

Priority Project

Water Quality Management Plan

For:

Apple Valley Assemblage

APN: 0463-373-01, 03, 04, 05 AND 06

Prepared for:

Lake Creek Industrial, LLC
13681 Newport Avenue, Suite 8301
Tustin, CA 92780
(949) 910-4616

Prepared by:

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Job No. 4099

Submittal Date: September 5, 2024

Revision No. and Date: _____

Revision No. and Date: _____

Final Approval Date:_____

Project Owner's Certification

This Town of Apple Valley Water Quality Management Plan (WQMP) has been prepared for Lake Creek Industrial, LLC by Thienes Engineering, Inc.. The WQMP is intended to comply with the requirements of the Town of Apple Valley and the Phase II Small MS4 General Permit for the Mojave River Watershed. The undersigned, while it owns the subject property, is responsible for the implementation of the provisions of this plan and will ensure that this plan is amended as appropriate to reflect up-to-date conditions on the site consistent with the Phase II Small MS4 Permit and the intent of the Town of Apple Valley's compliance efforts. Once the undersigned transfers its interest in the property, its successors in interest and the Town of Apple Valley shall be notified of the transfer. The new owner will be informed of its responsibility under this WQMP. A copy of the approved WQMP shall be available on the subject site in perpetuity.

"I certify under a penalty of law that the provisions (implementation, operation, maintenance, and funding) of the WQMP have been accepted and that the plan will be transferred to future successors."

Project Data			
Permit/Application Number(s):	TBD	Grading Permit Number(s):	TBD
Tract/Parcel Map Number(s):		Building Permit Number(s):	TBD
CUP, SUP, and/or APN (Specify Lot Numbers if Portions of Tract):			0463-373-01, 03, 04, 05 and 06

Owner's Signature			
Owner Name: Mike Tonkonogy			
Title	Manager		
Company	Lake Creek Industrial LLC		
Address	13681 Newport Avenue, Suite 8301		
Email	tmike@lakecreekindustrial.com		
Telephone #	(949) 910-4616		
Signature		Date	

Preparer's Certification

Project Data			
Permit/Application Number(s):	TBD	Grading Permit Number(s):	TBD
Tract/Parcel Map Number(s):	TBD	Building Permit Number(s):	TBD
CUP, SUP, and/or APN (Specify Lot Numbers if Portions of Tract):			0463-373-01, 03, 04, 05 and 06

"The selection, sizing and design of stormwater treatment and other stormwater quality and quantity control measures in this plan were prepared under my oversight and meet the requirements of State of California Water Resources Control Board Order No. 2013-0001-DWQ.

Engineer: Reinhard Stenzel		PE Stamp Below
Title	Director of Engineering	
Company	Thienes Engineering, Inc.	
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Signature		
Date	9/5/2024	

Table of Contents

Section I Introduction

Section 1 Discretionary Permits 1-1

Section 2 Project Description 2-1

2.1 Project Information 2-1
2.2 Property Ownership / Management 2-2
2.3 Potential Stormwater Pollutants 2-3

Section 3 Site and Watershed Description 3-1

Section 4 Best Management Practices 4-1

4.1 Source Control and Site Design BMPs 4-1
4.1.1 Source Control BMPs 4-1
4.1.2 Site Design BMPs 4-6
4.2 Treatment BMPs 4-8
4.3 BMP Selection and Sizing 4-15
4.3.1 Exceptions to Requirements for Bioretention Facilities 4-16
4.3.2 Site Design BMP 4-18
4.3.3 Infiltration BMP 4-20
4.3.4 Biotreatment BMP 4-25
4.3.5 Conformance Summary 4-29
4.3.6 Hydromodification Control BMP 4-33
4.4 Alternative Compliance Plan (if applicable) 4-34

Section 5 Inspection & Maintenance Responsibility Post Construction BMPs 5-1

Section 6 Site Plan and Drainage Plan 6-1

6.1. Site Plan and Drainage Plan 6-1
6.2 Electronic Data Submittal 6-1

Forms

Form 1-1 Project Information 1-1
Form 2.1-1 Description of Proposed Project 2-1
Form 2.2-1 Property Ownership/Management 2-2
Form 2.3-1 Pollutants of Concern 2-3
Form 3-1 Site Location and Hydrologic Features 3-1
Form 3-2 Existing Hydrologic Characteristics 3-2
Form 3-3 Watershed Description 3-4
Form 4.1-1 Non-Structural Source Control BMP 4-2
Form 4.1-2 Structural Source Control BMP 4-4
Form 4.1-3 Site Design Practices Checklist 4-6
Form 4.2-1 LID BMP Performance Criteria for Design Capture Volume (DA 1) 4-9
Form 4.2-1 LID BMP Performance Criteria for Design Capture Volume (DA 2) 4-9
Form 4.2-1 LID BMP Performance Criteria for Design Capture Volume (DA 3) 4-10
Form 4.2-1 LID BMP Performance Criteria for Design Capture Volume (DA 4) 4-10
Form 4.2-2 Summary of Hydromodification Assessment 4-11

Form 4.2-3 Hydromodification Assessment for Runoff Volume..... 4-12
Form 4.2-4 Hydromodification Assessment for Time of Concentration 4-13
Form 4.2-5 Hydromodification Assessment for Peak Runoff 4-14
Form 4.3-1 Infiltration BMP Feasibility 4-17
Form 4.3-2 Site Design BMP 4-18
Form 4.3-3 Infiltration LID BMP (DA 1) 4-21
Form 4.3-3 Infiltration LID BMP (DA 2) 4-22
Form 4.3-3 Infiltration LID BMP (DA 3) 4-23
Form 4.3-3 Infiltration LID BMP (DA 4) 4-24
Form 4.3-4 Selection and Evaluation of Biotreatment BMP 4-25
Form 4.3-5 Volume Based Biotreatment – Bioretention and Planter Boxes w/Underdrains .. 4-26
Form 4.3-6 Volume Based Biotreatment- Constructed Wetlands and Extended Detention ... 4-27
Form 4.3-7 Flow Based Biotreatment 4-28
Form 4.3-8 Conformance Summary and Alternative Compliance Volume Estimate (DA 1) 4-29
Form 4.3-8 Conformance Summary and Alternative Compliance Volume Estimate (DA 2) 4-30
Form 4.3-8 Conformance Summary and Alternative Compliance Volume Estimate (DA 3) 4-31
Form 4.3-8 Conformance Summary and Alternative Compliance Volume Estimate (DA 4) 4-32
Form 4.3-9 Hydromodification Control BMP..... 4-33
Form 5-1 BMP Inspection and Maintenance 5-2

Attachments

Attachment A: Existing Condition Site Photos
Attachment B: BMP Design Calculations & Supporting Documentation
Attachment C: WQMP Site Map
Attachment D: WQMP and Stormwater BMP Transfer, Access and Maintenance Agreement
Attachment E: Educational Materials
Attachment F: Infiltration Report
Attachment G: Hydrologic Conditions of Concern

Section I – Introduction

This WQMP template has been prepared specifically for the Phase II Small MS4 General Permit in the Mojave River Watershed. This location is within the jurisdiction of the Lahontan Regional Water Quality Control Board (LRWQCB) only. This document should not be confused with the WQMP template for the Santa Ana Phase I area of San Bernardino County.

WQMP preparers must refer to the MS4 Permit for the Mojave Watershed WQMP template and Technical Guidance (TGD) document found at: http://cms.sbcounty.gov/dpw/Land/NPDES.aspx to find pertinent arid region and Mojave River Watershed specific references and requirements.

Section 1 Discretionary Permit(s)

Form 1-1 Project Information					
Project Name	Apple Valley Assemblage				
Project Owner Contact Name:	Mike Tonkonogy				
Mailing Address:	13681 Newport Avenue, Suite 8301 Tustin, CA 92780	E-mail Address:	tmike@lakecreekindustrial.com	Telephone:	(949) 910-4616
Permit/Application Number(s):	TBD	Tract/Parcel Map Number(s):	TBD		
Additional Information/ Comments:	n/a				

Form 1-1 Project Information

Description of Project:	The project site encompasses approximately 224.90 acres. Improvements to the site include three (3) warehouse type buildings with associated truck yards. Vehicle parking will be on the north and south sides of the proposed buildings. Two earthen drainage channels (capturing offsite and onsite flows) will convey runoff along the northern, eastern, and southern boundaries of the site. Proposed infiltration basins will be street adjacent and throughout the site. Drainage from all three buildings will be collected in catch basins throughout the site. Each building will have multiple storm drain networks which will discharge into the infiltration basins. From the basins, overflows will discharge, either by gravity or pump, to the proposed earthen drainage channels. Onsite drainage will ultimately spillover into an existing earther channel located adjacent to the Apple Valley Airport. Runoff from the Building 1 site (DA 1 DMA A) will drain to several catch basins located throughout. Two storm drain systems (SD Lines A and B) will then convey runoff southerly into Infiltration Basin #1 for treatment. Runoff from the Building 2 site (DA 2 DMA A & DA 3 DMA A) will drain to several catch basins located throughout. Two storm drain systems (SD Lines C and D) will then convey runoff southerly. SD Lines C and D will drain into Infiltration Basin #3 and Infiltration Basin #2, respectively, for treatment. Runoff from the Building 3 site (DA 4 DMA A) will drain to several catch basins located throughout. Two storm drain systems (SD Lines E and F) will then convey runoff southerly into Infiltration Basin #4 for treatment. Under existing conditions, the project site accepts offsite flows – via surface flow – from the adjacent properties in the northeast. These flows will be conveyed towards westerly by the proposed onsite earthen drainage channels (DA 5 DMA A and DA 6 DMA A) that will run along the perimeter of the site. These earthen drainage channels (along with some driveway areas) add up to 22.42 acres and are considered self-treating areas that do not drain to the infiltration basins. The north earthen drainage channel (DA 6 DMA A) will begin at the northeast corner of site and flow from east to west and eventually spillover west into an existing earthen channel located adjacent to the airport. The south earthen drainage channel (DA 5 DMA A) will begin at the northeast corner of site and flow south and turn west at the southeast corner and will eventually spillover west into the same existing earthen channel located adjacent to the airport. Per the San Bernardino Stormwater Facility Mapping Tool, the project site is susceptible to Hydrologic Conditions of Concerns (HCOCs). The project proposes to mitigate the HCOC mitigation volume via infiltration basins.
Provide summary of Conceptual WQMP conditions (if previously submitted and approved). Attach complete copy.	n/a

Section 2 Project Description

2.1 Project Information

This section of the WQMP should provide the information listed below. The information provided for Conceptual/ Preliminary WQMP should give sufficient detail to identify the major proposed site design and LID BMPs and other anticipated water quality features that impact site planning. Final Project WQMP must specifically identify all BMP incorporated into the final site design and provide other detailed information as described herein.

The purpose of this information is to help determine the applicable development category, pollutants of concern, watershed description, and long-term maintenance responsibilities for the project, and any applicable water quality credits. This information will be used in conjunction with the information in Section 3, Site Description, to establish the performance criteria and to select the LID BMP or other BMP for the project or other alternative programs that the project will participate in, which are described in Section 4.

2.1.1 Project Sizing Categorization

If the Project is greater than 5,000 square feet, and not on the excluded list as found on Section 1.4 of the TGD, the Project is a Regulated Development Project.

If the Project is creating and/or replacing greater than 2,500 square feet but less than 5,000 square feet of impervious surface area, then it is considered a Site Design Only project. This criterion is applicable to all development types including detached single-family homes that create and/or replace greater than 2,500 square feet of impervious area and are not part of a larger plan of development.

Form 2.1-1 Description of Proposed Project

1 Regulated Development Project Category (Select all that apply):

☒ #1 New development involving the creation of 5,000 ft^2 or more of impervious surface collectively over entire site	☐ #2 Significant re-development involving the addition or replacement of 5,000 ft^2 or more of impervious surface on an already developed site	☐ #3 Road Project – any road, sidewalk, or bicycle lane project that creates greater than 5,000 square feet of contiguous impervious surface	☐ #4 LUPs – linear underground/overhead projects that has a discrete location with 5,000 sq. ft. or more new constructed impervious surface

☐ Site Design Only (Project Total Square Feet > 2,500 but < 5,000 sq.ft) *Will require source control Site Design LID BMPs and other LIP requirements. See section 4. (Please go to Forms 4.1-3 and 4.3-2)*

2 Project Area (ft^2):	9,796,664 (224.90 ac.)	**3** Number of Dwelling Units:	n/a	**4** SIC Code:	4225

5 Is Project going to be phased? Yes ☐ No ☒ *If yes, ensure that the WQMP evaluates each phase as a distinct DA, requiring LID BMPs to address runoff at time of completion.*

2.2 Property Ownership/Management

Describe the ownership/management of all portions of the project and site. State whether any infrastructure will transfer to public agencies (City, County, Caltrans, etc.) after project completion. State if a homeowners or property owners association will be formed and be responsible for the long-term maintenance of project stormwater facilities. Describe any lot-level stormwater features that will be the responsibility of individual property owners.

Form 2.2-1 Property Ownership/Management

Describe property ownership/management responsible for long-term maintenance of WQMP stormwater facilities:

Lake Creek Industrial, LLC
13681 Newport Avenue, Suite 8301
Tustin, CA 92780
Phone: (949) 910-4616
Contact: Mike Tonkonogy

No infrastructure will be transferred to a public agency after project completion.
A property owner's association (POA) will be formed for long-term maintenance of project stormwater facilities.

2.3 Potential Stormwater Pollutants

Best Management Practices (BMP) measures for pollutant generating activities and sources shall be designed consistent with recommendations from the CASQA Stormwater BMP Handbook for New Development and Redevelopment (or an equivalent manual). Pollutant generating activities must be considered when determining the overall pollutants of concern for the Project as presented in Form 2.3-1.

Determine and describe expected stormwater pollutants of concern based on land uses and site activities (refer to Table 3-2 in the TGD for WQMP).

Form 2.3-1 Pollutants of Concern

Pollutant	Please check: E=Expected, N=Not Expected		Additional Information and Comments
Pathogens (Bacterial / Virus)	E ☒	N ☐	Including petroleum hydrocarbons. Bacterial indicators are routinely detected in pavement runoff.
Nutrients - Phosphorous	E ☒	N ☐	Expected with proposed landscaping activities
Nutrients - Nitrogen	E ☒	N ☐	Expected with proposed landscaping activities
Noxious Aquatic Plants	E ☐	N ☒	Not expected with proposed site activities
Sediment	E ☒	N ☐	Expected with proposed landscaping activities
Metals	E ☒	N ☐	Expected with proposed parking lot activities.
Oil and Grease	E ☒	N ☐	Expected with proposed parking lot activities.
Trash/Debris	E ☒	N ☐	Expected with proposed parking lot and light industrial use activities.
Pesticides / Herbicides	E ☒	N ☐	Expected with proposed landscaping activities
Organic Compounds	E ☒	N ☐	Expected with proposed landscaping activities
Other:	E ☐	N ☐	

Section 3 Site and Watershed Description

Describe the project site conditions that will facilitate the selection of BMP through an analysis of the physical conditions and limitations of the site and its receiving waters. Identify distinct drainage areas (DA) that collect flow from a portion of the site and describe how runoff from each DA (and sub-watershed Drainage Management Areas (DMAs)) is conveyed to the site outlet(s). Refer to Section 3.2 in the TGD for WQMP. The form below is provided as an example. Then complete Forms 3.2 and 3.3 for each DA on the project site.

Form 3-1 Site Location and Hydrologic Features

Site coordinates *take GPS measurement at approximate center of site*	Latitude: 34.575429	Longitude: -117.179953	Thomas Bros Map page 4207 & 4208

1 San Bernardino County climatic region: ☒ Desert

2 Does the site have more than one drainage area (DA): Yes☒ No☐ *If no, proceed to Form 3-2. If yes, then use this form to show a conceptual schematic describing DMAs and hydrologic feature connecting DMAs to the site outlet(s). An example is provided below that can be modified for proposed project or a drawing clearly showing DMA and flow routing may be attached*

Conveyance	Briefly describe on-site drainage features to convey runoff that is not retained within a DMA
DA 1 DMA A to Earthen Drainage Channel (Outlet)	Runoff from the Building 1 site (DA 1 DMA A) will drain to several catch basins located throughout. Two storm drain systems (SD Lines A and B) will then convey runoff southerly into Infiltration Basin #1 for treatment. Overflows will discharge, either by gravity or pump, to the proposed earthen drainage channel.
DA 2 DMA A to Earthen Drainage Channel (Outlet)	Runoff from the Building 2 site (DA 2 DMA A & DA 3 DMA A) will drain to several catch basins located throughout. Two storm drain systems (SD Lines C and D) will then convey runoff southerly. SD Lines C and D will drain into Infiltration Basin #3 and Infiltration Basin #2, respectively, for treatment. Overflows will discharge, either by gravity or pump, to the proposed earthen drainage channel.
DA 3 DMA A to Earthen Drainage Channel (Outlet)	Runoff from the Building 2 site (DA 2 DMA A & DA 3 DMA A) will drain to several catch basins located throughout. Two storm drain systems (SD Lines C and D) will then convey runoff southerly. SD Lines C and D will drain into Infiltration Basin #3 and Infiltration Basin #2, respectively, for treatment. Overflows will discharge, either by gravity or pump, to the proposed earthen drainage channel.
DA 4 DMA A to Earthen Drainage Channel (Outlet)	Runoff from the Building 3 site (DA 4 DMA A) will drain to several catch basins located throughout. Two storm drain systems (SD Lines E and F) will then convey runoff southerly into Infiltration Basin #4 for treatment. Overflows will discharge, either by gravity or pump, to the proposed earthen drainage channel.

Form 3-2 Existing Hydrologic Characteristics for Drainage Areas

For Drainage Area's sub-watershed DMA, provide the following characteristics	**DA 1 (Hydrology Nodes 100-104)**	**DA 2 (Hydrology Nodes 200-204)**	**DA 3 (Hydrology Nodes 300-306)**	**DA 4 (Hydrology Nodes 400-405)**
1 DMA drainage area (ft^2)	1,404,810	1,516,324	2,783,048	2,453,735
2 Existing site impervious area (ft^2)	0	0	0	0
3 Antecedent moisture condition *For desert areas, use http://www.sbcounty.gov/dpw/floodcontrol/pdf/20100412_map.pdf*	AMC I	AMC I	AMC I	AMC I
4 Hydrologic soil group *Refer to County Hydrology Manual Addendum for Arid Regions – http://www.sbcounty.gov/dpw/floodcontrol/pdf/20100412_addendum.pdf*	HSG A/HSG B	HSG A/HSG B	HSG A/HSG B	HSG A/HSG B
5 Longest flowpath length (ft)	1,122	1,326	1,126	1,000
6 Longest flowpath slope (ft/ft)	0.0143	1.3575	1.7762	2.7000
7 Current land cover type(s) *Select from Fig C-3 of Hydrology Manual*	Barren	Barren	Barren	Barren
8 Pre-developed pervious area condition: *Based on the extent of wet season vegetated cover good >75%; Fair 50-75%; Poor <50% Attach photos of site to support rating*	Poor	Poor	Poor	Poor

Form 3-2 Existing Hydrologic Characteristics for Drainage Areas

For Drainage Area's sub-watershed DMA, provide the following characteristics	**DA 5 (Hydrology Nodes 500-503)**	**DA 6 (Hydrology Nodes 600-603)**	**DA 7 (Hydrology Nodes 700-702)**	**-**
1 DMA drainage area (ft^2)	588,060	657,756	392,911	-
2 Existing site impervious area (ft^2)	0	0	0	-
3 Antecedent moisture condition *For desert areas, use http://www.sbcounty.gov/dpw/floodcontrol/pdf/20100412_map.pdf*	AMC I	AMC I	AMC I	-
4 Hydrologic soil group *Refer to County Hydrology Manual Addendum for Arid Regions – http://www.sbcounty.gov/dpw/floodcontrol/pdf/20100412_addendum.pdf*	HSG A/HSG B	HSG A/HSG B	HSG A/HSG B	-
5 Longest flowpath length (ft)	1,164	1,000	854	-
6 Longest flowpath slope (ft/ft)	2.7491	2.7000	3.1616	-
7 Current land cover type(s) *Select from Fig C-3 of Hydrology Manual*	Barren	Barren	Barren	-
8 Pre-developed pervious area condition: *Based on the extent of wet season vegetated cover good >75%; Fair 50-75%; Poor <50% Attach photos of site to support rating*	Poor	Poor	Poor	-

Form 3-3 Watershed Description for Drainage Area

Receiving waters Refer to CWRCB site: http://www.waterboards.ca.gov/water_issues/programs/tmdl/integrated2010.shtml	Mojave River (Upper Narrows to Lower Narrows) Mojave River (below Lower Narrows) East Cronise Lake
Applicable TMDLs *http://www.waterboards.ca.gov/water_issues/programs/tmdl/integrated2010.shtml*	Mojave River (Upper Narrows to Lower Narrows): None Mojave River (below Lower Narrows): None East Cronise Lake: None
303(d) listed impairments *http://www.waterboards.ca.gov/water_issues/programs/tmdl/integrated2010.shtml*	Mojave River (Upper Narrows to Lower Narrows): Fluoride; Sulfates; Total Dissolved Solids Mojave River (below Lower Narrows): None East Cronise Lake: None
Environmentally Sensitive Areas (ESA) *Refer to Watershed Mapping Tool – http://sbcounty.permitrack.com/WAP*	n/a
Hydromodification Assessment	☒ Yes *Complete Hydromodification Assessment. Include Forms 4.2-2 through Form 4.2-5 and Hydromodification BMP Form 4.3-9 in submittal* ☐ No

Section 4 Best Management Practices (BMP)

4.1 Source Control and Site Design BMPs

The information and data in this section are required for both Regulated Development and Site Design Only Projects. Source Control and Site Design BMPs are the basis of site-specific pollution management.

4.1.1 Source Control BMPs

Non-structural and structural source control BMPs are required to be incorporated into all new development and significant redevelopment projects. Form 4.1-1 and 4.1-2 are used to describe specific source control BMPs used in the WQMP or to explain why a certain BMP is not applicable. Table 7-3 of the TGD for WQMP provides a list of applicable source control BMP for projects with specific types of potential pollutant sources or activities. The source control BMP in this table must be implemented for projects with these specific types of potential pollutant sources or activities.

The preparers of this WQMP have reviewed the source control BMP requirements for new development and significant redevelopment projects. The preparers have also reviewed the specific BMP required for project as specified in Forms 4.1-1 and 4.1-2. All applicable non-structural and structural source control BMP shall be implemented in the project.

The identified list of source control BMPs correspond to the CASQA Stormwater BMP Handbook for New Development and Redevelopment.

Form 4.1-1 Non-Structural Source Control BMPs

Identifier	Name	Check One		Describe BMP Implementation OR, if not applicable, state reason:
		Included	Not Applicable	
N1	Education of Property Owners, Tenants and Occupants on Stormwater BMPs	☒	☐	Property owner shall be familiar with the educational materials in Attachment "E" and the contents of the WQMP.
N2	Activity Restrictions	☒	☐	No outdoor work areas, processing, storage or wash area. Activities are restricted to only those for which a BMP has been implemented.
N3	Landscape Management BMPs	☒	☐	Fertilizer and pesticide usage will be consistent with County Management Guidelines for Use of Fertilizers and Pesticides.
N4	BMP Maintenance	☒	☐	BMP maintenance, implementation schedules, and responsible parties are included with each specific BMP narrative.
N5	Title 22 CCR Compliance (How development will comply)	☒	☐	Title 22 CCR is not applicable.
N6	Local Water Quality Ordinances	☐	☒	Local agency does not have additional water quality ordinances.
N7	Spill Contingency Plan	☒	☐	Owner/tenant will have a spill contingency plan based on individual site needs.
N8	Underground Storage Tank Compliance	☐	☒	No USTs onsite.
N9	Hazardous Materials Disclosure Compliance	☐	☒	No hazardous materials onsite.
N10	Uniform Fire Code Implementation	☒	☐	Owner will comply with Article 80 of the Uniform Fire Code enforced by the fire protection agency.
N11	Litter/Debris Control Program	☒	☐	Contract with their landscape maintenance firm to provide this service during regularly schedule maintenance.
N12	Employee Training	☒	☐	The owner will ensure that tenants are also familiar with onsite BMPs and necessary maintenance required of the tenants. Owner will check with City and County at least once a year to obtain new or updated educational materials and provide these materials to tenants. Employees shall be trained to clean up minor spills and participate in ongoing maintenance. The WQMP requires annual employee training and new hires within 2 months.
N13	Housekeeping of Loading Docks	☒	☐	Keep all fluids indoors. Clean up spills immediately and keep spills from entering storm drain system. No untreated discharges into the storm drain system. Area shall be inspected weekly for proper containment and practices with spills cleaned up immediately and disposed of properly.
N14	Catch Basin Inspection Program	☒	☐	Monthly inspection by property owner's designee. Drain inserts will be vacuumed when

Form 4.1-1 Non-Structural Source Control BMPs

				sediment or trash becomes 2-inches deep and disposed of properly.
N15	Vacuum Sweeping of Private Streets and Parking Lots	☒	☐	All landscape maintenance contractors will be required to sweep up all landscape cuttings, mowings and fertilizer materials off paved areas weekly and dispose of properly. Parking areas and drive ways will be swept monthly by sweeping contractor.
N16	Other Non-structural Measures for Public Agency Projects	☐	☒	Not a public agency project.
N17	Comply with all other applicable NPDES permits	☒	☐	Will comply with Construction General Permit and Industrial General Permit (may apply for No Exposure Certification/NEC).

Form 4.1-2 Structural Source Control BMPs

Identifier	Name	Check One		Describe BMP Implementation OR, If not applicable, state reason
		Included	Not Applicable	
S1	Provide storm drain system stencilling and signage (CASQA New Development BMP Handbook SD-13)	☒	☐	"No Dumping – Drains to River" stencils will be applied. Legibility of stencil will be maintained on a yearly basis.
S2	Design and construct outdoor material storage areas to reduce pollution introduction (CASQA New Development BMP Handbook SD-34)	☐	☒	No outdoor material storage areas onsite.
S3	Design and construct trash and waste storage areas to reduce pollution introduction (CASQA New Development BMP Handbook SD-32)	☒	☐	Paved with an impervious surface, designed not to allow run-on from adjoining areas, designed to divert drainage from adjoining roofs and pavements diverted around the area, screened or walled to prevent off-site transport of trash. Provide solid roof or awning to prevent direct contact with rainfall. All lids shall remain closed when not in use.
S4	Use efficient irrigation systems & landscape design, water conservation, smart controllers, and source control (Statewide Model Landscape Ordinance; CASQA New Development BMP Handbook SD-12)	☒	☐	Irrigation systems shall include reducers or shutoff valves triggered by a pressure drop to control water loss in the event of broken sprinkler heads or lines. Timers will be used to avoid over watering and watering cycles and duration shall be adjusted seasonally by the landscape maintenance contractor. The landscaping areas will be grouped with plants that have similar water requirements. Native or drought tolerant species shall also be used where appropriate to reduce excess irrigation runoff and promote surface filtration.
S5	Finish grade of landscaped areas at a minimum of 1-2 inches below top of curb, sidewalk, or pavement	☒	☐	Landscaped areas will be depressed in order to increase retention of stormwater/irrigation water and promote infiltration.
S6	Protect slopes and channels and provide energy dissipation (CASQA New Development BMP Handbook SD-10)	☒	☐	Energy dissipation is provided along inlets of infiltration basins and the earthen drainage channel network.
S7	Covered dock areas (CASQA New Development BMP Handbook SD-31)	☐	☒	Finished goods being loaded and unloaded at the docks may have the potential to contribute to stormwater pollution in the event of a spill. In lieu of covered docks (which is not practical for a site of this magnitude), a spill contingency plan will be available and employees shall be trained to clean up minor spills and participate in ongoing maintenance. The WQMP requires annual employee training and new hires within 2 months.
S8	Covered maintenance bays with spill containment plans (CASQA New Development BMP Handbook SD-31)	☐	☒	No maintenance bays onsite.

S9	Vehicle wash areas with spill containment plans (CASQA New Development BMP Handbook SD-33)	☐	☒	No vehicle wash areas onsite.
S10	Covered outdoor processing areas (CASQA New Development BMP Handbook SD-36)	☐	☒	No outdoor processing areas onsite.
S11	Equipment wash areas with spill containment plans (CASQA New Development BMP Handbook SD-33)	☐	☒	No equipment wash areas onsite.
S12	Fueling areas (CASQA New Development BMP Handbook SD-30)	☐	☒	No fueling areas onsite.
S13	Hillside landscaping (CASQA New Development BMP Handbook SD-10)	☐	☒	No hillsides onsite.
S14	Wash water control for food preparation areas	☐	☒	No food preparation onsite.
S15	Community car wash racks (CASQA New Development BMP Handbook SD-33)	☐	☒	No community cars wash racks onsite.

4.1.2 Site Design BMPs

As part of the planning phase of a project, the site design practices associated with new LID requirements in the Phase II Small MS4 Permit must be considered. Site design BMPs can result in smaller DCV to be managed by both LID and hydromodification control BMPs by reducing runoff generation.

As is stated in the Permit, it is necessary to evaluate site conditions such as soil type(s), existing vegetation and flow paths will influence the overall site design.

Describe site design and drainage plan including:

- A narrative of site design practices utilized or rationale for not using practices
- A narrative of how site plan incorporates preventive site design practices
- Include an attached Site Plan layout which shows how preventative site design practices are included in WQMP

Refer to Section 5.2 of the TGD for WQMP for more details.

Form 4.1-3 Site Design Practices Checklist

Site Design Practices *If yes, explain how preventative site design practice is addressed in project site plan. If no, other LID BMPs must be selected to meet targets*
Minimize impervious areas: Yes ☒ No ☐ Explanation: Sidewalk widths, drive aisle and parking stalls are reduced to City standards.
Maximize natural infiltration capacity; Including improvement and maintenance of soil: Yes ☐ No ☒ Explanation: The infiltration basins have been placed in permeable locations where runoff will be retained, then infiltrated for treatment.
Preserve existing drainage patterns and time of concentration: Yes ☒ No ☐ Explanation: Post-development drainage patterns will mimic pre-development conditions. Stormwater will be retained in infiltration basins and increase the time of concentration compared to existing condition.
Disconnect impervious areas. Including rerouting of rooftop drainage pipes to drain stormwater to storage or infiltration BMPs instead of to storm drain: Yes ☒ No ☐ Explanation: There are no accessible landscape areas to disconnect impervious areas. Roof drains are not able to flow into landscaping as they will create an erosion concern that could ultimately create ponding issues against the building. Rooftop drainage will be routed to the infiltration basins for treatment.
Use of Porous Pavement: Yes ☐ No ☒ Explanation: Not applicable. Runoff will drain into infiltration basins for treatment.
Protect existing vegetation and sensitive areas: Yes ☐ No ☒ Explanation: The existing vegetation will not be protected. There are no sensitive areas to protect within the project limits.
Re-vegetate disturbed areas. Including planting and preservation of drought tolerant vegetation: Yes ☒ No ☐ Explanation: All areas not covered by buildings, sidewalks, parking and other impervious surfaces will be re-vegetated.

Minimize unnecessary compaction in stormwater retention/infiltration basin/trench areas: Yes ☒ No ☐ Explanation: Infiltration areas will be staked to minimize unnecessary compaction during construction. Material storage areas and stockpiles will be located on areas that will not affect infiltration. Access routes for heavy equipment will be located around the infiltration location.
Utilize naturalized/rock-lined drainage swales in place of underground piping or imperviously lined swales: Yes ☐ No ☒ Explanation: Underground piping and imperviously lined swales are located at truck and car loading areas that could not be substituted with naturalized/rock-lined drainage swales. All Imperviously lined swales will be taken to infiltration basins for treatment.
Stake off areas that will be used for landscaping to minimize compaction during construction: Yes ☒ No ☐ Explanation: Landscaped areas will be staked to minimize unnecessary compaction during construction.
Use of Rain Barrels and Cisterns, Including the use of on-site water collection systems: Yes ☐ No ☒ Explanation: Not applicable. Runoff will drain into infiltration basins for treatment.
Stream Setbacks. Includes a specified distance from an adjacent steam: Yes ☐ No ☒ Explanation: Not applicable.

It is noted that, in the Phase II Small MS4 Permit, site design elements for green roofs and vegetative swales are required. Due to the local climatology in the Mojave River Watershed, proactive measures are taken to maximize the amount of drought tolerant vegetation. It is not practical in this region to have green roofs or vegetative swales. As part of site design the project proponent should utilize locally recommended vegetation types for landscaping. Typical landscaping recommendations are found in following local references:

San Bernardino County Special Districts:

Guide to High Desert Landscaping -
http://www.specialdistricts.org/Modules/ShowDocument.aspx?documentid=795

Recommended High-Desert Plants -
http://www.specialdistricts.org/modules/showdocument.aspx?documentid=553

Mojave Water Agency:

Desert Ranch: http://www.mojavewater.org/files/desertranchgardenprototype.pdf

Summertree: http://www.mojavewater.org/files/Summertree-Native-Plant-Brochure.pdf

Thornless Garden: http://www.mojavewater.org/files/thornlessgardenprototype.pdf

Mediterranean Garden: http://www.mojavewater.org/files/mediterraneangardenprototype.pdf

Lush and Efficient Garden: http://www.mojavewater.org/files/lushandefficientgardenprototype.pdf

Alliance for Water Awareness and Conservation (AWAC) outdoor tips – http://hdawac.org/save-outdoors.html

4.2 Treatment BMPs

After implementation and design of both Source Control and Site Design BMPs, any remaining runoff from impervious DMAs must be directed to one or more on-site, treatment BMPs (LID or biotreatment) designed to infiltrate, evaportranspire, and/or bioretain the amount of runoff specified in Permit Section E.12.e (ii)(c) Numeric Sizing Criteria for Storm Water Retention and Treatment.

4.2.1 Project Specific Hydrology Characterization

The purpose of this section of the Project WQMP is to establish targets for post-development hydrology based on performance criteria specified in the Phase II Small MS4 Permit. These targets include runoff volume for water quality control (referred to as LID design capture volume), and runoff volume, time of concentration, and peak runoff for protection from hydromodification.

If the project has more than one outlet for stormwater runoff, then complete additional versions of these forms for each DA / outlet.

It is noted that in the Phase II Small MS4 Permit jurisdictions, the LID BMP Design Capture Volume criteria is based on the 2-year rain event. The hydromodification performance criterion is based on the 10-year rain event.

Methods applied in the following forms include:

- For LID BMP Design Capture Volume (DCV), San Bernardino County requires use of the P_6 method (Form 4.2-1) For pre- and post-development hydrologic calculation, San Bernardino County requires the use of the Rational Method (San Bernardino County Hydrology Manual Section D). Forms 4.2-2 through Form 4.2-5 calculate hydrologic variables including runoff volume, time of concentration, and peak runoff from the project site pre- and post-development using the Hydrology Manual Rational Method approach. For projects greater than 640 acres (1.0 mi^2), the Rational Method and these forms should not be used. For such projects, the Unit Hydrograph Method (San Bernardino County Hydrology Manual Section E) shall be applied for hydrologic calculations for hydromodification performance criteria.

Refer to Section 4 in the TGD for WQMP for detailed guidance and instructions.

Form 4.2-1 LID BMP Performance Criteria for Design Capture Volume (DA 1)		
1 Project area **DA 1 DMA A** (ft^2): 2,666,743 (61.22 ac.)	**2** Imperviousness after applying preventative site design practices (Imp%): 95%	**3** Runoff Coefficient (Rc): 0.807 *$R_c = 0.858(Imp\%)^{\wedge 3}-0.78(Imp\%)^{\wedge 2}+0.774(Imp\%)+0.04$*
4 Determine 1-hour rainfall depth for a 2-year return period $P_{2yr\text{-}1hr}$ (in): 0.333 http://hdsc.nws.noaa.gov/hdsc/pfds/sa/sca_pfds.html		
5 Compute P_6, Mean 6-hr Precipitation (inches): 0.412 *P_6 = Item 4 *C_1, where C_1 is a function of site climatic region specified in Form 3-1 Item 1 (Desert = 1.2371)*		
6 Drawdown Rate *Use 48 hours as the default condition. Selection and use of the 24 hour drawdown time condition is subject to approval by the local jurisdiction. The necessary BMP footprint is a function of drawdown time. While shorter drawdown times reduce the performance criteria for LID BMP design capture volume, the depth of water that can be stored is also reduced.*		24-hrs ☐ 48-hrs ☒
7 Compute design capture volume, DCV (ft^3): 145,021 *DCV = 1/12 * [Item 1* Item 3 *Item 5 * C_2], where C_2 is a function of drawdown rate (24-hr = 1.582; 48-hr = 1.963) Compute separate DCV for each outlet from the project site per schematic drawn in Form 3-1 Item 2*		

Form 4.2-1 LID BMP Performance Criteria for Design Capture Volume (DA 2)		
1 Project area **DA 2 DMA A** (ft^2): 1,300,266 (29.85 ac.)	**2** Imperviousness after applying preventative site design practices (Imp%): 95%	**3** Runoff Coefficient (Rc): 0.807 *$R_c = 0.858(Imp\%)^{\wedge 3}-0.78(Imp\%)^{\wedge 2}+0.774(Imp\%)+0.04$*
4 Determine 1-hour rainfall depth for a 2-year return period $P_{2yr\text{-}1hr}$ (in): 0.333 http://hdsc.nws.noaa.gov/hdsc/pfds/sa/sca_pfds.html		
5 Compute P_6, Mean 6-hr Precipitation (inches): 0.412 *P_6 = Item 4 *C_1, where C_1 is a function of site climatic region specified in Form 3-1 Item 1 (Desert = 1.2371)*		
6 Drawdown Rate *Use 48 hours as the default condition. Selection and use of the 24 hour drawdown time condition is subject to approval by the local jurisdiction. The necessary BMP footprint is a function of drawdown time. While shorter drawdown times reduce the performance criteria for LID BMP design capture volume, the depth of water that can be stored is also reduced.*		24-hrs ☐ 48-hrs ☒
7 Compute design capture volume, DCV (ft^3): 70,710 *DCV = 1/12 * [Item 1* Item 3 *Item 5 * C_2], where C_2 is a function of drawdown rate (24-hr = 1.582; 48-hr = 1.963) Compute separate DCV for each outlet from the project site per schematic drawn in Form 3-1 Item 2*		

Form 4.2-1 LID BMP Performance Criteria for Design Capture Volume (DA 3)		
1 Project area **DA 3 DMA A** (ft^2): 1,978,495 (45.42 ac.)	**2** Imperviousness after applying preventative site design practices (Imp%): 95%	**3** Runoff Coefficient (Rc): 0.807 *$R_c = 0.858(Imp\%)^{\wedge 3}-0.78(Imp\%)^{\wedge 2}+0.774(Imp\%)+0.04$*
4 Determine 1-hour rainfall depth for a 2-year return period $P_{2yr\text{-}1hr}$ (in): 0.333 http://hdsc.nws.noaa.gov/hdsc/pfds/sa/sca_pfds.html		
5 Compute P_6, Mean 6-hr Precipitation (inches): 0.412 *P_6 = Item 4 *C_1, where C_1 is a function of site climatic region specified in Form 3-1 Item 1 (Desert = 1.2371)*		
6 Drawdown Rate *Use 48 hours as the default condition. Selection and use of the 24 hour drawdown time condition is subject to approval by the local jurisdiction. The necessary BMP footprint is a function of drawdown time. While shorter drawdown times reduce the performance criteria for LID BMP design capture volume, the depth of water that can be stored is also reduced.*		24-hrs ☐ 48-hrs ☒
7 Compute design capture volume, DCV (ft^3): 107,593 *DCV = 1/12 * [Item 1* Item 3 *Item 5 * C_2], where C_2 is a function of drawdown rate (24-hr = 1.582; 48-hr = 1.963)* *Compute separate DCV for each outlet from the project site per schematic drawn in Form 3-1 Item 2*		

Form 4.2-1 LID BMP Performance Criteria for Design Capture Volume (DA 4)		
1 Project area **DA 4 DMA A** (ft^2): 2,874,524 (65.99 ac.)	**2** Imperviousness after applying preventative site design practices (Imp%): 95%	**3** Runoff Coefficient (Rc): 0.807 *$R_c = 0.858(Imp\%)^{\wedge 3}-0.78(Imp\%)^{\wedge 2}+0.774(Imp\%)+0.04$*
4 Determine 1-hour rainfall depth for a 2-year return period $P_{2yr\text{-}1hr}$ (in): 0.333 http://hdsc.nws.noaa.gov/hdsc/pfds/sa/sca_pfds.html		
5 Compute P_6, Mean 6-hr Precipitation (inches): 0.412 *P_6 = Item 4 *C_1, where C_1 is a function of site climatic region specified in Form 3-1 Item 1 (Desert = 1.2371)*		
6 Drawdown Rate *Use 48 hours as the default condition. Selection and use of the 24 hour drawdown time condition is subject to approval by the local jurisdiction. The necessary BMP footprint is a function of drawdown time. While shorter drawdown times reduce the performance criteria for LID BMP design capture volume, the depth of water that can be stored is also reduced.*		24-hrs ☐ 48-hrs ☒
7 Compute design capture volume, DCV (ft^3): 156,320 *DCV = 1/12 * [Item 1* Item 3 *Item 5 * C_2], where C_2 is a function of drawdown rate (24-hr = 1.582; 48-hr = 1.963)* *Compute separate DCV for each outlet from the project site per schematic drawn in Form 3-1 Item 2*		

Form 4.2-2 Summary of Hydromodification Assessment

Is the change in post- and pre- condition flows captured on-site?: Yes ☐ No ☐

If "Yes", then complete Hydromodification assessment of site hydrology for 10yr storm event using Forms 4.2-3 through 4.2-5 and insert results below *(Forms 4.2-3 through 4.2-5 may be replaced by computer software analysis based on the San Bernardino County Hydrology Manual- Addendum 1)*

If "No," then proceed to Section 4.3 BMP Selection and Sizing

Condition	Runoff Volume (ft^3)	Time of Concentration (min)	Peak Runoff (cfs)
Pre-developed	**1** 481,896 *Form 4.2-3 Item 12*	**2** 30.0 *Form 4.2-4 Item 13*	**3** 108.2 *Form 4.2-5 Item 10*
Post-developed	**4** 1,229,485 *Form 4.2-3 Item 13*	**5** 10.0 *Form 4.2-4 Item 14*	**6** 311.7 *Form 4.2-5 Item 14*
Difference	**7** 747,589 *Item 4 – Item 1*	**8** 20.0 *Item 2 – Item 5*	**9** 203.5 *Item 6 – Item 3*
Difference (as % of pre-developed)	**10** 155% *Item 7 / Item 1*	**11** 67% *Item 8 / Item 2*	**12** 188% *Item 9 / Item 3*

See next page for HCOC summary. Refer to the computer software analysis based on the San Bernardino County Hydrology Manual in Attachment G of this WQMP report.

Form 4.2-3 Hydromodification Assessment for Runoff Volume

Weighted Curve Number Determination for: Pre-developed DA	DMA A	DMA B	DMA C	DMA D	DMA E	DMA F	DMA G	DMA H
1a Land Cover type								
2a Hydrologic Soil Group (HSG)								
3a DMA Area, ft^2 *sum of areas of DMA should equal area of DA*								
4a Curve Number (CN) *use Items 1 and 2 to select the appropriate CN from Appendix C-2 of the TGD for WQMP*								
Weighted Curve Number Determination for: Post-developed DA	DMA A	DMA B	DMA C	DMA D	DMA E	DMA F	DMA G	DMA H
1b Land Cover type								
2b Hydrologic Soil Group (HSG)								
3b DMA Area, ft^2 *sum of areas of DMA should equal area of DA*								
4b Curve Number (CN) *use Items 5 and 6 to select the appropriate CN from Appendix C-2 of the TGD for WQMP*								

5 Pre-Developed area-weighted CN:	**7** Pre-developed soil storage capacity, S (in): *S = (1000 / Item 5) - 10*	**9** Initial abstraction, I_a (in): *I_a = 0.2 * Item 7*
6 Post-Developed area-weighted CN:	**8** Post-developed soil storage capacity, S (in):	**10** Initial abstraction, I_a (in):

11 Precipitation for 10 yr, 24 hr storm (in):
Go to: http://hdsc.nws.noaa.gov/hdsc/pfds/sa/sca_pfds.html

12 Pre-developed Volume (ft^3):
*V_{pre} =(1 / 12) * (Item sum of Item 3) * [(Item 11 – Item 9)^2 / ((Item 11 – Item 9 + Item 7)*

13 Post-developed Volume (ft^3):
*V_{pre} =(1 / 12) * (Item sum of Item 3) * [(Item 11 – Item 10)^2 / ((Item 11 – Item 10 + Item 8)*

14 Volume Reduction needed to meet hydromodification requirement, (ft^3):
*Vhydro = (Item 13 * 0.95) – Item 12*

Form 4.2-4 Hydromodification Assessment for Time of Concentration

Compute time of concentration for pre and post developed conditions for each DA *(For projects using the Hydrology Manual complete the form below)*

Variables	Pre-developed DA1 *Use additional forms if there are more than 4 DMA*				Post-developed DA1 *Use additional forms if there are more than 4 DMA*			
	DMA A	DMA B	DMA C	DMA D	DMA A	DMA B	DMA C	DMA D
1 Length of flowpath (ft) *Use Form 3-2 Item 5 for pre-developed condition*								
2 Change in elevation (ft)								
3 Slope (ft/ft), S_o *= Item 2 / Item 1*								
4 Land cover								
5 Initial DMA Time of Concentration (min) *Appendix C-1 of the TGD for WQMP*								
6 Length of conveyance from DMA outlet to project site outlet (ft) *May be zero if DMA outlet is at project site outlet*								
7 Cross-sectional area of channel (ft^2)								
8 Wetted perimeter of channel (ft)								
9 Manning's roughness of channel (n)								
10 Channel flow velocity (ft/sec) V_{fps} *= (1.49 / Item 9) * (Item 7/Item 8)^0.67 * (Item 3)^0.5*								
11 Travel time to outlet (min) T_t *= Item 6 / (Item 10 * 60)*								
12 Total time of concentration (min) T_c *= Item 5 + Item 11*								

13 Pre-developed time of concentration (min): *Minimum of Item 12 pre-developed DMA*

14 Post-developed time of concentration (min): *Minimum of Item 12 post-developed DMA*

15 Additional time of concentration needed to meet hydromodification requirement (min): $T_{C\text{-}Hydro}$ *= (Item 13 * 0.95) – Item 14*

Form 4.2-5 Hydromodification Assessment for Peak Runoff

Compute peak runoff for pre- and post-developed conditions

Variables		Pre-developed DA to Project Outlet (*Use additional forms if more than 3 DMA)*			Post-developed DA to Project Outlet (*Use additional forms if more than 3 DMA)*		
		DMA A	DMA B	DMA C	DMA A	DMA B	DMA C
1 Rainfall Intensity for storm duration equal to time of concentration *I_{peak} = 10^(LOG Form 4.2-1 Item 4 - 0.7 LOG Form 4.2-4 Item 5 /60)*							
2 Drainage Area of each DMA (Acres) *For DMA with outlet at project site outlet, include upstream DMA (Using example schematic in Form 3-1, DMA A will include drainage from DMA C)*							
3 Ratio of pervious area to total area *For DMA with outlet at project site outlet, include upstream DMA (Using example schematic in Form 3-1, DMA A will include drainage from DMA C)*							
4 Pervious area infiltration rate (in/hr) *Use pervious area CN and antecedent moisture condition with Appendix C-3 of the TGD for WQMP*							
5 Maximum loss rate (in/hr) *F_m = Item 3 * Item 4* *Use area-weighted F_m from DMA with outlet at project site outlet, include upstream DMA (Using example schematic in Form 3-1, DMA A will include drainage from DMA C)*							
6 Peak Flow from DMA (cfs) *Q_p =Item 2 * 0.9 * (Item 1 - Item 5)*							
7 Time of concentration adjustment factor for other DMA to site discharge point *Form 4.2-4 Item 12 DMA / Other DMA upstream of site discharge point (If ratio is greater than 1.0, then use maximum value of 1.0)*	DMA A	*n/a*			*n/a*		
	DMA B		*n/a*			*n/a*	
	DMA C			*n/a*			*n/a*

8 Pre-developed Q_p at T_c for DMA A: *Q_p = Item 6_{DMAA} + [Item 6_{DMAB} * (Item 1_{DMAA} - Item 5_{DMAB})/(Item 1_{DMAB} - Item 5_{DMAB})* Item $7_{DMAA/2}$] + [Item 6_{DMAC} * (Item 1_{DMAA} - Item 5_{DMAC})/(Item 1_{DMAC} - Item 5_{DMAC})* Item $7_{DMAA/3}$]*	**9** Pre-developed Q_p at T_c for DMA B: *Q_p = Item 6_{DMAB} + [Item 6_{DMAA} * (Item 1_{DMAB} - Item 5_{DMAA})/(Item 1_{DMAA} - Item 5_{DMAA})* Item $7_{DMAB/1}$] + [Item 6_{DMAC} * (Item 1_{DMAB} - Item 5_{DMAC})/(Item 1_{DMAC} - Item 5_{DMAC})* Item $7_{DMAB/3}$]*	**10** Pre-developed Q_p at T_c for DMA C: *Q_p = Item 6_{DMAC} + [Item 6_{DMAA} * (Item 1_{DMAC} - Item 5_{DMAA})/(Item 1_{DMAA} - Item 5_{DMAA})* Item $7_{DMAC/1}$] + [Item 6_{DMAB} * (Item 1_{DMAC} - Item 5_{DMAB})/(Item 1_{DMAB} - Item 5_{DMAB})* Item $7_{DMAC/2}$]*
10 Peak runoff from pre-developed condition confluence analysis (cfs): *Maximum of Item 8, 9, and 10 (including additional forms as needed)*		
11 Post-developed Q_p at T_c for DMA A: *Same as Item 8 for post-developed values*	**12** Post-developed Q_p at T_c for DMA B: *Same as Item 9 for post-developed values*	**13** Post-developed Q_p at T_c for DMA C: *Same as Item 10 for post-developed values*
14 Peak runoff from post-developed condition confluence analysis (cfs): *Maximum of Item 11, 12, and 13 (including additional forms as needed)*		
15 Peak runoff reduction needed to meet Hydromodification Requirement (cfs): *$Q_{p\text{-}hydro}$ = (Item 14 * 0.95) – Item 10*		

4.3 BMP Selection and Sizing

Complete the following forms for each project site DA to document that the proposed treatment (LID/Bioretention) BMPs conform to the project DCV developed to meet performance criteria specified in the Phase II Small MS4 Permit (WQMP Template Section 4.2). For the LID DCV, the forms are ordered according to hierarchy of BMP selection as required by the Phase II Small MS4 Permit (see Section 5.3 in the TGD for WQMP). The forms compute the following for on-site LID BMP:

- Site Design BMPs (Form 4.3-2)
- Retention and Infiltration BMPs (Form 4.3-3) or
- Biotreatment BMPs (Form 4.3-4).

> Please note that the selected BMPs may also be used as dual purpose for on-site, hydromodification mitigation and management.

At the end of each form, additional fields facilitate the determination of the extent of mitigation provided by the specific BMP category, allowing for use of the next category of BMP in the hierarchy, if necessary.

The first step in the analysis, using Section 5.3.2 of the TGD for WQMP, is to complete Forms 4.3-1 and 4.3-3) to determine if retention and infiltration BMPs are infeasible for the project. For each feasibility criterion in Form 4.3-1, if the answer is "Yes," provide all study findings that includes relevant calculations, maps, data sources, etc. used to make the determination of infeasibility.

Next, complete Form 4.3-2 to determine the feasibility of applicable Site Design BMPs, and, if their implementation is feasible, the extent of mitigation of the DCV.

If no site constraints exist that would limit the type of BMP to be implemented in a DA, evaluate the use of combinations of LID BMPs, including all applicable Site Design BMPs to maximize on-site retention of the DCV. If no combination of BMP can mitigate the entire DCV, implement the single BMP type, or combination of BMP types, that maximizes on-site retention of the DCV within the minimum effective area.

If the combinations of site design, retention and/or infiltration BMPs is unable to mitigate the entire DCV, then the remainder of the volume-based performance criteria that cannot be achieved with site design, retention and/or infiltration BMPs must be managed through biotreatment BMPs. If biotreatment BMPs are used, then they must be sized to provide equivalent effectiveness based on Template Section 4.3.4.

4.3.1 Exceptions to Requirements for Bioretention Facilities

Contingent on a demonstration that use of bioretention or a facility of equivalent effectiveness is infeasible, other types of biotreatment or media filters (such as tree-box-type biofilters or in-vault media filters) may be used for the following categories of Regulated Projects:

1) Projects creating or replacing an acre or less of impervious area, and located in a designated pedestrian-oriented commercial district (i.e., smart growth projects), and having at least 85% of the entire project site covered by permanent structures;

2) Facilities receiving runoff solely from existing (pre-project) impervious areas; and

3) Historic sites, structures or landscapes that cannot alter their original configuration in order to maintain their historic integrity.

Form 4.3-1 Infiltration BMP Feasibility

Feasibility Criterion – Complete evaluation for each DA on the Project Site

[1] Would infiltration BMP pose significant risk for groundwater related concerns? Yes ☐ No ☒
Refer to Section 5.3.2.1 of the TGD for WQMP

If Yes, Provide basis: (attach)

[2] Would installation of infiltration BMP significantly increase the risk of geotechnical hazards? Yes ☐ No ☒
(Yes, if the answer to any of the following questions is yes, as established by a geotechnical expert):

- The location is less than 50 feet away from slopes steeper than 15 percent
- The location is less than ten feet from building foundations or an alternative setback.
- A study certified by a geotechnical professional or an available watershed study determines that stormwater infiltration would result in significantly increased risks of geotechnical hazards.

If Yes, Provide basis: (attach)

[3] Would infiltration of runoff on a Project site violate downstream water rights? Yes ☐ No ☒

If Yes, Provide basis: (attach)

[4] Is proposed infiltration facility located on hydrologic soil group (HSG) D soils or does the site geotechnical investigation indicate presence of soil characteristics, which support categorization as D soils? Yes ☐ No ☒

If Yes, Provide basis: (attach)

[5] Is the design infiltration rate, after accounting for safety factor of 2.0, below proposed facility less than 0.3 in/hr (accounting for soil amendments)? Yes ☐ No ☒

If Yes, Provide basis: (attach)

[6] Would on-site infiltration or reduction of runoff over pre-developed conditions be partially or fully inconsistent with watershed management strategies as defined in the WAP, or impair beneficial uses? Yes ☐ No ☒
See Section 3.5 of the TGD for WQMP and WAP

If Yes, Provide basis: (attach)

[7] Any answer from Item 1 through Item 3 is "Yes": Yes ☐ No ☒
If yes, infiltration of any volume is not feasible onsite. Proceed to Form 4.3-4, Selection and Evaluation of Biotreatment BMP . If no, then proceed to Item 8 below.

[8] Any answer from Item 4 through Item 6 is "Yes": Yes ☐ No ☒
If yes, infiltration is permissible but is not required to be considered. Proceed to Form 4.3-2, Site Design BMP.
If no, then proceed to Item 9, below.

[9] All answers to Item 1 through Item 6 are "No":
Infiltration of the full DCV is potentially feasible, LID infiltration BMP must be designed to infiltrate the full DCV to the MEP.
Proceed to Form 4.3-2, Site Design BMPs.

4.3.2 Site Design BMP

Section E.12.e. of the Small Phase II MS4 Permit emphasizes the use of LID preventative measures; and the use of Site Design BMPs reduces the portion of the DCV that must be addressed in downstream BMPs. Therefore, all applicable Site Design shall be provided except where they are mutually exclusive with each other, or with other BMPs. Mutual exclusivity may result from overlapping BMP footprints such that either would be potentially feasible by itself, but both could not be implemented. Please note that while there are no numeric standards regarding the use of Site Design BMPs. If a project cannot feasibly meet BMP sizing requirements or cannot fully address hydromodification, feasibility of all applicable Site Design BMPs must be part of demonstrating that the BMP system has been designed to retain the maximum feasible portion of the DCV. Complete Form 4.3-2 to identify and calculate estimated retention volume from implementing site design BMP. Refer to Section 5.4 in the TGD for more detailed guidance.

Form 4.3-2 Site Design BMPs

1 Implementation of Impervious Area Dispersion BMP (i.e. routing runoff from impervious to pervious areas), excluding impervious areas planned for routing to on-lot infiltration BMP: Yes ☐ No ☒ *If yes, complete Items 2-5; If no, proceed to Item 6*	DA DMA BMP Type	DA DMA BMP Type	DA DMA BMP Type *(Use additional forms for more BMPs)*
2 Total impervious area draining to pervious area (ft^2)			
3 Ratio of pervious area receiving runoff to impervious area			
4 Retention volume achieved from impervious area dispersion (ft^3) *V = Item2 * Item 3 * (0.5/12), assuming retention of 0.5 inches of runoff*			
5 Sum of retention volume achieved from impervious area dispersion (ft^3):		$V_{retention}$ *=Sum of Item 4 for all BMPs*	
6 Implementation of Localized On-lot Infiltration BMPs (e.g. on-lot rain gardens): Yes ☐ No ☒ *If yes, complete Items 7-13 for aggregate of all on-lot infiltration BMP in each DA; If no, proceed to Item 14*	DA DMA BMP Type	DA DMA BMP Type	DA DMA BMP Type *(Use additional forms for more BMPs)*
7 Ponding surface area (ft^2)			
8 Ponding depth (ft) (min. 0.5 ft.)			
9 Surface area of amended soil/gravel (ft^2)			
10 Average depth of amended soil/gravel (ft) (min. 1 ft.)			
11 Average porosity of amended soil/gravel			
12 Retention volume achieved from on-lot infiltration (ft^3) $V_{retention}$ *= (Item 7 *Item 8) + (Item 9 * Item 10 * Item 11)*			

Form 4.3-2 cont. Site Design BMPs

13 Runoff volume retention from on-lot infiltration (ft^3): $V_{retention}$ *=Sum of Item 12 for all BMPs*			
14 Implementation of Street Trees: Yes ☐ No ☒ *If yes, complete Items 14-18. If no, proceed to Item 19*	DA DMA BMP Type	DA DMA BMP Type	DA DMA BMP Type *(Use additional forms for more BMPs)*
15 Number of Street Trees			
16 Average canopy cover over impervious area (ft^2)			
17 Runoff volume retention from street trees (ft^3) $V_{retention}$ *= Item 15 * Item 16 * (0.05/12) assume runoff retention of 0.05 inches*			
18 Runoff volume retention from street tree BMPs (ft^3): $V_{retention}$ *= Sum of Item 17 for all BMPs*			
19 Total Retention Volume from Site Design BMPs: 0 *Sum of Items 5, 13 and 18*			

4.3.3 Infiltration BMPs

Use Form 4.3-3 to compute on-site retention of runoff from proposed retention and infiltration BMPs. Volume retention estimates are sensitive to the percolation rate used, which determines the amount of runoff that can be infiltrated within the specified drawdown time. The infiltration safety factor reduces field measured percolation to account for potential inaccuracy associated with field measurements, declining BMP performance over time, and compaction during construction. Appendix C of the TGD for WQMP provides guidance on estimating an appropriate safety factor to use in Form 4.3-3.

If site constraints limit the use of BMPs to a single type and implementation of retention and infiltration BMPs mitigate no more than 40% of the DCV, then they are considered infeasible and the Project Proponent may evaluate the effectiveness of BMPs lower in the LID hierarchy of use (Section 5.5 of the TGD for WQMP)

If implementation of infiltrations BMPs is feasible as determined using Form 4.3-1, then LID infiltration BMPs shall be implemented to the MEP (section 4.1 of the TGD for WQMP).

4.3.3.1 Allowed Variations for Special Site Conditions

The bioretention system design parameters of this Section may be adjusted for the following special site conditions:

1) Facilities located within 10 feet of structures or other potential geotechnical hazards established by the geotechnical expert for the project may incorporate an impervious cutoff wall between the bioretention facility and the structure or other geotechnical hazard.

2) Facilities with documented high concentrations of pollutants in underlying soil or groundwater, facilities located where infiltration could contribute to a geotechnical hazard, and facilities located on elevated plazas or other structures may incorporate an impervious liner and may locate the underdrain discharge at the bottom of the subsurface drainage/storage layer (this configuration is commonly known as a “flow-through planter”).

3) Facilities located in areas of high groundwater, highly infiltrative soils or where connection of underdrain to a surface drain or to a subsurface storm drain are infeasible, may omit the underdrain.

4) Facilities serving high-risk areas such as fueling stations, truck stops, auto repairs, and heavy industrial sites may be required to provide additional treatment to address pollutants of concern unless these high-risk areas are isolated from storm water runoff or bioretention areas with little chance of spill migration.

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Form 4.3-3 Infiltration LID BMP - including underground BMPs (DA 1)

1 Remaining LID DCV not met by site design BMP (ft^3): 145,021 *V_{unmet} = Form 4.2-1 Item 7 - Form 4.3-2 Item19*

BMP Type *Use columns to the right to compute runoff volume retention from proposed infiltration BMP (select BMP from Table 5-4 in TGD for WQMP) - Use additional forms for more BMPs*	**DA 1 DMA A BMP Type: Infiltration Basin #4**	**n/a**	**n/a**
2 Infiltration rate of underlying soils (in/hr) *See Section 5.4.2 and Appendix D of the TGD for WQMP for minimum requirements for assessment methods*	6.30		
3 Infiltration safety factor *See TGD Section 5.4.2 and Appendix D*	2.00		
4 Design percolation rate (in/hr) *P_{design} = Item 2 / Item 3*	3.15		
5 Ponded water drawdown time (hr) *Copy Item 6 in Form 4.2-1*	48		
6 Maximum ponding depth (ft) *BMP specific, see Table 5-4 of the TGD for WQMP for BMP design details*	3.70		
7 Ponding Depth (ft) *d_{BMP} = Minimum of (1/12*Item 4*Item 5) or Item 6*	3.70		
8 Infiltrating surface area, SA_{BMP} (ft^2) *the lesser of the area needed for infiltration of full DCV or minimum space requirements from Table 5.7 of the TGD for WQMP*	59,880		
9 Amended soil depth, d_{media} (ft) *Only included in certain BMP types, see Table 5-4 in the TGD for WQMP for reference to BMP design details*	n/a		
10 Amended soil porosity	n/a		
11 Gravel depth, d_{media} (ft) *Only included in certain BMP types, see Table 5-4 of the TGD for WQMP for BMP design details*	n/a		
12 Gravel porosity	n/a		
13 Duration of storm as basin is filling (hrs) *Typical ~ 3hrs*	3		
14 Above Ground Retention Volume (ft^3) *$V_{retention}$ = Item 8 * [Item7 + (Item 9 * Item 10) + (Item 11 * Item 12) + (Item 13 * (Item 4 / 12))]*	257,792 (see Attachment B)		
15 Underground Retention Volume (ft^3) *Volume determined using manufacturer's specifications and calculations*	n/a		

16 Total Retention Volume from LID Infiltration BMPs: 257,792 *(Sum of Items 14 and 15 for all infiltration BMP included in plan)*

17 Fraction of DCV achieved with infiltration BMP: 177.8% *Retention% = Item 16 / Form 4.2-1 Item 7*

18 Is full LID DCV retained onsite with combination of hydrologic source control and LID retention/infiltration BMPs? Yes ☒ No ☐

If yes, demonstrate conformance using Form 4.3-10; If no, then reduce Item 3, Factor of Safety to 2.0 and increase Item 8, Infiltrating Surface Area, such that the portion of the site area used for retention and infiltration BMPs equals or exceeds the minimum effective area thresholds (Table 5-7 of the TGD for WQMP) for the applicable category of development and repeat all above calculations.

Form 4.3-3 Infiltration LID BMP - including underground BMPs (DA 2)

1 Remaining LID DCV not met by site design BMP (ft^3): 70,710 *V_{unmet} = Form 4.2-1 Item 7 - Form 4.3-2 Item19*

BMP Type *Use columns to the right to compute runoff volume retention from proposed infiltration BMP (select BMP from Table 5-4 in TGD for WQMP) - Use additional forms for more BMPs*	**DA 2 DMA A BMP Type: Infiltration Basin #3**	**n/a**	**n/a**
2 Infiltration rate of underlying soils (in/hr) *See Section 5.4.2 and Appendix D of the TGD for WQMP for minimum requirements for assessment methods*	1.20		
3 Infiltration safety factor *See TGD Section 5.4.2 and Appendix D*	2.00		
4 Design percolation rate (in/hr) *P_{design} = Item 2 / Item 3*	0.60		
5 Ponded water drawdown time (hr) *Copy Item 6 in Form 4.2-1*	48		
6 Maximum ponding depth (ft) *BMP specific, see Table 5-4 of the TGD for WQMP for BMP design details*	2.40		
7 Ponding Depth (ft) *d_{BMP} = Minimum of (1/12*Item 4*Item 5) or Item 6*	2.40		
8 Infiltrating surface area, SA_{BMP} (ft^2) *the lesser of the area needed for infiltration of full DCV or minimum space requirements from Table 5.7 of the TGD for WQMP*	34,726		
9 Amended soil depth, d_{media} (ft) *Only included in certain BMP types, see Table 5-4 in the TGD for WQMP for reference to BMP design details*	n/a		
10 Amended soil porosity	n/a		
11 Gravel depth, d_{media} (ft) *Only included in certain BMP types, see Table 5-4 of the TGD for WQMP for BMP design details*	n/a		
12 Gravel porosity	n/a		
13 Duration of storm as basin is filling (hrs) *Typical ~ 3hrs*	3		
14 Above Ground Retention Volume (ft^3) *$V_{retention}$ = Item 8 * [Item7 + (Item 9 * Item 10) + (Item 11 * Item 12) + (Item 13 * (Item 4 / 12))]*	92,558 (See Attachment B)		
15 Underground Retention Volume (ft^3) *Volume determined using manufacturer's specifications and calculations*	n/a		

16 Total Retention Volume from LID Infiltration BMPs: 92,558 *(Sum of Items 14 and 15 for all infiltration BMP included in plan)*

17 Fraction of DCV achieved with infiltration BMP: 130.9% *Retention% = Item 16 / Form 4.2-1 Item 7*

18 Is full LID DCV retained onsite with combination of hydrologic source control and LID retention/infiltration BMPs? Yes ☒ No ☐

If yes, demonstrate conformance using Form 4.3-10; If no, then reduce Item 3, Factor of Safety to 2.0 and increase Item 8, Infiltrating Surface Area, such that the portion of the site area used for retention and infiltration BMPs equals or exceeds the minimum effective area thresholds (Table 5-7 of the TGD for WQMP) for the applicable category of development and repeat all above calculations.

Form 4.3-3 Infiltration LID BMP - including underground BMPs (DA 3)

1 Remaining LID DCV not met by site design BMP (ft^3): 107,593 *V_{unmet} = Form 4.2-1 Item 7 - Form 4.3-2 Item19*

BMP Type *Use columns to the right to compute runoff volume retention from proposed infiltration BMP (select BMP from Table 5-4 in TGD for WQMP) - Use additional forms for more BMPs*	**DA 3 DMA A BMP Type: Infiltration Basin #2**	**n/a**	**n/a**
2 Infiltration rate of underlying soils (in/hr) *See Section 5.4.2 and Appendix D of the TGD for WQMP for minimum requirements for assessment methods*	4.90		
3 Infiltration safety factor *See TGD Section 5.4.2 and Appendix D*	2.00		
4 Design percolation rate (in/hr) *P_{design} = Item 2 / Item 3*	2.45		
5 Ponded water drawdown time (hr) *Copy Item 6 in Form 4.2-1*	48		
6 Maximum ponding depth (ft) *BMP specific, see Table 5-4 of the TGD for WQMP for BMP design details*	4.40		
7 Ponding Depth (ft) *d_{BMP} = Minimum of (1/12*Item 4*Item 5) or Item 6*	4.40		
8 Infiltrating surface area, SA_{BMP} (ft^2) *the lesser of the area needed for infiltration of full DCV or minimum space requirements from Table 5.7 of the TGD for WQMP*	35,171		
9 Amended soil depth, d_{media} (ft) *Only included in certain BMP types, see Table 5-4 in the TGD for WQMP for reference to BMP design details*	n/a		
10 Amended soil porosity	n/a		
11 Gravel depth, d_{media} (ft) *Only included in certain BMP types, see Table 5-4 of the TGD for WQMP for BMP design details*	n/a		
12 Gravel porosity	n/a		
13 Duration of storm as basin is filling (hrs) *Typical ~ 3hrs*	3		
14 Above Ground Retention Volume (ft^3) *$V_{retention}$ = Item 8 * [Item7 + (Item 9 * Item 10) + (Item 11 * Item 12) + (Item 13 * (Item 4 / 12))]*	193,551 (See Attachment B)		
15 Underground Retention Volume (ft^3) *Volume determined using manufacturer's specifications and calculations*	n/a		

16 Total Retention Volume from LID Infiltration BMPs: 193,551 *(Sum of Items 14 and 15 for all infiltration BMP included in plan)*

17 Fraction of DCV achieved with infiltration BMP: 178.9% *Retention% = Item 16 / Form 4.2-1 Item 7*

18 Is full LID DCV retained onsite with combination of hydrologic source control and LID retention/infiltration BMPs? Yes ☒ No ☐

If yes, demonstrate conformance using Form 4.3-10; If no, then reduce Item 3, Factor of Safety to 2.0 and increase Item 8, Infiltrating Surface Area, such that the portion of the site area used for retention and infiltration BMPs equals or exceeds the minimum effective area thresholds (Table 5-7 of the TGD for WQMP) for the applicable category of development and repeat all above calculations.

Form 4.3-3 Infiltration LID BMP - including underground BMPs (DA 4)

1 Remaining LID DCV not met by site design BMP (ft^3): 156,320 *V_{unmet} = Form 4.2-1 Item 7 - Form 4.3-2 Item19*

BMP Type *Use columns to the right to compute runoff volume retention from proposed infiltration BMP (select BMP from Table 5-4 in TGD for WQMP) - Use additional forms for more BMPs*	**DA 4 DMA A BMP Type: Infiltration Basin #1**	**n/a**	**n/a**
2 Infiltration rate of underlying soils (in/hr) *See Section 5.4.2 and Appendix D of the TGD for WQMP for minimum requirements for assessment methods*	5.9		
3 Infiltration safety factor *See TGD Section 5.4.2 and Appendix D*	2.00		
4 Design percolation rate (in/hr) *P_{design} = Item 2 / Item 3*	2.95		
5 Ponded water drawdown time (hr) *Copy Item 6 in Form 4.2-1*	48		
6 Maximum ponding depth (ft) *BMP specific, see Table 5-4 of the TGD for WQMP for BMP design details*	4.20		
7 Ponding Depth (ft) *d_{BMP} = Minimum of (1/12*Item 4*Item 5) or Item 6*	4.20		
8 Infiltrating surface area, SA_{BMP} (ft^2) *the lesser of the area needed for infiltration of full DCV or minimum space requirements from Table 5.7 of the TGD for WQMP*	51,084		
9 Amended soil depth, d_{media} (ft) *Only included in certain BMP types, see Table 5-4 in the TGD for WQMP for reference to BMP design details*	n/a		
10 Amended soil porosity	n/a		
11 Gravel depth, d_{media} (ft) *Only included in certain BMP types, see Table 5-4 of the TGD for WQMP for BMP design details*	n/a		
12 Gravel porosity	n/a		
13 Duration of storm as basin is filling (hrs) *Typical ~ 3hrs*	3		
14 Above Ground Retention Volume (ft^3) *$V_{retention}$ = Item 8 * [Item7 + (Item 9 * Item 10) + (Item 11 * Item 12) + (Item 13 * (Item 4 / 12))]*	271,960 (See Attachment B)		
15 Underground Retention Volume (ft^3) *Volume determined using manufacturer's specifications and calculations*	n/a		

16 Total Retention Volume from LID Infiltration BMPs: 271,960 *(Sum of Items 14 and 15 for all infiltration BMP included in plan)*

17 Fraction of DCV achieved with infiltration BMP: 174.0% *Retention% = Item 16 / Form 4.2-1 Item 7*

18 Is full LID DCV retained onsite with combination of hydrologic source control and LID retention/infiltration BMPs? Yes ☒ No ☐

If yes, demonstrate conformance using Form 4.3-10; If no, then reduce Item 3, Factor of Safety to 2.0 and increase Item 8, Infiltrating Surface Area, such that the portion of the site area used for retention and infiltration BMPs equals or exceeds the minimum effective area thresholds (Table 5-7 of the TGD for WQMP) for the applicable category of development and repeat all above calculations.

4.3.4 Biotreatment BMP

Biotreatment BMPs may be considered if the full LID DCV cannot be met by maximizing retention and infiltration. A key consideration when using biotreatment BMP is the effectiveness of the proposed BMP in addressing the pollutants of concern for the project (see Table 5-5 of the TGD for WQMP).

Use Form 4.3-4 to summarize the potential for volume based and/or flow based biotreatment options to biotreat the remaining unmet LID DCV. Biotreatment computations are included as follows:

- Use Form 4.3-5 to compute biotreatment in small volume based biotreatment BMP (e.g. bioretention w/underdrains);
- Use Form 4.3-6 to compute biotreatment in large volume based biotreatment BMP (e.g. constructed wetlands);
- Use Form 4.3-7 to compute sizing criteria for flow-based biotreatment BMP (e.g. bioswales)

Form 4.3-4 Selection and Evaluation of Biotreatment BMP

1 Remaining LID DCV not met by site design , or infiltration, BMP for potential biotreatment (ft^3): *Form 4.2-1 Item 7 - Form 4.3-2 Item 19 – Form 4.3-3 Item 16*	List pollutants of concern *Copy from Form 2.3-1.*	
2 Biotreatment BMP Selected *(Select biotreatment BMP(s) necessary to ensure all pollutants of concern are addressed through Unit Operations and Processes, described in Table 5-5 of the TGD for WQMP)*	Volume-based biotreatment *Use Forms 4.3-5 and 4.3-6 to compute treated volume*	Flow-based biotreatment *Use Form 4.3-7 to compute treated flow*
	☐ Bioretention with underdrain ☐ Planter box with underdrain ☐ Constructed wetlands ☐ Wet extended detention ☐ Dry extended detention	☐ Vegetated swale ☐ Vegetated filter strip ☐ Proprietary biotreatment
3 Volume biotreated in volume based biotreatment BMP (ft^3): *Form 4.3-5 Item 15 + Form 4.3-6 Item 13*	**4** Compute remaining LID DCV with implementation of volume based biotreatment BMP (ft^3): *Item 1 – Item 3*	**5** Remaining fraction of LID DCV for sizing flow based biotreatment BMP: % *Item 4 / Item 1*
6 Flow-based biotreatment BMP capacity provided (cfs): *Use Figure 5-2 of the TGD for WQMP to determine flow capacity required to provide biotreatment of remaining percentage of unmet LID DCV (Item 5), for the project's precipitation zone (Form 3-1 Item 1)*		
7 Metrics for MEP determination: • Provided a WQMP with the portion of site area used for suite of LID BMP equal to minimum thresholds in Table 5-7 of the TGD for WQMP for the proposed category of development: ☐ *If maximized on-site retention BMPs is feasible for partial capture, then LID BMP implementation must be optimized to retain and infiltrate the maximum portion of the DCV possible within the prescribed minimum effective area. The remaining portion of the DCV shall then be mitigated using biotreatment BMP.*		

Form 4.3-5 Volume Based Biotreatment – Bioretention and Planter Boxes with Underdrains

Biotreatment BMP Type *(Bioretention w/underdrain, planter box w/underdrain, other comparable BMP)*	DA DMA BMP Type	DA DMA BMP Type	DA DMA BMP Type *(Use additional forms for more BMPs)*
1 Pollutants addressed with BMP *List all pollutant of concern that will be effectively reduced through specific Unit Operations and Processes described in Table 5-5 of the TGD for WQMP*			
2 Amended soil infiltration rate *Typical ~ 5.0*			
3 Amended soil infiltration safety factor *Typical ~ 2.0*			
4 Amended soil design percolation rate (in/hr) P_{design} *= Item 2 / Item 3*			
5 Ponded water drawdown time (hr) *Copy Item 6 from Form 4.2-1*			
6 Maximum ponding depth (ft) *see Table 5-6 of the TGD for WQMP for reference to BMP design details*			
7 Ponding Depth (ft) d_{BMP} *= Minimum of (1/12 * Item 4 * Item 5) or Item 6*			
8 Amended soil surface area (ft^2)			
9 Amended soil depth (ft) *see Table 5-6 of the TGD for WQMP for reference to BMP design details*			
10 Amended soil porosity, *n*			
11 Gravel depth (ft) *see Table 5-6 of the TGD for WQMP for reference to BMP design details*			
12 Gravel porosity, *n*			
13 Duration of storm as basin is filling (hrs) *Typical ~ 3hrs*			
14 Biotreated Volume (ft^3) $V_{biotreated}$ *= Item 8 * [(Item 7/2) + (Item 9 * Item 10) +(Item 11 * Item 12) + (Item 13 * (Item 4 / 12))]*			
15 Total biotreated volume from bioretention and/or planter box with underdrains BMP: *Sum of Item 14 for all volume-based BMPs included in this form*			

Form 4.3-6 Volume Based Biotreatment – Constructed Wetlands and Extended Detention

Biotreatment BMP Type *Constructed wetlands, extended wet detention, extended dry detention, or other comparable proprietary BMP. If BMP includes multiple modules (e.g. forebay and main basin), provide separate estimates for storage and pollutants treated in each module.*	DA DMA BMP Type		DA DMA BMP Type *(Use additional forms for more BMPs)*	
	Forebay	Basin	Forebay	Basin
1 Pollutants addressed with BMP forebay and basin *List all pollutant of concern that will be effectively reduced through specific Unit Operations and Processes described in Table 5-5 of the TGD for WQMP*				
2 Bottom width (ft)				
3 Bottom length (ft)				
4 Bottom area (ft^2) A_{bottom} = *Item 2 * Item 3*				
5 Side slope (ft/ft)				
6 Depth of storage (ft)				
7 Water surface area (ft^2) $A_{surface}$ =*(Item 2 + (2 * Item 5 * Item 6)) * (Item 3 + (2 * Item 5 * Item 6))*				
8 Storage volume (ft^3) *For BMP with a forebay, ensure fraction of total storage is within ranges specified in BMP specific fact sheets, see Table 5-6 of the TGD for WQMP for reference to BMP design details* V =*Item 6 / 3 * [Item 4 + Item 7 + (Item 4 * Item 7)^0.5]*				
9 Drawdown Time (hrs) *Copy Item 6 from Form 2.1*				
10 Outflow rate (cfs) Q_{BMP} = *(Item* $8_{forebay}$ + Item 8_{basin}*) / (Item 9 * 3600)*				
11 Duration of design storm event (hrs)				
12 Biotreated Volume (ft^3) $V_{biotreated}$ = *(Item* $8_{forebay}$ + Item 8_{basin}*) +(Item 10 * Item 11 * 3600)*				
13 Total biotreated volume from constructed wetlands, extended dry detention, or extended wet detention : *(Sum of Item 12 for all BMP included in plan)*				

Form 4.3-7 Flow Based Biotreatment

Biotreatment BMP Type *Vegetated swale, vegetated filter strip, or other comparable proprietary BMP*	DA DMA BMP Type	DA DMA BMP Type	DA DMA BMP Type *(Use additional forms for more BMPs)*
1 Pollutants addressed with BMP *List all pollutant of concern that will be effectively reduced through specific Unit Operations and Processes described in TGD Table 5-5*			
2 Flow depth for water quality treatment (ft) *BMP specific, see Table 5-6 of the TGD for WQMP for reference to BMP design details*			
3 Bed slope (ft/ft) *BMP specific, see Table 5-6 of the TGD for WQMP for reference to BMP design details*			
4 Manning's roughness coefficient			
5 Bottom width (ft) b_w *= (Form 4.3-5 Item 6 * Item 4) / (1.49 * Item 2^1.67 * Item 3^0.5)*			
6 Side Slope (ft/ft) *BMP specific, see Table 5-6 of the TGD for WQMP for reference to BMP design details*			
7 Cross sectional area (ft^2) *A = (Item 5 * Item 2) + (Item 6 * Item 2^2)*			
8 Water quality flow velocity (ft/sec) *V = Form 4.3-5 Item 6 / Item 7*			
9 Hydraulic residence time (min) *Pollutant specific, see Table 5-6 of the TGD for WQMP for reference to BMP design details*			
10 Length of flow based BMP (ft) *L = Item 8 * Item 9 * 60*			
11 Water surface area at water quality flow depth (ft^2) SA_{top} *= (Item 5 + (2 * Item 2 * Item 6)) * Item 10*			

4.3.5 Conformance Summary

Complete Form 4.3-8 to demonstrate how on-site LID DCV is met with proposed site design, infiltration, and/or biotreatment BMP. The bottom line of the form is used to describe the basis for infeasibility determination for on-site LID BMP to achieve full LID DCV, and provides methods for computing remaining volume to be addressed in an alternative compliance plan. If the project has more than one outlet, then complete additional versions of this form for each outlet.

Form 4.3-8 Conformance Summary and Alternative Compliance Volume Estimate (DA A)

1 Total LID DCV for the Project DA-1 DMA A (ft^3): 145,021 *Copy Item 7 in Form 4.2-1*

2 On-site retention with site design BMP (ft^3): 0 *Copy Item18 in Form 4.3-2*

3 On-site retention with LID infiltration BMP (ft^3): 257,792 *Copy Item 16 in Form 4.3-3*

4 On-site biotreatment with volume based biotreatment BMP (ft^3): 0 *Copy Item 3 in Form 4.3-4*

5 Flow capacity provided by flow based biotreatment BMP (cfs): 0 *Copy Item 6 in Form 4.3-4*

6 LID BMP performance criteria are achieved if answer to any of the following is "Yes":

- Full retention of LID DCV with site design or infiltration BMP: Yes ☒ No ☐
  If yes, sum of Items 2, 3, and 4 is greater than Item 1
- Combination of on-site retention BMPs for a portion of the LID DCV and volume-based biotreatment BMP that address all pollutants of concern for the remaining LID DCV: Yes ☐ No ☒
  If yes, a) sum of Items 2, 3, 4, and 5 is greater than Item 1, and Items 2, 3 and 4 are maximized; or b) Item 6 is greater than Form 4.3--5 Item 6 and Items 2, 3 and 4 are maximized
- On-site retention and infiltration is determined to be infeasible; therefore biotreatment BMP provides biotreatment for all pollutants of concern for full LID DCV: Yes ☐ No ☒
  If yes, Form 4.3-1 Items 7 and 8 were both checked yes

7 If the LID DCV is not achieved by any of these means, then the project may be allowed to develop an alternative compliance plan. Check box that describes the scenario which caused the need for alternative compliance:

- Combination of Site Design, retention and infiltration, , and biotreatment BMPs provide less than full LID DCV capture: ☐
  Checked yes if Form 4.3-4 Item 7is checked yes, Form 4.3-4 Item 6 is zero, and sum of Items 2, 3, 4, and 5 is less than Item 1. If so, apply water quality credits and calculate volume for alternative compliance, V_{alt} *= (Item 1 – Item 2 – Item 3 – Item 4 – Item 5) * (100 - Form 2.4-1 Item 2)%*

- Facilities, or a combination of facilities, of a different design than in Section E.12.e.(ii)(f) may be permitted if all of the following Phase II Small MS4 General Permit 2013-0001-DWQ 55 February 5, 2013 measures of equivalent effectiveness are demonstrated:
  1) Equal or greater amount of runoff infiltrated or evapotranspired; ☐
  2) Equal or lower pollutant concentrations in runoff that is discharged after biotreatment; ☐
  3) Equal or greater protection against shock loadings and spills; ☐
  4) Equal or greater accessibility and ease of inspection and maintenance. ☐

Form 4.3-8 Conformance Summary and Alternative Compliance Volume Estimate (DA 2)

1 Total LID DCV for the Project DA-1 DMA A (ft^3): 70,710 *Copy Item 7 in Form 4.2-1*

2 On-site retention with site design BMP (ft^3): 0 *Copy Item18 in Form 4.3-2*

3 On-site retention with LID infiltration BMP (ft^3): 92,558 *Copy Item 16 in Form 4.3-3*

4 On-site biotreatment with volume based biotreatment BMP (ft^3): 0 *Copy Item 3 in Form 4.3-4*

5 Flow capacity provided by flow based biotreatment BMP (cfs): 0 *Copy Item 6 in Form 4.3-4*

6 LID BMP performance criteria are achieved if answer to any of the following is "Yes":

- Full retention of LID DCV with site design or infiltration BMP: Yes ☒ No ☐
  If yes, sum of Items 2, 3, and 4 is greater than Item 1
- Combination of on-site retention BMPs for a portion of the LID DCV and volume-based biotreatment BMP that address all pollutants of concern for the remaining LID DCV: Yes ☐ No ☒
  If yes, a) sum of Items 2, 3, 4, and 5 is greater than Item 1, and Items 2, 3 and 4 are maximized; or b) Item 6 is greater than Form 4.3--5 Item 6 and Items 2, 3 and 4 are maximized
- On-site retention and infiltration is determined to be infeasible; therefore biotreatment BMP provides biotreatment for all pollutants of concern for full LID DCV: Yes ☐ No ☒
  If yes, Form 4.3-1 Items 7 and 8 were both checked yes

7 If the LID DCV is not achieved by any of these means, then the project may be allowed to develop an alternative compliance plan. Check box that describes the scenario which caused the need for alternative compliance:

- Combination of Site Design, retention and infiltration, , and biotreatment BMPs provide less than full LID DCV capture: ☐
  Checked yes if Form 4.3-4 Item 7is checked yes, Form 4.3-4 Item 6 is zero, and sum of Items 2, 3, 4, and 5 is less than Item 1. If so, apply water quality credits and calculate volume for alternative compliance, V_{alt} *= (Item 1 – Item 2 – Item 3 – Item 4 – Item 5) * (100 - Form 2.4-1 Item 2)%*

- Facilities, or a combination of facilities, of a different design than in Section E.12.e.(ii)(f) may be permitted if all of the following Phase II Small MS4 General Permit 2013-0001-DWQ 55 February 5, 2013 measures of equivalent effectiveness are demonstrated:
  1) Equal or greater amount of runoff infiltrated or evapotranspired; ☐
  2) Equal or lower pollutant concentrations in runoff that is discharged after biotreatment; ☐
  3) Equal or greater protection against shock loadings and spills; ☐
  4) Equal or greater accessibility and ease of inspection and maintenance. ☐

Form 4.3-8 Conformance Summary and Alternative Compliance Volume Estimate (DA 3)

1 Total LID DCV for the Project DA-1 DMA A (ft^3): 107,593 *Copy Item 7 in Form 4.2-1*

2 On-site retention with site design BMP (ft^3): 0 *Copy Item18 in Form 4.3-2*

3 On-site retention with LID infiltration BMP (ft^3): 193,551 *Copy Item 16 in Form 4.3-3*

4 On-site biotreatment with volume based biotreatment BMP (ft^3): 0 *Copy Item 3 in Form 4.3-4*

5 Flow capacity provided by flow based biotreatment BMP (cfs): 0 *Copy Item 6 in Form 4.3-4*

6 LID BMP performance criteria are achieved if answer to any of the following is "Yes":

- Full retention of LID DCV with site design or infiltration BMP: Yes ☒ No ☐
  If yes, sum of Items 2, 3, and 4 is greater than Item 1
- Combination of on-site retention BMPs for a portion of the LID DCV and volume-based biotreatment BMP that address all pollutants of concern for the remaining LID DCV: Yes ☐ No ☒
  If yes, a) sum of Items 2, 3, 4, and 5 is greater than Item 1, and Items 2, 3 and 4 are maximized; or b) Item 6 is greater than Form 4.3--5 Item 6 and Items 2, 3 and 4 are maximized
- On-site retention and infiltration is determined to be infeasible; therefore biotreatment BMP provides biotreatment for all pollutants of concern for full LID DCV: Yes ☐ No ☒
  If yes, Form 4.3-1 Items 7 and 8 were both checked yes

7 If the LID DCV is not achieved by any of these means, then the project may be allowed to develop an alternative compliance plan. Check box that describes the scenario which caused the need for alternative compliance:

- Combination of Site Design, retention and infiltration, , and biotreatment BMPs provide less than full LID DCV capture: ☐
  Checked yes if Form 4.3-4 Item 7is checked yes, Form 4.3-4 Item 6 is zero, and sum of Items 2, 3, 4, and 5 is less than Item 1. If so, apply water quality credits and calculate volume for alternative compliance, V_{alt} *= (Item 1 – Item 2 – Item 3 – Item 4 – Item 5) * (100 - Form 2.4-1 Item 2)%*

- Facilities, or a combination of facilities, of a different design than in Section E.12.e.(ii)(f) may be permitted if all of the following Phase II Small MS4 General Permit 2013-0001-DWQ 55 February 5, 2013 measures of equivalent effectiveness are demonstrated:
  1) Equal or greater amount of runoff infiltrated or evapotranspired; ☐
  2) Equal or lower pollutant concentrations in runoff that is discharged after biotreatment; ☐
  3) Equal or greater protection against shock loadings and spills; ☐
  4) Equal or greater accessibility and ease of inspection and maintenance. ☐

Form 4.3-8 Conformance Summary and Alternative Compliance Volume Estimate (DA 4)

1 Total LID DCV for the Project DA-1 DMA A (ft^3): 156,320 *Copy Item 7 in Form 4.2-1*

2 On-site retention with site design BMP (ft^3): 0 *Copy Item18 in Form 4.3-2*

3 On-site retention with LID infiltration BMP (ft^3): 271,960 *Copy Item 16 in Form 4.3-3*

4 On-site biotreatment with volume based biotreatment BMP (ft^3): 0 *Copy Item 3 in Form 4.3-4*

5 Flow capacity provided by flow based biotreatment BMP (cfs): 0 *Copy Item 6 in Form 4.3-4*

6 LID BMP performance criteria are achieved if answer to any of the following is "Yes":

- Full retention of LID DCV with site design or infiltration BMP: Yes ☒ No ☐
  If yes, sum of Items 2, 3, and 4 is greater than Item 1
- Combination of on-site retention BMPs for a portion of the LID DCV and volume-based biotreatment BMP that address all pollutants of concern for the remaining LID DCV: Yes ☐ No ☒
  If yes, a) sum of Items 2, 3, 4, and 5 is greater than Item 1, and Items 2, 3 and 4 are maximized; or b) Item 6 is greater than Form 4.3--5 Item 6 and Items 2, 3 and 4 are maximized
- On-site retention and infiltration is determined to be infeasible; therefore biotreatment BMP provides biotreatment for all pollutants of concern for full LID DCV: Yes ☐ No ☒
  If yes, Form 4.3-1 Items 7 and 8 were both checked yes

7 If the LID DCV is not achieved by any of these means, then the project may be allowed to develop an alternative compliance plan. Check box that describes the scenario which caused the need for alternative compliance:

- Combination of Site Design, retention and infiltration, , and biotreatment BMPs provide less than full LID DCV capture: ☐
  *Checked yes if Form 4.3-4 Item 7is checked yes, Form 4.3-4 Item 6 is zero, and sum of Items 2, 3, 4, and 5 is less than Item 1. If so, apply water quality credits and calculate volume for alternative compliance, V_{alt} = (Item 1 – Item 2 – Item 3 – Item 4 – Item 5) * (100 - Form 2.4-1 Item 2)%*

- Facilities, or a combination of facilities, of a different design than in Section E.12.e.(ii)(f) may be permitted if all of the following Phase II Small MS4 General Permit 2013-0001-DWQ 55 February 5, 2013 measures of equivalent effectiveness are demonstrated:
  1) Equal or greater amount of runoff infiltrated or evapotranspired; ☐
  2) Equal or lower pollutant concentrations in runoff that is discharged after biotreatment; ☐
  3) Equal or greater protection against shock loadings and spills; ☐
  4) Equal or greater accessibility and ease of inspection and maintenance. ☐

4.3.6 Hydromodification Control BMP

Use Form 4.3-9 to compute the remaining runoff volume retention, after Site Design BMPs are implemented, needed to address hydromodification, and the increase in time of concentration and decrease in peak runoff necessary to meet targets for protection of waterbodies with a potential hydromodification. Describe the proposed hydromodification treatment control BMP. Section 5.6 of the TGD for WQMP provides additional details on selection and evaluation of hydromodification control BMP.

Form 4.3-9 Hydromodification Control BMPs

1 Volume reduction needed for hydromodification performance criteria (ft^3): **686,116** *(Form 4.2-2 Item 4 * 0.95) – Form 4.2-2 Item 1*	**2** On-site retention with site design and infiltration, BMP (ft^3): **893,720** *Sum of Form 4.3-8 Items 2, 3, and 4. Evaluate option to increase implementation of on-site retention in Forms 4.3-2, 4.3-3, and 4.3-4 in excess of LID DCV toward achieving hydromodification volume reduction*
3 Remaining volume for hydromodification volume capture (ft^3): **0** *Item 1 – Item 2*	**4** Volume capture provided by incorporating additional on-site BMPs (ft^3): 0

5 Is Form 4.2-2 Item 11 less than or equal to 5%: Yes ☒ No ☐

If yes, hydromodification performance criteria is achieved. If no, select one or more mitigation options below:

- Demonstrate increase in time of concentration achieved by proposed LID site design, LID BMP, and additional on-site BMP ☐
- Increase time of concentration by preserving pre-developed flow path and/or increase travel time by reducing slope and increasing cross-sectional area and roughness for proposed on-site conveyance facilities ☐

6 Form 4.2-2 Item 12 less than or equal to 5%: Yes ☒ No ☐

If yes, hydromodification performance criteria is achieved. If no, select one or more mitigation options below:

- Demonstrate reduction in peak runoff achieved by proposed LID site design, LID BMPs, and additional on-site retention BMPs ☐

4.4 Alternative Compliance Plan (if applicable)

Describe an alternative compliance plan (if applicable) for projects not fully able to infiltrate, or biotreat the DCV via on-site LID practices. A project proponent must develop an alternative compliance plan to address the remainder of the LID DCV. Depending on project type some projects may qualify for water quality credits that can be applied to reduce the DCV that must be treated prior to development of an alternative compliance plan (see Form 2.4-1, Water Quality Credits). Form 4.3-9 Item 8 includes instructions on how to apply water quality credits when computing the DCV that must be met through alternative compliance.

Alternative Designs — Facilities, or a combination of facilities, of a different design than in Permit Section E.12.e.(ii)(f) may be permitted if all of the following measures of equivalent effectiveness are demonstrated:

1) Equal or greater amount of runoff infiltrated or evapotranspired;

2) Equal or lower pollutant concentrations in runoff that is discharged after biotreatment;

3) Equal or greater protection against shock loadings and spills;

4) Equal or greater accessibility and ease of inspection and maintenance.

The Project Proponent will need to obtain written approval for an alternative design from the Lahontan Regional Water Board Executive Officer (see Section 6 of the TGD for WQMP).

Section 5 Inspection and Maintenance Responsibility for Post Construction BMP

All BMPs included as part of the project WQMP are required to be maintained through regular scheduled inspection and maintenance (refer to Section 8, Post Construction BMP Requirements, in the TGD for WQMP). Fully complete Form 5-1 summarizing all BMP included in the WQMP. Attach additional forms as needed. The WQMP shall also include a detailed Operation and Maintenance Plan for all BMP and a Maintenance Agreement. The Maintenance Agreement must also be attached to the WQMP.

