
Appendix H2

Preliminary Water Quality Management Plan



Town of Apple Valley



Priority Project

Water Quality Management Plan

For:

Inland Empire North Logistics Center

APN 0472-231-08

Prepared for:

FGFW IV LLC

150 N. Market Street
Wichita, KS 67206
(702) 330-1715

Prepared by:

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Attn: Bret Thorpe

Submittal Date: August 18, 2023

Revision No. and Date: Insert No and Current Revision Date

Revision No. and Date: Insert No and Current Revision Date

Final Approval Date: _____

Project Owner's Certification

This Town of Apple Valley Water Quality Management Plan (WQMP) has been prepared for FGFW IV LLC by David Evans and Associates. 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):			0472-231-08
Owner's Signature			
Owner Name:			
Title			
Company	FGFW IV LLC		
Address	150 N. Market Street, Wichita, KS 67206		
Email			
Telephone #	(702) 330-1715		
Signature		Date	

Preparer's Certification

Project Data			
Permit/Application Number(s):	TBD	Grading Permit Number(s):	TBD
Tract/Parcel Map Number(s):		Building Permit Number(s):	
CUP, SUP, and/or APN (Specify Lot Numbers if Portions of Tract):			0472-231-08

“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: Bret Thorpe PE		PE Stamp Below
Title	Project Manager	
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Signature		
Date		

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Appendix J: Grading Plan

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		Inland Empire North Logistics Center			
Project Owner Contact Name:		Jessica Haughton			
Mailing Address:	FGFW IV, LLC 150 N. Market Street, Wichita, KS 67206	E-mail Address:	jhaughton@synergyconsultingca.com	Telephone:	(702) 330-1715
Permit/Application Number(s):	TBD	Tract/Parcel Map Number(s):	APN: 0472-231-08		
Additional Information/Comments:	This is a Preliminary WQMP				
Description of Project:	The Project site fronts the I-15 freeway south of the Stoddard Wells Rd. intersection located on the east side of the freeway in Apple Valley. The site is approximately 180 acres gross and 171.5 acres net. The site slopes up at an average slope of 4%, is primarily vacant except for a mining site at the Project site southeasterly boundary. The proposed project consists of two large warehouse type building, loading docks, parking for trucks and separate parking for passenger cars and landscaping. Four large infiltration basins are proposed, as well as some small LIDS areas where practical.				
Provide summary of Conceptual WQMP conditions (if previously submitted and approved). Attach complete copy.	Provide a Town of Apple Valley specific WQMP for approval.				

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):					
<input checked="" type="checkbox"/> #1 New development involving the creation of 5,000 ft ² or more of impervious surface collectively over entire site	<input type="checkbox"/> #2 Significant re-development involving the addition or replacement of 5,000 ft ² or more of impervious surface on an already developed site	<input type="checkbox"/> #3 Road Project – any road, sidewalk, or bicycle lane project that creates greater than 5,000 square feet of contiguous impervious surface	<input type="checkbox"/> #4 LUPs – linear underground/overhead projects that has a discrete location with 5,000 sq. ft. or more new constructed impervious surface		
<input type="checkbox"/> Site Design Only (Project Total Square Feet > 2,500 but < 5,000 sq.ft) <i>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)</i>					
² Project Area (ft ²):	7,473,154	³ Number of Dwelling Units:		⁴ SIC Code:	4225
⁵ Is Project going to be phased? Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> <i>If yes, ensure that the WQMP evaluates each phase as a distinct DA, requiring LID BMPs to address runoff at time of completion.</i>					

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:

The Property owner will be responsible for all the on-site BMPS such as infiltration basins, pre-treatment devices, landscaping and LID areas. Site maintenance BMPs is vested in;

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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 <input checked="" type="checkbox"/>	N <input type="checkbox"/>	Potential source - Parking lot, trash, wild bird, animal and pet wastes.
Nutrients - Phosphorous	E <input checked="" type="checkbox"/>	N <input type="checkbox"/>	Potential source - Landscape
Nutrients - Nitrogen	E <input checked="" type="checkbox"/>	N <input type="checkbox"/>	Potential Source - Landscape
Noxious Aquatic Plants	E <input type="checkbox"/>	N <input checked="" type="checkbox"/>	Can not see any potential source unless it is brought in with landscape plants and if the landscaping is maintained as required there is still no source. This type of plants can not survive within dry washes.
Sediment	E <input checked="" type="checkbox"/>	N <input type="checkbox"/>	Solid materials/ suspended solids from land surface is expected in addition to sediments from erosion.
Metals	E <input checked="" type="checkbox"/>	N <input type="checkbox"/>	Metal pollutants expected from vehicles circulating the parking lot, including tire wear and brake dust.
Oil and Grease	E <input checked="" type="checkbox"/>	N <input type="checkbox"/>	Surface area of parking lot and drive-thru will contribute to pollution from leaking vehicles and grease for production
Trash/Debris	E <input checked="" type="checkbox"/>	N <input type="checkbox"/>	Trash and debris pollution from general litter is expected on site from facility occupants, visitors and any work that may be performed on site premises.
Pesticides / Herbicides	E <input checked="" type="checkbox"/>	N <input type="checkbox"/>	Expected pollutants from maintenance of the site landscape area is expected.
Organic Compounds	E <input checked="" type="checkbox"/>	N <input type="checkbox"/>	Use of cleaning solvents/chemicals and maintenance of landscape area will contribute to pollution from organic compounds.
Other:	E <input type="checkbox"/>	N <input type="checkbox"/>	
Other:	E <input type="checkbox"/>	N <input type="checkbox"/>	
Other:	E <input type="checkbox"/>	N <input type="checkbox"/>	

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. ***If the project has more than one drainage area for stormwater management, then complete additional versions of these forms for each DA / outlet. A map presenting the DMAs must be included as an appendix to the WQMP document.***

Form 3-1 Site Location and Hydrologic Features			
Site coordinates take GPS measurement at approximate center of site	Latitude 34d 34m 32s	Longitude -117d 16m 1s	Thomas Bros Map page
<p>1 San Bernardino County climatic region: <input checked="" type="checkbox"/> Desert</p>			
<p>2 Does the site have more than one drainage area (DA): Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> <i>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</i></p>			
Conveyance	Briefly describe on-site drainage features to convey runoff that is not retained within a DMA		
DA1 DMA C flows to DA1 DMA A	<i>Ex. Bioretention overflow to vegetated bioswale with 4' bottom width, 5:1 side slopes and bed slope of 0.01. Conveys runoff for 1000' through DMA 1 to existing catch basin on SE corner of property</i>		
DA1 DMA A to Outlet 1			
DA1 DMA B to Outlet 1			
DA2 to Outlet 2			

Form 3-2 Existing Hydrologic Characteristics for Drainage Area 1				
For Drainage Area 1's sub-watershed DMA, provide the following characteristics	DMA A	DMA B	DMA C	DMA D
1 DMA drainage area (ft ²)	270,508	872,942	524,462	2,019,877
2 Existing site impervious area (ft ²)	0	0	0	0
3 Antecedent moisture condition <i>For desert areas, use http://www.sbcounty.gov/dpw/floodcontrol/pdf/20100412_map.pdf</i>	2	2	2	2
4 Hydrologic soil group <i>Refer to County Hydrology Manual Addendum for Arid Regions – http://www.sbcounty.gov/dpw/floodcontrol/pdf/20100412_addendum.pdf</i>	C	C	C	C
5 Longest flowpath length (ft)	883	1,238	1,401	2,401
6 Longest flowpath slope (ft/ft)	0.0147	0.041	0.044	0.043
7 Current land cover type(s) <i>Select from Fig C-3 of Hydrology Manual</i>	Barren	Barren	Barren	Barren
8 Pre-developed pervious area condition: <i>Based on the extent of wet season vegetated cover good >75%; Fair 50-75%; Poor <50% Attach photos of site to support rating</i>	Poor	Poor	Poor	Poor

Form 3-2 Existing Hydrologic Characteristics for Drainage Area 1 (use only as needed for additional DMA w/in DA 1)				
For Drainage Area 1's sub-watershed DMA, provide the following characteristics	DMA E	DMA F	DMA G	DMA H
1 DMA drainage area (ft ²)	2,351,369	1,072,447		
2 Existing site impervious area (ft ²)	0	0		
3 Antecedent moisture condition <i>For desert areas, use http://www.sbcounty.gov/dpw/floodcontrol/pdf/20100412_map.pdf</i>	2	2		
4 Hydrologic soil group <i>County Hydrology Manual Addendum for Arid Regions – http://www.sbcounty.gov/dpw/floodcontrol/pdf/20100412_addendum.pdf</i>	C	C		
5 Longest flowpath length (ft)	2,458	1,985		
6 Longest flowpath slope (ft/ft)	0.041	0.047		
7 Current land cover type(s) <i>Select from Fig C-3 of Hydrology Manual</i>	Barren	Barren		
8 Pre-developed pervious area condition: <i>Based on the extent of wet season vegetated cover good >75%; Fair 50-75%; Poor <50% Attach photos of site to support rating</i>	poor	poor		

Form 3-3 Watershed Description for Drainage Area	
<p>Receiving waters</p> <p>Refer to CWRCB site:</p> <p>http://www.waterboards.ca.gov/water_issues/programs/tmdl/integrated2010.shtml</p>	<p>Mojave River</p>
<p>Applicable TMDLs</p> <p>http://www.waterboards.ca.gov/water_issues/programs/tmdl/integrated2010.shtml</p>	<p>None</p>
<p>303(d) listed impairments</p> <p>http://www.waterboards.ca.gov/water_issues/programs/tmdl/integrated2010.shtml</p>	<p>Mojave River, upper to lower narrows</p> <p>Oxygen dissolved, Fluoride, Sulfates, TDS,</p> <p>Manganese, Sodium</p>
<p>Environmentally Sensitive Areas (ESA)</p> <p>Refer to Watershed Mapping Tool –</p> <p>http://sbcounty.permitrack.com/WAP</p>	<p>SW Willow Flycatcher</p> <p>Desert Tortoise Cat (3)</p> <p>Mojave Ground Squirrel</p>
<p>Hydromodification Assessment</p>	<p><input checked="" type="checkbox"/> Yes Complete Hydromodification Assessment. Include Forms 4.2-2 through Form 4.2-5 and Hydromodification BMP Form 4.3-9 in submittal</p> <p><input type="checkbox"/> No</p>

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	<input checked="" type="checkbox"/>	<input type="checkbox"/>	General information will be provided to the owner on housekeeping practices that contribute to the protection of storm water. The property owner and property manager will be familiar with the contents of this document and the BMPs used on the site. The owner will provide education materials to tenants (if applicable) on BMPs and housekeeping practices that contribute to the protection of storm water.
N2	Activity Restrictions	<input checked="" type="checkbox"/>	<input type="checkbox"/>	The property owner/manager shall control the discharge of the stormwater pollutants from this site through activity restrictions. Restrictions shall be provided to all new tenants/occupants through lease terms, or other mechanism upon first occupancy of the lease space and annually thereafter. Enforcement of activity restriction shall be on going during the operation of the project site.
N3	Landscape Management BMPs	<input checked="" type="checkbox"/>	<input type="checkbox"/>	The property owner, building operators, and landscape maintenance contractors will practice on going landscape maintenance BMPs consistent with applicable local ordinances and will regular inspect the irrigation system for signs of erosion or sediment debris buildup and clean/repair as needed.
N4	BMP Maintenance	<input checked="" type="checkbox"/>	<input type="checkbox"/>	The property owner/manager will maintain all post construction BMPs consistent with the O&M plan described in section 5 of this document (Form 5-1).
N5	Title 22 CCR Compliance (How development will comply)	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Hazardous wastes are not anticipated to be stored or handled of-site.
N6	Local Water Quality Ordinances	<input checked="" type="checkbox"/>	<input type="checkbox"/>	he owner shall comply with the Town of Apple Valley Stormwater Ordinance through the implementation of BMP's.
N7	Spill Contingency Plan	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Building operators shall prepare specific plans based on materials onsite for the cleanup of spills. Plans shall mandate stock piling of cleanup materials, notification of agencies, disposal, documentation, etc. Storage shall comply with Hazmat Regulations and any required contingency plans.

Form 4.1-1 Non-Structural Source Control BMPs				
N8	Underground Storage Tank Compliance	<input type="checkbox"/>	<input checked="" type="checkbox"/>	No underground storage tanks proposed.
N9	Hazardous Materials Disclosure Compliance	<input type="checkbox"/>	<input checked="" type="checkbox"/>	The storing of hazardous materials is not proposed.

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	
N10	Uniform Fire Code Implementation	<input checked="" type="checkbox"/>	<input type="checkbox"/>	This project will be developed and operated in accordance with Article 80 of the Uniform Fire Code.
N11	Litter/Debris Control Program	<input checked="" type="checkbox"/>	<input type="checkbox"/>	The building operator shall prepare and implement an employee training program. This program shall include trash management and litter control procedures including on spill cleanup, litter control, and material storage procedures.
N12	Employee Training	<input checked="" type="checkbox"/>	<input type="checkbox"/>	The property owner/manager shall prepare and implement an employee-training program in accordance with California Storm Water Quality Association Standards and BMP. This program shall be reviewed on a bi-annual basis or with the every new edition of the Stormwater Best Management Practice Handbook for Industrial and Commercial. See appendix for all educational material.
N13	Housekeeping of Loading Docks	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Loading docks shall be regularly maintained by keeping clean and orderly condition through a regular program of sweeping and litter control, cleaning up spills and broken containers immediately. Clean up should minimize use of water and do not discharge wash water into the storm drain.
N14	Catch Basin Inspection Program	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Catch basins shall be inspected visually on a monthly basis; the entire storm drain system shall be inspected and cleaned prior to the start of the rainy season.
N15	Vacuum Sweeping of Private Streets and Parking Lots	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Parking and dock areas will be swept regularly using a vacuum assisted sweeper. Frequency will depend on waste accumulations with a minimum of once per month and prior to the start of the rainy season.
N16	Other Non-structural Measures for Public Agency Projects	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Not a Public Agency project.

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N17	Comply with all other applicable NPDES permits	<input checked="" type="checkbox"/>	<input type="checkbox"/>	he developer will comply with the California statewide Construction General Permit during construction and all future occupants of the site shall comply with the requirements of the statewide General Stormwater Permit.
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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)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	All storm drain inlets shall have Stenciling illustrating an anti-dumping message.
S2	Design and construct outdoor material storage areas to reduce pollution introduction (CASQA New Development BMP Handbook SD-34)	<input type="checkbox"/>	<input checked="" type="checkbox"/>	This development does not include the storage of materials outdoors.
S3	Design and construct trash and waste storage areas to reduce pollution introduction (CASQA New Development BMP Handbook SD-32)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Trash storage areas shall be located away from storm drain inlets. All trash dumpsters/containers will be required to have a lid on at all times to prevent direct precipitation and prevent any rainfall from entering containers.
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)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Irrigation systems will be designed to each landscaped area's specific water need. Irrigation controls shall include rain-triggered shutoff devices to prevent irrigation after precipitation.
S5	Finish grade of landscaped areas at a minimum of 1-2 inches below top of curb, sidewalk, or pavement	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Landscaped areas shall be below a minimum of 1" to 2" below the top of curb or walk.
S6	Protect slopes and channels and provide energy dissipation (CASQA New Development BMP Handbook SD-10)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Install permanent stabilization BMPs on slopes as quickly as possible. Install drought resistant landscaping. Runoff to be conveyed away from tops of slopes.
S7	Covered dock areas (CASQA New Development BMP Handbook SD-31)	<input type="checkbox"/>	<input checked="" type="checkbox"/>	No covered dock areas within the new development.
S8	Covered maintenance bays with spill containment plans (CASQA New Development BMP Handbook SD-31)	<input type="checkbox"/>	<input checked="" type="checkbox"/>	No covered maintenance bays within the new development.
S9	Vehicle wash areas with spill containment plans (CASQA New Development BMP Handbook SD-33)	<input type="checkbox"/>	<input checked="" type="checkbox"/>	No vehicle wash areas proposed.
S10	Covered outdoor processing areas (CASQA New Development BMP Handbook SD-36)	<input type="checkbox"/>	<input checked="" type="checkbox"/>	No covered outdoor processing areas are proposed

Form 4.1-2 Structural Source Control BMPs

Identifier	Name	Check One		Describe BMP Implementation OR, If not applicable, state reason
		Included	Not Applicable	
S11	Equipment wash areas with spill containment plans (CASQA New Development BMP Handbook SD-33)	<input type="checkbox"/>	<input checked="" type="checkbox"/>	No equipment wash areas.
S12	Fueling areas (CASQA New Development BMP Handbook SD-30)	<input type="checkbox"/>	<input checked="" type="checkbox"/>	No fueling areas.
S13	Hillside landscaping (CASQA New Development BMP Handbook SD-10)	<input type="checkbox"/>	<input checked="" type="checkbox"/>	No natural existing hillsides on the project site.
S14	Wash water control for food preparation areas	<input type="checkbox"/>	<input checked="" type="checkbox"/>	No food preparation is proposed
S15	Community car wash racks (CASQA New Development BMP Handbook SD-33)	<input type="checkbox"/>	<input checked="" type="checkbox"/>	No Community car wash racks

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
<p>Site Design Practices <i>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</i></p>
<p>Minimize impervious areas: Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> Explanation: Impervious areas are minimized to the Maximum Extent Possible without costing the facility inefficiencies in circulation, parking and loading and unloading.</p>
<p>Maximize natural infiltration capacity; Including improvement and maintenance of soil: Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> Explanation: Underground infiltration system bottom with natural soils, no compaction. Landscaped areas will amend the soil and be depressed to facilitate infiltration.</p>
<p>Preserve existing drainage patterns and time of concentration: Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> Explanation: The site could not be developed due to the site topography as it is. The cost would be infeasible.</p>
<p>Disconnect impervious areas. Including rerouting of rooftop drainage pipes to drain stormwater to storage or infiltration BMPs instead of to storm drain: Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> Explanation: The site layout lends itself for some smaller parking areas to drain into impervious areas.</p>
<p>Use of Porous Pavement: Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> Explanation: Not practical with truck loading.</p>
<p>Protect existing vegetation and sensitive areas: Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> Explanation: There are no sensitive areas and site will have to be mass graded to develop it.</p>
<p>Re-vegetate disturbed areas. Including planting and preservation of drought tolerant vegetation: Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> Explanation: There is 10% minimum landscaping proposed which will incorporate drought tolerant vegetation.</p>

Minimize unnecessary compaction in stormwater retention/infiltration basin/trench areas: Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> Explanation: Site to be mass graded. Basin are attempted to be placed in fill areas to minimize excavation and thus avoid compaction. However, it is unknown if the preliminary Geotechnical report could recommend to over excavation.
Utilize naturalized/rock-lined drainage swales in place of underground piping or imperviously lined swales: Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> Explanation: Not practical in this development. The storm drain infrastructure is necessary to develop the site.
Stake off areas that will be used for landscaping to minimize compaction during construction: Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> Explanation: Site will be mass graded.
Use of Rain Barrels and Cisterns, Including the use of on-site water collection systems: Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> Explanation: The underground infiltration systems serve as a cistern where storm water is collected for infiltration as required by Town's storm water program and is number one on the BMP hierarchy list.
Stream Setbacks. Includes a specified distance from an adjacent steam: Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> Explanation: Not adjacent to a know stream.

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, evapotranspire, 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 mi²), 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 (ft ²): <p style="text-align: center;">2,065,180</p>	2 Imperviousness after applying preventative site design practices (Imp%): 0.1	3 Runoff Coefficient (Rc): <u>0.733</u> $R_c = 0.858(Imp\%)^{0.3} - 0.78(Imp\%)^{0.2} + 0.774(Imp\%) + 0.04$
4 Determine 1-hour rainfall depth for a 2-year return period P _{2yr-1hr} (in): 0.353 http://hdsc.nws.noaa.gov/hdsc/pfds/so/sca_pfds.html		
5 Compute P ₆ , Mean 6-hr Precipitation (inches): 0.44 <i>P₆ = Item 4 * C₁, where C₁ is a function of site climatic region specified in Form 3-1 Item 1 (Desert = 1.2371)</i>		
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 <input type="checkbox"/> 48-hrs <input checked="" type="checkbox"/>
7 Compute design capture volume, DCV (ft ³): 108,150 $DCV = 1/12 * [Item 1 * Item 3 * Item 5 * C_2]$, 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 (DA 1)			
Is the change in post- and pre- condition flows captured on-site? : Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> 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 82,447 <i>Form 4.2-3 Item 12</i>	2 7.17 <i>Form 4.2-4 Item 13</i>	3 70 <i>Form 4.2-5 Item 10</i>
Post-developed	4 308,736 <i>Form 4.2-3 Item 13</i>	5 13.25 <i>Form 4.2-4 Item 14</i>	6 20.2 <i>Form 4.2-5 Item 14</i>
Difference	7 226,289 <i>Item 4 - Item 1</i>	8 (-6.08) <i>Item 2 - Item 5</i>	9 (-49.8) <i>Item 6 - Item 3</i>
Difference (as % of pre-developed)	10 274% <i>Item 7 / Item 1</i>	11 (-85%) <i>Item 8 / Item 2</i>	12 (-70)% <i>Item 9 / Item 3</i>

Form 4.2-3 Hydromodification Assessment for Runoff Volume (DA 1)

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 <i>sum of areas of DMA should equal area of DA</i>								
4a Curve Number (CN) <i>use Items 1 and 2 to select the appropriate CN from Appendix C-2 of the TGD for WQMP</i>								
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 <i>sum of areas of DMA should equal area of DA</i>								
4b Curve Number (CN) <i>use Items 5 and 6 to select the appropriate CN from Appendix C-2 of the TGD for WQMP</i>								
5 Pre-Developed area-weighted CN:	7 Pre-developed soil storage capacity, S (in): $S = (1000 / \text{Item } 5) - 10$				9 Initial abstraction, I _a (in): $I_a = 0.2 * \text{Item } 7$			
6 Post-Developed area-weighted CN:	8 Post-developed soil storage capacity, S (in): $S = (1000 / \text{Item } 6) - 10$				10 Initial abstraction, I _a (in): $I_a = 0.2 * \text{Item } 8$			
11 Precipitation for 10 yr, 24 hr storm (in): 2.13 Go to: http://hdsc.nws.noaa.gov/hdsc/pfds/sa/sca_pfds.html								
12 Pre-developed Volume (ft ³): 82,447 $V_{pre} = (1 / 12) * (\text{Item sum of Item } 3) * [(\text{Item } 11 - \text{Item } 9)^2 / ((\text{Item } 11 - \text{Item } 9 + \text{Item } 7))$								
13 Post-developed Volume (ft ³): 308,736 $V_{pre} = (1 / 12) * (\text{Item sum of Item } 3) * [(\text{Item } 11 - \text{Item } 10)^2 / ((\text{Item } 11 - \text{Item } 10 + \text{Item } 8))$								
14 Volume Reduction needed to meet hydromodification requirement, (ft ³): 210,852 $V_{hydro} = (\text{Item } 13 * 0.95) - \text{Item } 12$								

See HCOC Analysis and unit hydrograph computations in Appendix D

Form 4.2-4 Hydromodification Assessment for Time of Concentration (DA 1)

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 <i>Use additional forms if there are more than 4 DMA</i>				Post-developed DA1 <i>Use additional forms if there are more than 4 DMA</i>			
	DMA A	DMA B	DMA C	DMA D	DMA A	DMA B	DMA C	DMA D
1 Length of flowpath (ft) <i>Use Form 3-2 Item 5 for pre-developed condition</i>								
2 Change in elevation (ft)								
3 Slope (ft/ft), $S_o = \text{Item 2} / \text{Item 1}$								
4 Land cover								
5 Initial DMA Time of Concentration (min) <i>Appendix C-1 of the TGD for WQMP</i>								
6 Length of conveyance from DMA outlet to project site outlet (ft) <i>May be zero if DMA outlet is at project site outlet</i>								
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) $V_{fps} = (1.49 / \text{Item 9}) * (\text{Item 7}/\text{Item 8})^{0.67} * (\text{Item 3})^{0.5}$								
11 Travel time to outlet (min) $T_t = \text{Item 6} / (\text{Item 10} * 60)$								
12 Total time of concentration (min) $T_c = \text{Item 5} + \text{Item 11}$								
13 Pre-developed time of concentration (min): 7.17 <i>Minimum of Item 12 pre-developed DMA</i>								
14 Post-developed time of concentration (min): 13.252 <i>Minimum of Item 12 post-developed DMA</i>								
15 Additional time of concentration needed to meet hydromodification requirement (min): 0 $T_{C-Hydro} = (\text{Item 13} * 0.95) - \text{Item 14}$								

See HCOC Analysis and unit hydrograph computations in Appendix D

Existing TC was taken from Rational method, shortest TC in the longest run = 7.17 min.

TC developed is more (longer) than TC existing as developed condition slopes are much flatter. (4% ex vs 0.5% dev.)

