) 446-5000	**Storm Water Requirements Applicability Checklist**	FORM **DS-560** February 2016

Project Address:	Project Number *(for the City Use Only)*:
Southview East - Airway Road	Project # 371807

SECTION 1. Construction Storm Water BMP Requirements:

All construction sites are required to implement construction BMPs in accordance with the performance standards in the Storm Water Standards Manual. Some sites are additionally required to obtain coverage under the State Construction General Permit (CGP)[1], which is administrated by the State Water Resources Control Board.

For all projects complete PART A: If project is required to submit a SWPPP or WPCP, continue to PART B.

PART A: 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, also known as the State Construction General Permit (CGP)? (Typically projects with land disturbance greater than or equal to 1 acre.)

   ◉ Yes; SWPPP required, skip questions 2-4 ○ No; next question

2. Does the project propose construction or demolition activity, including but not limited to, clearing, grading, grubbing, excavation, or any other activity that results in ground disturbance and contact with storm water runoff?

   ○ Yes; WPCP required, skip questions 3-4 ◉ No; next question

3. Does the project propose routine maintenance to maintain original line and grade, hydraulic capacity, or original purpose of the facility? (projects such as pipeline/utility replacement)

   ○ Yes; WPCP required, skip questions 4 ◉ No; next question

4. Does the project only include the following Permit types listed below?
   - Electrical Permit, Fire Alarm Permit, Fire Sprinkler Permit, Plumbing Permit, Sign Permit, Mechanical Permit, Spa Permit.
   - Individual Right of Way Permits that exclusively include one of the following activities and associated curb/ sidewalk repair: water services, sewer lateral, storm drain lateral, or dry utility service.
   - Right of Way Permits with a project footprint less than 150 linear feet that exclusively include only ONE of the following activities: curb ramp, sidewalk and driveway apron replacement, curb and gutter replacement, and retaining wall encroachments.

   ☐ Yes; no document required

Check one of the boxes to the right, and continue to PART B:

■ If you checked "Yes" for question 1,
a SWPPP is REQUIRED. Continue to PART B

☐ If you checked "No" for question 1, and checked "Yes" for question 2 or 3,
a WPCP is REQUIRED. If the project processes less than 5,000 square feet of ground disturbance AND has less than a 5-foot elevation change over the entire project area, a Minor WPCP may be required instead. **Continue to PART B.**

☐ If you checked "No" for all question 1-3, and checked "Yes" for question 4
PART B **does not apply and no document is required. Continue to Section 2.**

More information on the City's construction BMP requirements as well as CGP requirements can be found at:
www.sandiego.gov/stormwater/regulations/swguide/constructing.shtml

PART B: Determine Construction Site Priority.

This prioritization must be completed within this form, noted on the plans, and included in the SWPPP or WPCP. The city reserves the right to adjust the priority of projects both before and after construction. Construction projects are assigned an inspection frequency based on if the project has a "high threat to water quality." The City has aligned the local definition of "high threat to water quality" to the risk. Determination approach of the Stat e Construction General Permit (CGP). The CGP determines risk level based on project specific sediment risk and receiving water risk. Additional inspection is required for projects within the Areas of Special Biological Significance (ASBS) watershed. **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.

Complete PART B and continued to Section 2

1. ☐ **ASBS**
   a. Projects located in the ASBS watershed. A map of the ASBS watershed can he found here *<placeholder for ASBS map link>*

2. ■ **High Priority**
   a. Projects 1 acre or more determined to be Risk Level 2 or Risk Level 3 per the Construction General Permit and not located in the ASBS watershed.
   b. Projects 1 acre or more determined to be LUP Type 2 or LUP Type 3 per the Construction General Permit and not located in the ASBS watershed.

3. ☐ **Medium Priority**
   a. Projects 1 acre or more but not subject to an ASBS or high priority designation.
   b. Projects determined to be Risk Level 1 or LUP Type 1 per the Construction General Permit and not located in the ASBS watershed.

4. ☐ **Low Priority**
   a. Projects not subject to ASBS, high or medium priority designation.

SECTION 2. Permanent Storm Water BMP Requirements.

Additional information for determining the requirements is found in the Storm Water Standards Manual.

PART C: Determine if Not Subject to Permanent Storm Water Requirements.

Projects that are considered maintenance, or otherwise not categorized as "new development projects" or "redevelopment projects" according to the Storm Water Standards Manual are not subject to Permanent Storm Water BMPs.

If "yes" is checked for any number in Part C, proceed to Part F and check "Not Subject to Permanent Storm Water BMP Requirements".

If "no" is checked for all of the numbers in Part C continue to Part D.

1.	Does the project only include interior remodels and/or is the project entirely within an existing enclosed structure and does not have the potential to contact storm water?	☐ Yes ☒ No
2.	Does the project only include the construction of overhead or underground utilities without creating new impervious surfaces?	☐ Yes ☒ No
3.	Does the project fall under routine maintenance? Examples include, but are not limited to: roof or exterior structure surface replacement, resurfacing or reconfiguring surface parking lots or existing roadways without expanding the impervious footprint, and routine replacement of damaged pavement (grinding, overlay, and pothole repair).	☐ Yes ☒ No

Project Name: Southview East

PART D: PDP Exempt Requirements.

PDP Exempt projects are required to implement site design and source control BMPs.

If "yes" was checked for any questions in Part D, continue to Part F and check the box labeled "PDP Exempt."
If "no" was checked for all questions in Part D, continue to Part E.

1. Does the project ONLY include new or retrofit sidewalks, bicycle lanes, or trails that:

   • Are designed and constructed to direct storm water runoff to adjacent vegetated areas, or other non-erodible permeable areas? Or;
   • Are designed and constructed to be hydraulically disconnected from paved streets and roads? Or;
   • Are designed and constructed with permeable pavements or surfaces in accordance with the Green Streets guidance in the City's Storm Water Standards manual?

   ☐ Yes; PDP exempt requirements apply ☉ No; next question

2. Does the project ONLY include retrofitting or redeveloping existing paved alleys, streets or roads designed and constructed in accordance with the Green Streets guidance in the City's Storm Water Standards Manual?

   ☐ Yes; PDP exempt requirements apply ☉ No; PDP not exempt. PDP requirements apply.

PART E: Determine if Project is a Priority Development Project (PDP). Projects that match one of the definitions below are subject to additional requirements including preparation of a Storm Water Quality Management Plan (SWQMP).

If "yes" is checked for any number in PART E, continue to PART F and check the box labeled "Priority Development Project".
If "no" is checked for every number in PART E, continue to PART F and check the box labeled "Standard Project".

1.	**New Development that creates 10,000 square feet or more of impervious surfaces collectively over the project site.** This includes commercial, industrial, residential, mixed-use, and public development projects on public or private land.	☉ Yes ☐ No
2.	**Redevelopment project that creates and/or replaces 5,000 square feet or more of impervious surfaces on an existing site of 10,000 square feet or more of impervious surfaces.** This includes commercial, industrial, residential, mixed-use, and public development projects on public or private land.	☐ Yes ☉ No
3.	**New development or redevelopment of a restaurant.** Facilities that sell prepared foods and drinks for consumption, including stationary lunch counters and refreshment stands selling prepared foods and drinks for immediate consumption (SIC 5812), and where the land development creates and/or replace 5,000 square feet or more of impervious surface.	☐ Yes ☉ No
4.	**New development or redevelopment on a hillside.** The project creates and/or replaces 5,000 square feet or more of impervious surface (collectively over the project site) and where the development will grade on any natural slope that is twenty-five percent or greater.	☐ Yes ☉ No

Project Name: Southview East

5.	**New development or redevelopment of a parking lot that creates and/or replaces 5,000 square feet or more of impervious surface (collectively over the project site).**	☒ Yes ☒ No
6.	**New development or redevelopment of streets, roads, highways, freeways, and driveways.** The project creates and/or replaces 5,000 square feet or more of impervious surface (collectively over the project site).	☒ Yes ☒ No
7.	**New development or redevelopment discharging directly to an Environmentally Sensitive Area.** The project creates and/or replaces 2,500 square feet of impervious surface (collectively over project site), and discharges directly to an Environmentally Sensitive Area (ESA). "Discharging- directly to" includes flow that is conveyed overland a distance of 200 feet or less from the project to the ESA, or conveyed in a pipe or open channel any distance as an isolated flow from the project to the ESA (i.e. not commingled with flows from adjacent lands).	☒ Yes ☒ No
8.	**New development or redevelopment projects of a retail gasoline outlet that creates and/or replaces 5,000 square feet of impervious surface.** The development project meets the following criteria: (a) 5,000 square feet or more or (b) has a projected Average Daily Traffic of 100 or more vehicles per day.	☒ Yes ☒ No
9.	**New development or redevelopment projects of an automotive repair shops that creates and/or replaces 5,000 square feet or more of impervious surfaces.** Development projects categorized in any one of Standard Industrial Classification (SIC) codes 5013, 5014, 5541, 7532-7534, or 7536-7539.	☒ Yes ☒ No
10.	**Other Pollutant Generating Project.** The project is not covered in the categories above, results in the disturbance of one or more acres of land and is expected to generate pollutants post construction, such as fertilizers and pesticides. This does not include 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 of if they sheet flow to surrounding pervious surfaces.	☒ Yes ☒ No

PART F: Select the appropriate category based on the outcomes of PART C through PART E.

1.	The project is **NOT SUBJECT TO STORM WATER REQUIREMENTS.**	☐
2.	The project is a **STANDARD PROJECT**. Site design and source control BMP requirements apply. See the Storm Water Standards Manual for guidance.	☐
3.	The project is **PDP EXEMPT**. Site design and source control BMP requirements apply. See the Storm Water Standards Manual for guidance.	☐
4.	The project is a **PRIORITY DEVELOPMENT PROJECT**. Site design, source control, and structural pollutant control BMP requirements apply. See the Storm Water Standards Manual for guidance on determining if project requires hydromodification management.	☐

Name of Owner or Agent *(Please Print)*: Allen L. Butcher, PE	Title: Engineer Of Record
Signature:	Date: May 6, 2016

Project Name: Southview East

Applicability of Permanent, Post-Construction Storm Water BMP Requirements (Storm Water Intake Form for all Development Permit Applications)	**Form I-1**

Project Identification

Project Name: Southview East	
Permit Application Number: 371807	Date: 5/6/16

Determination of Requirements

The purpose of this form is to identify permanent, post-construction requirements that apply to the project. This form serves as a short summary of applicable requirements, in some cases referencing separate forms that will serve as the backup for the determination of requirements.

Answer each step below, starting with Step 1 and progressing through each step until reaching "Stop".
Refer to Part 1 of Storm Water Standards sections and/or separate forms referenced in each step below.

Step	Answer	Progression
Step 1: Is the project a "development project"? See Section 1.3 of the BMP Design Manual (Part 1 of Storm Water Standards) for guidance.	☒ Yes	Go to Step 2.
	☐ No	Stop. Permanent BMP requirements do not apply. No SWQMP will be required. Provide discussion below.
Discussion / justification if the project is not a "development project" (e.g., the project includes only interior remodels within an existing building): Click or tap here to enter text.		
Step 2: Is the project a Standard Project, Priority Development Project (PDP), or exception to PDP definitions? To answer this item, see Section 1.4 of the BMP Design Manual (Part 1 of Storm Water Standards) in its entirety for guidance, AND complete Storm Water Requirements Applicability Checklist.	☐ Standard Project	Stop. Standard Project requirements apply.
	☒ PDP	PDP requirements apply, including PDP SWQMP. Go to Step 3.
	☐ PDP Exempt	Stop. Standard Project requirements apply. Provide discussion and list any additional requirements below.

Discussion / justification, and additional requirements for exceptions to PDP definitions, if applicable: Click or tap here to enter text.

Form I-1 Page 2		
Step	Answer	Progression
Step 3. Is the project subject to earlier PDP requirements due to a prior lawful approval? See Section 1.10 of the BMP Design Manual (Part 1 of Storm Water Standards) for guidance.	☐ Yes	Consult the City Engineer to determine requirements. Provide discussion and identify requirements below. Go to Step 4.
	☐ No	BMP Design Manual PDP requirements apply. Go to Step 4.
Discussion / justification of prior lawful approval, and identify requirements (not required if prior lawful approval does not apply): Click or tap here to enter text.		
Step 4. Do hydromodification control requirements apply? See Section 1.6 of the BMP Design Manual (Part 1 of Storm Water Standards) for guidance.	☐ Yes	PDP structural BMPs required for pollutant control (Chapter 5) and hydromodification control (Chapter 6). Go to Step 5.
	☐ No	Stop. PDP structural BMPs required for pollutant control (Chapter 5) only. Provide brief discussion of exemption to hydromodification control below.
Discussion / justification if hydromodification control requirements do not apply: Click or tap here to enter text.		
Step 5. Does protection of critical coarse sediment yield areas apply? See Section 6.2 of the BMP Design Manual (Part 1 of Storm Water Standards) for guidance.	☐ Yes	Management measures required for protection of critical coarse sediment yield areas (Chapter 6.2). Stop.
	☐ No	Management measures not required for protection of critical coarse sediment yield areas. Provide brief discussion below. Stop.

Discussion / justification if protection of critical coarse sediment yield areas does <u>not</u> apply: Project is not located within the limits of Critical Coarse Sediment Yield zones

Project Name: Southview East

Site Information Checklist For PDPs	Form I-3B
Project Summary Information	
Project Name	Southview East
Project Address	Airway Road (East of Caliente)
Assessor's Parcel Number(s) (APN(s))	645-081-03
Permit Application Number	Project # 371807
Project Watershed	Select One: ○ San Dieguito River ○ Penasquitos ○ Mission Bay ○ San Diego River ○ San Diego Bay ◉ Tijuana River
Hydrologic subarea name with Numeric Identifier up to two decimal paces (9XX.XX)	Water Tanks 911.12
Project Area (total area of Assessor's Parcel(s) associated with the project or total area of the right-of-	21.17 Acres ([SQFT] Square Feet)
Area to be disturbed by the project (Project Footprint)	17.75 Acres ([SQFT] Square Feet)
Project Proposed Impervious Area (subset of Project Footprint)	10.37 Acres ([SQFT] Square Feet)
Project Proposed Pervious Area (subset of Project Footprint)	7.38 Acres ([SQFT] Square Feet)
Note: Proposed Impervious Area + Proposed Pervious Area = Area to be Disturbed by the Project. This may be less than the Project Area.	
The proposed increase or decrease in impervious area in the proposed condition as compared to the pre-project condition.	+1,000 %

Form I-3B Page 2 of 11
Description of Existing Site Condition and Drainage Patterns
Current Status of the Site (select all that apply): ☐ Existing development ☐ Previously graded but not built out ☐ Agricultural or other non-impervious use ■ Vacant, undeveloped/natural Description / Additional Information: Site has prior disturbance. Portions of the site were previously graded as part of the adjacent Southview Development.
Existing Land Cover Includes (select all that apply): ■ Vegetative Cover ☐ Non-Vegetated Pervious Areas ■ Impervious Areas Description / Additional Information: Impervious area limited to adjacent Southiew development tributary areas and portion of Airway Road and Caliente.. mpervious Area includes paving alogn Smythe Avenue and drainage ditches.
Underlying Soil belongs to Hydrologic Soil Group (select all that apply): ☐ NRCS Type A ☐ NRCS Type B ☐ NRCS Type C ■ NRCS Type D
Approximate Depth to Groundwater (GW): ◘ GW Depth < 5 feet ◘ 5 feet < GW Depth < 10 feet ◘ 10 feet < GW Depth < 20 feet ◙ GW Depth > 20 feet
Existing Natural Hydrologic Features (select all that apply): ■ Watercourses ☐ Seeps ☐ Springs ☐ Wetlands ☐ None Description / Additional Information: Finger canyons loated northeast of development envelope

Form I-3B Page 3 of 11
Description of Existing Site Topography and Drainage:
How is storm water runoff conveyed from the site? At a minimum, this description should answer: 1. Whether existing drainage conveyance is natural or urban; 2. If runoff from offsite is conveyed through the site? If yes, quantification of all offsite drainage areas, design flows, and locations where offsite flows enter the project site and summarize how such flows are conveyed through the site; 3. Provide details regarding existing project site drainage conveyance network, including storm drains, concrete channels, swales, detention facilities, storm water treatment facilities, and natural and constructed channels; 4. Identify all discharge locations from the existing project along with a summary of the conveyance system size and capacity for each of the discharge locations. Provide summary of the pre-project drainage areas and design flows to each of the existing runoff discharge locations.
Description / Additional Information:

The existing site is situated in the eastern portion the Otay Mesa Community Plan of the City of San Diego, located approximately 1.5 miles east of the Interstate 805 Freeway, 1 mile west of Brown Field Airport, and 1 mile north of the Mexico International Border. The site is located at the eastern end of Airway Road, east of the intersection of Caliente Avenue, souht of State Route 905.

Runoff from the north eastern portion generally drains south east into a canyon. The south eastern portion of the project drains generally easterly to a minor canyon located off-site.

Topography is mild with slopes ranging from 1%-5%. Although the site is undeveloped, past disturbances including dirt trails and earth berms are apparent. Vegetation is primarily long grasses in poor condition. Surficial soils are finely grained and include some clay. Infiltration rates are expected to be poor, consistent with Type D soils. A runoff coefficient of 0.40 (undeveloped / open space) was selected for the pre-development condition using the City of San Diego Drainage Manual.

The project will be developed in conjunction with the adjacent Southview development, which is also split north and south of Airway Road. The Southview East development will include the replacement of the two (2) of the existing combination (water quality treatment, HMP controls and detention) basins. The Southview East project will provide expanded treatment, HMP and Detention basins to include these offsite areas.

The northern portion of this project will accept runoff from portions of Caliente Ave and Airway Rd. (public streets) and from the Southview Lot 1 /"Tesoro" project.

The southern portion of this project accepts runoff from the adjacent Southview Lot 2 /"Vista Del Sur" project.

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Description of Proposed Site Development and Drainage Patterns

Project Description / Proposed Land Use and/or Activities:
"Southview East" will be a multi-family residential project, split north and south of the extension of Airway Road. Several attached product types (4-plex and 5-plex buildings) will be constructed, corresponding to a High Density Residential (HDR per Table 3-1 "Runoff Coefficients for Urban Areas"). The impervious portion of the site is estimated at 66%.

The project proposes biofiltration basins with either an adajcent basin (north side of airway) or an underground storage facility (south of Airway) to provide hydromodifcation and detention..

The north basin shall mitigate flows from the proposed development (north of Airway) as well as offsite runoff from the west "Tesoro" project. The southerly basin will also be sized to accommodate flows from a small portion of the Southview Lot 2 / Vista Del Sur development area.

List/describe proposed impervious features of the project (e.g., buildings, roadways, parking lots, courtyards, athletic courts, other impervious features):
Impervious surfaces including public and private street paving, sidewalk, walks, driveways, parking spaces, builidng roofs, patio/porch

List/describe proposed pervious features of the project (e.g., landscape areas):
Landscaped cut and fill slopes, yard areas, and areas adjacent to walkways/sidewalks. The eastern portion of the site will ungraded.

Does the project include grading and changes to site topography?

- [x] Yes
- [ ] No

Description / Additional Information:
Significant grading will be required.

Form I-3B Page 5 of 11

Does the project include changes to site drainage (e.g., installation of new storm water conveyance systems)?

- [x] Yes
- [ ] No

If yes, provide details regarding the proposed project site drainage conveyance network, including storm drains, concrete channels, swales, detention facilities, storm water treatment facilities, natural and constructed channels, and the method for conveying offsite flows through or around the proposed project site. Identify all discharge locations from the proposed project site along with a summary of the conveyance system size and capacity for each of the discharge locations. Provide a summary of pre and post-project drainage areas and design flows to each of the runoff discharge locations. Reference the drainage study for detailed calculations.

Description / Additional Information:
The project will continue the general west to east drainage trend. There are no storm drain systems downstream of the site for connection. Discharge points are located 1) northeast of the Airway Road terminus and 2) at the southeast corner of the development envelope. Private storm drain systems will convey project runoff, along with runoff from the Southview project to the 2 biofiltration basins, through the detention facilities and the storm drain outfalls.. Additional public storm drain inlets for Airway Road will also be routed to the basins.

See Project Drainage Study for detailed calculations

Form I-3B Page 6 of 11

Identify whether any of the following features, activities, and/or pollutant source areas will be present (select all that apply):

■ On-site storm drain inlets
☐ Interior floor drains and elevator shaft sump pumps
☐ Interior parking garages
☐ Need for future indoor & structural pest control
■ Landscape/Outdoor Pesticide Use
☐ Pools, spas, ponds, decorative fountains, and other water features
☐ Food service
■ Refuse areas
☐ Industrial processes
☐ Outdoor storage of equipment or materials
☐ Vehicle and Equipment Cleaning
☐ Vehicle/Equipment Repair and Maintenance
☐ Fuel Dispensing Areas
☐ Loading Docks
☐ Fire Sprinkler Test Water
☐ Miscellaneous Drain or Wash Water
■ Plazas, sidewalks, and parking lots
☐ Large Trash Generating Facilities
☐ Animal Facilities
☐ Plant Nurseries and Garden Centers
☐ Automotive-related Uses

Description / Additional Information:
Click or tap here to enter text.

Form I-3B Page 7 of 11
Identification and Narrative of Receiving Water
Narrative describing flow path from discharge location(s), through urban storm conveyance system, to receiving creeks, rivers, and lagoons and ultimate discharge location to Pacific Ocean (or bay, lagoon, lake or reservoir, as applicable) The discharge locations run overland to existing canyons, which trends easterly and then southerly . approximately 1.5 miles to the Mexico border, which then returns to the Unites States in the Tijuana River, to the Estuary and then the Pacific Ocean.
Provide a summary of all beneficial uses of receiving waters downstream of the project discharge locations. From the San Diego basin Plan, the existing beneficial uses are REC2, BIOL, WARM, WILD & RARE.
Identify all ASBS (areas of special biological significance) receiving waters downstream of the project discharge locations. None.
Provide distance from project outfall location to impaired or sensitive receiving waters. Project discharge is approximately 1.5 miles from the border, and approx. 2 miles to the Tijuana River.
Sumarize information regarding the proximity of the permanent, post-construction storm water BMPs to the City's Multi-Habitat Planning Area and environmentally sensitive lands Vernal pools are located northeast of the development envelope. See project environmental documents for further details..

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Identification of Receiving Water Pollutants of Concern

List any 303(d) impaired water bodies within the path of storm water from the project site to the Pacific Ocean (or bay, lagoon, lake or reservoir, as applicable), identify the pollutant(s)/stressor(s) causing impairment, and identify any TMDLs and/or Highest Priority Pollutants from the WQIP for the impaired water bodies:

303(d) Impaired Water Body	Pollutant(s)/Stressor(s)	TMDLs/ WQIP Highest Priority Pollutant
Tijuana River	Ind Bacteria, Eutrophic, Low	
	Dissolved Oxygen Pesticides,	
	Phosphorous, Trace Elements	
	Trash, Toxicity, Total N,	
	Organics, Surfactants, Solids	
	Selenium, Sediment/Silt	Sedimentation, Siltation
Tijuana River Estuary	Eutrophic …Turbidity	Turbidity
Pacific Ocean	Bacteria, Enter., Coliforms	N/A

Identification of Project Site Pollutants*

*Identification of project site pollutants is only required if flow-thru treatment BMPs are implemented onsite in lieu of retention or biofiltration BMPs (note the project must also participate in an alternative compliance program unless prior lawful approval to meet earlier PDP requirements is demonstrated)

Identify pollutants anticipated from the project site based on all proposed use(s) of the site (see BMP Design Manual (Part 1 of Storm Water Standards) Appendix B.6):

Pollutant	Not Applicable to the Project Site	Anticipated from the Project Site	Also a Receiving Water Pollutant of Concern
Sediment	☐	☐	☉
Nutrients	☐	☐	☉
Heavy Metals	☐	☐	☉
Organic Compounds	☐	☐	☉
Trash & Debris	☐	☐	☉
Oxygen Demanding Substances	☐	☐	☉
Oil & Grease	☐	☐	☉

Bacteria & Viruses	◘	◘	◙
Pesticides	◘	◘	◙

Form I-3B Page 9 of 11

Hydromodification Management Requirements

Do hydromodification management requirements apply (see Section 1.6 of the BMP Design Manual)?

- ◉ Yes, hydromodification management flow control structural BMPs required.
- ○ No, the project will discharge runoff directly to existing underground storm drains discharging directly to water storage reservoirs, lakes, enclosed embayments, or the Pacific Ocean.
- ○ No, the project will discharge runoff directly to conveyance channels whose bed and bank are concrete-lined all the way from the point of discharge to water storage reservoirs, lakes, enclosed embayments, or the Pacific Ocean.
- ○ No, the project will discharge runoff directly to an area identified as appropriate for an exemption by the WMAA for the watershed in which the project resides.

Description / Additional Information (to be provided if a 'No' answer has been selected above):
Click or tap here to enter text.

Critical Coarse Sediment Yield Areas*
*This Section only required if hydromodification management requirements apply

Based on Section 6.2 and Appendix H does CCSYA exist on the project footprint or in the upstream area draining through the project footprint?

- ◉ Yes
- ○ No, No critical coarse sediment yield areas to be protected based on WMAA maps

Discussion / Additional Information:
The nearest Potential CCSY Areas are approximately 100 feet northeast of the development limits, and adjacent to the southerly development limits (at the existing earth berm along the southerly boundary). The southerly PCCSYA limits appear to be in error based upon the location of the existing earth berm along the southerly boundary, and the earth channel located immediatley south of the berm. .

Form I-3B Page 10 of 11
Flow Control for Post-Project Runoff* *This Section only required if hydromodification management requirements apply
List and describe point(s) of compliance (POCs) for flow control for hydromodification management (see Section 6.3.1). For each POC, provide a POC identification name or number correlating to the project's HMP Exhibit and a receiving channel identification name or number correlating to the project's HMP Exhibit. POC 1 (North) discharges to the surface of the mesa, above the the existing canyon located east of development. There are no defined drainage courses upstream of the canyon. POC 2 (South) discharges at the toe of the manufatcured slope. Discharge will confluence with bypass runoff from the Southview devleopment, located east of the Southview East site. Site runoff discharges through the existing low point in the earth berm along the southerly boundary.
Has a geomorphic assessment been performed for the receiving channel(s)? ◉ No, the low flow threshold is 0.1Q2 (default low flow threshold) ○ Yes, the result is the low flow threshold is 0.1Q2 ○ Yes, the result is the low flow threshold is 0.3Q2 ○ Yes, the result is the low flow threshold is 0.5Q2 If a geomorphic assessment has been performed, provide title, date, and preparer: Click or tap here to enter text.
Discussion / Additional Information: (optional) Click or tap here to enter text.

Form I-3B Page 11 of 11
Other Site Requirements and Constraints
When applicable, list other site requirements or constraints that will influence storm water management design, such as zoning requirements including setbacks and open space, or local codes governing minimum street width, sidewalk construction, allowable pavement types, and drainage requirements. Primary constraints include Type "D" soils, runoff from the adjacent Southview development, lack of downstream storm drain systems, and the Vernal pools located at the eastern edge of the development.
Optional Additional Information or Continuation of Previous Sections As Needed
This space provided for additional information or continuation of information from previous sections as needed. Click or tap here to enter text.

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Project Name: Southview East

Source Control BMP Checklist for All Development Projects	Form I-4

Source Control BMPs

All development projects must implement source control BMPs SC-1 through SC-6 where applicable and feasible. See Chapter 4 and Appendix E of the BMP Design Manual (Part 1 of the Storm Water Standards) for information to implement source control BMPs shown in this checklist.

Answer each category below pursuant to the following.

- "Yes" means the project will implement the source control BMP as described in Chapter 4 and/or Appendix E of the BMP Design Manual. Discussion / justification is not required.
- "No" means the BMP is applicable to the project but it is not feasible to implement. Discussion / justification must be provided.
- "N/A" means the BMP is not applicable at the project site because the project does not include the feature that is addressed by the BMP (e.g., the project has no outdoor materials storage areas). Discussion / justification may be provided.

Source Control Requirement	Applied?		
SC-1 Prevention of Illicit Discharges into the MS4	☒ Yes	☐ No	☐ N/A
Discussion / justification if SC-1 not implemented: Click or tap here to enter text.			
SC-2 Storm Drain Stenciling or Signage	☒ Yes	☐ No	☐ N/A
Discussion / justification if SC-2 not implemented: Click or tap here to enter text.			
SC-3 Protect Outdoor Materials Storage Areas from Rainfall, Run-On, Runoff, and Wind Dispersal	☐ Yes	☐ No	☒ N/A
Discussion / justification if SC-3 not implemented: Click or tap here to enter text.			
SC-4 Protect Materials Stored in Outdoor Work Areas from Rainfall, Run-On, Runoff, and Wind Dispersal	☐ Yes	☐ No	☒ N/A
Discussion / justification if SC-4 not implemented: Click or tap here to enter text.			
SC-5 Protect Trash Storage Areas from Rainfall, Run-On, Runoff, and Wind Dispersal	☒ Yes	☐ No	☐ N/A

Project Name: Southview East

Form I-4 Page 2 of 2			
Source Control Requirement	Applied?		
SC-6 Additional BMPs Based on Potential Sources of Runoff Pollutants (must answer for each source listed below)			
On-site storm drain inlets	☒ Yes	☐ No	☐ N/A
Interior floor drains and elevator shaft sump pumps	☐ Yes	☐ No	☒ N/A
Interior parking garages	☐ Yes	☐ No	☒ N/A
Need for future indoor & structural pest control	☐ Yes	☐ No	☒ N/A
Landscape/Outdoor Pesticide Use	☒ Yes	☐ No	☐ N/A
Pools, spas, ponds, decorative fountains, and other water features	☐ Yes	☐ No	☒ N/A
Food service	☐ Yes	☐ No	☒ N/A
Refuse areas	☐ Yes	☐ No	☒ N/A
Industrial processes	☐ Yes	☐ No	☒ N/A
Outdoor storage of equipment or materials	☐ Yes	☐ No	☒ N/A
Vehicle/Equipment Repair and Maintenance	☐ Yes	☐ No	☒ N/A
Fuel Dispensing Areas	☐ Yes	☐ No	☒ N/A
Loading Docks	☐ Yes	☐ No	☒ N/A
Fire Sprinkler Test Water	☒ Yes	☐ No	☐ N/A
Miscellaneous Drain or Wash Water	☐ Yes	☐ No	☒ N/A
Plazas, sidewalks, and parking lots	☐ Yes	☐ No	☒ N/A
SC-6A: Large Trash Generating Facilities	☐ Yes	☐ No	☒ N/A
SC-6B: Animal Facilities	☐ Yes	☐ No	☒ N/A
SC-6C: Plant Nurseries and Garden Centers	☐ Yes	☐ No	☒ N/A
SC-6D: Automotive-related Uses	☐ Yes	☐ No	☒ N/A
Discussion / justification if SC-6 not implemented. Clearly identify which sources of runoff pollutants are discussed. Justification must be provided for <u>all</u> "No" answers shown above. Click or tap here to enter text.			

Project Name: Southview East

Site Design BMP Checklist for All Development Projects	Form I-5

Site Design BMPs

All development projects must implement site design BMPs SD-1 through SD-8 where applicable and feasible. See Chapter 4 and Appendix E of the BMP Design Manual (Part 1 of Storm Water Standards) for information to implement site design BMPs shown in this checklist.

Answer each category below pursuant to the following.

- "Yes" means the project will implement the site design BMP as described in Chapter 4 and/or Appendix E of the BMP Design Manual. Discussion / justification is not required.
- "No" means the BMP is applicable to the project but it is not feasible to implement. Discussion / justification must be provided.
- "N/A" means the BMP is not applicable at the project site because the project does not include the feature that is addressed by the BMP (e.g., the project site has no existing natural areas to conserve). Discussion / justification may be provided.

A site map with implemented site design BMPs must be included at the end of this checklist.

Site Design Requirement		Applied?		
SD-1 Maintain Natural Draiange Pathways and Hydrologic Features		☒ Yes	☐ No	☐ N/A
Discussion / justification if SD-1 not implemented:				
1-1	Are existing natural drainage pathways and hydrologic features mapped on the site map?	☒ Yes	☐ No	☐ N/A
1-2	Are street trees implemented? If yes, are they shown on the site map?	☐ Yes	☐ No	☒ N/A
1-3	Implemented street trees meet the design criteria in SD-1 Fact Sheet (e.g. soil volume, maximum credit, etc.)?	☐ Yes	☐ No	☒ N/A
1-4	Is street tree credit volume calculated using Appendix B.2.2.1 and SD-1 Fact Sheet in Appendix E?	☐ Yes	☐ No	☒ N/A
SD-2 Have natural areas, soils and vegetation been conserved?		☒ Yes	☐ No	☐ N/A

Discussion / justification if SD-2 not implemented:
Natural canyons and vernal pool areas are conserved and/or mitigated.

Project Name: Southview East

Form I-5 Page 2 of 4			
Site Design Requirement	Applied?		
SD-3 Minimize Impervious Area	☉ Yes	○ No	○ N/A
Discussion / justification if SD-3 not implemented: The use of private streets, attached residential buildings and 2-story construction, one sided private street sidewalk reduces the amount of impervious area.			
SD-4 Minimize Soil Compaction	○ Yes	☉ No	○ N/A
Discussion / justification if SD-4 not implemented: The existing topography and development of the site results in significant manufactured slopes, which require soil maximum compaction. The density of the development, and the extent of the retaining walls, private streets, driveways, guest parking spaces, sidewalks and utilities do not allow for areas of minimal soil compaction. The Type "D" hydrologic soils do not provide the opportunity for infiltration. The proposed biofiltration basins will include imported soil media will limited compaction.			
SD-5 Impervious Area Dispersion	○ Yes	☉ No	○ N/A
Discussion / justification if SD-5 not implemented: The proposed landscaped yard areas are not large enough to provide dispersion of roof runoff.			
5-1 Is the pervious area receiving runon from impervious area identified on the site map?	○ Yes	☉ No	
5-2 Does the pervious area satisfy the design criteria in SD-5 Fact Sheet in Appendix E (e.g. maximum slope, minimum length, etc.)	○ Yes	☉ No	

5-3	Is impervious area dispersion credit volume calculated using Appendix B.2.1.1 and SD-5 Fact Sheet in Appendix E?	☐ Yes	☒ No	

Project Name: Southview East

Form I-5 Page 3 of 4			
Site Design Requirement	Applied?		
SD-6 Runoff Collection	☐ Yes	☐ No	☒ N/A
Discussion / justification if SD-6 not implemented: Click or tap here to enter text.			
6a-1 Are green roofs implemented in accordance with design criteria in SD-6A Fact Sheet? If yes, are they shown on the site map?	☐ Yes	☐ No	☒ N/A
6a-2 Is green roof credit volume calculated using Appendix B.2.1.2 and SD-6A Fact Sheet in Appendix E?	☐ Yes	☐ No	☒ N/A
6b-1 Are permeable pavements implemented in accordance with design criteria in SD-6B Fact Sheet? If yes, are they shown on the site map?	☐ Yes	☐ No	☒ N/A
6b-2 Is permeable pavement credit volume calculated using Appendix B.2.1.3 and SD-6B Fact Sheet in Appendix E?	☐ Yes	☐ No	☒ N/A
SD-7 Landscaping with Native or Drought Tolerant Species	☐ Yes	☐ No	☒ N/A
Discussion / justification if SD-7 not implemented: Landscape selection includes native and/or drought tolerant species.			
SD-8 Harvesting and Using Precipitation	☐ Yes	☐ No	☒ N/A
Discussion / justification if SD-8 not implemented: Rain barrels not implemented.			
8-1 Are rain barrels implemented in accordance with design criteria in SD-8 Fact Sheet? If yes, are they shown on the site	☐ Yes	☐ No	☒ N/A

	map?			
8-2	Is rain barrel credit volume calculated using Appendix B.2.2.2 and SD-8 Fact Sheet in Appendix E?	☐ Yes	☐ No	◉ N/A

Form I-5 Page 4 of 4
Insert Site Map with all site design BMPs identified:
Insert Site Map Here.

Project Name: Southview East

Summary of PDP Structural BMPs	Form I-6
PDP Structural BMPs	
All PDPs must implement structural BMPs for storm water pollutant control (see Chapter 5 of the BMP Design Manual, Part 1 of Storm Water Standards). Selection of PDP structural BMPs for storm water pollutant control must be based on the selection process described in Chapter 5. PDPs subject to hydromodification management requirements must also implement structural BMPs for flow control for hydromodification management (see Chapter 6 of the BMP Design Manual). Both storm water pollutant control and flow control for hydromodification management can be achieved within the same structural BMP(s). PDP structural BMPs must be verified by the City at the completion of construction. This includes requiring the project owner or project owner's representative to certify construction of the structural BMPs (complete Form DS-563). PDP structural BMPs must be maintained into perpetuity (see Chapter 7 of the BMP Design Manual). Use this form to provide narrative description of the general strategy for structural BMP implementation at the project site in the box below. Then complete the PDP structural BMP summary information sheet (page 3 of this form) for each structural BMP within the project (copy the BMP summary information page as many times as needed to provide summary information for each individual structural BMP).	

Describe the general strategy for structural BMP implementation at the site. This information must describe how the steps for selecting and designing storm water pollutant control BMPs presented in Section 5.1 of the BMP Design Manual were followed, and the results (type of BMPs selected). For projects requiring hydromodification flow control BMPs, indicate whether pollutant control and flow control BMPs are integrated or separate.

The site topography, the location of the public street improvements, and connection with the existing Southview development results in the need to provide two structural BMP systems located North and South of Airway Road.

Due to the need to provide attenuation of larger storm events (detention), the HMP mitigation and detention will be provided in the same facility, to be located downstream of the treatment BMP.

The Type "D" soils indicate that full infiltration BMPs are not feasible. Infiltration testing at the proposed basin locations confirms that infiltration rates are less than 0.5"/hr. Exterior slopes along the eastern limits of development will be self-treating/self-mitigating.

(Continue on page 2 as necessary.)

Form I-6 Page 2 of X
(Page reserved for continuation of description of general strategy for structural BMP implementation at the site)
(Continued from page 1) Click or tap here to enter text.

Form I-6 Page 3 of X (Copy as many as needed)	
Structural BMP Summary Information	
Structural BMP ID No. Biofiltration 1 (North) and 2 (South)	
Construction Plan Sheet No. N/A	
Type of structural BMP: ☐ Retention by harvest and use (HU-1) ☐ Retention by infiltration basin (INF-1) ☐ Retention by bioretention (INF-2) ☐ Retention by permeable pavement (INF-3) ☉ Partial retention by biofiltration with partial retention (PR-1) ☐ Biofiltration (BF-1) ☐ Flow-thru treatment control with prior lawful approval to meet earlier PDP requirements (provide (BMP type/description in discussion section below) ☐ Flow-thru treatment control included as pre-treatment/forebay for an onsite retention or biofiltration BMP (provide BMP type/description and indicate which onsite retention or biofiltration BMP it serves in discussion section below) ☐ Flow-thru treatment control with alternative compliance (provide BMP type/description in discussion ☐ Detention pond or vault for hydromodification management ☐ Other (describe in discussion section below)	
Purpose: ☉ Pollutant control only ☐ Hydromodification control only ☐ Combined pollutant control and hydromodification control ☐ Pre-treatment/forebay for another structural BMP ☐ Other (describe in discussion section below)	
Who will certify construction of this BMP? Provide name and contact information for the party responsible to sign BMP verification form DS-563	Engineer of Work
Who will be the final owner of this BMP?	Project HOA
Who will maintain this BMP into perpetuity?	Project HOA
What is the funding mechanism for maintenance?	HOA monthly association fees.

Form I-6 Page 4 of X (Copy as many as needed)
Structural BMP ID No. Biofiltration 1 (North) and 2 (South) -1 and HMP-1 and -2
Construction Plan Sheet No. N/A
Discussion (as needed): The systems include Biofiltration basins (PR-1) in series with a HMP/Detention basin (North) or HMP/Detention tank (South) to provide hydromodification management, and attenuation (detention) of larger storms.

THE CITY OF SAN DIEGO City of San Diego **Development Services** 1222 First Ave., MD-302 San Diego, CA 92101 (619) 446-5000	**Permenant BMP Construction** **Self Certification Form**	FORM DS-563 January 2016

Date Prepared: Click here to enter text.	Project No.: Click here to enter text.
Project Applicant: Click here to enter text.	Phone: Click here to enter text.
Project Address: Click here to enter text.	
Project Engineer: Click here to enter text.	Phone: Click here to enter text.

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 Storm Water Quality Management Plan (SWQMP) 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. R9-2013-0001 as amended by R9-2015-0001 and R9-2015-0100. 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 structural BMP's required per the approved SWQMP and Construction Permit No. Click here to enter text.; and that said BMP's have been constructed in compliance with the approved plans and all applicable specifications, permits, ordinances and Order No. R9-2013-0001 as amended by R9-2015-0001 and R9-2015-0100 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: _ Insert Date___

Printed Name: _Click here to enter text.__

Title: _Click here to enter text._

Phone No. _Click here to enter text.__

Engineer's Stamp

DS-563 (12-15)

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ATTACHMENT 1
BACKUP FOR PDP POLLUTANT CONTROL BMPS

This is the cover sheet for Attachment 1.

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Project Name: Southview East

Indicate which Items are Included:

Attachment Sequence	Contents	Checklist
Attachment 1a	DMA Exhibit (Required) See DMA Exhibit Checklist.	■ Included
Attachment 1b	Tabular Summary of DMAs Showing DMA ID matching DMA Exhibit, DMA Area, and DMA Type (Required)* *Provide table in this Attachment OR on DMA Exhibit in Attachment 1a	◘ Included on DMA Exhibit in Attachment 1a ◘ Included as Attachment 1b, separate from DMA Exhibit
Attachment 1c	Form I-7, Harvest and Use Feasibility Screening Checklist (Required unless the entire project will use infiltration BMPs) Refer to Appendix B.3-1 of the BMP Design Manual to complete Form I-7.	◘ Included ◘ Not included because the entire project will use infiltration BMPs
Attachment 1d	Form I-8, Categorization of Infiltration Feasibility Condition (Required unless the project will use harvest and use BMPs) Refer to Appendices C and D of the BMP Design Manual to complete Form I-8.	◘ Included ◘ Not included because the entire project will use harvest and use BMPs
Attachment 1e	Pollutant Control BMP Design Worksheets / Calculations (Required) Refer to Appendices B and E of the BMP Design Manual for structural pollutant control BMP design guidelines and site design credit calculations	■ Included

Project Name: Southview East

Use this checklist to ensure the required information has been included on the DMA Exhibit:

The DMA Exhibit must identify:

☐ Underlying hydrologic soil group
☐ Approximate depth to groundwater
☐ Existing natural hydrologic features (watercourses, seeps, springs, wetlands)
☐ Critical coarse sediment yield areas to be protected
☐ Existing topography and impervious areas
☐ Existing and proposed site drainage network and connections to drainage offsite
☐ Proposed grading
☐ Proposed impervious features
☐ Proposed design features and surface treatments used to minimize imperviousness
☐ Drainage management area (DMA) boundaries, DMA ID numbers, and DMA areas (square footage or acreage), and DMA type (i.e., drains to BMP, self-retaining, or self-mitigating)
☐ Potential pollutant source areas and corresponding required source controls (see Chapter 4, Appendix E.1, and Form I-3B)
☐ Structural BMPs (identify location, type of BMP, and size/detail)

DMA/HMP EXHIBIT FOR:
SOUTHVIEW EAST

CALTRANS

SR-905

EB ON-RAMP

PROJECT BOUNDARY (TYP.)

CALIENTE AVENUE
(PER CITY OF SAN DIEGO DWG. NO. 35813-D)

R/W

OFFSITE
0.34 AC

OFFSITE
(0.56 AC.)

OFFSITE
0.22 AC

"TESORO" PROJECT
(SOUTHVIEW LOT 1)

DMA 1N
430,546 S.F.

TEMPORARY WQ/DETENTION
BASIN TO BE REMOVED

PROJECT BOUNDARY (TYP.)

DMA S1N
15,604 S.F.
SELF RETAINING

"SOUTHVIEW EAST"
NORTH SIDE

DMA S2N
5,582 S.F.
SELF RETAINING

EXIST. CANYON

BIOFILTRATION #1
10,139 S.F.

BASIN AND SLOPES
1.20 AC.

A
9.88 AC.

DWY M

DWY N

DWY J

DWY O

DWY P

DWY K

NORTH WATER
QUALITY BASIN

POC 1

DMA N-BASINS
430,546 S.F.
NORTH DETENTION BASIN #1
AND HMP

AIRWAY
(PER CITY OF SAN DIEGO DWG. NO. 35813-D, P.T.S. NO. 214832)

STREET 0.35 AC.

ROAD

DMA ST1N
15,073 S.F.

BIOFILTRATION #2
IMP 2
5,138 S.F.
519.0 F.G.

DMA 2S
232,234 S.F.

"VISTA DEL SUR"
PROJECT BASIN "7"

"VISTA DEL SUR"
(NOT A PART)

"SOUTHVIEW"
LOT 2

DMA S2S
43,403 S.F.
SELF RETAINING

"SOUTHVIEW EAST"
SOUTH SIDE

SANTA ALICIA

B
5.33 AC.

DWY A

DWY B

DWY C

DWY D

DWY E

DETENTION & HMP TANK
21,505 CF

BY-PASS STORM DRAIN

POC 2

DISCHARGE LOCATION
SOUTHVIEW LOT 2 BY-PASS

SOUTHERLY SITE DISCHARGE LOCATION
(LOW POINT IN EXIST. EARTH BERM

EXIST. EARTH
BERM

EXIST. EARTH
SWALE

SAN ELIJO

SAN JACINTO

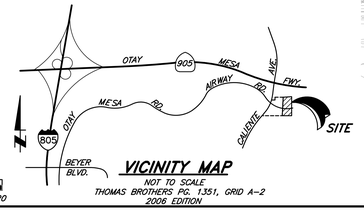
SAN JUAN

SAN ROBERTO

WHITE RD

SCALE 1" = 40'

GRAPHIC SCALE
40 0 40 80 120



VICINITY MAP
NOT TO SCALE
THOMAS BROTHERS PG. 1351, GRID A-2
2006 EDITION

LEGEND
BASIN LIMITS
DIRECTION OF FLOW
STORM DRAIN MANHOLE
BASIN NO. — A
AREA — 10.0 AC.

DMA/HMP EXHIBIT FOR:
SOUTHVIEW EAST

SHEET 1 OF 1 SHEETS

SB&O INC.
PLANNING ENGINEERING SURVEYING
3990 Ruffin Road, Suite 120
San Diego, Ca. 92123
858-560-1141
858-560-8157 Fax

70910.10

Harvest and Use Feasibility Checklist	Form I-7

1. Is there a demand for harvested water (check all that apply) at the project site that is reliably present during the wet season?

☐ Toilet and urinal flushing: **Residential @ 9.3 gallons per person**

☐ Landscape irrigation: **Plant Factor @ Upper Moderate= 0.7/Hydrazone Mod = 1,470 gals in 36 hrs**

☐ Other:_____ **Irrigation Demand = 2.7 x [(0.7 x 1,470)/0.9] x 0.015 =46.3 cf/36-hrs/acre**

Irrigation Demand per Modified ETWU Equation B.3-1 using General Landscape Type Hydazone Moderate from Table B.3.3 and Moderate Plant Water Use – Table B.3.2

2. If there is a demand; estimate the anticipated average wet season demand over a period of 36 hours. Guidance for planning level demand calculations for toilet/urinal flushing and landscape irrigation is provided in Section B.3.2.

Southview East + portion Southview = 189 DU x 3.5 people x 9.3 gals = 6,152 gals/day = 9,228 gals per 36 hrs
Toilet Flushing Demand: 256.3 cubic-feet / 36 hours
Total Pervious Area to Basins = 5.28 acre x 46.3 cubic-feet =
Landscape Irrigation: 244.5 cubic feet / 36 hours

3. Calculate the DCV using worksheet B-2.1.

DCV = 16,333 (cf) 25% = 4,038 cf

3a. Is the 36 hour demand greater than or equal to the DCV?	3b. Is the 36 hour demand greater than 0.25DCV but less than the full DCV?	3c. Is the 36 hour demand less than 0.25DCV?
Yes / **No** ⇨ ⇩	Yes / **No** ⇨ ⇩	**Yes** ⇩
Harvest and use appears to be feasible. Conduct more detailed evaluation and sizing calculations to confirm that DCV can be used at an adequate rate to meet drawdown criteria.	Harvest and use may be feasible. Conduct more detailed evaluation and sizing calculations to determine feasibility. Harvest and use may only be able to be used for a portion of the site, or (optionally) the storage may need to be upsized to meet long term capture targets while draining in longer than 36 hours.	**Harvest and use is considered to be infeasible.**

Is harvest and use feasible based on further evaluation?

Yes, refer to Appendix E to select and size harvest and use BMPs.

No, select alternate BMPs.

Categorization of Infiltration Feasibility Condition		Form I-8	
Part 1 - Full Infiltration Feasibility Screening Criteria **Would infiltration of the full design volume be feasible from a physical perspective without any undesirable consequences that cannot be reasonably mitigated?**			
Criteria	Screening Question	**Yes**	**No**
1	**Is the estimated reliable infiltration rate below proposed facility locations greater than 0.5 inches per hour?** The response to this Screening Question shall be based on a comprehensive evaluation of the factors presented in Appendix C.2 and Appendix D.		✓
Provide basis: See Geotechnical Addendum & Infiltration Test Results dated August 1, 2016 in Attachment 6. Summarize findings of studies; provide reference to studies, calculations, maps, data sources, etc. Provide narrative discussion of study/data source applicability.			
2	**Can infiltration greater than 0.5 inches per hour be allowed without increasing risk of geotechnical hazards (slope stability, groundwater mounding, utilities, or other factors) that cannot be mitigated to an acceptable level?** The response to this Screening Question shall be based on a comprehensive evaluation of the factors presented in Appendix C.2.		✓
Provide basis: See Geotechnical Addendum & Infiltration Test Results dated August 1, 2016 in Attachment 6. Summarize findings of studies; provide reference to studies, calculations, maps, data sources, etc. Provide narrative discussion of study/data source applicability.			

Form I-8 Page 2 of 4			
Criteria	Screening Question	**Yes**	**No**
3	**Can infiltration greater than 0.5 inches per hour be allowed without increasing risk of groundwater contamination (shallow water table, storm water pollutants or other factors) that cannot be mitigated to an acceptable level?** The response to this Screening Question shall be based on a comprehensive evaluation of the factors presented in Appendix C.3.	✓	
Provide basis: No evidence of contamination Summarize findings of studies; provide reference to studies, calculations, maps, data sources, etc. Provide narrative discussion of study/data source applicability.			
4	**Can infiltration greater than 0.5 inches per hour be allowed without causing potential water balance issues such as change of seasonality of ephemeral streams or increased discharge of contaminated groundwater to surface waters?** The response to this Screening Question shall be based on a comprehensive evaluation of the factors presented in Appendix C.3.	✓	
Provide basis: No evidence of downstream impacts to surface waters. Summarize findings of studies; provide reference to studies, calculations, maps, data sources, etc. Provide narrative discussion of study/data source applicability.			
Part 1 Result *	If all answers to rows 1 - 4 are "**Yes**" a full infiltration design is potentially feasible. The feasibility screening category is **Full Infiltration** If any answer from row 1-4 is "**No**", infiltration may be possible to some extent but would not generally be feasible or desirable to achieve a "full infiltration" design. Proceed to Part 2		**Full Infiltration** **Not feasible**

*To be completed using gathered site information and best professional judgment considering the definition of MEP in the MS4 Permit. Additional testing and/or studies may be required by Agency/Jurisdictions to substantiate findings

Form I-8 Page 3 of 4

Part 2 – Partial Infiltration vs. No Infiltration Feasibility Screening Criteria

Would infiltration of water in any appreciable amount be physically feasible without any negative consequences that cannot be reasonably mitigated?

Criteria	Screening Question	Yes	No
5	**Do soil and geologic conditions allow for infiltration in any appreciable rate or volume?** The response to this Screening Question shall be based on a comprehensive evaluation of the factors presented in Appendix C.2 and Appendix D.	✓	

Provide basis:

Minimal infiltration values based upon testing of site material. Observed infiltration data are approx. 0.1"/hr. See Geotechnical Addendum & Infiltration Test Results dated August 1, 2016 in Attachment 6.

Summarize findings of studies; provide reference to studies, calculations, maps, data sources, etc. Provide narrative discussion of study/data source applicability and why it was not feasible to mitigate low infiltration rates.

6	**Can Infiltration in any appreciable quantity be allowed without increasing risk of geotechnical hazards (slope stability, groundwater mounding, utilities, or other factors) that cannot be mitigated to an acceptable level**? The response to this Screening Question shall be based on a comprehensive evaluation of the factors presented in Appendix C.2.	✓	

Provide basis:

See discussion in the Geotechnical Addendum & Infiltration Test Results dated August 1, 2016 in Attachment 6.

Summarize findings of studies; provide reference to studies, calculations, maps, data sources, etc. Provide narrative discussion of study/data source applicability and why it was not feasible to mitigate low infiltration rates.

Form I-8 Page 4 of 4			
Criteria	Screening Question	**Yes**	**No**
7	**Can Infiltration in any appreciable quantity be allowed without posing significant risk for groundwater related concerns (shallow water table, storm water pollutants or other factors)?** The response to this Screening Question shall be based on a comprehensive evaluation of the factors presented in Appendix C.3.	✓	
Provide basis: No evidence of contamination Summarize findings of studies; provide reference to studies, calculations, maps, data sources, etc. Provide narrative discussion of study/data source applicability and why it was not feasible to mitigate low infiltration rates.			
8	**Can infiltration be allowed without violating downstream water rights**? The response to this Screening Question shall be based on a comprehensive evaluation of the factors presented in Appendix C.3.	✓	
Provide basis: No evidence of downstream impacts. Summarize findings of studies; provide reference to studies, calculations, maps, data sources, etc. Provide narrative discussion of study/data source applicability and why it was not feasible to mitigate low infiltration rates.			
Part 2 Result*	If all answers from row 1-4 are yes then partial infiltration design is potentially feasible. The feasibility screening category is **Partial Infiltration.** If any answer from row 5-8 is no, then infiltration of any volume is considered to be **infeasible** within the drainage area. The feasibility screening category is **No Infiltration.**	**Partial Infiltration**	

*To be completed using gathered site information and best professional judgment considering the definition of MEP in the MS4 Permit. Additional testing and/or studies may be required by Agency/Jurisdictions to substantiate findings

Project Name **Southview East** BMP ID **North Basin @ Airway**

	Design Capture Volume (DCV)			Worksheet B-2.1 City SD BMP Manual 2016		
	Surface	Area (sq-ft)	Area (acres)	Runoff Factor	C x A (acres)	
	Imperv (Roof/Paving)	296,877	6.815	0.9	6.134	
	Semi Pervious Area	-	0.000	0.2	0.000	
	Pervious Area	148,750	3.415	0.1	0.341	
A	Total Area	445,627	10.230	0.633	6.475	acre
B	Adjusted Impervious Area				282,064	sq-ft
C	**85th Percentile 24-Hour Storm**				0.46	inches
D	Design Capture Volume (Gross)			DCV =	10,812	cubic-ft
E	Volume Reductions (Street Trees / Rain Barrels)				0	cubic-ft

	Simple Sizing Method for Biofiltration BMPs				Worksheet B-5.1	
1	Remaining DCV after implementing Retention BMPs			**DCV =**	**10,812**	cubic-ft
	Partial Retention					
2	Infiltration rate from Worksheet D.5-1 if partial infiltration is feasible				**0.063**	in/hr
3	Allowable drawdown time for aggregate storage below the underdrain				36	hours
4	Depth of runoff that can be infiltrated [Line 2 x Line 3]				2.25	inches
5	Aggregate pore space				0.4	in / in
6	Required depth of gravel below the underdrain [Line 4/ Line 5]				5.63	inches
7	**Assumed surface area of the biofiltration BMP**	2,712	3,141	8,462	**8,462**	sq-ft
8	Media retained pore storage (filter/growing media)				0.1	in / in
9	Volume retained by BMP [[Line 4 + (Line 12 x Line 8)]/12] x Line 7				2,856	cubic-ft
10	DCV that requires biofiltration [Line 1 — Line 9]				7,957	cubic-ft
	BMP Parameters					
11	Surface Ponding [6 inch minimum, 12 inch maximum]				12	inches
12	Media Thickness [18 inches minimum] also add mulch layer thickness 3"				18	inches
13	Aggregate Storage above underdrain invert (3" + 3" Transition + 12 inches Stone)				18	inches
14	Freely drained pore storage (filter media + mulch)				0.2	in / in
15	Media filtration rate to be used for sizing (5 in/hr minimum)				**5**	in/hr
	Baseline Calculations					
16	Allowable Routing Time for sizing				6	hours
17	Depth filtered during storm [Line 15 x Line 16]				30.0	inches
18	Depth of Detention Storage [Line 11 + (Line 12 x Line 14) + (Line 13 x Line 5)]				22.8	inches
19	Total Depth Treated [Line 17 + Line 18]				52.8	inches
	Option 1 — Biofilter 1.5 times the DCV					
20	Required biofilter volume [1.5 x Line 10] cubic-feet				11,935	cubic-ft
21	Required Footprint [Line 20/ Line 19] x 12				**2,712**	sq-ft
	Option 2 - Store 0.75 of remaining DCV in pores and ponding					
22	Required Storage (surface + pores) Volume [0.75 x Line 10]				5,967	cubic-ft
23	Required Footprint [Line 22/ Line 18] x 12				**3,141**	sq-ft
	Footprint of the BMP					
24	Area draining to the BMP				445,627	sq-ft
25	Adjusted Runoff Factor (Refer to Appendix B.1 and B.2)				0.633	
26	Minimum BMP Sizing Factor = 3% [Alternative Worksheet B.5-2, Line 11]			2.41%	**3%**	
27	Minimum BMP Footprint				**8,462**	sq-ft
28	Footprint of BMP = Maximum (Minimum (Line 21, Line 23), Line 27) Surface Area =				**8,462**	sq-ft
	Check for Volume Reduction [Not Applicable for No Infiltration Condition]					
29	Calculate the fraction of DCV retained in the BMP [Line 9/Line 1]			**3.00%**	**0.2641**	
30	Minimum required fraction of DCV retained for partial infiltration condition				**0.3250**	
31	Is the DCV > 0.325 ? Increase the footrpint sizing factor on Line 26				**NO**	

Project Name **Southview East** BMP ID **North Basin @ Airway**

Factor of Safety and Design Infiltration Rate Worksheet			Worksheet D.5-1 City San Diego 2016			
Factor Category		Factor Description	Assigned Weight (w)	Factor Value (v)	Product (p) p = w x v	Comments
A	Suitability Assessment	Soil assessment methods	0.25	1	0.25	Infiltration testing
		Predominate soil texture	0.25	3	0.75	Granulary to Loamy
		Site soil variability	0.25	3	0.75	Variable
		Depth to groudwater / impervious layer	0.25	1	0.25	Depth > 15'
		Suitability Assessment Factor, Sa = Sum p			**2.00**	
B	Design	Level of pretreatment / expected sediment loads	0.50	1	0.50	Limited Pretreatment Low Sediment Load
		Redundancy / resiliency	0.25	1	0.25	Overflow pathway
		Compaction during construction	0.25	1	0.25	Restricted location
		Design Safety Factor, Sb = Σp			**1.00**	
Combined Safety Factor S = Sa x Sb					**2.00**	
Observed Infiltration Rate, in/hr, Kobserved (corrected for test specific bias)					0.125	in/hr
Design Infiltration Rate, in/hr, Kdesign = Kobserves/Stotal					**0.063**	in/hr

Supporting Data

Briefly Describe infiltration test and provide reference to test forms;

Infiltration testing

North Basin Area P1 = 0.11 in/hr P2 = 0.14 in/hr Average = 0.125 in/hr

Part A factor of Safety values per Worksheet Table D.5-1 form Geotechnical Report Sa = 2.0

Project Name **Southview East** BMP ID **South Basin**

	Design Capture Volume (DCV)			Worksheet B-2.1 City SD BMP Manual 2016		
	Surface	Area (sq-ft)	Area (acres)	Runoff Factor	C x A (acres)	
	Imperv (Roof/Paving)	150,999	3.466	0.9	3.120	
	Semi Pervious Area	-	0.000	0.2	0.000	
	Pervious Area	81,236	1.865	0.1	0.186	
A	Total Area	232,235	5.331	0.620	3.306	acre
B	Adjusted Impervious Area				144,023	sq-ft
C	**85th Percentile 24-Hour Storm**				0.46	inches
D	Design Capture Volume (Gross)			DCV =	5,521	cubic-ft
E	Volume Reductions (Street Trees / Rain Barrels				0	cubic-ft

	Simple Sizing Method for Biofiltration BMPs				Worksheet B-5.1	
1	Remaining DCV after implementing Retention BMPs			**DCV =**	**5,521**	cubic-ft
	Partial Retention					
2	Infiltration rate from Worksheet D.5-1 if partial infiltration is feasible				**0.040**	in/hr
3	Allowable drawdown time for aggregate storage below the underdrain				36	hours
4	Depth of runoff that can be infiltrated [Line 2 x Line 3]				1.44	inches
5	Aggregate pore space				0.4	in / in
6	Required depth of gravel below the underdrain [Line 4/ Line 5]				4321.00	inches
7	**Assumed surface area of the biofiltration BMP**	1,484	1,719	4,321	**4,321**	sq-ft
8	Media retained pore storage (filter/growing media)				0.1	in / in
9	Volume retained by BMP [[Line 4 + (Line 12 x Line 8)]/12] x Line 7				1,167	cubic-ft
10	DCV that requires biofiltration [Line 1 — Line 9]				4,354	cubic-ft
	BMP Parameters					
11	Surface Ponding [6 inch minimum, 12 inch maximum]				12	inches
12	Media Thickness [18 inches minimum] also add mulch layer thickness 3"				**18**	inches
13	Aggregate Storage above underdrain invert (3" + 3" Transition + 12 inches Stone)				18	inches
14	Freely drained pore storage (filter media + mulch)				0.2	in / in
15	Media filtration rate to be used for sizing (5 in/hr minimum)				**5**	in/hr
	Baseline Calculations					
16	Allowable Routing Time for sizing				6	hours
17	Depth filtered during storm [Line 15 x Line 16]				30.0	inches
18	Depth of Detention Storage [Line 11 + (Line 12 x Line 14) + (Line 13 x Line 5)]				22.8	inches
19	Total Depth Treated [Line 17 + Line 18]				52.8	inches
	Option 1 — Biofilter 1.5 times the DCV					
20	Required biofilter volume [1.5 x Line 10] cubic-feet				6,531	cubic-ft
21	Required Footprint [Line 20/ Line 19] x 12				**1,484**	sq-ft
	Option 2 - Store 0.75 of remaining DCV in pores and ponding					
22	Required Storage (surface + pores) Volume [0.75 x Line 10]				3,266	cubic-ft
23	Required Footprint [Line 22/ Line 18] x 12				**1,719**	sq-ft
	Footprint of the BMP					
24	Area draining to the BMP				232,235	sq-ft
25	Adjusted Runoff Factor (Refer to Appendix B.1 and B.2)				0.620	
26	Minimum BMP Sizing Factor = 3% [Alternative Worksheet B.5-2, Line 11]			1.69%	**3%**	
27	Minimum BMP Footprint				**4,321**	sq-ft
28	Footprint of BMP = Maximum (Minimum (Line 21, Line 23), Line 27) Surface Area =				**4,321**	sq-ft
	Check for Volume Reduction [Not Applicable for No Infiltration Condition]					
29	Calculate the fraction of DCV retained in the BMP [Line 9/Line 1]				**0.2113**	
30	Minimum required fraction of DCV retained for partial infiltration condition				**0.3250**	
31	Is the DCV > 0.325 ? Increase the footrpint sizing factor on Line 26				**NO**	

ATTACHMENT 2
BACKUP FOR PDP HYDROMODIFICATION CONTROL MEASURES

This is the cover sheet for Attachment 2.

☐ Mark this box if this attachment is empty because the project is exempt from PDP hydromodification management requirements.