> Note that at time of Project construction completion, the Maintenance Covenant must be completed, signed, notarized and submitted to the Town's Engineering Department

Form 5-1 BMP Inspection and Maintenance

BMP	Reponsible Party(s)	Inspection/ Maintenance Activities Required	Minimum Frequency of Activities
Infiltration Basin	Owner, Future Property Owners, and POA	Maintenance activities include repairing undercut and eroded areas at inflow and outflow structures. Remove trash, debris, grass clippings, trees, and other large vegetation from the basin and dispose of properly. Standing water that does not drain within 48 hours will need to be scraped until good drainage is reestablished. All maintenance activities should be conducted by hand labor. Heavy equipment shall not be used on the basin in order to prevent any type of soil compaction that would affect infiltration rates.	The infiltration basin shall be inspected and maintained in September prior to rainy season (begins October 1st) and after every rain event that is greater than
N1: Education of Property Owners, Tenants and Occupants on Stormwater BMPs	Owner, Future Property Owners, and POA	Responsible parties will familiarize him/herself with the educational materials in Attachment "E" and the contents of the WQMP.	Annually for all employees and within 2 months for new hires. Trainings shall be scheduled in the month of January.
N3: Landscape Management BMPs	Owner, Future Property Owners, and POA	Irrigation must be consistent with the City of Rialto's Water Conservation Ordinance. Fertilizer and pesticide usage will be consistent with County Management Guidelines for Use of Fertilizers and Pesticides.	Ongoing
N4: BMP Maintenance	Owner, Future Property Owners, and POA	BMP maintenance, implementation schedules, and responsible parties are included with each specific BMP narrative.	As described in each BMP.
N7: Spill Contingency Plan	Owner, Future Property Owners, and POA	Owner/tenant will have a spill contingency plan based on individual site needs.	Ongoing
N10: Uniform Fire Code Implementation	Owner, Future Property Owners, and POA	Owner will comply with Article 80 of the Uniform Fire Code enforced by the fire protection agency.	Ongoing
N11: Litter/Debris Control Program	Owner, Future Property Owners, and POA	Contract with their landscape maintenance firm to provide this service during regularly schedule maintenance.	Weekly
N12: Employee Training	Owner, Future Property Owners, and POA	The owner (POA) will ensure that tenants are also familiar with onsite BMPs and necessary maintenance required of the tenants. Owner (POA) will check with City and County at least once a year	Annually for all employees and within 2 months for new hires. Trainings shall be scheduled in the month of January.

Form 5-1 BMP Inspection and Maintenance

BMP	Reponsible Party(s)	Inspection/ Maintenance Activities Required	Minimum Frequency of Activities
		to obtain new or updated educational materials and provide these materials to tenants. Employees shall be trained to clean up minor spills and participate in ongoing maintenance. The WQMP requires annual employee training and new hires within 2 months.	
N13: Housekeeping of Loading Docks	Owner, Future Property Owners, and POA	Keep all fluids indoors. Clean up spills immediately and keep spills from entering storm drain system. No untreated discharges into the storm drain system. Area shall be inspected weekly for proper containment and practices with spills cleaned up immediately and disposed of properly.	Ongoing
N14: Catch Basin Inspection Program	Owner, Future Property Owners, and POA	Monthly inspection by property owner's designee. Drain inserts will be vacuumed when sediment or trash becomes 2-inches deep and disposed of properly.	Monthly inspection and maintain as necessary.
N15: Vacuum Sweeping of Private Streets and Parking Lots	Owner, Future Property Owners, and POA	All landscape maintenance contractors will be required to sweep up all landscape cuttings, mowings and fertilizer materials off paved areas weekly and dispose of properly. Parking areas and driveways will be swept monthly by sweeping contractor.	Monthly
S1: Provide storm drain system stenciling and signage (CASQA New Development BMP Handbook SD-13)	Owner, Future Property Owners, and POA	"No Dumping – Drains to River" stencils will be applied. Legibility of stencil will be maintained on a yearly basis.	Annually (in September before rainy season)
S3: Design and construct trash and waste storage areas to reduce pollution introduction (CASQA New Development BMP Handbook SD-32)	Owner, Future Property Owners, and POA	Paved with an impervious surface, designed not to allow run-on from adjoining areas, designed to divert drainage from adjoining roofs and pavements diverted around the area, screened, or walled to prevent off-site transport of trash. Provide solid roof or awning to prevent direct contact with rainfall. Lids shall remain closed when not in use.	Ongoing
S4: Use efficient irrigation systems & landscape design, water conservation, smart controllers, and source control (Statewide Model	Owner, Future Property Owners, and POA	Irrigation systems shall include reducers or shutoff valves triggered by a pressure drop to control water loss in the event of broken sprinkler heads or lines. Timers will be used to avoid over watering and watering cycles and duration shall be adjusted seasonally by the landscape maintenance contractor. The landscaping areas will be grouped with plants that have similar water requirements.	Adjust watering cycles and duration seasonally / quarterly.

Form 5-1 BMP Inspection and Maintenance

BMP	Reponsible Party(s)	Inspection/ Maintenance Activities Required	Minimum Frequency of Activities
Landscape Ordinance; CASQA New Development BMP Handbook SD-12)		Native or drought tolerant species shall also be used where appropriate to reduce excess irrigation runoff and promote surface filtration.	

Section 6 WQMP Attachments

6.1. Site Plan and Drainage Plan

Include a site plan and drainage plan sheet set containing the following minimum information:

- Project location
- Site boundary
- Land uses and land covers, as applicable
- Suitability/feasibility constraints
- Structural Source Control BMP locations
- Site Design Hydrologic Source Control BMP locations
- LID BMP details
- Drainage delineations and flow information
- Drainage connections

See Attachment C for WQMP Site Map.

6.2 Electronic Data Submittal

Minimum requirements include submittal of PDF exhibits in addition to hard copies. Format must not require specialized software to open. If the local jurisdiction requires specialized electronic document formats (as described in their local Local Implementation Plan), this section will describe the contents (e.g., layering, nomenclature, geo-referencing, etc.) of these documents so that they may be interpreted efficiently and accurately.

6.3 Post Construction

Attach all O&M Plans and Maintenance Covenant for BMP to the WQMP (Attachment D).

6.4 Other Supporting Documentation

- BMP Educational Materials (Attachment E)
- Infiltration Report (Attachment F)
- Activity Restriction-C, C&R's & Lease Agreements

Attachment A
Existing Condition Site Photos









Attachment B
BMP Design Calculations & Supporting Documentation

www.nws.noaa.gov

NOAA's National Weather Service
Hydrometeorological Design Studies Center
Precipitation Frequency Data Server (PFDS)

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Data Server
GIS Grids
Maps
Time Series
Temporals
Documents

Probable Maximum Precipitation
Documents

Miscellaneous
Publications
Storm Analysis
Record Precipitation

Contact Us
Inquiries

USA.gov

NOAA ATLAS 14 POINT PRECIPITATION FREQUENCY ESTIMATES: CA

Data description

Data type: Precipitation depth **Units:** English **Time series type:** Partial duration

Select location

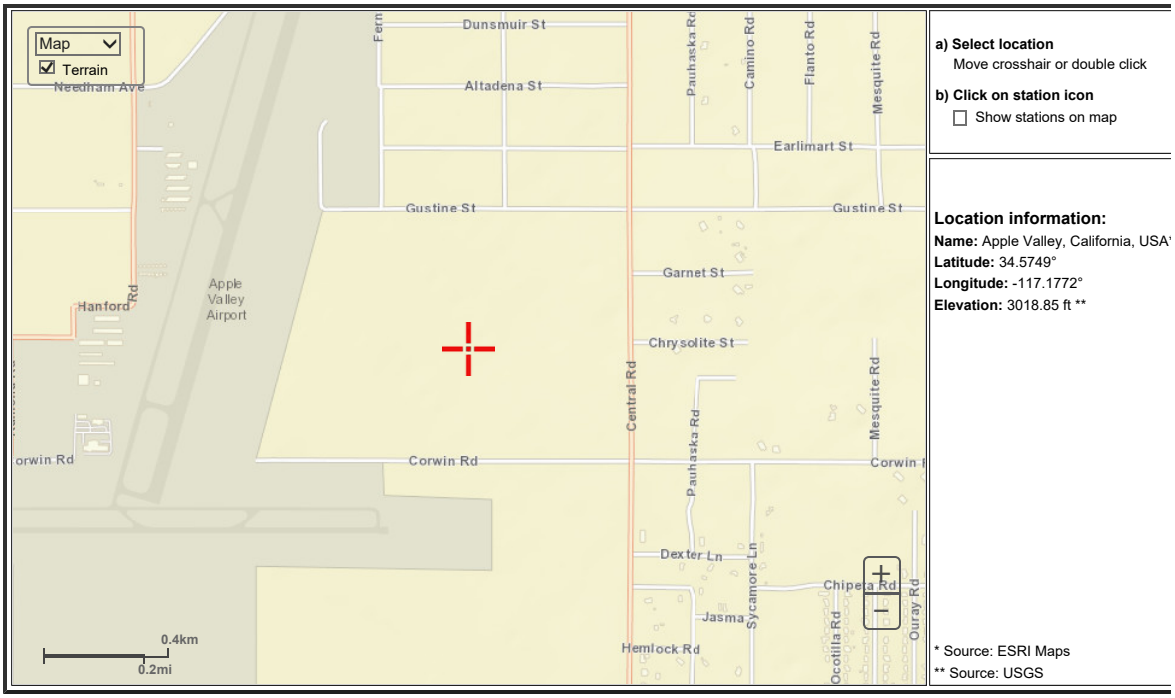
1) Manually:

a) By location (decimal degrees, use "-" for S and W): Latitude: 34.574891 Longitude: -117.17723 Submit

b) By station (list of CA stations): Select station

c) By address Search

2) Use map (if ESRI interactive map is not loading, try adding the host: **https://js.arcgis.com/** to the firewall, or contact us at hdsc.questions@noaa.gov):



a) Select location
Move crosshair or double click

b) Click on station icon
Show stations on map

Location information:
Name: Apple Valley, California, USA
Latitude: 34.5749°
Longitude: -117.1772°
Elevation: 3018.85 ft **

* Source: ESRI Maps
** Source: USGS

POINT PRECIPITATION FREQUENCY (PF) ESTIMATES

WITH 90% CONFIDENCE INTERVALS AND SUPPLEMENTARY INFORMATION
NOAA Atlas 14, Volume 6, Version 2

PF tabular PF graphical Supplementary information Print page

PDS-based precipitation frequency estimates with 90% confidence intervals (in inches)[1]

Duration	Average recurrence interval (years) 1	2	5	10	25	50	100	200	500	1000
5-min	**0.080** (0.066-0.098)	**0.113** (0.093-0.138)	**0.159** (0.131-0.196)	**0.199** (0.162-0.247)	**0.257** (0.203-0.330)	**0.305** (0.235-0.399)	**0.356** (0.268-0.477)	**0.412** (0.302-0.567)	**0.492** (0.346-0.705)	**0.558** (0.380-0.828)
10-min	**0.114** (0.094-0.140)	**0.162** (0.133-0.198)	**0.228** (0.187-0.281)	**0.286** (0.233-0.354)	**0.369** (0.291-0.473)	**0.437** (0.337-0.572)	**0.510** (0.385-0.684)	**0.590** (0.433-0.813)	**0.705** (0.496-1.01)	**0.799** (0.544-1.19)
15-min	**0.138** (0.114-0.169)	**0.196** (0.161-0.240)	**0.276** (0.227-0.340)	**0.345** (0.281-0.429)	**0.446** (0.352-0.572)	**0.529** (0.408-0.692)	**0.617** (0.465-0.827)	**0.713** (0.523-0.983)	**0.852** (0.600-1.22)	**0.967** (0.658-1.44)
30-min	**0.188** (0.155-0.230)	**0.266** (0.219-0.327)	**0.376** (0.308-0.462)	**0.470** (0.383-0.583)	**0.607** (0.479-0.778)	**0.719** (0.555-0.941)	**0.840** (0.633-1.13)	**0.971** (0.712-1.34)	**1.16** (0.817-1.66)	**1.32** (0.895-1.95)
60-min	**0.235** (0.194-0.288)	**0.333** (0.274-0.408)	**0.470** (0.386-0.578)	**0.588** (0.479-0.729)	**0.759** (0.598-0.973)	**0.900** (0.695-1.18)	**1.05** (0.792-1.41)	**1.21** (0.890-1.67)	**1.45** (1.02-2.08)	**1.65** (1.12-2.44)
2-hr	**0.335** (0.276-0.410)	**0.454** (0.374-0.557)	**0.619** (0.508-0.762)	**0.761** (0.619-0.944)	**0.964** (0.759-1.24)	**1.13** (0.871-1.48)	**1.30** (0.982-1.75)	**1.49** (1.09-2.05)	**1.76** (1.24-2.53)	**1.98** (1.35-2.94)
3-hr	**0.407** (0.336-0.499)	**0.544** (0.448-0.668)	**0.733** (0.601-0.901)	**0.893** (0.727-1.11)	**1.12** (0.884-1.44)	**1.31** (1.01-1.71)	**1.50** (1.13-2.01)	**1.71** (1.25-2.36)	**2.01** (1.41-2.88)	**2.25** (1.53-3.34)
6-hr	**0.558** (0.460-0.684)	**0.735** (0.605-0.903)	**0.977** (0.802-1.20)	**1.18** (0.962-1.47)	**1.47** (1.16-1.88)	**1.70** (1.31-2.22)	**1.94** (1.46-2.60)	**2.19** (1.61-3.02)	**2.55** (1.80-3.66)	**2.84** (1.93-4.22)
12-hr	**0.722**	**0.952**	**1.26**	**1.52**	**1.89**	**2.17**	**2.47**	**2.78**	**3.21**	**3.56**

	(0.595-0.885)	(0.784-1.17)	(1.04-1.55)	(1.24-1.89)	(1.49-2.42)	(1.68-2.84)	(1.86-3.31)	(2.04-3.83)	(2.26-4.61)	(2.42-5.28)
24-hr	**0.951** (0.844-1.09)	**1.27** (1.12-1.46)	**1.69** (1.49-1.95)	**2.04** (1.79-2.38)	**2.52** (2.14-3.04)	**2.90** (2.41-3.56)	**3.29** (2.66-4.14)	**3.69** (2.91-4.78)	**4.25** (3.21-5.74)	**4.69** (3.43-6.55)
2-day	**1.14** (1.01-1.31)	**1.55** (1.37-1.78)	**2.09** (1.84-2.41)	**2.53** (2.21-2.94)	**3.13** (2.65-3.77)	**3.59** (2.98-4.42)	**4.07** (3.30-5.12)	**4.56** (3.59-5.91)	**5.23** (3.96-7.06)	**5.76** (4.20-8.04)
3-day	**1.24** (1.10-1.43)	**1.71** (1.51-1.97)	**2.32** (2.05-2.68)	**2.81** (2.47-3.28)	**3.49** (2.96-4.20)	**4.01** (3.33-4.93)	**4.54** (3.68-5.72)	**5.08** (4.01-6.58)	**5.83** (4.41-7.87)	**6.41** (4.68-8.95)
4-day	**1.32** (1.17-1.52)	**1.81** (1.61-2.09)	**2.47** (2.18-2.85)	**3.00** (2.63-3.50)	**3.73** (3.16-4.48)	**4.28** (3.55-5.26)	**4.85** (3.93-6.10)	**5.43** (4.28-7.03)	**6.22** (4.70-8.40)	**6.84** (4.99-9.55)
7-day	**1.43** (1.27-1.65)	**1.96** (1.73-2.26)	**2.66** (2.35-3.07)	**3.23** (2.83-3.76)	**4.01** (3.40-4.83)	**4.62** (3.84-5.68)	**5.24** (4.25-6.60)	**5.88** (4.63-7.62)	**6.75** (5.11-9.12)	**7.44** (5.43-10.4)
10-day	**1.51** (1.34-1.74)	**2.06** (1.82-2.37)	**2.79** (2.47-3.23)	**3.40** (2.98-3.96)	**4.23** (3.58-5.09)	**4.88** (4.05-5.99)	**5.54** (4.49-6.97)	**6.23** (4.91-8.06)	**7.17** (5.42-9.68)	**7.91** (5.78-11.1)
20-day	**1.72** (1.52-1.98)	**2.35** (2.08-2.71)	**3.20** (2.83-3.70)	**3.91** (3.43-4.56)	**4.90** (4.15-5.90)	**5.68** (4.71-6.98)	**6.48** (5.25-8.16)	**7.32** (5.77-9.48)	**8.47** (6.41-11.4)	**9.38** (6.85-13.1)
30-day	**1.93** (1.72-2.23)	**2.65** (2.35-3.06)	**3.63** (3.21-4.19)	**4.45** (3.90-5.18)	**5.60** (4.75-6.74)	**6.51** (5.41-8.00)	**7.45** (6.04-9.39)	**8.44** (6.65-10.9)	**9.81** (7.42-13.2)	**10.9** (7.95-15.2)
45-day	**2.29** (2.03-2.64)	**3.15** (2.79-3.63)	**4.32** (3.82-4.99)	**5.31** (4.66-6.19)	**6.72** (5.70-8.09)	**7.84** (6.51-9.64)	**9.01** (7.30-11.3)	**10.2** (8.07-13.3)	**12.0** (9.04-16.1)	**13.3** (9.72-18.6)
60-day	**2.50** (2.22-2.87)	**3.42** (3.03-3.94)	**4.70** (4.15-5.42)	**5.78** (5.07-6.73)	**7.33** (6.21-8.82)	**8.57** (7.12-10.5)	**9.88** (8.01-12.4)	**11.3** (8.88-14.6)	**13.2** (9.98-17.8)	**14.7** (10.8-20.6)

[1] Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values.

Please refer to NOAA Atlas 14 document for more information.

Estimates from the table in CSV format: Precipitation frequency estimates Submit

Main Link Categories:
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US Department of Commerce
National Oceanic and Atmospheric Administration
National Weather Service
Office of Water Prediction (OWP)
1325 East West Highway
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Worksheet H: Factor of Safety and Design Infiltration Rate and Worksheet (DA 1)

Factor Category		Factor Description	Assigned Weight (w)	Factor Value (v)	Product (p) p = w x v
A	Suitability Assessment	Soil assessment methods	0.25	1	0.25
		Predominant soil texture	0.25	1	0.25
		Site soil variability	0.25	1	0.25
		Depth to groundwater / impervious layer	0.25	1	0.25
		Suitability Assessment Safety Factor, $S_A = \Sigma p$			1.00
B	Design	Tributary area size	0.25	3	0.75
		Level of pretreatment/ expected sediment loads	0.25	1	0.25
		Redundancy	0.25	3	0.75
		Compaction during construction	0.25	1	0.25
		Design Safety Factor, $S_B = \Sigma p$			2.00
Combined Safety Factor, $S_{TOT} = S_A \times S_B$					2.00
Measured Infiltration Rate, inch/hr, K_M (corrected for test-specific bias)					6.30 in/hr
Design Infiltration Rate, in/hr, $K_{DESIGN} = K_M / S_{TOT}$					3.15 in/hr

Supporting Data

Briefly describe infiltration test and provide reference to test forms:

A site-specific infiltration test was conducted at the project site to support a measured infiltration rate of 6.30 in/hr. The design infiltration rate will be 3.15 in/hr after applying the appropriate safety factors. This design rate is suitable for infiltration facilities.

Note: The minimum combined adjustment factor shall not be less than 2.0 and the maximum combined adjustment factor shall not exceed 9.0.

Worksheet H: Factor of Safety and Design Infiltration Rate and Worksheet (DA 2)

Factor Category		Factor Description	Assigned Weight (w)	Factor Value (v)	Product (p) p = w x v
A	Suitability Assessment	Soil assessment methods	0.25	1	0.25
		Predominant soil texture	0.25	1	0.25
		Site soil variability	0.25	1	0.25
		Depth to groundwater / impervious layer	0.25	1	0.25
		Suitability Assessment Safety Factor, $S_A = \Sigma p$			1.00
B	Design	Tributary area size	0.25	3	0.75
		Level of pretreatment/ expected sediment loads	0.25	1	0.25
		Redundancy	0.25	3	0.75
		Compaction during construction	0.25	1	0.25
		Design Safety Factor, $S_B = \Sigma p$			2.00
Combined Safety Factor, $S_{TOT} = S_A \times S_B$					2.00
Measured Infiltration Rate, inch/hr, K_M (corrected for test-specific bias)					1.20 in/hr
Design Infiltration Rate, in/hr, $K_{DESIGN} = K_M / S_{TOT}$					0.60 in/hr

Supporting Data

Briefly describe infiltration test and provide reference to test forms:

A site-specific infiltration test was conducted at the project site to support a measured infiltration rate of 1.20 in/hr. The design infiltration rate will be 0.60 in/hr after applying the appropriate safety factors. This design rate is suitable for infiltration facilities.

Note: The minimum combined adjustment factor shall not be less than 2.0 and the maximum combined adjustment factor shall not exceed 9.0.

Worksheet H: Factor of Safety and Design Infiltration Rate and Worksheet (DA 3)

Factor Category		Factor Description	Assigned Weight (w)	Factor Value (v)	Product (p) p = w x v
A	Suitability Assessment	Soil assessment methods	0.25	1	0.25
		Predominant soil texture	0.25	1	0.25
		Site soil variability	0.25	1	0.25
		Depth to groundwater / impervious layer	0.25	1	0.25
		Suitability Assessment Safety Factor, $S_A = \Sigma p$			1.00
B	Design	Tributary area size	0.25	3	0.75
		Level of pretreatment/ expected sediment loads	0.25	1	0.25
		Redundancy	0.25	3	0.75
		Compaction during construction	0.25	1	0.25
		Design Safety Factor, $S_B = \Sigma p$			2.00
Combined Safety Factor, $S_{TOT} = S_A \times S_B$					2.00
Measured Infiltration Rate, inch/hr, K_M (corrected for test-specific bias)					4.90 in/hr
Design Infiltration Rate, in/hr, $K_{DESIGN} = K_M / S_{TOT}$					2.45 in/hr

Supporting Data

Briefly describe infiltration test and provide reference to test forms:

A site-specific infiltration test was conducted at the project site to support a measured infiltration rate of 4.90 in/hr. The design infiltration rate will be 2.45 in/hr after applying the appropriate safety factors. This design rate is suitable for infiltration facilities.

Note: The minimum combined adjustment factor shall not be less than 2.0 and the maximum combined adjustment factor shall not exceed 9.0.

Worksheet H: Factor of Safety and Design Infiltration Rate and Worksheet (DA 4)

Factor Category		Factor Description	Assigned Weight (w)	Factor Value (v)	Product (p) p = w x v
A	Suitability Assessment	Soil assessment methods	0.25	1	0.25
		Predominant soil texture	0.25	1	0.25
		Site soil variability	0.25	1	0.25
		Depth to groundwater / impervious layer	0.25	1	0.25
		Suitability Assessment Safety Factor, $S_A = \Sigma p$			1.00
B	Design	Tributary area size	0.25	3	0.75
		Level of pretreatment/ expected sediment loads	0.25	1	0.25
		Redundancy	0.25	3	0.75
		Compaction during construction	0.25	1	0.25
		Design Safety Factor, $S_B = \Sigma p$			2.00
Combined Safety Factor, $S_{TOT} = S_A \times S_B$					2.00
Measured Infiltration Rate, inch/hr, K_M (corrected for test-specific bias)					5.90 in/hr
Design Infiltration Rate, in/hr, $K_{DESIGN} = K_M / S_{TOT}$					2.95 in/hr

Supporting Data

Briefly describe infiltration test and provide reference to test forms:

A site-specific infiltration test was conducted at the project site to support a measured infiltration rate of 5.90 in/hr. The design infiltration rate will be 2.95 in/hr after applying the appropriate safety factors. This design rate is suitable for infiltration facilities.

Note: The minimum combined adjustment factor shall not be less than 2.0 and the maximum combined adjustment factor shall not exceed 9.0.

VOLUME-BASED BMP DESIGN

$C_{BMP} = 0.858(imp)^3 - 0.78(imp)^2 + 0.774(imp) + 0.04$
P6 = (0.333)(1.2371) = 0.412 inches
$P0 = (1.963)(C_{BMP})(0.412)$
DCV = (P0 * Area) / 12

DA 1 DMA A – INFILTRATION BASIN #4

Region		Desert	
Drainage Area (acres)		61.22	acres
Drainage Area (sq-ft)		2,666,743	sq-ft
Impervious Coeff	i =	0.95	< 1.0
Runoff Coeff	**C =**	0.807	
1-hr 2-yr from NOAA		0.333	
P6 Coeff		1.2371	
Mean 6-hr (P6)		0.412	
Drawdown Rate (a)		1.963	
DCV		145,021	cu-ft
DCV		3.329	acre-ft

Design infiltration rate = 3.15 in/hr
d_{max} = 151.2 inches = Design infiltration rate x 48 hours = 3.15 in/hr x 48 hrs
d_{BMP} = 3.7 feet = 44.4 inches
$d_{max} > d_{BMP}$

INFILTRATION BASIN #4 (DA 1 @ Building 3)

Elevation (ft.)	Depth (ft.)	Volume (cu. ft.)	Cumulative Volume (cu. ft.)	
2,975.67	0.00	0.00	0.00	
2,975.77	0.10	5,813.24	5,813.24	
2,975.87	0.20	6,064.19	11,877.43	
2,975.97	0.30	6,116.29	17,993.73	
2,976.07	0.40	6,168.52	24,162.24	
2,976.17	0.50	6,220.86	30,383.10	
2,976.27	0.60	6,273.31	36,656.41	
2,976.37	0.70	6,325.89	42,982.30	
2,976.47	0.80	6,378.58	49,360.88	
2,976.57	0.90	6,431.39	55,792.27	
2,976.67	1.00	6,484.32	62,276.59	
2,976.77	1.10	6,537.37	68,813.96	
2,976.87	1.20	6,590.53	75,404.50	
2,976.97	1.30	6,643.82	82,048.31	
2,977.07	1.40	6,697.22	88,745.53	
2,977.17	1.50	6,750.74	95,496.27	
2,977.27	1.60	6,804.38	102,300.65	
2,977.37	1.70	6,858.13	109,158.78	
2,977.47	1.80	6,912.00	116,070.78	
2,977.57	1.90	6,966.00	123,036.78	
2,977.67	2.00	7,020.10	130,056.88	
2,977.77	2.10	7,074.33	137,131.21	
2,977.87	2.20	7,128.68	144,259.89	
2,977.97	2.30	7,183.14	151,443.03	
2,978.07	2.40	7,237.72	158,680.76	
2,978.17	2.50	7,292.42	165,973.18	
2,978.27	2.60	7,347.24	173,320.42	
2,978.37	2.70	7,402.17	180,722.59	
2,978.47	2.80	7,457.23	188,179.82	
2,978.57	2.90	7,512.40	195,692.22	
2,978.67	3.00	7,567.69	203,259.91	
2,978.77	3.10	7,623.10	210,883.00	
2,978.87	3.20	7,678.62	218,561.62	
2,978.97	3.30	7,734.26	226,295.89	
2,979.07	3.40	7,790.03	234,085.92	
2,979.17	3.50	7,845.91	241,931.82	
2,979.27	3.60	7,901.90	249,833.72	
2,979.37	**3.70**	**7,958.02**	**257,791.74**	> 207,246 cf HCOC & 145,021 cf DCV
2,979.47	3.80	8,014.25	265,806.00	
2,979.57	3.90	8,070.60	273,876.60	
2,979.67	4.00	8,127.07	282,003.67	
2,979.77	4.10	8,183.66	290,187.33	
2,979.87	4.20	8,240.37	298,427.70	
2,979.97	4.30	8,297.19	306,724.89	

DA 2 DMA A – INFILTRATION BASIN #3

Region		Desert	
Drainage Area (acres)		29.85	acres
Drainage Area (sq-ft)		1,300,266	sq-ft
Impervious Coeff	i =	0.95	< 1.0
Runoff Coeff	**C =**	0.807	
1-hr 2-yr from NOAA		0.333	
P6 Coeff		1.2371	
Mean 6-hr (P6)		0.412	
Drawdown Rate (a)		1.963	
DCV		70,710	cu-ft
DCV		1.623	acre-ft

Design infiltration rate = 0.60 in/hr
d_{max} = 28.8 inches = Design infiltration rate x 48 hours = 0.60 in/hr x 48 hrs
d_{BMP} = 2.4 feet = 28.8 inches
$d_{max} > d_{BMP}$

INFILTRATION BASIN #3 (DA 2 @ Building 2 West)

Elevation (ft.)	Depth (ft.)	Volume (cu. ft.)	Cumulative Volume (cu. ft.)	
2,983.11	0.00	0.00	0.00	
2,983.21	0.10	3,445.26	3,445.26	
2,983.31	0.20	3,530.13	6,975.39	
2,983.41	0.30	3,560.48	10,535.87	
2,983.51	0.40	3,590.97	14,126.84	
2,983.61	0.50	3,621.59	17,748.43	
2,983.71	0.60	3,652.35	21,400.77	
2,983.81	0.70	3,683.24	25,084.02	
2,983.91	0.80	3,714.27	28,798.29	
2,984.01	0.90	3,745.44	32,543.73	
2,984.11	1.00	3,776.74	36,320.48	
2,984.21	1.10	3,808.18	40,128.66	
2,984.31	1.20	3,839.76	43,968.42	
2,984.41	1.30	3,871.47	47,839.89	
2,984.51	1.40	3,903.32	51,743.20	
2,984.61	1.50	3,935.30	55,678.50	
2,984.71	1.60	3,967.42	59,645.92	
2,984.81	1.70	3,999.68	63,645.60	
2,984.91	1.80	4,032.07	67,677.67	
2,985.01	1.90	4,064.60	71,742.27	
2,985.11	2.00	4,097.26	75,839.53	
2,985.21	2.10	4,130.06	79,969.59	
2,985.31	2.20	4,163.00	84,132.58	
2,985.41	2.30	4,196.07	88,328.65	
2,985.51	**2.40**	**4,229.28**	**92,557.93**	> 90,977 cf HCOC & 70,710 cf DCV
2,985.61	2.50	4,262.62	96,820.55	
2,985.71	2.60	4,296.10	101,116.66	
2,985.81	2.70	4,329.72	105,446.38	
2,985.91	2.80	4,363.47	109,809.85	
2,986.01	2.90	4,397.36	114,207.21	
2,986.11	3.00	4,431.39	118,638.60	

DA 3 DMA A – INFILTRATION BASIN #2

Region		Desert	
Drainage Area (acres)		45.42	acres
Drainage Area (sq-ft)		1,978,495	sq-ft
Impervious Coeff	i =	0.95	< 1.0
Runoff Coeff	**C =**	**0.807**	
1-hr 2-yr from NOAA		0.333	
P6 Coeff		**1.2371**	
Mean 6-hr (P6)		**0.412**	
Drawdown Rate (a)		1.963	
DCV		**107,593**	cu-ft
DCV		**2.470**	acre-ft

Design infiltration rate = 2.45 in/hr
d_{max} = 117.6 inches = Design infiltration rate x 48 hours = 2.45 in/hr x 48 hrs
d_{BMP} = 4.4 feet = 52.8 inches
$d_{max} > d_{BMP}$

INFILTRATION BASIN #2 (DA 3 @ Building 2 East)

Elevation (ft.)	Depth (ft.)	Volume (cu. ft.)	Cumulative Volume (cu. ft.)
2,981.00	0.00	0.00	0.00
2,981.10	0.10	3,481.11	3,481.11
2,981.20	0.20	3,574.48	7,055.59
2,981.30	0.30	3,613.28	10,668.87
2,981.40	0.40	3,652.19	14,321.07
2,981.50	0.50	3,691.21	18,012.28
2,981.60	0.60	3,730.34	21,742.61
2,981.70	0.70	3,769.57	25,512.18
2,981.80	0.80	3,808.91	29,321.09
2,981.90	0.90	3,848.36	33,169.45
2,982.00	1.00	3,887.91	37,057.36
2,982.10	1.10	3,927.58	40,984.94
2,982.20	1.20	3,967.35	44,952.29
2,982.30	1.30	4,007.23	48,959.52
2,982.40	1.40	4,047.22	53,006.73
2,982.50	1.50	4,087.31	57,094.04
2,982.60	1.60	4,127.51	61,221.55
2,982.70	1.70	4,167.82	65,389.37
2,982.80	1.80	4,208.24	69,597.61
2,982.90	1.90	4,248.76	73,846.37
2,983.00	2.00	4,289.39	78,135.77
2,983.10	2.10	4,330.13	82,465.90
2,983.20	2.20	4,370.98	86,836.89
2,983.30	2.30	4,411.94	91,248.82
2,983.40	2.40	4,453.00	95,701.82
2,983.50	2.50	4,494.17	100,196.00
2,983.60	2.60	4,535.45	104,731.44
2,983.70	2.70	4,576.83	109,308.28
2,983.80	2.80	4,618.33	113,926.61
2,983.90	2.90	4,659.93	118,586.54
2,984.00	3.00	4,701.64	123,288.17
2,984.10	3.10	4,743.45	128,031.63
2,984.20	3.20	4,785.38	132,817.00
2,984.30	3.30	4,827.41	137,644.41
2,984.40	3.40	4,869.55	142,513.96
2,984.50	3.50	4,911.79	147,425.76
2,984.60	3.60	4,954.15	152,379.91
2,984.70	3.70	4,996.61	157,376.52
2,984.80	3.80	5,039.18	162,415.70
2,984.90	3.90	5,081.86	167,497.55
2,985.00	4.00	5,124.64	172,622.20
2,985.10	4.10	5,167.53	177,789.73
2,985.20	4.20	5,210.53	183,000.26
2,985.30	4.30	5,253.64	188,253.91

2,985.40	**4.40**	**5,296.86**	**193,550.76**
2,985.50	4.50	5,340.18	198,890.94
2,985.60	4.60	5,383.61	204,274.56
2,985.70	4.70	5,427.15	209,701.70
2,985.80	4.80	5,470.79	215,172.50
2,985.90	4.90	5,514.55	220,687.05
2,986.00	5.00	5,558.41	226,245.46
2,986.10	5.10	5,602.38	231,847.83
2,986.20	5.20	5,646.45	237,494.29
2,986.30	5.30	5,690.64	243,184.92
2,986.40	5.40	5,734.93	248,919.85
2,986.50	5.50	5,779.33	254,699.18
2,986.60	5.60	5,823.83	260,523.02
2,986.70	5.70	5,868.45	266,391.46
2,986.80	5.80	5,913.17	272,304.64
2,986.90	5.90	5,958.00	278,262.64
2,987.00	6.00	6,002.94	284,265.57

> 153,759 cf HCOC & 107,593 cf DCV

DA 4 DMA A – INFILTRATION BASIN #1

Region		Desert	
Drainage Area (acres)		65.99	acres
Drainage Area (sq-ft)		2,874,524	sq-ft
Impervious Coeff	i =	0.95	< 1.0
Runoff Coeff	**C =**	0.807	
1-hr 2-yr from NOAA		0.333	
P6 Coeff		1.2371	
Mean 6-hr (P6)		0.412	
Drawdown Rate (a)		1.963	
DCV		156,320	cu-ft
DCV		3.589	acre-ft

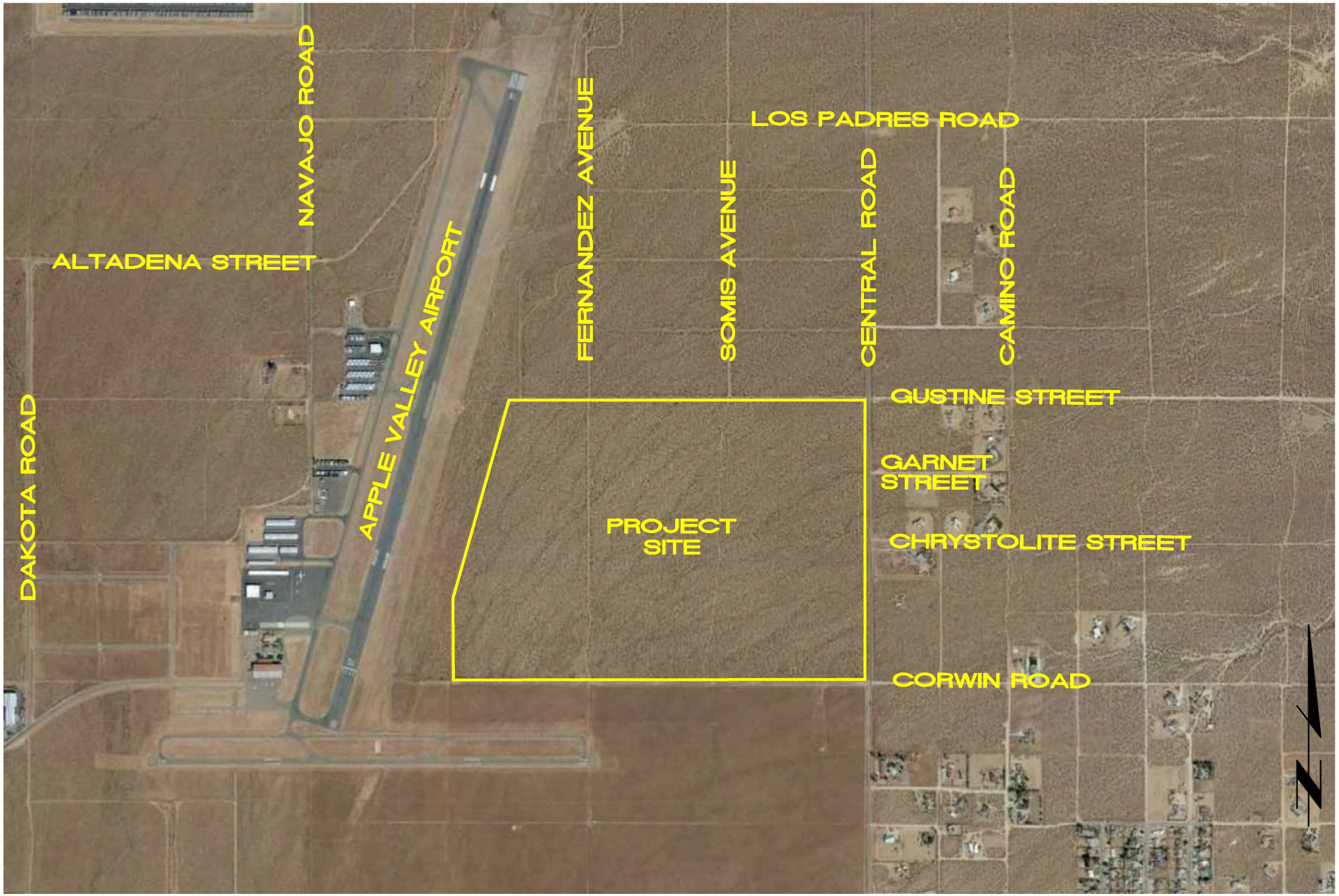
Design infiltration rate = 2.95 in/hr
d_{max} = 141.6 inches = Design infiltration rate x 48 hours = 2.95 in/hr x 48 hrs
d_{BMP} = 4.2 feet = 50.4 inches
$d_{max} > d_{BMP}$

INFILTRATION BASIN #1 (DA 4 @ Building 1)

Elevation (ft.)	Depth (ft.)	Volume (cu. ft.)	Cumulative Volume (cu. ft.)	
3,001.44	0.00	0.00	0.00	
3,001.54	0.10	5,034.95	5,034.95	
3,001.64	0.20	5,202.29	10,237.24	
3,001.74	0.30	5,265.94	15,503.18	
3,001.84	0.40	5,329.71	20,832.89	
3,001.94	0.50	5,393.63	26,226.52	
3,002.04	0.60	5,457.68	31,684.20	
3,002.14	0.70	5,521.86	37,206.06	
3,002.24	0.80	5,586.18	42,792.25	
3,002.34	0.90	5,650.64	48,442.88	
3,002.44	1.00	5,715.23	54,158.12	
3,002.54	1.10	5,779.96	59,938.07	
3,002.64	1.20	5,844.82	65,782.89	
3,002.74	1.30	5,909.82	71,692.71	
3,002.84	1.40	5,974.95	77,667.66	
3,002.94	1.50	6,040.22	83,707.88	
3,003.04	1.60	6,105.62	89,813.50	
3,003.14	1.70	6,171.16	95,984.66	
3,003.24	1.80	6,236.83	102,221.49	
3,003.34	1.90	6,302.64	108,524.14	
3,003.44	2.00	6,368.59	114,892.73	
3,003.54	2.10	6,434.67	121,327.40	
3,003.64	2.20	6,500.89	127,828.28	
3,003.74	2.30	6,567.24	134,395.52	
3,003.84	2.40	6,633.72	141,029.24	
3,003.94	2.50	6,700.35	147,729.59	
3,004.04	2.60	6,767.10	154,496.69	
3,004.14	2.70	6,834.00	161,330.69	
3,004.24	2.80	6,901.02	168,231.71	
3,004.34	2.90	6,968.19	175,199.90	
3,004.44	3.00	7,035.49	182,235.39	
3,004.54	3.10	7,102.92	189,338.31	
3,004.64	3.20	7,170.49	196,508.80	
3,004.74	3.30	7,238.20	203,747.00	
3,004.84	3.40	7,306.04	211,053.04	
3,004.94	3.50	7,374.01	218,427.05	
3,005.04	3.60	7,442.13	225,869.18	
3,005.14	3.70	7,510.37	233,379.55	
3,005.24	3.80	7,578.75	240,958.30	
3,005.34	3.90	7,647.27	248,605.58	
3,005.44	4.00	7,715.92	256,321.50	
3,005.54	4.10	7,784.71	264,106.21	
3,005.64	**4.20**	**7,853.64**	**271,959.85**	> 223,394 cf HCOC & 156,320 cf DCV
3,005.74	4.30	7,922.70	279,882.55	

3,005.84	4.40	7,991.89	287,874.44
3,005.94	4.50	8,061.22	295,935.66
3,006.00	4.56	4,870.07	300,805.73

Attachment C
WQMP Site Map



Last Update:10/18/21
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"VICINITY MAP"

FOR

APPLE VALLEY ASSEMBLAGE

Thienes Engineering, Inc.
CIVIL ENGINEERING • LAND SURVEYING
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GUSTINE ROAD

NORTHERLY EARTHEN DRAINAGE CHANNEL WITH RIPRAP LINED SLOPES

EARTHEN DRAINAGE CHANNEL WITH CONCRETE LINED SLOPES RUNOFF TO SPILLOVER ONTO THE EXISTING DRAINAGE CHANNEL

APPLE VALLEY AIRPORT

EXISTING DRAINAGE CHANNEL

DA 6 DMA A
6.48 AC.

DA 1 DMA A
61.22 AC.

BUILDING 3

DA 2 DMA A
29.85 AC.

DA 3 DMA A
45.42 AC.

BUILDING 2

DA 4 DMA A
65.99 AC.

BUILDING 1

DA 5 DMA A
22.42 AC.

DA 5 DMA A
15.94 AC.

SD LINE A

SD LINE B

SD LINE C

SD LINE D

SD LINE E

SD LINE F

EARTHEN DRAINAGE CHANNEL WITH RIPRAP LINED SLOPES

SOUTHERLY EARTHEN DRAINAGE CHANNEL WITH RIPRAP LINED SLOPES

INFILTRATION BASIN #4

INFILTRATION BASIN #3

INFILTRATION BASIN #2

INFILTRATION BASIN #1

INLET

OUTLET

EARTHEN DRAINAGE CHANNEL WITH CONCRETE LINED SLOPES RUNOFF TO SPILLOVER ONTO THE EXISTING DRAINAGE CHANNEL

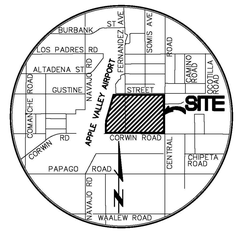
SOUTHERLY EARTHEN DRAINAGE CHANNEL WITH RIPRAP LINED SLOPES

CORWIN ROAD

CENTRAL ROAD

VICINITY MAP

N.T.S.



LEGEND

1. ABOVEGROUND LOADING DOCK
2. LANDSCAPE/IRRIGATION
3. STORM DRAIN SYSTEM SIGNS "NO DUMPING – DRAINS TO RIVER"
4. INFILTRATION BASINS
5. EDUCATIONAL MATERIALS
6. TRASH ENCLOSURE
7. STREET SWEEPING

NOTES:

RD ROOF DRAIN

PROJECT BOUNDARY

DRAINAGE AREAS

SURFACE FLOW DIRECTION

SD DIRECTION

DA 1 DMA A

DA 2 DMA A

DA 3 DMA A

DA 4 DMA A

DA 5 DMA A
DA 6 DMA A

0 60 120 240 360

SCALE: 1" = 120'

Last Update: 9/3/24
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CITY OF APPLE VALLEY

PUBLIC WORKS DEPARTMENT

BMP SITE MAP

APPLE VALLEY ASSEMBLAGE
SW CORNER OF GUSTINE ROAD AND CENTRAL ROAD

PREPARED FOR:

LAKE CREEK INDUSTRIAL LLC
13681 NEWPORT AVENUE, SUITE 8301
TUSTIN, CA 92780
PHONE: (949) 910-4616

Thienes Engineering, Inc.
CIVIL ENGINEERING * LAND SURVEYING
14349 FIRESTONE BOULEVARD
LA MIRADA, CALIFORNIA 90638
PH.(714)521-4811 FAX(714)521-4173

Designed by _____ Approved by _____ Date _____
Date _____
Checked by _____
Date _____
Designed by _____ Public Works Director _____ R.C.E. _____
Date _____
Checked by _____
Date _____

Sheet 1 of 1 Sheets

4099/1 OF 1 SHEET

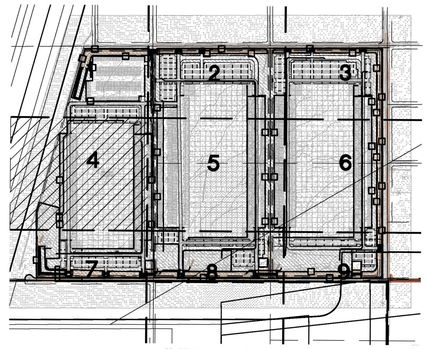
MATCH LINE - SEE SHEET 1

BUILDING 3
1,004,096 SF

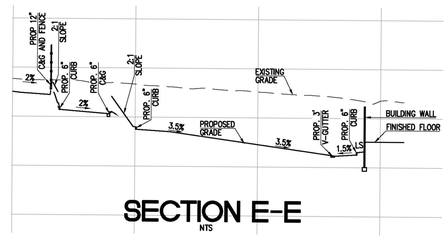
2995.22 FF
2994.55 PAD

MATCH LINE - SEE SHEET 5

MATCH LINE - SEE SHEET 7



INDEX MAP
NTS



SECTION E-E
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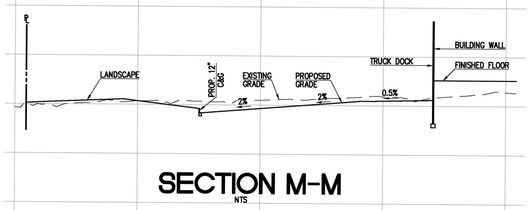

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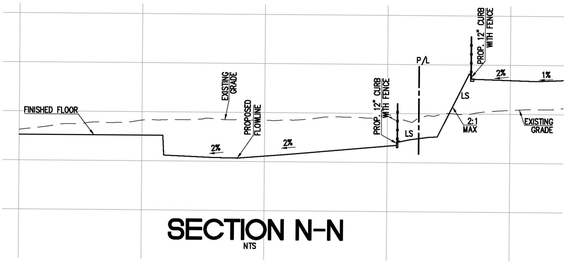

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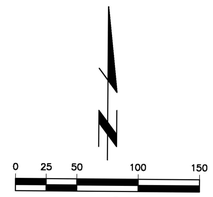

Last Update 8/3/22
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COUNTY OF SAN BERNARDINO
PUBLIC WORKS DEPARTMENT

GRADING PLAN
APPLE VALLEY ASSEMBLAGE
SW CORNER OF GUSTIN ROAD AND CENTRAL ROAD

4099 / 4 OF 47 SHEETS

PREPARED FOR:
LAKE CREEK INDUSTRIAL, LLC
13681 NEWPORT AVENUE, SUITE 8301
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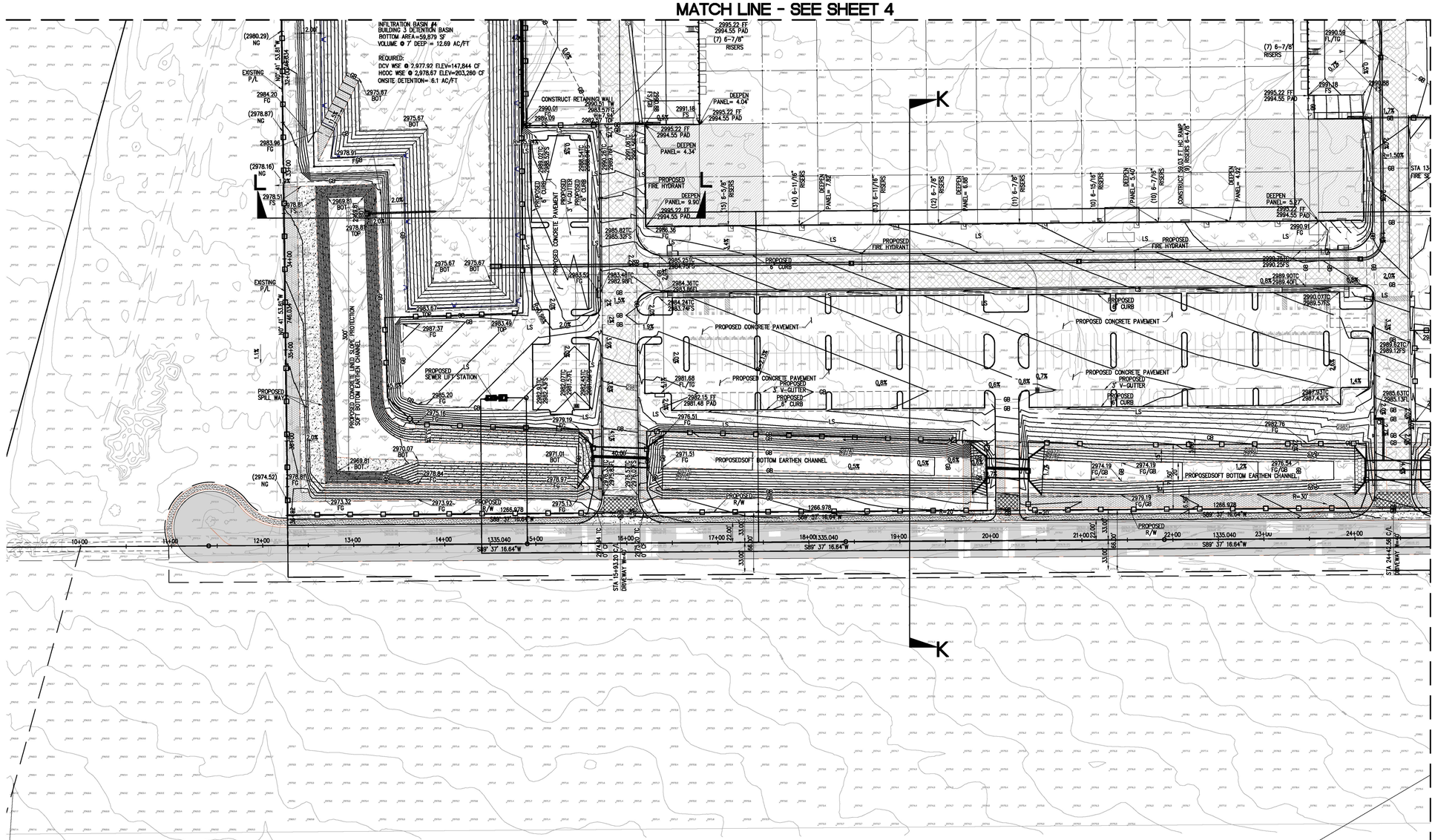
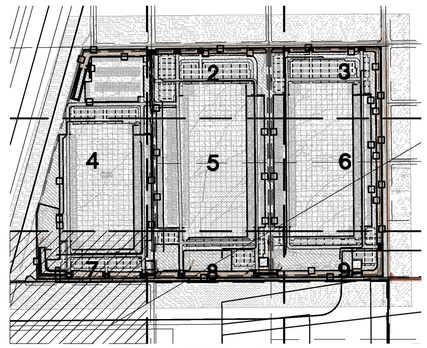
Designed by _____ Date _____
Checked by _____ Date _____
Designed by _____ Date _____
Checked by _____ Date _____

Approved by _____ Date _____
Public Works Director _____ R.C.E. XXXXX

Sheet 4 of 47 Sheets

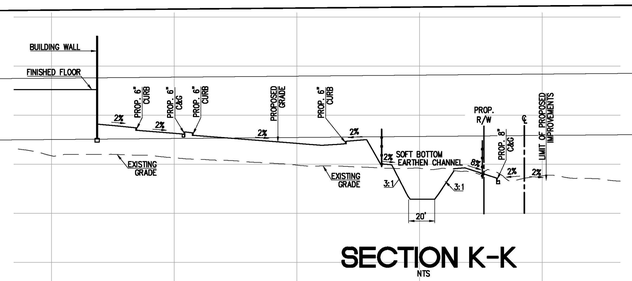
MATCH LINE - SEE SHEET 4





INDEX MAP
NTS

MATCH LINE - SEE SHEET 8



SECTION K-K
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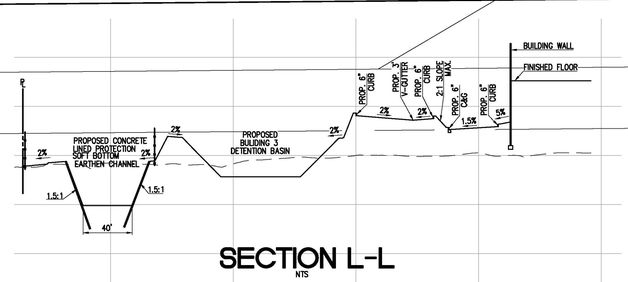

SECTION L-L
NTS

0 25 50 100 150

SCALE: 1"=50'

Last Update: 2/9/23
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COUNTY OF SAN BERNARDINO
PUBLIC WORKS DEPARTMENT

GRADING PLAN

APPLE VALLEY ASSEMBLAGE

SW CORNER OF GUSTIN ROAD AND CENTRAL ROAD

4099/ 7 OF 47 SHEETS

PREPARED FOR:
LAKE CREEK INDUSTRIAL, LLC
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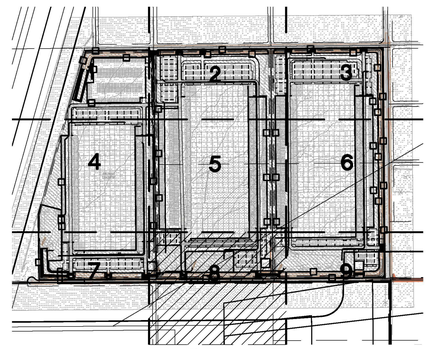
Designed by _____ Date _____
Checked by _____ Date _____
Designed by _____ Date _____
Checked by _____ Date _____

Approved by _____ Date _____
Public Works Director R.C.E. XXXXX

Sheet 7 of 47 Sheets

MATCH LINE - SEE SHEET 5

MATCH LINE - SEE SHEET 9



INDEX MAP
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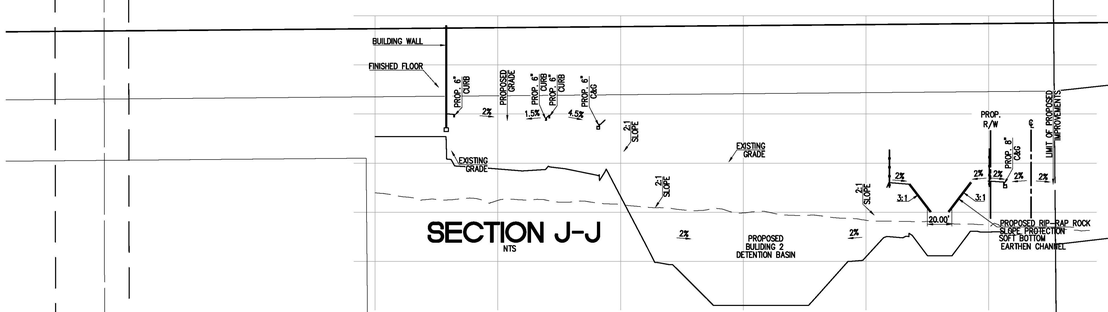

SECTION J-J
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SCALE: 1"=50'

Last Update: 2/9/23
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COUNTY OF SAN BERNARDINO
PUBLIC WORKS DEPARTMENT

GRADING PLAN

APPLE VALLEY ASSEMBLAGE

SW CORNER OF GUSTIN ROAD AND CENTRAL ROAD

4099/ 8 OF 47 SHEETS

PREPARED FOR:
LAKE CREEK INDUSTRIAL, LLC
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Designed by		Approved by	Date
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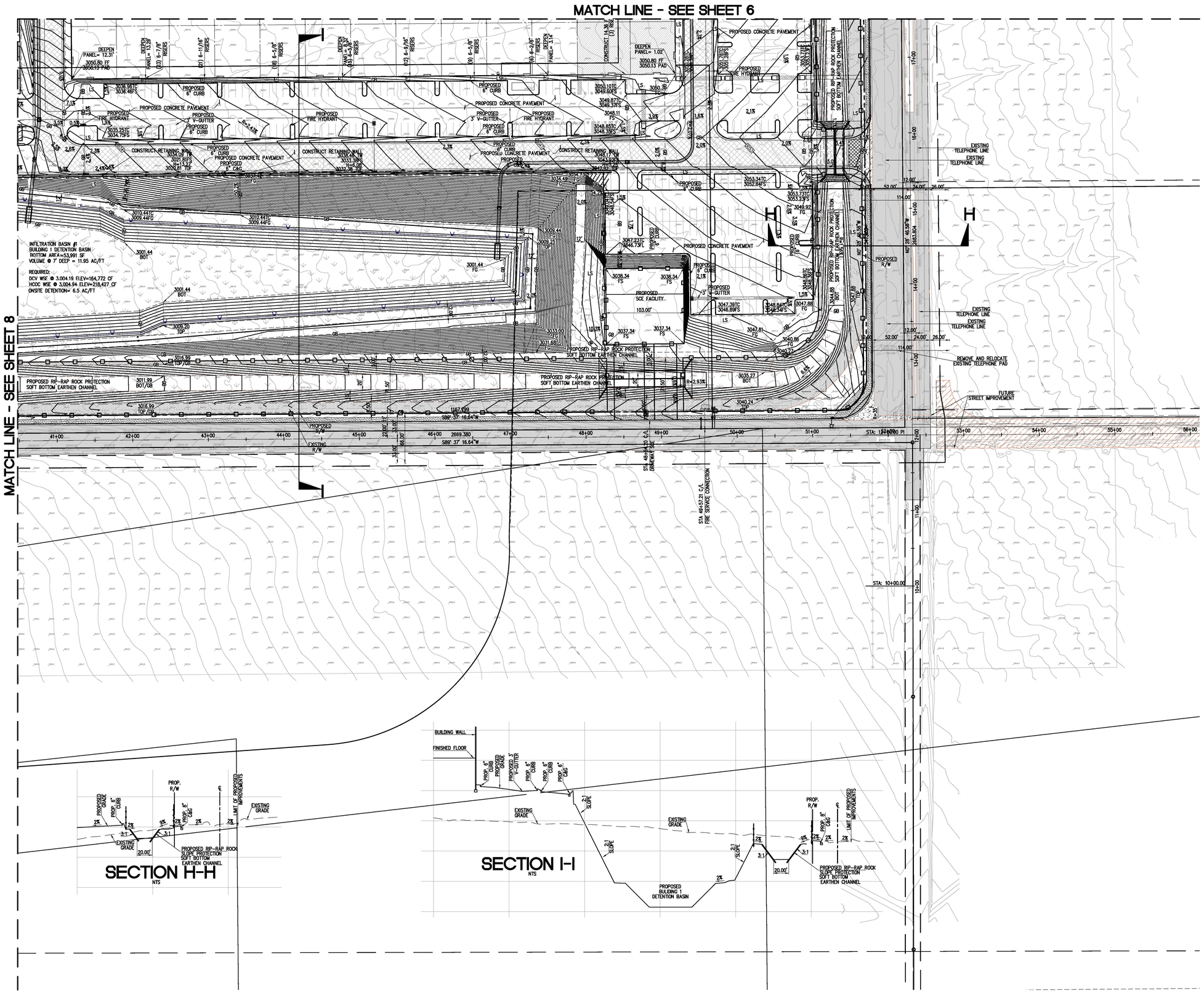
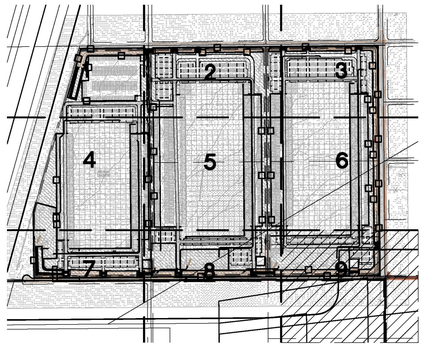
Designed by		Public Works Director	R.C.E. XXXXX
Date			
Checked by			
Date			

Sheet 8 of 47 Sheets





INDEX MAP
NTS

Last Update: 2/9/23
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COUNTY OF SAN BERNARDINO
PUBLIC WORKS DEPARTMENT

GRADING PLAN
APPLE VALLEY ASSEMBLAGE
SW CORNER OF GUSTIN ROAD AND CENTRAL ROAD

PREPARED FOR:
LAKE CREEK INDUSTRIAL, LLC
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Designed by
Date
Checked by
Date
Designed by
Date
Checked by
Date

Approved by Date
Public Works Director R.C.E. XXXXX

Sheet 9 of 47 Sheets

4099/ 9 OF 47 SHEETS

Attachment D
WQMP and Stormwater BMP Transfer, Access and Maintenance Agreement

Attachment E
Educational Materials

Regulatory information

The Federal Water Pollution Control Act prohibits the discharge of any pollutant to navigable waters from a point source unless the discharge is authorized by a National Pollutant Discharge Elimination System (NPDES) permit. The 1987 passage of the Water Quality Act established NPDES permit requirements for discharges of storm water. The NPDES permit program controls water pollution by regulating point sources that discharge pollutants into waters of the United States.

Industrial facilities and construction sites are regulated by the Regional Water Quality Control Board and State Water Resources Control Board, through general storm water permits. Most industrial, manufacturing or transportation businesses that store materials, products or equipment outdoors, or conduct vehicle washing or process operations outdoors are required to obtain coverage under the State Water Resources Control Board's General Industrial Activities Stormwater Permit. For more information about this permit, visit www.swrcb.ca.gov/stormwtr/industrial.html or contact your local storm water coordinator.

If your business conducts construction activities, including clearing, grading, stockpiling or excavation that results in soil disturbances of at least one acre, you are subject to the State Water Resources Control Board's General Construction Activities Stormwater Permit. To find out more about this storm water permit for construction, visit: www.swrcb.ca.gov/stormwtr/construction.html.

Cities and counties are regulated through permits issued by the Regional Boards. Since 1990, operators of large storm drain systems such as San Bernardino County's have been required to:

- Develop a storm water management program designed to prevent harmful pollutants from being dumped or washed by storm water runoff, into the storm water system, then discharged into local water bodies; and
- Obtain a National Pollutant Discharge Elimination System (NPDES) permit.

The NPDES permit programs in California are administered by the State Water Resources Control Board and by nine regional boards that issue NPDES permits and enforce regulations within their respective region.

San Bernardino County lies within the jurisdiction of the Santa Ana Region. This regional board issues a permit to the San Bernardino County Permittees, which includes the County of San Bernardino, San Bernardino County Flood Control District and incorporated cities of San Bernardino County. Since the program's inception, the County of San Bernardino has served as the principal permittee.

SAN BERNARDINO COUNTY
STORMWATER POLLUTION PREVENTION

Documents & reports:

The following documents describe the regulations and programs for water quality in San Bernardino County. You can review the latest Basin Plan, National Pollutant Discharge Elimination System (NPDES) Permit and Drainage Area Management Plan (DAMP).

- **Basin Plans:** The document for each region of the State Water Quality Board's jurisdiction, including Santa Ana, is the Water Quality Control Plan, commonly referred to as the Basin Plan. It is the foundation for the regulatory programs of each regional board. The Basin Plan documents the beneficial uses of the region's ground and surface waters, existing water quality conditions, problems, and goals, and actions by the regional board and others that are necessary to achieve and maintain water quality standards.

▸Water Control Plan for the Santa Ana River Basin

- **Municipal National Pollutant Discharge Elimination System (NPDES) Permits:** The permits of each region outline additional steps for a storm water management program and specify requirements to help protect the beneficial uses of the receiving waters. They require permittees to develop and implement Best Management Practices (BMPs) to control/reduce the discharge of pollutants to waters of the United States to the maximum extent practicable (MEP).

  ▸Santa Ana Regional Water Quality Control Board Municipal NPDES Permit Order No. R8-2002-0012

- **Report of Waste Discharge:** The Report of Waste Discharge (ROWD) describes the San Bernardino Stormwater Program, implemented by the County and cities to comply with their jointly held stormwater permit. It is the principle policy and guidance document for the NPDES Stormwater Program.

  ▸Report of Waste Discharge 2000

- **San Bernardino County Storm Water Program Annual Status Report:** The Annual Status Report is a requirement of the NPDES permit for submittal to the Regional Boards and United States Environmental Protection Agency. The report presents an analysis and assessment of permit compliance activities.

▸Annual report - will be posted soon

For more information about how you can prevent stormwater pollution:

www.sbcountystormwater.org

SAN BERNARDINO COUNTY
STORMWATER POLLUTION PREVENTION

Commercial landscape maintenance:

Yard waste, sediments and toxic lawn and garden chemicals used in commercial landscape maintenance often make their way into the San Bernardino County storm drain system and do not get treated before reaching the Santa Ana River. This pollutes our drinking water and contaminates local waterways, making them unsafe for people and wildlife. Follow these best management practices to prevent pollution, protect public health and avoid fines or legal action.

- **Recycle Yard Waste:** Recycle leaves, grass clippings and other yard waste. Do not blow, sweep, rake or hose yard waste into the street. Let your customers know about grass cycling --the natural recycling of grass by leaving clippings on the lawn when mowing instead of using a grass catcher. Grass clippings will quickly decompose, returning valuable nutrients to the soil. You can get more information at www.ciwmb.ca.gov/Organics.
- **Use Fertilizers, Herbicides & Pesticides Safely:** Fertilizers, herbicides and pesticides are often carried into the storm drain system by sprinkler runoff. Use natural, non-toxic alternatives to traditional garden chemicals. If you must use chemical fertilizers, herbicides, or pesticides spot apply rather than blanketing entire areas, avoid applying near curbs and driveways and never apply before a rain.
- **Recycle Hazardous Waste:** Pesticides, fertilizers, herbicides and motor oil contaminate landfills and should be disposed of through a Hazardous Waste Facility. For information on proper disposal, call (909) 386-8401.
- **Use Water Wisely:** Conserve water and prevent runoff by controlling the amount of water and direction of sprinklers. Sprinklers should be on long enough to allow water to soak into the ground but not so long as to cause runoff. Periodically inspect, fix leaks and realign sprinkler heads.
- **Planting:** Plant native vegetation to reduce the need of water, fertilizers, herbicides and pesticides.
- **Prevent Erosion:** Erosion washes sediments, debris and toxic runoff into the storm drain system, polluting waterways. Prevent erosion and sediment runoff by using ground cover, berms and vegetation down-slope to capture runoff. Avoid excavation or grading during wet weather.
- **Store Materials Safely:** Keep landscaping materials and debris away from the street, gutter and storm drains. On-site stockpiles of materials should be covered with plastic sheeting to protect from rain, wind and runoff.





For more information about how you can prevent stormwater pollution:

www.sbcountystormwater.org

SAN BERNARDINO COUNTY
STORMWATER POLLUTION PREVENTION

Construction & development:

Soil, cement wash, asphalt, oil and other hazardous debris from construction sites often make their way into the San Bernardino County storm drain system, and flow untreated into local waterways. Follow these best management practices to prevent pollution, protect public health and avoid fines or legal action.



- **Store Materials Safely:** Keep construction materials and debris away from the street, gutter and storm drains. Cover exposed stockpiles of soil, sand or gravel and excavated material with plastic sheeting, protected from rain, wind and runoff.
- **Preventing Erosion:** Avoid excavation or grading during wet weather. Plant temporary vegetation or add hydro mulch on slopes where construction is not immediately planned, and permanent vegetation once excavation and grading are complete. Construct diversion dikes to channel runoff to a detention basin and around the construction site. Use gravel approaches where truck traffic is frequent to reduce soil compaction and limit the tracking of sediment into the streets. For more information on erosion control, call (909) 799-7407.



- **Cleaning & Preventing Spills:** Use a drip pan and funnel when draining or pouring fluids. Sweep up dry spills, instead of hosing. Be ready for spills by preparing and using spill containment and cleanup kits that include safety equipment and dry cleanup materials such as kitty litter or sawdust. To report serious spills, call 911.
- **Maintaining Vehicles & Equipment:** Maintain and refuel vehicles and equipment at a single location on-site, away from the street, gutter and storm drains. Perform major equipment repairs and washings off-site. Inspect vehicles and equipment frequently for leaks, and prevent leaks from stored vehicles by draining gas, hydraulic oil, transmission, and brake and radiator fluids.
- **Ordering Materials & Recycling Waste:** Reduce waste by ordering only the amounts of materials needed for the job. Use recycled or recyclable materials whenever possible. You can recycle broken asphalt, concrete, wood, and cleared vegetation. Dispose of hazardous materials through a hazardous waste hauler or other means in accordance with the construction permit. Non-recyclable materials should be taken to a landfill or disposed of as hazardous waste. For recycling and disposal information, call (909) 386-8401.
- **Concrete and mortar application:** Never dispose of cement washout into driveways, streets, gutters or drainage ditches. Wash concrete mixers and equipment only in specified washout areas, where the water flows into lined containment ponds. Cement wash water can be recycled by pumping it back into cement mixers for reuse.

For more information about how you can prevent stormwater pollution:

www.sbcountystormwater.org

SAN BERNARDINO COUNTY
STORMWATER POLLUTION PREVENTION

General industrial & manufacturing businesses:

If you own, manage or help operate a business, especially an industrial or manufacturing company, you can help reduce storm water pollution. From environmentally friendly cleaning and maintenance activities, to recycling hazardous waste materials, businesses can do a lot to prevent storm water pollution.

- Review your cleaning and maintenance activities to look for ways to reduce runoff into the storm drain system, especially in outdoor areas like parking lots, loading docks and maintenance yards. Keep trash enclosure swept and trash bin lids closed.
- Train employees to wash vehicles and equipment indoors in a wash rack that is connected to the sanitary sewer or off-site at a commercial wash facility. Train janitorial staff to dispose of floor cleaning water in the sewer and not into the parking lot. Make sure that cooling towers, boilers, compressors, water softeners and other process equipment are connected to the sanitary sewer and do not discharge wastewater into the parking lot.
- If you use hazardous materials in your everyday business, like ink and solvents for commercial printing, or polishes and chemicals for car detailing or manufacturing after-market accessories, do not put these hazardous materials in the trash or pour them into the gutter. Take them to be recycled safely. Store chemicals, wastes, raw materials and contaminated equipment indoors or in a covered, spill contained area, to prevent exposure of these materials to storm water. For information on proper hazardous waste disposal, call (909)386-8401.
- Take advantage of less-toxic alternatives to dangerous chemicals. From detergents to drain openers, there are a lot of ways to get the same or better result without having to rely toxic substances.
- Looking for raw materials? San Bernardino County Materials Exchange Program, or SBCoMax is a partnership between the County and the California Integrated Waste Management Board, for businesses to provide used but usable materials to those interested in obtaining them. The program helps divert used materials from landfills, saves resources and can save you money.

For more information about how you can prevent stormwater pollution:

www.sbcountystormwater.org

San Bernardino County Stormwater Program
825 East Third Street · Room 127
San Bernardino, CA 94215-0835

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STANDARD
U.S. POSTAGE
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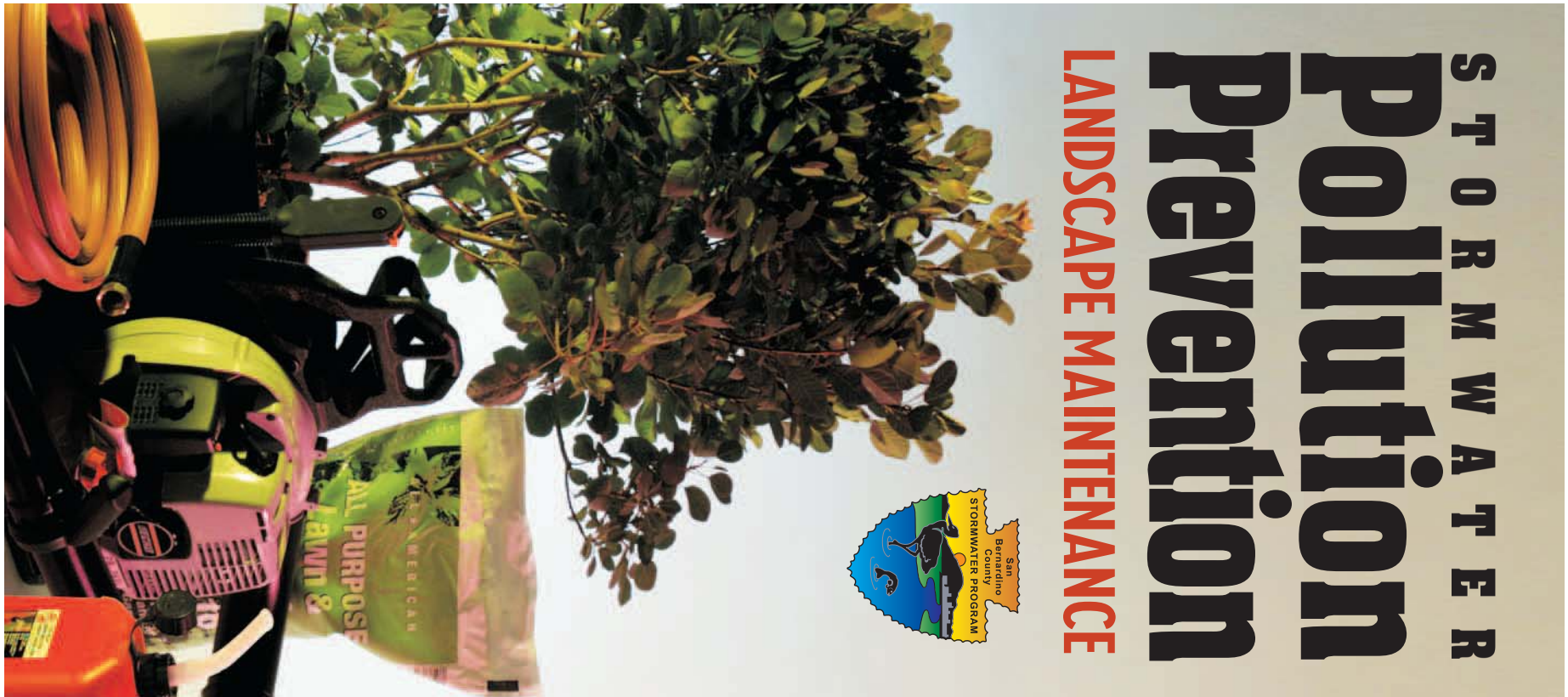
SACRAMENTO, CA
PERMIT# 000



STORMWATER Pollution Prevention

Stormwater Management Practices for Commercial Landscape Maintenance

Yard waste, sediments, and toxic lawn/garden chemicals used in commercial landscape maintenance often make their way into the San Bernardino County storm drain system and do not get treated before reaching the Santa Ana River. This pollutes our drinking water and contaminates local waterways, making them unsafe for people and wildlife. Following these best management practices will prevent pollution, comply with regulations and protect public health.

Recycle Yard Waste

Recycle leaves, grass clippings and other yard waste. Do not blow, sweep, rake or hose yard waste into the street. Try grasscycling - the natural recycling of grass by leaving clippings on the lawn when mowing. Grass clippings will quickly decompose, returning valuable nutrients to the soil. Further information can be obtained at www.ciwmb.ca.gov/Organics.

Use Fertilizers, Herbicides and Pesticides Safely

Fertilizers, herbicides and pesticides are often carried into the storm drain system by sprinkler runoff. Use of natural, non-toxic alternatives to the traditional fertilizers, herbicides and pesticides is highly recommended. If you must use chemical fertilizers, herbicides, or pesticides:



- Spot apply pesticides and herbicides, rather than blanketing entire areas.
- Avoid applying near curbs and driveways, and never apply before a rain.
- Apply fertilizers as needed, when plants can best use it, and when the potential for it being carried away by runoff is low.

Recycle Hazardous Waste

Pesticides, fertilizers, herbicides and motor oil contaminate landfills and should be disposed of through a Hazardous Waste Facility, which accepts these types of materials. For information on proper disposal call, (909) 386-8401.

Use Water Wisely

Conserve water and prevent runoff by controlling the amount of water and direction of sprinklers. Sprinklers should be on long enough to allow water to soak into the ground but not so long as to cause runoff. Periodically inspect, fix leaks and realign sprinkler heads. Plant native vegetation to reduce the need of water, fertilizers, herbicides, and pesticides.

Prevent Erosion

Erosion washes sediments, debris and toxic runoff into the storm drain system, polluting waterways.

- Prevent erosion and sediment runoff by using ground cover, berms and vegetation down-slope to capture runoff.
- Avoid excavation or grading during wet weather.

Store Materials Safely

Keep landscaping materials and debris away from the street, gutter and storm drains. On-site stockpiles of materials must be covered with plastic sheeting to protect from rain, wind and runoff.

To report illegal dumping call

(877) WASTE18

or visit our website:

sbcountystormwater.org

San Bernardino County STORMWATER PROGRAM

STORMWATER Pollution Prevention

FRESH CONCRETE & MORTAR APPLICATION

Cement wash, sediment, vehicle fluids, dust and hazardous debris from construction sites often make their way into the San Bernardino County storm drain system and do not get treated before reaching the Santa Ana River. This pollutes our drinking water and contaminates waterways, making them unsafe for people and wildlife. Follow these best management practices to prevent pollution and protect public health.



Storing Materials

Keep construction materials and debris away from the street, gutter and storm drains. Secure open bags of cement and cover exposed stockpiles of soil, sand or gravel and excavated material with plastic sheeting, protected from rain, wind and runoff.



Ordering Materials & Recycling Waste

Reduce waste by ordering only the amounts of materials needed for the job. Use recycled or recyclable materials whenever possible. When breaking up paving, recycle the pieces at a crushing company. You can also recycle broken asphalt, concrete, wood, and cleared vegetation. Non-recyclable materials should be taken to a landfill or disposed of as hazardous waste. Call (909) 386-8401 for recycling and disposal information.



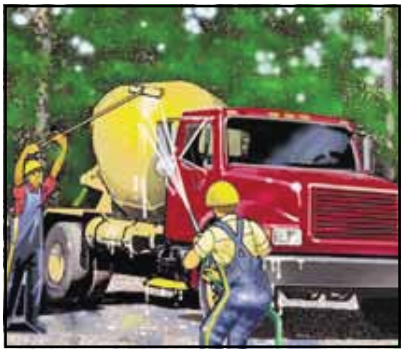
During Construction

Schedule excavation and grading during dry weather. Prevent mortar and cement from entering the street and storm drains by placing erosion controls. Setup small mixers on tarps or drop cloths, for easy cleanup of debris. Never bury waste material. Recycle or dispose of it as hazardous waste.



Cleaning Up

Wash concrete dust onto designated dirt areas, not down driveways or into the street or storm drains. Wash out concrete mixers and equipment in specified washout areas, where water can flow into a containment pond. Cement washwater can be recycled by pumping it back into cement mixers for reuse. Never dispose of cement washout into driveways, streets, gutters, storm drains or drainage ditches.



To report illegal dumping call

(877) WASTE18

sbcountystormwater.org

San Bernardino County STORMWATER PROGRAM

Prevención de Contaminación del Desagüe

APLICANDO CONCRETO FRESCO

Cemento, grava, asfalto y liquidos de auto, tierra y residuos peligrosos de lugares de concreto fresco por llegar a los drenajes del Condado de San Bernardino y terminando en el Rio de Santa Ana. Esto contamina el agua que tomamos, haciendola peligorsa para la gente y la vida salvaje. Sigue estas practicas para prevenir la contaminación y protejer la salud publica.



Almacenando Materiales
Manten materiales de construcción y residuos lejos de las calles, coladeras y desagües. Manten tapados los bultos de arena, grava y herramientas para excavar cuviertos con algun plastico para protejerlos de la lluvia, el aire y el desagüe.



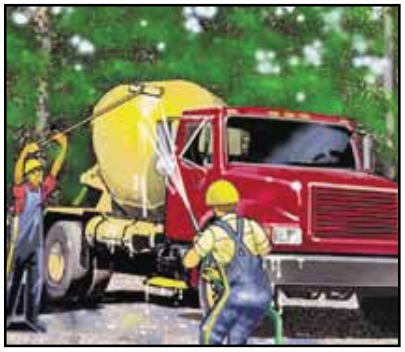
Ordenando Materiales & Reciclando
Reduce la cantidad al ordenar el material, solo ordena lo necesario. Usa materiales recicables cuando sea posible. Cuando estes rompiendo el pavimento, recicla los pedasos en la compañia demolidora. Se puede reciclar el aspfalto, concreto, madera y la vegetacion. Materiales no reciclados se deverian llevar a lugares de desechos peligrosos. llama al (909) 386-8401 para más información.



Durante Construcción
Planea las excavaciones durante clima seco. No dejes que el cemento o la cal lleguen hasta las calles o drenajes, evita esto con plantas temporales para detener el desagüe. Cubre las maquinas de mesclar con alguna garra para que se facilite la limpieza de residuos. Nunca entierres los desechos. Recicla todos los desechos peligrosos.



Limpiando
Lava la cal en un area designada, no la eches hacia la cochera o en la calle. Lava las mescladoras y las herramientas en un lugar especifico, donde el agua llegue a un contenedor. El agua de cemento se puede reciclar volviendola a usar en las mescladoras. Nunca dejes el agua de cemento que corra hacia las calles, alcantarillas o drenajes.



Para reportar actividades ilegales llamar al:

(877) WASTE18
sbcountystormwater.org

San Bernardino County
STORMWATER PROGRAM

STORMWATER Pollution Prevention

CONSTRUCTION

Cement wash, sediment, vehicle fluids, dust and hazardous debris from construction sites often make their way into the San Bernardino County storm drain system and do not get treated before reaching the Santa Ana River. This pollutes our drinking water and contaminates waterways, making them unsafe for people and wildlife. Follow these best management practices to prevent pollution and protect public health.



Store Materials Safely
Keep construction materials and debris away from the street, gutter and storm drains. Cover exposed stockpiles of soil, sand or gravel and excavated material with plastic sheeting, protected from rain, wind and runoff.



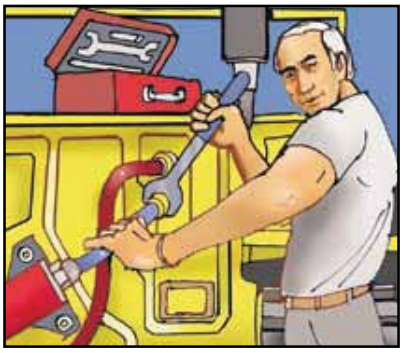
Ordering Materials & Recycling Waste
Reduce waste by ordering only the amounts of materials needed for the job. Use recycled or recyclable materials whenever possible. You can recycle broken asphalt, concrete, wood, and cleared vegetation. Non-recyclable materials should be taken to a landfill or disposed of as hazardous waste. For recycling and disposal information, call (909) 386-8401.



Cleaning & Preventing Spills
Use a drip pan and funnel when draining or pouring fluids. Sweep up dry spills, instead of hosing. Be ready for spills by preparing and using spill containment and cleanup kits that include safety equipment and dry cleanup materials such as kitty litter or sawdust. To report serious spills, call 911.



Preventing Erosion
Avoid excavation or grading during wet weather. Plant temporary vegetation or add hydromulch on slopes where construction is not immediately planned, and permanent vegetation once excavation and grading are complete. Construct diversion dikes to channel runoff to a detention basin and around the construction site. Channels can be lined with grass or roughened pavement to reduce runoff velocity.



Maintaining Vehicles & Equipment
Maintain and refuel vehicles and equipment at a single location on-site, away from the street, gutter and storm drains. Perform major equipment repairs and washings off-site. Inspect vehicles and equipment frequently for leaks, and prevent leaks from stored vehicles by draining gas, hydraulic oil, transmission, brake and radiator fluids.



To report illegal dumping call
(877) WASTE18
sbcountystormwater.org

San Bernardino County STORMWATER PROGRAM

Prevención de Contaminación del Desagüe

CONSTRUCCIÓN

Cemento, sedimentos, liquidos de auto, polvos y residuos peligrosos acaban por llegar a los drenajes del Condado de San Bernardino y terminando en el Rio de Santa Ana. Esto contamina el agua que tomamos, haciendola peligorsa para la gente y la vida salvaje. Sigue estas practicas para prevenir la contaminación y protejer la salud publica.



Almacenando Materiales Cuidadosamente

Manten materiales de construcción y residuos lejos de las calles, coladeras y desagües. Manten tapados los bultos de arena, grava y herramientas para excavar cuviertos con algun plastico para protejerlos de la lluvia, el aire y el desagüe.



Ordenando Materiales & Reciclando Desechos

Reduce la cantidad al ordenar el material, solo ordena lo necesario. Usa materiales que se puedan reciclar cuando sea posible. Se puede reciclar el aspfalto, concreto, madera y la vegetacion. Materiales no reciclados se deven llevar a lugares de desechos peligrosos. Para mas información llama al (909) 386-8401.



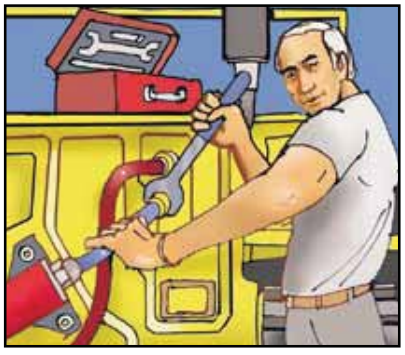
Limpiando & Previniendo Derrames

Usa siempre un enbudo al vaciar liquidos. Barre los derrames en ves de lavarlos con la manguera. Mantente siempre preparado para cualquier derrame, usa siempre las herramientas de seguridad al igual que materiales como, tierra para desechos de gato o aserrin. Para reportar derrames llama al 911.



Previniendo Erosiones

Evita las excavaciones durante lluvia. Planta vegetacion temporal en colinas donde aun no hay planes de construccion y planta vegetacion permanente al terminar las excavaciones. Construye algunos canales para el desagüe. Estos pueden ser creados con pasto y cemento para reducir la velocidad del desagüe.



Mantenimiento de Vehiculos & Herramientas

Has el mantenimiento y carga de vehiculos en el mismo lugar, lejos de la calle, las alcantarillas y los drenajes. Inspecciona los vehiculos y el equipo de cualquier goteadura y preveen goteaduras de autos que no se usan vasiandoles la gasolina, aceite de transmision, frenos y liquidos del radiador.



Para reportar actividades ilegales llamar al:

(877) WASTE18

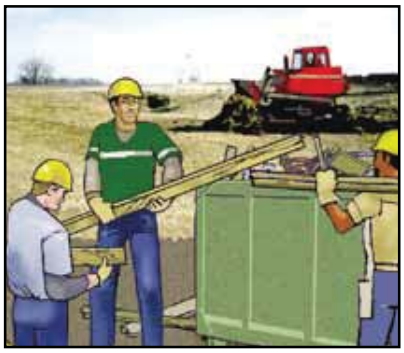
sbcountystormwater.org

San Bernardino County STORMWATER PROGRAM

STORMWATER Pollution Prevention

EXCAVATION AND GRADING

Sediment, cement wash, asphalt and vehicle fluids from soil excavation and grading often make their way into the San Bernardino County storm drain system and do not get treated before reaching the Santa Ana River. This pollutes our drinking water and contaminates waterways, making them unsafe for people and wildlife. Follow these best management practices to prevent pollution and protect public health.



Recycling Waste

Recycle broken asphalt, concrete, wood, and cleared vegetation whenever possible. Non-recyclable materials should be taken to a landfill or disposed of as hazardous waste. For recycling and disposal information, call (909) 386-8401.



Maintaining Vehicles & Equipment

Maintain and refuel vehicles and equipment at a single location on-site, away from the street, gutters and storm drains. Perform major equipment repairs and washings off-site. Inspect vehicles and equipment frequently for leaks. Use gravel approaches where truck traffic is heavy to reduce soil compaction and limit the tracking of sediment into the street.



Cleaning & Preventing Spills

Use a drip pan and funnel when draining or pouring fluids. Sweep up dry spills, instead of hosing. Be ready for spills by preparing and using spill containment and cleanup kits that include safety equipment and dry cleanup materials such as kitty litter or sawdust. Prevent leaks from stored vehicles by draining gas, hydraulic oil, transmission, brake and radiator fluids. To report serious spills, call 911.





Storing Materials

Keep construction materials and debris away from the street, gutter and storm drains. Cover exposed stockpiles of soil, sand or gravel and excavated material with plastic sheeting, protected from rain, wind and runoff.



Preventing Erosion

Avoid excavation or grading during wet weather. Plant temporary vegetation on slopes where construction is not immediately planned, and permanent vegetation once excavation and grading are complete. Construct diversion dikes to channel runoff. Channels can be lined with grass or roughened pavement to reduce runoff velocity.

To report illegal dumping call

(877) WASTE18

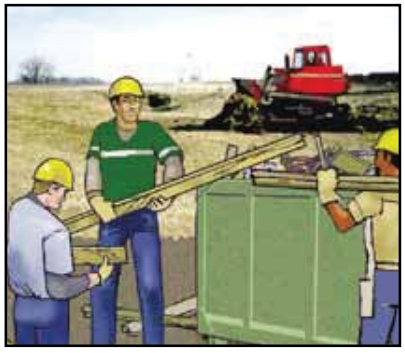
sbcountystormwater.org

San Bernardino County STORMWATER PROGRAM

Prevención de Contaminación del Desagüe

EXCAVACIONES

Sedimento, cemento, asfalto y liquidos de auto, tierra y residuos peligrosos de lugares de construcción acaban por llegar a los drenajes del Condado de San Bernardino y terminando en el Rio de Santa Ana. Esto contamina el agua que tomamos, haciendola peligorsa para la gente y la vida salvaje. Sigue estas practicas para prevenir la contaminación y protejer la salud publica.



Reciclando Desechos
Recicla el aspfalto, concreto, madera y la vegetacion cuando sea posible. Materiales no reciclados se deverian llevar a lugares de desechos peligrosos. Para màs informacion llama al (909) 386-8401.



Manteniendo Vehiculos & Herramientas
Has el mantenimiento y carga de vehiculos en el mismo lugar, lejos de la calle, las alcantarillas y los drenajes. Inspecciona los vehiculos y el equipo de cualquier goteadura. Usa grava donde mayormente se consentra el trafico de camiones para y reducir el sedimento en las calles.



Limpiando & Previniendo Derrames
Usa siempre un enbudo al vaciar liquidos. Barre los derrames en ves de lavarlos con la manguera. Mantente siempre preparado para cualquier derrame, usa siempre las herramientas de seguridad al igual que materiales como, tierra para desechos de gato o aserrin. Preveen goteaduras de autos que no se usan vasiandoles la gasolina, aceite de transmision, frenos y liquidos del radiador. Para reportar derrames llama al 911.



Almacenando Materiales
Manten materiales de construccion y residuos lejos de las calles, coladeras y desagües. Manten tapados los bultos de arena, grava y erramientas para excavar cuviertos con algun plastico para protejerlos de la lluvia, el aire y el desagüe.



Previniendo Erosiones
Evita las excavaciones durante lluvia. Planta vegetacion temporal en colinas donde aun no hay planes de construcción y planta vegetacion permanente al terminar las excavaciones. Construye algunos canales para el desagüe. Estos pueden ser creados con pasto y cemento para reducir la velocidad del desagüe.

Para reportar actividades ilegales llamar al:

(877) WASTE18
sbcountystormwater.org

San Bernardino County
STORMWATER PROGRAM

STORMWATER Pollution Prevention

ROADWORK AND PAVING

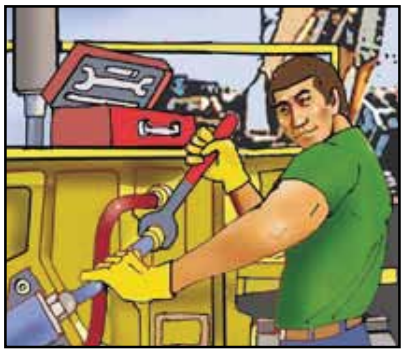
Asphalt, saw-cut slurry and excavated materials from road paving, surfacing and pavement removal often make their way into the San Bernardino County storm drain system and do not get treated before reaching the Santa Ana River. This pollutes our drinking water and contaminates waterways, making them unsafe for people and wildlife. Follow these best management practices to prevent pollution and protect public health.



Preventing Erosion
Schedule excavation and grading work during dry weather. Develop and implement erosion and sediment control plans for excavated embankments. Cover exposed stockpiles of soil, sand or gravel and excavated material with plastic sheeting, protected from rain, wind and runoff.



During Construction
Cover catch basins and maintenance holes when applying seal coat, slurry seal or fog seal. Use check dams, ditches or berms around excavations, and avoid over applying water for dust control. Never wash excess materials from exposed aggregate or concrete into the street, gutter or a storm drain.



Maintaining Vehicles & Equipment
Maintain and refuel vehicles and equipment at a single location on-site, away from the street, gutter and storm drains. Perform major equipment repairs and washings off-site. Inspect vehicles and equipment frequently for leaks, and prevent leaks from stored vehicles by draining gas, hydraulic oil, transmission, brake and radiator fluids.

Asphalt & Concrete Removal
Barricade storm drain openings during saw-cutting, and recycle broken up pavement at a crushing company. For recycling information, call (909) 386-8401.



Cleaning & Preventing Spills
Be ready for spills by preparing and using spill containment and cleanup kits that include safety equipment and dry cleanup materials such as kitty litter or sawdust. Sweep up dry spills, instead of hosing. Prevent spills from paver machines by using drip pans, or by placing absorbent materials like cloths or rags under the machines when not in use. To report serious spills, call 911.



To report illegal dumping call

(877) WASTE18

sbcountystormwater.org

San Bernardino County STORMWATER PROGRAM

Prevención de Contaminación del Desagüe

TRABAJO DE CARRETERAS & PAVIMENTO

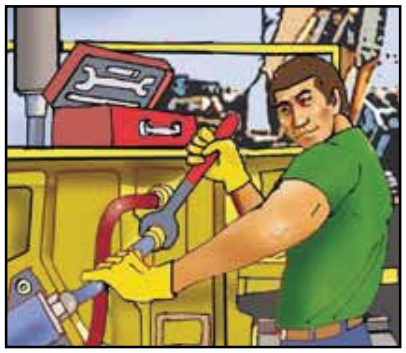
Asfalto, mezcla y materiales de excavaciones del pavimento acaban por llegar a los drenajes del Condado de San Bernardino y terminando en el Rio de Santa Ana. Esto contamina el agua que tomamos, haciendola peligorsa para la gente y la vida salvaje. Sigue estas practicas para prevenir la contaminación y protejer la salud publica.



Previniendo Erosiones
Planea las excavaciones trabajo de jardineria durante el clima seco. Desarrolla e implementa planes de embancamientos de control de sedimento y excavaciones. Cubre montones de tierra, grava y otros materiales con un plastico para protejerlos de la llvia, aire y desagüe.



Durante Construcción
Cubre los lavados y da mantenimiento a los hoyos al aplicar selladura o mezcla. Revisa las areas de excavaciones, y evita pasarte de agua para preveenir polvadura. Nunca laves los materiales llenos de concreto en la calle, drenajes o en el desagüe.



Mantenimiento de Vehiculos & Herramientas
Has el mantenimiento y carga de vehiculos en el mismo lugar, lejos de la calle, las alcantarillas y los drenajes. Inspecciona los vehiculos y el equipo de cualquier goteadura y evita goteaduras de autos que no se usan vasiandoles la gasolina, aceite de transmision, frenos y liquidos del radiador.

Removiendo Asfalto & Concreto
Bloquea alrededor de los drenajes cuando estes usando las maquinas de sierra, tambien recicla todo el pavimento roto en la compañia demolidora. Para más información llama al (909) 386-8401.



Limpiando & Previniendo Derrames
Mantente siempre preparado para cualquier derrame, usa siempre las herramientas de seguridad al igual que materiales como, tierra para desechos de gato o aserrin Barre los derrames en ves de lavarlos con la manguera. Previene los derrames de las maquinas usando enbudos o colocanto garras para absorver cualquier liquido. Para reportar derrames llama al 911.