Form 4.2-5 Hydromodification Assessment for Peak Runoff (DA 1)

Compute peak runoff for pre- and post-developed conditions

Variables	Pre-developed DA to Project Outlet <i>(Use additional forms if more than 3 DMA)</i>			Post-developed DA to Project Outlet <i>(Use additional forms if more than 3 DMA)</i>		
	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) <i>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)</i>						
3 Ratio of pervious area to total area <i>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)</i>						
4 Pervious area infiltration rate (in/hr) <i>Use pervious area CN and antecedent moisture condition with Appendix C-3 of the TGD for WQMP</i>						
5 Maximum loss rate (in/hr) $F_m = Item 3 * Item 4$ <i>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)</i>						
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 <i>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)</i>	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): 70 Maximum of Item 8, 9, and 10 (including additional forms as needed)						
11 Post-developed Q_p at T_c for DMA A: 20.2 <i>Same as Item 8 for post-developed values</i>	12 Post-developed Q_p at T_c for DMA B: <i>Same as Item 9 for post-developed values</i>			13 Post-developed Q_p at T_c for DMA C: <i>Same as Item 10 for post-developed values</i>		
14 Peak runoff from post-developed condition confluence analysis (cfs): 20.2 Maximum of Item 11, 12, and 13 (including additional forms as needed)						
15 Peak runoff reduction needed to meet Hydromodification Requirement (cfs): 0 $Q_{p-hydro} = (Item 14 * 0.95) - Item 10$						

See HCOC Analysis and unit hydrograph computations in Appendix D

4.3 BMP Selection and Sizing

Complete the following forms for each project site DA to document that the proposed treatment (LID/Bioretenion) 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 (DA 1)	
Feasibility Criterion – Complete evaluation for each DA on the Project Site	
<p>¹ Would infiltration BMP pose significant risk for groundwater related concerns? <i>Refer to Section 5.3.2.1 of the TGD for WQMP</i></p>	Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>
If Yes, Provide basis: (attach)	
<p>² Would installation of infiltration BMP significantly increase the risk of geotechnical hazards? (Yes, if the answer to any of the following questions is yes, as established by a geotechnical expert):</p> <ul style="list-style-type: none"> • 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. 	Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>
If Yes, Provide basis: (attach)	
<p>³ Would infiltration of runoff on a Project site violate downstream water rights?</p>	Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>
If Yes, Provide basis: (attach)	
<p>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?</p>	Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>
If Yes, Provide basis: (attach)	
<p>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)?</p>	Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>
If Yes, Provide basis: (attach)	
<p>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? <i>See Section 3.5 of the TGD for WQMP and WAP</i></p>	Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>
If Yes, Provide basis: (attach)	
<p>⁷ Any answer from Item 1 through Item 3 is “Yes”: <i>If yes, infiltration of any volume is not feasible onsite. Proceed to Form 4.3-4, Selection and Evaluation of Biotreatment BMP BMP. If no, then proceed to Item 8 below.</i></p>	Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>
<p>⁸ Any answer from Item 4 through Item 6 is “Yes”: <i>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.</i></p>	Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>
<p>⁹ All answers to Item 1 through Item 6 are “No”: <i>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.</i></p>	

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 (DA 1)			
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 <input type="checkbox"/> No <input type="checkbox"/> <i>If yes, complete Items 2-5; If no, proceed to Item 6</i>	DA DMA BMP Type	DA DMA BMP Type	DA DMA BMP Type <i>(Use additional forms for more BMPs)</i>
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) $V = \text{Item 2} * \text{Item 3} * (0.5/12)$, assuming retention of 0.5 inches of runoff			
5 Sum of retention volume achieved from impervious area dispersion (ft ³):		$V_{\text{retention}} = \text{Sum of Item 4 for all BMPs}$	
6 Implementation of Localized On-lot Infiltration BMPs (e.g. on-lot rain gardens): Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> <i>If yes, complete Items 7-13 for aggregate of all on-lot infiltration BMP in each DA; If no, proceed to Item 14</i>	DA 1A DMA A BMP Type HSC	DA 1 DMA A BMP Type HSC	DA BMP Type <i>(Use additional forms for more BMPs)</i>
7 Ponding surface area (ft ²)	25,000		
8 Ponding depth (ft) (min. 0.5 ft.)	2.5	1	
9 Surface area of amended soil/gravel (ft ²)	25,000		
10 Average depth of amended soil/gravel (ft) (min. 1 ft.)	1		
11 Average porosity of amended soil/gravel	0.4		
12 Retention volume achieved from on-lot infiltration (ft ³) $V_{\text{retention}} = (\text{Item 7} * \text{Item 8}) + (\text{Item 9} * \text{Item 10} * \text{Item 11})$	72,500		

Form 4.3-2 cont. Site Design BMPs (DA 1)			
13 Runoff volume retention from on-lot infiltration (ft ³): 72,500 $V_{retention} = \text{Sum of Item 12 for all BMPs}$			
14 Implementation of Street Trees: Yes <input type="checkbox"/> No <input type="checkbox"/> <i>If yes, complete Items 14-18. If no, proceed to Item 19</i>	DA BMP Type	DMA BMP Type	DA DMA BMP Type <i>(Use additional forms for more BMPs)</i>
15 Number of Street Trees			
16 Average canopy cover over impervious area (ft ²)			
17 Runoff volume retention from street trees (ft ³) $V_{retention} = \text{Item 15} * \text{Item 16} * (0.05/12)$ assume runoff retention of 0.05 inches			
18 Runoff volume retention from street tree BMPs (ft ³): $V_{retention} = \text{Sum of Item 17 for all BMPs}$			
19 Total Retention Volume from Site Design BMPs: 72,500 <i>Sum of Items 5, 13 and 18</i>			

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.

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

<p>1 Remaining LID DCV not met by site design BMP (ft³): 35,650 $V_{unmet} = \text{Form 4.2-1 Item 7} - \text{Form 4.3-2 Item 19}$</p>			
<p>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</p>	<p>DA DMA BMP Type</p>	<p>DA DMA BMP Type</p>	<p>DA DMA BMP Type (Use additional forms for more BMPs)</p>
<p>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</p>			
<p>3 Infiltration safety factor See TGD Section 5.4.2 and Appendix D</p>			
<p>4 Design percolation rate (in/hr) $P_{design} = \text{Item 2} / \text{Item 3}$</p>			
<p>5 Ponded water drawdown time (hr) Copy Item 6 in Form 4.2-1</p>			
<p>6 Maximum ponding depth (ft) BMP specific, see Table 5-4 of the TGD for WQMP for BMP design details</p>			
<p>7 Ponding Depth (ft) $d_{BMP} = \text{Minimum of } (1/12 * \text{Item 4} * \text{Item 5}) \text{ or Item 6}$</p>			
<p>8 Infiltrating surface area, SA_{BMP} (ft²) the lesser of the area needed for infiltration of full DCV or minimum space requirements from Table 5.7 of the TGD for WQMP</p>			
<p>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</p>			
<p>10 Amended soil porosity</p>			
<p>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</p>			
<p>12 Gravel porosity</p>			
<p>13 Duration of storm as basin is filling (hrs) Typical ~ 3hrs</p>			
<p>14 Above Ground Retention Volume (ft³) $V_{retention} = \text{Item 8} * [\text{Item 7} + (\text{Item 9} * \text{Item 10}) + (\text{Item 11} * \text{Item 12}) + (\text{Item 13} * (\text{Item 4} / 12))]$</p>			
<p>15 Underground Retention Volume (ft³) Volume determined using manufacturer's specifications and calculations</p>	227,392		
<p>16 Total Retention Volume from LID Infiltration BMPs: 227,392 (Sum of Items 14 and 15 for all infiltration BMP included in plan)</p>			
<p>17 Fraction of DCV achieved with infiltration BMP: 100% $\text{Retention\%} = \text{Item 16} / \text{Form 4.2-1 Item 7}$</p>			
<p>18 Is full LID DCV retained onsite with combination of hydrologic source control and LID retention/infiltration BMPs? Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> 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.</p>			

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 (DA 1)		
1 Remaining LID DCV not met by site design , or infiltration, BMP for potential biotreatment (ft ³): <i>Form 4.2-1 Item 7 - Form 4.3-2 Item 19 – Form 4.3-3 Item 16</i>		List pollutants of concern <i>Copy from Form 2.3-1.</i>
2 Biotreatment BMP Selected <i>(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)</i>	Volume-based biotreatment <i>Use Forms 4.3-5 and 4.3-6 to compute treated volume</i>	Flow-based biotreatment <i>Use Form 4.3-7 to compute treated flow</i>
	<input type="checkbox"/> Bioretention with underdrain <input type="checkbox"/> Planter box with underdrain <input type="checkbox"/> Constructed wetlands <input type="checkbox"/> Wet exte <input type="checkbox"/> Dry exte	Not used
3 Volume biotreated in volume based biotreatment BMP (ft ³): <i>Form 4.3-5 Item 15 + Form 4.3-6 Item 13</i>	4 Compute remaining LID DCV with implementation of volume based biotreatment BMP (ft ³): <i>Item 1 – Item 3</i>	5 Remaining fraction of LID DCV for sizing flow based biotreatment BMP: % <i>Item 4 / Item 1</i>
6 Flow-based biotreatment BMP capacity provided (cfs): <i>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)</i>		
7 Metrics for MEP determination: <ul style="list-style-type: none"> • 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: <input type="checkbox"/> <i>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.</i> 		

Form 4.3-5 Volume Based Biotreatment (DA 1) – Bioretention and Planter Boxes with Underdrains			
Biotreatment BMP Type <i>(Bioretention w/underdrain, planter box w/underdrain, other comparable BMP)</i>	DA DMA BMP Type	DA DMA BMP Type	DA DMA BMP Type <i>(Use additional forms for more BMPs)</i>
1 Pollutants addressed with BMP <i>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</i>			
2 Amended soil infiltration rate <i>Typical ~ 5.0</i>			
3 Amended soil infiltration safety factor <i>Typical ~ 2.0</i>			
4 Amended soil design percolation rate (in/hr) $P_{design} = \text{Item 2} / \text{Item 3}$			
5 Ponded water drawdown time (hr) <i>Cop)</i>	Not used		
6 Maximum ponding depth (ft) <i>see Table 5-6 of the TGD for WQMP for reference to BMP design details</i>			
7 Ponding Depth (ft) $d_{BMP} = \text{Minimum of } (1/12 * \text{Item 4} * \text{Item 5}) \text{ or Item 6}$			
8 Amended soil surface area (ft ²)			
9 Amended soil depth (ft) <i>see Table 5-6 of the TGD for WQMP for reference to BMP design details</i>			
10 Amended soil porosity, <i>n</i>			
11 Gravel depth (ft) <i>see Table 5-6 of the TGD for WQMP for reference to BMP design details</i>			
12 Gravel porosity, <i>n</i>			
13 Duration of storm as basin is filling (hrs) <i>Typical ~ 3hrs</i>			
14 Biotreated Volume (ft ³) $V_{biotreated} = \text{Item 8} * [(\text{Item 7}/2) + (\text{Item 9} * \text{Item 10}) + (\text{Item 11} * \text{Item 12}) + (\text{Item 13} * (\text{Item 4} / 12))]$			
15 Total biotreated volume from bioretention and/or planter box with underdrains BMP: <i>Sum of Item 14 for all volume-based BMPs included in this form</i>			

Form 4.3-6 Volume Based Biotreatment (DA 1) – Constructed Wetlands and Extended Detention

Biotreatment BMP Type <i>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.</i>	DA DMA BMP Type		DA DMA BMP Type <i>(Use additional forms for more BMPs)</i>	
	Forebay	Basin	Forebay	Basin
1 Pollutants addressed with BMP forebay and basin <i>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</i>				
2 Bottom width (ft)				
3 Bottom length (ft)				
4 Bottom area (ft ²) <i>A_{bottom} = Item 2 * Item 3</i>				
5 Side slope (ft/ft)				
6 Depth of storage (ft)				
7 Water surface area (ft ²) <i>A_{surface} = (Item 2 + (2 * Item 5 * Item 6)) * (Item 3 + (2 * Item 5 * Item 6))</i>				
8 Storage volume (ft ³) <i>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</i> <i>V = Item 6 / 3 * [Item 4 + Item 7 + (Item 4 * Item 7)^0.5]</i>				
9 Drawdown Time (hrs) <i>Copy Item 6 from Form 2.1</i>				
10 Outflow rate (cfs) <i>Q_{BMP} = (Item 8_{forebay} + Item 8_{basin}) / (Item 9 * 3600)</i>				
11 Duration of design storm event (hrs)				
12 Biotreated Volume (ft ³) <i>V_{biotreated} = (Item 8_{forebay} + Item 8_{basin}) + (Item 10 * Item 11 * 3600)</i>				
13 Total biotreated volume from constructed wetlands, extended dry detention, or extended wet detention : <i>(Sum of Item 12 for all BMP included in plan)</i>				

not used

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

Not used

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 1)	
1	Total LID DCV for the Project DA-1 (ft ³): 108,150 <i>Copy Item 7 in Form 4.2-1</i>
2	On-site retention with site design BMP (ft ³): 72,500 <i>Copy Item 18 in Form 4.3-2</i>
3	On-site retention with LID infiltration BMP (ft ³): 227,392 <i>Copy Item 16 in Form 4.3-3</i>
4	On-site biotreatment with volume based biotreatment BMP (ft ³): <i>Copy Item 3 in Form 4.3-4</i>
5	Flow capacity provided by flow based biotreatment BMP (cfs): <i>Copy Item 6 in Form 4.3-4</i>
6	<p>LID BMP performance criteria are achieved if answer to any of the following is "Yes":</p> <ul style="list-style-type: none"> • Full retention of LID DCV with site design or infiltration BMP: Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> <i>If yes, sum of Items 2, 3, and 4 is greater than Item 1</i> • 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 <input type="checkbox"/> No <input type="checkbox"/> <i>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</i> ▪ 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 <input type="checkbox"/> No <input type="checkbox"/> <i>If yes, Form 4.3-1 Items 7 and 8 were both checked yes</i>
7	<p>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:</p> <ul style="list-style-type: none"> • Combination of Site Design, retention and infiltration, , and biotreatment BMPs provide less than full LID DCV capture: <input type="checkbox"/> <i>Checked yes if Form 4.3-4 Item 7 is 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, $V_{alt} = (Item\ 1 - Item\ 2 - Item\ 3 - Item\ 4 - Item\ 5) * (100 - Form\ 2.4-1\ Item\ 2)\%$</i> • 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: <ul style="list-style-type: none"> 1) Equal or greater amount of runoff infiltrated or evapotranspired; <input type="checkbox"/> 2) Equal or lower pollutant concentrations in runoff that is discharged after biotreatment; <input type="checkbox"/> 3) Equal or greater protection against shock loadings and spills; <input type="checkbox"/> 4) Equal or greater accessibility and ease of inspection and maintenance. <input type="checkbox"/>

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 (DA 1)	
1 Volume reduction needed for hydromodification performance criteria (ft ³): 226,051 <i>(Form 4.2-2 Item 4 * 0.95) – Form 4.2-2 Item 1</i>	2 On-site retention with site design and infiltration, BMP (ft ³): 299,892 <i>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</i>
3 Remaining volume for hydromodification volume capture (ft ³): 0 <i>Item 1 – Item 2</i>	4 Volume capture provided by incorporating additional on-site BMPs (ft ³):
5 Is Form 4.2-2 Item 11 less than or equal to 5%: Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> <i>If yes, hydromodification performance criteria is achieved. If no, select one or more mitigation options below:</i> <ul style="list-style-type: none"> • Demonstrate increase in time of concentration achieved by proposed LID site design, LID BMP, and additional on-site BMP <input type="checkbox"/> • 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 <input type="checkbox"/> 	
6 Form 4.2-2 Item 12 less than or equal to 5%: Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> <i>If yes, hydromodification performance criteria is achieved. If no, select one or more mitigation options below:</i> <ul style="list-style-type: none"> • Demonstrate reduction in peak runoff achieved by proposed LID site design, LID BMPs, and additional on-site retention BMPs <input type="checkbox"/> 	

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: **Not used** n of facilities, of a different design than in Permit Section E.12.e.(ii)(f) may be permitted if all of the f . 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).

Form 4.2-1 LID BMP Performance Criteria for Design Capture Volume (DA 2)

1 Project area DA 2 (ft ²): 2,091,751	2 Imperviousness after applying preventative site design practices (Imp%): 90	3 Runoff Coefficient (Rc): <u> 0.73 </u> $R_c = 0.858(\text{Imp}\%)^3 - 0.78(\text{Imp}\%)^2 + 0.774(\text{Imp}\%) + 0.04$
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4 Determine 1-hour rainfall depth for a 2-year return period $P_{2\text{yr-1hr}}$ (in): 0.353 http://hdsc.nws.noaa.gov/hdsc/pfds/sa/sca_pfds.html

5 Compute P_6 , Mean 6-hr Precipitation (inches): 0.44
 $P_6 = \text{Item 4} * C_1$, where C_1 is a function of site climatic region specified in Form 3-1 Item 1 (Valley = 1.4807; Mountain = 1.909; Desert = 1.2371)

6 Drawdown Rate <i>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.</i>	24-hrs <input type="checkbox"/> 48-hrs <input checked="" type="checkbox"/>
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7 Compute design capture volume, DCV (ft³): 109,133
 $DCV = 1/12 * [\text{Item 1} * \text{Item 3} * \text{Item 5} * C_2]$, 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 HCOC Assessment (DA 2)

Does project have the potential to cause or contribute to an HCOC in a downstream channel: Yes No

Go to: <http://sbcounty.permitrack.com/WAP/>

If "Yes", then complete HCOC assessment of site hydrology for 2yr 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)

If "No," then proceed to Section 4.3 Project Conformance Analysis

Condition	Runoff Volume (ft ³)	Time of Concentration (min)	Peak Runoff (cfs)
Pre-developed	¹ 83,508 <i>Form 4.2-3 Item 12</i>	² 7.2 <i>Form 4.2-4 Item 13</i>	³ 71 <i>Form 4.2-5 Item 10</i>
Post-developed	⁴ 312,713 <i>Form 4.2-3 Item 13</i>	⁵ 17.2 <i>Form 4.2-4 Item 14</i>	⁶ 20.1 <i>Form 4.2-5 Item 14</i>
Difference	⁷ 229,205 <i>Item 4 – Item 1</i>	⁸ (-10) <i>Item 2 – Item 5</i>	⁹ (-50.9) <i>Item 6 – Item 3</i>
Difference (as % of pre-developed)	¹⁰ 274% <i>Item 7 / Item 1</i>	¹¹ (-138)% <i>Item 8 / Item 2</i>	¹² 72% <i>Item 9 / Item 3</i>

Form 4.2-3 HCOC Assessment for Runoff Volume (DA 2)

Form 4.2-3 HCOC Assessment for Runoff Volume (DA 2)								
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 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): $S = (1000 / \text{Item 5}) - 10$				9 Initial abstraction, I_a (in): $I_a = 0.2 * \text{Item 7}$			
6 Post-Developed area-weighted CN:	8 Post-developed soil storage capacity, S (in): $S = (1000 / \text{Item 6}) - 10$				10 Initial abstraction, I_a (in): $I_a = 0.2 * \text{Item 8}$			
11 Precipitation for 2 yr, 24 hr storm (in): 2.13 Go to: http://hdsc.nws.noaa.gov/hdsc/pfds/sa/sca_pfds.html								
12 Pre-developed Volume (ft ³): 83,508 $V_{pre} = (1 / 12) * (\text{Item sum of Item 3}) * [(\text{Item 11} - \text{Item 9})^2 / ((\text{Item 11} - \text{Item 9} + \text{Item 7}))]$								
13 Post-developed Volume (ft ³): 312,713 $V_{pre} = (1 / 12) * (\text{Item sum of Item 3}) * [(\text{Item 11} - \text{Item 10})^2 / ((\text{Item 11} - \text{Item 10} + \text{Item 8}))]$								
14 Volume Reduction needed to meet HCOC Requirement, (ft ³): 213,569 $V_{HCOC} = (\text{Item 13} * 0.95) - \text{Item 12}$								

See HCOC Analysis and unit hydrograph computations in Appendix D

Form 4.2-4 HCOC Assessment for Time of Concentration (DA 2)

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				Post-developed DA1			
	DMA E	DMA F	DMA G	DMA H	DMA E	DMA F	DMA G	DMA H
1 Length of flowpath (ft) <i>Use Form 3-2 Item 5 for pre-developed condition</i>								
2 Change in elevation (ft)								
3 Slope (ft/ft), $S_o = \text{Item 2} / \text{Item 1}$								
4 Land cover								
5 Initial DMA Time of Concentration (min) <i>Appendix C-1 of the TGD for WQMP</i>								
6 Length of conveyance from DMA outlet to project site outlet (ft) <i>May be zero if DMA outlet is at project site outlet</i>								
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) $V_{fps} = (1.49 / \text{Item 9}) * (\text{Item 7} / \text{Item 8})^{0.67} * (\text{Item 3})^{0.5}$								
11 Travel time to outlet (min) $T_t = \text{Item 6} / (\text{Item 10} * 60)$								
12 Total time of concentration (min) $T_c = \text{Item 5} + \text{Item 11}$								
13 Pre-developed time of concentration (min): 7.2 <i>Minimum of Item 12 pre-developed DMA</i>								
14 Post-developed time of concentration (min): 17.2 <i>Minimum of Item 12 post-developed DMA</i>								
15 Additional time of concentration needed to meet HCOC requirement (min): 0 $T_{C-HCOC} = (\text{Item 13} * 0.95) - \text{Item 14}$								

See HCOC Analysis and unit hydrograph computations in Appendix D

Form 4.2-5 HCOC Assessment for Peak Runoff (DA 2)

Compute peak runoff for pre and post developed conditions

Variables	Pre-developed DA to Project Outlet <i>Use additional forms if more than 3 DMA</i>			Post-developed DA to Project Outlet <i>Use additional forms if more than 3 DMA</i>		
	DMA A	DMA B	DMA C	DMA A	DMA B	DMA C
1 Rainfall Intensity for storm duration equal to time of concentration $I_{peak} = 10^{(LOG Form 4.2-1 Item 4 - 0.6 LOG Form 4.2-4 Item 5 / 60)}$						
2 Drainage Area of each DMA (ft ²) <i>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)</i>						
3 Ratio of pervious area to total area <i>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)</i>						
4 Pervious area infiltration rate (in/hr) <i>Use pervious area CN and antecedent moisture condition with Appendix C-3 of the TGD for WQMP</i>						
5 Maximum loss rate (in/hr) $F_m = Item 3 * Item 4$ <i>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)</i>						
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 <i>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)</i>	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: $Q_p = Item 6_{DMAC} + [Item 6_{DMAA} * (Item 1_{DMAC} - Item 5_{DMAA}) / (Item 1_{DMAA} - Item 5_{DMAA}) * Item 7_{DMAC/2}] + [Item 6_{DMAB} * (Item 1_{DMAC} - Item 5_{DMAB}) / (Item 1_{DMAB} - Item 5_{DMAB}) * Item 7_{DMAC/3}]$		
10 Peak runoff from pre-developed condition confluence analysis (cfs): 71 <i>Maximum of Item 8, 9, and 10 (including additional forms as needed)</i>						
11 Post-developed Q_p at T_c for DMA A: 20.1 <i>Same as Item 8 for post-developed values</i>	12 Post-developed Q_p at T_c for DMA B: <i>Same as Item 9 for post-developed values</i>			13 Post-developed Q_p at T_c for DMA C: <i>Same as Item 10 for post-developed values</i>		
14 Peak runoff from post-developed condition confluence analysis (cfs): 20.1 <i>Maximum of Item 11, 12, and 13 (including additional forms as needed)</i>						
15 Peak runoff reduction needed to meet HCOC Requirement (cfs): 0 $Q_{p-HCOC} = (Item 14 * 0.95) - Item 10$						

See HCOC Analysis and unit hydrograph computations in Appendix D

Form 4.3-1 Infiltration BMP Feasibility (DA 2)

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 eight 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, Harvest and Use 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, Hydrologic Source Control 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, Hydrologic Source Control BMP.