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Project Name: Southview East

Indicate which Items are Included:

Attachment Sequence	Contents	Checklist
Attachment 2a	Hydromodification Management Exhibit (Required)	■ Included See Hydromodification Management Exhibit Checklist.
Attachment 2b	Management of Critical Coarse Sediment Yield Areas (WMAA Exhibit is required, additional analyses are optional) See Section 6.2 of the BMP Design Manual.	■ Exhibit showing project drainage boundaries marked on WMAA Critical Coarse Sediment Yield Area Map (Required) Optional analyses for Critical Coarse Sediment Yield Area Determination ☐ 6.2.1 Verification of Geomorphic Landscape Units Onsite ☐ 6.2.2 Downstream Systems Sensitivity to Coarse Sediment ☐ 6.2.3 Optional Additional Analysis of Potential Critical Coarse Sediment Yield Areas Onsite
Attachment 2c	Geomorphic Assessment of Receiving Channels (Optional) See Section 6.3.4 of the BMP Design Manual.	◉ Not Performed ○ Included ○ Submitted as separate stand-alone document
Attachment 2d	Flow Control Facility Design and Structural BMP Drawdown Calculations (Required) Overflow Design Summary for each structural BMP See Chapter 6 and Appendix G of the BMP Design Manual	◉ Included ○ Submitted as separate stand-alone document
Attachment 2e	Vector Control Plan (Required when structural BMPs will not drain in 96 hours)	○ Included ◉ Not required because BMPs will drain in less than 96 hours

Project Name: Southview East

Use this checklist to ensure the required information has been included on the Hydromodification Management Exhibit:

The Hydromodification Management Exhibit must identify:

☐ Underlying hydrologic soil group
☐ Approximate depth to groundwater
☐ Existing natural hydrologic features (watercourses, seeps, springs, wetlands)
☐ Critical coarse sediment yield areas to be protected
☐ Existing topography
☐ Existing and proposed site drainage network and connections to drainage offsite
☐ Proposed grading
☐ Proposed impervious features
☐ Proposed design features and surface treatments used to minimize imperviousness
☐ Point(s) of Compliance (POC) for Hydromodification Management
☐ Existing and proposed drainage boundary and drainage area to each POC (when necessary, create separate exhibits for pre-development and post-project conditions)
☐ Structural BMPs for hydromodification management (identify location, type of BMP, and size/detail)


CRITICAL COURSE SEDIMENT YIELD MAP FOR:
SOUTHVIEW EAST
CALTRANS
SR-905
EB ON-RAMP
PROJECT BOUNDARY (TYP.)
CALIENTE AVENUE
(PER CITY OF SAN DIEGO DWG. NO. 35613-D)
OFFSITE 0.34 AC
OFFSITE (0.56 AC.)
OFFSITE 0.22 AC
"TESORO" PROJECT (SOUTHVIEW LOT 1)
DMA 1N 430,546 S.F.
TEMPORARY WQ/DETENTION BASIN TO BE REMOVED
DMA S1N 15,604 S.F. SELF RETAINING
"SOUTHVIEW EAST" NORTH SIDE
DMA S2N 5,582 S.F. SELF RETAINING
A 9.88 AC.
BIOFILTRATION #1 10,139 S.F.
BASIN AND SLOPES 1.20 AC.
EXIST. CANYON
NORTH WATER QUALITY BASIN
POC 1
DMA N-BASINS 430,546 S.F.
NORTH DETENTION BASIN #1 AND HMP
AIRWAY ROAD
(PER CITY OF SAN DIEGO DWG. NO. 35613-D, P.T.S. NO. 214832)
STREET 0.35 AC.
DMA ST1N 15,073 S.F.
BIOFILTRATION #2 IMP 2 5,138 S.F. 519.0 F.G.
DMA 2S 232,234 S.F.
DMA S2S 43,403 S.F. SELF RETAINING
"VISTA DEL SUR" PROJECT BASIN "7"
"VISTA DEL SUR" (NOT A PART)
"SOUTHVIEW EAST" SOUTH SIDE
"SOUTHVIEW" LOT 2
SANTA ALICIA
B 5.33 AC.
DETENTION & HMP TANK
BY-PASS STORM DRAIN
POC 2
DISCHARGE LOCATION SOUTHVIEW BY-PASS
SOUTHERLY SITE DISCHARGE LOCATION (LOW POINT IN EXIST. EARTH BERM
EXIST. EARTH BERM
EXIST. EARTH SWALE
SAN ROBERTO
GRAPHIC SCALE
40 0 40 80 120
SCALE: 1" = 40'
VICINITY MAP
NOT TO SCALE
THOMAS BROTHERS PG. 1351, GRID A-2
2006 EDITION
OTAY MESA RD
805
905
AIRWAY
CALIENTE AVE.
FWY.
BEYER BLVD.
SITE
LEGEND
BASIN LIMITS
DIRECTION OF FLOW
STORM DRAIN MANHOLE
BASIN NO.
AREA
A
10.0 AC.
SHEET 1 OF 1 SHEETS
SB&O INC.
PLANNING ENGINEERING SURVEYING
3990 Ruffin Road, Suite 120
San Diego, Ca. 92123
858-560-1141
858-560-8157 Fax
CRITICAL COURSE SEDIMENT YIELD MAP FOR:
SOUTHVIEW EAST
70910.10

ATTACHMENT

S.W.M.M. ~ HMP CONTINUOUS SIMULATION MODEL FOR:

"SOUTHVIEW EAST"

CITY OF SAN DIEGO, CA

August 11, 2016

PREPARED BY:

SB&O INC.
PLANNING ENGINEERING SURVEYING

3990 RUFFIN ROAD, SUITE 120

SAN DIEGO, CA 92123

858-560-1141

TABLE OF CONTENTS

APPENDICES

INTRODUCTION

This report, "S.W.M.M. ~ HMP CONTINUOUS SIMULATION MODELING FOR SOUTHVIEW EAST", is an attachment to the project Storm Water Quality Mitigation Plan (SWQMP) and is not intended to be an independent document.

The San Diego County final Hydromodification Management Plan (HMP) became effective in January of 2011, and is applicable to all priority projects regardless of size. The HMP model seeks to limit post development increases in runoff (magnitude and duration) for runoff event ranging from a fraction of the Q2 up to Q10.

Hydromodification flow control is achieved for this project by routing runoff through bio-retention basins that have enlarged subterranean storage volumes. Outflow is restricted by using multiple control openings at each discharge. To determine the hydromodification controls and storage dimensions, Continuous Simulation Modeling was done using the EPA Storm Water Management Model (SWMM) software. Separate reports have been prepared to analyze the onsite 100-year storm capacity and to analyze the capacity of the downstream public drainage system.

STORM WATER MANAGEMENT MODEL SOFTWARE

EPA's Storm Water Management Model (SWMM) was first developed in 1971, and has since undergone several major upgrades. It continues to be widely used throughout the world for planning, analysis and design related to stormwater runoff, combined sewers, sanitary sewers, and other drainage systems in urban areas, with many applications in non-urban areas as well.

This general purpose urban hydrology and conveyance system hydraulics software is a dynamic rainfall-runoff simulation model used for single event or long-term (continuous) simulation of runoff quantity and quality from primarily urban areas. The runoff component of SWMM operates on a collection of subcatchment areas that receive precipitation and generate runoff and pollutant loads. The routing portion of SWMM transports this runoff through a system of pipes, channels, storage/treatment devices, pumps, and regulators. SWMM tracks the quantity and quality of runoff generated within each subcatchment, and the flow rate, flow depth, and quality of water in each pipe and channel during a simulation period comprised of multiple time steps.

EPA has recently extended SWMM 5 to explicitly model the hydrologic performance of specific types of low impact development (LID) controls, such as porous pavement, bio-retention areas (e.g., rain gardens, green roofs, and street planters), rain barrels, infiltration trenches, and vegetative swales. The updated model allows engineers and planners to accurately represent any combination of LID controls within a study area to determine their effectiveness in managing stormwater and combined sewer overflows.

SWMM 5 was produced in a joint development effort with CDM, Inc., a global consulting, engineering, construction, and operations firm.

POINT OF COMPLIANCE (POC)

The lower flow threshold is determined by the sensitivity of the receiving water. Depending upon the downstream erosion potential, the allowable low flow threshold is set at 10% of pre-development Q2.

A field review revealed that the Erosion Susceptibility Rating of the channel bed and banks will likely be "High" and therefore a Southern California Coastal Water Research Project (SCCWRP) field screening was not performed.

Assuming a low-flow threshold of 0.1 Q2, we have assigned two POCs to the project, as shown on the enclosed exhibit.

ANALYSIS

For each of the POCs, three models were simulated: pre-development, post-development unmitigated, and post-development mitigated. A graphical depiction of the SWMM model for each of the six scenarios is included at the end of this report. The pre-development condition simulation is a representation of the undeveloped site. The post-development unmitigated simulation is a representation of the site after impervious area has been added without any storage volume to attenuate the runoff. Lastly, the post-developed site adds storage volume to reduce flows to meet the HMP requirements.

The performance standard requires the following:

1. For flow rates from 10% of the pre-project 2-year runoff event (0.1Q2) to the pre-project 10-year runoff event (Q10), the post-project discharge rates and durations shall not deviate above the pre-project rates and durations by more than 10% over more than 10% of the length of the flow duration curve.
2. For flow rates from 0.1 Q2 to Q5, the post-project peak flows shall not exceed pre-project peak flows. For flow rates from Q5 to Q10, post-project peak flows may exceed pre-project flows by up to 10% for a 1-year frequency interval. For example, post-project flows could exceed pre-project flows by up to 10% for the interval from Q9 to Q10 or from Q5.5 to Q6.5, but not from Q8 to Q10.

RAINFALL DATA

Precipitation is the principal driving variable in rainfall-runoff-quantity simulation. The volume and rate of storm water runoff depends directly on the precipitation magnitude, and its spatial and temporal distribution over the catchment. Each subcatchment in SWMM is linked to a Rain Gage object that describes the format and source of the rainfall input for the subcatchment. The same rain gage, "LowerOtayGage" and time series, "TS1" is applied to all scenarios for this project. A digital copy of each model is made accessible with the CD provided with this report.

Long-term hourly rainfall records have been prepared for the 19 rainfall stations. Sources of the rainfall data include ALERT data from the County of San Diego (which extend back to 1982), the California Climatic Data Archive, National Oceanic and Atmospheric Administration (NOAA), the National Climatic Data Center, and the Western Regional Climate Center. In all cases, the length of the overall rainfall station record is 35 years or the overall length of the rainfall record,

whichever is longer. The Bonita ALERT Station rainfall data was used for this project and can be found at, www.projectcleanwater.org. The

EVAPORATION

Single event simulations are usually insensitive to the evaporation rate. Thus, evaporation is typically neglected when a single rainfall event or a synthetic storm is simulated. However, this process is more significant when a continuous simulation is performed because it is through evaporation that depression storage is recovered and water levels in extended detention and wet ponds are reduced; thus it becomes an important component of the overall water budget. Several options are available for representing evaporation data in SWMM, including: (1) a single constant value, (2) historical daily average values stored in an external file, (3) a time series when high temporal resolution is available, and (4) monthly averages. Although conceptually evaporation should also affect the recovery of infiltration capacity within the pervious areas of the watershed, SWMM infiltration models do not explicitly take it into account. Instead, they employ simple empirical functions for this purpose.

For this project we apply monthly averages furnished by the California Irrigation Management Information System (CIMIS).

SUBCATCHMENTS

SWMM is a distributed model, which means that a study area can be subdivided into any number of irregular subcatchments to best capture the effect that spatial variability in topography, drainage pathways, land cover, and soil characteristics have on runoff generation. Each subcatchment can be further divided into three subareas: an impervious area with depression (detention) storage, an impervious area without depression storage, and a pervious area with depression storage. Only the latter area allows for rainfall losses due to infiltration into the soil. Described below are some of the characteristics of a subcatchment.

Width/Length

W = AREA ÷ LENGTH OF OVERLAND FLOW

The width can be defined as the subcatchment area divided by the length of the longest un-concentrated overland flow path that water can travel. If there are several such paths, then one would use an average of their lengths to compute a width. In natural areas, true overland flow can only occur for distances of about 500 feet before it begins to consolidate into rivulet flow. In urbanized catchments, true overland flow can be very short before it is collected into channels or pipes. A maximum overland flow length of 500 feet is appropriate for non-urban catchments, while the typical overland flow length is the length from the back of a representative lot to the center of the street for urban catchments. If the overland flow length varies greatly within the subcatchment, then an area-weighted average should be used.

Slope
This is the slope of the land surface over which runoff flows, and is the same for both the pervious and impervious surfaces. It is the slope of what one considers to be the overland flow path, or its area-weighted average, if there are several such paths in the subcatchment.

The provided HMP exhibits show the slopes of the overland flow paths for both the existing and proposed conditions. The slopes for the overland path of travel in the proposed conditions are assumed to be 2 percent, which is typical grade for a swale.

Imperviousness
This is the percentage of the subcatchment area that is covered by impervious surfaces, such as roofs and roadways, through which rainfall cannot infiltrate. Imperviousness tends to be the most sensitive parameter in the hydrologic characterization of a catchment, and can range anywhere from 5% for undeveloped areas up to 95% for high-density commercial areas.

Roughness Coefficient
The roughness coefficient reflects the amount of resistance that overland flow encounters as it runs off of the subcatchment surface. Since SWMM uses the Manning equation to compute the overland flow rate, this coefficient is the same as Manning's roughness coefficient *n*. Separate values are required for the impervious and pervious fractions of a subcatchment since the pervious *n* is generally an order of magnitude higher than the impervious *n*.

Utilized values from the San Diego County Drainage Design Manual, 2005:

Typical "n" values:

Surface	n	Reference
Existing Natural Terrain	0.050	Table A-5
Proposed Landscaping	0.030	Table A-5
Proposed Paving (AC, PCC)	0.015	Table A-1

Depression Storage "Dstore"
Depression storage corresponds to a volume that must be filled prior to the occurrence of any runoff. Different values can be used for the pervious and impervious areas of a subcatchment. It represents initial abstractions such as surface ponding, interception by flat roofs and vegetation, and surface wetting.

Typical "D" values:

Surface	D (in)
Impervious surfaces (AC,PCC)	0.05
Proposed Landscaping	0.10
Existing Natural Terrain	0.15

Percent of Impervious Area without Depression Storage
This parameter accounts for immediate runoff that occurs at the beginning of rainfall before depression storage is satisfied. It represents pavement close to the gutters that has no surface storage, pitched rooftops that drain directly to street gutters, new pavement that may not have surface ponding, etc. By default the value of this variable is 25%, but it can be changed in each

subcatchment. Unless special circumstances are known to exist, a percent imperviousness area without depression storage of 25% is recommended.

Subarea Routing
Choice of internal routing of runoff between pervious and impervious areas:
IMPERVIOUS: Runoff from pervious areas flow to impervious areas
PERVIOUS: Runoff from impervious areas flow to pervious areas
OUTLET: Runoff from both areas flow directly to outlets. This option is used in all cases.

Percent Routed
The percentage of runoff from the subcatchment that is to be routed. In all cases this is 100%.

Infiltration Model
Three different methods for computing infiltration loss on the pervious areas of a subcatchment are available in SWMM. They are the Horton, Green-Ampt and Curve Number models. There is no general agreement on which model is best. The Horton model has a long history of use in dynamic simulations, the Green-Ampt model is more physically-based, and the Curve Number model is derived from (but not the same as) the well-known SCS Curve Number method used in simplified runoff models.

We have chosen to use the Green-Ampt model for this project based upon the recommendations for type “D” soil:
Suction Head = 9 inches
Conductivity = .025
Initial Deficit = 0.30

Low Impact Development (LID) Controls
LID Controls are low impact development practices designed to capture surface runoff and provide some combination of detention, infiltration, and evapotranspiration. They are considered as properties of a given subcatchment, similar to how Aquifers and Snow Packs are treated. SWMM can explicitly model five different generic types of LID controls: Bio-retention Cells (with impermeable liner option), Infiltration Trenches, Continuous Porous Pavement Systems, Rain Barrels (or Cisterns) and Vegetative Swales.

Bio-retention cells, infiltration trenches, and porous pavement systems can all contain optional underdrain systems in their gravel storage beds to convey captured runoff off of the site rather than letting it all infiltrate. They can also have an impermeable floor or liner that prevents any infiltration into the native soil from occurring. Infiltration trenches and porous pavement systems can also be subject to a decrease in hydraulic conductivity over time due to clogging.

Although some LID practices con provide some flow reducing benefits, we have conservatively chosen to ignore them for HMP modeling.

STORAGE UNITS

SWMM routes runoff through storage units such as ponds and tanks with outlet orifices and weirs. Tanks can be modeled using either a storage curve function or a depth-area table. For this project we inputted a depth-area table and only allow for storage infiltration in open basins and no infiltration is allowed for tanks.

STATISTICS

SWMM computes peak flow frequency statistics by constructing a partial-duration series. This involves examining the entire runoff time series generated by the model, dividing the runoff time series into a set of discrete unrelated events, determining the peak flow for each event, ranking the peak flows for all events and then computing the recurrence interval or plotting position for each storm event. A separation event, defined as a time period in which runoff does not exceed a prescribed threshold, is required to parse the long-term flow records into discrete runoff events. The separation event corresponds to the required number of consecutive time intervals (24 hours in this case) with a flow value less than Flow Floor 1 (0.002 cfs/acre).

SWMM uses the Weibull method for construction of the partial-duration series, but the Final HMP gives preference to the Cunnane method. Both the Weibull and Cunnane methods result in very similar return periods and frequencies for events that occur below the Q10, and do not begin significantly contrasting until the low frequency (high flow) ranges. We have converted the SWMM partial duration series to a Cunnane plotting for this report and have included a table at the end of this report.

RESULTS

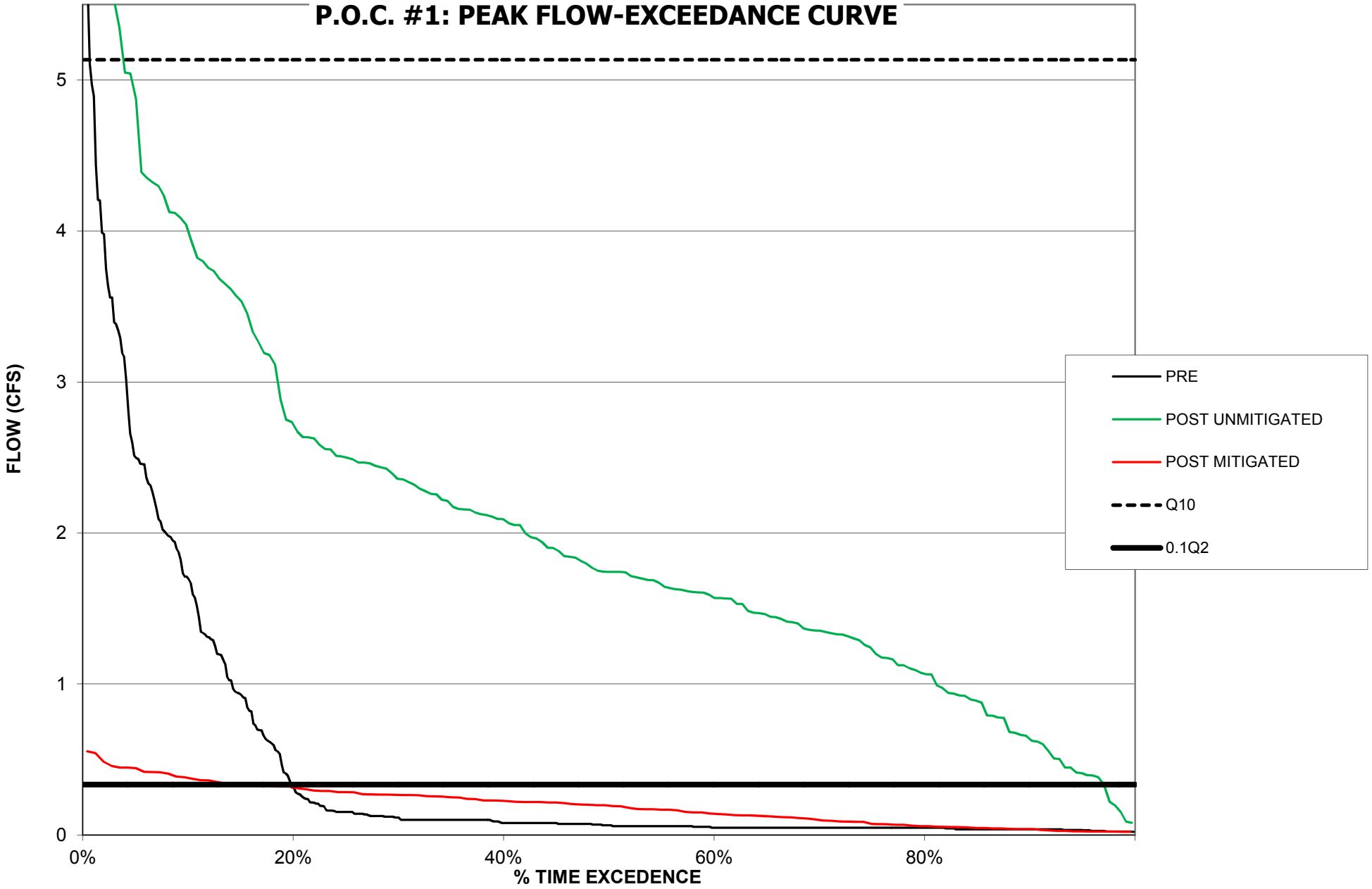
For each HMP tank (each POC) the results are included at the end of this report and are summarized as follows:

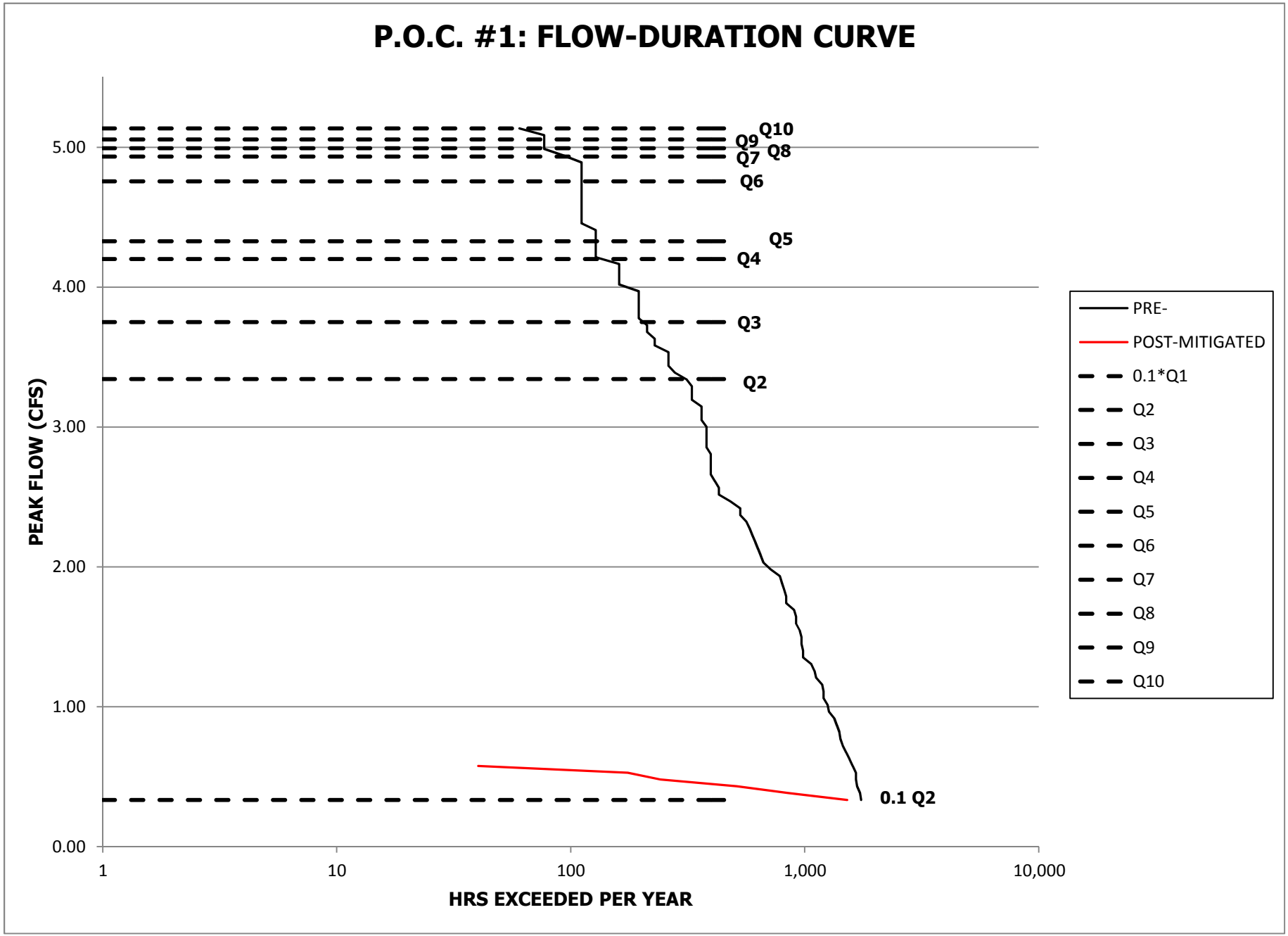
A. PEAK FLOW-EXCEEDANCE CURVE
B. FLOW-DURATION CURVE
C. FLOW-DURATION DATA TABLE
D. PEAK EVENT TABLE – EXISTING *(INCLUDES Q2 & Q10 THRESHOLDS)*
E. PEAK EVENT TABLE – POST-UNMITIGATED
F. PEAK EVENT TABLE – POST-MITIGATED

Observing flows between 0.1 Q2 and Q10, each of these charts or tables show that the flow control openings in the project HMP tank and pond reduce the runoff from the site to below a pre-developed condition and meet the performance standard requirements described above.

APPENDIX I: P.O.C. #1 SWMM RESULTS

A. PEAK FLOW-EXCEEDANCE CURVE
B. FLOW-DURATION CURVE
C. FLOW-DURATION DATA TABLE
D. PEAK EVENT TABLE – EXISTING *(INCLUDES Q2 & Q10 THRESHOLDS)*
E. PEAK EVENT TABLE – POST-UNMITIGATED
F. PEAK EVENT TABLE – POST-MITIGATED


P.O.C. #1: PEAK FLOW-EXCEEDANCE CURVE
FLOW (CFS)
0
1
2
3
4
5
0%
20%
40%
60%
80%
% TIME EXCEDENCE
PRE
POST UNMITIGATED
POST MITIGATED
Q10
0.1Q2


P.O.C. #1: FLOW-DURATION CURVE
PEAK FLOW (CFS)
5.00
4.00
3.00
2.00
1.00
0.00
1
10
100
1,000
10,000
HRS EXCEEDED PER YEAR
Q10
Q9
Q8
Q7
Q6
Q5
Q4
Q3
Q2
0.1 Q2
PRE-
POST-MITIGATED
0.1*Q1
Q2
Q3
Q4
Q5
Q6
Q7
Q8
Q9
Q10

P.O.C. #1: FLOW-DURATION TABLE

Q2 =	3.342	CFS	FRACTION =	10%
Q10 =	5.1344	CFS		
STEP =	0.048	CFS		
COUNT =	306,600	HRS		
	35	YRS		

	EXISTING			MITIGATED			PASS OR
INTERVAL	Q (CFS)	HRS>Q	HRS/YR	HRS>Q	HRS/YR	POST/PRE	FAIL
1	0.3342	60952	1741	53226	1521	87%	PASS
2	0.3827	60370	1725	29679	848	49%	PASS
3	0.4312	58591	1674	17905	512	31%	PASS
4	0.4797	58009	1657	8462	242	15%	PASS
5	0.5281	58009	1657	6132	175	11%	PASS
6	0.5766	56230	1607	1410	40	3%	PASS
7	0.6251	54483	1557	1410	NULL	NULL	NULL
8	0.6736	52705	1506	1410	NULL	NULL	NULL
9	0.7221	50957	1456	1410	NULL	NULL	NULL
10	0.7706	49761	1422	1410	NULL	NULL	NULL
11	0.8191	49179	1405	1410	NULL	NULL	NULL
12	0.8676	48014	1372	1410	NULL	NULL	NULL
13	0.9160	46818	1338	1410	NULL	NULL	NULL
14	0.9645	44457	1270	1410	NULL	NULL	NULL
15	1.0130	43874	1254	1410	NULL	NULL	NULL
16	1.0615	42127	1204	1410	NULL	NULL	NULL
17	1.1100	42127	1204	1410	NULL	NULL	NULL
18	1.1585	41544	1187	1410	NULL	NULL	NULL
19	1.2070	39183	1120	1410	NULL	NULL	NULL
20	1.2555	38601	1103	1410	NULL	NULL	NULL
21	1.3039	37405	1069	1410	NULL	NULL	NULL
22	1.3524	34462	985	1410	NULL	NULL	NULL
23	1.4009	34462	985	1410	NULL	NULL	NULL
24	1.4494	33879	968	1410	NULL	NULL	NULL
25	1.4979	33879	968	1410	NULL	NULL	NULL
26	1.5464	33297	951	1410	NULL	NULL	NULL
27	1.5949	32132	918	1410	NULL	NULL	NULL
28	1.6434	32132	918	1410	NULL	NULL	NULL
29	1.6918	31518	901	1410	NULL	NULL	NULL
30	1.7403	29188	834	1410	NULL	NULL	NULL
31	1.7888	29188	834	1410	NULL	NULL	NULL
32	1.8373	28575	816	1410	NULL	NULL	NULL
33	1.8858	27993	800	1410	NULL	NULL	NULL
34	1.9343	27410	783	1410	NULL	NULL	NULL
35	1.9828	25049	716	1410	NULL	NULL	NULL
36	2.0312	23302	666	1410	NULL	NULL	NULL
37	2.0797	22719	649	1410	NULL	NULL	NULL
38	2.1282	22106	632	1410	NULL	NULL	NULL
39	2.1767	21523	615	1410	NULL	NULL	NULL
40	2.2252	20941	598	1410	NULL	NULL	NULL
41	2.2737	20358	582	1410	NULL	NULL	NULL
42	2.3222	19776	565	1410	NULL	NULL	NULL
43	2.3707	18580	531	1410	NULL	NULL	NULL
44	2.4191	18580	531	1410	NULL	NULL	NULL
45	2.4676	16832	481	1410	NULL	NULL	NULL

46	2.5161	15054	430	1410	NULL	NULL	NULL
47	2.5646	15054	430	1410	NULL	NULL	NULL
48	2.6131	14472	413	1410	NULL	NULL	NULL
49	2.6616	13889	397	1410	NULL	NULL	NULL
50	2.7101	13889	397	1410	NULL	NULL	NULL
51	2.7586	13889	397	1410	NULL	NULL	NULL
52	2.8070	13889	397	1410	NULL	NULL	NULL
53	2.8555	13306	380	1410	NULL	NULL	NULL
54	2.9040	13306	380	1410	NULL	NULL	NULL
55	2.9525	13306	380	1410	NULL	NULL	NULL
56	3.0010	13306	380	1410	NULL	NULL	NULL
57	3.0495	12693	363	1410	NULL	NULL	NULL
58	3.0980	12693	363	1410	NULL	NULL	NULL
59	3.1465	12693	363	1410	NULL	NULL	NULL
60	3.1949	11528	329	1410	NULL	NULL	NULL
61	3.2434	11528	329	1410	NULL	NULL	NULL
62	3.2919	11528	329	1410	NULL	NULL	NULL
63	3.3404	10946	313	1410	NULL	NULL	NULL
64	3.3889	9750	279	1410	NULL	NULL	NULL
65	3.4374	9167	262	1410	NULL	NULL	NULL
66	3.4859	9167	262	1410	NULL	NULL	NULL
67	3.5343	9167	262	1410	NULL	NULL	NULL
68	3.5828	8002	229	1410	NULL	NULL	NULL
69	3.6313	8002	229	1410	NULL	NULL	NULL
70	3.6798	7420	212	1410	NULL	NULL	NULL
71	3.7283	7420	212	1410	NULL	NULL	NULL
72	3.7768	6837	195	1410	NULL	NULL	NULL
73	3.8253	6837	195	1410	NULL	NULL	NULL
74	3.8738	6837	195	1410	NULL	NULL	NULL
75	3.9222	6837	195	1410	NULL	NULL	NULL
76	3.9707	6837	195	1410	NULL	NULL	NULL
77	4.0192	5641	161	1410	NULL	NULL	NULL
78	4.0677	5641	161	1410	NULL	NULL	NULL
79	4.1162	5641	161	1410	NULL	NULL	NULL
80	4.1647	5641	161	1410	NULL	NULL	NULL
81	4.2132	4476	128	1410	NULL	NULL	NULL
82	4.2617	4476	128	1410	NULL	NULL	NULL
83	4.3101	4476	128	1410	NULL	NULL	NULL
84	4.3586	4476	128	1410	NULL	NULL	NULL
85	4.4071	4476	128	1410	NULL	NULL	NULL
86	4.4556	3894	111	1410	NULL	NULL	NULL
87	4.5041	3894	111	1410	NULL	NULL	NULL
88	4.5526	3894	111	1410	NULL	NULL	NULL
89	4.6011	3894	111	1410	NULL	NULL	NULL
90	4.6496	3894	111	1410	NULL	NULL	NULL
91	4.6980	3894	111	1410	NULL	NULL	NULL
92	4.7465	3894	111	1410	NULL	NULL	NULL
93	4.7950	3894	111	1410	NULL	NULL	NULL
94	4.8435	3894	111	1410	NULL	NULL	NULL
95	4.8920	3894	111	1410	NULL	NULL	NULL
96	4.9405	3281	94	1410	NULL	NULL	NULL
97	4.9890	2698	77	1410	NULL	NULL	NULL
98	5.0374	2698	77	1410	NULL	NULL	NULL
99	5.0859	2698	77	1410	NULL	NULL	NULL
100	5.1344	2116	60	1410	NULL	NULL	NULL

P.O.C. #1: PEAK EVENTS - EXISTING

WEIBULL (SWMM)

F = m/(nr+1) where F = frequency
m = event rank
nr = total number of event
n = number of year anlayzed

CUNNANE

F = (i-0.4)/(n+0.2)
i = rank
n = sample size = # of storms

Number of Years Analyzed (n): 35
Total number of events (nr) 521

	Weibull		Cunnane					SUMMARY OF PEAK EVENTS	
m or i	F	Return (yrs)	F	Return	Q	HRS>Q	HRS/YEAR		
1	0.19%	36.00	0.12%	58.67	10.835	368	10.51	**Q2**	**3.342**
2	0.38%	18.00	0.31%	22.00	6.337	950	27.16	**Q3**	**3.750**
3	0.57%	12.00	0.50%	13.54	5.587	1533	43.80	**Q4**	**4.201**
4	0.77%	9.00	0.69%	9.78	5.106	2116	60.44	**Q5**	**4.328**
5	0.96%	7.20	0.88%	7.65	4.971	2698	77.09	**Q6**	**4.756**
6	1.15%	6.00	1.07%	6.29	4.893	3281	93.73	**Q7**	**4.934**
7	1.34%	5.14	1.27%	5.33	4.436	3894	111.25	**Q8**	**4.993**
8	1.53%	4.50	1.46%	4.63	4.208	4476	127.90	**Q9**	**5.057**
9	1.72%	4.00	1.65%	4.09	4.201	5059	144.54	**Q10**	**5.134**
10	1.92%	3.60	1.84%	3.67	3.990	5641	161.18		
11	2.11%	3.27	2.03%	3.32	3.979	6224	177.83		
12	2.30%	3.00	2.23%	3.03	3.750	6837	195.35		
13	2.49%	2.77	2.42%	2.79	3.636	7420	211.99		
14	2.68%	2.57	2.61%	2.59	3.560	8002	228.64		
15	2.87%	2.40	2.80%	2.41	3.559	8585	245.28		
16	3.07%	2.25	2.99%	2.26	3.396	9167	261.92		
17	3.26%	2.12	3.18%	2.12	3.385	9750	278.57		
18	3.45%	2.00	3.38%	2.00	3.342	10363	296.09		
19	3.64%	1.89	3.57%	1.89	3.293	10946	312.73		
20	3.83%	1.80	3.76%	1.80	3.191	11528	329.38		
21	4.02%	1.71	3.95%	1.71	3.168	12111	346.02		
22	4.21%	1.64	4.14%	1.63	3.021	12693	362.66		
23	4.41%	1.57	4.34%	1.56	2.809	13306	380.18		
24	4.60%	1.50	4.53%	1.49	2.659	13889	396.83		
25	4.79%	1.44	4.72%	1.43	2.601	14472	413.47		
26	4.98%	1.38	4.91%	1.38	2.513	15054	430.12		
27	5.17%	1.33	5.10%	1.32	2.496	15637	446.76		
28	5.36%	1.29	5.30%	1.28	2.491	16250	464.28		
29	5.56%	1.24	5.49%	1.23	2.459	16832	480.92		
30	5.75%	1.20	5.68%	1.19	2.457	17415	497.57		
31	5.94%	1.16	5.87%	1.15	2.455	17997	514.21		
32	6.13%	1.13	6.06%	1.11	2.366	18580	530.86		
33	6.32%	1.09	6.25%	1.08	2.328	19163	547.50		
34	6.51%	1.06	6.45%	1.05	2.316	19776	565.02		
35	6.70%	1.03	6.64%	1.02	2.271	20358	581.66		
36	6.90%	1.00	6.83%	0.99	2.217	20941	598.31		
37	7.09%	0.97	7.02%	0.96	2.159	21523	614.95		
38	7.28%	0.95	7.21%	0.94	2.092	22106	631.60		
39	7.47%	0.92	7.41%	0.91	2.075	22719	649.12		
40	7.66%	0.90	7.60%	0.89	2.023	23302	665.76		
41	7.85%	0.88	7.79%	0.87	2.010	23884	682.40		
42	8.05%	0.86	7.98%	0.85	1.994	24467			
43	8.24%	0.84	8.17%	0.83	1.980	25049			
44	8.43%	0.82	8.37%	0.81	1.973	25662			

45	8.62%	0.80	8.56%	0.79	1.950	26245
46	8.81%	0.78	8.75%	0.77	1.941	26828
47	9.00%	0.77	8.94%	0.76	1.897	27410
48	9.20%	0.75	9.13%	0.74	1.873	27993
49	9.39%	0.73	9.32%	0.72	1.824	28575
50	9.58%	0.72	9.52%	0.71	1.732	29188
51	9.77%	0.71	9.71%	0.70	1.711	29771
52	9.96%	0.69	9.90%	0.68	1.711	30353
53	10.15%	0.68	10.09%	0.67	1.694	30936
54	10.34%	0.67	10.28%	0.66	1.668	31518
55	10.54%	0.65	10.48%	0.64	1.593	32132
56	10.73%	0.64	10.67%	0.63	1.573	32714
57	10.92%	0.63	10.86%	0.62	1.517	33297
58	11.11%	0.62	11.05%	0.61	1.442	33879
59	11.30%	0.61	11.24%	0.60	1.345	34462
60	11.49%	0.60	11.44%	0.59	1.338	35075
61	11.69%	0.59	11.63%	0.58	1.329	35658
62	11.88%	0.58	11.82%	0.57	1.312	36240
63	12.07%	0.57	12.01%	0.56	1.309	36823
64	12.26%	0.56	12.20%	0.55	1.296	37405
65	12.45%	0.55	12.39%	0.54	1.290	37988
66	12.64%	0.55	12.59%	0.54	1.252	38601
67	12.84%	0.54	12.78%	0.53	1.200	39183
68	13.03%	0.53	12.97%	0.52	1.197	39766
69	13.22%	0.52	13.16%	0.51	1.192	40349
70	13.41%	0.51	13.35%	0.51	1.164	40931
71	13.60%	0.51	13.55%	0.50	1.132	41544
72	13.79%	0.50	13.74%	0.49	1.046	42127
73	13.98%	0.49	13.93%	0.48	1.024	42709
74	14.18%	0.49	14.12%	0.48	1.024	43292
75	14.37%	0.48	14.31%	0.47	0.968	43874
76	14.56%	0.47	14.50%	0.47	0.950	44457
77	14.75%	0.47	14.70%	0.46	0.943	45070
78	14.94%	0.46	14.89%	0.45	0.938	45653
79	15.13%	0.46	15.08%	0.45	0.928	46235
80	15.33%	0.45	15.27%	0.44	0.911	46818
81	15.52%	0.44	15.46%	0.44	0.907	47400
82	15.71%	0.44	15.66%	0.43	0.844	48014
83	15.90%	0.43	15.85%	0.43	0.823	48596
84	16.09%	0.43	16.04%	0.42	0.818	49179
85	16.28%	0.42	16.23%	0.42	0.737	49761
86	16.48%	0.42	16.42%	0.41	0.726	50344
87	16.67%	0.41	16.62%	0.41	0.697	50957
88	16.86%	0.41	16.81%	0.40	0.694	51539
89	17.05%	0.40	17.00%	0.40	0.693	52122
90	17.24%	0.40	17.19%	0.39	0.659	52705
91	17.43%	0.40	17.38%	0.39	0.636	53287
92	17.62%	0.39	17.57%	0.38	0.626	53870
93	17.82%	0.39	17.77%	0.38	0.617	54483
94	18.01%	0.38	17.96%	0.38	0.607	55065
95	18.20%	0.38	18.15%	0.37	0.595	55648
96	18.39%	0.38	18.34%	0.37	0.562	56230
97	18.58%	0.37	18.53%	0.36	0.555	56813
98	18.77%	0.37	18.73%	0.36	0.537	57426
99	18.97%	0.36	18.92%	0.36	0.463	58009
100	19.16%	0.36	19.11%	0.35	0.416	58591
101	19.35%	0.36	19.30%	0.35	0.408	59174
102	19.54%	0.35	19.49%	0.35	0.395	59756
103	19.73%	0.35	19.69%	0.34	0.360	60370

104	19.92%	0.35	19.88%	0.34	0.316	60952
105	20.11%	0.34	20.07%	0.34	0.314	61535
106	20.31%	0.34	20.26%	0.33	0.282	62117
107	20.50%	0.34	20.45%	0.33	0.273	62700
108	20.69%	0.33	20.64%	0.33	0.269	63282
109	20.88%	0.33	20.84%	0.32	0.255	63895
110	21.07%	0.33	21.03%	0.32	0.246	64478
111	21.26%	0.32	21.22%	0.32	0.240	65061
112	21.46%	0.32	21.41%	0.32	0.238	65643
113	21.65%	0.32	21.60%	0.31	0.217	66226
114	21.84%	0.32	21.80%	0.31	0.216	66839
115	22.03%	0.31	21.99%	0.31	0.214	67421
116	22.22%	0.31	22.18%	0.30	0.208	68004
117	22.41%	0.31	22.37%	0.30	0.208	68586
118	22.61%	0.31	22.56%	0.30	0.193	69169
119	22.80%	0.30	22.76%	0.30	0.193	69782
120	22.99%	0.30	22.95%	0.29	0.188	70365
121	23.18%	0.30	23.14%	0.29	0.164	70947
122	23.37%	0.30	23.33%	0.29	0.162	71530
123	23.56%	0.29	23.52%	0.29	0.162	72112
124	23.75%	0.29	23.71%	0.28	0.162	72695
125	23.95%	0.29	23.91%	0.28	0.159	73308
126	24.14%	0.29	24.10%	0.28	0.152	73891
127	24.33%	0.28	24.29%	0.28	0.152	74473
128	24.52%	0.28	24.48%	0.28	0.152	75056
129	24.71%	0.28	24.67%	0.27	0.152	75638
130	24.90%	0.28	24.87%	0.27	0.152	76251
131	25.10%	0.27	25.06%	0.27	0.152	76834
132	25.29%	0.27	25.25%	0.27	0.152	77417
133	25.48%	0.27	25.44%	0.27	0.152	77999
134	25.67%	0.27	25.63%	0.26	0.152	78582
135	25.86%	0.27	25.83%	0.26	0.141	79195
136	26.05%	0.26	26.02%	0.26	0.141	79777
137	26.25%	0.26	26.21%	0.26	0.141	80360
138	26.44%	0.26	26.40%	0.26	0.141	80942
139	26.63%	0.26	26.59%	0.25	0.141	81525
140	26.82%	0.26	26.78%	0.25	0.137	82107
141	27.01%	0.26	26.98%	0.25	0.136	82721
142	27.20%	0.25	27.17%	0.25	0.131	83303
143	27.39%	0.25	27.36%	0.25	0.126	83886
144	27.59%	0.25	27.55%	0.25	0.126	84468
145	27.78%	0.25	27.74%	0.24	0.126	85051
146	27.97%	0.25	27.94%	0.24	0.126	85664
147	28.16%	0.24	28.13%	0.24	0.126	86247
148	28.35%	0.24	28.32%	0.24	0.126	86829
149	28.54%	0.24	28.51%	0.24	0.126	87412
150	28.74%	0.24	28.70%	0.24	0.121	87994
151	28.93%	0.24	28.89%	0.23	0.121	88577
152	29.12%	0.24	29.09%	0.23	0.121	89190
153	29.31%	0.24	29.28%	0.23	0.121	89772
154	29.50%	0.23	29.47%	0.23	0.121	90355
155	29.69%	0.23	29.66%	0.23	0.117	90938
156	29.89%	0.23	29.85%	0.23	0.116	91520
157	30.08%	0.23	30.05%	0.22	0.115	92133
158	30.27%	0.23	30.24%	0.22	0.100	92716
159	30.46%	0.23	30.43%	0.22	0.100	93298
160	30.65%	0.23	30.62%	0.22	0.100	93881
161	30.84%	0.22	30.81%	0.22	0.100	94463
162	31.03%	0.22	31.01%	0.22	0.100	95077

163	31.23%	0.22	31.20%	0.22	0.100	95659
164	31.42%	0.22	31.39%	0.22	0.100	96242
165	31.61%	0.22	31.58%	0.21	0.100	96824
166	31.80%	0.22	31.77%	0.21	0.100	97407
167	31.99%	0.22	31.96%	0.21	0.100	97989
168	32.18%	0.21	32.16%	0.21	0.100	98603
169	32.38%	0.21	32.35%	0.21	0.100	99185
170	32.57%	0.21	32.54%	0.21	0.100	99768
171	32.76%	0.21	32.73%	0.21	0.100	100350
172	32.95%	0.21	32.92%	0.21	0.100	100933
173	33.14%	0.21	33.12%	0.20	0.100	101546
174	33.33%	0.21	33.31%	0.20	0.100	102128
175	33.52%	0.21	33.50%	0.20	0.100	102711
176	33.72%	0.20	33.69%	0.20	0.100	103294
177	33.91%	0.20	33.88%	0.20	0.100	103876
178	34.10%	0.20	34.08%	0.20	0.100	104489
179	34.29%	0.20	34.27%	0.20	0.100	105072
180	34.48%	0.20	34.46%	0.20	0.100	105654
181	34.67%	0.20	34.65%	0.19	0.100	106237
182	34.87%	0.20	34.84%	0.19	0.100	106819
183	35.06%	0.20	35.03%	0.19	0.100	107402
184	35.25%	0.20	35.23%	0.19	0.100	108015
185	35.44%	0.19	35.42%	0.19	0.100	108598
186	35.63%	0.19	35.61%	0.19	0.100	109180
187	35.82%	0.19	35.80%	0.19	0.100	109763
188	36.02%	0.19	35.99%	0.19	0.100	110345
189	36.21%	0.19	36.19%	0.19	0.100	110959
190	36.40%	0.19	36.38%	0.19	0.100	111541
191	36.59%	0.19	36.57%	0.18	0.100	112124
192	36.78%	0.19	36.76%	0.18	0.100	112706
193	36.97%	0.19	36.95%	0.18	0.100	113289
194	37.16%	0.19	37.15%	0.18	0.100	113902
195	37.36%	0.18	37.34%	0.18	0.100	114484
196	37.55%	0.18	37.53%	0.18	0.100	115067
197	37.74%	0.18	37.72%	0.18	0.100	115650
198	37.93%	0.18	37.91%	0.18	0.100	116232
199	38.12%	0.18	38.10%	0.18	0.100	116815
200	38.31%	0.18	38.30%	0.18	0.100	117428
201	38.51%	0.18	38.49%	0.18	0.100	118010
202	38.70%	0.18	38.68%	0.17	0.100	118593
203	38.89%	0.18	38.87%	0.17	0.095	119175
204	39.08%	0.18	39.06%	0.17	0.090	119758
205	39.27%	0.18	39.26%	0.17	0.090	120371
206	39.46%	0.17	39.45%	0.17	0.090	120954
207	39.66%	0.17	39.64%	0.17	0.085	121536
208	39.85%	0.17	39.83%	0.17	0.079	122119
209	40.04%	0.17	40.02%	0.17	0.079	122701
210	40.23%	0.17	40.21%	0.17	0.079	123284
211	40.42%	0.17	40.41%	0.17	0.079	123897
212	40.61%	0.17	40.60%	0.17	0.079	124480
213	40.80%	0.17	40.79%	0.17	0.079	125062
214	41.00%	0.17	40.98%	0.16	0.079	125645
215	41.19%	0.17	41.17%	0.16	0.079	126227
216	41.38%	0.17	41.37%	0.16	0.079	126840
217	41.57%	0.17	41.56%	0.16	0.079	127423
218	41.76%	0.17	41.75%	0.16	0.079	128006
219	41.95%	0.16	41.94%	0.16	0.079	128588
220	42.15%	0.16	42.13%	0.16	0.079	129171
221	42.34%	0.16	42.33%	0.16	0.079	129784

222	42.53%	0.16	42.52%	0.16	0.079	130366
223	42.72%	0.16	42.71%	0.16	0.079	130949
224	42.91%	0.16	42.90%	0.16	0.079	131531
225	43.10%	0.16	43.09%	0.16	0.079	132114
226	43.30%	0.16	43.28%	0.16	0.079	132696
227	43.49%	0.16	43.48%	0.16	0.079	133310
228	43.68%	0.16	43.67%	0.15	0.079	133892
229	43.87%	0.16	43.86%	0.15	0.079	134475
230	44.06%	0.16	44.05%	0.15	0.079	135057
231	44.25%	0.16	44.24%	0.15	0.079	135640
232	44.44%	0.16	44.44%	0.15	0.079	136253
233	44.64%	0.15	44.63%	0.15	0.079	136836
234	44.83%	0.15	44.82%	0.15	0.079	137418
235	45.02%	0.15	45.01%	0.15	0.079	138001
236	45.21%	0.15	45.20%	0.15	0.074	138583
237	45.40%	0.15	45.40%	0.15	0.074	139196
238	45.59%	0.15	45.59%	0.15	0.074	139779
239	45.79%	0.15	45.78%	0.15	0.074	140361
240	45.98%	0.15	45.97%	0.15	0.074	140944
241	46.17%	0.15	46.16%	0.15	0.074	141527
242	46.36%	0.15	46.35%	0.15	0.074	142109
243	46.55%	0.15	46.55%	0.15	0.074	142722
244	46.74%	0.15	46.74%	0.14	0.074	143305
245	46.93%	0.15	46.93%	0.14	0.074	143887
246	47.13%	0.15	47.12%	0.14	0.074	144470
247	47.32%	0.15	47.31%	0.14	0.074	145052
248	47.51%	0.15	47.51%	0.14	0.074	145666
249	47.70%	0.14	47.70%	0.14	0.074	146248
250	47.89%	0.14	47.89%	0.14	0.074	146831
251	48.08%	0.14	48.08%	0.14	0.074	147413
252	48.28%	0.14	48.27%	0.14	0.074	147996
253	48.47%	0.14	48.47%	0.14	0.069	148609
254	48.66%	0.14	48.66%	0.14	0.069	149192
255	48.85%	0.14	48.85%	0.14	0.069	149774
256	49.04%	0.14	49.04%	0.14	0.069	150357
257	49.23%	0.14	49.23%	0.14	0.069	150939
258	49.43%	0.14	49.42%	0.14	0.064	151522
259	49.62%	0.14	49.62%	0.14	0.064	152135
260	49.81%	0.14	49.81%	0.14	0.064	152717
261	50.00%	0.14	50.00%	0.14	0.064	153300
262	50.19%	0.14	50.19%	0.13	0.064	153883
263	50.38%	0.14	50.38%	0.13	0.059	154465
264	50.57%	0.14	50.58%	0.13	0.059	155078
265	50.77%	0.14	50.77%	0.13	0.059	155661
266	50.96%	0.14	50.96%	0.13	0.059	156243
267	51.15%	0.13	51.15%	0.13	0.059	156826
268	51.34%	0.13	51.34%	0.13	0.059	157408
269	51.53%	0.13	51.53%	0.13	0.059	157991
270	51.72%	0.13	51.73%	0.13	0.059	158604
271	51.92%	0.13	51.92%	0.13	0.059	159187
272	52.11%	0.13	52.11%	0.13	0.059	159769
273	52.30%	0.13	52.30%	0.13	0.059	160352
274	52.49%	0.13	52.49%	0.13	0.059	160934
275	52.68%	0.13	52.69%	0.13	0.059	161548
276	52.87%	0.13	52.88%	0.13	0.059	162130
277	53.07%	0.13	53.07%	0.13	0.059	162713
278	53.26%	0.13	53.26%	0.13	0.059	163295
279	53.45%	0.13	53.45%	0.13	0.059	163878
280	53.64%	0.13	53.65%	0.13	0.059	164491

281	53.83%	0.13	53.84%	0.13	0.059	165073
282	54.02%	0.13	54.03%	0.13	0.059	165656
283	54.21%	0.13	54.22%	0.12	0.059	166239
284	54.41%	0.13	54.41%	0.12	0.059	166821
285	54.60%	0.13	54.60%	0.12	0.059	167404
286	54.79%	0.13	54.80%	0.12	0.059	168017
287	54.98%	0.13	54.99%	0.12	0.059	168599
288	55.17%	0.13	55.18%	0.12	0.059	169182
289	55.36%	0.12	55.37%	0.12	0.059	169764
290	55.56%	0.12	55.56%	0.12	0.059	170347
291	55.75%	0.12	55.76%	0.12	0.059	170960
292	55.94%	0.12	55.95%	0.12	0.059	171543
293	56.13%	0.12	56.14%	0.12	0.059	172125
294	56.32%	0.12	56.33%	0.12	0.059	172708
295	56.51%	0.12	56.52%	0.12	0.059	173290
296	56.70%	0.12	56.72%	0.12	0.059	173904
297	56.90%	0.12	56.91%	0.12	0.059	174486
298	57.09%	0.12	57.10%	0.12	0.059	175069
299	57.28%	0.12	57.29%	0.12	0.059	175651
300	57.47%	0.12	57.48%	0.12	0.059	176234
301	57.66%	0.12	57.67%	0.12	0.059	176816
302	57.85%	0.12	57.87%	0.12	0.059	177429
303	58.05%	0.12	58.06%	0.12	0.054	178012
304	58.24%	0.12	58.25%	0.12	0.054	178595
305	58.43%	0.12	58.44%	0.12	0.054	179177
306	58.62%	0.12	58.63%	0.12	0.054	179760
307	58.81%	0.12	58.83%	0.11	0.054	180373
308	59.00%	0.12	59.02%	0.11	0.054	180955
309	59.20%	0.12	59.21%	0.11	0.054	181538
310	59.39%	0.12	59.40%	0.11	0.054	182120
311	59.58%	0.12	59.59%	0.11	0.054	182703
312	59.77%	0.12	59.79%	0.11	0.048	183316
313	59.96%	0.12	59.98%	0.11	0.048	183899
314	60.15%	0.11	60.17%	0.11	0.048	184481
315	60.34%	0.11	60.36%	0.11	0.048	185064
316	60.54%	0.11	60.55%	0.11	0.048	185646
317	60.73%	0.11	60.74%	0.11	0.048	186229
318	60.92%	0.11	60.94%	0.11	0.048	186842
319	61.11%	0.11	61.13%	0.11	0.048	187425
320	61.30%	0.11	61.32%	0.11	0.048	188007
321	61.49%	0.11	61.51%	0.11	0.048	188590
322	61.69%	0.11	61.70%	0.11	0.048	189172
323	61.88%	0.11	61.90%	0.11	0.048	189785
324	62.07%	0.11	62.09%	0.11	0.048	190368
325	62.26%	0.11	62.28%	0.11	0.048	190950
326	62.45%	0.11	62.47%	0.11	0.048	191533
327	62.64%	0.11	62.66%	0.11	0.048	192116
328	62.84%	0.11	62.85%	0.11	0.048	192698
329	63.03%	0.11	63.05%	0.11	0.048	193311
330	63.22%	0.11	63.24%	0.11	0.048	193894
331	63.41%	0.11	63.43%	0.11	0.048	194476
332	63.60%	0.11	63.62%	0.11	0.048	195059
333	63.79%	0.11	63.81%	0.11	0.048	195641
334	63.98%	0.11	64.01%	0.11	0.048	196255
335	64.18%	0.11	64.20%	0.11	0.048	196837
336	64.37%	0.11	64.39%	0.10	0.048	197420
337	64.56%	0.11	64.58%	0.10	0.048	198002
338	64.75%	0.11	64.77%	0.10	0.048	198585
339	64.94%	0.11	64.97%	0.10	0.048	199198

340	65.13%	0.11	65.16%	0.10	0.048	199781
341	65.33%	0.11	65.35%	0.10	0.048	200363
342	65.52%	0.11	65.54%	0.10	0.048	200946
343	65.71%	0.10	65.73%	0.10	0.048	201528
344	65.90%	0.10	65.92%	0.10	0.048	202111
345	66.09%	0.10	66.12%	0.10	0.048	202724
346	66.28%	0.10	66.31%	0.10	0.048	203306
347	66.48%	0.10	66.50%	0.10	0.048	203889
348	66.67%	0.10	66.69%	0.10	0.048	204472
349	66.86%	0.10	66.88%	0.10	0.048	205054
350	67.05%	0.10	67.08%	0.10	0.048	205667
351	67.24%	0.10	67.27%	0.10	0.048	206250
352	67.43%	0.10	67.46%	0.10	0.048	206832
353	67.62%	0.10	67.65%	0.10	0.048	207415
354	67.82%	0.10	67.84%	0.10	0.048	207997
355	68.01%	0.10	68.04%	0.10	0.048	208611
356	68.20%	0.10	68.23%	0.10	0.048	209193
357	68.39%	0.10	68.42%	0.10	0.048	209776
358	68.58%	0.10	68.61%	0.10	0.048	210358
359	68.77%	0.10	68.80%	0.10	0.048	210941
360	68.97%	0.10	68.99%	0.10	0.048	211523
361	69.16%	0.10	69.19%	0.10	0.048	212137
362	69.35%	0.10	69.38%	0.10	0.048	212719
363	69.54%	0.10	69.57%	0.10	0.048	213302
364	69.73%	0.10	69.76%	0.10	0.048	213884
365	69.92%	0.10	69.95%	0.10	0.048	214467
366	70.11%	0.10	70.15%	0.10	0.048	215080
367	70.31%	0.10	70.34%	0.10	0.048	215662
368	70.50%	0.10	70.53%	0.10	0.048	216245
369	70.69%	0.10	70.72%	0.10	0.048	216828
370	70.88%	0.10	70.91%	0.10	0.048	217410
371	71.07%	0.10	71.11%	0.09	0.048	218023
372	71.26%	0.10	71.30%	0.09	0.048	218606
373	71.46%	0.10	71.49%	0.09	0.048	219188
374	71.65%	0.10	71.68%	0.09	0.048	219771
375	71.84%	0.10	71.87%	0.09	0.048	220353
376	72.03%	0.10	72.06%	0.09	0.048	220936
377	72.22%	0.10	72.26%	0.09	0.048	221549
378	72.41%	0.10	72.45%	0.09	0.048	222132
379	72.61%	0.09	72.64%	0.09	0.048	222714
380	72.80%	0.09	72.83%	0.09	0.048	223297
381	72.99%	0.09	73.02%	0.09	0.048	223879
382	73.18%	0.09	73.22%	0.09	0.048	224493
383	73.37%	0.09	73.41%	0.09	0.048	225075
384	73.56%	0.09	73.60%	0.09	0.048	225658
385	73.75%	0.09	73.79%	0.09	0.048	226240
386	73.95%	0.09	73.98%	0.09	0.048	226823
387	74.14%	0.09	74.17%	0.09	0.048	227405
388	74.33%	0.09	74.37%	0.09	0.048	228018
389	74.52%	0.09	74.56%	0.09	0.048	228601
390	74.71%	0.09	74.75%	0.09	0.048	229184
391	74.90%	0.09	74.94%	0.09	0.048	229766
392	75.10%	0.09	75.13%	0.09	0.048	230349
393	75.29%	0.09	75.33%	0.09	0.048	230962
394	75.48%	0.09	75.52%	0.09	0.048	231544
395	75.67%	0.09	75.71%	0.09	0.048	232127
396	75.86%	0.09	75.90%	0.09	0.048	232709
397	76.05%	0.09	76.09%	0.09	0.048	233292
398	76.25%	0.09	76.29%	0.09	0.048	233905

399	76.44%	0.09	76.48%	0.09	0.048	234488
400	76.63%	0.09	76.67%	0.09	0.048	235070
401	76.82%	0.09	76.86%	0.09	0.048	235653
402	77.01%	0.09	77.05%	0.09	0.048	236235
403	77.20%	0.09	77.24%	0.09	0.048	236818
404	77.39%	0.09	77.44%	0.09	0.048	237431
405	77.59%	0.09	77.63%	0.09	0.048	238014
406	77.78%	0.09	77.82%	0.09	0.048	238596
407	77.97%	0.09	78.01%	0.09	0.048	239179
408	78.16%	0.09	78.20%	0.09	0.048	239761
409	78.35%	0.09	78.40%	0.09	0.048	240374
410	78.54%	0.09	78.59%	0.09	0.048	240957
411	78.74%	0.09	78.78%	0.09	0.048	241539
412	78.93%	0.09	78.97%	0.09	0.048	242122
413	79.12%	0.09	79.16%	0.09	0.048	242705
414	79.31%	0.09	79.36%	0.09	0.048	243318
415	79.50%	0.09	79.55%	0.08	0.048	243900
416	79.69%	0.09	79.74%	0.08	0.048	244483
417	79.89%	0.09	79.93%	0.08	0.048	245065
418	80.08%	0.09	80.12%	0.08	0.048	245648
419	80.27%	0.09	80.31%	0.08	0.048	246230
420	80.46%	0.09	80.51%	0.08	0.048	246844
421	80.65%	0.09	80.70%	0.08	0.048	247426
422	80.84%	0.09	80.89%	0.08	0.048	248009
423	81.03%	0.09	81.08%	0.08	0.048	248591
424	81.23%	0.08	81.27%	0.08	0.048	249174
425	81.42%	0.08	81.47%	0.08	0.048	249787
426	81.61%	0.08	81.66%	0.08	0.048	250370
427	81.80%	0.08	81.85%	0.08	0.048	250952
428	81.99%	0.08	82.04%	0.08	0.043	251535
429	82.18%	0.08	82.23%	0.08	0.043	252117
430	82.38%	0.08	82.43%	0.08	0.043	252730
431	82.57%	0.08	82.62%	0.08	0.043	253313
432	82.76%	0.08	82.81%	0.08	0.043	253895
433	82.95%	0.08	83.00%	0.08	0.038	254478
434	83.14%	0.08	83.19%	0.08	0.038	255061
435	83.33%	0.08	83.38%	0.08	0.038	255643
436	83.52%	0.08	83.58%	0.08	0.038	256256
437	83.72%	0.08	83.77%	0.08	0.038	256839
438	83.91%	0.08	83.96%	0.08	0.038	257421
439	84.10%	0.08	84.15%	0.08	0.038	258004
440	84.29%	0.08	84.34%	0.08	0.038	258586
441	84.48%	0.08	84.54%	0.08	0.038	259200
442	84.67%	0.08	84.73%	0.08	0.038	259782
443	84.87%	0.08	84.92%	0.08	0.038	260365
444	85.06%	0.08	85.11%	0.08	0.038	260947
445	85.25%	0.08	85.30%	0.08	0.038	261530
446	85.44%	0.08	85.50%	0.08	0.038	262143
447	85.63%	0.08	85.69%	0.08	0.038	262726
448	85.82%	0.08	85.88%	0.08	0.038	263308
449	86.02%	0.08	86.07%	0.08	0.038	263891
450	86.21%	0.08	86.26%	0.08	0.038	264473
451	86.40%	0.08	86.45%	0.08	0.038	265056
452	86.59%	0.08	86.65%	0.08	0.038	265669
453	86.78%	0.08	86.84%	0.08	0.038	266251
454	86.97%	0.08	87.03%	0.08	0.038	266834
455	87.16%	0.08	87.22%	0.08	0.038	267417
456	87.36%	0.08	87.41%	0.08	0.038	267999
457	87.55%	0.08	87.61%	0.08	0.038	268612