Para reportar actividades ilegales llamar al:

(877) WASTE18

sbcountystormwater.org

San Bernardino County STORMWATER PROGRAM

STORMWATER Pollution Prevention

Important Phone Numbers

San Bernardino County Flood Control
(909) 387-8112

County of San Bernardino
(909) 387-8109

City of Big Bear Lake
(909) 866-5831

City of Chino (909) 591-9850

City of Chino Hills (909) 364-2722

City of Colton (909) 370-6128

City of Fontana (909) 350-6772

City of Grand Terrace
(909) 824-6671 x 226

City of Highland (909) 864-8732 x 230

City of Loma Linda (909) 799-4405

City of Montclair (909) 625-9470

City of Ontario (909) 395-2025

City of Rancho Cucamonga
(909) 477-2740 x 4063

City of Redlands (909) 798-7655

City of Rialto (909) 421-4921

City of San Bernardino (909) 384-5154

City of Upland (909) 931-4370

City of Yucaipa (909) 797-2489 x 243

San Bernardino County
Stormwater Program
825 East Third Street • Room 201
San Bernardino, CA 94215-0835

STORMWATER Pollution Prevention

INDUSTRIAL AND COMMERCIAL FACILITIES



Pollution Prevention

STORMWATER

To reduce the amount of pollutants reaching our storm drain system, which leads to the Santa Ana River and Pacific Ocean, the San Bernardino County Stormwater Program has developed Best Management Practices (BMPs) for Industrial and Commercial Facilities. City and County ordinances require that businesses comply with these BMPs, where applicable, to protect local water quality. Local cities and the County are required to verify implementation of these BMPs by performing regular facility inspections.



Prohibited Discharges

- Discontinue all non-stormwater discharges to the storm drain system. It is prohibited to discharge any chemicals, wastes or wastewater into the gutter, street or storm drain.

Outdoor Storage

- Install covers and secondary containment areas for all hazardous materials and wastes stored outdoors in accordance with County and/or City standards.
- Keep all temporary waste containers covered, except when in direct use.
- Sweep outdoor areas instead of using a hose or pressure washer.

Outdoor Processes

- Move all process operations including vehicle and equipment maintenance inside of the building or into a covered and contained area.
- Wash equipment and vehicles in a contained and covered wash bay which is closed-loop or connected to a clarifier sized to city standards, then discharged to a sanitary sewer or take them to a commercial car wash.

Spills and Clean Ups

- Clean up spills immediately when they occur, using dry clean up methods such as absorbent materials and followed by proper disposal of materials.
- Always have a spill kit available near chemical loading dock doors, vehicle maintenance and fueling areas.
- Follow your Business Emergency Plan, as filed with the County Fire Department at (909) 386-8401.

Industrial and Commercial Facilities

- Report all prohibited discharges and non-implementation of BMPs to your local Stormwater Coordinator either at (800) CLEANUP or as listed at www.sbcounty.gov/stormwater.
- Report hazardous materials spills to (800) 33 TOXIC and your local Fire Department Hazmat Team at 911.

Training

Train employees in spill response procedures and prohibited discharges to the storm drain system, as prescribed in your local Stormwater Ordinance and in applicable Best Management Practices available at www.cabmphandbooks.com and www. sbcounty.gov/stormwater.

Permitting

Stormwater discharges associated with specific categories of commercial and industrial facilities are regulated by the State Water Resources Control Board (SWRCB) through an Industrial Storm Water General Permit. A copy of the General Permit and application forms are available at: www.waterboards.ca.gov/stormwtr/industrial.html

To report illegal dumping or for more information on stormwater pollution prevention, call:

1 (800) CLEANUP

or visit our websites at:

www.sbcounty.gov/stormwater

www.1800cleanup.org

San Bernardino County STORMWATER PROGRAM

Prevención de Contaminación
AL SISTEMA DE DRENAJE

Números de Teléfono Importantes

San Bernardino County Flood Control
(909) 387-8112

County of San Bernardino
(909) 387-8109

City of Big Bear Lake
(909) 866-5831

City of Chino (909) 591-9850

City of Chino Hills (909) 364-2722

City of Colton (909) 370-6128

City of Fontana (909) 350-6772

City of Grand Terrace
(909) 824-6671 x 226

City of Highland (909) 864-8732 x 230

City of Loma Linda (909) 799-4405

City of Montclair (909) 625-9470

City of Ontario (909) 395-2025

City of Rancho Cucamonga
(909) 477-2740 x 4063

City of Redlands (909) 798-7655

City of Rialto (909) 421-4921

City of San Bernardino (909) 384-5154

City of Upland (909) 931-4370

City of Yucaipa (909) 797-2489 x 243

San Bernardino County
Stormwater Program
825 East Third Street • Room 201
San Bernardino, CA 94215-0835

Prevención de Contaminación
AL SISTEMA DE DRENAJE

INSTALACIONES INDUSTRIALES Y COMERCIALES



Prevención de Contaminación
AL SISTEMA DE DRENAJE

Para reducir la cantidad de contaminantes que alcanzan nuestro sistema de aguas pluviales, las cuales desembocan en el Río Santa Ana y el Océano Pacífico, el Programa del Condado de San Bernandino ha desarrollado las pautas de Mejores Prácticas de Manejo (BMPs, por sus siglas en inglés) para instalaciones industriales y comerciales. Los decretos de la ciudad y del condado establecen que todas las empresas deben de cumplir con estas BMPs, cuando corresponda, para proteger la calidad del agua local. Las ciudades locales y el condado tienen la obligación de verificar la implementación de estas BMPs al llevar a cabo inspecciones regulares en sus instalaciones.



Desagües Prohibidos

- Descontinúe todo desagüe de aguas no pluviales al sistema de drenaje de aguas pluviales. Está prohibido descargar cualquier sustancia química, residuo o agua residual a los drenajes de la cuneta, de la calle o de aguas pluviales.

Almacenamiento al Aire Libre

- Instale cubiertas y áreas de retención secundarias para todos los materiales peligrosos y residuos almacenados al aire libre, estas instalaciones deberán de cumplir con los estándares establecidos por el condado y/o la ciudad.
- Mantenga todos los recipientes temporales de residuos cubiertos, con la excepción de cuando se estén utilizando directamente.
- Barra todas las áreas al aire libre en lugar de usar una manguera o un equipo de limpieza con agua a alta presión.

Procesos al Aire Libre

- Reubique todos los procesos u operaciones, incluyendo el mantenimiento de vehículos y equipo, dentro de un edificio en una área cubierta e independiente.
- Lave el equipo y los vehículos en una fosa de lavado independiente que tenga un anillo cerrado o bien, esté conectada a un clarificador del tamaño de los estándares municipales, luego elimine los residuos en un drenaje sanitario o llévelos a un lavador de carros comercial.

Derrames y Limpieza

- Limpie los derrames inmediatamente, utilice métodos de limpieza en seco como son el uso de materiales absorbentes y elimine estos materiales de la manera adecuada.
- Siempre tenga a la mano un estuche para derrames cerca de las puertas de los muelles de carga de sustancias químicas, en las áreas de mantenimiento de vehículos y en las áreas de combustible.
- Siga su Plan de Emergencia Comercial, como lo registró con el Departamento de Bomberos del Condado marcando al (909) 386-8401.
- Reporte todos los desagües prohibidos y cualquier punto no implementado de las BMPs a su coordinador local de Aguas Pluviales llamando al (800) CLEANUP o como se indica en el enlace www.sbcounty.gov/stormwater.
- Reporte cualquier derrame peligroso al (800) 33 TOXIC y al equipo Hazmat de su departamento local de bomberos marcando al 911.

Instalaciones Industriales y Comerciales

Capacitación

Capacite a los empleados sobre los procedimientos de respuesta ante un derrame y los desagües prohibidos al sistema de aguas pluviales, como lo indica el decreto local de aguas pluviales de Mejores Prácticas de Manejo (BMPs) disponibles en el sitio www.cabmphandbooks.com y www.sbcounty.gov/stormwater.

Autoridad Competente

Los desagües de aguas pluviales relacionados con categorías específicas de instalaciones comerciales e industriales están regulados por la Junta Estatal de Control de Recursos Acuáticos (State Water Resources Control Board, SWRCB) a través de un permiso industrial general de aguas pluviales. Para obtener una copia de este permiso general y una solicitud, visite el sitio: www.waterboards.ca.gov/stormwtr/industrial.html

Para reportar el desagüe de residuos ilegales o para obtener información adicional sobre la prevención de contaminación a las aguas pluviales, llame a:

1 (800) CLEANUP

o visite nuestro sitio:

www.sbcounty.gov/stormwater

www.1800cleanup.org

San Bernardino County STORMWATER PROGRAM

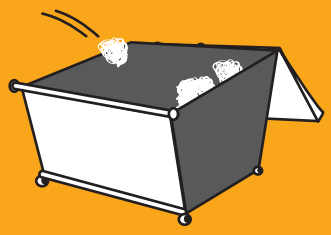
COMMERCIAL TRASH ENCLOSURES

FOLLOW THESE **REQUIREMENTS** TO **KEEP OUR WATERWAYS CLEAN**

Trash enclosures, such as those found in commercial and apartment complexes, typically contain materials that are intended to find their way to a landfill or a recycling facility. **These materials are NOT meant to go into our local lakes and rivers.**

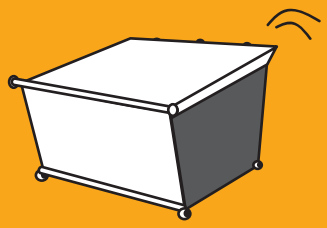
PROTECT WATER QUALITY BY FOLLOWING THESE SIMPLE STEPS

PUT TRASH INSIDE



Place trash inside the bin (preferably in sealed bags)

CLOSE THE LID



Prevent rain from entering the bin in order to avoid leakage of polluted water runoff

KEEP TOXICS OUT



- Paint
- Grease, fats and used oils
- Batteries, electronics and fluorescent lights

SOME ADDITIONAL GUIDELINES, INCLUDE

✓ SWEEP FREQUENTLY

Sweep trash enclosure areas frequently, instead of hosing them down, to prevent polluted water from flowing into the streets and storm drains.

✓ FIX LEAKS

Address trash bin leaks immediately by using dry clean up methods and report to your waste hauler to receive a replacement.

✓ CONSTRUCT ROOF

Construct a solid cover roof over the existing trash enclosure structure to prevent rainwater from coming into contact with trash and garbage. Check with your local City/County for Building Codes.

In San Bernardino County, stormwater pollution is caused by food waste, landscape waste, chemicals and other debris that are washed into storm drains and end up in our waterways - untreated! You can be part of the solution by maintaining a water-friendly trash enclosure.

THANK YOU FOR HELPING TO KEEP SAN BERNARDINO COUNTY CLEAN AND HEALTHY!

San Bernardino County STORMWATER PROGRAM

To report illegal dumping **(877-WASTE18)** or
to find a household hazardous waste facility (800-OILY CAT): **sbcountystormwater.org**
To dispose of hazardous waste call the San Bernardino County Fire Dept. - CUPA Program **(909) 386-8401**

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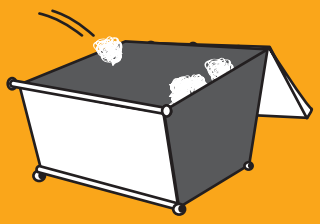
CONTENEDORES COMERCIALES PARA LA BASURA

SIGA ESTOS **PASOS** PARA MANTENER **LIMPIAS NUESTRAS VÍAS FLUVIALES**

Los contenedores de basura, tales como aquellos que se encuentran en las unidades comerciales y departamentos, generalmente contienen materiales que están destinados a los rellenos sanitarios o en algún establecimiento de reciclaje.
Estos materiales NO deben ser vertidos en nuestros lagos y ríos locales.

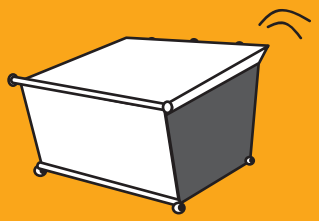
SIGA ESTOS PASOS PARA PROTEGER LA CALIDAD DEL AGUA

COLOQUE LA BASURA ADENTRO



Coloque la basura adentro del contenedor (preferentemente en bolsas selladas)

CIERRE LA TAPA



Evite que la lluvia ingrese al contenedor para evitar un escape de escorrentía contaminada

MANTENGA LOS PRODUCTOS TÓXICOS AFUERA



- Pintura
- Lubricante, grasas y aceites usados
- Baterías, componentes electrónicos y luces fluorescentes

ALGUNAS GUÍAS ADICIONALES, LAS CUALES INCLUYEN

✓ BARRER CON FRECUENCIA

Barra con frecuencia las áreas de los recintos para la basura, en lugar de lavarlas con una manguera, para evitar que el agua contaminada se vierta en las calles y los desagües de lluvia.

✓ REPARE LAS GOTERAS

Ocúpese inmediatamente de las goteras en los contenedores de basura. Use los métodos de limpieza en seco e infórmele a su recolector de basura para que reciba un reemplazo.

✓ CONSTRUYA UN TECHO

Construya un techo de cubierta sólida sobre la estructura actual del recinto para la basura a fin de evitar que el agua de lluvia entre en contacto con los desechos y la basura. Consulte con su Ciudad/Condado para conocer los Códigos de Construcción.

En el Condado de San Bernardino, los desechos de alimentos y jardines, los productos químicos y otros restos que se vierten en los desagües de aguas pluviales y que terminan en nuestras vías fluviales sin tratamiento alguno provocan la contaminación de estas aguas. Usted puede ser parte de la solución si mantiene un recinto para la basura que no contamine el agua.

¡MUCHAS GRACIAS POR AYUDAR A MANTENER EL CONDADO DE SB LIMPIO Y SIN CONTAMINACIÓN!

San Bernardino County STORMWATER PROGRAM

Para informar acerca del vertedero ilegal, llame a **(877-WASTE18)**, o para encontrar un establecimiento donde arrojar los residuos peligrosos del hogar, llame a **(800-OILY CAT)**: **sbcountystormwater.org**
Para deshacerse de los residuos peligrosos llame al Condado de San Bernardino Departamento de Bomberos - programa CUPA **(909) 386-8401**

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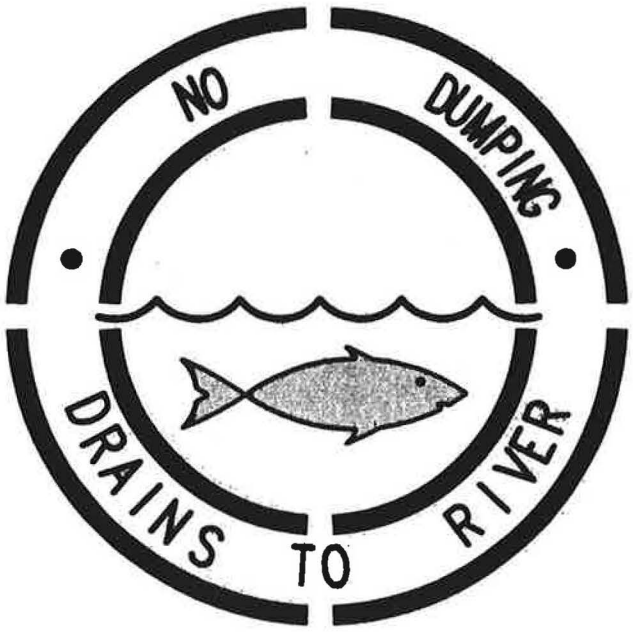

SAMPLE STENCIL TO BE USED NEAR GRATE AND CURB OPENING INLETS

SYMBOL TO BE 24" IN DIAMETER

Thienes Engineering
CIVIL ENGINEERING • LAND SURVEYING
14349 FIRESTONE BOULEVARD
LA MIRADA, CALIFORNIA 90638
PH.(714)521-4811 FAX(714)521-4173

SAMPLE CATCH BASIN STENCIL
PER BMP SD-13

Infiltration Basin TC-11

General Description

An infiltration basin is a shallow impoundment that is designed to infiltrate stormwater. Infiltration basins store stormwater runoff until it gradually exfiltrates into the underlying soil. Pollutant removal occurs through the infiltration of runoff and the adsorption of pollutants into the soil and vegetation. Additional benefits include:

- Reduced runoff volume and attenuation of peak flows, and
- Facilitated groundwater recharge thus helping to maintain low flows in stream systems.

Inspection/Maintenance Considerations

The use and regular maintenance of pretreatment BMPs will significantly minimize maintenance requirements for the basin. Installing vegetated swales or a sediment forebay upstream from the infiltration basin can provide effective pretreatment and reduce maintenance.

Spill response procedures and controls should be implemented to prevent spills from reaching the infiltration system. This BMP may require groundwater monitoring, and basins cannot be put into operation until the upstream tributary area is stabilized.

Advanced BMPs Covered



Maintenance Concerns

- *Vector Control*
- *Clogged soil or outlet structures*
- *Vegetation/Landscape Maintenance*
- *Groundwater contamination*
- *Accumulation of metals*
- *Aesthetics*

Targeted Constituents

Sediment	■
Nutrients	■
Trash	■
Metals	■
Bacteria	■
Oil and Grease	■
Organics	■

Legend (Removal Effectiveness)

● Low ▲ Medium ■ High

✱ Requires Pretreatment

Note: The removal effectiveness ratings shown in the table are for properly designed, sited, and maintained BMPs; some configurations will have variations in pollutant effectiveness.

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Inspection Activities	Suggested Frequency
☐ Observe drain time for a storm after completion or modification of the facility to confirm that the desired drain time has been obtained. ☐ Newly established vegetation should be inspected several times to determine if any landscape maintenance (reseeding, irrigation, etc.) is necessary. ☐ Inspect for upslope or adjacent contributing sediment sources and ensure that pretreatment systems are in place.	Post construction and semi-annually (beginning and end of rainy season)
☐ Inspect for the following issues: differential accumulation of sediment, signs of wetness or damage to structures, erosion of the basin floor, dead or dying grass on the bottom, condition of riprap, drain time, signs of petroleum hydrocarbon contamination, standing water, trash and debris, sediment accumulation, slope stability, pretreatment device condition	Semi-annually and after extreme events
Maintenance Activities	**Suggested Frequency**
☐ Factors responsible for clogging should be repaired immediately.	Immediately
☐ Remove invasive weeds once monthly during the first two growing seasons.	Monthly during growing season
☐ Stabilize eroded banks with erosion control mat or mulch and revegetate. ☐ Repair undercut and eroded areas at inflow and outflow structures. ☐ Maintain access to the basin for regular maintenance activities. ☐ Mow as appropriate for vegetative cover species. ☐ Monitor health of vegetation and replace as necessary. ☐ Control mosquitoes as necessary. ☐ Remove litter and debris from infiltration basin area as required. ☐ Trim vegetation to prevent establishment of woody vegetation that decreases storage volume.	Standard maintenance (as needed)
☐ Mow and remove grass clippings, litter, and debris. ☐ Replant eroded or barren spots to prevent erosion and accumulation of sediment.	Semi-annual
☐ Scrape bottom and remove sediment when accumulated sediment reduces original infiltration rate by 25-50%. Restore original cross-section and infiltration rate. Properly dispose of sediment. ☐ Seed or sod to restore ground cover. ☐ Disc or otherwise aerate bottom. ☐ Dethatch basin bottom.	3-5 year maintenance

If there are actual signs of clogging or significant loss of infiltrative capacity the following maintenance activities should be considered:

- ☐ Mechanically de-thatching and/or aerating the top soils along the sides and bottom of the basin.
- ☐ Tilling or dicing to scarify the bottom of the basin

These activities should be on an "as-needed" rather than on a routine basis. Always remove deposited sediments before scarification, and use a hand-guided rotary tiller, if possible, or a disc harrow pulled by a light tractor.

Clogged infiltration basins with surface standing water can become a breeding area for mosquitoes and midges. Maintenance efforts associated with infiltration basins should include frequent inspections to ensure that water infiltrates into the subsurface completely (recommended infiltration rate of 96 hours or less) and that vegetation is carefully managed to prevent creating mosquito and other vector habitats.

Additional Information

In most cases, surface sediment removed from an infiltration basin during periodic maintenance to restore capacity does not contain toxic materials (e/g metals, oil and grease, or organics) at levels posing a hazardous concern. Studies to date indicate that pond sediments are generally below toxicity limits and can be safely landfilled or disposed onsite. Onsite sediment disposal is always preferable (if local authorities permit) as long as the sediments are deposited away from the perimeter to prevent their reentry into the basin. Sediments should be tested for toxic materials in compliance with current landfill requirements and disposed of properly.

Maintenance activities should use lightweight equipment (e.g. bobcat), which will not compact the underlying soil to remove the top layer of sediment. The remaining soil should be tilled and revegetated as soon as possible.

Sediment removal within the basin should be performed when the sediment is dry enough so that it is cracked and readily separates from the basin floor. This minimizes intermixing of the finer sediment with underlying coarser material on the basin floor.

Special maintenance considerations are required maintain infiltration basins effectiveness in cold climates. Treating runoff containing salt-based deicers in an infiltration basin may reduce soil fertility cause vegetation to fail. Incorporating mulch into the soil can help to mitigate this problem. Infiltration basins should not be used to store snow plowed from highways or parking lots. The sand in this snow can clog the basin. In addition, the chlorides and other pollutants can contaminate the groundwater.

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Non-Stormwater Discharges SC-10

Description

Non-stormwater discharges (NSWDs) are flows that do not consist entirely of stormwater. Some non-stormwater discharges do not include pollutants and may be discharged to the storm drain if local regulations allow. These include uncontaminated groundwater and natural springs. There are also some non-stormwater discharges that typically do not contain pollutants and may be discharged to the storm drain with conditions. These include: potable water sources, fire hydrant flushing, air conditioner condensate, landscape irrigation drainage and landscape watering, emergency firefighting, etc. as discussed in Section 2.

However there are certain non-stormwater discharges that pose an environmental concern. These discharges may originate from illegal dumping of industrial material or wastes and illegal connections such as internal floor drains, appliances, industrial processes, sinks, and toilets that are illegally connected to the nearby storm drainage system through on-site drainage and piping. These unauthorized discharges (examples of which may include: process waste waters, cooling waters, wash waters, and sanitary wastewater) can carry substances such as paint, oil, fuel and other automotive fluids, chemicals and other pollutants into storm drains.

Non-stormwater discharges will need to be addressed through a combination of detection and elimination. The ultimate goal is to effectively eliminate unauthorized non-stormwater discharges to the stormwater drainage system through implementation of measures to detect, correct, and enforce against illicit connections and illegal discharges of

Objectives
■ *Cover*
■ *Contain*
■ *Educate*
■ *Reduce/Minimize*
■ *Product Substitution*

Targeted Constituents	
Sediment	
Nutrients	✓
Trash	
Metals	✓
Bacteria	✓
Oil and Grease	✓
Organics	✓

Minimum BMPs Covered	
Good Housekeeping	✓
Preventative Maintenance	
Spill and Leak Prevention and Response	✓
Material Handling & Waste Management	
Erosion and Sediment Controls	
Employee Training Program	✓
Quality Assurance Record Keeping	✓

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pollutants on streets and into the storm drain system and downstream water bodies.

Approach

Initially the Discharger must make an assessment of non-stormwater discharges to determine which types must be eliminated or addressed through BMPs. The focus of the following approach is the elimination of unauthorized non-stormwater discharges. See other BMP Fact Sheets for activity-specific pollution prevention procedures.

General Pollution Prevention Protocols

- Implement waste management controls described in SC-34 Waste Handling and Disposal.

- Develop clear protocols and lines of communication for effectively prohibiting non-stormwater discharges, especially those that are not classified as hazardous. These are often not responded to as effectively as they need to be.

- Stencil or demarcate storm drains, where applicable, to prevent illegal disposal of pollutants. Storm drain inlets should have messages such as "Dump No Waste Drains to Stream" or similar stenciled or demarcated next to them to warn against ignorant or unintentional dumping of pollutants into the storm drainage system.

- Manage and control sources of water such as hose bibs, faucets, wash racks, irrigation heads, etc. Identify hoses and faucets in the SWPPP, and post signage for appropriate use.

Non-Stormwater Discharge Investigation Protocols

Identifying the sources of non-stormwater discharges requires the Discharger to conduct an investigation of the facility at regular intervals. There are several categories of non-stormwater discharges:

- Visible, easily identifiable discharges, typically generated as surface runoff, such as uncontained surface runoff from vehicle or equipment washing; and

- Non-visible, (e.g., subsurface) discharges into the site drainage system through a variety of pathways that are not obvious.

The approach to detecting and eliminating non-stormwater discharges will vary considerably, as discussed below:

Visible and identifiable discharges

- Conduct routine inspections of the facilities and of each major activity area and identify visible evidence of unauthorized non-stormwater discharges. This may include:

  - ✓ Visual observations of actual discharges occurring;

- ✓ Evidence of surface staining, discoloring etc. that indicates that discharges have occurred;
- ✓ Pools of water in low lying areas when a rain event has not occurred; and
- ✓ Discussions with operations personnel to understand practices that may lead to unauthorized discharges.

- □ If evidence of non-stormwater discharges is discovered:
  - ✓ Document the location and circumstances using Worksheets 5 and 6 (Section 2 of the manual), including digital photos;
  - ✓ Identify and implement any quick remedy or corrective action (e.g., moving uncovered containers inside or to a proper location); and
  - ✓ Develop a plan to eliminate the discharge. Consult the appropriate activity-specific BMP Fact Sheet for alternative approaches to manage and eliminate the discharge.
- □ Consult the appropriate activity-specific BMP Fact Sheet for alternative approaches to manage and eliminate the discharge. Make sure the facility SWPPP is up-to-date and includes applicable BMPs to address the non-stormwater discharge.

Other Illegal Discharges (Non visible)

Illicit Connections

- □ Locate discharges from the industrial storm drainage system to the municipal storm drain system through review of "as-built" piping schematics.
- □ Isolate problem areas and plug illicit discharge points.
- □ Locate and evaluate discharges to the storm drain system.
- □ Visual Inspection and Inventory:
  - ✓ Inventory and inspect each discharge point during dry weather.
  - ✓ Keep in mind that drainage from a storm event can continue for a day or two following the end of a storm and groundwater may infiltrate the underground stormwater collection system.
  - ✓ Non-stormwater discharges are often intermittent and may require periodic inspections.

Review Infield Piping

- □ A review of the "as-built" piping schematic is a way to determine if there are any connections to the stormwater collection system.

- Inspect the path of loading/unloading area drain inlets and floor drains in older buildings.

- Never assume storm drains are connected to the sanitary sewer system.

Monitoring for investigation/detection of illegal discharges

- If a suspected illegal or unknown discharge is detected, monitoring of the discharge may help identify the content and/or suggest the source. This may be done with a field screening analysis, flow meter measurements, or by collecting a sample for laboratory analysis. Section 5 and Appendix D describe the necessary field equipment and procedures for field investigations.

- Investigative monitoring may be conducted over time. For example if, a discharge is intermittent, then monitoring might be conducted to determine the timing of the discharge to determine the source.

- Investigative monitoring may be conducted over a spatial area. For example, if a discharge is observed in a pipe, then monitoring might be conducted at accessible upstream locations in order to pinpoint the source of the discharge.

- Generally, investigative monitoring requiring collection of samples and submittal for lab analysis requires proper planning and specially trained staff.

Smoke Testing

Smoke testing of wastewater and stormwater collection systems is used to detect connections between the two piping systems. Smoke testing is generally performed at a downstream location and the smoke is forced upstream using blowers to create positive pressure. The advantage to smoke testing is that it can potentially identify multiple potential discharge sources at once.

- Smoke testing uses a harmless, non-toxic smoke cartridges developed specifically for this purpose.

- Smoke testing requires specialized equipment (e.g., cartridges, blowers) and is generally only appropriate for specially trained staff.

- A Standard Operating Procedure (SOP) for smoke testing is highly desirable. The SOP should address the following elements:

  - ✓ Proper planning and notification of nearby residents and emergency services is necessary since introducing smoke into the system may result in false alarms;

  - ✓ During dry weather, the stormwater collection system is filled with smoke and then traced back to sources;

- ✓ Temporary isolation of segments of pipe using sand bags is often needed to force the smoke into leaking pipes; and
- ✓ The appearance of smoke in a waste vent pipe, at a sewer manhole, or even the base of a toilet indicates that there may be a connection between the sanitary and storm water systems.

- Most municipal wastewater agencies will have necessary staff and equipment to conduct smoke testing and they should be contacted if cross connections with the sanitary sewer are suspected. See SC-44 Drainage System Maintenance for more information.

Dye Testing

- Dye testing is typically performed when there is a suspected specific pollutant source and location (i.e., leaking sanitary sewer) and there is evidence of dry weather flows in the stormwater collection system.
- Dye is released at a probable upstream source location, either the facility's sanitary or process wastewater system. The dye must be released with a sufficient volume of water to flush the system.
- Operators then visually examine the downstream discharge points from the stormwater collection system for the presence of the dye.
- Dye testing can be performed informally using commercially available products in order to conduct an initial investigation for fairly obvious cross-connections.
- More detailed dye testing should be performed by properly trained staff and follow SOPs. Specialized equipment such as fluorometers may be necessary to detect low concentrations of dye.
- Most municipal wastewater agencies will have necessary staff and equipment to conduct dye testing and they should be contacted if cross connections with the sanitary sewer are suspected.

TV Inspection of Drainage System

- Closed Circuit Television (CCTV) can be employed to visually identify illicit connections to the industrial storm drainage system. Two types of CCTV systems are available: (1) a small specially designed camera that can be manually pushed on a stiff cable through storm drains to observe the interior of the piping, or (2) a larger remote operated video camera on treads or wheels that can be guided through storm drains to view the interior of the pipe.
- CCTV systems often include a high-pressure water jet and camera on a flexible cable. The water jet cleans debris and biofilm off the inside of pipes so the camera can take video images of the pipe condition.

- CCTV units can detect large cracks and other defects such as offsets in pipe ends caused by root intrusions or shifting substrate.
- CCTV can also be used to detect dye introduced into the sanitary sewer.
- CCTV inspections require specialized equipment and properly trained staff and are generally best left to specialized contractors or municipal public works staff.

Illegal Dumping

- Substances illegally dumped on streets and into the storm drain systems and creeks may include paints, used oil and other automotive fluids, construction debris, chemicals, fresh concrete, leaves, grass clippings, and pet wastes. These wastes can cause stormwater and receiving water quality problems as well as clog the storm drain system itself.
- Establish a system for tracking incidents. The system should be designed to identify the following:
  - ✓ Illegal dumping hot spots;
  - ✓ Types and quantities (in some cases) of wastes;
  - ✓ Patterns in time of occurrence (time of day/night, month, or year);
  - ✓ Mode of dumping (abandoned containers, "midnight dumping" from moving vehicles, direct dumping of materials, accidents/spills);
  - ✓ An anonymous tip/reporting mechanism; and
  - ✓ Evidence of responsible parties (e.g., tagging, encampments, etc.).
- One of the keys to success of reducing or eliminating illegal dumping is increasing the number of people at the facility who are aware of the problem and who have the tools to at least identify the incident, if not correct it. Therefore, train field staff to recognize and report the incidents.

Once a site has been cleaned:

- Post "No Dumping" signs with a phone number for reporting dumping and disposal.
- Landscaping and beautification efforts of hot spots may also discourage future dumping, as well as provide open space and increase property values.
- Lighting or barriers may also be needed to discourage future dumping.
- See fact sheet SC-11 Spill Prevention, Control, and Cleanup.

Inspection

- Regularly inspect and clean up hot spots and other storm drainage areas where illegal dumping and disposal occurs.
- Conduct field investigations of the industrial storm drain system for potential sources of non-stormwater discharges.
- Pro-actively conduct investigations of high priority areas. Based on historical data, prioritize specific geographic areas and/or incident type for pro-active investigations.



Spill and Leak Prevention and Response

- On paved surfaces, clean up spills with as little water as possible. Use a rag for small spills, a damp mop for general cleanup, and absorbent material for larger spills. If the spilled material is hazardous, then the used cleanup materials are also hazardous and must be sent to a certified laundry (rags) or disposed of as hazardous waste.
- Never hose down or bury dry material spills. Sweep up the material and dispose of properly.
- Use adsorbent materials on small spills rather than hosing down the spill. Remove the adsorbent materials promptly and dispose of properly.
- For larger spills, a private spill cleanup company or Hazmat team may be necessary.
- See SC-11 Spill Prevention Control and Cleanup.



Employee Training Program

- Training of technical staff in identifying and documenting illegal dumping incidents is required. The frequency of training must be presented in the SWPPP, and depends on site-specific industrial materials and activities.
- Consider posting a quick reference table near storm drains to reinforce training.
- Train employees to identify non-stormwater discharges and report discharges to the appropriate departments.
- Educate employees about spill prevention and cleanup.
- Well-trained employees can reduce human errors that lead to accidental releases or spills. The employee should have the tools and knowledge to immediately begin cleaning up a spill should one occur. Employees should be familiar with the Spill Prevention Control and Countermeasure Plan. Employees should be able to identify work/jobs with high potential for spills and suggest methods to reduce possibility.
- Determine and implement appropriate outreach efforts to reduce non-permissible non-stormwater discharges.

- Conduct spill response drills annually (if no events occurred) in order to evaluate the effectiveness of the plan.
- When a responsible party is identified, educate the party on the impacts of his or her actions.



Quality Assurance and Record Keeping

Performance Evaluation

- Annually review internal investigation results; assess whether goals were met and what changes or improvements are necessary.
- Obtain feedback from personnel assigned to respond to, or inspect for, illicit connections and illegal dumping incidents.
- Develop document and data management procedures.
- A database is useful for defining and tracking the magnitude and location of the problem.
- Report prohibited non-stormwater discharges observed during the course of normal daily activities so they can be investigated, contained, and cleaned up or eliminated.
- Document that non-stormwater discharges have been eliminated by recording tests performed, methods used, dates of testing, and any on-site drainage points observed.
- Annually document and report the results of the program.
- Maintain documentation of illicit connection and illegal dumping incidents, including significant conditionally exempt discharges that are not properly managed.
- Document training activities.

Potential Limitations and Work-Arounds

Some facilities may have space constraints, limited staffing and time limitations that may preclude implementation of BMPs. Provided below are typical limitations and recommended "work-arounds."

- Many facilities do not have accurate, up-to-date 'as-built' plans or drawings which may be necessary in order to conduct non-stormwater discharge assessments.
  - ✓ Online tools such as Google Earth™ can provide an aerial view of the facility and may be useful in understanding drainage patterns and potential sources of non-stormwater discharges
  - ✓ Local municipal jurisdictions may have useful drainage systems maps.

- Video surveillance cameras are commonly used to secure the perimeter of industrial facilities against break-ins and theft. These surveillance systems may also be useful for capturing illegal dumping activities. Minor, temporary adjustments to the field of view of existing surveillance camera systems to target known or suspected problem areas may be a cost-effective way of capturing illegal dumping activities and identifying the perpetrators.

Potential Capital Facility Costs and Operation & Maintenance Requirements

Facilities

- Capital facility cost requirements may be minimal unless cross-connections to storm drains are detected.
- Indoor floor drains may require re-plumbing if cross-connections are detected.
- Leaky sanitary sewers will require repair or replacement which can have significant costs depending on the size and industrial activity at the facility.

Maintenance (including administrative and staffing)

- The primary effort is for staff time and depends on how aggressively a program is implemented.
- Costs for containment, and disposal of any leak or discharge is borne by the Discharger.
- Illicit connections can be difficult to locate especially if there is groundwater infiltration.
- Illegal dumping and illicit connection violations requires technical staff to detect and investigate them.

Supplemental Information

Permit Requirements

The IGP authorizes certain Non-Storm Water Discharges (NSWDs) provided BMPs are included in the SWPPP and implemented to:

- Reduce or prevent the contact of authorized NSWDs with materials or equipment that are potential sources of pollutants;
- Reduce, to the extent practicable, the flow or volume of authorized NSWDs;
- Ensure that authorized NSWDs do not contain quantities of pollutants that cause or contribute to an exceedance of a water quality standards (WQS); and,

- Reduce or prevent discharges of pollutants in authorized NSWDs in a manner that reflects best industry practice considering technological availability and economic practicability and achievability."

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Spill Prevention, Control & Cleanup SC-11

Description

Many activities that occur at an industrial or commercial site have the potential to cause accidental spills. Preparation for accidental spills, with proper training and reporting systems implemented, can minimize the discharge of pollutants to the environment.

Spills and leaks are one of the largest contributors of stormwater pollutants. Spill prevention and control plans are applicable to any site at which hazardous materials are stored or used. An effective plan should have spill prevention and response procedures that identify hazardous material storage areas, specify material handling procedures, describe spill response procedures, and provide locations of spill clean-up equipment and materials. The plan should take steps to identify and characterize potential spills, eliminate and reduce spill potential, respond to spills when they occur in an effort to prevent pollutants from entering the stormwater drainage system, and train personnel to prevent and control future spills. An adequate supply of spill clean-up materials must be maintained onsite.

Objectives
■ *Cover*
■ *Contain*
■ *Educate*
■ *Reduce/Minimize*
■ *Product Substitution*

Targeted Constituents	
Sediment	
Nutrients	
Trash	
Metals	✓
Bacteria	
Oil and Grease	✓
Organics	✓

Minimum BMPs Covered	
Good Housekeeping	
Preventative Maintenance	
Spill and Leak Prevention and Response	✓
Material Handling & Waste Management	
Erosion and Sediment Controls	
Employee Training Program	✓
Quality Assurance Record Keeping	✓

Approach

General Pollution Prevention Protocols

- ☐ Develop procedures to prevent/mitigate spills to storm drain systems.
- ☐ Develop and standardize reporting procedures, containment, storage, and disposal activities, documentation, and follow-up procedures.
- ☐ Establish procedures and/or controls to minimize spills and leaks. The procedures should address:
  - ✓ Description of the facility, owner and address, activities, chemicals, and quantities present;

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- ✓ Facility map of the locations of industrial materials;
- ✓ Notification and evacuation procedures;
- ✓ Cleanup instructions;
- ✓ Identification of responsible departments; and
- ✓ Identify key spill response personnel.

- ☐ Recycle, reclaim, or reuse materials whenever possible. This will reduce the amount of process materials that are brought into the facility.



Spill and Leak Prevention and Response

Spill Prevention

- ☐ Develop procedures to prevent/mitigate spills to storm drain systems. Develop and standardize reporting procedures, containment, storage, and disposal activities, documentation, and follow-up procedures.

- ☐ If illegal dumping is observed at the facility:

  - ✓ Post "No Dumping" signs with a phone number for reporting illegal dumping and disposal. Signs should also indicate fines and penalties applicable for illegal dumping.
  - ✓ Landscaping and beautification efforts may also discourage illegal dumping.
  - ✓ Bright lighting and/or entrance barriers may also be needed to discourage illegal dumping.

- ☐ Store and contain liquid materials in such a manner that if the container is ruptured, the contents will not discharge, flow, or be washed into the storm drainage system, surface waters, or groundwater.

- ☐ If the liquid is oil, gas, or other material that separates from and floats on water, install a spill control device (such as a tee section) in the catch basins that collects runoff from the storage tank area.



Preventative Maintenance

- ☐ Place drip pans or absorbent materials beneath all mounted taps, and at all potential drip and spill locations during filling and unloading of tanks. Any collected liquids or soiled absorbent materials must be reused/recycled or properly disposed.

- ☐ Store and maintain appropriate spill cleanup materials in a location known to all near the tank storage area; and ensure that employees are familiar with the site's spill control plan and/or proper spill cleanup procedures.

- ☐ Sweep and clean the storage area monthly if it is paved, *do not hose down the area to a storm drain.*

- ☐ Check tanks (and any containment sumps) daily for leaks and spills. Replace tanks that are leaking, corroded, or otherwise deteriorating with tanks in good condition. Collect all spilled liquids and properly dispose of them.

- ☐ Label all containers according to their contents (e.g., solvent, gasoline).

- ☐ Label hazardous substances regarding the potential hazard (corrosive, radioactive, flammable, explosive, poisonous).

- ☐ Prominently display required labels on transported hazardous and toxic materials (per US DOT regulations).

- ☐ Identify key spill response personnel.

Spill Response

- ☐ Clean up leaks and spills immediately.

- ☐ Place a stockpile of spill cleanup materials where it will be readily accessible (e.g., near storage and maintenance areas).

- ☐ On paved surfaces, clean up spills with as little water as possible.

  - ✓ Use a rag for small spills, a damp mop for general cleanup, and absorbent material for larger spills.

  - ✓ If the spilled material is hazardous, then the used cleanup materials are also hazardous and must be sent to a certified laundry (rags) or disposed of as hazardous waste.

  - ✓ If possible use physical methods for the cleanup of dry chemicals (e.g., brooms, shovels, sweepers, or vacuums).

- ☐ Never hose down or bury dry material spills. Sweep up the material and dispose of properly.

- ☐ Chemical cleanups of material can be achieved with the use of adsorbents, gels, and foams. Use adsorbent materials on small spills rather than hosing down the spill. Remove the adsorbent materials promptly and dispose of properly.

- ☐ For larger spills, a private spill cleanup company or Hazmat team may be necessary.

Reporting

- Report spills that pose an immediate threat to human health or the environment to the Regional Water Quality Control Board or local authority as location regulations dictate.
- Federal regulations require that any oil spill into a water body or onto an adjoining shoreline be reported to the National Response Center (NRC) at 800-424-8802 (24 hour).
- Report spills to 911 for dispatch and clean-up assistance when needed. Do not contact fire agencies directly.
- Establish a system for tracking incidents. The system should be designed to identify the following:
  - ✓ Types and quantities (in some cases) of wastes;
  - ✓ Patterns in time of occurrence (time of day/night, month, or year);
  - ✓ Mode of dumping (abandoned containers, "midnight dumping" from moving vehicles, direct dumping of materials, accidents/spills);
  - ✓ Clean-up procedures; and
  - ✓ Responsible parties.



Employee Training Program

- Educate employees about spill prevention and cleanup.
- Well-trained employees can reduce human errors that lead to accidental releases or spills:
  - ✓ The employee should have the tools and knowledge to immediately begin cleaning up a spill should one occur; and
  - ✓ Employees should be familiar with the Spill Prevention Control and Countermeasure Plan.
- Employees should be educated about aboveground storage tank requirements. Employees responsible for aboveground storage tanks and liquid transfers should be thoroughly familiar with the Spill Prevention Control and Countermeasure Plan and the plan should be readily available.
- Train employees to recognize and report illegal dumping incidents.

Other Considerations (Limitations and Regulations)

- State regulations exist for facilities with a storage capacity of 10,000 gallons or more of petroleum to prepare a Spill Prevention Control and Countermeasure (SPCC) Plan (Health & Safety Code Chapter 6.67).
- State regulations also exist for storage of hazardous materials (Health & Safety Code Chapter 6.95), including the preparation of area and business plans for emergency response to the releases or threatened releases.
- Consider requiring smaller secondary containment areas (less than 200 sq. ft.) to be connected to the sanitary sewer, prohibiting any hard connections to the storm drain.

Requirements

Costs (including capital and operation & maintenance)

- Will vary depending on the size of the facility and the necessary controls.
- Prevention of leaks and spills is inexpensive. Treatment and/or disposal of contaminated soil or water can be quite expensive.

Maintenance (including administrative and staffing)

- Develop spill prevention and control plan, provide and document training, conduct inspections of material storage areas, and supply spill kits.
- Extra time is needed to properly handle and dispose of spills, which results in increased labor costs.

Supplemental Information

Further Detail of the BMP

Reporting

Record keeping and internal reporting represent good operating practices because they can increase the efficiency of the facility and the effectiveness of BMPs. A good record keeping system helps the facility minimize incident recurrence, correctly respond with appropriate cleanup activities, and comply with legal requirements. A record keeping and reporting system should be set up for documenting spills, leaks, and other discharges, including discharges of hazardous substances in reportable quantities. Incident records describe the quality and quantity of non-stormwater discharges to the storm sewer. These records should contain the following information:

- Date and time of the incident;
- Weather conditions;
- Duration of the spill/leak/discharge;

- Cause of the spill/leak/discharge;
- Response procedures implemented;
- Persons notified; and
- Environmental problems associated with the spill/leak/discharge.

Separate record keeping systems should be established to document housekeeping and preventive maintenance inspections, and training activities. All housekeeping and preventive maintenance inspections should be documented. Inspection documentation should contain the following information:

- Date and time the inspection was performed;
- Name of the inspector;
- Items inspected;
- Problems noted;
- Corrective action required; and
- Date corrective action was taken.

Other means to document and record inspection results are field notes, timed and dated photographs, videotapes, and drawings and maps.

Aboveground Tank Leak and Spill Control

Accidental releases of materials from aboveground liquid storage tanks present the potential for contaminating stormwater with many different pollutants. Materials spilled, leaked, or lost from tanks may accumulate in soils or on impervious surfaces and be carried away by stormwater runoff.

The most common causes of unintentional releases are:

- Installation problems;
- Failure of piping systems (pipes, pumps, flanges, couplings, hoses, and valves);
- External corrosion and structural failure;
- Spills and overfills due to operator error; and
- Leaks during pumping of liquids or gases from truck or rail car to a storage tank or vice versa.

Storage of reactive, ignitable, or flammable liquids should comply with the Uniform Fire Code and the National Electric Code. Practices listed below should be employed to enhance the code requirements:

- Tanks should be placed in a designated area.
- Tanks located in areas where firearms are discharged should be encapsulated in concrete or the equivalent.
- Designated areas should be impervious and paved with Portland cement concrete, free of cracks and gaps, in order to contain leaks and spills.
- Liquid materials should be stored in UL approved double walled tanks or surrounded by a curb or dike to provide the volume to contain 10 percent of the volume of all of the containers or 110 percent of the volume of the largest container, whichever is greater. The area inside the curb should slope to a drain.
- For used oil or dangerous waste, a dead-end sump should be installed in the drain.
- All other liquids should be drained to the sanitary sewer if available. The drain must have a positive control such as a lock, valve, or plug to prevent release of contaminated liquids.
- Accumulated stormwater in petroleum storage areas should be passed through an oil/water separator.

Maintenance is critical to preventing leaks and spills. Conduct routine inspections and:

- Check for external corrosion and structural failure.
- Check for spills and overfills due to operator error.
- Check for failure of piping system (pipes, pumps, flanges, coupling, hoses, and valves).
- Check for leaks or spills during pumping of liquids or gases from truck or rail car to a storage facility or vice versa.
- Visually inspect new tank or container installation for loose fittings, poor welding, and improper or poorly fitted gaskets.
- Inspect tank foundations, connections, coatings, and tank walls and piping system. Look for corrosion, leaks, cracks, scratches, and other physical damage that may weaken the tank or container system.
- Frequently relocate accumulated stormwater during the wet season.

- Periodically conduct integrity testing by a qualified professional.

Vehicle Leak and Spill Control

Major spills on roadways and other public areas are generally handled by highly trained Hazmat teams from local fire departments or environmental health departments. The measures listed below pertain to leaks and smaller spills at vehicle maintenance shops.

In addition to implementing the spill prevention, control, and clean up practices above, use the following measures related to specific activities:

Vehicle and Equipment Maintenance

- Perform all vehicle fluid removal or changing inside or under cover to prevent the run-on of stormwater and the runoff of spills.
- Regularly inspect vehicles and equipment for leaks, and repair immediately.
- Check incoming vehicles and equipment (including delivery trucks, and employee and subcontractor vehicles) for leaking oil and fluids. Do not allow leaking vehicles or equipment onsite.
- Always use secondary containment, such as a drain pan or drop cloth, to catch spills or leaks when removing or changing fluids.
- Immediately drain all fluids from wrecked vehicles.
- Store wrecked vehicles or damaged equipment under cover.
- Place drip pans or absorbent materials under heavy equipment when not in use.
- Use absorbent materials on small spills rather than hosing down the spill.
- Remove the adsorbent materials promptly and dispose of properly.
- Promptly transfer used fluids to the proper waste or recycling drums. Don't leave full drip pans or other open containers lying around.
- Oil filters disposed of in trashcans or dumpsters can leak oil and contaminate stormwater. Place the oil filter in a funnel over a waste oil recycling drum to drain excess oil before disposal. Oil filters can also be recycled. Ask your oil supplier or recycler about recycling oil filters.
- Store cracked batteries in a non-leaking secondary container. Do this with all cracked batteries, even if you think all the acid has drained out. If you drop a battery, treat it as if it is cracked. Put it into the containment area until you are sure it is not leaking.

Vehicle and Equipment Fueling

- Design the fueling area to prevent the run-on of stormwater and the runoff of spills:

  Cover fueling area if possible.

  Use a perimeter drain or slope pavement inward with drainage to a sump.

  Pave fueling area with concrete rather than asphalt.

- If dead-end sump is not used to collect spills, install an oil/water separator.
- Install vapor recovery nozzles to help control drips as well as air pollution.
- Discourage "topping-off" of fuel tanks.
- Use secondary containment when transferring fuel from the tank truck to the fuel tank.
- Use absorbent materials on small spills and general cleaning rather than hosing down the area. Remove the absorbent materials promptly.
- Carry out all Federal and State requirements regarding underground storage tanks, or install above ground tanks.
- Do not use mobile fueling of mobile industrial equipment around the facility; rather, transport the equipment to designated fueling areas.
- Keep your Spill Prevention Control and Countermeasure (SPCC) Plan up-to-date.
- Train employees in proper fueling and cleanup procedures.

Industrial Spill Prevention Response

For the purposes of developing a spill prevention and response program to meet the stormwater regulations, facility managers should use information provided in this fact sheet and the spill prevention/response portions of the fact sheets in this handbook, for specific activities.

The program should:

- Integrate with existing emergency response/hazardous materials programs (e.g., Fire Department).
- Develop procedures to prevent/mitigate spills to storm drain systems.
- Identify responsible departments.

- Develop and standardize reporting procedures, containment, storage, and disposal activities, documentation, and follow-up procedures.
- Address spills at municipal facilities, as well as public areas.
- Provide training concerning spill prevention, response and cleanup to all appropriate personnel.

References and Resources

California's Nonpoint Source Program Plan. http://www.swrcb.ca.gov/nps/index.html.

Clark County Storm Water Pollution Control Manual. Available online at: http://www.co.clark.wa.us/pubworks/bmpman.pdf.

King County Storm Water Pollution Control Manual. Available online at: http://dnr.metrokc.gov/wlr/dss/spcm.htm.

Orange County Stormwater Program, Best Management Practices for Industrial/Commercial Business Activities. Available online at: http://ocwatersheds.com/documents/bmp/industrialcommercialbusinessesactivities

Santa Clara Valley Urban Runoff Pollution Prevention Program. http://www.scvurppp.org.

The Stormwater Managers Resource Center. http://www.stormwatercenter.net/.

Outdoor Loading/Unloading SC-30

Description

The loading/unloading of materials usually takes place outside on docks or terminals; therefore, materials spilled, leaked, or lost during loading/unloading may collect in the soil or on other surfaces and have the potential to be carried away by wind, stormwater runoff or when the area is cleaned. Additionally, rainfall may wash pollutants from machinery used to unload or move materials. Implementation of the following protocols will prevent or reduce the discharge of pollutants to stormwater from outdoor loading/unloading of materials.

Approach

Reduce potential for pollutant discharge through source control pollution prevention and BMP implementation. Successful implementation depends on effective training of employees on applicable BMPs and general pollution prevention strategies and objectives.

General Pollution Prevention Protocols

- Park tank trucks or delivery vehicles in designated areas so that spills or leaks can be contained.
- Limit exposure of material to rainfall whenever possible.
- Prevent stormwater run-on.
- Check equipment regularly for leaks.



Good Housekeeping

- Develop an operations plan that describes procedures for loading and/or unloading.
- Conduct loading and unloading in dry weather if possible.

Objectives
■ *Cover*
■ *Contain*
■ *Educate*
■ *Reduce/Minimize*
■ *Product Substitution*

Targeted Constituents	
Sediment	✓
Nutrients	✓
Trash	
Metals	✓
Bacteria	
Oil and Grease	✓
Organics	✓

Minimum BMPs Covered	
Good Housekeeping	✓
Preventative Maintenance	
Spill and Leak Prevention and Response	✓
Material Handling & Waste Management	✓
Erosion and Sediment Controls	
Employee Training Program	✓
Quality Assurance Record Keeping	✓

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- Cover designated loading/unloading areas to reduce exposure of materials to rain.
- Consider placing a seal or door skirt between delivery vehicles and building to prevent exposure to rain.
- Design loading/unloading area to prevent stormwater run-on, which would include grading or berming the area, and position roof downspouts so they direct stormwater away from the loading/unloading areas.
- Have employees load and unload all materials and equipment in covered areas such as building overhangs at loading docks if feasible.
- Load/unload only at designated loading areas.
- Use drip pans underneath hose and pipe connections and other leak-prone spots during liquid transfer operations, and when making and breaking connections. Several drip pans should be stored in a covered location near the liquid transfer area so that they are always available, yet protected from precipitation when not in use. Drip pans can be made specifically for railroad tracks. Drip pans must be cleaned periodically, and drip collected materials must be disposed of properly.
- Pave loading areas with concrete instead of asphalt.
- Avoid placing storm drains inlets in the area.
- Grade and/or berm the loading/unloading area with drainage to sump; regularly remove materials accumulated in sump.



Spill Response and Prevention Procedures

- Keep your spill prevention and control plan up-to-date or have an emergency spill cleanup plan readily available, as applicable.
- Contain leaks during transfer.
- Store and maintain appropriate spill cleanup materials in a location that is readily accessible and known to all employees.
- Ensure that employees are familiar with the site's spill control plan and proper spill cleanup procedures.
- Use drip pans or comparable devices when transferring oils, solvents, and paints.



Material Handling and Waste Management

- Spot clean leaks and drips routinely to prevent runoff of spillage.
- Do not pour liquid wastes into floor drains, sinks, outdoor storm drain inlets, or other storm drains or sewer connections.

- Do not put used or leftover cleaning solutions, solvents, and automotive fluids in the storm drain or sanitary sewer.
- Collect leaking or dripping fluids in drip pans or containers. Fluids are easier to recycle if kept separate.
- Promptly transfer used fluids to the proper waste or recycling drums. Do not leave drip pans or other open containers lying around.
- Minimize the possibility of stormwater pollution from outside waste receptacles by doing at least one of the following:
  - ✓ Use only watertight waste receptacle(s) and keep the lid(s) closed.
  - ✓ Grade and pave the waste receptacle area to prevent run-on of stormwater.
  - ✓ Install a roof over the waste receptacle area.
  - ✓ Install a low containment berm around the waste receptacle area.
  - ✓ Use and maintain drip pans under waste receptacles.
- Post "no littering" signs.
- Perform work area clean-up and dry sweep after daily operations.



Employee Training Program

- Train employees (e.g., fork lift operators) and contractors on proper spill containment and cleanup.
- Have employees trained in spill containment and cleanup present during loading/unloading.
- Train employees in proper handling techniques during liquid transfers to avoid spills.
- Make sure forklift operators are properly trained on loading and unloading procedures.



Quality Assurance and Record Keeping

- Keep accurate maintenance logs that document activities performed, quantities of materials removed, and improvement actions.
- Keep accurate logs of spill response actions that document what was spilled, how it was cleaned up, and how the waste was disposed.
- Establish procedures to complete logs and file them in the central office.
- Keep accurate logs of daily clean-up operations.

Potential Limitations and Work-Arounds

Some facilities may have space constraints, limited staffing and time limitations that may preclude implementation of BMPs. Provided below are typical limitations and recommended "work-arounds."

- Space and time limitations may preclude all transfers from being performed indoors or under cover.
  - ✓ Designate specific areas for outdoor loading and unloading.
  - ✓ Require employees to understand and follow spill and leak prevention BMPs.
- It may not be possible to conduct transfers only during dry weather.
  - ✓ Limit materials and equipment rainfall exposure to all extents practicable.
  - ✓ Require employees to understand and follow spill and leak prevention BMPs.

Potential Capital Facility Costs and Operation & Maintenance Requirements

Facilities

Many facilities will already have indoor or covered areas where loading/unloading takes place and will require no additional capital expenditures.

If outdoor activities are required, construction of berms or other means to retain spills and leaks may require appropriate constructed systems for containment. These containment areas may require significant new capital investment.

Capital investments will likely be required at some sites if adequate cover and containment facilities do not exist and can vary significantly depending upon site conditions.

Maintenance

Most of the operations and maintenance activities associated with implementing this BMP are integrally linked to routine operations as previously described. Therefore additional O&M is not required.

- Conduct regular inspections and make repairs and improvements as necessary.
- Check loading and unloading equipment regularly for leaks.
- Conduct regular broom dry-sweeping of area. Do not wash with water.

Supplemental Information

Loading and Unloading of Liquids

- Loading or unloading of liquids should occur in the manufacturing building so that any spills that are not completely retained can be discharged to the sanitary sewer,

treatment plant, or treated in a manner consistent with local sewer authorities and permit requirements.

- For loading and unloading tank trucks to above and below ground storage tanks, the following procedures should be used:
  - ✓ The area where the transfer takes place should be paved. If the liquid is reactive with the asphalt, Portland cement should be used to pave the area.
  - ✓ The transfer area should be designed to prevent run-on of stormwater from adjacent areas. Sloping the pad and using a curb, like a speed bump, around the uphill side of the transfer area should reduce run-on.
  - ✓ The transfer area should be designed to prevent runoff of spilled liquids from the area. Sloping the area to a drain should prevent runoff. The drain should be connected to a dead-end sump or to the sanitary sewer. A positive control valve should be installed on the drain.
- For transfer from rail cars to storage tanks that must occur outside, use the following procedures:
  - ✓ Drip pans should be placed at locations where spillage may occur, such as hose connections, hose reels, and filler nozzles. Use drip pans when making and breaking connections.
  - ✓ Drip pan systems should be installed between the rails to collect spillage from tank cars.

References and Resources

Minnesota Pollution Control Agency, *Industrial Stormwater Best Management Practices Guidebook BMP 26 Fueling and Liquid Loading/Unloading Operations*. Available online at: http://www.pca.state.mn.us/index.php/view-document.html?gid=10557.

New Jersey Department of Environmental Protection, 2013. *Basic Industrial Stormwater General Permit Guidance Document NJPDES General Permit No NJ0088315*. Available online at: http://www.nj.gov/dep/dwq/pdf/5G2_guidance_color.pdf.

Orange County Stormwater Program, Best Management Practices for Industrial/Commercial Business Activities. Available online at: http://ocwatersheds.com/documents/bmp/industrialcommercialbusinessesactivities.

Oregon Department of Environmental Quality, 2013. *Industrial Stormwater Best Management Practices Manual- BMP 26 Fueling and Liquid Loading/Unloading Operations*. Available online at: http://www.deq.state.or.us/wq/wqpermit/docs/IndBMP021413.pdf.

Sacramento Stormwater Management Program, *Best Management Practices for Industrial Storm Water Pollution Control*. Available online at: http://www.msa.saccounty.net/sactostormwater/documents/guides/industrial-BMP-manual.pdf.

Sacramento County Environmental Management Stormwater Program: *Best Management Practices*. Available online at: http://www.emd.saccounty.net/EnvHealth/Stormwater/Stormwater-BMPs.html.

Santa Clara Valley Urban Runoff Pollution Prevention Program. http://www.scvurppp-w2k.com/.

US EPA. National Pollutant Discharge Elimination System – Industrial Fact Sheet Series for Activities Covered by EPA's Multi Sector General Permit. Available online at: http://cfpub.epa.gov/npdes/stormwater/swsectors.cfm.

Outdoor Equipment Operations SC-32

Description

Outside process equipment operations and maintenance can contaminate stormwater runoff. Activities, such as grinding, painting, coating, sanding, degreasing or parts cleaning, landfills and waste piles, and solid waste treatment and disposal are examples of process operations that can lead to contamination of stormwater runoff. The targeted constituents will vary for each site depending on the operation being performed.

Approach

Implement source control BMPs to limit exposure of outdoor equipment to direct precipitation and stormwater run-on. Refer to SC-22 Vehicle and Equipment Repair for additional information.

General Pollution Prevention Protocols

- ☐ Perform the activity during dry periods whenever possible.
- ☐ Install secondary containment measures where leaks and spills may occur.
- ☐ Use non-toxic chemicals for maintenance and minimize or eliminate the use of solvents.
- ☐ Connect process equipment area to public sanitary sewer or facility wastewater treatment system when possible. Some jurisdictions require that secondary containment areas be connected to the sanitary sewer, prohibiting any hard connections to the storm drain.



Good Housekeeping

- ☐ Manage materials and waste properly (see Material Handling and Waste Management) to reduce adverse impacts on stormwater quality.

Objectives
■ Cover
■ *Contain*
■ *Educate*
■ *Reduce/Minimize*

Targeted Constituents	
Sediment	✓
Nutrients	✓
Trash	✓
Metals	✓
Bacteria	✓
Oil and Grease	✓
Organics	✓

Minimum BMPs Covered	
Good Housekeeping	✓
Preventative Maintenance	✓
Spill and Leak Prevention and Response	✓
Material Handling & Waste Management	✓
Erosion and Sediment Controls	
Employee Training Program	✓
Quality Assurance Record Keeping	✓

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- Cover the work area with a permanent roof if possible.
- Use drop cloths for sanding and painting operations.
- Use a vacuum for fine particle clean-up in pavement cracks and crevices.
- Minimize contact of stormwater with outside process equipment operations through berming and drainage routing (run-on prevention).
- "Spot clean" leaks and drips routinely. Leaks are not cleaned up until the absorbent is picked up and disposed of properly.
- Paint signs on storm drain inlets to indicate that they are not to receive liquid or solid wastes.
- Use roll down or permanent walls when windy/breezy to prevent wind transport of particulates/pollutants.



Preventative Maintenance

- Design outdoor equipment areas to prevent stormwater runoff and spills. Use a perimeter drain or slope pavement inward with drainage to sump.
- Dry clean the work area regularly. Do not wash outdoor equipment with water if there is a direct connection to the storm drain.
- Pave area with concrete rather than asphalt.
- Inspect outdoor equipment regularly for leaks or spills. Also check for structural failure, spills and overfills due to operator error, and/or failure of piping system.
- Inspect and clean, if necessary, storm drain inlets and catch basins within the outdoor equipment area before October 1 each year.



Spill Response and Prevention Procedures

- Keep your Spill Prevention Control and Countermeasure (SPCC) Plan up-to-date.
- Have employees trained in emergency spill cleanup procedures present when dangerous waste, liquid chemicals, or other wastes are delivered.
- Place a stockpile of spill cleanup materials where it will be readily accessible.
- Prevent operator errors by using engineering safe guards and thus reducing accidental releases of pollutant.



Material Handling and Waste Management

- Do not pour liquid wastes into floor drains, sinks, outdoor storm drain inlets, or other storm drain or sewer connections.
- Collect leaking or dripping fluids in drip pans or containers. Fluids are easier to recycle if kept separate.
- Promptly transfer used fluids to the proper waste or recycling drums. Do not leave drip pans or other open containers lying around.
- Minimize the possibility of stormwater pollution from outside waste receptacles by doing at least one of the following:
  - ✓ Use only watertight waste receptacle(s) and keep the lid(s) closed.
  - ✓ Grade and pave the waste receptacle area to prevent run-on of stormwater.
  - ✓ Install a roof over the waste receptacle area.



Employee Training Program

- Educate employees about pollution prevention measures and goals.
- Train employees on proper equipment operation and maintenance procedures.
- Train all employees upon hiring and annually thereafter on proper methods for handling and disposing of waste. Ensure that all employees understand stormwater discharge prohibitions, wastewater discharge requirements, and these best management practices.
- Use a training log or similar method to document training.
- Ensure that employees are familiar with the site's spill control plan and/or proper spill cleanup procedures.



Quality Assurance and Record Keeping

- Keep accurate maintenance logs that document minimum BMP activities performed for outdoor equipment, types and quantities of materials removed and disposed of, and any improvement actions.
- Keep accurate logs of spill response actions that document what was spilled, how it was cleaned up, and how the waste was disposed.
- Establish procedures to complete logs and file them in the central office.

Potential Limitations and Work-Arounds

Some facilities may have space constraints, limited staffing and time limitations that may preclude implementation of BMPs. Provided below are typical limitations and recommended "work-arounds."

- Providing cover over outdoor equipment may be impractical or cost-prohibitive.
  - ✓ Operate outdoor equipment only during periods of dry weather.
- Regular operations and time limitations may require outdoor activities during wet weather.
  - ✓ Designate specific areas for outdoor activities.
  - ✓ Allow time for work area clean-up after each shift.
  - ✓ Require employees to understand and follow preventive maintenance and spill and leak prevention BMPs.
  - ✓ Design and install secondary containment and good housekeeping BMPs for outdoor equipment area.
- Storage sheds often must meet building and fire code requirements.

Potential Capital Facility Costs and Operation & Maintenance Requirements

Facilities

- Many facilities will already have indoor covered areas where vehicle and equipment repairs take place and will require no additional capital expenditures.
- If outdoor activities are required, construction of berms or other means to retain spills and leaks may require appropriate constructed systems for containment. These containment areas may require significant new capital investment.
- Capital investments will likely be required at some sites if adequate cover and containment facilities do not exist and can vary significantly depending upon site conditions.

Maintenance

- Most of the operations and maintenance activities associated with implementing this BMP are integrally linked to routine operations as previously described. Therefore additional O&M is not required.
- For facilities responsible for pre-treating their wastewater prior to discharging, the proper functioning of structural treatment system is an important maintenance consideration.
- Routine cleanout of oil and grease is required for the devices to maintain their effectiveness, usually at least once a month. During periods of heavy rainfall, cleanout is required more often to ensure pollutants are not washed through the trap. Sediment removal is also required on a regular basis to keep the device working efficiently.

References and Resources

Minnesota Pollution Control Agency. *Industrial Stormwater Best Management Practices Guidebook BMP 26 Fueling and Liquid Loading/Unloading Operations*. Available online at: http://www.pca.state.mn.us/index.php/view-document.html?gid=10557.

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Santa Clara Valley Urban Runoff Pollution Prevention Program. http://www.scvurppp-w2k.com/

US EPA. National Pollutant Discharge Elimination System – Industrial Fact Sheet Series for Activities Covered by EPA's Multi Sector General Permit. Available online at: http://cfpub.epa.gov/npdes/stormwater/swsectors.cfm.

Waste Handling & Disposal SC-34

Description

Improper storage and handling of solid wastes can allow toxic compounds, oils and greases, heavy metals, nutrients, suspended solids, and other pollutants to enter stormwater runoff. The discharge of pollutants to stormwater from waste handling and disposal can be prevented and reduced by tracking waste generation, storage, and disposal; reducing waste generation and disposal through source reduction, reuse, and recycling; and preventing run-on and runoff.

Approach

Reduce potential for pollutant discharge through source control pollution prevention and BMP implementation. Successful implementation depends on effective training of employees on applicable BMPs and general pollution prevention strategies and objectives.

General Pollution Prevention Protocols

- ☐ Accomplish reduction in the amount of waste generated using the following source controls:
  - ✓ Production planning and sequencing;
  - ✓ Process or equipment modification;
  - ✓ Raw material substitution or elimination;
  - ✓ Loss prevention and housekeeping;
  - ✓ Waste segregation and separation; and
  - ✓ Close loop recycling.
- ☐ Establish a material tracking system to increase awareness about material usage. This may reduce spills and minimize contamination, thus reducing the amount of waste produced.
- ☐ Recycle materials whenever possible.

Objectives
■ *Cover*
■ *Contain*
■ *Educate*
■ *Reduce/Minimize*
■ *Product Substitution*

Targeted Constituents	
Sediment	
Nutrients	
Trash	
Metals	✓
Bacteria	✓
Oil and Grease	✓
Organics	✓

Minimum BMPs Covered	
Good Housekeeping	✓
Preventative Maintenance	✓
Spill and Leak Prevention and Response	✓
Material Handling & Waste Management	✓
Erosion and Sediment Controls	
Employee Training Program	✓
Quality Assurance Record Keeping	✓

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- Use the entire product before disposing of the container.
- To the extent possible, store wastes under cover or indoors after ensuring all safety concerns such as fire hazard and ventilation are addressed.
- Provide containers for each waste stream at each work station. Allow time after shift to clean area.



Good Housekeeping

- Cover storage containers with leak proof lids or some other means. If waste is not in containers, cover all waste piles (plastic tarps are acceptable coverage) and prevent stormwater run-on and runoff with a berm. The waste containers or piles must be covered except when in use.
- Use drip pans or absorbent materials whenever grease containers are emptied by vacuum trucks or other means. Grease cannot be left on the ground. Collected grease must be properly disposed of as garbage.
- Dispose of rinse and wash water from cleaning waste containers into a sanitary sewer if allowed by the local sewer authority. Do not discharge wash water to the street or storm drain. Clean in a designated wash area that drains to a clarifier.
- Transfer waste from damaged containers into safe containers.
- Take special care when loading or unloading wastes to minimize losses. Loading systems can be used to minimize spills and fugitive emission losses such as dust or mist. Vacuum transfer systems can minimize waste loss.
- Keep the waste management area clean at all times by sweeping and cleaning up spills immediately.
- Use dry methods when possible (e.g., sweeping, use of absorbents) when cleaning around restaurant/food handling dumpster areas. If water must be used after sweeping/using absorbents, collect water and discharge through grease interceptor to the sewer.
- Stencil or demarcate storm drains on the facility's property with prohibitive message regarding waste disposal.
- Cover waste piles with temporary covering material such as reinforced tarpaulin, polyethylene, polyurethane, polypropylene or hypalon.
- If possible, move the activity indoor after ensuring all safety concerns such as fire hazard and ventilation are addressed.



Preventative Maintenance

- Prevent stormwater run-on from entering the waste management area by enclosing the area or building a berm around the area.
- Prevent waste materials from directly contacting rain.

- Cover waste piles with temporary covering material such as reinforced tarpaulin, polyethylene, polyurethane, polypropylene or hypalon.
- Cover the area with a permanent roof if feasible.
- Cover dumpsters to prevent rain from washing waste out of holes or cracks in the bottom of the dumpster.
- Check waste containers weekly for leaks and to ensure that lids are on tightly. Replace any that are leaking, corroded, or otherwise deteriorating.
- Sweep and clean the waste management area regularly. Use dry methods when possible (e.g., sweeping, vacuuming, use of absorbents) when cleaning around restaurant/food handling dumpster areas. If water must be used after sweeping/using absorbents, collect water and discharge through grease interceptor to the sewer.
- Inspect and replace faulty pumps or hoses regularly to minimize the potential of releases and spills.
- Repair leaking equipment including valves, lines, seals, or pumps promptly.



Spill Response and Prevention Procedures

- Keep your spill prevention and plan up-to-date.
- Have an emergency plan, equipment and trained personnel ready at all times to deal immediately with major spills.
- Collect all spilled liquids and properly dispose of them.
- Store and maintain appropriate spill cleanup materials in a location known to all near the designated wash area.
- Ensure that vehicles transporting waste have spill prevention equipment that can prevent spills during transport. Spill prevention equipment includes:
  - ✓ Vehicles equipped with baffles for liquid waste; and
  - ✓ Trucks with sealed gates and spill guards for solid waste.



Material Handling and Waste Management

Litter Control

- Post "No Littering" signs and enforce anti-litter laws.
- Provide a sufficient number of litter receptacles for the facility.
- Clean out and cover litter receptacles frequently to prevent spillage.

Waste Collection

- Keep waste collection areas clean.

- Inspect solid waste containers for structural damage regularly. Repair or replace damaged containers as necessary.
- Secure solid waste containers; containers must be closed tightly when not in use.
- Do not fill waste containers with washout water or any other liquid.
- Ensure that only appropriate solid wastes are added to the solid waste container. Certain wastes such as hazardous wastes, appliances, fluorescent lamps, pesticides, etc., may not be disposed of in solid waste containers (see chemical/ hazardous waste collection section below).
- Do not mix wastes; this can cause chemical reactions, make recycling impossible, and complicate disposal. Affix labels to all waste containers.

Chemical/Hazardous Wastes

- Select designated hazardous waste collection areas on-site.
- Store hazardous materials and wastes in covered containers and protect them from vandalism.
- Place hazardous waste containers in secondary containment.
- Make sure that hazardous waste is collected, removed, and disposed of only at authorized disposal areas.
- Hazardous waste cannot be reused or recycled; it must be disposed of by a licensed hazardous waste hauler.



Employee Training Program

- Educate employees about pollution prevention measures and goals.
- Train employees how to properly handle and dispose of waste using the source control BMPs described above.
- Train employees and subcontractors in proper hazardous waste management.
- Use a training log or similar method to document training.
- Ensure that employees are familiar with the site's spill control plan and/or proper spill cleanup procedures.



Quality Assurance and Record Keeping

- Keep accurate maintenance logs that document minimum BMP activities performed for waste handling and disposal, types and quantities of waste disposed of, and any improvement actions.
- Keep accurate logs of spill response actions that document what was spilled, how it was cleaned up, and how the waste was disposed.

- Establish procedures to complete logs and file them in the central office.

Potential Capital Facility Costs and Operation & Maintenance Requirements

Facilities

- Capital costs will vary substantially depending on the size of the facility and the types of waste handled. Significant capital costs may be associated with reducing wastes by modifying processes or implementing closed-loop recycling.
- Many facilities will already have indoor covered areas where waste materials will be stored and will require no additional capital expenditures for providing cover.
- If outdoor storage of wastes is required, construction of berms or other means to prevent stormwater run-on and runoff may require appropriate constructed systems for containment.
- Capital investments will likely be required at some sites if adequate cover and containment facilities do not exist and can vary significantly depending upon site conditions.

Maintenance

- Check waste containers weekly for leaks and to ensure that lids are on tightly. Replace any that are leaking, corroded, or otherwise deteriorating.
- Sweep and clean the waste management area regularly. Use dry methods when possible (e.g., sweeping, use of absorbents) when cleaning around restaurant/food handling dumpster areas. If water must be used after sweeping/using absorbents, collect water and discharge through grease interceptor to the sewer.
- Inspect and replace faulty pumps or hoses regularly to minimize the potential of releases and spills.
- Repair leaking equipment including valves, lines, seals, or pumps promptly.

References and Resources

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Safer Alternative Products SC-35

Description

Promote the use of less harmful products and products that contain little or no TMDL and 303(d) list pollutants. Alternatives exist for most product classes including chemical fertilizers, pesticides, cleaning solutions, janitorial chemicals, automotive and paint products, and consumables (batteries, fluorescent lamps).

Approach

Pattern a new program after the many established programs around the state and country. Integrate this best management practice as much as possible with existing programs at your facility.

Develop a comprehensive program based on:

- The "Precautionary Principle," which is an alternative to the "Risk Assessment" model that says it's acceptable to use a potentially harmful product until physical evidence of its harmful effects are established and deemed too costly from an environmental or public health perspective. For instance, a risk assessment approach might say it's acceptable to use a pesticide until there is direct proof of an environmental impact. The Precautionary Principle approach is used to evaluate whether a given product is safe, whether it is really necessary, and whether alternative products would perform just as well.
- Environmentally Preferable Purchasing Program to minimize the purchase of products containing hazardous ingredients used in the facility's custodial services, fleet maintenance, and facility maintenance in favor of using alternate products that pose less risk to employees and to the environment.
- Integrated Pest Management (IPM) or Less-Toxic Pesticide Program, which uses a pest management approach that minimizes the use of toxic chemicals and gets rid of pests

Objectives
■ *Educate*
■ *Reduce/Minimize*
■ *Product Substitution*

Targeted Constituents	
Sediment	
Nutrients	✓
Trash	
Metals	✓
Bacteria	
Oil and Grease	✓
Organics	✓

Minimum BMPs Covered	
Good Housekeeping	
Preventative Maintenance	
Spill and Leak Prevention and Response	
Material Handling & Waste Management	
Erosion and Sediment Controls	
Employee Training Program	✓
Quality Assurance Record Keeping	

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by methods that pose a lower risk to employees, the public, and the environment.

- Energy Efficiency Program including no-cost and low-cost energy conservation and efficiency actions that can reduce both energy consumption and electricity bills, along with long-term energy efficiency investments.

Consider the following mechanisms for developing and implementing a comprehensive program:

- Policies
- Procedures
  - ✓ Standard operating procedures (SOPs);
  - ✓ Purchasing guidelines and procedures; and
  - ✓ Bid packages (services and supplies).
- Materials
  - ✓ Preferred or approved product and supplier lists;
  - ✓ Product and supplier evaluation criteria;
  - ✓ Training sessions and manuals; and
  - ✓ Fact sheets for employees.

Implement this BMP in conjunction with the Vehicle and Equipment Management fact sheets (SC-20 – SC-22) and SC-41 Building and Grounds Maintenance.



Employee Training Program

- Employees who handle potentially harmful materials should be trained in the use of safer alternatives.
- Purchasing departments should be trained on safer alternative products and encouraged to procure less hazardous materials and products that contain little or no harmful substances or TMDL pollutants.
- Employees and contractors / service providers can both be educated about safer alternatives by using information developed by a number of organizations including the references and resources provided in this fact sheet.

Potential Limitations and Work-Arounds

Some facilities may have space constraints, limited staffing and time limitations that may preclude implementation of BMPs. Provided below are typical limitations and recommended "work-arounds"

- Alternative products may not be available, suitable, or effective in every case.

- ✓ Minimize use of hazardous/harmful products if no alternative product is available.

Regulatory Considerations

This BMP has no regulatory requirements unless local/municipal ordinance applies. Existing regulations already encourage facilities to reduce the use of hazardous materials through incentives such as reduced:

- Specialized equipment storage and handling requirements;
- Storm water runoff sampling requirements;
- Training and licensing requirements; and
- Record keeping and reporting requirements.

Cost Considerations

- The primary cost is for staff time to: 1) develop new policies and procedures and 2) educate purchasing departments and employees who handle potentially harmful materials about the availability, procurement, and use of safer alternatives.
- Some alternative products may be slightly more expensive than conventional products.

Supplemental Information

The following discussion provides some general information on safer alternatives. More specific information on particular hazardous materials and the available alternatives may be found in the references and resources listed below.

- Automotive products – Less toxic alternatives are not available for many automotive products, especially engine fluids. But there are alternatives to grease lubricants, car polishes, degreasers, and windshield washer solution. Refined motor oil is also available.
- Vehicle/Trailer lubrication – Fifth wheel bearings on trucks require routine lubrication. Adhesive lubricants are available to replace typical chassis grease.
- Cleaners – Vegetables-based or citrus-based soaps are available to replace petroleum-based soaps/detergents.
- Paint products – Water-based paints, wood preservatives, stains, and finishes with low VOC content are available.
- Pesticides – Specific alternative products or methods exist to control most insects, fungi, and weeds.
- Chemical Fertilizers – Compost and soil amendments are natural alternatives.
- Consumables – Manufacturers have either reduced or are in the process of reducing the amount of heavy metals in consumables such as batteries and fluorescent lamps.

All fluorescent lamps contain mercury, however low-mercury containing lamps are now available from most hardware and lighting stores. Fluorescent lamps are also more energy efficient than the average incandescent lamp.

- Janitorial chemicals – Even biodegradable soap can harm fish and wildlife before it biodegrades. Biodegradable does not mean non-toxic. Safer products and procedures are available for floor stripping and cleaning, as well as carpet, glass, metal, and restroom cleaning and disinfecting. Use paper products with post-consumer recycled content and implement electric had dryers.

Examples

There are a number of business and trade associations, and communities with effective programs. Some of the more prominent are listed below in the references and resources section.

References and Resources

Note: Many of these references provide alternative products for materials that typically are used inside and disposed to the sanitary sewer as well as alternatives to products that usually end up in the storm drain.

General Sustainable Practices and Pollution Prevention Including Pollutant-Specific Information

California Department of Toxic Substances Control, http://www.dtsc.ca.gov/PollutionPrevention/GreenTechnology/Index.cfm.

CalRecycle, http://www.calrecycle.ca.gov/Business/Regulated.htm.

City of Santa Monica Office of Sustainability and Environment, http://www.smgov.net/departments/ose/.

City of Palo Alto, http:// www.city.palo-alto.ca.us/cleanbay.

City and County of San Francisco, Department of the Environment, http://www.sfenvironment.org/toxics-health/greener-business-practices.

Green Business Program, http://www.greenbiz.ca.gov/GRlocal.html .

Product Stewardship Institute, http://www.productstewardship.us/index.cfm.

Sacramento Clean Water Business Partners. http://www.sacstormwater.org/CleanWaterBusinessPartners/CleanWaterBusinessPartners.html.

USEPA. National Pollutant Discharge Elimination System (NPDES) Stormwater Discharges From Industrial Facilities, http://cfpub.epa.gov/npdes/stormwater/indust.cfm.

USEPA Region IX Pollution Prevention Program, http://www.epa.gov/region9/waste/p2/business.html.

Western Sustainability and Pollution Prevention Network, http://wsppn.org/.

Metals (mercury, copper)

National Electrical Manufacturers Association – Environmental Stewardship, http://www.nema.org/Policy/Environmental-Stewardship/pages/default.aspx.

Sustainable Conservation, http://www.suscon.org.

Auto Recycling Project

Brake Pad Partnership

Pesticides and Chemical Fertilizers

Bio-Integral Resource Center, http://www.birc.org.

California Department of Pesticide Regulation, http://www.cdpr.ca.gov/dprprograms.htm.

University of California Statewide IPM Program, http://www.ipm.ucdavis.edu/default.html.

Dioxins

Bay Area Dioxins Project, http://www.abag.ca.gov/bayarea/dioxin/project_materials.htm.

Building & Grounds Maintenance SC-41

Description

Stormwater runoff from building and grounds maintenance activities can be contaminated with toxic hydrocarbons in solvents, fertilizers and pesticides, suspended solids, heavy metals, abnormal pH, and oils and greases. Utilizing the protocols in this fact sheet will prevent or reduce the discharge of pollutants to stormwater from building and grounds maintenance activities by washing and cleaning up with as little water as possible, following good landscape management practices, preventing and cleaning up spills immediately, keeping debris from entering the storm drains, and maintaining the stormwater collection system.

Approach

Reduce potential for pollutant discharge through source control pollution prevention and BMP implementation. Successful implementation depends on effective training of employees on applicable BMPs and general pollution prevention strategies and objectives.

General Pollution Prevention Protocols

- ☐ Switch to non-toxic chemicals for maintenance to the maximum extent possible.
- ☐ Choose cleaning agents that can be recycled.
- ☐ Encourage proper lawn management and landscaping, including use of native vegetation.
- ☐ Encourage use of Integrated Pest Management techniques for pest control.
- ☐ Encourage proper onsite recycling of yard trimmings.
- ☐ Recycle residual paints, solvents, lumber, and other material as much as possible.

Objectives
■ *Cover*
■ *Contain*
■ *Educate*
■ *Reduce/Minimize*
■ *Product Substitution*

Targeted Constituents	
Sediment	✓
Nutrients	✓
Trash	
Metals	✓
Bacteria	✓
Oil and Grease	
Organics	

Minimum BMPs Covered	
Good Housekeeping	✓
Preventative Maintenance	
Spill and Leak Prevention and Response	✓
Material Handling & Waste Management	✓
Erosion and Sediment Controls	
Employee Training Program	✓
Quality Assurance Record Keeping	✓

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- Clean work areas at the end of each work shift using dry cleaning methods such as sweeping and vacuuming.



Good Housekeeping

Pressure Washing of Buildings, Rooftops, and Other Large Objects

- In situations where soaps or detergents are used and the surrounding area is paved, pressure washers must use a water collection device that enables collection of wash water and associated solids. A sump pump, wet vacuum or similarly effective device must be used to collect the runoff and loose materials. The collected runoff and solids must be disposed of properly.

- If soaps or detergents are not used, and the surrounding area is paved, wash runoff does not have to be collected but must be screened. Pressure washers must use filter fabric or some other type of screen on the ground and/or in the catch basin to trap the particles in wash water runoff.

- If you are pressure washing on a grassed area (with or without soap), runoff must be dispersed as sheet flow as much as possible, rather than as a concentrated stream. The wash runoff must remain on the grass and not drain to pavement.

Landscaping Activities

- Dispose of grass clippings, leaves, sticks, or other collected vegetation as garbage, or by composting. Do not dispose of collected vegetation into waterways or storm drainage systems.

- Use mulch or other erosion control measures on exposed soils. See also SC-40, Contaminated and Erodible Areas, for more information.

Building Repair, Remodeling, and Construction

- Do not dump any toxic substance or liquid waste on the pavement, the ground, or toward a storm drain.

- Use ground or drop cloths underneath outdoor painting, scraping, and sandblasting work, and properly dispose of collected material daily.

- Use a ground cloth or oversized tub for activities such as paint mixing and tool cleaning.

- Clean paintbrushes and tools covered with water-based paints in sinks connected to sanitary sewers or in portable containers that can be dumped into a sanitary sewer drain. Brushes and tools covered with non-water-based paints, finishes, or other materials must be cleaned in a manner that enables collection of used solvents (e.g., paint thinner, turpentine, etc.) for recycling or proper disposal.

- Use a storm drain cover, filter fabric, or similarly effective runoff control mechanism if dust, grit, wash water, or other pollutants may escape the work area and enter a catch basin. This is particularly necessary on rainy days. The containment device(s) must be in place at the beginning of the work day, and accumulated dirty runoff and

solids must be collected and disposed of before removing the containment device(s) at the end of the work day.

- If you need to de-water an excavation site, you may need to filter the water before discharging to a catch basin or off-site. If directed off-site, you should direct the water through hay bales and filter fabric or use other sediment filters or traps.
- Store toxic material under cover during precipitation events and when not in use. A cover would include tarps or other temporary cover material.

Mowing, Trimming, and Planting

- Dispose of leaves, sticks, or other collected vegetation as garbage, by composting or at a permitted landfill. Do not dispose of collected vegetation into waterways or storm drainage systems.
- Use mulch or other erosion control measures when soils are exposed.
- Place temporarily stockpiled material away from watercourses and drain inlets, and berm or cover stockpiles to prevent material releases to the storm drain system.
- Consider an alternative approach when bailing out muddy water: do not put it in the storm drain; pour over landscaped areas.
- Use hand weeding where practical.

Fertilizer and Pesticide Management

- Do not use pesticides if rain is expected.
- Do not mix or prepare pesticides for application near storm drains.
- Use the minimum amount needed for the job.
- Calibrate fertilizer distributors to avoid excessive application.
- Employ techniques to minimize off-target application (e.g., spray drift) of pesticides, including consideration of alternative application techniques.
- Apply pesticides only when wind speeds are low.
- Fertilizers should be worked into the soil rather than dumped or broadcast onto the surface.
- Irrigate slowly to prevent runoff and then only as much as is needed.
- Clean pavement and sidewalk if fertilizer is spilled on these surfaces before applying irrigation water.

Inspection

- Inspect irrigation system periodically to ensure that the right amount of water is being applied and that excessive runoff is not occurring. Minimize excess watering and repair leaks in the irrigation system as soon as they are observed.

Building & Grounds Maintenance SC-41



Spill Response and Prevention Procedures

- Keep your Spill Prevention Control and Countermeasure (SPCC) Plan up-to-date.
- Place a stockpile of spill cleanup materials, such as brooms, dustpans, and vacuum sweepers (if desired) near the storage area where it will be readily accessible.
- Have employees trained in spill containment and cleanup present during the loading/unloading of dangerous wastes, liquid chemicals, or other materials.
- Familiarize employees with the Spill Prevention Control and Countermeasure Plan.
- Clean up spills immediately.



Material Handling and Waste Management

- Follow all federal, state, and local laws and regulations governing the use, storage, and disposal of fertilizers and pesticides and training of applicators and pest control advisors.
- Use less toxic pesticides that will do the job when applicable. Avoid use of copper-based pesticides if possible.
- Dispose of empty pesticide containers according to the instructions on the container label.
- Use up the pesticides. Rinse containers, and use rinse water as product. Dispose of unused pesticide as hazardous waste.
- Implement storage requirements for pesticide products with guidance from the local fire department and County Agricultural Commissioner. Provide secondary containment for pesticides.



Employee Training Program

- Educate and train employees on pesticide use and in pesticide application techniques to prevent pollution.
- Train employees and contractors in proper techniques for spill containment and cleanup.
- Be sure the frequency of training takes into account the complexity of the operations and the needs of individual staff.



Quality Assurance and Record Keeping

- Keep accurate logs that document maintenance activities performed and minimum BMP measures implemented.
- Keep accurate logs of spill response actions that document what was spilled, how it was cleaned up, and how the waste was disposed.
- Establish procedures to complete logs and file them in the central office.

Potential Capital Facility Costs and Operation & Maintenance Requirements

Facilities

- Additional capital costs are not anticipated for building and grounds maintenance. Implementation of the minimum BMPs described above should be conducted as part of regular site operations.

Maintenance

- Maintenance activities for the BMPs described above will be minimal, and no additional cost is anticipated.

Supplemental Information

Fire Sprinkler Line Flushing

Site fire sprinkler line flushing may be a source of non-stormwater runoff pollution. The water entering the system is usually potable water, though in some areas it may be non-potable reclaimed wastewater. There are subsequent factors that may drastically reduce the quality of the water in such systems. Black iron pipe is usually used since it is cheaper than potable piping, but it is subject to rusting and results in lower quality water. Initially, the black iron pipe has an oil coating to protect it from rusting between manufacture and installation; this will contaminate the water from the first flush but not from subsequent flushes. Nitrates, poly-phosphates and other corrosion inhibitors, as well as fire suppressants and antifreeze may be added to the sprinkler water system. Water generally remains in the sprinkler system a long time (typically a year) and between flushes may accumulate iron, manganese, lead, copper, nickel, and zinc. The water generally becomes anoxic and contains living and dead bacteria and breakdown products from chlorination. This may result in a significant BOD problem and the water often smells. Consequently dispose fire sprinkler line flush water into the sanitary sewer. Do not allow discharge to storm drain or infiltration due to potential high levels of pollutants in fire sprinkler line water.

References and Resources

City of Seattle, Seattle Public Utilities Department of Planning and Development, 2009. *Stormwater Manual Vol. 1 Source Control Technical Requirements Manual.*

Kennedy/Jenks Consultants, 2007. *The Truckee Meadows Industrial and Commercial Storm Water Best Management Practices Handbook*. Available online at: http://www.cityofsparks.us/sites/default/files/assets/documents/env-control/construction/TM-I-C_BMP_Handbook_2-07-final.pdf.

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US EPA, 1997. *Best Management Practices Handbook for Hazardous Waste Containers*. Available online at: http://www.epa.gov/region6/6en/h/handbk4.pdf.

Ventura Countywide Stormwater Management Program Clean Business Fact Sheets. Available online at: http://www.vcstormwater.org/documents/programs_business/building.pdf.

Building Repair and Construction SC-42

Description

Site modifications are common, particularly at large industrial sites. The activity may vary from minor and normal building repair to major remodeling, or the construction of new facilities. These activities can generate pollutants including solvents, paints, paint and varnish removers, finishing residues, spent thinners, soap cleaners, kerosene, asphalt and concrete materials, adhesive residues, and old asbestos installation. Protocols in this fact sheet are intended to prevent or reduce the discharge of pollutants to stormwater from building repair, remodeling, and minor construction by using soil erosion controls, enclosing or covering building material storage areas, using good housekeeping practices, using safer alternative products, and training employees.

This fact sheet is intended to be used for minor repairs and construction. If major construction is required, the guidelines in the Construction BMP Handbook should be followed.

Approach

The BMP approach is to reduce potential for pollutant discharges through source control pollution prevention and BMP implementation. Successful implementation depends on effective training of employees on applicable BMPs and general pollution prevention strategies and objectives.

General Pollution Prevention Protocols

- ☐ Recycle residual paints, solvents, lumber, and other materials to the maximum extent practicable.
- ☐ Avoid outdoor repairs and construction during periods of wet weather.
- ☐ Use safer alternative products to the maximum extent practicable. See also SC-35 Safer Alternative Products for more information.

Objectives
■ *Cover*
■ *Contain*
■ *Educate*
■ *Reduce/Minimize*
■ *Product Substitution*

Targeted Constituents	
Sediment	✓
Nutrients	
Trash	✓
Metals	✓
Bacteria	
Oil and Grease	✓
Organics	✓

Minimum BMPs Covered	
Good Housekeeping	✓
Preventative Maintenance	
Spill and Leak Prevention and Response	✓
Material Handling & Waste Management	✓
Erosion and Sediment Controls	✓
Employee Training Program	✓
Quality Assurance Record Keeping	✓

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- Buy recycled products to the maximum extent practicable.
- Inform on-site contractors of company policy on these matters and include appropriate provisions in their contract to ensure certain proper housekeeping and disposal practices are implemented.
- Make sure that nearby storm drains are well marked to minimize the chance of inadvertent disposal of residual paints and other liquids.



Good Housekeeping

Repair & Remodeling

- Keep the work site clean and orderly. Remove debris in a timely fashion. Sweep and vacuum the area regularly to remove sediments and small debris.
- Cover raw materials of particular concern that must be left outside, particularly during the rainy season. See also SC-33 Outdoor Storage of Raw Materials for more information.
- Use equipment and tools such as bag sanders to reduce accumulation of debris.
- Limit/prohibit work on windy days; implement roll-down walls or other measures to reduce wind transport of pollutants.
- Do not dump waste liquids down the storm drain.
- Dispose of wash water, sweepings, and sediments properly.
- Store liquid materials properly that are normally used in repair and remodeling such as paints and solvents. See also SC-31 Outdoor Liquid Container Storage for more information.
- Sweep out rain gutters or wash the gutter and trap the particles at the outlet of the downspout. A sock or geofabric placed over the outlet may effectively trap the materials. If the downspout is tight lined, place a temporary plug at the first convenient point in the storm drain and pump out the water with a vactor truck, and clean the catch basin sump where you placed the plug.
- Clean the storm drain system in the immediate vicinity of the construction activity after it is completed. See also SC-44 Drainage System Maintenance for more information.

Painting

- Enclose painting operations consistent with local air quality regulations and OSHA.
- Local air pollution regulations may, in many areas of the state, specify painting procedures which if properly carried out are usually sufficient to protect water quality.
- Develop paint handling procedures for proper use, storage, and disposal of paints.

- Transport paint and materials to and from job sites in containers with secure lids and tied down to the transport vehicle.
- Test and inspect spray equipment prior to starting to paint. Tighten all hoses and connections and do not overfill paint containers.
- Mix paint indoors before using so that any spill will not be exposed to rain. Do so even during dry weather because cleanup of a spill will never be 100 percent effective.
- Transfer and load paint and hot thermoplastic away from storm drain inlets.
- Do not transfer or load paint near storm drain inlets.
- Plug nearby storm drain inlets prior to starting painting and remove plugs when job is complete when there is risk of a spill reaching storm drains.
- Cover nearby storm drain inlets prior to starting work if sand blasting is used to remove paint.
- Use a ground cloth to collect the chips if painting requires scraping or sand blasting of the existing surface. Dispose of the residue properly.
- Cover or enclose painting operations properly to avoid drift.
- Clean the application equipment in a sink that is connected to the sanitary sewer if using water based paints.
- Capture all cleanup-water and dispose of properly.
- Dispose of paints containing lead or tributyl tin and considered a hazardous waste properly.
- Store leftover paints if they are to be kept for the next job properly, or dispose properly.
- Recycle paint when possible. Dispose of paint at an appropriate household hazardous waste facility.



Spill Response and Prevention Procedures

- Keep your spill prevention and control plan up-to-date.
- Place a stockpile of spill cleanup materials where it will be readily accessible.
- Clean up spills immediately.
- Excavate and remove the contaminated (stained) soil if a spill occurs on dirt.



Material Handling and Waste Management

- Post “No Littering” signs and enforce anti-litter laws.

- Provide a sufficient number of litter receptacles for the facility.
- Clean out and cover litter receptacles frequently to prevent spillage.
- Keep waste collection areas clean.
- Inspect solid waste containers for structural damage regularly. Repair or replace damaged containers as necessary.
- Secure solid waste containers; containers must be closed tightly when not in use.
- Do not fill waste containers with washout water or any other liquid.
- Ensure that only appropriate solid wastes are added to the solid waste container. Certain wastes such as hazardous wastes, appliances, fluorescent lamps, pesticides, etc., may not be disposed of in solid waste containers (see chemical/ hazardous waste collection section below).
- Do not mix wastes; this can cause chemical reactions, make recycling impossible, and complicate disposal. Affix labels to all waste containers.
- Make sure that hazardous waste is collected, removed, and disposed of properly. See also SC-34, Waste Handling and Disposal for more information.