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

1 Remaining LID DCV not met by site design HSC BMP (ft³): 109,133 $V_{unmet} = \text{Form 4.2-1 Item 7} - \text{Form 4.3-2 Item 30}$

BMP Type <i>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</i>	DA 2 BMP Type	DMA A BMP Type	DA BMP Type	DMA BMP Type
2 Infiltration rate of underlying soils (in/hr) <i>See Section 5.4.2 and Appendix D of the TGD for WQMP for minimum requirements for assessment methods</i>				
3 Infiltration safety factor <i>See TGD Section 5.4.2 and Appendix D</i>				
4 Design percolation rate (in/hr) $P_{design} = \text{Item 2} / \text{Item 3}$				
5 Ponded water drawdown time (hr) <i>Copy Item 6 in Form 4.2-1</i>				
6 Maximum ponding depth (ft) <i>BMP specific, see Table 5-4 of the TGD for WQMP for BMP design details</i>				
7 Ponding Depth (ft) $d_{BMP} = \text{Minimum of } (1/12 * \text{Item 4} * \text{Item 5}) \text{ or Item 6}$				
8 Infiltrating surface area, SA_{BMP} (ft ²) <i>the lesser of the area needed for infiltration of full DCV or minimum space requirements from Table 5.7 of the TGD for WQMP</i>				
9 Amended soil depth, d_{media} (ft) <i>Only included in certain BMP types, see Table 5-4 in the TGD for WQMP for reference to BMP design details</i>				
10 Amended soil porosity				
11 Gravel depth, d_{media} (ft) <i>Only included in certain BMP types, see Table 5-4 of the TGD for WQMP for BMP design details</i>				
12 Gravel porosity				
13 Duration of storm as basin is filling (hrs) <i>Typical ~ 3hrs</i>				
14 Above Ground Retention Volume (ft ³) $V_{retention} = \text{Item 8} * [\text{Item 7} + (\text{Item 9} * \text{Item 10}) + (\text{Item 11} * \text{Item 12}) + (\text{Item 13} * (\text{Item 4} / 12))]$				
15 Underground Retention Volume (ft ³) <i>Volume determined using manufacturer's specifications and calculations</i>				

16 Total Retention Volume from LID Infiltration BMPs: 227,392 *(Sum of Items 14 and 15 for all infiltration BMP included in plan)*

17 Fraction of DCV achieved with infiltration BMP: 208% $\text{Retention\%} = \text{Item 16} / \text{Form 4.2-1 Item 7}$

18 Is full LID DCV retained on-site with combination of hydrologic source control and LID retention and 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 4.3-8 Conformance Summary and Alternative Compliance Volume Estimate (DA 2)

1 Total LID DCV for the Project DA 2 (ft³): 109,133 *Copy Item 7 in Form 4.2-1*

2 On-site retention with site design hydrologic source control LID BMP (ft³): *Copy Item 30 in Form 4.3-2*

3 On-site retention with LID infiltration BMP (ft³): 230,364 *Copy Item 16 in Form 4.3-3*

4 On-site retention with LID harvest and use BMP (ft³): *Copy Item 9 in Form 4.3-4*

5 On-site biotreatment with volume based biotreatment BMP (ft³): *Copy Item 3 in Form 4.3-5*

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

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

- Full retention of LID DCV with site design HSC, infiltration, or harvest and use 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 and biotreatment BMP provide 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

8 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 HSC, retention and infiltration, harvest and use, and biotreatment BMPs provide less than full LID DCV capture:
*Checked yes for Form 4.3-5 Item 7, 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, $V_{alt} = (Item\ 1 - Item\ 2 - Item\ 3 - Item\ 4 - Item\ 5) * (100 - Form\ 2.4-1\ Item\ 2)\%$*
- An approved Watershed Action Plan (WAP) demonstrates that water quality and hydrologic impacts of urbanization are more effective when managed in at an off-site facility:
Attach appropriate WAP section, including technical documentation, showing effectiveness comparisons for the project site and regional watershed

Form 4.3-9 Hydromodification Control BMPs (DA 2)

1 Volume reduction needed for HCOC performance criteria (ft³): 210,852
(Form 4.2-2 Item 4 * 0.95) – Form 4.2-2 Item 1

2 On-site retention with site design hydrologic source control, infiltration, and harvest and use LID BMP (ft³): 230,364 *Sum of Form 4.3-9 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 HCOC volume reduction

3 Remaining volume for HCOC volume capture (ft³): 0 *Item 1 – Item 2*

4 Volume capture provided by incorporating additional on-site or off-site retention BMPs (ft³): *Existing downstream BMP may be used to demonstrate additional volume capture (if so, attach to this WQMP a hydrologic analysis showing how the additional volume would be retained during a 2-yr storm event for the regional watershed)*

5 If Item 4 is less than Item 3, incorporate in-stream controls on downstream waterbody segment to prevent impacts due to hydromodification *Attach in-stream control BMP selection and evaluation to this WQMP*

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

If yes, HCOC 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 or off-site retention BMP
BMP upstream of a waterbody segment with a potential HCOC may be used to demonstrate increased time of concentration through hydrograph attenuation (if so, show that the hydraulic residence time provided in BMP for a 2-year storm event is equal or greater than the addition time of concentration requirement in Form 4.2-4 Item 15)
- 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
- Incorporate appropriate in-stream controls for downstream waterbody segment to prevent impacts due to hydromodification, in a plan approved and signed by a licensed engineer in the State of California

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

If yes, HCOC 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 or off-site retention BMPs
BMPs upstream of a waterbody segment with a potential HCOC may be used to demonstrate additional peak runoff reduction through hydrograph attenuation (if so, attach to this WQMP, a hydrograph analysis showing how the peak runoff would be reduced during a 2-yr storm event)
- Incorporate appropriate in-stream controls for downstream waterbody segment to prevent impacts due to hydromodification, in a plan approved and signed by a licensed engineer in the State of California

Form 4.2-1 LID BMP Performance Criteria for Design Capture Volume (DA 3)

1 Project area DA 3 (ft ²): 1,680,109	2 Imperviousness after applying preventative site design practices (Imp%): 90	3 Runoff Coefficient (Rc): <u> 0.73 </u> $R_c = 0.858(\text{Imp}\%)^3 - 0.78(\text{Imp}\%)^2 + 0.774(\text{Imp}\%) + 0.04$
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4 Determine 1-hour rainfall depth for a 2-year return period $P_{2\text{yr-1hr}}$ (in): 0.353 http://hdsc.nws.noaa.gov/hdsc/pfds/sa/sca_pfds.html

5 Compute P_6 , Mean 6-hr Precipitation (inches): 0.44
 $P_6 = \text{Item 4} * C_1$, where C_1 is a function of site climatic region specified in Form 3-1 Item 1 (Valley = 1.4807; Mountain = 1.909; Desert = 1.2371)

6 Drawdown Rate <i>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.</i>	24-hrs <input type="checkbox"/> 48-hrs <input checked="" type="checkbox"/>
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7 Compute design capture volume, DCV (ft³): 87,635
 $DCV = 1/12 * [\text{Item 1} * \text{Item 3} * \text{Item 5} * C_2]$, 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 HCOC Assessment (DA 3)

Does project have the potential to cause or contribute to an HCOC in a downstream channel: Yes No

Go to: <http://sbcounty.permitrack.com/WAP/>

If "Yes", then complete HCOC assessment of site hydrology for 2yr 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)

If "No," then proceed to Section 4.3 Project Conformance Analysis

Condition	Runoff Volume (ft ³)	Time of Concentration (min)	Peak Runoff (cfs)
Pre-developed	1 67,074 <i>Form 4.2-3 Item 12</i>	2 7.2 <i>Form 4.2-4 Item 13</i>	3 57 <i>Form 4.2-5 Item 10</i>
Post-developed	4 183,902 <i>Form 4.2-3 Item 13</i>	5 12.5 <i>Form 4.2-4 Item 14</i>	6 13.2 <i>Form 4.2-5 Item 14</i>
Difference	7 116,198 <i>Item 4 – Item 1</i>	8 (-5.3) <i>Item 2 – Item 5</i>	9 (-43.8) <i>Item 6 – Item 3</i>
Difference (as % of pre-developed)	10 173% <i>Item 7 / Item 1</i>	11 (-74)% <i>Item 8 / Item 2</i>	12 77% <i>Item 9 / Item 3</i>

Form 4.2-3 HCOC Assessment for Runoff Volume (DA 3)

Form 4.2-3 HCOC Assessment for Runoff Volume (DA 3)								
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): $S = (1000 / \text{Item 5}) - 10$				9 Initial abstraction, I_a (in): $I_a = 0.2 * \text{Item 7}$			
6 Post-Developed area-weighted CN:	8 Post-developed soil storage capacity, S (in): $S = (1000 / \text{Item 6}) - 10$				10 Initial abstraction, I_a (in): $I_a = 0.2 * \text{Item 8}$			
11 Precipitation for 2 yr, 24 hr storm (in): 2.13 Go to: http://hdsc.nws.noaa.gov/hdsc/pfds/so/sca_pfds.html								
12 Pre-developed Volume (ft ³): 67,074 $V_{pre} = (1 / 12) * (\text{Item sum of Item 3}) * [(\text{Item 11} - \text{Item 9})^2 / ((\text{Item 11} - \text{Item 9} + \text{Item 7}))]$								
13 Post-developed Volume (ft ³): 183,902 $V_{pre} = (1 / 12) * (\text{Item sum of Item 3}) * [(\text{Item 11} - \text{Item 10})^2 / ((\text{Item 11} - \text{Item 10} + \text{Item 8}))]$								
14 Volume Reduction needed to meet HCOC Requirement, (ft ³): 107,634 $V_{HCOC} = (\text{Item 13} * 0.95) - \text{Item 12}$								

See HCOC Analysis and unit hydrograph computations in Appendix D

Form 4.2-4 HCOC Assessment for Time of Concentration (DA 3)

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				Post-developed DA1			
	DMA E	DMA F	DMA G	DMA H	DMA E	DMA F	DMA G	DMA H
1 Length of flowpath (ft) <i>Use Form 3-2 Item 5 for pre-developed condition</i>								
2 Change in elevation (ft)								
3 Slope (ft/ft), $S_o = \text{Item 2} / \text{Item 1}$								
4 Land cover								
5 Initial DMA Time of Concentration (min) <i>Appendix C-1 of the TGD for WQMP</i>								
6 Length of conveyance from DMA outlet to project site outlet (ft) <i>May be zero if DMA outlet is at project site outlet</i>								
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) $V_{fps} = (1.49 / \text{Item 9}) * (\text{Item 7} / \text{Item 8})^{0.67} * (\text{Item 3})^{0.5}$								
11 Travel time to outlet (min) $T_t = \text{Item 6} / (\text{Item 10} * 60)$								
12 Total time of concentration (min) $T_c = \text{Item 5} + \text{Item 11}$								
13 Pre-developed time of concentration (min): 7.2 <i>Minimum of Item 12 pre-developed DMA</i>								
14 Post-developed time of concentration (min): 12.5 <i>Minimum of Item 12 post-developed DMA</i>								
15 Additional time of concentration needed to meet HCOC requirement (min): 0 $T_{C-HCOC} = (\text{Item 13} * 0.95) - \text{Item 14}$								

See HCOC Analysis and unit hydrograph computations in Appendix D

Form 4.2-5 HCOC Assessment for Peak Runoff (DA 3)

Compute peak runoff for pre and post developed conditions

Variables	Pre-developed DA to Project Outlet <i>Use additional forms if more than 3 DMA</i>			Post-developed DA to Project Outlet <i>Use additional forms if more than 3 DMA</i>		
	DMA A	DMA B	DMA C	DMA A	DMA B	DMA C
1 Rainfall Intensity for storm duration equal to time of concentration $I_{peak} = 10^{(LOG Form 4.2-1 Item 4 - 0.6 LOG Form 4.2-4 Item 5 / 60)}$						
2 Drainage Area of each DMA (ft ²) <i>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)</i>						
3 Ratio of pervious area to total area <i>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)</i>						
4 Pervious area infiltration rate (in/hr) <i>Use pervious area CN and antecedent moisture condition with Appendix C-3 of the TGD for WQMP</i>						
5 Maximum loss rate (in/hr) $F_m = Item 3 * Item 4$ <i>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)</i>						
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 <i>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)</i>	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): 57 <i>Maximum of Item 8, 9, and 10 (including additional forms as needed)</i>						
11 Post-developed Q_p at T_c for DMA A: 13.2 <i>Same as Item 8 for post-developed values</i>	12 Post-developed Q_p at T_c for DMA B: <i>Same as Item 9 for post-developed values</i>			13 Post-developed Q_p at T_c for DMA C: <i>Same as Item 10 for post-developed values</i>		
14 Peak runoff from post-developed condition confluence analysis (cfs): 13.2 <i>Maximum of Item 11, 12, and 13 (including additional forms as needed)</i>						
15 Peak runoff reduction needed to meet HCOC Requirement (cfs): 0 $Q_{p-HCOC} = (Item 14 * 0.95) - Item 10$						

See HCOC Analysis and unit hydrograph computations in Appendix D

Form 4.3-1 Infiltration BMP Feasibility (DA 3)

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 eight 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, Harvest and Use 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, Hydrologic Source Control 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, Hydrologic Source Control BMP.

Form 4.3-2 Site Design Hydrologic Source Control BMPs (DA 3)

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 <input type="checkbox"/> No <input type="checkbox"/> <i>If yes, complete Items 2-5; If no, proceed to Item 6</i>	DA DMA BMP Type	DA DMA BMP Type	DA DMA BMP Type <i>(Use additional forms for more BMPs)</i>
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) $V = \text{Item 2} * \text{Item 3} * (0.5/12)$, assuming retention of 0.5 inches of runoff			
5 Sum of retention volume achieved from impervious area dispersion (ft ³): $V_{\text{retention}} = \text{Sum of Item 4 for all BMPs}$			
6 Implementation of Localized On-lot Infiltration BMPs (e.g. on-lot rain gardens): Yes <input type="checkbox"/> No <input type="checkbox"/> <i>If yes, complete Items 7-13 for aggregate of all on-lot infiltration BMP in each DA; If no, proceed to Item 14</i>	DA 3 DMA C BMP Type HSC	DA DMA BMP Type	DA DMA BMP Type <i>(Use additional forms for more BMPs)</i>
7 Ponding surface area (ft ²)	22,000		
8 Ponding depth (ft)	1.5		
9 Surface area of amended soil/gravel (ft ²)	15,000		
10 Average depth of amended soil/gravel (ft)	1		
11 Average porosity of amended soil/gravel	0.4		
12 Retention volume achieved from on-lot infiltration (ft ³) $V_{\text{retention}} = (\text{Item 7} * \text{Item 8}) + (\text{Item 9} * \text{Item 10} * \text{Item 11})$	39,000		
13 Runoff volume retention from on-lot infiltration (ft ³): 39,000 $V_{\text{retention}} = \text{Sum of Item 12 for all BMPs}$			

Form 4.3-2 cont. Site Design Hydrologic Source Control BMPs (DA 3)

14 Implementation of evapotranspiration BMP (green, brown, or blue roofs): Yes <input type="checkbox"/> No <input type="checkbox"/> <i>If yes, complete Items 15-20. If no, proceed to Item 21</i>	DA DMA BMP Type	DA DMA BMP Type	DA DMA BMP Type <i>(Use additional forms for more BMPs)</i>
15 Rooftop area planned for ET BMP (ft ²)			
16 Average wet season ET demand (in/day) <i>Use local values, typical ~ 0.1</i>			
17 Daily ET demand (ft ³ /day) <i>Item 15 * (Item 16 / 12)</i>			
18 Drawdown time (hrs) <i>Copy Item 6 in Form 4.2-1</i>			
19 Retention Volume (ft ³) <i>V_{retention} = Item 17 * (Item 18 / 24)</i>			
20 Runoff volume retention from evapotranspiration BMPs (ft ³): <i>V_{retention} = Sum of Item 19 for all BMPs</i>			
21 Implementation of Street Trees: Yes <input type="checkbox"/> No <input type="checkbox"/> <i>If yes, complete Items 22-25. If no, proceed to Item 26</i>	DA DMA BMP Type	DA DMA BMP Type	DA DMA BMP Type <i>(Use additional forms for more BMPs)</i>
22 Number of Street Trees			
23 Average canopy cover over impervious area (ft ²)			
24 Runoff volume retention from street trees (ft ³) <i>V_{retention} = Item 22 * Item 23 * (0.05/12) assume runoff retention of 0.05 inches</i>			
25 Runoff volume retention from street tree BMPs (ft ³): <i>V_{retention} = Sum of Item 24 for all BMPs</i>			
26 Implementation of residential rain barrels/cisterns: Yes <input type="checkbox"/> No <input type="checkbox"/> <i>If yes, complete Items 27-29; If no, proceed to Item 30</i>	DA DMA BMP Type	DA DMA BMP Type	DA DMA BMP Type <i>(Use additional forms for more BMPs)</i>
27 Number of rain barrels/cisterns			
28 Runoff volume retention from rain barrels/cisterns (ft ³) <i>V_{retention} = Item 27 * 3</i>			
29 Runoff volume retention from residential rain barrels/Cisterns (ft ³): <i>V_{retention} = Sum of Item 28 for all BMPs</i>			
30 Total Retention Volume from Site Design Hydrologic Source Control BMPs: 39,000 <i>Sum of Items 5, 13, 20, 25 and 29</i>			

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

1 Remaining LID DCV not met by site design HSC BMP (ft³): 48,635 $V_{unmet} = \text{Form 4.2-1 Item 7} - \text{Form 4.3-2 Item 30}$

BMP Type <i>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</i>	DA 3 BMP Type	DMA A BMP Type	DA BMP Type	DMA BMP Type
2 Infiltration rate of underlying soils (in/hr) <i>See Section 5.4.2 and Appendix D of the TGD for WQMP for minimum requirements for assessment methods</i>				
3 Infiltration safety factor <i>See TGD Section 5.4.2 and Appendix D</i>				
4 Design percolation rate (in/hr) $P_{design} = \text{Item 2} / \text{Item 3}$				
5 Ponded water drawdown time (hr) <i>Copy Item 6 in Form 4.2-1</i>				
6 Maximum ponding depth (ft) <i>BMP specific, see Table 5-4 of the TGD for WQMP for BMP design details</i>				
7 Ponding Depth (ft) $d_{BMP} = \text{Minimum of } (1/12 * \text{Item 4} * \text{Item 5}) \text{ or Item 6}$				
8 Infiltrating surface area, SA_{BMP} (ft ²) <i>the lesser of the area needed for infiltration of full DCV or minimum space requirements from Table 5.7 of the TGD for WQMP</i>				
9 Amended soil depth, d_{media} (ft) <i>Only included in certain BMP types, see Table 5-4 in the TGD for WQMP for reference to BMP design details</i>				
10 Amended soil porosity				
11 Gravel depth, d_{media} (ft) <i>Only included in certain BMP types, see Table 5-4 of the TGD for WQMP for BMP design details</i>				
12 Gravel porosity				
13 Duration of storm as basin is filling (hrs) <i>Typical ~ 3hrs</i>				
14 Above Ground Retention Volume (ft ³) $V_{retention} = \text{Item 8} * [\text{Item 7} + (\text{Item 9} * \text{Item 10}) + (\text{Item 11} * \text{Item 12}) + (\text{Item 13} * (\text{Item 4} / 12))]$				
15 Underground Retention Volume (ft ³) <i>Volume determined using manufacturer's specifications and calculations</i>				

16 Total Retention Volume from LID Infiltration BMPs: 185,343 *(Sum of Items 14 and 15 for all infiltration BMP included in plan)*

17 Fraction of DCV achieved with infiltration BMP: 211% $\text{Retention\%} = \text{Item 16} / \text{Form 4.2-1 Item 7}$

18 Is full LID DCV retained on-site with combination of hydrologic source control and LID retention and 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 4.3-8 Conformance Summary and Alternative Compliance Volume Estimate (DA 3)

1 Total LID DCV for the Project DA 3 (ft³): 87,635 *Copy Item 7 in Form 4.2-1*

2 On-site retention with site design hydrologic source control LID BMP (ft³): 39,000 *Copy Item 30 in Form 4.3-2*

3 On-site retention with LID infiltration BMP (ft³): 185,343 *Copy Item 16 in Form 4.3-3*

4 On-site retention with LID harvest and use BMP (ft³): *Copy Item 9 in Form 4.3-4*

5 On-site biotreatment with volume based biotreatment BMP (ft³): *Copy Item 3 in Form 4.3-5*

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

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

- Full retention of LID DCV with site design HSC, infiltration, or harvest and use 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 and biotreatment BMP provide 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

8 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 HSC, retention and infiltration, harvest and use, and biotreatment BMPs provide less than full LID DCV capture:
*Checked yes for Form 4.3-5 Item 7, 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, $V_{alt} = (Item\ 1 - Item\ 2 - Item\ 3 - Item\ 4 - Item\ 5) * (100 - Form\ 2.4-1\ Item\ 2)\%$*
- An approved Watershed Action Plan (WAP) demonstrates that water quality and hydrologic impacts of urbanization are more effective when managed in at an off-site facility:
Attach appropriate WAP section, including technical documentation, showing effectiveness comparisons for the project site and regional watershed

Form 4.3-9 Hydromodification Control BMPs (DA 3)

1 Volume reduction needed for HCOC performance criteria (ft³): 107,634
(Form 4.2-2 Item 4 * 0.95) – Form 4.2-2 Item 1

2 On-site retention with site design hydrologic source control, infiltration, and harvest and use LID BMP (ft³): 224,343 *Sum of Form 4.3-9 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 HCOC volume reduction

3 Remaining volume for HCOC volume capture (ft³): 0 *Item 1 – Item 2*

4 Volume capture provided by incorporating additional on-site or off-site retention BMPs (ft³): *Existing downstream BMP may be used to demonstrate additional volume capture (if so, attach to this WQMP a hydrologic analysis showing how the additional volume would be retained during a 2-yr storm event for the regional watershed)*

5 If Item 4 is less than Item 3, incorporate in-stream controls on downstream waterbody segment to prevent impacts due to hydromodification *Attach in-stream control BMP selection and evaluation to this WQMP*

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

If yes, HCOC 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 or off-site retention BMP
BMP upstream of a waterbody segment with a potential HCOC may be used to demonstrate increased time of concentration through hydrograph attenuation (if so, show that the hydraulic residence time provided in BMP for a 2-year storm event is equal or greater than the addition time of concentration requirement in Form 4.2-4 Item 15)
- 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
- Incorporate appropriate in-stream controls for downstream waterbody segment to prevent impacts due to hydromodification, in a plan approved and signed by a licensed engineer in the State of California

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

If yes, HCOC 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 or off-site retention BMPs
BMPs upstream of a waterbody segment with a potential HCOC may be used to demonstrate additional peak runoff reduction through hydrograph attenuation (if so, attach to this WQMP, a hydrograph analysis showing how the peak runoff would be reduced during a 2-yr storm event)
- Incorporate appropriate in-stream controls for downstream waterbody segment to prevent impacts due to hydromodification, in a plan approved and signed by a licensed engineer in the State of California

Form 4.2-1 LID BMP Performance Criteria for Design Capture Volume (DA 4)

1 Project area DA 4 (ft ²): 1,636,114	2 Imperviousness after applying preventative site design practices (Imp%): 90	3 Runoff Coefficient (Rc): <u> 0.73 </u> $R_c = 0.858(\text{Imp}\%)^3 - 0.78(\text{Imp}\%)^2 + 0.774(\text{Imp}\%) + 0.04$
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4 Determine 1-hour rainfall depth for a 2-year return period $P_{2\text{yr-1hr}}$ (in): 0.353 http://hdsc.nws.noaa.gov/hdsc/pfds/sa/sca_pfds.html

5 Compute P_6 , Mean 6-hr Precipitation (inches): 0.44
 $P_6 = \text{Item 4} * C_1$, where C_1 is a function of site climatic region specified in Form 3-1 Item 1 (Valley = 1.4807; Mountain = 1.909; Desert = 1.2371)

6 Drawdown Rate <i>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.</i>	24-hrs <input type="checkbox"/> 48-hrs <input checked="" type="checkbox"/>
---	---

7 Compute design capture volume, DCV (ft³): 85,336
 $DCV = 1/12 * [\text{Item 1} * \text{Item 3} * \text{Item 5} * C_2]$, 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 HCOC Assessment (DA 4)

Does project have the potential to cause or contribute to an HCOC in a downstream channel: Yes No

Go to: <http://sbcounty.permitrack.com/WAP/>

If "Yes", then complete HCOC assessment of site hydrology for 2yr 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)

If "No," then proceed to Section 4.3 Project Conformance Analysis

Condition	Runoff Volume (ft ³)	Time of Concentration (min)	Peak Runoff (cfs)
Pre-developed	¹ 65,317 <i>Form 4.2-3 Item 12</i>	² 7.2 <i>Form 4.2-4 Item 13</i>	³ 55.5 <i>Form 4.2-5 Item 10</i>
Post-developed	⁴ 179,086 <i>Form 4.2-3 Item 13</i>	⁵ 11.04 <i>Form 4.2-4 Item 14</i>	⁶ 10.2 <i>Form 4.2-5 Item 14</i>
Difference	⁷ 113,769 <i>Item 4 – Item 1</i>	⁸ (-3.8) <i>Item 2 – Item 5</i>	⁹ (-45.3) <i>Item 6 – Item 3</i>
Difference (as % of pre-developed)	¹⁰ 174% <i>Item 7 / Item 1</i>	¹¹ (-53)% <i>Item 8 / Item 2</i>	¹² (-82)% <i>Item 9 / Item 3</i>

Form 4.2-3 HCOC Assessment for Runoff Volume (DA 4)

Form 4.2-3 HCOC Assessment for Runoff Volume (DA 4)								
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								
See HCOC Analysis and unit hydrograph computations in Appendix D								
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): $S = (1000 / \text{Item 5}) - 10$				9 Initial abstraction, I _a (in): $I_a = 0.2 * \text{Item 7}$			
6 Post-Developed area-weighted CN:	8 Post-developed soil storage capacity, S (in): $S = (1000 / \text{Item 6}) - 10$				10 Initial abstraction, I _a (in): $I_a = 0.2 * \text{Item 8}$			
11 Precipitation for 2 yr, 24 hr storm (in): 2.13 Go to: http://hdsc.nws.noaa.gov/hdsc/pfds/so/sca_pfds.html								
12 Pre-developed Volume (ft ³): 65,317 $V_{pre} = (1 / 12) * (\text{Item sum of Item 3}) * [(\text{Item 11} - \text{Item 9})^2 / ((\text{Item 11} - \text{Item 9} + \text{Item 7}))]$								
13 Post-developed Volume (ft ³): 179,086 $V_{pre} = (1 / 12) * (\text{Item sum of Item 3}) * [(\text{Item 11} - \text{Item 10})^2 / ((\text{Item 11} - \text{Item 10} + \text{Item 8}))]$								
14 Volume Reduction needed to meet HCOC Requirement, (ft ³): 104,815 $V_{HCOC} = (\text{Item 13} * 0.95) - \text{Item 12}$								

Form 4.2-4 HCOC Assessment for Time of Concentration (DA 4)

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				Post-developed DA1			
	DMA E	DMA F	DMA G	DMA H	DMA E	DMA F	DMA G	DMA H
1 Length of flowpath (ft) <i>Use Form 3-2 Item 5 for pre-developed condition</i>								
2 Change in elevation (ft)								
3 Slope (ft/ft), $S_o = \text{Item 2} / \text{Item 1}$								
4 Land cover								
5 Initial DMA Time of Concentration (min) <i>Appendix C-1 of the TGD for WQMP</i>								
6 Length of conveyance from DMA outlet to project site outlet (ft) <i>May be zero if DMA outlet is at project site outlet</i>								
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) $V_{fps} = (1.49 / \text{Item 9}) * (\text{Item 7} / \text{Item 8})^{0.67} * (\text{Item 3})^{0.5}$								
11 Travel time to outlet (min) $T_t = \text{Item 6} / (\text{Item 10} * 60)$								
12 Total time of concentration (min) $T_c = \text{Item 5} + \text{Item 11}$								
13 Pre-developed time of concentration (min): 7.2 <i>Minimum of Item 12 pre-developed DMA</i>								
14 Post-developed time of concentration (min): 11.04 <i>Minimum of Item 12 post-developed DMA</i>								
15 Additional time of concentration needed to meet HCOC requirement (min): 0 $T_{C-HCOC} = (\text{Item 13} * 0.95) - \text{Item 14}$								

See HCOC Analysis and unit hydrograph computations in Appendix D

Form 4.2-5 HCOC Assessment for Peak Runoff (DA 4)

Compute peak runoff for pre and post developed conditions

Variables	Pre-developed DA to Project Outlet <i>Use additional forms if more than 3 DMA</i>			Post-developed DA to Project Outlet <i>Use additional forms if more than 3 DMA</i>		
	DMA A	DMA B	DMA C	DMA A	DMA B	DMA C
1 Rainfall Intensity for storm duration equal to time of concentration <i>$I_{peak} = 10^{(LOG Form 4.2-1 Item 4 - 0.6 LOG Form 4.2-4 Item 5 / 60)}$</i>						
2 Drainage Area of each DMA (ft ²) <i>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)</i>						
3 Ratio of pervious area to total area <i>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)</i>						
4 Pervious area infiltration rate (in/hr) <i>Use pervious area CN and antecedent moisture condition with Appendix C-3 of the TGD for WQMP</i>						
5 Maximum loss rate (in/hr) <i>$F_m = Item 3 * Item 4$ 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)</i>						
6 Peak Flow from DMA (cfs) <i>$Q_p = Item 2 * 0.9 * (Item 1 - Item 5)$</i>						
7 Time of concentration adjustment factor for other DMA to site discharge point <i>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)</i>	DMA A	<i>n/a</i>		<i>n/a</i>		
	DMA B		<i>n/a</i>		<i>n/a</i>	
	DMA C			<i>n/a</i>		<i>n/a</i>
8 Pre-developed Q_p at T_c for DMA A: 55.5 Q_p <i>$= Item 6_{DMAA} + [Item 6_{DMAB} * (Item 1_{DMAA} - Item 5_{DMAB}) / (Item 1_{DMAB} - Item 5_{DMAB}) * Item 7_{DMAA/2}] + [Item 6_{DMAC} * (Item 1_{DMAA} - Item 5_{DMAC}) / (Item 1_{DMAC} - Item 5_{DMAC}) * Item 7_{DMAA/3}]$</i>	9 Pre-developed Q_p at T_c for DMA B: <i>$Q_p = Item 6_{DMAB} + [Item 6_{DMAA} * (Item 1_{DMAB} - Item 5_{DMAA}) / (Item 1_{DMAA} - Item 5_{DMAA}) * Item 7_{DMAB/1}] + [Item 6_{DMAC} * (Item 1_{DMAB} - Item 5_{DMAC}) / (Item 1_{DMAC} - Item 5_{DMAC}) * Item 7_{DMAB/3}]$</i>			10 Pre-developed Q_p at T_c for DMA C: <i>$Q_p = Item 6_{DMAC} + [Item 6_{DMAA} * (Item 1_{DMAC} - Item 5_{DMAA}) / (Item 1_{DMAA} - Item 5_{DMAA}) * Item 7_{DMAC/1}] + [Item 6_{DMAB} * (Item 1_{DMAC} - Item 5_{DMAB}) / (Item 1_{DMAB} - Item 5_{DMAB}) * Item 7_{DMAC/2}]$</i>		
10 Peak runoff from pre-developed condition confluence analysis (cfs): 55.5 <i>Maximum of Item 8, 9, and 10 (including additional forms as needed)</i>						
11 Post-developed Q_p at T_c for DMA A: 10.2 <i>Same as Item 8 for post-developed values</i>	12 Post-developed Q_p at T_c for DMA B: <i>Same as Item 9 for post-developed values</i>			13 Post-developed Q_p at T_c for DMA C: <i>Same as Item 10 for post-developed values</i>		
14 Peak runoff from post-developed condition confluence analysis (cfs): 10.2 <i>Maximum of Item 11, 12, and 13 (including additional forms as needed)</i>						
15 Peak runoff reduction needed to meet HCOC Requirement (cfs): 0 $Q_{p-HCOC} = (Item 14 * 0.95) - Item 10$						

See HCOC Analysis and unit hydrograph computations in Appendix D

Form 4.3-1 Infiltration BMP Feasibility (DA 4)

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 eight 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, Harvest and Use 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, Hydrologic Source Control 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, Hydrologic Source Control BMP.