458	87.74%	0.08	87.80%	0.08	0.038	269195
459	87.93%	0.08	87.99%	0.08	0.038	269777
460	88.12%	0.08	88.18%	0.08	0.038	270360
461	88.31%	0.08	88.37%	0.08	0.038	270942
462	88.51%	0.08	88.56%	0.08	0.038	271525
463	88.70%	0.08	88.76%	0.08	0.038	272138
464	88.89%	0.08	88.95%	0.08	0.038	272721
465	89.08%	0.08	89.14%	0.08	0.038	273303
466	89.27%	0.08	89.33%	0.08	0.038	273886
467	89.46%	0.08	89.52%	0.08	0.038	274468
468	89.66%	0.08	89.72%	0.08	0.038	275082
469	89.85%	0.08	89.91%	0.08	0.038	275664
470	90.04%	0.08	90.10%	0.07	0.038	276247
471	90.23%	0.08	90.29%	0.07	0.038	276829
472	90.42%	0.08	90.48%	0.07	0.038	277412
473	90.61%	0.08	90.68%	0.07	0.038	278025
474	90.80%	0.08	90.87%	0.07	0.038	278607
475	91.00%	0.08	91.06%	0.07	0.038	279190
476	91.19%	0.08	91.25%	0.07	0.038	279773
477	91.38%	0.08	91.44%	0.07	0.038	280355
478	91.57%	0.08	91.63%	0.07	0.038	280938
479	91.76%	0.08	91.83%	0.07	0.038	281551
480	91.95%	0.08	92.02%	0.07	0.038	282133
481	92.15%	0.07	92.21%	0.07	0.038	282716
482	92.34%	0.07	92.40%	0.07	0.038	283298
483	92.53%	0.07	92.59%	0.07	0.038	283881
484	92.72%	0.07	92.79%	0.07	0.038	284494
485	92.91%	0.07	92.98%	0.07	0.038	285077
486	93.10%	0.07	93.17%	0.07	0.033	285659
487	93.30%	0.07	93.36%	0.07	0.033	286242
488	93.49%	0.07	93.55%	0.07	0.033	286824
489	93.68%	0.07	93.75%	0.07	0.033	287438
490	93.87%	0.07	93.94%	0.07	0.033	288020
491	94.06%	0.07	94.13%	0.07	0.033	288603
492	94.25%	0.07	94.32%	0.07	0.033	289185
493	94.44%	0.07	94.51%	0.07	0.033	289768
494	94.64%	0.07	94.70%	0.07	0.033	290350
495	94.83%	0.07	94.90%	0.07	0.033	290963
496	95.02%	0.07	95.09%	0.07	0.032	291546
497	95.21%	0.07	95.28%	0.07	0.032	292128
498	95.40%	0.07	95.47%	0.07	0.032	292711
499	95.59%	0.07	95.66%	0.07	0.032	293294
500	95.79%	0.07	95.86%	0.07	0.028	293907
501	95.98%	0.07	96.05%	0.07	0.028	294489
502	96.17%	0.07	96.24%	0.07	0.028	295072
503	96.36%	0.07	96.43%	0.07	0.028	295654
504	96.55%	0.07	96.62%	0.07	0.028	296237
505	96.74%	0.07	96.82%	0.07	0.028	296850
506	96.93%	0.07	97.01%	0.07	0.028	297433
507	97.13%	0.07	97.20%	0.07	0.025	298015
508	97.32%	0.07	97.39%	0.07	0.023	298598
509	97.51%	0.07	97.58%	0.07	0.023	299180
510	97.70%	0.07	97.77%	0.07	0.023	299763
511	97.89%	0.07	97.97%	0.07	0.023	300376
512	98.08%	0.07	98.16%	0.07	0.023	300959
513	98.28%	0.07	98.35%	0.07	0.023	301541
514	98.47%	0.07	98.54%	0.07	0.023	302124
515	98.66%	0.07	98.73%	0.07	0.023	302706
516	98.85%	0.07	98.93%	0.07	0.023	303319

517	99.04%	0.07	99.12%	0.07	0.023	303902
518	99.23%	0.07	99.31%	0.07	0.023	304484
519	99.43%	0.07	99.50%	0.07	0.023	305067
520	99.62%	0.07	99.69%	0.07	0.022	305650
521	99.81%	0.07	99.88%	0.07	0.022	306232

P.O.C. #1: PEAK EVENTS - POST UNMITIGATED

WEIBULL (SWMM)

F = m/(nr+1) where F = frequency
m = event rank
nr = total number of event
n = number of year anlayzed

CUNNANE

F = (i-0.4)/(n+0.2)
i = rank
n = sample size = # of storms

Number of Years Analyzed (n): 35
Total number of events (nr) 189

	Weibull		Cunnane		
m or i	**F**	**Return (yrs)**	**F**	**Return**	**Q**
1	0.53%	36.00	0.32%	58.67	11.021
2	1.05%	18.00	0.85%	22.00	6.965
3	1.58%	12.00	1.37%	13.54	6.492
4	2.11%	9.00	1.90%	9.78	5.981
5	2.63%	7.20	2.43%	7.65	5.557
6	3.16%	6.00	2.96%	6.29	5.541
7	3.68%	5.14	3.49%	5.33	5.351
8	4.21%	4.50	4.02%	4.63	5.049
9	4.74%	4.00	4.55%	4.09	5.044
10	5.26%	3.60	5.07%	3.67	4.873
11	5.79%	3.27	5.60%	3.32	4.389
12	6.32%	3.00	6.13%	3.03	4.351
13	6.84%	2.77	6.66%	2.79	4.322
14	7.37%	2.57	7.19%	2.59	4.298
15	7.89%	2.40	7.72%	2.41	4.236
16	8.42%	2.25	8.25%	2.26	4.125
17	8.95%	2.12	8.77%	2.12	4.120
18	9.47%	2.00	9.30%	2.00	4.088
19	10.00%	1.89	9.83%	1.89	4.043
20	10.53%	1.80	10.36%	1.80	3.928
21	11.05%	1.71	10.89%	1.71	3.823
22	11.58%	1.64	11.42%	1.63	3.802
23	12.11%	1.57	11.95%	1.56	3.757
24	12.63%	1.50	12.47%	1.49	3.736
25	13.16%	1.44	13.00%	1.43	3.684
26	13.68%	1.38	13.53%	1.38	3.651
27	14.21%	1.33	14.06%	1.32	3.616
28	14.74%	1.29	14.59%	1.28	3.572
29	15.26%	1.24	15.12%	1.23	3.533
30	15.79%	1.20	15.64%	1.19	3.457
31	16.32%	1.16	16.17%	1.15	3.333
32	16.84%	1.13	16.70%	1.11	3.265
33	17.37%	1.09	17.23%	1.08	3.193
34	17.89%	1.06	17.76%	1.05	3.179
35	18.42%	1.03	18.29%	1.02	3.114
36	18.95%	1.00	18.82%	0.99	2.881
37	19.47%	0.97	19.34%	0.96	2.750

38	20.00%	0.95	19.87%	0.94	2.736
39	20.53%	0.92	20.40%	0.91	2.672
40	21.05%	0.90	20.93%	0.89	2.635
41	21.58%	0.88	21.46%	0.87	2.634
42	22.11%	0.86	21.99%	0.85	2.626
43	22.63%	0.84	22.52%	0.83	2.583
44	23.16%	0.82	23.04%	0.81	2.557
45	23.68%	0.80	23.57%	0.79	2.553
46	24.21%	0.78	24.10%	0.77	2.512
47	24.74%	0.77	24.63%	0.76	2.507
48	25.26%	0.75	25.16%	0.74	2.498
49	25.79%	0.73	25.69%	0.72	2.488
50	26.32%	0.72	26.22%	0.71	2.466
51	26.84%	0.71	26.74%	0.70	2.466
52	27.37%	0.69	27.27%	0.68	2.463
53	27.89%	0.68	27.80%	0.67	2.446
54	28.42%	0.67	28.33%	0.66	2.435
55	28.95%	0.65	28.86%	0.64	2.426
56	29.47%	0.64	29.39%	0.63	2.397
57	30.00%	0.63	29.92%	0.62	2.359
58	30.53%	0.62	30.44%	0.61	2.355
59	31.05%	0.61	30.97%	0.60	2.337
60	31.58%	0.60	31.50%	0.59	2.320
61	32.11%	0.59	32.03%	0.58	2.293
62	32.63%	0.58	32.56%	0.57	2.277
63	33.16%	0.57	33.09%	0.56	2.259
64	33.68%	0.56	33.62%	0.55	2.256
65	34.21%	0.55	34.14%	0.54	2.221
66	34.74%	0.55	34.67%	0.54	2.213
67	35.26%	0.54	35.20%	0.53	2.172
68	35.79%	0.53	35.73%	0.52	2.159
69	36.32%	0.52	36.26%	0.51	2.156
70	36.84%	0.51	36.79%	0.51	2.155
71	37.37%	0.51	37.32%	0.50	2.136
72	37.89%	0.50	37.84%	0.49	2.125
73	38.42%	0.49	38.37%	0.48	2.119
74	38.95%	0.49	38.90%	0.48	2.109
75	39.47%	0.48	39.43%	0.47	2.094
76	40.00%	0.47	39.96%	0.47	2.092
77	40.53%	0.47	40.49%	0.46	2.065
78	41.05%	0.46	41.01%	0.45	2.053
79	41.58%	0.46	41.54%	0.45	2.053
80	42.11%	0.45	42.07%	0.44	1.998
81	42.63%	0.44	42.60%	0.44	1.972
82	43.16%	0.44	43.13%	0.43	1.963
83	43.68%	0.43	43.66%	0.43	1.940
84	44.21%	0.43	44.19%	0.42	1.903
85	44.74%	0.42	44.71%	0.42	1.901
86	45.26%	0.42	45.24%	0.41	1.880
87	45.79%	0.41	45.77%	0.41	1.847
88	46.32%	0.41	46.30%	0.40	1.843
89	46.84%	0.40	46.83%	0.40	1.837

90	47.37%	0.40	47.36%	0.39	1.814
91	47.89%	0.40	47.89%	0.39	1.797
92	48.42%	0.39	48.41%	0.38	1.770
93	48.95%	0.39	48.94%	0.38	1.750
94	49.47%	0.38	49.47%	0.38	1.744
95	50.00%	0.38	50.00%	0.37	1.742
96	50.53%	0.38	50.53%	0.37	1.742
97	51.05%	0.37	51.06%	0.36	1.742
98	51.58%	0.37	51.59%	0.36	1.739
99	52.11%	0.36	52.11%	0.36	1.714
100	52.63%	0.36	52.64%	0.35	1.707
101	53.16%	0.36	53.17%	0.35	1.698
102	53.68%	0.35	53.70%	0.35	1.689
103	54.21%	0.35	54.23%	0.34	1.688
104	54.74%	0.35	54.76%	0.34	1.671
105	55.26%	0.34	55.29%	0.34	1.644
106	55.79%	0.34	55.81%	0.33	1.635
107	56.32%	0.34	56.34%	0.33	1.628
108	56.84%	0.33	56.87%	0.33	1.624
109	57.37%	0.33	57.40%	0.32	1.616
110	57.89%	0.33	57.93%	0.32	1.610
111	58.42%	0.32	58.46%	0.32	1.607
112	58.95%	0.32	58.99%	0.32	1.606
113	59.47%	0.32	59.51%	0.31	1.592
114	60.00%	0.32	60.04%	0.31	1.569
115	60.53%	0.31	60.57%	0.31	1.569
116	61.05%	0.31	61.10%	0.30	1.566
117	61.58%	0.31	61.63%	0.30	1.565
118	62.11%	0.31	62.16%	0.30	1.531
119	62.63%	0.30	62.68%	0.30	1.530
120	63.16%	0.30	63.21%	0.29	1.485
121	63.68%	0.30	63.74%	0.29	1.473
122	64.21%	0.30	64.27%	0.29	1.469
123	64.74%	0.29	64.80%	0.29	1.464
124	65.26%	0.29	65.33%	0.28	1.445
125	65.79%	0.29	65.86%	0.28	1.442
126	66.32%	0.29	66.38%	0.28	1.431
127	66.84%	0.28	66.91%	0.28	1.413
128	67.37%	0.28	67.44%	0.28	1.410
129	67.89%	0.28	67.97%	0.27	1.401
130	68.42%	0.28	68.50%	0.27	1.368
131	68.95%	0.27	69.03%	0.27	1.359
132	69.47%	0.27	69.56%	0.27	1.355
133	70.00%	0.27	70.08%	0.27	1.353
134	70.53%	0.27	70.61%	0.26	1.344
135	71.05%	0.27	71.14%	0.26	1.336
136	71.58%	0.26	71.67%	0.26	1.329
137	72.11%	0.26	72.20%	0.26	1.327
138	72.63%	0.26	72.73%	0.26	1.316
139	73.16%	0.26	73.26%	0.25	1.303
140	73.68%	0.26	73.78%	0.25	1.291
141	74.21%	0.26	74.31%	0.25	1.259

142	74.74%	0.25	74.84%	0.25	1.242
143	75.26%	0.25	75.37%	0.25	1.199
144	75.79%	0.25	75.90%	0.25	1.176
145	76.32%	0.25	76.43%	0.24	1.173
146	76.84%	0.25	76.96%	0.24	1.164
147	77.37%	0.24	77.48%	0.24	1.125
148	77.89%	0.24	78.01%	0.24	1.124
149	78.42%	0.24	78.54%	0.24	1.105
150	78.95%	0.24	79.07%	0.24	1.093
151	79.47%	0.24	79.60%	0.23	1.075
152	80.00%	0.24	80.13%	0.23	1.065
153	80.53%	0.24	80.66%	0.23	1.063
154	81.05%	0.23	81.18%	0.23	0.990
155	81.58%	0.23	81.71%	0.23	0.973
156	82.11%	0.23	82.24%	0.23	0.941
157	82.63%	0.23	82.77%	0.22	0.936
158	83.16%	0.23	83.30%	0.22	0.925
159	83.68%	0.23	83.83%	0.22	0.922
160	84.21%	0.23	84.36%	0.22	0.898
161	84.74%	0.22	84.88%	0.22	0.890
162	85.26%	0.22	85.41%	0.22	0.877
163	85.79%	0.22	85.94%	0.22	0.791
164	86.32%	0.22	86.47%	0.22	0.790
165	86.84%	0.22	87.00%	0.21	0.778
166	87.37%	0.22	87.53%	0.21	0.776
167	87.89%	0.22	88.05%	0.21	0.682
168	88.42%	0.21	88.58%	0.21	0.676
169	88.95%	0.21	89.11%	0.21	0.664
170	89.47%	0.21	89.64%	0.21	0.658
171	90.00%	0.21	90.17%	0.21	0.624
172	90.53%	0.21	90.70%	0.21	0.618
173	91.05%	0.21	91.23%	0.20	0.601
174	91.58%	0.21	91.75%	0.20	0.557
175	92.11%	0.21	92.28%	0.20	0.507
176	92.63%	0.20	92.81%	0.20	0.503
177	93.16%	0.20	93.34%	0.20	0.447
178	93.68%	0.20	93.87%	0.20	0.447
179	94.21%	0.20	94.40%	0.20	0.414
180	94.74%	0.20	94.93%	0.20	0.409
181	95.26%	0.20	95.45%	0.19	0.396
182	95.79%	0.20	95.98%	0.19	0.394
183	96.32%	0.20	96.51%	0.19	0.382
184	96.84%	0.20	97.04%	0.19	0.332
185	97.37%	0.19	97.57%	0.19	0.220
186	97.89%	0.19	98.10%	0.19	0.196
187	98.42%	0.19	98.63%	0.19	0.152
188	98.95%	0.19	99.15%	0.19	0.089
189	99.47%	0.19	99.68%	0.19	0.081

P.O.C. #1: PEAK EVENTS - POST MITIGATED

WEIBULL (SWMM)

F = m/(nr+1) where F = frequency
m = event rank
nr = total number of event
n = number of year anlayzed

CUNNANE

F = (i-0.4)/(n+0.2)
i = rank
n = sample size = # of storms

Number of Years Analyzed (n): 35
Total number of events (nr) 130

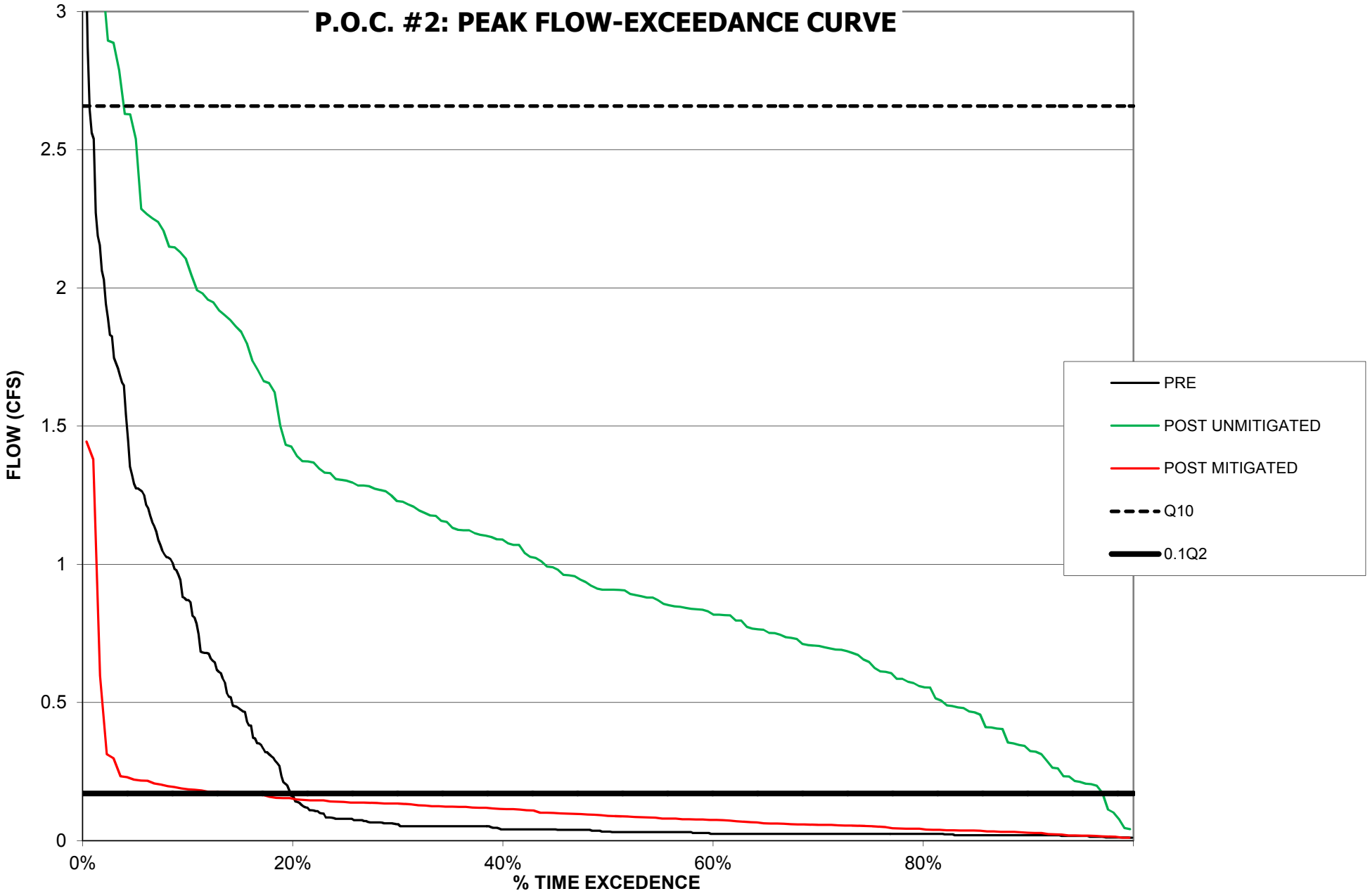
	Weibull		Cunnane			
m or i	F	Return (yrs)	F	Return	Q	HRS>Q
1	0.76%	36.00	0.46%	58.67	0.554	1410
2	1.53%	18.00	1.23%	22.00	0.542	3771
3	2.29%	12.00	2.00%	13.54	0.485	6132
4	3.05%	9.00	2.76%	9.78	0.458	8462
5	3.82%	7.20	3.53%	7.65	0.447	10823
6	4.58%	6.00	4.30%	6.29	0.447	13184
7	5.34%	5.14	5.07%	5.33	0.442	15545
8	6.11%	4.50	5.84%	4.63	0.419	17905
9	6.87%	4.00	6.61%	4.09	0.417	20266
10	7.63%	3.60	7.37%	3.67	0.416	22596
11	8.40%	3.27	8.14%	3.32	0.406	24957
12	9.16%	3.00	8.91%	3.03	0.387	27318
13	9.92%	2.77	9.68%	2.79	0.382	29679
14	10.69%	2.57	10.45%	2.59	0.372	32040
15	11.45%	2.40	11.21%	2.41	0.363	34370
16	12.21%	2.25	11.98%	2.26	0.362	36731
17	12.98%	2.12	12.75%	2.12	0.351	39092
18	13.74%	2.00	13.52%	2.00	0.343	41452
19	14.50%	1.89	14.29%	1.89	0.342	43813
20	15.27%	1.80	15.05%	1.80	0.342	46143
21	16.03%	1.71	15.82%	1.71	0.341	48504
22	16.79%	1.64	16.59%	1.63	0.339	50865
23	17.56%	1.57	17.36%	1.56	0.329	53226
24	18.32%	1.50	18.13%	1.49	0.323	55587
25	19.08%	1.44	18.89%	1.43	0.322	57917
26	19.85%	1.38	19.66%	1.38	0.321	60278
27	20.61%	1.33	20.43%	1.32	0.310	62638
28	21.37%	1.29	21.20%	1.28	0.304	64999
29	22.14%	1.24	21.97%	1.23	0.295	67360
30	22.90%	1.20	22.73%	1.19	0.292	69690
31	23.66%	1.16	23.50%	1.15	0.292	72051
32	24.43%	1.13	24.27%	1.11	0.284	74412
33	25.19%	1.09	25.04%	1.08	0.284	76773
34	25.95%	1.06	25.81%	1.05	0.283	79133
35	26.72%	1.03	26.57%	1.02	0.270	81464
36	27.48%	1.00	27.34%	0.99	0.269	83824
37	28.24%	0.97	28.11%	0.96	0.268	86185

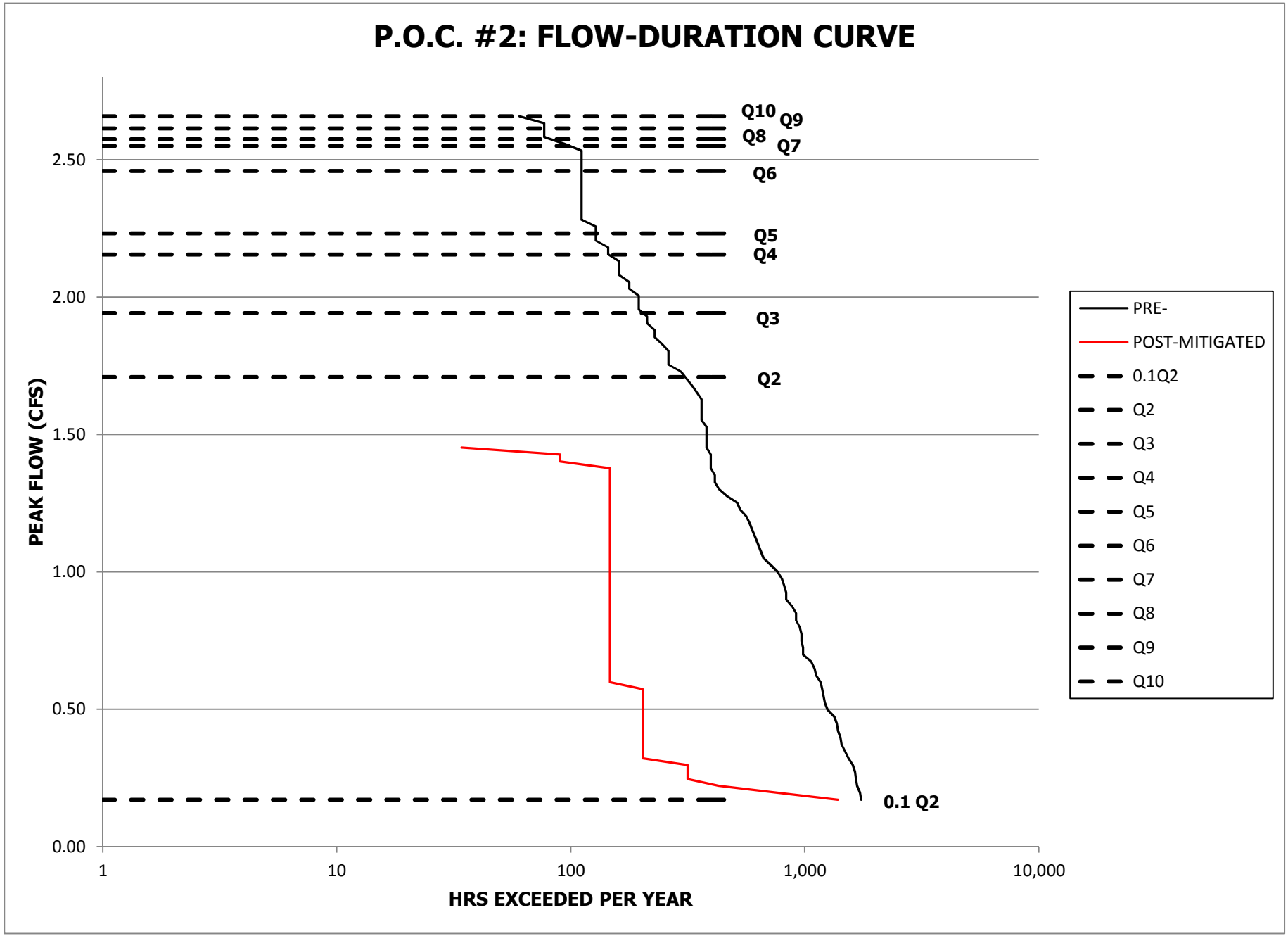
38	29.01%	0.95	28.88%	0.94	0.267	88546
39	29.77%	0.92	29.65%	0.91	0.266	90907
40	30.53%	0.90	30.41%	0.89	0.265	93237
41	31.30%	0.88	31.18%	0.87	0.264	95598
42	32.06%	0.86	31.95%	0.85	0.263	97959
43	32.82%	0.84	32.72%	0.83	0.257	100320
44	33.59%	0.82	33.49%	0.81	0.255	102680
45	34.35%	0.80	34.25%	0.79	0.254	105011
46	35.11%	0.78	35.02%	0.77	0.250	107371
47	35.88%	0.77	35.79%	0.76	0.248	109732
48	36.64%	0.75	36.56%	0.74	0.239	112093
49	37.40%	0.73	37.33%	0.72	0.238	114454
50	38.17%	0.72	38.10%	0.71	0.229	116815
51	38.93%	0.71	38.86%	0.70	0.229	119145
52	39.69%	0.69	39.63%	0.68	0.227	121506
53	40.46%	0.68	40.40%	0.67	0.224	123866
54	41.22%	0.67	41.17%	0.66	0.220	126227
55	41.98%	0.65	41.94%	0.64	0.218	128588
56	42.75%	0.64	42.70%	0.63	0.218	130918
57	43.51%	0.63	43.47%	0.62	0.218	133279
58	44.27%	0.62	44.24%	0.61	0.216	135640
59	45.04%	0.61	45.01%	0.60	0.215	138001
60	45.80%	0.60	45.78%	0.59	0.211	140361
61	46.56%	0.59	46.54%	0.58	0.205	142692
62	47.33%	0.58	47.31%	0.57	0.202	145052
63	48.09%	0.57	48.08%	0.56	0.200	147413
64	48.85%	0.56	48.85%	0.55	0.197	149774
65	49.62%	0.55	49.62%	0.54	0.197	152135
66	50.38%	0.55	50.38%	0.54	0.192	154465
67	51.15%	0.54	51.15%	0.53	0.190	156826
68	51.91%	0.53	51.92%	0.52	0.179	159187
69	52.67%	0.52	52.69%	0.51	0.172	161548
70	53.44%	0.51	53.46%	0.51	0.171	163908
71	54.20%	0.51	54.22%	0.50	0.170	166239
72	54.96%	0.50	54.99%	0.49	0.167	168599
73	55.73%	0.49	55.76%	0.48	0.167	170960
74	56.49%	0.49	56.53%	0.48	0.163	173321
75	57.25%	0.48	57.30%	0.47	0.152	175682
76	58.02%	0.47	58.06%	0.47	0.149	178012
77	58.78%	0.47	58.83%	0.46	0.149	180373
78	59.54%	0.46	59.60%	0.45	0.142	182734
79	60.31%	0.46	60.37%	0.45	0.139	185094
80	61.07%	0.45	61.14%	0.44	0.137	187455
81	61.83%	0.44	61.90%	0.44	0.132	189785
82	62.60%	0.44	62.67%	0.43	0.130	192146
83	63.36%	0.43	63.44%	0.43	0.130	194507
84	64.12%	0.43	64.21%	0.42	0.127	196868
85	64.89%	0.42	64.98%	0.42	0.124	199229
86	65.65%	0.42	65.75%	0.41	0.122	201590
87	66.41%	0.41	66.51%	0.41	0.119	203920
88	67.18%	0.41	67.28%	0.40	0.117	206280
89	67.94%	0.40	68.05%	0.40	0.112	208641

90	68.70%	0.40	68.82%	0.39	0.109	211002
91	69.47%	0.40	69.59%	0.39	0.104	213363
92	70.23%	0.39	70.35%	0.38	0.096	215693
93	70.99%	0.39	71.12%	0.38	0.094	218054
94	71.76%	0.38	71.89%	0.38	0.090	220415
95	72.52%	0.38	72.66%	0.37	0.088	222776
96	73.28%	0.38	73.43%	0.37	0.087	225136
97	74.05%	0.37	74.19%	0.36	0.087	227467
98	74.81%	0.37	74.96%	0.36	0.073	229827
99	75.57%	0.36	75.73%	0.36	0.072	232188
100	76.34%	0.36	76.50%	0.35	0.070	234549
101	77.10%	0.36	77.27%	0.35	0.068	236910
102	77.86%	0.35	78.03%	0.35	0.067	239240
103	78.63%	0.35	78.80%	0.34	0.062	241601
104	79.39%	0.35	79.57%	0.34	0.059	243962
105	80.15%	0.34	80.34%	0.34	0.058	246322
106	80.92%	0.34	81.11%	0.33	0.055	248683
107	81.68%	0.34	81.87%	0.33	0.054	251013
108	82.44%	0.33	82.64%	0.33	0.052	253374
109	83.21%	0.33	83.41%	0.32	0.051	255735
110	83.97%	0.33	84.18%	0.32	0.050	258096
111	84.73%	0.32	84.95%	0.32	0.047	260457
112	85.50%	0.32	85.71%	0.32	0.047	262787
113	86.26%	0.32	86.48%	0.31	0.044	265148
114	87.02%	0.32	87.25%	0.31	0.043	267509
115	87.79%	0.31	88.02%	0.31	0.041	269869
116	88.55%	0.31	88.79%	0.30	0.040	272230
117	89.31%	0.31	89.55%	0.30	0.040	274560
118	90.08%	0.31	90.32%	0.30	0.039	276921
119	90.84%	0.30	91.09%	0.30	0.034	279282
120	91.60%	0.30	91.86%	0.29	0.030	281643
121	92.37%	0.30	92.63%	0.29	0.028	284004
122	93.13%	0.30	93.39%	0.29	0.028	286334
123	93.89%	0.29	94.16%	0.29	0.025	288695
124	94.66%	0.29	94.93%	0.28	0.024	291055
125	95.42%	0.29	95.70%	0.28	0.023	293416
126	96.18%	0.29	96.47%	0.28	0.023	295777
127	96.95%	0.28	97.24%	0.28	0.023	298138
128	97.71%	0.28	98.00%	0.28	0.023	300468
129	98.47%	0.28	98.77%	0.27	0.022	302829
130	99.24%	0.28	99.54%	0.27	0.021	305190

APPENDIX II: P.O.C. #2 SWMM RESULTS

A. PEAK FLOW-EXCEEDANCE CURVE
B. FLOW-DURATION CURVE
C. FLOW-DURATION DATA TABLE
D. PEAK EVENT TABLE – EXISTING *(INCLUDES Q2 & Q10 THRESHOLDS)*
E. PEAK EVENT TABLE – POST-UNMITIGATED
F. PEAK EVENT TABLE – POST-MITIGATED


P.O.C. #2: PEAK FLOW-EXCEEDANCE CURVE
FLOW (CFS)
3
2.5
2
1.5
1
0.5
0
0%
20%
40%
60%
80%
% TIME EXCEDENCE
PRE
POST UNMITIGATED
POST MITIGATED
Q10
0.1Q2


P.O.C. #2: FLOW-DURATION CURVE
PEAK FLOW (CFS)
2.50
2.00
1.50
1.00
0.50
0.00
1
10
100
1,000
10,000
HRS EXCEEDED PER YEAR
Q10
Q9
Q8
Q7
Q6
Q5
Q4
Q3
Q2
0.1 Q2
PRE-
POST-MITIGATED
0.1Q2
Q2
Q3
Q4
Q5
Q6
Q7
Q8
Q9
Q10

P.O.C. #1: FLOW-DURATION TABLE

Q2 =	3.342	CFS	FRACTION =	10%
Q10 =	5.1344	CFS		
STEP =	0.048	CFS		
COUNT =	306,600	HRS		
	35	YRS		

	EXISTING			MITIGATED			PASS OR
INTERVAL	Q (CFS)	HRS>Q	HRS/YR	HRS>Q	HRS/YR	POST/PRE	FAIL
1	0.3342	60952	1741	53226	1521	87%	PASS
2	0.3827	60370	1725	29679	848	49%	PASS
3	0.4312	58591	1674	17905	512	31%	PASS
4	0.4797	58009	1657	8462	242	15%	PASS
5	0.5281	58009	1657	6132	175	11%	PASS
6	0.5766	56230	1607	1410	40	3%	PASS
7	0.6251	54483	1557	1410	NULL	NULL	NULL
8	0.6736	52705	1506	1410	NULL	NULL	NULL
9	0.7221	50957	1456	1410	NULL	NULL	NULL
10	0.7706	49761	1422	1410	NULL	NULL	NULL
11	0.8191	49179	1405	1410	NULL	NULL	NULL
12	0.8676	48014	1372	1410	NULL	NULL	NULL
13	0.9160	46818	1338	1410	NULL	NULL	NULL
14	0.9645	44457	1270	1410	NULL	NULL	NULL
15	1.0130	43874	1254	1410	NULL	NULL	NULL
16	1.0615	42127	1204	1410	NULL	NULL	NULL
17	1.1100	42127	1204	1410	NULL	NULL	NULL
18	1.1585	41544	1187	1410	NULL	NULL	NULL
19	1.2070	39183	1120	1410	NULL	NULL	NULL
20	1.2555	38601	1103	1410	NULL	NULL	NULL
21	1.3039	37405	1069	1410	NULL	NULL	NULL
22	1.3524	34462	985	1410	NULL	NULL	NULL
23	1.4009	34462	985	1410	NULL	NULL	NULL
24	1.4494	33879	968	1410	NULL	NULL	NULL
25	1.4979	33879	968	1410	NULL	NULL	NULL
26	1.5464	33297	951	1410	NULL	NULL	NULL
27	1.5949	32132	918	1410	NULL	NULL	NULL
28	1.6434	32132	918	1410	NULL	NULL	NULL
29	1.6918	31518	901	1410	NULL	NULL	NULL
30	1.7403	29188	834	1410	NULL	NULL	NULL
31	1.7888	29188	834	1410	NULL	NULL	NULL
32	1.8373	28575	816	1410	NULL	NULL	NULL
33	1.8858	27993	800	1410	NULL	NULL	NULL
34	1.9343	27410	783	1410	NULL	NULL	NULL
35	1.9828	25049	716	1410	NULL	NULL	NULL
36	2.0312	23302	666	1410	NULL	NULL	NULL
37	2.0797	22719	649	1410	NULL	NULL	NULL
38	2.1282	22106	632	1410	NULL	NULL	NULL
39	2.1767	21523	615	1410	NULL	NULL	NULL
40	2.2252	20941	598	1410	NULL	NULL	NULL
41	2.2737	20358	582	1410	NULL	NULL	NULL
42	2.3222	19776	565	1410	NULL	NULL	NULL
43	2.3707	18580	531	1410	NULL	NULL	NULL
44	2.4191	18580	531	1410	NULL	NULL	NULL
45	2.4676	16832	481	1410	NULL	NULL	NULL

46	2.5161	15054	430	1410	NULL	NULL	NULL
47	2.5646	15054	430	1410	NULL	NULL	NULL
48	2.6131	14472	413	1410	NULL	NULL	NULL
49	2.6616	13889	397	1410	NULL	NULL	NULL
50	2.7101	13889	397	1410	NULL	NULL	NULL
51	2.7586	13889	397	1410	NULL	NULL	NULL
52	2.8070	13889	397	1410	NULL	NULL	NULL
53	2.8555	13306	380	1410	NULL	NULL	NULL
54	2.9040	13306	380	1410	NULL	NULL	NULL
55	2.9525	13306	380	1410	NULL	NULL	NULL
56	3.0010	13306	380	1410	NULL	NULL	NULL
57	3.0495	12693	363	1410	NULL	NULL	NULL
58	3.0980	12693	363	1410	NULL	NULL	NULL
59	3.1465	12693	363	1410	NULL	NULL	NULL
60	3.1949	11528	329	1410	NULL	NULL	NULL
61	3.2434	11528	329	1410	NULL	NULL	NULL
62	3.2919	11528	329	1410	NULL	NULL	NULL
63	3.3404	10946	313	1410	NULL	NULL	NULL
64	3.3889	9750	279	1410	NULL	NULL	NULL
65	3.4374	9167	262	1410	NULL	NULL	NULL
66	3.4859	9167	262	1410	NULL	NULL	NULL
67	3.5343	9167	262	1410	NULL	NULL	NULL
68	3.5828	8002	229	1410	NULL	NULL	NULL
69	3.6313	8002	229	1410	NULL	NULL	NULL
70	3.6798	7420	212	1410	NULL	NULL	NULL
71	3.7283	7420	212	1410	NULL	NULL	NULL
72	3.7768	6837	195	1410	NULL	NULL	NULL
73	3.8253	6837	195	1410	NULL	NULL	NULL
74	3.8738	6837	195	1410	NULL	NULL	NULL
75	3.9222	6837	195	1410	NULL	NULL	NULL
76	3.9707	6837	195	1410	NULL	NULL	NULL
77	4.0192	5641	161	1410	NULL	NULL	NULL
78	4.0677	5641	161	1410	NULL	NULL	NULL
79	4.1162	5641	161	1410	NULL	NULL	NULL
80	4.1647	5641	161	1410	NULL	NULL	NULL
81	4.2132	4476	128	1410	NULL	NULL	NULL
82	4.2617	4476	128	1410	NULL	NULL	NULL
83	4.3101	4476	128	1410	NULL	NULL	NULL
84	4.3586	4476	128	1410	NULL	NULL	NULL
85	4.4071	4476	128	1410	NULL	NULL	NULL
86	4.4556	3894	111	1410	NULL	NULL	NULL
87	4.5041	3894	111	1410	NULL	NULL	NULL
88	4.5526	3894	111	1410	NULL	NULL	NULL
89	4.6011	3894	111	1410	NULL	NULL	NULL
90	4.6496	3894	111	1410	NULL	NULL	NULL
91	4.6980	3894	111	1410	NULL	NULL	NULL
92	4.7465	3894	111	1410	NULL	NULL	NULL
93	4.7950	3894	111	1410	NULL	NULL	NULL
94	4.8435	3894	111	1410	NULL	NULL	NULL
95	4.8920	3894	111	1410	NULL	NULL	NULL
96	4.9405	3281	94	1410	NULL	NULL	NULL
97	4.9890	2698	77	1410	NULL	NULL	NULL
98	5.0374	2698	77	1410	NULL	NULL	NULL
99	5.0859	2698	77	1410	NULL	NULL	NULL
100	5.1344	2116	60	1410	NULL	NULL	NULL

P.O.C. #2: PEAK EVENTS - EXISTING

WEIBULL (SWMM)

F = m/(nr+1) where F = frequency
m = event rank
nr = total number of event
n = number of year anlayzed

CUNNANE

F = (i-0.4)/(n+0.2)
i = rank
n = sample size = # of storms

Number of Years Analyzed (n): 35
Total number of events (nr) 521

	Weibull		Cunnane					SUMMARY OF PEAK EVENTS	
m or i	F	Return (yrs)	F	Return	Q	HRS>Q	HRS/YEAR		
1	0.19%	36.00	0.12%	58.67	5.629	368	10.51	**Q2**	**1.709**
2	0.38%	18.00	0.31%	22.00	3.269	950	27.16	**Q3**	**1.942**
3	0.57%	12.00	0.50%	13.54	2.872	1533	43.80	**Q4**	**2.155**
4	0.77%	9.00	0.69%	9.78	2.645	2116	60.44	**Q5**	**2.232**
5	0.96%	7.20	0.88%	7.65	2.561	2698	77.09	**Q6**	**2.459**
6	1.15%	6.00	1.07%	6.29	2.539	3281	93.73	**Q7**	**2.551**
7	1.34%	5.14	1.27%	5.33	2.272	3894	111.25	**Q8**	**2.575**
8	1.53%	4.50	1.46%	4.63	2.188	4476	127.90	**Q9**	**2.614**
9	1.72%	4.00	1.65%	4.09	2.155	5059	144.54	**Q10**	**2.658**
10	1.92%	3.60	1.84%	3.67	2.063	5641	161.18		
11	2.11%	3.27	2.03%	3.32	2.030	6224	177.83		
12	2.30%	3.00	2.23%	3.03	1.942	6837	195.35		
13	2.49%	2.77	2.42%	2.79	1.892	7420	211.99		
14	2.68%	2.57	2.61%	2.59	1.830	8002	228.64		
15	2.87%	2.40	2.80%	2.41	1.825	8585	245.28		
16	3.07%	2.25	2.99%	2.26	1.747	9167	261.92		
17	3.26%	2.12	3.18%	2.12	1.730	9750	278.57		
18	3.45%	2.00	3.38%	2.00	1.709	10363	296.09		
19	3.64%	1.89	3.57%	1.89	1.682	10946	312.73		
20	3.83%	1.80	3.76%	1.80	1.657	11528	329.38		
21	4.02%	1.71	3.95%	1.71	1.648	12111	346.02		
22	4.21%	1.64	4.14%	1.63	1.542	12693	362.66		
23	4.41%	1.57	4.34%	1.56	1.446	13306	380.18		
24	4.60%	1.50	4.53%	1.49	1.354	13889	396.83		
25	4.79%	1.44	4.72%	1.43	1.324	14472	413.47		
26	4.98%	1.38	4.91%	1.38	1.292	15054	430.12		
27	5.17%	1.33	5.10%	1.32	1.275	15637	446.76		
28	5.36%	1.29	5.30%	1.28	1.275	16250	464.28		
29	5.56%	1.24	5.49%	1.23	1.269	16832	480.92		
30	5.75%	1.20	5.68%	1.19	1.263	17415	497.57		
31	5.94%	1.16	5.87%	1.15	1.250	17997	514.21		
32	6.13%	1.13	6.06%	1.11	1.215	18580	530.86		
33	6.32%	1.09	6.25%	1.08	1.203	19163	547.50		
34	6.51%	1.06	6.45%	1.05	1.176	19776	565.02		
35	6.70%	1.03	6.64%	1.02	1.153	20358	581.66		
36	6.90%	1.00	6.83%	0.99	1.139	20941	598.31		
37	7.09%	0.97	7.02%	0.96	1.118	21523	614.95		
38	7.28%	0.95	7.21%	0.94	1.088	22106	631.60		
39	7.47%	0.92	7.41%	0.91	1.070	22719	649.12		
40	7.66%	0.90	7.60%	0.89	1.049	23302	665.76		
41	7.85%	0.88	7.79%	0.87	1.036	23884	682.40		
42	8.05%	0.86	7.98%	0.85	1.026	24467			
43	8.24%	0.84	8.17%	0.83	1.025	25049			
44	8.43%	0.82	8.37%	0.81	1.019	25662			

45	8.62%	0.80	8.56%	0.79	1.006	26245
46	8.81%	0.78	8.75%	0.77	0.983	26828
47	9.00%	0.77	8.94%	0.76	0.979	27410
48	9.20%	0.75	9.13%	0.74	0.963	27993
49	9.39%	0.73	9.32%	0.72	0.943	28575
50	9.58%	0.72	9.52%	0.71	0.881	29188
51	9.77%	0.71	9.71%	0.70	0.878	29771
52	9.96%	0.69	9.90%	0.68	0.871	30353
53	10.15%	0.68	10.09%	0.67	0.871	30936
54	10.34%	0.67	10.28%	0.66	0.863	31518
55	10.54%	0.65	10.48%	0.64	0.814	32132
56	10.73%	0.64	10.67%	0.63	0.807	32714
57	10.92%	0.63	10.86%	0.62	0.785	33297
58	11.11%	0.62	11.05%	0.61	0.747	33879
59	11.30%	0.61	11.24%	0.60	0.684	34462
60	11.49%	0.60	11.44%	0.59	0.681	35075
61	11.69%	0.59	11.63%	0.58	0.679	35658
62	11.88%	0.58	11.82%	0.57	0.679	36240
63	12.07%	0.57	12.01%	0.56	0.677	36823
64	12.26%	0.56	12.20%	0.55	0.659	37405
65	12.45%	0.55	12.39%	0.54	0.651	37988
66	12.64%	0.55	12.59%	0.54	0.645	38601
67	12.84%	0.54	12.78%	0.53	0.618	39183
68	13.03%	0.53	12.97%	0.52	0.611	39766
69	13.22%	0.52	13.16%	0.51	0.606	40349
70	13.41%	0.51	13.35%	0.51	0.587	40931
71	13.60%	0.51	13.55%	0.50	0.572	41544
72	13.79%	0.50	13.74%	0.49	0.534	42127
73	13.98%	0.49	13.93%	0.48	0.521	42709
74	14.18%	0.49	14.12%	0.48	0.519	43292
75	14.37%	0.48	14.31%	0.47	0.489	43874
76	14.56%	0.47	14.50%	0.47	0.486	44457
77	14.75%	0.47	14.70%	0.46	0.484	45070
78	14.94%	0.46	14.89%	0.45	0.479	45653
79	15.13%	0.46	15.08%	0.45	0.473	46235
80	15.33%	0.45	15.27%	0.44	0.468	46818
81	15.52%	0.44	15.46%	0.44	0.466	47400
82	15.71%	0.44	15.66%	0.43	0.432	48014
83	15.90%	0.43	15.85%	0.43	0.417	48596
84	16.09%	0.43	16.04%	0.42	0.416	49179
85	16.28%	0.42	16.23%	0.42	0.372	49761
86	16.48%	0.42	16.42%	0.41	0.370	50344
87	16.67%	0.41	16.62%	0.41	0.353	50957
88	16.86%	0.41	16.81%	0.40	0.352	51539
89	17.05%	0.40	17.00%	0.40	0.346	52122
90	17.24%	0.40	17.19%	0.39	0.333	52705
91	17.43%	0.40	17.38%	0.39	0.320	53287
92	17.62%	0.39	17.57%	0.38	0.320	53870
93	17.82%	0.39	17.77%	0.38	0.312	54483
94	18.01%	0.38	17.96%	0.38	0.306	55065
95	18.20%	0.38	18.15%	0.37	0.300	55648
96	18.39%	0.38	18.34%	0.37	0.289	56230
97	18.58%	0.37	18.53%	0.36	0.281	56813
98	18.77%	0.37	18.73%	0.36	0.271	57426
99	18.97%	0.36	18.92%	0.36	0.234	58009
100	19.16%	0.36	19.11%	0.35	0.213	58591
101	19.35%	0.36	19.30%	0.35	0.206	59174
102	19.54%	0.35	19.49%	0.35	0.200	59756
103	19.73%	0.35	19.69%	0.34	0.182	60370

104	19.92%	0.35	19.88%	0.34	0.162	60952
105	20.11%	0.34	20.07%	0.34	0.160	61535
106	20.31%	0.34	20.26%	0.33	0.142	62117
107	20.50%	0.34	20.45%	0.33	0.140	62700
108	20.69%	0.33	20.64%	0.33	0.137	63282
109	20.88%	0.33	20.84%	0.32	0.130	63895
110	21.07%	0.33	21.03%	0.32	0.124	64478
111	21.26%	0.32	21.22%	0.32	0.121	65061
112	21.46%	0.32	21.41%	0.32	0.119	65643
113	21.65%	0.32	21.60%	0.31	0.110	66226
114	21.84%	0.32	21.80%	0.31	0.110	66839
115	22.03%	0.31	21.99%	0.31	0.109	67421
116	22.22%	0.31	22.18%	0.30	0.107	68004
117	22.41%	0.31	22.37%	0.30	0.107	68586
118	22.61%	0.31	22.56%	0.30	0.100	69169
119	22.80%	0.30	22.76%	0.30	0.099	69782
120	22.99%	0.30	22.95%	0.29	0.098	70365
121	23.18%	0.30	23.14%	0.29	0.084	70947
122	23.37%	0.30	23.33%	0.29	0.084	71530
123	23.56%	0.29	23.52%	0.29	0.084	72112
124	23.75%	0.29	23.71%	0.28	0.083	72695
125	23.95%	0.29	23.91%	0.28	0.082	73308
126	24.14%	0.29	24.10%	0.28	0.079	73891
127	24.33%	0.28	24.29%	0.28	0.079	74473
128	24.52%	0.28	24.48%	0.28	0.079	75056
129	24.71%	0.28	24.67%	0.27	0.079	75638
130	24.90%	0.28	24.87%	0.27	0.079	76251
131	25.10%	0.27	25.06%	0.27	0.079	76834
132	25.29%	0.27	25.25%	0.27	0.079	77417
133	25.48%	0.27	25.44%	0.27	0.079	77999
134	25.67%	0.27	25.63%	0.26	0.079	78582
135	25.86%	0.27	25.83%	0.26	0.074	79195
136	26.05%	0.26	26.02%	0.26	0.074	79777
137	26.25%	0.26	26.21%	0.26	0.074	80360
138	26.44%	0.26	26.40%	0.26	0.074	80942
139	26.63%	0.26	26.59%	0.25	0.074	81525
140	26.82%	0.26	26.78%	0.25	0.071	82107
141	27.01%	0.26	26.98%	0.25	0.071	82721
142	27.20%	0.25	27.17%	0.25	0.068	83303
143	27.39%	0.25	27.36%	0.25	0.066	83886
144	27.59%	0.25	27.55%	0.25	0.066	84468
145	27.78%	0.25	27.74%	0.24	0.066	85051
146	27.97%	0.25	27.94%	0.24	0.066	85664
147	28.16%	0.24	28.13%	0.24	0.066	86247
148	28.35%	0.24	28.32%	0.24	0.066	86829
149	28.54%	0.24	28.51%	0.24	0.065	87412
150	28.74%	0.24	28.70%	0.24	0.063	87994
151	28.93%	0.24	28.89%	0.23	0.063	88577
152	29.12%	0.24	29.09%	0.23	0.063	89190
153	29.31%	0.24	29.28%	0.23	0.063	89772
154	29.50%	0.23	29.47%	0.23	0.063	90355
155	29.69%	0.23	29.66%	0.23	0.061	90938
156	29.89%	0.23	29.85%	0.23	0.060	91520
157	30.08%	0.23	30.05%	0.22	0.060	92133
158	30.27%	0.23	30.24%	0.22	0.052	92716
159	30.46%	0.23	30.43%	0.22	0.052	93298
160	30.65%	0.23	30.62%	0.22	0.052	93881
161	30.84%	0.22	30.81%	0.22	0.052	94463
162	31.03%	0.22	31.01%	0.22	0.052	95077

163	31.23%	0.22	31.20%	0.22	0.052	95659
164	31.42%	0.22	31.39%	0.22	0.052	96242
165	31.61%	0.22	31.58%	0.21	0.052	96824
166	31.80%	0.22	31.77%	0.21	0.052	97407
167	31.99%	0.22	31.96%	0.21	0.052	97989
168	32.18%	0.21	32.16%	0.21	0.052	98603
169	32.38%	0.21	32.35%	0.21	0.052	99185
170	32.57%	0.21	32.54%	0.21	0.052	99768
171	32.76%	0.21	32.73%	0.21	0.052	100350
172	32.95%	0.21	32.92%	0.21	0.052	100933
173	33.14%	0.21	33.12%	0.20	0.052	101546
174	33.33%	0.21	33.31%	0.20	0.052	102128
175	33.52%	0.21	33.50%	0.20	0.052	102711
176	33.72%	0.20	33.69%	0.20	0.052	103294
177	33.91%	0.20	33.88%	0.20	0.052	103876
178	34.10%	0.20	34.08%	0.20	0.052	104489
179	34.29%	0.20	34.27%	0.20	0.052	105072
180	34.48%	0.20	34.46%	0.20	0.052	105654
181	34.67%	0.20	34.65%	0.19	0.052	106237
182	34.87%	0.20	34.84%	0.19	0.052	106819
183	35.06%	0.20	35.03%	0.19	0.052	107402
184	35.25%	0.20	35.23%	0.19	0.052	108015
185	35.44%	0.19	35.42%	0.19	0.052	108598
186	35.63%	0.19	35.61%	0.19	0.052	109180
187	35.82%	0.19	35.80%	0.19	0.052	109763
188	36.02%	0.19	35.99%	0.19	0.052	110345
189	36.21%	0.19	36.19%	0.19	0.052	110959
190	36.40%	0.19	36.38%	0.19	0.052	111541
191	36.59%	0.19	36.57%	0.18	0.052	112124
192	36.78%	0.19	36.76%	0.18	0.052	112706
193	36.97%	0.19	36.95%	0.18	0.052	113289
194	37.16%	0.19	37.15%	0.18	0.052	113902
195	37.36%	0.18	37.34%	0.18	0.052	114484
196	37.55%	0.18	37.53%	0.18	0.052	115067
197	37.74%	0.18	37.72%	0.18	0.052	115650
198	37.93%	0.18	37.91%	0.18	0.052	116232
199	38.12%	0.18	38.10%	0.18	0.052	116815
200	38.31%	0.18	38.30%	0.18	0.052	117428
201	38.51%	0.18	38.49%	0.18	0.052	118010
202	38.70%	0.18	38.68%	0.17	0.052	118593
203	38.89%	0.18	38.87%	0.17	0.049	119175
204	39.08%	0.18	39.06%	0.17	0.047	119758
205	39.27%	0.18	39.26%	0.17	0.047	120371
206	39.46%	0.17	39.45%	0.17	0.047	120954
207	39.66%	0.17	39.64%	0.17	0.044	121536
208	39.85%	0.17	39.83%	0.17	0.041	122119
209	40.04%	0.17	40.02%	0.17	0.041	122701
210	40.23%	0.17	40.21%	0.17	0.041	123284
211	40.42%	0.17	40.41%	0.17	0.041	123897
212	40.61%	0.17	40.60%	0.17	0.041	124480
213	40.80%	0.17	40.79%	0.17	0.041	125062
214	41.00%	0.17	40.98%	0.16	0.041	125645
215	41.19%	0.17	41.17%	0.16	0.041	126227
216	41.38%	0.17	41.37%	0.16	0.041	126840
217	41.57%	0.17	41.56%	0.16	0.041	127423
218	41.76%	0.17	41.75%	0.16	0.041	128006
219	41.95%	0.16	41.94%	0.16	0.041	128588
220	42.15%	0.16	42.13%	0.16	0.041	129171
221	42.34%	0.16	42.33%	0.16	0.041	129784

222	42.53%	0.16	42.52%	0.16	0.041	130366
223	42.72%	0.16	42.71%	0.16	0.041	130949
224	42.91%	0.16	42.90%	0.16	0.041	131531
225	43.10%	0.16	43.09%	0.16	0.041	132114
226	43.30%	0.16	43.28%	0.16	0.041	132696
227	43.49%	0.16	43.48%	0.16	0.041	133310
228	43.68%	0.16	43.67%	0.15	0.041	133892
229	43.87%	0.16	43.86%	0.15	0.041	134475
230	44.06%	0.16	44.05%	0.15	0.041	135057
231	44.25%	0.16	44.24%	0.15	0.041	135640
232	44.44%	0.16	44.44%	0.15	0.041	136253
233	44.64%	0.15	44.63%	0.15	0.041	136836
234	44.83%	0.15	44.82%	0.15	0.041	137418
235	45.02%	0.15	45.01%	0.15	0.041	138001
236	45.21%	0.15	45.20%	0.15	0.039	138583
237	45.40%	0.15	45.40%	0.15	0.039	139196
238	45.59%	0.15	45.59%	0.15	0.039	139779
239	45.79%	0.15	45.78%	0.15	0.039	140361
240	45.98%	0.15	45.97%	0.15	0.039	140944
241	46.17%	0.15	46.16%	0.15	0.039	141527
242	46.36%	0.15	46.35%	0.15	0.039	142109
243	46.55%	0.15	46.55%	0.15	0.039	142722
244	46.74%	0.15	46.74%	0.14	0.039	143305
245	46.93%	0.15	46.93%	0.14	0.039	143887
246	47.13%	0.15	47.12%	0.14	0.039	144470
247	47.32%	0.15	47.31%	0.14	0.039	145052
248	47.51%	0.15	47.51%	0.14	0.039	145666
249	47.70%	0.14	47.70%	0.14	0.039	146248
250	47.89%	0.14	47.89%	0.14	0.039	146831
251	48.08%	0.14	48.08%	0.14	0.039	147413
252	48.28%	0.14	48.27%	0.14	0.039	147996
253	48.47%	0.14	48.47%	0.14	0.036	148609
254	48.66%	0.14	48.66%	0.14	0.036	149192
255	48.85%	0.14	48.85%	0.14	0.036	149774
256	49.04%	0.14	49.04%	0.14	0.036	150357
257	49.23%	0.14	49.23%	0.14	0.036	150939
258	49.43%	0.14	49.42%	0.14	0.033	151522
259	49.62%	0.14	49.62%	0.14	0.033	152135
260	49.81%	0.14	49.81%	0.14	0.033	152717
261	50.00%	0.14	50.00%	0.14	0.033	153300
262	50.19%	0.14	50.19%	0.13	0.033	153883
263	50.38%	0.14	50.38%	0.13	0.031	154465
264	50.57%	0.14	50.58%	0.13	0.031	155078
265	50.77%	0.14	50.77%	0.13	0.031	155661
266	50.96%	0.14	50.96%	0.13	0.031	156243
267	51.15%	0.13	51.15%	0.13	0.031	156826
268	51.34%	0.13	51.34%	0.13	0.031	157408
269	51.53%	0.13	51.53%	0.13	0.031	157991
270	51.72%	0.13	51.73%	0.13	0.031	158604
271	51.92%	0.13	51.92%	0.13	0.031	159187
272	52.11%	0.13	52.11%	0.13	0.031	159769
273	52.30%	0.13	52.30%	0.13	0.031	160352
274	52.49%	0.13	52.49%	0.13	0.031	160934
275	52.68%	0.13	52.69%	0.13	0.031	161548
276	52.87%	0.13	52.88%	0.13	0.031	162130
277	53.07%	0.13	53.07%	0.13	0.031	162713
278	53.26%	0.13	53.26%	0.13	0.031	163295
279	53.45%	0.13	53.45%	0.13	0.031	163878
280	53.64%	0.13	53.65%	0.13	0.031	164491

281	53.83%	0.13	53.84%	0.13	0.031	165073
282	54.02%	0.13	54.03%	0.13	0.031	165656
283	54.21%	0.13	54.22%	0.12	0.031	166239
284	54.41%	0.13	54.41%	0.12	0.031	166821
285	54.60%	0.13	54.60%	0.12	0.031	167404
286	54.79%	0.13	54.80%	0.12	0.031	168017
287	54.98%	0.13	54.99%	0.12	0.031	168599
288	55.17%	0.13	55.18%	0.12	0.031	169182
289	55.36%	0.12	55.37%	0.12	0.031	169764
290	55.56%	0.12	55.56%	0.12	0.031	170347
291	55.75%	0.12	55.76%	0.12	0.031	170960
292	55.94%	0.12	55.95%	0.12	0.031	171543
293	56.13%	0.12	56.14%	0.12	0.031	172125
294	56.32%	0.12	56.33%	0.12	0.031	172708
295	56.51%	0.12	56.52%	0.12	0.031	173290
296	56.70%	0.12	56.72%	0.12	0.031	173904
297	56.90%	0.12	56.91%	0.12	0.031	174486
298	57.09%	0.12	57.10%	0.12	0.031	175069
299	57.28%	0.12	57.29%	0.12	0.031	175651
300	57.47%	0.12	57.48%	0.12	0.031	176234
301	57.66%	0.12	57.67%	0.12	0.031	176816
302	57.85%	0.12	57.87%	0.12	0.031	177429
303	58.05%	0.12	58.06%	0.12	0.028	178012
304	58.24%	0.12	58.25%	0.12	0.028	178595
305	58.43%	0.12	58.44%	0.12	0.028	179177
306	58.62%	0.12	58.63%	0.12	0.028	179760
307	58.81%	0.12	58.83%	0.11	0.028	180373
308	59.00%	0.12	59.02%	0.11	0.028	180955
309	59.20%	0.12	59.21%	0.11	0.028	181538
310	59.39%	0.12	59.40%	0.11	0.028	182120
311	59.58%	0.12	59.59%	0.11	0.028	182703
312	59.77%	0.12	59.79%	0.11	0.025	183316
313	59.96%	0.12	59.98%	0.11	0.025	183899
314	60.15%	0.11	60.17%	0.11	0.025	184481
315	60.34%	0.11	60.36%	0.11	0.025	185064
316	60.54%	0.11	60.55%	0.11	0.025	185646
317	60.73%	0.11	60.74%	0.11	0.025	186229
318	60.92%	0.11	60.94%	0.11	0.025	186842
319	61.11%	0.11	61.13%	0.11	0.025	187425
320	61.30%	0.11	61.32%	0.11	0.025	188007
321	61.49%	0.11	61.51%	0.11	0.025	188590
322	61.69%	0.11	61.70%	0.11	0.025	189172
323	61.88%	0.11	61.90%	0.11	0.025	189785
324	62.07%	0.11	62.09%	0.11	0.025	190368
325	62.26%	0.11	62.28%	0.11	0.025	190950
326	62.45%	0.11	62.47%	0.11	0.025	191533
327	62.64%	0.11	62.66%	0.11	0.025	192116
328	62.84%	0.11	62.85%	0.11	0.025	192698
329	63.03%	0.11	63.05%	0.11	0.025	193311
330	63.22%	0.11	63.24%	0.11	0.025	193894
331	63.41%	0.11	63.43%	0.11	0.025	194476
332	63.60%	0.11	63.62%	0.11	0.025	195059
333	63.79%	0.11	63.81%	0.11	0.025	195641
334	63.98%	0.11	64.01%	0.11	0.025	196255
335	64.18%	0.11	64.20%	0.11	0.025	196837
336	64.37%	0.11	64.39%	0.10	0.025	197420
337	64.56%	0.11	64.58%	0.10	0.025	198002
338	64.75%	0.11	64.77%	0.10	0.025	198585
339	64.94%	0.11	64.97%	0.10	0.025	199198

340	65.13%	0.11	65.16%	0.10	0.025	199781
341	65.33%	0.11	65.35%	0.10	0.025	200363
342	65.52%	0.11	65.54%	0.10	0.025	200946
343	65.71%	0.10	65.73%	0.10	0.025	201528
344	65.90%	0.10	65.92%	0.10	0.025	202111
345	66.09%	0.10	66.12%	0.10	0.025	202724
346	66.28%	0.10	66.31%	0.10	0.025	203306
347	66.48%	0.10	66.50%	0.10	0.025	203889
348	66.67%	0.10	66.69%	0.10	0.025	204472
349	66.86%	0.10	66.88%	0.10	0.025	205054
350	67.05%	0.10	67.08%	0.10	0.025	205667
351	67.24%	0.10	67.27%	0.10	0.025	206250
352	67.43%	0.10	67.46%	0.10	0.025	206832
353	67.62%	0.10	67.65%	0.10	0.025	207415
354	67.82%	0.10	67.84%	0.10	0.025	207997
355	68.01%	0.10	68.04%	0.10	0.025	208611
356	68.20%	0.10	68.23%	0.10	0.025	209193
357	68.39%	0.10	68.42%	0.10	0.025	209776
358	68.58%	0.10	68.61%	0.10	0.025	210358
359	68.77%	0.10	68.80%	0.10	0.025	210941
360	68.97%	0.10	68.99%	0.10	0.025	211523
361	69.16%	0.10	69.19%	0.10	0.025	212137
362	69.35%	0.10	69.38%	0.10	0.025	212719
363	69.54%	0.10	69.57%	0.10	0.025	213302
364	69.73%	0.10	69.76%	0.10	0.025	213884
365	69.92%	0.10	69.95%	0.10	0.025	214467
366	70.11%	0.10	70.15%	0.10	0.025	215080
367	70.31%	0.10	70.34%	0.10	0.025	215662
368	70.50%	0.10	70.53%	0.10	0.025	216245
369	70.69%	0.10	70.72%	0.10	0.025	216828
370	70.88%	0.10	70.91%	0.10	0.025	217410
371	71.07%	0.10	71.11%	0.09	0.025	218023
372	71.26%	0.10	71.30%	0.09	0.025	218606
373	71.46%	0.10	71.49%	0.09	0.025	219188
374	71.65%	0.10	71.68%	0.09	0.025	219771
375	71.84%	0.10	71.87%	0.09	0.025	220353
376	72.03%	0.10	72.06%	0.09	0.025	220936
377	72.22%	0.10	72.26%	0.09	0.025	221549
378	72.41%	0.10	72.45%	0.09	0.025	222132
379	72.61%	0.09	72.64%	0.09	0.025	222714
380	72.80%	0.09	72.83%	0.09	0.025	223297
381	72.99%	0.09	73.02%	0.09	0.025	223879
382	73.18%	0.09	73.22%	0.09	0.025	224493
383	73.37%	0.09	73.41%	0.09	0.025	225075
384	73.56%	0.09	73.60%	0.09	0.025	225658
385	73.75%	0.09	73.79%	0.09	0.025	226240
386	73.95%	0.09	73.98%	0.09	0.025	226823
387	74.14%	0.09	74.17%	0.09	0.025	227405
388	74.33%	0.09	74.37%	0.09	0.025	228018
389	74.52%	0.09	74.56%	0.09	0.025	228601
390	74.71%	0.09	74.75%	0.09	0.025	229184
391	74.90%	0.09	74.94%	0.09	0.025	229766
392	75.10%	0.09	75.13%	0.09	0.025	230349
393	75.29%	0.09	75.33%	0.09	0.025	230962
394	75.48%	0.09	75.52%	0.09	0.025	231544
395	75.67%	0.09	75.71%	0.09	0.025	232127
396	75.86%	0.09	75.90%	0.09	0.025	232709
397	76.05%	0.09	76.09%	0.09	0.025	233292
398	76.25%	0.09	76.29%	0.09	0.025	233905