Sediment and Erosion Controls

- Limit disturbance to bare soils and preserve natural vegetation whenever possible. See also EC-2, Preservation of Existing Vegetation, in the Construction BMP Handbook.
- Stabilize loose soils by re-vegetating whenever possible. See also EC-4 Hydroseeding, in the Construction BMP Handbook.
- Utilize non-vegetative stabilization methods for areas prone to erosion where vegetative options are not feasible. Examples include:
  - ✓ Areas of vehicular or pedestrian traffic such as roads or paths;
  - ✓ Arid environments where vegetation would not provide timely ground coverage, or would require excessive irrigation;
  - ✓ Rocky substrate, infertile or droughty soils where vegetation would be difficult to establish; and
  - ✓ Areas where vegetation will not grow adequately within the construction time frame.

  There are several non-vegetative stabilization methods and selection should be based on site-specific conditions. See also EC-16 Non-Vegetative Stabilization, in the Construction BMP Handbook.

- Utilize chemical stabilization when needed. See also EC-5 Soil Binders, in the Construction BMP Handbook.
- Use geosynthetic membranes to control erosion if feasible. See also EC-7 Geotextiles and Mats, in the Construction BMP Handbook.
- Stabilize all roadways, entrances, and exits to sufficiently control discharges of erodible materials from discharging or being tracked off the site. See also TC 1-3 Tracking Control, in the Construction BMP Handbook.
- Refer to the supplemental information provided below for projects that involve more extensive soil disturbance activities.



Employee Training Program

- Educate employees about pollution prevention measures and goals.
- Train employees how to properly implement the source control BMPs described above. Detailed information for Sediment and Erosion Control BMPs is provided in the Construction BMP Handbook.
- Proper education of off-site contractors is often overlooked. The conscientious efforts of well trained employees can be lost by unknowing off-site contractors, so make sure they are well informed about pollutant source control responsibilities.
- Use a training log or similar method to document training.



Quality Assurance and Record Keeping

- Keep accurate maintenance logs that document minimum BMP activities performed for building repair and construction, types and quantities of waste disposed of, and any improvement actions.
- Keep accurate logs of spill response actions that document what was spilled, how it was cleaned up, and how the waste was disposed.
- Establish procedures to complete logs and file them in the central office.

Potential Limitations and Work-Arounds

Some facilities may have space constraints, limited staffing and time limitations that may preclude implementation of BMPs. Provided below are typical limitations and recommended "work-arounds."

- This BMP is for minor construction only. The State's General Construction Activity Stormwater Permit has more extensive requirements for larger projects that would disturb one or more acres of surface.
  - ✓ Refer to the companion "Construction Best Management Practice Handbook" which contains specific guidance and best management practices for larger-scale projects.

- Time constraints may require some outdoor repairs and construction during wet weather.
  - ✓ Require employees to understand and follow good housekeeping and spill and leak prevention BMPs.
  - ✓ Inspect sediment and erosion control BMPs daily during periods of wet weather and repair or improve BMP implementation as necessary.
- Hazardous waste that cannot be reused or recycled must be disposed of by a licensed hazardous waste hauler.
  - ✓ Minimize use of hazardous materials to the maximum extent practicable.
- Be certain that actions to help stormwater quality are consistent with Cal- and Fed-OSHA and air quality regulations.
- Prices for recycled/safer alternative materials and fluids may be higher than those of conventional materials.

Potential Capital Facility Costs and Operation & Maintenance Requirements

Facilities

- Limited capital investments may be required at some sites if adequate cover and containment facilities do not exist for construction materials and wastes.
- Purchase and installation of erosion and sediment controls, if needed will require additional capital investments, and this amount will vary depending on site characteristics and the types of BMPs being implemented.
- Minimize costs by maintaining existing vegetation and limiting construction operations on bare soils.

Maintenance

- The erosion and sediment control BMPs described above require periodic inspection and maintenance to remain effective. The cost of these actions will vary depending on site characteristics and the types of BMPs being implemented.
- Irrigation costs may be required to establish and maintain vegetation.

Supplemental Information

Soil/Erosion Control

If the work involves exposing large areas of soil, employ the appropriate soil erosion and control techniques. See the Construction Best Management Practice Handbook. If old buildings are being torn down and not replaced in the near future, stabilize the site using measures described in SC-40 Contaminated or Erodible Areas.

Building Repair and Construction SC-42

If a building is to be placed over an open area with a storm drainage system, make sure the storm inlets within the building are covered or removed, or the storm line is connected to the sanitary sewer. If because of the remodeling a new drainage system is to be installed or the existing system is to be modified, consider installing catch basins as they serve as effective "in-line" treatment devices. Include in the catch basin a "turn-down" elbow or similar device to trap floatables.

References and Resources

City of Seattle, Seattle Public Utilities Department of Planning and Development, 2009. *Stormwater Manual Vol. 1 Source Control Technical Requirements Manual*.

California Stormwater Quality Association, 2012. *Construction Stormwater Best Management Practice Handbook*. Available at http://www.casqa.org.

Kennedy/Jenks Consultants, 2007. *The Truckee Meadows Industrial and Commercial Storm Water Best Management Practices Handbook*. Available online at: http://www.cityofsparks.us/sites/default/files/assets/documents/env-control/construction/TM-I-C_BMP_Handbook_2-07-final.pdf.

Sacramento Stormwater Management Program. *Best Management Practices for Industrial Storm Water Pollution Control*. Available online at: http://www.msa.saccounty.net/sactostormwater/documents/guides/industrial-BMP-manual.pdf.

US EPA. *Construction Site Stormwater Runoff Control*. Available online at: http://cfpub.epa.gov/npdes/stormwater/menuofbmps/index.cfm?action=min_measure&min_measure_id=4.

Parking Area Maintenance SC-43

Description

Parking lots can contribute a number of substances, such as trash, suspended solids, hydrocarbons, oil and grease, and heavy metals that can enter receiving waters through stormwater runoff or non-stormwater discharges. The protocols in this fact sheet are intended to prevent or reduce the discharge of pollutants from parking areas and include using good housekeeping practices, following appropriate cleaning BMPs, and training employees.

BMPs for other outdoor areas on site (loading/unloading, material storage, and equipment operations) are described in SC-30 through SC-33.

Approach

The goal of this program is to ensure stormwater pollution prevention practices are considered when conducting activities on or around parking areas to reduce potential for pollutant discharge to receiving waters. Successful implementation depends on effective training of employees on applicable BMPs and general pollution prevention strategies and objectives.

General Pollution Prevention Protocols

- Encourage advanced designs and maintenance strategies for impervious parking lots. Refer to the treatment control BMP fact sheets in this manual for additional information.
- Keep accurate maintenance logs to evaluate BMP implementation.

Good Housekeeping

- Keep all parking areas clean and orderly. Remove debris, litter, and sediments in a timely fashion.
- Post "No Littering" signs and enforce anti-litter laws.

Objectives
Cover
Contain
Educate
Reduce/Minimize
Product Substitution

Targeted Constituents	
Sediment	✓
Nutrients	
Trash	✓
Metals	✓
Bacteria	
Oil and Grease	✓
Organics	✓

Minimum BMPs Covered	
Good Housekeeping	✓
Preventative Maintenance	✓
Spill and Leak Prevention and Response	✓
Material Handling & Waste Management	
Erosion and Sediment Controls	
Employee Training Program	✓
Quality Assurance Record Keeping	✓

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- ☐ Provide an adequate number of litter receptacles.
- ☐ Clean out and cover litter receptacles frequently to prevent spillage.

Preventative Maintenance

Inspection

Have designated personnel conduct inspections of parking facilities and stormwater conveyance systems associated with parking facilities on a regular basis.

- ☐ Inspect cleaning equipment/sweepers for leaks on a regular basis.

Surface Cleaning

- ☐ Use dry cleaning methods (e.g., sweeping, vacuuming) to prevent the discharge of pollutants into the stormwater conveyance system if possible.
- ☐ Establish frequency of public parking lot sweeping based on usage and field observations of waste accumulation.
- ☐ Sweep all parking lots at least once before the onset of the wet season.
- ☐ Dispose of parking lot sweeping debris and dirt at a landfill.
- ☐ Follow the procedures below if water is used to clean surfaces:
  - ✓ Block the storm drain or contain runoff.
  - ✓ Collect and pump wash water to the sanitary sewer or discharge to a pervious surface. Do not allow wash water to enter storm drains.
- ☐ Follow the procedures below when cleaning heavy oily deposits:
  - ✓ Clean oily spots with absorbent materials.
  - ✓ Use a screen or filter fabric over inlet, then wash surfaces.
  - ✓ Do not allow discharges to the storm drain.
  - ✓ Vacuum/pump discharges to a tank or discharge to sanitary sewer.
  - ✓ Dispose of spilled materials and absorbents appropriately.

Surface Repair

- ☐ Check local ordinance for SUSMP/LID ordinance.
- ☐ Preheat, transfer or load hot bituminous material away from storm drain inlets.
- ☐ Apply concrete, asphalt, and seal coat during dry weather to prevent contamination from contacting stormwater runoff.
- ☐ Cover and seal nearby storm drain inlets where applicable (with waterproof material or mesh) and manholes before applying seal coat, slurry seal, etc. Leave covers in

place until job is complete and all water from emulsified oil sealants has drained or evaporated. Clean any debris from these covered manholes and drains for proper disposal.

- Use only as much water as necessary for dust control during sweeping to avoid runoff.
- Catch drips from paving equipment that is not in use with pans or absorbent material placed under the machines. Dispose of collected material and absorbents properly.



Spill Response and Prevention Procedures

- Keep your Spill Prevention Control and Countermeasure (SPCC) Plan up-to-date.
- Place a stockpile of spill cleanup materials where it will be readily accessible or at a central location.
- Clean up fluid spills immediately with absorbent rags or material.
- Dispose of spilled material and absorbents properly.



Employee Training Program

- Provide regular training to field employees and/or contractors regarding cleaning of paved areas and proper operation of equipment.
- Train employees and contractors in proper techniques for spill containment and cleanup.
- Use a training log or similar method to document training.



Quality Assurance and Record Keeping

- Keep accurate maintenance logs that document minimum BMP activities performed for parking area maintenance, types and quantities of waste disposed of, and any improvement actions.
- Keep accurate logs of spill response actions that document what was spilled, how it was cleaned up, and how the waste was disposed.
- Establish procedures to complete logs and file them in the central office.

Potential Capital Facility Costs and Operation & Maintenance Requirements

Facilities

- Capital investments may be required at some sites to purchase sweeping equipment, train sweeper operators, install oil/water/sand separators, or implement advanced BMPs. These costs can vary significantly depending upon site conditions and the amount of BMPs required.

Maintenance

- Sweep and clean parking lots regularly to minimize pollutant transport into storm drains from stormwater runoff.
- Clean out oil/water/sand separators regularly, especially after heavy storms.
- Maintain advanced BMPs such as vegetated swales, infiltration trenches, or detention basins as appropriate. Refer to the treatment control fact sheets for more information.

Supplemental Information

Advanced BMPs

Some parking areas may require advanced BMPs to further reduce pollutants in stormwater runoff, and a few examples are listed below. Refer to the Treatment Control Fact Sheets and the New Development and Redevelopment Manual for more information.

- When possible, direct sheet runoff to flow into biofilters (vegetated strip and swale) and/or infiltration devices.
- Utilize sand filters or oleophilic collectors for oily waste in low quantities.
- Arrange rooftop drains to prevent drainage directly onto paved surfaces.
- Design lot to include semi-permeable hardscape.

References and Resources

City of Seattle, Seattle Public Utilities Department of Planning and Development, 2009. *Stormwater Manual Vol. 1 Source Control Technical Requirements Manual.*

California Stormwater Quality Association, 2003. *New Development and Redevelopment Stormwater Best Management Practice Handbook*. Available online at: https://www.casqa.org/resources/bmp-handbooks/new-development-redevelopment-bmp-handbook.

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The Storm Water Managers Resource Center, http://www.stormwatercenter.net.

US EPA. *Post-Construction Stormwater Management in New Development and Redevelopment*. BMP Fact Sheets. Available online at: http://cfpub.epa.gov/npdes/stormwater/menuofbmps/index.cfm?action=min_measure&min_measure_id=5.

Drainage System Maintenance SC-44

Description

As a consequence of its function, the stormwater drainage facilities on site convey stormwater that may contain certain pollutants either to the offsite conveyance system that collects and transports urban runoff and stormwater, or directly to receiving waters. The protocols in this fact sheet are intended to reduce pollutants leaving the site to the offsite drainage infrastructure or to receiving waters through proper on-site conveyance system operation and maintenance. The targeted constituents will vary depending on site characteristics and operations.

Approach

Successful implementation depends on effective training of employees on applicable BMPs and general pollution prevention strategies and objectives.

General Pollution Prevention Protocols

- ☐ Maintain catch basins, stormwater inlets, and other stormwater conveyance structures on a regular basis to remove pollutants, reduce high pollutant concentrations during the first flush of storms, prevent clogging of the downstream conveyance system, restore catch basins' sediment trapping capacity, and ensure the system functions properly hydraulically to avoid flooding.
- ☐ Develop and follow a site specific drainage system maintenance plan that describes maintenance locations, methods, required equipment, water sources, sediment collection areas, disposal requirements, and any other pertinent information.

Good Housekeeping

Illicit Connections and Discharges

- ☐ Look for evidence of illegal discharges or illicit connections during routine maintenance of conveyance system and drainage structures:

Objectives
■ *Cover*
■ *Contain*
■ *Educate*
■ *Reduce/Minimize*

Targeted Constituents	
Sediment	✓
Nutrients	✓
Trash	✓
Metals	✓
Bacteria	✓
Oil and Grease	✓
Organics	✓

Minimum BMPs Covered	
Good Housekeeping	✓
Preventative Maintenance	✓
Spill and Leak Prevention and Response	✓
Material Handling & Waste Management	
Erosion and Sediment Controls	
Employee Training Program	✓
Quality Assurance Record Keeping	✓

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- ✓ Identify evidence of spills such as paints, discoloring, odors, etc.
- ✓ Record locations of apparent illegal discharges/illicit connections.
- ✓ Track flows back to potential discharges and conduct aboveground inspections. This can be done through visual inspection of upgradient manholes or alternate techniques including zinc chloride smoke testing, fluorometric dye testing, physical inspection testing, or television camera inspection.
- ✓ Eliminate the discharge once the origin of flow is established.

- ☐ Stencil or demarcate storm drains, where applicable, to prevent illegal disposal of pollutants. Storm drain inlets should have messages such as "Dump No Waste Drains to Stream" or similar stenciled next to them to warn against ignorant or intentional dumping of pollutants into the storm drainage system.
- ☐ Refer to fact sheet SC-10 Non-Stormwater Discharges for additional information.

Illegal Dumping

- ☐ Inspect and clean up hot spots and other storm drainage areas regularly where illegal dumping and disposal occurs.
- ☐ Establish a system for tracking incidents. The system should be designed to identify the following:
  - ✓ Illegal dumping hot spots;
  - ✓ Types and quantities (in some cases) of wastes;
  - ✓ Patterns in time of occurrence (time of day/night, month, or year);
  - ✓ Mode of dumping (abandoned containers, "midnight dumping" from moving vehicles, direct dumping of materials, accidents/spills); and
  - ✓ Responsible parties.
- ☐ Post "No Dumping" signs in problem areas with a phone number for reporting dumping and disposal. Signs should also indicate fines and penalties for illegal dumping.
- ☐ Refer to fact sheet SC-10 Non-Stormwater Discharges for additional information.



Preventative Maintenance

Catch Basins/Inlet Structures

- ☐ Staff should regularly inspect facilities to ensure compliance with the following:
  - ✓ Immediate repair of any deterioration threatening structural integrity.
  - ✓ Cleaning before the sump is 40% full. Catch basins should be cleaned as frequently as needed to meet this standard.

- Clean catch basins, storm drain inlets, and other conveyance structures before the wet season to remove sediments and debris accumulated during the summer.
- Conduct inspections more frequently during the wet season for problem areas where sediment or trash accumulates more often. Prioritize storm drain inlets; clean and repair as needed.
- Keep accurate logs of the number of catch basins cleaned.
- Store wastes collected from cleaning activities of the drainage system in appropriate containers or temporary storage sites in a manner that prevents discharge to the storm drain.
- Dewater the wastes if necessary with outflow into the sanitary sewer if permitted. Water should be treated with an appropriate filtering device prior to discharge to the sanitary sewer. If discharge to the sanitary sewer is not allowed, water should be pumped or vacuumed to a tank and properly disposed. Do not dewater near a storm drain or stream.

Storm Drain Conveyance System

- Locate reaches of storm drain with deposit problems and develop a flushing schedule that keeps the pipe clear of excessive buildup.
- Collect and pump flushed effluent to the sanitary sewer for treatment whenever possible.

Pump Stations

- Clean all storm drain pump stations prior to the wet season to remove silt and trash.
- Do not allow discharge to reach the storm drain system when cleaning a storm drain pump station or other facility.
- Conduct routine maintenance at each pump station.
- Inspect, clean, and repair as necessary all outlet structures prior to the wet season.

Open Channel

- Modify storm channel characteristics to improve channel hydraulics, increase pollutant removals, and enhance channel/creek aesthetic and habitat value.
- Conduct channel modification/improvement in accordance with existing laws. Any person, government agency, or public utility proposing an activity that will change the natural state of any river, stream, or lake in California, must enter into a Steam or Lake Alteration Agreement with the Department of Fish and Wildlife. The developer-applicant should also contact local governments (city, county, special districts), other state agencies (SWRCB, RWQCB, Department of Forestry, Department of Water Resources), and Army Corps of Engineers and USFWS.



Spill Response and Prevention Procedures

- Keep your spill prevention control plan up-to-date.

- Investigate all reports of spills, leaks, and/or illegal dumping promptly.
- Place a stockpile of spill cleanup materials where it will be readily accessible or at a central location.
- Clean up all spills and leaks using "dry" methods (with absorbent materials and/or rags) or dig up, remove, and properly dispose of contaminated soil.



Employee Training Program

- Educate employees about pollution prevention measures and goals.
- Train employees how to properly handle and dispose of waste using the source control BMPs described above.
- Train employees and subcontractors in proper hazardous waste management.
- Use a training log or similar method to document training.
- Ensure that employees are familiar with the site's spill control plan and/or proper spill cleanup procedures.
- Have staff involved in detection and removal of illicit connections trained in the following:
  - ✓ OSHA-required Health and Safety Training (29 CFR 1910.120) plus annual refresher training (as needed).
  - ✓ OSHA Confined Space Entry training (Cal-OSHA Confined Space, Title 8 and Federal OSHA 29 CFR 1910.146).
  - ✓ Procedural training (field screening, sampling, smoke/dye testing, TV inspection).



Quality Assurance and Record Keeping

- Keep accurate maintenance logs that document minimum BMP activities performed for drainage system maintenance, types and quantities of waste disposed of, and any improvement actions.
- Keep accurate logs of spill response actions that document what was spilled, how it was cleaned up, and how the waste was disposed.
- Keep accurate logs of illicit connections, illicit discharges, and illegal dumping into the storm drain system including how wastes were cleaned up and disposed.
- Establish procedures to complete logs and file them in the central office.

Potential Limitations and Work-Arounds

Provided below are typical limitations and recommended "work-arounds" for drainage system maintenance:

- Clean-up activities may create a slight disturbance for local aquatic species. Access to items and material on private property may be limited. Trade-offs may exist between channel hydraulics and water quality/riparian habitat. If storm channels or basins are recognized as wetlands, many activities, including maintenance, may be subject to regulation and permitting.

  - ✓ Perform all maintenance onsite and do not flush accumulated material downstream to private property or riparian habitats.

- Storm drain flushing is most effective in small diameter pipes (36-inch diameter pipe or less, depending on water supply and sediment collection capacity). Other considerations associated with storm drain flushing may include the availability of a water source, finding a downstream area to collect sediments, and liquid/sediment disposal.

  - ✓ Develop and follow a site specific drainage system maintenance plan that describes maintenance locations, methods, required equipment, water sources, sediment collection areas, disposal requirements, and any other pertinent information.

- Regulations may include adoption of substantial penalties for illegal dumping and disposal.

  - ✓ Do not dump illegal materials anywhere onsite.

  - ✓ Identify illicit connections, illicit discharge, and illegal dumping.

  - ✓ Cleanup spills immediately and properly dispose of wastes.

- Local municipal codes may include sections prohibiting discharge of soil, debris, refuse, hazardous wastes, and other pollutants into the sanitary sewer system.

  - ✓ Collect all materials and pollutants accumulated in drainage system and dispose of according to local regulations.

  - ✓ Install debris excluders in areas with a trash TMDL.

Potential Capital Facility Costs and Operation & Maintenance Requirements

Facilities

- Capital costs will vary substantially depending on the size of the facility and characteristics of the drainage system. Significant capital costs may be associated with purchasing water trucks, vacuum trucks, and any other necessary cleaning equipment or improving the drainage infrastructure to reduce the potential .

- Developing and implementing a site specific drainage system maintenance plan will require additional capital if a similar program is not already in place.

Maintenance

- Two-person teams may be required to clean catch basins with vactor trucks.
- Teams of at least two people plus administrative personnel are required to identify illicit discharges, depending on the complexity of the storm sewer system.
- Arrangements must be made for proper disposal of collected wastes.
- Technical staff are required to detect and investigate illegal dumping violations.
- Methods used for illicit connection detection (smoke testing, dye testing, visual inspection, and flow monitoring) can be costly and time-consuming. Site-specific factors, such as the level of impervious area, the density and ages of buildings, and type of land use will determine the level of investigation necessary.

Supplemental Information

Storm Drain Flushing

Flushing is a common maintenance activity used to improve pipe hydraulics and to remove pollutants in storm drainage systems. Flushing may be designed to hydraulically convey accumulated material to strategic locations, such as an open channel, another point where flushing will be initiated, or the sanitary sewer and the treatment facilities, thus preventing re-suspension and overflow of a portion of the solids during storm events. Flushing prevents "plug flow" discharges of concentrated pollutant loadings and sediments. Deposits can hinder the designed conveyance capacity of the storm drain system and potentially cause backwater conditions in severe cases of clogging.

Storm drain flushing usually takes place along segments of pipe with grades that are too flat to maintain adequate velocity to keep particles in suspension. An upstream manhole is selected to place an inflatable device that temporarily plugs the pipe. Further upstream, water is pumped into the line to create a flushing wave. When the upstream reach of pipe is sufficiently full to cause a flushing wave, the inflated device is rapidly deflated with the assistance of a vacuum pump, thereby releasing the backed up water and resulting in the cleaning of the storm drain segment.

To further reduce impacts of stormwater pollution, a second inflatable device placed well downstream may be used to recollect the water after the force of the flushing wave has dissipated. A pump may then be used to transfer the water and accumulated material to the sanitary sewer for treatment. In some cases, an interceptor structure may be more practical or required to recollect the flushed waters.

It has been found that cleansing efficiency of periodic flush waves is dependent upon flush volume, flush discharge rate, sewer slope, sewer length, sewer flow rate, sewer diameter, and population density. As a rule of thumb, the length of line to be flushed should not exceed 700 feet. At this maximum recommended length, the percent removal efficiency ranges between 65-75% for organics and 55-65% for dry weather grit/inorganic material. The percent removal efficiency drops rapidly beyond that. Water is commonly supplied by a water truck, but fire hydrants can also supply water. To make the best use of water, it is recommended that reclaimed water be used if allowed or that fire hydrant line flushing coincide with storm sewer flushing.

References and Resources

City of Seattle, Seattle Public Utilities Department of Planning and Development, 2009. *Stormwater Manual Vol. 1 Source Control Technical Requirements Manual*.

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Efficient Irrigation SD-12



Design Objectives

- ☑ Maximize Infiltration
- ☑ Provide Retention
- ☑ Slow Runoff
- Minimize Impervious Land Coverage
- Prohibit Dumping of Improper Materials
- Contain Pollutants
- Collect and Convey

Description

Irrigation water provided to landscaped areas may result in excess irrigation water being conveyed into stormwater drainage systems.

Approach

Project plan designs for development and redevelopment should include application methods of irrigation water that minimize runoff of excess irrigation water into the stormwater conveyance system.

Suitable Applications

Appropriate applications include residential, commercial and industrial areas planned for development or redevelopment. (Detached residential single-family homes are typically excluded from this requirement.)

Design Considerations

Designing New Installations

The following methods to reduce excessive irrigation runoff should be considered, and incorporated and implemented where determined applicable and feasible by the Permittee:

- Employ rain-triggered shutoff devices to prevent irrigation after precipitation.
- Design irrigation systems to each landscape area's specific water requirements.
- Include design featuring flow reducers or shutoff valves triggered by a pressure drop to control water loss in the event of broken sprinkler heads or lines.
- Implement landscape plans consistent with County or City water conservation resolutions, which may include provision of water sensors, programmable irrigation times (for short cycles), etc.

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- Design timing and application methods of irrigation water to minimize the runoff of excess irrigation water into the storm water drainage system.
- Group plants with similar water requirements in order to reduce excess irrigation runoff and promote surface filtration. Choose plants with low irrigation requirements (for example, native or drought tolerant species). Consider design features such as:
  - Using mulches (such as wood chips or bar) in planter areas without ground cover to minimize sediment in runoff
  - Installing appropriate plant materials for the location, in accordance with amount of sunlight and climate, and use native plant materials where possible and/or as recommended by the landscape architect
  - Leaving a vegetative barrier along the property boundary and interior watercourses, to act as a pollutant filter, where appropriate and feasible
  - Choosing plants that minimize or eliminate the use of fertilizer or pesticides to sustain growth
- Employ other comparable, equally effective methods to reduce irrigation water runoff.

Redeveloping Existing Installations

Various jurisdictional stormwater management and mitigation plans (SUSMP, WQMP, etc.) define "redevelopment" in terms of amounts of additional impervious area, increases in gross floor area and/or exterior construction, and land disturbing activities with structural or impervious surfaces. The definition of " redevelopment" must be consulted to determine whether or not the requirements for new development apply to areas intended for redevelopment. If the definition applies, the steps outlined under "designing new installations" above should be followed.

Other Resources

A Manual for the Standard Urban Stormwater Mitigation Plan (SUSMP), Los Angeles County Department of Public Works, May 2002.

Model Standard Urban Storm Water Mitigation Plan (SUSMP) for San Diego County, Port of San Diego, and Cities in San Diego County, February 14, 2002.

Model Water Quality Management Plan (WQMP) for County of Orange, Orange County Flood Control District, and the Incorporated Cities of Orange County, Draft February 2003.

Ventura Countywide Technical Guidance Manual for Stormwater Quality Control Measures, July 2002.

Storm Drain Signage SD-13



Design Objectives

- Maximize Infiltration
- Provide Retention
- Slow Runoff
- Minimize Impervious Land Coverage
- ☑ Prohibit Dumping of Improper Materials
- Contain Pollutants
- Collect and Convey

Description

Waste materials dumped into storm drain inlets can have severe impacts on receiving and ground waters. Posting notices regarding discharge prohibitions at storm drain inlets can prevent waste dumping. Storm drain signs and stencils are highly visible source controls that are typically placed directly adjacent to storm drain inlets.

Approach

The stencil or affixed sign contains a brief statement that prohibits dumping of improper materials into the urban runoff conveyance system. Storm drain messages have become a popular method of alerting the public about the effects of and the prohibitions against waste disposal.

Suitable Applications

Stencils and signs alert the public to the destination of pollutants discharged to the storm drain. Signs are appropriate in residential, commercial, and industrial areas, as well as any other area where contributions or dumping to storm drains is likely.

Design Considerations

Storm drain message markers or placards are recommended at all storm drain inlets within the boundary of a development project. The marker should be placed in clear sight facing toward anyone approaching the inlet from either side. All storm drain inlet locations should be identified on the development site map.

Designing New Installations

The following methods should be considered for inclusion in the project design and show on project plans:

- Provide stenciling or labeling of all storm drain inlets and catch basins, constructed or modified, within the project area with prohibitive language. Examples include “NO DUMPING

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– DRAINS TO OCEAN" and/or other graphical icons to discourage illegal dumping.

- Post signs with prohibitive language and/or graphical icons, which prohibit illegal dumping at public access points along channels and creeks within the project area.

Note - Some local agencies have approved specific signage and/or storm drain message placards for use. Consult local agency stormwater staff to determine specific requirements for placard types and methods of application.

Redeveloping Existing Installations

Various jurisdictional stormwater management and mitigation plans (SUSMP, WQMP, etc.) define "redevelopment" in terms of amounts of additional impervious area, increases in gross floor area and/or exterior construction, and land disturbing activities with structural or impervious surfaces. If the project meets the definition of "redevelopment", then the requirements stated under " designing new installations" above should be included in all project design plans.

Additional Information

Maintenance Considerations

- Legibility of markers and signs should be maintained. If required by the agency with jurisdiction over the project, the owner/operator or homeowner's association should enter into a maintenance agreement with the agency or record a deed restriction upon the property title to maintain the legibility of placards or signs.

Placement

- Signage on top of curbs tends to weather and fade.

- Signage on face of curbs tends to be worn by contact with vehicle tires and sweeper brooms.

Supplemental Information

Examples

- Most MS4 programs have storm drain signage programs. Some MS4 programs will provide stencils, or arrange for volunteers to stencil storm drains as part of their outreach program.

Other Resources

A Manual for the Standard Urban Stormwater Mitigation Plan (SUSMP), Los Angeles County Department of Public Works, May 2002.

Model Standard Urban Storm Water Mitigation Plan (SUSMP) for San Diego County, Port of San Diego, and Cities in San Diego County, February 14, 2002.

Model Water Quality Management Plan (WQMP) for County of Orange, Orange County Flood Control District, and the Incorporated Cities of Orange County, Draft February 2003.

Ventura Countywide Technical Guidance Manual for Stormwater Quality Control Measures, July 2002.

Maintenance Bays & Docks SD-31



Design Objectives

- Maximize Infiltration
- Provide Retention
- Slow Runoff
- Minimize Impervious Land Coverage
- ☑ Prohibit Dumping of Improper Materials
- ☑ Contain Pollutants
- Collect and Convey

Description

Several measures can be taken to prevent operations at maintenance bays and loading docks from contributing a variety of toxic compounds, oil and grease, heavy metals, nutrients, suspended solids, and other pollutants to the stormwater conveyance system.

Approach

In designs for maintenance bays and loading docks, containment is encouraged. Preventative measures include overflow containment structures and dead-end sumps. However, in the case of loading docks from grocery stores and warehouse/distribution centers, engineered infiltration systems may be considered.

Suitable Applications

Appropriate applications include commercial and industrial areas planned for development or redevelopment.

Design Considerations

Design requirements for vehicle maintenance and repair are governed by Building and Fire Codes, and by current local agency ordinances, and zoning requirements. The design criteria described in this fact sheet are meant to enhance and be consistent with these code requirements.

Designing New Installations

Designs of maintenance bays should consider the following:

- Repair/maintenance bays and vehicle parts with fluids should be indoors; or designed to preclude urban run-on and runoff.
- Repair/maintenance floor areas should be paved with Portland cement concrete (or equivalent smooth impervious surface).

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- Repair/maintenance bays should be designed to capture all wash water leaks and spills. Provide impermeable berms, drop inlets, trench catch basins, or overflow containment structures around repair bays to prevent spilled materials and wash-down waters form entering the storm drain system. Connect drains to a sump for collection and disposal. Direct connection of the repair/maintenance bays to the storm drain system is prohibited. If required by local jurisdiction, obtain an Industrial Waste Discharge Permit.

- Other features may be comparable and equally effective.

The following designs of loading/unloading dock areas should be considered:

- Loading dock areas should be covered, or drainage should be designed to preclude urban run-on and runoff.

- Direct connections into storm drains from depressed loading docks (truck wells) are prohibited.

- Below-grade loading docks from grocery stores and warehouse/distribution centers of fresh food items should drain through water quality inlets, or to an engineered infiltration system, or an equally effective alternative. Pre-treatment may also be required.

- Other features may be comparable and equally effective.

Redeveloping Existing Installations

Various jurisdictional stormwater management and mitigation plans (SUSMP, WQMP, etc.) define "redevelopment" in terms of amounts of additional impervious area, increases in gross floor area and/or exterior construction, and land disturbing activities with structural or impervious surfaces. The definition of " redevelopment" must be consulted to determine whether or not the requirements for new development apply to areas intended for redevelopment. If the definition applies, the steps outlined under "designing new installations" above should be followed.

Additional Information

Stormwater and non-stormwater will accumulate in containment areas and sumps with impervious surfaces. Contaminated accumulated water must be disposed of in accordance with applicable laws and cannot be discharged directly to the storm drain or sanitary sewer system without the appropriate permit.

Other Resources

A Manual for the Standard Urban Stormwater Mitigation Plan (SUSMP), Los Angeles County Department of Public Works, May 2002.

Model Standard Urban Storm Water Mitigation Plan (SUSMP) for San Diego County, Port of San Diego, and Cities in San Diego County, February 14, 2002.

Model Water Quality Management Plan (WQMP) for County of Orange, Orange County Flood Control District, and the Incorporated Cities of Orange County, Draft February 2003.

Ventura Countywide Technical Guidance Manual for Stormwater Quality Control Measures, July 2002.

Trash Storage Areas SD-32

Description

Trash storage areas are areas where a trash receptacle (s) are located for use as a repository for solid wastes. Stormwater runoff from areas where trash is stored or disposed of can be polluted. In addition, loose trash and debris can be easily transported by water or wind into nearby storm drain inlets, channels, and/or creeks. Waste handling operations that may be sources of stormwater pollution include dumpsters, litter control, and waste piles.

Approach

This fact sheet contains details on the specific measures required to prevent or reduce pollutants in stormwater runoff associated with trash storage and handling. Preventative measures including enclosures, containment structures, and impervious pavements to mitigate spills, should be used to reduce the likelihood of contamination.

Design Objectives

- Maximize Infiltration
- Provide Retention
- Slow Runoff
- Minimize Impervious Land Coverage
- Prohibit Dumping of Improper Materials
- ☑ Contain Pollutants
- Collect and Convey

Suitable Applications

Appropriate applications include residential, commercial and industrial areas planned for development or redevelopment. (Detached residential single-family homes are typically excluded from this requirement.)

Design Considerations

Design requirements for waste handling areas are governed by Building and Fire Codes, and by current local agency ordinances and zoning requirements. The design criteria described in this fact sheet are meant to enhance and be consistent with these code and ordinance requirements. Hazardous waste should be handled in accordance with legal requirements established in Title 22, California Code of Regulation.

Wastes from commercial and industrial sites are typically hauled by either public or commercial carriers that may have design or access requirements for waste storage areas. The design criteria in this fact sheet are recommendations and are not intended to be in conflict with requirements established by the waste hauler. The waste hauler should be contacted prior to the design of your site trash collection areas. Conflicts or issues should be discussed with the local agency.

Designing New Installations

Trash storage areas should be designed to consider the following structural or treatment control BMPs:

- Design trash container areas so that drainage from adjoining roofs and pavement is diverted around the area(s) to avoid run-on. This might include berming or grading the waste handling area to prevent run-on of stormwater.
- Make sure trash container areas are screened or walled to prevent off-site transport of trash.

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- Use lined bins or dumpsters to reduce leaking of liquid waste.
- Provide roofs, awnings, or attached lids on all trash containers to minimize direct precipitation and prevent rainfall from entering containers.
- Pave trash storage areas with an impervious surface to mitigate spills.
- Do not locate storm drains in immediate vicinity of the trash storage area.
- Post signs on all dumpsters informing users that hazardous materials are not to be disposed of therein.

Redeveloping Existing Installations

Various jurisdictional stormwater management and mitigation plans (SUSMP, WQMP, etc.) define "redevelopment" in terms of amounts of additional impervious area, increases in gross floor area and/or exterior construction, and land disturbing activities with structural or impervious surfaces. The definition of " redevelopment" must be consulted to determine whether or not the requirements for new development apply to areas intended for redevelopment. If the definition applies, the steps outlined under "designing new installations" above should be followed.

Additional Information

Maintenance Considerations

The integrity of structural elements that are subject to damage (i.e., screens, covers, and signs) must be maintained by the owner/operator. Maintenance agreements between the local agency and the owner/operator may be required. Some agencies will require maintenance deed restrictions to be recorded of the property title. If required by the local agency, maintenance agreements or deed restrictions must be executed by the owner/operator before improvement plans are approved.

Other Resources

A Manual for the Standard Urban Stormwater Mitigation Plan (SUSMP), Los Angeles County Department of Public Works, May 2002.

Model Standard Urban Storm Water Mitigation Plan (SUSMP) for San Diego County, Port of San Diego, and Cities in San Diego County, February 14, 2002.

Model Water Quality Management Plan (WQMP) for County of Orange, Orange County Flood Control District, and the Incorporated Cities of Orange County, Draft February 2003.

Ventura Countywide Technical Guidance Manual for Stormwater Quality Control Measures, July 2002.

TYPICAL SPILL PLAN

The spill plan should include a list of potential pollutants for this site. The likely spill locations are apartment plumbing and parking areas. Typical sources of pollutants that occur on residential rental properties:

* Sewage spills resulting from pipe failures, grease and rag blockages, pump failures, and improper connections.
* Automotive fluid spills (used motor oil, antifreeze, lubricants, & solvents) from leaky vehicles and activities associated with auto repair/maintenance (oil changes, engine work, etc.). Even when restricted or forbidden, these occur.

The spill plan should have a brief written policy/procedure for each BMP that applies to this property. Some of the practices that will help prevent spills and discharges are:

* Frequently maintain and inspect the property's sewer collection system.
* Educate tenants regarding proper cooking grease disposal. • Routinely inspect parking lots and other outdoor areas for automotive fluid spills
* Establish a written policy that either prohibits vehicle maintenance activities onsite or limits the activity to a specific area where potential discharges can be contained (such as an enclosed bay).
* Acquire a spill cleanup kit that addresses automotive fluid discharges and discharges of other types of chemicals that are stored and/or used onsite.
* Educate maintenance crew regarding proper disposal and/or recycling of yard wastes (leaves and grass clippings).
* Immediately cleanup up any spills upon discovery and properly dispose of wastes.
* Prohibit car washing in apartment complexes. Prohibit mobile car washers that do not contain waste water.

A typical spill plan calls for a spill kit. The spill plan should note when the spill kit is located.

* Spill kits commonly contain the following items:
* Instructions for use
* Numbers to call for help and spill reporting
* Nitrile gloves
* Safety Glasses or goggles
* Spill barriers, socks or booms
* Absorbent materials
* Disposal bags and a container for collection and disposal of used absorbent.

Instructions include:

Step 1: Confine the spill
Create a barrier around the outside of the spill with the socks or booms.

Step 2: Stop the flow
Find where the liquid is coming from and shut down the source.

Step 3: Clean up the mess
Working from the outside to the inside of the spill, use the absorbents in the kit to clean up.

Step 4: Dispose of used absorbents

Attachment F
Infiltration Report

March 21, 2023

Lake Creek Industrial, LLC
1302 Brittany Cross Road
Santa Ana, California 92705

Attention: Mr. Bob Kubichek
Senior Vice President

Project No.: **22G153-3**

Subject: **Results of Additional Infiltration Testing**
Proposed Apple Valley Assemblage
NWC Central Road and Corwin Road
Apple Valley, California

References: 1) Geotechnical Investigation, Proposed Apple Valley Assemblage, NWC Central Road and Corwin Road, Apple Valley, California, prepared by Southern California Geotechnical, Inc. (SCG) for Lake Creek Industrial, LLC, SCG Project No. 22G153-1, dated July 11, 2022.

2) Results of Infiltration Testing, Proposed Apple Valley Assemblage, NWC Central Road and Corwin Road, Apple Valley, California, prepared by Southern California Geotechnical, Inc. (SCG) for Lake Creek Industrial, LLC, SCG Project No. 22G153-2, dated July 12, 2022.

Mr. Kubichek:

In accordance with your request, we have performed infiltration testing at the subject site. We are pleased to present this report summarizing the results of the additional infiltration testing and our design recommendations.

Scope of Services

The scope of services performed for this project was in accordance with our Change Order No. 22G153-CO, dated February 14, 2023. The scope of services included site reconnaissance, subsurface exploration, field testing, and engineering analysis to determine the infiltration rates of the on-site soils. The infiltration testing was performed in general accordance with the guidelines published in Riverside County – Low Impact Development BMP Design Handbook – Section 2.3 of Appendix A, prepared for the Riverside County Department of Environmental Health (RCDEH), dated December 2013. The San Bernardino County standards defer to the guidelines published by the RCDEH.

Site Description

The subject site is located at the northwest corner of Central Road and Corwin Road in Apple Valley, California. The site is bounded to the north by Gustine Road, to the west by Apple Valley Airport, to the south by Corwin Road, and to the east by Central Road. The general location of the site is illustrated on the Site Location Map, included as Plate 1 of this report.

The site is comprised of several parcels, which total 288± acres in size. The site is vacant and undeveloped. Two (2) north-south trending dirt roads are present in the western and central areas of the site. A fire hydrant is present near the western dirt road. Ground surface cover throughout the site consists of alluvial soils with sparse vegetation growth throughout.

Detailed topographic information was provided on the preliminary grading plan prepared by Thienes Engineering, Inc. (TEI), the project civil engineer. The site elevations range from a high of 3085± feet mean sea level (msl) in the northeastern corner of the site to a low of 2973± feet msl in the southwestern corner of the site. Overall, the site slopes downward toward the southwest at a gradient of about 2± percent. The site topography is slightly rolling, with several northeast to southwest trending natural drainage courses. The depths of these drainage courses with respect to the adjacent grades are approximately 2 to 3± feet. There is 112± feet of elevation differential across the site.

Proposed Development

Based on a site plan (2023-02-08 Infiltration Exhibit TEI 4099) prepared by TEI and provided by the client, the site is expected to be developed with three (3) warehouses. The approximate building sizes are described below:

Building No.	Size (ft^2)	Location
1	1,226,848±	West
2	1,228,258±	Central
3	992,520±	East

The buildings are expected to include dock-high doors in the truck court areas. We expect that the buildings will be surrounded by asphaltic concrete pavements in the parking and drive areas, Portland cement concrete pavements in the truck court areas, with isolated areas of concrete flatwork and landscape planters.

The site will use on-site storm water infiltration. Based on the infiltration exhibit prepared by TEI, there will be at least four (4) proposed infiltration basins will be located throughout the site, identified as Infiltration Basin Nos. 1 through 4. The locations and depths of the proposed infiltration basins are depicted below:

Infiltration Basin No.	Location	Depth Below Existing Grade (feet)
1	Southeast	18 to 25
2	South-Central	20 to 25
3	South-Central	14
4	Northwest	5

Previous Studies

SCG previously performed a geotechnical investigation at the subject site (Reference No. 1). As a part of this study, forty-seven (47) borings were advanced to depths of 10 to 30± feet below the existing site grades.

Native alluvium was encountered at the ground surface at all of the boring locations, extending to at least the maximum depth explored of 30± feet below surface grade. The near surface alluvial soils, extending to depths up to 10± feet, generally consisted of medium dense to very dense fine sandy silts and fine to coarse sandy silts. These soils are weakly cemented with trace amounts of clay content. At greater depths, the alluvial soils generally consisted of dense to very dense fine sandy silts and hard fine to coarse sandy clays. Generally, these soils possess weak to moderate cementation.

SCG also performed infiltration testing at the subject site (Reference No. 2). As part of this investigation, six (6) infiltration tests were performed at the subject site at depths of 10 to 12± feet below existing site grades. Native alluvium was encountered at the ground surface at all of the infiltration test locations, extending to at least the maximum explored depth of 12± feet below the existing site grades. The alluvium generally consisted of medium dense to very dense silty fine to medium sands and silty fine to coarse sands. Occasional layers of medium dense fine to coarse sandy silts were encountered. Trace to little quantities of fine gravel and coarse sand were encountered within the infiltration borings. Based on the previous infiltration tests results, SCG recommended infiltration rates of 4.0 and 6.3 inches per hour be used in the design of the previously proposed infiltration basins located in the southeast and southwest corners of the site.

Groundwater

Free water was not encountered during the drilling of any of the borings. Based on the moisture content of the recovered soil samples and the lack of free water in the borings, the static groundwater table is considered to have been present at a depth greater than 30± feet below existing site grades.

Subsurface Exploration

Scope of Exploration

The subsurface exploration for the infiltration testing consisted of six (6) infiltration test borings (identified as Infiltration Test Nos. I-7 through I-12) advanced to depths ranging from 5 to 25± feet below the existing site grades. The borings were logged during drilling by a member of our staff and were advanced using a truck-mounted drilling rig, equipped with 8-inch-diameter hollow stem augers. The approximate locations of the infiltration test borings are indicated on the Infiltration Test Location Plan, enclosed as Plate 2 of this report.

Upon the completion of the infiltration borings, the bottom of each test boring was covered with 2± inches of clean ¾-inch gravel. A sufficient length of 3-inch-diameter perforated PVC casing was then placed into each test hole so that the PVC casing extended from the bottom of the test hole to the ground surface. Clean ¾-inch gravel was then installed in the annulus surrounding the PVC casing.

Geotechnical Conditions

Younger alluvium was encountered at the ground surface at several of the infiltration boring locations, extending to a depth of 7± feet below the existing site grades. The younger alluvium

generally consists of medium dense fine to medium sandy silts and silty fine to medium sands. Older alluvium was encountered at the ground surface or beneath the younger alluvium at all of the infiltration boring locations, extending to at least the maximum explored depth of 25± feet below existing site grades. The older alluvial soils consist of dense to very dense fine to medium sandy silts and silty fine to medium sands with trace amounts of coarse sand. Trace quantities of clay were occasionally encountered in the alluvial soils. The Boring Logs, which illustrate the conditions encountered at each test location are included within this report.

Infiltration Testing

The infiltration testing was performed in general accordance with the guidelines published in Riverside County – Low Impact Development BMP Design Handbook – Section 2.3 of Appendix A, which apply to San Bernardino County.

Pre-soaking

In accordance with the county infiltration standards for sandy soils, all infiltration test borings were pre-soaked 2 hours prior to the infiltration testing or until all of the water had percolated through the test holes. The pre-soaking process consisted of inverting a full 5-gallon bottle of clear water over each hole so that the hole was filled to an elevation of at least 5 times the hole's radius above the gravel at the bottom of each hole. Pre-soaking was completed after all of the water had percolated through the test holes.

Infiltration Testing Procedure

Following the pre-soaking process of the infiltration test borings, SCG performed the infiltration testing. Each test hole was filled with water to a depth of at least 5 times the hole's radius above the gravel at the bottom of the test holes. In accordance with the San Bernardino County guidelines, since "sandy soils" (where 6 inches of water infiltrated into the surrounding soils in less than 25 minutes for two consecutive readings) were encountered at the bottom of all of the infiltration test borings, readings were taken at 10-minute intervals for a total of at least 1 hour. The water level readings are presented on the spreadsheets enclosed with this report. The infiltration rates for each of the timed intervals are also tabulated on the spreadsheets.

The infiltration rates for the tests are tabulated in inches per hour. In accordance with the typically accepted practice, it is recommended that the most conservative reading from the latter part of the infiltration tests be used for design. These rates are summarized below:

Infiltration Test No.	Depth (feet)	Soil Description	Measured Infiltration Rate (inches/hour)
I-7	5	Light Brown Silty fine to coarse Sand, trace Clay	3.7
I-8	14	Light Brown Silty fine to medium Sand, trace coarse Sand	1.2
I-9	20	Light Brown Silty fine to coarse Sand	5.0
I-10	25	Light Brown Silty fine to medium Sand, trace coarse Sand	4.8
I-11	18	Brown Silty fine to coarse Sand	3.7
I-12	25	Brown Silty fine to coarse Sand	8.0

Laboratory Testing

Moisture Content

The moisture contents for the recovered soil samples within the borings were determined in accordance with ASTM D-2216 and are expressed as a percentage of the dry weight. These test results are presented on the Boring Logs.

Grain Size Analysis

The grain size distribution of selected soils collected from the base of each infiltration test boring have been determined using a range of wire mesh screens. These tests were performed in general accordance with ASTM D-422 and/or ASTM D-1140. The weight of the portion of the sample retained on each screen is recorded and the percentage finer or coarser of the total weight is calculated. The results of these tests are presented on Plates C-1 through C-6 of this report.

Design Recommendations

A total of six (6) infiltration tests were performed at the subject site as a part of this investigation. The measured infiltration rates at the infiltration test locations range from 1.2 to 8.0 inches per hour.

Based on the results of the infiltration testing, the following infiltration rates should be used in the design of the infiltration systems in their respective locations and depths:

Infiltration Basin No.	Infiltration Test Nos.	Depth (feet)	Infiltration System Location	Design Infiltration Rate (inches/hour)
1	I-11/I-12	18 to 25	Southeast	5.9*
2	I-9/I-10	20 to 25	South	4.9*
3	I-8	14	South	1.2
4	I-7	5	Northwest	3.7

***Note: These infiltration rates are averages of the infiltration test results within each respective basin.**

The design of the proposed storm water infiltration system should be performed by the project civil engineer, in accordance with the City of Apple Valley and/or County of San Bernardino guidelines. However, it is recommended that the system be constructed so as to facilitate removal of silt and clay, or other deleterious materials from any water that may enter the systems. The presence of such materials would decrease the effective infiltration rates. **It is recommended that the project civil engineer apply an appropriate factor of safety. The infiltration rate recommended above is based on the assumption that only clean water will be introduced to the subsurface profile. Any fines, debris, or organic materials could significantly impact the infiltration rate.** It should be noted that the recommended infiltration rate is based on infiltration testing at six (6) discrete locations and the overall infiltration rate of the storm water infiltration system could vary considerably.

Infiltration Rate Considerations

The infiltration rates presented herein were determined in accordance with the San Bernardino County guidelines and are considered valid only for the time and place of the actual test. Varying subsurface conditions will exist in other areas of the site, which could alter the recommended infiltration rates presented above. The infiltration rates will decline over time between maintenance cycles as silt or clay particles accumulate on the BMP surface. The infiltration rate is highly dependent upon a number of factors, including density, silt and clay content, grainsize distribution throughout the range of particle sizes, and particle shape. Small changes in these factors can cause large changes in the infiltration rates.

Infiltration rates are based on unsaturated flow. As water is introduced into soils by infiltration, the soils become saturated and the wetting front advances from the unsaturated zone to the saturated zone. Once the soils become saturated, infiltration rates become zero, and water can only move through soils by hydraulic conductivity at a rate determined by pressure head and soil permeability. Changes in soil moisture content will affect the infiltration rate. Infiltration rates should be expected to decrease until the soils become saturated. Soil permeability values will then govern groundwater movement. Permeability values may be on the order of 10 to 20 times less than infiltration rates. The system designer should incorporate adequate factors of safety and allow for overflow design into appropriate traditional storm drain systems, which would transport storm water off-site.

Construction Considerations

The infiltration rates presented in this report are specific to the tested locations and depths. Infiltration rates can be significantly reduced if the soils are subjected to excessive disturbance or compaction during construction. Compaction of the soils at the bottom of the infiltration

system can significantly reduce the infiltration ability of the basins. Therefore, the subgrade soils within proposed infiltration system areas should not be over-excavated, undercut or compacted in any significant manner. **It is recommended that a note to this effect be added to the project plans and/or specifications.**

We recommend that a representative from the geotechnical engineer be on-site during the construction of the proposed infiltration systems to identify the soil classification at the base of each system. The infiltration rate of the system will likely vary if the composition of the soil located beneath the system is not consistent with the test soils.

We recommend that scrapers and other rubber-tired heavy equipment not be operated on the basin bottom, or at levels lower than 2 feet above the bottom of the system, particularly within basins. As such, the bottom 24 inches of the infiltration systems should be excavated with non-rubber-tired equipment, such as excavators.

Basin Maintenance

The proposed project includes infiltration basins. Water flowing into these basins will carry some level of sediment. Wind-blown sediments and erosion of the basin side walls will also contribute to sediment deposition at the bottom of the basin. This layer has the potential to significantly reduce the infiltration rate of the basin subgrade soils. Therefore, a formal basin maintenance program should be established to ensure that these silt and clay deposits are removed from the basin on a regular basis. Appropriate vegetation on the basin sidewalls and bottom may reduce erosion and sediment deposition.

Basin maintenance should also include measures to prevent animal burrows, and to repair any burrows or damage caused by such. Animal burrows in the basin sidewalls can significantly increase the risk of erosion and piping failures.

Location of Infiltration Systems

The use of on-site storm water infiltration systems carries a risk of creating adverse geotechnical conditions. Increasing the moisture content of the soil can cause the soil to lose internal shear strength and increase its compressibility, resulting in a change in the designed engineering properties. Overlying structures and pavements in the infiltration area could potentially be damaged due to saturation of the subgrade soils. **The proposed infiltration systems for this site should be located at least 25 feet away from any structures, including retaining walls.** Even with this provision of locating the infiltration system at least 25 feet from the buildings, it is possible that infiltrating water into the subsurface soils could have an adverse effect on the proposed or existing structures. It should also be noted that utility trenches which happen to collect storm water can also serve as conduits to transmit storm water toward the structure, depending on the slope of the utility trench. Therefore, consideration should also be given to the proposed locations of underground utilities which may pass near the proposed infiltration system.

The infiltration system designer should also give special consideration to the effect that the proposed infiltration systems may have on nearby subterranean structures, open excavations, or descending slopes. In particular, infiltration systems should not be located near the crest of descending slopes, particularly where the slopes are comprised of granular soils. Such systems

will require specialized design and analysis to evaluate the potential for slope instability, piping failures and other phenomena that typically apply to earthen dam design. This type of analysis is beyond the scope of this infiltration test report, but these factors should be considered by the infiltration system designer when locating the infiltration systems.

General Comments

This report has been prepared as an instrument of service for use by the client in order to aid in the evaluation of this property and to assist the architects and engineers in the design and preparation of the project plans and specifications. This report may be provided to the contractor(s) and other design consultants to disclose information relative to the project. However, this report is not intended to be utilized as a specification in and of itself, without appropriate interpretation by the project architect, structural engineer, and/or civil engineer. The design of the proposed storm water infiltration system is the responsibility of the civil engineer. The role of the geotechnical engineer is limited to determination of infiltration rate only. By using the design infiltration rate contained herein, the civil engineer agrees to indemnify, defend, and hold harmless the geotechnical engineer for all aspects of the design and performance of the proposed storm water infiltration system. The reproduction and distribution of this report must be authorized by the client and Southern California Geotechnical, Inc. Furthermore, any reliance on this report by an unauthorized third party is at such party's sole risk, and we accept no responsibility for damage or loss which may occur.

The analysis of this site was based on a subsurface profile interpolated from limited discrete soil samples. While the materials encountered in the project area are considered to be representative of the total area, some variations should be expected between boring locations and testing depths. If the conditions encountered during construction vary significantly from those detailed herein, we should be contacted immediately to determine if the conditions alter the recommendations contained herein.

This report has been based on assumed or provided characteristics of the proposed development. It is recommended that the owner, client, architect, structural engineer, and civil engineer carefully review these assumptions to ensure that they are consistent with the characteristics of the proposed development. If discrepancies exist, they should be brought to our attention to verify that they do not affect the conclusions and recommendations contained herein. We also recommend that the project plans and specifications be submitted to our office for review to verify that our recommendations have been correctly interpreted. The analysis, conclusions, and recommendations contained within this report have been promulgated in accordance with generally accepted professional geotechnical engineering practice. No other warranty is implied or expressed.

Closure

We sincerely appreciate the opportunity to be of service on this project. We look forward to providing additional consulting services during the course of the project. If we may be of further assistance in any manner, please contact our office.

Respectfully Submitted,

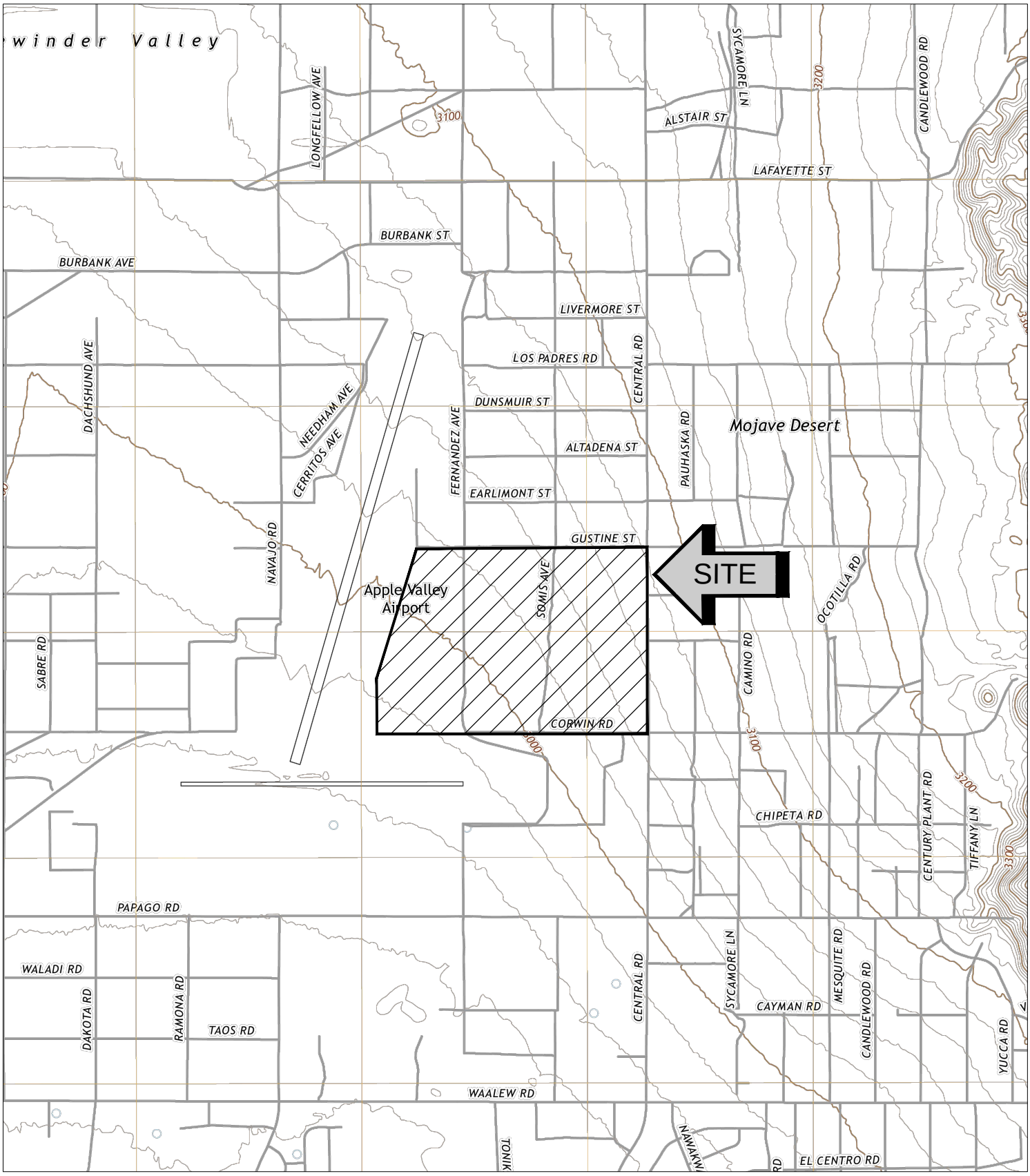
SOUTHERN CALIFORNIA GEOTECHNICAL, INC.

Ryan Bremer
Staff Geologist

Robert G. Trazo, GE 2655
Principal Engineer

REGISTERED PROFESSIONAL ENGINEER
ROBERT TRAZO
No. 2655
GEOTECHNICAL
STATE OF CALIFORNIA

Enclosures: Plate 1 - Site Location Map
Plate 2 - Infiltration Test Location Plan
Boring Log Legend and Logs (8 Pages)
Infiltration Test Results Spreadsheets (6 Pages)
Grain Size Analysis Graphs (6 Pages)



SOURCE: USGS TOPOGRAPHIC MAPS OF THE APPLE VALLEY NORTH QUADRANGLE, SAN BERNARDINO COUNTY, CALIFORNIA, 2021.

SITE LOCATION MAP

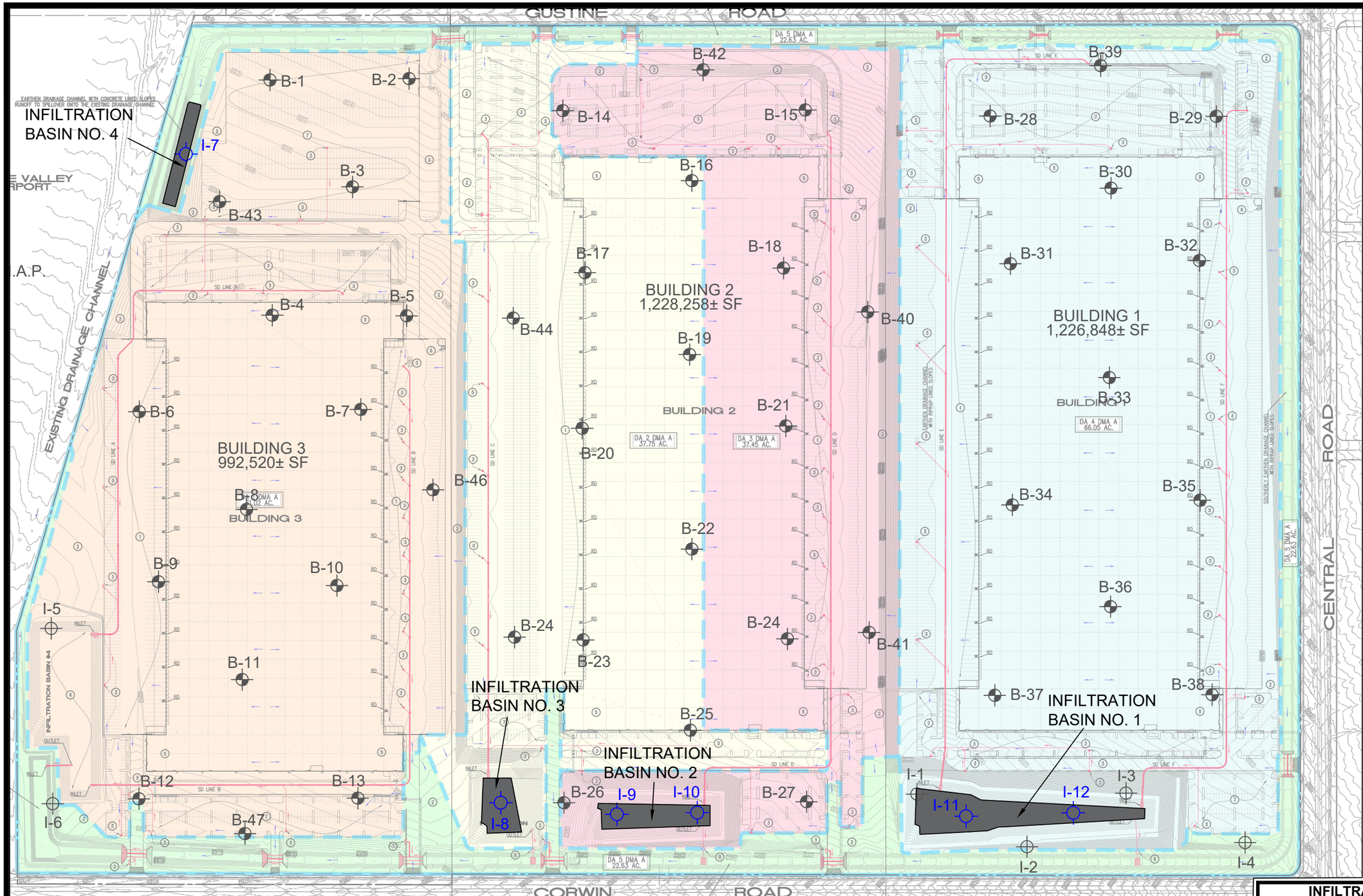
PROPOSED APPLE VALLEY ASSEMBLAGE

APPLE VALLEY, CALIFORNIA

SCALE: 1" = 2000'	
DRAWN: RB CHKD: RGT	
SCG PROJECT 22G153-3	
PLATE 1	

SoCalGeo

SOUTHERN CALIFORNIA GEOTECHNICAL



GEOTECHNICAL LEGEND

- APPROXIMATE INFILTRATION TEST LOCATION
- PREVIOUS BORING LOCATION (SCG PROJECT NO. 22G153-1)
- PREVIOUS INFILTRATION TEST LOCATION (SCG PROJECT NO. 22G153-2)

NOTE: CONCEPTUAL SITE PLAN PREPARED BY THIENES ENGINEERING, INC. (TEI)

INFILTRATION TEST LOCATION PLAN

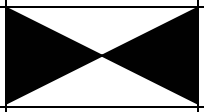
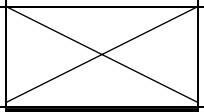
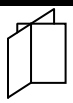
PROPOSED APPLE VALLEY ASSEMBLAGE

APPLE VALLEY, CALIFORNIA

SCALE: 1" = 300'	
DRAWN: RB CHKD: RGT	
SCG PROJECT 22G153-3	
PLATE 2	

SOUTHERN CALIFORNIA GEOTECHNICAL

BORING LOG LEGEND

SAMPLE TYPE	GRAPHICAL SYMBOL	SAMPLE DESCRIPTION
AUGER		SAMPLE COLLECTED FROM AUGER CUTTINGS, NO FIELD MEASUREMENT OF SOIL STRENGTH. (DISTURBED)
CORE		ROCK CORE SAMPLE: TYPICALLY TAKEN WITH A DIAMOND-TIPPED CORE BARREL. TYPICALLY USED ONLY IN HIGHLY CONSOLIDATED BEDROCK.
GRAB		SOIL SAMPLE TAKEN WITH NO SPECIALIZED EQUIPMENT, SUCH AS FROM A STOCKPILE OR THE GROUND SURFACE. (DISTURBED)
CS		CALIFORNIA SAMPLER: 2-1/2 INCH I.D. SPLIT BARREL SAMPLER, LINED WITH 1-INCH HIGH BRASS RINGS. DRIVEN WITH SPT HAMMER. (RELATIVELY UNDISTURBED)
NSR		NO RECOVERY: THE SAMPLING ATTEMPT DID NOT RESULT IN RECOVERY OF ANY SIGNIFICANT SOIL OR ROCK MATERIAL.
SPT		STANDARD PENETRATION TEST: SAMPLER IS A 1.4 INCH INSIDE DIAMETER SPLIT BARREL, DRIVEN 18 INCHES WITH THE SPT HAMMER. (DISTURBED)
SH		SHELBY TUBE: TAKEN WITH A THIN WALL SAMPLE TUBE, PUSHED INTO THE SOIL AND THEN EXTRACTED. (UNDISTURBED)
VANE		VANE SHEAR TEST: SOIL STRENGTH OBTAINED USING A 4 BLADED SHEAR DEVICE. TYPICALLY USED IN SOFT CLAYS-NO SAMPLE RECOVERED.

COLUMN DESCRIPTIONS

DEPTH: Distance in feet below the ground surface.

SAMPLE: Sample Type as depicted above.

BLOW COUNT: Number of blows required to advance the sampler 12 inches using a 140 lb hammer with a 30-inch drop. 50/3" indicates penetration refusal (>50 blows) at 3 inches. WH indicates that the weight of the hammer was sufficient to push the sampler 6 inches or more.

POCKET PEN.: Approximate shear strength of a cohesive soil sample as measured by pocket penetrometer.

GRAPHIC LOG: Graphic Soil Symbol as depicted on the following page.

DRY DENSITY: Dry density of an undisturbed or relatively undisturbed sample in lbs/ft^3.

MOISTURE CONTENT: Moisture content of a soil sample, expressed as a percentage of the dry weight.

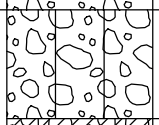
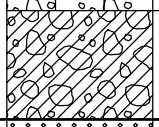
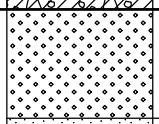
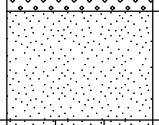
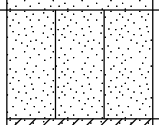
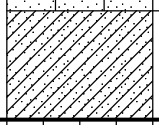
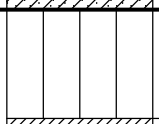
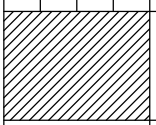
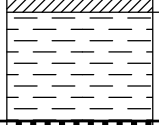
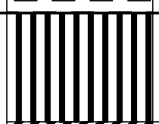
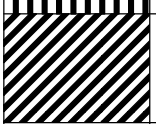
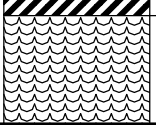
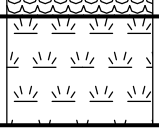
LIQUID LIMIT: The moisture content above which a soil behaves as a liquid.

PLASTIC LIMIT: The moisture content above which a soil behaves as a plastic.

PASSING #200 SIEVE: The percentage of the sample finer than the #200 standard sieve.

UNCONFINED SHEAR: The shear strength of a cohesive soil sample, as measured in the unconfined state.

SOIL CLASSIFICATION CHART

MAJOR DIVISIONS			SYMBOLS		TYPICAL DESCRIPTIONS
			GRAPH	LETTER	
COARSE GRAINED SOILS MORE THAN 50% OF MATERIAL IS LARGER THAN NO. 200 SIEVE SIZE	GRAVEL AND GRAVELLY SOILS MORE THAN 50% OF COARSE FRACTION RETAINED ON NO. 4 SIEVE	CLEAN GRAVELS (LITTLE OR NO FINES)		GW	WELL-GRADED GRAVELS, GRAVEL - SAND MIXTURES, LITTLE OR NO FINES
				GP	POORLY-GRADED GRAVELS, GRAVEL - SAND MIXTURES, LITTLE OR NO FINES
		GRAVELS WITH FINES (APPRECIABLE AMOUNT OF FINES)		GM	SILTY GRAVELS, GRAVEL - SAND - SILT MIXTURES
				GC	CLAYEY GRAVELS, GRAVEL - SAND - CLAY MIXTURES
	SAND AND SANDY SOILS MORE THAN 50% OF COARSE FRACTION PASSING ON NO. 4 SIEVE	CLEAN SANDS (LITTLE OR NO FINES)		SW	WELL-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
				SP	POORLY-GRADED SANDS, GRAVELLY SAND, LITTLE OR NO FINES
		SANDS WITH FINES (APPRECIABLE AMOUNT OF FINES)		SM	SILTY SANDS, SAND - SILT MIXTURES
				SC	CLAYEY SANDS, SAND - CLAY MIXTURES
FINE GRAINED SOILS MORE THAN 50% OF MATERIAL IS SMALLER THAN NO. 200 SIEVE SIZE	SILTS AND CLAYS	LIQUID LIMIT LESS THAN 50		ML	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY
				CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
				OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
	SILTS AND CLAYS	LIQUID LIMIT GREATER THAN 50		MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SAND OR SILTY SOILS
				CH	INORGANIC CLAYS OF HIGH PLASTICITY
				OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS
HIGHLY ORGANIC SOILS				PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENTS

NOTE: DUAL SYMBOLS ARE USED TO INDICATE BORDERLINE SOIL CLASSIFICATIONS

SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

BORING NO. I-7

JOB NO.: 22G153-3
PROJECT: Proposed Apple Valley Assemblage
LOCATION: Apple Valley, California

DRILLING DATE: 2/21/23
DRILLING METHOD: Hollow Stem Auger
LOGGED BY: Ryan Bremer

WATER DEPTH: Dry
CAVE DEPTH: ---
READING TAKEN: At Completion

FIELD RESULTS						LABORATORY RESULTS						
DEPTH (FEET)	SAMPLE	BLOW COUNT	POCKET PEN. (TSF)	GRAPHIC LOG	DESCRIPTION SURFACE ELEVATION: --- MSL	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTIC LIMIT	PASSING #200 SIEVE (%)	ORGANIC CONTENT (%)	COMMENTS
					OLDER ALLUVIUM: Light Brown Silty fine to coarse Sand, trace Clay, very dense-dry							
		72/9"					1			28		
5					Boring Terminated at 5'							

TBL 22G153-3.GPJ SOCALGEO.GDT 3/21/23

TEST BORING LOG **PLATE B-1**

SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

BORING NO. I-8

JOB NO.: 22G153-3
PROJECT: Proposed Apple Valley Assemblage
LOCATION: Apple Valley, California

DRILLING DATE: 2/21/23
DRILLING METHOD: Hollow Stem Auger
LOGGED BY: Ryan Bremer

WATER DEPTH: Dry
CAVE DEPTH: ---
READING TAKEN: At Completion

FIELD RESULTS						LABORATORY RESULTS						
DEPTH (FEET)	SAMPLE	BLOW COUNT	POCKET PEN. (TSF)	GRAPHIC LOG	DESCRIPTION SURFACE ELEVATION: --- MSL	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTIC LIMIT	PASSING #200 SIEVE (%)	ORGANIC CONTENT (%)	COMMENTS
					YOUNGER ALLUVIUM: Light Brown fine to medium Sandy Silt, trace coarse Sand, medium dense-dry to damp							
		19					2					
5												
					OLDER ALLUVIUM: Light Brown Silty fine to coarse Sand to fine to coarse Sandy Silt, very dense-damp							
		66/11"					3					
10												
					Light Brown Silty fine to medium Sand, trace coarse Sand, some Calcareous veining, very dense-damp to moist							
		78/9"					9			31		
					Boring Terminated at 14'							

TBL 22G153-3.GPJ SOCALGEO.GDT 3/21/23

TEST BORING LOG

PLATE B-2

SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

BORING NO. I-9

JOB NO.: 22G153-3
PROJECT: Proposed Apple Valley Assemblage
LOCATION: Apple Valley, California

DRILLING DATE: 2/21/23
DRILLING METHOD: Hollow Stem Auger
LOGGED BY: Ryan Bremer

WATER DEPTH: Dry
CAVE DEPTH: ---
READING TAKEN: At Completion

FIELD RESULTS						LABORATORY RESULTS						
DEPTH (FEET)	SAMPLE	BLOW COUNT	POCKET PEN. (TSF)	GRAPHIC LOG	DESCRIPTION SURFACE ELEVATION: --- MSL	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTIC LIMIT	PASSING #200 SIEVE (%)	ORGANIC CONTENT (%)	COMMENTS
5		78/9"			OLDER ALLUVIUM: Light Brown fine to medium Sandy Silt, trace coarse Sand, very dense-dry to damp		2					
10		80/8"			Light Brown Silty fine to medium Sand to fine to medium Sandy Silt, trace Clay, very dense-damp		5					
15		81/8"			Light Brown Silty fine to coarse Sand, very dense-damp		4					
20		62/10"					4			20		
					Boring Terminated at 20'							

TBL 22G153-3.GPJ SOCALGEO.GDT 3/21/23

TEST BORING LOG

PLATE B-3

SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

BORING NO. I-10

JOB NO.: 22G153-3
PROJECT: Proposed Apple Valley Assemblage
LOCATION: Apple Valley, California

DRILLING DATE: 2/21/23
DRILLING METHOD: Hollow Stem Auger
LOGGED BY: Ryan Bremer

WATER DEPTH: Dry
CAVE DEPTH: ---
READING TAKEN: At Completion

FIELD RESULTS						LABORATORY RESULTS						
DEPTH (FEET)	SAMPLE	BLOW COUNT	POCKET PEN. (TSF)	GRAPHIC LOG	DESCRIPTION SURFACE ELEVATION: --- MSL	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTIC LIMIT	PASSING #200 SIEVE (%)	ORGANIC CONTENT (%)	COMMENTS
5		76/9"			OLDER ALLUVIUM: Red Brown to Light Brown fine to coarse Sandy Silt, very dense-dry @ 0 to 7 feet, trace Clay		1					
10		74/11"					1					
15		59/11"			Brown Silty fine Sand to fine Sandy Silt, trace medium to coarse Sand, little Calcareous veining, very dense-damp		6					
20		69/9"			Light Brown Silty fine to medium Sand, trace coarse Sand, very dense-dry to damp		1					
25		72/9"					2			24		
					Boring Terminated at 25'							

TBL 22G153-3.GPJ SOCALGEO.GDT 3/21/23

TEST BORING LOG

PLATE B-4

SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

BORING NO. I-11

JOB NO.: 22G153-3
PROJECT: Proposed Apple Valley Assemblage
LOCATION: Apple Valley, California

DRILLING DATE: 2/21/23
DRILLING METHOD: Hollow Stem Auger
LOGGED BY: Ryan Bremer

WATER DEPTH: Dry
CAVE DEPTH: ---
READING TAKEN: At Completion

FIELD RESULTS						LABORATORY RESULTS						
DEPTH (FEET)	SAMPLE	BLOW COUNT	POCKET PEN. (TSF)	GRAPHIC LOG	DESCRIPTION SURFACE ELEVATION: --- MSL	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTIC LIMIT	PASSING #200 SIEVE (%)	ORGANIC CONTENT (%)	COMMENTS
					YOUNGER ALLUVIUM: Light Brown Silty fine to medium Sand, trace fine root fibers, medium dense-dry							
		16					1					
5												
					OLDER ALLUVIUM: Light brown Silty fine to medium Sand, trace fine root fibers, trace coarse Sand, very dense-damp							
		57/11"					5					
10												
					Brown Silty fine to coarse Sand, trace Clay, very dense-dry							
		76/8"					1					
15					@ 16½ to 18 feet, no Clay, medium dense							
		25					1			20		
					Boring Terminated at 18'							

TBL 22G153-3.GPJ SOCALGEO.GDT 3/21/23

TEST BORING LOG

PLATE B-5

SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

BORING NO. I-12

JOB NO.: 22G153-3
PROJECT: Proposed Apple Valley Assemblage
LOCATION: Apple Valley, California

DRILLING DATE: 2/21/23
DRILLING METHOD: Hollow Stem Auger
LOGGED BY: Ryan Bremer

WATER DEPTH: Dry
CAVE DEPTH: ---
READING TAKEN: At Completion

FIELD RESULTS						LABORATORY RESULTS						
DEPTH (FEET)	SAMPLE	BLOW COUNT	POCKET PEN. (TSF)	GRAPHIC LOG	DESCRIPTION SURFACE ELEVATION: --- MSL	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTIC LIMIT	PASSING #200 SIEVE (%)	ORGANIC CONTENT (%)	COMMENTS
5		56			OLDER ALLUVIUM: Light Brown Silty fine to coarse Sand, very dense-dry		1					
10		72/9"			Brown fine to coarse Sandy Silt, very dense-dry to damp		2					
15		70/8"			Brown Silty fine to coarse Sand, trace Clay, very dense-dry to damp		2					
20		50/1"			@ 17 to 25 feet, no Clay		2					
25		68					1			17		
					Boring Terminated at 25'							

TBL 22G153-3.GPJ SOCALGEO.GDT 3/21/23

TEST BORING LOG **PLATE B-6**

INFILTRATION CALCULATIONS

Project Name	Proposed Apple Valley Assemblage
Project Location	Apple Valley, CA
Project Number	22G153-3
Engineer	JJH

Test Hole Radius	4	(in)
Test Depth	5.10	(ft)

Infiltration Test Hole	I-7

Soil Criteria Test

Interval Number		Time	Time Interval (min)	Water Depth (ft)	Change in Water Level (in)	Did 6 inches of water seep away in less than 25 minutes?	Sandy Soils or Non-Sandy Soils?
1	Initial	9:30 AM	25.00	3.10	18.24	YES	SANDY SOILS
	Final	9:55 AM		4.62			
2	Initial	9:58 AM	25.00	3.10	16.20	YES	SANDY SOILS
	Final	10:23 AM		4.45			

Test Data

Interval Number		Time	Time Interval (min)	Water Depth (ft)	Change in Water Level (ft)	Average Head Height (ft)	Infiltration Rate Q (in/hr)
1	Initial	10:24 AM	10.00	3.10	0.70	1.65	4.62
	Final	10:34 AM		3.80			
2	Initial	10:35 AM	10.00	3.10	0.61	1.70	3.93
	Final	10:45 AM		3.71			
3	Initial	10:46 AM	10.00	3.10	0.61	1.70	3.93
	Final	10:56 AM		3.71			
4	Initial	10:58 AM	10.00	3.10	0.61	1.70	3.93
	Final	11:08 AM		3.71			
5	Initial	11:10 AM	10.00	3.10	0.60	1.70	3.86
	Final	11:20 AM		3.70			
6	Initial	11:21 AM	10.00	3.10	0.58	1.71	3.71
	Final	11:31 AM		3.68			

Per County Standards, Infiltration Rate calculated as follows:

$$Q = \frac{\Delta H(60r)}{\Delta t(r + 2H_{avg})}$$

Where: Q = Infiltration Rate (in inches per hour)
ΔH = Change in Height (Water Level) over the time interval
r = Test Hole (Borehole) Radius
Δt = Time Interval
H_{avg} = Average Head Height over the time interval

INFILTRATION CALCULATIONS

Project Name	Proposed Apple Valley Assemblage
Project Location	Apple Valley, CA
Project Number	22G153-3
Engineer	JJH

Test Hole Radius	4	(in)
Test Depth	13.95	(ft)

Infiltration Test Hole	I-8

Soil Criteria Test

Interval Number		Time	Time Interval (min)	Water Depth (ft)	Change in Water Level (in)	Did 6 inches of water seep away in less than 25 minutes?	Sandy Soils or Non-Sandy Soils?
1	Initial	2:33 PM	25.00	11.95	11.40	YES	SANDY SOILS
	Final	2:58 PM		12.90			
2	Initial	3:00 PM	25.00	11.95	8.04	YES	SANDY SOILS
	Final	3:25 PM		12.62			

Test Data

Interval Number		Time	Time Interval (min)	Water Depth (ft)	Change in Water Level (ft)	Average Head Height (ft)	Infiltration Rate Q (in/hr)
1	Initial	3:30 PM	10.00	11.95	0.23	1.89	1.35
	Final	3:40 PM		12.18			
2	Initial	3:40 PM	10.00	11.95	0.22	1.89	1.28
	Final	3:50 PM		12.17			
3	Initial	3:50 PM	10.00	11.95	0.22	1.89	1.28
	Final	4:00 PM		12.17			
4	Initial	4:00 PM	10.00	11.95	0.21	1.90	1.22
	Final	4:10 PM		12.16			
5	Initial	4:10 PM	10.00	11.95	0.21	1.90	1.22
	Final	4:20 PM		12.16			
6	Initial	4:20 PM	10.00	11.95	0.21	1.90	1.22
	Final	4:30 PM		12.16			

Per County Standards, Infiltration Rate calculated as follows:

$$Q = \frac{\Delta H(60r)}{\Delta t(r + 2H_{avg})}$$

Where: Q = Infiltration Rate (in inches per hour)
ΔH = Change in Height (Water Level) over the time interval
r = Test Hole (Borehole) Radius
Δt = Time Interval
H_{avg} = Average Head Height over the time interval

INFILTRATION CALCULATIONS

Project Name	Proposed Apple Valley Assemblage
Project Location	Apple Valley, CA
Project Number	22G153-3
Engineer	JJH

Test Hole Radius	4	(in)
Test Depth	20.00	(ft)

Infiltration Test Hole: I-9

Soil Criteria Test

Interval Number		Time	Time Interval (min)	Water Depth (ft)	Change in Water Level (in)	Did 6 inches of water seep away in less than 25 minutes?	Sandy Soils or Non-Sandy Soils?
1	Initial	2:33 PM	25.00	18.00	16.80	YES	SANDY SOILS
	Final	2:58 PM		19.40			
2	Initial	2:59 PM	25.00	18.00	16.80	YES	SANDY SOILS
	Final	3:24 PM		19.40			

Test Data

Interval Number		Time	Time Interval (min)	Water Depth (ft)	Change in Water Level (ft)	Average Head Height (ft)	Infiltration Rate Q (in/hr)
1	Initial	3:30 PM	10.00	18.00	0.65	1.68	4.24
	Final	3:40 PM		18.65			
2	Initial	3:40 PM	10.00	18.00	0.78	1.61	5.27
	Final	3:50 PM		18.78			
3	Initial	3:50 PM	10.00	18.00	0.75	1.63	5.02
	Final	4:00 PM		18.75			
4	Initial	4:00 PM	10.00	18.00	0.75	1.63	5.02
	Final	4:10 PM		18.75			
5	Initial	4:10 PM	10.00	18.00	0.75	1.63	5.02
	Final	4:20 PM		18.75			
6	Initial	4:20 PM	10.00	18.00	0.75	1.63	5.02
	Final	4:30 PM		18.75			

Per County Standards, Infiltration Rate calculated as follows:

$$Q = \frac{\Delta H(60r)}{\Delta t(r + 2H_{avg})}$$

Where:
- Q = Infiltration Rate (in inches per hour)
- ΔH = Change in Height (Water Level) over the time interval
- r = Test Hole (Borehole) Radius
- Δt = Time Interval
- H_{avg} = Average Head Height over the time interval

INFILTRATION CALCULATIONS

Project Name	Proposed Apple Valley Assemblage
Project Location	Apple Valley, CA
Project Number	22G153-3
Engineer	JJH

Test Hole Radius	4	(in)
Test Depth	25.00	(ft)

Infiltration Test Hole: I-10

Soil Criteria Test

Interval Number		Time	Time Interval (min)	Water Depth (ft)	Change in Water Level (in)	Did 6 inches of water seep away in less than 25 minutes?	Sandy Soils or Non-Sandy Soils?
1	Initial	11:12 AM	25.00	22.60	24.00	YES	SANDY SOILS
	Final	11:37 AM		24.60			
2	Initial	11:38 AM	25.00	22.60	24.00	YES	SANDY SOILS
	Final	12:03 PM		24.60			

Test Data

Interval Number		Time	Time Interval (min)	Water Depth (ft)	Change in Water Level (ft)	Average Head Height (ft)	Infiltration Rate Q (in/hr)
1	Initial	12:05 PM	10.00	22.60	1.02	1.89	5.95
	Final	12:15 PM		23.62			
2	Initial	12:15 PM	10.00	22.60	0.92	1.94	5.24
	Final	12:25 PM		23.52			
3	Initial	12:26 PM	10.00	22.60	0.88	1.96	4.97
	Final	12:36 PM		23.48			
4	Initial	12:36 PM	10.00	22.60	0.85	1.98	4.76
	Final	12:46 PM		23.45			
5	Initial	12:48 PM	10.00	22.60	0.85	1.98	4.76
	Final	12:58 PM		23.45			
6	Initial	12:59 PM	10.00	22.60	0.86	1.97	4.83
	Final	1:09 PM		23.46			

Per County Standards, Infiltration Rate calculated as follows:

$$Q = \frac{\Delta H(60r)}{\Delta t(r + 2H_{avg})}$$

Where:
- Q = Infiltration Rate (in inches per hour)
- ΔH = Change in Height (Water Level) over the time interval
- r = Test Hole (Borehole) Radius
- Δt = Time Interval
- H_{avg} = Average Head Height over the time interval

INFILTRATION CALCULATIONS

Project Name	Proposed Apple Valley Assemblage
Project Location	Apple Valley, CA
Project Number	22G153-3
Engineer	JJH

Test Hole Radius	4	(in)
Test Depth	17.90	(ft)

Infiltration Test Hole: I-11

Soil Criteria Test

Interval Number		Time	Time Interval (min)	Water Depth (ft)	Change in Water Level (in)	Did 6 inches of water seep away in less than 25 minutes?	Sandy Soils or Non-Sandy Soils?
1	Initial	11:23 AM	25.00	15.80	24.00	YES	SANDY SOILS
	Final	11:48 AM		17.80			
2	Initial	11:50 AM	25.00	15.80	19.80	YES	SANDY SOILS
	Final	12:15 PM		17.45			

Test Data

Interval Number		Time	Time Interval (min)	Water Depth (ft)	Change in Water Level (ft)	Average Head Height (ft)	Infiltration Rate Q (in/hr)
1	Initial	12:20 PM	10.00	15.80	0.96	1.62	6.45
	Final	12:30 PM		16.76			
2	Initial	12:30 PM	10.00	15.80	0.83	1.69	5.38
	Final	12:40 PM		16.63			
3	Initial	12:41 PM	10.00	15.80	0.79	1.71	5.07
	Final	12:51 PM		16.59			
4	Initial	12:51 PM	10.00	15.80	0.68	1.76	4.24
	Final	1:01 PM		16.48			
5	Initial	1:05 PM	10.00	15.80	0.62	1.79	3.80
	Final	1:15 PM		16.42			
6	Initial	1:15 PM	10.00	15.80	0.61	1.80	3.73
	Final	1:25 PM		16.41			

Per County Standards, Infiltration Rate calculated as follows:

$$Q = \frac{\Delta H(60r)}{\Delta t(r + 2H_{avg})}$$

Where:
- Q = Infiltration Rate (in inches per hour)
- ΔH = Change in Height (Water Level) over the time interval
- r = Test Hole (Borehole) Radius
- Δt = Time Interval
- H_{avg} = Average Head Height over the time interval

INFILTRATION CALCULATIONS

Project Name	Proposed Apple Valley Assemblage
Project Location	Apple Valley, CA
Project Number	22G153-3
Engineer	JJH

Test Hole Radius	4	(in)
Test Depth	24.90	(ft)

Infiltration Test Hole	I-12

Soil Criteria Test

Interval Number		Time	Time Interval (min)	Water Depth (ft)	Change in Water Level (in)	Did 6 inches of water seep away in less than 25 minutes?	Sandy Soils or Non-Sandy Soils?
1	Initial	11:40 AM	25.00	22.80	24.00	YES	SANDY SOILS
	Final	12:05 PM		24.80			
2	Initial	12:05 PM	25.00	22.80	24.00	YES	SANDY SOILS
	Final	12:30 PM		24.80			

Test Data

Interval Number		Time	Time Interval (min)	Water Depth (ft)	Change in Water Level (ft)	Average Head Height (ft)	Infiltration Rate Q (in/hr)
1	Initial	12:38 PM	10.00	22.80	1.15	1.53	8.16
	Final	12:48 PM		23.95			
2	Initial	12:50 PM	10.00	22.80	1.08	1.56	7.51
	Final	1:00 PM		23.88			
3	Initial	1:24 PM	10.00	22.80	1.14	1.53	8.06
	Final	1:34 PM		23.94			
4	Initial	1:35 PM	10.00	22.80	1.13	1.54	7.97
	Final	1:45 PM		23.93			
5	Initial	1:45 PM	10.00	22.80	1.13	1.54	7.97
	Final	1:55 PM		23.93			
6	Initial	1:55 PM	10.00	22.80	1.13	1.54	7.97
	Final	2:05 PM		23.93			

Per County Standards, Infiltration Rate calculated as follows:

$$Q = \frac{\Delta H(60r)}{\Delta t(r + 2H_{avg})}$$

Where: Q = Infiltration Rate (in inches per hour)
ΔH = Change in Height (Water Level) over the time interval
r = Test Hole (Borehole) Radius
Δt = Time Interval
H_{avg} = Average Head Height over the time interval

Grain Size Distribution

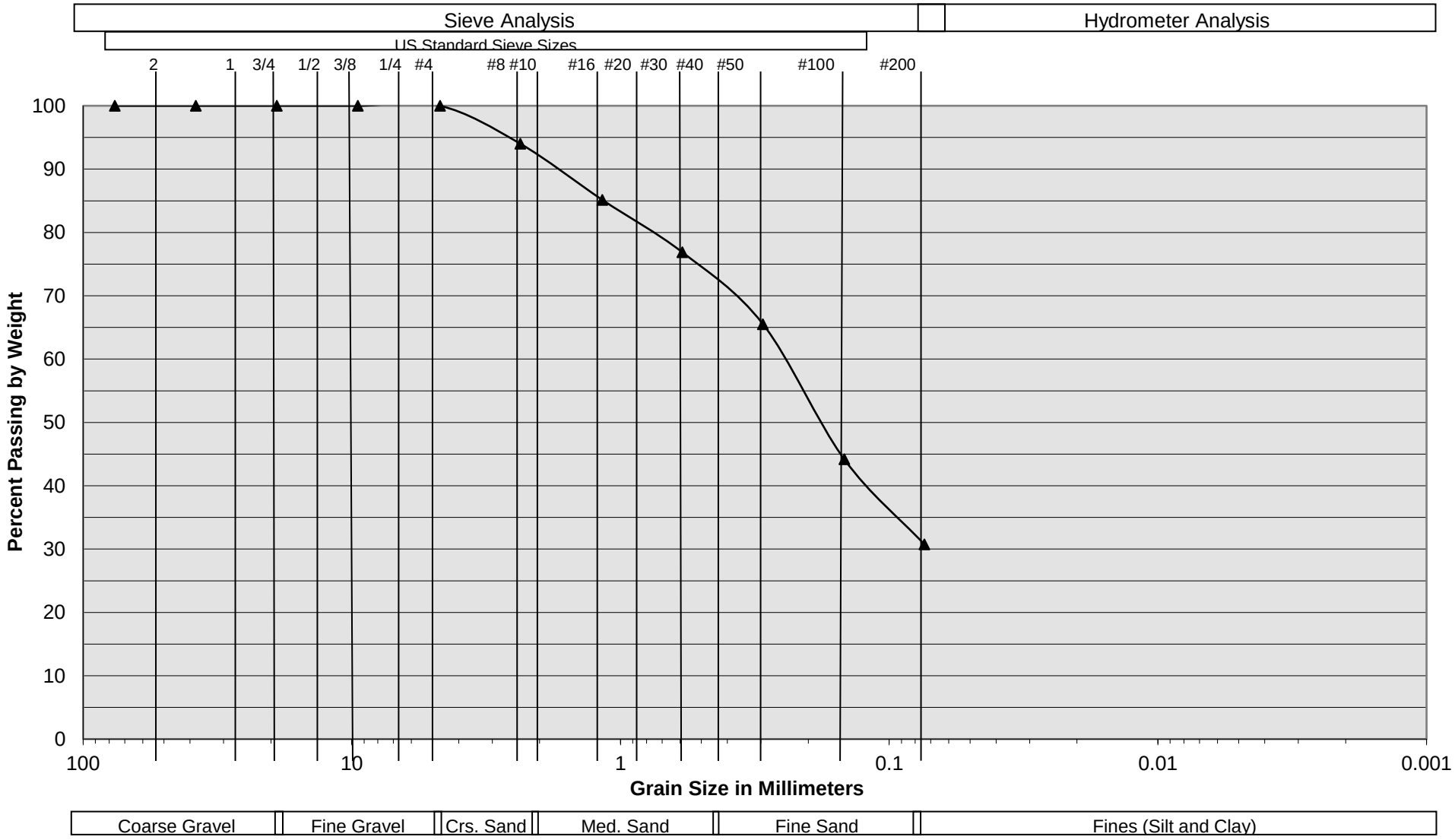


Sample Description	I-7 @ 3½ to 5 feet
Soil Classification	Light Brown Silty fine to coarse Sand, trace Clay

Proposed Apple Valley Assemblage
Apple Valley, California
Project No. 22G153-3
PLATE C- 1