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

1 Remaining LID DCV not met by site design HSC BMP (ft³): 85,336 $V_{unmet} = \text{Form 4.2-1 Item 7} - \text{Form 4.3-2 Item 30}$

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

16 Total Retention Volume from LID Infiltration BMPs: 180,500 *(Sum of Items 14 and 15 for all infiltration BMP included in plan)*

17 Fraction of DCV achieved with infiltration BMP: 211% $\text{Retention}\% = \text{Item 16} / \text{Form 4.2-1 Item 7}$

18 Is full LID DCV retained on-site with combination of hydrologic source control and LID retention and 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 4.3-8 Conformance Summary and Alternative Compliance Volume Estimate (DA 4)

1 Total LID DCV for the Project DA 4 (ft³): 85,336 *Copy Item 7 in Form 4.2-1*

2 On-site retention with site design hydrologic source control LID BMP (ft³): 0 *Copy Item 30 in Form 4.3-2*

3 On-site retention with LID infiltration BMP (ft³): 180,500 *Copy Item 16 in Form 4.3-3*

4 On-site retention with LID harvest and use BMP (ft³): *Copy Item 9 in Form 4.3-4*

5 On-site biotreatment with volume based biotreatment BMP (ft³): *Copy Item 3 in Form 4.3-5*

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

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

- Full retention of LID DCV with site design HSC, infiltration, or harvest and use 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 and biotreatment BMP provide 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

8 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 HSC, retention and infiltration, harvest and use, and biotreatment BMPs provide less than full LID DCV capture:
*Checked yes for Form 4.3-5 Item 7, 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, $V_{alt} = (Item\ 1 - Item\ 2 - Item\ 3 - Item\ 4 - Item\ 5) * (100 - Form\ 2.4-1\ Item\ 2)\%$*
- An approved Watershed Action Plan (WAP) demonstrates that water quality and hydrologic impacts of urbanization are more effective when managed in at an off-site facility:
Attach appropriate WAP section, including technical documentation, showing effectiveness comparisons for the project site and regional watershed

Form 4.3-9 Hydromodification Control BMPs (DA 4)

1 Volume reduction needed for HCOC performance criteria (ft³): 104,815
(Form 4.2-2 Item 4 * 0.95) – Form 4.2-2 Item 1

2 On-site retention with site design hydrologic source control, infiltration, and harvest and use LID BMP (ft³): 180,500 *Sum of Form 4.3-9 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 HCOC volume reduction

3 Remaining volume for HCOC volume capture (ft³): 0 *Item 1 – Item 2*

4 Volume capture provided by incorporating additional on-site or off-site retention BMPs (ft³): *Existing downstream BMP may be used to demonstrate additional volume capture (if so, attach to this WQMP a hydrologic analysis showing how the additional volume would be retained during a 2-yr storm event for the regional watershed)*

5 If Item 4 is less than Item 3, incorporate in-stream controls on downstream waterbody segment to prevent impacts due to hydromodification *Attach in-stream control BMP selection and evaluation to this WQMP*

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

If yes, HCOC 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 or off-site retention BMP
BMP upstream of a waterbody segment with a potential HCOC may be used to demonstrate increased time of concentration through hydrograph attenuation (if so, show that the hydraulic residence time provided in BMP for a 2-year storm event is equal or greater than the addition time of concentration requirement in Form 4.2-4 Item 15)
- 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
- Incorporate appropriate in-stream controls for downstream waterbody segment to prevent impacts due to hydromodification, in a plan approved and signed by a licensed engineer in the State of California

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

If yes, HCOC 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 or off-site retention BMPs
BMPs upstream of a waterbody segment with a potential HCOC may be used to demonstrate additional peak runoff reduction through hydrograph attenuation (if so, attach to this WQMP, a hydrograph analysis showing how the peak runoff would be reduced during a 2-yr storm event)
- Incorporate appropriate in-stream controls for downstream waterbody segment to prevent impacts due to hydromodification, in a plan approved and signed by a licensed engineer in the State of California

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 (use additional forms as necessary)			
BMP	Reponsible Party(s)	Inspection/ Maintenance Activities Required	Minimum Frequency of Activities
Site Design on-lot infiltration	FGFW IV, LLC	Inspect Basin for trash, buildup of sediment and weeds. Clean out weeds and trash, remove sediment build up. Maintain landscaping around sides and adjacent area.	Twice yearly, April and October suggested.
Underground infiltration	FGFW IV, LLC	Inspect and Flush debris and sediment after major storms. . Ensure outflow orifices are clear of debris.	Minimum once yearly and after a major rainstorm.
Storm drain and Catch basin stenciling	FGFW IV, LLC	Inspect catch basins, check for illicit dumping or spills, Inspect storm drain for trash and sediment. Clean if necessary. Refresh stenciling if needed.	Once yearly prior to rainy season
Parking lot sweeping	FGFW IV, LLC	Inspect for spills, oil drips and trash. Clean any spills, oil immediately. Inspect for accumulation of dirt/dust. Sweep parking as needed.	Monthly
Catch basin inserts	FGFW IV, LLC	Inspect for trash and debris and check the oil absorbing pillow.	Twice a year.
Irrigation and Landscaping	FGFW IV, LLC	Maintain landscaping, replace dead material. Inspect irrigation, fix and repair leaks.	Weekly to monthly.

MOJAVE RIVER WATERSHED Water Quality Management Plan (WQMP)

Trash Enclosures	FGFW IV, LLC	Inspect and clean trash and debris. Do not wash area. Ensure lids are closed and enclosure properly maintained.	Weekly
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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

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. See following page for Maintenance Covenant Template

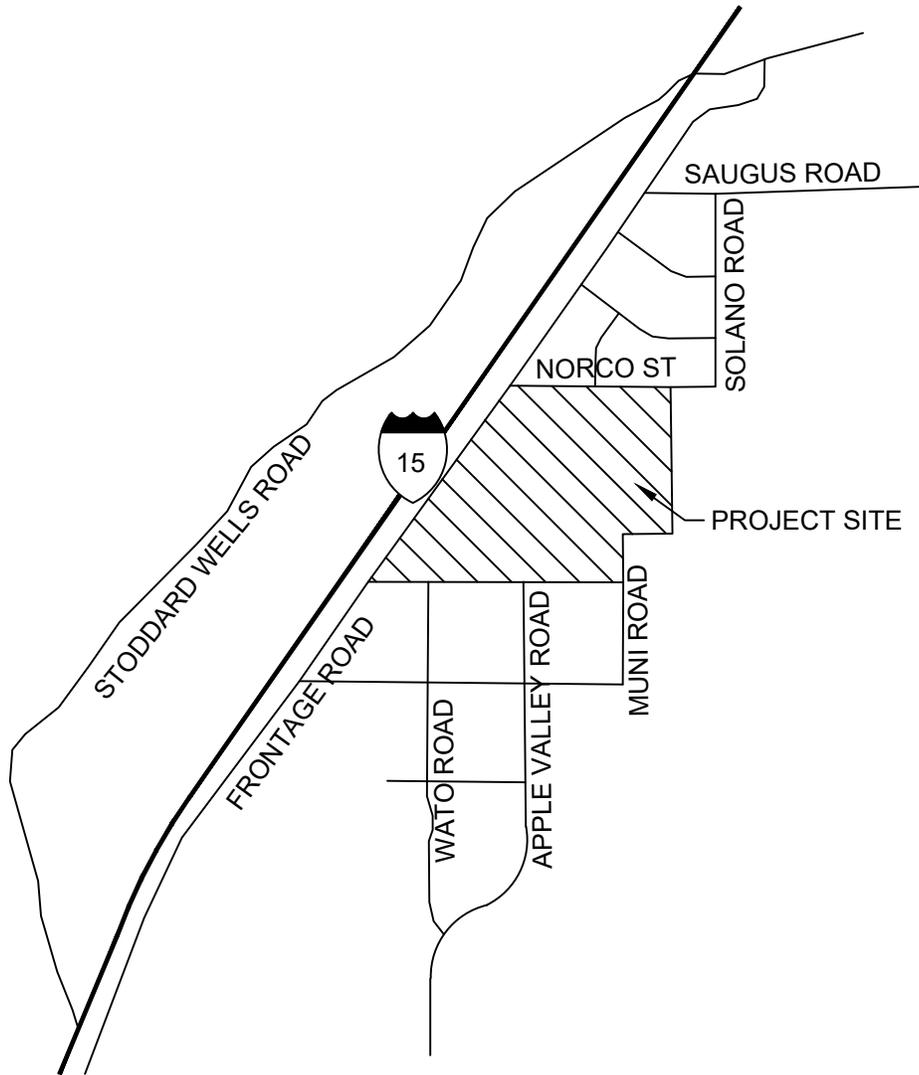
6.4 Other Supporting Documentation

- BMP Educational Materials
- Activity Restriction-C, C&R's & Lease Agreements

Appendix A

Vicinity Map

INLAND EMPIRE NORTH LOGISTICS CENTER



VICINITY MAP

N.T.S.



18484 Outer Highway 18N Suite 225
Apple Valley California 92307
Phone: 760.524.9100

VICINITY MAP

TOWN OF APPLE VALLEY

Appendix B

- WQMP Exhibit

Appendix C

LID BMP sizing Calculations

SUBJECT	By	Date	Job No	Area
San Bernardino County Volume BMP	Helen Wilson	9-Aug-22	FGFW0001	Area DA 1

Design Procedure for BMP Design Volume

 85th percentile runoff

Designer: Helen Wilson
 Company: DEA Inc
 Date: 9-Aug-2022
 Project: Inland Empire North Logistics Center
 Location: San Bernardino County

1. Determine Runoff coefficient a. Determine total impervious area b. Determine total tributary area c. Determine impervious fraction $i = (1) / (2)$ d. Composite Runoff Coefficient $C = 0.858i^3 - 0.780i^2 + 0.774i + 0.040$	$I_{\text{impervious}} =$ 42.76 acres (1) $A_{\text{total}} =$ 47.41 acres (2) $i =$ 0.90 (3) $C_{\text{BMP}} =$ 0.733 (4)
2. Determine the Area Averaged "6-hour Mean Storm Rainfall" a. Regression Coefficient b. Rainfall c. 6 Hour Mean Storm Rainfall $P_6 = (5)*(6)$	$P_{6r} =$ 1.24 (5) $P =$ 0.353 in (6) $P_6 =$ 0.44 in (7)
a. Drawdown time $a = 1.582$ for 24 hours $a = 1.963$ for 48 hours b. $P_0 = a * C_{\text{BMP}} * P_6$ $P_0 = (8)*(4)*(7)$	$a =$ 1.963 (8) $P_0 =$ 0.63 (9)
4. Calculate Target Storage Volume a. $V_0 = (P_0 * A) / 12 = (9) \times (2) / 12$ [in-feet]	$V_0 =$ 2.48 acre-ft (10) $V_0 =$ 108,150.36 ft³ (11)

SUBJECT	By	Date	Job No	Area
San Bernardino County Volume BMP	Helen Wilson	9-Aug-22	FGFW0001	Area DA 2

Design Procedure for BMP Design Volume

 85th percentile runoff

Designer: Helen Wilson
 Company: DEA Inc
 Date: 9-Aug-2022
 Project: Inland Empire North Logistics Center
 Location: San Bernardino County

1. Determine Runoff coefficient a. Determine total impervious area b. Determine total tributary area c. Determine impervious fraction $i = (1) / (2)$ d. Composite Runoff Coefficient $C = 0.858i^3 - 0.780i^2 + 0.774i + 0.040$	$I_{\text{impervious}} =$ 43.22 acres (1) $A_{\text{total}} =$ 48.02 acres (2) $i =$ 0.90 (3) $C_{\text{BMP}} =$ 0.730 (4)
2. Determine the Area Averaged "6-hour Mean Storm Rainfall" a. Regression Coefficient b. Rainfall c. 6 Hour Mean Storm Rainfall $P_6 = (5)*(6)$	$P_{6r} =$ 1.24 (5) $P =$ 0.353 in (6) $P_6 =$ 0.44 in (7)
a. Drawdown time $a = 1.582$ for 24 hours $a = 1.963$ for 48 hours b. $P_0 = a * C_{\text{BMP}} * P_6$ $P_0 = (8)*(4)*(7)$	$a =$ 1.963 (8) $P_0 =$ 0.63 (9)
4. Calculate Target Storage Volume a. $V_0 = (P_0 * A) / 12 = (9) \times (2) / 12$ [in-feet]	$V_0 =$ 2.51 acre-ft (10) $V_0 =$ 109,132.78 ft³ (11)

SUBJECT	By	Date	Job No	Area
San Bernardino County Volume BMP	Helen Wilson	9-Aug-22	FGFW0001	Area DA 3

Design Procedure for BMP Design Volume

 85th percentile runoff

Designer: Helen Wilson
 Company: DEA Inc
 Date: 9-Aug-2022
 Project: Inland Empire North Logistics Center
 Location: San Bernardino County

1. Determine Runoff coefficient a. Determine total impervious area b. Determine total tributary area c. Determine impervious fraction $i = (1) / (2)$ d. Composite Runoff Coefficient $C = 0.858i^3 - 0.780i^2 + 0.774i + 0.040$	$I_{\text{impervious}} =$ 34.71 acres (1) $A_{\text{total}} =$ 38.57 acres (2) $i =$ 0.90 (3) $C_{\text{BMP}} =$ 0.730 (4)
2. Determine the Area Averaged "6-hour Mean Storm Rainfall" a. Regression Coefficient b. Rainfall c. 6 Hour Mean Storm Rainfall $P_6 = (5)*(6)$	$P_{6r} =$ 1.24 (5) $P =$ 0.353 in (6) $P_6 =$ 0.44 in (7)
a. Drawdown time $a = 1.582$ for 24 hours $a = 1.963$ for 48 hours b. $P_0 = a * C_{\text{BMP}} * P_6$ $P_0 = (8)*(4)*(7)$	$a =$ 1.963 (8) $P_0 =$ 0.63 (9)
4. Calculate Target Storage Volume a. $V_0 = (P_0 * A) / 12 = (9) \times (2) / 12$ [in-feet]	$V_0 =$ 2.01 acre-ft (10) $V_0 =$ 87,635.36 ft³ (11)

SUBJECT	By	Date	Job No	Area
San Bernardino County Volume BMP	Helen Wilson	9-Aug-22	FGFW0001	Area DA 4

Design Procedure for BMP Design Volume

 85th percentile runoff

Designer: Helen Wilson
 Company: DEA Inc
 Date: 9-Aug-2022
 Project: Inland Empire North Logistics Center
 Location: San Bernardino County

1. Determine Runoff coefficient a. Determine total impervious area b. Determine total tributary area c. Determine impervious fraction $i = (1) / (2)$ d. Composite Runoff Coefficient $C = 0.858i^3 - 0.780i^2 + 0.774i + 0.040$	$I_{\text{impervious}} =$ 33.80 acres (1) $A_{\text{total}} =$ 37.56 acres (2) $i =$ 0.90 (3) $C_{\text{BMP}} =$ 0.730 (4)
2. Determine the Area Averaged "6-hour Mean Storm Rainfall" a. Regression Coefficient b. Rainfall c. 6 Hour Mean Storm Rainfall $P_6 = (5)*(6)$	$P_{6r} =$ 1.24 (5) $P =$ 0.353 in (6) $P_6 =$ 0.44 in (7)
a. Drawdown time $a = 1.582$ for 24 hours $a = 1.963$ for 48 hours b. $P_0 = a * C_{\text{BMP}} * P_6$ $P_0 = (8)*(4)*(7)$	$a =$ 1.963 (8) $P_0 =$ 0.63 (9)
4. Calculate Target Storage Volume a. $V_0 = (P_0 * A) / 12 = (9) \times (2) / 12$ [in-feet]	$V_0 =$ 1.96 acre-ft (10) $V_0 =$ 85,335.64 ft³ (11)

Appendix D

HCOC Analysis

Unit Hydrograph Analysis

Unit Hydrograph

Area ID	TC (hour)	Qp10 (cfs)	Volume10 (Ac ft)	Qp100 (cfs)	Volume100 (Ac ft)
Area A	0.12	252.9	6.8491	553.8	32.1453
Developed					
Area A-D		299.2	25.6714*	542.47	45.0234*
Difference		46.3	18.7773** (817,939 CF)	11.3	12.8691* (560,578 CF)

* Tentative values for Developed for initial design consideration and to compare with Developed, 10year below. This initial value uses only HSG C, whereas the areas in the table below used HSG A, C, and D which are estimated off the USDA soils information for the site.

**10-year volume difference is larger than 100-year, therefore 10-year prevails as to volume mitigation.

Unit Hydrograph by Area

Developed, 10-year

Area ID	TC (hour)	Qp (cfs)	Qp (cfs) after basin routing	Volume (Ac ft)	Volume (CF)
Area A	0.22087	62.17	20.2	6.9477	302,642
Area B	0.2196	62.89	20.1	7.0372	306,540
Area C	0.208	49.79	13.2	5.6539	246,280
Area D	0.184	54.05	10.2	5.5083	239,942
Total		228.9	67.7	25.1522	1,095,404

Take difference in 10-year volume=817,939 cf divided by site acreage = 171.56 ac= 4,768 cf/acre.

Area	Acreage	Minimum Volume by acre (cf)
A	47.41	226,051
B	48.02	228,960
C	38.57	183,902
D	37.56	179,086
Total	171.56	817,999 > 817,939 provided ok

U n i t H y d r o g r a p h A n a l y s i s

Copyright (c) CIVILCADD/CIVILDESIGN, 1989 - 2014, Version 9.0

Study date 08/07/22

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San Bernardino County Synthetic Unit Hydrology Method
Manual date - August 1986

Program License Serial Number 6385

IENLC
10-year existing
on-site

Storm Event Year = 10

Antecedent Moisture Condition = 2

English (in-lb) Input Units Used

English Rainfall Data (Inches) Input Values Used

English Units used in output format

Area averaged rainfall intensity isohyetal data:

Sub-Area (Ac.)	Duration (hours)	Isohyetal (In)
Rainfall data for year 10		
171.56	1	0.61

Rainfall data for year 10
171.56 6 1.24

Rainfall data for year 10
171.56 24 2.13

+++++

***** Area-averaged max loss rate, Fm *****

SCS curve No.(AMCII)	SCS curve NO.(AMC 2)	Area (Ac.)	Area Fraction	Fp(Fig C6) (In/Hr)	Ap (dec.)	Fm (In/Hr)
69.0	69.0	171.56	1.000	0.548	1.000	0.548

Area-averaged adjusted loss rate Fm (In/Hr) = 0.548

***** Area-Averaged low loss rate fraction, Yb *****

Area (Ac.)	Area Fract	SCS CN (AMC2)	SCS CN (AMC2)	S	Pervious Yield Fr
171.56	1.000	69.0	69.0	4.49	0.124

Area-averaged catchment yield fraction, Y = 0.124

Area-averaged low loss fraction, Yb = 0.876

User entry of time of concentration = 0.120 (hours)

+++++

Watershed area = 171.56(Ac.)

Catchment Lag time = 0.096 hours

Unit interval = 5.000 minutes

Unit interval percentage of lag time = 87.1688

Hydrograph baseflow = 0.00(CFS)

Average maximum watershed loss rate(Fm) = 0.548(In/Hr)

Average low loss rate fraction (Yb) = 0.876 (decimal)

DESERT S-Graph Selected

Computed peak 5-minute rainfall = 0.289(In)

Computed peak 30-minute rainfall = 0.495(In)

Specified peak 1-hour rainfall = 0.609(In)

Computed peak 3-hour rainfall = 0.942(In)

Specified peak 6-hour rainfall = 1.240(In)

Specified peak 24-hour rainfall = 2.130(In)

Rainfall depth area reduction factors:

Using a total area of 171.56(Ac.) (Ref: fig. E-4)

5-minute factor = 0.992 Adjusted rainfall = 0.287(In)

30-minute factor = 0.992 Adjusted rainfall = 0.491(In)

1-hour factor = 0.992 Adjusted rainfall = 0.604(In)

3-hour factor = 0.999 Adjusted rainfall = 0.941(In)

6-hour factor = 0.999 Adjusted rainfall = 1.239(In)

24-hour factor = 1.000 Adjusted rainfall = 2.130(In)

U n i t H y d r o g r a p h

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Interval 'S' Graph Unit Hydrograph

Number	Mean values	((CFS))

	(K =	2074.80 (CFS))
1	13.019	270.127
2	61.403	1003.856
3	80.329	392.689
4	88.806	175.876
5	93.470	96.766
6	96.332	59.379
7	97.934	33.240
8	98.945	20.986
9	100.000	10.493

Peak Unit Number	Adjusted mass (In)	rainfall (In)	Unit rainfall (In)
1	0.2867	0.2867	0.2867
2	0.3529	0.0663	0.0663
3	0.3986	0.0456	0.0456
4	0.4345	0.0359	0.0359
5	0.4646	0.0301	0.0301
6	0.4907	0.0261	0.0261
7	0.5139	0.0232	0.0232
8	0.5349	0.0210	0.0210
9	0.5542	0.0192	0.0192
10	0.5719	0.0178	0.0178
11	0.5885	0.0166	0.0166
12	0.6041	0.0156	0.0156
13	0.6239	0.0198	0.0198
14	0.6428	0.0189	0.0189
15	0.6610	0.0181	0.0181
16	0.6784	0.0174	0.0174
17	0.6952	0.0168	0.0168
18	0.7114	0.0162	0.0162
19	0.7271	0.0157	0.0157
20	0.7423	0.0152	0.0152
21	0.7570	0.0147	0.0147
22	0.7714	0.0143	0.0143
23	0.7853	0.0140	0.0140
24	0.7989	0.0136	0.0136
25	0.8122	0.0133	0.0133
26	0.8251	0.0129	0.0129
27	0.8378	0.0127	0.0127
28	0.8502	0.0124	0.0124
29	0.8623	0.0121	0.0121
30	0.8742	0.0119	0.0119
31	0.8858	0.0116	0.0116
32	0.8972	0.0114	0.0114
33	0.9084	0.0112	0.0112
34	0.9194	0.0110	0.0110

35	0.9302	0.0108
36	0.9408	0.0106
37	0.9511	0.0103
38	0.9613	0.0101
39	0.9713	0.0100
40	0.9811	0.0098
41	0.9908	0.0097
42	1.0003	0.0095
43	1.0097	0.0094
44	1.0190	0.0093
45	1.0281	0.0091
46	1.0371	0.0090
47	1.0460	0.0089
48	1.0548	0.0088
49	1.0635	0.0087
50	1.0721	0.0086
51	1.0806	0.0085
52	1.0889	0.0084
53	1.0972	0.0083
54	1.1054	0.0082
55	1.1135	0.0081
56	1.1215	0.0080
57	1.1294	0.0079
58	1.1373	0.0078
59	1.1450	0.0078
60	1.1527	0.0077
61	1.1603	0.0076
62	1.1678	0.0075
63	1.1753	0.0075
64	1.1826	0.0074
65	1.1900	0.0073
66	1.1972	0.0072
67	1.2044	0.0072
68	1.2115	0.0071
69	1.2185	0.0071
70	1.2255	0.0070
71	1.2325	0.0069
72	1.2393	0.0069
73	1.2460	0.0067
74	1.2527	0.0066
75	1.2592	0.0066
76	1.2658	0.0065
77	1.2723	0.0065
78	1.2787	0.0064
79	1.2851	0.0064
80	1.2914	0.0063
81	1.2977	0.0063
82	1.3039	0.0062
83	1.3101	0.0062
84	1.3162	0.0061