399	76.44%	0.09	76.48%	0.09	0.025	234488
400	76.63%	0.09	76.67%	0.09	0.025	235070
401	76.82%	0.09	76.86%	0.09	0.025	235653
402	77.01%	0.09	77.05%	0.09	0.025	236235
403	77.20%	0.09	77.24%	0.09	0.025	236818
404	77.39%	0.09	77.44%	0.09	0.025	237431
405	77.59%	0.09	77.63%	0.09	0.025	238014
406	77.78%	0.09	77.82%	0.09	0.025	238596
407	77.97%	0.09	78.01%	0.09	0.025	239179
408	78.16%	0.09	78.20%	0.09	0.025	239761
409	78.35%	0.09	78.40%	0.09	0.025	240374
410	78.54%	0.09	78.59%	0.09	0.025	240957
411	78.74%	0.09	78.78%	0.09	0.025	241539
412	78.93%	0.09	78.97%	0.09	0.025	242122
413	79.12%	0.09	79.16%	0.09	0.025	242705
414	79.31%	0.09	79.36%	0.09	0.025	243318
415	79.50%	0.09	79.55%	0.08	0.025	243900
416	79.69%	0.09	79.74%	0.08	0.025	244483
417	79.89%	0.09	79.93%	0.08	0.025	245065
418	80.08%	0.09	80.12%	0.08	0.025	245648
419	80.27%	0.09	80.31%	0.08	0.025	246230
420	80.46%	0.09	80.51%	0.08	0.025	246844
421	80.65%	0.09	80.70%	0.08	0.025	247426
422	80.84%	0.09	80.89%	0.08	0.025	248009
423	81.03%	0.09	81.08%	0.08	0.025	248591
424	81.23%	0.08	81.27%	0.08	0.025	249174
425	81.42%	0.08	81.47%	0.08	0.025	249787
426	81.61%	0.08	81.66%	0.08	0.025	250370
427	81.80%	0.08	81.85%	0.08	0.025	250952
428	81.99%	0.08	82.04%	0.08	0.023	251535
429	82.18%	0.08	82.23%	0.08	0.023	252117
430	82.38%	0.08	82.43%	0.08	0.023	252730
431	82.57%	0.08	82.62%	0.08	0.023	253313
432	82.76%	0.08	82.81%	0.08	0.023	253895
433	82.95%	0.08	83.00%	0.08	0.020	254478
434	83.14%	0.08	83.19%	0.08	0.020	255061
435	83.33%	0.08	83.38%	0.08	0.020	255643
436	83.52%	0.08	83.58%	0.08	0.020	256256
437	83.72%	0.08	83.77%	0.08	0.020	256839
438	83.91%	0.08	83.96%	0.08	0.020	257421
439	84.10%	0.08	84.15%	0.08	0.020	258004
440	84.29%	0.08	84.34%	0.08	0.020	258586
441	84.48%	0.08	84.54%	0.08	0.020	259200
442	84.67%	0.08	84.73%	0.08	0.020	259782
443	84.87%	0.08	84.92%	0.08	0.020	260365
444	85.06%	0.08	85.11%	0.08	0.020	260947
445	85.25%	0.08	85.30%	0.08	0.020	261530
446	85.44%	0.08	85.50%	0.08	0.020	262143
447	85.63%	0.08	85.69%	0.08	0.020	262726
448	85.82%	0.08	85.88%	0.08	0.020	263308
449	86.02%	0.08	86.07%	0.08	0.020	263891
450	86.21%	0.08	86.26%	0.08	0.020	264473
451	86.40%	0.08	86.45%	0.08	0.020	265056
452	86.59%	0.08	86.65%	0.08	0.020	265669
453	86.78%	0.08	86.84%	0.08	0.020	266251
454	86.97%	0.08	87.03%	0.08	0.020	266834
455	87.16%	0.08	87.22%	0.08	0.020	267417
456	87.36%	0.08	87.41%	0.08	0.020	267999
457	87.55%	0.08	87.61%	0.08	0.020	268612

458	87.74%	0.08	87.80%	0.08	0.020	269195
459	87.93%	0.08	87.99%	0.08	0.020	269777
460	88.12%	0.08	88.18%	0.08	0.020	270360
461	88.31%	0.08	88.37%	0.08	0.020	270942
462	88.51%	0.08	88.56%	0.08	0.020	271525
463	88.70%	0.08	88.76%	0.08	0.020	272138
464	88.89%	0.08	88.95%	0.08	0.020	272721
465	89.08%	0.08	89.14%	0.08	0.020	273303
466	89.27%	0.08	89.33%	0.08	0.020	273886
467	89.46%	0.08	89.52%	0.08	0.020	274468
468	89.66%	0.08	89.72%	0.08	0.020	275082
469	89.85%	0.08	89.91%	0.08	0.020	275664
470	90.04%	0.08	90.10%	0.07	0.020	276247
471	90.23%	0.08	90.29%	0.07	0.020	276829
472	90.42%	0.08	90.48%	0.07	0.020	277412
473	90.61%	0.08	90.68%	0.07	0.020	278025
474	90.80%	0.08	90.87%	0.07	0.020	278607
475	91.00%	0.08	91.06%	0.07	0.020	279190
476	91.19%	0.08	91.25%	0.07	0.020	279773
477	91.38%	0.08	91.44%	0.07	0.020	280355
478	91.57%	0.08	91.63%	0.07	0.020	280938
479	91.76%	0.08	91.83%	0.07	0.020	281551
480	91.95%	0.08	92.02%	0.07	0.020	282133
481	92.15%	0.07	92.21%	0.07	0.020	282716
482	92.34%	0.07	92.40%	0.07	0.020	283298
483	92.53%	0.07	92.59%	0.07	0.020	283881
484	92.72%	0.07	92.79%	0.07	0.020	284494
485	92.91%	0.07	92.98%	0.07	0.020	285077
486	93.10%	0.07	93.17%	0.07	0.017	285659
487	93.30%	0.07	93.36%	0.07	0.017	286242
488	93.49%	0.07	93.55%	0.07	0.017	286824
489	93.68%	0.07	93.75%	0.07	0.017	287438
490	93.87%	0.07	93.94%	0.07	0.017	288020
491	94.06%	0.07	94.13%	0.07	0.017	288603
492	94.25%	0.07	94.32%	0.07	0.017	289185
493	94.44%	0.07	94.51%	0.07	0.017	289768
494	94.64%	0.07	94.70%	0.07	0.017	290350
495	94.83%	0.07	94.90%	0.07	0.017	290963
496	95.02%	0.07	95.09%	0.07	0.017	291546
497	95.21%	0.07	95.28%	0.07	0.017	292128
498	95.40%	0.07	95.47%	0.07	0.017	292711
499	95.59%	0.07	95.66%	0.07	0.017	293294
500	95.79%	0.07	95.86%	0.07	0.014	293907
501	95.98%	0.07	96.05%	0.07	0.014	294489
502	96.17%	0.07	96.24%	0.07	0.014	295072
503	96.36%	0.07	96.43%	0.07	0.014	295654
504	96.55%	0.07	96.62%	0.07	0.014	296237
505	96.74%	0.07	96.82%	0.07	0.014	296850
506	96.93%	0.07	97.01%	0.07	0.014	297433
507	97.13%	0.07	97.20%	0.07	0.013	298015
508	97.32%	0.07	97.39%	0.07	0.012	298598
509	97.51%	0.07	97.58%	0.07	0.012	299180
510	97.70%	0.07	97.77%	0.07	0.012	299763
511	97.89%	0.07	97.97%	0.07	0.012	300376
512	98.08%	0.07	98.16%	0.07	0.012	300959
513	98.28%	0.07	98.35%	0.07	0.012	301541
514	98.47%	0.07	98.54%	0.07	0.012	302124
515	98.66%	0.07	98.73%	0.07	0.012	302706
516	98.85%	0.07	98.93%	0.07	0.012	303319

517	99.04%	0.07	99.12%	0.07	0.012	303902
518	99.23%	0.07	99.31%	0.07	0.012	304484
519	99.43%	0.07	99.50%	0.07	0.012	305067
520	99.62%	0.07	99.69%	0.07	0.011	305650
521	99.81%	0.07	99.88%	0.07	0.011	306232

P.O.C. #2: PEAK EVENTS - POST UNMITIGATED

WEIBULL (SWMM)

F = m/(nr+1) where F = frequency
m = event rank
nr = total number of event
n = number of year anlayzed

CUNNANE

F = (i-0.4)/(n+0.2)
i = rank
n = sample size = # of storms

Number of Years Analyzed (n): 35
Total number of events (nr) 189

	Weibull		Cunnane		
m or i	**F**	**Return (yrs)**	**F**	**Return**	**Q**
1	0.53%	36.00	0.32%	58.67	5.742
2	1.05%	18.00	0.85%	22.00	3.629
3	1.58%	12.00	1.37%	13.54	3.382
4	2.11%	9.00	1.90%	9.78	3.116
5	2.63%	7.20	2.43%	7.65	2.895
6	3.16%	6.00	2.96%	6.29	2.887
7	3.68%	5.14	3.49%	5.33	2.788
8	4.21%	4.50	4.02%	4.63	2.630
9	4.74%	4.00	4.55%	4.09	2.628
10	5.26%	3.60	5.07%	3.67	2.539
11	5.79%	3.27	5.60%	3.32	2.286
12	6.32%	3.00	6.13%	3.03	2.267
13	6.84%	2.77	6.66%	2.79	2.252
14	7.37%	2.57	7.19%	2.59	2.239
15	7.89%	2.40	7.72%	2.41	2.207
16	8.42%	2.25	8.25%	2.26	2.149
17	8.95%	2.12	8.77%	2.12	2.147
18	9.47%	2.00	9.30%	2.00	2.130
19	10.00%	1.89	9.83%	1.89	2.106
20	10.53%	1.80	10.36%	1.80	2.047
21	11.05%	1.71	10.89%	1.71	1.992
22	11.58%	1.64	11.42%	1.63	1.981
23	12.11%	1.57	11.95%	1.56	1.957
24	12.63%	1.50	12.47%	1.49	1.947
25	13.16%	1.44	13.00%	1.43	1.919
26	13.68%	1.38	13.53%	1.38	1.902
27	14.21%	1.33	14.06%	1.32	1.884
28	14.74%	1.29	14.59%	1.28	1.861
29	15.26%	1.24	15.12%	1.23	1.841
30	15.79%	1.20	15.64%	1.19	1.801
31	16.32%	1.16	16.17%	1.15	1.736
32	16.84%	1.13	16.70%	1.11	1.701
33	17.37%	1.09	17.23%	1.08	1.663
34	17.89%	1.06	17.76%	1.05	1.656
35	18.42%	1.03	18.29%	1.02	1.622
36	18.95%	1.00	18.82%	0.99	1.501
37	19.47%	0.97	19.34%	0.96	1.433

38	20.00%	0.95	19.87%	0.94	1.426
39	20.53%	0.92	20.40%	0.91	1.392
40	21.05%	0.90	20.93%	0.89	1.373
41	21.58%	0.88	21.46%	0.87	1.372
42	22.11%	0.86	21.99%	0.85	1.368
43	22.63%	0.84	22.52%	0.83	1.346
44	23.16%	0.82	23.04%	0.81	1.332
45	23.68%	0.80	23.57%	0.79	1.330
46	24.21%	0.78	24.10%	0.77	1.309
47	24.74%	0.77	24.63%	0.76	1.306
48	25.26%	0.75	25.16%	0.74	1.302
49	25.79%	0.73	25.69%	0.72	1.296
50	26.32%	0.72	26.22%	0.71	1.285
51	26.84%	0.71	26.74%	0.70	1.285
52	27.37%	0.69	27.27%	0.68	1.283
53	27.89%	0.68	27.80%	0.67	1.274
54	28.42%	0.67	28.33%	0.66	1.269
55	28.95%	0.65	28.86%	0.64	1.264
56	29.47%	0.64	29.39%	0.63	1.249
57	30.00%	0.63	29.92%	0.62	1.229
58	30.53%	0.62	30.44%	0.61	1.227
59	31.05%	0.61	30.97%	0.60	1.217
60	31.58%	0.60	31.50%	0.59	1.209
61	32.11%	0.59	32.03%	0.58	1.195
62	32.63%	0.58	32.56%	0.57	1.186
63	33.16%	0.57	33.09%	0.56	1.177
64	33.68%	0.56	33.62%	0.55	1.175
65	34.21%	0.55	34.14%	0.54	1.157
66	34.74%	0.55	34.67%	0.54	1.153
67	35.26%	0.54	35.20%	0.53	1.132
68	35.79%	0.53	35.73%	0.52	1.125
69	36.32%	0.52	36.26%	0.51	1.123
70	36.84%	0.51	36.79%	0.51	1.123
71	37.37%	0.51	37.32%	0.50	1.113
72	37.89%	0.50	37.84%	0.49	1.107
73	38.42%	0.49	38.37%	0.48	1.104
74	38.95%	0.49	38.90%	0.48	1.099
75	39.47%	0.48	39.43%	0.47	1.091
76	40.00%	0.47	39.96%	0.47	1.090
77	40.53%	0.47	40.49%	0.46	1.076
78	41.05%	0.46	41.01%	0.45	1.070
79	41.58%	0.46	41.54%	0.45	1.070
80	42.11%	0.45	42.07%	0.44	1.041
81	42.63%	0.44	42.60%	0.44	1.027
82	43.16%	0.44	43.13%	0.43	1.023
83	43.68%	0.43	43.66%	0.43	1.011
84	44.21%	0.43	44.19%	0.42	0.992
85	44.74%	0.42	44.71%	0.42	0.990
86	45.26%	0.42	45.24%	0.41	0.980
87	45.79%	0.41	45.77%	0.41	0.962
88	46.32%	0.41	46.30%	0.40	0.960
89	46.84%	0.40	46.83%	0.40	0.957

90	47.37%	0.40	47.36%	0.39	0.945
91	47.89%	0.40	47.89%	0.39	0.936
92	48.42%	0.39	48.41%	0.38	0.922
93	48.95%	0.39	48.94%	0.38	0.912
94	49.47%	0.38	49.47%	0.38	0.908
95	50.00%	0.38	50.00%	0.37	0.908
96	50.53%	0.38	50.53%	0.37	0.908
97	51.05%	0.37	51.06%	0.36	0.907
98	51.58%	0.37	51.59%	0.36	0.906
99	52.11%	0.36	52.11%	0.36	0.893
100	52.63%	0.36	52.64%	0.35	0.889
101	53.16%	0.36	53.17%	0.35	0.885
102	53.68%	0.35	53.70%	0.35	0.880
103	54.21%	0.35	54.23%	0.34	0.880
104	54.74%	0.35	54.76%	0.34	0.870
105	55.26%	0.34	55.29%	0.34	0.857
106	55.79%	0.34	55.81%	0.33	0.852
107	56.32%	0.34	56.34%	0.33	0.848
108	56.84%	0.33	56.87%	0.33	0.846
109	57.37%	0.33	57.40%	0.32	0.842
110	57.89%	0.33	57.93%	0.32	0.839
111	58.42%	0.32	58.46%	0.32	0.837
112	58.95%	0.32	58.99%	0.32	0.836
113	59.47%	0.32	59.51%	0.31	0.830
114	60.00%	0.32	60.04%	0.31	0.818
115	60.53%	0.31	60.57%	0.31	0.818
116	61.05%	0.31	61.10%	0.30	0.816
117	61.58%	0.31	61.63%	0.30	0.815
118	62.11%	0.31	62.16%	0.30	0.797
119	62.63%	0.30	62.68%	0.30	0.797
120	63.16%	0.30	63.21%	0.29	0.774
121	63.68%	0.30	63.74%	0.29	0.767
122	64.21%	0.30	64.27%	0.29	0.765
123	64.74%	0.29	64.80%	0.29	0.763
124	65.26%	0.29	65.33%	0.28	0.752
125	65.79%	0.29	65.86%	0.28	0.751
126	66.32%	0.29	66.38%	0.28	0.745
127	66.84%	0.28	66.91%	0.28	0.736
128	67.37%	0.28	67.44%	0.28	0.734
129	67.89%	0.28	67.97%	0.27	0.730
130	68.42%	0.28	68.50%	0.27	0.712
131	68.95%	0.27	69.03%	0.27	0.708
132	69.47%	0.27	69.56%	0.27	0.706
133	70.00%	0.27	70.08%	0.27	0.705
134	70.53%	0.27	70.61%	0.26	0.700
135	71.05%	0.27	71.14%	0.26	0.696
136	71.58%	0.26	71.67%	0.26	0.692
137	72.11%	0.26	72.20%	0.26	0.691
138	72.63%	0.26	72.73%	0.26	0.686
139	73.16%	0.26	73.26%	0.25	0.679
140	73.68%	0.26	73.78%	0.25	0.672
141	74.21%	0.26	74.31%	0.25	0.656

142	74.74%	0.25	74.84%	0.25	0.647
143	75.26%	0.25	75.37%	0.25	0.625
144	75.79%	0.25	75.90%	0.25	0.613
145	76.32%	0.25	76.43%	0.24	0.611
146	76.84%	0.25	76.96%	0.24	0.606
147	77.37%	0.24	77.48%	0.24	0.586
148	77.89%	0.24	78.01%	0.24	0.586
149	78.42%	0.24	78.54%	0.24	0.575
150	78.95%	0.24	79.07%	0.24	0.570
151	79.47%	0.24	79.60%	0.23	0.560
152	80.00%	0.24	80.13%	0.23	0.555
153	80.53%	0.24	80.66%	0.23	0.554
154	81.05%	0.23	81.18%	0.23	0.515
155	81.58%	0.23	81.71%	0.23	0.507
156	82.11%	0.23	82.24%	0.23	0.490
157	82.63%	0.23	82.77%	0.22	0.487
158	83.16%	0.23	83.30%	0.22	0.482
159	83.68%	0.23	83.83%	0.22	0.480
160	84.21%	0.23	84.36%	0.22	0.468
161	84.74%	0.22	84.88%	0.22	0.464
162	85.26%	0.22	85.41%	0.22	0.456
163	85.79%	0.22	85.94%	0.22	0.411
164	86.32%	0.22	86.47%	0.22	0.410
165	86.84%	0.22	87.00%	0.21	0.406
166	87.37%	0.22	87.53%	0.21	0.404
167	87.89%	0.22	88.05%	0.21	0.355
168	88.42%	0.21	88.58%	0.21	0.352
169	88.95%	0.21	89.11%	0.21	0.346
170	89.47%	0.21	89.64%	0.21	0.343
171	90.00%	0.21	90.17%	0.21	0.324
172	90.53%	0.21	90.70%	0.21	0.322
173	91.05%	0.21	91.23%	0.20	0.313
174	91.58%	0.21	91.75%	0.20	0.289
175	92.11%	0.21	92.28%	0.20	0.264
176	92.63%	0.20	92.81%	0.20	0.262
177	93.16%	0.20	93.34%	0.20	0.233
178	93.68%	0.20	93.87%	0.20	0.232
179	94.21%	0.20	94.40%	0.20	0.216
180	94.74%	0.20	94.93%	0.20	0.213
181	95.26%	0.20	95.45%	0.19	0.206
182	95.79%	0.20	95.98%	0.19	0.205
183	96.32%	0.20	96.51%	0.19	0.199
184	96.84%	0.20	97.04%	0.19	0.173
185	97.37%	0.19	97.57%	0.19	0.113
186	97.89%	0.19	98.10%	0.19	0.102
187	98.42%	0.19	98.63%	0.19	0.078
188	98.95%	0.19	99.15%	0.19	0.046
189	99.47%	0.19	99.68%	0.19	0.042

P.O.C. #2: PEAK EVENTS - POST MITIGATED

WEIBULL (SWMM)

F = m/(nr+1) where F = frequency
m = event rank
nr = total number of event
n = number of year anlayzed

CUNNANE

F = (i-0.4)/(n+0.2)
i = rank
n = sample size = # of storms

Number of Years Analyzed (n): 35
Total number of events (nr) 155

	Weibull		Cunnane			
m or i	**F**	**Return (yrs)**	**F**	**Return**	**Q**	**HRS>Q**
1	0.64%	36.00	0.39%	58.67	1.444	1196
2	1.28%	18.00	1.03%	22.00	1.380	3158
3	1.92%	12.00	1.68%	13.54	0.597	5151
4	2.56%	9.00	2.32%	9.78	0.313	7113
5	3.21%	7.20	2.96%	7.65	0.298	9075
6	3.85%	6.00	3.61%	6.29	0.233	11068
7	4.49%	5.14	4.25%	5.33	0.230	13031
8	5.13%	4.50	4.90%	4.63	0.221	15023
9	5.77%	4.00	5.54%	4.09	0.218	16986
10	6.41%	3.60	6.19%	3.67	0.217	18979
11	7.05%	3.27	6.83%	3.32	0.207	20941
12	7.69%	3.00	7.47%	3.03	0.203	22903
13	8.33%	2.77	8.12%	2.79	0.197	24896
14	8.97%	2.57	8.76%	2.59	0.194	26858
15	9.62%	2.40	9.41%	2.41	0.189	28851
16	10.26%	2.25	10.05%	2.26	0.186	30813
17	10.90%	2.12	10.70%	2.12	0.184	32806
18	11.54%	2.00	11.34%	2.00	0.182	34768
19	12.18%	1.89	11.98%	1.89	0.177	36731
20	12.82%	1.80	12.63%	1.80	0.177	38724
21	13.46%	1.71	13.27%	1.71	0.176	40686
22	14.10%	1.64	13.92%	1.63	0.176	42679
23	14.74%	1.57	14.56%	1.56	0.173	44641
24	15.38%	1.50	15.21%	1.49	0.171	46634
25	16.03%	1.44	15.85%	1.43	0.170	48596
26	16.67%	1.38	16.49%	1.38	0.167	50558
27	17.31%	1.33	17.14%	1.32	0.166	52551
28	17.95%	1.29	17.78%	1.28	0.159	54513
29	18.59%	1.24	18.43%	1.23	0.155	56506
30	19.23%	1.20	19.07%	1.19	0.154	58469
31	19.87%	1.16	19.72%	1.15	0.154	60462
32	20.51%	1.13	20.36%	1.11	0.149	62424
33	21.15%	1.09	21.01%	1.08	0.148	64417
34	21.79%	1.06	21.65%	1.05	0.146	66379
35	22.44%	1.03	22.29%	1.02	0.146	68341
36	23.08%	1.00	22.94%	0.99	0.146	70334
37	23.72%	0.97	23.58%	0.96	0.142	72296

38	24.36%	0.95	24.23%	0.94	0.141	74289
39	25.00%	0.92	24.87%	0.91	0.140	76251
40	25.64%	0.90	25.52%	0.89	0.138	78244
41	26.28%	0.88	26.16%	0.87	0.138	80207
42	26.92%	0.86	26.80%	0.85	0.138	82169
43	27.56%	0.84	27.45%	0.83	0.137	84162
44	28.21%	0.82	28.09%	0.81	0.136	86124
45	28.85%	0.80	28.74%	0.79	0.135	88117
46	29.49%	0.78	29.38%	0.77	0.135	90079
47	30.13%	0.77	30.03%	0.76	0.135	92072
48	30.77%	0.75	30.67%	0.74	0.133	94034
49	31.41%	0.73	31.31%	0.72	0.131	95996
50	32.05%	0.72	31.96%	0.71	0.128	97989
51	32.69%	0.71	32.60%	0.70	0.127	99952
52	33.33%	0.69	33.25%	0.68	0.125	101945
53	33.97%	0.68	33.89%	0.67	0.125	103907
54	34.62%	0.67	34.54%	0.66	0.123	105900
55	35.26%	0.65	35.18%	0.64	0.123	107862
56	35.90%	0.64	35.82%	0.63	0.122	109824
57	36.54%	0.63	36.47%	0.62	0.122	111817
58	37.18%	0.62	37.11%	0.61	0.120	113779
59	37.82%	0.61	37.76%	0.60	0.119	115772
60	38.46%	0.60	38.40%	0.59	0.119	117734
61	39.10%	0.59	39.05%	0.58	0.117	119727
62	39.74%	0.58	39.69%	0.57	0.115	121690
63	40.38%	0.57	40.34%	0.56	0.114	123682
64	41.03%	0.56	40.98%	0.55	0.114	125645
65	41.67%	0.55	41.62%	0.54	0.113	127607
66	42.31%	0.55	42.27%	0.54	0.110	129600
67	42.95%	0.54	42.91%	0.53	0.109	131562
68	43.59%	0.53	43.56%	0.52	0.101	133555
69	44.23%	0.52	44.20%	0.51	0.101	135517
70	44.87%	0.51	44.85%	0.51	0.100	137510
71	45.51%	0.51	45.49%	0.50	0.099	139472
72	46.15%	0.50	46.13%	0.49	0.098	141435
73	46.79%	0.49	46.78%	0.48	0.097	143427
74	47.44%	0.49	47.42%	0.48	0.096	145390
75	48.08%	0.48	48.07%	0.47	0.095	147383
76	48.72%	0.47	48.71%	0.47	0.094	149345
77	49.36%	0.47	49.36%	0.46	0.092	151338
78	50.00%	0.46	50.00%	0.45	0.090	153300
79	50.64%	0.46	50.64%	0.45	0.089	155262
80	51.28%	0.45	51.29%	0.44	0.088	157255
81	51.92%	0.44	51.93%	0.44	0.087	159217
82	52.56%	0.44	52.58%	0.43	0.086	161210
83	53.21%	0.43	53.22%	0.43	0.085	163173
84	53.85%	0.43	53.87%	0.42	0.084	165165
85	54.49%	0.42	54.51%	0.42	0.083	167128
86	55.13%	0.42	55.15%	0.41	0.080	169090
87	55.77%	0.41	55.80%	0.41	0.080	171083
88	56.41%	0.41	56.44%	0.40	0.080	173045
89	57.05%	0.40	57.09%	0.40	0.078	175038

90	57.69%	0.40	57.73%	0.39	0.078	177000
91	58.33%	0.40	58.38%	0.39	0.077	178993
92	58.97%	0.39	59.02%	0.38	0.077	180955
93	59.62%	0.39	59.66%	0.38	0.075	182918
94	60.26%	0.38	60.31%	0.38	0.075	184910
95	60.90%	0.38	60.95%	0.37	0.074	186873
96	61.54%	0.38	61.60%	0.37	0.073	188866
97	62.18%	0.37	62.24%	0.36	0.070	190828
98	62.82%	0.37	62.89%	0.36	0.069	192821
99	63.46%	0.36	63.53%	0.36	0.067	194783
100	64.10%	0.36	64.18%	0.35	0.066	196776
101	64.74%	0.36	64.82%	0.35	0.063	198738
102	65.38%	0.35	65.46%	0.35	0.062	200700
103	66.03%	0.35	66.11%	0.34	0.062	202693
104	66.67%	0.35	66.75%	0.34	0.061	204656
105	67.31%	0.34	67.40%	0.34	0.060	206648
106	67.95%	0.34	68.04%	0.33	0.059	208611
107	68.59%	0.34	68.69%	0.33	0.059	210604
108	69.23%	0.33	69.33%	0.33	0.058	212566
109	69.87%	0.33	69.97%	0.32	0.057	214528
110	70.51%	0.33	70.62%	0.32	0.057	216521
111	71.15%	0.32	71.26%	0.32	0.057	218483
112	71.79%	0.32	71.91%	0.32	0.056	220476
113	72.44%	0.32	72.55%	0.31	0.055	222438
114	73.08%	0.32	73.20%	0.31	0.055	224431
115	73.72%	0.31	73.84%	0.31	0.054	226393
116	74.36%	0.31	74.48%	0.30	0.053	228356
117	75.00%	0.31	75.13%	0.30	0.052	230349
118	75.64%	0.31	75.77%	0.30	0.051	232311
119	76.28%	0.30	76.42%	0.30	0.049	234304
120	76.92%	0.30	77.06%	0.29	0.045	236266
121	77.56%	0.30	77.71%	0.29	0.044	238259
122	78.21%	0.30	78.35%	0.29	0.043	240221
123	78.85%	0.29	78.99%	0.29	0.043	242183
124	79.49%	0.29	79.64%	0.28	0.043	244176
125	80.13%	0.29	80.28%	0.28	0.040	246138
126	80.77%	0.29	80.93%	0.28	0.039	248131
127	81.41%	0.28	81.57%	0.28	0.039	250094
128	82.05%	0.28	82.22%	0.28	0.038	252087
129	82.69%	0.28	82.86%	0.27	0.038	254049
130	83.33%	0.28	83.51%	0.27	0.037	256042
131	83.97%	0.27	84.15%	0.27	0.037	258004
132	84.62%	0.27	84.79%	0.27	0.037	259966
133	85.26%	0.27	85.44%	0.27	0.036	261959
134	85.90%	0.27	86.08%	0.26	0.034	263921
135	86.54%	0.27	86.73%	0.26	0.034	265914
136	87.18%	0.26	87.37%	0.26	0.032	267876
137	87.82%	0.26	88.02%	0.26	0.032	269869
138	88.46%	0.26	88.66%	0.26	0.032	271832
139	89.10%	0.26	89.30%	0.25	0.030	273794
140	89.74%	0.26	89.95%	0.25	0.029	275787
141	90.38%	0.26	90.59%	0.25	0.028	277749

142	91.03%	0.25	91.24%	0.25	0.028	279742
143	91.67%	0.25	91.88%	0.25	0.024	281704
144	92.31%	0.25	92.53%	0.25	0.023	283697
145	92.95%	0.25	93.17%	0.24	0.022	285659
146	93.59%	0.25	93.81%	0.24	0.019	287621
147	94.23%	0.24	94.46%	0.24	0.019	289614
148	94.87%	0.24	95.10%	0.24	0.018	291577
149	95.51%	0.24	95.75%	0.24	0.018	293570
150	96.15%	0.24	96.39%	0.24	0.017	295532
151	96.79%	0.24	97.04%	0.23	0.016	297525
152	97.44%	0.24	97.68%	0.23	0.015	299487
153	98.08%	0.24	98.32%	0.23	0.014	301449
154	98.72%	0.23	98.97%	0.23	0.011	303442
155	99.36%	0.23	99.61%	0.23	0.011	305404

APPENDIX III: INPUT PARAMETERS

SB&O Inc.
(858) 560-1141
www.SBOINC.com

SWMM MODEL INPUT PARAMETERS
EXISTING CONDITION

```
[OPTIONS]
FLOW_UNITS           CFS
INFILTRATION         GREEN_AMPT
FLOW_ROUTING         KINWAVE
START_DATE           10/03/1970
START_TIME           00:00:00
REPORT_START_DATE    10/03/1970
REPORT_START_TIME    00:00:00
END_DATE             06/01/2008
END_TIME             00:00:00
SWEEP_START          01/01
SWEEP_END            12/31
DRY_DAYS             0
REPORT_STEP          00:15:00
WET_STEP             00:05:00
DRY_STEP             01:00:00
ROUTING_STEP         0:00:30
ALLOW_PONDING        NO
INERTIAL_DAMPING     PARTIAL
VARIABLE_STEP        0.75
LENGTHENING_STEP     0
MIN_SURFAREA         0
NORMAL_FLOW_LIMITED  BOTH
SKIP_STEADY_STATE    NO
FORCE_MAIN_EQUATION  H-W
LINK_OFFSETS         DEPTH
MIN_SLOPE            0

[EVAPORATION]
;;Type       Parameters
;;---------- ----------
CONSTANT     .1475
DRY_ONLY     NO

[RAINGAGES]
;;               Rain      Time   Snow   Data
;;Name           Type      Intrvl Catch  Source
;;-------------- --------- ------ ------ ----------
BONITA           INTENSITY 1:00   1.0    TIMESERIES BONITA
```

```
[SUBCATCHMENTS]
;;                                                 Total    Pcnt.             Pcnt.    Curb     Snow
;;Name           Raingage         Outlet           Area     Imperv   Width    Slope    Length   Pack
;;-------------- ---------------- ---------------- -------- -------- -------- -------- -------- --------
1-NORTH          BONITA           POC1             10.23    5        891      2        0
2-SOUTH          BONITA           POC2             5.33     5        465      1.8      0

[SUBAREAS]
;;Subcatchment   N-Imperv   N-Perv     S-Imperv   S-Perv     PctZero    RouteTo    PctRouted
;;-------------- ---------- ---------- ---------- ---------- ---------- ---------- ----------
1-NORTH          .015       .05        .05        .15        25         OUTLET
2-SOUTH          .015       .05        0.05       .15        25         OUTLET

[INFILTRATION]
;;Subcatchment   Suction    HydCon     IMDmax
;;-------------- ---------- ---------- ----------
1-NORTH          9          .025       .3
2-SOUTH          9          .025       .3

[OUTFALLS]
;;               Invert     Outfall    Stage/Table      Tide
;;Name           Elev.      Type       Time Series      Gate
;;-------------- ---------- ---------- ---------------- ----
POC1             0          FREE                        NO
POC2             0          FREE                        NO



SWMM MODEL INPUT PARAMETERS
MITIGATED CONDITION

[OPTIONS]
FLOW_UNITS           CFS
INFILTRATION         GREEN_AMPT
FLOW_ROUTING         KINWAVE
START_DATE           10/03/1970
START_TIME           00:00:00
REPORT_START_DATE    10/03/1970
REPORT_START_TIME    00:00:00
END_DATE             06/01/2008
END_TIME             00:00:00
SWEEP_START          01/01
SWEEP_END            12/31
DRY_DAYS             0
```

```
REPORT_STEP          00:15:00
WET_STEP             00:05:00
DRY_STEP             01:00:00
ROUTING_STEP         0:00:30
ALLOW_PONDING        NO
INERTIAL_DAMPING     PARTIAL
VARIABLE_STEP        0.75
LENGTHENING_STEP     0
MIN_SURFAREA         0
NORMAL_FLOW_LIMITED  BOTH
SKIP_STEADY_STATE    NO
FORCE_MAIN_EQUATION  H-W
LINK_OFFSETS         DEPTH
MIN_SLOPE            0

[EVAPORATION]
;;Type       Parameters
;;---------- ----------
CONSTANT     .1475
DRY_ONLY     NO

[RAINGAGES]
;;               Rain      Time   Snow   Data
;;Name           Type      Intrvl Catch  Source
;;-------------- --------- ------ ------ ----------
BONITA           INTENSITY 1:00   1.0    TIMESERIES BONITA

[SUBCATCHMENTS]
;;                                          Total    Pcnt.             Pcnt.    Curb     Snow
;;Name           Raingage         Outlet           Area     Imperv   Width    Slope    Length   Pack
;;-------------- ---------------- ---------------- -------- -------- -------- -------- -------- --------
1-NORTH          BONITA           N-STORAGE        10.23    .67      22281    2        0
2-SOUTH          BONITA           S-STORAGE        5.33     0.66     11609    2        0

[SUBAREAS]
;;Subcatchment   N-Imperv   N-Perv     S-Imperv   S-Perv     PctZero    RouteTo    PctRouted
;;-------------- ---------- ---------- ---------- ---------- ---------- ---------- ----------
1-NORTH          .015       .03        .05        .1         25         PERVIOUS   100
2-SOUTH          .015       .03        0.05       .1         25         PERVIOUS   100

[INFILTRATION]
;;Subcatchment   Suction    HydCon     IMDmax
;;-------------- ---------- ---------- ----------
1-NORTH          9          .025       .3
2-SOUTH          9          .025       .3
```

```
[OUTFALLS]
;;               Invert     Outfall    Stage/Table      Tide
;;Name           Elev.      Type       Time Series      Gate
;;-------------- ---------- ---------- ---------------- ----
POC1             0          FREE                        NO
POC2             0          FREE                        NO

[STORAGE]
;;               Invert   Max.     Init.    Storage    Curve                    Ponded   Evap.
;;Name           Elev.    Depth    Depth    Curve      Params                   Area     Frac.    Infiltration
Parameters
;;-------------- -------- -------- -------- ---------- -------- -------- -------- -------- -------- ------------------
----
N-STORAGE        0        5.5      0        TABULAR    S1                       0        1
S-STORAGE        0        5.5      0        TABULAR    S2                       0        0

[ORIFICES]
;;               Inlet            Outlet           Orifice      Crest      Disch.     Flap Open/Close
;;Name           Node             Node             Type         Height     Coeff.     Gate Time
;;-------------- ---------------- ---------------- ------------ ---------- ---------- ---- ----------
O1-N             N-STORAGE        POC1             SIDE         0          0.65       NO   0
O1-S             S-STORAGE        POC2             SIDE         0          0.65       NO   0

[WEIRS]
;;               Inlet            Outlet           Weir         Crest      Disch.     Flap End      End
;;Name           Node             Node             Type         Height     Coeff.     Gate Con.     Coeff.
;;-------------- ---------------- ---------------- ------------ ---------- ---------- ---- -------- ----------
W1-N             N-STORAGE        POC1             TRANSVERSE   5          3.33       NO   0        0
W1-S             S-STORAGE        POC2             TRANSVERSE   4          3.33       NO   0        0

[XSECTIONS]
;;Link           Shape        Geom1            Geom2      Geom3      Geom4      Barrels
;;-------------- ------------ ---------------- ---------- ---------- ---------- ----------
O1-N             CIRCULAR     .2917            0          0          0
O1-S             CIRCULAR     .17              0          0          0
W1-N             RECT_OPEN    .5               4          0          0
W1-S             RECT_OPEN    1.5              .33        0          0

[CURVES]
;;Name           Type       X-Value    Y-Value
;;-------------- ---------- ---------- ----------
S1               Storage    0.0        14921.0
S1                          0.1        15049.3
S1                          0.2        15177.6
```

S1	0.3	15306.0
S1	0.4	15434.3
S1	0.5	15562.6
S1	0.6	15690.9
S1	0.7	15819.3
S1	0.8	15947.6
S1	0.9	16075.9
S1	1.0	16204.2
S1	1.1	16332.5
S1	1.2	16460.9
S1	1.3	16589.2
S1	1.4	16717.5
S1	1.5	19409.3
S1	1.6	19537.6
S1	1.7	19666.0
S1	1.8	19794.3
S1	1.9	19922.6
S1	2.0	20050.9
S1	2.1	20179.3
S1	2.2	20307.6
S1	2.3	20435.9
S1	2.4	20564.2
S1	2.5	20692.5
S1	2.6	20820.9
S1	2.7	20949.2
S1	2.8	21077.5
S1	2.9	21205.8
S1	3.0	21334.1
S1	3.1	21462.5
S1	3.2	21590.8
S1	3.3	21719.1
S1	3.4	21847.4
S1	3.5	27957.3
S1	3.6	28165.3
S1	3.7	28373.4
S1	3.8	28581.5
S1	3.9	28789.5
S1	4.0	28997.6
S1	4.1	29205.7
S1	4.2	29413.8
S1	4.3	29621.8
S1	4.4	29829.9
S1	4.5	30038.0
S1	4.6	30246.0
S1	4.7	30454.1

S1		4.8	30662.2
S1		4.9	30870.3
S1		5.0	31078.3
S1		5.1	31286.4
S1		5.2	31494.5
S1		5.3	31702.5
S1		5.4	31910.6
S1		5.5	32247.0
S2	Storage	0.0	3910.0
S2		0.1	3910.0
S2		0.2	3910.0
S2		0.3	3910.0
S2		0.4	3910.0
S2		0.5	3910.0
S2		0.6	3910.0
S2		0.7	3910.0
S2		0.8	3910.0
S2		0.9	3910.0
S2		1.0	3910.0
S2		1.1	3910.0
S2		1.2	3910.0
S2		1.3	3910.0
S2		1.4	3910.0
S2		1.5	3910.0
S2		1.6	3910.0
S2		1.7	3910.0
S2		1.8	3910.0
S2		1.9	3910.0
S2		2.0	3910.0
S2		2.1	3910.0
S2		2.2	3910.0
S2		2.3	3910.0
S2		2.4	3910.0
S2		2.5	3910.0
S2		2.6	3910.0
S2		2.7	3910.0
S2		2.8	3910.0
S2		2.9	3910.0
S2		3.0	3910.0
S2		3.1	3910.0
S2		3.2	3910.0
S2		3.3	3910.0
S2		3.4	3910.0
S2		3.5	3910.0

S2	3.6	3910.0
S2	3.7	3910.0
S2	3.8	3910.0
S2	3.9	3910.0
S2	4.0	3910.0
S2	4.1	3910.0
S2	4.2	3910.0
S2	4.3	3910.0
S2	4.4	3910.0
S2	4.5	3910.0
S2	4.6	3910.0
S2	4.7	3910.0
S2	4.8	3910.0
S2	4.9	3910.0
S2	5.0	3910.0
S2	5.1	3910.0
S2	5.2	3910.0
S2	5.3	3910.0
S2	5.4	3910.0
S2	5.5	3910.0

ATTACHMENT 3
STRUCTURAL BMP MAINTENANCE INFORMATION

This is the cover sheet for Attachment 3.

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Project Name: Southview East

Indicate which Items are Included:

Attachment Sequence	Contents	Checklist
Attachment 3a	Structural BMP Maintenance Thresholds and Actions (Required)	■ Included See Structural BMP Maintenance Information Checklist.
Attachment 3b	Maintenance Agreement (Form DS-3247) (when applicable)	◘ Included ◘ Not Applicable

Project Name: Southview East

Use this checklist to ensure the required information has been included in the Structural BMP Maintenance Information Attachment:

Preliminary Design / Planning / CEQA level submittal:

- Attachment 3a must identify:
  - ☐ Typical maintenance indicators and actions for proposed structural BMP(s) based on Section 7.7 of the BMP Design Manual
- Attachment 3b is not required for preliminary design / planning / CEQA level submittal.

Final Design level submittal:

Attachment 3a must identify:

- ☐ Specific maintenance indicators and actions for proposed structural BMP(s). This shall be based on Section 7.7 of the BMP Design Manual and enhanced to reflect actual proposed components of the structural BMP(s)
- ☐ How to access the structural BMP(s) to inspect and perform maintenance
- ☐ Features that are provided to facilitate inspection (e.g., observation ports, cleanouts, silt posts, or other features that allow the inspector to view necessary components of the structural BMP and compare to maintenance thresholds)
- ☐ Manufacturer and part number for proprietary parts of structural BMP(s) when applicable
- ☐ Maintenance thresholds specific to the structural BMP(s), with a location-specific frame of reference (e.g., level of accumulated materials that triggers removal of the materials, to be identified based on viewing marks on silt posts or measured with a survey rod with respect to a fixed benchmark within the BMP)
- ☐ When applicable, frequency of bioretention soil media replacement
- ☐ Recommended equipment to perform maintenance
- ☐ When applicable, necessary special training or certification requirements for inspection and maintenance personnel such as confined space entry or hazardous waste management

Attachment 3b: For private entity operation and maintenance, Attachment 3b must include a Storm Water Management and Discharge Control Maintenance Agreement (Form DS-3247). The following information must be included in the exhibits attached to the maintenance agreement:

- ☐ Vicinity map
- ☐ Site design BMPs for which DCV reduction is claimed for meeting the pollutant control obligations.
- ☐ BMP and HMP location and dimensions
- ☐ BMP and HMP specifications/cross section/model
- ☐ Maintenance recommendations and frequency
- ☐ LID features such as (permeable paver and LS location, dim, SF).

Project Name: Southview East

THE CITY OF SAN DIEGO RECORDING REQUESTED BY: **THE CITY OF SAN DIEGO** AND WHEN RECORDED MAIL Click or tap here to enter text. Click or tap here to enter text. Click or tap here to enter text.	(THIS SPACE IS FOR THE RECORDER'S USE ONLY)

STORM WATER MANAGEMENT AND DISCHARGE CONTROL MAINTENANCE AGREEMENT

APPROVAL NUMBER:	ASSESSOR'S PARCEL NUMBER:	PROJECT NUMBER:
Click or tap here to enter text.	Click or tap here to enter text.	Click or tap here to enter text.

This agreement is made by and between the City of San Diego, a municipal corporation [City] and Click or tap here to enter text.

the owner or duly authorized representative of the owner [Property Owner] of property located at:
Click or tap here to enter text.

(PROPERTY ADDRESS)

and more particularly described as: Click or tap here to enter text.

(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 Storm Water Quality Management Plan [SWQMP] and Grading and/or Improvement Plan Drawing No(s), or Building Plan Project No(s): Click or 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): Click or tap here to enter text.

Project Name: Southview East

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):Click or tap here to enter text..

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)Click or tap here to enter text..

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 Exhibits(s):Click or tap here to enter text.

(Owner Signature)

Click or tap here to enter text.

(Print Name and Title)

Click or tap here to enter text.

(Company/Organization Name)

Click or tap to enter a date.

(Date)

THE CITY OF SAN DIEGO

APPROVED:

(City Control engineer Signature

(Print Name)

(Date)

NOTE: ALL SIGNATURES MUST INCLUDE NOTARY ACKNOWLEDMENTS PER CIVIL CODE SEC. 1180 ET.SEQ

ATTACHMENT 4
COPY OF PLAN SHEETS SHOWING PERMANENT STORM WATER BMPS

This is the cover sheet for Attachment 4.

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Use this checklist to ensure the required information has been included on the plans:

The plans must identify:

- ☐ Structural BMP(s) with ID numbers matching Form I-6 Summary of PDP Structural BMPs
- ☐ The grading and drainage design shown on the plans must be consistent with the delineation of DMAs shown on the DMA exhibit
- ☐ Details and specifications for construction of structural BMP(s)
- ☐ Signage indicating the location and boundary of structural BMP(s) as required by the City Engineer
- ☐ How to access the structural BMP(s) to inspect and perform maintenance
- ☐ Features that are provided to facilitate inspection (e.g., observation ports, cleanouts, silt posts, or other features that allow the inspector to view necessary components of the structural BMP and compare to maintenance thresholds)
- ☐ Manufacturer and part number for proprietary parts of structural BMP(s) when applicable
- ☐ Maintenance thresholds specific to the structural BMP(s), with a location-specific frame of reference (e.g., level of accumulated materials that triggers removal of the materials, to be identified based on viewing marks on silt posts or measured with a survey rod with respect to a fixed benchmark within the BMP)
- ☐ Recommended equipment to perform maintenance
- ☐ When applicable, necessary special training or certification requirements for inspection and maintenance personnel such as confined space entry or hazardous waste management
- ☐ Include landscaping plan sheets showing vegetation requirements for vegetated structural BMP(s)
- ☐ All BMPs must be fully dimensioned on the plans
- ☐ When propritery BMPs are used, site specific cross section with outflow, inflow and model number shall be provided. Broucher photocopies are not allowed.

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ATTACHMENT 5
DRAINAGE REPORT

Attach project's drainage report. Refer to Drainage Design Manual to determine the reporting requirements.

SB&O INC.
PLANNING ENGINEERING SURVEYING

DETENTION BASIN DESIGN REPORT

FOR

SOUTHVIEW EAST

City of San Diego TM/SDP
IO No.24004729 / Project No.371807

IN

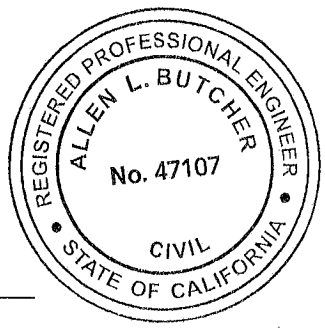
COUNTY OF SAN DIEGO

Prepared for:

CORNERSTONE COMMUNITIES
4365 Executive Drive, Suite 600
San Diego, CA 92121
Telephone: 858-458-9700

Prepared by:

SB&O, Inc.
3990 Ruffin Road, Suite 120
San Diego, CA 92123
858-560-1141
SB&O Job No. 70910.10



Allen L. Butcher PE 47107
EXP. 12/31/2017

F 4.0 Third Submittal

May 6, 2016

TABLE OF CONTENTS

EXHIBITS

APPENDIX

SCOPE OF REPORT

The project is located in the Otay Mesa Community, which is tributary to the Tijuana River Valley (911.12). In accordance with City of San Diego (City) policy for Otay Mesa, post-development peak flow rates may not exceed pre-development conditions for storms ranging from the 2-year up to the 50-year return frequency. The purpose of this report is to document the volume of storage required to mitigate post-development runoff increases.

The project proposes to use biofiltration basins for treatment, followed by detention facilities for combined HMP control and storm attenuation. Details and calculations related to water quality treatment and HMP compliance are contained in a separate Water Quality Technical Report for the project.

The Southview East project will be an extension of the adjacent Southview development, and will remove the most easterly water quality, HMP and detention facilities in the Southview development. Similar to the Southview development, the Southview East project is split north and south of Airway, with drainage facilities for each side of the street..

The Southview East development located north of Airway, will construct replacement basins (treatment and HMP/Detention basins in series) for both projects immediately east of the development limits, for the entire area north of Airway Road.. The Southview East area, located south of Airway Road, will remove only the most easterly water quality facility and provide a replacement biofiltration basin along with a HMP/detention tank.

Since the proposed development will remove the existing detention facilities, the post-development peak flow rates will be compared to existing tributary areas of the same size.

EXISTING SITE

The existing site is situated in the eastern portion the Otay Mesa Community Plan of the City of San Diego, located approximately 1.5 miles east of the Interstate 805 Freeway, 1 mile west of Brown Field Airport, and 1 mile north of the Mexico International Border. The site is located east of the intersection of Caliente Avenue and Airway Road.

Although the site is undeveloped, past disturbances include dirt trails. Runoff from the site is trends southwest to northeast. All of the site runoff is tributary to the canyon located east of the site, then southerly toward the Tijuana River. Topography is mild with slopes ranging from 1% up to 5%. Vegetation is primarily long grasses in poor condition. Surficial soils are finely grained and include some clay. Infiltration rates are expected to be poor, consistent with Type D soils.

See Map Pocket # 1 for a Drainage Map of the Existing Condition

PROJECT DESCRIPTION

The Southview East project is approximately 8 acres, split north and south of Airway Road. Product type is Residential / Multifamily with private drives. Post development drainage patterns will generally continue the west to east trend. Discharge will be at 2 primary locations, north of Airway, and near the southeastern development limits..

The Southview East project will remove the Southview Lot 1 combination basin (biofiltration, HMP mitigation and detention basin located north of Airway Road), and the most easterly Southview Lot 2 combination basin.

A Site Exhibit depicting the development plan, street patterns, storm drain systems and combination/detention basin locations is provided in Map Pocket #2.

RATIONAL METHOD HYDROLOGY

In accordance with the City of San Diego Drainage Manual, the rational method was used to estimate peak flow rates for the current conditions. Selected City of San Diego Drainage Design Manual excerpts may be found in the Appendix.

Rational Method Runoff Coefficients for un-developed conditions are not provided in Table 2. A runoff coefficient of 0.40 was selected for the pre-development condition. The existing conditions are disturbed, runoff patterns are generally sheet flow, with average flow lengths in excess of 500 feet, and land slopes slightly greater than 1%. These conditions are more closely related to urban conditions rather than "natural watershed". Based upon the Urban Area Overland Time of Concentration Nomograph, these times of concentration are as follows;

Basin	**North (including Lot 1)**	**South**
Overland Distance (ft.)	1,050	600
C factor	0.4	0.4
Slope (%)	2	3
Time of Concentration (min)	32.4	21.4

The peak rainfall intensity is then estimated from the Rainfall IDF Curve, which yields the following runoff estimates;

North + Lot 1 Existing **Tc=32.4 min** **C=0.4** **Area=11.99 ac**

Frequency (year)	**City** - Intensity (in/hr)	Peak Discharge (cfs)
2	0.93	4.44
5	1.19	5.69
10	1.40	6.71
25	1.66	8.15
50	1.82	8.75
100	1.95	9.35

South Existing **Tc=21.4 min** **C=0.4** **Area=5.33 ac**

Frequency (year)	**City** - Intensity (in/hr)	Peak Discharge (cfs)
2	1.09	2.33
5	1.40	2.99
10	1.65	3.52
25	1.96	4.18
50	2.15	4.59
100	2.30	4.90

Post Development (City)

The post development drainage patterns will maintain the general west-to-east trend. The post development imperviousness of 66% indicates a C-factor of 0.75. The areas tributary to the northerly basin include undeveloped areas northwest of Southview (overland flow path) and gutter flows from Caliente (north of the Airway intersection) leading to a much longer time of concentration. The detailed hydraulic calculations for storm drain design in Southview Lot 1 estimated the time of concentration at 17.5 minutes. The development intensity for multifamily residential results in short overland flow lengths, with longer travel distances in gutters and pipe segments. In order to provide conservative peak flow estimates for the preliminary phase, a minimum time of concentration of 5 minutes was used for the Southerly development areas. A peak flow comparison is summarized below;

North + Lot 1 - Developed **Tc=17.5 min** **C=0.75** **Area=11.99 ac**

Frequency (year)	**City** -Intensity (in/hr)	Peak Discharge (cfs)	Pre-Development (cfs)
2	1.35	12.14	4.44
5	1.65	14.84	5.69
10	1.95	17.54	6.71
25	2.30	20.68	8.15
50	2.50	22.48	8.75
100	2.76	24.82	9.35

South - Developed **Tc=5.0 min** **C=0.75** **Area=5.33 ac**

Frequency (year)	Intensity (in/hr)	Peak Discharge (cfs)	Pre-Development (cfs)
2	2.23	8.93	2.33
5	2.86	11.44	2.99
10	3.37	13.49	3.52
25	4.00	16.00	4.18
50	4.40	17.58	4.59
100	4.70	18.79	4.90

As expected, the comparison confirms significant peak flow increases over pre-development conditions. Rational Method calculations (City) are provided in Exhibit A

RATIONAL METHOD HYDROGRAPH METHODOLOGY

The City of San Diego Drainage Design Manual provides for peak runoff rates for small drainage basins using a Rational Method. The procedure is based upon the City of San Diego Intensity-Duration-Frequency (IDF) Nomograph to determine peak rainfall intensity using a time of concentration (event duration).

In order to model the effects of a detention basin, a runoff time series must be available. The County of San Diego Hydrology Manual includes a similar Rational Method, but also includes a procedure to develop a time based runoff series. The methodology assumes a simple triangular hydrograph, the 6-hour rainfall total, and Rational Method input variables. The methodology provides runoff values at time intervals equal to multiples of the time of concentration. Details related to the procedure to develop the hydrograph are provided in Chapter 6 of the County of San Diego Hydrology Manual (See Appendix).

Peak flow rates for the post-development interim conditions were calculated using the **County** Rational Method, with an estimated time of concentration, and runoff coefficients identical to the City calculations. See Exhibit B for County Rational Method calculations.

North + Lot 1 - Developed **Tc=18 min** **C=0.75** **Area=11.99 ac**

Frequency (year)	**County** _ Intensity (in/hr)	Peak Discharge (cfs)	Pre-Development (cfs)
2	1.10	9.85	3.60
5	1.50	13.48	4.92
10	1.73	15.56	5.68
25	1.90	17.11	6.25
50	2.08	18.67	6.81
100	2.31	20.74	7.57

South Developed **Tc=5 min C=0.75 Area=5.33 ac**

Frequency (year)	**County**-Intensity (in/hr)	Peak Discharge (cfs)	Pre-Development (cfs)
2	2.50	10.01	1.83
5	3.43	13.69	2.50
10	3.95	15.80	2.89
25	4.35	17.38	3.17
50	4.74	18.96	3.46
100	5.27	21.06	3.85

Using the County peak flow rates, post development hydrographs were developed.

A copy of the hydrographs for the 2, 5, 10, 25, 50 and 100-year storms are provided in Exhibit B.

DETENTION BASINS

For purposes of detention basin routing, the attenuation effects of the biofiltration basins are ignored. The detention model will be based upon the HMP controls and volumes. The north basin volumes include the upper volume of the adjacent biofiltration basin. Elevation-storage-discharge rating tables were prepared using the incremental volumes and corresponding outflows. Discharge values for the basins were estimated using standard weir and orifice flow equations. An iterative process was utilized to determine the number, size and elevation of the discharge control openings. The detention basins were modeled using the following data;

North **Detention Storage (includes part of Biofiltration) = 2.58 ac-ft.**

Elevation	Description	Opening Size	Comment
510.5	Bottom of Basin	3.5"	Lower Drain
515.0	Biofiltration	Spillway entry	
515.0	Rectangular Weir	48" wide x 6"high	Upper Drain
515.5	Grated Top of Structure	12" Round Grate	Overflow
516.0	Top of Detention Basin		Earth Berm

South **Detention Storage (Tank only) = 0.48 ac-ft.**

Elevation	Description	Opening Size	Comment
512.0	Bottom of Tank	34' x 110'	5.5' tall
512.0	Round Opening	3.5"	Lower Drain
516.0	Weir – Vertical Slot	4" wide x 18" tall	Upper Drain
517.5	Top of Tank	"	

The Storage Indication Tables for the basins are provided in Exhibits C and D, respectively.

DETENTION ANALYSES

The range of storm hydrographs were routed through the detention basins, including the 2-, 5-, 10-, 25-, 50- and 100-year events. A review of the results indicates that the combined composite basins will attenuate post-development peak flow rates to less than pre-development levels.

Peak Basin Outflow – North

Frequency (year)	Post Development (cfs)	Pre-Development (cfs)	Basin Outflow (cfs)
2	9.85	3.60	0.43
5	13.48	4.92	0.51
10	15.56	5.68	0.54
25	17.11	6.25	0.58
50	18.67	6.81	0.60
100	20.74	7.57	0.63

Peak Basin Outflow – South

Frequency (year)	Post Development (cfs)	Pre-Development (cfs)	Basin Outflow (cfs)
2	10.01	1.83	0.19
5	13.69	2.50	0.23
10	15.80	2.89	0.50
25	17.38	3.17	0.85
50	18.96	3.46	1.14.
100	21.06	3.85	1.80

The 100-year storage depth for the North basin is 3.3 feet of the 5.5 feet maximum basin depth. The 100-year storage depth for the South basin is 5.3 feet of the 5.5 feet maximum tank height.

Summary results are provided in Exhibit E, with individual basins detailed in Exhibits F &G.

DRAIN TIME CALCULATION

The design procedure for storm drain facilities includes a recommended maximum drain time of 96 hours to avoid vector concerns. The time series for the 10-year analyses were extended to verify the drain time.

The basin storage volumes are based upon the combination of the above and below grade volumes. Since the below grade volumes are inaccessible void spaces, the water surface must be below the surface of the bio-retention basin in order to demonstrate compliance. The following is a summary of the 10-year time to drain for the basins;

10-year drain time	Storage Depth (feet)	Time (hrs)
North Basin	3.0	60.9
South Tank	4.4	47.0

Drain time simulations for the 10-year storms are provided in Exhibit H.

CONCLUSION

This study and the calculations presented herein demonstrate the adequacy of the bioretention basins to attenuate post-development peak flow rates for the applicable range of storms, including the 2-, 5-, 10-, 25-, 50- and 100-year events.