SoCalGeo
SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

Grain Size Distribution

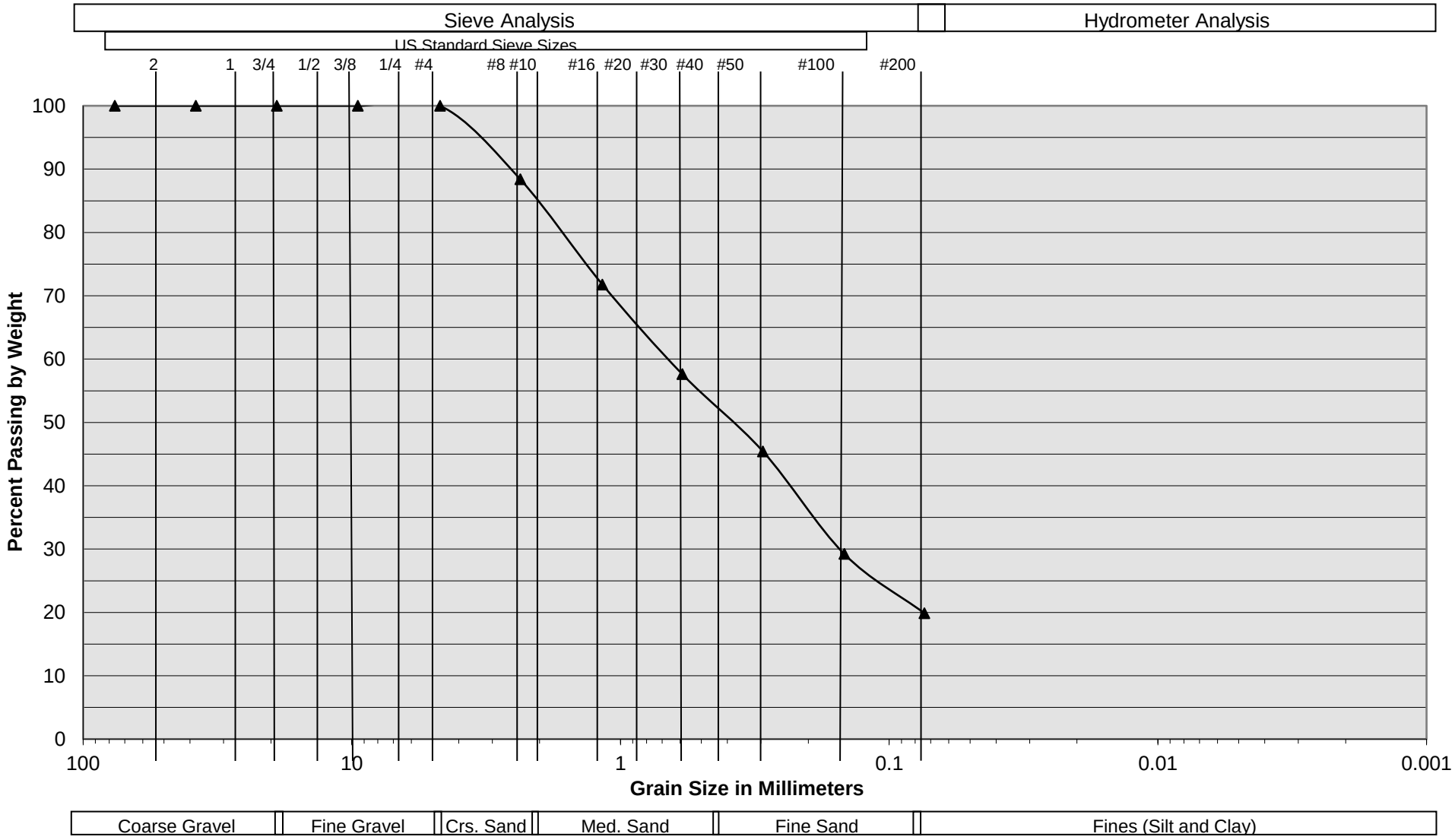


Sample Description	I-8 @ 12½ to 14 feet
Soil Classification	Light Brown Silty fine to medium Sand, trace coarse Sand

Proposed Apple Valley Assemblage
Apple Valley, California
Project No. 22G153-3
PLATE C- 2

SoCalGeo
SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

Grain Size Distribution

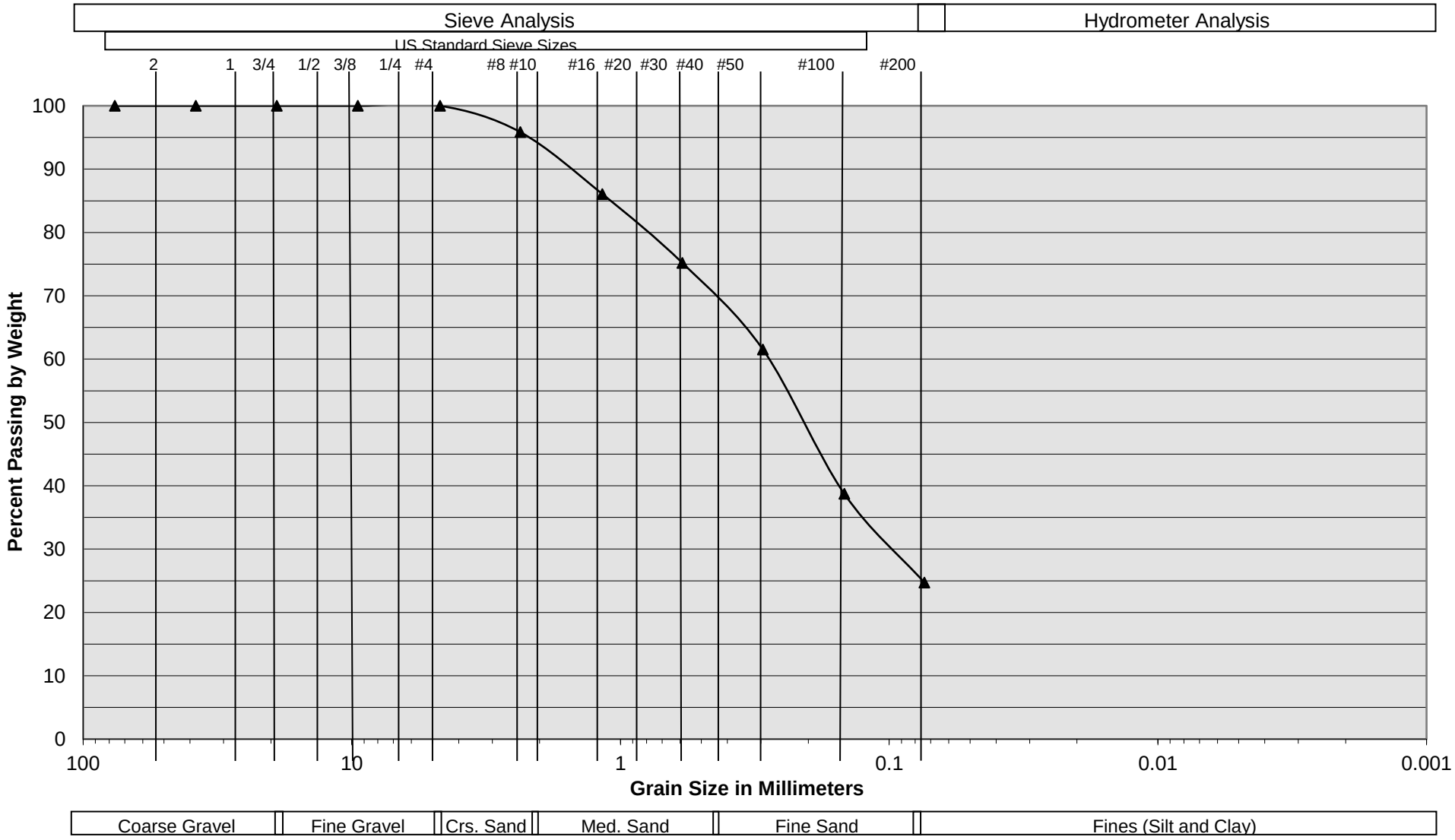


Sample Description	I-9 @ 18½ to 20 feet
Soil Classification	Light Brown Silty fine to coarse Sand

Proposed Apple Valley Assemblage
Apple Valley, California
Project No. 22G153-3
PLATE C- 3

SoCalGeo
SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

Grain Size Distribution

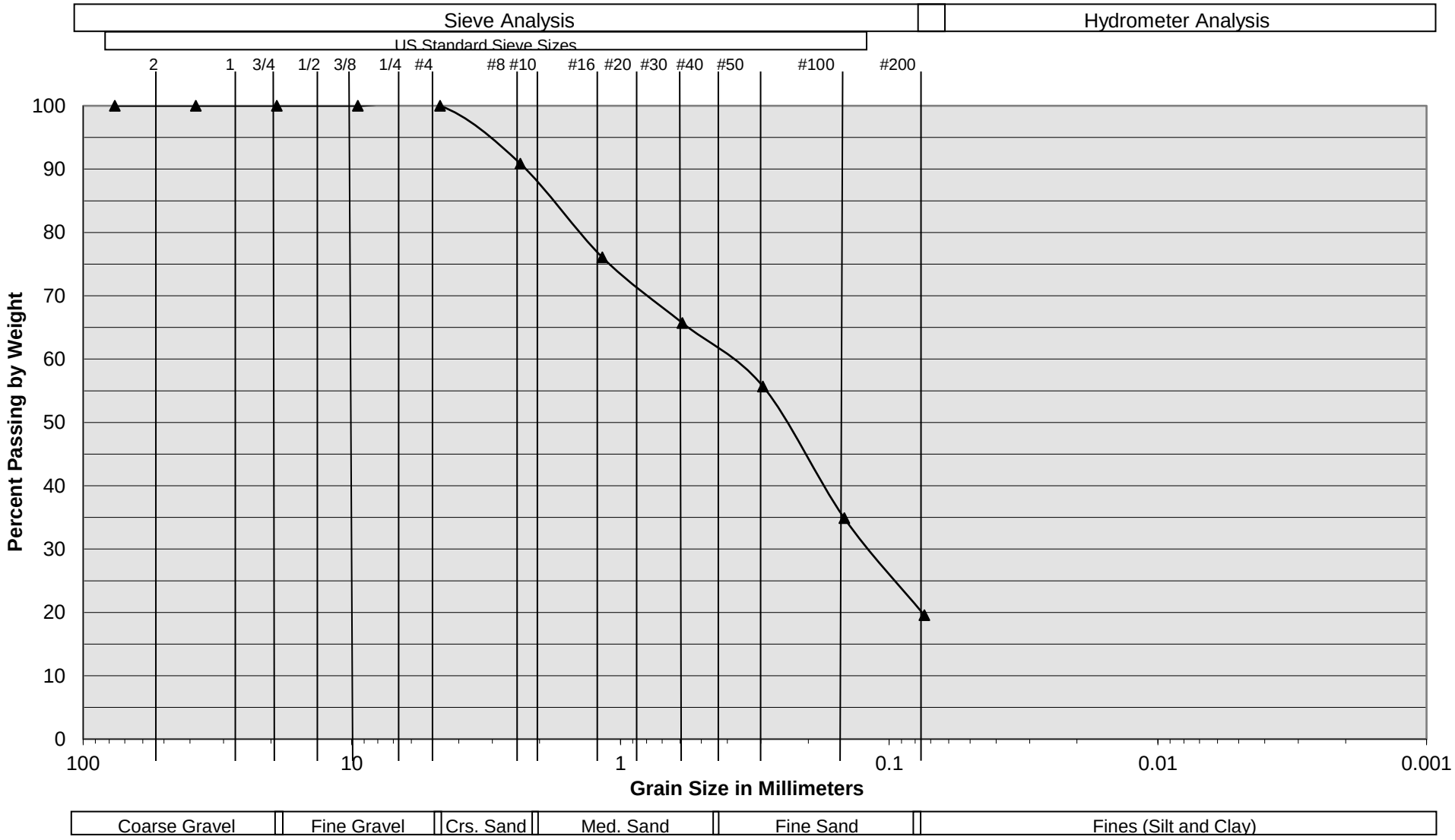


Sample Description	I-10 @ 23½ to 25 feet
Soil Classification	Light Brown Silty fine to medium Sand, trace coarse Sand

Proposed Apple Valley Assemblage
Apple Valley, California
Project No. 22G153-3
PLATE C- 4

SoCalGeo
SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

Grain Size Distribution

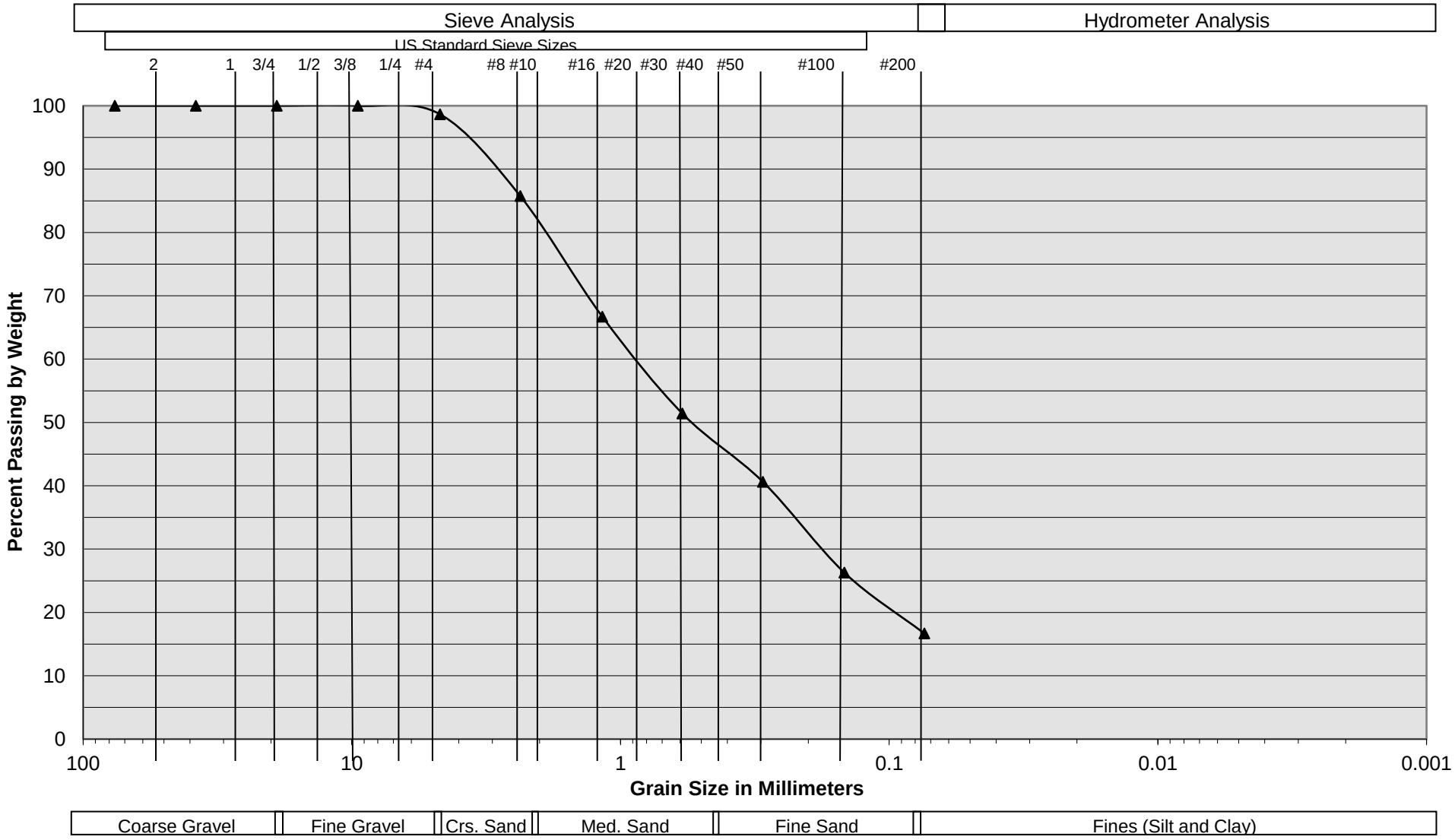


Sample Description	I-11 @ 16½ to 18 feet
Soil Classification	Brown Silty fine to coarse Sand

Proposed Apple Valley Assemblage
Apple Valley, California
Project No. 22G153-3
PLATE C- 5

SoCalGeo
SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

Grain Size Distribution



Sample Description	I-12 @ 23½ to 25 feet
Soil Classification	Brown Silty fine to coarse Sand

Proposed Apple Valley Assemblage
Apple Valley, California
Project No. 22G153-3
PLATE C- 6

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A California Corporation

July 12, 2022

SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

Lake Creek Industrial, LLC
1302 Brittany Cross Road
Santa Ana, California 92705

Attention: Mr. Mike Tonkonogy
Manager

Project No.: **22G153-2**

Subject: **Results of Infiltration Testing**
Proposed Apple Valley Assemblage
NWC Central Road and Corwin Road
Apple Valley, California

Reference: Geotechnical Investigation, Proposed Apple Valley Assemblage, NWC Central Road and Corwin Road, Apple Valley, California, Prepared by Southern California Geotechnical, Inc. (SCG) for Lake Creek Industrial, LLC, SCG Project No. 22G153-1.

Mr. Tonkonogy:

In accordance with your request, we have performed infiltration testing at the subject site. We are pleased to present this report summarizing the results of the infiltration testing and our design recommendations.

Scope of Services

The scope of services performed for this project was in accordance with our Proposal No. 22P160R, dated March 24, 2022. The scope of services included site reconnaissance, subsurface exploration, field testing, and engineering analysis to determine the infiltration rates of the on-site soils. The infiltration testing was performed in general accordance with the guidelines published in Riverside County – Low Impact Development BMP Design Handbook – Section 2.3 of Appendix A, prepared for the Riverside County Department of Environmental Health (RCDEH), dated December 2013. The San Bernardino County standards defer to the guidelines published by the RCDEH.

Site Description

The subject site is located at the northwest corner of Central Road and Corwin Road in Apple Valley, California. The site is bounded to the north by Gustine Road, to the west by Apple Valley Airport, to the south by Corwin Road, and to the east by Central Road. The general location of the site is illustrated on the Site Location Map, included as Plate 1 of this report.

The site is comprised of several parcels, which total 288± acres in size. The site is vacant and undeveloped. Two (2) north-south trending dirt roads are present in the western and central areas of the site. A fire hydrant is present near the western dirt road. Ground surface cover throughout the site consists of alluvial soils with sparse vegetation growth throughout.

Detailed topographic information was not available at the time of this report. Based on elevations obtained from Google Earth and visual observations made at the time of the subsurface investigation, the overall site slopes downward toward the southwest at a gradient of about 2± percent. The site topography is slightly rolling, with several northeast to southwest trending drainage courses. The depths of these drainage courses with respect to the adjacent grade were estimated to be as much as 2 to 3± feet. There is about 105± feet of elevation differential across the site.

Proposed Development

Based on a site plan (A1-02) provided by the client, the site is expected to be developed with four (4) warehouses. The approximate building sizes are described below:

Building No.	Size (ft^2)	Location
1	322,612	Northwest
2	774,013	Southwest
3	1,467,948	Central
4	1,171,496	East

The buildings are expected to include dock-high doors in the truck court areas. We expect that the buildings will be surrounded by asphaltic concrete pavements in the parking and drive areas, Portland cement concrete pavements in the truck court areas, with isolated areas of concrete flatwork and landscape planters.

The site will use on-site storm water infiltration. Two (2) proposed detention basins will be located in the southwest and southeast areas of the site, identified as Proposed Detention Basin "A" and Proposed Detention Basin "B", respectively. The bottom of the infiltration basins will extend to depths of 10 to 12± feet below ground surface.

Concurrent Study

SCG concurrently performed a geotechnical investigation at the subject site, referenced above. As a part of this study, forty-seven (47) borings were advanced to depths of 10 to 30± feet below the existing site grades.

Native alluvium was encountered at the ground surface at all of the boring locations, extending to at least the maximum depth explored of 30± feet below surface grade. The near the surface alluvial soils, extending to depths of 10± feet, generally consist of medium dense to very dense fine sandy silts and fine to coarse sandy silts. These soils are weakly cemented and trace clay content. At depths greater than 10± feet, the alluvial soils generally consist of dense to very dense fine sandy silts and hard fine to coarse sandy clays. Generally, these soils possess weak to moderate cementation.

Groundwater

Free water was not encountered during the drilling of any of the borings. Based on the moisture content of the recovered soil samples and the lack of free water in the borings, the static

groundwater table is considered to have been present at a depth greater than 30± feet below existing site grades.

As part of our research, we reviewed available groundwater data in order to determine the historic high groundwater level for the site. Recent water level data was obtained from the California State Water Resources Control Board, GeoTracker, website, http://geotracker.waterboards.ca.gov/. The nearest monitoring well on record is located 3000± feet southeast of the site. Water level readings within this monitoring well indicate a groundwater level of 240± feet below the ground surface in March 2017.

Subsurface Exploration

Scope of Exploration

The subsurface exploration for the infiltration testing consisted of six (6) infiltration test borings advanced to depths of 10 to 12± feet below the existing site grades. The borings were logged during drilling by a member of our staff and were advanced using a truck-mounted drilling rig, equipped with 8-inch-diameter hollow stem augers. The approximate locations of the infiltration test borings (identified as I-1 through I-6) are indicated on the Infiltration Test Location Plan, enclosed as Plate 2 of this report.

Upon the completion of the infiltration borings, the bottom of each test boring was covered with 2± inches of clean ¾-inch gravel. A sufficient length of 3-inch-diameter perforated PVC casing was then placed into each test hole so that the PVC casing extended from the bottom of the test hole to the ground surface. Clean ¾-inch gravel was then installed in the annulus surrounding the PVC casing.

Geotechnical Conditions

Native alluvium was encountered at the ground surface at all of the infiltration test locations, extending to at least the maximum explored depth of 12± feet below the existing site grades. The alluvium generally consists of medium dense to very dense silty fine to medium sands and silty fine to coarse sands. Occasional layers of medium dense fine to coarse sandy silts were encountered. Trace to little quantities of fine gravel and coarse sand were encountered within the infiltration borings. Occasional samples possess weak cementation. The Boring Logs, which illustrate the conditions encountered at each test location are included within this report.

Infiltration Testing

As previously mentioned, the infiltration testing was performed in general accordance with the guidelines published in Riverside County – Low Impact Development BMP Design Handbook – Section 2.3 of Appendix A, which apply to San Bernardino County.

Pre-soaking

In accordance with the county infiltration standards for sandy soils, all infiltration test borings were pre-soaked 2 hours prior to the infiltration testing or until all of the water had percolated through the test holes. The pre-soaking process consisted of inverting a full 5-gallon bottle of

clear water over each hole so that the hole was filled to an elevation of at least 5 times the hole's radius above the gravel at the bottom of each hole. Pre-soaking was completed after all of the water had percolated through the test holes.

Infiltration Testing Procedure

Following the pre-soaking process of the infiltration test borings, SCG performed the infiltration testing. Each test hole was filled with water to a depth of at least 5 times the hole's radius above the gravel at the bottom of the test holes. In accordance with the San Bernardino County guidelines, since "sandy soils" (where 6 inches of water infiltrated into the surrounding soils in less than 25 minutes for two consecutive readings) were encountered at the bottom of all of the infiltration test borings, readings were taken at 10-minute intervals for a total of at least 1 hour. The water level readings are presented on the spreadsheets enclosed with this report. The infiltration rates for each of the timed intervals are also tabulated on the spreadsheets.

The infiltration rates for the tests are tabulated in inches per hour. In accordance with the typically accepted practice, it is recommended that the most conservative reading from the latter part of the infiltration tests be used for design. These rates are summarized below:

Infiltration Test No.	Depth (feet)	Soil Description	Measured Infiltration Rate (inches/hour)
I-1	10	Silty fine to coarse Sand	4.2
I-2	10	Silty fine to coarse Sand	4.6
I-3	12	Silty fine to coarse Sand, trace fine Gravel	4.2
I-4	12	Silty fine to coarse Sand, trace fine Gravel	3.0
I-5	10	Silty fine to coarse Sand	8.3
I-6	10	Silty fine to coarse Sand	4.3

Laboratory Testing

Moisture Content

The moisture contents for the recovered soil samples within the borings were determined in accordance with ASTM D-2216 and are expressed as a percentage of the dry weight. These test results are presented on the Boring Logs.

Grain Size Analysis

The grain size distribution of selected soils collected from the base of each infiltration test boring have been determined using a range of wire mesh screens. These tests were performed

in general accordance with ASTM D-422 and/or ASTM D-1140. The weight of the portion of the sample retained on each screen is recorded and the percentage finer or coarser of the total weight is calculated. The results of these tests are presented on Plates C-1 through C-6 of this report.

Design Recommendations

A total of six (6) infiltration tests were performed at the subject site. The measured infiltration rates at the infiltration test locations range from 3.0 to 8.3 inches per hour.

Based on the results of the infiltration testing, the following infiltration rates should be used in the design of the infiltration systems in their respective locations and depths:

Infiltration System	Infiltration Test No.	Infiltration System Location	Infiltration Rate (inches/hour)
"A"	I-5 and I-6	Southwest	6.3*
"B"	I-1 through I-4	Southeast	4.0*

***Note: These infiltration rates are averages of the infiltration test results within each respective basin.**

The design of the proposed storm water infiltration system should be performed by the project civil engineer, in accordance with the City of Apple Valley and/or County of San Bernardino guidelines. However, it is recommended that the system be constructed so as to facilitate removal of silt and clay, or other deleterious materials from any water that may enter the systems. The presence of such materials would decrease the effective infiltration rates. **It is recommended that the project civil engineer apply an appropriate factor of safety. The infiltration rate recommended above is based on the assumption that only clean water will be introduced to the subsurface profile. Any fines, debris, or organic materials could significantly impact the infiltration rate.** It should be noted that the recommended infiltration rate is based on infiltration testing at six (6) discrete locations and the overall infiltration rate of the storm water infiltration system could vary considerably.

Infiltration Rate Considerations

The infiltration rates presented herein were determined in accordance with the San Bernardino County guidelines and are considered valid only for the time and place of the actual test. Varying subsurface conditions will exist in other areas of the site, which could alter the recommended infiltration rates presented above. The infiltration rates will decline over time between maintenance cycles as silt or clay particles accumulate on the BMP surface. The infiltration rate is highly dependent upon a number of factors, including density, silt and clay content, grainsize distribution throughout the range of particle sizes, and particle shape. Small changes in these factors can cause large changes in the infiltration rates.

Infiltration rates are based on unsaturated flow. As water is introduced into soils by infiltration, the soils become saturated and the wetting front advances from the unsaturated zone to the saturated zone. Once the soils become saturated, infiltration rates become zero, and water can only move through soils by hydraulic conductivity at a rate determined by pressure head and soil permeability. Changes in soil moisture content will affect the infiltration rate. Infiltration

rates should be expected to decrease until the soils become saturated. Soil permeability values will then govern groundwater movement. Permeability values may be on the order of 10 to 20 times less than infiltration rates. The system designer should incorporate adequate factors of safety and allow for overflow design into appropriate traditional storm drain systems, which would transport storm water off-site.

Construction Considerations

The infiltration rates presented in this report are specific to the tested locations and depths. Infiltration rates can be significantly reduced if the soils are subjected to excessive disturbance or compaction during construction. Compaction of the soils at the bottom of the infiltration system can significantly reduce the infiltration ability of the basins. Therefore, the subgrade soils within proposed infiltration system areas should not be over-excavated, undercut or compacted in any significant manner. **It is recommended that a note to this effect be added to the project plans and/or specifications.**

We recommend that a representative from the geotechnical engineer be on-site during the construction of the proposed infiltration systems to identify the soil classification at the base of each system. The infiltration rate of the system will likely vary if the composition of the soil located beneath the system is not consistent with the test soils.

We recommend that scrapers and other rubber-tired heavy equipment not be operated on the basin bottom, or at levels lower than 2 feet above the bottom of the system, particularly within basins. As such, the bottom 24 inches of the infiltration systems should be excavated with non-rubber-tired equipment, such as excavators.

Basin Maintenance

The proposed project includes infiltration basins. Water flowing into these basins will carry some level of sediment. Wind-blown sediments and erosion of the basin side walls will also contribute to sediment deposition at the bottom of the basin. This layer has the potential to significantly reduce the infiltration rate of the basin subgrade soils. Therefore, a formal basin maintenance program should be established to ensure that these silt and clay deposits are removed from the basin on a regular basis. Appropriate vegetation on the basin sidewalls and bottom may reduce erosion and sediment deposition.

Basin maintenance should also include measures to prevent animal burrows, and to repair any burrows or damage caused by such. Animal burrows in the basin sidewalls can significantly increase the risk of erosion and piping failures.

Location of Infiltration Systems

The use of on-site storm water infiltration systems carries a risk of creating adverse geotechnical conditions. Increasing the moisture content of the soil can cause the soil to lose internal shear strength and increase its compressibility, resulting in a change in the designed engineering properties. Overlying structures and pavements in the infiltration area could potentially be damaged due to saturation of the subgrade soils. **The proposed infiltration systems for this site should be located at least 25 feet away from any structures, including retaining walls.** Even with this provision of locating the infiltration system at least

25 feet from the buildings, it is possible that infiltrating water into the subsurface soils could have an adverse effect on the proposed or existing structures. It should also be noted that utility trenches which happen to collect storm water can also serve as conduits to transmit storm water toward the structure, depending on the slope of the utility trench. Therefore, consideration should also be given to the proposed locations of underground utilities which may pass near the proposed infiltration system.

The infiltration system designer should also give special consideration to the effect that the proposed infiltration systems may have on nearby subterranean structures, open excavations, or descending slopes. In particular, infiltration systems should not be located near the crest of descending slopes, particularly where the slopes are comprised of granular soils. Such systems will require specialized design and analysis to evaluate the potential for slope instability, piping failures and other phenomena that typically apply to earthen dam design. This type of analysis is beyond the scope of this infiltration test report, but these factors should be considered by the infiltration system designer when locating the infiltration systems.

General Comments

This report has been prepared as an instrument of service for use by the client in order to aid in the evaluation of this property and to assist the architects and engineers in the design and preparation of the project plans and specifications. This report may be provided to the contractor(s) and other design consultants to disclose information relative to the project. However, this report is not intended to be utilized as a specification in and of itself, without appropriate interpretation by the project architect, structural engineer, and/or civil engineer. The design of the proposed storm water infiltration system is the responsibility of the civil engineer. The role of the geotechnical engineer is limited to determination of infiltration rate only. By using the design infiltration rate contained herein, the civil engineer agrees to indemnify, defend, and hold harmless the geotechnical engineer for all aspects of the design and performance of the proposed storm water infiltration system. The reproduction and distribution of this report must be authorized by the client and Southern California Geotechnical, Inc. Furthermore, any reliance on this report by an unauthorized third party is at such party's sole risk, and we accept no responsibility for damage or loss which may occur.

The analysis of this site was based on a subsurface profile interpolated from limited discrete soil samples. While the materials encountered in the project area are considered to be representative of the total area, some variations should be expected between boring locations and testing depths. If the conditions encountered during construction vary significantly from those detailed herein, we should be contacted immediately to determine if the conditions alter the recommendations contained herein.

This report has been based on assumed or provided characteristics of the proposed development. It is recommended that the owner, client, architect, structural engineer, and civil engineer carefully review these assumptions to ensure that they are consistent with the characteristics of the proposed development. If discrepancies exist, they should be brought to our attention to verify that they do not affect the conclusions and recommendations contained herein. We also recommend that the project plans and specifications be submitted to our office for review to verify that our recommendations have been correctly interpreted. The analysis, conclusions, and recommendations contained within this report have been promulgated in

accordance with generally accepted professional geotechnical engineering practice. No other warranty is implied or expressed.

Closure

We sincerely appreciate the opportunity to be of service on this project. We look forward to providing additional consulting services during the course of the project. If we may be of further assistance in any manner, please contact our office.

Respectfully Submitted,

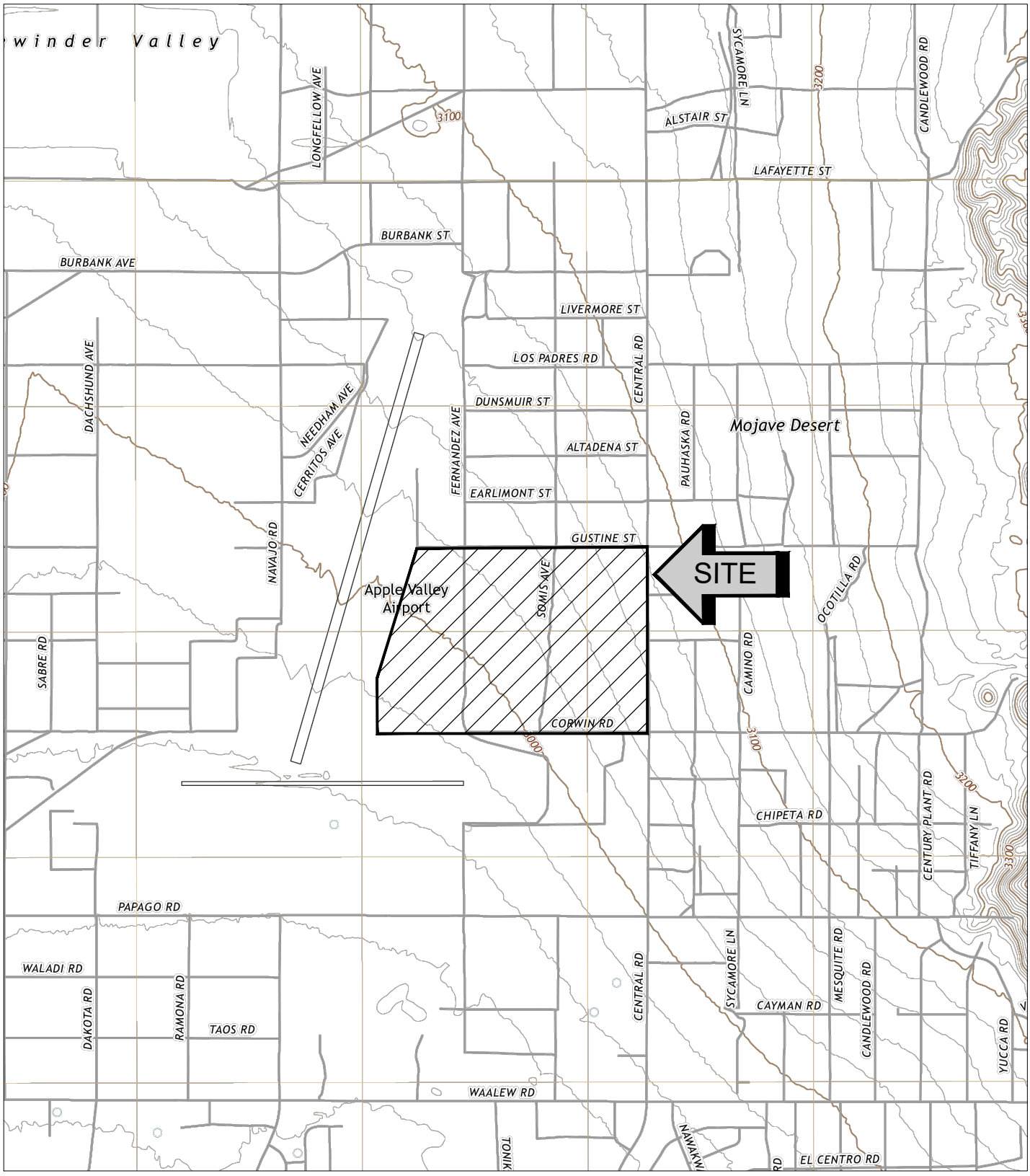
SOUTHERN CALIFORNIA GEOTECHNICAL, INC.

Jamie Hayward
Staff Geologist



Daniel Nielsen, GE 3166
Senior Engineer

Enclosures: Plate 1 - Site Location Map
Plate 2 - Infiltration Test Location Plan
Boring Log Legend and Logs (8 Pages)
Infiltration Test Results Spreadsheets (6 Pages)
Grain Size Analysis Graphs (6 Pages)



SOURCE: USGS TOPOGRAPHIC MAPS OF THE APPLE VALLEY NORTH QUADRANGLE, SAN BERNARDINO COUNTY, CALIFORNIA, 2021.

SITE LOCATION MAP

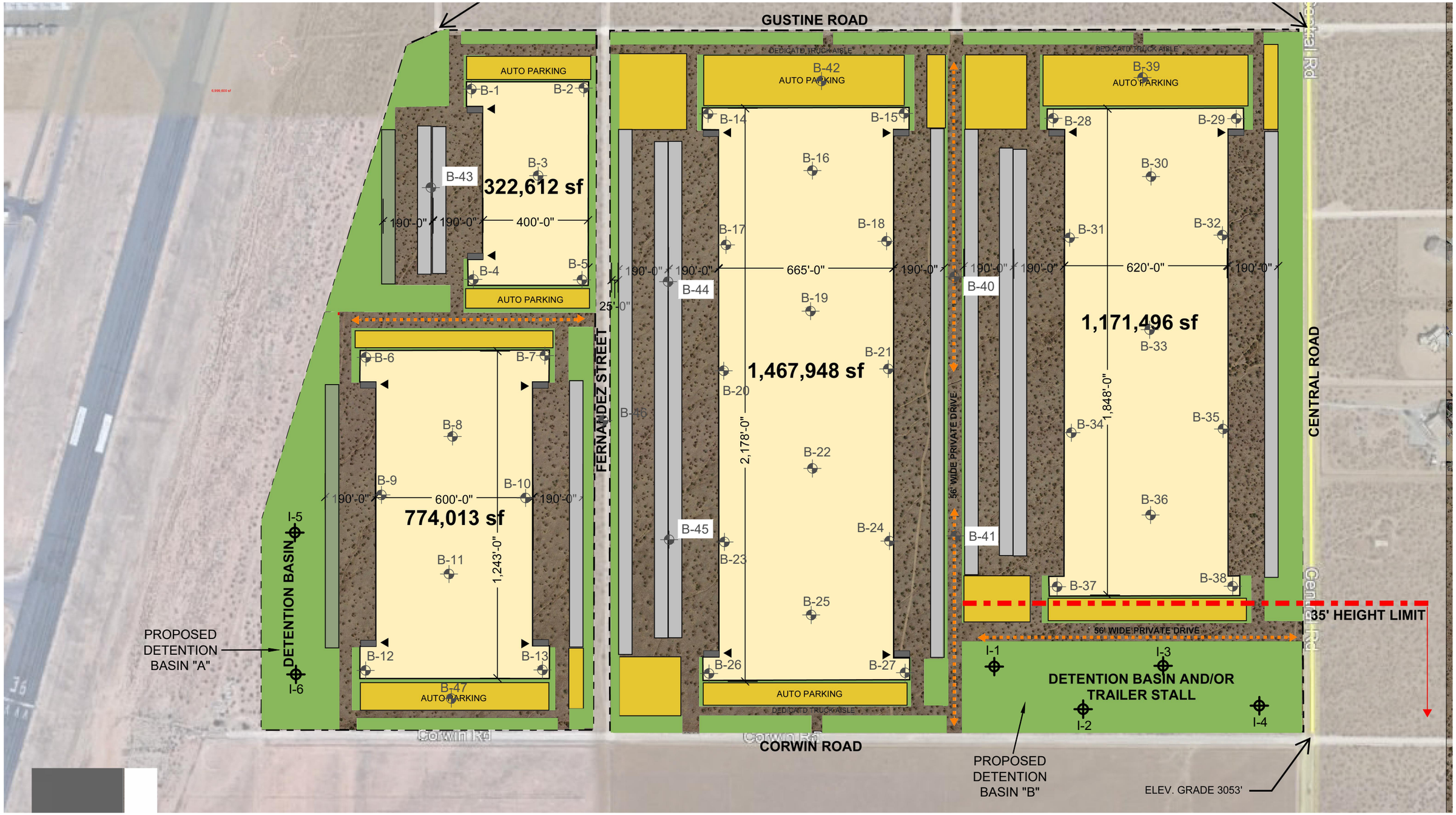
PROPOSED APPLE VALLEY ASSEMBLAGE

APPLE VALLEY, CALIFORNIA

SCALE: 1" = 2000'	
DRAWN: ME CHKD: DN	
SCG PROJECT 22G153-2	
PLATE 1	

SoCalGeo

SOUTHERN CALIFORNIA GEOTECHNICAL



GEOTECHNICAL LEGEND

- APPROXIMATE INFILTRATION TEST LOCATION
- APPROXIMATE BORING LOCATION (SCG PROJECT NO. 22G153-1)

NOTE: CONCEPTUAL SITE PLAN PREPARED BY SKH ARCHITECT.

INFILTRATION TEST LOCATION PLAN

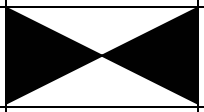
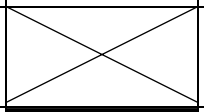
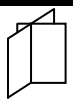
PROPOSED APPLE VALLEY ASSEMBLAGE

APPLE VALLEY, CALIFORNIA

SCALE: 1" = 350'	
DRAWN: ME CHKD: DN	
SCG PROJECT 22G153-2	
PLATE 2	

SOUTHERN CALIFORNIA GEOTECHNICAL

BORING LOG LEGEND

SAMPLE TYPE	GRAPHICAL SYMBOL	SAMPLE DESCRIPTION
AUGER		SAMPLE COLLECTED FROM AUGER CUTTINGS, NO FIELD MEASUREMENT OF SOIL STRENGTH. (DISTURBED)
CORE		ROCK CORE SAMPLE: TYPICALLY TAKEN WITH A DIAMOND-TIPPED CORE BARREL. TYPICALLY USED ONLY IN HIGHLY CONSOLIDATED BEDROCK.
GRAB		SOIL SAMPLE TAKEN WITH NO SPECIALIZED EQUIPMENT, SUCH AS FROM A STOCKPILE OR THE GROUND SURFACE. (DISTURBED)
CS		CALIFORNIA SAMPLER: 2-1/2 INCH I.D. SPLIT BARREL SAMPLER, LINED WITH 1-INCH HIGH BRASS RINGS. DRIVEN WITH SPT HAMMER. (RELATIVELY UNDISTURBED)
NSR		NO RECOVERY: THE SAMPLING ATTEMPT DID NOT RESULT IN RECOVERY OF ANY SIGNIFICANT SOIL OR ROCK MATERIAL.
SPT		STANDARD PENETRATION TEST: SAMPLER IS A 1.4 INCH INSIDE DIAMETER SPLIT BARREL, DRIVEN 18 INCHES WITH THE SPT HAMMER. (DISTURBED)
SH		SHELBY TUBE: TAKEN WITH A THIN WALL SAMPLE TUBE, PUSHED INTO THE SOIL AND THEN EXTRACTED. (UNDISTURBED)
VANE		VANE SHEAR TEST: SOIL STRENGTH OBTAINED USING A 4 BLADED SHEAR DEVICE. TYPICALLY USED IN SOFT CLAYS-NO SAMPLE RECOVERED.

COLUMN DESCRIPTIONS

DEPTH: Distance in feet below the ground surface.

SAMPLE: Sample Type as depicted above.

BLOW COUNT: Number of blows required to advance the sampler 12 inches using a 140 lb hammer with a 30-inch drop. 50/3" indicates penetration refusal (>50 blows) at 3 inches. WH indicates that the weight of the hammer was sufficient to push the sampler 6 inches or more.

POCKET PEN.: Approximate shear strength of a cohesive soil sample as measured by pocket penetrometer.

GRAPHIC LOG: Graphic Soil Symbol as depicted on the following page.

DRY DENSITY: Dry density of an undisturbed or relatively undisturbed sample in lbs/ft^3.

MOISTURE CONTENT: Moisture content of a soil sample, expressed as a percentage of the dry weight.

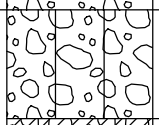
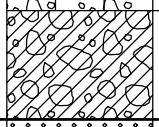
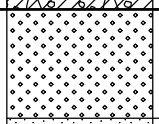
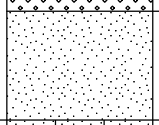
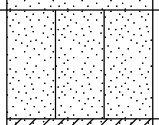
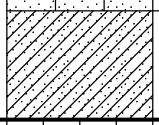
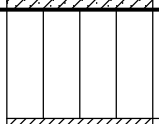
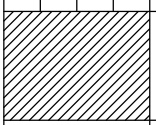
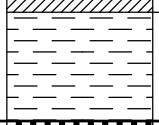
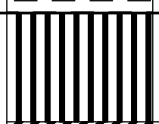
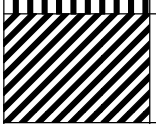
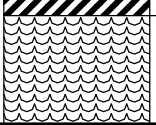
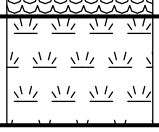
LIQUID LIMIT: The moisture content above which a soil behaves as a liquid.

PLASTIC LIMIT: The moisture content above which a soil behaves as a plastic.

PASSING #200 SIEVE: The percentage of the sample finer than the #200 standard sieve.

UNCONFINED SHEAR: The shear strength of a cohesive soil sample, as measured in the unconfined state.

SOIL CLASSIFICATION CHART

MAJOR DIVISIONS			SYMBOLS		TYPICAL DESCRIPTIONS
			GRAPH	LETTER	
COARSE GRAINED SOILS MORE THAN 50% OF MATERIAL IS LARGER THAN NO. 200 SIEVE SIZE	GRAVEL AND GRAVELLY SOILS MORE THAN 50% OF COARSE FRACTION RETAINED ON NO. 4 SIEVE	CLEAN GRAVELS (LITTLE OR NO FINES)		GW	WELL-GRADED GRAVELS, GRAVEL - SAND MIXTURES, LITTLE OR NO FINES
				GP	POORLY-GRADED GRAVELS, GRAVEL - SAND MIXTURES, LITTLE OR NO FINES
		GRAVELS WITH FINES (APPRECIABLE AMOUNT OF FINES)		GM	SILTY GRAVELS, GRAVEL - SAND - SILT MIXTURES
				GC	CLAYEY GRAVELS, GRAVEL - SAND - CLAY MIXTURES
	SAND AND SANDY SOILS MORE THAN 50% OF COARSE FRACTION PASSING ON NO. 4 SIEVE	CLEAN SANDS (LITTLE OR NO FINES)		SW	WELL-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
				SP	POORLY-GRADED SANDS, GRAVELLY SAND, LITTLE OR NO FINES
		SANDS WITH FINES (APPRECIABLE AMOUNT OF FINES)		SM	SILTY SANDS, SAND - SILT MIXTURES
				SC	CLAYEY SANDS, SAND - CLAY MIXTURES
FINE GRAINED SOILS MORE THAN 50% OF MATERIAL IS SMALLER THAN NO. 200 SIEVE SIZE	SILTS AND CLAYS	LIQUID LIMIT LESS THAN 50		ML	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY
				CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
				OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
	SILTS AND CLAYS	LIQUID LIMIT GREATER THAN 50		MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SAND OR SILTY SOILS
				CH	INORGANIC CLAYS OF HIGH PLASTICITY
				OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS
HIGHLY ORGANIC SOILS				PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENTS

NOTE: DUAL SYMBOLS ARE USED TO INDICATE BORDERLINE SOIL CLASSIFICATIONS

SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

BORING NO. I-1

JOB NO.: 22G153-2
PROJECT: Apple Valley Assemblage
LOCATION: Apple Valley

DRILLING DATE: 3/30/22
DRILLING METHOD: Hollow Stem Auger
LOGGED BY: Michelle Esparza

WATER DEPTH: Dry
CAVE DEPTH: ---
READING TAKEN: At Completion

FIELD RESULTS						LABORATORY RESULTS						
DEPTH (FEET)	SAMPLE	BLOW COUNT	POCKET PEN. (TSF)	GRAPHIC LOG	DESCRIPTION SURFACE ELEVATION: --- MSL	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTIC LIMIT	PASSING #200 SIEVE (%)	ORGANIC CONTENT (%)	COMMENTS
					ALLUVIUM: Brown Silty fine to coarse Sand, trace fine Gravel, trace fine root fibers, dense to very dense-dry to damp							
		30					2					
5		75/11"					3					
		53			@ 8.5 feet, trace fine Gravel		2					
10					Boring Terminated at 10'							

TBL 22G153-2 (INFILTRATIONS).GPJ SOCALGEO.GDT 7/8/22

TEST BORING LOG

PLATE I-1

SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

BORING NO. I-2

JOB NO.: 22G153-2
PROJECT: Apple Valley Assemblage
LOCATION: Apple Valley

DRILLING DATE: 3/30/22
DRILLING METHOD: Hollow Stem Auger
LOGGED BY: Michelle Esparza

WATER DEPTH: Dry
CAVE DEPTH: ---
READING TAKEN: At Completion

FIELD RESULTS						LABORATORY RESULTS						
DEPTH (FEET)	SAMPLE	BLOW COUNT	POCKET PEN. (TSF)	GRAPHIC LOG	DESCRIPTION SURFACE ELEVATION: --- MSL	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTIC LIMIT	PASSING #200 SIEVE (%)	ORGANIC CONTENT (%)	COMMENTS
					ALLUVIUM: Brown Silty fine to medium Sand, little coarse Sand, trace fine root fibers, weakly cemented, dense to very dense-dry to damp							
		38					2					
5		70/10"					4					
		80/10"					4					
10					Boring Terminated at 10'							

TBL 22G153-2 (INFILTRATIONS).GPJ SOCALGEO.GDT 7/8/22

TEST BORING LOG

PLATE I-2

SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

BORING NO. I-3

JOB NO.: 22G153-2
PROJECT: Apple Valley Assemblage
LOCATION: Apple Valley

DRILLING DATE: 3/30/22
DRILLING METHOD: Hollow Stem Auger
LOGGED BY: Michelle Esparza

WATER DEPTH: Dry
CAVE DEPTH: ---
READING TAKEN: At Completion

FIELD RESULTS						LABORATORY RESULTS						
DEPTH (FEET)	SAMPLE	BLOW COUNT	POCKET PEN. (TSF)	GRAPHIC LOG	DESCRIPTION SURFACE ELEVATION: --- MSL	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTIC LIMIT	PASSING #200 SIEVE (%)	ORGANIC CONTENT (%)	COMMENTS
					ALLUVIUM: Brown Silty fine to coarse Sand, weakly cemented, dense to very dense-dry to damp							
		38					4					
5												
		50/5"					2					
10					Brown Silty fine to medium Sand, little coarse Sand, trace fine Gravel, very dense-damp		3					
		74/5"										
					Boring Terminated at 12'							

TBL 22G153-2 (INFILTRATIONS).GPJ SOCALGEO.GDT 7/8/22

TEST BORING LOG

PLATE I-3

SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

BORING NO. I-4

JOB NO.: 22G153-2
PROJECT: Apple Valley Assemblage
LOCATION: Apple Valley

DRILLING DATE: 3/30/22
DRILLING METHOD: Hollow Stem Auger
LOGGED BY: Michelle Esparza

WATER DEPTH: Dry
CAVE DEPTH: ---
READING TAKEN: At Completion

FIELD RESULTS						LABORATORY RESULTS						
DEPTH (FEET)	SAMPLE	BLOW COUNT	POCKET PEN. (TSF)	GRAPHIC LOG	DESCRIPTION SURFACE ELEVATION: --- MSL	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTIC LIMIT	PASSING #200 SIEVE (%)	ORGANIC CONTENT (%)	COMMENTS
					ALLUVIUM: Brown Silty fine to medium Sand, little coarse Sand, trace fine Gravel, weakly cemented, very dense-dry to damp							
		50/4"					3					
5												
		65/11"					4					
10		73					2					
					Boring Terminated at 12'							

TBL 22G153-2 (INFILTRATIONS).GPJ SOCALGEO.GDT 7/8/22

TEST BORING LOG **PLATE I-4**

SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

BORING NO. I-5

JOB NO.: 22G153-2
PROJECT: Apple Valley Assemblage
LOCATION: Apple Valley

DRILLING DATE: 3/29/22
DRILLING METHOD: Hollow Stem Auger
LOGGED BY: Joey Hernandez

WATER DEPTH: Dry
CAVE DEPTH: ---
READING TAKEN: At Completion

FIELD RESULTS						LABORATORY RESULTS						
DEPTH (FEET)	SAMPLE	BLOW COUNT	POCKET PEN. (TSF)	GRAPHIC LOG	DESCRIPTION SURFACE ELEVATION: --- MSL	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTIC LIMIT	PASSING #200 SIEVE (%)	ORGANIC CONTENT (%)	COMMENTS
		11			ALLUVIUM: Brown fine to coarse Sandy Silt, medium dense-dry		2					
		25			Brown Silty fine to coarse Sand, medium dense to dense-dry to damp		2					
5		29					5					
		31			@ 8.5 feet, trace fine root fibers		2					
10					Boring Terminated at 10'							

TBL 22G153-2 (INFILTRATIONS).GPJ SOCALGEO.GDT 7/8/22

TEST BORING LOG

PLATE I-5

SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

BORING NO. I-6

JOB NO.: 22G153-2
PROJECT: Apple Valley Assemblage
LOCATION: Apple Valley

DRILLING DATE: 3/29/22
DRILLING METHOD: Hollow Stem Auger
LOGGED BY: Joey Hernandez

WATER DEPTH: Dry
CAVE DEPTH: ---
READING TAKEN: At Completion

FIELD RESULTS						LABORATORY RESULTS						
DEPTH (FEET)	SAMPLE	BLOW COUNT	POCKET PEN. (TSF)	GRAPHIC LOG	DESCRIPTION SURFACE ELEVATION: --- MSL	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTIC LIMIT	PASSING #200 SIEVE (%)	ORGANIC CONTENT (%)	COMMENTS
		9			ALLUVIUM: Brown Silty fine to coarse Sand, trace fine Gravel, loose to medium dense-dry to damp		2					
		18					4					
5												
		46			Light Brown Silty fine to medium Sand, trace coarse Sand, dense-moist		10					
		55			Light Brown Silty fine to coarse Sand, very dense-damp		3					
10												
					Boring Terminated at 10'							

TBL 22G153-2 (INFILTRATIONS).GPJ SOCALGEO.GDT 7/8/22

TEST BORING LOG **PLATE I-6**

INFILTRATION CALCULATIONS

Project Name	Proposed Apple Valley Assemblage
Project Location	Apple Valley, CA
Project Number	22G153-2
Engineer	GP

Test Hole Radius	4	(in)
Test Depth	10.20	(ft)

Infiltration Test Hole	I-1

Soil Criteria Test

Interval Number		Time	Time Interval (min)	Water Depth (ft)	Change in Water Level (in)	Did 6 inches of water seep away in less than 25 minutes?	Sandy Soils or Non-Sandy Soils?
1	Initial	10:32 AM	25.00	8.20	21.60	YES	SANDY SOILS
	Final	10:57 AM		10.00			
2	Initial	10:58 AM	25.00	8.20	17.04	YES	SANDY SOILS
	Final	11:23 AM		9.62			

Test Data

Interval Number		Time	Time Interval (min)	Water Depth (ft)	Change in Water Level (ft)	Average Head Height (ft)	Infiltration Rate Q (in/hr)
1	Initial	11:24 AM	10.00	8.20	0.74	1.63	4.94
	Final	11:34 AM		8.94			
2	Initial	11:35 AM	10.00	8.20	0.73	1.64	4.86
	Final	11:45 AM		8.93			
3	Initial	11:46 AM	10.00	8.20	0.70	1.65	4.62
	Final	11:56 AM		8.90			
4	Initial	11:57 AM	10.00	8.20	0.67	1.67	4.39
	Final	12:07 PM		8.87			
5	Initial	12:08 PM	10.00	8.20	0.65	1.68	4.24
	Final	12:18 PM		8.85			
6	Initial	12:19 PM	10.00	8.20	0.64	1.68	4.16
	Final	12:29 PM		8.84			

Per County Standards, Infiltration Rate calculated as follows:

$$Q = \frac{\Delta H(60r)}{\Delta t(r + 2H_{avg})}$$

Where:
- Q = Infiltration Rate (in inches per hour)
- ΔH = Change in Height (Water Level) over the time interval
- r = Test Hole (Borehole) Radius
- Δt = Time Interval
- H_{avg} = Average Head Height over the time interval

INFILTRATION CALCULATIONS

Project Name	Proposed Apple Valley Assemblage
Project Location	Apple Valley, CA
Project Number	22G153-2
Engineer	GP

Test Hole Radius	4	(in)
Test Depth	10.10	(ft)

Infiltration Test Hole	I-2

Soil Criteria Test

Interval Number		Time	Time Interval (min)	Water Depth (ft)	Change in Water Level (in)	Did 6 inches of water seep away in less than 25 minutes?	Sandy Soils or Non-Sandy Soils?
1	Initial	11:42 AM	25.00	8.10	21.60	YES	SANDY SOILS
	Final	12:07 PM		9.90			
2	Initial	12:08 PM	25.00	8.10	17.76	YES	SANDY SOILS
	Final	12:33 PM		9.58			

Test Data

Interval Number		Time	Time Interval (min)	Water Depth (ft)	Change in Water Level (ft)	Average Head Height (ft)	Infiltration Rate Q (in/hr)
1	Initial	12:34 PM	10.00	8.10	0.75	1.63	5.02
	Final	12:44 PM		8.85			
2	Initial	12:45 PM	10.00	8.10	0.73	1.64	4.86
	Final	12:55 PM		8.83			
3	Initial	12:56 PM	10.00	8.10	0.73	1.64	4.86
	Final	1:06 PM		8.83			
4	Initial	1:07 PM	10.00	8.10	0.71	1.65	4.70
	Final	1:17 PM		8.81			
5	Initial	1:18 PM	10.00	8.10	0.70	1.65	4.62
	Final	1:28 PM		8.80			
6	Initial	1:29 PM	10.00	8.10	0.70	1.65	4.62
	Final	1:39 PM		8.80			

Per County Standards, Infiltration Rate calculated as follows:

$$Q = \frac{\Delta H(60r)}{\Delta t(r + 2H_{avg})}$$

Where: Q = Infiltration Rate (in inches per hour)
ΔH = Change in Height (Water Level) over the time interval
r = Test Hole (Borehole) Radius
Δt = Time Interval
H_{avg} = Average Head Height over the time interval

INFILTRATION CALCULATIONS

Project Name	Proposed Apple Valley Assemblage
Project Location	Apple Valley, CA
Project Number	22G153-2
Engineer	GP

Test Hole Radius	4	(in)
Test Depth	12.00	(ft)

Infiltration Test Hole	I-3

Soil Criteria Test

Interval Number		Time	Time Interval (min)	Water Depth (ft)	Change in Water Level (in)	Did 6 inches of water seep away in less than 25 minutes?	Sandy Soils or Non-Sandy Soils?
1	Initial	8:56 AM	25.00	10.00	18.84	YES	SANDY SOILS
	Final	9:21 AM		11.57			
2	Initial	9:22 AM	25.00	10.00	15.60	YES	SANDY SOILS
	Final	9:47 AM		11.30			

Test Data

Interval Number		Time	Time Interval (min)	Water Depth (ft)	Change in Water Level (ft)	Average Head Height (ft)	Infiltration Rate Q (in/hr)
1	Initial	9:48 AM	10.00	10.00	0.70	1.65	4.62
	Final	9:58 AM		10.70			
2	Initial	9:59 AM	10.00	10.00	0.68	1.66	4.47
	Final	10:09 AM		10.68			
3	Initial	10:10 AM	10.00	10.00	0.67	1.67	4.39
	Final	10:20 AM		10.67			
4	Initial	10:21 AM	10.00	10.00	0.67	1.67	4.39
	Final	10:31 AM		10.67			
5	Initial	10:32 AM	10.00	10.00	0.66	1.67	4.31
	Final	10:42 AM		10.66			
6	Initial	10:43 AM	10.00	10.00	0.65	1.68	4.24
	Final	10:53 AM		10.65			

Per County Standards, Infiltration Rate calculated as follows:

$$Q = \frac{\Delta H(60r)}{\Delta t(r + 2H_{avg})}$$

Where: Q = Infiltration Rate (in inches per hour)
ΔH = Change in Height (Water Level) over the time interval
r = Test Hole (Borehole) Radius
Δt = Time Interval
H_{avg} = Average Head Height over the time interval

INFILTRATION CALCULATIONS

Project Name	Proposed Apple Valley Assemblage
Project Location	Apple Valley, CA
Project Number	22G153-2
Engineer	GP

Test Hole Radius	4	(in)
Test Depth	12.00	(ft)

Infiltration Test Hole	I-4

Soil Criteria Test

Interval Number		Time	Time Interval (min)	Water Depth (ft)	Change in Water Level (in)	Did 6 inches of water seep away in less than 25 minutes?	Sandy Soils or Non-Sandy Soils?
1	Initial	8:10 AM	25.00	10.00	19.56	YES	SANDY SOILS
	Final	8:35 AM		11.63			
2	Initial	8:36 AM	25.00	10.00	13.80	YES	SANDY SOILS
	Final	9:01 AM		11.15			

Test Data

Interval Number		Time	Time Interval (min)	Water Depth (ft)	Change in Water Level (ft)	Average Head Height (ft)	Infiltration Rate Q (in/hr)
1	Initial	9:05 AM	10.00	10.00	0.60	1.70	3.86
	Final	9:15 AM		10.60			
2	Initial	9:16 AM	10.00	10.00	0.57	1.72	3.64
	Final	9:26 AM		10.57			
3	Initial	9:27 AM	10.00	10.00	0.55	1.73	3.49
	Final	9:37 AM		10.55			
4	Initial	9:38 AM	10.00	10.00	0.54	1.73	3.42
	Final	9:48 AM		10.54			
5	Initial	9:49 AM	10.00	10.00	0.53	1.74	3.34
	Final	9:59 AM		10.53			
6	Initial	10:00 AM	10.00	10.00	0.48	1.76	2.99
	Final	10:10 AM		10.48			

Per County Standards, Infiltration Rate calculated as follows:

$$Q = \frac{\Delta H(60r)}{\Delta t(r + 2H_{avg})}$$

Where: Q = Infiltration Rate (in inches per hour)

ΔH = Change in Height (Water Level) over the time interval

r = Test Hole (Borehole) Radius

Δt = Time Interval

H_{avg} = Average Head Height over the time interval

INFILTRATION CALCULATIONS

Project Name	Proposed Apple Valley Assemblage
Project Location	Apple Valley, CA
Project Number	22G153-2
Engineer	GP

Test Hole Radius	4	(in)
Test Depth	10.20	(ft)

Infiltration Test Hole	I-5

Soil Criteria Test

Interval Number		Time	Time Interval (min)	Water Depth (ft)	Change in Water Level (in)	Did 6 inches of water seep away in less than 25 minutes?	Sandy Soils or Non-Sandy Soils?
1	Initial	8:02 AM	25.00	8.20	24.00	YES	SANDY SOILS
	Final	8:27 AM		10.20			
2	Initial	8:27 AM	25.00	8.20	24.00	YES	SANDY SOILS
	Final	8:52 AM		10.20			

Test Data

Interval Number		Time	Time Interval (min)	Water Depth (ft)	Change in Water Level (ft)	Average Head Height (ft)	Infiltration Rate Q (in/hr)
1	Initial	8:54 AM	10.00	8.20	1.20	1.40	9.19
	Final	9:04 AM		9.40			
2	Initial	9:05 AM	10.00	8.20	1.20	1.40	9.19
	Final	9:15 AM		9.40			
3	Initial	9:16 AM	10.00	8.20	1.19	1.41	9.09
	Final	9:26 AM		9.39			
4	Initial	9:27 AM	10.00	8.20	1.19	1.41	9.09
	Final	9:37 AM		9.39			
5	Initial	9:38 AM	10.00	8.20	1.19	1.41	9.09
	Final	9:48 AM		9.39			
6	Initial	9:49 AM	10.00	8.20	1.11	1.45	8.26
	Final	9:59 AM		9.31			

Per County Standards, Infiltration Rate calculated as follows:

$$Q = \frac{\Delta H(60r)}{\Delta t(r + 2H_{avg})}$$

Where: Q = Infiltration Rate (in inches per hour)
ΔH = Change in Height (Water Level) over the time interval
r = Test Hole (Borehole) Radius
Δt = Time Interval
H_{avg} = Average Head Height over the time interval

INFILTRATION CALCULATIONS

Project Name	Proposed Apple Valley Assemblage
Project Location	Apple Valley, CA
Project Number	22G153-2
Engineer	GP

Test Hole Radius	4	(in)
Test Depth	10.20	(ft)

Infiltration Test Hole	I-6

Soil Criteria Test

Interval Number		Time	Time Interval (min)	Water Depth (ft)	Change in Water Level (in)	Did 6 inches of water seep away in less than 25 minutes?	Sandy Soils or Non-Sandy Soils?
1	Initial	7:47 AM	25.00	8.20	22.80	YES	SANDY SOILS
	Final	8:12 AM		10.10			
2	Initial	8:13 AM	25.00	8.20	20.04	YES	SANDY SOILS
	Final	8:38 AM		9.87			

Test Data

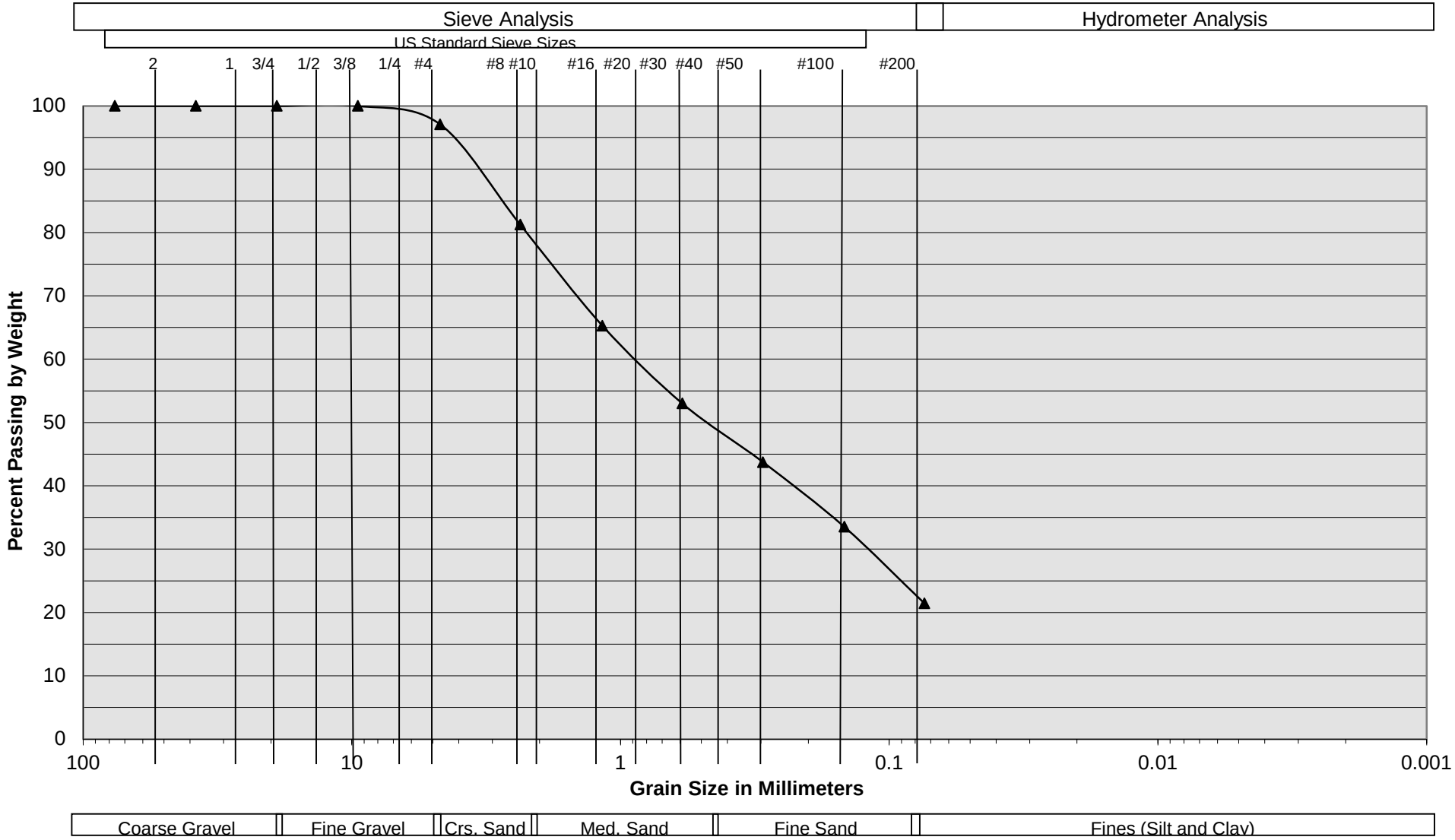
Interval Number		Time	Time Interval (min)	Water Depth (ft)	Change in Water Level (ft)	Average Head Height (ft)	Infiltration Rate Q (in/hr)
1	Initial	8:39 AM	10.00	8.20	0.70	1.65	4.62
	Final	8:49 AM		8.90			
2	Initial	8:50 AM	10.00	8.20	0.70	1.65	4.62
	Final	9:00 AM		8.90			
3	Initial	9:01 AM	10.00	8.20	0.69	1.66	4.55
	Final	9:11 AM		8.89			
4	Initial	9:12 AM	10.00	8.20	0.69	1.66	4.55
	Final	9:22 AM		8.89			
5	Initial	9:23 AM	10.00	8.20	0.67	1.67	4.39
	Final	9:33 AM		8.87			
6	Initial	9:34 AM	10.00	8.20	0.66	1.67	4.31
	Final	9:44 AM		8.86			

Per County Standards, Infiltration Rate calculated as follows:

$$Q = \frac{\Delta H(60r)}{\Delta t(r + 2H_{avg})}$$

Where: Q = Infiltration Rate (in inches per hour)
ΔH = Change in Height (Water Level) over the time interval
r = Test Hole (Borehole) Radius
Δt = Time Interval
H_{avg} = Average Head Height over the time interval

Grain Size Distribution



Sample Description	I-1 @ 8½ feet
Soil Classification	Silty fine to coarse Sand

Proposed Apple Valley Assemblage
Apple Valley, California
Project No. 22G153-2
PLATE C- 1

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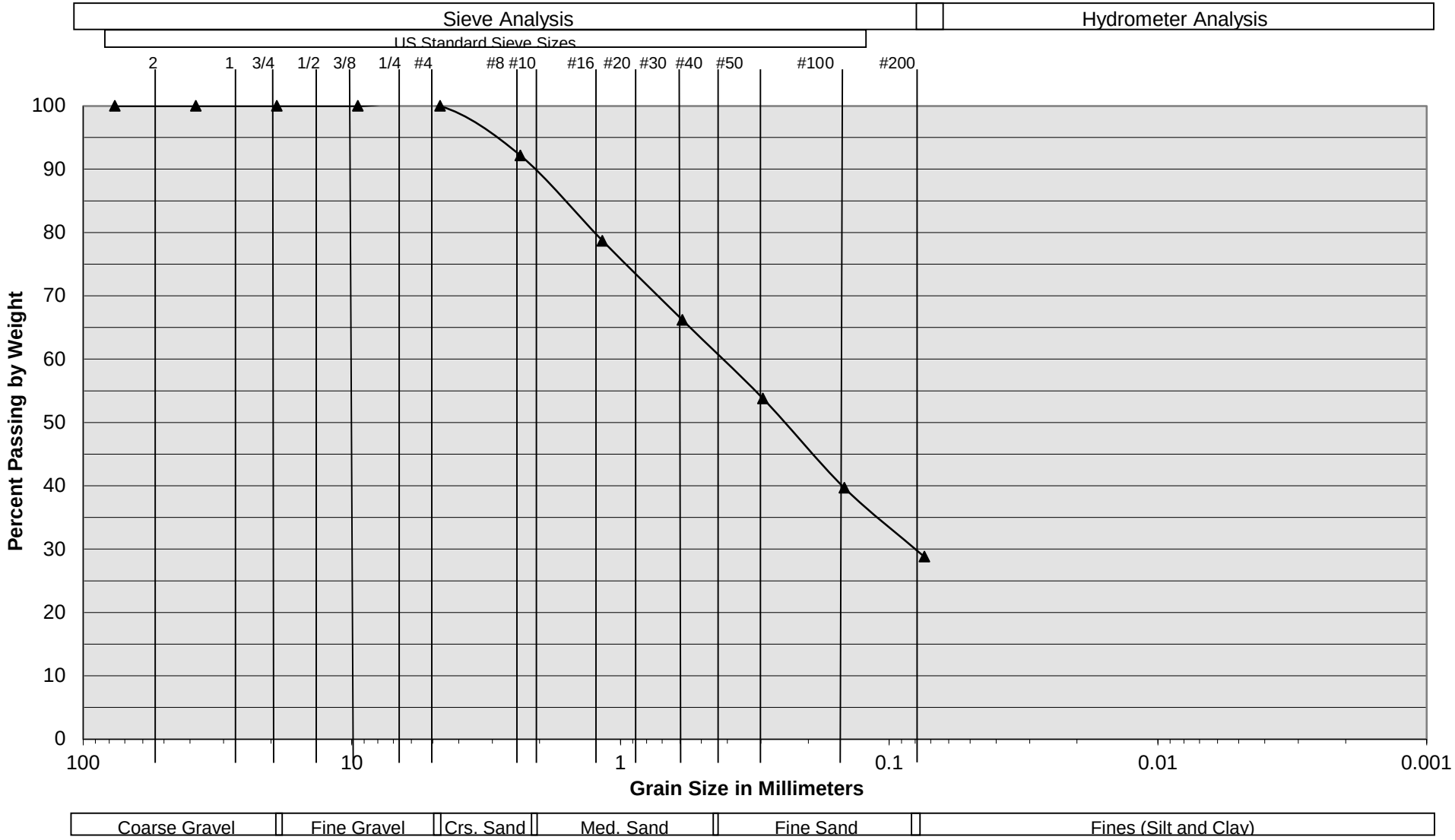
A California Corporation

Grain Size Distribution



Sample Description	I-2 @ 8½ feet
Soil Classification	Silty fine to coarse Sand

Proposed Apple Valley Assemblage
Apple Valley, California
Project No. 22G153-2
PLATE C- 2

SoCalGeo
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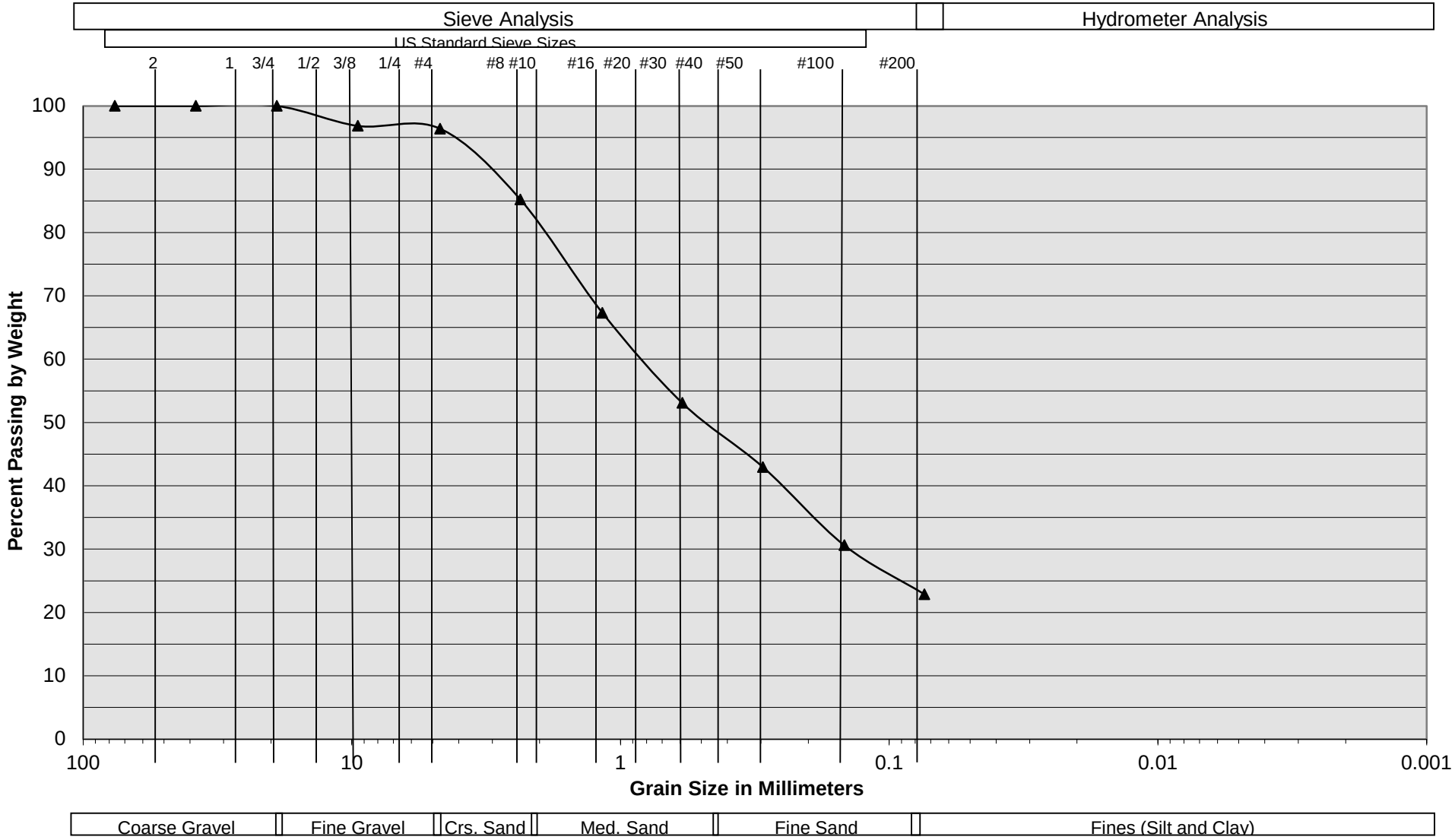
Grain Size Distribution



Sample Description	I-3 @ 10½ feet
Soil Classification	Silty fine to coarse Sand, trace fine Gravel

Proposed Apple Valley Assemblage
Apple Valley, California
Project No. 22G153-2
PLATE C- 3

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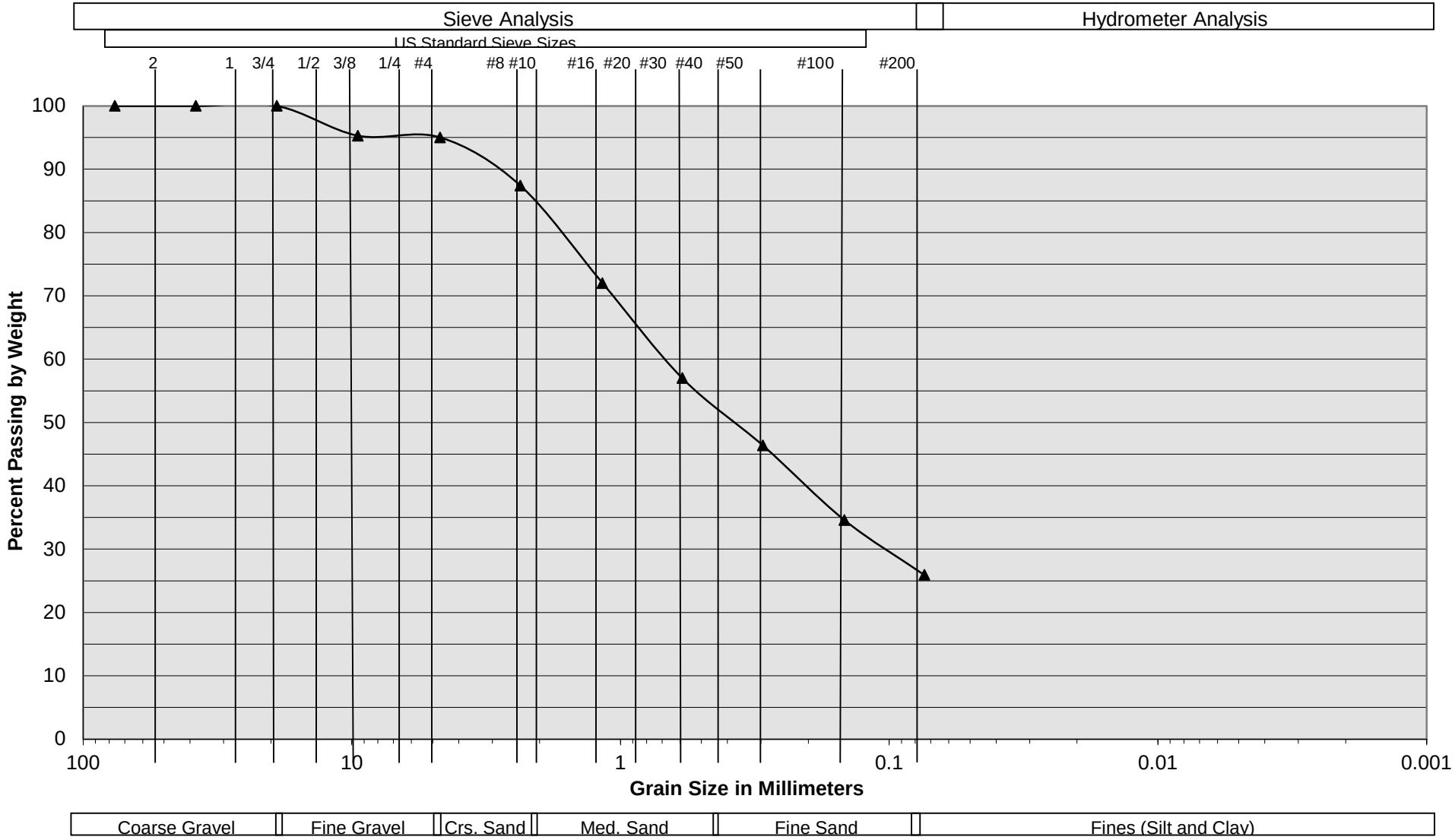
Grain Size Distribution



Sample Description	I-4 @ 10½ feet
Soil Classification	Silty fine to coarse Sand, trace fine Gravel

Proposed Apple Valley Assemblage
Apple Valley, California
Project No. 22G153-2
PLATE C- 4

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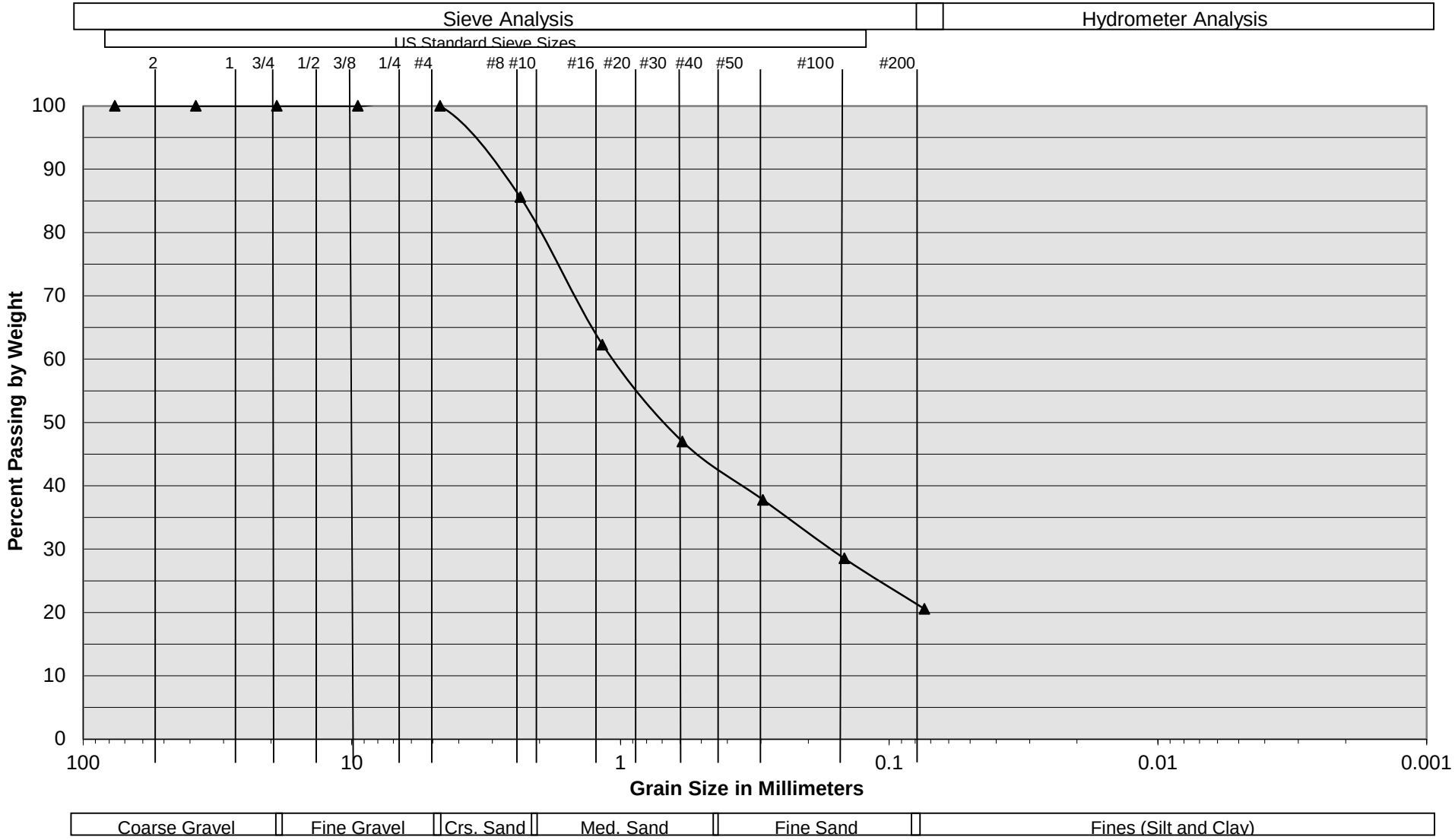
Grain Size Distribution



Sample Description	I-5 @ 8½ feet
Soil Classification	Silty fine to coarse Sand

Proposed Apple Valley Assemblage
Apple Valley, California
Project No. 22G153-2
PLATE C- 5

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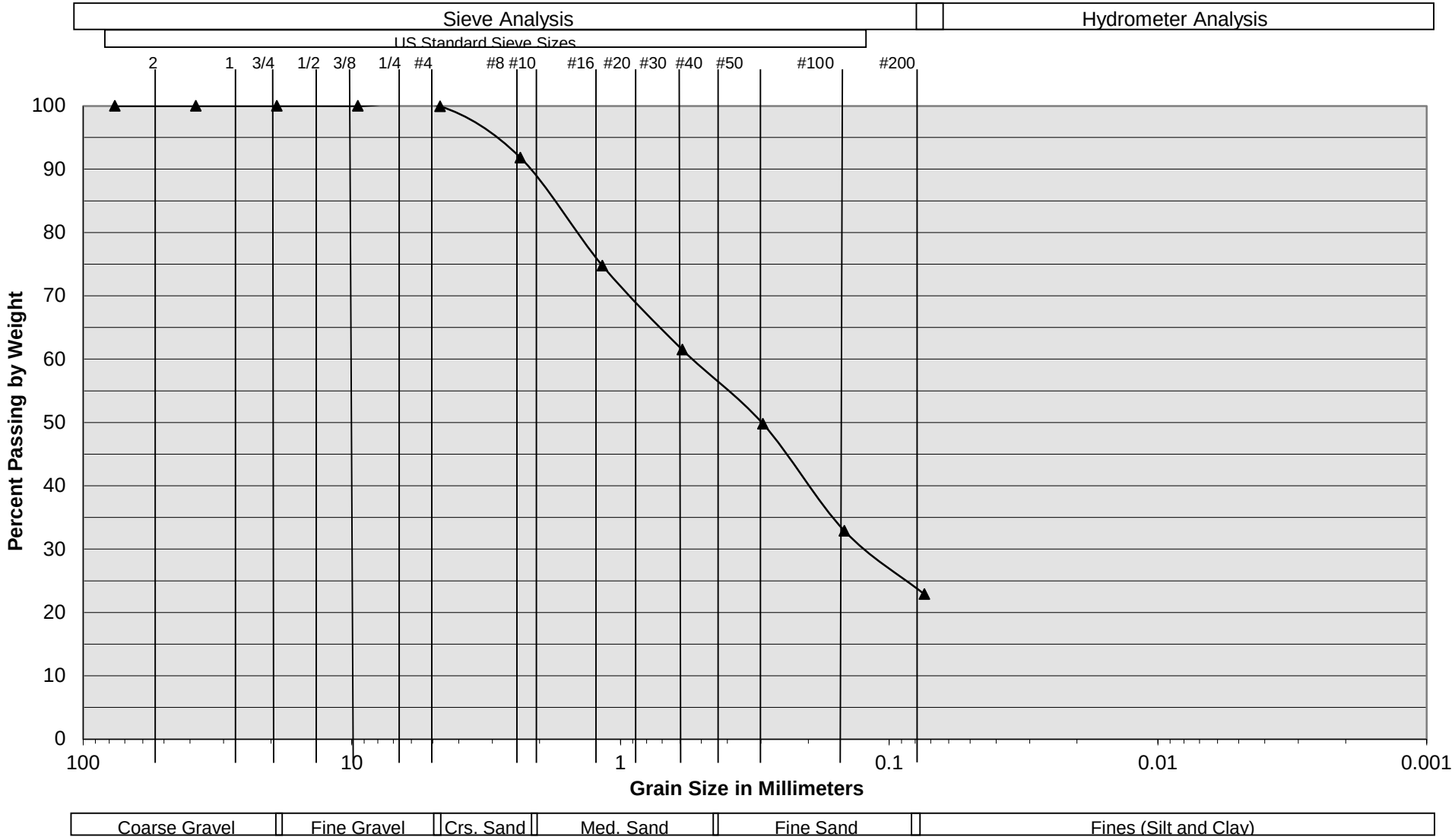
Grain Size Distribution



Sample Description	I-6 @ 8½ feet
Soil Classification	Silty fine to coarse Sand

Proposed Apple Valley Assemblage
Apple Valley, California
Project No. 22G153-2
PLATE C- 6

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Attachment G
Hydrologic Conditions of Concern

Summary Table

HCOC VOLUME (VOL) MITIGATION OF 10-YR, 24-HR STORM EVENT

TOTAL SITE AREA	224.90	acres
PRE-DEVELOPMENT VOLUME	11.0628	ac-ft
PRE-DEVELOPMENT VOLUME	481,896	cu-ft
POST-DEVELOPMENT VOLUME	28.2251	ac-ft
POST-DEVELOPMENT VOLUME	1,229,485	cu-ft
MIN. MITIGATION VOLUME	15.7510	ac-ft [(post-vol * 0.95) - pre-vol]
MIN. MITIGATION VOLUME	686,116	cu-ft [(post-vol * 0.95) - pre-vol]

	AREA (acres)	POST-DEVELOPMENT VOLUME (CU-FT)	POST-DEVELOPMENT VOLUME (AC-FT)
DA 1 DMA A (Infiltration Basin #4)	61.22	334,937	7.6891
DA 2 DMA A (Infiltration Basin #3)	29.85	163,350	3.7500
DA 3 DMA A (Infiltration Basin #2)	45.42	248,196	5.6978
DA 4 DMA A (Infiltration Basin #1)	65.99	360,564	8.2774
DA 5 DMA A (Channel South)	15.94	87,050	1.9984
DA 6 DMA A (Channel North)	6.48	35,388	0.8124
TOTAL	224.90	1,229,485	28.2251

	VOL. PROVIDED (CU-FT)	VOL. PROVIDED (AC-FT)	
DA 1 DMA A (Infiltraton Basin #4 @ 3.70' WSE)	257,792	5.9181	
DA 2 DMA A (Infiltraton Basin #3 @ 2.40' WSE)	92,558	2.1248	
DA 3 DMA A (Infiltraton Basin #2 @ 4.40' WSE)	193,551	4.4433	
DA 4 DMA A (Infiltraton Basin #1 @ 4.20' WSE)	271,960	6.2433	
DA 5 DMA A (Channel South @ 2.9' WSE)	55,125	1.2655	
DA 6 DMA A (Channel North @ 1.6' WSE)	22,734	0.5219	
TOTAL	893,720	cf-ft > 686116 cf-ft	**HCOC Vol Mitigated**
TOTAL	20.5170	ac-ft > 15.751 ac-ft	**HCOC Vol Mitigated**

HCOC FLOWRATE (Q) MITIGATION OF 10-YR, 24-HR STORM EVENT			
TOTAL SITE AREA	224.90	acres	
PRE-DEVELOPMENT PEAK FLOWRATE (Qp)	108.24	cfs @ 16.50 hrs per Hydrograph	
POST-DEVELOPMENT PEAK FLOWRATE (Qp)	311.69	cfs @ 16.31 hrs per Hydrograph	
MIN. MITIGATION PEAK FLOWRATE	187.87	cfs [(post-Qp * 0.95) - pre-Qp]	
DA 1 DMA A Post-Development Flowrate @ Qp	84.18	cfs @ 16.17 hrs	
DA 2 DMA A Post-Development Flowrate @ Qp	37.23	cfs @ 16.20 hrs	
DA 3 DMA A Post-Development Flowrate @ Qp	60.20	cfs @ 16.18 hrs	
DA 4 DMA A Post-Development Flowrate @ Qp	85.71	cfs @ 16.19 hrs	
DA 5 DMA A Post-Development Flowrate @ Qp	31.55	cfs @ 16.08 hrs	
DA 6 DMA A Post-Development Flowrate @ Qp	12.82	cfs @ 16.08 hrs	
TOTAL	311.69	cfs	
DA 1 DMA A Post-Development Volume @ Qp	5.1245	ac-ft < 5.9181 ac-ft	Qp Retained
DA 2 DMA A Post-Development Volume @ Qp	2.4869	ac-ft > 2.1248 ac-ft	Qp Undetained
DA 3 DMA A Post-Development Volume @ Qp	3.7931	ac-ft < 4.4433 ac-ft	Qp Retained
DA 4 DMA A Post-Development Volume @ Qp	5.5141	ac-ft < 6.2433 ac-ft	Qp Retained
DA 5 DMA A Post-Development Volume @ Qp	1.3319	ac-ft > 1.2655 ac-ft	Qp Undetained
DA 6 DMA A Post-Development Volume @ Qp	0.5414	ac-ft > 0.5219 ac-ft	Qp Undetained
DA 1 DMA A Post-Development Flowrate After Qp	12.20	cfs @ 16.34 hrs	Qp Retained
DA 2 DMA A Post-Development Flowrate @ Qp	37.23	cfs @ 16.20 hrs	Qp Undetained
DA 3 DMA A Post-Development Flowrate After Qp	8.64	cfs @ 16.36 hrs	Qp Retained
DA 4 DMA A Post-Development Flowrate After Qp	12.22	cfs @ 16.38 hrs	Qp Retained
DA 5 DMA A Post-Development Flowrate @ Qp	31.55	cfs @ 16.08 hrs	Qp Undetained
DA 6 DMA A Post-Development Flowrate @ Qp	12.82	cfs @ 16.08 hrs	Qp Undetained
TOTAL	114.66	cfs after retention	
MITIGATED PEAK FLOW RATE	197.03	cfs > 187.87 cfs	**HCOC Qp Mitigated**
(difference of 311.69 cfs and 114.66 cfs)			

HCOC TIME OF CONCENTRATION (Tc) MITIGATION OF 10-YR, 24-HR STORM EVENT			
PRE-DEVELOPMENT Tc	30.00	mins	
PRE-DEVELOPMENT Tc (+/- 5% is not a HCOC)	28.50	mins	
** The below demonstrates how long it would take to fill each respective detention basin using the Qp which is an extreme worst case scenario. Time to fill the basin/channels are still greater than the pre-development Tc.*			
DA 1 DMA A (Infiltraton Basin #4 @ 3.70' WSE)	257,792	cu-ft	
DA 1 DMA A Post-Development Flowrate @ Qp	84.18	cfs @ 16.17 hrs	
Time Required to Fill Infiltraton Basin #4 using Qp	51.04	mins > 28.5 mins	**HCOC Tc Mitigated**
DA 2 DMA A (Infiltraton Basin #3 @ 2.40' WSE)	92,558	cu-ft	
DA 2 DMA A Post-Development Flowrate @ Qp	37.23	cfs @ 16.20 hrs	
Time Required to Fill Infiltraton Basin #3 using Qp	41.44	mins > 28.5 mins	**HCOC Tc Mitigated**
DA 3 DMA A (Infiltraton Basin #2 @ 4.40' WSE)	193,551	cu-ft	
DA 3 DMA A Post-Development Flowrate @ Qp	60.20	cfs @ 16.18 hrs	
Time Required to Fill Infiltraton Basin #2 using Qp	53.59	mins > 28.5 mins	**HCOC Tc Mitigated**
DA 4 DMA A (Infiltraton Basin #1 @ 4.20' WSE)	271,960	cu-ft	
DA 4 DMA A Post-Development Flowrate @ Qp	85.71	cfs @ 16.19 hrs	
Time Required to Fill Infiltraton Basin #1 using Qp	52.88	mins > 28.5 mins	**HCOC Tc Mitigated**
DA 5 DMA A (Channel South @ 2.9' WSE)	55,125	cu-ft	
DA 5 DMA A Post-Development Flowrate @ Qp	31.55	cfs @ 16.08 hrs	
Time Required to Fill Channel South using Qp	29.12	mins > 28.5 mins	**HCOC Tc Mitigated**
DA 6 DMA A (Channel North @ 1.6' WSE)	22,734	cu-ft	
DA 6 DMA A Post-Development Flowrate @ Qp	12.82	cfs @ 16.08 hrs	
Time Required to Fill Channel North using Qp	29.56	mins > 28.5 mins	**HCOC Tc Mitigated**