85	1.3223	0.0061
86	1.3284	0.0061
87	1.3344	0.0060
88	1.3404	0.0060
89	1.3463	0.0059
90	1.3522	0.0059
91	1.3580	0.0058
92	1.3638	0.0058
93	1.3696	0.0058
94	1.3753	0.0057
95	1.3810	0.0057
96	1.3867	0.0057
97	1.3923	0.0056
98	1.3979	0.0056
99	1.4034	0.0056
100	1.4090	0.0055
101	1.4144	0.0055
102	1.4199	0.0055
103	1.4253	0.0054
104	1.4307	0.0054
105	1.4361	0.0054
106	1.4414	0.0053
107	1.4467	0.0053
108	1.4519	0.0053
109	1.4572	0.0052
110	1.4624	0.0052
111	1.4676	0.0052
112	1.4727	0.0051
113	1.4778	0.0051
114	1.4829	0.0051
115	1.4880	0.0051
116	1.4930	0.0050
117	1.4980	0.0050
118	1.5030	0.0050
119	1.5080	0.0050
120	1.5129	0.0049
121	1.5178	0.0049
122	1.5227	0.0049
123	1.5276	0.0049
124	1.5324	0.0048
125	1.5372	0.0048
126	1.5420	0.0048
127	1.5468	0.0048
128	1.5515	0.0047
129	1.5563	0.0047
130	1.5610	0.0047
131	1.5656	0.0047
132	1.5703	0.0047
133	1.5749	0.0046
134	1.5795	0.0046

135	1.5841	0.0046
136	1.5887	0.0046
137	1.5933	0.0046
138	1.5978	0.0045
139	1.6023	0.0045
140	1.6068	0.0045
141	1.6113	0.0045
142	1.6157	0.0045
143	1.6202	0.0044
144	1.6246	0.0044
145	1.6290	0.0044
146	1.6333	0.0044
147	1.6377	0.0044
148	1.6420	0.0043
149	1.6464	0.0043
150	1.6507	0.0043
151	1.6550	0.0043
152	1.6592	0.0043
153	1.6635	0.0043
154	1.6677	0.0042
155	1.6719	0.0042
156	1.6761	0.0042
157	1.6803	0.0042
158	1.6845	0.0042
159	1.6887	0.0042
160	1.6928	0.0041
161	1.6969	0.0041
162	1.7010	0.0041
163	1.7051	0.0041
164	1.7092	0.0041
165	1.7133	0.0041
166	1.7173	0.0040
167	1.7213	0.0040
168	1.7254	0.0040
169	1.7294	0.0040
170	1.7334	0.0040
171	1.7373	0.0040
172	1.7413	0.0040
173	1.7452	0.0039
174	1.7492	0.0039
175	1.7531	0.0039
176	1.7570	0.0039
177	1.7609	0.0039
178	1.7648	0.0039
179	1.7686	0.0039
180	1.7725	0.0039
181	1.7763	0.0038
182	1.7801	0.0038
183	1.7840	0.0038
184	1.7878	0.0038

185	1.7915	0.0038
186	1.7953	0.0038
187	1.7991	0.0038
188	1.8028	0.0038
189	1.8066	0.0037
190	1.8103	0.0037
191	1.8140	0.0037
192	1.8177	0.0037
193	1.8214	0.0037
194	1.8251	0.0037
195	1.8287	0.0037
196	1.8324	0.0037
197	1.8361	0.0036
198	1.8397	0.0036
199	1.8433	0.0036
200	1.8469	0.0036
201	1.8505	0.0036
202	1.8541	0.0036
203	1.8577	0.0036
204	1.8613	0.0036
205	1.8648	0.0036
206	1.8684	0.0035
207	1.8719	0.0035
208	1.8754	0.0035
209	1.8789	0.0035
210	1.8824	0.0035
211	1.8859	0.0035
212	1.8894	0.0035
213	1.8929	0.0035
214	1.8964	0.0035
215	1.8998	0.0035
216	1.9033	0.0034
217	1.9067	0.0034
218	1.9101	0.0034
219	1.9135	0.0034
220	1.9170	0.0034
221	1.9203	0.0034
222	1.9237	0.0034
223	1.9271	0.0034
224	1.9305	0.0034
225	1.9338	0.0034
226	1.9372	0.0034
227	1.9405	0.0033
228	1.9439	0.0033
229	1.9472	0.0033
230	1.9505	0.0033
231	1.9538	0.0033
232	1.9571	0.0033
233	1.9604	0.0033
234	1.9637	0.0033

235	1.9670	0.0033
236	1.9702	0.0033
237	1.9735	0.0033
238	1.9767	0.0032
239	1.9800	0.0032
240	1.9832	0.0032
241	1.9864	0.0032
242	1.9896	0.0032
243	1.9928	0.0032
244	1.9960	0.0032
245	1.9992	0.0032
246	2.0024	0.0032
247	2.0056	0.0032
248	2.0088	0.0032
249	2.0119	0.0032
250	2.0151	0.0032
251	2.0182	0.0031
252	2.0213	0.0031
253	2.0245	0.0031
254	2.0276	0.0031
255	2.0307	0.0031
256	2.0338	0.0031
257	2.0369	0.0031
258	2.0400	0.0031
259	2.0431	0.0031
260	2.0462	0.0031
261	2.0492	0.0031
262	2.0523	0.0031
263	2.0554	0.0031
264	2.0584	0.0030
265	2.0614	0.0030
266	2.0645	0.0030
267	2.0675	0.0030
268	2.0705	0.0030
269	2.0735	0.0030
270	2.0765	0.0030
271	2.0795	0.0030
272	2.0825	0.0030
273	2.0855	0.0030
274	2.0885	0.0030
275	2.0915	0.0030
276	2.0944	0.0030
277	2.0974	0.0030
278	2.1004	0.0030
279	2.1033	0.0029
280	2.1062	0.0029
281	2.1092	0.0029
282	2.1121	0.0029
283	2.1150	0.0029
284	2.1179	0.0029

285	2.1209	0.0029
286	2.1238	0.0029
287	2.1267	0.0029
288	2.1295	0.0029

Unit Period (number)	Unit Rainfall (In)	Unit Soil-Loss (In)	Effective Rainfall (In)
1	0.0029	0.0025	0.0004
2	0.0029	0.0025	0.0004
3	0.0029	0.0025	0.0004
4	0.0029	0.0026	0.0004
5	0.0029	0.0026	0.0004
6	0.0029	0.0026	0.0004
7	0.0029	0.0026	0.0004
8	0.0030	0.0026	0.0004
9	0.0030	0.0026	0.0004
10	0.0030	0.0026	0.0004
11	0.0030	0.0026	0.0004
12	0.0030	0.0026	0.0004
13	0.0030	0.0026	0.0004
14	0.0030	0.0026	0.0004
15	0.0030	0.0027	0.0004
16	0.0030	0.0027	0.0004
17	0.0030	0.0027	0.0004
18	0.0031	0.0027	0.0004
19	0.0031	0.0027	0.0004
20	0.0031	0.0027	0.0004
21	0.0031	0.0027	0.0004
22	0.0031	0.0027	0.0004
23	0.0031	0.0027	0.0004
24	0.0031	0.0027	0.0004
25	0.0031	0.0027	0.0004
26	0.0031	0.0028	0.0004
27	0.0032	0.0028	0.0004
28	0.0032	0.0028	0.0004
29	0.0032	0.0028	0.0004
30	0.0032	0.0028	0.0004
31	0.0032	0.0028	0.0004
32	0.0032	0.0028	0.0004
33	0.0032	0.0028	0.0004
34	0.0032	0.0028	0.0004
35	0.0033	0.0029	0.0004
36	0.0033	0.0029	0.0004
37	0.0033	0.0029	0.0004
38	0.0033	0.0029	0.0004
39	0.0033	0.0029	0.0004
40	0.0033	0.0029	0.0004
41	0.0033	0.0029	0.0004

42	0.0033	0.0029	0.0004
43	0.0034	0.0029	0.0004
44	0.0034	0.0030	0.0004
45	0.0034	0.0030	0.0004
46	0.0034	0.0030	0.0004
47	0.0034	0.0030	0.0004
48	0.0034	0.0030	0.0004
49	0.0034	0.0030	0.0004
50	0.0035	0.0030	0.0004
51	0.0035	0.0030	0.0004
52	0.0035	0.0031	0.0004
53	0.0035	0.0031	0.0004
54	0.0035	0.0031	0.0004
55	0.0035	0.0031	0.0004
56	0.0035	0.0031	0.0004
57	0.0036	0.0031	0.0004
58	0.0036	0.0031	0.0004
59	0.0036	0.0032	0.0004
60	0.0036	0.0032	0.0004
61	0.0036	0.0032	0.0005
62	0.0036	0.0032	0.0005
63	0.0037	0.0032	0.0005
64	0.0037	0.0032	0.0005
65	0.0037	0.0032	0.0005
66	0.0037	0.0033	0.0005
67	0.0037	0.0033	0.0005
68	0.0038	0.0033	0.0005
69	0.0038	0.0033	0.0005
70	0.0038	0.0033	0.0005
71	0.0038	0.0033	0.0005
72	0.0038	0.0033	0.0005
73	0.0039	0.0034	0.0005
74	0.0039	0.0034	0.0005
75	0.0039	0.0034	0.0005
76	0.0039	0.0034	0.0005
77	0.0039	0.0034	0.0005
78	0.0039	0.0035	0.0005
79	0.0040	0.0035	0.0005
80	0.0040	0.0035	0.0005
81	0.0040	0.0035	0.0005
82	0.0040	0.0035	0.0005
83	0.0041	0.0036	0.0005
84	0.0041	0.0036	0.0005
85	0.0041	0.0036	0.0005
86	0.0041	0.0036	0.0005
87	0.0042	0.0036	0.0005
88	0.0042	0.0037	0.0005
89	0.0042	0.0037	0.0005
90	0.0042	0.0037	0.0005
91	0.0043	0.0037	0.0005

92	0.0043	0.0037	0.0005
93	0.0043	0.0038	0.0005
94	0.0043	0.0038	0.0005
95	0.0044	0.0038	0.0005
96	0.0044	0.0038	0.0005
97	0.0044	0.0039	0.0005
98	0.0044	0.0039	0.0006
99	0.0045	0.0039	0.0006
100	0.0045	0.0039	0.0006
101	0.0045	0.0040	0.0006
102	0.0046	0.0040	0.0006
103	0.0046	0.0040	0.0006
104	0.0046	0.0040	0.0006
105	0.0047	0.0041	0.0006
106	0.0047	0.0041	0.0006
107	0.0047	0.0041	0.0006
108	0.0047	0.0042	0.0006
109	0.0048	0.0042	0.0006
110	0.0048	0.0042	0.0006
111	0.0049	0.0043	0.0006
112	0.0049	0.0043	0.0006
113	0.0049	0.0043	0.0006
114	0.0050	0.0043	0.0006
115	0.0050	0.0044	0.0006
116	0.0050	0.0044	0.0006
117	0.0051	0.0045	0.0006
118	0.0051	0.0045	0.0006
119	0.0052	0.0045	0.0006
120	0.0052	0.0046	0.0006
121	0.0053	0.0046	0.0007
122	0.0053	0.0046	0.0007
123	0.0054	0.0047	0.0007
124	0.0054	0.0047	0.0007
125	0.0055	0.0048	0.0007
126	0.0055	0.0048	0.0007
127	0.0056	0.0049	0.0007
128	0.0056	0.0049	0.0007
129	0.0057	0.0050	0.0007
130	0.0057	0.0050	0.0007
131	0.0058	0.0051	0.0007
132	0.0058	0.0051	0.0007
133	0.0059	0.0052	0.0007
134	0.0059	0.0052	0.0007
135	0.0060	0.0053	0.0007
136	0.0061	0.0053	0.0008
137	0.0061	0.0054	0.0008
138	0.0062	0.0054	0.0008
139	0.0063	0.0055	0.0008
140	0.0063	0.0055	0.0008
141	0.0064	0.0056	0.0008

142	0.0065	0.0057	0.0008
143	0.0066	0.0058	0.0008
144	0.0066	0.0058	0.0008
145	0.0069	0.0060	0.0009
146	0.0069	0.0061	0.0009
147	0.0071	0.0062	0.0009
148	0.0071	0.0062	0.0009
149	0.0072	0.0063	0.0009
150	0.0073	0.0064	0.0009
151	0.0075	0.0065	0.0009
152	0.0075	0.0066	0.0009
153	0.0077	0.0067	0.0010
154	0.0078	0.0068	0.0010
155	0.0079	0.0069	0.0010
156	0.0080	0.0070	0.0010
157	0.0082	0.0072	0.0010
158	0.0083	0.0072	0.0010
159	0.0085	0.0074	0.0011
160	0.0086	0.0075	0.0011
161	0.0088	0.0077	0.0011
162	0.0089	0.0078	0.0011
163	0.0091	0.0080	0.0011
164	0.0093	0.0081	0.0012
165	0.0095	0.0084	0.0012
166	0.0097	0.0085	0.0012
167	0.0100	0.0087	0.0012
168	0.0101	0.0089	0.0013
169	0.0106	0.0093	0.0013
170	0.0108	0.0095	0.0013
171	0.0112	0.0098	0.0014
172	0.0114	0.0100	0.0014
173	0.0119	0.0104	0.0015
174	0.0121	0.0106	0.0015
175	0.0127	0.0111	0.0016
176	0.0129	0.0113	0.0016
177	0.0136	0.0119	0.0017
178	0.0140	0.0122	0.0017
179	0.0147	0.0129	0.0018
180	0.0152	0.0133	0.0019
181	0.0162	0.0142	0.0020
182	0.0168	0.0147	0.0021
183	0.0181	0.0159	0.0023
184	0.0189	0.0166	0.0024
185	0.0156	0.0136	0.0019
186	0.0166	0.0145	0.0021
187	0.0192	0.0168	0.0024
188	0.0210	0.0184	0.0026
189	0.0261	0.0229	0.0032
190	0.0301	0.0263	0.0037
191	0.0456	0.0400	0.0057

192	0.0663	0.0457	0.0206
193	0.2867	0.0457	0.2410
194	0.0359	0.0315	0.0045
195	0.0232	0.0203	0.0029
196	0.0178	0.0156	0.0022
197	0.0198	0.0174	0.0025
198	0.0174	0.0153	0.0022
199	0.0157	0.0137	0.0020
200	0.0143	0.0126	0.0018
201	0.0133	0.0116	0.0016
202	0.0124	0.0108	0.0015
203	0.0116	0.0102	0.0014
204	0.0110	0.0096	0.0014
205	0.0103	0.0090	0.0013
206	0.0098	0.0086	0.0012
207	0.0094	0.0082	0.0012
208	0.0090	0.0079	0.0011
209	0.0087	0.0076	0.0011
210	0.0084	0.0073	0.0010
211	0.0081	0.0071	0.0010
212	0.0078	0.0069	0.0010
213	0.0076	0.0067	0.0009
214	0.0074	0.0065	0.0009
215	0.0072	0.0063	0.0009
216	0.0070	0.0061	0.0009
217	0.0067	0.0059	0.0008
218	0.0065	0.0057	0.0008
219	0.0064	0.0056	0.0008
220	0.0062	0.0055	0.0008
221	0.0061	0.0053	0.0008
222	0.0060	0.0052	0.0007
223	0.0058	0.0051	0.0007
224	0.0057	0.0050	0.0007
225	0.0056	0.0049	0.0007
226	0.0055	0.0048	0.0007
227	0.0054	0.0047	0.0007
228	0.0053	0.0047	0.0007
229	0.0052	0.0046	0.0007
230	0.0051	0.0045	0.0006
231	0.0051	0.0044	0.0006
232	0.0050	0.0044	0.0006
233	0.0049	0.0043	0.0006
234	0.0048	0.0042	0.0006
235	0.0048	0.0042	0.0006
236	0.0047	0.0041	0.0006
237	0.0046	0.0041	0.0006
238	0.0046	0.0040	0.0006
239	0.0045	0.0040	0.0006
240	0.0045	0.0039	0.0006
241	0.0044	0.0038	0.0005

242	0.0043	0.0038	0.0005
243	0.0043	0.0038	0.0005
244	0.0042	0.0037	0.0005
245	0.0042	0.0037	0.0005
246	0.0041	0.0036	0.0005
247	0.0041	0.0036	0.0005
248	0.0040	0.0035	0.0005
249	0.0040	0.0035	0.0005
250	0.0040	0.0035	0.0005
251	0.0039	0.0034	0.0005
252	0.0039	0.0034	0.0005
253	0.0038	0.0034	0.0005
254	0.0038	0.0033	0.0005
255	0.0038	0.0033	0.0005
256	0.0037	0.0033	0.0005
257	0.0037	0.0032	0.0005
258	0.0037	0.0032	0.0005
259	0.0036	0.0032	0.0005
260	0.0036	0.0031	0.0004
261	0.0036	0.0031	0.0004
262	0.0035	0.0031	0.0004
263	0.0035	0.0031	0.0004
264	0.0035	0.0030	0.0004
265	0.0034	0.0030	0.0004
266	0.0034	0.0030	0.0004
267	0.0034	0.0030	0.0004
268	0.0034	0.0029	0.0004
269	0.0033	0.0029	0.0004
270	0.0033	0.0029	0.0004
271	0.0033	0.0029	0.0004
272	0.0032	0.0028	0.0004
273	0.0032	0.0028	0.0004
274	0.0032	0.0028	0.0004
275	0.0032	0.0028	0.0004
276	0.0032	0.0028	0.0004
277	0.0031	0.0027	0.0004
278	0.0031	0.0027	0.0004
279	0.0031	0.0027	0.0004
280	0.0031	0.0027	0.0004
281	0.0030	0.0027	0.0004
282	0.0030	0.0026	0.0004
283	0.0030	0.0026	0.0004
284	0.0030	0.0026	0.0004
285	0.0030	0.0026	0.0004
286	0.0029	0.0026	0.0004
287	0.0029	0.0026	0.0004
288	0.0029	0.0025	0.0004

Total soil rain loss = 1.65(In)

Total effective rainfall = 0.48(In)
 Peak flow rate in flood hydrograph = 252.93(CFS)

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24 - H O U R S T O R M
 R u n o f f H y d r o g r a p h

 Hydrograph in 5 Minute intervals ((CFS))

Time(h+m)	Volume Ac.Ft	Q(CFS)	0	75.0	150.0	225.0	300.0
0+ 5	0.0007	0.10	Q				
0+10	0.0038	0.46	Q				
0+15	0.0080	0.60	Q				
0+20	0.0125	0.67	Q				
0+25	0.0174	0.70	Q				
0+30	0.0224	0.73	Q				
0+35	0.0275	0.74	Q				
0+40	0.0327	0.75	Q				
0+45	0.0379	0.76	Q				
0+50	0.0431	0.76	Q				
0+55	0.0483	0.76	Q				
1+ 0	0.0536	0.76	Q				
1+ 5	0.0589	0.77	Q				
1+10	0.0642	0.77	Q				
1+15	0.0695	0.77	Q				
1+20	0.0748	0.77	Q				
1+25	0.0802	0.78	Q				
1+30	0.0856	0.78	Q				
1+35	0.0910	0.78	Q				
1+40	0.0964	0.79	Q				
1+45	0.1018	0.79	Q				
1+50	0.1072	0.79	Q				
1+55	0.1127	0.79	Q				
2+ 0	0.1182	0.80	Q				
2+ 5	0.1237	0.80	Q				
2+10	0.1292	0.80	Q				
2+15	0.1348	0.81	Q				
2+20	0.1403	0.81	Q				
2+25	0.1459	0.81	Q				
2+30	0.1515	0.81	Q				
2+35	0.1572	0.82	Q				
2+40	0.1628	0.82	Q				
2+45	0.1685	0.82	Q				
2+50	0.1742	0.83	QV				
2+55	0.1799	0.83	QV				
3+ 0	0.1856	0.83	QV				
3+ 5	0.1914	0.84	QV				
3+10	0.1972	0.84	QV				

3+15	0.2030	0.84	QV
3+20	0.2088	0.85	QV
3+25	0.2147	0.85	QV
3+30	0.2205	0.85	QV
3+35	0.2264	0.86	QV
3+40	0.2323	0.86	QV
3+45	0.2383	0.86	QV
3+50	0.2443	0.87	QV
3+55	0.2503	0.87	QV
4+ 0	0.2563	0.87	QV
4+ 5	0.2623	0.88	QV
4+10	0.2684	0.88	QV
4+15	0.2745	0.88	QV
4+20	0.2806	0.89	QV
4+25	0.2867	0.89	QV
4+30	0.2929	0.90	QV
4+35	0.2991	0.90	QV
4+40	0.3053	0.90	QV
4+45	0.3116	0.91	QV
4+50	0.3179	0.91	QV
4+55	0.3242	0.92	QV
5+ 0	0.3305	0.92	QV
5+ 5	0.3369	0.92	QV
5+10	0.3433	0.93	Q V
5+15	0.3497	0.93	Q V
5+20	0.3562	0.94	Q V
5+25	0.3627	0.94	Q V
5+30	0.3692	0.95	Q V
5+35	0.3757	0.95	Q V
5+40	0.3823	0.96	Q V
5+45	0.3889	0.96	Q V
5+50	0.3956	0.97	Q V
5+55	0.4023	0.97	Q V
6+ 0	0.4090	0.97	Q V
6+ 5	0.4157	0.98	Q V
6+10	0.4225	0.98	Q V
6+15	0.4293	0.99	Q V
6+20	0.4362	0.99	Q V
6+25	0.4431	1.00	Q V
6+30	0.4500	1.01	Q V
6+35	0.4569	1.01	Q V
6+40	0.4639	1.02	Q V
6+45	0.4710	1.02	Q V
6+50	0.4780	1.03	Q V
6+55	0.4851	1.03	Q V
7+ 0	0.4923	1.04	Q V
7+ 5	0.4995	1.04	Q V
7+10	0.5067	1.05	Q V
7+15	0.5140	1.06	Q V
7+20	0.5213	1.06	Q V

7+25	0.5286	1.07	Q	V
7+30	0.5360	1.07	Q	V
7+35	0.5435	1.08	Q	V
7+40	0.5509	1.09	Q	V
7+45	0.5585	1.09	Q	V
7+50	0.5660	1.10	Q	V
7+55	0.5737	1.11	Q	V
8+ 0	0.5813	1.11	Q	V
8+ 5	0.5890	1.12	Q	V
8+10	0.5968	1.13	Q	V
8+15	0.6046	1.13	Q	V
8+20	0.6125	1.14	Q	V
8+25	0.6204	1.15	Q	V
8+30	0.6284	1.16	Q	V
8+35	0.6364	1.16	Q	V
8+40	0.6445	1.17	Q	V
8+45	0.6526	1.18	Q	V
8+50	0.6608	1.19	Q	V
8+55	0.6690	1.20	Q	V
9+ 0	0.6773	1.21	Q	V
9+ 5	0.6857	1.21	Q	V
9+10	0.6941	1.22	Q	V
9+15	0.7026	1.23	Q	V
9+20	0.7111	1.24	Q	V
9+25	0.7197	1.25	Q	V
9+30	0.7284	1.26	Q	V
9+35	0.7371	1.27	Q	V
9+40	0.7459	1.28	Q	V
9+45	0.7548	1.29	Q	V
9+50	0.7637	1.30	Q	V
9+55	0.7728	1.31	Q	V
10+ 0	0.7818	1.32	Q	V
10+ 5	0.7910	1.33	Q	V
10+10	0.8003	1.34	Q	V
10+15	0.8096	1.35	Q	V
10+20	0.8190	1.37	Q	V
10+25	0.8285	1.38	Q	V
10+30	0.8380	1.39	Q	V
10+35	0.8477	1.40	Q	V
10+40	0.8574	1.42	Q	V
10+45	0.8672	1.43	Q	V
10+50	0.8772	1.44	Q	V
10+55	0.8872	1.45	Q	V
11+ 0	0.8973	1.47	Q	V
11+ 5	0.9075	1.48	Q	V
11+10	0.9179	1.50	Q	V
11+15	0.9283	1.51	Q	V
11+20	0.9388	1.53	Q	V
11+25	0.9495	1.55	Q	V
11+30	0.9602	1.56	Q	V

11+35	0.9711	1.58	Q	V				
11+40	0.9821	1.60	Q	V				
11+45	0.9932	1.61	Q	V				
11+50	1.0045	1.63	Q	V				
11+55	1.0159	1.65	Q	V				
12+ 0	1.0274	1.67	Q	V				
12+ 5	1.0391	1.70	Q	V				
12+10	1.0510	1.74	Q	V				
12+15	1.0632	1.76	Q	V				
12+20	1.0755	1.79	Q	V				
12+25	1.0880	1.81	Q	V				
12+30	1.1006	1.84	Q	V				
12+35	1.1134	1.86	Q	V				
12+40	1.1265	1.89	Q	V				
12+45	1.1397	1.92	Q	V				
12+50	1.1531	1.95	Q	V				
12+55	1.1667	1.98	Q	V				
13+ 0	1.1805	2.01	Q	V				
13+ 5	1.1946	2.04	Q	V				
13+10	1.2089	2.07	Q	V				
13+15	1.2234	2.11	Q	V				
13+20	1.2381	2.15	Q	V				
13+25	1.2532	2.18	Q	V				
13+30	1.2685	2.23	Q	V				
13+35	1.2841	2.26	Q	V				
13+40	1.3000	2.31	Q	V				
13+45	1.3162	2.36	Q	V				
13+50	1.3328	2.41	Q	V				
13+55	1.3498	2.46	Q	V				
14+ 0	1.3671	2.52	Q	V				
14+ 5	1.3848	2.58	Q	V				
14+10	1.4032	2.66	Q	V				
14+15	1.4220	2.73	Q	V				
14+20	1.4414	2.82	Q	V				
14+25	1.4613	2.89	Q	V				
14+30	1.4818	2.98	Q	V				
14+35	1.5030	3.07	Q	V				
14+40	1.5248	3.17	Q	V				
14+45	1.5473	3.27	Q	V				
14+50	1.5707	3.40	Q	V				
14+55	1.5950	3.52	Q	V				
15+ 0	1.6203	3.68	Q	V				
15+ 5	1.6467	3.83	Q	V				
15+10	1.6744	4.02	Q	V				
15+15	1.7034	4.22	Q	V				
15+20	1.7342	4.48	Q	V				
15+25	1.7657	4.56	Q	V				
15+30	1.7950	4.26	Q	V				
15+35	1.8250	4.36	Q	V				
15+40	1.8578	4.75	Q	V				