EXHIBIT A

RATIONAL METHOD CALCULATIONS

CITY OF SAN DIEGO

Southview East - North

5/06/2016

Pre-Development Condition

Rational Method Calculations

City of San Diego Drainage Manual

E-North (SV East + Lot 1 SV)

A =	11.99	ac
Lo =	1050	ft
C =	0.4	Table 2
S =	2	%
Tc =	32.4	min

Storm (year)	Intensity (in/hr)	Q (cfs)
2	0.93	4.44
5	1.19	5.69
10	1.40	6.71
25	1.70	8.15
50	1.82	8.75
100	1.95	9.35

Southview East - North

5/06/2016

Post Development Condition

Rational Method Calculations

City of San Diego Drainage Manual

North (SV East + Lot 1 SV)

A = 11.99 ac

C = 0.75 Imperv = 67%

Tc = 17.5 min

Storm (year)	Intensity (in/hr)	Q (cfs)
2	1.35	12.14
5	1.65	14.84
10	1.95	17.54
25	2.30	20.68
50	2.50	22.48
100	2.76	24.82

Southview East

Pre-Development Condition

Rational Method Calculations

City of San Diego Drainage Manual

E-South

A =	5.33	ac
Lo =	600	ft
C =	0.4	Table 2
S =	3	%
Tc =	21.4	min

Storm (year)	Intensity (in/hr)	Q (cfs)
2	1.09	2.33
5	1.40	2.99
10	1.65	3.52
25	1.96	4.18
50	2.15	4.59
100	2.3	4.90

Southview East

Post Development Condition

Rational Method Calculations

City of San Diego Drainage Manual

Southvew East - Southern

A = 5.33 ac

C = 0.75 Imperv = 67%

Tc = 5.0 min

Storm (year)	Intensity (in/hr)	Q (cfs)
2	2.23	8.93
5	2.86	11.44
10	3.37	13.49
25	4.00	16.00
50	4.40	17.58
100	4.70	18.79

EXHIBIT B

RATIONAL METHOD HYDROGRAPHS

COUNTY OF SAN DIEGO

Southview East - North

SV E North + SV Lot 1 + Airway/Caliente

Final Design 5/06/2016

Rational Method Unit Hydrograph

Ultimate
6 hr Storm

County of San Diego Hydrology Manual - Ch 6

SV E North + SV Lot 1

Area	11.99 ac	Imperv	P6	0.95 in	P24	1.46	
C	0.75		Storm	2 year			
Tc=	17.5	67%					
Tc=	18 minutes		I=	1.10 in/hr	7.44 P6 Tc ^-0.645		
Qpeak =	9.85 cfs		Vol	31,011			
				30,935	0.713		
N=	21 Number of Precipitation Blocks			(76)			
				-0.24%			

Southview East - North

SV E North + SV Lot 1 + Airway/Caliente

Qn = 60 C A Pn/Tc
Pt(n) = 0.124 P6 (n Tc)^0.355
Pn = Pt(n) - Pt(n-1)

County of San Diego - Rational Method Hydrograph Procedure

N	Pt(n)	Pn	Q(n)	Q(n)
1	0.33	0.33	9.85	9.85
2	0.42	0.09	2.75	2.75
3	0.49	0.07	1.95	1.95
4	0.54	0.05	1.56	1.56
5	0.58	0.04	1.33	1.33
6	0.62	0.04	1.17	1.17
7	0.66	0.03	1.05	1.05
8	0.69	0.03	0.95	0.95
9	0.72	0.03	0.88	0.88
10	0.74	0.03	0.82	0.82
11	0.77	0.03	0.77	0.77
12	0.79	0.02	0.72	0.72
13	0.82	0.02	0.69	0.69
14	0.84	0.02	0.65	0.65
15	0.86	0.02	0.62	0.62
16	0.88	0.02	0.60	0.60
17	0.90	0.02	0.57	0.57
18	0.92	0.02	0.55	0.55
19	0.93	0.02	0.53	0.53
20	0.95	0.02	0.51	0.51
21	0.97	0.02	0.50	0.50

N	Time (min)	Time (hrs)	Qn (cfs)	N	Time (min)	Time (hrs)	Qn (cfs)
1	258	4.30	9.85	4	276	4.60	1.56
2	240	4.00	2.75	7	294	4.90	1.05
3	222	3.70	1.95	10	312	5.20	0.82
5	204	3.40	1.33	13	330	5.50	0.69
6	186	3.10	1.17	16	348	5.80	0.60
8	168	2.80	0.95	19	366	6.10	0.53
9	150	2.50	0.88	22	384	6.40	0.00
11	132	2.20	0.77				
12	114	1.90	0.72				
14	96	1.60	0.65				
15	78	1.30	0.62				
17	60	1.00	0.57				
18	42	0.70	0.55				
20	24	0.40	0.51				
21	6	0.10	0.50				

Southview East - North

SV E North + SV Lot 1 + Airway/Caliente

Final Design
Ultimate

5/06/2016

Post Development Hydrographs - 6 Hour Rational Method

						Ratio X/2		1.37	1.58	1.74	1.89	2.11
						P6	0.95	1.30	1.50	1.65	1.80	2.00
				9.85		Pre-Deve	3.60	4.92	5.68	6.25	6.81	7.57
						Peak	9.85	13.48	15.56	17.11	18.67	20.74
				2 Year		Return /Year	**2**	**5**	**10**	**25**	**50**	**100**
Time (min)	Qn (cfs)	Time (min)	Time (hrs)	Qn (cfs)	Vol (cf)	Time (hrs)	Q(n)	Q(n)	Q(n)	Q(n)	Q(n)	Q(n)
18	0.499	0	0.00	0.000	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00
36	0.515	18	0.30	0.499	135	0.08	0.50	0.68	0.79	0.87	0.94	1.05
54	0.552	36	0.60	0.515	547	0.17	0.51	0.70	0.81	0.89	0.98	1.08
72	0.574	54	0.90	0.552	576	0.25	0.55	0.76	0.87	0.96	1.05	1.16
90	0.623	72	1.20	0.574	608	0.33	0.57	0.78	0.91	1.00	1.09	1.21
108	0.653	90	1.50	0.623	646	0.42	0.62	0.85	0.98	1.08	1.18	1.31
126	0.724	108	1.80	0.653	689	0.50	0.65	0.89	1.03	1.13	1.24	1.37
144	0.768	126	2.10	0.724	743	0.58	0.72	0.99	1.14	1.26	1.37	1.52
162	0.880	144	2.40	0.768	806	0.67	0.77	1.05	1.21	1.33	1.45	1.62
180	0.954	162	2.70	0.880	890	0.75	0.88	1.20	1.39	1.53	1.67	1.85
198	1.166	180	3.00	0.954	991	0.83	0.95	1.31	1.51	1.66	1.81	2.01
216	1.329	198	3.30	1.166	1,145	0.92	1.17	1.60	1.84	2.03	2.21	2.46
234	1.951	216	3.60	1.329	1,347	1.00	1.33	1.82	2.10	2.31	2.52	2.80
252	2.749	234	3.90	1.951	1,771	1.08	1.95	2.67	3.08	3.39	3.70	4.11
270	**9.852**	252	4.20	2.749	2,538	1.17	2.75	3.76	4.34	4.77	5.21	5.79
288	1.565	270	4.50	9.852	6,804	1.25	**9.85**	**13.48**	**15.56**	**17.11**	**18.67**	**20.74**
306	1.047	288	4.80	1.565	6,165	1.33	1.56	2.14	2.47	2.72	2.96	3.29
324	0.819	306	5.10	1.047	1,410	1.42	1.05	1.43	1.65	1.82	1.98	2.20
342	0.686	324	5.40	0.819	1,008	1.50	0.82	1.12	1.29	1.42	1.55	1.72
360	0.597	342	5.70	0.686	813	1.58	0.69	0.94	1.08	1.19	1.30	1.44
378	0.533	360	6.00	0.597	693	1.67	0.60	0.82	0.94	1.04	1.13	1.26
		378	6.30	0.533	610	1.75	0.53	0.73	0.84	0.93	1.01	1.12

Southview East

Final Design 5/6/2016

South Basin

Rational Method Unit Hydrograph 6 hr Storm

County of San Diego Hydrology Manual - Chapter 6

Area	5.33 ac	P6	0.95 in	P24	1.46
C	0.75	Storm	2 year		
Tc=	5				
Tc=	5 min	I=	2.50 in/hr	7.44 P6 Tc ^-0.645	
Qpeak =	10.01 cfs	Vol	13,785		
			13,959	0.7125	
N=	72 Number of Precipitation Blocks		174		
			1.26%		

Qn = 60 C A Pn/Tc

Pt(n) = 0.124 P6 (n Tc)^0.355

Pn = Pt(n) - Pt(n-1)

Southview East

South Basin

County of San Diego Rational Method Hydrographs

N	Pt(n)	Pn	Q(n)	Q(n)
1	0.21	0.21	10.01	10.01
2	0.27	0.06	2.79	2.79
3	0.31	0.04	1.98	1.98
4	0.34	0.03	1.59	1.59
5	0.37	0.03	1.35	1.35
6	0.39	0.02	1.18	1.18
7	0.42	0.02	1.06	1.06
8	0.44	0.02	0.97	0.97
9	0.46	0.02	0.89	0.89
10	0.47	0.02	0.83	0.83
11	0.49	0.02	0.78	0.78
12	0.50	0.02	0.74	0.74
13	0.52	0.01	0.70	0.70
14	0.53	0.01	0.66	0.66
15	0.55	0.01	0.63	0.63
16	0.56	0.01	0.61	0.61
17	0.57	0.01	0.58	0.58
18	0.58	0.01	0.56	0.56
19	0.59	0.01	0.54	0.54
20	0.60	0.01	0.52	0.52
21	0.61	0.01	0.51	0.51
22	0.62	0.01	0.49	0.49
23	0.63	0.01	0.48	0.48
24	0.64	0.01	0.46	0.46
25	0.65	0.01	0.45	0.45
26	0.66	0.01	0.44	0.44
27	0.67	0.01	0.43	0.43
28	0.68	0.01	0.42	0.42
29	0.69	0.01	0.41	0.41
30	0.70	0.01	0.40	0.40
31	0.71	0.01	0.39	0.39
32	0.71	0.01	0.38	0.38
33	0.72	0.01	0.38	0.38
34	0.73	0.01	0.37	0.37
35	0.74	0.01	0.36	0.36
36	0.74	0.01	0.36	0.36
37	0.75	0.01	0.35	0.35
38	0.76	0.01	0.34	0.34
39	0.77	0.01	0.34	0.34
40	0.77	0.01	0.33	0.33
41	0.78	0.01	0.33	0.33
42	0.79	0.01	0.32	0.32
43	0.79	0.01	0.32	0.32
44	0.80	0.01	0.31	0.31
45	0.81	0.01	0.31	0.31
46	0.81	0.01	0.30	0.30
47	0.82	0.01	0.30	0.30
48	0.82	0.01	0.29	0.29
49	0.83	0.01	0.29	0.29
50	0.84	0.01	0.29	0.29
51	0.84	0.01	0.28	0.28
52	0.85	0.01	0.28	0.28
53	0.85	0.01	0.28	0.28
54	0.86	0.01	0.27	0.27
55	0.87	0.01	0.27	0.27
56	0.87	0.01	0.27	0.27
57	0.88	0.01	0.26	0.26
58	0.88	0.01	0.26	0.26
59	0.89	0.01	0.26	0.26
60	0.89	0.01	0.25	0.25
61	0.90	0.01	0.25	0.25
62	0.90	0.01	0.25	0.25
63	0.91	0.01	0.25	0.25
64	0.91	0.01	0.24	0.24
65	0.92	0.01	0.24	0.24
66	0.92	0.00	0.24	0.24
67	0.93	0.00	0.24	0.24
68	0.93	0.00	0.23	0.23
69	0.94	0.00	0.23	0.23
70	0.94	0.00	0.23	0.23
71	0.95	0.00	0.23	0.23
72	0.95	0.00	0.23	0.23
		0.95		

N	Time (min)	Time (hrs)	Qn (cfs)
1	245	4.08	10.01
2	240	4.00	2.79
3	235	3.92	1.98
5	230	3.83	1.35
6	225	3.75	1.18
8	220	3.67	0.97
9	215	3.58	0.89
11	210	3.50	0.78
12	205	3.42	0.74
14	200	3.33	0.66
15	195	3.25	0.63
17	190	3.17	0.58
18	185	3.08	0.56
20	180	3.00	0.52
21	175	2.92	0.51
23	170	2.83	0.48
24	165	2.75	0.46
26	160	2.67	0.44
27	155	2.58	0.43
29	150	2.50	0.41
30	145	2.42	0.40
32	140	2.33	0.38
33	135	2.25	0.38
35	130	2.17	0.36
36	125	2.08	0.36
38	120	2.00	0.34
39	115	1.92	0.34
41	110	1.83	0.33
42	105	1.75	0.32
44	100	1.67	0.31
45	95	1.58	0.31
47	90	1.50	0.30
48	85	1.42	0.29
50	80	1.33	0.29
51	75	1.25	0.28
53	70	1.17	0.28
54	65	1.08	0.27
56	60	1.00	0.27
57	55	0.92	0.26
59	50	0.83	0.26
60	45	0.75	0.25
62	40	0.67	0.25
63	35	0.58	0.25
65	30	0.50	0.24
66	25	0.42	0.24
68	20	0.33	0.23
69	15	0.25	0.23
71	10	0.17	0.23
72	5	0.08	0.23

N	Time (min)	Time (hrs)	Qn (cfs)
4	250	4.17	1.59
7	255	4.25	1.06
10	260	4.33	0.83
13	265	4.42	0.70
16	270	4.50	0.61
19	275	4.58	0.54
22	280	4.67	0.49
25	285	4.75	0.45
28	290	4.83	0.42
31	295	4.92	0.39
34	300	5.00	0.37
37	305	5.08	0.35
40	310	5.17	0.33
43	315	5.25	0.32
46	320	5.33	0.30
49	325	5.42	0.29
52	330	5.50	0.28
55	335	5.58	0.27
58	340	5.67	0.26
61	345	5.75	0.25
64	350	5.83	0.24
67	355	5.92	0.24
70	360	6.00	0.23
73	365	6.08	0.23

N	Time (hrs)	Qn (cfs)
72	5	0.226
71	10	0.228
69	15	0.233
68	20	0.235
66	25	0.239
65	30	0.242
63	35	0.247
62	40	0.249
60	45	0.255
59	50	0.257
57	55	0.263
56	60	0.266
54	65	0.273
53	70	0.276
51	75	0.283
50	80	0.287
48	85	0.294
47	90	0.299
45	95	0.307
44	100	0.312
42	105	0.321
41	110	0.326
39	115	0.337
38	120	0.343
36	125	0.355
35	130	0.362
33	135	0.376
32	140	0.384
30	145	0.400
29	150	0.409
27	155	0.429
26	160	0.440
24	165	0.464
23	170	0.477
21	175	0.506
20	180	0.523
18	185	0.561
17	190	0.582
15	195	0.633
14	200	0.663
12	205	0.735
11	210	0.780
9	215	0.894
8	220	0.969
6	225	1.185
5	230	1.349
3	235	1.981
2	240	2.791
1	245	10.006
4	250	1.589
7	255	1.063
10	260	0.832
13	265	0.697
16	270	0.606
19	275	0.541
22	280	0.491
25	285	0.451
28	290	0.419
31	295	0.392
34	300	0.369
37	305	0.349
40	310	0.332
43	315	0.316
46	320	0.303
49	325	0.291
52	330	0.279
55	335	0.269
58	340	0.260
61	345	0.252
64	350	0.244
67	355	0.237
70	360	0.230
73	365	0.226

Southview
South Basin

Final Design 5/6/2016

Post Development Hydrographs - 6 Hour Rational Method (County)

				Intensity	2.50	3.43	3.95	4.35	4.74	5.27
				Ratio X/2		1.37	1.58	1.74	1.89	2.11
				P6	0.95	1.30	1.50	1.65	1.80	2.00
		10.01		Pre-Deve	1.83	2.50	2.89	3.17	3.46	3.85
				Peak	10.01	13.69	15.80	17.38	18.96	21.06
		2 Year		Return /Year	**2**	**5**	**10**	**25**	**50**	**100**
Time (min)	Time (hrs)	Qn (cfs)	Vol (cf)	Time (hrs)	Q(n)	Q(n)	Q(n)	Q(n)	Q(n)	Q(n)
0	0.00	0.000	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5	0.08	0.226	34	0.08	0.23	0.31	0.36	0.39	0.43	0.48
10	0.17	0.228	68	0.17	0.23	0.31	0.36	0.40	0.43	0.48
15	0.25	0.233	69	0.25	0.23	0.32	0.37	0.40	0.44	0.49
20	0.33	0.235	70	0.33	0.23	0.32	0.37	0.41	0.44	0.49
25	0.42	0.239	71	0.42	0.24	0.33	0.38	0.42	0.45	0.50
30	0.50	0.242	72	0.50	0.24	0.33	0.38	0.42	0.46	0.51
35	0.58	0.247	73	0.58	0.25	0.34	0.39	0.43	0.47	0.52
40	0.67	0.249	74	0.67	0.25	0.34	0.39	0.43	0.47	0.52
45	0.75	0.255	76	0.75	0.25	0.35	0.40	0.44	0.48	0.54
50	0.83	0.257	77	0.83	0.26	0.35	0.41	0.45	0.49	0.54
55	0.92	0.263	78	0.92	0.26	0.36	0.42	0.46	0.50	0.55
60	1.00	0.266	79	1.00	0.27	0.36	0.42	0.46	0.50	0.56
65	1.08	0.273	81	1.08	0.27	0.37	0.43	0.47	0.52	0.57
70	1.17	0.276	82	1.17	0.28	0.38	0.44	0.48	0.52	0.58
75	1.25	0.283	84	1.25	0.28	0.39	0.45	0.49	0.54	0.60
80	1.33	0.287	85	1.33	0.29	0.39	0.45	0.50	0.54	0.60
85	1.42	0.294	87	1.42	0.29	0.40	0.46	0.51	0.56	0.62
90	1.50	0.299	89	1.50	0.30	0.41	0.47	0.52	0.57	0.63
95	1.58	0.307	91	1.58	0.31	0.42	0.48	0.53	0.58	0.65
100	1.67	0.312	93	1.67	0.31	0.43	0.49	0.54	0.59	0.66
105	1.75	0.321	95	1.75	0.32	0.44	0.51	0.56	0.61	0.68
110	1.83	0.326	97	1.83	0.33	0.45	0.52	0.57	0.62	0.69
115	1.92	0.337	100	1.92	0.34	0.46	0.53	0.59	0.64	0.71
120	2.00	0.343	102	2.00	0.34	0.47	0.54	0.60	0.65	0.72
125	2.08	0.355	105	2.08	0.36	0.49	0.56	0.62	0.67	0.75
130	2.17	0.362	108	2.17	0.36	0.50	0.57	0.63	0.69	0.76
135	2.25	0.376	111	2.25	0.38	0.51	0.59	0.65	0.71	0.79
140	2.33	0.384	114	2.33	0.38	0.53	0.61	0.67	0.73	0.81
145	2.42	0.400	118	2.42	0.40	0.55	0.63	0.70	0.76	0.84
150	2.50	0.409	121	2.50	0.41	0.56	0.65	0.71	0.78	0.86
155	2.58	0.429	126	2.58	0.43	0.59	0.68	0.75	0.81	0.90
160	2.67	0.440	130	2.67	0.44	0.60	0.69	0.76	0.83	0.93
165	2.75	0.464	136	2.75	0.46	0.63	0.73	0.81	0.88	0.98
170	2.83	0.477	141	2.83	0.48	0.65	0.75	0.83	0.90	1.00
175	2.92	0.506	147	2.92	0.51	0.69	0.80	0.88	0.96	1.07
180	3.00	0.523	154	3.00	0.52	0.72	0.83	0.91	0.99	1.10
185	3.08	0.561	163	3.08	0.56	0.77	0.89	0.97	1.06	1.18
190	3.17	0.582	171	3.17	0.58	0.80	0.92	1.01	1.10	1.23
195	3.25	0.633	182	3.25	0.63	0.87	1.00	1.10	1.20	1.33
200	3.33	0.663	194	3.33	0.66	0.91	1.05	1.15	1.26	1.40
205	3.42	0.735	210	3.42	0.74	1.01	1.16	1.28	1.39	1.55
210	3.50	0.780	227	3.50	0.78	1.07	1.23	1.35	1.48	1.64
215	3.58	0.894	251	3.58	0.89	1.22	1.41	1.55	1.69	1.88
220	3.67	0.969	279	3.67	0.97	1.33	1.53	1.68	1.84	2.04
225	3.75	1.185	323	3.75	1.18	1.62	1.87	2.06	2.24	2.49
230	3.83	1.349	380	3.83	1.35	1.85	2.13	2.34	2.56	2.84
235	3.92	1.981	500	3.92	1.98	2.71	3.13	3.44	3.75	4.17
240	4.00	2.791	716	4.00	2.79	3.82	4.41	4.85	5.29	5.88
245	4.08	10.006	1,920	4.08	10.01	13.69	15.80	17.38	18.96	21.06
250	4.17	1.589	1,739	4.17	1.59	2.17	2.51	2.76	3.01	3.35
255	4.25	1.063	398	4.25	1.06	1.45	1.68	1.85	2.01	2.24
260	4.33	0.832	284	4.33	0.83	1.14	1.31	1.44	1.58	1.75
265	4.42	0.697	229	4.42	0.70	0.95	1.10	1.21	1.32	1.47
270	4.50	0.606	195	4.50	0.61	0.83	0.96	1.05	1.15	1.28
275	4.58	0.541	172	4.58	0.54	0.74	0.85	0.94	1.03	1.14
280	4.67	0.491	155	4.67	0.49	0.67	0.78	0.85	0.93	1.03
285	4.75	0.451	141	4.75	0.45	0.62	0.71	0.78	0.86	0.95
290	4.83	0.419	131	4.83	0.42	0.57	0.66	0.73	0.79	0.88
295	4.92	0.392	122	4.92	0.39	0.54	0.62	0.68	0.74	0.82
300	5.00	0.369	114	5.00	0.37	0.50	0.58	0.64	0.70	0.78
305	5.08	0.349	108	5.08	0.35	0.48	0.55	0.61	0.66	0.73
310	5.17	0.332	102	5.17	0.33	0.45	0.52	0.58	0.63	0.70
315	5.25	0.316	97	5.25	0.32	0.43	0.50	0.55	0.60	0.67
320	5.33	0.303	93	5.33	0.30	0.41	0.48	0.53	0.57	0.64
325	5.42	0.291	89	5.42	0.29	0.40	0.46	0.50	0.55	0.61
330	5.50	0.279	86	5.50	0.28	0.38	0.44	0.49	0.53	0.59
335	5.58	0.269	82	5.58	0.27	0.37	0.43	0.47	0.51	0.57
340	5.67	0.260	79	5.67	0.26	0.36	0.41	0.45	0.49	0.55
345	5.75	0.252	77	5.75	0.25	0.34	0.40	0.44	0.48	0.53
350	5.83	0.244	74	5.83	0.24	0.33	0.39	0.42	0.46	0.51
355	5.92	0.237	72	5.92	0.24	0.32	0.37	0.41	0.45	0.50
360	6.00	0.230	70	6.00	0.23	0.32	0.36	0.40	0.44	0.48
365	6.08	0.226	68	6.08	0.23	0.31	0.36	0.39	0.43	0.48

13,959

EXHIBIT C

NORTH BASIN

STORAGE INDCATION TABLES & RATING CURVES

SV East ~ North Detention Basin

		Base	510.5		0 cf				3.5		4.60	
		Top	516.00		112,400 cf				Subdrain	Round	Notch	Overflow
		Storage @ Overflow	515.50		96,180 cf		2.580355		3.5		6	60
Basin Storage Volumes			116.86%		dT= 18						48	Round
									510.50		515	515.50
									Subdrain			
DEPTH	ELEV	AREA	Storage	'ater Qual	Effective STORAGE	2S/dT	2S/dT + O	OUTFLOW	#1	#2	#3	Overflow
(FT)		(SF)	(CF)	(CF)	(CF)	(CFS)	(CFS)	(CFS)	(CFS)	(CFS)	(CFS)	(CFS)
0.00	510.50	**14,920**			0	0.00	0.00	0.0000	0.0000			
0.10	510.60	15,042	1,498		1,498	2.77	2.80	0.0249	0.0249			
0.20	510.70	15,165	3,008		3,008	5.57	5.64	0.0704	0.0704			
0.30	510.80	15,287	4,531		4,531	8.39	8.52	0.1294	0.1294			
0.40	510.90	15,410	6,066		6,066	11.23	11.41	0.1783	0.1783			
0.50	511.00	15,532	7,613		7,613	14.10	14.31	0.2105	0.2105			
0.60	511.10	15,654	9,172		9,172	16.99	17.22	0.2384	0.2384			
0.70	511.20	15,777	10,744		10,744	19.90	20.16	0.2633	0.2633			
0.80	511.30	15,899	12,328		12,328	22.83	23.12	0.2861	0.2861			
0.90	511.40	16,022	13,924		13,924	25.78	26.09	0.3072	0.3072			
1.00	511.50	16,144	15,532		15,532	28.76	29.09	0.3269	0.3269			
1.10	511.60	16,270	17,153		17,153	31.76	32.11	0.3455	0.3455			
1.20	511.70	16,397	18,786		18,786	34.79	35.15	0.3632	0.3632			
1.30	511.80	16,523	20,432		20,432	37.84	38.22	0.3800	0.3800			
1.40	511.90	16,650	22,091		22,091	40.91	41.30	0.3961	0.3961			
1.50	512.00	16,776	23,762		23,762	44.00	44.42	0.4116	0.4116			
1.60	512.10	16,902	25,446		25,446	47.12	47.55	0.4265	0.4265			
1.70	512.20	17,029	27,142		27,142	50.26	50.70	0.4410	0.4410			
1.80	512.30	17,155	28,852		28,852	53.43	53.88	0.4549	0.4549			
1.90	512.40	17,282	30,574		30,574	56.62	57.09	0.4685	0.4685			
2.00	512.50	17,408	32,308		32,308	59.83	60.31	0.4816	0.4816			
2.10	512.60	17,537	34,055		34,055	63.07	63.56	0.4945	0.4945			
2.20	512.70	17,667	35,815		35,815	66.32	66.83	0.5070	0.5070			
2.30	512.80	17,796	37,589		37,589	69.61	70.13	0.5191	0.5191			
2.40	512.90	17,926	39,375		39,375	72.92	73.45	0.5311	0.5311			
2.50	513.00	18,055	41,174		41,174	76.25	76.79	0.5427	0.5427			
2.60	513.10	18,184	42,986		42,986	79.60	80.16	0.5541	0.5541			
2.70	513.20	18,314	44,811		44,811	82.98	83.55	0.5653	0.5653			
2.80	513.30	18,443	46,648		46,648	86.39	86.96	0.5763	0.5763			
2.90	513.40	18,573	48,499		48,499	89.81	90.40	0.5870	0.5870			
3.00	513.50	18,702	50,363		50,363	93.26	93.86	0.5976	0.5976			
3.10	513.60	18,836	52,240		52,240	96.74	97.35	0.6079	0.6079			
3.20	513.70	18,969	54,130		54,130	100.24	100.86	0.6182	0.6182			
3.30	513.80	19,103	56,034		56,034	103.77	104.39	0.6282	0.6282			
3.40	513.90	19,236	57,951		57,951	107.32	107.95	0.6381	0.6381			
3.50	514.00	19,370	59,881		59,881	110.89	111.54	0.6478	0.6478			
3.60	514.10	19,503	61,825		61,825	114.49	115.15	0.6574	0.6574			
3.70	514.20	19,637	63,781		63,781	118.11	118.78	0.6668	0.6668			
3.80	514.30	19,770	65,752		65,752	121.76	122.44	0.6761	0.6761			
3.90	514.40	19,904	67,735		67,735	125.44	126.12	0.6853	0.6853			
4.00	514.50	20,037	69,733		69,733	129.13	129.83	0.6944	0.6944			
4.10	514.60	20,173	71,743		71,743	132.86	133.56	0.7034	0.7034			
4.20	514.70	20,309	73,767		73,767	136.61	137.32	0.7122	0.7122			
4.30	514.80	20,446	75,805		75,805	140.38	141.10	0.7209	0.7209			
4.40	514.90	20,582	77,856		77,856	144.18	144.91	0.7296	0.7296			
4.50	515.00	30,874	80,429		80,429	148.94	149.68	0.7381	0.7381			
4.60	515.10	31,125	83,529		83,529	154.68	155.43	0.7465	0.7465		0.0000	
4.70	515.20	31,376	86,654		86,654	160.47	161.65	1.1764	0.7548		0.4216	
4.80	515.30	31,627	89,804		89,804	166.30	168.26	1.9555	0.7631		1.1925	
4.90	515.40	31,878	92,979		92,979	172.18	175.15	2.9619	0.7712		2.1907	
5.00	515.50	32,129	96,180		96,180	178.11	182.26	4.1521	0.7793		3.3728	0.0000
5.10	515.60	32,227	99,398		99,398	184.07	189.91	5.8424	0.7873		4.7136	0.3415
5.20	515.70	32,325	102,625		102,625	190.05	198.00	7.9573	0.7952		6.1962	0.9660
5.30	515.80	32,424	105,863		105,863	196.04	205.72	9.6803	0.8030		7.1027	1.7746
5.40	515.90	32,522	109,110		109,110	202.06	213.45	11.3953	0.8108		7.8523	2.7322
5.50	516.00	33,284	112,400		112,400	208.15	221.32	13.1732	0.8185		8.5363	3.8184

Southview East - North Detention Basin

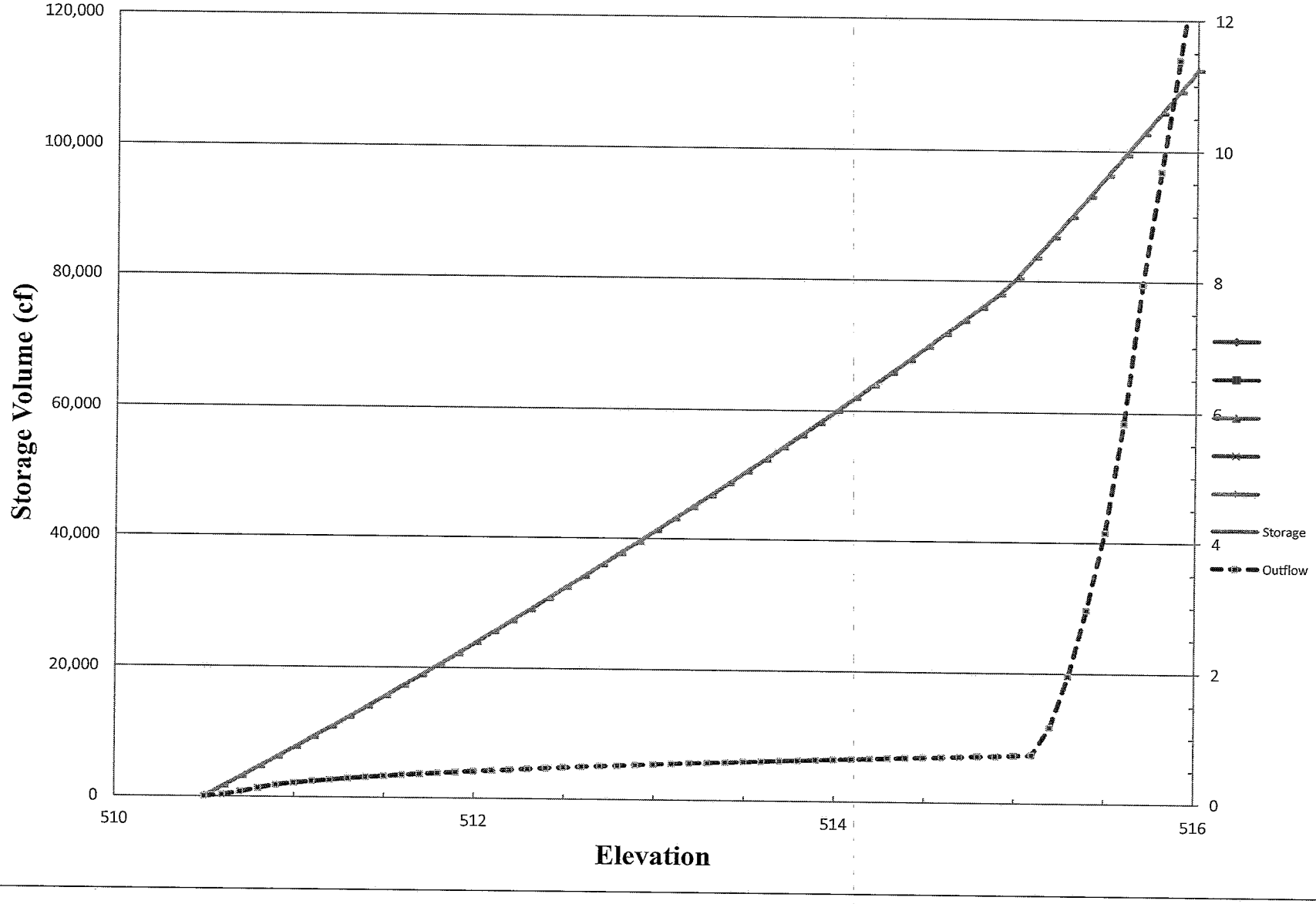


EXHIBIT D

SOUTH BASIN

STORAGE INDCATION TABLES & RATING CURVES

Southview East Detention Basin - South

		Floor	512.0		0 cf					Upper			
		Top	517.5		21,114 cf		0.484711	Subdrain		1.5		0	Round
		Storage @ Overflow	515.0		11,339 cf				2	0.333		0	
Basin Storage Volumes			186.21%		dT= 10				512.00	516.0	0		0.0

DEPTH (FT)	ELEV	AREA (SF)	Storage (CF)	Void	STORAGE (CF)	2S/dT (CFS)	2S/dT + O (CFS)	OUTFLOW (CFS)	#1 (CFS)	#2 (CFS)	#3 (CFS)	Overflow (CFS)
0.00	512.00	**3,910**	0	0	0	0.00	0.00	0.00	0.00			
0.10	512.10	3,910	391	1.0	391	1.30	1.32	0.01	0.01			
0.20	512.20	3,910	391	1.0	782	2.61	2.65	0.04	0.04			
0.30	512.30	3,910	391	1.0	1,173	3.91	3.96	0.05	0.05			
0.40	512.40	3,910	391	1.0	1,564	5.21	5.28	0.06	0.06			
0.50	512.50	3,910	391	1.0	1,955	6.52	6.59	0.07	0.07			
0.60	512.60	3,910	391	1.0	2,346	7.82	7.90	0.08	0.08			
0.70	512.70	3,910	391	1.0	2,737	9.12	9.21	0.09	0.09			
0.80	512.80	3,910	391	1.0	3,128	10.43	10.52	0.10	0.10			
0.90	512.90	3,910	391	1.0	3,519	11.73	11.83	0.10	0.10			
1.00	513.00	3,910	391	1.0	3,910	13.03	13.14	0.11	0.11			
1.10	513.10	3,910	391	1.0	4,301	14.34	14.45	0.12	0.12			
1.20	513.20	3,910	391	1.0	4,692	15.64	15.76	0.12	0.12			
1.30	513.30	3,910	391	1.0	5,083	16.94	17.07	0.13	0.13			
1.40	513.40	3,910	391	1.0	5,474	18.25	18.38	0.13	0.13			
1.50	513.50	3,910	391	1.0	5,865	19.55	19.69	0.14	0.14			
1.60	513.60	3,910	391	1.0	6,256	20.85	21.00	0.14	0.14			
1.70	513.70	3,910	391	1.0	6,647	22.16	22.30	0.15	0.15			
1.80	513.80	3,910	391	1.0	7,038	23.46	23.61	0.15	0.15			
1.90	513.90	3,910	391	1.0	7,429	24.76	24.92	0.16	0.16			
2.00	514.00	3,910	391	1.0	7,820	26.07	26.23	0.16	0.16			
2.10	514.10	3,910	391	1.0	8,211	27.37	27.53	0.16	0.16			
2.20	514.20	3,910	391	1.0	8,602	28.67	28.84	0.17	0.17			
2.30	514.30	3,910	391	1.0	8,993	29.98	30.15	0.17	0.17			
2.40	514.40	3,910	391	1.0	9,384	31.28	31.46	0.18	0.18			
2.50	514.50	3,910	391	1.0	9,775	32.58	32.76	0.18	0.18			
2.60	514.60	3,910	391	1.0	10,166	33.89	34.07	0.18	0.18			
2.70	514.70	3,910	391	1.0	10,557	35.19	35.38	0.19	0.19			
2.80	514.80	3,910	391	1.0	10,948	36.49	36.68	0.19	0.19			
2.90	514.90	3,910	391	1.0	11,339	37.80	37.99	0.19	0.19			
3.00	515.00	3,910	391	1.0	11,730	39.10	39.30	0.20	0.20			
3.10	515.10	3,910	391	1.0	12,121	40.40	40.60	0.20	0.20			
3.20	515.20	3,910	391	1.0	12,512	41.71	41.91	0.20	0.20			
3.30	515.30	3,910	391	1.0	12,903	43.01	43.22	0.21	0.21			
3.40	515.40	3,910	391	1.0	13,294	44.31	44.52	0.21	0.21			
3.50	515.50	3,910	391	1.0	13,685	45.62	45.83	0.21	0.21			
3.60	515.60	3,910	391	1.0	14,076	46.92	47.14	0.22	0.22			
3.70	515.70	3,910	391	1.0	14,467	48.22	48.44	0.22	0.22			
3.80	515.80	3,910	391	1.0	14,858	49.53	49.75	0.22	0.22			
3.90	515.90	3,910	391	1.0	15,249	50.83	51.06	0.23	0.23			
4.00	516.00	3,910	391	1.0	15,640	52.13	52.36	0.23	0.23	0.0000		
4.10	516.10	3,910	391	1.0	16,031	53.44	53.70	0.26	0.23	0.0327		
4.20	516.20	3,910	391	1.0	16,422	54.74	55.07	0.33	0.23	0.0924		
4.30	516.30	3,910	391	1.0	16,813	56.04	56.45	0.41	0.24	0.1698		
4.40	516.40	3,910	391	1.0	17,204	57.35	57.85	0.50	0.24	0.2614		
4.50	516.50	3,910	391	1.0	17,595	58.65	59.26	0.61	0.24	0.3653		
4.60	516.60	3,910	391	1.0	17,986	59.95	60.68	0.73	0.25	0.4802		
4.70	516.70	3,910	391	1.0	18,377	61.26	62.11	0.85	0.25	0.6052		
4.80	516.80	3,910	391	1.0	18,768	62.56	63.55	0.99	0.25	0.7394		
4.90	516.90	3,910	391	1.0	19,159	63.86	65.00	1.14	0.25	0.8823		
5.00	517.00	3,910	391	1.0	19,550	65.17	66.46	1.29	0.26	1.0333		
5.10	517.10	3,910	391	1.0	19,941	66.47	67.92	1.45	0.26	1.1921		
5.20	517.20	3,910	391	1.0	20,332	67.77	69.39	1.62	0.26	1.3584		
5.30	517.30	3,910	391	1.0	20,723	69.08	70.87	1.80	0.26	1.5316		
5.40	517.40	3,910	391	1.0	21,114	70.38	72.36	1.98	0.27	1.7117		
5.50	517.50	3,910	391	1.0	21,505	71.68	73.75	2.07	0.27	1.8004		

Southview East -
South Detention Basin = SVE + VDS 7

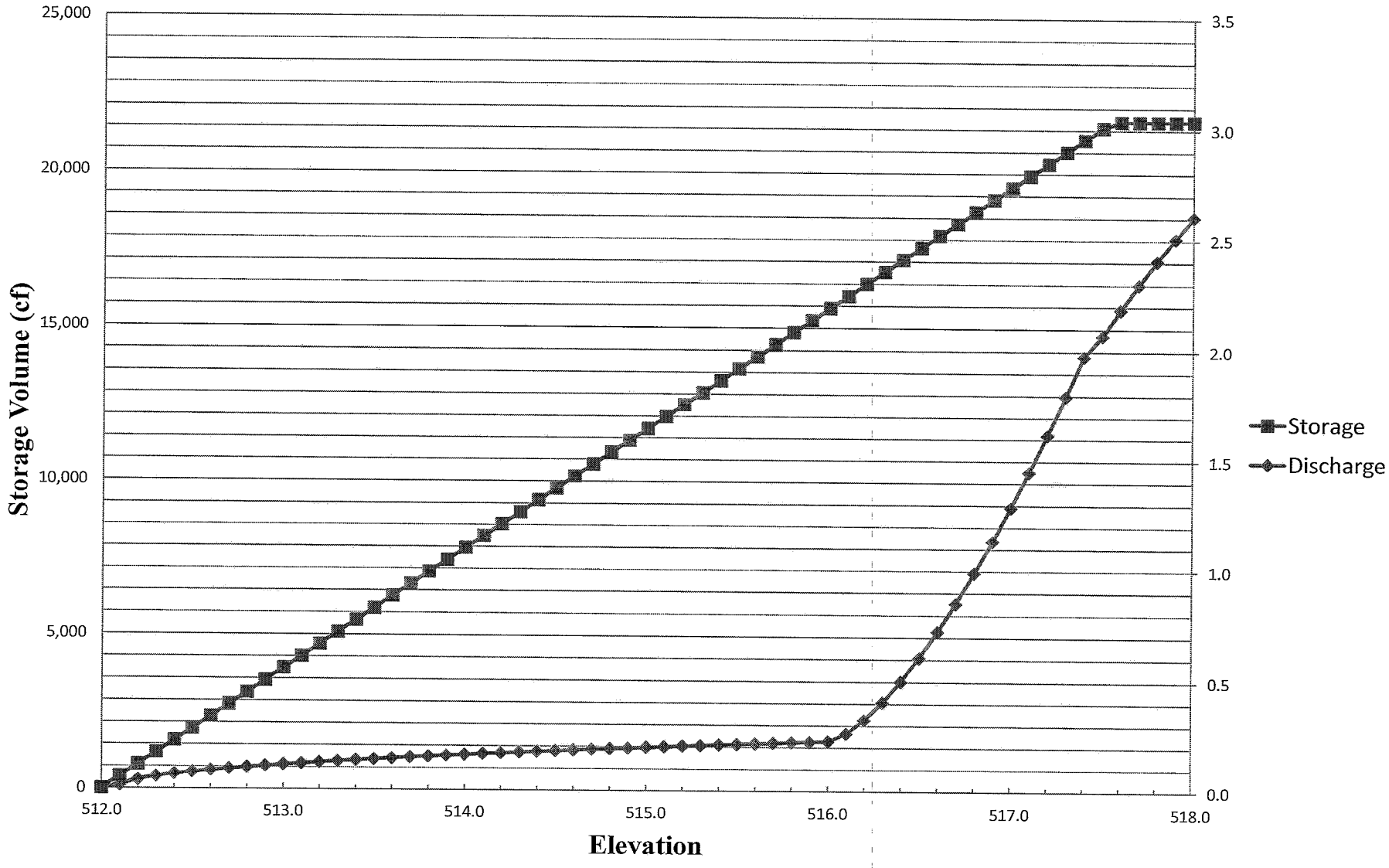


EXHIBIT E

SUMMARY OF DETENTION ANALYSES

NORTH & SOUTH BASINS

SV East ~ North Detention Basin

Airway

Tributary Area — Final Design — 5/06/2016

SV Lot 1 + SVE North	10.23 ac	
Basins + Slope	1.20	
Offsite (West)	0.56	
Total Area	11.99 ac	

6-Hour Rational Method Hydrograph

		Elev	Storage (cf)	Storage (ac-ft)
Btm Storage		510.50	0	0.00
Floor of Basin	0.00	510.50	0	0.00
Overflow	5.00	515.50	96,180	2.21
Top Of Basin	5.50	516.00	112,400	2.58

Storm Frequency	Qexist (cfs)	Qin (cfs)	Qout (cfs)	WSEL (ft)
2 YEAR	3.60	9.85	0.43	512.10
5 YEAR	4.92	13.48	0.51	512.70
10 YEAR	5.68	15.56	0.54	513.00
25 YEAR	6.25	17.11	0.58	513.30
50 YEAR	6.81	18.67	0.60	513.50
100 YEAR	7.57	20.74	0.63	513.80

	Length (ft)	Width (ft)	Area (sf)	Area (ac)
Top of Detention Basin				

Outlet Control Structure — Use 4' x 4' structure (Inside DImension)

Opening	#1	#2	#3	Overflow - Grate
Elevation	510.5	0.0	Not Used	515.50
Width (in)	3.50	0	48	
Height (in)	3.50	0	6	

Outlet Dia	12	in
Flowline	506.00	
Top of Structure	515.50	

Southview East Detention Basin - South

Tributary Area	5.33 ac	Final Design	6-May-16
	5.33		
Street / Offsite	0	6-Hour Rational Method Hydrograph	
Total Area	5.33 ac		

		Elev	Storage (cf)	Storage (ac-ft)
Floor of Basin		512.00	0	0.00
Overflow	3.00	515.00	11,339	0.26
Top Of Basin	5.50	517.50	21,114	0.48

Storm Frequency	Qexist (cfs)	Qin (cfs)	Qout (cfs)	WSEL (ft)
2 YEAR	1.83	6.40	0.19	514.90
5 YEAR	2.50	8.76	0.23	516.00
10 YEAR	2.89	10.10	0.50	516.40
25 YEAR	3.17	11.11	0.85	516.70
50 YEAR	3.46	12.12	1.14	516.90
100 YEAR	3.85	13.47	1.80	517.30

	Round	Rect Vert Weir		
Opening	#1	#2	#3	Overflow
Elevation	512.0	516.0	0.0	0.00
Width (in)	2.00	4.0	0	
Height (in)	2.00	18.0	0	
Outlet Dia	18 in			
Flowline	512.00			
Top of Structure	0.00			

EXHIBIT F

DETENTION BASIN STORM ROUTING

NORTH BASIN

North

DETENTION BASIN ROUTING

3.60

9.85

0.43

2 YEAR EVENT ~ 6 Hour STORM

512.10

18 Interval	Minutes T (HRS)	Q IN (CFS)	2S/dT+O	2S/dT-O (CFS)	O (CFS)	Basin WSEL
1	0.30	0.499	0.00	0.00	0.00	510.50
2	0.60	0.515	1.01	1.01	0.00	510.50
3	0.90	0.552	2.08	2.08	0.00	510.50
4	1.20	0.574	3.21	3.16	0.02	510.60
5	1.50	0.623	4.35	4.30	0.02	510.60
6	1.80	0.653	5.58	5.53	0.02	510.60
7	2.10	0.724	6.91	6.77	0.07	510.70
8	2.40	0.768	8.26	8.12	0.07	510.70
9	2.70	0.880	9.76	9.51	0.13	510.80
10	3.00	0.954	11.34	11.08	0.13	510.80
11	3.30	1.166	13.20	12.85	0.18	510.90
12	3.60	1.329	15.34	14.92	0.21	511.00
13	3.90	1.951	18.20	17.72	0.24	511.10
14	4.20	2.749	22.42	21.90	0.26	511.20
15	4.50	9.852	34.50	33.80	0.35	511.60
16	4.80	1.565	45.22	44.40	0.41	512.00
17	5.10	1.047	47.01	46.19	0.41	512.00
18	5.40	0.819	48.05	47.20	0.43	512.10
19	5.70	0.686	48.70	47.85	0.43	512.10
20	6.00	0.597	49.13	48.28	0.43	512.10
21	6.30	0.533	49.41	48.56	0.43	512.10
22	6.60	0.000	49.09	48.24	0.43	512.10
23	6.90	0.000	48.24	47.38	0.43	512.10
24	7.20	0.000	47.38	46.56	0.41	512.00
25	7.50	0.000	46.56	45.74	0.41	512.00
26	7.80	0.000	45.74	44.92	0.41	512.00
27	8.10	0.000	44.92	44.09	0.41	512.00
28	8.40	0.000	44.09	43.30	0.40	511.90
29	8.70	0.000	43.30	42.51	0.40	511.90
30	9.00	0.000	42.51	41.72	0.40	511.90
31	9.30	0.000	41.72	40.92	0.40	511.90
32	9.60	0.000	40.92	40.16	0.38	511.80
33	9.90	0.000	40.16	39.40	0.38	511.80
34	10.20	0.000	39.40	38.64	0.38	511.80
35	10.50	0.000	38.64	37.88	0.38	511.80
36	10.80	0.000	37.88	37.16	0.36	511.70
37	11.10	0.000	37.16	36.43	0.36	511.70
38	11.40	0.000	36.43	35.70	0.36	511.70
39	11.70	0.000	35.70	34.98	0.36	511.70
40	12.00	0.000	34.98	34.29	0.35	511.60

North

DETENTION BASIN ROUTING

4.92

13.48

0.51

5 YEAR EVENT ~ 6 Hour STORM

18

512.70

Interval	Minutes T (HRS)	Q IN (CFS)	2S/dT+O	2S/dT-O (CFS)	O (CFS)	Basin WSEL
1	0.30	0.682	0.00	0.00	0.00	510.50
2	0.60	0.705	1.39	1.39	0.00	510.50
3	0.90	0.756	2.85	2.80	0.02	510.60
4	1.20	0.785	4.34	4.29	0.02	510.60
5	1.50	0.853	5.93	5.78	0.07	510.70
6	1.80	0.893	7.53	7.39	0.07	510.70
7	2.10	0.991	9.27	9.02	0.13	510.80
8	2.40	1.051	11.06	10.80	0.13	510.80
9	2.70	1.204	13.05	12.70	0.18	510.90
10	3.00	1.306	15.21	14.79	0.21	511.00
11	3.30	1.596	17.69	17.21	0.24	511.10
12	3.60	1.818	20.63	20.10	0.26	511.20
13	3.90	2.669	24.59	24.01	0.29	511.30
14	4.20	3.761	30.44	29.79	0.33	511.50
15	4.50	13.482	47.03	46.21	0.41	512.00
16	4.80	2.141	61.83	60.87	0.48	512.50
17	5.10	1.433	64.44	63.46	0.49	512.60
18	5.40	1.121	66.01	65.02	0.49	512.60
19	5.70	0.939	67.08	66.07	0.51	512.70
20	6.00	0.817	67.82	66.81	0.51	512.70
21	6.30	0.729	68.35	67.34	0.51	512.70
22	6.60	0.000	68.07	67.05	0.51	512.70
23	6.90	0.000	67.05	66.04	0.51	512.70
24	7.20	0.000	66.04	65.05	0.49	512.60
25	7.50	0.000	65.05	64.06	0.49	512.60
26	7.80	0.000	64.06	63.07	0.49	512.60
27	8.10	0.000	63.07	62.11	0.48	512.50
28	8.40	0.000	62.11	61.15	0.48	512.50
29	8.70	0.000	61.15	60.18	0.48	512.50
30	9.00	0.000	60.18	59.25	0.47	512.40
31	9.30	0.000	59.25	58.31	0.47	512.40
32	9.60	0.000	58.31	57.37	0.47	512.40
33	9.90	0.000	57.37	56.44	0.47	512.40
34	10.20	0.000	56.44	55.53	0.45	512.30
35	10.50	0.000	55.53	54.62	0.45	512.30
36	10.80	0.000	54.62	53.71	0.45	512.30
37	11.10	0.000	53.71	52.82	0.44	512.20
38	11.40	0.000	52.82	51.94	0.44	512.20
39	11.70	0.000	51.94	51.06	0.44	512.20
40	12.00	0.000	51.06	50.18	0.44	512.20

North

DETENTION BASIN ROUTING

5.68

15.56

0.54

10 YEAR EVENT ~ 6 Hour STORM

513.00

18 Interval	Minutes T (HRS)	Q IN (CFS)	2S/dT+O	2S/dT-O (CFS)	O (CFS)	Basin WSEL
1	0.30	0.787	0.00	0.00	0.00	510.50
2	0.60	0.813	1.60	1.60	0.00	510.50
3	0.90	0.872	3.29	3.24	0.02	510.60
4	1.20	0.906	5.01	4.96	0.02	510.60
5	1.50	0.984	6.85	6.71	0.07	510.70
6	1.80	1.031	8.73	8.47	0.13	510.80
7	2.10	1.143	10.64	10.38	0.13	510.80
8	2.40	1.212	12.74	12.38	0.18	510.90
9	2.70	1.390	14.98	14.56	0.21	511.00
10	3.00	1.507	17.46	16.98	0.24	511.10
11	3.30	1.842	20.33	19.80	0.26	511.20
12	3.60	2.098	23.74	23.17	0.29	511.30
13	3.90	3.080	28.35	27.74	0.31	511.40
14	4.20	4.340	35.16	34.43	0.36	511.70
15	4.50	15.556	54.33	53.42	0.45	512.30
16	4.80	2.470	71.44	70.40	0.52	512.80
17	5.10	1.653	74.53	73.46	0.53	512.90
18	5.40	1.293	76.41	75.35	0.53	512.90
19	5.70	1.083	77.73	76.64	0.54	513.00
20	6.00	0.943	78.67	77.58	0.54	513.00
21	6.30	0.841	79.36	78.28	0.54	513.00
22	6.60	0.000	79.12	78.03	0.54	513.00
23	6.90	0.000	78.03	76.95	0.54	513.00
24	7.20	0.000	76.95	75.86	0.54	513.00
25	7.50	0.000	75.86	74.80	0.53	512.90
26	7.80	0.000	74.80	73.74	0.53	512.90
27	8.10	0.000	73.74	72.68	0.53	512.90
28	8.40	0.000	72.68	71.64	0.52	512.80
29	8.70	0.000	71.64	70.60	0.52	512.80
30	9.00	0.000	70.60	69.56	0.52	512.80
31	9.30	0.000	69.56	68.55	0.51	512.70
32	9.60	0.000	68.55	67.53	0.51	512.70
33	9.90	0.000	67.53	66.52	0.51	512.70
34	10.20	0.000	66.52	65.53	0.49	512.60
35	10.50	0.000	65.53	64.54	0.49	512.60
36	10.80	0.000	64.54	63.55	0.49	512.60
37	11.10	0.000	63.55	62.59	0.48	512.50
38	11.40	0.000	62.59	61.63	0.48	512.50
39	11.70	0.000	61.63	60.66	0.48	512.50
40	12.00	0.000	60.66	59.70	0.48	512.50

North

DETENTION BASIN ROUTING

6.25

17.11

0.58

25 YEAR EVENT ~ 6 Hour STORM

18 Min

513.30

Interval	T (HRS)	Q IN (CFS)	2S/dT+O	2S/dT-O (CFS)	O (CFS)	Basin WSEL
1	0.30	0.866	0.00	0.00	0.00	510.50
2	0.60	0.894	1.76	1.76	0.00	510.50
3	0.90	0.959	3.61	3.56	0.02	510.60
4	1.20	0.996	5.52	5.47	0.02	510.60
5	1.50	1.083	7.55	7.41	0.07	510.70
6	1.80	1.134	9.62	9.36	0.13	510.80
7	2.10	1.258	11.76	11.40	0.18	510.90
8	2.40	1.334	13.99	13.63	0.18	510.90
9	2.70	1.529	16.50	16.08	0.21	511.00
10	3.00	1.657	19.26	18.78	0.24	511.10
11	3.30	2.026	22.47	21.94	0.26	511.20
12	3.60	2.308	26.27	25.66	0.31	511.40
13	3.90	3.388	31.36	30.70	0.33	511.50
14	4.20	4.774	38.86	38.10	0.38	511.80
15	4.50	17.111	59.99	59.05	0.47	512.40
16	4.80	2.718	78.88	77.80	0.54	513.00
17	5.10	1.818	82.33	81.22	0.55	513.10
18	5.40	1.423	84.46	83.33	0.57	513.20
19	5.70	1.192	85.95	84.82	0.57	513.20
20	6.00	1.037	87.05	85.89	0.58	513.30
21	6.30	0.925	87.86	86.70	0.58	513.30
22	6.60	0.000	87.63	86.48	0.58	513.30
23	6.90	0.000	86.48	85.35	0.57	513.20
24	7.20	0.000	85.35	84.22	0.57	513.20
25	7.50	0.000	84.22	83.08	0.57	513.20
26	7.80	0.000	83.08	81.98	0.55	513.10
27	8.10	0.000	81.98	80.87	0.55	513.10
28	8.40	0.000	80.87	79.76	0.55	513.10
29	8.70	0.000	79.76	78.67	0.54	513.00
30	9.00	0.000	78.67	77.59	0.54	513.00
31	9.30	0.000	77.59	76.50	0.54	513.00
32	9.60	0.000	76.50	75.44	0.53	512.90
33	9.90	0.000	75.44	74.38	0.53	512.90
34	10.20	0.000	74.38	73.32	0.53	512.90
35	10.50	0.000	73.32	72.28	0.52	512.80
36	10.80	0.000	72.28	71.24	0.52	512.80
37	11.10	0.000	71.24	70.20	0.52	512.80
38	11.40	0.000	70.20	69.16	0.52	512.80
39	11.70	0.000	69.16	68.15	0.51	512.70
40	12.00	0.000	68.15	67.14	0.51	512.70

North

DETENTION BASIN ROUTING

6.81

18.67

0.60

50 YEAR EVENT ~ 6 Hour STORM

513.50

18 Interval	Min T (HRS)	Q IN (CFS)	2S/dT+O	2S/dT-O (CFS)	O (CFS)	Basin WSEL
1	0.30	0.945	0.00	0.00	0.00	510.50
2	0.60	0.976	1.92	1.92	0.00	510.50
3	0.90	1.046	3.94	3.89	0.02	510.60
4	1.20	1.087	6.03	5.88	0.07	510.70
5	1.50	1.181	8.15	8.01	0.07	510.70
6	1.80	1.237	10.43	10.17	0.13	510.80
7	2.10	1.372	12.78	12.42	0.18	510.90
8	2.40	1.455	15.25	14.83	0.21	511.00
9	2.70	1.668	17.95	17.47	0.24	511.10
10	3.00	1.808	20.95	20.42	0.26	511.20
11	3.30	2.210	24.44	23.87	0.29	511.30
12	3.60	2.517	28.60	27.98	0.31	511.40
13	3.90	3.696	34.20	33.50	0.35	511.60
14	4.20	5.208	42.41	41.62	0.40	511.90
15	4.50	18.667	65.49	64.50	0.49	512.60
16	4.80	2.965	86.13	85.00	0.57	513.20
17	5.10	1.983	89.95	88.80	0.58	513.30
18	5.40	1.552	92.33	91.16	0.59	513.40
19	5.70	1.300	94.01	92.82	0.60	513.50
20	6.00	1.131	95.25	94.05	0.60	513.50
21	6.30	1.009	96.19	95.00	0.60	513.50
22	6.60	0.000	96.01	94.81	0.60	513.50
23	6.90	0.000	94.81	93.62	0.60	513.50
24	7.20	0.000	93.62	92.44	0.59	513.40
25	7.50	0.000	92.44	91.27	0.59	513.40
26	7.80	0.000	91.27	90.10	0.59	513.40
27	8.10	0.000	90.10	88.94	0.58	513.30
28	8.40	0.000	88.94	87.79	0.58	513.30
29	8.70	0.000	87.79	86.64	0.58	513.30
30	9.00	0.000	86.64	85.51	0.57	513.20
31	9.30	0.000	85.51	84.38	0.57	513.20
32	9.60	0.000	84.38	83.25	0.57	513.20
33	9.90	0.000	83.25	82.14	0.55	513.10
34	10.20	0.000	82.14	81.03	0.55	513.10
35	10.50	0.000	81.03	79.92	0.55	513.10
36	10.80	0.000	79.92	78.84	0.54	513.00
37	11.10	0.000	78.84	77.75	0.54	513.00
38	11.40	0.000	77.75	76.67	0.54	513.00
39	11.70	0.000	76.67	75.60	0.53	512.90
40	12.00	0.000	75.60	74.54	0.53	512.90

North

DETENTION BASIN ROUTING

7.57

20.74

0.63

100 YEAR EVENT ~ 6 Hour STORM

18 Interval

Min T (HRS)

Q IN (CFS)

2S/dT+O

2S/dT-O (CFS)

O (CFS)

513.80 Basin WSEL

Interval	Min T (HRS)	Q IN (CFS)	2S/dT+O	2S/dT-O (CFS)	O (CFS)	Basin WSEL
1	0.30	1.050	0.00	0.00	0.00	510.50
2	0.60	1.084	2.13	2.13	0.00	510.50
3	0.90	1.162	4.38	4.33	0.02	510.60
4	1.20	1.207	6.70	6.56	0.07	510.70
5	1.50	1.312	9.08	8.82	0.13	510.80
6	1.80	1.374	11.51	11.15	0.18	510.90
7	2.10	1.524	14.05	13.69	0.18	510.90
8	2.40	1.616	16.83	16.41	0.21	511.00
9	2.70	1.853	19.88	19.40	0.24	511.10
10	3.00	2.009	23.27	22.69	0.29	511.30
11	3.30	2.456	27.16	26.54	0.31	511.40
12	3.60	2.797	31.80	31.14	0.33	511.50
13	3.90	4.107	38.05	37.32	0.36	511.70
14	4.20	5.786	47.21	46.39	0.41	512.00
15	4.50	20.741	72.92	71.88	0.52	512.80
16	4.80	3.294	95.92	94.72	0.60	513.50
17	5.10	2.204	100.22	99.00	0.61	513.60
18	5.40	1.724	102.93	101.69	0.62	513.70
19	5.70	1.444	104.86	103.61	0.63	513.80
20	6.00	1.257	106.31	105.05	0.63	513.80
21	6.30	1.121	107.43	106.17	0.63	513.80
22	6.60	0.000	107.30	106.04	0.63	513.80
23	6.90	0.000	106.04	104.78	0.63	513.80
24	7.20	0.000	104.78	103.53	0.63	513.80
25	7.50	0.000	103.53	102.29	0.62	513.70
26	7.80	0.000	102.29	101.05	0.62	513.70
27	8.10	0.000	101.05	99.82	0.62	513.70
28	8.40	0.000	99.82	98.60	0.61	513.60
29	8.70	0.000	98.60	97.39	0.61	513.60
30	9.00	0.000	97.39	96.17	0.61	513.60
31	9.30	0.000	96.17	94.97	0.60	513.50
32	9.60	0.000	94.97	93.78	0.60	513.50
33	9.90	0.000	93.78	92.61	0.59	513.40
34	10.20	0.000	92.61	91.43	0.59	513.40
35	10.50	0.000	91.43	90.26	0.59	513.40
36	10.80	0.000	90.26	89.11	0.58	513.30
37	11.10	0.000	89.11	87.95	0.58	513.30
38	11.40	0.000	87.95	86.80	0.58	513.30
39	11.70	0.000	86.80	85.67	0.57	513.20
40	12.00	0.000	85.67	84.54	0.57	513.20

EXHIBIT G

DETENTION BASIN STORM ROUTING

SOUTH BASIN

South

DETENTION BASIN ROUTING

1.83

6.40

0.19

2 YEAR EVENT ~ 6 Hour STORM

514.90

10 Interval	Minutes T (HRS)	Q IN (CFS)	2S/dT+O	2S/dT-O (CFS)	O (CFS)	Basin WSEL
1	0.17	0.227	0.00	0.00	0.00	512.00
2	0.33	0.231	0.46	0.46	0.00	512.00
3	0.50	0.241	0.93	0.93	0.00	512.00
4	0.67	0.245	1.42	1.39	0.01	512.10
5	0.83	0.256	1.89	1.86	0.01	512.10
6	1.00	0.262	2.38	2.35	0.01	512.10
7	1.17	0.274	2.88	2.80	0.04	512.20
8	1.33	0.281	3.36	3.28	0.04	512.20
9	1.50	0.296	3.86	3.78	0.04	512.20
10	1.67	0.305	4.38	4.27	0.05	512.30
11	1.83	0.324	4.90	4.79	0.05	512.30
12	2.00	0.334	5.45	5.32	0.06	512.40
13	2.17	0.359	6.02	5.89	0.06	512.40
14	2.33	0.372	6.62	6.47	0.07	512.50
15	2.50	0.405	7.24	7.10	0.07	512.50
16	2.67	0.424	7.92	7.76	0.08	512.60
17	2.83	0.470	8.65	8.49	0.08	512.60
18	3.00	0.499	9.46	9.27	0.09	512.70
19	3.17	0.572	10.34	10.16	0.09	512.70
20	3.33	0.620	11.35	11.16	0.10	512.80
21	3.50	0.758	12.54	12.33	0.10	512.90
22	3.67	0.863	13.95	13.73	0.11	513.00
23	3.83	1.267	15.86	15.61	0.12	513.20
24	4.00	1.785	18.66	18.40	0.13	513.40
25	4.17	6.399	26.58	26.26	0.16	514.00
26	4.33	1.016	33.68	33.32	0.18	514.50
27	4.50	0.680	35.02	34.65	0.18	514.60
28	4.67	0.532	35.86	35.49	0.19	514.70
29	4.83	0.446	36.46	36.09	0.19	514.70
30	5.00	0.388	36.92	36.54	0.19	514.80
31	5.17	0.346	37.28	36.90	0.19	514.80
32	5.33	0.314	37.56	37.18	0.19	514.80
33	5.50	0.289	37.78	37.40	0.19	514.80
34	5.67	0.268	37.95	37.57	0.19	514.80
35	5.83	0.251	38.09	37.70	0.19	514.90
36	6.00	0.236	38.19	37.80	0.19	514.90
37	6.17	0.000	38.04	37.65	0.19	514.90
38	6.33	0.000	37.65	37.27	0.19	514.80
39	6.50	0.000	37.27	36.89	0.19	514.80
40	6.67	0.000	36.89	36.51	0.19	514.80
41	6.83	0.000	36.51	36.14	0.19	514.70
42	7.00	0.000	36.14	35.76	0.19	514.70
43	7.17	0.000	35.76	35.39	0.19	514.70
44	7.33	0.000	35.39	35.01	0.19	514.70

45	7.50	0.000	35.01	34.65	0.18	514.60
46	7.67	0.000	34.65	34.28	0.18	514.60
47	7.83	0.000	34.28	33.92	0.18	514.60
48	8.00	0.000	33.92	33.56	0.18	514.50
49	8.17	0.000	33.56	33.20	0.18	514.50
50	8.33	0.000	33.20	32.84	0.18	514.50
51	8.50	0.000	32.84	32.48	0.18	514.50
52	8.67	0.000	32.48	32.13	0.18	514.40
53	8.83	0.000	32.13	31.78	0.18	514.40
54	9.00	0.000	31.78	31.42	0.18	514.40
55	9.17	0.000	31.42	31.08	0.17	514.30
56	9.33	0.000	31.08	30.74	0.17	514.30
57	9.50	0.000	30.74	30.39	0.17	514.30
58	9.67	0.000	30.39	30.05	0.17	514.30
59	9.83	0.000	30.05	29.71	0.17	514.20
60	10.00	0.000	29.71	29.38	0.17	514.20
61	10.17	0.000	29.38	29.04	0.17	514.20
62	10.33	0.000	29.04	28.70	0.17	514.20
63	10.50	0.000	28.70	28.38	0.16	514.10
64	10.67	0.000	28.38	28.05	0.16	514.10
65	10.83	0.000	28.05	27.72	0.16	514.10
66	11.00	0.000	27.72	27.39	0.16	514.10
67	11.17	0.000	27.39	27.07	0.16	514.00
68	11.33	0.000	27.07	26.75	0.16	514.00
69	11.50	0.000	26.75	26.43	0.16	514.00
70	11.67	0.000	26.43	26.11	0.16	514.00
71	11.83	0.000	26.11	25.80	0.16	513.90
72	12.00	0.000	25.80	25.49	0.16	513.90
73	12.17	0.000	25.49	25.18	0.16	513.90
74	12.33	0.000	25.18	24.87	0.16	513.90
75	12.50	0.000	24.87	24.56	0.15	513.80
76	12.67	0.000	24.56	24.26	0.15	513.80
77	12.83	0.000	24.26	23.96	0.15	513.80
78	13.00	0.000	23.96	23.66	0.15	513.80
79	13.17	0.000	23.66	23.35	0.15	513.80
80	13.33	0.000	23.35	23.06	0.15	513.70
81	13.50	0.000	23.06	22.77	0.15	513.70
82	13.67	0.000	22.77	22.47	0.15	513.70
83	13.83	0.000	22.47	22.18	0.15	513.70
84	14.00	0.000	22.18	21.90	0.14	513.60
85	14.17	0.000	21.90	21.61	0.14	513.60
86	14.33	0.000	21.61	21.33	0.14	513.60
87	14.50	0.000	21.33	21.04	0.14	513.60
88	14.67	0.000	21.04	20.76	0.14	513.60
89	14.83	0.000	20.76	20.48	0.14	513.50
90	15.00	0.000	20.48	20.21	0.14	513.50
91	15.17	0.000	20.21	19.93	0.14	513.50
92	15.33	0.000	19.93	19.66	0.14	513.50
93	15.50	0.000	19.66	19.39	0.13	513.40
94	15.67	0.000	19.39	19.13	0.13	513.40
95	15.83	0.000	19.13	18.86	0.13	513.40
96	16.00	0.000	18.86	18.60	0.13	513.40