Infiltration Basin and Drainage Channel Volumes

INFILTRATION BASIN #4 (DA 1 @ Building 3)

Elevation (ft.)	Depth (ft.)	Volume (cu-ft)	Cumulative Volume (cu-ft)	
2,975.67	0.00	0.00	0.00	
2,975.77	0.10	5,813.24	5,813.24	
2,975.87	0.20	6,064.19	11,877.43	
2,975.97	0.30	6,116.29	17,993.73	
2,976.07	0.40	6,168.52	24,162.24	
2,976.17	0.50	6,220.86	30,383.10	
2,976.27	0.60	6,273.31	36,656.41	
2,976.37	0.70	6,325.89	42,982.30	
2,976.47	0.80	6,378.58	49,360.88	
2,976.57	0.90	6,431.39	55,792.27	
2,976.67	1.00	6,484.32	62,276.59	
2,976.77	1.10	6,537.37	68,813.96	
2,976.87	1.20	6,590.53	75,404.50	
2,976.97	1.30	6,643.82	82,048.31	
2,977.07	1.40	6,697.22	88,745.53	
2,977.17	1.50	6,750.74	95,496.27	
2,977.27	1.60	6,804.38	102,300.65	
2,977.37	1.70	6,858.13	109,158.78	
2,977.47	1.80	6,912.00	116,070.78	
2,977.57	1.90	6,966.00	123,036.78	
2,977.67	2.00	7,020.10	130,056.88	
2,977.77	2.10	7,074.33	137,131.21	
2,977.87	2.20	7,128.68	144,259.89	
2,977.97	2.30	7,183.14	151,443.03	
2,978.07	2.40	7,237.72	158,680.76	
2,978.17	2.50	7,292.42	165,973.18	
2,978.27	2.60	7,347.24	173,320.42	
2,978.37	2.70	7,402.17	180,722.59	
2,978.47	2.80	7,457.23	188,179.82	
2,978.57	2.90	7,512.40	195,692.22	
2,978.67	3.00	7,567.69	203,259.91	
2,978.77	3.10	7,623.10	210,883.00	
2,978.87	3.20	7,678.62	218,561.62	
2,978.97	3.30	7,734.26	226,295.89	
2,979.07	3.40	7,790.03	234,085.92	
2,979.17	3.50	7,845.91	241,931.82	
2,979.27	3.60	7,901.90	249,833.72	
2,979.37	**3.70**	**7,958.02**	**257,791.74**	> 145,021 cu-ft DCV
2,979.47	3.80	8,014.25	265,806.00	
2,979.57	3.90	8,070.60	273,876.60	
2,979.67	4.00	8,127.07	282,003.67	
2,979.77	4.10	8,183.66	290,187.33	
2,979.87	4.20	8,240.37	298,427.70	
2,979.97	4.30	8,297.19	306,724.89	

INFILTRATION BASIN #3 (DA 2 @ Building 2 West)

Elevation (ft.)	Depth (ft.)	Volume (cu-ft)	Cumulative Volume (cu-ft)	
2,983.11	0.00	0.00	0.00	
2,983.21	0.10	3,445.26	3,445.26	
2,983.31	0.20	3,530.13	6,975.39	
2,983.41	0.30	3,560.48	10,535.87	
2,983.51	0.40	3,590.97	14,126.84	
2,983.61	0.50	3,621.59	17,748.43	
2,983.71	0.60	3,652.35	21,400.77	
2,983.81	0.70	3,683.24	25,084.02	
2,983.91	0.80	3,714.27	28,798.29	
2,984.01	0.90	3,745.44	32,543.73	
2,984.11	1.00	3,776.74	36,320.48	
2,984.21	1.10	3,808.18	40,128.66	
2,984.31	1.20	3,839.76	43,968.42	
2,984.41	1.30	3,871.47	47,839.89	
2,984.51	1.40	3,903.32	51,743.20	
2,984.61	1.50	3,935.30	55,678.50	
2,984.71	1.60	3,967.42	59,645.92	
2,984.81	1.70	3,999.68	63,645.60	
2,984.91	1.80	4,032.07	67,677.67	
2,985.01	1.90	4,064.60	71,742.27	
2,985.11	2.00	4,097.26	75,839.53	
2,985.21	2.10	4,130.06	79,969.59	
2,985.31	2.20	4,163.00	84,132.58	
2,985.41	2.30	4,196.07	88,328.65	
2,985.51	**2.40**	**4,229.28**	**92,557.93**	> 70,710 CU-FT DCV
2,985.61	2.50	4,262.62	96,820.55	
2,985.71	2.60	4,296.10	101,116.66	
2,985.81	2.70	4,329.72	105,446.38	
2,985.91	2.80	4,363.47	109,809.85	
2,986.01	2.90	4,397.36	114,207.21	
2,986.11	3.00	4,431.39	118,638.60	

INFILTRATION BASIN #2 (DA 3 @ Building 2 East)

Elevation (ft.)	Depth (ft.)	Volume (cu-ft)	Cumulative Volume (cu-ft)
2,981.00	0.00	0.00	0.00
2,981.10	0.10	3,481.11	3,481.11
2,981.20	0.20	3,574.48	7,055.59
2,981.30	0.30	3,613.28	10,668.87
2,981.40	0.40	3,652.19	14,321.07
2,981.50	0.50	3,691.21	18,012.28
2,981.60	0.60	3,730.34	21,742.61
2,981.70	0.70	3,769.57	25,512.18
2,981.80	0.80	3,808.91	29,321.09
2,981.90	0.90	3,848.36	33,169.45
2,982.00	1.00	3,887.91	37,057.36
2,982.10	1.10	3,927.58	40,984.94
2,982.20	1.20	3,967.35	44,952.29
2,982.30	1.30	4,007.23	48,959.52
2,982.40	1.40	4,047.22	53,006.73
2,982.50	1.50	4,087.31	57,094.04
2,982.60	1.60	4,127.51	61,221.55
2,982.70	1.70	4,167.82	65,389.37
2,982.80	1.80	4,208.24	69,597.61
2,982.90	1.90	4,248.76	73,846.37
2,983.00	2.00	4,289.39	78,135.77
2,983.10	2.10	4,330.13	82,465.90
2,983.20	2.20	4,370.98	86,836.89
2,983.30	2.30	4,411.94	91,248.82
2,983.40	2.40	4,453.00	95,701.82
2,983.50	2.50	4,494.17	100,196.00
2,983.60	2.60	4,535.45	104,731.44
2,983.70	2.70	4,576.83	109,308.28
2,983.80	2.80	4,618.33	113,926.61
2,983.90	2.90	4,659.93	118,586.54
2,984.00	3.00	4,701.64	123,288.17
2,984.10	3.10	4,743.45	128,031.63
2,984.20	3.20	4,785.38	132,817.00
2,984.30	3.30	4,827.41	137,644.41
2,984.40	3.40	4,869.55	142,513.96
2,984.50	3.50	4,911.79	147,425.76
2,984.60	3.60	4,954.15	152,379.91
2,984.70	3.70	4,996.61	157,376.52
2,984.80	3.80	5,039.18	162,415.70
2,984.90	3.90	5,081.86	167,497.55
2,985.00	4.00	5,124.64	172,622.20
2,985.10	4.10	5,167.53	177,789.73
2,985.20	4.20	5,210.53	183,000.26
2,985.30	4.30	5,253.64	188,253.91

2,985.40	**4.40**	**5,296.86**	**193,550.76**
2,985.50	4.50	5,340.18	198,890.94
2,985.60	4.60	5,383.61	204,274.56
2,985.70	4.70	5,427.15	209,701.70
2,985.80	4.80	5,470.79	215,172.50
2,985.90	4.90	5,514.55	220,687.05
2,986.00	5.00	5,558.41	226,245.46
2,986.10	5.10	5,602.38	231,847.83
2,986.20	5.20	5,646.45	237,494.29
2,986.30	5.30	5,690.64	243,184.92
2,986.40	5.40	5,734.93	248,919.85
2,986.50	5.50	5,779.33	254,699.18
2,986.60	5.60	5,823.83	260,523.02
2,986.70	5.70	5,868.45	266,391.46
2,986.80	5.80	5,913.17	272,304.64
2,986.90	5.90	5,958.00	278,262.64
2,987.00	6.00	6,002.94	284,265.57

> 107,593 CU-FT DCV

INFILTRATION BASIN #1 (DA 4 @ Building 1)

Elevation (ft.)	Depth (ft.)	Volume (cu-ft)	Cumulative Volume (cu-ft)	
3,001.44	0.00	0.00	0.00	
3,001.54	0.10	5,034.95	5,034.95	
3,001.64	0.20	5,202.29	10,237.24	
3,001.74	0.30	5,265.94	15,503.18	
3,001.84	0.40	5,329.71	20,832.89	
3,001.94	0.50	5,393.63	26,226.52	
3,002.04	0.60	5,457.68	31,684.20	
3,002.14	0.70	5,521.86	37,206.06	
3,002.24	0.80	5,586.18	42,792.25	
3,002.34	0.90	5,650.64	48,442.88	
3,002.44	1.00	5,715.23	54,158.12	
3,002.54	1.10	5,779.96	59,938.07	
3,002.64	1.20	5,844.82	65,782.89	
3,002.74	1.30	5,909.82	71,692.71	
3,002.84	1.40	5,974.95	77,667.66	
3,002.94	1.50	6,040.22	83,707.88	
3,003.04	1.60	6,105.62	89,813.50	
3,003.14	1.70	6,171.16	95,984.66	
3,003.24	1.80	6,236.83	102,221.49	
3,003.34	1.90	6,302.64	108,524.14	
3,003.44	2.00	6,368.59	114,892.73	
3,003.54	2.10	6,434.67	121,327.40	
3,003.64	2.20	6,500.89	127,828.28	
3,003.74	2.30	6,567.24	134,395.52	
3,003.84	2.40	6,633.72	141,029.24	
3,003.94	2.50	6,700.35	147,729.59	
3,004.04	2.60	6,767.10	154,496.69	
3,004.14	2.70	6,834.00	161,330.69	
3,004.24	2.80	6,901.02	168,231.71	
3,004.34	2.90	6,968.19	175,199.90	
3,004.44	3.00	7,035.49	182,235.39	
3,004.54	3.10	7,102.92	189,338.31	
3,004.64	3.20	7,170.49	196,508.80	
3,004.74	3.30	7,238.20	203,747.00	
3,004.84	3.40	7,306.04	211,053.04	
3,004.94	3.50	7,374.01	218,427.05	
3,005.04	3.60	7,442.13	225,869.18	
3,005.14	3.70	7,510.37	233,379.55	
3,005.24	3.80	7,578.75	240,958.30	
3,005.34	3.90	7,647.27	248,605.58	
3,005.44	4.00	7,715.92	256,321.50	
3,005.54	4.10	7,784.71	264,106.21	
3,005.64	**4.20**	**7,853.64**	**271,959.85**	> 156,320 cu-ft DCV
3,005.74	4.30	7,922.70	279,882.55	

3,005.84	4.40	7,991.89	287,874.44
3,005.94	4.50	8,061.22	295,935.66
3,006.00	4.56	4,870.07	300,805.73

SOUTH CHANNEL (DA 5)

Elevation (ft.)	Depth (ft.)	Volume (cu. ft.)	Cumulative Volume (cu. ft.)
2,969.81	0.00	0.00	0.00
2,969.91	0.10	1,213.53	1,213.53
2,970.01	0.20	1,346.02	2,559.56
2,970.11	0.30	1,412.16	3,971.71
2,970.21	0.40	1,463.93	5,435.64
2,970.31	0.50	1,514.48	6,950.12
2,970.41	0.60	1,566.15	8,516.26
2,970.51	0.70	1,618.96	10,135.22
2,970.61	0.80	1,672.90	11,808.12
2,970.71	0.90	1,727.98	13,536.10
2,970.81	1.00	1,784.19	15,320.29
2,970.91	1.10	1,841.55	17,161.84
2,971.01	1.20	1,900.03	19,061.87
2,971.11	1.30	1,941.32	21,003.19
2,971.21	1.40	1,963.82	22,967.00
2,971.31	1.50	1,986.32	24,953.32
2,971.41	1.60	2,008.82	26,962.14
2,971.51	1.70	2,031.33	28,993.47
2,971.61	1.80	2,053.83	31,047.30
2,971.71	1.90	2,076.34	33,123.64
2,971.81	2.00	2,098.84	35,222.48
2,971.91	2.10	2,121.35	37,343.84
2,972.01	2.20	2,143.86	39,487.70
2,972.11	2.30	2,166.38	41,654.07
2,972.21	2.40	2,188.89	43,842.96
2,972.31	2.50	2,211.40	46,054.36
2,972.41	2.60	2,233.92	48,288.28
2,972.51	2.70	2,256.43	50,544.71
2,972.61	2.80	2,278.95	52,823.67
2,972.71	**2.90**	**2,301.47**	**55,125.14**

NORTH CHANNEL (DA 6)

Elevation (ft.)	Depth (ft.)	Volume (cu. ft.)	Cumulative Volume (cu. ft.)
3,003.80	0.00	0.00	0.00
3,003.90	0.10	1,277.13	1,277.13
3,004.00	0.20	1,298.36	2,575.50
3,004.10	0.30	1,319.26	3,894.76
3,004.20	0.40	1,339.82	5,234.58
3,004.30	0.50	1,360.05	6,594.62
3,004.40	0.60	1,379.94	7,974.57
3,004.50	0.70	1,399.50	9,374.07
3,004.60	0.80	1,418.73	10,792.81
3,004.70	0.90	1,437.63	12,230.43
3,004.80	1.00	1,456.19	13,686.62
3,004.90	1.10	1,474.41	15,161.03
3,005.00	1.20	1,490.51	16,651.54
3,005.10	1.30	1,502.58	18,154.12
3,005.20	1.40	1,514.53	19,668.65
3,005.30	1.50	1,526.47	21,195.12
3,005.40	**1.60**	**1,538.41**	**22,733.53**

NOAA Atlas Rainfall Intensities

10-year, 24-hour

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NOAA ATLAS 14 POINT PRECIPITATION FREQUENCY ESTIMATES: CA

Data description

Data type: Precipitation depth **Units:** English **Time series type:** Partial duration

Select location

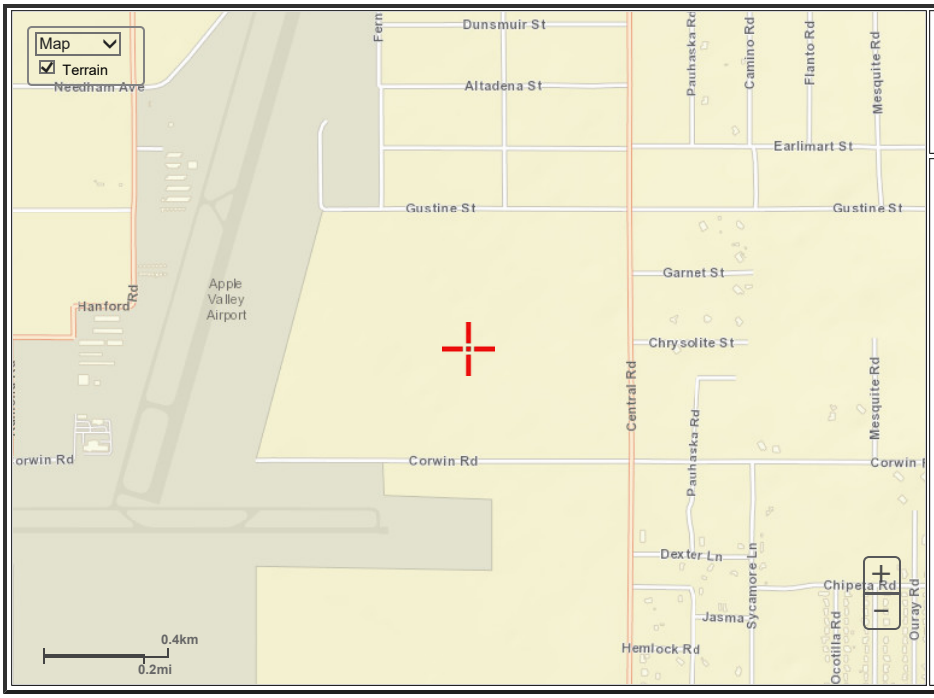
1) Manually:

a) By location (decimal degrees, use "-" for S and W): Latitude: 34.574891 Longitude: -117.17723 Submit

b) By station (list of CA stations): Select station

c) By address Search

2) Use map (if ESRI interactive map is not loading, try adding the host: **https://js.arcgis.com/** to the firewall, or contact us at hdsc.questions@noaa.gov):



a) Select location
Move crosshair or double click

b) Click on station icon
Show stations on map

Location information:
Name: Apple Valley, California, USA
Latitude: 34.5749°
Longitude: -117.1772°
Elevation: 3018.85 ft **

* Source: ESRI Maps
** Source: USGS

POINT PRECIPITATION FREQUENCY (PF) ESTIMATES

WITH 90% CONFIDENCE INTERVALS AND SUPPLEMENTARY INFORMATION
NOAA Atlas 14, Volume 6, Version 2

PF tabular PF graphical Supplementary information Print page

PDS-based precipitation frequency estimates with 90% confidence intervals (in inches)[1]

Duration	Average recurrence interval (years) 1	2	5	10	25	50	100	200	500	1000
5-min	**0.080** (0.066-0.098)	**0.113** (0.093-0.138)	**0.159** (0.131-0.196)	**0.199** (0.162-0.247)	**0.257** (0.203-0.330)	**0.305** (0.235-0.399)	**0.356** (0.268-0.477)	**0.412** (0.302-0.567)	**0.492** (0.346-0.705)	**0.558** (0.380-0.828)
10-min	**0.114** (0.094-0.140)	**0.162** (0.133-0.198)	**0.228** (0.187-0.281)	**0.286** (0.233-0.354)	**0.369** (0.291-0.473)	**0.437** (0.337-0.572)	**0.510** (0.385-0.684)	**0.590** (0.433-0.813)	**0.705** (0.496-1.01)	**0.799** (0.544-1.19)
15-min	**0.138** (0.114-0.169)	**0.196** (0.161-0.240)	**0.276** (0.227-0.340)	**0.345** (0.281-0.429)	**0.446** (0.352-0.572)	**0.529** (0.408-0.692)	**0.617** (0.465-0.827)	**0.713** (0.523-0.983)	**0.852** (0.600-1.22)	**0.967** (0.658-1.44)
30-min	**0.188** (0.155-0.230)	**0.266** (0.219-0.327)	**0.376** (0.308-0.462)	**0.470** (0.383-0.583)	**0.607** (0.479-0.778)	**0.719** (0.555-0.941)	**0.840** (0.633-1.13)	**0.971** (0.712-1.34)	**1.16** (0.817-1.66)	**1.32** (0.895-1.95)
60-min	**0.235** (0.194-0.288)	**0.333** (0.274-0.408)	**0.470** (0.386-0.578)	**0.588** (0.479-0.729)	**0.759** (0.598-0.973)	**0.900** (0.695-1.18)	**1.05** (0.792-1.41)	**1.21** (0.890-1.67)	**1.45** (1.02-2.08)	**1.65** (1.12-2.44)
2-hr	**0.335** (0.276-0.410)	**0.454** (0.374-0.557)	**0.619** (0.508-0.762)	**0.761** (0.619-0.944)	**0.964** (0.759-1.24)	**1.13** (0.871-1.48)	**1.30** (0.982-1.75)	**1.49** (1.09-2.05)	**1.76** (1.24-2.53)	**1.98** (1.35-2.94)
3-hr	**0.407** (0.336-0.499)	**0.544** (0.448-0.668)	**0.733** (0.601-0.901)	**0.893** (0.727-1.11)	**1.12** (0.884-1.44)	**1.31** (1.01-1.71)	**1.50** (1.13-2.01)	**1.71** (1.25-2.36)	**2.01** (1.41-2.88)	**2.25** (1.53-3.34)
6-hr	**0.558** (0.460-0.684)	**0.735** (0.605-0.903)	**0.977** (0.802-1.20)	**1.18** (0.962-1.47)	**1.47** (1.16-1.88)	**1.70** (1.31-2.22)	**1.94** (1.46-2.60)	**2.19** (1.61-3.02)	**2.55** (1.80-3.66)	**2.84** (1.93-4.22)
12-hr	**0.722**	**0.952**	**1.26**	**1.52**	**1.89**	**2.17**	**2.47**	**2.78**	**3.21**	**3.56**

	(0.595-0.885)	(0.784-1.17)	(1.04-1.55)	(1.24-1.89)	(1.49-2.42)	(1.68-2.84)	(1.86-3.31)	(2.04-3.83)	(2.26-4.61)	(2.42-5.28)
24-hr	**0.951** (0.844-1.09)	**1.27** (1.12-1.46)	**1.69** (1.49-1.95)	**2.04** (1.79-2.38)	**2.52** (2.14-3.04)	**2.90** (2.41-3.56)	**3.29** (2.66-4.14)	**3.69** (2.91-4.78)	**4.25** (3.21-5.74)	**4.69** (3.43-6.55)
2-day	**1.14** (1.01-1.31)	**1.55** (1.37-1.78)	**2.09** (1.84-2.41)	**2.53** (2.21-2.94)	**3.13** (2.65-3.77)	**3.59** (2.98-4.42)	**4.07** (3.30-5.12)	**4.56** (3.59-5.91)	**5.23** (3.96-7.06)	**5.76** (4.20-8.04)
3-day	**1.24** (1.10-1.43)	**1.71** (1.51-1.97)	**2.32** (2.05-2.68)	**2.81** (2.47-3.28)	**3.49** (2.96-4.20)	**4.01** (3.33-4.93)	**4.54** (3.68-5.72)	**5.08** (4.01-6.58)	**5.83** (4.41-7.87)	**6.41** (4.68-8.95)
4-day	**1.32** (1.17-1.52)	**1.81** (1.61-2.09)	**2.47** (2.18-2.85)	**3.00** (2.63-3.50)	**3.73** (3.16-4.48)	**4.28** (3.55-5.26)	**4.85** (3.93-6.10)	**5.43** (4.28-7.03)	**6.22** (4.70-8.40)	**6.84** (4.99-9.55)
7-day	**1.43** (1.27-1.65)	**1.96** (1.73-2.26)	**2.66** (2.35-3.07)	**3.23** (2.83-3.76)	**4.01** (3.40-4.83)	**4.62** (3.84-5.68)	**5.24** (4.25-6.60)	**5.88** (4.63-7.62)	**6.75** (5.11-9.12)	**7.44** (5.43-10.4)
10-day	**1.51** (1.34-1.74)	**2.06** (1.82-2.37)	**2.79** (2.47-3.23)	**3.40** (2.98-3.96)	**4.23** (3.58-5.09)	**4.88** (4.05-5.99)	**5.54** (4.49-6.97)	**6.23** (4.91-8.06)	**7.17** (5.42-9.68)	**7.91** (5.78-11.1)
20-day	**1.72** (1.52-1.98)	**2.35** (2.08-2.71)	**3.20** (2.83-3.70)	**3.91** (3.43-4.56)	**4.90** (4.15-5.90)	**5.68** (4.71-6.98)	**6.48** (5.25-8.16)	**7.32** (5.77-9.48)	**8.47** (6.41-11.4)	**9.38** (6.85-13.1)
30-day	**1.93** (1.72-2.23)	**2.65** (2.35-3.06)	**3.63** (3.21-4.19)	**4.45** (3.90-5.18)	**5.60** (4.75-6.74)	**6.51** (5.41-8.00)	**7.45** (6.04-9.39)	**8.44** (6.65-10.9)	**9.81** (7.42-13.2)	**10.9** (7.95-15.2)
45-day	**2.29** (2.03-2.64)	**3.15** (2.79-3.63)	**4.32** (3.82-4.99)	**5.31** (4.66-6.19)	**6.72** (5.70-8.09)	**7.84** (6.51-9.64)	**9.01** (7.30-11.3)	**10.2** (8.07-13.3)	**12.0** (9.04-16.1)	**13.3** (9.72-18.6)
60-day	**2.50** (2.22-2.87)	**3.42** (3.03-3.94)	**4.70** (4.15-5.42)	**5.78** (5.07-6.73)	**7.33** (6.21-8.82)	**8.57** (7.12-10.5)	**9.88** (8.01-12.4)	**11.3** (8.88-14.6)	**13.2** (9.98-17.8)	**14.7** (10.8-20.6)

[1] Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values.

Please refer to NOAA Atlas 14 document for more information.

Estimates from the table in CSV format: Precipitation frequency estimates Submit

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<u>Existing Condition (Entire Site)</u>
Time of Concentration (Tc)
Volume (Vol)
Flowrate (Q)

```
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                          Analysis prepared by:

                            THIENES ENGINEERING
                          16800 VALLEY VIEW AVENUE
                             LA MIRADA CA 90638
                    PH: (714) 521-4811 FAX: (714) 521-4173

 ************************* DESCRIPTION OF STUDY *************************
* TEI JOB NO. 4099                                                      *
* EXISTING CONDITION (NODES 100-104)                                    *
* 10-YEAR STORM EVENT                                                   *
 ************************************************************************

  FILE NAME: C:\XDRIVE\4099\E100-10.DAT
  TIME/DATE OF STUDY: 10:18 08/14/2024
========================================================================
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
========================================================================
                    --*TIME-OF-CONCENTRATION MODEL*--

  USER SPECIFIED STORM EVENT(YEAR) =   10.00
  SPECIFIED MINIMUM PIPE SIZE(INCH) =  12.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.95
  *USER-DEFINED LOGARITHMIC INTERPOLATION USED FOR RAINFALL*

  SLOPE OF INTENSITY DURATION CURVE(LOG(I;IN/HR) vs. LOG(Tc;MIN)) = 0.6000
  USER SPECIFIED 1-HOUR INTENSITY(INCH/HOUR) = 0.5900

  *ANTECEDENT MOISTURE CONDITION (AMC) II ASSUMED FOR RATIONAL METHOD*


************************************************************************
  FLOW PROCESS FROM NODE    100.00 TO NODE    101.00 IS CODE =  21
------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
========================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =  1000.00
  ELEVATION DATA: UPSTREAM(FEET) =   3027.77  DOWNSTREAM(FEET) =   3009.80

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =   18.589
  *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  1.192
  SUBAREA Tc AND LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap      SCS   Tc
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  NATURAL POOR COVER
  "BARREN"                   C        4.67      0.18      1.00    91   18.59
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.18
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.00
  SUBAREA RUNOFF(CFS) =      4.25
  TOTAL AREA(ACRES) =      4.67   PEAK FLOW RATE(CFS) =      4.25

************************************************************************
  FLOW PROCESS FROM NODE    101.00 TO NODE    102.00 IS CODE =  52
------------------------------------------------------------------------
  >>>>>COMPUTE NATURAL VALLEY CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA<<<<<
========================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   3009.80  DOWNSTREAM(FEET) =   2999.18
  CHANNEL LENGTH THRU SUBAREA(FEET) =   618.00   CHANNEL SLOPE =  0.0172
  CHANNEL FLOW THRU SUBAREA(CFS) =      4.25
  FLOW VELOCITY(FEET/SEC) =   2.66 (PER LACFCD/RCFC&WCD HYDROLOGY MANUAL)
  TRAVEL TIME(MIN.) =   3.87   Tc(MIN.) =  22.46
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    102.00 =  1618.00 FEET.
```

```
****************************************************************************
  FLOW PROCESS FROM NODE    102.00 TO NODE    102.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN) =  22.46
  *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  1.064
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp          Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  NATURAL POOR COVER
  "BARREN"                   C        6.82      0.18      1.00    91
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.18
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.00
  SUBAREA AREA(ACRES) =    6.82      SUBAREA RUNOFF(CFS) =    5.43
  EFFECTIVE AREA(ACRES) =    11.49   AREA-AVERAGED Fm(INCH/HR) =  0.18
  AREA-AVERAGED Fp(INCH/HR) =  0.18  AREA-AVERAGED Ap =  1.00
  TOTAL AREA(ACRES) =    11.49       PEAK FLOW RATE(CFS) =       9.14

****************************************************************************
  FLOW PROCESS FROM NODE    102.00 TO NODE    103.00 IS CODE =  52
----------------------------------------------------------------------------
  >>>>>COMPUTE NATURAL VALLEY CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   2999.18  DOWNSTREAM(FEET) =   2990.20
  CHANNEL LENGTH THRU SUBAREA(FEET) =   638.00   CHANNEL SLOPE =  0.0141
  CHANNEL FLOW THRU SUBAREA(CFS) =      9.14
  FLOW VELOCITY(FEET/SEC) =   2.90 (PER LACFCD/RCFC&WCD HYDROLOGY MANUAL)
  TRAVEL TIME(MIN.) =   3.67   Tc(MIN.) =  26.12
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    103.00 =  2256.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    103.00 TO NODE    103.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN) =  26.12
  *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  0.972
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp          Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  NATURAL POOR COVER
  "BARREN"                   C       10.22      0.18      1.00    91
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.18
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.00
  SUBAREA AREA(ACRES) =   10.22      SUBAREA RUNOFF(CFS) =    7.28
  EFFECTIVE AREA(ACRES) =    21.71   AREA-AVERAGED Fm(INCH/HR) =  0.18
  AREA-AVERAGED Fp(INCH/HR) =  0.18  AREA-AVERAGED Ap =  1.00
  TOTAL AREA(ACRES) =    21.71       PEAK FLOW RATE(CFS) =      15.47

****************************************************************************
  FLOW PROCESS FROM NODE    103.00 TO NODE    104.00 IS CODE =  52
----------------------------------------------------------------------------
  >>>>>COMPUTE NATURAL VALLEY CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   2990.20  DOWNSTREAM(FEET) =   2974.34
  CHANNEL LENGTH THRU SUBAREA(FEET) =  1222.00   CHANNEL SLOPE =  0.0130
  CHANNEL FLOW THRU SUBAREA(CFS) =     15.47
  FLOW VELOCITY(FEET/SEC) =   3.19 (PER LACFCD/RCFC&WCD HYDROLOGY MANUAL)
  TRAVEL TIME(MIN.) =   6.39   Tc(MIN.) =  32.51
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    104.00 =  3478.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    104.00 TO NODE    104.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN) =  32.51
  *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  0.852
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp          Ap     SCS
```

```
      LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  NATURAL POOR COVER
  "BARREN"                    C       10.54      0.18       1.00    91
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.18
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.00
  SUBAREA AREA(ACRES) =   10.54      SUBAREA RUNOFF(CFS) =    6.38
  EFFECTIVE AREA(ACRES) =    32.25   AREA-AVERAGED Fm(INCH/HR) =  0.18
  AREA-AVERAGED Fp(INCH/HR) =  0.18  AREA-AVERAGED Ap =  1.00
  TOTAL AREA(ACRES) =    32.25       PEAK FLOW RATE(CFS) =      19.51
================================================================================
  END OF STUDY SUMMARY:
  TOTAL AREA(ACRES)      =     32.25  TC(MIN.) =     32.51
  EFFECTIVE AREA(ACRES) =     32.25  AREA-AVERAGED Fm(INCH/HR)=  0.18
  AREA-AVERAGED Fp(INCH/HR) =  0.18  AREA-AVERAGED Ap =  1.00
  PEAK FLOW RATE(CFS)    =     19.51
================================================================================
================================================================================
  END OF RATIONAL METHOD ANALYSIS

1
```

```
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                        Analysis prepared by:

                         THIENES ENGINEERING
                       16800 VALLEY VIEW AVENUE
                          LA MIRADA CA 90638
                  PH: (714) 521-4811 FAX: (714) 521-4173

 ************************* DESCRIPTION OF STUDY *************************
* TEI JOB NO. 4099                                                      *
* EXISTING CONDITION (NODES 200-204)                                    *
* 10-YEAR STORM EVENT                                                   *
 ************************************************************************

  FILE NAME: C:\XDRIVE\4099\E200-10.DAT
  TIME/DATE OF STUDY: 10:20 08/14/2024
========================================================================
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
========================================================================
                    --*TIME-OF-CONCENTRATION MODEL*--

  USER SPECIFIED STORM EVENT(YEAR) =   10.00
  SPECIFIED MINIMUM PIPE SIZE(INCH) =  12.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.95
  *USER-DEFINED LOGARITHMIC INTERPOLATION USED FOR RAINFALL*

  SLOPE OF INTENSITY DURATION CURVE(LOG(I;IN/HR) vs. LOG(Tc;MIN)) = 0.6000
  USER SPECIFIED 1-HOUR INTENSITY(INCH/HOUR) = 0.5900

  *ANTECEDENT MOISTURE CONDITION (AMC) II ASSUMED FOR RATIONAL METHOD*


************************************************************************
  FLOW PROCESS FROM NODE    200.00 TO NODE    201.00 IS CODE =  21
------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
========================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =  1000.00
  ELEVATION DATA: UPSTREAM(FEET) =   3045.90  DOWNSTREAM(FEET) =   3021.14

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =   17.434
  *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  1.239
  SUBAREA Tc AND LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap      SCS   Tc
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  NATURAL POOR COVER
  "BARREN"                   C        5.02      0.18      1.00    91   17.43
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.18
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.00
  SUBAREA RUNOFF(CFS) =      4.78
  TOTAL AREA(ACRES) =      5.02   PEAK FLOW RATE(CFS) =      4.78

************************************************************************
  FLOW PROCESS FROM NODE    201.00 TO NODE    202.00 IS CODE =  52
------------------------------------------------------------------------
  >>>>>COMPUTE NATURAL VALLEY CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA<<<<<
========================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   3021.14  DOWNSTREAM(FEET) =   3003.58
  CHANNEL LENGTH THRU SUBAREA(FEET) =   946.00   CHANNEL SLOPE =  0.0186
  CHANNEL FLOW THRU SUBAREA(CFS) =      4.78
  FLOW VELOCITY(FEET/SEC) =   2.84 (PER LACFCD/RCFC&WCD HYDROLOGY MANUAL)
  TRAVEL TIME(MIN.) =   5.54   Tc(MIN.) =  22.98
  LONGEST FLOWPATH FROM NODE    200.00 TO NODE    202.00 =  1946.00 FEET.
```

```
****************************************************************************
  FLOW PROCESS FROM NODE    202.00 TO NODE    202.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN) =  22.98
  *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  1.049
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  NATURAL POOR COVER
  "BARREN"                    C        7.07      0.18      1.00    91
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.18
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.00
  SUBAREA AREA(ACRES) =    7.07      SUBAREA RUNOFF(CFS) =    5.53
  EFFECTIVE AREA(ACRES) =    12.09   AREA-AVERAGED Fm(INCH/HR) =  0.18
  AREA-AVERAGED Fp(INCH/HR) =  0.18  AREA-AVERAGED Ap =  1.00
  TOTAL AREA(ACRES) =    12.09       PEAK FLOW RATE(CFS) =       9.46

****************************************************************************
  FLOW PROCESS FROM NODE    202.00 TO NODE    203.00 IS CODE =  52
----------------------------------------------------------------------------
  >>>>>COMPUTE NATURAL VALLEY CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   3003.58  DOWNSTREAM(FEET) =   2991.60
  CHANNEL LENGTH THRU SUBAREA(FEET) =   706.00   CHANNEL SLOPE =  0.0170
  CHANNEL FLOW THRU SUBAREA(CFS) =      9.46
  FLOW VELOCITY(FEET/SEC) =   3.21 (PER LACFCD/RCFC&WCD HYDROLOGY MANUAL)
  TRAVEL TIME(MIN.) =   3.67   Tc(MIN.) =  26.64
  LONGEST FLOWPATH FROM NODE    200.00 TO NODE    203.00 =  2652.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    203.00 TO NODE    203.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN) =  26.64
  *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  0.960
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  NATURAL POOR COVER
  "BARREN"                    C       10.32      0.18      1.00    91
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.18
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.00
  SUBAREA AREA(ACRES) =   10.32      SUBAREA RUNOFF(CFS) =    7.25
  EFFECTIVE AREA(ACRES) =    22.41   AREA-AVERAGED Fm(INCH/HR) =  0.18
  AREA-AVERAGED Fp(INCH/HR) =  0.18  AREA-AVERAGED Ap =  1.00
  TOTAL AREA(ACRES) =    22.41       PEAK FLOW RATE(CFS) =      15.74

****************************************************************************
  FLOW PROCESS FROM NODE    203.00 TO NODE    204.00 IS CODE =  52
----------------------------------------------------------------------------
  >>>>>COMPUTE NATURAL VALLEY CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   2991.60  DOWNSTREAM(FEET) =   2974.34
  CHANNEL LENGTH THRU SUBAREA(FEET) =  1326.00   CHANNEL SLOPE =  0.0130
  CHANNEL FLOW THRU SUBAREA(CFS) =     15.74
  FLOW VELOCITY(FEET/SEC) =   3.21 (PER LACFCD/RCFC&WCD HYDROLOGY MANUAL)
  TRAVEL TIME(MIN.) =   6.89   Tc(MIN.) =  33.53
  LONGEST FLOWPATH FROM NODE    200.00 TO NODE    204.00 =  3978.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    204.00 TO NODE    204.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN) =  33.53
  *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  0.836
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
```

```
      LAND USE            GROUP   (ACRES)   (INCH/HR)   (DECIMAL)   CN
  NATURAL POOR COVER
  "BARREN"                    C       12.40       0.18        1.00    91
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.18
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.00
  SUBAREA AREA(ACRES) =   12.40      SUBAREA RUNOFF(CFS) =    7.33
  EFFECTIVE AREA(ACRES) =    34.81   AREA-AVERAGED Fm(INCH/HR) =  0.18
  AREA-AVERAGED Fp(INCH/HR) =  0.18  AREA-AVERAGED Ap =  1.00
  TOTAL AREA(ACRES) =    34.81       PEAK FLOW RATE(CFS) =      20.57
================================================================================
  END OF STUDY SUMMARY:
  TOTAL AREA(ACRES)      =     34.81  TC(MIN.) =     33.53
  EFFECTIVE AREA(ACRES) =     34.81  AREA-AVERAGED Fm(INCH/HR)=  0.18
  AREA-AVERAGED Fp(INCH/HR) =  0.18  AREA-AVERAGED Ap =  1.00
  PEAK FLOW RATE(CFS)    =     20.57
================================================================================
================================================================================
  END OF RATIONAL METHOD ANALYSIS

1
```

```
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                        Analysis prepared by:

                         THIENES ENGINEERING
                       16800 VALLEY VIEW AVENUE
                          LA MIRADA CA 90638
                  PH: (714) 521-4811 FAX: (714) 521-4173

 ************************* DESCRIPTION OF STUDY *************************
* TEI JOB NO. 4099                                                      *
* EXISTING CONDITION (NODES 300-306)                                    *
* 10-YEAR STORM EVENT                                                   *
 ************************************************************************

  FILE NAME: C:\XDRIVE\4099\E300-10.DAT
  TIME/DATE OF STUDY: 10:25 08/14/2024
========================================================================
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
========================================================================
                    --*TIME-OF-CONCENTRATION MODEL*--

  USER SPECIFIED STORM EVENT(YEAR) =   10.00
  SPECIFIED MINIMUM PIPE SIZE(INCH) =  12.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.95
  *USER-DEFINED LOGARITHMIC INTERPOLATION USED FOR RAINFALL*

  SLOPE OF INTENSITY DURATION CURVE(LOG(I;IN/HR) vs. LOG(Tc;MIN)) = 0.6000
  USER SPECIFIED 1-HOUR INTENSITY(INCH/HOUR) = 0.5900

  *ANTECEDENT MOISTURE CONDITION (AMC) II ASSUMED FOR RATIONAL METHOD*


************************************************************************
  FLOW PROCESS FROM NODE    300.00 TO NODE    301.00 IS CODE =  21
------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
========================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =  1000.00
  ELEVATION DATA: UPSTREAM(FEET) =   3079.60  DOWNSTREAM(FEET) =   3048.50

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =   16.657
  *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  1.273
  SUBAREA Tc AND LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap      SCS   Tc
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  NATURAL POOR COVER
  "BARREN"                   C        4.31      0.18      1.00    91   16.66
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.18
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.00
  SUBAREA RUNOFF(CFS) =      4.24
  TOTAL AREA(ACRES) =      4.31   PEAK FLOW RATE(CFS) =      4.24

************************************************************************
  FLOW PROCESS FROM NODE    301.00 TO NODE    302.00 IS CODE =  52
------------------------------------------------------------------------
  >>>>>COMPUTE NATURAL VALLEY CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA<<<<<
========================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   3048.50  DOWNSTREAM(FEET) =   3033.50
  CHANNEL LENGTH THRU SUBAREA(FEET) =   525.00   CHANNEL SLOPE =  0.0286
  CHANNEL FLOW THRU SUBAREA(CFS) =      4.24
  FLOW VELOCITY(FEET/SEC) =   3.43 (PER LACFCD/RCFC&WCD HYDROLOGY MANUAL)
  TRAVEL TIME(MIN.) =   2.55   Tc(MIN.) =  19.21
  LONGEST FLOWPATH FROM NODE    300.00 TO NODE    302.00 =  1525.00 FEET.
```

```
****************************************************************************
  FLOW PROCESS FROM NODE    302.00 TO NODE    302.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN) =  19.21
  *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  1.169
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  NATURAL POOR COVER
  "BARREN"                   C        6.23      0.18      1.00    91
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.18
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.00
  SUBAREA AREA(ACRES) =    6.23      SUBAREA RUNOFF(CFS) =    5.54
  EFFECTIVE AREA(ACRES) =    10.54   AREA-AVERAGED Fm(INCH/HR) =  0.18
  AREA-AVERAGED Fp(INCH/HR) =  0.18  AREA-AVERAGED Ap =  1.00
  TOTAL AREA(ACRES) =    10.54       PEAK FLOW RATE(CFS) =       9.38

****************************************************************************
  FLOW PROCESS FROM NODE    302.00 TO NODE    303.00 IS CODE =  52
----------------------------------------------------------------------------
  >>>>>COMPUTE NATURAL VALLEY CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   3033.50  DOWNSTREAM(FEET) =   3019.50
  CHANNEL LENGTH THRU SUBAREA(FEET) =   540.00   CHANNEL SLOPE =  0.0259
  CHANNEL FLOW THRU SUBAREA(CFS) =      9.38
  FLOW VELOCITY(FEET/SEC) =   3.96 (PER LACFCD/RCFC&WCD HYDROLOGY MANUAL)
  TRAVEL TIME(MIN.) =   2.27   Tc(MIN.) =  21.48
  LONGEST FLOWPATH FROM NODE    300.00 TO NODE    303.00 =  2065.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    303.00 TO NODE    303.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN) =  21.48
  *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  1.093
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  NATURAL POOR COVER
  "BARREN"                   C        9.21      0.18      1.00    91
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.18
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.00
  SUBAREA AREA(ACRES) =    9.21      SUBAREA RUNOFF(CFS) =    7.57
  EFFECTIVE AREA(ACRES) =    19.75   AREA-AVERAGED Fm(INCH/HR) =  0.18
  AREA-AVERAGED Fp(INCH/HR) =  0.18  AREA-AVERAGED Ap =  1.00
  TOTAL AREA(ACRES) =    19.75       PEAK FLOW RATE(CFS) =      16.22

****************************************************************************
  FLOW PROCESS FROM NODE    303.00 TO NODE    304.00 IS CODE =  52
----------------------------------------------------------------------------
  >>>>>COMPUTE NATURAL VALLEY CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   3019.50  DOWNSTREAM(FEET) =   3003.50
  CHANNEL LENGTH THRU SUBAREA(FEET) =   525.00   CHANNEL SLOPE =  0.0305
  CHANNEL FLOW THRU SUBAREA(CFS) =     16.22
  FLOW VELOCITY(FEET/SEC) =   4.95 (PER LACFCD/RCFC&WCD HYDROLOGY MANUAL)
  TRAVEL TIME(MIN.) =   1.77   Tc(MIN.) =  23.25
  LONGEST FLOWPATH FROM NODE    300.00 TO NODE    304.00 =  2590.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    304.00 TO NODE    304.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN) =  23.25
  *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  1.042
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
```

```
      LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  NATURAL POOR COVER
  "BARREN"                  C       13.74      0.18      1.00    91
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.18
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.00
  SUBAREA AREA(ACRES) =   13.74      SUBAREA RUNOFF(CFS) =   10.66
  EFFECTIVE AREA(ACRES) =    33.49   AREA-AVERAGED Fm(INCH/HR) =  0.18
  AREA-AVERAGED Fp(INCH/HR) =  0.18  AREA-AVERAGED Ap =  1.00
  TOTAL AREA(ACRES) =    33.49       PEAK FLOW RATE(CFS) =      25.98

****************************************************************************
  FLOW PROCESS FROM NODE    304.00 TO NODE    305.00 IS CODE =  52
----------------------------------------------------------------------------
  >>>>>COMPUTE NATURAL VALLEY CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   3003.50  DOWNSTREAM(FEET) =   2984.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =  1126.00   CHANNEL SLOPE =  0.0173
  CHANNEL FLOW THRU SUBAREA(CFS) =     25.98
  FLOW VELOCITY(FEET/SEC) =   4.23 (PER LACFCD/RCFC&WCD HYDROLOGY MANUAL)
  TRAVEL TIME(MIN.) =   4.43   Tc(MIN.) =  27.68
  LONGEST FLOWPATH FROM NODE    300.00 TO NODE    305.00 =  3716.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    305.00 TO NODE    305.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN) =  27.68
  *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  0.939
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap     SCS
      LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  NATURAL POOR COVER
  "BARREN"                  C       16.84      0.18      1.00    91
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.18
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.00
  SUBAREA AREA(ACRES) =   16.84      SUBAREA RUNOFF(CFS) =   11.50
  EFFECTIVE AREA(ACRES) =    50.33   AREA-AVERAGED Fm(INCH/HR) =  0.18
  AREA-AVERAGED Fp(INCH/HR) =  0.18  AREA-AVERAGED Ap =  1.00
  TOTAL AREA(ACRES) =    50.33       PEAK FLOW RATE(CFS) =      34.36

****************************************************************************
  FLOW PROCESS FROM NODE    305.00 TO NODE    306.00 IS CODE =  52
----------------------------------------------------------------------------
  >>>>>COMPUTE NATURAL VALLEY CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   2984.00  DOWNSTREAM(FEET) =   2979.30
  CHANNEL LENGTH THRU SUBAREA(FEET) =   374.00   CHANNEL SLOPE =  0.0126
  CHANNEL FLOW THRU SUBAREA(CFS) =     34.36
  FLOW VELOCITY(FEET/SEC) =   3.90 (PER LACFCD/RCFC&WCD HYDROLOGY MANUAL)
  TRAVEL TIME(MIN.) =   1.60   Tc(MIN.) =  29.28
  LONGEST FLOWPATH FROM NODE    300.00 TO NODE    306.00 =  4090.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    306.00 TO NODE    306.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN) =  29.28
  *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  0.907
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap     SCS
      LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  NATURAL POOR COVER
  "BARREN"                  C       13.56      0.18      1.00    91
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.18
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.00
  SUBAREA AREA(ACRES) =   13.56      SUBAREA RUNOFF(CFS) =    8.88
  EFFECTIVE AREA(ACRES) =    63.89   AREA-AVERAGED Fm(INCH/HR) =  0.18
  AREA-AVERAGED Fp(INCH/HR) =  0.18  AREA-AVERAGED Ap =  1.00
  TOTAL AREA(ACRES) =    63.89       PEAK FLOW RATE(CFS) =      41.83
```

```
================================================================================
  END OF STUDY SUMMARY:
  TOTAL AREA(ACRES)      =     63.89  TC(MIN.) =      29.28
  EFFECTIVE AREA(ACRES) =     63.89  AREA-AVERAGED Fm(INCH/HR)=  0.18
  AREA-AVERAGED Fp(INCH/HR) =  0.18  AREA-AVERAGED Ap =  1.00
  PEAK FLOW RATE(CFS)    =     41.83
================================================================================
================================================================================
  END OF RATIONAL METHOD ANALYSIS

1
```

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************************************************************************
          RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE
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 ************************* DESCRIPTION OF STUDY *************************
* TEI JOB NO. 4099                                                      *
* EXISTING CONDITION (NODES 400-405)                                    *
* 10-YEAR STORM EVENT                                                   *
 ************************************************************************

  FILE NAME: C:\XDRIVE\4099\E400-10.DAT
  TIME/DATE OF STUDY: 10:27 08/14/2024
========================================================================
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
========================================================================
                    --*TIME-OF-CONCENTRATION MODEL*--

  USER SPECIFIED STORM EVENT(YEAR) =   10.00
  SPECIFIED MINIMUM PIPE SIZE(INCH) =  12.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.95
  *USER-DEFINED LOGARITHMIC INTERPOLATION USED FOR RAINFALL*

  SLOPE OF INTENSITY DURATION CURVE(LOG(I;IN/HR) vs. LOG(Tc;MIN)) = 0.6000
  USER SPECIFIED 1-HOUR INTENSITY(INCH/HOUR) = 0.5900

  *ANTECEDENT MOISTURE CONDITION (AMC) II ASSUMED FOR RATIONAL METHOD*


************************************************************************
  FLOW PROCESS FROM NODE    400.00 TO NODE    401.00 IS CODE =  21
------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
========================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =  1000.00
  ELEVATION DATA: UPSTREAM(FEET) =   3079.78  DOWNSTREAM(FEET) =   3050.71

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =   16.884
  *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  1.263
  SUBAREA Tc AND LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap      SCS   Tc
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  NATURAL POOR COVER
  "BARREN"                   C        4.87      0.18      1.00    91   16.88
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.18
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.00
  SUBAREA RUNOFF(CFS) =      4.74
  TOTAL AREA(ACRES) =      4.87   PEAK FLOW RATE(CFS) =      4.74

************************************************************************
  FLOW PROCESS FROM NODE    401.00 TO NODE    402.00 IS CODE =  52
------------------------------------------------------------------------
  >>>>>COMPUTE NATURAL VALLEY CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA<<<<<
========================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   3050.71  DOWNSTREAM(FEET) =   3029.01
  CHANNEL LENGTH THRU SUBAREA(FEET) =   766.00   CHANNEL SLOPE =  0.0283
  CHANNEL FLOW THRU SUBAREA(CFS) =      4.74
  FLOW VELOCITY(FEET/SEC) =   3.51 (PER LACFCD/RCFC&WCD HYDROLOGY MANUAL)
  TRAVEL TIME(MIN.) =   3.64   Tc(MIN.) =  20.52
  LONGEST FLOWPATH FROM NODE    400.00 TO NODE    402.00 =  1766.00 FEET.
```

```
****************************************************************************
  FLOW PROCESS FROM NODE    402.00 TO NODE    402.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN) =  20.52
  *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  1.123
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  NATURAL POOR COVER
  "BARREN"                   C        6.98      0.18      1.00    91
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.18
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.00
  SUBAREA AREA(ACRES) =    6.98      SUBAREA RUNOFF(CFS) =    5.92
  EFFECTIVE AREA(ACRES) =    11.85   AREA-AVERAGED Fm(INCH/HR) =  0.18
  AREA-AVERAGED Fp(INCH/HR) =  0.18  AREA-AVERAGED Ap =  1.00
  TOTAL AREA(ACRES) =    11.85       PEAK FLOW RATE(CFS) =      10.06

****************************************************************************
  FLOW PROCESS FROM NODE    402.00 TO NODE    403.00 IS CODE =  52
----------------------------------------------------------------------------
  >>>>>COMPUTE NATURAL VALLEY CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   3029.01  DOWNSTREAM(FEET) =   3016.92
  CHANNEL LENGTH THRU SUBAREA(FEET) =   531.00   CHANNEL SLOPE =  0.0228
  CHANNEL FLOW THRU SUBAREA(CFS) =     10.06
  FLOW VELOCITY(FEET/SEC) =   3.78 (PER LACFCD/RCFC&WCD HYDROLOGY MANUAL)
  TRAVEL TIME(MIN.) =   2.34   Tc(MIN.) =  22.87
  LONGEST FLOWPATH FROM NODE    400.00 TO NODE    403.00 =  2297.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    403.00 TO NODE    403.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN) =  22.87
  *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  1.052
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  NATURAL POOR COVER
  "BARREN"                   C       10.44      0.18      1.00    91
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.18
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.00
  SUBAREA AREA(ACRES) =   10.44      SUBAREA RUNOFF(CFS) =    8.20
  EFFECTIVE AREA(ACRES) =    22.29   AREA-AVERAGED Fm(INCH/HR) =  0.18
  AREA-AVERAGED Fp(INCH/HR) =  0.18  AREA-AVERAGED Ap =  1.00
  TOTAL AREA(ACRES) =    22.29       PEAK FLOW RATE(CFS) =      17.50

****************************************************************************
  FLOW PROCESS FROM NODE    403.00 TO NODE    404.00 IS CODE =  52
----------------------------------------------------------------------------
  >>>>>COMPUTE NATURAL VALLEY CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   3016.92  DOWNSTREAM(FEET) =   2997.88
  CHANNEL LENGTH THRU SUBAREA(FEET) =   875.00   CHANNEL SLOPE =  0.0218
  CHANNEL FLOW THRU SUBAREA(CFS) =     17.50
  FLOW VELOCITY(FEET/SEC) =   4.26 (PER LACFCD/RCFC&WCD HYDROLOGY MANUAL)
  TRAVEL TIME(MIN.) =   3.42   Tc(MIN.) =  26.29
  LONGEST FLOWPATH FROM NODE    400.00 TO NODE    404.00 =  3172.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    404.00 TO NODE    404.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN) =  26.29
  *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  0.968
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
```

```
      LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  NATURAL POOR COVER
  "BARREN"                   C       15.40      0.18       1.00    91
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.18
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.00
  SUBAREA AREA(ACRES) =   15.40      SUBAREA RUNOFF(CFS) =   10.92
  EFFECTIVE AREA(ACRES) =    37.69   AREA-AVERAGED Fm(INCH/HR) =  0.18
  AREA-AVERAGED Fp(INCH/HR) =  0.18  AREA-AVERAGED Ap =  1.00
  TOTAL AREA(ACRES) =    37.69       PEAK FLOW RATE(CFS) =      26.73

****************************************************************************
  FLOW PROCESS FROM NODE    404.00 TO NODE    405.00 IS CODE =  52
----------------------------------------------------------------------------
  >>>>>COMPUTE NATURAL VALLEY CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   2997.88  DOWNSTREAM(FEET) =   2982.64
  CHANNEL LENGTH THRU SUBAREA(FEET) =   906.00   CHANNEL SLOPE =  0.0168
  CHANNEL FLOW THRU SUBAREA(CFS) =     26.73
  FLOW VELOCITY(FEET/SEC) =   4.21 (PER LACFCD/RCFC&WCD HYDROLOGY MANUAL)
  TRAVEL TIME(MIN.) =   3.59   Tc(MIN.) =  29.88
  LONGEST FLOWPATH FROM NODE    400.00 TO NODE    405.00 =  4078.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    405.00 TO NODE    405.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN) =  29.88
  *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  0.896
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS
      LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  NATURAL POOR COVER
  "BARREN"                   C       18.64      0.18       1.00    91
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.18
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.00
  SUBAREA AREA(ACRES) =   18.64      SUBAREA RUNOFF(CFS) =   12.02
  EFFECTIVE AREA(ACRES) =    56.33   AREA-AVERAGED Fm(INCH/HR) =  0.18
  AREA-AVERAGED Fp(INCH/HR) =  0.18  AREA-AVERAGED Ap =  1.00
  TOTAL AREA(ACRES) =    56.33       PEAK FLOW RATE(CFS) =      36.32
============================================================================
  END OF STUDY SUMMARY:
  TOTAL AREA(ACRES)      =     56.33  TC(MIN.) =     29.88
  EFFECTIVE AREA(ACRES) =     56.33  AREA-AVERAGED Fm(INCH/HR)=  0.18
  AREA-AVERAGED Fp(INCH/HR) =  0.18  AREA-AVERAGED Ap =  1.00
  PEAK FLOW RATE(CFS)    =     36.32
============================================================================
============================================================================
  END OF RATIONAL METHOD ANALYSIS

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```

```
************************************************************************
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                          Analysis prepared by:

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 ************************* DESCRIPTION OF STUDY *************************
* TEI JOB NO. 4099                                                      *
* EXISTING CONDITION (NODES 500-503)                                    *
* 10-YEAR STORM EVENT                                                   *
 ************************************************************************

  FILE NAME: C:\XDRIVE\4099\E500-10.DAT
  TIME/DATE OF STUDY: 10:29 08/14/2024
========================================================================
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
========================================================================
                    --*TIME-OF-CONCENTRATION MODEL*--

  USER SPECIFIED STORM EVENT(YEAR) =   10.00
  SPECIFIED MINIMUM PIPE SIZE(INCH) =  12.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.95
  *USER-DEFINED LOGARITHMIC INTERPOLATION USED FOR RAINFALL*

  SLOPE OF INTENSITY DURATION CURVE(LOG(I;IN/HR) vs. LOG(Tc;MIN)) = 0.6000
  USER SPECIFIED 1-HOUR INTENSITY(INCH/HOUR) = 0.5900

  *ANTECEDENT MOISTURE CONDITION (AMC) II ASSUMED FOR RATIONAL METHOD*


************************************************************************
  FLOW PROCESS FROM NODE    500.00 TO NODE    501.00 IS CODE =  21
------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
========================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   761.00
  ELEVATION DATA: UPSTREAM(FEET) =   3065.93  DOWNSTREAM(FEET) =   3042.00

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =   14.901
  *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  1.361
  SUBAREA Tc AND LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap      SCS   Tc
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  NATURAL POOR COVER
  "BARREN"                   C        3.32      0.18      1.00    91   14.90
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.18
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.00
  SUBAREA RUNOFF(CFS) =      3.53
  TOTAL AREA(ACRES) =      3.32   PEAK FLOW RATE(CFS) =      3.53

************************************************************************
  FLOW PROCESS FROM NODE    501.00 TO NODE    502.00 IS CODE =  52
------------------------------------------------------------------------
  >>>>>COMPUTE NATURAL VALLEY CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA<<<<<
========================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   3042.00  DOWNSTREAM(FEET) =   3009.80
  CHANNEL LENGTH THRU SUBAREA(FEET) =  1164.00   CHANNEL SLOPE =  0.0277
  CHANNEL FLOW THRU SUBAREA(CFS) =      3.53
  FLOW VELOCITY(FEET/SEC) =   3.24 (PER LACFCD/RCFC&WCD HYDROLOGY MANUAL)
  TRAVEL TIME(MIN.) =   5.99   Tc(MIN.) =  20.89
  LONGEST FLOWPATH FROM NODE    500.00 TO NODE    502.00 =  1925.00 FEET.
```

```
****************************************************************************
  FLOW PROCESS FROM NODE    502.00 TO NODE    502.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN) =  20.89
  *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  1.111
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp          Ap      SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  NATURAL POOR COVER
  "BARREN"                   C        6.48      0.18      1.00    91
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.18
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.00
  SUBAREA AREA(ACRES) =    6.48      SUBAREA RUNOFF(CFS) =    5.43
  EFFECTIVE AREA(ACRES) =     9.80   AREA-AVERAGED Fm(INCH/HR) =  0.18
  AREA-AVERAGED Fp(INCH/HR) =  0.18  AREA-AVERAGED Ap =  1.00
  TOTAL AREA(ACRES) =     9.80       PEAK FLOW RATE(CFS) =       8.21

****************************************************************************
  FLOW PROCESS FROM NODE    502.00 TO NODE    503.00 IS CODE =  52
----------------------------------------------------------------------------
  >>>>>COMPUTE NATURAL VALLEY CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   3009.80  DOWNSTREAM(FEET) =   2998.21
  CHANNEL LENGTH THRU SUBAREA(FEET) =   501.00   CHANNEL SLOPE =  0.0231
  CHANNEL FLOW THRU SUBAREA(CFS) =      8.21
  FLOW VELOCITY(FEET/SEC) =   3.62 (PER LACFCD/RCFC&WCD HYDROLOGY MANUAL)
  TRAVEL TIME(MIN.) =   2.31   Tc(MIN.) =  23.20
  LONGEST FLOWPATH FROM NODE    500.00 TO NODE    503.00 =  2426.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    503.00 TO NODE    503.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN) =  23.20
  *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  1.043
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp          Ap      SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  NATURAL POOR COVER
  "BARREN"                   C        3.68      0.18      1.00    91
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.18
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.00
  SUBAREA AREA(ACRES) =    3.68      SUBAREA RUNOFF(CFS) =    2.86
  EFFECTIVE AREA(ACRES) =    13.48   AREA-AVERAGED Fm(INCH/HR) =  0.18
  AREA-AVERAGED Fp(INCH/HR) =  0.18  AREA-AVERAGED Ap =  1.00
  TOTAL AREA(ACRES) =    13.48       PEAK FLOW RATE(CFS) =      10.47
============================================================================
  END OF STUDY SUMMARY:
  TOTAL AREA(ACRES)      =     13.48  TC(MIN.) =     23.20
  EFFECTIVE AREA(ACRES) =     13.48  AREA-AVERAGED Fm(INCH/HR)=  0.18
  AREA-AVERAGED Fp(INCH/HR) =  0.18  AREA-AVERAGED Ap =  1.00
  PEAK FLOW RATE(CFS)    =     10.47
============================================================================
============================================================================
  END OF RATIONAL METHOD ANALYSIS

1
```

```
************************************************************************
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                          Analysis prepared by:

                            THIENES ENGINEERING
                          16800 VALLEY VIEW AVENUE
                             LA MIRADA CA 90638
                   PH: (714) 521-4811 FAX: (714) 521-4173

 ************************* DESCRIPTION OF STUDY *************************
* TEI JOB NO. 4099                                                      *
* EXISTING CONDITION (NODES 600-603)                                    *
* 10-YEAR STORM EVENT                                                   *
 ************************************************************************

  FILE NAME: C:\XDRIVE\4099\E600-10.DAT
  TIME/DATE OF STUDY: 10:30 08/14/2024
========================================================================
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
========================================================================
                    --*TIME-OF-CONCENTRATION MODEL*--

  USER SPECIFIED STORM EVENT(YEAR) =   10.00
  SPECIFIED MINIMUM PIPE SIZE(INCH) =  12.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.95
  *USER-DEFINED LOGARITHMIC INTERPOLATION USED FOR RAINFALL*

  SLOPE OF INTENSITY DURATION CURVE(LOG(I;IN/HR) vs. LOG(Tc;MIN)) = 0.6000
  USER SPECIFIED 1-HOUR INTENSITY(INCH/HOUR) = 0.5900

  *ANTECEDENT MOISTURE CONDITION (AMC) II ASSUMED FOR RATIONAL METHOD*


************************************************************************
  FLOW PROCESS FROM NODE    600.00 TO NODE    601.00 IS CODE =  21
------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
========================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =  1000.00
  ELEVATION DATA: UPSTREAM(FEET) =   3062.24  DOWNSTREAM(FEET) =   3033.00

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =   16.864
  *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  1.263
  SUBAREA Tc AND LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap      SCS   Tc
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  NATURAL POOR COVER
  "BARREN"                   C        4.86      0.18      1.00    91   16.86
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.18
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.00
  SUBAREA RUNOFF(CFS) =      4.74
  TOTAL AREA(ACRES) =      4.86   PEAK FLOW RATE(CFS) =      4.74

************************************************************************
  FLOW PROCESS FROM NODE    601.00 TO NODE    602.00 IS CODE =  52
------------------------------------------------------------------------
  >>>>>COMPUTE NATURAL VALLEY CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA<<<<<
========================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   3033.00  DOWNSTREAM(FEET) =   3011.70
  CHANNEL LENGTH THRU SUBAREA(FEET) =   795.00   CHANNEL SLOPE =  0.0268
  CHANNEL FLOW THRU SUBAREA(CFS) =      4.74
  FLOW VELOCITY(FEET/SEC) =   3.41 (PER LACFCD/RCFC&WCD HYDROLOGY MANUAL)
  TRAVEL TIME(MIN.) =   3.89   Tc(MIN.) =  20.75
  LONGEST FLOWPATH FROM NODE    600.00 TO NODE    602.00 =  1795.00 FEET.
```

```
****************************************************************************
  FLOW PROCESS FROM NODE    602.00 TO NODE    602.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN) =  20.75
  *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  1.116
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp          Ap      SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  NATURAL POOR COVER
  "BARREN"                   C        6.87      0.18      1.00    91
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.18
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.00
  SUBAREA AREA(ACRES) =    6.87      SUBAREA RUNOFF(CFS) =    5.79
  EFFECTIVE AREA(ACRES) =    11.73   AREA-AVERAGED Fm(INCH/HR) =  0.18
  AREA-AVERAGED Fp(INCH/HR) =  0.18  AREA-AVERAGED Ap =  1.00
  TOTAL AREA(ACRES) =    11.73       PEAK FLOW RATE(CFS) =       9.88

****************************************************************************
  FLOW PROCESS FROM NODE    602.00 TO NODE    603.00 IS CODE =  52
----------------------------------------------------------------------------
  >>>>>COMPUTE NATURAL VALLEY CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   3011.70  DOWNSTREAM(FEET) =   3003.80
  CHANNEL LENGTH THRU SUBAREA(FEET) =   370.00   CHANNEL SLOPE =  0.0214
  CHANNEL FLOW THRU SUBAREA(CFS) =      9.88
  FLOW VELOCITY(FEET/SEC) =   3.64 (PER LACFCD/RCFC&WCD HYDROLOGY MANUAL)
  TRAVEL TIME(MIN.) =   1.69   Tc(MIN.) =  22.44
  LONGEST FLOWPATH FROM NODE    600.00 TO NODE    603.00 =  2165.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    603.00 TO NODE    603.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN) =  22.44
  *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  1.064
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp          Ap      SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  NATURAL POOR COVER
  "BARREN"                   C        3.37      0.18      1.00    91
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.18
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.00
  SUBAREA AREA(ACRES) =    3.37      SUBAREA RUNOFF(CFS) =    2.68
  EFFECTIVE AREA(ACRES) =    15.10   AREA-AVERAGED Fm(INCH/HR) =  0.18
  AREA-AVERAGED Fp(INCH/HR) =  0.18  AREA-AVERAGED Ap =  1.00
  TOTAL AREA(ACRES) =    15.10       PEAK FLOW RATE(CFS) =      12.02
============================================================================
  END OF STUDY SUMMARY:
  TOTAL AREA(ACRES)      =     15.10  TC(MIN.) =     22.44
  EFFECTIVE AREA(ACRES) =     15.10  AREA-AVERAGED Fm(INCH/HR)=  0.18
  AREA-AVERAGED Fp(INCH/HR) =  0.18  AREA-AVERAGED Ap =  1.00
  PEAK FLOW RATE(CFS)    =     12.02
============================================================================
============================================================================
  END OF RATIONAL METHOD ANALYSIS

1
```

```
************************************************************************
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                        Analysis prepared by:

                         THIENES ENGINEERING
                       16800 VALLEY VIEW AVENUE
                          LA MIRADA CA 90638
                  PH: (714) 521-4811 FAX: (714) 521-4173

 ************************* DESCRIPTION OF STUDY *************************
* TEI JOB NO. 4099                                                      *
* EXISTING CONDITION (NODES 700-702)                                    *
* 10-YEAR STORM EVENT                                                   *
 ************************************************************************

  FILE NAME: C:\XDRIVE\4099\E700-10.DAT
  TIME/DATE OF STUDY: 10:32 08/14/2024
========================================================================
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
========================================================================
                    --*TIME-OF-CONCENTRATION MODEL*--

  USER SPECIFIED STORM EVENT(YEAR) =   10.00
  SPECIFIED MINIMUM PIPE SIZE(INCH) =  12.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.95
  *USER-DEFINED LOGARITHMIC INTERPOLATION USED FOR RAINFALL*

  SLOPE OF INTENSITY DURATION CURVE(LOG(I;IN/HR) vs. LOG(Tc;MIN)) = 0.6000
  USER SPECIFIED 1-HOUR INTENSITY(INCH/HOUR) = 0.5900

  *ANTECEDENT MOISTURE CONDITION (AMC) II ASSUMED FOR RATIONAL METHOD*


************************************************************************
  FLOW PROCESS FROM NODE    700.00 TO NODE    701.00 IS CODE =  21
------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
========================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   854.00
  ELEVATION DATA: UPSTREAM(FEET) =   3055.46  DOWNSTREAM(FEET) =   3028.40

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =   15.580
  *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  1.325
  SUBAREA Tc AND LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap      SCS   Tc
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  NATURAL POOR COVER
  "BARREN"                   C        4.20      0.18      1.00    91   15.58
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.18
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.00
  SUBAREA RUNOFF(CFS) =      4.33
  TOTAL AREA(ACRES) =      4.20   PEAK FLOW RATE(CFS) =      4.33

************************************************************************
  FLOW PROCESS FROM NODE    701.00 TO NODE    702.00 IS CODE =  52
------------------------------------------------------------------------
  >>>>>COMPUTE NATURAL VALLEY CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA<<<<<
========================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   3028.40  DOWNSTREAM(FEET) =   3023.30
  CHANNEL LENGTH THRU SUBAREA(FEET) =   181.00   CHANNEL SLOPE =  0.0282
  CHANNEL FLOW THRU SUBAREA(CFS) =      4.33
  FLOW VELOCITY(FEET/SEC) =   3.42 (PER LACFCD/RCFC&WCD HYDROLOGY MANUAL)
  TRAVEL TIME(MIN.) =   0.88   Tc(MIN.) =  16.46
  LONGEST FLOWPATH FROM NODE    700.00 TO NODE    702.00 =  1035.00 FEET.
```

```
****************************************************************************
  FLOW PROCESS FROM NODE    702.00 TO NODE    702.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN) =  16.46
  *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  1.282
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp          Ap      SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  NATURAL POOR COVER
  "BARREN"                    C        4.81      0.18      1.00    91
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.18
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.00
  SUBAREA AREA(ACRES) =    4.81      SUBAREA RUNOFF(CFS) =    4.77
  EFFECTIVE AREA(ACRES) =     9.01   AREA-AVERAGED Fm(INCH/HR) =  0.18
  AREA-AVERAGED Fp(INCH/HR) =  0.18  AREA-AVERAGED Ap =  1.00
  TOTAL AREA(ACRES) =     9.01       PEAK FLOW RATE(CFS) =       8.94
============================================================================
  END OF STUDY SUMMARY:
  TOTAL AREA(ACRES)      =      9.01  TC(MIN.) =     16.46
  EFFECTIVE AREA(ACRES) =       9.01  AREA-AVERAGED Fm(INCH/HR)=  0.18
  AREA-AVERAGED Fp(INCH/HR) =  0.18  AREA-AVERAGED Ap =  1.00
  PEAK FLOW RATE(CFS)    =      8.94
============================================================================
============================================================================
  END OF RATIONAL METHOD ANALYSIS

1
```

```
******************************************************************************
          NON-HOMOGENEOUS WATERSHED AREA-AVERAGED LOSS RATE (Fm)
                    AND LOW LOSS FRACTION ESTIMATIONS
==============================================================================
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                           Analysis prepared by:

                        THIENES ENGINEERING, INC.
                           14349 FIRESTONE BLVD
                           LA MIRIADA, CA 90638
                               714-521-4811

******************************************************************************
------------------------------------------------------------------------------

 Problem Descriptions:
  TEI JOB NUMBER 4099
  EXISTING CONDITIONS
  10-YEAR STORM EVENT
==============================================================================
*** NON-HOMOGENEOUS WATERSHED AREA-AVERAGED LOSS RATE (Fm)
    AND LOW LOSS FRACTION ESTIMATIONS FOR AMC I:

    TOTAL 24-HOUR DURATION RAINFALL DEPTH =     2.04 (inches)

    SOIL-COVER     AREA      PERCENT OF    SCS CURVE    LOSS RATE
       TYPE      (Acres)   PERVIOUS AREA     NUMBER    Fp(in./hr.)    YIELD
         1        224.90      100.00       90.(AMC II)     0.400       0.249

    TOTAL AREA (Acres) =    224.90

    AREA-AVERAGED LOSS RATE, Fm (in./hr.) =  0.400

    AREA-AVERAGED LOW LOSS FRACTION, Y = 0.751
==============================================================================

 Problem Descriptions:
  TEI JOB NUMBER 4099
  EXISTING CONDITIONS
  10-YEAR STORM EVENT
------------------------------------------------------------------------------


    RATIONAL METHOD CALIBRATION COEFFICIENT = 0.90
    TOTAL CATCHMENT AREA(ACRES) =  224.90
    SOIL-LOSS RATE, Fm,(INCH/HR) =  0.400
    LOW LOSS FRACTION = 0.751
    TIME OF CONCENTRATION(MIN.) = 30.25
    SMALL AREA PEAK Q COMPUTED USING PEAK FLOW RATE FORMULA
    USER SPECIFIED RAINFALL VALUES ARE USED
    RETURN FREQUENCY(YEARS) =  10
       5-MINUTE POINT RAINFALL VALUE(INCHES) =  0.20
      30-MINUTE POINT RAINFALL VALUE(INCHES) =  0.47
       1-HOUR   POINT RAINFALL VALUE(INCHES) =  0.59
       3-HOUR   POINT RAINFALL VALUE(INCHES) =  0.88
       6-HOUR   POINT RAINFALL VALUE(INCHES) =  1.18
      24-HOUR   POINT RAINFALL VALUE(INCHES) =  2.04

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

    TOTAL CATCHMENT   RUNOFF  VOLUME(ACRE-FEET) =    11.06
    TOTAL CATCHMENT SOIL-LOSS VOLUME(ACRE-FEET) =    27.17

******************************************************************************
  TIME     VOLUME       Q    0.       27.5      55.0      82.5     110.0
 (HOURS)    (AF)      (CFS)
------------------------------------------------------------------------------
  0.37      0.0260      1.70  Q         .         .         .         .
  0.88      0.0972      1.72  Q         .         .         .         .
  1.38      0.1696      1.76  Q         .         .         .         .
```

1.88	0.2435	1.79	Q	.	.	.	.
2.39	0.3191	1.84	Q	.	.	.	.
2.89	0.3962	1.87	Q	.	.	.	.
3.40	0.4752	1.92	Q	.	.	.	.
3.90	0.5560	1.95	Q	.	.	.	.
4.40	0.6388	2.02	Q	.	.	.	.
4.91	0.7237	2.06	Q	.	.	.	.
5.41	0.8109	2.13	Q	.	.	.	.
5.92	0.9006	2.17	Q	.	.	.	.
6.42	0.9929	2.26	Q	.	.	.	.
6.93	1.0881	2.31	Q	.	.	.	.
7.43	1.1864	2.41	Q	.	.	.	.
7.93	1.2880	2.47	Q	.	.	.	.
8.44	1.3935	2.59	Q	.	.	.	.
8.94	1.5030	2.66	Q	.	.	.	.
9.45	1.6171	2.82	.Q	.	.	.	.
9.95	1.7363	2.90	.Q	.	.	.	.
10.45	1.8614	3.10	.Q	.	.	.	.
10.96	1.9929	3.21	.Q	.	.	.	.
11.46	2.1322	3.47	.Q	.	.	.	.
11.97	2.2801	3.63	.Q	.	.	.	.
12.47	2.4434	4.21	.Q	.	.	.	.
12.98	2.6240	4.46	.Q	.	.	.	.
13.48	2.8220	5.05	.Q	.	.	.	.
13.98	3.0402	5.43	.Q	.	.	.	.
14.49	3.2744	5.81	. Q	.	.	.	.
14.99	3.5322	6.56	. Q	.	.	.	.
15.50	3.8677	9.55	. Q	.	.	.	.
16.00	4.3135	11.85	. Q	.	.	.	.
16.50	6.8153	108.24	.	.	.	.	Q.
17.01	9.2306	7.70	. Q	.	.	.	.
17.51	9.5138	5.90	. Q	.	.	.	.
18.02	9.7352	4.73	.Q	.	.	.	.
18.52	9.9129	3.80	.Q	.	.	.	.
19.02	10.0616	3.34	.Q	.	.	.	.
19.53	10.1936	3.00	.Q	.	.	.	.
20.03	10.3130	2.74	Q	.	.	.	.
20.54	10.4227	2.53	Q	.	.	.	.
21.04	10.5246	2.36	Q	.	.	.	.
21.55	10.6198	2.21	Q	.	.	.	.
22.05	10.7096	2.09	Q	.	.	.	.
22.55	10.7945	1.99	Q	.	.	.	.
23.06	10.8754	1.89	Q	.	.	.	.
23.56	10.9526	1.81	Q	.	.	.	.
24.07	11.0266	1.74	Q	.	.	.	.
24.57	11.0628	0.00	Q	.	.	.	.

time @ Qp

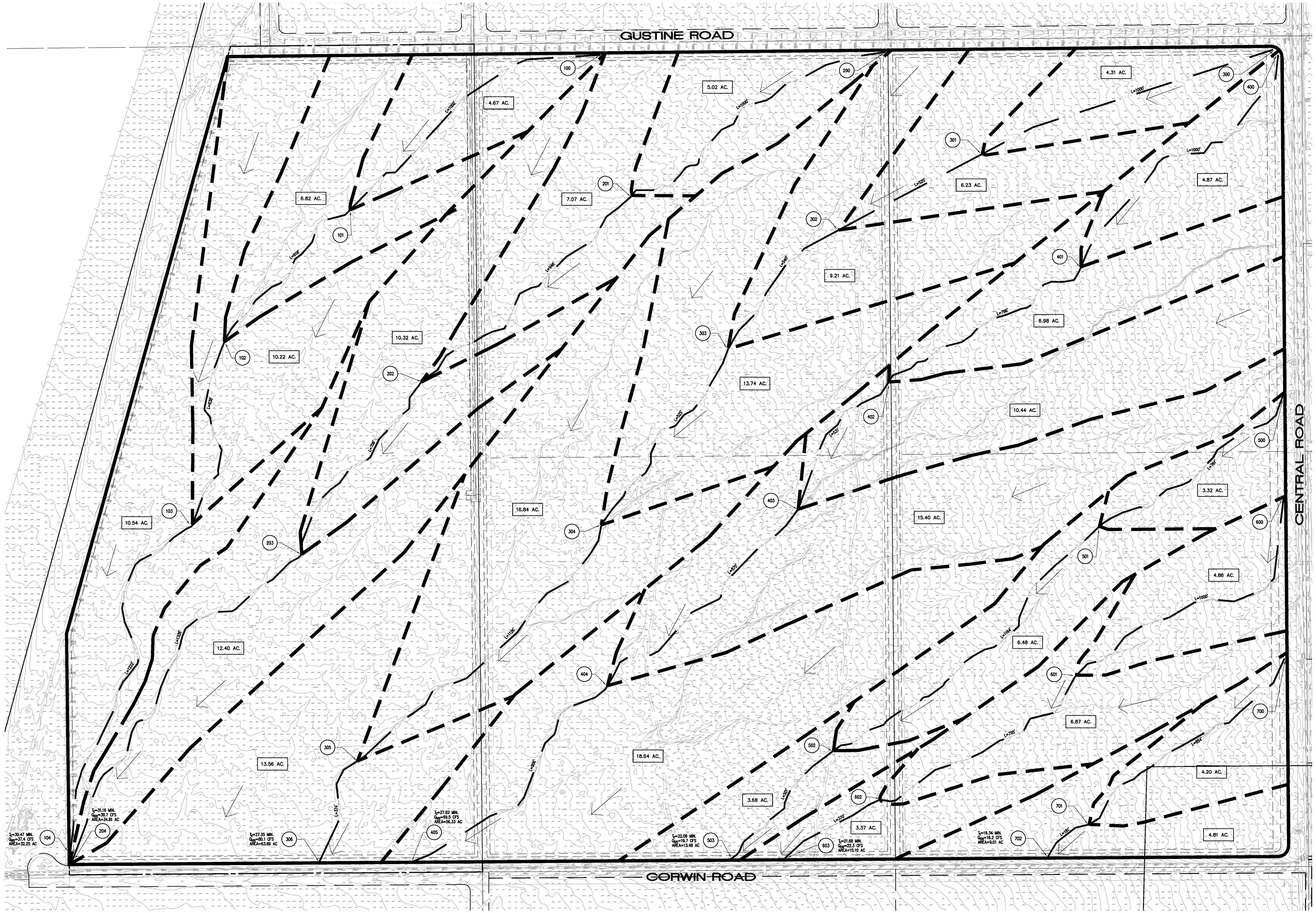
pre-development Qp

pre-development volume

TIME DURATION(minutes) OF PERCENTILES OF ESTIMATED PEAK FLOW RATE:
(Note: 100% of Peak Flow Rate estimate assumed to have
an instantaneous time duration)

Percentile of Estimated Peak Flow Rate	Duration (minutes)
0%	1452.0
10%	60.5
20%	30.2
30%	30.2
40%	30.2
50%	30.2
60%	30.2
70%	30.2
80%	30.2
90%	30.2

Existing Condition
Hydrology Map


GUSTINE ROAD
CENTRAL ROAD
CORWIN ROAD
100
200
300
400
500
600
700
101
201
301
401
501
601
701
102
202
302
402
502
602
702
103
203
303
403
503
603
104
204
304
404
504
604
305
405
306
4.67 AC.
5.02 AC.
4.31 AC.
6.82 AC.
7.07 AC.
6.23 AC.
4.87 AC.
10.22 AC.
10.32 AC.
9.21 AC.
6.98 AC.
13.74 AC.
10.44 AC.
10.54 AC.
16.84 AC.
15.40 AC.
3.32 AC.
12.40 AC.
4.86 AC.
13.56 AC.
18.64 AC.
6.48 AC.
3.68 AC.
3.37 AC.
6.87 AC.
4.20 AC.
4.81 AC.
L=2000'
L=1000'
L=1000'
L=1

Proposed Condition (DA 1 DMA A)
Time of Concentration (Tc)
Volume (Vol)
Flowrate (Q)

```
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                        Analysis prepared by:

                         THIENES ENGINEERING
                       16800 VALLEY VIEW AVENUE
                          LA MIRADA CA 90638
                 PH: (714) 521-4811 FAX: (714) 521-4173

 ************************* DESCRIPTION OF STUDY *************************
* TEI JOB NO. 4099                                                      *
* PROPOSED CONDITION (NODES 100-213)                                    *
* 10-YEAR STORM EVENT                                                   *
 ************************************************************************

  FILE NAME: C:\XDRIVE\4099\P100-10.DAT
  TIME/DATE OF STUDY: 10:34 08/14/2024
========================================================================
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
========================================================================
                    --*TIME-OF-CONCENTRATION MODEL*--

  USER SPECIFIED STORM EVENT(YEAR) =   10.00
  SPECIFIED MINIMUM PIPE SIZE(INCH) =  12.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.95
  *USER-DEFINED LOGARITHMIC INTERPOLATION USED FOR RAINFALL*

  SLOPE OF INTENSITY DURATION CURVE(LOG(I;IN/HR) vs. LOG(Tc;MIN)) = 0.6000
  USER SPECIFIED 1-HOUR INTENSITY(INCH/HOUR) = 0.5900

  *ANTECEDENT MOISTURE CONDITION (AMC) II ASSUMED FOR RATIONAL METHOD*


************************************************************************
  FLOW PROCESS FROM NODE    100.00 TO NODE    101.00 IS CODE =  21
------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
========================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   695.00
  ELEVATION DATA: UPSTREAM(FEET) =   3017.41  DOWNSTREAM(FEET) =   3004.12

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    9.191
  *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  1.819
  SUBAREA Tc AND LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap      SCS   Tc
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  COMMERCIAL                 C        4.48      0.57       0.10    69    9.19
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.57
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
  SUBAREA RUNOFF(CFS) =      7.10
  TOTAL AREA(ACRES) =      4.48   PEAK FLOW RATE(CFS) =      7.10

************************************************************************
  FLOW PROCESS FROM NODE    101.00 TO NODE    102.00 IS CODE =  31
------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
========================================================================
  ELEVATION DATA: UPSTREAM(FEET) =  3000.12  DOWNSTREAM(FEET) =  2999.99
  FLOW LENGTH(FEET) =    25.00   MANNING'S N =  0.012
  DEPTH OF FLOW IN  18.0 INCH PIPE IS  13.2 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   5.11
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      7.10
  PIPE TRAVEL TIME(MIN.) =   0.08    Tc(MIN.) =   9.27
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    102.00 =   720.00 FEET.
```

```
****************************************************************************
  FLOW PROCESS FROM NODE    102.00 TO NODE    102.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN) =   9.27
  *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  1.809
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                 C        1.30      0.57       0.10    69
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.57
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
  SUBAREA AREA(ACRES) =    1.30      SUBAREA RUNOFF(CFS) =    2.05
  EFFECTIVE AREA(ACRES) =     5.78   AREA-AVERAGED Fm(INCH/HR) =  0.06
  AREA-AVERAGED Fp(INCH/HR) =  0.57  AREA-AVERAGED Ap =  0.10
  TOTAL AREA(ACRES) =     5.78       PEAK FLOW RATE(CFS) =       9.12

****************************************************************************
  FLOW PROCESS FROM NODE    102.00 TO NODE    102.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN) =   9.27
  *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  1.809
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                 C        2.42      0.57       0.10    69
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.57
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
  SUBAREA AREA(ACRES) =    2.42      SUBAREA RUNOFF(CFS) =    3.82
  EFFECTIVE AREA(ACRES) =     8.20   AREA-AVERAGED Fm(INCH/HR) =  0.06
  AREA-AVERAGED Fp(INCH/HR) =  0.57  AREA-AVERAGED Ap =  0.10
  TOTAL AREA(ACRES) =     8.20       PEAK FLOW RATE(CFS) =      12.93

****************************************************************************
  FLOW PROCESS FROM NODE    102.00 TO NODE    103.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =  2999.99  DOWNSTREAM(FEET) =  2987.04
  FLOW LENGTH(FEET) =   198.00   MANNING'S N =  0.012
  DEPTH OF FLOW IN  15.0 INCH PIPE IS   9.6 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  15.57
  ESTIMATED PIPE DIAMETER(INCH) =  15.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =     12.93
  PIPE TRAVEL TIME(MIN.) =   0.21    Tc(MIN.) =   9.48
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    103.00 =   918.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    103.00 TO NODE    103.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN) =   9.48
  *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  1.785
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                 C        3.86      0.57       0.10    69
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.57
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
  SUBAREA AREA(ACRES) =    3.86      SUBAREA RUNOFF(CFS) =    6.00
  EFFECTIVE AREA(ACRES) =    12.06   AREA-AVERAGED Fm(INCH/HR) =  0.06
  AREA-AVERAGED Fp(INCH/HR) =  0.57  AREA-AVERAGED Ap =  0.10
  TOTAL AREA(ACRES) =    12.06       PEAK FLOW RATE(CFS) =      18.76

****************************************************************************
  FLOW PROCESS FROM NODE    103.00 TO NODE    104.00 IS CODE =  31
----------------------------------------------------------------------------
```

```
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =  2987.04  DOWNSTREAM(FEET) =  2986.44
  FLOW LENGTH(FEET) =   119.00   MANNING'S N =  0.012
  DEPTH OF FLOW IN  27.0 INCH PIPE IS  18.4 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   6.50
  ESTIMATED PIPE DIAMETER(INCH) =  27.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =     18.76
  PIPE TRAVEL TIME(MIN.) =   0.31    Tc(MIN.) =   9.79
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    104.00 =  1037.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    104.00 TO NODE    104.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN) =   9.79
  *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  1.751
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp          Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                 C        1.54      0.57       0.10    69
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.57
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
  SUBAREA AREA(ACRES) =    1.54      SUBAREA RUNOFF(CFS) =    2.35
  EFFECTIVE AREA(ACRES) =    13.60   AREA-AVERAGED Fm(INCH/HR) =  0.06
  AREA-AVERAGED Fp(INCH/HR) =  0.57  AREA-AVERAGED Ap =  0.10
  TOTAL AREA(ACRES) =    13.60       PEAK FLOW RATE(CFS) =      20.74

****************************************************************************
  FLOW PROCESS FROM NODE    104.00 TO NODE    107.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =  2986.44  DOWNSTREAM(FEET) =  2984.24
  FLOW LENGTH(FEET) =   441.00   MANNING'S N =  0.012
  DEPTH OF FLOW IN  27.0 INCH PIPE IS  20.0 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   6.57
  ESTIMATED PIPE DIAMETER(INCH) =  27.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =     20.74
  PIPE TRAVEL TIME(MIN.) =   1.12    Tc(MIN.) =  10.91
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    107.00 =  1478.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    107.00 TO NODE    107.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =  10.91
  RAINFALL INTENSITY(INCH/HR) =   1.64
  AREA-AVERAGED Fm(INCH/HR) =  0.06
  AREA-AVERAGED Fp(INCH/HR) =  0.57
  AREA-AVERAGED Ap =  0.10
  EFFECTIVE STREAM AREA(ACRES) =   13.60
  TOTAL STREAM AREA(ACRES) =   13.60
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     20.74

****************************************************************************
  FLOW PROCESS FROM NODE    105.00 TO NODE    106.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   555.00
  ELEVATION DATA: UPSTREAM(FEET) =   2999.21  DOWNSTREAM(FEET) =   2988.21

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    8.340
  *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  1.928
```

```
  SUBAREA Tc AND LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS   Tc
        LAND USE           GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  COMMERCIAL                 C        5.36      0.57       0.10    69    8.34
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.57
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
  SUBAREA RUNOFF(CFS) =      9.03
  TOTAL AREA(ACRES) =      5.36   PEAK FLOW RATE(CFS) =      9.03

****************************************************************************
  FLOW PROCESS FROM NODE    106.00 TO NODE    107.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =  2985.21  DOWNSTREAM(FEET) =  2984.24
  FLOW LENGTH(FEET) =    60.00   MANNING'S N =  0.012
  DEPTH OF FLOW IN  18.0 INCH PIPE IS  10.5 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   8.46
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      9.03
  PIPE TRAVEL TIME(MIN.) =   0.12    Tc(MIN.) =   8.46
  LONGEST FLOWPATH FROM NODE    105.00 TO NODE    107.00 =   615.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    107.00 TO NODE    107.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =   8.46
  RAINFALL INTENSITY(INCH/HR) =   1.91
  AREA-AVERAGED Fm(INCH/HR) =  0.06
  AREA-AVERAGED Fp(INCH/HR) =  0.57
  AREA-AVERAGED Ap =  0.10
  EFFECTIVE STREAM AREA(ACRES) =    5.36
  TOTAL STREAM AREA(ACRES) =    5.36
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      9.03

  ** CONFLUENCE DATA **
   STREAM     Q     Tc   Intensity   Fp(Fm)     Ap   Ae     HEADWATER
   NUMBER   (CFS) (MIN.) (INCH/HR) (INCH/HR)       (ACRES)    NODE
      1     20.74  10.91    1.641  0.57( 0.06) 0.10    13.6     100.00
      2      9.03   8.46    1.912  0.57( 0.06) 0.10     5.4     105.00

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

  ** PEAK FLOW RATE TABLE **
   STREAM     Q     Tc   Intensity   Fp(Fm)     Ap   Ae     HEADWATER
   NUMBER   (CFS) (MIN.) (INCH/HR) (INCH/HR)       (ACRES)    NODE
      1     28.45  10.91    1.641  0.57( 0.06) 0.10    19.0     100.00
      2     27.85   8.46    1.912  0.57( 0.06) 0.10    15.9     105.00

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =     28.45    Tc(MIN.) =    10.91
  EFFECTIVE AREA(ACRES) =    18.96   AREA-AVERAGED Fm(INCH/HR) =  0.06
  AREA-AVERAGED Fp(INCH/HR) =  0.57  AREA-AVERAGED Ap =  0.10
  TOTAL AREA(ACRES) =     18.96
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    107.00 =  1478.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    107.00 TO NODE    108.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =  2984.24  DOWNSTREAM(FEET) =  2982.73
  FLOW LENGTH(FEET) =   304.00   MANNING'S N =  0.012
  DEPTH OF FLOW IN  30.0 INCH PIPE IS  22.9 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   7.06
```

```
  ESTIMATED PIPE DIAMETER(INCH) =  30.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =     28.45
  PIPE TRAVEL TIME(MIN.) =   0.72    Tc(MIN.) =  11.63
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    108.00 =  1782.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    108.00 TO NODE    108.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN) =  11.63
  *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  1.579
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                 C        4.24      0.57      0.10    69
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.57
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
  SUBAREA AREA(ACRES) =    4.24      SUBAREA RUNOFF(CFS) =    5.81
  EFFECTIVE AREA(ACRES) =    23.20   AREA-AVERAGED Fm(INCH/HR) =  0.06
  AREA-AVERAGED Fp(INCH/HR) =  0.57  AREA-AVERAGED Ap =  0.10
  TOTAL AREA(ACRES) =    23.20       PEAK FLOW RATE(CFS) =      31.80

  ** PEAK FLOW RATE TABLE **
   STREAM     Q     Tc    Intensity   Fp(Fm)      Ap   Ae     HEADWATER
   NUMBER   (CFS) (MIN.) (INCH/HR) (INCH/HR)       (ACRES)    NODE
      1     31.80  11.63    1.579  0.57( 0.06) 0.10    23.2     100.00
      2     31.98   9.18    1.820  0.57( 0.06) 0.10    20.1     105.00
  NEW PEAK FLOW DATA ARE:
  PEAK FLOW RATE(CFS) =     31.98  Tc(MIN.) =   9.18
  AREA-AVERAGED Fm(INCH/HR) =  0.06  AREA-AVERAGED Fp(INCH/HR) =  0.57
  AREA-AVERAGED Ap =  0.10  EFFECTIVE AREA(ACRES) =     20.15

****************************************************************************
  FLOW PROCESS FROM NODE    108.00 TO NODE    109.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =  2982.73  DOWNSTREAM(FEET) =  2981.22
  FLOW LENGTH(FEET) =   304.00   MANNING'S N =  0.012
  DEPTH OF FLOW IN  33.0 INCH PIPE IS  22.6 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   7.38
  ESTIMATED PIPE DIAMETER(INCH) =  33.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =     31.98
  PIPE TRAVEL TIME(MIN.) =   0.69    Tc(MIN.) =   9.86
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    109.00 =  2086.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    109.00 TO NODE    109.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN) =   9.86
  *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  1.743
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                 C        3.37      0.57      0.10    69
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.57
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
  SUBAREA AREA(ACRES) =    3.37      SUBAREA RUNOFF(CFS) =    5.12
  EFFECTIVE AREA(ACRES) =    23.52   AREA-AVERAGED Fm(INCH/HR) =  0.06
  AREA-AVERAGED Fp(INCH/HR) =  0.57  AREA-AVERAGED Ap =  0.10
  TOTAL AREA(ACRES) =    26.57       PEAK FLOW RATE(CFS) =      35.69

****************************************************************************
  FLOW PROCESS FROM NODE    109.00 TO NODE    110.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =  2981.22  DOWNSTREAM(FEET) =  2980.64
```

```
  FLOW LENGTH(FEET) =   116.00   MANNING'S N =  0.012
  DEPTH OF FLOW IN  33.0 INCH PIPE IS  24.6 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   7.53
  ESTIMATED PIPE DIAMETER(INCH) =  33.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =     35.69
  PIPE TRAVEL TIME(MIN.) =   0.26    Tc(MIN.) =  10.12
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    110.00 =  2202.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    110.00 TO NODE    110.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN) =  10.12
  *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  1.716
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap      SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                 C        4.44      0.57       0.10    69
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.57
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
  SUBAREA AREA(ACRES) =    4.44      SUBAREA RUNOFF(CFS) =    6.63
  EFFECTIVE AREA(ACRES) =    27.96   AREA-AVERAGED Fm(INCH/HR) =  0.06
  AREA-AVERAGED Fp(INCH/HR) =  0.57  AREA-AVERAGED Ap =  0.10
  TOTAL AREA(ACRES) =    31.01       PEAK FLOW RATE(CFS) =      41.76

****************************************************************************
  FLOW PROCESS FROM NODE    110.00 TO NODE    110.00 IS CODE =  10
----------------------------------------------------------------------------
  >>>>>MAIN-STREAM MEMORY COPIED ONTO MEMORY BANK # 1 <<<<<
============================================================================

****************************************************************************
  FLOW PROCESS FROM NODE    200.00 TO NODE    201.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   529.00
  ELEVATION DATA: UPSTREAM(FEET) =   3023.18  DOWNSTREAM(FEET) =   3013.00

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    8.230
  *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  1.943
  SUBAREA Tc AND LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap      SCS   Tc
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  COMMERCIAL                 C        0.39      0.57       0.10    69    8.23
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.57
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
  SUBAREA RUNOFF(CFS) =      0.66
  TOTAL AREA(ACRES) =      0.39   PEAK FLOW RATE(CFS) =      0.66

****************************************************************************
  FLOW PROCESS FROM NODE    201.00 TO NODE    202.00 IS CODE =  61
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STANDARD CURB SECTION USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) = 3013.00  DOWNSTREAM ELEVATION(FEET) = 2990.59
  STREET LENGTH(FEET) =   508.00   CURB HEIGHT(INCHES) =  8.0
  STREET HALFWIDTH(FEET) = 20.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  15.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0149

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       3.85
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.32
```

```
    HALFSTREET FLOOD WIDTH(FEET) =    8.15
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    4.50
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    1.45
  STREET FLOW TRAVEL TIME(MIN.) =   1.88   Tc(MIN.) =  10.11
  *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  1.718
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                 C        4.25      0.57      0.10    69
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.57
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
  SUBAREA AREA(ACRES) =    4.25      SUBAREA RUNOFF(CFS) =    6.35
  EFFECTIVE AREA(ACRES) =    4.64    AREA-AVERAGED Fm(INCH/HR) =  0.06
  AREA-AVERAGED Fp(INCH/HR) =  0.57  AREA-AVERAGED Ap =  0.10
  TOTAL AREA(ACRES) =    4.64        PEAK FLOW RATE(CFS) =       6.94

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.37   HALFSTREET FLOOD WIDTH(FEET) =  10.82
  FLOW VELOCITY(FEET/SEC.) =  5.10   DEPTH*VELOCITY(FT*FT/SEC.) =   1.91
  LONGEST FLOWPATH FROM NODE    200.00 TO NODE    202.00 =  1037.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    202.00 TO NODE    202.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN) =  10.11
  *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  1.718
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                 C        1.61      0.57      0.10    69
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.57
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
  SUBAREA AREA(ACRES) =    1.61      SUBAREA RUNOFF(CFS) =    2.41
  EFFECTIVE AREA(ACRES) =     6.25   AREA-AVERAGED Fm(INCH/HR) =  0.06
  AREA-AVERAGED Fp(INCH/HR) =  0.57  AREA-AVERAGED Ap =  0.10
  TOTAL AREA(ACRES) =     6.25       PEAK FLOW RATE(CFS) =       9.34

****************************************************************************
  FLOW PROCESS FROM NODE    202.00 TO NODE    203.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =  2986.65  DOWNSTREAM(FEET) =  2986.17
  FLOW LENGTH(FEET) =   137.00   MANNING'S N =  0.012
  DEPTH OF FLOW IN  21.0 INCH PIPE IS  16.2 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   4.68
  ESTIMATED PIPE DIAMETER(INCH) =  21.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      9.34
  PIPE TRAVEL TIME(MIN.) =   0.49    Tc(MIN.) =  10.60
  LONGEST FLOWPATH FROM NODE    200.00 TO NODE    203.00 =  1174.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    203.00 TO NODE    203.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN) =  10.60
  *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  1.670
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                 C        2.09      0.57      0.10    69
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.57
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
  SUBAREA AREA(ACRES) =    2.09      SUBAREA RUNOFF(CFS) =    3.03
  EFFECTIVE AREA(ACRES) =     8.34   AREA-AVERAGED Fm(INCH/HR) =  0.06
  AREA-AVERAGED Fp(INCH/HR) =  0.57  AREA-AVERAGED Ap =  0.10
  TOTAL AREA(ACRES) =     8.34       PEAK FLOW RATE(CFS) =      12.11

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