15+45	1.8941	5.27	Q	V			
15+50	1.9366	6.18	Q	V			
15+55	1.9884	7.52	Q	V			
16+ 0	2.0837	13.83	Q	V			
16+ 5	2.6985	89.28		Q	V		
16+10	4.4405	252.93			V	Q	
16+15	5.1601	104.48		Q		V	
16+20	5.5057	50.19		Q		V	
16+25	5.7099	29.65	Q			V	
16+30	5.8478	20.02	Q			V	
16+35	5.9381	13.11	Q			V	
16+40	6.0037	9.53	Q			V	
16+45	6.0483	6.47	Q			V	
16+50	6.0735	3.65	Q			V	
16+55	6.0967	3.37	Q			V	
17+ 0	6.1184	3.15	Q			V	
17+ 5	6.1388	2.96	Q			V	
17+10	6.1579	2.78	Q			V	
17+15	6.1760	2.63	Q			V	
17+20	6.1933	2.51	Q			V	
17+25	6.2098	2.40	Q			V	
17+30	6.2256	2.30	Q			V	
17+35	6.2409	2.21	Q			V	
17+40	6.2555	2.13	Q			V	
17+45	6.2697	2.06	Q			V	
17+50	6.2835	2.00	Q			V	
17+55	6.2968	1.94	Q			V	
18+ 0	6.3098	1.88	Q			V	
18+ 5	6.3223	1.83	Q			V	
18+10	6.3345	1.76	Q			V	
18+15	6.3463	1.71	Q			V	
18+20	6.3578	1.67	Q			V	
18+25	6.3690	1.63	Q			V	
18+30	6.3799	1.59	Q			V	
18+35	6.3907	1.56	Q			V	
18+40	6.4012	1.52	Q			V	
18+45	6.4114	1.49	Q			V	
18+50	6.4215	1.46	Q			V	
18+55	6.4314	1.44	Q			V	
19+ 0	6.4411	1.41	Q			V	
19+ 5	6.4506	1.38	Q			V	
19+10	6.4600	1.36	Q			V	
19+15	6.4692	1.34	Q			V	
19+20	6.4783	1.32	Q			V	
19+25	6.4872	1.29	Q			V	
19+30	6.4959	1.27	Q			V	
19+35	6.5046	1.25	Q			V	
19+40	6.5131	1.24	Q			V	
19+45	6.5215	1.22	Q			V	
19+50	6.5298	1.20	Q			V	

19+55	6.5379	1.18	Q				V
20+ 0	6.5460	1.17	Q				V
20+ 5	6.5539	1.15	Q				V
20+10	6.5618	1.14	Q				V
20+15	6.5695	1.12	Q				V
20+20	6.5771	1.11	Q				V
20+25	6.5847	1.10	Q				V
20+30	6.5922	1.08	Q				V
20+35	6.5995	1.07	Q				V
20+40	6.6068	1.06	Q				V
20+45	6.6140	1.05	Q				V
20+50	6.6212	1.04	Q				V
20+55	6.6282	1.02	Q				V
21+ 0	6.6352	1.01	Q				V
21+ 5	6.6421	1.00	Q				V
21+10	6.6489	0.99	Q				V
21+15	6.6557	0.98	Q				V
21+20	6.6624	0.97	Q				V
21+25	6.6690	0.96	Q				V
21+30	6.6756	0.95	Q				V
21+35	6.6821	0.94	Q				V
21+40	6.6885	0.94	Q				V
21+45	6.6949	0.93	Q				V
21+50	6.7012	0.92	Q				V
21+55	6.7075	0.91	Q				V
22+ 0	6.7137	0.90	Q				V
22+ 5	6.7199	0.89	Q				V
22+10	6.7260	0.89	Q				V
22+15	6.7321	0.88	Q				V
22+20	6.7381	0.87	Q				V
22+25	6.7440	0.86	Q				V
22+30	6.7499	0.86	Q				V
22+35	6.7558	0.85	Q				V
22+40	6.7616	0.84	Q				V
22+45	6.7674	0.84	Q				V
22+50	6.7731	0.83	Q				V
22+55	6.7788	0.83	Q				V
23+ 0	6.7844	0.82	Q				V
23+ 5	6.7900	0.81	Q				V
23+10	6.7956	0.81	Q				V
23+15	6.8011	0.80	Q				V
23+20	6.8066	0.80	Q				V
23+25	6.8120	0.79	Q				V
23+30	6.8174	0.78	Q				V
23+35	6.8228	0.78	Q				V
23+40	6.8281	0.77	Q				V
23+45	6.8334	0.77	Q				V
23+50	6.8386	0.76	Q				V
23+55	6.8439	0.76	Q				V
24+ 0	6.8491	0.75	Q				V

U n i t H y d r o g r a p h A n a l y s i s

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Study date 08/07/22

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San Bernardino County Synthetic Unit Hydrology Method
Manual date - August 1986

Program License Serial Number 6385

IENLC
10-year
developed condition
onsite

Storm Event Year = 10

Antecedent Moisture Condition = 2

English (in-lb) Input Units Used

English Rainfall Data (Inches) Input Values Used

English Units used in output format

Area averaged rainfall intensity isohyetal data:

Sub-Area (Ac.)	Duration (hours)	Isohyetal (In)
Rainfall data for year 10		
171.56	1	0.61

Rainfall data for year 10
171.56 6 1.24

Rainfall data for year 10
171.56 24 2.13

+++++

***** Area-averaged max loss rate, Fm *****

SCS curve No.(AMCII)	SCS curve NO.(AMC 2)	Area (Ac.)	Area Fraction	Fp(Fig C6) (In/Hr)	Ap (dec.)	Fm (In/Hr)
69.0	69.0	171.56	1.000	0.548	0.100	0.055

Area-averaged adjusted loss rate Fm (In/Hr) = 0.055

***** Area-Averaged low loss rate fraction, Yb *****

Area (Ac.)	Area Fract	SCS CN (AMC2)	SCS CN (AMC2)	S	Pervious Yield Fr
17.16	0.100	69.0	69.0	4.49	0.124
154.40	0.900	98.0	98.0	0.20	0.894

Area-averaged catchment yield fraction, Y = 0.817

Area-averaged low loss fraction, Yb = 0.183

Direct entry of lag time by user

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Watershed area = 171.56(Ac.)

Catchment Lag time = 0.120 hours

Unit interval = 5.000 minutes

Unit interval percentage of lag time = 69.7350

Hydrograph baseflow = 0.00(CFS)

Average maximum watershed loss rate(Fm) = 0.055(In/Hr)

Average low loss rate fraction (Yb) = 0.183 (decimal)

DESERT S-Graph Selected

Computed peak 5-minute rainfall = 0.289(In)

Computed peak 30-minute rainfall = 0.495(In)

Specified peak 1-hour rainfall = 0.609(In)

Computed peak 3-hour rainfall = 0.942(In)

Specified peak 6-hour rainfall = 1.240(In)

Specified peak 24-hour rainfall = 2.130(In)

Rainfall depth area reduction factors:

Using a total area of 171.56(Ac.) (Ref: fig. E-4)

5-minute factor = 0.992 Adjusted rainfall = 0.287(In)

30-minute factor = 0.992 Adjusted rainfall = 0.491(In)

1-hour factor = 0.992 Adjusted rainfall = 0.604(In)

3-hour factor = 0.999 Adjusted rainfall = 0.941(In)

6-hour factor = 0.999 Adjusted rainfall = 1.239(In)

24-hour factor = 1.000 Adjusted rainfall = 2.130(In)

U n i t H y d r o g r a p h

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Interval Number	'S' Graph Mean values	Unit Hydrograph ((CFS))

(K = 2074.80 (CFS))		
1	7.744	160.671
2	50.264	882.215
3	73.446	480.976
4	83.543	209.492
5	89.449	122.532
6	93.132	76.411
7	95.628	51.795
8	97.303	34.745
9	98.238	19.416
10	99.050	16.835
11	99.701	13.513
12	100.000	6.202

Peak Unit Number	Adjusted mass rainfall (In)	Unit rainfall (In)

1	0.2867	0.2867
2	0.3529	0.0663
3	0.3986	0.0456
4	0.4345	0.0359
5	0.4646	0.0301
6	0.4907	0.0261
7	0.5139	0.0232
8	0.5349	0.0210
9	0.5542	0.0192
10	0.5719	0.0178
11	0.5885	0.0166
12	0.6041	0.0156
13	0.6239	0.0198
14	0.6428	0.0189
15	0.6610	0.0181
16	0.6784	0.0174
17	0.6952	0.0168
18	0.7114	0.0162
19	0.7271	0.0157
20	0.7423	0.0152
21	0.7570	0.0147
22	0.7714	0.0143
23	0.7853	0.0140
24	0.7989	0.0136
25	0.8122	0.0133
26	0.8251	0.0129
27	0.8378	0.0127
28	0.8502	0.0124
29	0.8623	0.0121
30	0.8742	0.0119

31	0.8858	0.0116
32	0.8972	0.0114
33	0.9084	0.0112
34	0.9194	0.0110
35	0.9302	0.0108
36	0.9408	0.0106
37	0.9511	0.0103
38	0.9613	0.0101
39	0.9713	0.0100
40	0.9811	0.0098
41	0.9908	0.0097
42	1.0003	0.0095
43	1.0097	0.0094
44	1.0190	0.0093
45	1.0281	0.0091
46	1.0371	0.0090
47	1.0460	0.0089
48	1.0548	0.0088
49	1.0635	0.0087
50	1.0721	0.0086
51	1.0806	0.0085
52	1.0889	0.0084
53	1.0972	0.0083
54	1.1054	0.0082
55	1.1135	0.0081
56	1.1215	0.0080
57	1.1294	0.0079
58	1.1373	0.0078
59	1.1450	0.0078
60	1.1527	0.0077
61	1.1603	0.0076
62	1.1678	0.0075
63	1.1753	0.0075
64	1.1826	0.0074
65	1.1900	0.0073
66	1.1972	0.0072
67	1.2044	0.0072
68	1.2115	0.0071
69	1.2185	0.0071
70	1.2255	0.0070
71	1.2325	0.0069
72	1.2393	0.0069
73	1.2460	0.0067
74	1.2527	0.0066
75	1.2592	0.0066
76	1.2658	0.0065
77	1.2723	0.0065
78	1.2787	0.0064
79	1.2851	0.0064
80	1.2914	0.0063

81	1.2977	0.0063
82	1.3039	0.0062
83	1.3101	0.0062
84	1.3162	0.0061
85	1.3223	0.0061
86	1.3284	0.0061
87	1.3344	0.0060
88	1.3404	0.0060
89	1.3463	0.0059
90	1.3522	0.0059
91	1.3580	0.0058
92	1.3638	0.0058
93	1.3696	0.0058
94	1.3753	0.0057
95	1.3810	0.0057
96	1.3867	0.0057
97	1.3923	0.0056
98	1.3979	0.0056
99	1.4034	0.0056
100	1.4090	0.0055
101	1.4144	0.0055
102	1.4199	0.0055
103	1.4253	0.0054
104	1.4307	0.0054
105	1.4361	0.0054
106	1.4414	0.0053
107	1.4467	0.0053
108	1.4519	0.0053
109	1.4572	0.0052
110	1.4624	0.0052
111	1.4676	0.0052
112	1.4727	0.0051
113	1.4778	0.0051
114	1.4829	0.0051
115	1.4880	0.0051
116	1.4930	0.0050
117	1.4980	0.0050
118	1.5030	0.0050
119	1.5080	0.0050
120	1.5129	0.0049
121	1.5178	0.0049
122	1.5227	0.0049
123	1.5276	0.0049
124	1.5324	0.0048
125	1.5372	0.0048
126	1.5420	0.0048
127	1.5468	0.0048
128	1.5515	0.0047
129	1.5563	0.0047
130	1.5610	0.0047

131	1.5656	0.0047
132	1.5703	0.0047
133	1.5749	0.0046
134	1.5795	0.0046
135	1.5841	0.0046
136	1.5887	0.0046
137	1.5933	0.0046
138	1.5978	0.0045
139	1.6023	0.0045
140	1.6068	0.0045
141	1.6113	0.0045
142	1.6157	0.0045
143	1.6202	0.0044
144	1.6246	0.0044
145	1.6290	0.0044
146	1.6333	0.0044
147	1.6377	0.0044
148	1.6420	0.0043
149	1.6464	0.0043
150	1.6507	0.0043
151	1.6550	0.0043
152	1.6592	0.0043
153	1.6635	0.0043
154	1.6677	0.0042
155	1.6719	0.0042
156	1.6761	0.0042
157	1.6803	0.0042
158	1.6845	0.0042
159	1.6887	0.0042
160	1.6928	0.0041
161	1.6969	0.0041
162	1.7010	0.0041
163	1.7051	0.0041
164	1.7092	0.0041
165	1.7133	0.0041
166	1.7173	0.0040
167	1.7213	0.0040
168	1.7254	0.0040
169	1.7294	0.0040
170	1.7334	0.0040
171	1.7373	0.0040
172	1.7413	0.0040
173	1.7452	0.0039
174	1.7492	0.0039
175	1.7531	0.0039
176	1.7570	0.0039
177	1.7609	0.0039
178	1.7648	0.0039
179	1.7686	0.0039
180	1.7725	0.0039

181	1.7763	0.0038
182	1.7801	0.0038
183	1.7840	0.0038
184	1.7878	0.0038
185	1.7915	0.0038
186	1.7953	0.0038
187	1.7991	0.0038
188	1.8028	0.0038
189	1.8066	0.0037
190	1.8103	0.0037
191	1.8140	0.0037
192	1.8177	0.0037
193	1.8214	0.0037
194	1.8251	0.0037
195	1.8287	0.0037
196	1.8324	0.0037
197	1.8361	0.0036
198	1.8397	0.0036
199	1.8433	0.0036
200	1.8469	0.0036
201	1.8505	0.0036
202	1.8541	0.0036
203	1.8577	0.0036
204	1.8613	0.0036
205	1.8648	0.0036
206	1.8684	0.0035
207	1.8719	0.0035
208	1.8754	0.0035
209	1.8789	0.0035
210	1.8824	0.0035
211	1.8859	0.0035
212	1.8894	0.0035
213	1.8929	0.0035
214	1.8964	0.0035
215	1.8998	0.0035
216	1.9033	0.0034
217	1.9067	0.0034
218	1.9101	0.0034
219	1.9135	0.0034
220	1.9170	0.0034
221	1.9203	0.0034
222	1.9237	0.0034
223	1.9271	0.0034
224	1.9305	0.0034
225	1.9338	0.0034
226	1.9372	0.0034
227	1.9405	0.0033
228	1.9439	0.0033
229	1.9472	0.0033
230	1.9505	0.0033

231	1.9538	0.0033
232	1.9571	0.0033
233	1.9604	0.0033
234	1.9637	0.0033
235	1.9670	0.0033
236	1.9702	0.0033
237	1.9735	0.0033
238	1.9767	0.0032
239	1.9800	0.0032
240	1.9832	0.0032
241	1.9864	0.0032
242	1.9896	0.0032
243	1.9928	0.0032
244	1.9960	0.0032
245	1.9992	0.0032
246	2.0024	0.0032
247	2.0056	0.0032
248	2.0088	0.0032
249	2.0119	0.0032
250	2.0151	0.0032
251	2.0182	0.0031
252	2.0213	0.0031
253	2.0245	0.0031
254	2.0276	0.0031
255	2.0307	0.0031
256	2.0338	0.0031
257	2.0369	0.0031
258	2.0400	0.0031
259	2.0431	0.0031
260	2.0462	0.0031
261	2.0492	0.0031
262	2.0523	0.0031
263	2.0554	0.0031
264	2.0584	0.0030
265	2.0614	0.0030
266	2.0645	0.0030
267	2.0675	0.0030
268	2.0705	0.0030
269	2.0735	0.0030
270	2.0765	0.0030
271	2.0795	0.0030
272	2.0825	0.0030
273	2.0855	0.0030
274	2.0885	0.0030
275	2.0915	0.0030
276	2.0944	0.0030
277	2.0974	0.0030
278	2.1004	0.0030
279	2.1033	0.0029
280	2.1062	0.0029

281	2.1092	0.0029
282	2.1121	0.0029
283	2.1150	0.0029
284	2.1179	0.0029
285	2.1209	0.0029
286	2.1238	0.0029
287	2.1267	0.0029
288	2.1295	0.0029

Unit Period (number)	Unit Rainfall (In)	Unit Soil-Loss (In)	Effective Rainfall (In)
1	0.0029	0.0005	0.0024
2	0.0029	0.0005	0.0024
3	0.0029	0.0005	0.0024
4	0.0029	0.0005	0.0024
5	0.0029	0.0005	0.0024
6	0.0029	0.0005	0.0024
7	0.0029	0.0005	0.0024
8	0.0030	0.0005	0.0024
9	0.0030	0.0005	0.0024
10	0.0030	0.0005	0.0024
11	0.0030	0.0005	0.0024
12	0.0030	0.0005	0.0024
13	0.0030	0.0006	0.0025
14	0.0030	0.0006	0.0025
15	0.0030	0.0006	0.0025
16	0.0030	0.0006	0.0025
17	0.0030	0.0006	0.0025
18	0.0031	0.0006	0.0025
19	0.0031	0.0006	0.0025
20	0.0031	0.0006	0.0025
21	0.0031	0.0006	0.0025
22	0.0031	0.0006	0.0025
23	0.0031	0.0006	0.0025
24	0.0031	0.0006	0.0025
25	0.0031	0.0006	0.0026
26	0.0031	0.0006	0.0026
27	0.0032	0.0006	0.0026
28	0.0032	0.0006	0.0026
29	0.0032	0.0006	0.0026
30	0.0032	0.0006	0.0026
31	0.0032	0.0006	0.0026
32	0.0032	0.0006	0.0026
33	0.0032	0.0006	0.0026
34	0.0032	0.0006	0.0026
35	0.0033	0.0006	0.0027
36	0.0033	0.0006	0.0027
37	0.0033	0.0006	0.0027

38	0.0033	0.0006	0.0027
39	0.0033	0.0006	0.0027
40	0.0033	0.0006	0.0027
41	0.0033	0.0006	0.0027
42	0.0033	0.0006	0.0027
43	0.0034	0.0006	0.0027
44	0.0034	0.0006	0.0028
45	0.0034	0.0006	0.0028
46	0.0034	0.0006	0.0028
47	0.0034	0.0006	0.0028
48	0.0034	0.0006	0.0028
49	0.0034	0.0006	0.0028
50	0.0035	0.0006	0.0028
51	0.0035	0.0006	0.0028
52	0.0035	0.0006	0.0028
53	0.0035	0.0006	0.0029
54	0.0035	0.0006	0.0029
55	0.0035	0.0006	0.0029
56	0.0035	0.0007	0.0029
57	0.0036	0.0007	0.0029
58	0.0036	0.0007	0.0029
59	0.0036	0.0007	0.0029
60	0.0036	0.0007	0.0029
61	0.0036	0.0007	0.0030
62	0.0036	0.0007	0.0030
63	0.0037	0.0007	0.0030
64	0.0037	0.0007	0.0030
65	0.0037	0.0007	0.0030
66	0.0037	0.0007	0.0030
67	0.0037	0.0007	0.0031
68	0.0038	0.0007	0.0031
69	0.0038	0.0007	0.0031
70	0.0038	0.0007	0.0031
71	0.0038	0.0007	0.0031
72	0.0038	0.0007	0.0031
73	0.0039	0.0007	0.0031
74	0.0039	0.0007	0.0032
75	0.0039	0.0007	0.0032
76	0.0039	0.0007	0.0032
77	0.0039	0.0007	0.0032
78	0.0039	0.0007	0.0032
79	0.0040	0.0007	0.0032
80	0.0040	0.0007	0.0033
81	0.0040	0.0007	0.0033
82	0.0040	0.0007	0.0033
83	0.0041	0.0007	0.0033
84	0.0041	0.0007	0.0033
85	0.0041	0.0008	0.0034
86	0.0041	0.0008	0.0034
87	0.0042	0.0008	0.0034

88	0.0042	0.0008	0.0034
89	0.0042	0.0008	0.0034
90	0.0042	0.0008	0.0034
91	0.0043	0.0008	0.0035
92	0.0043	0.0008	0.0035
93	0.0043	0.0008	0.0035
94	0.0043	0.0008	0.0035
95	0.0044	0.0008	0.0036
96	0.0044	0.0008	0.0036
97	0.0044	0.0008	0.0036
98	0.0044	0.0008	0.0036
99	0.0045	0.0008	0.0037
100	0.0045	0.0008	0.0037
101	0.0045	0.0008	0.0037
102	0.0046	0.0008	0.0037
103	0.0046	0.0008	0.0038
104	0.0046	0.0008	0.0038
105	0.0047	0.0009	0.0038
106	0.0047	0.0009	0.0038
107	0.0047	0.0009	0.0039
108	0.0047	0.0009	0.0039
109	0.0048	0.0009	0.0039
110	0.0048	0.0009	0.0039
111	0.0049	0.0009	0.0040
112	0.0049	0.0009	0.0040
113	0.0049	0.0009	0.0040
114	0.0050	0.0009	0.0041
115	0.0050	0.0009	0.0041
116	0.0050	0.0009	0.0041
117	0.0051	0.0009	0.0042
118	0.0051	0.0009	0.0042
119	0.0052	0.0009	0.0042
120	0.0052	0.0010	0.0043
121	0.0053	0.0010	0.0043
122	0.0053	0.0010	0.0043
123	0.0054	0.0010	0.0044
124	0.0054	0.0010	0.0044
125	0.0055	0.0010	0.0045
126	0.0055	0.0010	0.0045
127	0.0056	0.0010	0.0045
128	0.0056	0.0010	0.0046
129	0.0057	0.0010	0.0046
130	0.0057	0.0010	0.0047
131	0.0058	0.0011	0.0047
132	0.0058	0.0011	0.0047
133	0.0059	0.0011	0.0048
134	0.0059	0.0011	0.0048
135	0.0060	0.0011	0.0049
136	0.0061	0.0011	0.0049
137	0.0061	0.0011	0.0050

138	0.0062	0.0011	0.0051
139	0.0063	0.0012	0.0051
140	0.0063	0.0012	0.0052
141	0.0064	0.0012	0.0052
142	0.0065	0.0012	0.0053
143	0.0066	0.0012	0.0054
144	0.0066	0.0012	0.0054
145	0.0069	0.0013	0.0056
146	0.0069	0.0013	0.0057
147	0.0071	0.0013	0.0058
148	0.0071	0.0013	0.0058
149	0.0072	0.0013	0.0059
150	0.0073	0.0013	0.0060
151	0.0075	0.0014	0.0061
152	0.0075	0.0014	0.0061
153	0.0077	0.0014	0.0063
154	0.0078	0.0014	0.0063
155	0.0079	0.0015	0.0065
156	0.0080	0.0015	0.0065
157	0.0082	0.0015	0.0067
158	0.0083	0.0015	0.0068
159	0.0085	0.0016	0.0069
160	0.0086	0.0016	0.0070
161	0.0088	0.0016	0.0072
162	0.0089	0.0016	0.0073
163	0.0091	0.0017	0.0075
164	0.0093	0.0017	0.0076
165	0.0095	0.0017	0.0078
166	0.0097	0.0018	0.0079
167	0.0100	0.0018	0.0081
168	0.0101	0.0019	0.0083
169	0.0106	0.0019	0.0087
170	0.0108	0.0020	0.0088
171	0.0112	0.0021	0.0091
172	0.0114	0.0021	0.0093
173	0.0119	0.0022	0.0097
174	0.0121	0.0022	0.0099
175	0.0127	0.0023	0.0103
176	0.0129	0.0024	0.0106
177	0.0136	0.0025	0.0111
178	0.0140	0.0026	0.0114
179	0.0147	0.0027	0.0120
180	0.0152	0.0028	0.0124
181	0.0162	0.0030	0.0132
182	0.0168	0.0031	0.0137
183	0.0181	0.0033	0.0148
184	0.0189	0.0035	0.0155
185	0.0156	0.0029	0.0127
186	0.0166	0.0030	0.0135
187	0.0192	0.0035	0.0157

188	0.0210	0.0039	0.0172
189	0.0261	0.0046	0.0216
190	0.0301	0.0046	0.0255
191	0.0456	0.0046	0.0411
192	0.0663	0.0046	0.0617
193	0.2867	0.0046	0.2821
194	0.0359	0.0046	0.0314
195	0.0232	0.0043	0.0190
196	0.0178	0.0033	0.0145
197	0.0198	0.0036	0.0162
198	0.0174	0.0032	0.0142
199	0.0157	0.0029	0.0128
200	0.0143	0.0026	0.0117
201	0.0133	0.0024	0.0108
202	0.0124	0.0023	0.0101
203	0.0116	0.0021	0.0095
204	0.0110	0.0020	0.0090
205	0.0103	0.0019	0.0084
206	0.0098	0.0018	0.0080
207	0.0094	0.0017	0.0077
208	0.0090	0.0017	0.0074
209	0.0087	0.0016	0.0071
210	0.0084	0.0015	0.0068
211	0.0081	0.0015	0.0066
212	0.0078	0.0014	0.0064
213	0.0076	0.0014	0.0062
214	0.0074	0.0014	0.0060
215	0.0072	0.0013	0.0059
216	0.0070	0.0013	0.0057
217	0.0067	0.0012	0.0055
218	0.0065	0.0012	0.0053
219	0.0064	0.0012	0.0052
220	0.0062	0.0011	0.0051
221	0.0061	0.0011	0.0050
222	0.0060	0.0011	0.0049
223	0.0058	0.0011	0.0048
224	0.0057	0.0011	0.0047
225	0.0056	0.0010	0.0046
226	0.0055	0.0010	0.0045
227	0.0054	0.0010	0.0044
228	0.0053	0.0010	0.0043
229	0.0052	0.0010	0.0043
230	0.0051	0.0009	0.0042
231	0.0051	0.0009	0.0041
232	0.0050	0.0009	0.0041
233	0.0049	0.0009	0.0040
234	0.0048	0.0009	0.0040
235	0.0048	0.0009	0.0039
236	0.0047	0.0009	0.0038
237	0.0046	0.0008	0.0038