South

DETENTION BASIN ROUTING

2.50

8.76

0.23

5 YEAR EVENT ~ 6 Hour STORM

516.00

10 Interval	Minutes T (HRS)	Q IN (CFS)	2S/dT+O	2S/dT-O (CFS)	O (CFS)	Basin WSEL
1	0.17	0.311	0.00	0.00	0.00	512.00
2	0.33	0.317	0.63	0.63	0.00	512.00
3	0.50	0.329	1.27	1.27	0.00	512.00
4	0.67	0.336	1.94	1.91	0.01	512.10
5	0.83	0.350	2.59	2.57	0.01	512.10
6	1.00	0.358	3.27	3.19	0.04	512.20
7	1.17	0.375	3.93	3.85	0.04	512.20
8	1.33	0.385	4.61	4.50	0.05	512.30
9	1.50	0.406	5.29	5.16	0.06	512.40
10	1.67	0.417	5.99	5.86	0.06	512.40
11	1.83	0.443	6.72	6.57	0.07	512.50
12	2.00	0.458	7.47	7.32	0.07	512.50
13	2.17	0.491	8.27	8.10	0.08	512.60
14	2.33	0.510	9.10	8.94	0.08	512.60
15	2.50	0.554	10.00	9.82	0.09	512.70
16	2.67	0.580	10.95	10.76	0.10	512.80
17	2.83	0.643	11.98	11.77	0.10	512.90
18	3.00	0.682	13.10	12.89	0.10	512.90
19	3.17	0.782	14.35	14.13	0.11	513.00
20	3.33	0.848	15.76	15.52	0.12	513.20
21	3.50	1.037	17.40	17.15	0.13	513.30
22	3.67	1.181	19.37	19.10	0.13	513.40
23	3.83	1.734	22.02	21.73	0.14	513.60
24	4.00	2.443	25.91	25.60	0.16	513.90
25	4.17	8.756	36.79	36.41	0.19	514.80
26	4.33	1.391	46.56	46.13	0.21	515.50
27	4.50	0.930	48.45	48.02	0.22	515.70
28	4.67	0.728	49.67	49.23	0.22	515.70
29	4.83	0.610	50.57	50.13	0.22	515.80
30	5.00	0.531	51.27	50.82	0.23	515.90
31	5.17	0.473	51.82	51.37	0.23	515.90
32	5.33	0.430	52.27	51.82	0.23	515.90
33	5.50	0.395	52.65	52.19	0.23	516.00
34	5.67	0.367	52.95	52.49	0.23	516.00
35	5.83	0.343	53.20	52.74	0.23	516.00
36	6.00	0.323	53.41	52.95	0.23	516.00
37	6.17	0.000	53.28	52.82	0.23	516.00
38	6.33	0.000	52.82	52.36	0.23	516.00
39	6.50	0.000	52.36	51.91	0.23	515.90
40	6.67	0.000	51.91	51.46	0.23	515.90
41	6.83	0.000	51.46	51.01	0.23	515.90
42	7.00	0.000	51.01	50.56	0.22	515.80
43	7.17	0.000	50.56	50.12	0.22	515.80
44	7.33	0.000	50.12	49.67	0.22	515.80

45	7.50	0.000	49.67	49.23	0.22	515.70
46	7.67	0.000	49.23	48.79	0.22	515.70
47	7.83	0.000	48.79	48.35	0.22	515.70
48	8.00	0.000	48.35	47.92	0.22	515.60
49	8.17	0.000	47.92	47.49	0.22	515.60
50	8.33	0.000	47.49	47.05	0.22	515.60
51	8.50	0.000	47.05	46.63	0.21	515.50
52	8.67	0.000	46.63	46.20	0.21	515.50
53	8.83	0.000	46.20	45.77	0.21	515.50
54	9.00	0.000	45.77	45.35	0.21	515.40
55	9.17	0.000	45.35	44.93	0.21	515.40
56	9.33	0.000	44.93	44.51	0.21	515.40
57	9.50	0.000	44.51	44.10	0.21	515.30
58	9.67	0.000	44.10	43.68	0.21	515.30
59	9.83	0.000	43.68	43.27	0.21	515.30
60	10.00	0.000	43.27	42.85	0.21	515.30
61	10.17	0.000	42.85	42.45	0.20	515.20
62	10.33	0.000	42.45	42.04	0.20	515.20
63	10.50	0.000	42.04	41.63	0.20	515.20
64	10.67	0.000	41.63	41.23	0.20	515.10
65	10.83	0.000	41.23	40.83	0.20	515.10
66	11.00	0.000	40.83	40.43	0.20	515.10
67	11.17	0.000	40.43	40.03	0.20	515.00
68	11.33	0.000	40.03	39.64	0.20	515.00
69	11.50	0.000	39.64	39.24	0.20	515.00
70	11.67	0.000	39.24	38.86	0.19	514.90
71	11.83	0.000	38.86	38.47	0.19	514.90
72	12.00	0.000	38.47	38.08	0.19	514.90
73	12.17	0.000	38.08	37.69	0.19	514.90
74	12.33	0.000	37.69	37.31	0.19	514.80
75	12.50	0.000	37.31	36.93	0.19	514.80
76	12.67	0.000	36.93	36.55	0.19	514.80
77	12.83	0.000	36.55	36.18	0.19	514.70
78	13.00	0.000	36.18	35.80	0.19	514.70
79	13.17	0.000	35.80	35.43	0.19	514.70
80	13.33	0.000	35.43	35.06	0.19	514.70
81	13.50	0.000	35.06	34.69	0.18	514.60
82	13.67	0.000	34.69	34.32	0.18	514.60
83	13.83	0.000	34.32	33.96	0.18	514.60
84	14.00	0.000	33.96	33.60	0.18	514.50
85	14.17	0.000	33.60	33.24	0.18	514.50
86	14.33	0.000	33.24	32.88	0.18	514.50
87	14.50	0.000	32.88	32.52	0.18	514.50
88	14.67	0.000	32.52	32.17	0.18	514.40
89	14.83	0.000	32.17	31.82	0.18	514.40
90	15.00	0.000	31.82	31.47	0.18	514.40
91	15.17	0.000	31.47	31.11	0.18	514.40
92	15.33	0.000	31.11	30.77	0.17	514.30
93	15.50	0.000	30.77	30.43	0.17	514.30
94	15.67	0.000	30.43	30.08	0.17	514.30
95	15.83	0.000	30.08	29.75	0.17	514.20
96	16.00	0.000	29.75	29.41	0.17	514.20

South

DETENTION BASIN ROUTING

2.89

10.10

0.50

10 YEAR EVENT ~ 6 Hour STORM

516.40

10 Interval	Minutes T (HRS)	Q IN (CFS)	2S/dT+O	2S/dT-O (CFS)	O (CFS)	Basin WSEL
1	0.17	0.359	0.00	0.00	0.00	512.00
2	0.33	0.365	0.72	0.72	0.00	512.00
3	0.50	0.380	1.47	1.44	0.01	512.10
4	0.67	0.388	2.21	2.18	0.01	512.10
5	0.83	0.404	2.97	2.89	0.04	512.20
6	1.00	0.413	3.71	3.63	0.04	512.20
7	1.17	0.433	4.48	4.37	0.05	512.30
8	1.33	0.444	5.25	5.14	0.05	512.30
9	1.50	0.468	6.05	5.92	0.06	512.40
10	1.67	0.481	6.87	6.72	0.07	512.50
11	1.83	0.511	7.71	7.56	0.07	512.50
12	2.00	0.528	8.60	8.44	0.08	512.60
13	2.17	0.566	9.53	9.35	0.09	512.70
14	2.33	0.588	10.50	10.32	0.09	512.70
15	2.50	0.639	11.55	11.35	0.10	512.80
16	2.67	0.669	12.66	12.45	0.10	512.90
17	2.83	0.742	13.87	13.65	0.11	513.00
18	3.00	0.787	15.18	14.94	0.12	513.10
19	3.17	0.903	16.63	16.39	0.12	513.20
20	3.33	0.979	18.27	18.01	0.13	513.30
21	3.50	1.196	20.19	19.91	0.14	513.50
22	3.67	1.362	22.47	22.18	0.15	513.70
23	3.83	2.000	25.54	25.23	0.16	513.90
24	4.00	2.819	30.05	29.71	0.17	514.20
25	4.17	10.103	42.64	42.23	0.20	515.20
26	4.33	1.604	53.94	53.41	0.26	516.10
27	4.50	1.074	56.09	55.43	0.33	516.20
28	4.67	0.840	57.35	56.53	0.41	516.30
29	4.83	0.704	58.07	57.07	0.50	516.40
30	5.00	0.612	58.39	57.39	0.50	516.40
31	5.17	0.546	58.54	57.54	0.50	516.40
32	5.33	0.496	58.58	57.58	0.50	516.40
33	5.50	0.456	58.53	57.53	0.50	516.40
34	5.67	0.423	58.41	57.40	0.50	516.40
35	5.83	0.396	58.22	57.22	0.50	516.40
36	6.00	0.372	57.99	56.99	0.50	516.40
37	6.17	0.000	57.36	56.54	0.41	516.30
38	6.33	0.000	56.54	55.73	0.41	516.30
39	6.50	0.000	55.73	55.08	0.33	516.20
40	6.67	0.000	55.08	54.42	0.33	516.20
41	6.83	0.000	54.42	53.90	0.26	516.10
42	7.00	0.000	53.90	53.37	0.26	516.10
43	7.17	0.000	53.37	52.91	0.23	516.00
44	7.33	0.000	52.91	52.45	0.23	516.00

45	7.50	0.000	52.45	52.00	0.23	516.00
46	7.67	0.000	52.00	51.54	0.23	515.90
47	7.83	0.000	51.54	51.09	0.23	515.90
48	8.00	0.000	51.09	50.64	0.23	515.90
49	8.17	0.000	50.64	50.20	0.22	515.80
50	8.33	0.000	50.20	49.75	0.22	515.80
51	8.50	0.000	49.75	49.31	0.22	515.80
52	8.67	0.000	49.31	48.87	0.22	515.70
53	8.83	0.000	48.87	48.43	0.22	515.70
54	9.00	0.000	48.43	47.99	0.22	515.60
55	9.17	0.000	47.99	47.56	0.22	515.60
56	9.33	0.000	47.56	47.13	0.22	515.60
57	9.50	0.000	47.13	46.70	0.21	515.50
58	9.67	0.000	46.70	46.27	0.21	515.50
59	9.83	0.000	46.27	45.85	0.21	515.50
60	10.00	0.000	45.85	45.42	0.21	515.50
61	10.17	0.000	45.42	45.00	0.21	515.40
62	10.33	0.000	45.00	44.58	0.21	515.40
63	10.50	0.000	44.58	44.16	0.21	515.40
64	10.67	0.000	44.16	43.74	0.21	515.30
65	10.83	0.000	43.74	43.33	0.21	515.30
66	11.00	0.000	43.33	42.91	0.21	515.30
67	11.17	0.000	42.91	42.51	0.20	515.20
68	11.33	0.000	42.51	42.10	0.20	515.20
69	11.50	0.000	42.10	41.69	0.20	515.20
70	11.67	0.000	41.69	41.29	0.20	515.10
71	11.83	0.000	41.29	40.89	0.20	515.10
72	12.00	0.000	40.89	40.49	0.20	515.10
73	12.17	0.000	40.49	40.09	0.20	515.00
74	12.33	0.000	40.09	39.70	0.20	515.00
75	12.50	0.000	39.70	39.30	0.20	515.00
76	12.67	0.000	39.30	38.91	0.20	515.00
77	12.83	0.000	38.91	38.52	0.19	514.90
78	13.00	0.000	38.52	38.13	0.19	514.90
79	13.17	0.000	38.13	37.75	0.19	514.90
80	13.33	0.000	37.75	37.37	0.19	514.80
81	13.50	0.000	37.37	36.99	0.19	514.80
82	13.67	0.000	36.99	36.60	0.19	514.80
83	13.83	0.000	36.60	36.23	0.19	514.70
84	14.00	0.000	36.23	35.86	0.19	514.70

South

DETENTION BASIN ROUTING

3.17

11.11

0.85

25 YEAR EVENT ~ 6 Hour STORM

516.70

10 Min Interval	T (HRS)	Q IN (CFS)	2S/dT+O	2S/dT-O (CFS)	O (CFS)	Basin WSEL
1	0.17	0.395	0.00	0.00	0.00	512.00
2	0.33	0.402	0.80	0.80	0.00	512.00
3	0.50	0.418	1.62	1.59	0.01	512.10
4	0.67	0.426	2.43	2.40	0.01	512.10
5	0.83	0.445	3.27	3.19	0.04	512.20
6	1.00	0.455	4.09	3.98	0.05	512.30
7	1.17	0.477	4.92	4.81	0.05	512.30
8	1.33	0.489	5.77	5.64	0.06	512.40
9	1.50	0.515	6.65	6.50	0.07	512.50
10	1.67	0.530	7.54	7.39	0.07	512.50
11	1.83	0.562	8.49	8.32	0.08	512.60
12	2.00	0.581	9.46	9.28	0.09	512.70
13	2.17	0.623	10.48	10.30	0.09	512.70
14	2.33	0.647	11.57	11.38	0.10	512.80
15	2.50	0.703	12.73	12.52	0.10	512.90
16	2.67	0.736	13.96	13.74	0.11	513.00
17	2.83	0.817	15.29	15.06	0.12	513.10
18	3.00	0.866	16.74	16.50	0.12	513.20
19	3.17	0.993	18.36	18.10	0.13	513.30
20	3.33	1.076	20.17	19.89	0.14	513.50
21	3.50	1.316	22.29	22.00	0.14	513.60
22	3.67	1.499	24.82	24.51	0.15	513.80
23	3.83	2.201	28.21	27.89	0.16	514.10
24	4.00	3.100	33.19	32.83	0.18	514.50
25	4.17	11.113	47.04	46.61	0.21	515.50
26	4.33	1.765	59.49	58.28	0.61	516.50
27	4.50	1.181	61.22	59.77	0.73	516.60
28	4.67	0.924	61.88	60.42	0.73	516.60
29	4.83	0.774	62.12	60.42	0.85	516.70
30	5.00	0.674	61.86	60.41	0.73	516.60
31	5.17	0.601	61.69	60.23	0.73	516.60
32	5.33	0.545	61.38	59.93	0.73	516.60
33	5.50	0.501	60.98	59.52	0.73	516.60
34	5.67	0.465	60.49	59.28	0.61	516.50
35	5.83	0.435	60.18	58.96	0.61	516.50
36	6.00	0.410	59.80	58.59	0.61	516.50
37	6.17	0.000	59.00	58.00	0.50	516.40
38	6.33	0.000	58.00	56.99	0.50	516.40
39	6.50	0.000	56.99	56.18	0.41	516.30
40	6.67	0.000	56.18	55.52	0.33	516.20
41	6.83	0.000	55.52	54.87	0.33	516.20
42	7.00	0.000	54.87	54.34	0.26	516.10
43	7.17	0.000	54.34	53.81	0.26	516.10
44	7.33	0.000	53.81	53.29	0.26	516.10

South

DETENTION BASIN ROUTING

3.46

12.12

1.14

50 YEAR EVENT ~ 6 Hour STORM

516.90

10 Min Interval	T (HRS)	Q IN (CFS)	2S/dT+O	2S/dT-O (CFS)	O (CFS)	Basin WSEL
1	0.17	0.431	0.00	0.00	0.00	512.00
2	0.33	0.439	0.87	0.87	0.00	512.00
3	0.50	0.456	1.76	1.73	0.01	512.10
4	0.67	0.465	2.65	2.58	0.04	512.20
5	0.83	0.485	3.53	3.45	0.04	512.20
6	1.00	0.496	4.43	4.32	0.05	512.30
7	1.17	0.520	5.34	5.21	0.06	512.40
8	1.33	0.533	6.26	6.13	0.06	512.40
9	1.50	0.562	7.22	7.07	0.07	512.50
10	1.67	0.578	8.21	8.05	0.08	512.60
11	1.83	0.614	9.24	9.06	0.09	512.70
12	2.00	0.634	10.31	10.12	0.09	512.70
13	2.17	0.679	11.44	11.24	0.10	512.80
14	2.33	0.706	12.63	12.42	0.10	512.90
15	2.50	0.767	13.89	13.67	0.11	513.00
16	2.67	0.803	15.24	15.01	0.12	513.10
17	2.83	0.891	16.70	16.46	0.12	513.20
18	3.00	0.945	18.29	18.04	0.13	513.30
19	3.17	1.083	20.07	19.79	0.14	513.50
20	3.33	1.174	22.05	21.76	0.14	513.60
21	3.50	1.435	24.37	24.07	0.15	513.80
22	3.67	1.635	27.14	26.82	0.16	514.00
23	3.83	2.401	30.86	30.51	0.17	514.30
24	4.00	3.382	36.30	35.92	0.19	514.70
25	4.17	12.124	51.43	50.98	0.23	515.90
26	4.33	1.925	65.03	62.75	1.14	516.90
27	4.50	1.288	65.97	63.70	1.14	516.90
28	4.67	1.008	65.99	63.72	1.14	516.90
29	4.83	0.844	65.57	63.30	1.14	516.90
30	5.00	0.735	64.88	62.90	0.99	516.80
31	5.17	0.656	64.29	62.31	0.99	516.80
32	5.33	0.595	63.56	61.58	0.99	516.80
33	5.50	0.547	62.72	61.02	0.85	516.70
34	5.67	0.508	62.07	60.62	0.73	516.60
35	5.83	0.475	61.60	60.15	0.73	516.60
36	6.00	0.447	61.07	59.62	0.73	516.60
37	6.17	0.000	60.07	58.85	0.61	516.50
38	6.33	0.000	58.85	57.85	0.50	516.40
39	6.50	0.000	57.85	56.85	0.50	516.40
40	6.67	0.000	56.85	56.03	0.41	516.30
41	6.83	0.000	56.03	55.38	0.33	516.20
42	7.00	0.000	55.38	54.72	0.33	516.20
43	7.17	0.000	54.72	54.20	0.26	516.10
44	7.33	0.000	54.20	53.67	0.26	516.10

45	7.50	0.000	53.67	53.21	0.23	516.00
46	7.67	0.000	53.21	52.75	0.23	516.00
47	7.83	0.000	52.75	52.30	0.23	516.00
48	8.00	0.000	52.30	51.85	0.23	515.90
49	8.17	0.000	51.85	51.39	0.23	515.90
50	8.33	0.000	51.39	50.94	0.23	515.90
51	8.50	0.000	50.94	50.50	0.22	515.80
52	8.67	0.000	50.50	50.05	0.22	515.80
53	8.83	0.000	50.05	49.61	0.22	515.80
54	9.00	0.000	49.61	49.17	0.22	515.70
55	9.17	0.000	49.17	48.73	0.22	515.70
56	9.33	0.000	48.73	48.29	0.22	515.70
57	9.50	0.000	48.29	47.86	0.22	515.60
58	9.67	0.000	47.86	47.42	0.22	515.60
59	9.83	0.000	47.42	46.99	0.22	515.60
60	10.00	0.000	46.99	46.56	0.21	515.50
61	10.17	0.000	46.56	46.14	0.21	515.50
62	10.33	0.000	46.14	45.71	0.21	515.50
63	10.50	0.000	45.71	45.29	0.21	515.40
64	10.67	0.000	45.29	44.87	0.21	515.40
65	10.83	0.000	44.87	44.45	0.21	515.40
66	11.00	0.000	44.45	44.03	0.21	515.30
67	11.17	0.000	44.03	43.62	0.21	515.30
68	11.33	0.000	43.62	43.20	0.21	515.30
69	11.50	0.000	43.20	42.80	0.20	515.20
70	11.67	0.000	42.80	42.39	0.20	515.20
71	11.83	0.000	42.39	41.98	0.20	515.20
72	12.00	0.000	41.98	41.57	0.20	515.20
73	12.17	0.000	41.57	41.17	0.20	515.10
74	12.33	0.000	41.17	40.77	0.20	515.10
75	12.50	0.000	40.77	40.37	0.20	515.10
76	12.67	0.000	40.37	39.97	0.20	515.00
77	12.83	0.000	39.97	39.58	0.20	515.00
78	13.00	0.000	39.58	39.18	0.20	515.00
79	13.17	0.000	39.18	38.80	0.19	514.90
80	13.33	0.000	38.80	38.41	0.19	514.90
81	13.50	0.000	38.41	38.02	0.19	514.90
82	13.67	0.000	38.02	37.63	0.19	514.90
83	13.83	0.000	37.63	37.25	0.19	514.80
84	14.00	0.000	37.25	36.87	0.19	514.80

South

DETENTION BASIN ROUTING

3.85

13.47

1.80

100 YEAR EVENT ~ 6 Hour STORM

517.30

Interval	10 Min T (HRS)	Q IN (CFS)	2S/dT+O	2S/dT-O (CFS)	O (CFS)	Basin WSEL
1	0.17	0.478	0.00	0.00	0.00	512.00
2	0.33	0.487	0.97	0.97	0.00	512.00
3	0.50	0.506	1.96	1.93	0.01	512.10
4	0.67	0.517	2.95	2.87	0.04	512.20
5	0.83	0.539	3.93	3.85	0.04	512.20
6	1.00	0.551	4.94	4.83	0.05	512.30
7	1.17	0.578	5.96	5.83	0.06	512.40
8	1.33	0.592	7.00	6.85	0.07	512.50
9	1.50	0.624	8.07	7.90	0.08	512.60
10	1.67	0.642	9.17	9.00	0.08	512.60
11	1.83	0.682	10.33	10.15	0.09	512.70
12	2.00	0.704	11.53	11.34	0.10	512.80
13	2.17	0.755	12.79	12.59	0.10	512.90
14	2.33	0.784	14.12	13.90	0.11	513.00
15	2.50	0.852	15.54	15.31	0.12	513.10
16	2.67	0.893	17.05	16.81	0.12	513.20
17	2.83	0.990	18.69	18.43	0.13	513.40
18	3.00	1.050	20.47	20.19	0.14	513.50
19	3.17	1.203	22.44	22.15	0.15	513.70
20	3.33	1.305	24.66	24.36	0.15	513.80
21	3.50	1.595	27.26	26.94	0.16	514.00
22	3.67	1.817	30.35	30.00	0.17	514.30
23	3.83	2.667	34.49	34.12	0.18	514.60
24	4.00	3.758	40.55	40.15	0.20	515.00
25	4.17	13.471	57.38	56.57	0.41	516.30
26	4.33	2.139	72.18	68.59	1.80	517.30
27	4.50	1.431	72.16	68.57	1.80	517.30
28	4.67	1.120	71.12	67.53	1.80	517.30
29	4.83	0.938	69.58	66.34	1.62	517.20
30	5.00	0.816	68.10	65.20	1.45	517.10
31	5.17	0.728	66.74	64.16	1.29	517.00
32	5.33	0.661	65.55	63.28	1.14	516.90
33	5.50	0.608	64.55	62.57	0.99	516.80
34	5.67	0.564	63.74	61.76	0.99	516.80
35	5.83	0.528	62.85	61.15	0.85	516.70
36	6.00	0.497	62.17	60.46	0.85	516.70
37	6.17	0.000	60.96	59.51	0.73	516.60
38	6.33	0.000	59.51	58.29	0.61	516.50
39	6.50	0.000	58.29	57.29	0.50	516.40
40	6.67	0.000	57.29	56.48	0.41	516.30
41	6.83	0.000	56.48	55.66	0.41	516.30
42	7.00	0.000	55.66	55.01	0.33	516.20
43	7.17	0.000	55.01	54.48	0.26	516.10
44	7.33	0.000	54.48	53.95	0.26	516.10

45	7.50	0.000	53.95	53.42	0.26	516.10
46	7.67	0.000	53.42	52.97	0.23	516.00
47	7.83	0.000	52.97	52.51	0.23	516.00
48	8.00	0.000	52.51	52.05	0.23	516.00
49	8.17	0.000	52.05	51.60	0.23	515.90
50	8.33	0.000	51.60	51.15	0.23	515.90
51	8.50	0.000	51.15	50.70	0.23	515.90
52	8.67	0.000	50.70	50.25	0.22	515.80
53	8.83	0.000	50.25	49.81	0.22	515.80
54	9.00	0.000	49.81	49.36	0.22	515.80
55	9.17	0.000	49.36	48.92	0.22	515.70
56	9.33	0.000	48.92	48.48	0.22	515.70
57	9.50	0.000	48.48	48.04	0.22	515.70
58	9.67	0.000	48.04	47.61	0.22	515.60
59	9.83	0.000	47.61	47.18	0.22	515.60
60	10.00	0.000	47.18	46.74	0.22	515.60
61	10.17	0.000	46.74	46.32	0.21	515.50
62	10.33	0.000	46.32	45.89	0.21	515.50
63	10.50	0.000	45.89	45.46	0.21	515.50
64	10.67	0.000	45.46	45.04	0.21	515.40
65	10.83	0.000	45.04	44.62	0.21	515.40
66	11.00	0.000	44.62	44.20	0.21	515.40
67	11.17	0.000	44.20	43.79	0.21	515.30
68	11.33	0.000	43.79	43.37	0.21	515.30
69	11.50	0.000	43.37	42.96	0.21	515.30
70	11.67	0.000	42.96	42.55	0.20	515.20
71	11.83	0.000	42.55	42.14	0.20	515.20
72	12.00	0.000	42.14	41.73	0.20	515.20
73	12.17	0.000	41.73	41.33	0.20	515.10
74	12.33	0.000	41.33	40.93	0.20	515.10
75	12.50	0.000	40.93	40.53	0.20	515.10
76	12.67	0.000	40.53	40.14	0.20	515.00
77	12.83	0.000	40.14	39.74	0.20	515.00
78	13.00	0.000	39.74	39.35	0.20	515.00
79	13.17	0.000	39.35	38.95	0.20	515.00
80	13.33	0.000	38.95	38.57	0.19	514.90
81	13.50	0.000	38.57	38.18	0.19	514.90
82	13.67	0.000	38.18	37.79	0.19	514.90
83	13.83	0.000	37.79	37.41	0.19	514.80
84	14.00	0.000	37.41	37.03	0.19	514.80
85	14.17	0.000	37.03	36.65	0.19	514.80
86	14.33	0.000	36.65	36.27	0.19	514.70
87	14.50	0.000	36.27	35.90	0.19	514.70
88	14.67	0.000	35.90	35.53	0.19	514.70
89	14.83	0.000	35.53	35.15	0.19	514.70
90	15.00	0.000	35.15	34.79	0.18	514.60
91	15.17	0.000	34.79	34.42	0.18	514.60
92	15.33	0.000	34.42	34.05	0.18	514.60
93	15.50	0.000	34.05	33.70	0.18	514.50
94	15.67	0.000	33.70	33.34	0.18	514.50
95	15.83	0.000	33.34	32.98	0.18	514.50
96	16.00	0.000	32.98	32.62	0.18	514.50

EXHIBIT H

DETENTION BASIN STORM ROUTING

10-Year Drain Time Calculations – North & South

North

DETENTION BASIN ROUTING

5.68

15.56

0.54

10 YEAR EVENT ~ 6 Hour STORM

513.00

18 Interval	Minutes T (HRS)	Q IN (CFS)	2S/dT+O	2S/dT-O (CFS)	O (CFS)	Basin WSEL
1	0.30	0.787	0.00	0.00	0.00	510.50
2	0.60	0.813	1.60	1.60	0.00	510.50
3	0.90	0.872	3.29	3.24	0.02	510.60
4	1.20	0.906	5.01	4.96	0.02	510.60
5	1.50	0.984	6.85	6.71	0.07	510.70
6	1.80	1.031	8.73	8.47	0.13	510.80
7	2.10	1.143	10.64	10.38	0.13	510.80
8	2.40	1.212	12.74	12.38	0.18	510.90
9	2.70	1.390	14.98	14.56	0.21	511.00
10	3.00	1.507	17.46	16.98	0.24	511.10
11	3.30	1.842	20.33	19.80	0.26	511.20
12	3.60	2.098	23.74	23.17	0.29	511.30
13	3.90	3.080	28.35	27.74	0.31	511.40
14	4.20	4.340	35.16	34.43	0.36	511.70
15	4.50	15.556	54.33	53.42	0.45	512.30
16	4.80	2.470	71.44	70.40	0.52	512.80
17	5.10	1.653	74.53	73.46	0.53	512.90
18	5.40	1.293	76.41	75.35	0.53	512.90
19	5.70	1.083	77.73	76.64	0.54	513.00
20	6.00	0.943	78.67	77.58	0.54	513.00
21	6.30	0.841	79.36	78.28	0.54	513.00
22	6.60	0.000	79.12	78.03	0.54	513.00
23	6.90	0.000	78.03	76.95	0.54	513.00
24	7.20	0.000	76.95	75.86	0.54	513.00
25	7.50	0.000	75.86	74.80	0.53	512.90
26	7.80	0.000	74.80	73.74	0.53	512.90
27	8.10	0.000	73.74	72.68	0.53	512.90
28	8.40	0.000	72.68	71.64	0.52	512.80
29	8.70	0.000	71.64	70.60	0.52	512.80
30	9.00	0.000	70.60	69.56	0.52	512.80
31	9.30	0.000	69.56	68.55	0.51	512.70
32	9.60	0.000	68.55	67.53	0.51	512.70
33	9.90	0.000	67.53	66.52	0.51	512.70
34	10.20	0.000	66.52	65.53	0.49	512.60
35	10.50	0.000	65.53	64.54	0.49	512.60
36	10.80	0.000	64.54	63.55	0.49	512.60
37	11.10	0.000	63.55	62.59	0.48	512.50
38	11.40	0.000	62.59	61.63	0.48	512.50
39	11.70	0.000	61.63	60.66	0.48	512.50
40	12.00	0.000	60.66	59.70	0.48	512.50
41	12.30	0.000	59.70	58.76	0.47	512.40
42	12.60	0.000	58.76	57.83	0.47	512.40
43	12.90	0.000	57.83	56.89	0.47	512.40
44	13.20	0.000	56.89	55.98	0.45	512.30

45	13.50	0.000	55.98	55.07	0.45	512.30
46	13.80	0.000	55.07	54.16	0.45	512.30
47	14.10	0.000	54.16	53.25	0.45	512.30
48	14.40	0.000	53.25	52.37	0.44	512.20
49	14.70	0.000	52.37	51.49	0.44	512.20
50	15.00	0.000	51.49	50.61	0.44	512.20
51	15.30	0.000	50.61	49.75	0.43	512.10
52	15.60	0.000	49.75	48.90	0.43	512.10
53	15.90	0.000	48.90	48.05	0.43	512.10
54	16.20	0.000	48.05	47.19	0.43	512.10
55	16.50	0.000	47.19	46.37	0.41	512.00
56	16.80	0.000	46.37	45.55	0.41	512.00
57	17.10	0.000	45.55	44.72	0.41	512.00
58	17.40	0.000	44.72	43.90	0.41	512.00
59	17.70	0.000	43.90	43.11	0.40	511.90
60	18.00	0.000	43.11	42.32	0.40	511.90
61	18.30	0.000	42.32	41.52	0.40	511.90
62	18.60	0.000	41.52	40.73	0.40	511.90
63	18.90	0.000	40.73	39.97	0.38	511.80
64	19.20	0.000	39.97	39.21	0.38	511.80
65	19.50	0.000	39.21	38.45	0.38	511.80
66	19.80	0.000	38.45	37.69	0.38	511.80
67	20.10	0.000	37.69	36.96	0.36	511.70
68	20.40	0.000	36.96	36.24	0.36	511.70
69	20.70	0.000	36.24	35.51	0.36	511.70
70	21.00	0.000	35.51	34.79	0.36	511.70
71	21.30	0.000	34.79	34.09	0.35	511.60
72	21.60	0.000	34.09	33.40	0.35	511.60
73	21.90	0.000	33.40	32.71	0.35	511.60
74	22.20	0.000	32.71	32.02	0.35	511.60
75	22.50	0.000	32.02	31.37	0.33	511.50
76	22.80	0.000	31.37	30.71	0.33	511.50
77	23.10	0.000	30.71	30.06	0.33	511.50
78	23.40	0.000	30.06	29.41	0.33	511.50
79	23.70	0.000	29.41	28.75	0.33	511.50
80	24.00	0.000	28.75	28.14	0.31	511.40
81	24.30	0.000	28.14	27.52	0.31	511.40
82	24.60	0.000	27.52	26.91	0.31	511.40
83	24.90	0.000	26.91	26.30	0.31	511.40
84	25.20	0.000	26.30	25.68	0.31	511.40
85	25.50	0.000	25.68	25.11	0.29	511.30
86	25.80	0.000	25.11	24.54	0.29	511.30
87	26.10	0.000	24.54	23.96	0.29	511.30
88	26.40	0.000	23.96	23.39	0.29	511.30
89	26.70	0.000	23.39	22.82	0.29	511.30
90	27.00	0.000	22.82	22.29	0.26	511.20
91	27.30	0.000	22.29	21.77	0.26	511.20
92	27.60	0.000	21.77	21.24	0.26	511.20
93	27.90	0.000	21.24	20.71	0.26	511.20
94	28.20	0.000	20.71	20.19	0.26	511.20
95	28.50	0.000	20.19	19.66	0.26	511.20
96	28.80	0.000	19.66	19.18	0.24	511.10

97	29.10	0.000	19.18	18.71	0.24	511.10
98	29.40	0.000	18.71	18.23	0.24	511.10
99	29.70	0.000	18.23	17.75	0.24	511.10
100	30.00	0.000	17.75	17.28	0.24	511.10
101	30.30	0.000	17.28	16.80	0.24	511.10
102	30.60	0.000	16.80	16.38	0.21	511.00
103	30.90	0.000	16.38	15.96	0.21	511.00
104	31.20	0.000	15.96	15.54	0.21	511.00
105	31.50	0.000	15.54	15.12	0.21	511.00
106	31.80	0.000	15.12	14.69	0.21	511.00
107	32.10	0.000	14.69	14.27	0.21	511.00
108	32.40	0.000	14.27	13.92	0.18	510.90
109	32.70	0.000	13.92	13.56	0.18	510.90
110	33.00	0.000	13.56	13.20	0.18	510.90
111	33.30	0.000	13.20	12.85	0.18	510.90
112	33.60	0.000	12.85	12.49	0.18	510.90
113	33.90	0.000	12.49	12.13	0.18	510.90
114	34.20	0.000	12.13	11.78	0.18	510.90
115	34.50	0.000	11.78	11.42	0.18	510.90
116	34.80	0.000	11.42	11.06	0.18	510.90
117	35.10	0.000	11.06	10.81	0.13	510.80
118	35.40	0.000	10.81	10.55	0.13	510.80
119	35.70	0.000	10.55	10.29	0.13	510.80
120	36.00	0.000	10.29	10.03	0.13	510.80
121	36.30	0.000	10.03	9.77	0.13	510.80
122	36.60	0.000	9.77	9.51	0.13	510.80
123	36.90	0.000	9.51	9.25	0.13	510.80
124	37.20	0.000	9.25	8.99	0.13	510.80
125	37.50	0.000	8.99	8.73	0.13	510.80
126	37.80	0.000	8.73	8.48	0.13	510.80
127	38.10	0.000	8.48	8.34	0.07	510.70
128	38.40	0.000	8.34	8.19	0.07	510.70
129	38.70	0.000	8.19	8.05	0.07	510.70
130	39.00	0.000	8.05	7.91	0.07	510.70
131	39.30	0.000	7.91	7.77	0.07	510.70
132	39.60	0.000	7.77	7.63	0.07	510.70
133	39.90	0.000	7.63	7.49	0.07	510.70
134	40.20	0.000	7.49	7.35	0.07	510.70
135	40.50	0.000	7.35	7.21	0.07	510.70
136	40.80	0.000	7.21	7.07	0.07	510.70
137	41.10	0.000	7.07	6.93	0.07	510.70
138	41.40	0.000	6.93	6.79	0.07	510.70
139	41.70	0.000	6.79	6.64	0.07	510.70
140	42.00	0.000	6.64	6.50	0.07	510.70
141	42.30	0.000	6.50	6.36	0.07	510.70
142	42.60	0.000	6.36	6.22	0.07	510.70
143	42.90	0.000	6.22	6.08	0.07	510.70
144	43.20	0.000	6.08	5.94	0.07	510.70
145	43.50	0.000	5.94	5.80	0.07	510.70
146	43.80	0.000	5.80	5.66	0.07	510.70
147	44.10	0.000	5.66	5.52	0.07	510.70
148	44.40	0.000	5.52	5.47	0.02	510.60

149	44.70	0.000	5.47	5.42	0.02	510.60
150	45.00	0.000	5.42	5.37	0.02	510.60
151	45.30	0.000	5.37	5.32	0.02	510.60
152	45.60	0.000	5.32	5.27	0.02	510.60
153	45.90	0.000	5.27	5.22	0.02	510.60
154	46.20	0.000	5.22	5.17	0.02	510.60
155	46.50	0.000	5.17	5.12	0.02	510.60
156	46.80	0.000	5.12	5.07	0.02	510.60
157	47.10	0.000	5.07	5.02	0.02	510.60
158	47.40	0.000	5.02	4.97	0.02	510.60
159	47.70	0.000	4.97	4.92	0.02	510.60
160	48.00	0.000	4.92	4.87	0.02	510.60
161	48.30	0.000	4.87	4.82	0.02	510.60
162	48.60	0.000	4.82	4.77	0.02	510.60
163	48.90	0.000	4.77	4.72	0.02	510.60
164	49.20	0.000	4.72	4.67	0.02	510.60
165	49.50	0.000	4.67	4.62	0.02	510.60
166	49.80	0.000	4.62	4.57	0.02	510.60
167	50.10	0.000	4.57	4.52	0.02	510.60
168	50.40	0.000	4.52	4.47	0.02	510.60
169	50.70	0.000	4.47	4.42	0.02	510.60
170	51.00	0.000	4.42	4.37	0.02	510.60
171	51.30	0.000	4.37	4.32	0.02	510.60
172	51.60	0.000	4.32	4.27	0.02	510.60
173	51.90	0.000	4.27	4.22	0.02	510.60
174	52.20	0.000	4.22	4.17	0.02	510.60
175	52.50	0.000	4.17	4.12	0.02	510.60
176	52.80	0.000	4.12	4.07	0.02	510.60
177	53.10	0.000	4.07	4.02	0.02	510.60
178	53.40	0.000	4.02	3.97	0.02	510.60
179	53.70	0.000	3.97	3.92	0.02	510.60
180	54.00	0.000	3.92	3.87	0.02	510.60
181	54.30	0.000	3.87	3.82	0.02	510.60
182	54.60	0.000	3.82	3.77	0.02	510.60
183	54.90	0.000	3.77	3.72	0.02	510.60
184	55.20	0.000	3.72	3.67	0.02	510.60
185	55.50	0.000	3.67	3.63	0.02	510.60
186	55.80	0.000	3.63	3.58	0.02	510.60
187	56.10	0.000	3.58	3.53	0.02	510.60
188	56.40	0.000	3.53	3.48	0.02	510.60
189	56.70	0.000	3.48	3.43	0.02	510.60
190	57.00	0.000	3.43	3.38	0.02	510.60
191	57.30	0.000	3.38	3.33	0.02	510.60
192	57.60	0.000	3.33	3.28	0.02	510.60
193	57.90	0.000	3.28	3.23	0.02	510.60
194	58.20	0.000	3.23	3.18	0.02	510.60
195	58.50	0.000	3.18	3.13	0.02	510.60
196	58.80	0.000	3.13	3.08	0.02	510.60
197	59.10	0.000	3.08	3.03	0.02	510.60
198	59.40	0.000	3.03	2.98	0.02	510.60
199	59.70	0.000	2.98	2.93	0.02	510.60
200	60.00	0.000	2.93	2.88	0.02	510.60

201	60.30	0.000	2.88	2.83	0.02	510.60
202	60.60	0.000	2.83	2.78	0.02	510.60
203	60.90	0.000	2.78	2.78	0.00	510.50

South

DETENTION BASIN ROUTING

2.89

10.10

0.50

10 YEAR EVENT ~ 6 Hour STORM

516.40

10 Interval	Minutes T (HRS)	Q IN (CFS)	2S/dT+O	2S/dT-O (CFS)	O (CFS)	Basin WSEL
1	0.17	0.359	0.00	0.00	0.00	512.00
2	0.33	0.365	0.72	0.72	0.00	512.00
3	0.50	0.380	1.47	1.44	0.01	512.10
4	0.67	0.388	2.21	2.18	0.01	512.10
5	0.83	0.404	2.97	2.89	0.04	512.20
6	1.00	0.413	3.71	3.63	0.04	512.20
7	1.17	0.433	4.48	4.37	0.05	512.30
8	1.33	0.444	5.25	5.14	0.05	512.30
9	1.50	0.468	6.05	5.92	0.06	512.40
10	1.67	0.481	6.87	6.72	0.07	512.50
11	1.83	0.511	7.71	7.56	0.07	512.50
12	2.00	0.528	8.60	8.44	0.08	512.60
13	2.17	0.566	9.53	9.35	0.09	512.70
14	2.33	0.588	10.50	10.32	0.09	512.70
15	2.50	0.639	11.55	11.35	0.10	512.80
16	2.67	0.669	12.66	12.45	0.10	512.90
17	2.83	0.742	13.87	13.65	0.11	513.00
18	3.00	0.787	15.18	14.94	0.12	513.10
19	3.17	0.903	16.63	16.39	0.12	513.20
20	3.33	0.979	18.27	18.01	0.13	513.30
21	3.50	1.196	20.19	19.91	0.14	513.50
22	3.67	1.362	22.47	22.18	0.15	513.70
23	3.83	2.000	25.54	25.23	0.16	513.90
24	4.00	2.819	30.05	29.71	0.17	514.20
25	4.17	10.103	42.64	42.23	0.20	515.20
26	4.33	1.604	53.94	53.41	0.26	516.10
27	4.50	1.074	56.09	55.43	0.33	516.20
28	4.67	0.840	57.35	56.53	0.41	516.30
29	4.83	0.704	58.07	57.07	0.50	516.40
30	5.00	0.612	58.39	57.39	0.50	516.40
31	5.17	0.546	58.54	57.54	0.50	516.40
32	5.33	0.496	58.58	57.58	0.50	516.40
33	5.50	0.456	58.53	57.53	0.50	516.40
34	5.67	0.423	58.41	57.40	0.50	516.40
35	5.83	0.396	58.22	57.22	0.50	516.40
36	6.00	0.372	57.99	56.99	0.50	516.40
37	6.17	0.000	57.36	56.54	0.41	516.30
38	6.33	0.000	56.54	55.73	0.41	516.30
39	6.50	0.000	55.73	55.08	0.33	516.20
40	6.67	0.000	55.08	54.42	0.33	516.20
41	6.83	0.000	54.42	53.90	0.26	516.10
42	7.00	0.000	53.90	53.37	0.26	516.10
43	7.17	0.000	53.37	52.91	0.23	516.00
44	7.33	0.000	52.91	52.45	0.23	516.00

45	7.50	0.000	52.45	52.00	0.23	516.00
46	7.67	0.000	52.00	51.54	0.23	515.90
47	7.83	0.000	51.54	51.09	0.23	515.90
48	8.00	0.000	51.09	50.64	0.23	515.90
49	8.17	0.000	50.64	50.20	0.22	515.80
50	8.33	0.000	50.20	49.75	0.22	515.80
51	8.50	0.000	49.75	49.31	0.22	515.80
52	8.67	0.000	49.31	48.87	0.22	515.70
53	8.83	0.000	48.87	48.43	0.22	515.70
54	9.00	0.000	48.43	47.99	0.22	515.60
55	9.17	0.000	47.99	47.56	0.22	515.60
56	9.33	0.000	47.56	47.13	0.22	515.60
57	9.50	0.000	47.13	46.70	0.21	515.50
58	9.67	0.000	46.70	46.27	0.21	515.50
59	9.83	0.000	46.27	45.85	0.21	515.50
60	10.00	0.000	45.85	45.42	0.21	515.50
61	10.17	0.000	45.42	45.00	0.21	515.40
62	10.33	0.000	45.00	44.58	0.21	515.40
63	10.50	0.000	44.58	44.16	0.21	515.40
64	10.67	0.000	44.16	43.74	0.21	515.30
65	10.83	0.000	43.74	43.33	0.21	515.30
66	11.00	0.000	43.33	42.91	0.21	515.30
67	11.17	0.000	42.91	42.51	0.20	515.20
68	11.33	0.000	42.51	42.10	0.20	515.20
69	11.50	0.000	42.10	41.69	0.20	515.20
70	11.67	0.000	41.69	41.29	0.20	515.10
71	11.83	0.000	41.29	40.89	0.20	515.10
72	12.00	0.000	40.89	40.49	0.20	515.10
73	12.17	0.000	40.49	40.09	0.20	515.00
74	12.33	0.000	40.09	39.70	0.20	515.00
75	12.50	0.000	39.70	39.30	0.20	515.00
76	12.67	0.000	39.30	38.91	0.20	515.00
77	12.83	0.000	38.91	38.52	0.19	514.90
78	13.00	0.000	38.52	38.13	0.19	514.90
79	13.17	0.000	38.13	37.75	0.19	514.90
80	13.33	0.000	37.75	37.37	0.19	514.80
81	13.50	0.000	37.37	36.99	0.19	514.80
82	13.67	0.000	36.99	36.60	0.19	514.80
83	13.83	0.000	36.60	36.23	0.19	514.70
84	14.00	0.000	36.23	35.86	0.19	514.70
85	14.17	0.000	35.86	35.48	0.19	514.70
86	14.33	0.000	35.48	35.11	0.19	514.70
87	14.50	0.000	35.11	34.74	0.18	514.60
88	14.67	0.000	34.74	34.38	0.18	514.60
89	14.83	0.000	34.38	34.01	0.18	514.60
90	15.00	0.000	34.01	33.65	0.18	514.50
91	15.17	0.000	33.65	33.29	0.18	514.50
92	15.33	0.000	33.29	32.93	0.18	514.50
93	15.50	0.000	32.93	32.57	0.18	514.50
94	15.67	0.000	32.57	32.22	0.18	514.40
95	15.83	0.000	32.22	31.87	0.18	514.40
96	16.00	0.000	31.87	31.52	0.18	514.40

97	16.17	0.000	31.52	31.17	0.18	514.40
98	16.33	0.000	31.17	30.82	0.17	514.30
99	16.50	0.000	30.82	30.48	0.17	514.30
100	16.67	0.000	30.48	30.14	0.17	514.30
101	16.83	0.000	30.14	29.80	0.17	514.20
102	17.00	0.000	29.80	29.46	0.17	514.20
103	17.17	0.000	29.46	29.13	0.17	514.20
104	17.33	0.000	29.13	28.79	0.17	514.20
105	17.50	0.000	28.79	28.46	0.16	514.10
106	17.67	0.000	28.46	28.14	0.16	514.10
107	17.83	0.000	28.14	27.81	0.16	514.10
108	18.00	0.000	27.81	27.48	0.16	514.10
109	18.17	0.000	27.48	27.16	0.16	514.00
110	18.33	0.000	27.16	26.84	0.16	514.00
111	18.50	0.000	26.84	26.52	0.16	514.00
112	18.67	0.000	26.52	26.20	0.16	514.00
113	18.83	0.000	26.20	25.89	0.16	513.90
114	19.00	0.000	25.89	25.58	0.16	513.90
115	19.17	0.000	25.58	25.27	0.16	513.90
116	19.33	0.000	25.27	24.96	0.16	513.90
117	19.50	0.000	24.96	24.64	0.16	513.90
118	19.67	0.000	24.64	24.34	0.15	513.80
119	19.83	0.000	24.34	24.04	0.15	513.80
120	20.00	0.000	24.04	23.74	0.15	513.80
121	20.17	0.000	23.74	23.43	0.15	513.80
122	20.33	0.000	23.43	23.14	0.15	513.70
123	20.50	0.000	23.14	22.85	0.15	513.70
124	20.67	0.000	22.85	22.55	0.15	513.70
125	20.83	0.000	22.55	22.26	0.15	513.70
126	21.00	0.000	22.26	21.97	0.14	513.60
127	21.17	0.000	21.97	21.69	0.14	513.60
128	21.33	0.000	21.69	21.40	0.14	513.60
129	21.50	0.000	21.40	21.12	0.14	513.60
130	21.67	0.000	21.12	20.84	0.14	513.60
131	21.83	0.000	20.84	20.56	0.14	513.50
132	22.00	0.000	20.56	20.29	0.14	513.50
133	22.17	0.000	20.29	20.01	0.14	513.50
134	22.33	0.000	20.01	19.74	0.14	513.50
135	22.50	0.000	19.74	19.46	0.14	513.50
136	22.67	0.000	19.46	19.20	0.13	513.40
137	22.83	0.000	19.20	18.93	0.13	513.40
138	23.00	0.000	18.93	18.67	0.13	513.40
139	23.17	0.000	18.67	18.40	0.13	513.40
140	23.33	0.000	18.40	18.14	0.13	513.40
141	23.50	0.000	18.14	17.88	0.13	513.30
142	23.67	0.000	17.88	17.63	0.13	513.30
143	23.83	0.000	17.63	17.37	0.13	513.30
144	24.00	0.000	17.37	17.12	0.13	513.30
145	24.17	0.000	17.12	16.86	0.13	513.30
146	24.33	0.000	16.86	16.62	0.12	513.20
147	24.50	0.000	16.62	16.37	0.12	513.20
148	24.67	0.000	16.37	16.13	0.12	513.20

149	24.83	0.000	16.13	15.89	0.12	513.20
150	25.00	0.000	15.89	15.64	0.12	513.20
151	25.17	0.000	15.64	15.41	0.12	513.10
152	25.33	0.000	15.41	15.18	0.12	513.10
153	25.50	0.000	15.18	14.94	0.12	513.10
154	25.67	0.000	14.94	14.71	0.12	513.10
155	25.83	0.000	14.71	14.48	0.12	513.10
156	26.00	0.000	14.48	14.24	0.12	513.10
157	26.17	0.000	14.24	14.02	0.11	513.00
158	26.33	0.000	14.02	13.80	0.11	513.00
159	26.50	0.000	13.80	13.58	0.11	513.00
160	26.67	0.000	13.58	13.36	0.11	513.00
161	26.83	0.000	13.36	13.14	0.11	513.00
162	27.00	0.000	13.14	12.93	0.10	512.90
163	27.17	0.000	12.93	12.72	0.10	512.90
164	27.33	0.000	12.72	12.51	0.10	512.90
165	27.50	0.000	12.51	12.30	0.10	512.90
166	27.67	0.000	12.30	12.09	0.10	512.90
167	27.83	0.000	12.09	11.89	0.10	512.90
168	28.00	0.000	11.89	11.68	0.10	512.90
169	28.17	0.000	11.68	11.48	0.10	512.80
170	28.33	0.000	11.48	11.29	0.10	512.80
171	28.50	0.000	11.29	11.09	0.10	512.80
172	28.67	0.000	11.09	10.89	0.10	512.80
173	28.83	0.000	10.89	10.70	0.10	512.80
174	29.00	0.000	10.70	10.50	0.10	512.80
175	29.17	0.000	10.50	10.32	0.09	512.70
176	29.33	0.000	10.32	10.14	0.09	512.70
177	29.50	0.000	10.14	9.96	0.09	512.70
178	29.67	0.000	9.96	9.78	0.09	512.70
179	29.83	0.000	9.78	9.60	0.09	512.70
180	30.00	0.000	9.60	9.42	0.09	512.70
181	30.17	0.000	9.42	9.23	0.09	512.70
182	30.33	0.000	9.23	9.05	0.09	512.70
183	30.50	0.000	9.05	8.89	0.08	512.60
184	30.67	0.000	8.89	8.72	0.08	512.60
185	30.83	0.000	8.72	8.55	0.08	512.60
186	31.00	0.000	8.55	8.39	0.08	512.60
187	31.17	0.000	8.39	8.22	0.08	512.60
188	31.33	0.000	8.22	8.06	0.08	512.60
189	31.50	0.000	8.06	7.89	0.08	512.60
190	31.67	0.000	7.89	7.74	0.07	512.50
191	31.83	0.000	7.74	7.59	0.07	512.50
192	32.00	0.000	7.59	7.44	0.07	512.50
193	32.17	0.000	7.44	7.29	0.07	512.50
194	32.33	0.000	7.29	7.14	0.07	512.50
195	32.50	0.000	7.14	7.00	0.07	512.50
196	32.67	0.000	7.00	6.85	0.07	512.50
197	32.83	0.000	6.85	6.70	0.07	512.50
198	33.00	0.000	6.70	6.55	0.07	512.50
199	33.17	0.000	6.55	6.42	0.06	512.40
200	33.33	0.000	6.42	6.29	0.06	512.40

201	33.50	0.000	6.29	6.16	0.06	512.40
202	33.67	0.000	6.16	6.03	0.06	512.40
203	33.83	0.000	6.03	5.90	0.06	512.40
204	34.00	0.000	5.90	5.77	0.06	512.40
205	34.17	0.000	5.77	5.64	0.06	512.40
206	34.33	0.000	5.64	5.51	0.06	512.40
207	34.50	0.000	5.51	5.38	0.06	512.40
208	34.67	0.000	5.38	5.25	0.06	512.40
209	34.83	0.000	5.25	5.14	0.05	512.30
210	35.00	0.000	5.14	5.03	0.05	512.30
211	35.17	0.000	5.03	4.93	0.05	512.30
212	35.33	0.000	4.93	4.82	0.05	512.30
213	35.50	0.000	4.82	4.71	0.05	512.30
214	35.67	0.000	4.71	4.60	0.05	512.30
215	35.83	0.000	4.60	4.50	0.05	512.30
216	36.00	0.000	4.50	4.39	0.05	512.30
217	36.17	0.000	4.39	4.28	0.05	512.30
218	36.33	0.000	4.28	4.17	0.05	512.30
219	36.50	0.000	4.17	4.07	0.05	512.30
220	36.67	0.000	4.07	3.96	0.05	512.30
221	36.83	0.000	3.96	3.88	0.04	512.20
222	37.00	0.000	3.88	3.80	0.04	512.20
223	37.17	0.000	3.80	3.72	0.04	512.20
224	37.33	0.000	3.72	3.64	0.04	512.20
225	37.50	0.000	3.64	3.56	0.04	512.20
226	37.67	0.000	3.56	3.48	0.04	512.20
227	37.83	0.000	3.48	3.41	0.04	512.20
228	38.00	0.000	3.41	3.33	0.04	512.20
229	38.17	0.000	3.33	3.25	0.04	512.20
230	38.33	0.000	3.25	3.17	0.04	512.20
231	38.50	0.000	3.17	3.09	0.04	512.20
232	38.67	0.000	3.09	3.01	0.04	512.20
233	38.83	0.000	3.01	2.93	0.04	512.20
234	39.00	0.000	2.93	2.85	0.04	512.20
235	39.17	0.000	2.85	2.77	0.04	512.20
236	39.33	0.000	2.77	2.70	0.04	512.20
237	39.50	0.000	2.70	2.62	0.04	512.20
238	39.67	0.000	2.62	2.59	0.01	512.10
239	39.83	0.000	2.59	2.56	0.01	512.10
240	40.00	0.000	2.56	2.53	0.01	512.10
241	40.17	0.000	2.53	2.50	0.01	512.10
242	40.33	0.000	2.50	2.47	0.01	512.10
243	40.50	0.000	2.47	2.44	0.01	512.10
244	40.67	0.000	2.44	2.41	0.01	512.10
245	40.83	0.000	2.41	2.38	0.01	512.10
246	41.00	0.000	2.38	2.35	0.01	512.10
247	41.17	0.000	2.35	2.32	0.01	512.10
248	41.33	0.000	2.32	2.29	0.01	512.10
249	41.50	0.000	2.29	2.26	0.01	512.10
250	41.67	0.000	2.26	2.23	0.01	512.10
251	41.83	0.000	2.23	2.20	0.01	512.10
252	42.00	0.000	2.20	2.17	0.01	512.10

253	42.17	0.000	2.17	2.14	0.01	512.10
254	42.33	0.000	2.14	2.11	0.01	512.10
255	42.50	0.000	2.11	2.08	0.01	512.10
256	42.67	0.000	2.08	2.05	0.01	512.10
257	42.83	0.000	2.05	2.02	0.01	512.10
258	43.00	0.000	2.02	1.99	0.01	512.10
259	43.17	0.000	1.99	1.96	0.01	512.10
260	43.33	0.000	1.96	1.93	0.01	512.10
261	43.50	0.000	1.93	1.90	0.01	512.10
262	43.67	0.000	1.90	1.87	0.01	512.10
263	43.83	0.000	1.87	1.84	0.01	512.10
264	44.00	0.000	1.84	1.81	0.01	512.10
265	44.17	0.000	1.81	1.78	0.01	512.10
266	44.33	0.000	1.78	1.75	0.01	512.10
267	44.50	0.000	1.75	1.72	0.01	512.10
268	44.67	0.000	1.72	1.69	0.01	512.10
269	44.83	0.000	1.69	1.66	0.01	512.10
270	45.00	0.000	1.66	1.63	0.01	512.10
271	45.17	0.000	1.63	1.60	0.01	512.10
272	45.33	0.000	1.60	1.57	0.01	512.10
273	45.50	0.000	1.57	1.54	0.01	512.10
274	45.67	0.000	1.54	1.51	0.01	512.10
275	45.83	0.000	1.51	1.48	0.01	512.10
276	46.00	0.000	1.48	1.45	0.01	512.10
277	46.17	0.000	1.45	1.42	0.01	512.10
278	46.33	0.000	1.42	1.39	0.01	512.10
279	46.50	0.000	1.39	1.36	0.01	512.10
280	46.67	0.000	1.36	1.33	0.01	512.10
281	46.83	0.000	1.33	1.30	0.01	512.10
282	47.00	0.000	1.30	1.30	0.00	512.00

APPENDIX

CITY OF SAN DIEGO DRAINAGE DESGN MANUAL EXCERPTS

CITY OF SAN DIEGO RATIONAL METHOD

COUNTY OF SAN DIEGO HYDROLOGY MANUAL EXCEPTS

CHAPTER 3 – RATIONAL METHOD
CHAPTER 6 – RATIONAL METHOD HYDROGRAPHS
6-HOUR ISOPLUVIAL MAPS

TABLE 2

RUNOFF COEFFICIENTS (RATIONAL METHOD)

DEVELOPED AREAS (URBAN)

Land Use	Coefficient, C Soil Type (1)
	D
Residential:	
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%

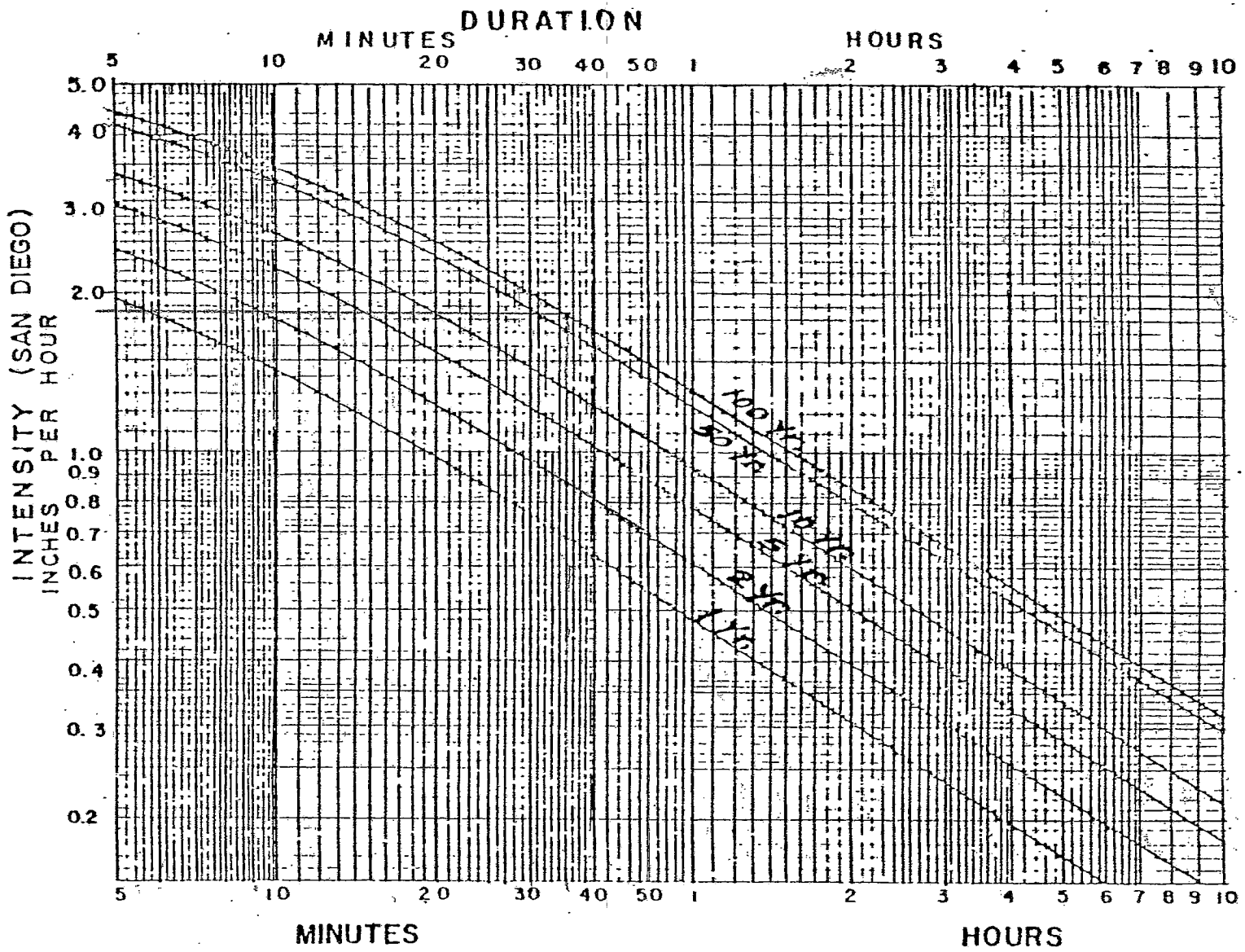
Revised C = $\frac{50}{80} \times 0.85$ = 0.53

APPENDIX

RAINFALL INTENSITY - DURATION - FREQUENCY CURVES for COUNTY OF SAN DIEGO

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

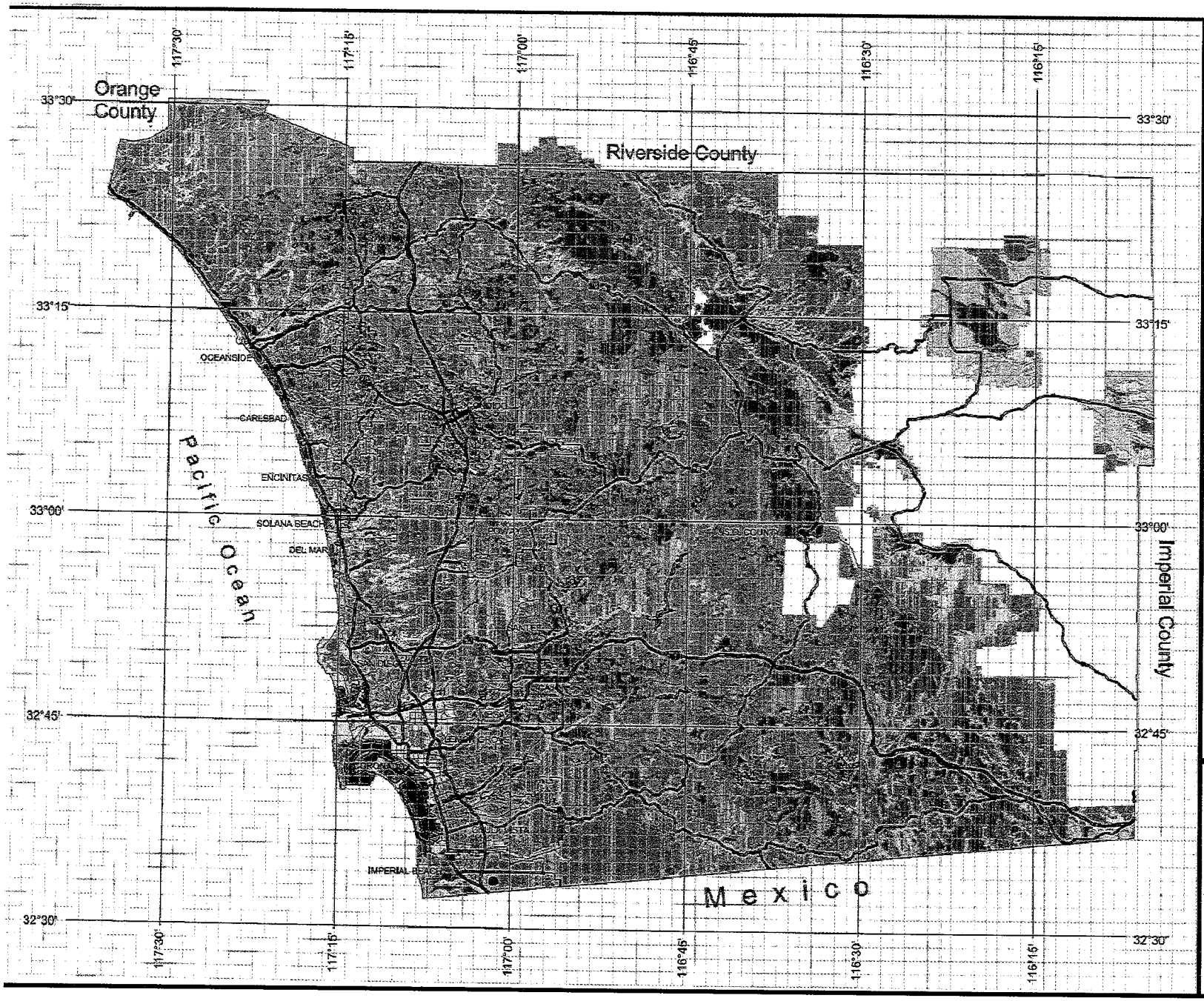
To obtain correct intensity, multiply intensity on chart by factor for design elevation.