```
  FLOW PROCESS FROM NODE    203.00 TO NODE    204.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =  2986.17  DOWNSTREAM(FEET) =  2985.76
  FLOW LENGTH(FEET) =   116.00   MANNING'S N =  0.012
  DEPTH OF FLOW IN  24.0 INCH PIPE IS  17.0 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   5.07
  ESTIMATED PIPE DIAMETER(INCH) =  24.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =     12.11
  PIPE TRAVEL TIME(MIN.) =   0.38    Tc(MIN.) =  10.98
  LONGEST FLOWPATH FROM NODE    200.00 TO NODE    204.00 =  1290.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    204.00 TO NODE    204.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN) =  10.98
  *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  1.635
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                 C        1.61      0.57       0.10    69
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.57
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
  SUBAREA AREA(ACRES) =     1.61      SUBAREA RUNOFF(CFS) =     2.29
  EFFECTIVE AREA(ACRES) =     9.95   AREA-AVERAGED Fm(INCH/HR) =  0.06
  AREA-AVERAGED Fp(INCH/HR) =  0.57  AREA-AVERAGED Ap =  0.10
  TOTAL AREA(ACRES) =     9.95       PEAK FLOW RATE(CFS) =      14.13

****************************************************************************
  FLOW PROCESS FROM NODE    204.00 TO NODE    205.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =  2985.76  DOWNSTREAM(FEET) =  2985.35
  FLOW LENGTH(FEET) =   116.00   MANNING'S N =  0.012
  DEPTH OF FLOW IN  24.0 INCH PIPE IS  19.6 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   5.15
  ESTIMATED PIPE DIAMETER(INCH) =  24.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =     14.13
  PIPE TRAVEL TIME(MIN.) =   0.38    Tc(MIN.) =  11.35
  LONGEST FLOWPATH FROM NODE    200.00 TO NODE    205.00 =  1406.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    205.00 TO NODE    205.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN) =  11.35
  *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  1.602
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                 C        1.61      0.57       0.10    69
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.57
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
  SUBAREA AREA(ACRES) =     1.61      SUBAREA RUNOFF(CFS) =     2.24
  EFFECTIVE AREA(ACRES) =    11.56   AREA-AVERAGED Fm(INCH/HR) =  0.06
  AREA-AVERAGED Fp(INCH/HR) =  0.57  AREA-AVERAGED Ap =  0.10
  TOTAL AREA(ACRES) =    11.56       PEAK FLOW RATE(CFS) =      16.08

****************************************************************************
  FLOW PROCESS FROM NODE    205.00 TO NODE    206.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =  2985.35  DOWNSTREAM(FEET) =  2984.94
  FLOW LENGTH(FEET) =   116.00   MANNING'S N =  0.012
```

```
  DEPTH OF FLOW IN  27.0 INCH PIPE IS  18.7 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   5.46
  ESTIMATED PIPE DIAMETER(INCH) =  27.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =     16.08
  PIPE TRAVEL TIME(MIN.) =   0.35    Tc(MIN.) =  11.71
  LONGEST FLOWPATH FROM NODE    200.00 TO NODE    206.00 =  1522.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    206.00 TO NODE    206.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN) =  11.71
  *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  1.573
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                 C        1.16      0.57       0.10    69
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.57
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
  SUBAREA AREA(ACRES) =    1.16      SUBAREA RUNOFF(CFS) =    1.58
  EFFECTIVE AREA(ACRES) =    12.72   AREA-AVERAGED Fm(INCH/HR) =  0.06
  AREA-AVERAGED Fp(INCH/HR) =  0.57  AREA-AVERAGED Ap =  0.10
  TOTAL AREA(ACRES) =    12.72       PEAK FLOW RATE(CFS) =      17.36

****************************************************************************
  FLOW PROCESS FROM NODE    206.00 TO NODE    207.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =  2984.94  DOWNSTREAM(FEET) =  2984.53
  FLOW LENGTH(FEET) =   116.00   MANNING'S N =  0.012
  DEPTH OF FLOW IN  27.0 INCH PIPE IS  19.9 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   5.53
  ESTIMATED PIPE DIAMETER(INCH) =  27.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =     17.36
  PIPE TRAVEL TIME(MIN.) =   0.35    Tc(MIN.) =  12.06
  LONGEST FLOWPATH FROM NODE    200.00 TO NODE    207.00 =  1638.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    207.00 TO NODE    207.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN) =  12.06
  *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  1.545
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                 C        1.61      0.57       0.10    69
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.57
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
  SUBAREA AREA(ACRES) =    1.61      SUBAREA RUNOFF(CFS) =    2.16
  EFFECTIVE AREA(ACRES) =    14.33   AREA-AVERAGED Fm(INCH/HR) =  0.06
  AREA-AVERAGED Fp(INCH/HR) =  0.57  AREA-AVERAGED Ap =  0.10
  TOTAL AREA(ACRES) =    14.33       PEAK FLOW RATE(CFS) =      19.20

****************************************************************************
  FLOW PROCESS FROM NODE    207.00 TO NODE    208.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =  2984.53  DOWNSTREAM(FEET) =  2984.12
  FLOW LENGTH(FEET) =   116.00   MANNING'S N =  0.012
  DEPTH OF FLOW IN  27.0 INCH PIPE IS  21.8 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   5.57
  ESTIMATED PIPE DIAMETER(INCH) =  27.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =     19.20
  PIPE TRAVEL TIME(MIN.) =   0.35    Tc(MIN.) =  12.40
  LONGEST FLOWPATH FROM NODE    200.00 TO NODE    208.00 =  1754.00 FEET.
```

```
****************************************************************************
  FLOW PROCESS FROM NODE    208.00 TO NODE    208.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN) =  12.40
  *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  1.519
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                 C        1.61      0.57      0.10    69
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.57
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
  SUBAREA AREA(ACRES) =    1.61      SUBAREA RUNOFF(CFS) =    2.12
  EFFECTIVE AREA(ACRES) =    15.94   AREA-AVERAGED Fm(INCH/HR) =  0.06
  AREA-AVERAGED Fp(INCH/HR) =  0.57  AREA-AVERAGED Ap =  0.10
  TOTAL AREA(ACRES) =    15.94       PEAK FLOW RATE(CFS) =      20.98

****************************************************************************
  FLOW PROCESS FROM NODE    208.00 TO NODE    209.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =  2983.72  DOWNSTREAM(FEET) =  2983.31
  FLOW LENGTH(FEET) =   116.00   MANNING'S N =  0.012
  DEPTH OF FLOW IN  30.0 INCH PIPE IS  20.6 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   5.85
  ESTIMATED PIPE DIAMETER(INCH) =  30.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =     20.98
  PIPE TRAVEL TIME(MIN.) =   0.33    Tc(MIN.) =  12.73
  LONGEST FLOWPATH FROM NODE    200.00 TO NODE    209.00 =  1870.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    209.00 TO NODE    209.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN) =  12.73
  *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  1.495
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                 C        1.61      0.57      0.10    69
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.57
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
  SUBAREA AREA(ACRES) =    1.61      SUBAREA RUNOFF(CFS) =    2.08
  EFFECTIVE AREA(ACRES) =    17.55   AREA-AVERAGED Fm(INCH/HR) =  0.06
  AREA-AVERAGED Fp(INCH/HR) =  0.57  AREA-AVERAGED Ap =  0.10
  TOTAL AREA(ACRES) =    17.55       PEAK FLOW RATE(CFS) =      22.73

****************************************************************************
  FLOW PROCESS FROM NODE    209.00 TO NODE    210.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =  2983.31  DOWNSTREAM(FEET) =  2982.90
  FLOW LENGTH(FEET) =   116.00   MANNING'S N =  0.012
  DEPTH OF FLOW IN  30.0 INCH PIPE IS  21.9 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   5.92
  ESTIMATED PIPE DIAMETER(INCH) =  30.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =     22.73
  PIPE TRAVEL TIME(MIN.) =   0.33    Tc(MIN.) =  13.06
  LONGEST FLOWPATH FROM NODE    200.00 TO NODE    210.00 =  1986.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    210.00 TO NODE    210.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN) =  13.06
  *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  1.473
```

```
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                  C        2.88      0.57       0.10    69
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.57
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
  SUBAREA AREA(ACRES) =    2.88      SUBAREA RUNOFF(CFS) =    3.67
  EFFECTIVE AREA(ACRES) =    20.43   AREA-AVERAGED Fm(INCH/HR) =  0.06
  AREA-AVERAGED Fp(INCH/HR) =  0.57  AREA-AVERAGED Ap =  0.10
  TOTAL AREA(ACRES) =    20.43       PEAK FLOW RATE(CFS) =      26.04

****************************************************************************
  FLOW PROCESS FROM NODE    210.00 TO NODE    211.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =  2982.90  DOWNSTREAM(FEET) =  2980.79
  FLOW LENGTH(FEET) =   604.00   MANNING'S N =  0.012
  DEPTH OF FLOW IN  33.0 INCH PIPE IS  22.1 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   6.16
  ESTIMATED PIPE DIAMETER(INCH) =  33.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =     26.04
  PIPE TRAVEL TIME(MIN.) =   1.63    Tc(MIN.) =  14.70
  LONGEST FLOWPATH FROM NODE    200.00 TO NODE    211.00 =  2590.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    211.00 TO NODE    211.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN) =  14.70
  *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  1.372
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                  C        1.04      0.57       0.10    69
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.57
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
  SUBAREA AREA(ACRES) =    1.04      SUBAREA RUNOFF(CFS) =    1.23
  EFFECTIVE AREA(ACRES) =    21.47   AREA-AVERAGED Fm(INCH/HR) =  0.06
  AREA-AVERAGED Fp(INCH/HR) =  0.57  AREA-AVERAGED Ap =  0.10
  TOTAL AREA(ACRES) =    21.47       PEAK FLOW RATE(CFS) =      26.04
  NOTE: PEAK FLOW RATE DEFAULTED TO UPSTREAM VALUE

****************************************************************************
  FLOW PROCESS FROM NODE    211.00 TO NODE    212.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =  2980.79  DOWNSTREAM(FEET) =  2979.33
  FLOW LENGTH(FEET) =   416.00   MANNING'S N =  0.012
  DEPTH OF FLOW IN  33.0 INCH PIPE IS  22.1 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   6.17
  ESTIMATED PIPE DIAMETER(INCH) =  33.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =     26.04
  PIPE TRAVEL TIME(MIN.) =   1.12    Tc(MIN.) =  15.82
  LONGEST FLOWPATH FROM NODE    200.00 TO NODE    212.00 =  3006.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    212.00 TO NODE    212.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN) =  15.82
  *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  1.313
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                  C        1.35      0.57       0.10    69
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.57
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
```

```
  SUBAREA AREA(ACRES) =    1.35      SUBAREA RUNOFF(CFS) =    1.53
  EFFECTIVE AREA(ACRES) =    22.82   AREA-AVERAGED Fm(INCH/HR) =  0.06
  AREA-AVERAGED Fp(INCH/HR) =  0.57  AREA-AVERAGED Ap =  0.10
  TOTAL AREA(ACRES) =    22.82       PEAK FLOW RATE(CFS) =      26.04
  NOTE: PEAK FLOW RATE DEFAULTED TO UPSTREAM VALUE

****************************************************************************
  FLOW PROCESS FROM NODE    212.00 TO NODE    213.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =  2979.33  DOWNSTREAM(FEET) =  2977.52
  FLOW LENGTH(FEET) =    90.00   MANNING'S N =  0.012
  DEPTH OF FLOW IN  24.0 INCH PIPE IS  15.8 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  11.89
  ESTIMATED PIPE DIAMETER(INCH) =  24.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =     26.04
  PIPE TRAVEL TIME(MIN.) =   0.13    Tc(MIN.) =  15.95
  LONGEST FLOWPATH FROM NODE    200.00 TO NODE    213.00 =  3096.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    213.00 TO NODE    213.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN) =  15.95
  *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  1.307
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp          Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                 C        0.87      0.57       0.10    69
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.57
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
  SUBAREA AREA(ACRES) =    0.87      SUBAREA RUNOFF(CFS) =    0.98
  EFFECTIVE AREA(ACRES) =    23.69   AREA-AVERAGED Fm(INCH/HR) =  0.06
  AREA-AVERAGED Fp(INCH/HR) =  0.57  AREA-AVERAGED Ap =  0.10
  TOTAL AREA(ACRES) =    23.69       PEAK FLOW RATE(CFS) =      26.65

****************************************************************************
  FLOW PROCESS FROM NODE    213.00 TO NODE    213.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN) =  15.95
  *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  1.307
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp          Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                 C        1.68      0.57       0.10    69
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.57
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
  SUBAREA AREA(ACRES) =    1.68      SUBAREA RUNOFF(CFS) =    1.89
  EFFECTIVE AREA(ACRES) =    25.37   AREA-AVERAGED Fm(INCH/HR) =  0.06
  AREA-AVERAGED Fp(INCH/HR) =  0.57  AREA-AVERAGED Ap =  0.10
  TOTAL AREA(ACRES) =    25.37       PEAK FLOW RATE(CFS) =      28.54

****************************************************************************
  FLOW PROCESS FROM NODE    213.00 TO NODE    213.00 IS CODE =  11
----------------------------------------------------------------------------
  >>>>>CONFLUENCE MEMORY BANK # 1 WITH THE MAIN-STREAM MEMORY<<<<<
============================================================================

  ** MAIN STREAM CONFLUENCE DATA **
   STREAM      Q      Tc   Intensity   Fp(Fm)      Ap   Ae      HEADWATER
   NUMBER    (CFS) (MIN.) (INCH/HR) (INCH/HR)        (ACRES)    NODE
      1     28.54  15.95    1.307  0.57( 0.06) 0.10    25.4      200.00
  LONGEST FLOWPATH FROM NODE    200.00 TO NODE    213.00 =  3096.00 FEET.

  ** MEMORY BANK #  1 CONFLUENCE DATA **
   STREAM      Q      Tc   Intensity   Fp(Fm)      Ap   Ae      HEADWATER
   NUMBER    (CFS) (MIN.) (INCH/HR) (INCH/HR)        (ACRES)    NODE
      1     41.76  10.12    1.716  0.57( 0.06) 0.10    28.0      105.00
```

```
     2     40.48  12.57    1.507  0.57( 0.06) 0.10    31.0     100.00
  LONGEST FLOWPATH FROM NODE      0.00 TO NODE    213.00 =     0.00 FEET.

  ** PEAK FLOW RATE TABLE **
   STREAM     Q     Tc   Intensity   Fp(Fm)     Ap   Ae     HEADWATER
   NUMBER   (CFS) (MIN.) (INCH/HR) (INCH/HR)       (ACRES)    NODE
      1     63.43  15.95    1.307  0.57( 0.06) 0.10    56.4     200.00
      2     65.82  10.12    1.716  0.57( 0.06) 0.10    44.1     105.00
      3     66.59  12.57    1.507  0.57( 0.06) 0.10    51.0     100.00
    TOTAL AREA(ACRES) =     56.38

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =       66.59  Tc(MIN.) =   12.570
  EFFECTIVE AREA(ACRES) =     51.01  AREA-AVERAGED Fm(INCH/HR) =  0.06
  AREA-AVERAGED Fp(INCH/HR) =  0.57  AREA-AVERAGED Ap =  0.10
  TOTAL AREA(ACRES) =     56.38
  LONGEST FLOWPATH FROM NODE    200.00 TO NODE    213.00 =  3096.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    213.00 TO NODE    213.00 IS CODE =  12
----------------------------------------------------------------------------
  >>>>>CLEAR MEMORY BANK # 1 <<<<<
============================================================================

****************************************************************************
  FLOW PROCESS FROM NODE    213.00 TO NODE    213.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN) =  12.57
  *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  1.507
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp          Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                 C        4.31      0.57       0.10    69
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.57
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
  SUBAREA AREA(ACRES) =     4.31      SUBAREA RUNOFF(CFS) =     5.63
  EFFECTIVE AREA(ACRES) =    55.32   AREA-AVERAGED Fm(INCH/HR) =  0.06
  AREA-AVERAGED Fp(INCH/HR) =  0.57  AREA-AVERAGED Ap =  0.10
  TOTAL AREA(ACRES) =    60.69       PEAK FLOW RATE(CFS) =      72.22

  ** PEAK FLOW RATE TABLE **
   STREAM     Q     Tc   Intensity   Fp(Fm)     Ap   Ae     HEADWATER
   NUMBER   (CFS) (MIN.) (INCH/HR) (INCH/HR)       (ACRES)    NODE
      1     68.28  15.95    1.307  0.57( 0.06) 0.10    60.7     200.00
      2     72.25  10.12    1.716  0.57( 0.06) 0.10    48.4     105.00
      3     72.22  12.57    1.507  0.57( 0.06) 0.10    55.3     100.00
  NEW PEAK FLOW DATA ARE:
  PEAK FLOW RATE(CFS) =     72.25  Tc(MIN.) =  10.12
  AREA-AVERAGED Fm(INCH/HR) =  0.06  AREA-AVERAGED Fp(INCH/HR) =  0.57
  AREA-AVERAGED Ap =  0.10  EFFECTIVE AREA(ACRES) =     48.37
============================================================================
  END OF STUDY SUMMARY:
  TOTAL AREA(ACRES)     =     60.69  TC(MIN.) =     10.12
  EFFECTIVE AREA(ACRES) =     48.37  AREA-AVERAGED Fm(INCH/HR)=  0.06
  AREA-AVERAGED Fp(INCH/HR) =  0.57  AREA-AVERAGED Ap =  0.10
  PEAK FLOW RATE(CFS)   =     72.25

  ** PEAK FLOW RATE TABLE **
   STREAM     Q     Tc   Intensity   Fp(Fm)     Ap   Ae     HEADWATER
   NUMBER   (CFS) (MIN.) (INCH/HR) (INCH/HR)       (ACRES)    NODE
      1     72.25  10.12    1.716  0.57( 0.06) 0.10    48.4     105.00
      2     72.22  12.57    1.507  0.57( 0.06) 0.10    55.3     100.00
      3     68.28  15.95    1.307  0.57( 0.06) 0.10    60.7     200.00
============================================================================
============================================================================
  END OF RATIONAL METHOD ANALYSIS
```

```
**************************************************************************
                    SMALL AREA UNIT HYDROGRAPH MODEL

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                          Analysis prepared by:

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                             LA MIRADA CA 90638
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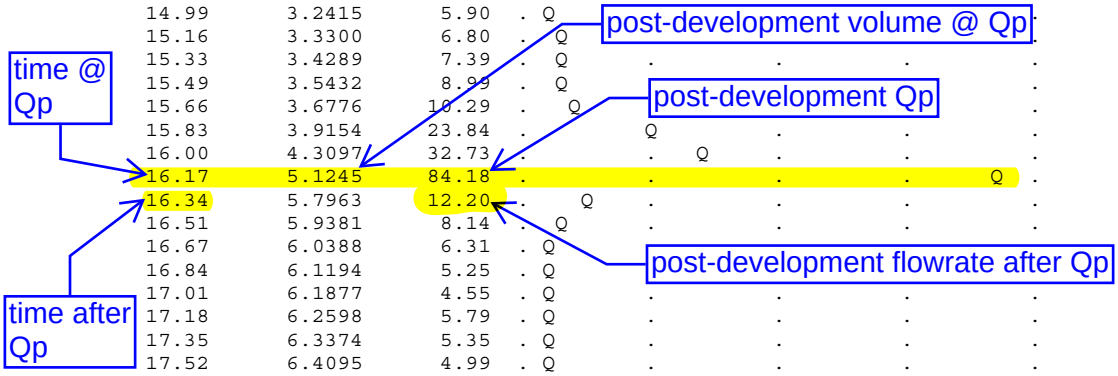
    RATIONAL METHOD CALIBRATION COEFFICIENT = 0.90
    TOTAL CATCHMENT AREA(ACRES) =   61.22
    SOIL-LOSS RATE, Fm,(INCH/HR) =  0.081
    LOW LOSS FRACTION = 0.200
    TIME OF CONCENTRATION(MIN.) = 10.12
    SMALL AREA PEAK Q COMPUTED USING PEAK FLOW RATE FORMULA
    USER SPECIFIED RAINFALL VALUES ARE USED
    RETURN FREQUENCY(YEARS) =  10
       5-MINUTE POINT RAINFALL VALUE(INCHES) =  0.19
      30-MINUTE POINT RAINFALL VALUE(INCHES) =  0.47
       1-HOUR   POINT RAINFALL VALUE(INCHES) =  0.59
       3-HOUR   POINT RAINFALL VALUE(INCHES) =  0.85
       6-HOUR   POINT RAINFALL VALUE(INCHES) =  1.18
      24-HOUR   POINT RAINFALL VALUE(INCHES) =  2.04

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

    TOTAL CATCHMENT   RUNOFF  VOLUME(ACRE-FEET) =     7.69
    TOTAL CATCHMENT SOIL-LOSS VOLUME(ACRE-FEET) =     2.72

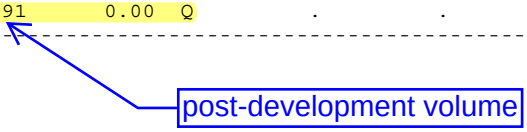
**************************************************************************
  TIME     VOLUME       Q    0.       22.5      45.0      67.5      90.0
 (HOURS)    (AF)      (CFS)
--------------------------------------------------------------------------
  0.15      0.0103      1.48  Q         .         .         .         .
  0.31      0.0310      1.49  Q         .         .         .         .
  0.48      0.0519      1.50  Q         .         .         .         .
  0.65      0.0728      1.51  Q         .         .         .         .
  0.82      0.0939      1.52  Q         .         .         .         .
  0.99      0.1152      1.53  Q         .         .         .         .
  1.16      0.1366      1.54  Q         .         .         .         .
  1.33      0.1581      1.55  Q         .         .         .         .
  1.49      0.1798      1.56  Q         .         .         .         .
  1.66      0.2016      1.57  Q         .         .         .         .
  1.83      0.2236      1.58  Q         .         .         .         .
  2.00      0.2457      1.60  Q         .         .         .         .
  2.17      0.2680      1.60  Q         .         .         .         .
  2.34      0.2905      1.62  Q         .         .         .         .
  2.51      0.3131      1.63  Q         .         .         .         .
  2.68      0.3360      1.64  Q         .         .         .         .
  2.84      0.3589      1.65  Q         .         .         .         .
  3.01      0.3821      1.67  Q         .         .         .         .
  3.18      0.4054      1.68  Q         .         .         .         .
  3.35      0.4290      1.70  Q         .         .         .         .
  3.52      0.4527      1.71  Q         .         .         .         .
  3.69      0.4766      1.72  Q         .         .         .         .
  3.86      0.5007      1.73  Q         .         .         .         .
  4.02      0.5250      1.75  Q         .         .         .         .
  4.19      0.5495      1.76  Q         .         .         .         .
  4.36      0.5742      1.78  Q         .         .         .         .
  4.53      0.5991      1.79  Q         .         .         .         .
  4.70      0.6243      1.82  Q         .         .         .         .
  4.87      0.6497      1.83  Q         .         .         .         .
  5.04      0.6753      1.85  Q         .         .         .         .
  5.21      0.7011      1.86  Q         .         .         .         .
  5.37      0.7272      1.88  Q         .         .         .         .
  5.54      0.7535      1.90  Q         .         .         .         .
```

5.71	0.7801	1.92	Q	.	.	.	.
5.88	0.8070	1.93	Q	.	.	.	.
6.05	0.8341	1.96	Q	.	.	.	.
6.22	0.8615	1.97	Q	.	.	.	.
6.39	0.8892	2.00	Q	.	.	.	.
6.55	0.9171	2.01	Q	.	.	.	.
6.72	0.9454	2.04	Q	.	.	.	.
6.89	0.9740	2.06	Q	.	.	.	.
7.06	1.0029	2.09	Q	.	.	.	.
7.23	1.0321	2.10	Q	.	.	.	.
7.40	1.0617	2.14	Q	.	.	.	.
7.57	1.0916	2.15	Q	.	.	.	.
7.74	1.1218	2.19	Q	.	.	.	.
7.90	1.1525	2.21	Q	.	.	.	.
8.07	1.1835	2.24	Q	.	.	.	.
8.24	1.2149	2.26	.Q	.	.	.	.
8.41	1.2467	2.30	.Q	.	.	.	.
8.58	1.2790	2.32	.Q	.	.	.	.
8.75	1.3117	2.37	.Q	.	.	.	.
8.92	1.3448	2.39	.Q	.	.	.	.
9.08	1.3784	2.43	.Q	.	.	.	.
9.25	1.4125	2.46	.Q	.	.	.	.
9.42	1.4471	2.51	.Q	.	.	.	.
9.59	1.4822	2.53	.Q	.	.	.	.
9.76	1.5179	2.59	.Q	.	.	.	.
9.93	1.5542	2.62	.Q	.	.	.	.
10.10	1.5911	2.67	.Q	.	.	.	.
10.27	1.6285	2.70	.Q	.	.	.	.
10.43	1.6667	2.77	.Q	.	.	.	.
10.60	1.7055	2.80	.Q	.	.	.	.
10.77	1.7451	2.87	.Q	.	.	.	.
10.94	1.7854	2.91	.Q	.	.	.	.
11.11	1.8265	2.99	.Q	.	.	.	.
11.28	1.8685	3.03	.Q	.	.	.	.
11.45	1.9114	3.12	.Q	.	.	.	.
11.61	1.9552	3.16	.Q	.	.	.	.
11.78	2.0000	3.26	.Q	.	.	.	.
11.95	2.0458	3.32	.Q	.	.	.	.
12.12	2.0955	3.82	.Q	.	.	.	.
12.29	2.1512	4.17	.Q	.	.	.	.
12.46	2.2102	4.30	.Q	.	.	.	.
12.63	2.2707	4.37	.Q	.	.	.	.
12.80	2.3328	4.53	. Q	.	.	.	.
12.96	2.3965	4.61	. Q	.	.	.	.
13.13	2.4620	4.79	. Q	.	.	.	.
13.30	2.5295	4.89	. Q	.	.	.	.
13.47	2.5991	5.10	. Q	.	.	.	.
13.64	2.6711	5.22	. Q	.	.	.	.
13.81	2.7457	5.48	. Q	.	.	.	.
13.98	2.8232	5.63	. Q	.	.	.	.
14.14	2.8943	4.57	. Q	.	.	.	.
14.31	2.9566	4.36	.Q	.	.	.	.
14.48	3.0202	4.76	. Q	.	.	.	.
14.65	3.0881	4.99	. Q	.	.	.	.
14.82	3.1616	5.56	. Q	.	.	.	.
14.99	3.2415	5.90	. Q	.	.	.	.
15.16	3.3300	6.80	. Q	.	.	.	.
15.33	3.4289	7.39	. Q	.	.	.	.
15.49	3.5432	8.99	. Q	.	.	.	.
15.66	3.6776	10.29	. Q	.	.	.	.
15.83	3.9154	23.84	. Q	.	.	.	.
16.00	4.3097	32.73	. Q	.	.	.	.
16.17	5.1245	84.18	.	.	.	. Q	.
16.34	5.7963	12.20	. Q	.	.	.	.
16.51	5.9381	8.14	. Q	.	.	.	.
16.67	6.0388	6.31	. Q	.	.	.	.
16.84	6.1194	5.25	. Q	.	.	.	.
17.01	6.1877	4.55	. Q	.	.	.	.
17.18	6.2598	5.79	. Q	.	.	.	.
17.35	6.3374	5.35	. Q	.	.	.	.
17.52	6.4095	4.99	. Q	.	.	.	.
17.69	6.4771	4.70	. Q	.	.	.	.
17.86	6.5408	4.45	.Q	.	.	.	.



18.02	6.6013	4.23	.Q	.	.	.	.
18.19	6.6543	3.37	.Q	.	.	.	.
18.36	6.7002	3.21	.Q	.	.	.	.
18.53	6.7441	3.07	.Q	.	.	.	.
18.70	6.7860	2.95	.Q	.	.	.	.
18.87	6.8264	2.84	.Q	.	.	.	.
19.04	6.8652	2.74	.Q	.	.	.	.
19.20	6.9027	2.64	.Q	.	.	.	.
19.37	6.9390	2.56	.Q	.	.	.	.
19.54	6.9741	2.48	.Q	.	.	.	.
19.71	7.0083	2.41	.Q	.	.	.	.
19.88	7.0414	2.34	.Q	.	.	.	.
20.05	7.0736	2.28	.Q	.	.	.	.
20.22	7.1051	2.23	Q	.	.	.	.
20.39	7.1357	2.17	Q	.	.	.	.
20.55	7.1656	2.12	Q	.	.	.	.
20.72	7.1948	2.07	Q	.	.	.	.
20.89	7.2234	2.03	Q	.	.	.	.
21.06	7.2514	1.99	Q	.	.	.	.
21.23	7.2788	1.95	Q	.	.	.	.
21.40	7.3056	1.91	Q	.	.	.	.
21.57	7.3320	1.87	Q	.	.	.	.
21.73	7.3578	1.84	Q	.	.	.	.
21.90	7.3832	1.80	Q	.	.	.	.
22.07	7.4081	1.77	Q	.	.	.	.
22.24	7.4327	1.74	Q	.	.	.	.
22.41	7.4568	1.71	Q	.	.	.	.
22.58	7.4805	1.69	Q	.	.	.	.
22.75	7.5038	1.66	Q	.	.	.	.
22.92	7.5268	1.64	Q	.	.	.	.
23.08	7.5494	1.61	Q	.	.	.	.
23.25	7.5717	1.59	Q	.	.	.	.
23.42	7.5937	1.57	Q	.	.	.	.
23.59	7.6154	1.54	Q	.	.	.	.
23.76	7.6368	1.52	Q	.	.	.	.
23.93	7.6579	1.50	Q	.	.	.	.
24.10	7.6787	1.48	Q	.	.	.	.
24.26	7.6891	0.00	Q	.	.	.	.

1



Proposed Condition (DA 2 DMA A)
Time of Concentration (Tc)
Volume (Vol)
Flowrate (Q)

```
************************************************************************
          RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE
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                        Analysis prepared by:

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                       16800 VALLEY VIEW AVENUE
                          LA MIRADA CA 90638
                 PH: (714) 521-4811 FAX: (714) 521-4173

 ************************* DESCRIPTION OF STUDY *************************
* TEI JOB NO. 4099                                                      *
* PROPOSED CONDITION (NODES 300-307)                                    *
* 10-YEAR STORM EVENT                                                   *
 ************************************************************************

  FILE NAME: C:\XDRIVE\4099\P300-10.DAT
  TIME/DATE OF STUDY: 10:35 08/14/2024
========================================================================
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
========================================================================
                    --*TIME-OF-CONCENTRATION MODEL*--

  USER SPECIFIED STORM EVENT(YEAR) =   10.00
  SPECIFIED MINIMUM PIPE SIZE(INCH) =  12.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.95
  *USER-DEFINED LOGARITHMIC INTERPOLATION USED FOR RAINFALL*

  SLOPE OF INTENSITY DURATION CURVE(LOG(I;IN/HR) vs. LOG(Tc;MIN)) = 0.6000
  USER SPECIFIED 1-HOUR INTENSITY(INCH/HOUR) = 0.5900

  *ANTECEDENT MOISTURE CONDITION (AMC) II ASSUMED FOR RATIONAL METHOD*


************************************************************************
  FLOW PROCESS FROM NODE    300.00 TO NODE    301.00 IS CODE =  21
------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
========================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   537.00
  ELEVATION DATA: UPSTREAM(FEET) =   3018.42  DOWNSTREAM(FEET) =   3010.74

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    8.786
  *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  1.868
  SUBAREA Tc AND LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap      SCS   Tc
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  COMMERCIAL                 C        6.78      0.57       0.10    69    8.79
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.57
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
  SUBAREA RUNOFF(CFS) =     11.06
  TOTAL AREA(ACRES) =      6.78   PEAK FLOW RATE(CFS) =     11.06

************************************************************************
  FLOW PROCESS FROM NODE    301.00 TO NODE    302.00 IS CODE =  31
------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
========================================================================
  ELEVATION DATA: UPSTREAM(FEET) =  3006.74  DOWNSTREAM(FEET) =  3000.73
  FLOW LENGTH(FEET) =    17.00   MANNING'S N =  0.012
  DEPTH OF FLOW IN  12.0 INCH PIPE IS   6.0 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  28.40
  ESTIMATED PIPE DIAMETER(INCH) =  12.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =     11.06
  PIPE TRAVEL TIME(MIN.) =   0.01    Tc(MIN.) =   8.80
  LONGEST FLOWPATH FROM NODE    300.00 TO NODE    302.00 =   554.00 FEET.
```

```
****************************************************************************
  FLOW PROCESS FROM NODE    302.00 TO NODE    302.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN) =   8.80
  *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  1.867
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                 C        1.62      0.57       0.10    69
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.57
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
  SUBAREA AREA(ACRES) =    1.62      SUBAREA RUNOFF(CFS) =    2.64
  EFFECTIVE AREA(ACRES) =     8.40   AREA-AVERAGED Fm(INCH/HR) =  0.06
  AREA-AVERAGED Fp(INCH/HR) =  0.57  AREA-AVERAGED Ap =  0.10
  TOTAL AREA(ACRES) =     8.40       PEAK FLOW RATE(CFS) =      13.69

****************************************************************************
  FLOW PROCESS FROM NODE    302.00 TO NODE    302.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN) =   8.80
  *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  1.867
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                 C        1.30      0.57       0.10    69
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.57
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
  SUBAREA AREA(ACRES) =    1.30      SUBAREA RUNOFF(CFS) =    2.12
  EFFECTIVE AREA(ACRES) =     9.70   AREA-AVERAGED Fm(INCH/HR) =  0.06
  AREA-AVERAGED Fp(INCH/HR) =  0.57  AREA-AVERAGED Ap =  0.10
  TOTAL AREA(ACRES) =     9.70       PEAK FLOW RATE(CFS) =      15.81

****************************************************************************
  FLOW PROCESS FROM NODE    302.00 TO NODE    303.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =  3000.73  DOWNSTREAM(FEET) =  2999.79
  FLOW LENGTH(FEET) =   268.00   MANNING'S N =  0.012
  DEPTH OF FLOW IN  27.0 INCH PIPE IS  18.5 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   5.43
  ESTIMATED PIPE DIAMETER(INCH) =  27.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =     15.81
  PIPE TRAVEL TIME(MIN.) =   0.82    Tc(MIN.) =   9.62
  LONGEST FLOWPATH FROM NODE    300.00 TO NODE    303.00 =   822.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    303.00 TO NODE    303.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN) =   9.62
  *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  1.770
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                 C        4.21      0.57       0.10    69
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.57
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
  SUBAREA AREA(ACRES) =    4.21      SUBAREA RUNOFF(CFS) =    6.49
  EFFECTIVE AREA(ACRES) =    13.91   AREA-AVERAGED Fm(INCH/HR) =  0.06
  AREA-AVERAGED Fp(INCH/HR) =  0.57  AREA-AVERAGED Ap =  0.10
  TOTAL AREA(ACRES) =    13.91       PEAK FLOW RATE(CFS) =      21.45

****************************************************************************
  FLOW PROCESS FROM NODE    303.00 TO NODE    304.00 IS CODE =  31
----------------------------------------------------------------------------
```

```
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =  2999.79  DOWNSTREAM(FEET) =  2998.85
  FLOW LENGTH(FEET) =   268.00   MANNING'S N =  0.012
  DEPTH OF FLOW IN  30.0 INCH PIPE IS  21.0 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   5.85
  ESTIMATED PIPE DIAMETER(INCH) =  30.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =     21.45
  PIPE TRAVEL TIME(MIN.) =   0.76    Tc(MIN.) =  10.38
  LONGEST FLOWPATH FROM NODE    300.00 TO NODE    304.00 =  1090.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    304.00 TO NODE    304.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN) =  10.38
  *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  1.690
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp          Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                 C        4.70      0.57       0.10    69
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.57
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
  SUBAREA AREA(ACRES) =    4.70      SUBAREA RUNOFF(CFS) =    6.91
  EFFECTIVE AREA(ACRES) =    18.61   AREA-AVERAGED Fm(INCH/HR) =  0.06
  AREA-AVERAGED Fp(INCH/HR) =  0.57  AREA-AVERAGED Ap =  0.10
  TOTAL AREA(ACRES) =    18.61       PEAK FLOW RATE(CFS) =      27.36

****************************************************************************
  FLOW PROCESS FROM NODE    304.00 TO NODE    305.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =  2998.85  DOWNSTREAM(FEET) =  2997.91
  FLOW LENGTH(FEET) =   268.00   MANNING'S N =  0.012
  DEPTH OF FLOW IN  33.0 INCH PIPE IS  22.9 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   6.22
  ESTIMATED PIPE DIAMETER(INCH) =  33.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =     27.36
  PIPE TRAVEL TIME(MIN.) =   0.72    Tc(MIN.) =  11.10
  LONGEST FLOWPATH FROM NODE    300.00 TO NODE    305.00 =  1358.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    305.00 TO NODE    305.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN) =  11.10
  *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  1.624
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp          Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                 C        4.51      0.57       0.10    69
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.57
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
  SUBAREA AREA(ACRES) =    4.51      SUBAREA RUNOFF(CFS) =    6.36
  EFFECTIVE AREA(ACRES) =    23.12   AREA-AVERAGED Fm(INCH/HR) =  0.06
  AREA-AVERAGED Fp(INCH/HR) =  0.57  AREA-AVERAGED Ap =  0.10
  TOTAL AREA(ACRES) =    23.12       PEAK FLOW RATE(CFS) =      32.61

****************************************************************************
  FLOW PROCESS FROM NODE    305.00 TO NODE    306.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =  2997.91  DOWNSTREAM(FEET) =  2996.97
  FLOW LENGTH(FEET) =   268.00   MANNING'S N =  0.012
  DEPTH OF FLOW IN  33.0 INCH PIPE IS  26.6 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   6.35
```

```
  ESTIMATED PIPE DIAMETER(INCH) =  33.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =     32.61
  PIPE TRAVEL TIME(MIN.) =   0.70    Tc(MIN.) =  11.80
  LONGEST FLOWPATH FROM NODE    300.00 TO NODE    306.00 =  1626.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    306.00 TO NODE    306.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN) =  11.80
  *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  1.565
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                  C        4.39      0.57       0.10    69
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.57
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
  SUBAREA AREA(ACRES) =    4.39      SUBAREA RUNOFF(CFS) =    5.96
  EFFECTIVE AREA(ACRES) =    27.51   AREA-AVERAGED Fm(INCH/HR) =  0.06
  AREA-AVERAGED Fp(INCH/HR) =  0.57  AREA-AVERAGED Ap =  0.10
  TOTAL AREA(ACRES) =    27.51       PEAK FLOW RATE(CFS) =      37.35

****************************************************************************
  FLOW PROCESS FROM NODE    306.00 TO NODE    307.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =  2996.97  DOWNSTREAM(FEET) =  2983.11
  FLOW LENGTH(FEET) =   387.00   MANNING'S N =  0.012
  DEPTH OF FLOW IN  24.0 INCH PIPE IS  16.6 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  16.08
  ESTIMATED PIPE DIAMETER(INCH) =  24.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =     37.35
  PIPE TRAVEL TIME(MIN.) =   0.40    Tc(MIN.) =  12.20
  LONGEST FLOWPATH FROM NODE    300.00 TO NODE    307.00 =  2013.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    307.00 TO NODE    307.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN) =  12.20
  *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  1.534
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                  C        2.28      0.57       0.10    69
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.57
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
  SUBAREA AREA(ACRES) =    2.28      SUBAREA RUNOFF(CFS) =    3.03
  EFFECTIVE AREA(ACRES) =    29.79   AREA-AVERAGED Fm(INCH/HR) =  0.06
  AREA-AVERAGED Fp(INCH/HR) =  0.57  AREA-AVERAGED Ap =  0.10
  TOTAL AREA(ACRES) =    29.79       PEAK FLOW RATE(CFS) =      39.61
============================================================================
  END OF STUDY SUMMARY:
  TOTAL AREA(ACRES)     =     29.79  TC(MIN.) =     12.20
  EFFECTIVE AREA(ACRES) =     29.79  AREA-AVERAGED Fm(INCH/HR)=  0.06
  AREA-AVERAGED Fp(INCH/HR) =  0.57  AREA-AVERAGED Ap =  0.10
  PEAK FLOW RATE(CFS)   =     39.61
============================================================================
============================================================================
  END OF RATIONAL METHOD ANALYSIS
```

```
**************************************************************************
                    SMALL AREA UNIT HYDROGRAPH MODEL

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                           Analysis prepared by:

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    RATIONAL METHOD CALIBRATION COEFFICIENT = 0.90
    TOTAL CATCHMENT AREA(ACRES) =   29.85
    SOIL-LOSS RATE, Fm,(INCH/HR) =  0.081
    LOW LOSS FRACTION = 0.200
    TIME OF CONCENTRATION(MIN.) = 12.20
    SMALL AREA PEAK Q COMPUTED USING PEAK FLOW RATE FORMULA
    USER SPECIFIED RAINFALL VALUES ARE USED
    RETURN FREQUENCY(YEARS) =  10
       5-MINUTE POINT RAINFALL VALUE(INCHES) =  0.19
      30-MINUTE POINT RAINFALL VALUE(INCHES) =  0.47
       1-HOUR   POINT RAINFALL VALUE(INCHES) =  0.59
       3-HOUR   POINT RAINFALL VALUE(INCHES) =  0.85
       6-HOUR   POINT RAINFALL VALUE(INCHES) =  1.18
      24-HOUR   POINT RAINFALL VALUE(INCHES) =  2.04

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

    TOTAL CATCHMENT   RUNOFF  VOLUME(ACRE-FEET) =     3.75
    TOTAL CATCHMENT SOIL-LOSS VOLUME(ACRE-FEET) =     1.32

**************************************************************************
  TIME     VOLUME       Q    0.       10.0      20.0      30.0      40.0
 (HOURS)    (AF)      (CFS)
--------------------------------------------------------------------------
  0.14      0.0061      0.72  Q         .         .         .         .
  0.34      0.0182      0.73  Q         .         .         .         .
  0.55      0.0305      0.73  Q         .         .         .         .
  0.75      0.0428      0.74  Q         .         .         .         .
  0.95      0.0553      0.74  Q         .         .         .         .
  1.16      0.0678      0.75  Q         .         .         .         .
  1.36      0.0805      0.75  Q         .         .         .         .
  1.56      0.0932      0.76  Q         .         .         .         .
  1.77      0.1061      0.77  Q         .         .         .         .
  1.97      0.1191      0.78  Q         .         .         .         .
  2.17      0.1322      0.78  Q         .         .         .         .
  2.38      0.1454      0.79  Q         .         .         .         .
  2.58      0.1587      0.80  Q         .         .         .         .
  2.78      0.1721      0.80  Q         .         .         .         .
  2.99      0.1857      0.81  Q         .         .         .         .
  3.19      0.1994      0.82  Q         .         .         .         .
  3.39      0.2132      0.83  Q         .         .         .         .
  3.60      0.2272      0.84  Q         .         .         .         .
  3.80      0.2413      0.84  Q         .         .         .         .
  4.00      0.2555      0.85  Q         .         .         .         .
  4.21      0.2699      0.86  Q         .         .         .         .
  4.41      0.2844      0.87  Q         .         .         .         .
  4.61      0.2991      0.88  Q         .         .         .         .
  4.82      0.3139      0.89  Q         .         .         .         .
  5.02      0.3289      0.90  Q         .         .         .         .
  5.22      0.3441      0.91  Q         .         .         .         .
  5.43      0.3595      0.92  Q         .         .         .         .
  5.63      0.3750      0.93  Q         .         .         .         .
  5.83      0.3907      0.94  Q         .         .         .         .
  6.04      0.4066      0.95  Q         .         .         .         .
  6.24      0.4226      0.96  Q         .         .         .         .
  6.44      0.4389      0.98  Q         .         .         .         .
  6.65      0.4554      0.99  Q         .         .         .         .
```

6.85	0.4721	1.00	.Q	.	.	.	.	
7.05	0.4890	1.01	.Q	.	.	.	.	
7.26	0.5062	1.03	.Q	.	.	.	.	
7.46	0.5236	1.04	.Q	.	.	.	.	
7.66	0.5412	1.06	.Q	.	.	.	.	
7.87	0.5591	1.07	.Q	.	.	.	.	
8.07	0.5773	1.09	.Q	.	.	.	.	
8.27	0.5957	1.10	.Q	.	.	.	.	
8.48	0.6145	1.13	.Q	.	.	.	.	
8.68	0.6335	1.14	.Q	.	.	.	.	
8.88	0.6529	1.16	.Q	.	.	.	.	
9.09	0.6725	1.18	.Q	.	.	.	.	
9.29	0.6926	1.21	.Q	.	.	.	.	
9.49	0.7130	1.22	.Q	.	.	.	.	
9.70	0.7337	1.25	.Q	.	.	.	.	
9.90	0.7549	1.27	.Q	.	.	.	.	
10.10	0.7765	1.30	.Q	.	.	.	.	
10.31	0.7985	1.32	.Q	.	.	.	.	
10.51	0.8210	1.36	.Q	.	.	.	.	
10.71	0.8440	1.38	.Q	.	.	.	.	
10.92	0.8675	1.42	.Q	.	.	.	.	
11.12	0.8916	1.44	.Q	.	.	.	.	
11.32	0.9163	1.49	.Q	.	.	.	.	
11.53	0.9416	1.52	.Q	.	.	.	.	
11.73	0.9675	1.57	.Q	.	.	.	.	
11.93	0.9943	1.60	.Q	.	.	.	.	
12.14	1.0232	1.84	.Q	.	.	.	.	
12.34	1.0557	2.04	. Q	.	.	.	.	
12.54	1.0906	2.12	. Q	.	.	.	.	
12.75	1.1266	2.16	. Q	.	.	.	.	
12.95	1.1637	2.26	. Q	.	.	.	.	
13.15	1.2020	2.31	. Q	.	.	.	.	
13.36	1.2418	2.42	. Q	.	.	.	.	
13.56	1.2830	2.49	. Q	.	.	.	.	
13.76	1.3261	2.63	. Q	.	.	.	.	
13.97	1.3711	2.72	. Q	.	.	.	.	
14.17	1.4129	2.26	. Q	.	.	.	.	
14.37	1.4499	2.15	. Q	.	.	.	.	
14.58	1.4880	2.39	. Q	.	.	.	.	
14.78	1.5295	2.54	. Q	.	.	.	.	
14.98	1.5754	2.93	. Q	.	.	.	.	
15.19	1.6267	3.18	. Q	.	.	.	.	
15.39	1.6864	3.92	. Q	.	.	.	.	
15.59	1.7565	4.43	. Q	.	.	.	.	
15.80	1.8633	8.28	. Q	.	.	.	.	
16.00	2.0534	14.36	. . Q	.	.	.	.	
16.20	2.4869	37.23	. .	.	.	. Q	.	
16.41	2.8438	5.25	. Q	.	.	.	.	
16.61	2.9173	3.50	. Q	.	.	.	.	
16.81	2.9696	2.72	. Q	.	.	.	.	
17.02	3.0114	2.26	. Q	.	.	.	.	
17.22	3.0540	2.81	. Q	.	.	.	.	
17.42	3.0991	2.56	. Q	.	.	.	.	
17.63	3.1404	2.36	. Q	.	.	.	.	
17.83	3.1788	2.21	. Q	.	.	.	.	
18.03	3.2148	2.08	. Q	.	.	.	.	
18.24	3.2460	1.64	.Q	.	.	.	.	
18.44	3.2727	1.55	.Q	.	.	.	.	
18.64	3.2981	1.47	.Q	.	.	.	.	
18.85	3.3221	1.40	.Q	.	.	.	.	
19.05	3.3451	1.34	.Q	.	.	.	.	
19.25	3.3672	1.28	.Q	.	.	.	.	
19.46	3.3884	1.24	.Q	.	.	.	.	
19.66	3.4087	1.19	.Q	.	.	.	.	
19.86	3.4284	1.15	.Q	.	.	.	.	
20.07	3.4475	1.11	.Q	.	.	.	.	
20.27	3.4659	1.08	.Q	.	.	.	.	
20.47	3.4838	1.05	.Q	.	.	.	.	
20.68	3.5012	1.02	.Q	.	.	.	.	
20.88	3.5182	0.99	Q	.	.	.	.	
21.08	3.5346	0.97	Q	.	.	.	.	
21.29	3.5507	0.95	Q	.	.	.	.	
21.49	3.5664	0.92	Q	.	.	.	.	

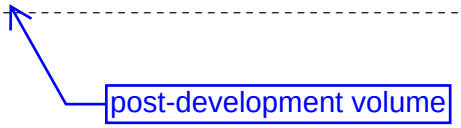
time @ Qp

post-development volume @ Qp

post-development Qp

21.69	3.5818	0.90	Q	.	.	.	.
21.90	3.5968	0.88	Q	.	.	.	.
22.10	3.6115	0.86	Q	.	.	.	.
22.30	3.6258	0.85	Q	.	.	.	.
22.51	3.6399	0.83	Q	.	.	.	.
22.71	3.6538	0.81	Q	.	.	.	.
22.91	3.6673	0.80	Q	.	.	.	.
23.12	3.6807	0.79	Q	.	.	.	.
23.32	3.6937	0.77	Q	.	.	.	.
23.52	3.7066	0.76	Q	.	.	.	.
23.73	3.7193	0.75	Q	.	.	.	.
23.93	3.7317	0.73	Q	.	.	.	.
24.13	3.7440	0.72	Q	.	.	.	.
24.34	3.7500	0.00	Q	.	.	.	.

1



Proposed Condition (DA 3 DMA A)
Time of Concentration (Tc)
Volume (Vol)
Flowrate (Q)

```
************************************************************************
          RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE
       (Reference: 1986 SAN BERNARDINO CO. HYDROLOGY CRITERION)
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          Ver. 8.0  Release Date: 01/01/99  License ID 1435

                        Analysis prepared by:

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 ************************* DESCRIPTION OF STUDY *************************
* TEI JOB NO. 4099                                                      *
* PROPOSED CONDITION (NODES 400-435)                                    *
* 10-YEAR STORM EVENT                                                   *
 ************************************************************************

  FILE NAME: C:\XDRIVE\4099\P400-10.DAT
  TIME/DATE OF STUDY: 10:39 08/14/2024
========================================================================
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
========================================================================
                    --*TIME-OF-CONCENTRATION MODEL*--

  USER SPECIFIED STORM EVENT(YEAR) =   10.00
  SPECIFIED MINIMUM PIPE SIZE(INCH) =  12.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.95
  *USER-DEFINED LOGARITHMIC INTERPOLATION USED FOR RAINFALL*

  SLOPE OF INTENSITY DURATION CURVE(LOG(I;IN/HR) vs. LOG(Tc;MIN)) = 0.6000
  USER SPECIFIED 1-HOUR INTENSITY(INCH/HOUR) = 0.5900

  *ANTECEDENT MOISTURE CONDITION (AMC) II ASSUMED FOR RATIONAL METHOD*


************************************************************************
  FLOW PROCESS FROM NODE    400.00 TO NODE    401.00 IS CODE =  21
------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
========================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   459.00
  ELEVATION DATA: UPSTREAM(FEET) =   3021.09  DOWNSTREAM(FEET) =   3013.01

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    7.915
  *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  1.989
  SUBAREA Tc AND LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap      SCS   Tc
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  COMMERCIAL                 C        2.83      0.57       0.10    69    7.92
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.57
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
  SUBAREA RUNOFF(CFS) =      4.92
  TOTAL AREA(ACRES) =      2.83   PEAK FLOW RATE(CFS) =      4.92

************************************************************************
  FLOW PROCESS FROM NODE    401.00 TO NODE    402.00 IS CODE =  31
------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
========================================================================
  ELEVATION DATA: UPSTREAM(FEET) =  3009.01  DOWNSTREAM(FEET) =  3008.22
  FLOW LENGTH(FEET) =    22.00   MANNING'S N =  0.012
  DEPTH OF FLOW IN  12.0 INCH PIPE IS   7.3 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   9.79
  ESTIMATED PIPE DIAMETER(INCH) =  12.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      4.92
  PIPE TRAVEL TIME(MIN.) =   0.04    Tc(MIN.) =   7.95
  LONGEST FLOWPATH FROM NODE    400.00 TO NODE    402.00 =   481.00 FEET.
```

```
****************************************************************************
  FLOW PROCESS FROM NODE    402.00 TO NODE    402.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN) =   7.95
  *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  1.983
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                 C        1.26      0.57       0.10    69
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.57
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
  SUBAREA AREA(ACRES) =    1.26      SUBAREA RUNOFF(CFS) =    2.19
  EFFECTIVE AREA(ACRES) =     4.09   AREA-AVERAGED Fm(INCH/HR) =  0.06
  AREA-AVERAGED Fp(INCH/HR) =  0.57  AREA-AVERAGED Ap =  0.10
  TOTAL AREA(ACRES) =     4.09       PEAK FLOW RATE(CFS) =       7.09

****************************************************************************
  FLOW PROCESS FROM NODE    402.00 TO NODE    402.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN) =   7.95
  *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  1.983
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                 C        0.79      0.57       0.10    69
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.57
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
  SUBAREA AREA(ACRES) =    0.79      SUBAREA RUNOFF(CFS) =    1.37
  EFFECTIVE AREA(ACRES) =     4.88   AREA-AVERAGED Fm(INCH/HR) =  0.06
  AREA-AVERAGED Fp(INCH/HR) =  0.57  AREA-AVERAGED Ap =  0.10
  TOTAL AREA(ACRES) =     4.88       PEAK FLOW RATE(CFS) =       8.46

****************************************************************************
  FLOW PROCESS FROM NODE    402.00 TO NODE    402.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN) =   7.95
  *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  1.983
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                 C        1.27      0.57       0.10    69
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.57
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
  SUBAREA AREA(ACRES) =    1.27      SUBAREA RUNOFF(CFS) =    2.20
  EFFECTIVE AREA(ACRES) =     6.15   AREA-AVERAGED Fm(INCH/HR) =  0.06
  AREA-AVERAGED Fp(INCH/HR) =  0.57  AREA-AVERAGED Ap =  0.10
  TOTAL AREA(ACRES) =     6.15       PEAK FLOW RATE(CFS) =      10.67

****************************************************************************
  FLOW PROCESS FROM NODE    402.00 TO NODE    402.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN) =   7.95
  *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  1.983
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                 C        0.69      0.57       0.10    69
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.57
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
  SUBAREA AREA(ACRES) =    0.69      SUBAREA RUNOFF(CFS) =    1.20
  EFFECTIVE AREA(ACRES) =     6.84   AREA-AVERAGED Fm(INCH/HR) =  0.06
  AREA-AVERAGED Fp(INCH/HR) =  0.57  AREA-AVERAGED Ap =  0.10
  TOTAL AREA(ACRES) =     6.84       PEAK FLOW RATE(CFS) =      11.86
```

```
****************************************************************************
  FLOW PROCESS FROM NODE    402.00 TO NODE    403.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =  3008.22  DOWNSTREAM(FEET) =  3006.62
  FLOW LENGTH(FEET) =   386.00   MANNING'S N =  0.012
  DEPTH OF FLOW IN  24.0 INCH PIPE IS  15.8 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   5.40
  ESTIMATED PIPE DIAMETER(INCH) =  24.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =     11.86
  PIPE TRAVEL TIME(MIN.) =   1.19    Tc(MIN.) =   9.14
  LONGEST FLOWPATH FROM NODE    400.00 TO NODE    403.00 =   867.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    403.00 TO NODE    403.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN) =   9.14
  *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  1.824
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                 C        2.63      0.57      0.10    69
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.57
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
  SUBAREA AREA(ACRES) =    2.63      SUBAREA RUNOFF(CFS) =    4.18
  EFFECTIVE AREA(ACRES) =     9.47   AREA-AVERAGED Fm(INCH/HR) =  0.06
  AREA-AVERAGED Fp(INCH/HR) =  0.57  AREA-AVERAGED Ap =  0.10
  TOTAL AREA(ACRES) =     9.47       PEAK FLOW RATE(CFS) =      15.06

****************************************************************************
  FLOW PROCESS FROM NODE    403.00 TO NODE    404.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =  3006.62  DOWNSTREAM(FEET) =  3006.05
  FLOW LENGTH(FEET) =   163.00   MANNING'S N =  0.012
  DEPTH OF FLOW IN  27.0 INCH PIPE IS  17.9 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   5.38
  ESTIMATED PIPE DIAMETER(INCH) =  27.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =     15.06
  PIPE TRAVEL TIME(MIN.) =   0.51    Tc(MIN.) =   9.65
  LONGEST FLOWPATH FROM NODE    400.00 TO NODE    404.00 =  1030.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    404.00 TO NODE    404.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN) =   9.65
  *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  1.766
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                 C        0.49      0.57      0.10    69
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.57
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
  SUBAREA AREA(ACRES) =    0.49      SUBAREA RUNOFF(CFS) =    0.75
  EFFECTIVE AREA(ACRES) =     9.96   AREA-AVERAGED Fm(INCH/HR) =  0.06
  AREA-AVERAGED Fp(INCH/HR) =  0.57  AREA-AVERAGED Ap =  0.10
  TOTAL AREA(ACRES) =     9.96       PEAK FLOW RATE(CFS) =      15.33

****************************************************************************
  FLOW PROCESS FROM NODE    404.00 TO NODE    412.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =  3006.05  DOWNSTREAM(FEET) =  3005.24
```

```
  FLOW LENGTH(FEET) =   255.00   MANNING'S N =  0.012
  DEPTH OF FLOW IN  27.0 INCH PIPE IS  18.8 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   5.19
  ESTIMATED PIPE DIAMETER(INCH) =  27.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =     15.33
  PIPE TRAVEL TIME(MIN.) =   0.82    Tc(MIN.) =  10.47
  LONGEST FLOWPATH FROM NODE    400.00 TO NODE    412.00 =  1285.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    412.00 TO NODE    412.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =  10.47
  RAINFALL INTENSITY(INCH/HR) =   1.68
  AREA-AVERAGED Fm(INCH/HR) =  0.06
  AREA-AVERAGED Fp(INCH/HR) =  0.57
  AREA-AVERAGED Ap =  0.10
  EFFECTIVE STREAM AREA(ACRES) =    9.96
  TOTAL STREAM AREA(ACRES) =    9.96
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     15.33

****************************************************************************
  FLOW PROCESS FROM NODE    410.00 TO NODE    411.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   328.00
  ELEVATION DATA: UPSTREAM(FEET) =   3023.39  DOWNSTREAM(FEET) =   3010.71

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    5.913
  *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  2.370
  SUBAREA Tc AND LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS   Tc
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  COMMERCIAL                  C        5.36      0.57       0.10    69    5.91
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.57
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
  SUBAREA RUNOFF(CFS) =     11.16
  TOTAL AREA(ACRES) =      5.36   PEAK FLOW RATE(CFS) =     11.16

****************************************************************************
  FLOW PROCESS FROM NODE    411.00 TO NODE    412.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =  3006.71  DOWNSTREAM(FEET) =  3005.24
  FLOW LENGTH(FEET) =    28.00   MANNING'S N =  0.012
  DEPTH OF FLOW IN  15.0 INCH PIPE IS   9.4 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  13.83
  ESTIMATED PIPE DIAMETER(INCH) =  15.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =     11.16
  PIPE TRAVEL TIME(MIN.) =   0.03    Tc(MIN.) =   5.95
  LONGEST FLOWPATH FROM NODE    410.00 TO NODE    412.00 =   356.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    412.00 TO NODE    412.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =   5.95
  RAINFALL INTENSITY(INCH/HR) =   2.36
  AREA-AVERAGED Fm(INCH/HR) =  0.06
  AREA-AVERAGED Fp(INCH/HR) =  0.57
  AREA-AVERAGED Ap =  0.10
```

```
  EFFECTIVE STREAM AREA(ACRES) =    5.36
  TOTAL STREAM AREA(ACRES) =    5.36
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     11.16

  ** CONFLUENCE DATA **
   STREAM     Q     Tc   Intensity   Fp(Fm)     Ap   Ae     HEADWATER
   NUMBER   (CFS) (MIN.) (INCH/HR) (INCH/HR)       (ACRES)    NODE
      1     15.33  10.47    1.682  0.57( 0.06) 0.10    10.0     400.00
      2     11.16   5.95    2.362  0.57( 0.06) 0.10     5.4     410.00

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

  ** PEAK FLOW RATE TABLE **
   STREAM     Q     Tc   Intensity   Fp(Fm)     Ap   Ae     HEADWATER
   NUMBER   (CFS) (MIN.) (INCH/HR) (INCH/HR)       (ACRES)    NODE
      1     23.19  10.47    1.682  0.57( 0.06) 0.10    15.3     400.00
      2     23.50   5.95    2.362  0.57( 0.06) 0.10    11.0     410.00

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =     23.50    Tc(MIN.) =     5.95
  EFFECTIVE AREA(ACRES) =    11.02   AREA-AVERAGED Fm(INCH/HR) =  0.06
  AREA-AVERAGED Fp(INCH/HR) =  0.57  AREA-AVERAGED Ap =  0.10
  TOTAL AREA(ACRES) =     15.32
  LONGEST FLOWPATH FROM NODE    400.00 TO NODE    412.00 =  1285.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    412.00 TO NODE    413.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =  3005.24  DOWNSTREAM(FEET) =  3004.71
  FLOW LENGTH(FEET) =   151.00   MANNING'S N =  0.012
  DEPTH OF FLOW IN  30.0 INCH PIPE IS  22.6 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   5.93
  ESTIMATED PIPE DIAMETER(INCH) =  30.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =     23.50
  PIPE TRAVEL TIME(MIN.) =   0.42    Tc(MIN.) =   6.37
  LONGEST FLOWPATH FROM NODE    400.00 TO NODE    413.00 =  1436.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    413.00 TO NODE    413.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN) =   6.37
  *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  2.266
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                  C        1.84      0.57      0.10    69
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.57
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
  SUBAREA AREA(ACRES) =    1.84      SUBAREA RUNOFF(CFS) =    3.66
  EFFECTIVE AREA(ACRES) =    12.86   AREA-AVERAGED Fm(INCH/HR) =  0.06
  AREA-AVERAGED Fp(INCH/HR) =  0.57  AREA-AVERAGED Ap =  0.10
  TOTAL AREA(ACRES) =    17.16       PEAK FLOW RATE(CFS) =      25.56

****************************************************************************
  FLOW PROCESS FROM NODE    413.00 TO NODE    414.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =  3004.71  DOWNSTREAM(FEET) =  3004.18
  FLOW LENGTH(FEET) =   151.00   MANNING'S N =  0.012
  DEPTH OF FLOW IN  30.0 INCH PIPE IS  24.5 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   5.96
  ESTIMATED PIPE DIAMETER(INCH) =  30.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =     25.56
  PIPE TRAVEL TIME(MIN.) =   0.42    Tc(MIN.) =   6.79
  LONGEST FLOWPATH FROM NODE    400.00 TO NODE    414.00 =  1587.00 FEET.
```

```
****************************************************************************
  FLOW PROCESS FROM NODE    414.00 TO NODE    414.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN) =   6.79
  *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  2.180
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                 C        2.25      0.57       0.10    69
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.57
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
  SUBAREA AREA(ACRES) =    2.25      SUBAREA RUNOFF(CFS) =    4.30
  EFFECTIVE AREA(ACRES) =    15.11   AREA-AVERAGED Fm(INCH/HR) =  0.06
  AREA-AVERAGED Fp(INCH/HR) =  0.57  AREA-AVERAGED Ap =  0.10
  TOTAL AREA(ACRES) =    19.41       PEAK FLOW RATE(CFS) =      28.87

****************************************************************************
  FLOW PROCESS FROM NODE    414.00 TO NODE    415.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =  3004.18  DOWNSTREAM(FEET) =  3003.66
  FLOW LENGTH(FEET) =   151.00   MANNING'S N =  0.012
  DEPTH OF FLOW IN  33.0 INCH PIPE IS  24.0 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   6.23
  ESTIMATED PIPE DIAMETER(INCH) =  33.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =     28.87
  PIPE TRAVEL TIME(MIN.) =   0.40    Tc(MIN.) =   7.20
  LONGEST FLOWPATH FROM NODE    400.00 TO NODE    415.00 =  1738.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    415.00 TO NODE    415.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN) =   7.20
  *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  2.106
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                 C        1.84      0.57       0.10    69
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.57
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
  SUBAREA AREA(ACRES) =    1.84      SUBAREA RUNOFF(CFS) =    3.39
  EFFECTIVE AREA(ACRES) =    16.95   AREA-AVERAGED Fm(INCH/HR) =  0.06
  AREA-AVERAGED Fp(INCH/HR) =  0.57  AREA-AVERAGED Ap =  0.10
  TOTAL AREA(ACRES) =    21.25       PEAK FLOW RATE(CFS) =      31.26

****************************************************************************
  FLOW PROCESS FROM NODE    415.00 TO NODE    416.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =  3003.66  DOWNSTREAM(FEET) =  3003.13
  FLOW LENGTH(FEET) =   151.00   MANNING'S N =  0.012
  DEPTH OF FLOW IN  33.0 INCH PIPE IS  25.5 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   6.34
  ESTIMATED PIPE DIAMETER(INCH) =  33.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =     31.26
  PIPE TRAVEL TIME(MIN.) =   0.40    Tc(MIN.) =   7.59
  LONGEST FLOWPATH FROM NODE    400.00 TO NODE    416.00 =  1889.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    416.00 TO NODE    416.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN) =   7.59
```

```
  *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  2.039
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                 C        2.25      0.57      0.10    69
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.57
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
  SUBAREA AREA(ACRES) =    2.25      SUBAREA RUNOFF(CFS) =    4.01
  EFFECTIVE AREA(ACRES) =    19.20   AREA-AVERAGED Fm(INCH/HR) =  0.06
  AREA-AVERAGED Fp(INCH/HR) =  0.57  AREA-AVERAGED Ap =  0.10
  TOTAL AREA(ACRES) =    23.50       PEAK FLOW RATE(CFS) =      34.25

****************************************************************************
  FLOW PROCESS FROM NODE    416.00 TO NODE    417.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =  3003.13  DOWNSTREAM(FEET) =  3002.60
  FLOW LENGTH(FEET) =   151.00   MANNING'S N =  0.012
  DEPTH OF FLOW IN  36.0 INCH PIPE IS  24.8 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   6.59
  ESTIMATED PIPE DIAMETER(INCH) =  36.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =     34.25
  PIPE TRAVEL TIME(MIN.) =   0.38    Tc(MIN.) =   7.98
  LONGEST FLOWPATH FROM NODE    400.00 TO NODE    417.00 =  2040.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    417.00 TO NODE    417.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN) =   7.98
  *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  1.980
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                 C        2.26      0.57      0.10    69
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.57
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
  SUBAREA AREA(ACRES) =    2.26      SUBAREA RUNOFF(CFS) =    3.91
  EFFECTIVE AREA(ACRES) =    21.46   AREA-AVERAGED Fm(INCH/HR) =  0.06
  AREA-AVERAGED Fp(INCH/HR) =  0.57  AREA-AVERAGED Ap =  0.10
  TOTAL AREA(ACRES) =    25.76       PEAK FLOW RATE(CFS) =      37.14

****************************************************************************
  FLOW PROCESS FROM NODE    417.00 TO NODE    418.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =  3002.60  DOWNSTREAM(FEET) =  3002.07
  FLOW LENGTH(FEET) =   151.00   MANNING'S N =  0.012
  DEPTH OF FLOW IN  36.0 INCH PIPE IS  26.5 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   6.67
  ESTIMATED PIPE DIAMETER(INCH) =  36.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =     37.14
  PIPE TRAVEL TIME(MIN.) =   0.38    Tc(MIN.) =   8.35
  LONGEST FLOWPATH FROM NODE    400.00 TO NODE    418.00 =  2191.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    418.00 TO NODE    418.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN) =   8.35
  *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  1.926
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                 C        1.84      0.57      0.10    69
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.57
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
```

```
  SUBAREA AREA(ACRES) =    1.84      SUBAREA RUNOFF(CFS) =    3.10
  EFFECTIVE AREA(ACRES) =    23.30   AREA-AVERAGED Fm(INCH/HR) =  0.06
  AREA-AVERAGED Fp(INCH/HR) =  0.57  AREA-AVERAGED Ap =  0.10
  TOTAL AREA(ACRES) =    27.60      PEAK FLOW RATE(CFS) =      39.19

****************************************************************************
  FLOW PROCESS FROM NODE    418.00 TO NODE    419.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =  3002.07  DOWNSTREAM(FEET) =  3001.54
  FLOW LENGTH(FEET) =   151.00   MANNING'S N =  0.012
  DEPTH OF FLOW IN  36.0 INCH PIPE IS  27.7 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   6.71
  ESTIMATED PIPE DIAMETER(INCH) =  36.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =     39.19
  PIPE TRAVEL TIME(MIN.) =   0.37    Tc(MIN.) =   8.73
  LONGEST FLOWPATH FROM NODE    400.00 TO NODE    419.00 =  2342.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    419.00 TO NODE    419.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN) =   8.73
  *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  1.876
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                  C        2.25      0.57       0.10    69
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.57
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
  SUBAREA AREA(ACRES) =    2.25      SUBAREA RUNOFF(CFS) =    3.68
  EFFECTIVE AREA(ACRES) =    25.55   AREA-AVERAGED Fm(INCH/HR) =  0.06
  AREA-AVERAGED Fp(INCH/HR) =  0.57  AREA-AVERAGED Ap =  0.10
  TOTAL AREA(ACRES) =    29.85      PEAK FLOW RATE(CFS) =      41.83

****************************************************************************
  FLOW PROCESS FROM NODE    419.00 TO NODE    420.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =  3001.54  DOWNSTREAM(FEET) =  3001.02
  FLOW LENGTH(FEET) =   151.00   MANNING'S N =  0.012
  DEPTH OF FLOW IN  39.0 INCH PIPE IS  26.8 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   6.88
  ESTIMATED PIPE DIAMETER(INCH) =  39.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =     41.83
  PIPE TRAVEL TIME(MIN.) =   0.37    Tc(MIN.) =   9.09
  LONGEST FLOWPATH FROM NODE    400.00 TO NODE    420.00 =  2493.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    420.00 TO NODE    420.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN) =   9.09
  *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  1.830
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                  C        1.84      0.57       0.10    69
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.57
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
  SUBAREA AREA(ACRES) =    1.84      SUBAREA RUNOFF(CFS) =    2.94
  EFFECTIVE AREA(ACRES) =    27.39   AREA-AVERAGED Fm(INCH/HR) =  0.06
  AREA-AVERAGED Fp(INCH/HR) =  0.57  AREA-AVERAGED Ap =  0.10
  TOTAL AREA(ACRES) =    31.69      PEAK FLOW RATE(CFS) =      43.71

****************************************************************************
  FLOW PROCESS FROM NODE    420.00 TO NODE    421.00 IS CODE =  31
```

```
--------------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
================================================================================
  ELEVATION DATA: UPSTREAM(FEET) =  3001.02  DOWNSTREAM(FEET) =  3000.49
  FLOW LENGTH(FEET) =   151.00   MANNING'S N =  0.012
  DEPTH OF FLOW IN  39.0 INCH PIPE IS  27.5 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   6.98
  ESTIMATED PIPE DIAMETER(INCH) =  39.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =     43.71
  PIPE TRAVEL TIME(MIN.) =   0.36    Tc(MIN.) =   9.45
  LONGEST FLOWPATH FROM NODE    400.00 TO NODE    421.00 =  2644.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    421.00 TO NODE    421.00 IS CODE =  81
--------------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
================================================================================
  MAINLINE Tc(MIN) =   9.45
  *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  1.788
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                 C        3.63      0.57       0.10    69
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.57
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
  SUBAREA AREA(ACRES) =    3.63      SUBAREA RUNOFF(CFS) =    5.66
  EFFECTIVE AREA(ACRES) =    31.02   AREA-AVERAGED Fm(INCH/HR) =  0.06
  AREA-AVERAGED Fp(INCH/HR) =  0.57  AREA-AVERAGED Ap =  0.10
  TOTAL AREA(ACRES) =    35.32       PEAK FLOW RATE(CFS) =      48.33

****************************************************************************
  FLOW PROCESS FROM NODE    421.00 TO NODE    422.00 IS CODE =  31
--------------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
================================================================================
  ELEVATION DATA: UPSTREAM(FEET) =  3000.49  DOWNSTREAM(FEET) =  3000.18
  FLOW LENGTH(FEET) =    88.00   MANNING'S N =  0.012
  DEPTH OF FLOW IN  39.0 INCH PIPE IS  29.9 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   7.09
  ESTIMATED PIPE DIAMETER(INCH) =  39.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =     48.33
  PIPE TRAVEL TIME(MIN.) =   0.21    Tc(MIN.) =   9.66
  LONGEST FLOWPATH FROM NODE    400.00 TO NODE    422.00 =  2732.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    422.00 TO NODE    422.00 IS CODE =  81
--------------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
================================================================================
  MAINLINE Tc(MIN) =   9.66
  *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  1.765
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                 C        0.85      0.57       0.10    69
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.57
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
  SUBAREA AREA(ACRES) =    0.85      SUBAREA RUNOFF(CFS) =    1.31
  EFFECTIVE AREA(ACRES) =    31.87   AREA-AVERAGED Fm(INCH/HR) =  0.06
  AREA-AVERAGED Fp(INCH/HR) =  0.57  AREA-AVERAGED Ap =  0.10
  TOTAL AREA(ACRES) =    36.17       PEAK FLOW RATE(CFS) =      48.99

****************************************************************************
  FLOW PROCESS FROM NODE    422.00 TO NODE    423.00 IS CODE =  31
--------------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
================================================================================
  ELEVATION DATA: UPSTREAM(FEET) =  3000.18  DOWNSTREAM(FEET) =  2999.47
  FLOW LENGTH(FEET) =   205.00   MANNING'S N =  0.012
  DEPTH OF FLOW IN  39.0 INCH PIPE IS  30.5 INCHES
```

```
  PIPE-FLOW VELOCITY(FEET/SEC.) =   7.04
  ESTIMATED PIPE DIAMETER(INCH) =  39.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =     48.99
  PIPE TRAVEL TIME(MIN.) =   0.49    Tc(MIN.) =  10.15
  LONGEST FLOWPATH FROM NODE    400.00 TO NODE    423.00 =  2937.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    423.00 TO NODE    423.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN) =  10.15
  *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  1.714
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp          Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                 C        0.36      0.57       0.10    69
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.57
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
  SUBAREA AREA(ACRES) =    0.36      SUBAREA RUNOFF(CFS) =    0.54
  EFFECTIVE AREA(ACRES) =    32.23   AREA-AVERAGED Fm(INCH/HR) =  0.06
  AREA-AVERAGED Fp(INCH/HR) =  0.57  AREA-AVERAGED Ap =  0.10
  TOTAL AREA(ACRES) =    36.53       PEAK FLOW RATE(CFS) =      48.99
  NOTE: PEAK FLOW RATE DEFAULTED TO UPSTREAM VALUE

****************************************************************************
  FLOW PROCESS FROM NODE    423.00 TO NODE    424.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =  2999.47  DOWNSTREAM(FEET) =  2998.59
  FLOW LENGTH(FEET) =   251.00   MANNING'S N =  0.012
  DEPTH OF FLOW IN  39.0 INCH PIPE IS  30.3 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   7.08
  ESTIMATED PIPE DIAMETER(INCH) =  39.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =     48.99
  PIPE TRAVEL TIME(MIN.) =   0.59    Tc(MIN.) =  10.74
  LONGEST FLOWPATH FROM NODE    400.00 TO NODE    424.00 =  3188.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    424.00 TO NODE    424.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN) =  10.74
  *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  1.656
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp          Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                 C        1.15      0.57       0.10    69
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.57
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
  SUBAREA AREA(ACRES) =    1.15      SUBAREA RUNOFF(CFS) =    1.66
  EFFECTIVE AREA(ACRES) =    33.38   AREA-AVERAGED Fm(INCH/HR) =  0.06
  AREA-AVERAGED Fp(INCH/HR) =  0.57  AREA-AVERAGED Ap =  0.10
  TOTAL AREA(ACRES) =    37.68       PEAK FLOW RATE(CFS) =      48.99
  NOTE: PEAK FLOW RATE DEFAULTED TO UPSTREAM VALUE

****************************************************************************
  FLOW PROCESS FROM NODE    424.00 TO NODE    435.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =  2998.59  DOWNSTREAM(FEET) =  2994.06
  FLOW LENGTH(FEET) =   127.00   MANNING'S N =  0.012
  DEPTH OF FLOW IN  27.0 INCH PIPE IS  18.2 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  17.23
  ESTIMATED PIPE DIAMETER(INCH) =  27.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =     48.99
  PIPE TRAVEL TIME(MIN.) =   0.12    Tc(MIN.) =  10.86
  LONGEST FLOWPATH FROM NODE    400.00 TO NODE    435.00 =  3315.00 FEET.
```

```
****************************************************************************
  FLOW PROCESS FROM NODE    435.00 TO NODE    435.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =  10.86
  RAINFALL INTENSITY(INCH/HR) =   1.65
  AREA-AVERAGED Fm(INCH/HR) =  0.06
  AREA-AVERAGED Fp(INCH/HR) =  0.57
  AREA-AVERAGED Ap =  0.10
  EFFECTIVE STREAM AREA(ACRES) =   33.38
  TOTAL STREAM AREA(ACRES) =   37.68
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     48.99

****************************************************************************
  FLOW PROCESS FROM NODE    430.00 TO NODE    431.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   309.00
  ELEVATION DATA: UPSTREAM(FEET) =   3010.37  DOWNSTREAM(FEET) =   3004.10

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    6.567
  *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  2.225
  SUBAREA Tc AND LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS   Tc
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  COMMERCIAL                  C        1.03      0.57       0.10    69    6.57
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.57
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
  SUBAREA RUNOFF(CFS) =      2.01
  TOTAL AREA(ACRES) =      1.03   PEAK FLOW RATE(CFS) =      2.01

****************************************************************************
  FLOW PROCESS FROM NODE    431.00 TO NODE    432.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =  3000.10  DOWNSTREAM(FEET) =  2999.88
  FLOW LENGTH(FEET) =    56.00   MANNING'S N =  0.012
  DEPTH OF FLOW IN  12.0 INCH PIPE IS   8.5 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   3.37
  ESTIMATED PIPE DIAMETER(INCH) =  12.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      2.01
  PIPE TRAVEL TIME(MIN.) =   0.28    Tc(MIN.) =   6.84
  LONGEST FLOWPATH FROM NODE    430.00 TO NODE    432.00 =   365.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    432.00 TO NODE    432.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN) =   6.84
  *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  2.170
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                  C        1.26      0.57       0.10    69
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.57
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
  SUBAREA AREA(ACRES) =    1.26      SUBAREA RUNOFF(CFS) =    2.40
  EFFECTIVE AREA(ACRES) =     2.29   AREA-AVERAGED Fm(INCH/HR) =  0.06
  AREA-AVERAGED Fp(INCH/HR) =  0.57  AREA-AVERAGED Ap =  0.10
  TOTAL AREA(ACRES) =     2.29       PEAK FLOW RATE(CFS) =       4.36

****************************************************************************
  FLOW PROCESS FROM NODE    432.00 TO NODE    433.00 IS CODE =  31
```

```
--------------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
================================================================================
  ELEVATION DATA: UPSTREAM(FEET) =  2999.88  DOWNSTREAM(FEET) =  2999.53
  FLOW LENGTH(FEET) =    70.00   MANNING'S N =  0.012
  DEPTH OF FLOW IN  15.0 INCH PIPE IS  11.2 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   4.45
  ESTIMATED PIPE DIAMETER(INCH) =  15.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      4.36
  PIPE TRAVEL TIME(MIN.) =   0.26    Tc(MIN.) =   7.11
  LONGEST FLOWPATH FROM NODE    430.00 TO NODE    433.00 =   435.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    433.00 TO NODE    433.00 IS CODE =  81
--------------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
================================================================================
  MAINLINE Tc(MIN) =   7.11
  *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  2.122
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                 C        0.79      0.57       0.10    69
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.57
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
  SUBAREA AREA(ACRES) =    0.79      SUBAREA RUNOFF(CFS) =    1.47
  EFFECTIVE AREA(ACRES) =     3.08   AREA-AVERAGED Fm(INCH/HR) =  0.06
  AREA-AVERAGED Fp(INCH/HR) =  0.57  AREA-AVERAGED Ap =  0.10
  TOTAL AREA(ACRES) =     3.08       PEAK FLOW RATE(CFS) =       5.73

****************************************************************************
  FLOW PROCESS FROM NODE    433.00 TO NODE    433.00 IS CODE =  81
--------------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
================================================================================
  MAINLINE Tc(MIN) =   7.11
  *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  2.122
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                 C        0.87      0.57       0.10    69
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.57
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
  SUBAREA AREA(ACRES) =    0.87      SUBAREA RUNOFF(CFS) =    1.62
  EFFECTIVE AREA(ACRES) =     3.95   AREA-AVERAGED Fm(INCH/HR) =  0.06
  AREA-AVERAGED Fp(INCH/HR) =  0.57  AREA-AVERAGED Ap =  0.10
  TOTAL AREA(ACRES) =     3.95       PEAK FLOW RATE(CFS) =       7.34

****************************************************************************
  FLOW PROCESS FROM NODE    433.00 TO NODE    434.00 IS CODE =  31
--------------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
================================================================================
  ELEVATION DATA: UPSTREAM(FEET) =  2999.88  DOWNSTREAM(FEET) =  2994.34
  FLOW LENGTH(FEET) =   289.00   MANNING'S N =  0.012
  DEPTH OF FLOW IN  15.0 INCH PIPE IS   9.9 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   8.50
  ESTIMATED PIPE DIAMETER(INCH) =  15.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      7.34
  PIPE TRAVEL TIME(MIN.) =   0.57    Tc(MIN.) =   7.67
  LONGEST FLOWPATH FROM NODE    430.00 TO NODE    434.00 =   724.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    434.00 TO NODE    434.00 IS CODE =  81
--------------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
================================================================================
  MAINLINE Tc(MIN) =   7.67
  *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  2.027
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
```

```
      LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                C        0.67       0.57       0.10    69
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.57
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
  SUBAREA AREA(ACRES) =    0.67      SUBAREA RUNOFF(CFS) =    1.19
  EFFECTIVE AREA(ACRES) =     4.62   AREA-AVERAGED Fm(INCH/HR) =  0.06
  AREA-AVERAGED Fp(INCH/HR) =  0.57  AREA-AVERAGED Ap =  0.10
  TOTAL AREA(ACRES) =     4.62       PEAK FLOW RATE(CFS) =       8.19

****************************************************************************
  FLOW PROCESS FROM NODE    434.00 TO NODE    435.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =  2994.34  DOWNSTREAM(FEET) =  2994.06
  FLOW LENGTH(FEET) =     8.00   MANNING'S N =  0.012
  DEPTH OF FLOW IN  15.0 INCH PIPE IS   8.7 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  11.04
  ESTIMATED PIPE DIAMETER(INCH) =  15.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      8.19
  PIPE TRAVEL TIME(MIN.) =   0.01    Tc(MIN.) =   7.69
  LONGEST FLOWPATH FROM NODE    430.00 TO NODE    435.00 =   732.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    435.00 TO NODE    435.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =   7.69
  RAINFALL INTENSITY(INCH/HR) =   2.02
  AREA-AVERAGED Fm(INCH/HR) =  0.06
  AREA-AVERAGED Fp(INCH/HR) =  0.57
  AREA-AVERAGED Ap =  0.10
  EFFECTIVE STREAM AREA(ACRES) =    4.62
  TOTAL STREAM AREA(ACRES) =    4.62
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      8.19

  ** CONFLUENCE DATA **
   STREAM     Q     Tc   Intensity   Fp(Fm)     Ap   Ae     HEADWATER
   NUMBER   (CFS) (MIN.) (INCH/HR) (INCH/HR)       (ACRES)    NODE
      1     43.66  15.47    1.330  0.57( 0.06) 0.10    37.7     400.00
      1     48.99  10.86    1.645  0.57( 0.06) 0.10    33.4     410.00
      2      8.19   7.69    2.025  0.57( 0.06) 0.10     4.6     430.00

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

  ** PEAK FLOW RATE TABLE **
   STREAM     Q     Tc   Intensity   Fp(Fm)     Ap   Ae     HEADWATER
   NUMBER   (CFS) (MIN.) (INCH/HR) (INCH/HR)       (ACRES)    NODE
      1     55.61  10.86    1.645  0.57( 0.06) 0.10    38.0     410.00
      2     48.96  15.47    1.330  0.57( 0.06) 0.10    42.3     400.00
      3     51.14   7.69    2.025  0.57( 0.06) 0.10    28.2     430.00

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =     55.61    Tc(MIN.) =    10.86
  EFFECTIVE AREA(ACRES) =    38.00   AREA-AVERAGED Fm(INCH/HR) =  0.06
  AREA-AVERAGED Fp(INCH/HR) =  0.57  AREA-AVERAGED Ap =  0.10
  TOTAL AREA(ACRES) =     42.30
  LONGEST FLOWPATH FROM NODE    400.00 TO NODE    435.00 =  3315.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    435.00 TO NODE    435.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN) =  10.86
  *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  1.645
  SUBAREA LOSS RATE DATA(AMC  II):
```

```
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                  C        3.07      0.57       0.10    69
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.57
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
  SUBAREA AREA(ACRES) =    3.07      SUBAREA RUNOFF(CFS) =    4.39
  EFFECTIVE AREA(ACRES) =    41.07   AREA-AVERAGED Fm(INCH/HR) =  0.06
  AREA-AVERAGED Fp(INCH/HR) =  0.57  AREA-AVERAGED Ap =  0.10
  TOTAL AREA(ACRES) =    45.37       PEAK FLOW RATE(CFS) =      58.72
================================================================================
  END OF STUDY SUMMARY:
  TOTAL AREA(ACRES)      =     45.37  TC(MIN.) =     10.86
  EFFECTIVE AREA(ACRES) =     41.07  AREA-AVERAGED Fm(INCH/HR)=  0.06
  AREA-AVERAGED Fp(INCH/HR) =  0.57  AREA-AVERAGED Ap =  0.10
  PEAK FLOW RATE(CFS)    =     58.72

  ** PEAK FLOW RATE TABLE **
   STREAM     Q     Tc   Intensity   Fp(Fm)     Ap   Ae     HEADWATER
   NUMBER   (CFS) (MIN.) (INCH/HR) (INCH/HR)       (ACRES)    NODE
      1     55.45   7.69    2.025  0.57( 0.06) 0.10    31.3     430.00
      2     58.72  10.86    1.645  0.57( 0.06) 0.10    41.1     410.00
      3     52.02  15.47    1.330  0.57( 0.06) 0.10    45.4     400.00
================================================================================
================================================================================
  END OF RATIONAL METHOD ANALYSIS

1
```

```
**************************************************************************
                    SMALL AREA UNIT HYDROGRAPH MODEL

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                           Analysis prepared by:

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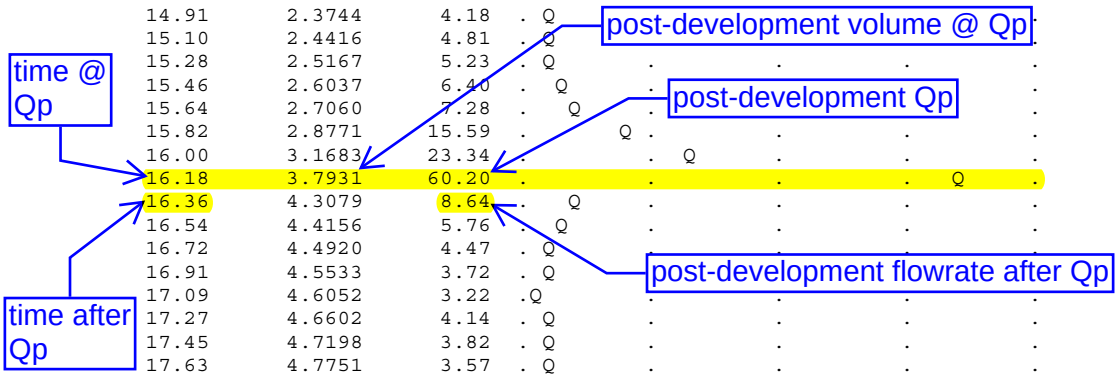
    RATIONAL METHOD CALIBRATION COEFFICIENT = 0.90
    TOTAL CATCHMENT AREA(ACRES) =   45.42
    SOIL-LOSS RATE, Fm,(INCH/HR) =  0.081
    LOW LOSS FRACTION = 0.200
    TIME OF CONCENTRATION(MIN.) = 10.86
    SMALL AREA PEAK Q COMPUTED USING PEAK FLOW RATE FORMULA
    USER SPECIFIED RAINFALL VALUES ARE USED
    RETURN FREQUENCY(YEARS) =  10
       5-MINUTE POINT RAINFALL VALUE(INCHES) =  0.19
      30-MINUTE POINT RAINFALL VALUE(INCHES) =  0.47
       1-HOUR   POINT RAINFALL VALUE(INCHES) =  0.59
       3-HOUR   POINT RAINFALL VALUE(INCHES) =  0.85
       6-HOUR   POINT RAINFALL VALUE(INCHES) =  1.18
      24-HOUR   POINT RAINFALL VALUE(INCHES) =  2.04

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

    TOTAL CATCHMENT   RUNOFF  VOLUME(ACRE-FEET) =     5.70
    TOTAL CATCHMENT SOIL-LOSS VOLUME(ACRE-FEET) =     2.02

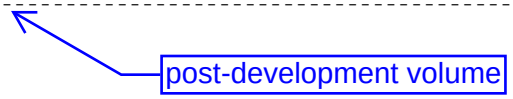
**************************************************************************
  TIME     VOLUME       Q    0.       17.5      35.0      52.5      70.0
 (HOURS)    (AF)      (CFS)
--------------------------------------------------------------------------
  0.07      0.0000      0.00  Q         .         .         .         .
  0.25      0.0083      1.10  Q         .         .         .         .
  0.43      0.0248      1.11  Q         .         .         .         .
  0.61      0.0414      1.12  Q         .         .         .         .
  0.80      0.0582      1.12  Q         .         .         .         .
  0.98      0.0751      1.13  Q         .         .         .         .
  1.16      0.0921      1.14  Q         .         .         .         .
  1.34      0.1093      1.15  Q         .         .         .         .
  1.52      0.1265      1.16  Q         .         .         .         .
  1.70      0.1439      1.17  Q         .         .         .         .
  1.88      0.1615      1.17  Q         .         .         .         .
  2.06      0.1791      1.19  Q         .         .         .         .
  2.24      0.1969      1.19  Q         .         .         .         .
  2.42      0.2149      1.21  Q         .         .         .         .
  2.61      0.2330      1.21  Q         .         .         .         .
  2.79      0.2512      1.23  Q         .         .         .         .
  2.97      0.2696      1.23  Q         .         .         .         .
  3.15      0.2881      1.25  Q         .         .         .         .
  3.33      0.3068      1.25  Q         .         .         .         .
  3.51      0.3257      1.27  Q         .         .         .         .
  3.69      0.3447      1.28  Q         .         .         .         .
  3.87      0.3639      1.29  Q         .         .         .         .
  4.05      0.3833      1.30  Q         .         .         .         .
  4.23      0.4028      1.31  Q         .         .         .         .
  4.42      0.4225      1.32  Q         .         .         .         .
  4.60      0.4424      1.34  Q         .         .         .         .
  4.78      0.4625      1.35  Q         .         .         .         .
  4.96      0.4828      1.36  Q         .         .         .         .
  5.14      0.5033      1.37  Q         .         .         .         .
  5.32      0.5240      1.39  Q         .         .         .         .
  5.50      0.5449      1.40  Q         .         .         .         .
  5.68      0.5660      1.42  Q         .         .         .         .
  5.86      0.5873      1.43  Q         .         .         .         .
```

6.04	0.6089	1.45	Q	.	.	.	.
6.23	0.6307	1.46	Q	.	.	.	.
6.41	0.6527	1.48	Q	.	.	.	.
6.59	0.6750	1.50	Q	.	.	.	.
6.77	0.6976	1.52	Q	.	.	.	.
6.95	0.7204	1.53	Q	.	.	.	.
7.13	0.7435	1.56	Q	.	.	.	.
7.31	0.7669	1.57	Q	.	.	.	.
7.49	0.7905	1.60	Q	.	.	.	.
7.67	0.8145	1.61	Q	.	.	.	.
7.86	0.8388	1.64	Q	.	.	.	.
8.04	0.8634	1.65	Q	.	.	.	.
8.22	0.8883	1.68	Q	.	.	.	.
8.40	0.9136	1.70	Q	.	.	.	.
8.58	0.9392	1.73	Q	.	.	.	.
8.76	0.9652	1.75	Q	.	.	.	.
8.94	0.9916	1.78	.Q	.	.	.	.
9.12	1.0184	1.80	.Q	.	.	.	.
9.30	1.0457	1.84	.Q	.	.	.	.
9.48	1.0733	1.86	.Q	.	.	.	.
9.66	1.1014	1.90	.Q	.	.	.	.
9.85	1.1300	1.92	.Q	.	.	.	.
10.03	1.1591	1.97	.Q	.	.	.	.
10.21	1.1888	1.99	.Q	.	.	.	.
10.39	1.2190	2.04	.Q	.	.	.	.
10.57	1.2497	2.07	.Q	.	.	.	.
10.75	1.2811	2.13	.Q	.	.	.	.
10.93	1.3131	2.15	.Q	.	.	.	.
11.11	1.3458	2.22	.Q	.	.	.	.
11.29	1.3792	2.25	.Q	.	.	.	.
11.48	1.4134	2.32	.Q	.	.	.	.
11.66	1.4484	2.36	.Q	.	.	.	.
11.84	1.4842	2.44	.Q	.	.	.	.
12.02	1.5210	2.48	.Q	.	.	.	.
12.20	1.5625	3.08	.Q	.	.	.	.
12.38	1.6089	3.13	.Q	.	.	.	.
12.56	1.6565	3.24	.Q	.	.	.	.
12.74	1.7054	3.30	.Q	.	.	.	.
12.92	1.7556	3.42	.Q	.	.	.	.
13.10	1.8074	3.49	.Q	.	.	.	.
13.28	1.8608	3.65	. Q	.	.	.	.
13.47	1.9160	3.73	. Q	.	.	.	.
13.65	1.9733	3.92	. Q	.	.	.	.
13.83	2.0327	4.03	. Q	.	.	.	.
14.01	2.0947	4.26	. Q	.	.	.	.
14.19	2.1538	3.64	. Q	.	.	.	.
14.37	2.2063	3.37	.Q	.	.	.	.
14.55	2.2579	3.53	. Q	.	.	.	.
14.73	2.3137	3.93	. Q	.	.	.	.
14.91	2.3744	4.18	. Q	.	.	.	.
15.10	2.4416	4.81	. Q	.	.	.	.
15.28	2.5167	5.23	. Q	.	.	.	.
15.46	2.6037	6.40	. Q	.	.	.	.
15.64	2.7060	7.28	. Q	.	.	.	.
15.82	2.8771	15.59	. Q	.	.	.	.
16.00	3.1683	23.34	. Q	.	.	.	.
16.18	3.7931	60.20	.	.	.	. Q	.
16.36	4.3079	8.64	. Q	.	.	.	.
16.54	4.4156	5.76	. Q	.	.	.	.
16.72	4.4920	4.47	. Q	.	.	.	.
16.91	4.5533	3.72	. Q	.	.	.	.
17.09	4.6052	3.22	.Q	.	.	.	.
17.27	4.6602	4.14	. Q	.	.	.	.
17.45	4.7198	3.82	. Q	.	.	.	.
17.63	4.7751	3.57	. Q	.	.	.	.
17.81	4.8269	3.36	.Q	.	.	.	.
17.99	4.8758	3.18	.Q	.	.	.	.
18.17	4.9190	2.60	.Q	.	.	.	.
18.35	4.9564	2.40	.Q	.	.	.	.
18.53	4.9914	2.28	.Q	.	.	.	.
18.72	5.0248	2.19	.Q	.	.	.	.
18.90	5.0568	2.10	.Q	.	.	.	.
19.08	5.0876	2.02	.Q	.	.	.	.



19.26	5.1172	1.95	.Q	.	.	.	.
19.44	5.1459	1.88	.Q	.	.	.	.
19.62	5.1735	1.82	.Q	.	.	.	.
19.80	5.2003	1.76	.Q	.	.	.	.
19.98	5.2264	1.71	Q	.	.	.	.
20.16	5.2516	1.67	Q	.	.	.	.
20.34	5.2762	1.62	Q	.	.	.	.
20.52	5.3002	1.58	Q	.	.	.	.
20.71	5.3236	1.54	Q	.	.	.	.
20.89	5.3464	1.51	Q	.	.	.	.
21.07	5.3687	1.47	Q	.	.	.	.
21.25	5.3905	1.44	Q	.	.	.	.
21.43	5.4118	1.41	Q	.	.	.	.
21.61	5.4327	1.38	Q	.	.	.	.
21.79	5.4532	1.36	Q	.	.	.	.
21.97	5.4733	1.33	Q	.	.	.	.
22.15	5.4930	1.31	Q	.	.	.	.
22.33	5.5124	1.28	Q	.	.	.	.
22.52	5.5314	1.26	Q	.	.	.	.
22.70	5.5501	1.24	Q	.	.	.	.
22.88	5.5685	1.22	Q	.	.	.	.
23.06	5.5866	1.20	Q	.	.	.	.
23.24	5.6044	1.18	Q	.	.	.	.
23.42	5.6219	1.16	Q	.	.	.	.
23.60	5.6392	1.15	Q	.	.	.	.
23.78	5.6562	1.13	Q	.	.	.	.
23.96	5.6730	1.11	Q	.	.	.	.
24.15	5.6896	1.10	Q	.	.	.	.
24.33	5.6978	0.00	Q	.	.	.	.

1



Proposed Condition (DA 4 DMA A)
Time of Concentration (Tc)
Volume (Vol)
Flowrate (Q)

```
************************************************************************
          RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE
       (Reference: 1986 SAN BERNARDINO CO. HYDROLOGY CRITERION)
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          Ver. 8.0  Release Date: 01/01/99  License ID 1435

                        Analysis prepared by:

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 ************************* DESCRIPTION OF STUDY *************************
* TEI JOB NO. 4099                                                      *
* PROPOSED CONDITION (NODES 500-613)                                    *
* 10-YEAR STORM EVENT                                                   *
 ************************************************************************

  FILE NAME: C:\XDRIVE\4099\P500-10.DAT
  TIME/DATE OF STUDY: 10:40 08/14/2024
========================================================================
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
========================================================================
                    --*TIME-OF-CONCENTRATION MODEL*--

  USER SPECIFIED STORM EVENT(YEAR) =   10.00
  SPECIFIED MINIMUM PIPE SIZE(INCH) =  12.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.95
  *USER-DEFINED LOGARITHMIC INTERPOLATION USED FOR RAINFALL*

  SLOPE OF INTENSITY DURATION CURVE(LOG(I;IN/HR) vs. LOG(Tc;MIN)) = 0.6000
  USER SPECIFIED 1-HOUR INTENSITY(INCH/HOUR) = 0.5900

  *ANTECEDENT MOISTURE CONDITION (AMC) II ASSUMED FOR RATIONAL METHOD*


************************************************************************
  FLOW PROCESS FROM NODE    500.00 TO NODE    501.00 IS CODE =  21
------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
========================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   450.00
  ELEVATION DATA: UPSTREAM(FEET) =   3053.81  DOWNSTREAM(FEET) =   3046.86

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    8.061
  *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  1.967
  SUBAREA Tc AND LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap      SCS   Tc
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  COMMERCIAL                 C        3.16      0.57       0.10    69    8.06
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.57
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
  SUBAREA RUNOFF(CFS) =      5.43
  TOTAL AREA(ACRES) =      3.16   PEAK FLOW RATE(CFS) =      5.43

************************************************************************
  FLOW PROCESS FROM NODE    501.00 TO NODE    502.00 IS CODE =  31
------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
========================================================================
  ELEVATION DATA: UPSTREAM(FEET) =  3042.86  DOWNSTREAM(FEET) =  3041.58
  FLOW LENGTH(FEET) =   505.00   MANNING'S N =  0.012
  DEPTH OF FLOW IN  18.0 INCH PIPE IS  14.3 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   3.60
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      5.43
  PIPE TRAVEL TIME(MIN.) =   2.34    Tc(MIN.) =  10.40
  LONGEST FLOWPATH FROM NODE    500.00 TO NODE    502.00 =   955.00 FEET.
```

```
****************************************************************************
  FLOW PROCESS FROM NODE    502.00 TO NODE    502.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN) =  10.40
  *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  1.689
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                 C        0.82      0.57       0.10    69
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.57
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
  SUBAREA AREA(ACRES) =    0.82      SUBAREA RUNOFF(CFS) =    1.20
  EFFECTIVE AREA(ACRES) =     3.98   AREA-AVERAGED Fm(INCH/HR) =  0.06
  AREA-AVERAGED Fp(INCH/HR) =  0.57  AREA-AVERAGED Ap =  0.10
  TOTAL AREA(ACRES) =     3.98       PEAK FLOW RATE(CFS) =       5.85

****************************************************************************
  FLOW PROCESS FROM NODE    502.00 TO NODE    502.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN) =  10.40
  *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  1.689
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                 C        1.39      0.57       0.10    69
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.57
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
  SUBAREA AREA(ACRES) =    1.39      SUBAREA RUNOFF(CFS) =    2.04
  EFFECTIVE AREA(ACRES) =     5.37   AREA-AVERAGED Fm(INCH/HR) =  0.06
  AREA-AVERAGED Fp(INCH/HR) =  0.57  AREA-AVERAGED Ap =  0.10
  TOTAL AREA(ACRES) =     5.37       PEAK FLOW RATE(CFS) =       7.89

****************************************************************************
  FLOW PROCESS FROM NODE    502.00 TO NODE    502.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN) =  10.40
  *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  1.689
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                 C        2.17      0.57       0.10    69
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.57
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
  SUBAREA AREA(ACRES) =    2.17      SUBAREA RUNOFF(CFS) =    3.19
  EFFECTIVE AREA(ACRES) =     7.54   AREA-AVERAGED Fm(INCH/HR) =  0.06
  AREA-AVERAGED Fp(INCH/HR) =  0.57  AREA-AVERAGED Ap =  0.10
  TOTAL AREA(ACRES) =     7.54       PEAK FLOW RATE(CFS) =      11.07

****************************************************************************
  FLOW PROCESS FROM NODE    502.00 TO NODE    505.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =  3041.58  DOWNSTREAM(FEET) =  3039.52
  FLOW LENGTH(FEET) =   392.00   MANNING'S N =  0.012
  DEPTH OF FLOW IN  21.0 INCH PIPE IS  15.8 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   5.72
  ESTIMATED PIPE DIAMETER(INCH) =  21.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =     11.07
  PIPE TRAVEL TIME(MIN.) =   1.14    Tc(MIN.) =  11.54
  LONGEST FLOWPATH FROM NODE    500.00 TO NODE    505.00 =  1347.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    505.00 TO NODE    505.00 IS CODE =   1
----------------------------------------------------------------------------
```

```
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =  11.54
  RAINFALL INTENSITY(INCH/HR) =   1.59
  AREA-AVERAGED Fm(INCH/HR) =  0.06
  AREA-AVERAGED Fp(INCH/HR) =  0.57
  AREA-AVERAGED Ap =  0.10
  EFFECTIVE STREAM AREA(ACRES) =    7.54
  TOTAL STREAM AREA(ACRES) =    7.54
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     11.07

****************************************************************************
  FLOW PROCESS FROM NODE    503.00 TO NODE    504.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   629.00
  ELEVATION DATA: UPSTREAM(FEET) =   3052.15  DOWNSTREAM(FEET) =   3043.91

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    9.525
  *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  1.780
  SUBAREA Tc AND LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp          Ap     SCS   Tc
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  COMMERCIAL                 C        6.01      0.57       0.10    69    9.53
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.57
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
  SUBAREA RUNOFF(CFS) =      9.32
  TOTAL AREA(ACRES) =      6.01   PEAK FLOW RATE(CFS) =      9.32

****************************************************************************
  FLOW PROCESS FROM NODE    504.00 TO NODE    505.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =  3040.92  DOWNSTREAM(FEET) =  3039.52
  FLOW LENGTH(FEET) =   122.00   MANNING'S N =  0.012
  DEPTH OF FLOW IN  18.0 INCH PIPE IS  12.0 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   7.44
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      9.32
  PIPE TRAVEL TIME(MIN.) =   0.27    Tc(MIN.) =   9.80
  LONGEST FLOWPATH FROM NODE    503.00 TO NODE    505.00 =   751.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    505.00 TO NODE    505.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =   9.80
  RAINFALL INTENSITY(INCH/HR) =   1.75
  AREA-AVERAGED Fm(INCH/HR) =  0.06
  AREA-AVERAGED Fp(INCH/HR) =  0.57
  AREA-AVERAGED Ap =  0.10
  EFFECTIVE STREAM AREA(ACRES) =    6.01
  TOTAL STREAM AREA(ACRES) =    6.01
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      9.32

  ** CONFLUENCE DATA **
   STREAM     Q     Tc   Intensity   Fp(Fm)     Ap   Ae     HEADWATER
   NUMBER   (CFS) (MIN.) (INCH/HR) (INCH/HR)        (ACRES)    NODE
      1     11.07  11.54    1.586  0.57( 0.06) 0.10     7.5     500.00
      2      9.32   9.80    1.750  0.57( 0.06) 0.10     6.0     503.00

  RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
```

```
  CONFLUENCE FORMULA USED FOR  2 STREAMS.