238	0.0046	0.0008	0.0037
239	0.0045	0.0008	0.0037
240	0.0045	0.0008	0.0036
241	0.0044	0.0008	0.0036
242	0.0043	0.0008	0.0035
243	0.0043	0.0008	0.0035
244	0.0042	0.0008	0.0035
245	0.0042	0.0008	0.0034
246	0.0041	0.0008	0.0034
247	0.0041	0.0008	0.0033
248	0.0040	0.0007	0.0033
249	0.0040	0.0007	0.0033
250	0.0040	0.0007	0.0032
251	0.0039	0.0007	0.0032
252	0.0039	0.0007	0.0032
253	0.0038	0.0007	0.0031
254	0.0038	0.0007	0.0031
255	0.0038	0.0007	0.0031
256	0.0037	0.0007	0.0030
257	0.0037	0.0007	0.0030
258	0.0037	0.0007	0.0030
259	0.0036	0.0007	0.0030
260	0.0036	0.0007	0.0029
261	0.0036	0.0007	0.0029
262	0.0035	0.0006	0.0029
263	0.0035	0.0006	0.0029
264	0.0035	0.0006	0.0028
265	0.0034	0.0006	0.0028
266	0.0034	0.0006	0.0028
267	0.0034	0.0006	0.0028
268	0.0034	0.0006	0.0027
269	0.0033	0.0006	0.0027
270	0.0033	0.0006	0.0027
271	0.0033	0.0006	0.0027
272	0.0032	0.0006	0.0027
273	0.0032	0.0006	0.0026
274	0.0032	0.0006	0.0026
275	0.0032	0.0006	0.0026
276	0.0032	0.0006	0.0026
277	0.0031	0.0006	0.0026
278	0.0031	0.0006	0.0025
279	0.0031	0.0006	0.0025
280	0.0031	0.0006	0.0025
281	0.0030	0.0006	0.0025
282	0.0030	0.0006	0.0025
283	0.0030	0.0006	0.0024
284	0.0030	0.0005	0.0024
285	0.0030	0.0005	0.0024
286	0.0029	0.0005	0.0024
287	0.0029	0.0005	0.0024

2+55	1.1703	5.47	QV
3+ 0	1.2082	5.49	QV
3+ 5	1.2461	5.51	QV
3+10	1.2842	5.53	QV
3+15	1.3225	5.55	Q V
3+20	1.3609	5.58	Q V
3+25	1.3994	5.60	Q V
3+30	1.4381	5.62	Q V
3+35	1.4770	5.64	Q V
3+40	1.5160	5.67	Q V
3+45	1.5551	5.69	Q V
3+50	1.5945	5.71	Q V
3+55	1.6340	5.73	Q V
4+ 0	1.6736	5.76	Q V
4+ 5	1.7135	5.78	Q V
4+10	1.7535	5.81	Q V
4+15	1.7936	5.83	Q V
4+20	1.8340	5.86	Q V
4+25	1.8745	5.88	Q V
4+30	1.9151	5.91	Q V
4+35	1.9560	5.93	Q V
4+40	1.9970	5.96	Q V
4+45	2.0382	5.98	Q V
4+50	2.0796	6.01	Q V
4+55	2.1212	6.04	Q V
5+ 0	2.1630	6.07	Q V
5+ 5	2.2050	6.09	Q V
5+10	2.2471	6.12	Q V
5+15	2.2895	6.15	Q V
5+20	2.3320	6.18	Q V
5+25	2.3748	6.21	Q V
5+30	2.4177	6.24	Q V
5+35	2.4609	6.26	Q V
5+40	2.5042	6.30	Q V
5+45	2.5478	6.33	Q V
5+50	2.5916	6.36	Q V
5+55	2.6356	6.39	Q V
6+ 0	2.6798	6.42	Q V
6+ 5	2.7242	6.45	Q V
6+10	2.7689	6.49	Q V
6+15	2.8138	6.52	Q V
6+20	2.8589	6.55	Q V
6+25	2.9042	6.58	Q V
6+30	2.9498	6.62	Q V
6+35	2.9956	6.65	Q V
6+40	3.0417	6.69	Q V
6+45	3.0880	6.72	Q V
6+50	3.1346	6.76	Q V
6+55	3.1814	6.80	Q V
7+ 0	3.2285	6.84	Q V

7+ 5	3.2758	6.87	Q	V				
7+10	3.3234	6.91	Q	V				
7+15	3.3712	6.95	Q	V				
7+20	3.4194	6.99	Q	V				
7+25	3.4678	7.03	Q	V				
7+30	3.5165	7.07	Q	V				
7+35	3.5655	7.11	Q	V				
7+40	3.6147	7.16	Q	V				
7+45	3.6643	7.20	Q	V				
7+50	3.7142	7.24	Q	V				
7+55	3.7643	7.28	Q	V				
8+ 0	3.8148	7.33	Q	V				
8+ 5	3.8656	7.37	Q	V				
8+10	3.9167	7.42	Q	V				
8+15	3.9681	7.47	Q	V				
8+20	4.0199	7.52	Q	V				
8+25	4.0720	7.56	Q	V				
8+30	4.1244	7.62	Q	V				
8+35	4.1772	7.66	Q	V				
8+40	4.2303	7.72	Q	V				
8+45	4.2838	7.77	Q	V				
8+50	4.3377	7.82	Q	V				
8+55	4.3919	7.87	Q	V				
9+ 0	4.4465	7.93	Q	V				
9+ 5	4.5015	7.98	Q	V				
9+10	4.5569	8.05	Q	V				
9+15	4.6127	8.10	Q	V				
9+20	4.6689	8.16	Q	V				
9+25	4.7256	8.22	Q	V				
9+30	4.7826	8.29	Q	V				
9+35	4.8401	8.34	Q	V				
9+40	4.8980	8.41	Q	V				
9+45	4.9564	8.47	Q	V				
9+50	5.0152	8.55	Q	V				
9+55	5.0745	8.61	Q	V				
10+ 0	5.1343	8.68	Q	V				
10+ 5	5.1946	8.75	Q	V				
10+10	5.2554	8.83	Q	V				
10+15	5.3167	8.90	Q	V				
10+20	5.3785	8.98	Q	V				
10+25	5.4409	9.05	Q	V				
10+30	5.5038	9.14	Q	V				
10+35	5.5673	9.21	Q	V				
10+40	5.6314	9.30	Q	V				
10+45	5.6960	9.38	Q	V				
10+50	5.7613	9.48	Q	V				
10+55	5.8271	9.56	Q	V				
11+ 0	5.8936	9.66	Q	V				
11+ 5	5.9608	9.75	Q	V				
11+10	6.0286	9.85	Q	V				

11+15	6.0971	9.95	Q	V			
11+20	6.1664	10.06	Q	V			
11+25	6.2363	10.15	Q	V			
11+30	6.3070	10.27	Q	V			
11+35	6.3785	10.37	Q	V			
11+40	6.4508	10.50	Q	V			
11+45	6.5238	10.61	Q	V			
11+50	6.5978	10.74	Q	V			
11+55	6.6725	10.85	Q	V			
12+ 0	6.7482	10.99	Q	V			
12+ 5	6.8249	11.13	Q	V			
12+10	6.9032	11.37	Q	V			
12+15	6.9828	11.55	Q	V			
12+20	7.0635	11.73	Q	V			
12+25	7.1454	11.88	Q	V			
12+30	7.2284	12.06	Q	V			
12+35	7.3126	12.22	Q	V			
12+40	7.3981	12.41	Q	V			
12+45	7.4847	12.58	Q	V			
12+50	7.5726	12.77	Q	V			
12+55	7.6619	12.95	Q	V			
13+ 0	7.7526	13.17	Q	V			
13+ 5	7.8446	13.36	Q	V			
13+10	7.9382	13.60	Q	V			
13+15	8.0333	13.81	Q	V			
13+20	8.1302	14.06	Q	V			
13+25	8.2286	14.29	Q	V			
13+30	8.3290	14.57	Q	V			
13+35	8.4311	14.83	Q	V			
13+40	8.5353	15.14	Q	V			
13+45	8.6415	15.42	Q	V			
13+50	8.7501	15.76	Q	V			
13+55	8.8608	16.08	Q	V			
14+ 0	8.9742	16.46	Q	V			
14+ 5	9.0901	16.84	Q	V			
14+10	9.2098	17.38	Q	V			
14+15	9.3327	17.84	Q	V			
14+20	9.4592	18.37	Q	V			
14+25	9.5890	18.85	Q	V			
14+30	9.7228	19.43	Q	V			
14+35	9.8604	19.98	Q	V			
14+40	10.0027	20.66	Q	V			
14+45	10.1494	21.30	Q	V			
14+50	10.3017	22.11	Q	V			
14+55	10.4593	22.89	Q	V			
15+ 0	10.6237	23.87	Q	V			
15+ 5	10.7947	24.83	Q	V			
15+10	10.9742	26.06	Q	V			
15+15	11.1621	27.29	Q	V			
15+20	11.3612	28.91	Q	V			

15+25	11.5668	29.86	Q		V			
15+30	11.7617	28.30	Q		V			
15+35	11.9576	28.45	Q		V			
15+40	12.1688	30.66	Q		V			
15+45	12.4007	33.67	Q		V			
15+50	12.6716	39.33	Q		V			
15+55	13.0021	48.00	Q		V			
16+ 0	13.4719	68.21		Q	V			
16+ 5	14.3733	130.88			Q	V		
16+10	16.4336	299.16				V		Q
16+15	17.7340	188.81				Q	V	
16+20	18.4700	106.87			Q		V	
16+25	18.9825	74.41		Q			V	
16+30	19.3870	58.73		Q			V	
16+35	19.7213	48.54		Q			V	
16+40	19.9998	40.44		Q			V	
16+45	20.2312	33.60		Q			V	
16+50	20.4401	30.33		Q			V	
16+55	20.6274	27.20	Q				V	
17+ 0	20.7889	23.44	Q				V	
17+ 5	20.9291	20.36	Q				V	
17+10	21.0599	19.00	Q				V	
17+15	21.1835	17.94	Q				V	
17+20	21.3009	17.04	Q				V	
17+25	21.4127	16.24	Q				V	
17+30	21.5198	15.54	Q				V	
17+35	21.6226	14.92	Q				V	
17+40	21.7215	14.37	Q				V	
17+45	21.8170	13.87	Q				V	
17+50	21.9094	13.41	Q				V	
17+55	21.9989	12.99	Q				V	
18+ 0	22.0857	12.61	Q				V	
18+ 5	22.1700	12.24	Q				V	
18+10	22.2515	11.83	Q				V	
18+15	22.3305	11.47	Q				V	
18+20	22.4074	11.17	Q				V	
18+25	22.4824	10.89	Q				V	
18+30	22.5557	10.63	Q				V	
18+35	22.6272	10.39	Q				V	
18+40	22.6973	10.17	Q				V	
18+45	22.7659	9.96	Q				V	
18+50	22.8331	9.76	Q				V	
18+55	22.8990	9.57	Q				V	
19+ 0	22.9636	9.39	Q				V	
19+ 5	23.0271	9.22	Q				V	
19+10	23.0895	9.06	Q				V	
19+15	23.1508	8.90	Q				V	
19+20	23.2111	8.75	Q				V	
19+25	23.2704	8.61	Q				V	
19+30	23.3288	8.48	Q				V	

19+35	23.3863	8.35	Q				V
19+40	23.4429	8.22	Q				V
19+45	23.4987	8.10	Q				V
19+50	23.5537	7.99	Q				V
19+55	23.6079	7.87	Q				V
20+ 0	23.6614	7.77	Q				V
20+ 5	23.7142	7.66	Q				V
20+10	23.7663	7.56	Q				V
20+15	23.8177	7.47	Q				V
20+20	23.8685	7.37	Q				V
20+25	23.9186	7.28	Q				V
20+30	23.9682	7.20	Q				V
20+35	24.0171	7.11	Q				V
20+40	24.0655	7.03	Q				V
20+45	24.1134	6.95	Q				V
20+50	24.1607	6.87	Q				V
20+55	24.2075	6.80	Q				V
21+ 0	24.2538	6.72	Q				V
21+ 5	24.2996	6.65	Q				V
21+10	24.3450	6.58	Q				V
21+15	24.3898	6.52	Q				V
21+20	24.4343	6.45	Q				V
21+25	24.4783	6.39	Q				V
21+30	24.5218	6.32	Q				V
21+35	24.5650	6.26	Q				V
21+40	24.6077	6.21	Q				V
21+45	24.6500	6.15	Q				V
21+50	24.6920	6.09	Q				V
21+55	24.7336	6.04	Q				V
22+ 0	24.7748	5.98	Q				V
22+ 5	24.8156	5.93	Q				V
22+10	24.8561	5.88	Q				V
22+15	24.8963	5.83	Q				V
22+20	24.9361	5.78	Q				V
22+25	24.9756	5.73	Q				V
22+30	25.0147	5.69	Q				V
22+35	25.0536	5.64	Q				V
22+40	25.0921	5.60	Q				V
22+45	25.1303	5.55	Q				V
22+50	25.1683	5.51	Q				V
22+55	25.2059	5.47	Q				V
23+ 0	25.2433	5.43	Q				V
23+ 5	25.2804	5.39	Q				V
23+10	25.3172	5.35	Q				V
23+15	25.3538	5.31	Q				V
23+20	25.3900	5.27	Q				V
23+25	25.4261	5.23	Q				V
23+30	25.4618	5.19	Q				V
23+35	25.4974	5.16	Q				V
23+40	25.5327	5.12	Q				V

23+45	25.5677	5.09	Q				V
23+50	25.6025	5.05	Q				V
23+55	25.6371	5.02	Q				V
24+ 0	25.6714	4.99	Q				V

U n i t H y d r o g r a p h A n a l y s i s

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Study date 08/06/22

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San Bernardino County Synthetic Unit Hydrology Method
Manual date - August 1986

Program License Serial Number 6385

IEN
Area A
10-year Developed

Storm Event Year = 10

Antecedent Moisture Condition = 2

English (in-lb) Input Units Used

English Rainfall Data (Inches) Input Values Used

English Units used in output format

Area averaged rainfall intensity isohyetal data:

Sub-Area (Ac.)	Duration (hours)	Isohyetal (In)
Rainfall data for year 10		
47.41	1	0.61

Rainfall data for year 10		
47.41	6	1.24

Rainfall data for year 10		
47.41	24	2.13

+++++

***** Area-averaged max loss rate, Fm *****

SCS curve No.(AMCII)	SCS curve NO.(AMC 2)	Area (Ac.)	Area Fraction	Fp(Fig C6) (In/Hr)	Ap (dec.)	Fm (In/Hr)
69.0	69.0	47.41	1.000	0.548	0.100	0.055

Area-averaged adjusted loss rate Fm (In/Hr) = 0.055

***** Area-Averaged low loss rate fraction, Yb *****

Area (Ac.)	Area Fract	SCS CN (AMC2)	SCS CN (AMC2)	S	Pervious Yield Fr
4.74	0.100	69.0	69.0	4.49	0.124
42.67	0.900	98.0	98.0	0.20	0.894

Area-averaged catchment yield fraction, Y = 0.817

Area-averaged low loss fraction, Yb = 0.183

User entry of time of concentration = 0.221 (hours)

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Watershed area = 47.41(Ac.)

Catchment Lag time = 0.177 hours

Unit interval = 5.000 minutes

Unit interval percentage of lag time = 47.1620

Hydrograph baseflow = 0.00(CFS)

Average maximum watershed loss rate(Fm) = 0.055(In/Hr)

Average low loss rate fraction (Yb) = 0.183 (decimal)

DESERT S-Graph Selected

Computed peak 5-minute rainfall = 0.289(In)

Computed peak 30-minute rainfall = 0.495(In)

Specified peak 1-hour rainfall = 0.609(In)

Computed peak 3-hour rainfall = 0.942(In)

Specified peak 6-hour rainfall = 1.240(In)

Specified peak 24-hour rainfall = 2.130(In)

Rainfall depth area reduction factors:

Using a total area of 47.41(Ac.) (Ref: fig. E-4)

5-minute factor = 0.998 Adjusted rainfall = 0.288(In)

30-minute factor = 0.998 Adjusted rainfall = 0.494(In)

1-hour factor = 0.998 Adjusted rainfall = 0.608(In)

3-hour factor = 1.000 Adjusted rainfall = 0.942(In)

6-hour factor = 1.000 Adjusted rainfall = 1.240(In)

24-hour factor = 1.000 Adjusted rainfall = 2.130(In)

U n i t H y d r o g r a p h

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Interval Number	'S' Graph Mean values	Unit Hydrograph ((CFS))

(K = 573.36 (CFS))		
1	3.598	20.628
2	27.153	135.056
3	57.843	175.965
4	71.760	79.798
5	79.835	46.300
6	85.165	30.559
7	89.031	22.163
8	91.745	15.561
9	93.875	12.216
10	95.494	9.280
11	96.745	7.176
12	97.641	5.135
13	98.199	3.199
14	98.740	3.104
15	99.303	3.226
16	99.694	2.242
17	100.000	1.756

Peak Unit Number	Adjusted mass rainfall (In)	Unit rainfall (In)

1	0.2883	0.2883
2	0.3550	0.0666
3	0.4009	0.0459
4	0.4370	0.0361
5	0.4673	0.0303
6	0.4936	0.0263
7	0.5169	0.0234
8	0.5381	0.0211
9	0.5574	0.0194
10	0.5753	0.0179
11	0.5920	0.0167
12	0.6076	0.0157
13	0.6273	0.0197
14	0.6462	0.0188
15	0.6642	0.0180
16	0.6815	0.0173
17	0.6981	0.0167
18	0.7142	0.0161
19	0.7298	0.0156
20	0.7449	0.0151
21	0.7595	0.0146
22	0.7737	0.0142
23	0.7875	0.0138
24	0.8010	0.0135
25	0.8142	0.0131

26	0.8270	0.0128
27	0.8395	0.0125
28	0.8518	0.0123
29	0.8638	0.0120
30	0.8755	0.0118
31	0.8871	0.0115
32	0.8984	0.0113
33	0.9094	0.0111
34	0.9203	0.0109
35	0.9310	0.0107
36	0.9415	0.0105
37	0.9518	0.0103
38	0.9620	0.0101
39	0.9719	0.0100
40	0.9818	0.0098
41	0.9914	0.0097
42	1.0010	0.0095
43	1.0104	0.0094
44	1.0196	0.0093
45	1.0288	0.0091
46	1.0378	0.0090
47	1.0467	0.0089
48	1.0555	0.0088
49	1.0641	0.0087
50	1.0727	0.0086
51	1.0812	0.0085
52	1.0895	0.0084
53	1.0978	0.0083
54	1.1060	0.0082
55	1.1141	0.0081
56	1.1221	0.0080
57	1.1300	0.0079
58	1.1378	0.0078
59	1.1456	0.0077
60	1.1532	0.0077
61	1.1608	0.0076
62	1.1684	0.0075
63	1.1758	0.0074
64	1.1832	0.0074
65	1.1905	0.0073
66	1.1977	0.0072
67	1.2049	0.0072
68	1.2120	0.0071
69	1.2190	0.0070
70	1.2260	0.0070
71	1.2330	0.0069
72	1.2398	0.0069
73	1.2465	0.0067
74	1.2531	0.0066
75	1.2597	0.0066

76	1.2663	0.0065
77	1.2727	0.0065
78	1.2792	0.0064
79	1.2855	0.0064
80	1.2919	0.0063
81	1.2981	0.0063
82	1.3044	0.0062
83	1.3106	0.0062
84	1.3167	0.0061
85	1.3228	0.0061
86	1.3289	0.0061
87	1.3349	0.0060
88	1.3408	0.0060
89	1.3468	0.0059
90	1.3526	0.0059
91	1.3585	0.0058
92	1.3643	0.0058
93	1.3701	0.0058
94	1.3758	0.0057
95	1.3815	0.0057
96	1.3872	0.0057
97	1.3928	0.0056
98	1.3984	0.0056
99	1.4039	0.0056
100	1.4094	0.0055
101	1.4149	0.0055
102	1.4204	0.0055
103	1.4258	0.0054
104	1.4312	0.0054
105	1.4365	0.0054
106	1.4419	0.0053
107	1.4471	0.0053
108	1.4524	0.0053
109	1.4576	0.0052
110	1.4629	0.0052
111	1.4680	0.0052
112	1.4732	0.0051
113	1.4783	0.0051
114	1.4834	0.0051
115	1.4885	0.0051
116	1.4935	0.0050
117	1.4985	0.0050
118	1.5035	0.0050
119	1.5085	0.0050
120	1.5134	0.0049
121	1.5183	0.0049
122	1.5232	0.0049
123	1.5280	0.0049
124	1.5329	0.0048
125	1.5377	0.0048

126	1.5425	0.0048
127	1.5472	0.0048
128	1.5520	0.0047
129	1.5567	0.0047
130	1.5614	0.0047
131	1.5661	0.0047
132	1.5707	0.0047
133	1.5754	0.0046
134	1.5800	0.0046
135	1.5846	0.0046
136	1.5892	0.0046
137	1.5937	0.0046
138	1.5982	0.0045
139	1.6027	0.0045
140	1.6072	0.0045
141	1.6117	0.0045
142	1.6162	0.0045
143	1.6206	0.0044
144	1.6250	0.0044
145	1.6294	0.0044
146	1.6338	0.0044
147	1.6381	0.0044
148	1.6425	0.0043
149	1.6468	0.0043
150	1.6511	0.0043
151	1.6554	0.0043
152	1.6597	0.0043
153	1.6639	0.0043
154	1.6682	0.0042
155	1.6724	0.0042
156	1.6766	0.0042
157	1.6808	0.0042
158	1.6849	0.0042
159	1.6891	0.0042
160	1.6932	0.0041
161	1.6974	0.0041
162	1.7015	0.0041
163	1.7056	0.0041
164	1.7096	0.0041
165	1.7137	0.0041
166	1.7177	0.0040
167	1.7218	0.0040
168	1.7258	0.0040
169	1.7298	0.0040
170	1.7338	0.0040
171	1.7377	0.0040
172	1.7417	0.0040
173	1.7457	0.0039
174	1.7496	0.0039
175	1.7535	0.0039

176	1.7574	0.0039
177	1.7613	0.0039
178	1.7652	0.0039
179	1.7690	0.0039
180	1.7729	0.0039
181	1.7767	0.0038
182	1.7806	0.0038
183	1.7844	0.0038
184	1.7882	0.0038
185	1.7920	0.0038
186	1.7957	0.0038
187	1.7995	0.0038
188	1.8032	0.0037
189	1.8070	0.0037
190	1.8107	0.0037
191	1.8144	0.0037
192	1.8181	0.0037
193	1.8218	0.0037
194	1.8255	0.0037
195	1.8292	0.0037
196	1.8328	0.0037
197	1.8365	0.0036
198	1.8401	0.0036
199	1.8437	0.0036
200	1.8473	0.0036
201	1.8509	0.0036
202	1.8545	0.0036
203	1.8581	0.0036
204	1.8617	0.0036
205	1.8652	0.0036
206	1.8688	0.0035
207	1.8723	0.0035
208	1.8758	0.0035
209	1.8793	0.0035
210	1.8828	0.0035
211	1.8863	0.0035
212	1.8898	0.0035
213	1.8933	0.0035
214	1.8968	0.0035
215	1.9002	0.0035
216	1.9037	0.0034
217	1.9071	0.0034
218	1.9105	0.0034
219	1.9139	0.0034
220	1.9173	0.0034
221	1.9207	0.0034
222	1.9241	0.0034
223	1.9275	0.0034
224	1.9309	0.0034
225	1.9342	0.0034

226	1.9376	0.0034
227	1.9409	0.0033
228	1.9443	0.0033
229	1.9476	0.0033
230	1.9509	0.0033
231	1.9542	0.0033
232	1.9575	0.0033
233	1.9608	0.0033
234	1.9641	0.0033
235	1.9673	0.0033
236	1.9706	0.0033
237	1.9739	0.0033
238	1.9771	0.0032
239	1.9803	0.0032
240	1.9836	0.0032
241	1.9868	0.0032
242	1.9900	0.0032
243	1.9932	0.0032
244	1.9964	0.0032
245	1.9996	0.0032
246	2.0028	0.0032
247	2.0060	0.0032
248	2.0091	0.0032
249	2.0123	0.0032
250	2.0154	0.0032
251	2.0186	0.0031
252	2.0217	0.0031
253	2.0248	0.0031
254	2.0280	0.0031
255	2.0311	0.0031
256	2.0342	0.0031
257	2.0373	0.0031
258	2.0404	0.0031
259	2.0434	0.0031
260	2.0465	0.0031
261	2.0496	0.0031
262	2.0527	0.0031
263	2.0557	0.0031
264	2.0588	0.0030
265	2.0618	0.0030
266	2.0648	0.0030
267	2.0679	0.0030
268	2.0709	0.0030
269	2.0739	0.0030
270	2.0769	0.0030
271	2.0799	0.0030
272	2.0829	0.0030
273	2.0859	0.0030
274	2.0888	0.0030
275	2.0918	0.0030

276	2.0948	0.0030
277	2.0977	0.0030
278	2.1007	0.0030
279	2.1036	0.0029
280	2.1066	0.0029
281	2.1095	0.0029
282	2.1124	0.0029
283	2.1154	0.0029
284	2.1183	0.0029
285	2.1212	0.0029
286	2.1241	0.0029
287	2.1270	0.0029
288	2.1299	0.0029