CITY SD FOF CHART

County of San Diego Hydrology Manual

Soil Hydrologic Groups



Legend

Soil Groups

- Group A
- Group B
- Group C
- Group D
- Undetermined
- Data Unavailable

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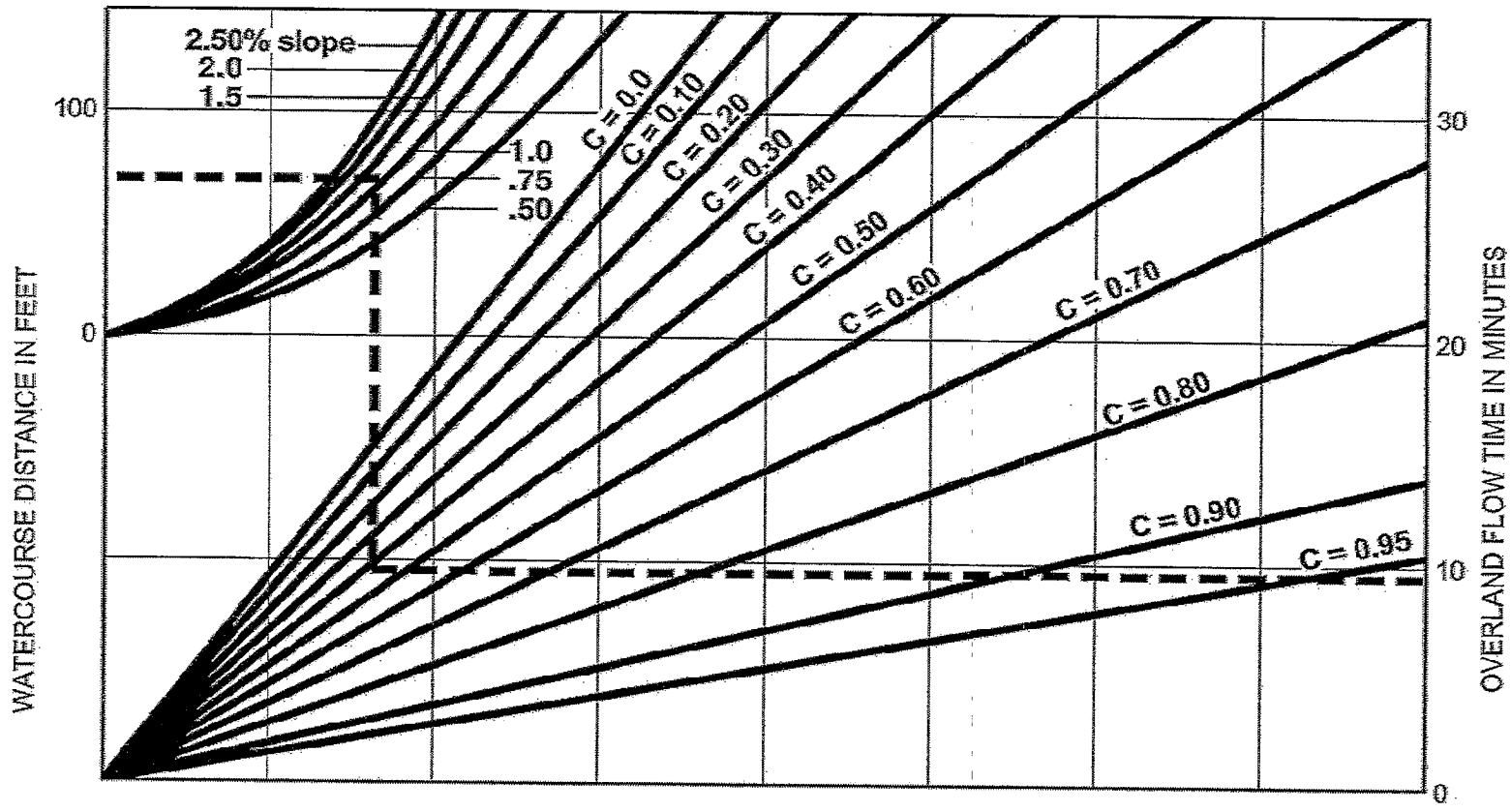
Table 3-1
RUNOFF COEFFICIENTS FOR URBAN AREAS

Land Use		Runoff Coefficient "C"				
			Soil Type			
NRCS Elements	County Elements	% IMPER.	A	B	C	D
Undisturbed Natural Terrain (Natural)	Permanent Open Space	0*	0.20	0.25	0.30	0.35
Low Density Residential (LDR)	Residential, 1.0 DU/A or less	10	0.27	0.32	0.36	0.41
Low Density Residential (LDR)	Residential, 2.0 DU/A or less	20	0.34	0.38	0.42	0.46
Low Density Residential (LDR)	Residential, 2.9 DU/A or less	25	0.38	0.41	0.45	0.49
Medium Density Residential (MDR)	Residential, 4.3 DU/A or less	30	0.41	0.45	0.48	0.52
Medium Density Residential (MDR)	Residential, 7.3 DU/A or less	40	0.48	0.51	0.54	0.57
Medium Density Residential (MDR)	Residential, 10.9 DU/A or less	45	0.52	0.54	0.57	0.60
Medium Density Residential (MDR)	Residential, 14.5 DU/A or less	50	0.55	0.58	0.60	0.63
High Density Residential (HDR)	Residential, 24.0 DU/A or less	65	0.66	0.67	0.69	0.71
High Density Residential (HDR)	Residential, 43.0 DU/A or less	80	0.76	0.77	0.78	0.79
Commercial/Industrial (N. Com)	Neighborhood Commercial	80	0.76	0.77	0.78	0.79
Commercial/Industrial (G. Com)	General Commercial	85	0.80	0.80	0.81	0.82
Commercial/Industrial (O.P. Com)	Office Professional/Commercial	90	0.83	0.84	0.84	0.85
Commercial/Industrial (Limited I.)	Limited Industrial	90	0.83	0.84	0.84	0.85
Commercial/Industrial (General I.)	General Industrial	95	0.87	0.87	0.87	0.87

*The values associated with 0% impervious may be used for direct calculation of the runoff coefficient as described in Section 3.1.2 (representing the pervious runoff coefficient, Cp, for the soil type), or for areas that will remain undisturbed in perpetuity. Justification must be given that the area will remain natural forever (e.g., the area is located in Cleveland National Forest).
DU/A = dwelling units per acre
NRCS = National Resources Conservation Service



EXAMPLE:

Given: Watercourse Distance (D) = 70 Feet
Slope (s) = 1.3%
Runoff Coefficient (C) = 0.41
Overland Flow Time (T) = 9.5 Minutes

$$T = \frac{1.8\,(1.1-C)\sqrt{D}}{\sqrt[3]{s}}$$

SOURCE: Airport Drainage, Federal Aviation Administration, 1965

Rational Formula - Overland Time of Flow Nomograph

FIGURE

3-3

Note that the Initial Time of Concentration should be reflective of the general land-use at the upstream end of a drainage basin. A single lot with an area of two or less acres does not have a significant effect where the drainage basin area is 20 to 600 acres.

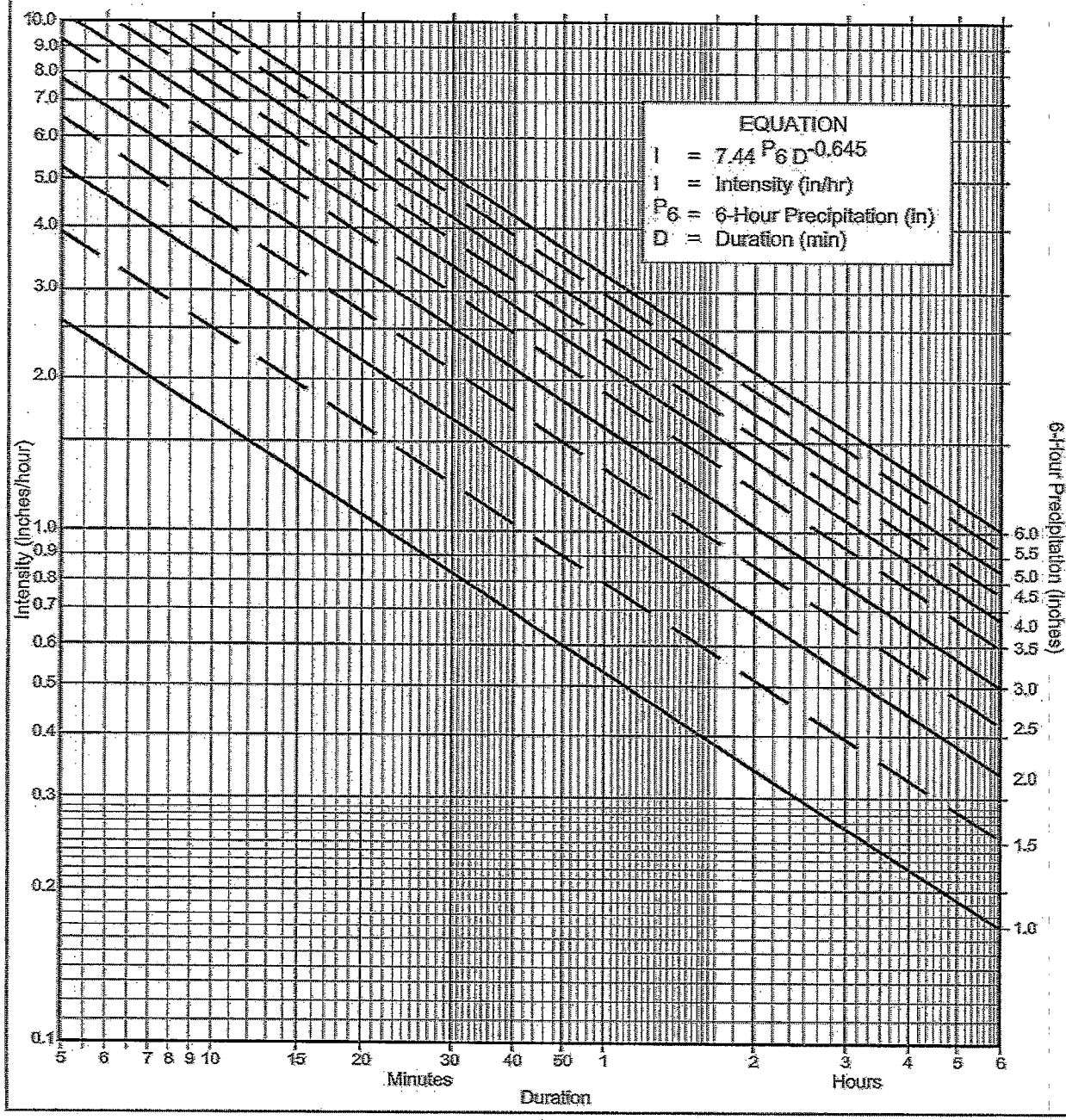
Table 3-2 provides limits of the length (Maximum Length (L_M)) of sheet flow to be used in hydrology studies. Initial T_i values based on average C values for the Land Use Element are also included. These values can be used in planning and design applications as described below. Exceptions may be approved by the "Regulating Agency" when submitted with a detailed study.

Table 3-2

MAXIMUM OVERLAND FLOW LENGTH (L_M) & INITIAL TIME OF CONCENTRATION (T_i)

Element*	DU/ Acre	.5%		1%		2%		3%		5%		10%	
		L_M	T_i	L_M	T_i	L_M	T_i	L_M	T_i	L_M	T_i	L_M	T_i
Natural		50	13.2	70	12.5	85	10.9	100	10.3	100	8.7	100	6.9
LDR	1	50	12.2	70	11.5	85	10.0	100	9.5	100	8.0	100	6.4
LDR	2	50	11.3	70	10.5	85	9.2	100	8.8	100	7.4	100	5.8
LDR	2.9	50	10.7	70	10.0	85	8.8	95	8.1	100	7.0	100	5.6
MDR	4.3	50	10.2	70	9.6	80	8.1	95	7.8	100	6.7	100	5.3
MDR	7.3	50	9.2	65	8.4	80	7.4	95	7.0	100	6.0	100	4.8
MDR	10.9	50	8.7	65	7.9	80	6.9	90	6.4	100	5.7	100	4.5
MDR	14.5	50	8.2	65	7.4	80	6.5	90	6.0	100	5.4	100	4.3
HDR	24	50	6.7	65	6.1	75	5.1	90	4.9	95	4.3	100	3.5
HDR	43	50	5.3	65	4.7	75	4.0	85	3.8	95	3.4	100	2.7
N. Com		50	5.3	60	4.5	75	4.0	85	3.8	95	3.4	100	2.7
G. Com		50	4.7	60	4.1	75	3.6	85	3.4	90	2.9	100	2.4
O.P./Com		50	4.2	60	3.7	70	3.1	80	2.9	90	2.6	100	2.2
Limited I.		50	4.2	60	3.7	70	3.1	80	2.9	90	2.6	100	2.2
General I.		50	3.7	60	3.2	70	2.7	80	2.6	90	2.3	100	1.9

*See Table 3-1 for more detailed description



Directions for Application:

(1) From precipitation maps determine 6 hr and 24 hr amounts for the selected frequency. These maps are included in the County Hydrology Manual (10, 50, and 100 yr maps included in the Design and Procedure Manual).

(2) Adjust 6 hr precipitation (if necessary) so that it is within the range of 45% to 65% of the 24 hr precipitation (not applicable to Desert).

(3) Plot 6 hr precipitation on the right side of the chart.

(4) Draw a line through the point parallel to the plotted lines.

(5) This line is the intensity-duration curve for the location being analyzed.

Application Form:

(a) Selected frequency _____ year

(b) P_6 = _____ in., P_{24} = _____, $\frac{P_6}{P_{24}}$ = _____ %(2)

(c) Adjusted P_6(2) = _____ in.

(d) t_x = _____ min.

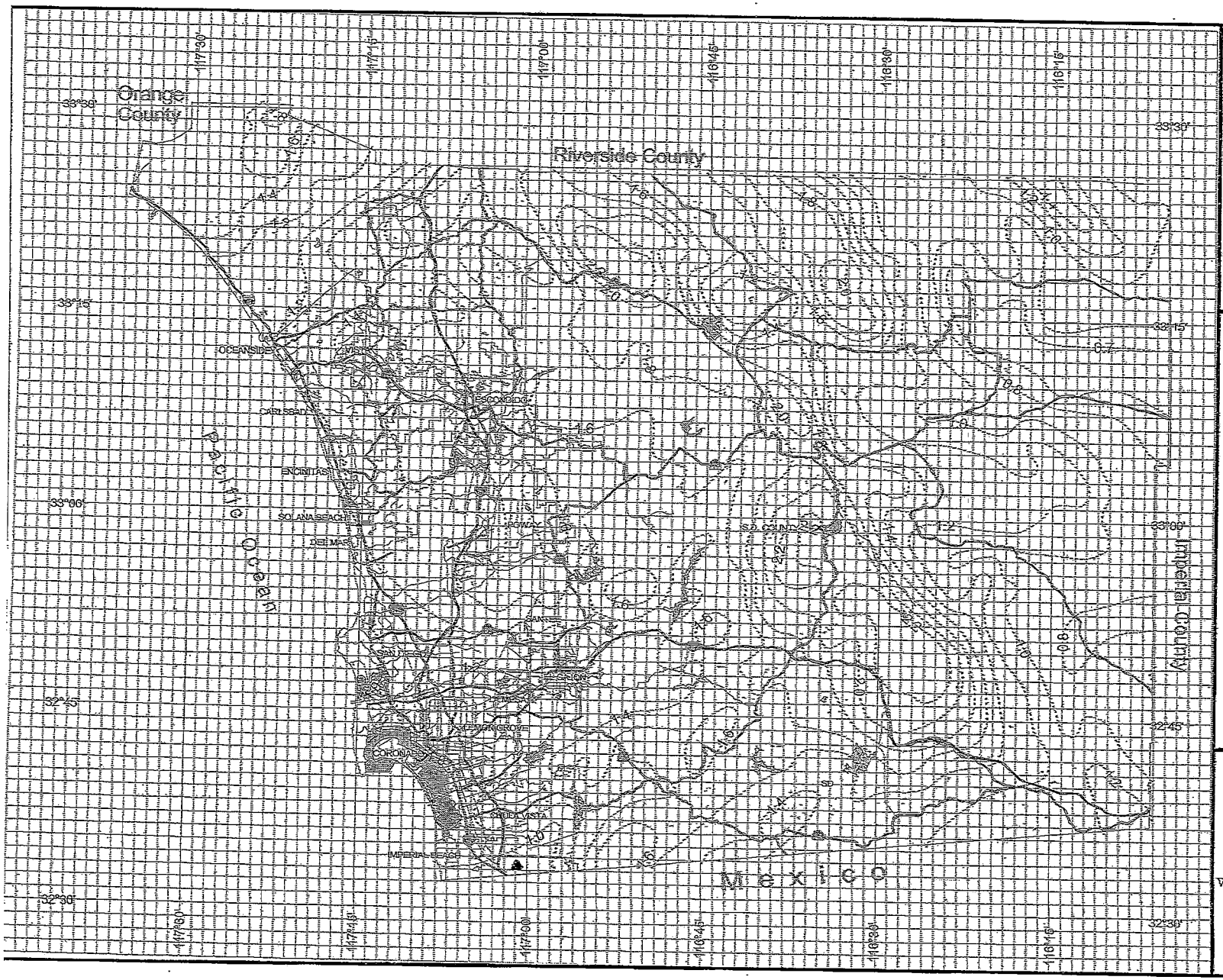
(e) I = _____ in./hr.

Note: This chart replaces the Intensity-Duration-Frequency curves used since 1965.

P6	1	1.5	2	2.5	3	3.5	4	4.5	5	5.5	6
Duration	I	I	I	I	I	I	I	I	I	I	I
5	2.63	3.95	5.27	6.59	7.90	9.22	10.54	11.86	13.17	14.49	15.81
7	2.12	3.18	4.24	5.30	6.36	7.42	8.48	9.54	10.60	11.66	12.72
10	1.68	2.53	3.37	4.21	5.05	5.90	6.74	7.58	8.42	9.27	10.11
15	1.30	1.95	2.59	3.24	3.89	4.54	5.19	5.84	6.49	7.13	7.78
20	1.08	1.62	2.15	2.69	3.23	3.77	4.31	4.85	5.39	5.93	6.46
25	0.93	1.40	1.87	2.33	2.80	3.27	3.73	4.20	4.67	5.13	5.60
30	0.83	1.24	1.66	2.07	2.49	2.90	3.32	3.73	4.15	4.56	4.98
40	0.69	1.03	1.38	1.72	2.07	2.41	2.76	3.10	3.45	3.79	4.13
50	0.60	0.90	1.19	1.49	1.79	2.09	2.39	2.69	2.98	3.28	3.58
60	0.53	0.80	1.06	1.33	1.59	1.86	2.12	2.39	2.65	2.92	3.18
90	0.41	0.61	0.82	1.02	1.23	1.43	1.63	1.84	2.04	2.25	2.45
120	0.34	0.51	0.68	0.85	1.02	1.19	1.36	1.53	1.70	1.87	2.04
150	0.29	0.44	0.59	0.73	0.88	1.03	1.18	1.32	1.47	1.62	1.76
180	0.26	0.39	0.52	0.65	0.78	0.91	1.04	1.18	1.31	1.44	1.57
240	0.22	0.33	0.43	0.54	0.65	0.76	0.87	0.98	1.08	1.19	1.30
300	0.19	0.28	0.38	0.47	0.56	0.66	0.75	0.85	0.94	1.03	1.13
360	0.17	0.25	0.33	0.42	0.50	0.58	0.67	0.75	0.84	0.92	1.00

Intensity-Duration Design Chart - Template

FIGURE
3-1



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Rainfall Isopluvials

2 Year Rainfall Event - 6 Hours

Isopluvial (inches)

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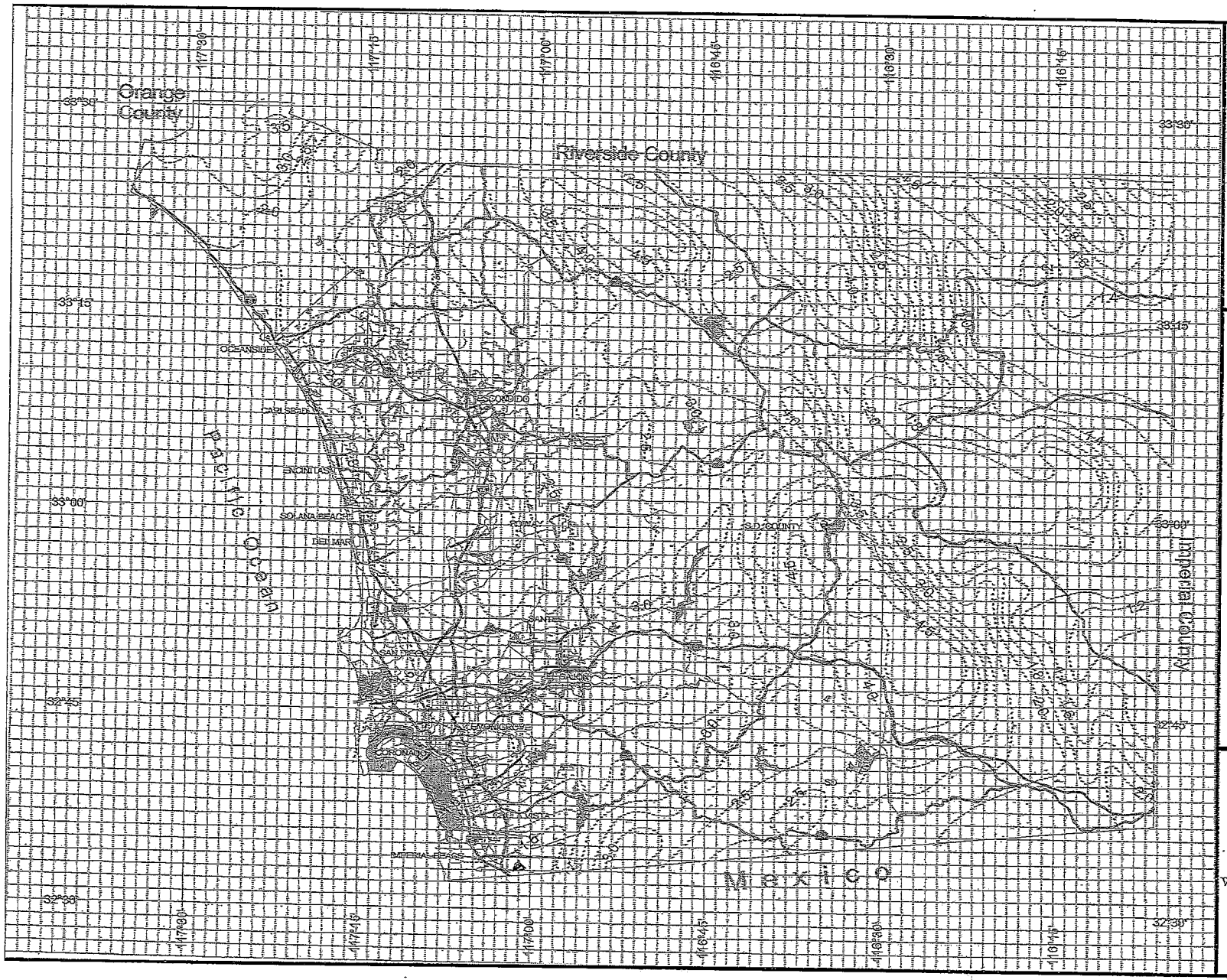

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Rainfall Isopluvials

2 Year Rainfall Event – 24 Hours

Isopluvial (inches)

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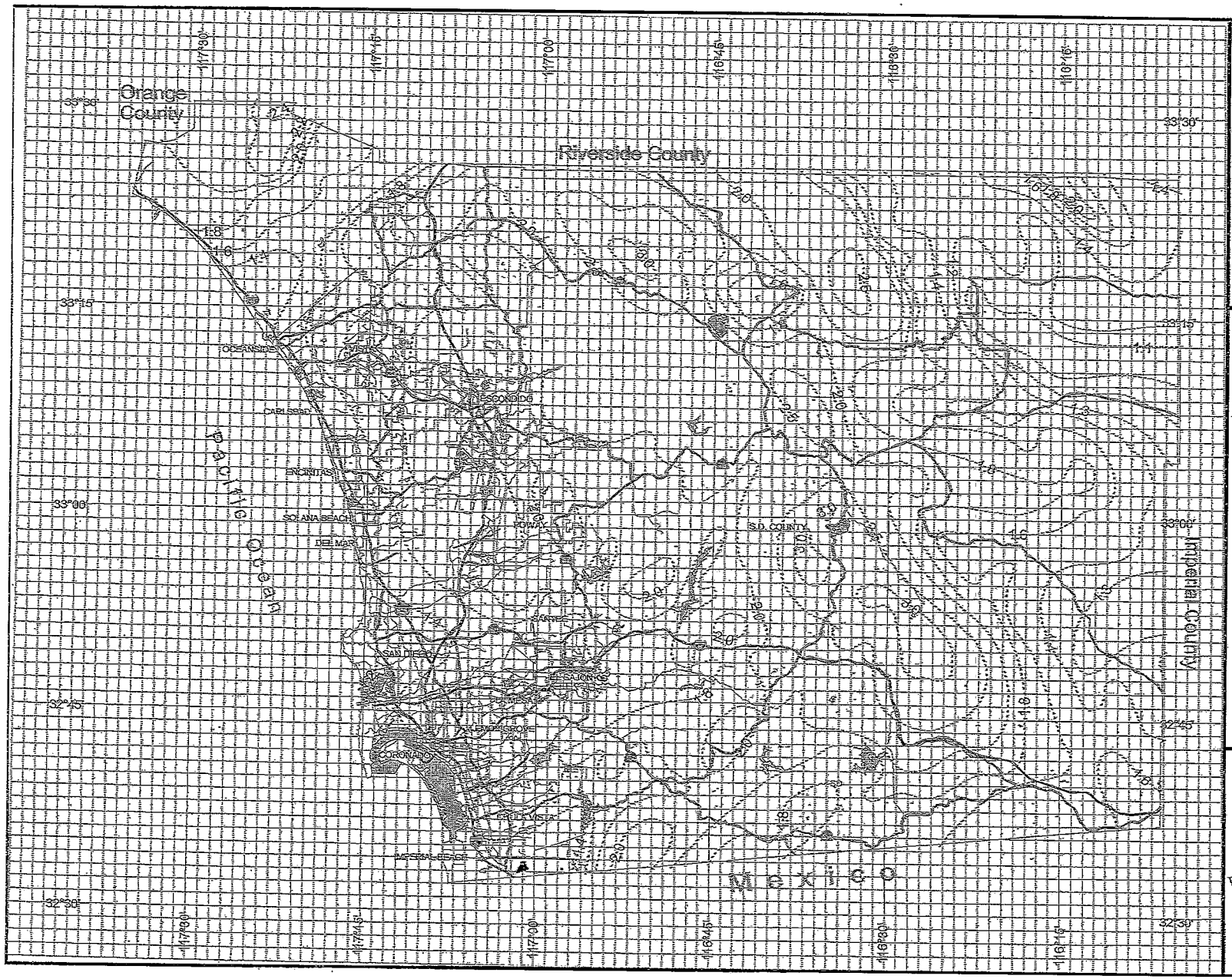
3 0 3 Miles



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Rainfall Isopluvials

5 Year Rainfall Event - 6 Hours

Isopluvial (inches)

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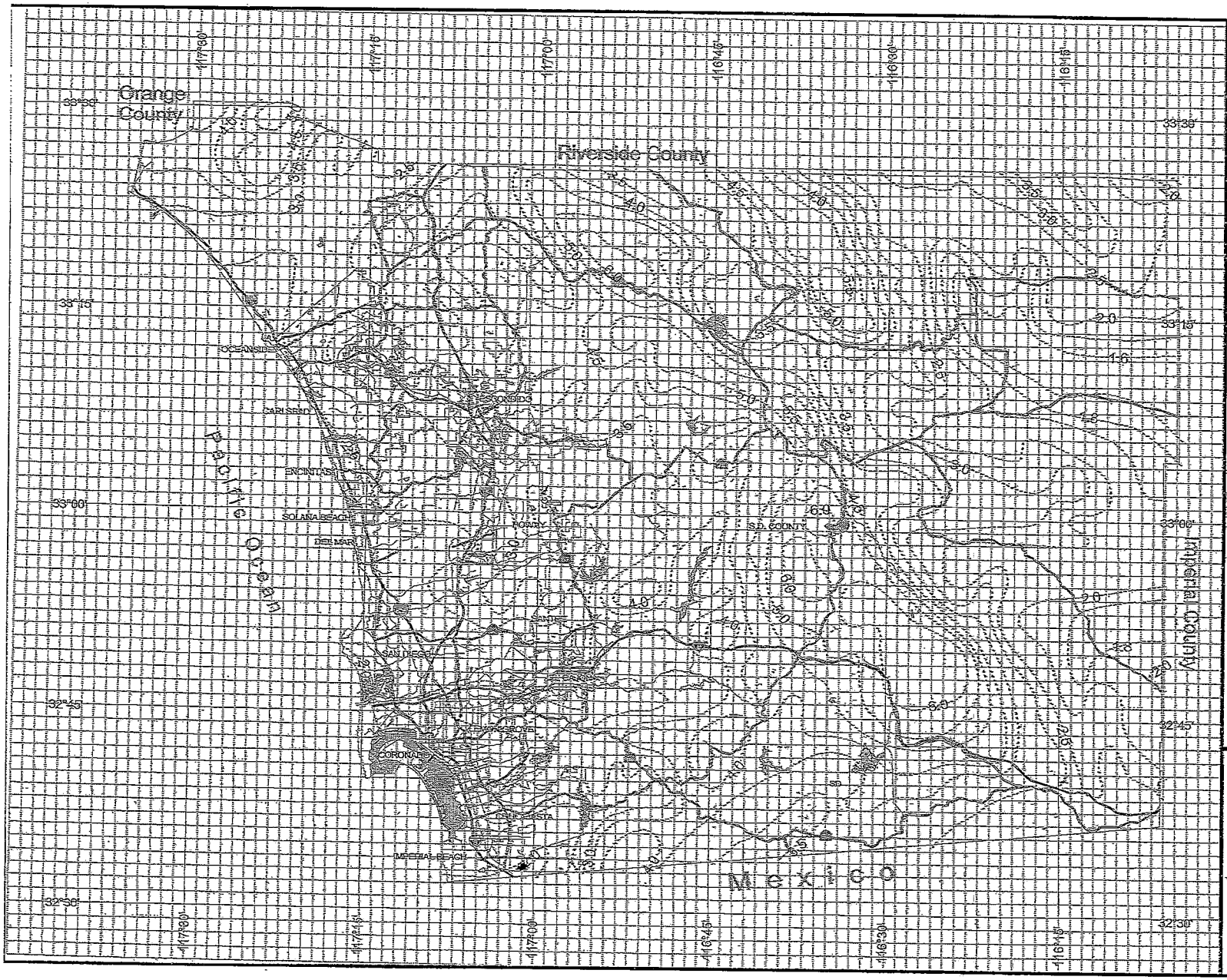

County of San Diego Hydrology Manual

Rainfall Isopluvials

5 Year Rainfall Event - 24 Hours

Isopluvial (inches)

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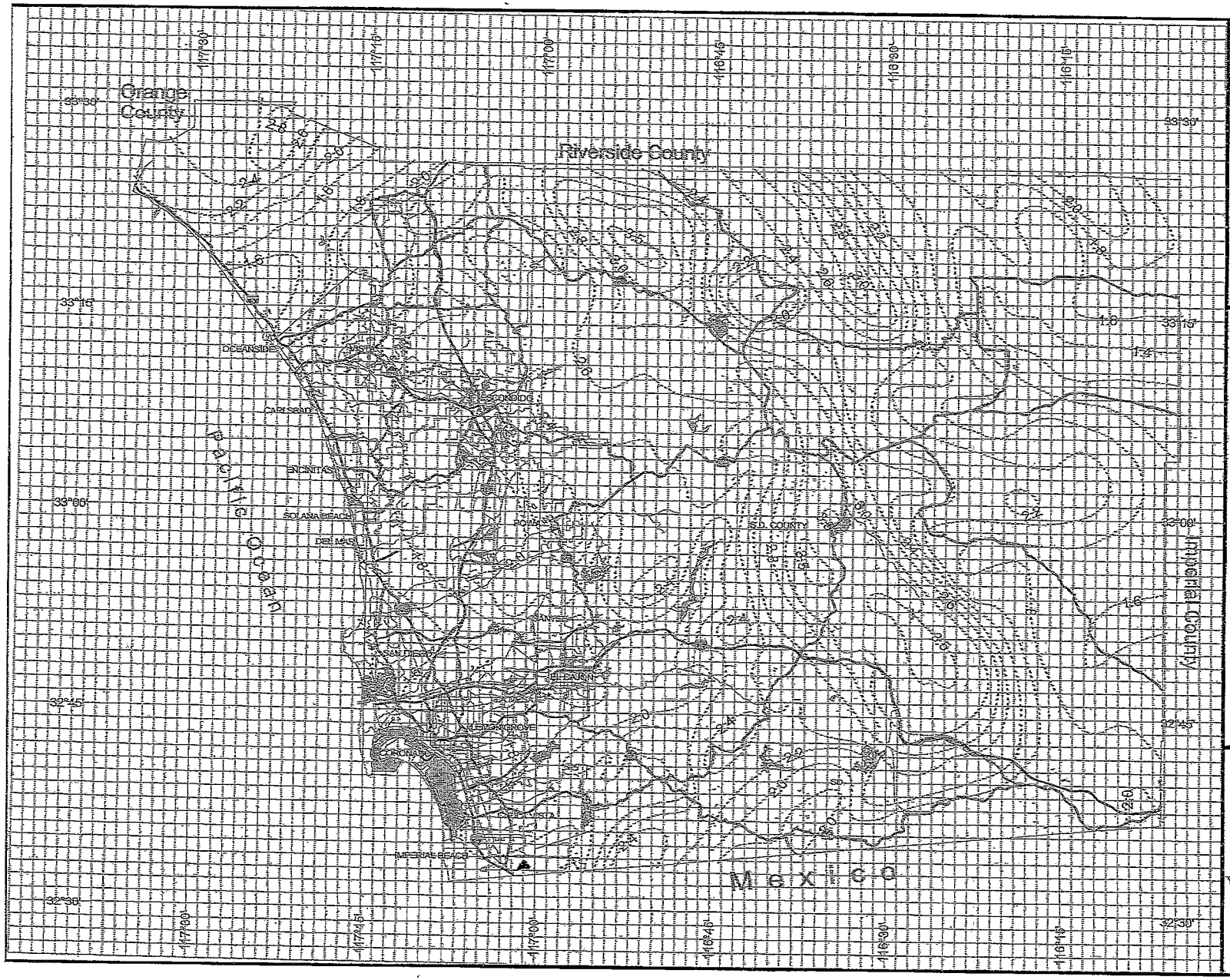
3 0 3 Miles



County of San Diego Hydrology Manual

Rainfall Isopluvials

10 Year Rainfall Event - 6 Hours

Isopluvial (inches)

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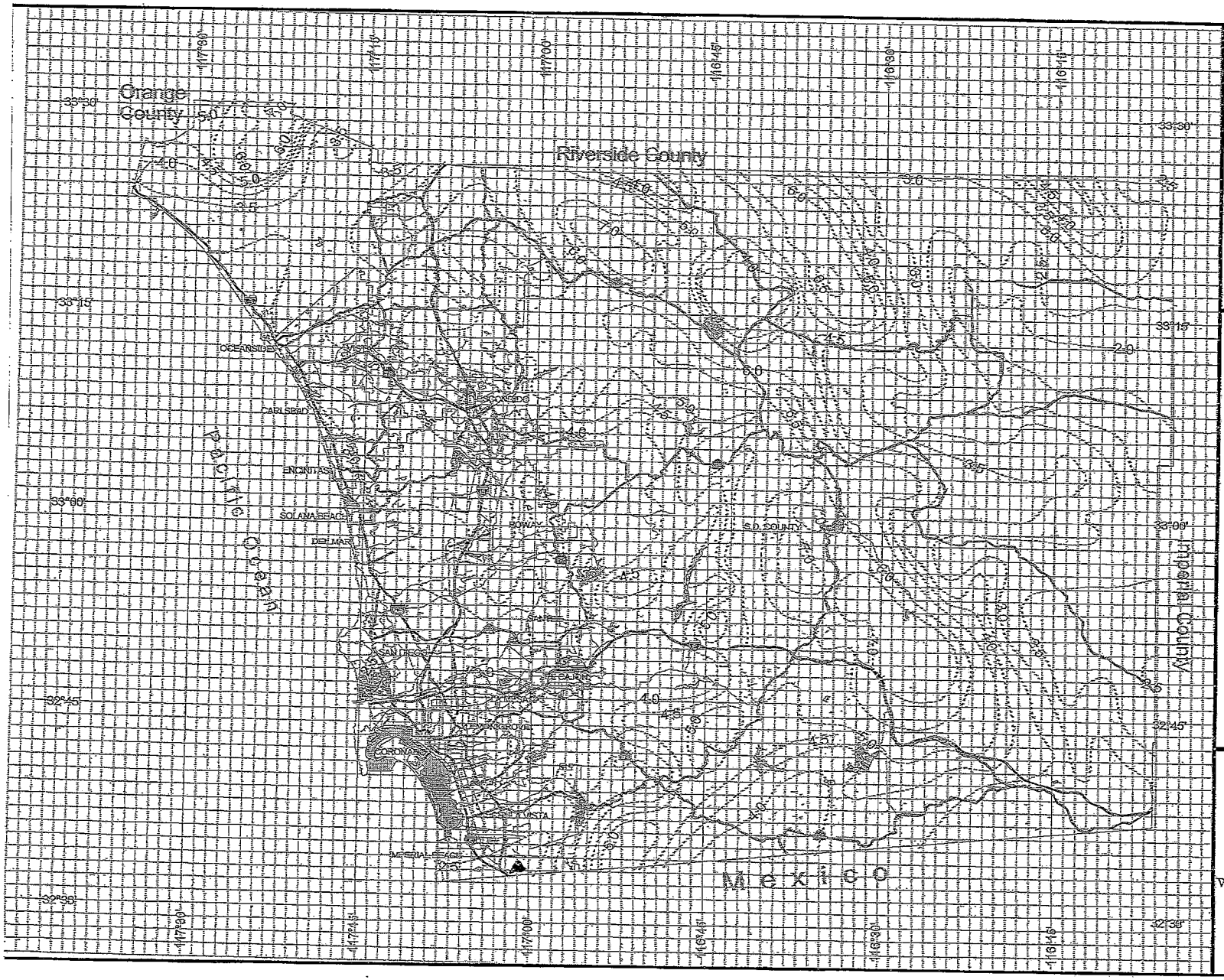
3 0 3 Miles



County of San Diego Hydrology Manual

Rainfall Isopluvials

10 Year Rainfall Event - 24 Hours

Isopluvial (inches)

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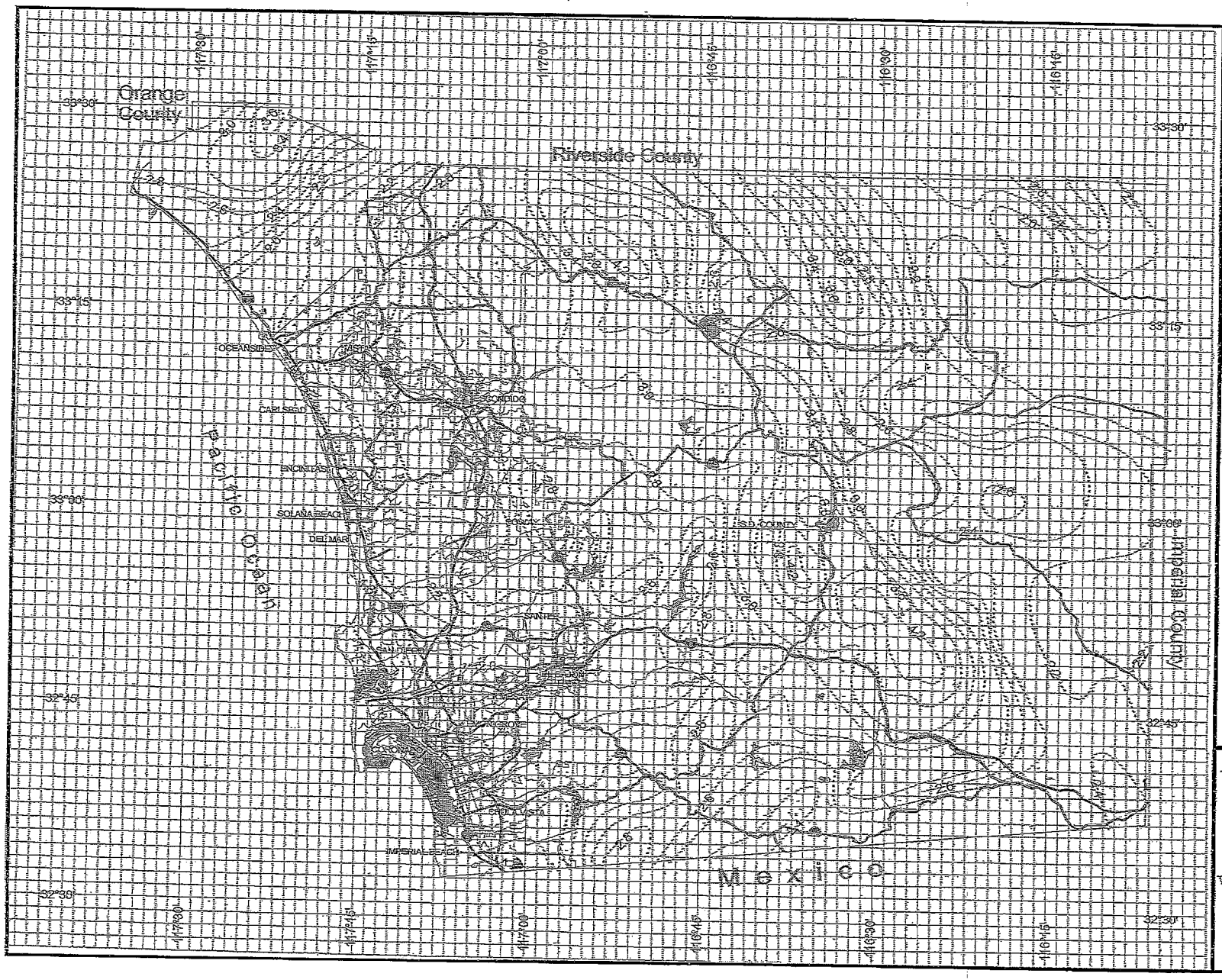

County of San Diego Hydrology Manual

Rainfall Isopluvials

25 Year Rainfall Event - 6 Hours

Isopluvial (inches)

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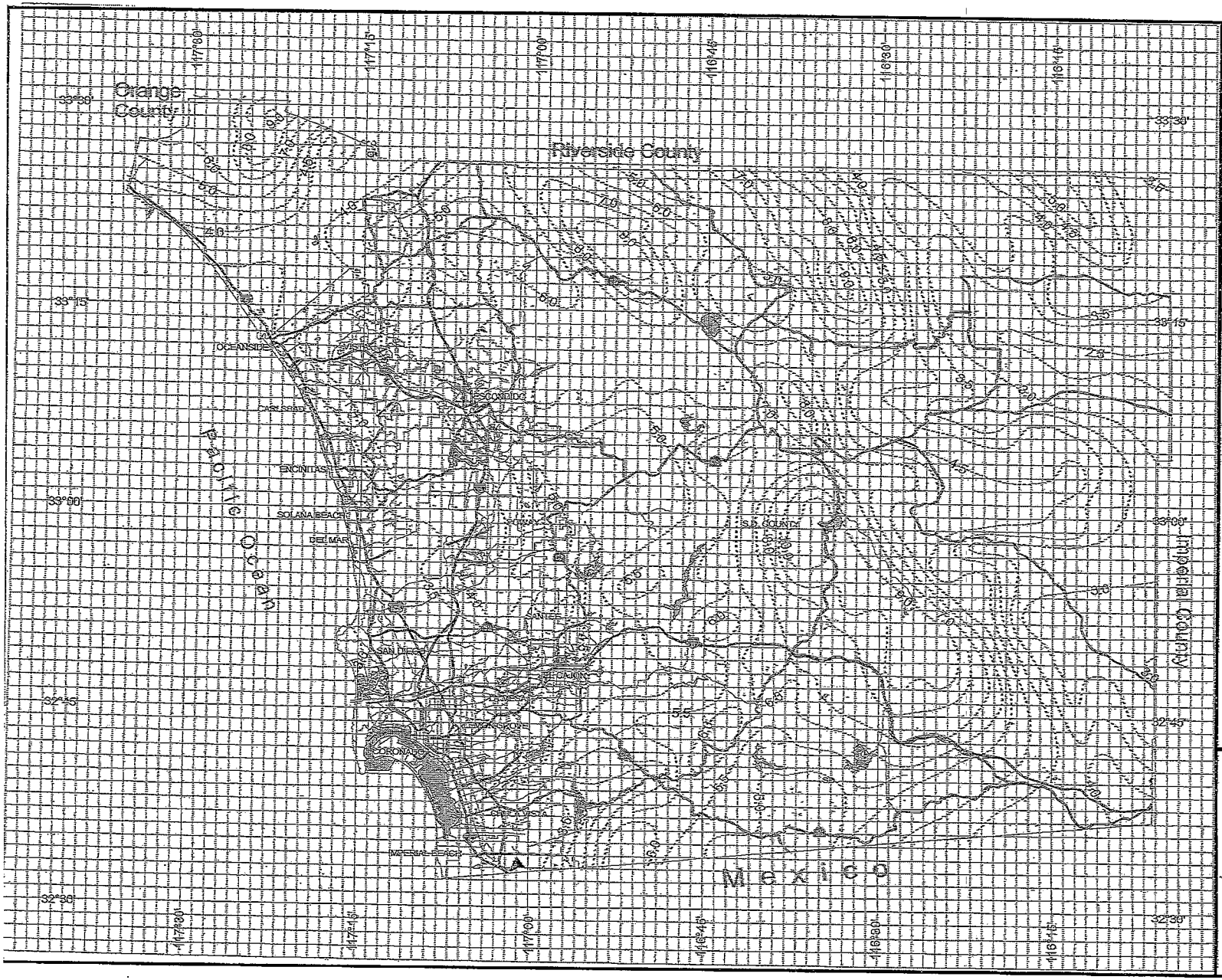
3 0 3 Miles



County of San Diego Hydrology Manual

Rainfall Isopluvials

25 Year Rainfall Event - 24 Hours

isopluvial (inches)

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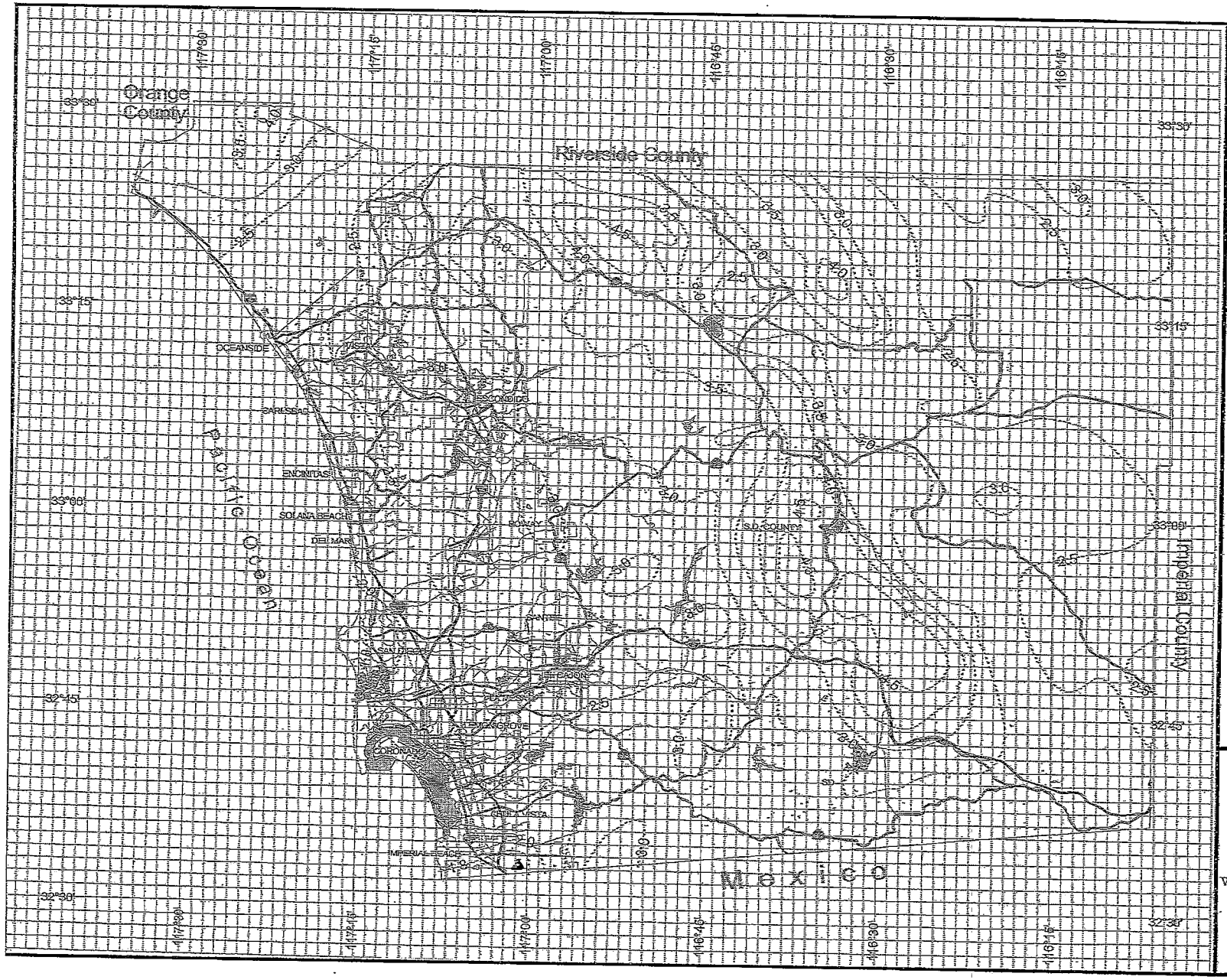
N W E S

3 0 3 Miles



County of San Diego Hydrology Manual

Rainfall Isopluvials

50 Year Rainfall Event - 6 Hours

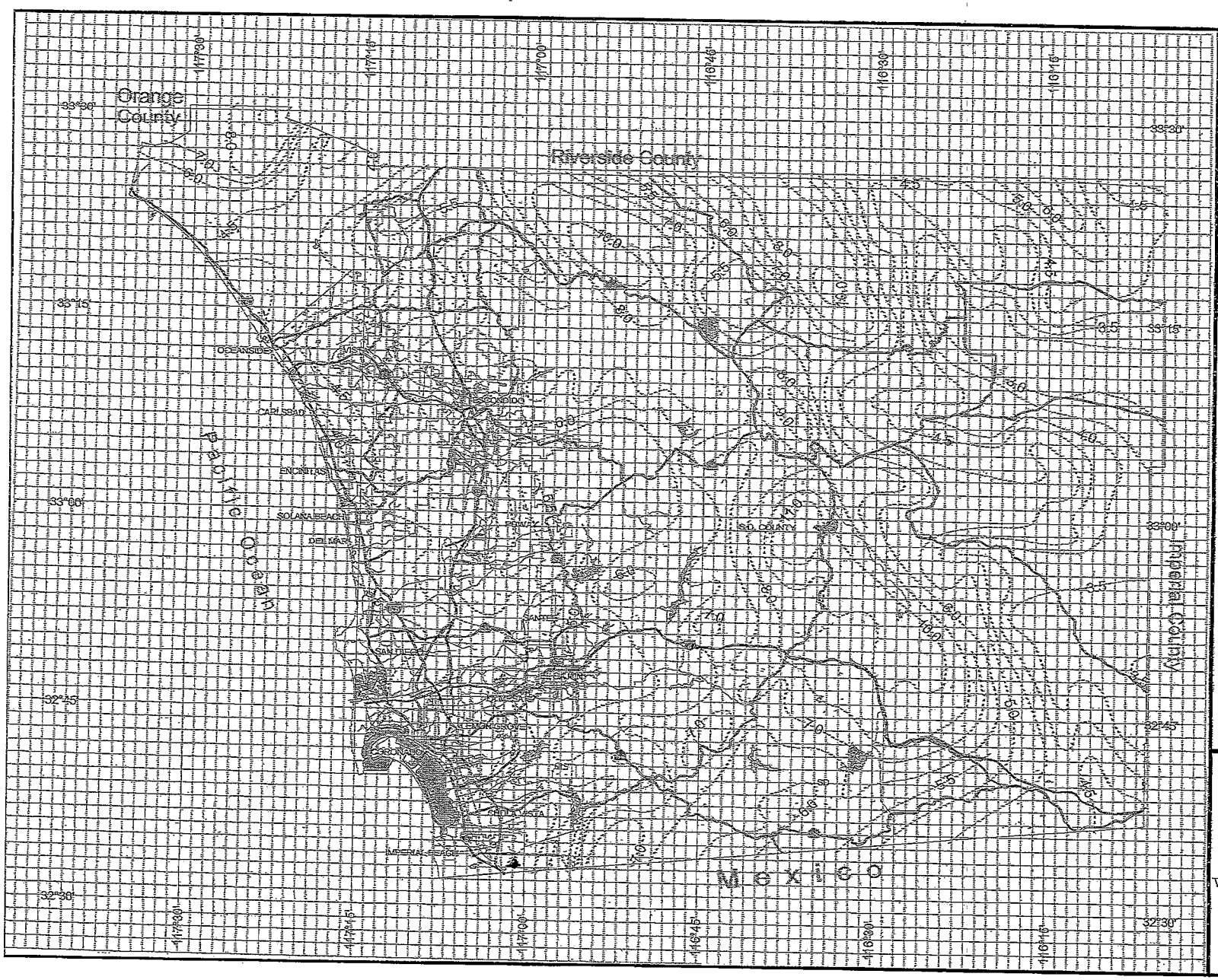
Isopluvial (inches)

DPW GIS

SanGIS
We Have San Diego Covered!

N W E S

3 0 3 Miles



County of San Diego Hydrology Manual

Rainfall Isopluvials

50 Year Rainfall Event – 24 Hours

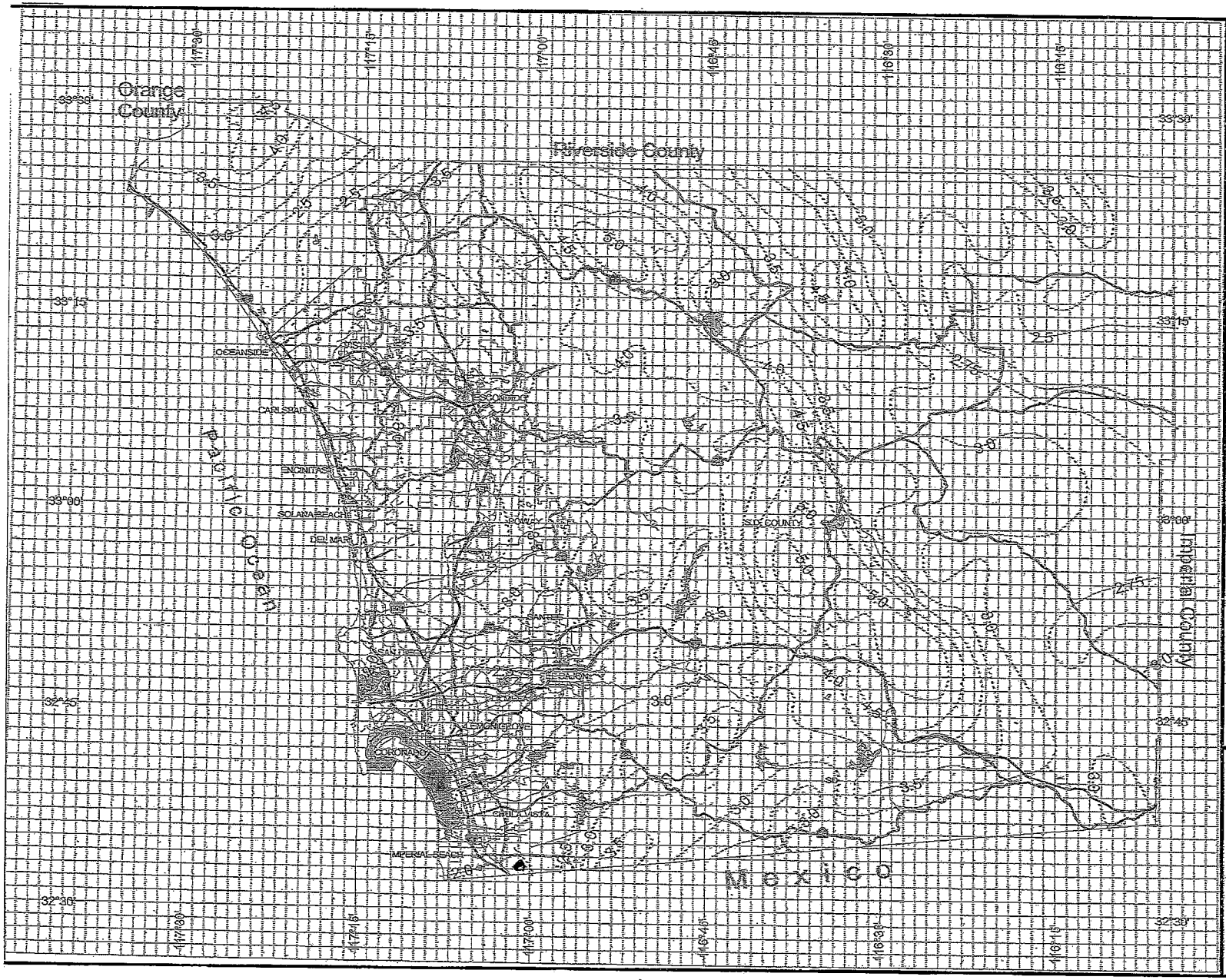
Isopluvial (inches)

DPW GIS

SanGIS
We Have San Diego Covered

N
W E
S

3 0 3 Miles



County of San Diego Hydrology Manual

Rainfall Isopluvials

100 Year Rainfall Event - 6 Hours

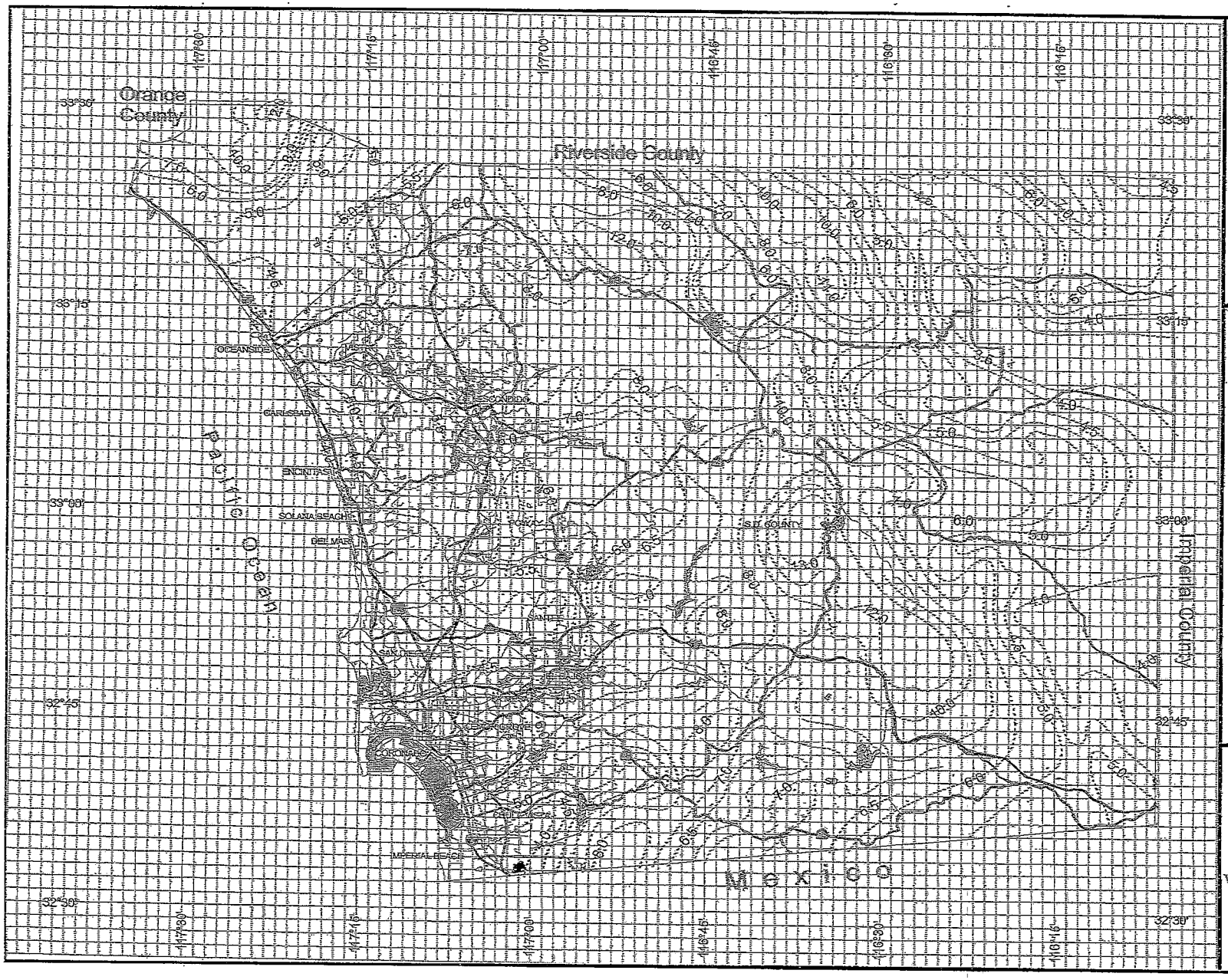
Isopluvial (inches)

DPW GIS

SanGIS
We Have San Diego Covered!

N
W E
S

3 0 3 Miles



County of San Diego Hydrology Manual

Rainfall Isopluvials

100 Year Rainfall Event - 24 Hours

Isopluvial (inches)

DPW GIS
Department of Public Works
Geographic Information Services

SanGIS
We Have San Diego Covered!

N
W E
S

3 0 3 Miles

SECTION 6
RATIONAL METHOD HYDROGRAPH PROCEDURE

6.1 INTRODUCTION

The procedures in this section are for the development of hydrographs from RM study results for study areas up to approximately 1 square mile in size. The RM, discussed in Section 3, is a mathematical formula used to determine the maximum runoff rate from a given rainfall. It has particular application in urban storm drainage, where it is used to estimate peak runoff rates from small urban and rural watersheds for the design of storm drains and small drainage structures. However, in some instances such as for design of detention basins, the peak runoff rate is insufficient information for the design, and a hydrograph is needed. Unlike the NRCS hydrologic method (discussed in Section 4), the RM itself does not create hydrographs. The procedures for detention basin design based on RM study results were first developed as part of the East Otay Mesa Drainage Study. Rick Engineering Company performed this study under the direction of County Flood Control. The procedures in this section may be used for the development of hydrographs from RM study results for study areas up to approximately 1 square mile in size.