  ** PEAK FLOW RATE TABLE **
   STREAM     Q     Tc   Intensity   Fp(Fm)     Ap   Ae     HEADWATER
   NUMBER   (CFS) (MIN.) (INCH/HR) (INCH/HR)       (ACRES)    NODE
      1     19.49  11.54    1.586  0.57( 0.06) 0.10    13.6     500.00
      2     19.73   9.80    1.750  0.57( 0.06) 0.10    12.4     503.00

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =     19.73    Tc(MIN.) =     9.80
  EFFECTIVE AREA(ACRES) =    12.41   AREA-AVERAGED Fm(INCH/HR) =  0.06
  AREA-AVERAGED Fp(INCH/HR) =  0.57  AREA-AVERAGED Ap =  0.10
  TOTAL AREA(ACRES) =     13.55
  LONGEST FLOWPATH FROM NODE    500.00 TO NODE    505.00 =  1347.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    505.00 TO NODE    506.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =  3039.52  DOWNSTREAM(FEET) =  3037.95
  FLOW LENGTH(FEET) =   301.00   MANNING'S N =  0.012
  DEPTH OF FLOW IN  27.0 INCH PIPE IS  18.9 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   6.65
  ESTIMATED PIPE DIAMETER(INCH) =  27.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =     19.73
  PIPE TRAVEL TIME(MIN.) =   0.75    Tc(MIN.) =  10.55
  LONGEST FLOWPATH FROM NODE    500.00 TO NODE    506.00 =  1648.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    506.00 TO NODE    506.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN) =  10.55
  *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  1.674
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                 C        4.15      0.57      0.10    69
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.57
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
  SUBAREA AREA(ACRES) =    4.15      SUBAREA RUNOFF(CFS) =    6.04
  EFFECTIVE AREA(ACRES) =    16.56   AREA-AVERAGED Fm(INCH/HR) =  0.06
  AREA-AVERAGED Fp(INCH/HR) =  0.57  AREA-AVERAGED Ap =  0.10
  TOTAL AREA(ACRES) =    17.70       PEAK FLOW RATE(CFS) =      24.10

****************************************************************************
  FLOW PROCESS FROM NODE    506.00 TO NODE    507.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =  3037.95  DOWNSTREAM(FEET) =  3036.37
  FLOW LENGTH(FEET) =   301.00   MANNING'S N =  0.012
  DEPTH OF FLOW IN  30.0 INCH PIPE IS  19.7 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   7.05
  ESTIMATED PIPE DIAMETER(INCH) =  30.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =     24.10
  PIPE TRAVEL TIME(MIN.) =   0.71    Tc(MIN.) =  11.26
  LONGEST FLOWPATH FROM NODE    500.00 TO NODE    507.00 =  1949.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    507.00 TO NODE    507.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN) =  11.26
  *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  1.610
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
```

```
  COMMERCIAL                  C        4.64      0.57      0.10    69
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.57
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
  SUBAREA AREA(ACRES) =    4.64      SUBAREA RUNOFF(CFS) =    6.49
  EFFECTIVE AREA(ACRES) =    21.20   AREA-AVERAGED Fm(INCH/HR) =  0.06
  AREA-AVERAGED Fp(INCH/HR) =  0.57  AREA-AVERAGED Ap =  0.10
  TOTAL AREA(ACRES) =    22.34       PEAK FLOW RATE(CFS) =      29.63

****************************************************************************
  FLOW PROCESS FROM NODE    507.00 TO NODE    508.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =  3036.37  DOWNSTREAM(FEET) =  3034.79
  FLOW LENGTH(FEET) =   302.00   MANNING'S N =  0.012
  DEPTH OF FLOW IN  30.0 INCH PIPE IS  23.2 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   7.26
  ESTIMATED PIPE DIAMETER(INCH) =  30.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =     29.63
  PIPE TRAVEL TIME(MIN.) =   0.69    Tc(MIN.) =  11.96
  LONGEST FLOWPATH FROM NODE    500.00 TO NODE    508.00 =  2251.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    508.00 TO NODE    508.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN) =  11.96
  *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  1.553
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                  C        4.15      0.57      0.10    69
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.57
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
  SUBAREA AREA(ACRES) =    4.15      SUBAREA RUNOFF(CFS) =    5.59
  EFFECTIVE AREA(ACRES) =    25.35   AREA-AVERAGED Fm(INCH/HR) =  0.06
  AREA-AVERAGED Fp(INCH/HR) =  0.57  AREA-AVERAGED Ap =  0.10
  TOTAL AREA(ACRES) =    26.49       PEAK FLOW RATE(CFS) =      34.14

****************************************************************************
  FLOW PROCESS FROM NODE    508.00 TO NODE    509.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =  3034.79  DOWNSTREAM(FEET) =  3032.14
  FLOW LENGTH(FEET) =   301.00   MANNING'S N =  0.012
  DEPTH OF FLOW IN  30.0 INCH PIPE IS  21.1 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   9.28
  ESTIMATED PIPE DIAMETER(INCH) =  30.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =     34.14
  PIPE TRAVEL TIME(MIN.) =   0.54    Tc(MIN.) =  12.50
  LONGEST FLOWPATH FROM NODE    500.00 TO NODE    509.00 =  2552.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    509.00 TO NODE    509.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN) =  12.50
  *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  1.512
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                  C        5.41      0.57      0.10    69
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.57
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
  SUBAREA AREA(ACRES) =    5.41      SUBAREA RUNOFF(CFS) =    7.09
  EFFECTIVE AREA(ACRES) =    30.76   AREA-AVERAGED Fm(INCH/HR) =  0.06
  AREA-AVERAGED Fp(INCH/HR) =  0.57  AREA-AVERAGED Ap =  0.10
  TOTAL AREA(ACRES) =    31.90       PEAK FLOW RATE(CFS) =      40.30
```

```
****************************************************************************
  FLOW PROCESS FROM NODE    509.00 TO NODE    510.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =  3032.14  DOWNSTREAM(FEET) =  3027.88
  FLOW LENGTH(FEET) =   240.00   MANNING'S N =  0.012
  DEPTH OF FLOW IN  27.0 INCH PIPE IS  20.5 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  12.44
  ESTIMATED PIPE DIAMETER(INCH) =  27.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =     40.30
  PIPE TRAVEL TIME(MIN.) =   0.32    Tc(MIN.) =  12.82
  LONGEST FLOWPATH FROM NODE    500.00 TO NODE    510.00 =  2792.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    510.00 TO NODE    510.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN) =  12.82
  *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  1.489
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp          Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                 C        1.14      0.57       0.10    69
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.57
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
  SUBAREA AREA(ACRES) =    1.14      SUBAREA RUNOFF(CFS) =    1.47
  EFFECTIVE AREA(ACRES) =    31.90   AREA-AVERAGED Fm(INCH/HR) =  0.06
  AREA-AVERAGED Fp(INCH/HR) =  0.57  AREA-AVERAGED Ap =  0.10
  TOTAL AREA(ACRES) =    33.04       PEAK FLOW RATE(CFS) =      41.14

****************************************************************************
  FLOW PROCESS FROM NODE    510.00 TO NODE    510.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN) =  12.82
  *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  1.489
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp          Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                 C        1.58      0.57       0.10    69
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.57
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
  SUBAREA AREA(ACRES) =    1.58      SUBAREA RUNOFF(CFS) =    2.04
  EFFECTIVE AREA(ACRES) =    33.48   AREA-AVERAGED Fm(INCH/HR) =  0.06
  AREA-AVERAGED Fp(INCH/HR) =  0.57  AREA-AVERAGED Ap =  0.10
  TOTAL AREA(ACRES) =    34.62       PEAK FLOW RATE(CFS) =      43.17

****************************************************************************
  FLOW PROCESS FROM NODE    510.00 TO NODE    510.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN) =  12.82
  *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  1.489
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp          Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                 C        0.65      0.57       0.10    69
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.57
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
  SUBAREA AREA(ACRES) =    0.65      SUBAREA RUNOFF(CFS) =    0.84
  EFFECTIVE AREA(ACRES) =    34.13   AREA-AVERAGED Fm(INCH/HR) =  0.06
  AREA-AVERAGED Fp(INCH/HR) =  0.57  AREA-AVERAGED Ap =  0.10
  TOTAL AREA(ACRES) =    35.27       PEAK FLOW RATE(CFS) =      44.01

****************************************************************************
  FLOW PROCESS FROM NODE    510.00 TO NODE    510.00 IS CODE =  10
----------------------------------------------------------------------------
```

```
  >>>>>MAIN-STREAM MEMORY COPIED ONTO MEMORY BANK # 1 <<<<<
================================================================================

********************************************************************************
  FLOW PROCESS FROM NODE    600.00 TO NODE    601.00 IS CODE =  21
--------------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
================================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   569.00
  ELEVATION DATA: UPSTREAM(FEET) =   3075.43  DOWNSTREAM(FEET) =   3046.09

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    6.957
  *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  2.149
  SUBAREA Tc AND LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap      SCS   Tc
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  COMMERCIAL                 C        3.75      0.57       0.10    69    6.96
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.57
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
  SUBAREA RUNOFF(CFS) =      7.06
  TOTAL AREA(ACRES) =      3.75   PEAK FLOW RATE(CFS) =      7.06

********************************************************************************
  FLOW PROCESS FROM NODE    601.00 TO NODE    602.00 IS CODE =  31
--------------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
================================================================================
  ELEVATION DATA: UPSTREAM(FEET) =  3043.09  DOWNSTREAM(FEET) =  3041.96
  FLOW LENGTH(FEET) =    27.00   MANNING'S N =  0.012
  DEPTH OF FLOW IN  12.0 INCH PIPE IS   9.0 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  11.12
  ESTIMATED PIPE DIAMETER(INCH) =  12.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      7.06
  PIPE TRAVEL TIME(MIN.) =   0.04    Tc(MIN.) =   7.00
  LONGEST FLOWPATH FROM NODE    600.00 TO NODE    602.00 =   596.00 FEET.

********************************************************************************
  FLOW PROCESS FROM NODE    602.00 TO NODE    602.00 IS CODE =  81
--------------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
================================================================================
  MAINLINE Tc(MIN) =   7.00
  *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  2.142
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap      SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                 C        1.51      0.57       0.10    69
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.57
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
  SUBAREA AREA(ACRES) =    1.51      SUBAREA RUNOFF(CFS) =    2.83
  EFFECTIVE AREA(ACRES) =     5.26   AREA-AVERAGED Fm(INCH/HR) =  0.06
  AREA-AVERAGED Fp(INCH/HR) =  0.57  AREA-AVERAGED Ap =  0.10
  TOTAL AREA(ACRES) =     5.26       PEAK FLOW RATE(CFS) =       9.87

********************************************************************************
  FLOW PROCESS FROM NODE    602.00 TO NODE    603.00 IS CODE =  31
--------------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
================================================================================
  ELEVATION DATA: UPSTREAM(FEET) =  3041.96  DOWNSTREAM(FEET) =  3041.22
  FLOW LENGTH(FEET) =   150.00   MANNING'S N =  0.012
  DEPTH OF FLOW IN  21.0 INCH PIPE IS  14.7 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   5.48
  ESTIMATED PIPE DIAMETER(INCH) =  21.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      9.87
  PIPE TRAVEL TIME(MIN.) =   0.46    Tc(MIN.) =   7.45
  LONGEST FLOWPATH FROM NODE    600.00 TO NODE    603.00 =   746.00 FEET.

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

```
 FLOW PROCESS FROM NODE    603.00 TO NODE    603.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
 MAINLINE Tc(MIN) =   7.45
 *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  2.062
 SUBAREA LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS
      LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
 COMMERCIAL                  C        1.68      0.57       0.10    69
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.57
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
 SUBAREA AREA(ACRES) =     1.68      SUBAREA RUNOFF(CFS) =     3.03
 EFFECTIVE AREA(ACRES) =     6.94   AREA-AVERAGED Fm(INCH/HR) =  0.06
 AREA-AVERAGED Fp(INCH/HR) =  0.57  AREA-AVERAGED Ap =  0.10
 TOTAL AREA(ACRES) =     6.94       PEAK FLOW RATE(CFS) =      12.53

****************************************************************************
 FLOW PROCESS FROM NODE    603.00 TO NODE    604.00 IS CODE =  31
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =  3041.22  DOWNSTREAM(FEET) =  3040.45
 FLOW LENGTH(FEET) =   150.00   MANNING'S N =  0.012
 DEPTH OF FLOW IN  24.0 INCH PIPE IS  15.2 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =   5.95
 ESTIMATED PIPE DIAMETER(INCH) =  24.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =     12.53
 PIPE TRAVEL TIME(MIN.) =   0.42    Tc(MIN.) =   7.87
 LONGEST FLOWPATH FROM NODE    600.00 TO NODE    604.00 =   896.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    604.00 TO NODE    604.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
 MAINLINE Tc(MIN) =   7.87
 *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  1.995
 SUBAREA LOSS RATE DATA(AMC  II):
  DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS
      LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
 COMMERCIAL                  C        2.09      0.57       0.10    69
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.57
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
 SUBAREA AREA(ACRES) =     2.09      SUBAREA RUNOFF(CFS) =     3.65
 EFFECTIVE AREA(ACRES) =     9.03   AREA-AVERAGED Fm(INCH/HR) =  0.06
 AREA-AVERAGED Fp(INCH/HR) =  0.57  AREA-AVERAGED Ap =  0.10
 TOTAL AREA(ACRES) =     9.03       PEAK FLOW RATE(CFS) =      15.76

****************************************************************************
 FLOW PROCESS FROM NODE    604.00 TO NODE    605.00 IS CODE =  31
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =  3040.45  DOWNSTREAM(FEET) =  3039.71
 FLOW LENGTH(FEET) =   150.00   MANNING'S N =  0.012
 DEPTH OF FLOW IN  24.0 INCH PIPE IS  18.5 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =   6.07
 ESTIMATED PIPE DIAMETER(INCH) =  24.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =     15.76
 PIPE TRAVEL TIME(MIN.) =   0.41    Tc(MIN.) =   8.29
 LONGEST FLOWPATH FROM NODE    600.00 TO NODE    605.00 =  1046.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    605.00 TO NODE    605.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
 MAINLINE Tc(MIN) =   8.29
 *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  1.935
 SUBAREA LOSS RATE DATA(AMC  II):
```

```
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS
        LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                   C        1.68      0.57       0.10    69
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.57
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
  SUBAREA AREA(ACRES) =     1.68      SUBAREA RUNOFF(CFS) =     2.84
  EFFECTIVE AREA(ACRES) =    10.71   AREA-AVERAGED Fm(INCH/HR) =  0.06
  AREA-AVERAGED Fp(INCH/HR) =  0.57  AREA-AVERAGED Ap =  0.10
  TOTAL AREA(ACRES) =    10.71       PEAK FLOW RATE(CFS) =      18.11

****************************************************************************
  FLOW PROCESS FROM NODE    605.00 TO NODE    606.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =  3039.71  DOWNSTREAM(FEET) =  3038.95
  FLOW LENGTH(FEET) =   150.00   MANNING'S N =  0.012
  DEPTH OF FLOW IN  27.0 INCH PIPE IS  17.9 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   6.47
  ESTIMATED PIPE DIAMETER(INCH) =  27.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =     18.11
  PIPE TRAVEL TIME(MIN.) =   0.39    Tc(MIN.) =   8.67
  LONGEST FLOWPATH FROM NODE    600.00 TO NODE    606.00 =  1196.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    606.00 TO NODE    606.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN) =   8.67
  *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  1.883
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS
        LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                   C        2.09      0.57       0.10    69
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.57
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
  SUBAREA AREA(ACRES) =     2.09      SUBAREA RUNOFF(CFS) =     3.44
  EFFECTIVE AREA(ACRES) =    12.80   AREA-AVERAGED Fm(INCH/HR) =  0.06
  AREA-AVERAGED Fp(INCH/HR) =  0.57  AREA-AVERAGED Ap =  0.10
  TOTAL AREA(ACRES) =    12.80       PEAK FLOW RATE(CFS) =      21.04

****************************************************************************
  FLOW PROCESS FROM NODE    606.00 TO NODE    607.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =  3038.95  DOWNSTREAM(FEET) =  3038.20
  FLOW LENGTH(FEET) =   150.00   MANNING'S N =  0.012
  DEPTH OF FLOW IN  27.0 INCH PIPE IS  20.2 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   6.59
  ESTIMATED PIPE DIAMETER(INCH) =  27.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =     21.04
  PIPE TRAVEL TIME(MIN.) =   0.38    Tc(MIN.) =   9.05
  LONGEST FLOWPATH FROM NODE    600.00 TO NODE    607.00 =  1346.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    607.00 TO NODE    607.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN) =   9.05
  *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  1.835
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS
        LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                   C        2.09      0.57       0.10    69
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.57
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
  SUBAREA AREA(ACRES) =     2.09      SUBAREA RUNOFF(CFS) =     3.35
  EFFECTIVE AREA(ACRES) =    14.89   AREA-AVERAGED Fm(INCH/HR) =  0.06
```

```
  AREA-AVERAGED Fp(INCH/HR) =  0.57  AREA-AVERAGED Ap =  0.10
  TOTAL AREA(ACRES) =    14.89       PEAK FLOW RATE(CFS) =      23.84

****************************************************************************
  FLOW PROCESS FROM NODE    607.00 TO NODE    608.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =  3038.20  DOWNSTREAM(FEET) =  3037.44
  FLOW LENGTH(FEET) =   150.00   MANNING'S N =  0.012
  DEPTH OF FLOW IN  30.0 INCH PIPE IS  19.8 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   6.93
  ESTIMATED PIPE DIAMETER(INCH) =  30.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =     23.84
  PIPE TRAVEL TIME(MIN.) =   0.36    Tc(MIN.) =   9.41
  LONGEST FLOWPATH FROM NODE    600.00 TO NODE    608.00 =  1496.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    608.00 TO NODE    608.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN) =   9.41
  *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  1.793
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                 C        1.68      0.57      0.10    69
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.57
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
  SUBAREA AREA(ACRES) =    1.68      SUBAREA RUNOFF(CFS) =    2.63
  EFFECTIVE AREA(ACRES) =    16.57   AREA-AVERAGED Fm(INCH/HR) =  0.06
  AREA-AVERAGED Fp(INCH/HR) =  0.57  AREA-AVERAGED Ap =  0.10
  TOTAL AREA(ACRES) =    16.57       PEAK FLOW RATE(CFS) =      25.89

****************************************************************************
  FLOW PROCESS FROM NODE    608.00 TO NODE    609.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =  3037.44  DOWNSTREAM(FEET) =  3036.69
  FLOW LENGTH(FEET) =   150.00   MANNING'S N =  0.012
  DEPTH OF FLOW IN  30.0 INCH PIPE IS  21.2 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   7.00
  ESTIMATED PIPE DIAMETER(INCH) =  30.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =     25.89
  PIPE TRAVEL TIME(MIN.) =   0.36    Tc(MIN.) =   9.77
  LONGEST FLOWPATH FROM NODE    600.00 TO NODE    609.00 =  1646.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    609.00 TO NODE    609.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN) =   9.77
  *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  1.753
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                 C        2.10      0.57      0.10    69
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.57
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
  SUBAREA AREA(ACRES) =    2.10      SUBAREA RUNOFF(CFS) =    3.21
  EFFECTIVE AREA(ACRES) =    18.67   AREA-AVERAGED Fm(INCH/HR) =  0.06
  AREA-AVERAGED Fp(INCH/HR) =  0.57  AREA-AVERAGED Ap =  0.10
  TOTAL AREA(ACRES) =    18.67       PEAK FLOW RATE(CFS) =      28.51

****************************************************************************
  FLOW PROCESS FROM NODE    609.00 TO NODE    610.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
```

```
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
================================================================================
  ELEVATION DATA: UPSTREAM(FEET) =  3036.69  DOWNSTREAM(FEET) =  3035.93
  FLOW LENGTH(FEET) =   150.00   MANNING'S N =  0.012
  DEPTH OF FLOW IN  30.0 INCH PIPE IS  22.8 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   7.13
  ESTIMATED PIPE DIAMETER(INCH) =  30.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =     28.51
  PIPE TRAVEL TIME(MIN.) =   0.35    Tc(MIN.) =  10.12
  LONGEST FLOWPATH FROM NODE    600.00 TO NODE    610.00 =  1796.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    610.00 TO NODE    610.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
================================================================================
  MAINLINE Tc(MIN) =  10.12
  *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  1.716
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                  C        2.10      0.57       0.10    69
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.57
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
  SUBAREA AREA(ACRES) =    2.10      SUBAREA RUNOFF(CFS) =    3.14
  EFFECTIVE AREA(ACRES) =    20.77   AREA-AVERAGED Fm(INCH/HR) =  0.06
  AREA-AVERAGED Fp(INCH/HR) =  0.57  AREA-AVERAGED Ap =  0.10
  TOTAL AREA(ACRES) =    20.77       PEAK FLOW RATE(CFS) =      31.03

****************************************************************************
  FLOW PROCESS FROM NODE    610.00 TO NODE    611.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
================================================================================
  ELEVATION DATA: UPSTREAM(FEET) =  3035.93  DOWNSTREAM(FEET) =  3035.19
  FLOW LENGTH(FEET) =   150.00   MANNING'S N =  0.012
  DEPTH OF FLOW IN  33.0 INCH PIPE IS  22.1 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   7.32
  ESTIMATED PIPE DIAMETER(INCH) =  33.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =     31.03
  PIPE TRAVEL TIME(MIN.) =   0.34    Tc(MIN.) =  10.46
  LONGEST FLOWPATH FROM NODE    600.00 TO NODE    611.00 =  1946.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    611.00 TO NODE    611.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
================================================================================
  MAINLINE Tc(MIN) =  10.46
  *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  1.683
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                  C        3.02      0.57       0.10    69
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.57
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
  SUBAREA AREA(ACRES) =    3.02      SUBAREA RUNOFF(CFS) =    4.42
  EFFECTIVE AREA(ACRES) =    23.79   AREA-AVERAGED Fm(INCH/HR) =  0.06
  AREA-AVERAGED Fp(INCH/HR) =  0.57  AREA-AVERAGED Ap =  0.10
  TOTAL AREA(ACRES) =    23.79       PEAK FLOW RATE(CFS) =      34.81

****************************************************************************
  FLOW PROCESS FROM NODE    611.00 TO NODE    612.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
================================================================================
  ELEVATION DATA: UPSTREAM(FEET) =  3035.18  DOWNSTREAM(FEET) =  3034.72
  FLOW LENGTH(FEET) =    93.00   MANNING'S N =  0.012
  DEPTH OF FLOW IN  33.0 INCH PIPE IS  24.2 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   7.47
  ESTIMATED PIPE DIAMETER(INCH) =  33.00    NUMBER OF PIPES =   1
```

```
  PIPE-FLOW(CFS) =     34.81
  PIPE TRAVEL TIME(MIN.) =   0.21    Tc(MIN.) =  10.67
  LONGEST FLOWPATH FROM NODE    600.00 TO NODE    612.00 =  2039.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    612.00 TO NODE    612.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN) =  10.67
  *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  1.663
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                 C        0.63      0.57      0.10    69
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.57
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
  SUBAREA AREA(ACRES) =    0.63      SUBAREA RUNOFF(CFS) =    0.91
  EFFECTIVE AREA(ACRES) =    24.42   AREA-AVERAGED Fm(INCH/HR) =  0.06
  AREA-AVERAGED Fp(INCH/HR) =  0.57  AREA-AVERAGED Ap =  0.10
  TOTAL AREA(ACRES) =    24.42       PEAK FLOW RATE(CFS) =      35.30

****************************************************************************
  FLOW PROCESS FROM NODE    612.00 TO NODE    613.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =  3034.72  DOWNSTREAM(FEET) =  3033.30
  FLOW LENGTH(FEET) =   282.00   MANNING'S N =  0.012
  DEPTH OF FLOW IN  33.0 INCH PIPE IS  24.3 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   7.54
  ESTIMATED PIPE DIAMETER(INCH) =  33.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =     35.30
  PIPE TRAVEL TIME(MIN.) =   0.62    Tc(MIN.) =  11.29
  LONGEST FLOWPATH FROM NODE    600.00 TO NODE    613.00 =  2321.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    613.00 TO NODE    613.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN) =  11.29
  *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  1.607
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                 C        1.23      0.57      0.10    69
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.57
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
  SUBAREA AREA(ACRES) =    1.23      SUBAREA RUNOFF(CFS) =    1.72
  EFFECTIVE AREA(ACRES) =    25.65   AREA-AVERAGED Fm(INCH/HR) =  0.06
  AREA-AVERAGED Fp(INCH/HR) =  0.57  AREA-AVERAGED Ap =  0.10
  TOTAL AREA(ACRES) =    25.65       PEAK FLOW RATE(CFS) =      35.79

****************************************************************************
  FLOW PROCESS FROM NODE    613.00 TO NODE    613.00 IS CODE =  11
----------------------------------------------------------------------------
  >>>>>CONFLUENCE MEMORY BANK # 1 WITH THE MAIN-STREAM MEMORY<<<<<
============================================================================

  ** MAIN STREAM CONFLUENCE DATA **
   STREAM     Q     Tc   Intensity   Fp(Fm)     Ap   Ae     HEADWATER
   NUMBER   (CFS) (MIN.) (INCH/HR) (INCH/HR)       (ACRES)    NODE
      1     35.79  11.29    1.607  0.57( 0.06) 0.10    25.6     600.00
  LONGEST FLOWPATH FROM NODE    600.00 TO NODE    613.00 =  2321.00 FEET.

  ** MEMORY BANK #  1 CONFLUENCE DATA **
   STREAM     Q     Tc   Intensity   Fp(Fm)     Ap   Ae     HEADWATER
   NUMBER   (CFS) (MIN.) (INCH/HR) (INCH/HR)       (ACRES)    NODE
      1     44.01  12.82    1.489  0.57( 0.06) 0.10    34.1     503.00
      2     41.93  14.60    1.378  0.57( 0.06) 0.10    35.3     500.00
  LONGEST FLOWPATH FROM NODE      0.00 TO NODE    613.00 =     0.00 FEET.
```

```
  ** PEAK FLOW RATE TABLE **
   STREAM     Q     Tc   Intensity   Fp(Fm)     Ap   Ae     HEADWATER
   NUMBER   (CFS) (MIN.) (INCH/HR) (INCH/HR)       (ACRES)    NODE
      1     77.75  11.29    1.607  0.57( 0.06) 0.10    55.7     600.00
      2     77.09  12.82    1.489  0.57( 0.06) 0.10    59.8     503.00
      3     72.42  14.60    1.378  0.57( 0.06) 0.10    60.9     500.00
    TOTAL AREA(ACRES) =     60.92

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =       77.75  Tc(MIN.) =   11.293
  EFFECTIVE AREA(ACRES) =     55.71  AREA-AVERAGED Fm(INCH/HR) =  0.06
  AREA-AVERAGED Fp(INCH/HR) =  0.57  AREA-AVERAGED Ap =  0.10
  TOTAL AREA(ACRES) =     60.92
  LONGEST FLOWPATH FROM NODE    600.00 TO NODE    613.00 =  2321.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    613.00 TO NODE    613.00 IS CODE =  12
----------------------------------------------------------------------------
  >>>>>CLEAR MEMORY BANK # 1 <<<<<
============================================================================

****************************************************************************
  FLOW PROCESS FROM NODE    613.00 TO NODE    613.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN) =  11.29
  *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  1.607
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                 C        5.10      0.57       0.10    69
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.57
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.10
  SUBAREA AREA(ACRES) =    5.10      SUBAREA RUNOFF(CFS) =    7.12
  EFFECTIVE AREA(ACRES) =    60.81   AREA-AVERAGED Fm(INCH/HR) =  0.06
  AREA-AVERAGED Fp(INCH/HR) =  0.57  AREA-AVERAGED Ap =  0.10
  TOTAL AREA(ACRES) =    66.02       PEAK FLOW RATE(CFS) =      84.87
============================================================================
  END OF STUDY SUMMARY:
  TOTAL AREA(ACRES)     =     66.02  TC(MIN.) =     11.29
  EFFECTIVE AREA(ACRES) =     60.81  AREA-AVERAGED Fm(INCH/HR)=  0.06
  AREA-AVERAGED Fp(INCH/HR) =  0.57  AREA-AVERAGED Ap =  0.10
  PEAK FLOW RATE(CFS)   =     84.87

  ** PEAK FLOW RATE TABLE **
   STREAM     Q     Tc   Intensity   Fp(Fm)     Ap   Ae     HEADWATER
   NUMBER   (CFS) (MIN.) (INCH/HR) (INCH/HR)       (ACRES)    NODE
      1     84.87  11.29    1.607  0.57( 0.06) 0.10    60.8     600.00
      2     83.66  12.82    1.489  0.57( 0.06) 0.10    64.9     503.00
      3     78.49  14.60    1.378  0.57( 0.06) 0.10    66.0     500.00
============================================================================
============================================================================
  END OF RATIONAL METHOD ANALYSIS

1
```

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**************************************************************************
                    SMALL AREA UNIT HYDROGRAPH MODEL

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                           Analysis prepared by:

                             THIENES ENGINEERING
                           16800 VALLEY VIEW AVENUE
                              LA MIRADA CA 90638
                      PH: (714) 521-4811 FAX: (714) 521-4173



    RATIONAL METHOD CALIBRATION COEFFICIENT = 0.90
    TOTAL CATCHMENT AREA(ACRES) =   65.99
    SOIL-LOSS RATE, Fm,(INCH/HR) =  0.081
    LOW LOSS FRACTION = 0.200
    TIME OF CONCENTRATION(MIN.) = 11.29
    SMALL AREA PEAK Q COMPUTED USING PEAK FLOW RATE FORMULA
    USER SPECIFIED RAINFALL VALUES ARE USED
    RETURN FREQUENCY(YEARS) =  10
       5-MINUTE POINT RAINFALL VALUE(INCHES) =  0.19
      30-MINUTE POINT RAINFALL VALUE(INCHES) =  0.47
       1-HOUR   POINT RAINFALL VALUE(INCHES) =  0.59
       3-HOUR   POINT RAINFALL VALUE(INCHES) =  0.85
       6-HOUR   POINT RAINFALL VALUE(INCHES) =  1.18
      24-HOUR   POINT RAINFALL VALUE(INCHES) =  2.04

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

    TOTAL CATCHMENT   RUNOFF  VOLUME(ACRE-FEET) =     8.28
    TOTAL CATCHMENT SOIL-LOSS VOLUME(ACRE-FEET) =     2.94

**************************************************************************
  TIME     VOLUME       Q    0.       22.5      45.0      67.5      90.0
 (HOURS)    (AF)      (CFS)
--------------------------------------------------------------------------
  0.01      0.0000      0.00  Q         .         .         .         .
  0.19      0.0124      1.60  Q         .         .         .         .
  0.38      0.0374      1.61  Q         .         .         .         .
  0.57      0.0625      1.62  Q         .         .         .         .
  0.76      0.0877      1.63  Q         .         .         .         .
  0.95      0.1132      1.64  Q         .         .         .         .
  1.13      0.1389      1.66  Q         .         .         .         .
  1.32      0.1648      1.67  Q         .         .         .         .
  1.51      0.1908      1.68  Q         .         .         .         .
  1.70      0.2171      1.69  Q         .         .         .         .
  1.89      0.2436      1.71  Q         .         .         .         .
  2.08      0.2703      1.72  Q         .         .         .         .
  2.26      0.2972      1.74  Q         .         .         .         .
  2.45      0.3243      1.75  Q         .         .         .         .
  2.64      0.3516      1.77  Q         .         .         .         .
  2.83      0.3792      1.78  Q         .         .         .         .
  3.02      0.4070      1.80  Q         .         .         .         .
  3.20      0.4351      1.81  Q         .         .         .         .
  3.39      0.4634      1.83  Q         .         .         .         .
  3.58      0.4920      1.84  Q         .         .         .         .
  3.77      0.5208      1.86  Q         .         .         .         .
  3.96      0.5499      1.88  Q         .         .         .         .
  4.15      0.5792      1.90  Q         .         .         .         .
  4.33      0.6089      1.91  Q         .         .         .         .
  4.52      0.6388      1.94  Q         .         .         .         .
  4.71      0.6690      1.95  Q         .         .         .         .
  4.90      0.6996      1.98  Q         .         .         .         .
  5.09      0.7304      1.99  Q         .         .         .         .
  5.27      0.7616      2.02  Q         .         .         .         .
  5.46      0.7930      2.03  Q         .         .         .         .
  5.65      0.8249      2.06  Q         .         .         .         .
  5.84      0.8570      2.08  Q         .         .         .         .
  6.03      0.8895      2.11  Q         .         .         .         .
```
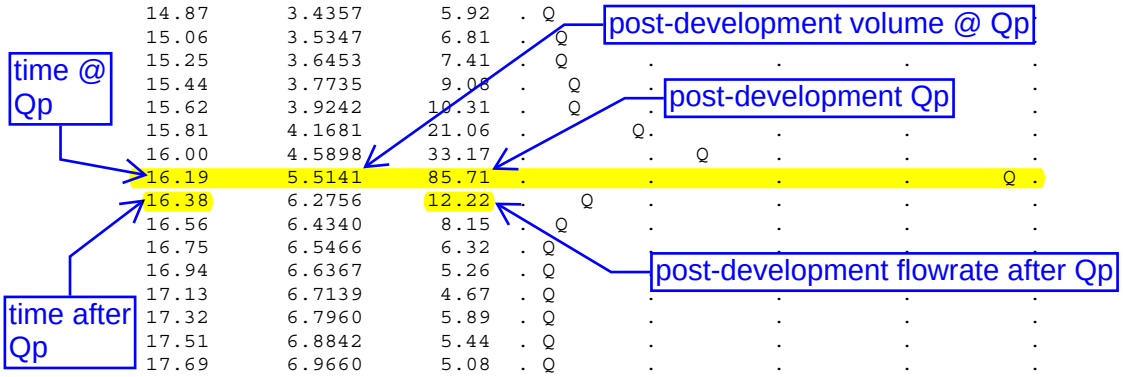

6.22	0.9224	2.12	Q
6.40	0.9557	2.16	Q
6.59	0.9894	2.17	Q
6.78	1.0234	2.21	Q
6.97	1.0579	2.23	Q
7.16	1.0928	2.26	.Q
7.34	1.1282	2.28	.Q
7.53	1.1640	2.32	.Q
7.72	1.2003	2.34	.Q
7.91	1.2371	2.39	.Q
8.10	1.2744	2.41	.Q
8.29	1.3122	2.46	.Q
8.47	1.3506	2.48	.Q
8.66	1.3895	2.53	.Q
8.85	1.4291	2.56	.Q
9.04	1.4692	2.61	.Q
9.23	1.5100	2.64	.Q
9.41	1.5515	2.70	.Q
9.60	1.5937	2.73	.Q
9.79	1.6367	2.79	.Q
9.98	1.6804	2.83	.Q
10.17	1.7249	2.90	.Q
10.35	1.7703	2.94	.Q
10.54	1.8166	3.02	.Q
10.73	1.8638	3.06	.Q
10.92	1.9120	3.15	.Q
11.11	1.9613	3.19	.Q
11.30	2.0118	3.29	.Q
11.48	2.0634	3.35	.Q
11.67	2.1163	3.46	.Q
11.86	2.1705	3.52	.Q
12.05	2.2262	3.65	.Q
12.24	2.2886	4.37	.Q
12.42	2.3583	4.61	. Q
12.61	2.4306	4.69	. Q
12.80	2.5050	4.88	. Q
12.99	2.5816	4.97	. Q
13.18	2.6607	5.19	. Q
13.37	2.7424	5.31	. Q
13.55	2.8271	5.58	. Q
13.74	2.9151	5.73	. Q
13.93	3.0068	6.07	. Q
14.12	3.1026	6.26	. Q
14.31	3.1883	4.77	. Q
14.49	3.2643	5.00	. Q
14.68	3.3465	5.57	. Q
14.87	3.4357	5.92	. Q
15.06	3.5347	6.81	. Q
15.25	3.6453	7.41	. Q
15.44	3.7735	9.08	. Q
15.62	3.9242	10.31	. Q
15.81	4.1681	21.06	. Q.
16.00	4.5898	33.17	. . Q
16.19	5.5141	85.71	. . . Q .
16.38	6.2756	12.22	. Q .
16.56	6.4340	8.15	. Q
16.75	6.5466	6.32	. Q
16.94	6.6367	5.26	. Q
17.13	6.7139	4.67	. Q
17.32	6.7960	5.89	. Q
17.51	6.8842	5.44	. Q
17.69	6.9660	5.08	. Q
17.88	7.0427	4.78	. Q
18.07	7.1151	4.53	. Q
18.26	7.1781	3.58	.Q
18.45	7.2324	3.40	.Q
18.63	7.2840	3.24	.Q
18.82	7.3334	3.10	.Q
19.01	7.3806	2.98	.Q
19.20	7.4260	2.86	.Q
19.39	7.4697	2.76	.Q
19.58	7.5119	2.67	.Q
19.76	7.5528	2.58	.Q



19.95	7.5923	2.50	.Q	.	.	.	.
20.14	7.6307	2.43	.Q	.	.	.	.
20.33	7.6680	2.37	.Q	.	.	.	.
20.52	7.7043	2.30	.Q	.	.	.	.
20.70	7.7397	2.24	Q	.	.	.	.
20.89	7.7742	2.19	Q	.	.	.	.
21.08	7.8078	2.14	Q	.	.	.	.
21.27	7.8407	2.09	Q	.	.	.	.
21.46	7.8729	2.05	Q	.	.	.	.
21.64	7.9044	2.00	Q	.	.	.	.
21.83	7.9352	1.96	Q	.	.	.	.
22.02	7.9654	1.92	Q	.	.	.	.
22.21	7.9951	1.89	Q	.	.	.	.
22.40	8.0242	1.85	Q	.	.	.	.
22.59	8.0527	1.82	Q	.	.	.	.
22.77	8.0808	1.79	Q	.	.	.	.
22.96	8.1084	1.76	Q	.	.	.	.
23.15	8.1355	1.73	Q	.	.	.	.
23.34	8.1622	1.70	Q	.	.	.	.
23.53	8.1885	1.68	Q	.	.	.	.
23.71	8.2143	1.65	Q	.	.	.	.
23.90	8.2398	1.63	Q	.	.	.	.
24.09	8.2649	1.60	Q	.	.	.	.
24.28	8.2774	0.00	Q	.	.	.	.

1



Proposed Condition (DA 5 DMA A)
Time of Concentration (Tc)
Volume (Vol)
Flowrate (Q)

```
**************************************************************************
                    SMALL AREA UNIT HYDROGRAPH MODEL

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                           Analysis prepared by:

                             THIENES ENGINEERING
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                              LA MIRADA CA 90638
                      PH: (714) 521-4811 FAX: (714) 521-4173



    RATIONAL METHOD CALIBRATION COEFFICIENT = 0.90
    TOTAL CATCHMENT AREA(ACRES) =   15.94
    SOIL-LOSS RATE, Fm,(INCH/HR) =  0.081
    LOW LOSS FRACTION = 0.200
    TIME OF CONCENTRATION(MIN.) =  5.00
    SMALL AREA PEAK Q COMPUTED USING PEAK FLOW RATE FORMULA
    USER SPECIFIED RAINFALL VALUES ARE USED
    RETURN FREQUENCY(YEARS) =  10
       5-MINUTE POINT RAINFALL VALUE(INCHES) =  0.19
      30-MINUTE POINT RAINFALL VALUE(INCHES) =  0.47
       1-HOUR   POINT RAINFALL VALUE(INCHES) =  0.59
       3-HOUR   POINT RAINFALL VALUE(INCHES) =  0.85
       6-HOUR   POINT RAINFALL VALUE(INCHES) =  1.18
      24-HOUR   POINT RAINFALL VALUE(INCHES) =  2.04

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

    TOTAL CATCHMENT   RUNOFF  VOLUME(ACRE-FEET) =     2.00
    TOTAL CATCHMENT SOIL-LOSS VOLUME(ACRE-FEET) =     0.71

**************************************************************************
  TIME     VOLUME       Q    0.       10.0      20.0      30.0      40.0
 (HOURS)    (AF)      (CFS)
--------------------------------------------------------------------------
  0.08      0.0013      0.39  Q         .         .         .         .
  0.17      0.0040      0.39  Q         .         .         .         .
  0.25      0.0067      0.39  Q         .         .         .         .
  0.33      0.0093      0.39  Q         .         .         .         .
  0.42      0.0120      0.39  Q         .         .         .         .
  0.50      0.0147      0.39  Q         .         .         .         .
  0.58      0.0174      0.39  Q         .         .         .         .
  0.67      0.0201      0.39  Q         .         .         .         .
  0.75      0.0228      0.40  Q         .         .         .         .
  0.83      0.0256      0.40  Q         .         .         .         .
  0.92      0.0283      0.40  Q         .         .         .         .
  1.00      0.0311      0.40  Q         .         .         .         .
  1.08      0.0338      0.40  Q         .         .         .         .
  1.17      0.0366      0.40  Q         .         .         .         .
  1.25      0.0393      0.40  Q         .         .         .         .
  1.33      0.0421      0.40  Q         .         .         .         .
  1.42      0.0449      0.41  Q         .         .         .         .
  1.50      0.0477      0.41  Q         .         .         .         .
  1.58      0.0505      0.41  Q         .         .         .         .
  1.67      0.0534      0.41  Q         .         .         .         .
  1.75      0.0562      0.41  Q         .         .         .         .
  1.83      0.0590      0.41  Q         .         .         .         .
  1.92      0.0619      0.42  Q         .         .         .         .
  2.00      0.0648      0.42  Q         .         .         .         .
  2.08      0.0676      0.42  Q         .         .         .         .
  2.17      0.0705      0.42  Q         .         .         .         .
  2.25      0.0734      0.42  Q         .         .         .         .
  2.33      0.0763      0.42  Q         .         .         .         .
  2.42      0.0792      0.42  Q         .         .         .         .
  2.50      0.0821      0.43  Q         .         .         .         .
  2.58      0.0851      0.43  Q         .         .         .         .
  2.67      0.0880      0.43  Q         .         .         .         .
  2.75      0.0910      0.43  Q         .         .         .         .
```
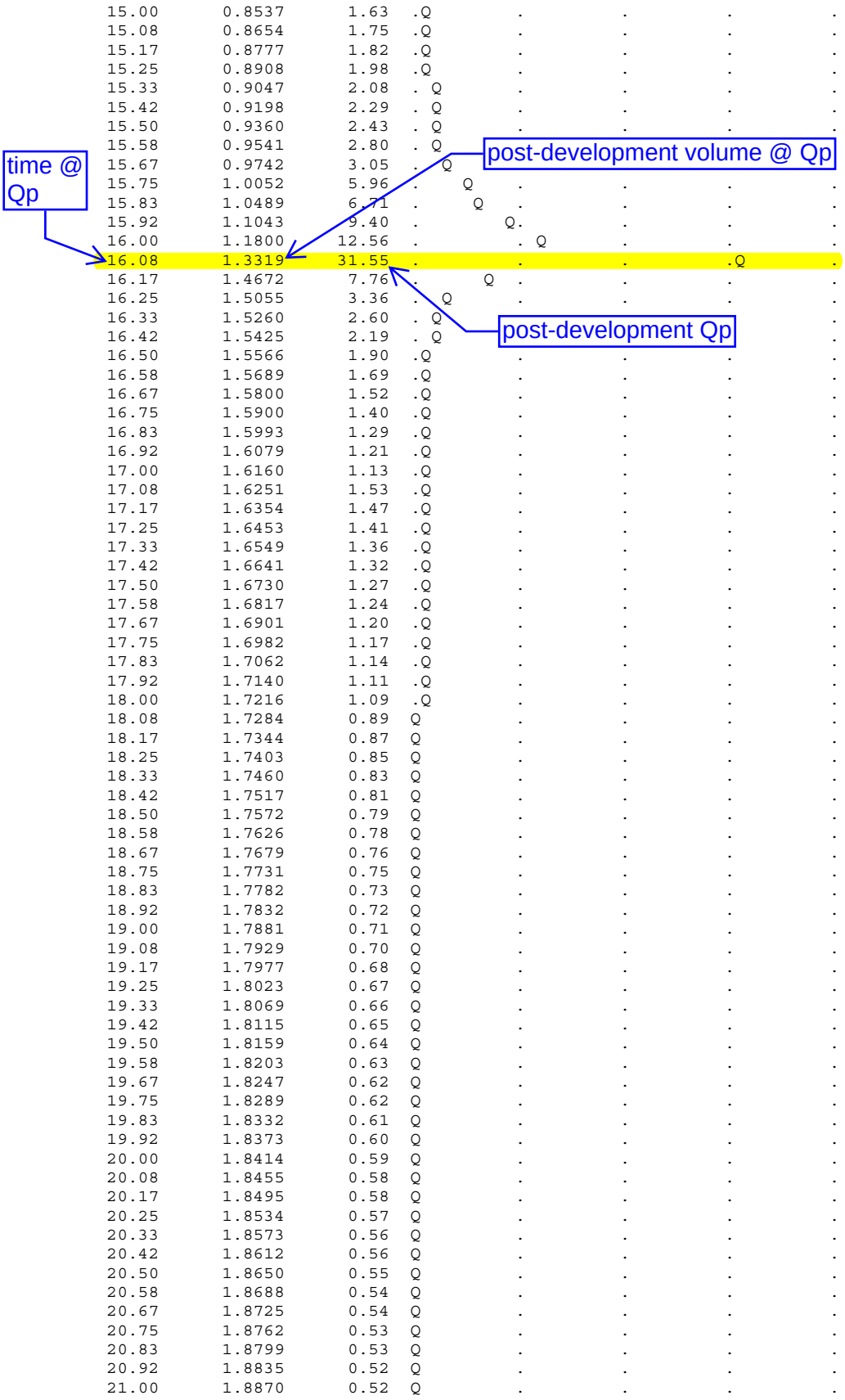

2.83	0.0940	0.43	Q	.	.	.	.
2.92	0.0969	0.43	Q	.	.	.	.
3.00	0.0999	0.44	Q	.	.	.	.
3.08	0.1029	0.44	Q	.	.	.	.
3.17	0.1060	0.44	Q	.	.	.	.
3.25	0.1090	0.44	Q	.	.	.	.
3.33	0.1120	0.44	Q	.	.	.	.
3.42	0.1151	0.44	Q	.	.	.	.
3.50	0.1181	0.45	Q	.	.	.	.
3.58	0.1212	0.45	Q	.	.	.	.
3.67	0.1243	0.45	Q	.	.	.	.
3.75	0.1274	0.45	Q	.	.	.	.
3.83	0.1305	0.45	Q	.	.	.	.
3.92	0.1336	0.46	Q	.	.	.	.
4.00	0.1368	0.46	Q	.	.	.	.
4.08	0.1399	0.46	Q	.	.	.	.
4.17	0.1431	0.46	Q	.	.	.	.
4.25	0.1463	0.46	Q	.	.	.	.
4.33	0.1495	0.46	Q	.	.	.	.
4.42	0.1527	0.47	Q	.	.	.	.
4.50	0.1559	0.47	Q	.	.	.	.
4.58	0.1591	0.47	Q	.	.	.	.
4.67	0.1624	0.47	Q	.	.	.	.
4.75	0.1657	0.48	Q	.	.	.	.
4.83	0.1689	0.48	Q	.	.	.	.
4.92	0.1722	0.48	Q	.	.	.	.
5.00	0.1755	0.48	Q	.	.	.	.
5.08	0.1789	0.48	Q	.	.	.	.
5.17	0.1822	0.49	Q	.	.	.	.
5.25	0.1856	0.49	Q	.	.	.	.
5.33	0.1889	0.49	Q	.	.	.	.
5.42	0.1923	0.49	Q	.	.	.	.
5.50	0.1957	0.49	Q	.	.	.	.
5.58	0.1991	0.50	Q	.	.	.	.
5.67	0.2026	0.50	Q	.	.	.	.
5.75	0.2060	0.50	Q	.	.	.	.
5.83	0.2095	0.50	Q	.	.	.	.
5.92	0.2130	0.51	Q	.	.	.	.
6.00	0.2165	0.51	Q	.	.	.	.
6.08	0.2200	0.51	Q	.	.	.	.
6.17	0.2235	0.51	Q	.	.	.	.
6.25	0.2271	0.52	Q	.	.	.	.
6.33	0.2307	0.52	Q	.	.	.	.
6.42	0.2342	0.52	Q	.	.	.	.
6.50	0.2379	0.53	Q	.	.	.	.
6.58	0.2415	0.53	Q	.	.	.	.
6.67	0.2451	0.53	Q	.	.	.	.
6.75	0.2488	0.53	Q	.	.	.	.
6.83	0.2525	0.54	Q	.	.	.	.
6.92	0.2562	0.54	Q	.	.	.	.
7.00	0.2599	0.54	Q	.	.	.	.
7.08	0.2637	0.55	Q	.	.	.	.
7.17	0.2675	0.55	Q	.	.	.	.
7.25	0.2713	0.55	Q	.	.	.	.
7.33	0.2751	0.56	Q	.	.	.	.
7.42	0.2789	0.56	Q	.	.	.	.
7.50	0.2828	0.56	Q	.	.	.	.
7.58	0.2867	0.57	Q	.	.	.	.
7.67	0.2906	0.57	Q	.	.	.	.
7.75	0.2945	0.57	Q	.	.	.	.
7.83	0.2984	0.58	Q	.	.	.	.
7.92	0.3024	0.58	Q	.	.	.	.
8.00	0.3064	0.58	Q	.	.	.	.
8.08	0.3104	0.59	Q	.	.	.	.
8.17	0.3145	0.59	Q	.	.	.	.
8.25	0.3186	0.59	Q	.	.	.	.
8.33	0.3227	0.60	Q	.	.	.	.
8.42	0.3268	0.60	Q	.	.	.	.
8.50	0.3310	0.61	Q	.	.	.	.
8.58	0.3352	0.61	Q	.	.	.	.
8.67	0.3394	0.61	Q	.	.	.	.
8.75	0.3436	0.62	Q	.	.	.	.
8.83	0.3479	0.62	Q	.	.	.	.

8.92	0.3522	0.63	Q	.	.	.	.
9.00	0.3565	0.63	Q	.	.	.	.
9.08	0.3609	0.64	Q	.	.	.	.
9.17	0.3653	0.64	Q	.	.	.	.
9.25	0.3697	0.65	Q	.	.	.	.
9.33	0.3742	0.65	Q	.	.	.	.
9.42	0.3787	0.66	Q	.	.	.	.
9.50	0.3832	0.66	Q	.	.	.	.
9.58	0.3878	0.67	Q	.	.	.	.
9.67	0.3924	0.67	Q	.	.	.	.
9.75	0.3970	0.68	Q	.	.	.	.
9.83	0.4017	0.68	Q	.	.	.	.
9.92	0.4064	0.69	Q	.	.	.	.
10.00	0.4111	0.69	Q	.	.	.	.
10.08	0.4159	0.70	Q	.	.	.	.
10.17	0.4208	0.70	Q	.	.	.	.
10.25	0.4256	0.71	Q	.	.	.	.
10.33	0.4305	0.72	Q	.	.	.	.
10.42	0.4355	0.72	Q	.	.	.	.
10.50	0.4405	0.73	Q	.	.	.	.
10.58	0.4456	0.74	Q	.	.	.	.
10.67	0.4506	0.74	Q	.	.	.	.
10.75	0.4558	0.75	Q	.	.	.	.
10.83	0.4610	0.76	Q	.	.	.	.
10.92	0.4662	0.77	Q	.	.	.	.
11.00	0.4715	0.77	Q	.	.	.	.
11.08	0.4769	0.78	Q	.	.	.	.
11.17	0.4823	0.79	Q	.	.	.	.
11.25	0.4877	0.80	Q	.	.	.	.
11.33	0.4932	0.80	Q	.	.	.	.
11.42	0.4988	0.81	Q	.	.	.	.
11.50	0.5044	0.82	Q	.	.	.	.
11.58	0.5101	0.83	Q	.	.	.	.
11.67	0.5159	0.84	Q	.	.	.	.
11.75	0.5217	0.85	Q	.	.	.	.
11.83	0.5276	0.86	Q	.	.	.	.
11.92	0.5336	0.87	Q	.	.	.	.
12.00	0.5396	0.88	Q	.	.	.	.
12.08	0.5463	1.07	.Q	.	.	.	.
12.17	0.5537	1.08	.Q	.	.	.	.
12.25	0.5612	1.10	.Q	.	.	.	.
12.33	0.5688	1.11	.Q	.	.	.	.
12.42	0.5765	1.12	.Q	.	.	.	.
12.50	0.5843	1.13	.Q	.	.	.	.
12.58	0.5921	1.15	.Q	.	.	.	.
12.67	0.6001	1.16	.Q	.	.	.	.
12.75	0.6081	1.18	.Q	.	.	.	.
12.83	0.6163	1.19	.Q	.	.	.	.
12.92	0.6246	1.21	.Q	.	.	.	.
13.00	0.6330	1.23	.Q	.	.	.	.
13.08	0.6415	1.25	.Q	.	.	.	.
13.17	0.6502	1.26	.Q	.	.	.	.
13.25	0.6589	1.29	.Q	.	.	.	.
13.33	0.6679	1.30	.Q	.	.	.	.
13.42	0.6769	1.33	.Q	.	.	.	.
13.50	0.6861	1.34	.Q	.	.	.	.
13.58	0.6955	1.38	.Q	.	.	.	.
13.67	0.7050	1.39	.Q	.	.	.	.
13.75	0.7147	1.43	.Q	.	.	.	.
13.83	0.7246	1.45	.Q	.	.	.	.
13.92	0.7347	1.49	.Q	.	.	.	.
14.00	0.7450	1.51	.Q	.	.	.	.
14.08	0.7540	1.09	.Q	.	.	.	.
14.17	0.7616	1.11	.Q	.	.	.	.
14.25	0.7694	1.16	.Q	.	.	.	.
14.33	0.7774	1.18	.Q	.	.	.	.
14.42	0.7858	1.23	.Q	.	.	.	.
14.50	0.7944	1.26	.Q	.	.	.	.
14.58	0.8033	1.33	.Q	.	.	.	.
14.67	0.8125	1.36	.Q	.	.	.	.
14.75	0.8222	1.44	.Q	.	.	.	.
14.83	0.8322	1.48	.Q	.	.	.	.
14.92	0.8427	1.57	.Q	.	.	.	.



15.00	0.8537	1.63	.Q
15.08	0.8654	1.75	.Q
15.17	0.8777	1.82	.Q
15.25	0.8908	1.98	.Q
15.33	0.9047	2.08	. Q
15.42	0.9198	2.29	. Q
15.50	0.9360	2.43	. Q
15.58	0.9541	2.80	. Q
15.67	0.9742	3.05	. Q
15.75	1.0052	5.96	. Q
15.83	1.0489	6.71	. Q
15.92	1.1043	9.40	. Q.
16.00	1.1800	12.56	. . Q
16.08	1.3319	31.55	. .Q
16.17	1.4672	7.76	. Q
16.25	1.5055	3.36	. Q
16.33	1.5260	2.60	. Q
16.42	1.5425	2.19	. Q
16.50	1.5566	1.90	.Q
16.58	1.5689	1.69	.Q
16.67	1.5800	1.52	.Q
16.75	1.5900	1.40	.Q
16.83	1.5993	1.29	.Q
16.92	1.6079	1.21	.Q
17.00	1.6160	1.13	.Q
17.08	1.6251	1.53	.Q
17.17	1.6354	1.47	.Q
17.25	1.6453	1.41	.Q
17.33	1.6549	1.36	.Q
17.42	1.6641	1.32	.Q
17.50	1.6730	1.27	.Q
17.58	1.6817	1.24	.Q
17.67	1.6901	1.20	.Q
17.75	1.6982	1.17	.Q
17.83	1.7062	1.14	.Q
17.92	1.7140	1.11	.Q
18.00	1.7216	1.09	.Q
18.08	1.7284	0.89	Q
18.17	1.7344	0.87	Q
18.25	1.7403	0.85	Q
18.33	1.7460	0.83	Q
18.42	1.7517	0.81	Q
18.50	1.7572	0.79	Q
18.58	1.7626	0.78	Q
18.67	1.7679	0.76	Q
18.75	1.7731	0.75	Q
18.83	1.7782	0.73	Q
18.92	1.7832	0.72	Q
19.00	1.7881	0.71	Q
19.08	1.7929	0.70	Q
19.17	1.7977	0.68	Q
19.25	1.8023	0.67	Q
19.33	1.8069	0.66	Q
19.42	1.8115	0.65	Q
19.50	1.8159	0.64	Q
19.58	1.8203	0.63	Q
19.67	1.8247	0.62	Q
19.75	1.8289	0.62	Q
19.83	1.8332	0.61	Q
19.92	1.8373	0.60	Q
20.00	1.8414	0.59	Q
20.08	1.8455	0.58	Q
20.17	1.8495	0.58	Q
20.25	1.8534	0.57	Q
20.33	1.8573	0.56	Q
20.42	1.8612	0.56	Q
20.50	1.8650	0.55	Q
20.58	1.8688	0.54	Q
20.67	1.8725	0.54	Q
20.75	1.8762	0.53	Q
20.83	1.8799	0.53	Q
20.92	1.8835	0.52	Q
21.00	1.8870	0.52	Q

21.08	1.8906	0.51	Q	.	.	.	.
21.17	1.8941	0.51	Q	.	.	.	.
21.25	1.8975	0.50	Q	.	.	.	.
21.33	1.9010	0.50	Q	.	.	.	.
21.42	1.9044	0.49	Q	.	.	.	.
21.50	1.9078	0.49	Q	.	.	.	.
21.58	1.9111	0.48	Q	.	.	.	.
21.67	1.9144	0.48	Q	.	.	.	.
21.75	1.9177	0.47	Q	.	.	.	.
21.83	1.9209	0.47	Q	.	.	.	.
21.92	1.9241	0.47	Q	.	.	.	.
22.00	1.9273	0.46	Q	.	.	.	.
22.08	1.9305	0.46	Q	.	.	.	.
22.17	1.9336	0.45	Q	.	.	.	.
22.25	1.9368	0.45	Q	.	.	.	.
22.33	1.9399	0.45	Q	.	.	.	.
22.42	1.9429	0.44	Q	.	.	.	.
22.50	1.9460	0.44	Q	.	.	.	.
22.58	1.9490	0.44	Q	.	.	.	.
22.67	1.9520	0.43	Q	.	.	.	.
22.75	1.9549	0.43	Q	.	.	.	.
22.83	1.9579	0.43	Q	.	.	.	.
22.92	1.9608	0.42	Q	.	.	.	.
23.00	1.9637	0.42	Q	.	.	.	.
23.08	1.9666	0.42	Q	.	.	.	.
23.17	1.9695	0.41	Q	.	.	.	.
23.25	1.9723	0.41	Q	.	.	.	.
23.33	1.9751	0.41	Q	.	.	.	.
23.42	1.9779	0.41	Q	.	.	.	.
23.50	1.9807	0.40	Q	.	.	.	.
23.58	1.9835	0.40	Q	.	.	.	.
23.67	1.9862	0.40	Q	.	.	.	.
23.75	1.9890	0.39	Q	.	.	.	.
23.83	1.9917	0.39	Q	.	.	.	.
23.92	1.9944	0.39	Q	.	.	.	.
24.00	1.9970	0.39	Q	.	.	.	.
24.08	1.9984	0.00	Q	.	.	.	.

1



Proposed Condition (DA 6 DMA A)
Time of Concentration (Tc)
Volume (Vol)
Flowrate (Q)

```
**************************************************************************
                    SMALL AREA UNIT HYDROGRAPH MODEL

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              Ver. 8.0  Release Date: 01/01/99  License ID 1435

                           Analysis prepared by:

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    RATIONAL METHOD CALIBRATION COEFFICIENT = 0.90
    TOTAL CATCHMENT AREA(ACRES) =    6.48
    SOIL-LOSS RATE, Fm,(INCH/HR) =  0.081
    LOW LOSS FRACTION = 0.200
    TIME OF CONCENTRATION(MIN.) =  5.00
    SMALL AREA PEAK Q COMPUTED USING PEAK FLOW RATE FORMULA
    USER SPECIFIED RAINFALL VALUES ARE USED
    RETURN FREQUENCY(YEARS) =  10
       5-MINUTE POINT RAINFALL VALUE(INCHES) =  0.19
      30-MINUTE POINT RAINFALL VALUE(INCHES) =  0.47
       1-HOUR   POINT RAINFALL VALUE(INCHES) =  0.59
       3-HOUR   POINT RAINFALL VALUE(INCHES) =  0.85
       6-HOUR   POINT RAINFALL VALUE(INCHES) =  1.18
      24-HOUR   POINT RAINFALL VALUE(INCHES) =  2.04

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

    TOTAL CATCHMENT   RUNOFF  VOLUME(ACRE-FEET) =     0.81
    TOTAL CATCHMENT SOIL-LOSS VOLUME(ACRE-FEET) =     0.29

**************************************************************************
  TIME     VOLUME       Q    0.        5.0      10.0      15.0      20.0
 (HOURS)    (AF)      (CFS)
--------------------------------------------------------------------------
  0.08      0.0005      0.16  Q         .         .         .         .
  0.17      0.0016      0.16  Q         .         .         .         .
  0.25      0.0027      0.16  Q         .         .         .         .
  0.33      0.0038      0.16  Q         .         .         .         .
  0.42      0.0049      0.16  Q         .         .         .         .
  0.50      0.0060      0.16  Q         .         .         .         .
  0.58      0.0071      0.16  Q         .         .         .         .
  0.67      0.0082      0.16  Q         .         .         .         .
  0.75      0.0093      0.16  Q         .         .         .         .
  0.83      0.0104      0.16  Q         .         .         .         .
  0.92      0.0115      0.16  Q         .         .         .         .
  1.00      0.0126      0.16  Q         .         .         .         .
  1.08      0.0137      0.16  Q         .         .         .         .
  1.17      0.0149      0.16  Q         .         .         .         .
  1.25      0.0160      0.16  Q         .         .         .         .
  1.33      0.0171      0.16  Q         .         .         .         .
  1.42      0.0183      0.17  Q         .         .         .         .
  1.50      0.0194      0.17  Q         .         .         .         .
  1.58      0.0205      0.17  Q         .         .         .         .
  1.67      0.0217      0.17  Q         .         .         .         .
  1.75      0.0228      0.17  Q         .         .         .         .
  1.83      0.0240      0.17  Q         .         .         .         .
  1.92      0.0252      0.17  Q         .         .         .         .
  2.00      0.0263      0.17  Q         .         .         .         .
  2.08      0.0275      0.17  Q         .         .         .         .
  2.17      0.0287      0.17  Q         .         .         .         .
  2.25      0.0298      0.17  Q         .         .         .         .
  2.33      0.0310      0.17  Q         .         .         .         .
  2.42      0.0322      0.17  Q         .         .         .         .
  2.50      0.0334      0.17  Q         .         .         .         .
  2.58      0.0346      0.17  Q         .         .         .         .
  2.67      0.0358      0.17  Q         .         .         .         .
  2.75      0.0370      0.18  Q         .         .         .         .
```

2.83	0.0382	0.18	Q	.	.	.	.
2.92	0.0394	0.18	Q	.	.	.	.
3.00	0.0406	0.18	Q	.	.	.	.
3.08	0.0418	0.18	Q	.	.	.	.
3.17	0.0431	0.18	Q	.	.	.	.
3.25	0.0443	0.18	Q	.	.	.	.
3.33	0.0455	0.18	Q	.	.	.	.
3.42	0.0468	0.18	Q	.	.	.	.
3.50	0.0480	0.18	Q	.	.	.	.
3.58	0.0493	0.18	Q	.	.	.	.
3.67	0.0505	0.18	Q	.	.	.	.
3.75	0.0518	0.18	Q	.	.	.	.
3.83	0.0531	0.18	Q	.	.	.	.
3.92	0.0543	0.19	Q	.	.	.	.
4.00	0.0556	0.19	Q	.	.	.	.
4.08	0.0569	0.19	Q	.	.	.	.
4.17	0.0582	0.19	Q	.	.	.	.
4.25	0.0595	0.19	Q	.	.	.	.
4.33	0.0608	0.19	Q	.	.	.	.
4.42	0.0621	0.19	Q	.	.	.	.
4.50	0.0634	0.19	Q	.	.	.	.
4.58	0.0647	0.19	Q	.	.	.	.
4.67	0.0660	0.19	Q	.	.	.	.
4.75	0.0673	0.19	Q	.	.	.	.
4.83	0.0687	0.19	Q	.	.	.	.
4.92	0.0700	0.19	Q	.	.	.	.
5.00	0.0714	0.20	Q	.	.	.	.
5.08	0.0727	0.20	Q	.	.	.	.
5.17	0.0741	0.20	Q	.	.	.	.
5.25	0.0754	0.20	Q	.	.	.	.
5.33	0.0768	0.20	Q	.	.	.	.
5.42	0.0782	0.20	Q	.	.	.	.
5.50	0.0796	0.20	Q	.	.	.	.
5.58	0.0809	0.20	Q	.	.	.	.
5.67	0.0823	0.20	Q	.	.	.	.
5.75	0.0837	0.20	Q	.	.	.	.
5.83	0.0852	0.21	Q	.	.	.	.
5.92	0.0866	0.21	Q	.	.	.	.
6.00	0.0880	0.21	Q	.	.	.	.
6.08	0.0894	0.21	Q	.	.	.	.
6.17	0.0909	0.21	Q	.	.	.	.
6.25	0.0923	0.21	Q	.	.	.	.
6.33	0.0938	0.21	Q	.	.	.	.
6.42	0.0952	0.21	Q	.	.	.	.
6.50	0.0967	0.21	Q	.	.	.	.
6.58	0.0982	0.22	Q	.	.	.	.
6.67	0.0997	0.22	Q	.	.	.	.
6.75	0.1011	0.22	Q	.	.	.	.
6.83	0.1026	0.22	Q	.	.	.	.
6.92	0.1042	0.22	Q	.	.	.	.
7.00	0.1057	0.22	Q	.	.	.	.
7.08	0.1072	0.22	Q	.	.	.	.
7.17	0.1087	0.22	Q	.	.	.	.
7.25	0.1103	0.22	Q	.	.	.	.
7.33	0.1118	0.23	Q	.	.	.	.
7.42	0.1134	0.23	Q	.	.	.	.
7.50	0.1150	0.23	Q	.	.	.	.
7.58	0.1165	0.23	Q	.	.	.	.
7.67	0.1181	0.23	Q	.	.	.	.
7.75	0.1197	0.23	Q	.	.	.	.
7.83	0.1213	0.23	Q	.	.	.	.
7.92	0.1229	0.24	Q	.	.	.	.
8.00	0.1246	0.24	Q	.	.	.	.
8.08	0.1262	0.24	Q	.	.	.	.
8.17	0.1279	0.24	Q	.	.	.	.
8.25	0.1295	0.24	Q	.	.	.	.
8.33	0.1312	0.24	Q	.	.	.	.
8.42	0.1329	0.24	Q	.	.	.	.
8.50	0.1345	0.25	Q	.	.	.	.
8.58	0.1363	0.25	Q	.	.	.	.
8.67	0.1380	0.25	Q	.	.	.	.
8.75	0.1397	0.25	Q	.	.	.	.
8.83	0.1414	0.25	Q	.	.	.	.

8.92	0.1432	0.26	Q	.	.	.	.
9.00	0.1449	0.26	Q	.	.	.	.
9.08	0.1467	0.26	Q	.	.	.	.
9.17	0.1485	0.26	Q	.	.	.	.
9.25	0.1503	0.26	Q	.	.	.	.
9.33	0.1521	0.26	Q	.	.	.	.
9.42	0.1539	0.27	Q	.	.	.	.
9.50	0.1558	0.27	Q	.	.	.	.
9.58	0.1576	0.27	Q	.	.	.	.
9.67	0.1595	0.27	Q	.	.	.	.
9.75	0.1614	0.28	Q	.	.	.	.
9.83	0.1633	0.28	Q	.	.	.	.
9.92	0.1652	0.28	Q	.	.	.	.
10.00	0.1671	0.28	Q	.	.	.	.
10.08	0.1691	0.28	Q	.	.	.	.
10.17	0.1710	0.29	Q	.	.	.	.
10.25	0.1730	0.29	Q	.	.	.	.
10.33	0.1750	0.29	Q	.	.	.	.
10.42	0.1770	0.29	Q	.	.	.	.
10.50	0.1791	0.30	Q	.	.	.	.
10.58	0.1811	0.30	Q	.	.	.	.
10.67	0.1832	0.30	Q	.	.	.	.
10.75	0.1853	0.31	Q	.	.	.	.
10.83	0.1874	0.31	Q	.	.	.	.
10.92	0.1895	0.31	Q	.	.	.	.
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11.08	0.1939	0.32	Q	.	.	.	.
11.17	0.1961	0.32	Q	.	.	.	.
11.25	0.1983	0.32	Q	.	.	.	.
11.33	0.2005	0.33	Q	.	.	.	.
11.42	0.2028	0.33	Q	.	.	.	.
11.50	0.2051	0.33	Q	.	.	.	.
11.58	0.2074	0.34	Q	.	.	.	.
11.67	0.2097	0.34	Q	.	.	.	.
11.75	0.2121	0.35	Q	.	.	.	.
11.83	0.2145	0.35	Q	.	.	.	.
11.92	0.2169	0.35	Q	.	.	.	.
12.00	0.2194	0.36	Q	.	.	.	.
12.08	0.2221	0.44	Q	.	.	.	.
12.17	0.2251	0.44	Q	.	.	.	.
12.25	0.2282	0.45	Q	.	.	.	.
12.33	0.2312	0.45	Q	.	.	.	.
12.42	0.2344	0.46	Q	.	.	.	.
12.50	0.2375	0.46	Q	.	.	.	.
12.58	0.2407	0.47	Q	.	.	.	.
12.67	0.2439	0.47	Q	.	.	.	.
12.75	0.2472	0.48	Q	.	.	.	.
12.83	0.2505	0.48	Q	.	.	.	.
12.92	0.2539	0.49	Q	.	.	.	.
13.00	0.2573	0.50	Q	.	.	.	.
13.08	0.2608	0.51	.Q	.	.	.	.
13.17	0.2643	0.51	.Q	.	.	.	.
13.25	0.2679	0.52	.Q	.	.	.	.
13.33	0.2715	0.53	.Q	.	.	.	.
13.42	0.2752	0.54	.Q	.	.	.	.
13.50	0.2789	0.55	.Q	.	.	.	.
13.58	0.2827	0.56	.Q	.	.	.	.
13.67	0.2866	0.57	.Q	.	.	.	.
13.75	0.2906	0.58	.Q	.	.	.	.
13.83	0.2946	0.59	.Q	.	.	.	.
13.92	0.2987	0.60	.Q	.	.	.	.
14.00	0.3029	0.61	.Q	.	.	.	.
14.08	0.3065	0.44	Q	.	.	.	.
14.17	0.3096	0.45	Q	.	.	.	.
14.25	0.3128	0.47	Q	.	.	.	.
14.33	0.3160	0.48	Q	.	.	.	.
14.42	0.3194	0.50	.Q	.	.	.	.
14.50	0.3229	0.51	.Q	.	.	.	.
14.58	0.3265	0.54	.Q	.	.	.	.
14.67	0.3303	0.55	.Q	.	.	.	.
14.75	0.3342	0.58	.Q	.	.	.	.
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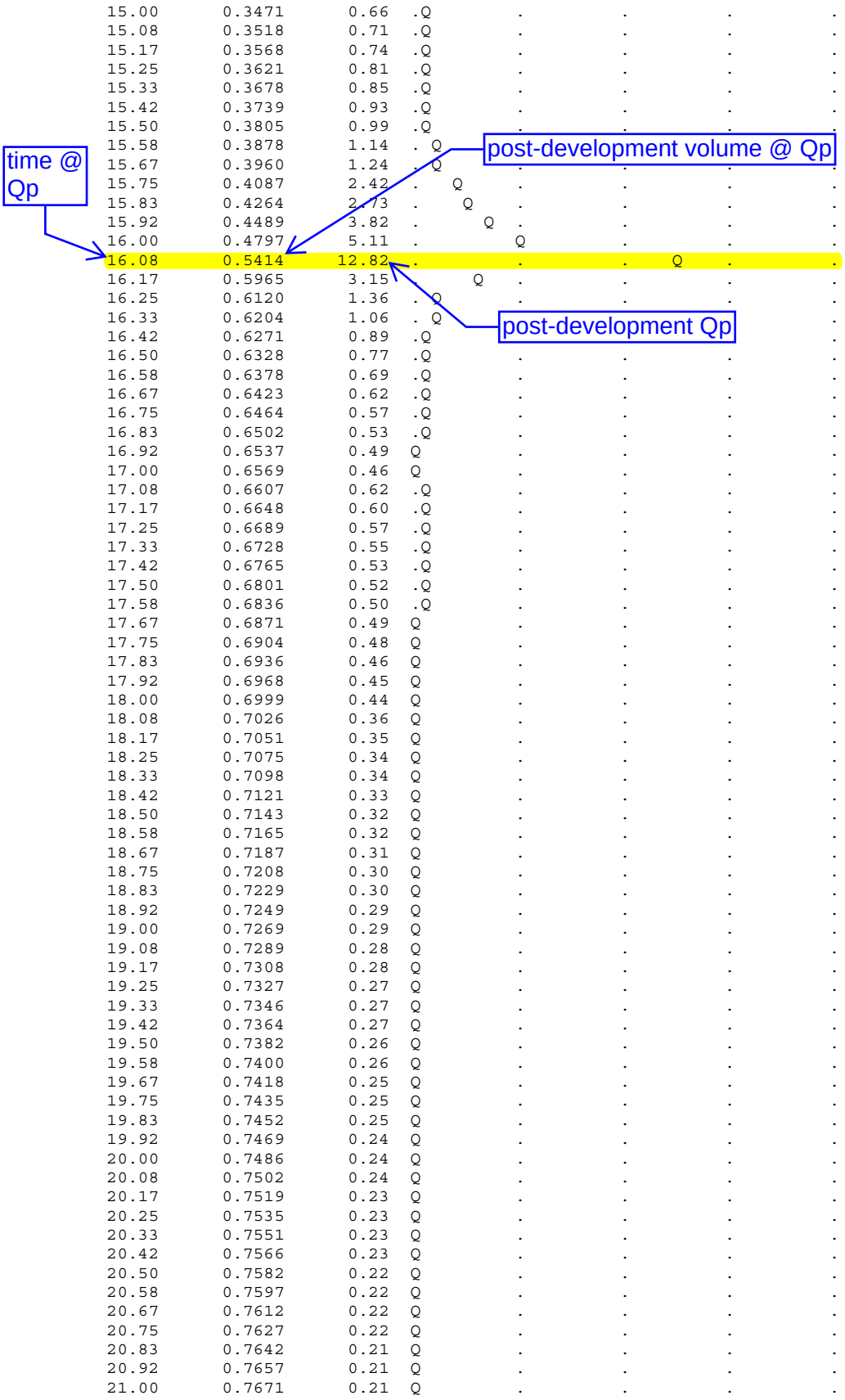

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16.00	0.4797	5.11	. Q
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16.17	0.5965	3.15	. Q
16.25	0.6120	1.36	. Q
16.33	0.6204	1.06	. Q
16.42	0.6271	0.89	.Q
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16.58	0.6378	0.69	.Q
16.67	0.6423	0.62	.Q
16.75	0.6464	0.57	.Q
16.83	0.6502	0.53	.Q
16.92	0.6537	0.49	Q
17.00	0.6569	0.46	Q
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17.17	0.6648	0.60	.Q
17.25	0.6689	0.57	.Q
17.33	0.6728	0.55	.Q
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17.58	0.6836	0.50	.Q
17.67	0.6871	0.49	Q
17.75	0.6904	0.48	Q
17.83	0.6936	0.46	Q
17.92	0.6968	0.45	Q
18.00	0.6999	0.44	Q
18.08	0.7026	0.36	Q
18.17	0.7051	0.35	Q
18.25	0.7075	0.34	Q
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18.42	0.7121	0.33	Q
18.50	0.7143	0.32	Q
18.58	0.7165	0.32	Q
18.67	0.7187	0.31	Q
18.75	0.7208	0.30	Q
18.83	0.7229	0.30	Q
18.92	0.7249	0.29	Q
19.00	0.7269	0.29	Q
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19.17	0.7308	0.28	Q
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19.58	0.7400	0.26	Q
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19.75	0.7435	0.25	Q
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19.92	0.7469	0.24	Q
20.00	0.7486	0.24	Q
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20.33	0.7551	0.23	Q
20.42	0.7566	0.23	Q
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20.58	0.7597	0.22	Q
20.67	0.7612	0.22	Q
20.75	0.7627	0.22	Q
20.83	0.7642	0.21	Q
20.92	0.7657	0.21	Q
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21.42	0.7742	0.20	Q	.	.	.	.
21.50	0.7755	0.20	Q	.	.	.	.
21.58	0.7769	0.20	Q	.	.	.	.
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21.83	0.7809	0.19	Q	.	.	.	.
21.92	0.7822	0.19	Q	.	.	.	.
22.00	0.7835	0.19	Q	.	.	.	.
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22.17	0.7861	0.18	Q	.	.	.	.
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22.33	0.7886	0.18	Q	.	.	.	.
22.42	0.7898	0.18	Q	.	.	.	.
22.50	0.7911	0.18	Q	.	.	.	.
22.58	0.7923	0.18	Q	.	.	.	.
22.67	0.7935	0.18	Q	.	.	.	.
22.75	0.7947	0.17	Q	.	.	.	.
22.83	0.7959	0.17	Q	.	.	.	.
22.92	0.7971	0.17	Q	.	.	.	.
23.00	0.7983	0.17	Q	.	.	.	.
23.08	0.7995	0.17	Q	.	.	.	.
23.17	0.8006	0.17	Q	.	.	.	.
23.25	0.8018	0.17	Q	.	.	.	.
23.33	0.8029	0.17	Q	.	.	.	.
23.42	0.8041	0.16	Q	.	.	.	.
23.50	0.8052	0.16	Q	.	.	.	.
23.58	0.8063	0.16	Q	.	.	.	.
23.67	0.8074	0.16	Q	.	.	.	.
23.75	0.8086	0.16	Q	.	.	.	.
23.83	0.8097	0.16	Q	.	.	.	.
23.92	0.8108	0.16	Q	.	.	.	.
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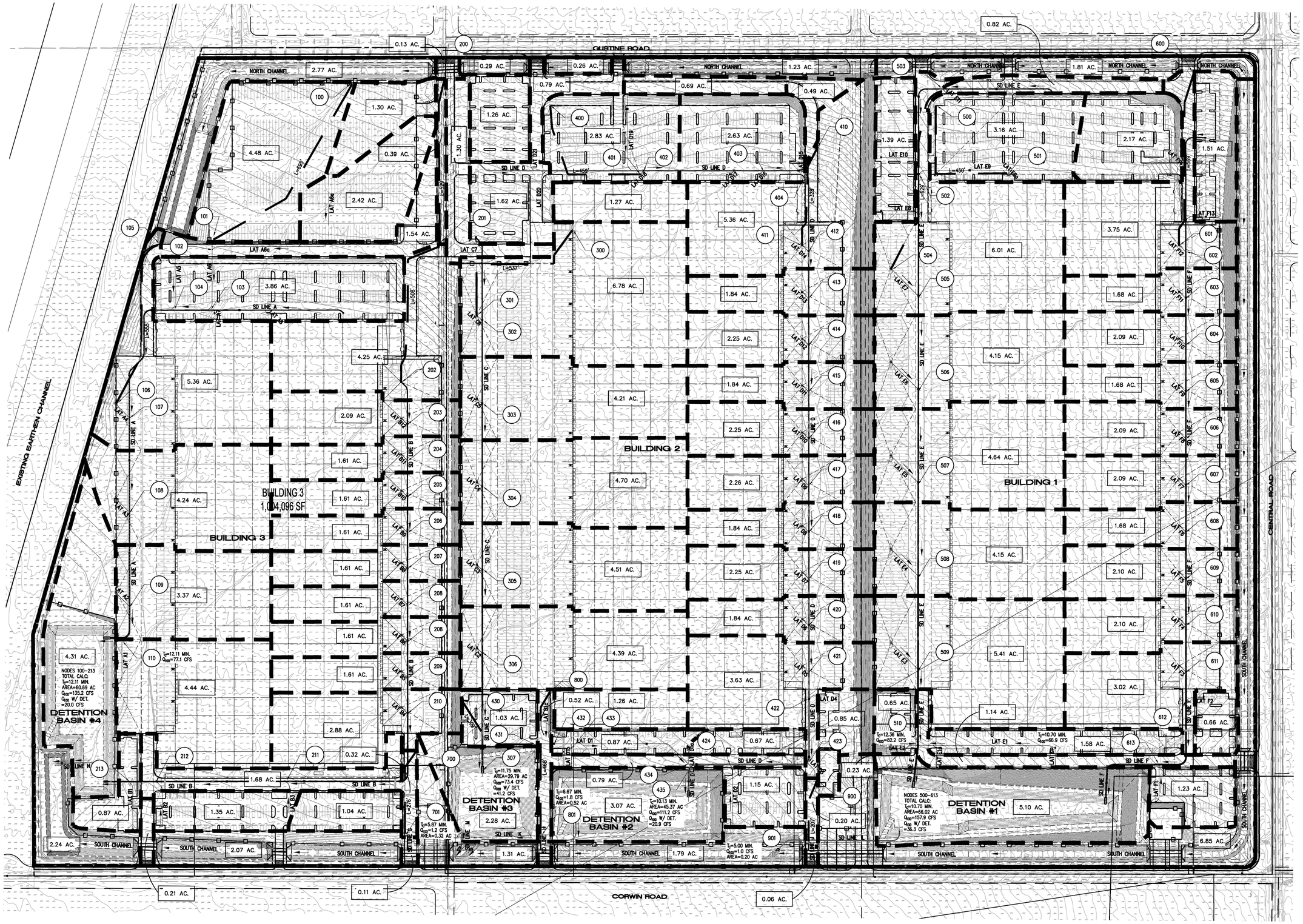
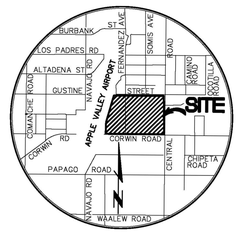
1



Proposed Condition
Hydrology Map





VICINITY MAP

N.T.S.

LEGEND

- PROJECT BOUNDARY
- SUBAREA BOUNDARY
- FLOW PATH
- 4.10 AC. — SUBAREA AREA
- 100 — NODE NUMBER
- PIPE/CHANNEL FLOW DIRECTION

SOIL TYPE: "C"
RAINFALL: 1.05"

TOPOGRAPHIC SURVEY AND MAPPING SOURCE:
- THIENES ENGINEERING, INC. 4/5/2022
- CENTRAL COAST AERIAL MAPPING 3/30/2022

Last Update:8/30/24
O:\4000-4099\4098\4098HYD.dwg

CITY OF APPLE VALLEY
PUBLIC WORKS DEPARTMENT

PROPOSED CONDITION HYDROLOGY MAP
APPLE VALLEY ASSEMBLAGE
SW CORNER OF QUSTINE ROAD AND CENTRAL ROAD

PREPARED FOR:
LAKE CREEK INDUSTRIAL LLC
1302 BRITNEY CROSS ROAD
SANTA ANA, CA 92705
PHONE: (949) 910-4616

Thienes Engineering, Inc.
CIVIL ENGINEERING • LAND SURVEYING
14349 FIRESTONE BOULEVARD
LA MIRADA, CALIFORNIA 90638
PH.(714)521-4811 FAX(714)521-4173

Designed by _____ Date _____
Checked by _____ Date _____
Designed by _____ Date _____
Checked by _____ Date _____

Approved by _____ Date _____
Public Works Director R.C.E. XXXXX

Sheet 1 of 1 Sheets

4099/1 OF 1 SHEET