6.2 HYDROGRAPH DEVELOPMENT

The concept of this hydrograph procedure is based on the RM formula:

$$Q = C\,I\,A$$

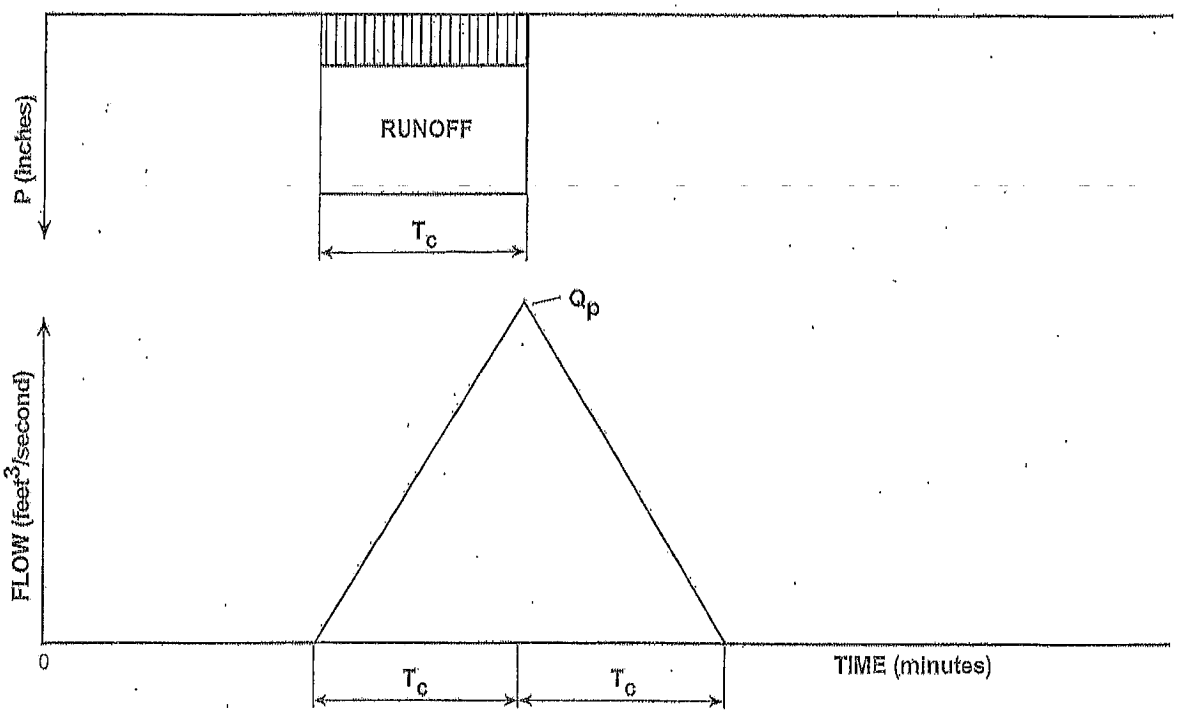
Where:
- Q = peak discharge, in cubic feet per second (cfs)
- C = runoff coefficient, proportion of the rainfall that runs off the surface (no units)
- I = average rainfall intensity for a duration equal to the T_c for the area, in inches per hour
- A = drainage area contributing to the design location, in acres

The RM formula is discussed in more detail in Section 3.

An assumption of the RM is that discharge increases linearly over the T_c for the drainage area until reaching the peak discharge as defined by the RM formula, and then decreases linearly. A linear hydrograph can be developed for the peak flow occurring over the T_c as shown in Figure 6-1. However, for designs that are dependent on the total storm volume, it is not sufficient to consider a single hydrograph for peak flow occurring over the T_c at the beginning of a 6-hour storm event because the hydrograph does not account for the entire volume of runoff from the storm event. The volume under the hydrograph shown in Figure 6-1 is equal to the rainfall intensity multiplied by the duration for which that intensity occurs (T_c), the drainage area (A) contributing to the design location, and the runoff coefficient (C) for the drainage area. For designs that are dependent on the total storm volume, a hydrograph must be generated to account for the entire volume of runoff from the 6-hour storm event. The hydrograph for the entire 6-hour storm event is generated by creating a rainfall distribution consisting of blocks of rain, creating an incremental hydrograph for each block of rain, and adding the hydrographs from each block of rain. This process creates a hydrograph that contains runoff from all the blocks of rain and accounts for the entire volume of runoff from the 6-hour storm event. The total volume under the resulting hydrograph is equal to the following equation:

$$VOL = CP_6A \qquad \text{(Eq. 6-1)}$$

Where: VOL = volume of runoff (acre-inches)
P_6 = 6-hour rainfall (inches)
C = runoff coefficient
A = area of the watershed (acres)



Triangular Hydrograph

FIGURE

6-1

6.2.1 Rainfall Distribution

Figure 6-2 shows a 6-hour rainfall distribution consisting of blocks of rain over increments of time equal to T_o. The number of blocks is determined by rounding T_o to the nearest whole number of minutes, dividing 360 minutes (6 hours) by T_o, and rounding again to the nearest whole number. The blocks are distributed using a (2/3, 1/3) distribution in which the peak rainfall block is placed at the 4-hour time within the 6-hour rainfall duration. The additional blocks are distributed in a sequence alternating two blocks to the left and one block to the right of the 4-hour time (see Figure 6-2). The total amount of rainfall ($P_{T(N)}$) for any given block (N) is determined as follows:

$$P_{T(N)} = (I_{T(N)}\ T_{T(N)}) / 60$$

Where: $P_{T(N)}$ = total amount of rainfall for any given block (N)

$I_{T(N)}$ = average rainfall intensity for a duration equal to $T_{T(N)}$ in inches per hour

$T_{T(N)} = NT_o$ in minutes (N is an integer representing the given block number of rainfall)

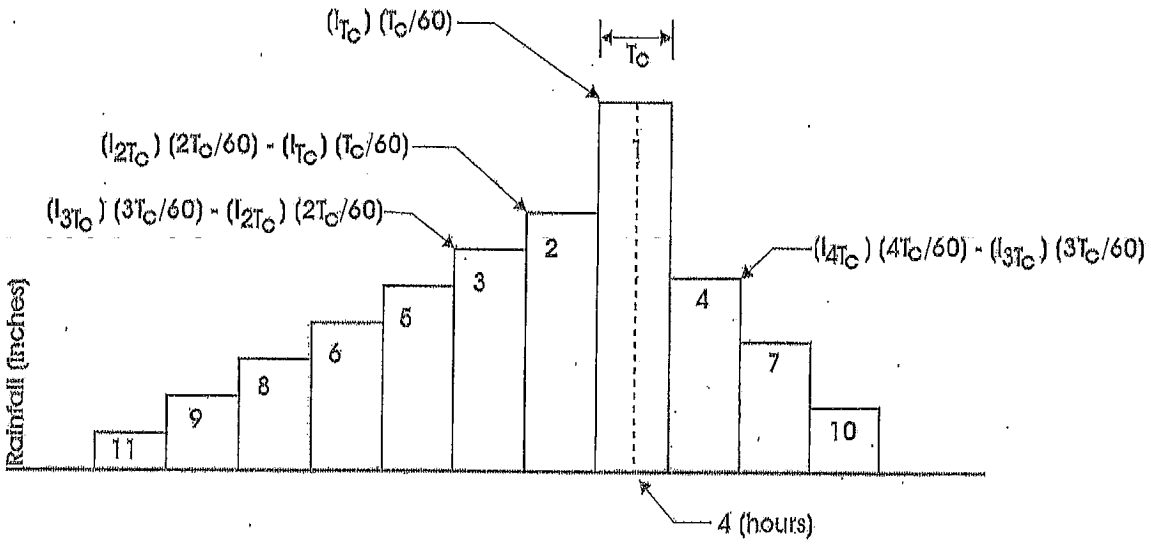
Intensity is calculated using the following equation (described in detail in Section 3):

$$I = 7.44\ P_6\ D^{-0.645}$$

Where: I = average rainfall intensity for a duration equal to D in inches per hour

P_6 = adjusted 6-hour storm rainfall

D = duration in minutes



FIGURE

6-2

Rainfall Distribution

Substituting the equation for I in the equation above for $P_{T(N)}$ and setting the duration (D) equal to $T_{T(N)}$ yields:

$$P_{T(N)} = [(7.44\ P_6/T_{T(N)}^{0.645})(T_{T(N)})] / 60$$
$$P_{T(N)} = 0.124\ P_6 T_{T(N)}^{0.355}$$

Substituting NT_o for T_T (where N equals the block number of rainfall) in the equation above yields:

$$P_{T(N)} = 0.124\ P_6\ (NT_o)^{0.355} \qquad \text{(Eq. 6-2)}$$

Equation 6-2 represents the total rainfall amount for a rainfall block with a time base equal to $T_{T(N)}$ (NT_o). The actual time base of each rainfall block in the rainfall distribution is T_o, as shown in Figure 6-2. The actual rainfall amount (P_N) for each block of rain is equal to P_T at N ($P_{T(N)}$) minus the previous P_T at N–1 ($P_{T(N-1)}$) at any given multiple of T_o (any NT_o). For example, the rainfall for block 2 is equal to $P_{T(N)}$ at $T_{T(N)} = 2T_o$ minus the $P_{T(N)}$ at $T_{T(N)} = 1T_o$, and the rainfall for block 3 equals $P_{T(N)}$ at $T_{T(N)} = 3T_o$ minus the $P_{T(N)}$ at $T_{T(N)} = 2T_o$, or P_N can be represented by the following equation:

$$P_N = P_{T(N)} - P_{T(N-1)} \qquad \text{(Eq. 6-3)}$$

For the rainfall distribution, the rainfall at block N = 1, ($1T_o$), is centered at 4 hours, the rainfall at block N = 2, ($2T_o$), is centered at 4 hours – $1T_o$, the rainfall at block N = 3, ($3T_o$), is centered at 4 hours – $2T_o$, and the rainfall at at block N = 4, ($4T_o$), is centered at 4 hours + $1T_o$. The sequence continues alternating two blocks to the left and one block to the right (see Figure 6-2).

6.2.2 Construction of Incremental Hydrographs

Figure 6-1 shows the relationship of a single block of rain to a single hydrograph. Figure 6-3 shows the relationship of the rainfall distribution to the overall hydrograph for the storm event. The peak flow amount from each block of rain is determined by the RM formula, Q = CIA, where I equals I_N (the actual rainfall intensity for the rainfall block). I_N is determined by dividing P_N by the actual time base of the block, T_c. The following equation shows this relationship:

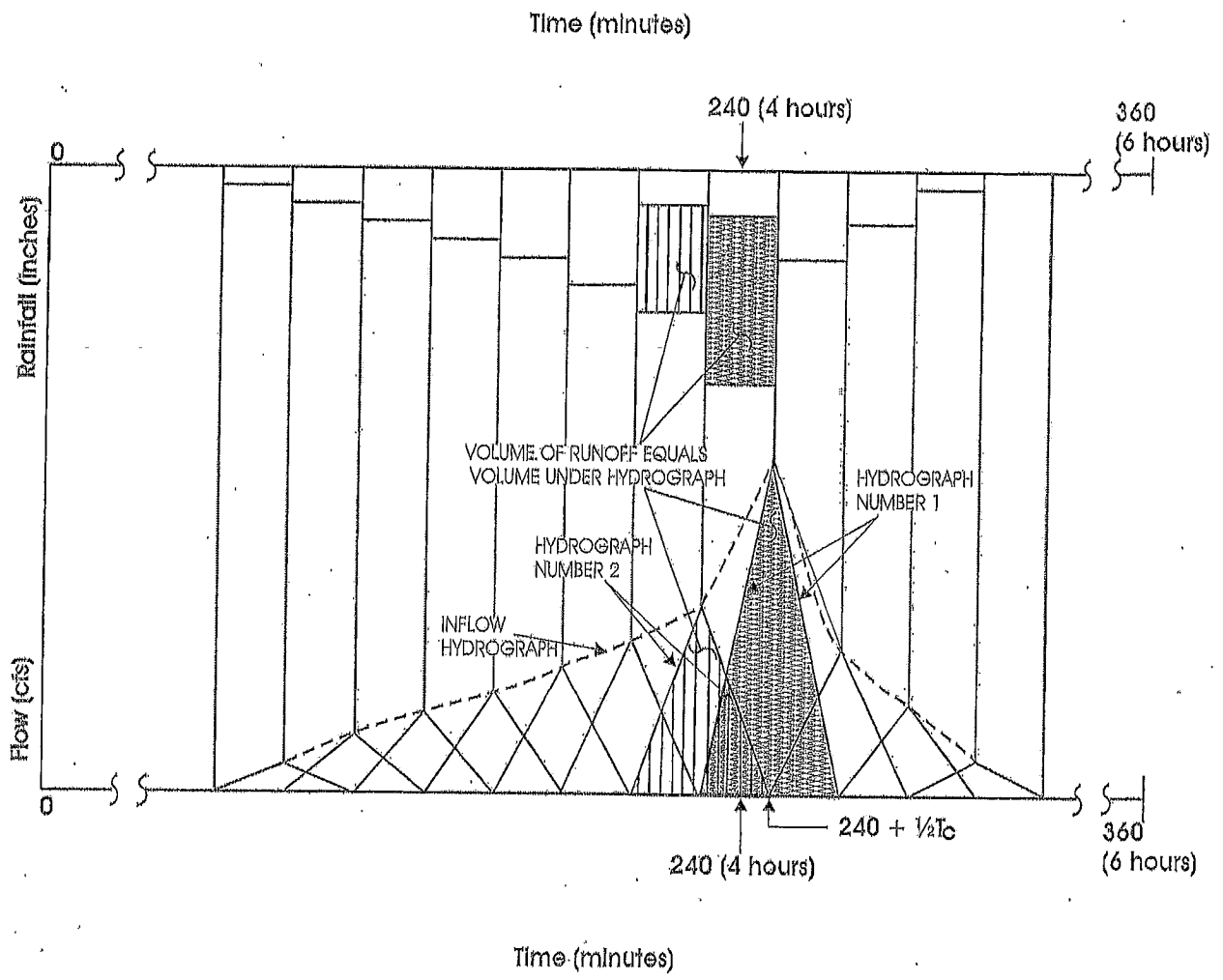
$$I_N = 60\ P_N/T_c \qquad \text{(Eq. 6-4)}$$

Where: I_N = average rainfall intensity for a duration equal to T_c in inches per hour
P_N = rainfall amount for the block in inches
T_c = time of concentration in minutes

By substituting equation 6-4 into the rational equation, the following relationship is obtained:

$$Q_N = 60\ CAP_N/T_c \text{ (cfs)} \qquad \text{(Eq. 6-5)}$$

Finally, the overall hydrograph for the storm event is determined by adding all the hydrographs from each block of rain. Since the peak flow amount for each incremental hydrograph corresponds to a zero flow amount from the previous and proceeding hydrographs, as shown in Figure 6-3, the inflow hydrograph can be plotted by connecting the peak flow amounts (see the dashed line in Figure 6-3).



FIGURE

6-Hour Rational Method Hydrograph

6-3

6.3 GENERATING A HYDROGRAPH USING RATHYDRO

The rainfall distribution and related hydrographs can be developed using the RATHYDRO computer program provided to the County by Rick Engineering Company. A copy of this program is available at no cost from the County. The output from this computer program may be used with HEC-1 or other software for routing purposes.

The design storm pattern used by the RATHYDRO program is based on the (2/3, 1/3) distribution described in Sections 4.1.1 and 6.2.1. The ordinates on the hydrograph are calculated based on the County of San Diego Intensity-Duration Design Chart (Figure 3-1), which uses the intensity equation described in Sections 3.1.3 and 6.2.1 to relate the intensity (I) of the storm to T_c, $I = 7.44\ P_6 D^{-0.645}$. The computer program uses equations 6-2 and 6-3 described above and calculates I_N directly. The intensity at any given multiple of T_c is calculated by the following equation:

$$I_N = [(I_{T(N)})\ (T_{T(N)}) - (I_{T(N-1)})\ (T_{T(N-1)})] / T_c \qquad \text{(Eq. 6-6)}$$

Where: N = number of rainfall blocks

$T_{T(N)}$ = time of concentration at rainfall block N in minutes (equal to NT_c)

I_N = actual rainfall intensity at rainfall block N in inches per hour

$I_{T(N)}$ = rainfall intensity at time of concentration $T_{T(N)}$ in inches per hour

Figure 6-2 shows the rainfall distribution used in the RM hydrograph, computed at multiples of T_c. The rainfall at block N = 1, ($1T_c$), is centered at 4 hours, the rainfall at block N = 2, ($2T_c$), is centered at 4 hours – $1T_c$, the rainfall at block N = 3, ($3T_c$), is centered at 4 hours – $2T_c$, and the rainfall at at block N = 4, ($4T_c$), is centered at 4 hours + $1T_c$. The sequence continues alternating two blocks to the left and one block to the right (see Figure 6-2).

As described in Section 6.2.2, the peak discharge (Q_N) of the hydrograph for any given rainfall block (N) is determined by the RM formula Q = CIA, where I = I_N = the actual

rainfall intensity for the rainfall block. The RATHYDRO program substitutes equation 6-6 into the RM formula to determine Q_N yielding the following equation:

$$Q_N = [(I_{T(N)})(T_{T(N)}) - (I_{T(N-1)})(T_{T(N-1)})]\, CA / T_c \qquad \text{(Eq. 6-7)}$$

Where: Q_N = peak discharge for rainfall block N in cubic feet per second (cfs)
N = number of rainfall blocks
$T_{T(N)}$ = time of concentration at rainfall block N in minutes (equal to NT_c)
$I_{T(N)}$ = rainfall intensity at time of concentration $T_{T(N)}$ in inches per hour
C = RM runoff coefficient
A = area of the watershed (acres)

To develop the hydrograph for the 6-hour design storm, a series of triangular hydrographs with ordinates at multiples of the given T_c are created and added to create the hydrograph. This hydrograph has its peak at 4 hours plus ½ of the T_c. The total volume under the hydrograph is equal to the following equation (equation 6-1):

$$VOL = CP_6A$$

Where: VOL = volume of runoff (acre-inches)
P_6 = 6-hour rainfall (inches)
C = runoff coefficient
A = area of the watershed (acres)

EXISTING DRAINAGE EXHIBIT FOR:
SOUTHVIEW EAST

CALTRANS

SR-905

EB ON-RAMP

PROJECT BOUNDARY (TYP.)

PROJECT LIMITS

VERNAL POOLS (TYP.)

CALIENTE AVENUE
(PER CITY OF SAN DIEGO DWG. NO. 35813-D)

R/W

OFFSITE
(056 AC.)

T.M. NO. 25169
"SOUTHVIEW LOT 1"

NORTH SIDE
11.99 AC.

PROJECT BOUNDARY (TYP.)

"SOUTHVIEW EAST"
NORTH SIDE

EXIST. MHPA
BOUNDARY

PROJECT BOUNDARY (TYP.)

L = 1050'
S = 2%

AIRWAY ROAD
(PER CITY OF SAN DIEGO DWG. NO. 35813-D, P.T.S. NO. 214832)

EXIST. MHPA
BOUNDARY

T.M. NO. 25169
"VISTA DEL SUR"
(NOT A PART)

"SOUTHVIEW EAST"
SOUTH SIDE

L = 600'
S = 3%

PROJECT LIMITS

SOUTH SIDE
5.33 AC.

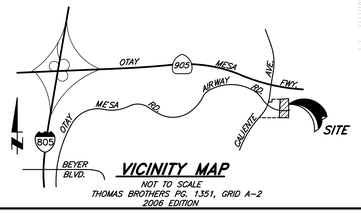
EXIST. MHPA
BOUNDARY

EXIST. SOUTHVIEW
DISCHARGE

PROJECT BOUNDARY (TYP.)

SCALE: 1" = 40'

GRAPHIC SCALE
40 0 40 80 120



VICINITY MAP
NOT TO SCALE
THOMAS BROTHERS PG. 1351, GRID A-2
2006 EDITION

LEGEND
BASIN LIMITS
PATH OF FLOW
BASIN NO. — A
AREA — 10.0 AC.

EXISTING DRAINAGE EXHIBIT FOR:
SOUTHVIEW EAST

SHEET 1 OF 1 SHEETS

SB&O INC.
PLANNING ENGINEERING SURVEYING
3990 Ruffin Road, Suite 120
San Diego, Ca. 92123
858-560-1141
858-560-8157 Fax

70910.10

PROPOSED DRAINAGE EXHIBIT FOR:
SOUTHVIEW EAST
CALTRANS
SR-905
EB ON-RAMP
PROJECT BOUNDARY (TYP.)
CALIENTE AVENUE
(PER CITY OF SAN DIEGO DWG. NO. 35613-D)
R/W
OFFSITE
(0.56 AC.)
"TESORO" PROJECT
(SOUTHVIEW LOT 1)
TEMPORARY WQ/DETENTION
BASIN TO BE REMOVED
DWY M
DWY N
DWY K
DWY J
DWY O
DWY P
DWY Q
DWY R
A
9.88 AC.
"SOUTHVIEW EAST"
NORTH SIDE
BIOFILTRATION #1
BASIN AND SLOPES
1.20 AC.
POC 1
NORTH WATER QUALITY BASIN
NORTH DETENTION BASIN
AND HMP
AIRWAY ROAD
(PER CITY OF SAN DIEGO DWG. NO. 35613-D, P.T.S. NO. 214832)
STREET 0.35 AC.
SOUTH WATER
QUALITY BASIN
BIOFILTRATION #2
"VISTA DEL SUR"
(NOT A PART)
"VISTA DEL SUR"
PROJECT BASIN "7"
"SOUTHVIEW"
LOT 2
SAN ROBERTO
SANTA ALICIA
DWY B
DWY C
DWY D
DWY E
B
5.33 AC.
"SOUTHVIEW EAST"
SOUTH SIDE
DETENTION TANK
POC 2
DISCHARGE LOCATION
SOUTHVIEW BY PASS
Obscured Area
SCALE: 1" = 40'
GRAPHIC SCALE
40 0 40 80 120
OTAY MESA RD.
905
AIRWAY RD.
CALIENTE AVE.
805
BEYER BLVD.
SITE
VICINITY MAP
NOT TO SCALE
THOMAS BROTHERS PG. 1351, GRID A-2
2006 EDITION
LEGEND
BASIN LIMITS
DIRECTION OF FLOW
STORM DRAIN MANHOLE
BASIN NO.
AREA
A
10.0 AC.
PROPOSED DRAINAGE EXHIBIT FOR:
SOUTHVIEW EAST
SHEET 1 OF 1 SHEETS
SB&O INC.
PLANNING ENGINEERING SURVEYING
3990 Ruffin Road, Suite 120
San Diego, Ca. 92123
858-560-1141
858-560-8157 Fax
70910.10

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ATTACHMENT 6
GEOTECHNICAL AND GROUNDWATER INVESTIGATION REPORT

Attach project's geotechnical and groundwater investigation report. Refer to Appendix C.4 to determine the reporting requirements.

UPDATED STORM WATER MANAGEMENT RECOMMENDATIONS

SOUTHVIEW EAST
SAN DIEGO, CALIFORNIA

GEOCON
INCORPORATED

GEOTECHNICAL
ENVIRONMENTAL
MATERIALS

PREPARED FOR

CORNERSTONE COMMUNITIES
SAN DIEGO, CALIFORNIA

AUGUST 1, 2016
PROJECT NO. G1622-52-03

Project No. G1622-52-03
August 1, 2016

Cornerstone Communities
4365 Executive Drive, Suite 600
San Diego, California 92121

Attention: Mr. Jack Robson

Subject: UPDATED STORM WATER MANAGEMENT RECOMMENDATIONS
SOUTHVIEW EAST
SAN DIEGO, CALIFORNIA

Reference: *Geotechnical Investigation, Southview East, San Diego, California*, prepared by Geocon Incorporated, dated May 20, 2014 (Project No. G1622-52-03).

Dear Mr. Robson:

In accordance with your request, we performed in-situ infiltration testing in preparation of our recommendations provided in this updated storm water management report for the proposed residential development in the City of San Diego, California.

PROJECT DESCRIPTION

The property is located east of Caliente Avenue and San Ysidro High School, north and south of the future Airway Road Extension, south of SR-905, and west of undeveloped property within the San Ysidro and Otay Mesa area in the City of San Diego, California (see Vicinity Map, Figure 1). Based on the grading plans, 19 residential structures (11 buildings and 8 buildings, north and south Airway Road, respectively) are planned with accompanied utilities, driveways, and landscaping. In addition, two water quality basins are planned on the east-central and southeast portions of the property.

Topographically, the property is characterized by mesa land with nearly flat to gently inclined ground surfaces over most of the site. A berm approximately 5 to 7 feet high and 25 feet wide is present along the southern edge and around the southeast corner of the site. Ground surfaces over much of the property are generally flat to gently sloping due to previous cultivation over many years. The southern and western portions of the property generally slope down from southwest to northeast toward a canyon drainage located within the eastern central portion of the site. The northern portion of the property generally slopes down from north to south toward the same canyon. The edges of the canyon have slope heights of about 30 to 40 feet. Site elevations vary from a high of approximately

529 feet Mean Sea Level (MSL) in the western portion of the site to a low of approximately 505 feet MSL near the edge of the canyon in the eastern central portion of the site. The bottom of the canyon slopes down to an elevation of approximately 467 feet MSL at the eastern property line.

STORM WATER MANAGEMENT BACKGROUND

We understand storm water management devices are being proposed in accordance with the *2016 City of San Diego Storm Water Standards* (SWS). If not properly 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 effect on seepage transmission and the potential adverse impacts that may occur if the storm water management features are not properly designed and constructed. We have not performed a hydrogeological study at the site. If infiltration of storm water runoff occurs, downstream properties and improvements may be subjected to seeps, springs, slope instability, raised groundwater, movement of foundations and slabs, or other undesirable impacts as a result of water infiltration.

Hydrologic Soil Group

The United States Department of Agriculture (USDA), Natural Resources Conservation Services, possesses general information regarding the existing soil conditions for areas within the United States. The USDA website also provides the Hydrologic Soil Group. Table 1 presents the descriptions of the hydrologic soil groups. If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. In addition, the USDA website also provides an estimated saturated hydraulic conductivity for the existing soil.

TABLE 1
HYDROLOGIC SOIL GROUP DEFINITIONS

Soil Group	Soil Group Definition
A	Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.
B	Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.
C	Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.
D	Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

The property is underlain by man-made previously placed fill and should be classified as Soil Group D. Table 2 presents the information from the USDA website for the subject property. The Hydrologic Soil Group Map, Figure 2, presents output from the USDA website showing the limits of the soil units.

TABLE 2
USDA WEB SOIL SURVEY – HYDROLOGIC SOIL GROUP

Map Unit Name	Map Unit Symbol	Approximate Percentage of Property	Hydrologic Soil Group	k_{SAT} of Most Limiting Layer (inches/hour)
Olivenhain Cobbly Loam, 2 to 9 Percent Slopes	OhC	85	D	0.00 – 0.06
Olivenhain Cobbly Loam, 30 to 50 Percent Slopes	OhF	8	D	0.00 – 0.06
Stockpen Gravelly Clay Loam, 2 to 5 Percent Slopes	SuB	7	D	0.00 – 0.06

In-Situ Testing

The infiltration rate, percolation rates and saturated hydraulic conductivity are different and have different meanings. Percolation rates tend to overestimate infiltration rates and saturated hydraulic conductivities by a factor of 10 or more. Table 3 describes the differences in the definitions.

TABLE 3
SOIL PERMEABILITY DEFINITIONS

Term	Definition
Infiltration Rate	The observation of the flow of water through a material into the ground downward into a given soil structure under long term conditions. This is a function of layering of soil, density, pore space, discontinuities and initial moisture content.
Percolation Rate	The observation of the flow of water through a material into the ground downward and laterally into a given soil structure under long term conditions. This is a function of layering of soil, density, pore space, discontinuities and initial moisture content.
Saturated Hydraulic Conductivity (k_{SAT}, Permeability)	The volume of water that will move in a porous medium under a hydraulic gradient through a unit area. This is a function of density, structure, stratification, fines content and discontinuities. It is also a function of the properties of the liquid as well as of the porous medium.

The degree of soil compaction or in-situ density has a significant impact on soil permeability and infiltration. Based on our experience and other studies we performed an increase in compaction results in a decrease in soil permeability.

We performed 4 open-pit percolation tests on the property. The Geologic Map, Figure 4, presents the approximate locations of the percolation tests. The test pits varied from 2 to 4 feet deep and we placed within the two proposed basins at the approximate elevation of the bottom of the basin as indicated on the grading plans. The results of the tests provide parameters regarding the saturated hydraulic conductivity and infiltration characteristics of on-site soils likely to be present at the location of the bottom of the proposed basins. Table 4 presents the results of the estimated field soil infiltration rate obtained from the field tests. The field sheets are also attached herein. We adjusted the infiltration rates to be equal to the saturated hydraulic conductivity test results based on the discussion in the County of Riverside *Design Handbook for Low Impact Development Best Management Practices.*

TABLE 4
FIELD OPEN-PIT PERCOLATION TESTS

Test No.	Geologic Unit	Test Depth and Elevation (feet and MSL)	Percolation Rate (minutes/inch)	Infiltration Rate (minutes/inch)	Worksheet[1] Infiltration Rate (inch/hour)
P-1 (Lot 4 Basin)	Topsoil	(-2 feet) 519 feet MSL	240	0.11	0.06
P-2 (Lot 4 Basin)	Topsoil	(-2 feet) 519 feet MSL	160	0.14	0.07
P-3 (Lot 3 Basin)	Topsoil	(-2 feet) 510 feet MSL	240	0.07	0.04
P-4 (Lot 3 Basin)	Qvop	(-4 feet) 510 feet MSL	240	0.09	0.05

[1] Using a factor of safety of 2 for Worksheet C.4-1.

STORM WATER MANAGEMENT CONCLUSIONS

Soil Types

Topsoil – A blanket of disturbed topsoil covers the entire site. The thickness of topsoil observed is estimated to be approximately 1 to 5 feet. The topsoil is characterized as soft to stiff and loose to medium dense, dry to moist, brown to dark brown, silty to sandy clay and silty to clayey sand derived from the underlying Very Old Paralic Deposits. The topsoil possesses a “high” to “very high” expansion potential (expansion index greater than 90). A potential for hydroconsolidation exists within the topsoil due to the loose nature of the soil encountered. Water that is allowed to migrate within into the topsoil cannot be controlled. The infiltration rate for the topsoil is less than 0.5 inches

per hour due to the clayey nature of the materials. Therefore, full infiltration within the topsoil should be considered infeasible. Partial infiltration should be feasible but expansion and contraction of the topsoil would loosen the material.

Infiltration mitigation for the topsoil will include removing the materials and exposing the underlying Very Old Paralic Deposits.

Very Old Paralic Deposits – The topsoil on the property is underlain by Very Old Paralic Deposits to depths of up to about 5 feet. Based on the boring logs, laboratory tests and our observations, the Very Old Paralic Deposits consist of two fairly distinct layers composed of an upper clay layer overlying a lower, coarse-grained, granular layer. The thickness of clay encountered in the exploratory excavations ranged up to about 6 feet. This clay upper portion of the deposit primarily consists of stiff, moist, dark brown to olive, silty to sandy clay. The clay typically possesses a "high" to "very high" expansion potential (expansion index greater than 90).

The lower layer below the clay consists of dense to very dense, cemented, inter-bedded light brown to grayish brown, clayey to sandy gravel and gravelly sand. We encountered areas that possess caliche and pinhole voids (potentially porous materials).

The infiltration rates within the Very Old Paralic Deposits are considered to be low due to the cemented nature of the materials and the Hydrologic Soil Group D classification. In addition, the clayey nature and the existence of the caliche would expand and hydroconsolidate, respectively, if water were to infiltrate. The referenced report shows about 0.5 percent hydroconsolidation that would result in a settlement of about ¾ inch for a layer of about 8 feet. Therefore, full infiltration is considered infeasible within the Very Old Paralic Deposits. Partial infiltration should be feasible within this geologic unit.

Mitigation measures do not exist that can remove the cemented nature of the formational materials increase the infiltration rates reliably in the formational materials.

Proposed Compacted Fill – Some compacted fill exists to the west and will be placed on the property during site development. The compacted fill will be comprised of on-site materials that are considered coarse-grained soil. In addition, the fill will be compacted to a dry density of at least 90 percent of the laboratory maximum dry density.

The SWS discusses compacted fill as follows:

- *For engineered fills, infiltration rates may still be quite uncertain due to layering and heterogeneities introduced as part of construction that cannot be precisely controlled.*
- *Where possible, infiltration BMPs on fill material should be designed such that their infiltrating surface extends into native soils.*
- *Because of the uncertainty of fill parameters as well as potential compaction of the native soils, an infiltration BMP may not be feasible.*

If we designed a fill that could allow infiltration (i.e. use loosely, compacted granular material), water would not infiltrate the Very Old Paralic Deposits and would move laterally. Therefore, full and partial infiltration should be considered infeasible within compacted fill.

Groundwater Elevations

We did not encounter groundwater during the geotechnical investigation. We expect the groundwater elevation exists deeper than 300 feet below grade. Therefore, full and partial infiltration should be considered feasible due to groundwater characteristics.

New or Existing Utilities

Existing utilities are not located adjacent to the property on the northern, southern and eastern property boundaries. Utilities have been recently installed with the current construction operations to the west. Full and partial infiltration near these utilities should be considered infeasible within these areas. Mitigation would include installing liners and setback from utility corridors.

Soil or Groundwater Contamination

We do not expect contamination exists on the property. Therefore, full and partial infiltration is considered feasible based on contamination characteristics.

Slopes and Other Geologic Hazards

Slopes exist to the east of the property that would be affected by full infiltration. The slopes are about 25 feet high adjacent to the property and consist of Very Old Paralic Deposits and undocumented fill. We expect the undocumented fill was placed during previous agriculture uses of the property. The San Diego and Otay Formations exist below and is exposed downstream of the adjacent slope. Figure 4 presents slope stability calculations of the undocumented fill. Based on the results, the fill slope possesses a factor of safety of about 1.4 and a surficial factor of safety of 1.1. Therefore, full infiltration should be considered infeasible to prevent the undocumented fill from becoming

saturated. In addition, a mapped landslide exists to the southeast that ranges in elevation of about 323 to 485 feet MSL. The use of partial infiltration within the Very Old Paralic Deposits is suitable.

Storm Water Management Devices

Liners should be incorporated along the sides of the planned storm water devices. The bottom of the basin can remain open to water infiltration. The liners should be impermeable (e.g. High-density polyethylene, HDPE, with a thickness of about 30 mil or equivalent Polyvinyl Chloride**,** PVC) to prevent water migration. The penetration of the liners should be properly waterproofed. The devices should also be installed in accordance with the manufacturer's recommendations.

Planters located adjacent to the right of ways should be properly lined and deepened to prevent water migration into the adjacent improvements. Water storage devices can be installed to reduce the velocity and amount of water entering the storm drain system. The project civil engineer should provide the final design of the storm water management devices.

Storm Water Standard Worksheets

The SWS requests the geotechnical engineer complete the *Categorization of Infiltration Feasibility Condition* (Worksheet C.4-1 or I-8) worksheet information to help evaluate the potential for infiltration on the property. The attached Worksheet C.4-1 presents the completed information for the submittal process.

The regional storm water standards also have a worksheet (Worksheet D.5-1 or Form I-9) that helps the project civil engineer estimate the factor of safety based on several factors. Table 5 describes the suitability assessment input parameters related to the geotechnical engineering aspects for the factor of safety determination.

TABLE 5
SUITABILITY ASSESSMENT RELATED CONSIDERATIONS FOR INFILTRATION FACILITY SAFETY FACTORS

Consideration	High Concern – 3 Points	Medium Concern – 2 Points	Low Concern – 1 Point
Assessment Methods	Use of soil survey maps or simple texture analysis to estimate short-term infiltration rates. Use of well permeameter or borehole methods without accompanying continuous boring log. Relatively sparse testing with direct infiltration methods	Use of well permeameter or borehole methods with accompanying continuous boring log. Direct measurement of infiltration area with localized infiltration measurement methods (e.g., infiltrometer). Moderate spatial resolution	Direct measurement with localized (i.e. small-scale) infiltration testing methods at relatively high resolution or use of extensive test pit infiltration measurement methods.

TABLE 5 (Concluded)
SUITABILITY ASSESSMENT RELATED CONSIDERATIONS FOR INFILTRATION FACILITY SAFETY FACTORS

Consideration	High Concern – 3 Points	Medium Concern – 2 Points	Low Concern – 1 Point
Predominant Soil Texture	Silty and clayey soils with significant fines	Loamy soils	Granular to slightly loamy soils
Site Soil Variability	Highly variable soils indicated from site assessment or unknown variability	Soil boring/test pits indicate moderately homogenous soils	Soil boring/test pits indicate relatively homogenous soils
Depth to Groundwater/ Impervious Layer	<5 feet below facility bottom	5-15 feet below facility bottom	>15 feet below facility bottom

Based on our previous geotechnical investigations, the information herein and the previous table, Table 6 presents the estimated factor values for the evaluation of the factor of safety. This table only presents the suitability assessment safety factor (Part A) of the worksheet. The project civil engineer should evaluate the safety factor for design (Part B) and use the combined safety factor for the design infiltration rate.

TABLE 6
FACTOR OF SAFETY WORKSHEET D.5-1 DESIGN VALUES – PART A[1]

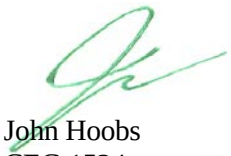
Suitability Assessment Factor Category	Assigned Weight (w)	Factor Value (v)	Product (p = w x v)
Assessment Methods	0.25	1	0.25
Predominant Soil Texture	0.25	3	0.75
Site Soil Variability	0.25	3	0.75
Depth to Groundwater/Impervious Layer	0.25	1	0.25
Suitability Assessment Safety Factor, $S_A = \Sigma p$			2.00

[1] The project civil engineer should complete Worksheet D.5-1 or Form I-9 using the data on this table. Additional information is required to evaluate the design factor of safety.

Should you have questions regarding this report, or if we may be of further service, please contact the undersigned at your convenience.

Very truly yours,

GEOCON INCORPORATED



Shawn Foy Weedon
GE 2714

John Hoobs
CEG 1524

SFW:JH:dmc

(e-mail) Addressee

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PHONE 858 558-6900 - FAX 858 558-6159

SW / SW		

VICINITY MAP

SOUTHVIEW EAST
SAN DIEGO, CALIFORNIA

DATE 8-1-2016	PROJECT NO. G1622-52-03	FIG. 1

OhC, OhF and SuB possess a Hydrologic Soil Site Class D

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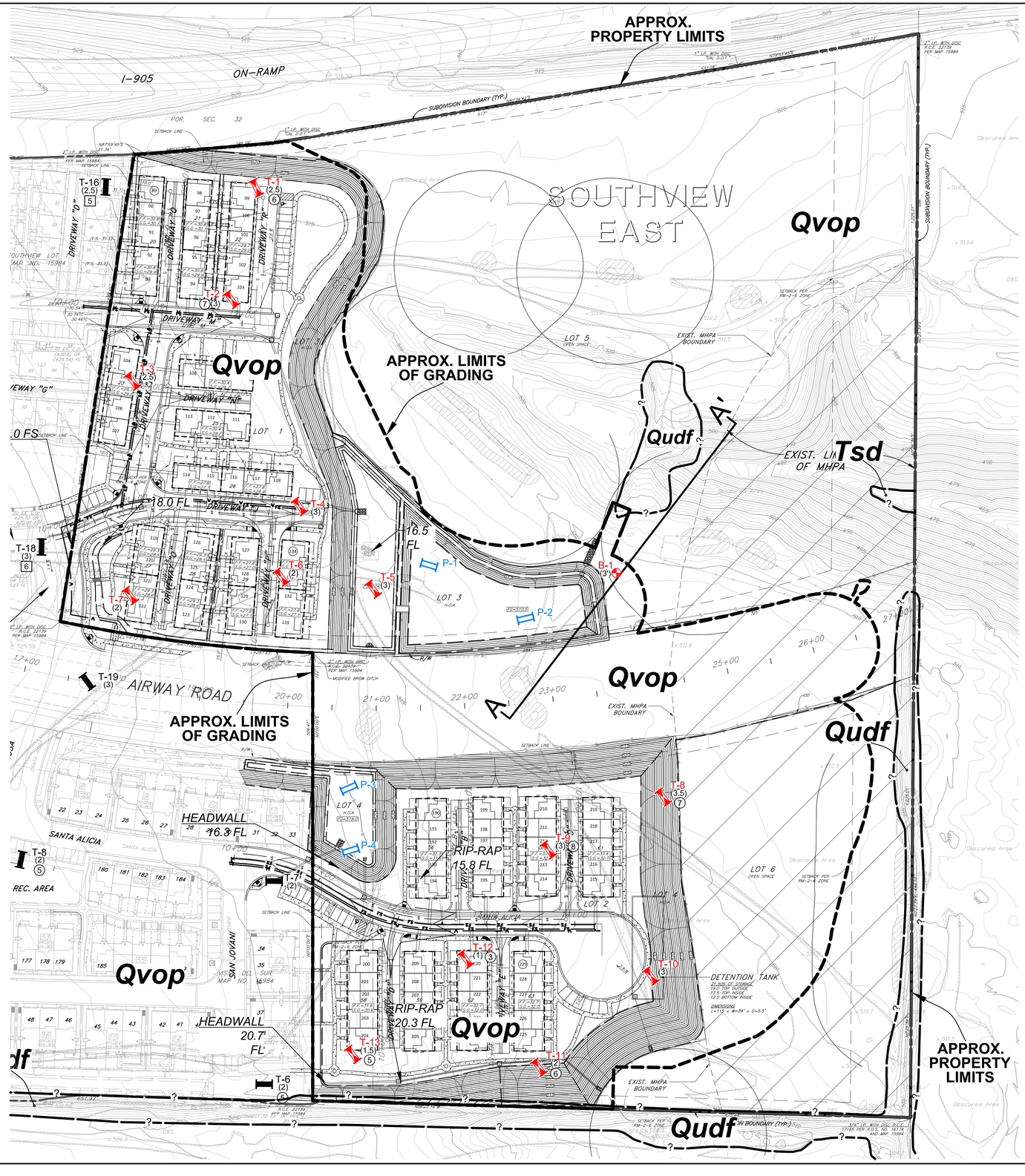
SOIL HYDROLOGIC SOIL MAP

SOUTHVIEW EAST
SAN DIEGO, CALIFORNIA

DATE 8-1-2016	PROJECT NO. G1622-52-03	FIG. 2



GEOCON LEGEND

- ***Qudf*** .....UNDOCUMENTED FILL
- ***Qvop*** .....VERY OLD PARALIC DEPOSITS
- ***Tsd*** .....SAN DIEGO FORMATION
- B-1 .....APPROX. LOCATION OF EXPLORATORY BORING (This Study)
- T-13 .....APPROX. LOCATION OF EXPLORATORY TRENCH (This Study)
- T-20 .....APPROX. LOCATION OF PREVIOUS EXPLORATORY TRENCH
- (2) .....APPROX. DEPTH TO FORMATONAL MATERIAL (IN FEET)
- (5) .....APPROX. DEPTH OF CLAY REMOVAL (IN FEET)
- [10] .....ESTIMATED REMOVAL DEPTH DUE TO POROUS/CALICHE MATERIALS (IN FEET)
- .....APPROX. LOCATION OF GEOLOGIC CONTACT (Queried Where Uncertain)
- A A' .....APPROX. LOCATION OF GEOLOGIC CROSS-SECTION
- P-4 .....APPROX. LOCATION OF INFILTRATION TEST PITS

GEOLOGIC MAP

SOUTHVIEW EAST
SAN DIEGO, CALIFORNIA

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SCALE	1" = 60'	DATE	08 - 01 - 2016
PROJECT NO.	G1622 - 52 - 03	FIGURE	3
SHEET	1 OF 1		

Plotted:08/01/2016 11:09AM | By:RUBEN AGUILAR | File Location:Y:\PROJECTS\G1622-52-03 Southview\SHEETS\G1622-52-03 GeoMap (UPD-06-28-2016).dwg

Surficial Slope Stability Evaluation

Slope Height, H (feet)	∞	
Vertical Depth of Stauration, Z (feet)	3	
Slope Inclination	2.00	:1
Slope Inclination, I (degrees)	26.6	
Unit Weight of Water, γW (pcf)	62.4	
Total Unit Weight of Soil, γ_T (pcf)	120	
Friction Angle, ϕ (degrees)	25	
Cohesion, C (psf)	100	
Factor of Safety = $(C+(\gamma_T-\gamma_W)Z\cos^2 i \tan\phi)/(\gamma_T Z \sin i \cos i)$	**1.14**	

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.

Slope Stability Evaluation

Slope Height, H (feet)	25	
Slope Inclination	2.0	:1
Total Unit Weight of Soil, γ_T (pcf)	120	
Friction Angle, ϕ (degrees)	25	
Cohesion, C (psf)	100	
$\gamma_{C\phi} = (\gamma H \tan\phi)/C$	14.0	
N_{Cf} (from Chart)	42	
Factor of Safety = $(N_{Cf}C)/(\gamma H)$	**1.40**	

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, DimensionlessParameters for Homogeneous Earth Slopes,* Journal of Soil Mechanics and Foundation Design, No. SM6, November 1967.

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SLOPE STABILITY ANALYSIS

SOUTHVIEW EAST
SAN DIEGO, CALIFORNIA

DATE 8-1-2016 | PROJECT NO. G1622-52-03 | FIG. 4

Categorization of Infiltration Feasibility Condition	Worksheet C.4-1

Part 1 - Full Infiltration Feasibility Screening Criteria

Would infiltration of the full design volume be feasible from a physical perspective without any undesirable consequences that cannot be reasonably mitigated?

Criteria	Screening Question	Yes	No
1	**Is the estimated reliable infiltration rate below proposed facility locations greater than 0.5 inches per hour?** The response to this Screening Question shall be based on a comprehensive evaluation of the factors presented in Appendix C.2 and Appendix D.		X

Provide basis:

The following includes the results of the field infiltration tests:

P-1: 0.11 inches/hour (0.06 with a FOS of 2.0)
P-2: 0.14 inches/hour (0.07 with a FOS of 2.0)
P-3: 0.07 inches/hour (0.04 with a FOS of 2.0)
P-4: 0.09 inches/hour (0.05 with a FOS of 2.0)

The rates are less than 0.5 inches/hour. Therefore, full infiltration is not feasible.

Summarize findings of studies; provide reference to studies, calculations, maps, data sources, etc. Provide narrative discussion of study/data source applicability.

2	**Can infiltration greater than 0.5 inches per hour be allowed without increasing risk of geotechnical hazards (slope stability, groundwater mounding, utilities, or other factors) that cannot be mitigated to an acceptable level?** The response to this Screening Question shall be based on a comprehensive evaluation of the factors presented in Appendix C.2.		X

Provide basis:

The project geotechnical report shows topsoil, Very Old Paralic Deposits, San Diego Formation and Otay Formation underlies the site. We expect water that would be allowed to infiltrate would move laterally onsite to proposed improvements and outside of the property limits and would reduce the stability of the adjacent slopes. The undocumented fill could lose stability, slide downward and cause damage to the existing environmentally protected area. In addition, a landslide exists about 2,000 feet to the southeast of the property that shows the area is prone to landsliding. Full infiltration would increase the risk of slope instability and should be considered infeasible.

Summarize findings of studies; provide reference to studies, calculations, maps, data sources, etc. Provide narrative discussion of study/data source applicability.

Worksheet C.4-1 Page 2 of 4			
Criteria	Screening Question	**Yes**	**No**
3	**Can infiltration greater than 0.5 inches per hour be allowed without increasing risk of groundwater contamination (shallow water table, storm water pollutants or other factors) that cannot be mitigated to an acceptable level?** The response to this Screening Question shall be based on a comprehensive evaluation of the factors presented in Appendix C.3.	X	
Provide basis: We estimate the depth to groundwater is in excess of about 300 feet below the existing grades. We understand contamination does not exist on the property. Therefore, we expect the risk of groundwater contamination is negligible and would not be increased due to infiltration. Summarize findings of studies; provide reference to studies, calculations, maps, data sources, etc. Provide narrative discussion of study/data source applicability.			
4	**Can infiltration greater than 0.5 inches per hour be allowed without causing potential water balance issues such as change of seasonality of ephemeral streams or increased discharge of contaminated groundwater to surface waters?** The response to this Screening Question shall be based on a comprehensive evaluation of the factors presented in Appendix C.3.	X	
Provide basis: We do not expect full infiltration would cause water balance issues including change of ephemeral streams or discharge of contaminated water to surface waters. Summarize findings of studies; provide reference to studies, calculations, maps, data sources, etc. Provide narrative discussion of study/data source applicability.			
Part 1 Result*	If all answers to rows 1 - 4 are "**Yes**" a full infiltration design is potentially feasible. The feasibility screening category is **Full Infiltration** If any answer from row 1-4 is "**No**", infiltration may be possible to some extent but would not generally be feasible or desirable to achieve a "full infiltration" design. Proceed to Part 2		No Full Infiltration

*To be completed using gathered site information and best professional judgment considering the definition of MEP in the MS4 Permit. Additional testing and/or studies may be required by the City to substantiate findings.

Worksheet C.4-1 Page 3 of 4

Part 2 – Partial Infiltration vs. No Infiltration Feasibility Screening Criteria

Would infiltration of water in any appreciable amount be physically feasible without any negative consequences that cannot be reasonably mitigated?

Criteria	Screening Question	Yes	No
5	**Do soil and geologic conditions allow for infiltration in any appreciable rate or volume?** The response to this Screening Question shall be based on a comprehensive evaluation of the factors presented in Appendix C.2 and Appendix D.	X	

Provide basis:

The following includes the results of the field infiltration tests:

P-1: 0.11 inches/hour (0.06 with a FOS of 2.0)
P-2: 0.14 inches/hour (0.07 with a FOS of 2.0)
P-3: 0.07 inches/hour (0.04 with a FOS of 2.0)
P-4: 0.09 inches/hour (0.05 with a FOS of 2.0)

The rates are less than 0.5 inches/hour. Therefore, partial infiltration is feasible.

Summarize findings of studies; provide reference to studies, calculations, maps, data sources, etc. Provide narrative discussion of study/data source applicability and why it was not feasible to mitigate low infiltration rates.

Criteria	Screening Question	Yes	No
6	**Can Infiltration in any appreciable quantity be allowed without increasing risk of geotechnical hazards (slope stability, groundwater mounding, utilities, or other factors) that cannot be mitigated to an acceptable level**? The response to this Screening Question shall be based on a comprehensive evaluation of the factors presented in Appendix C.2.	X	

Provide basis:

Based on the location of the basin located at least 50 feet from any existing or proposed slopes, the lack of a near surface groundwater, or utilities in the vicinity, partial infiltration will be suitable for use in design of the two basins.

Summarize findings of studies; provide reference to studies, calculations, maps, data sources, etc. Provide narrative discussion of study/data source applicability and why it was not feasible to mitigate low infiltration rates.

Worksheet C.4-1 Page 4 of 4			
Criteria	Screening Question	**Yes**	**No**
7	**Can Infiltration in any appreciable quantity be allowed without posing significant risk for groundwater related concerns (shallow water table, storm water pollutants or other factors)?** The response to this Screening Question shall be based on a comprehensive evaluation of the factors presented in Appendix C.3.	X	
Provide basis: We estimate the depth to groundwater is in excess of about 300 feet below the existing grades. Therefore, we expect the risk of groundwater contamination is negligible and would not be increased due to partial infiltration. Summarize findings of studies; provide reference to studies, calculations, maps, data sources, etc. Provide narrative discussion of study/data source applicability and why it was not feasible to mitigate low infiltration rates.			
8	**Can infiltration be allowed without violating downstream water rights**? The response to this Screening Question shall be based on a comprehensive evaluation of the factors presented in Appendix C.3.	X	
Provide basis: We expect downstream water rights would not be violated because this issue is not common within the City of San Diego. However, the client should evaluate if this potential exists. Summarize findings of studies; provide reference to studies, calculations, maps, data sources, etc. Provide narrative discussion of study/data source applicability and why it was not feasible to mitigate low infiltration rates.			
Part 2 Result*	If all answers from row 1-4 are yes then partial infiltration design is potentially feasible. The feasibility screening category is **Partial Infiltration.** If any answer from row 5-8 is no, then infiltration of any volume is considered to be **infeasible** within the drainage area. The feasibility screening category is **No Infiltration.**	Partial Infiltration	

*To be completed using gathered site information and best professional judgment considering the definition of MEP in the MS4 Permit. Additional testing and/or studies may be required by the City to substantiate findings.

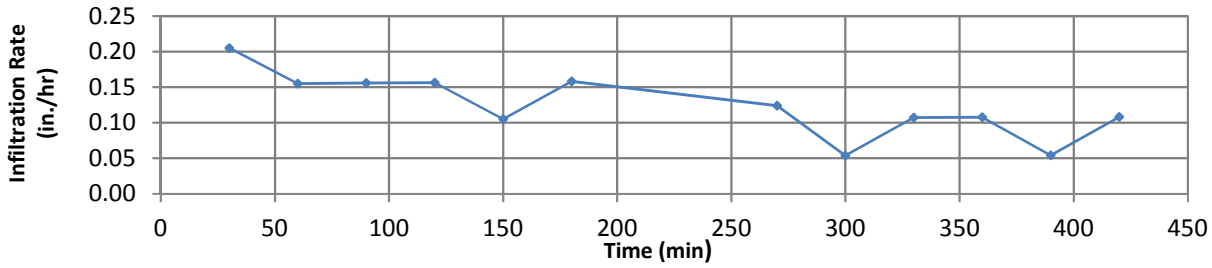
GEOCON

Shallow-Pit Infiltration Test

Project Name:	Southview East	**Date:**	7/13/2016
Project Number:	G1622-52-03	**By:**	BK
Open-Pit Location:	P-1		

Pit Length, *L* (in.)	72	**Pit Area, *A* , (in.^{2})**	3456
Pit Width, *W* (in.)	48	**Pit Volume, *V* (in.^{3})**	76032
Pit Depth, *D* (in.)	22		

					$\Delta t / \Delta H$	$\Delta H*A$	$V_{inf} / \Delta t$	$A+(2*H_{avg}*L*W)$	$Q*60/A_{wet}$
Reading	**Time, *t* (min)**	**Δt (min)**	**Water Height, *H* (in.)**	**ΔH (in.)**	**Perc. Rate (min./inch)**	**Infiltrated Water Volume, V_{inf} (in.^{3})**	**Flow Rate, *Q* (in.^{3}/min)**	**Wetted Area, A_{wet} (in.^{2})**	**Infiltration Rate, I_r (in./hr)**
1	0.00		20.81						
2	30.00	30.00	20.56	0.25	120.00	864.00	28.80	8421.00	0.21
3	60.00	30.00	20.38	0.19	160.00	648.00	21.60	8368.50	0.15
4	90.00	30.00	20.19	0.19	160.00	648.00	21.60	8323.50	0.16
5	120.00	30.00	20.00	0.19	160.00	648.00	21.60	8278.50	0.16
6	150.00	30.00	19.88	0.13	240.00	432.00	14.40	8241.00	0.10
7	180.00	30.00	19.69	0.19	160.00	648.00	21.60	8203.50	0.16
8	270.00	90.00	19.25	0.44	205.71	1512.00	16.80	8128.50	0.12
9	300.00	30.00	19.19	0.06	480.00	216.00	7.20	8068.50	0.05
10	330.00	30.00	19.06	0.13	240.00	432.00	14.40	8046.00	0.11
11	360.00	30.00	18.94	0.13	240.00	432.00	14.40	8016.00	0.11
12	390.00	30.00	18.88	0.06	480.00	216.00	7.20	7993.50	0.05
13	420.00	30.00	18.75	0.13	240.00	432.00	14.40	7971.00	0.11



Percolation Rate (Minutes/Inch) = 240.0

Soil Infiltration Rate at End of Test (Inches/Hour) = 0.11

GEOCON

Shallow-Pit Infiltration Test

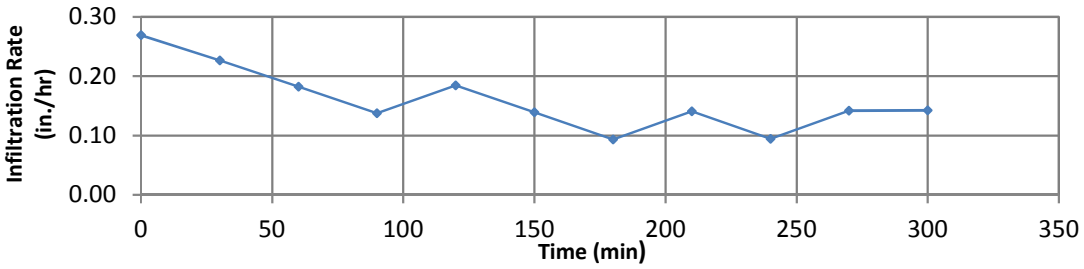
Project Name: Southview East
Project Number: G1622-52-03
Open-Pit Location: P-2

Date: 7/13/2016
By: BK

Pit Length (in.) 72
Pit Width (in.) 42
Pit Depth (in.) 25

Pit Area, *A*, (in.^{2}) 3024
Pit Volume (in.^{3}) 75600

					$\Delta t / \Delta H$	$\Delta H * A$	$V_{inf} / \Delta t$	$A+(2*H_{avg} * L*W)$	$Q*60/A_{wet}$
Reading	**Time, *t* (min)**	**Δt (min)**	**Water Height, *H* (in.)**	**ΔH (in.)**	**Perc. Rate (min./inch)**	**Infiltrated Water Volume, V_{inf} (in.^{3})**	**Flow Rate, *Q* (in.^{3}/min)**	**Wetted Area, A_{wet} (in.^{2})**	**Infiltration Rate, I_r (in./hr)**
1	0.00		23.88						
2	30.00	30.00	23.50	0.38	80.00	1134.00	37.80	8424.75	0.27
3	60.00	30.00	23.19	0.31	96.00	945.00	31.50	8346.38	0.23
4	90.00	30.00	22.94	0.25	120.00	756.00	25.20	8282.25	0.18
5	120.00	30.00	22.75	0.19	160.00	567.00	18.90	8232.38	0.14
6	150.00	30.00	22.50	0.25	120.00	756.00	25.20	8182.50	0.18
7	180.00	30.00	22.31	0.19	160.00	567.00	18.90	8132.63	0.14
8	210.00	30.00	22.19	0.13	240.00	378.00	12.60	8097.00	0.09
9	240.00	30.00	22.00	0.19	160.00	567.00	18.90	8061.38	0.14
10	270.00	30.00	21.88	0.13	240.00	378.00	12.60	8025.75	0.09
11	300.00	30.00	21.69	0.19	160.00	567.00	18.90	7990.13	0.14
12	330.00	30.00	21.50	0.19	160.00	567.00	18.90	7947.38	0.14



Percolation Rate (Minutes/Inch) = 160.0

Soil Infiltration Rate at End of Test (Inches/Hour) = 0.14

GEOCON

Shallow-Pit Infiltration Test

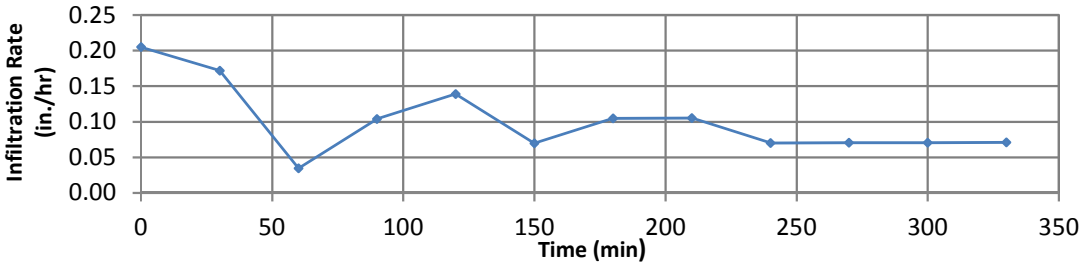
Project Name: Southview East
Project Number: G1622-52-03
Open-Pit Location: P-3

Date: 7/13/2016
By: BK

Pit Length (in.) 60
Pit Width (in.) 60
Pit Depth (in.) 46

Pit Area, *A* , (in.^{2}) 3600
Pit Volume (in.^{3}) 165600

					$\Delta t / \Delta H$	$\Delta H * A$	$V_{inf} / \Delta t$	$A+(2*H_{avg} * L*W)$	$Q*60/A_{wet}$
Reading	**Time, *t* (min)**	**Δt (min)**	**Water Height, *H* (in.)**	**ΔH (in.)**	**Perc. Rate (min./inch)**	**Infiltrated Water Volume, V_{inf} (in.^{3})**	**Flow Rate, *Q* (in.^{3}/min)**	**Wetted Area, A_{wet} (in.^{2})**	**Infiltration Rate, I_r (in./hr)**
1	0.00		40.06						
2	30.00	30.00	39.69	0.38	80.00	1350.00	45.00	13170.00	0.21
3	60.00	30.00	39.38	0.31	96.00	1125.00	37.50	13087.50	0.17
4	90.00	30.00	39.31	0.06	480.00	225.00	7.50	13042.50	0.03
5	120.00	30.00	39.13	0.19	160.00	675.00	22.50	13012.50	0.10
6	150.00	30.00	38.88	0.25	120.00	900.00	30.00	12960.00	0.14
7	180.00	30.00	38.75	0.13	240.00	450.00	15.00	12915.00	0.07
8	210.00	30.00	38.56	0.19	160.00	675.00	22.50	12877.50	0.10
9	240.00	30.00	38.38	0.19	160.00	675.00	22.50	12832.50	0.11
10	270.00	30.00	38.25	0.13	240.00	450.00	15.00	12795.00	0.07
11	300.00	30.00	38.13	0.13	240.00	450.00	15.00	12765.00	0.07
12	330.00	30.00	38.00	0.13	240.00	450.00	15.00	12735.00	0.07
13	360.00	30.00	37.88	0.13	240.00	450.00	15.00	12705.00	0.07



Percolation Rate (Minutes/Inch) = 240.0

Soil Infiltration Rate at End of Test (Inches/Hour) = 0.07

GEOCON

Shallow-Pit Infiltration Test

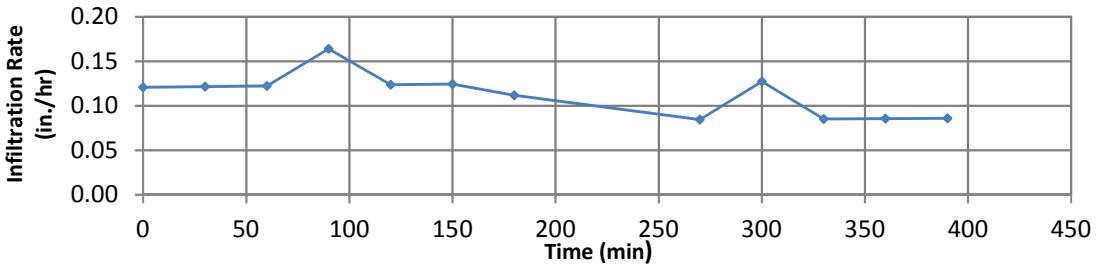
Project Name: Southview East
Project Number: G1622-52-03
Open-Pit Location: P-4

Date: 7/13/2016
By: BK

Pit Length (in.) 60.0
Pit Width (in.) 36.0
Pit Depth (in.) 24.0

Pit Area, *A* , (in.^{2}) 2160.0
Pit Volume (in.^{3}) 51840.0

					$\Delta t / \Delta H$	$\Delta H * A$	$V_{inf} / \Delta t$	$A+(2*H_{avg} * L*W)$	$Q*60/A_{wet}$
Reading	**Time, *t* (min)**	**Δt (min)**	**Water Height, *H* (in.)**	**ΔH (in.)**	**Perc. Rate (min./inch)**	**Infiltrated Water Volume, V_{inf} (in.^{3})**	**Flow Rate, *Q* (in.^{3}/min)**	**Wetted Area, A_{wet} (in.^{2})**	**Infiltration Rate, I_r (in./hr)**
1	0.00		23.75						
2	30.00	30.00	23.56	0.19	160.00	405.00	13.50	6702.0	0.12
3	60.00	30.00	23.38	0.19	160.00	405.00	13.50	6666.0	0.12
4	90.00	30.00	23.19	0.19	160.00	405.00	13.50	6630.0	0.12
5	120.00	30.00	22.94	0.25	120.00	540.00	18.00	6588.0	0.16
6	150.00	30.00	22.75	0.19	160.00	405.00	13.50	6546.0	0.12
7	180.00	30.00	22.56	0.19	160.00	405.00	13.50	6510.0	0.12
8	270.00	90.00	22.06	0.50	180.00	1080.00	12.00	6444.0	0.11
9	300.00	30.00	21.94	0.13	240.00	270.00	9.00	6384.0	0.08
10	330.00	30.00	21.75	0.19	160.00	405.00	13.50	6354.0	0.13
11	360.00	30.00	21.63	0.13	240.00	270.00	9.00	6324.0	0.09
12	390.00	30.00	21.50	0.13	240.00	270.00	9.00	6300.0	0.09
13	420.00	30.00	21.38	0.13	240.00	270.00	9.00	6276.0	0.09



Percolation Rate (Minutes/Inch) = 240.0

Soil Infiltration Rate at End of Test (Inches/Hour) = 0.09

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