Unit Period (number)	Unit Rainfall (In)	Unit Soil-Loss (In)	Effective Rainfall (In)
1	0.0029	0.0005	0.0024
2	0.0029	0.0005	0.0024
3	0.0029	0.0005	0.0024
4	0.0029	0.0005	0.0024
5	0.0029	0.0005	0.0024
6	0.0029	0.0005	0.0024
7	0.0029	0.0005	0.0024
8	0.0030	0.0005	0.0024
9	0.0030	0.0005	0.0024
10	0.0030	0.0005	0.0024
11	0.0030	0.0005	0.0024
12	0.0030	0.0005	0.0024
13	0.0030	0.0006	0.0025
14	0.0030	0.0006	0.0025
15	0.0030	0.0006	0.0025
16	0.0030	0.0006	0.0025
17	0.0030	0.0006	0.0025
18	0.0031	0.0006	0.0025
19	0.0031	0.0006	0.0025
20	0.0031	0.0006	0.0025
21	0.0031	0.0006	0.0025
22	0.0031	0.0006	0.0025
23	0.0031	0.0006	0.0025
24	0.0031	0.0006	0.0025
25	0.0031	0.0006	0.0026
26	0.0031	0.0006	0.0026
27	0.0032	0.0006	0.0026
28	0.0032	0.0006	0.0026
29	0.0032	0.0006	0.0026
30	0.0032	0.0006	0.0026
31	0.0032	0.0006	0.0026
32	0.0032	0.0006	0.0026

33	0.0032	0.0006	0.0026
34	0.0032	0.0006	0.0026
35	0.0033	0.0006	0.0027
36	0.0033	0.0006	0.0027
37	0.0033	0.0006	0.0027
38	0.0033	0.0006	0.0027
39	0.0033	0.0006	0.0027
40	0.0033	0.0006	0.0027
41	0.0033	0.0006	0.0027
42	0.0033	0.0006	0.0027
43	0.0034	0.0006	0.0027
44	0.0034	0.0006	0.0028
45	0.0034	0.0006	0.0028
46	0.0034	0.0006	0.0028
47	0.0034	0.0006	0.0028
48	0.0034	0.0006	0.0028
49	0.0034	0.0006	0.0028
50	0.0035	0.0006	0.0028
51	0.0035	0.0006	0.0028
52	0.0035	0.0006	0.0028
53	0.0035	0.0006	0.0029
54	0.0035	0.0006	0.0029
55	0.0035	0.0006	0.0029
56	0.0035	0.0007	0.0029
57	0.0036	0.0007	0.0029
58	0.0036	0.0007	0.0029
59	0.0036	0.0007	0.0029
60	0.0036	0.0007	0.0029
61	0.0036	0.0007	0.0030
62	0.0036	0.0007	0.0030
63	0.0037	0.0007	0.0030
64	0.0037	0.0007	0.0030
65	0.0037	0.0007	0.0030
66	0.0037	0.0007	0.0030
67	0.0037	0.0007	0.0031
68	0.0037	0.0007	0.0031
69	0.0038	0.0007	0.0031
70	0.0038	0.0007	0.0031
71	0.0038	0.0007	0.0031
72	0.0038	0.0007	0.0031
73	0.0039	0.0007	0.0031
74	0.0039	0.0007	0.0032
75	0.0039	0.0007	0.0032
76	0.0039	0.0007	0.0032
77	0.0039	0.0007	0.0032
78	0.0039	0.0007	0.0032
79	0.0040	0.0007	0.0032
80	0.0040	0.0007	0.0033
81	0.0040	0.0007	0.0033
82	0.0040	0.0007	0.0033

83	0.0041	0.0007	0.0033
84	0.0041	0.0007	0.0033
85	0.0041	0.0008	0.0034
86	0.0041	0.0008	0.0034
87	0.0042	0.0008	0.0034
88	0.0042	0.0008	0.0034
89	0.0042	0.0008	0.0034
90	0.0042	0.0008	0.0034
91	0.0043	0.0008	0.0035
92	0.0043	0.0008	0.0035
93	0.0043	0.0008	0.0035
94	0.0043	0.0008	0.0035
95	0.0044	0.0008	0.0036
96	0.0044	0.0008	0.0036
97	0.0044	0.0008	0.0036
98	0.0044	0.0008	0.0036
99	0.0045	0.0008	0.0037
100	0.0045	0.0008	0.0037
101	0.0045	0.0008	0.0037
102	0.0046	0.0008	0.0037
103	0.0046	0.0008	0.0037
104	0.0046	0.0008	0.0038
105	0.0047	0.0009	0.0038
106	0.0047	0.0009	0.0038
107	0.0047	0.0009	0.0039
108	0.0047	0.0009	0.0039
109	0.0048	0.0009	0.0039
110	0.0048	0.0009	0.0039
111	0.0049	0.0009	0.0040
112	0.0049	0.0009	0.0040
113	0.0049	0.0009	0.0040
114	0.0050	0.0009	0.0041
115	0.0050	0.0009	0.0041
116	0.0050	0.0009	0.0041
117	0.0051	0.0009	0.0042
118	0.0051	0.0009	0.0042
119	0.0052	0.0009	0.0042
120	0.0052	0.0010	0.0043
121	0.0053	0.0010	0.0043
122	0.0053	0.0010	0.0043
123	0.0054	0.0010	0.0044
124	0.0054	0.0010	0.0044
125	0.0055	0.0010	0.0045
126	0.0055	0.0010	0.0045
127	0.0056	0.0010	0.0045
128	0.0056	0.0010	0.0046
129	0.0057	0.0010	0.0046
130	0.0057	0.0010	0.0047
131	0.0058	0.0011	0.0047
132	0.0058	0.0011	0.0047

133	0.0059	0.0011	0.0048
134	0.0059	0.0011	0.0048
135	0.0060	0.0011	0.0049
136	0.0061	0.0011	0.0049
137	0.0061	0.0011	0.0050
138	0.0062	0.0011	0.0051
139	0.0063	0.0012	0.0051
140	0.0063	0.0012	0.0052
141	0.0064	0.0012	0.0052
142	0.0065	0.0012	0.0053
143	0.0066	0.0012	0.0054
144	0.0066	0.0012	0.0054
145	0.0069	0.0013	0.0056
146	0.0069	0.0013	0.0057
147	0.0070	0.0013	0.0058
148	0.0071	0.0013	0.0058
149	0.0072	0.0013	0.0059
150	0.0073	0.0013	0.0060
151	0.0074	0.0014	0.0061
152	0.0075	0.0014	0.0061
153	0.0077	0.0014	0.0063
154	0.0077	0.0014	0.0063
155	0.0079	0.0015	0.0065
156	0.0080	0.0015	0.0065
157	0.0082	0.0015	0.0067
158	0.0083	0.0015	0.0068
159	0.0085	0.0016	0.0069
160	0.0086	0.0016	0.0070
161	0.0088	0.0016	0.0072
162	0.0089	0.0016	0.0073
163	0.0091	0.0017	0.0075
164	0.0093	0.0017	0.0076
165	0.0095	0.0017	0.0078
166	0.0097	0.0018	0.0079
167	0.0100	0.0018	0.0081
168	0.0101	0.0019	0.0083
169	0.0105	0.0019	0.0086
170	0.0107	0.0020	0.0087
171	0.0111	0.0020	0.0091
172	0.0113	0.0021	0.0092
173	0.0118	0.0022	0.0096
174	0.0120	0.0022	0.0098
175	0.0125	0.0023	0.0102
176	0.0128	0.0024	0.0105
177	0.0135	0.0025	0.0110
178	0.0138	0.0025	0.0113
179	0.0146	0.0027	0.0119
180	0.0151	0.0028	0.0123
181	0.0161	0.0030	0.0131
182	0.0167	0.0031	0.0136

183	0.0180	0.0033	0.0147
184	0.0188	0.0034	0.0154
185	0.0157	0.0029	0.0128
186	0.0167	0.0031	0.0136
187	0.0194	0.0035	0.0158
188	0.0211	0.0039	0.0173
189	0.0263	0.0046	0.0217
190	0.0303	0.0046	0.0257
191	0.0459	0.0046	0.0413
192	0.0666	0.0046	0.0621
193	0.2883	0.0046	0.2838
194	0.0361	0.0046	0.0316
195	0.0234	0.0043	0.0191
196	0.0179	0.0033	0.0146
197	0.0197	0.0036	0.0161
198	0.0173	0.0032	0.0141
199	0.0156	0.0029	0.0127
200	0.0142	0.0026	0.0116
201	0.0131	0.0024	0.0107
202	0.0123	0.0022	0.0100
203	0.0115	0.0021	0.0094
204	0.0109	0.0020	0.0089
205	0.0103	0.0019	0.0084
206	0.0098	0.0018	0.0080
207	0.0094	0.0017	0.0077
208	0.0090	0.0017	0.0074
209	0.0087	0.0016	0.0071
210	0.0084	0.0015	0.0068
211	0.0081	0.0015	0.0066
212	0.0078	0.0014	0.0064
213	0.0076	0.0014	0.0062
214	0.0074	0.0014	0.0060
215	0.0072	0.0013	0.0059
216	0.0070	0.0013	0.0057
217	0.0067	0.0012	0.0055
218	0.0065	0.0012	0.0053
219	0.0064	0.0012	0.0052
220	0.0062	0.0011	0.0051
221	0.0061	0.0011	0.0050
222	0.0060	0.0011	0.0049
223	0.0058	0.0011	0.0048
224	0.0057	0.0011	0.0047
225	0.0056	0.0010	0.0046
226	0.0055	0.0010	0.0045
227	0.0054	0.0010	0.0044
228	0.0053	0.0010	0.0043
229	0.0052	0.0010	0.0043
230	0.0051	0.0009	0.0042
231	0.0051	0.0009	0.0041
232	0.0050	0.0009	0.0041

233	0.0049	0.0009	0.0040
234	0.0048	0.0009	0.0040
235	0.0048	0.0009	0.0039
236	0.0047	0.0009	0.0038
237	0.0046	0.0008	0.0038
238	0.0046	0.0008	0.0037
239	0.0045	0.0008	0.0037
240	0.0045	0.0008	0.0036
241	0.0044	0.0008	0.0036
242	0.0043	0.0008	0.0035
243	0.0043	0.0008	0.0035
244	0.0042	0.0008	0.0035
245	0.0042	0.0008	0.0034
246	0.0041	0.0008	0.0034
247	0.0041	0.0008	0.0033
248	0.0040	0.0007	0.0033
249	0.0040	0.0007	0.0033
250	0.0040	0.0007	0.0032
251	0.0039	0.0007	0.0032
252	0.0039	0.0007	0.0032
253	0.0038	0.0007	0.0031
254	0.0038	0.0007	0.0031
255	0.0038	0.0007	0.0031
256	0.0037	0.0007	0.0030
257	0.0037	0.0007	0.0030
258	0.0037	0.0007	0.0030
259	0.0036	0.0007	0.0030
260	0.0036	0.0007	0.0029
261	0.0036	0.0007	0.0029
262	0.0035	0.0006	0.0029
263	0.0035	0.0006	0.0029
264	0.0035	0.0006	0.0028
265	0.0034	0.0006	0.0028
266	0.0034	0.0006	0.0028
267	0.0034	0.0006	0.0028
268	0.0034	0.0006	0.0027
269	0.0033	0.0006	0.0027
270	0.0033	0.0006	0.0027
271	0.0033	0.0006	0.0027
272	0.0032	0.0006	0.0027
273	0.0032	0.0006	0.0026
274	0.0032	0.0006	0.0026
275	0.0032	0.0006	0.0026
276	0.0032	0.0006	0.0026
277	0.0031	0.0006	0.0026
278	0.0031	0.0006	0.0025
279	0.0031	0.0006	0.0025
280	0.0031	0.0006	0.0025
281	0.0030	0.0006	0.0025
282	0.0030	0.0006	0.0025

283	0.0030	0.0005	0.0024
284	0.0030	0.0005	0.0024
285	0.0030	0.0005	0.0024
286	0.0029	0.0005	0.0024
287	0.0029	0.0005	0.0024
288	0.0029	0.0005	0.0024

Total soil rain loss = 0.33(In)
Total effective rainfall = 1.80(In)
Peak flow rate in flood hydrograph = 63.66(CFS)

++++
24 - H O U R S T O R M
R u n o f f H y d r o g r a p h

Hydrograph in 5 Minute intervals ((CFS))

Time(h+m)	Volume Ac.Ft	Q(CFS)	0	17.5	35.0	52.5	70.0
0+ 5	0.0003	0.05	Q				
0+10	0.0029	0.37	Q				
0+15	0.0083	0.78	Q				
0+20	0.0150	0.97	Q				
0+25	0.0225	1.09	Q				
0+30	0.0305	1.16	Q				
0+35	0.0389	1.22	Q				
0+40	0.0475	1.26	Q				
0+45	0.0564	1.29	Q				
0+50	0.0655	1.32	Q				
0+55	0.0747	1.34	Q				
1+ 0	0.0841	1.36	Q				
1+ 5	0.0935	1.37	Q				
1+10	0.1030	1.38	Q				
1+15	0.1126	1.39	Q				
1+20	0.1222	1.40	Q				
1+25	0.1319	1.41	Q				
1+30	0.1417	1.42	Q				
1+35	0.1515	1.42	Q				
1+40	0.1613	1.43	Q				
1+45	0.1711	1.43	Q				
1+50	0.1810	1.44	QV				
1+55	0.1909	1.44	QV				
2+ 0	0.2009	1.45	QV				
2+ 5	0.2109	1.45	QV				
2+10	0.2209	1.46	QV				
2+15	0.2310	1.46	QV				
2+20	0.2411	1.47	QV				
2+25	0.2512	1.47	QV				

2+30	0.2614	1.48	QV
2+35	0.2716	1.48	QV
2+40	0.2819	1.49	QV
2+45	0.2921	1.49	QV
2+50	0.3025	1.50	QV
2+55	0.3128	1.51	QV
3+ 0	0.3232	1.51	QV
3+ 5	0.3337	1.52	QV
3+10	0.3442	1.52	QV
3+15	0.3547	1.53	QV
3+20	0.3653	1.53	Q V
3+25	0.3759	1.54	Q V
3+30	0.3865	1.55	Q V
3+35	0.3972	1.55	Q V
3+40	0.4080	1.56	Q V
3+45	0.4187	1.57	Q V
3+50	0.4296	1.57	Q V
3+55	0.4404	1.58	Q V
4+ 0	0.4513	1.58	Q V
4+ 5	0.4623	1.59	Q V
4+10	0.4733	1.60	Q V
4+15	0.4843	1.60	Q V
4+20	0.4954	1.61	Q V
4+25	0.5066	1.62	Q V
4+30	0.5178	1.62	Q V
4+35	0.5290	1.63	Q V
4+40	0.5403	1.64	Q V
4+45	0.5516	1.65	Q V
4+50	0.5630	1.65	Q V
4+55	0.5745	1.66	Q V
5+ 0	0.5860	1.67	Q V
5+ 5	0.5975	1.68	Q V
5+10	0.6091	1.68	Q V
5+15	0.6207	1.69	Q V
5+20	0.6324	1.70	Q V
5+25	0.6442	1.71	Q V
5+30	0.6560	1.71	Q V
5+35	0.6679	1.72	Q V
5+40	0.6798	1.73	Q V
5+45	0.6918	1.74	Q V
5+50	0.7038	1.75	Q V
5+55	0.7159	1.76	Q V
6+ 0	0.7281	1.77	Q V
6+ 5	0.7403	1.77	Q V
6+10	0.7526	1.78	Q V
6+15	0.7649	1.79	Q V
6+20	0.7773	1.80	Q V
6+25	0.7898	1.81	Q V
6+30	0.8023	1.82	Q V
6+35	0.8149	1.83	Q V

6+40	0.8276	1.84	Q	V
6+45	0.8403	1.85	Q	V
6+50	0.8531	1.86	Q	V
6+55	0.8659	1.87	Q	V
7+ 0	0.8789	1.88	Q	V
7+ 5	0.8919	1.89	Q	V
7+10	0.9050	1.90	Q	V
7+15	0.9181	1.91	Q	V
7+20	0.9313	1.92	Q	V
7+25	0.9446	1.93	Q	V
7+30	0.9580	1.94	Q	V
7+35	0.9715	1.95	Q	V
7+40	0.9850	1.97	Q	V
7+45	0.9986	1.98	Q	V
7+50	1.0123	1.99	Q	V
7+55	1.0261	2.00	Q	V
8+ 0	1.0400	2.01	Q	V
8+ 5	1.0539	2.03	Q	V
8+10	1.0679	2.04	Q	V
8+15	1.0821	2.05	Q	V
8+20	1.0963	2.06	Q	V
8+25	1.1106	2.08	Q	V
8+30	1.1250	2.09	Q	V
8+35	1.1395	2.10	Q	V
8+40	1.1540	2.12	Q	V
8+45	1.1687	2.13	Q	V
8+50	1.1835	2.15	Q	V
8+55	1.1984	2.16	Q	V
9+ 0	1.2134	2.18	Q	V
9+ 5	1.2285	2.19	Q	V
9+10	1.2437	2.21	Q	V
9+15	1.2590	2.22	Q	V
9+20	1.2744	2.24	Q	V
9+25	1.2899	2.26	Q	V
9+30	1.3056	2.27	Q	V
9+35	1.3214	2.29	Q	V
9+40	1.3372	2.31	Q	V
9+45	1.3532	2.32	Q	V
9+50	1.3694	2.34	Q	V
9+55	1.3856	2.36	Q	V
10+ 0	1.4020	2.38	Q	V
10+ 5	1.4186	2.40	Q	V
10+10	1.4352	2.42	Q	V
10+15	1.4520	2.44	Q	V
10+20	1.4690	2.46	Q	V
10+25	1.4860	2.48	Q	V
10+30	1.5033	2.50	Q	V
10+35	1.5207	2.52	Q	V
10+40	1.5382	2.55	Q	V
10+45	1.5559	2.57	Q	V

10+50	1.5738	2.59	Q	V			
10+55	1.5918	2.62	Q	V			
11+ 0	1.6100	2.64	Q	V			
11+ 5	1.6284	2.67	Q	V			
11+10	1.6470	2.70	Q	V			
11+15	1.6657	2.72	Q	V			
11+20	1.6847	2.75	Q	V			
11+25	1.7038	2.78	Q	V			
11+30	1.7231	2.81	Q	V			
11+35	1.7427	2.84	Q	V			
11+40	1.7624	2.87	Q	V			
11+45	1.7824	2.90	Q	V			
11+50	1.8026	2.93	Q	V			
11+55	1.8231	2.97	Q	V			
12+ 0	1.8437	3.00	Q	V			
12+ 5	1.8647	3.04	Q	V			
12+10	1.8859	3.09	Q	V			
12+15	1.9076	3.14	Q	V			
12+20	1.9296	3.19	Q	V			
12+25	1.9519	3.24	Q	V			
12+30	1.9745	3.28	Q	V			
12+35	1.9974	3.33	Q	V			
12+40	2.0207	3.38	Q	V			
12+45	2.0443	3.43	Q	V			
12+50	2.0682	3.47	Q	V			
12+55	2.0925	3.53	Q	V			
13+ 0	2.1171	3.58	Q	V			
13+ 5	2.1422	3.64	Q	V			
13+10	2.1676	3.69	Q	V			
13+15	2.1935	3.76	Q	V			
13+20	2.2198	3.82	Q	V			
13+25	2.2466	3.89	Q	V			
13+30	2.2738	3.95	Q	V			
13+35	2.3015	4.03	Q	V			
13+40	2.3298	4.10	Q	V			
13+45	2.3586	4.18	Q	V			
13+50	2.3880	4.27	Q	V			
13+55	2.4180	4.36	Q	V			
14+ 0	2.4487	4.45	Q	V			
14+ 5	2.4800	4.55	Q	V			
14+10	2.5121	4.66	Q	V			
14+15	2.5451	4.78	Q	V			
14+20	2.5788	4.91	Q	V			
14+25	2.6135	5.04	Q	V			
14+30	2.6492	5.18	Q	V			
14+35	2.6859	5.33	Q	V			
14+40	2.7237	5.49	Q	V			
14+45	2.7628	5.67	Q	V			
14+50	2.8032	5.86	Q	V			
14+55	2.8450	6.08	Q	V			

15+ 0	2.8884	6.31	Q		V			
15+ 5	2.9337	6.57	Q		V			
15+10	2.9809	6.86	Q		V			
15+15	3.0305	7.19	Q		V			
15+20	3.0826	7.57	Q		V			
15+25	3.1371	7.92	Q		V			
15+30	3.1913	7.87	Q		V			
15+35	3.2446	7.74	Q		V			
15+40	3.3004	8.11	Q		V			
15+45	3.3611	8.80	Q	Q	V			
15+50	3.4295	9.93	Q	Q	V			
15+55	3.5107	11.80	Q	Q	V			
16+ 0	3.6178	15.55		Q	V			
16+ 5	3.7989	26.30			Q	V		
16+10	4.1868	56.32				V	Q	
16+15	4.6253	63.66					V	Q
16+20	4.8789	36.83			Q		V	
16+25	5.0534	25.33			Q		V	
16+30	5.1885	19.62		Q			V	
16+35	5.3019	16.45		Q			V	
16+40	5.3965	13.74		Q			V	
16+45	5.4789	11.96		Q			V	
16+50	5.5506	10.42		Q			V	
16+55	5.6140	9.19		Q			V	
17+ 0	5.6697	8.09	Q				V	
17+ 5	5.7189	7.14	Q				V	
17+10	5.7651	6.71	Q				V	
17+15	5.8088	6.35	Q				V	
17+20	5.8484	5.75	Q				V	
17+25	5.8849	5.29	Q				V	
17+30	5.9165	4.59	Q				V	
17+35	5.9465	4.37	Q				V	
17+40	5.9753	4.18	Q				V	
17+45	6.0030	4.02	Q				V	
17+50	6.0297	3.87	Q				V	
17+55	6.0555	3.74	Q				V	
18+ 0	6.0804	3.62	Q				V	
18+ 5	6.1045	3.51	Q				V	
18+10	6.1279	3.39	Q				V	
18+15	6.1505	3.28	Q				V	
18+20	6.1725	3.19	Q				V	
18+25	6.1938	3.10	Q				V	
18+30	6.2147	3.03	Q				V	
18+35	6.2350	2.95	Q				V	
18+40	6.2549	2.89	Q				V	
18+45	6.2743	2.82	Q				V	
18+50	6.2933	2.76	Q				V	
18+55	6.3120	2.71	Q				V	
19+ 0	6.3302	2.65	Q				V	
19+ 5	6.3482	2.60	Q				V	

19+10	6.3657	2.55	Q				V
19+15	6.3830	2.51	Q				V
19+20	6.4000	2.47	Q				V
19+25	6.4167	2.42	Q				V
19+30	6.4331	2.38	Q				V
19+35	6.4493	2.35	Q				V
19+40	6.4652	2.31	Q				V
19+45	6.4809	2.28	Q				V
19+50	6.4963	2.24	Q				V
19+55	6.5115	2.21	Q				V
20+ 0	6.5265	2.18	Q				V
20+ 5	6.5413	2.15	Q				V
20+10	6.5559	2.12	Q				V
20+15	6.5703	2.09	Q				V
20+20	6.5846	2.07	Q				V
20+25	6.5986	2.04	Q				V
20+30	6.6125	2.01	Q				V
20+35	6.6262	1.99	Q				V
20+40	6.6397	1.97	Q				V
20+45	6.6531	1.94	Q				V
20+50	6.6664	1.92	Q				V
20+55	6.6794	1.90	Q				V
21+ 0	6.6924	1.88	Q				V
21+ 5	6.7052	1.86	Q				V
21+10	6.7179	1.84	Q				V
21+15	6.7304	1.82	Q				V
21+20	6.7428	1.80	Q				V
21+25	6.7551	1.78	Q				V
21+30	6.7673	1.77	Q				V
21+35	6.7793	1.75	Q				V
21+40	6.7912	1.73	Q				V
21+45	6.8030	1.72	Q				V
21+50	6.8147	1.70	Q				V
21+55	6.8263	1.68	Q				V
22+ 0	6.8378	1.67	Q				V
22+ 5	6.8492	1.65	Q				V
22+10	6.8605	1.64	Q				V
22+15	6.8717	1.63	Q				V
22+20	6.8828	1.61	Q				V
22+25	6.8938	1.60	Q				V
22+30	6.9047	1.58	Q				V
22+35	6.9156	1.57	Q				V
22+40	6.9263	1.56	Q				V
22+45	6.9370	1.55	Q				V
22+50	6.9475	1.53	Q				V
22+55	6.9580	1.52	Q				V
23+ 0	6.9684	1.51	Q				V
23+ 5	6.9787	1.50	Q				V
23+10	6.9890	1.49	Q				V
23+15	6.9992	1.48	Q				V

23+20	7.0093	1.47	Q				V
23+25	7.0193	1.46	Q				V
23+30	7.0293	1.45	Q				V
23+35	7.0392	1.44	Q				V
23+40	7.0490	1.43	Q				V
23+45	7.0587	1.42	Q				V
23+50	7.0684	1.41	Q				V
23+55	7.0780	1.40	Q				V
24+ 0	7.0876	1.39	Q				V

U n i t H y d r o g r a p h A n a l y s i s

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Study date 08/06/22

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San Bernardino County Synthetic Unit Hydrology Method
Manual date - August 1986

Program License Serial Number 6385

IEN
Area B
10-year developed

Storm Event Year = 10

Antecedent Moisture Condition = 2

English (in-lb) Input Units Used

English Rainfall Data (Inches) Input Values Used

English Units used in output format

Area averaged rainfall intensity isohyetal data:

Sub-Area (Ac.)	Duration (hours)	Isohyetal (In)
Rainfall data for year 10		
48.02	1	0.61

Rainfall data for year 10
48.02 6 1.24

Rainfall data for year 10
48.02 24 2.13

++++

***** Area-averaged max loss rate, Fm *****

SCS curve No.(AMCII)	SCS curve NO.(AMC 2)	Area (Ac.)	Area Fraction	Fp(Fig C6) (In/Hr)	Ap (dec.)	Fm (In/Hr)
69.0	69.0	48.02	1.000	0.548	0.100	0.055

Area-averaged adjusted loss rate Fm (In/Hr) = 0.055

***** Area-Averaged low loss rate fraction, Yb *****

Area (Ac.)	Area Fract	SCS CN (AMC2)	SCS CN (AMC2)	S	Pervious Yield Fr
4.80	0.100	69.0	69.0	4.49	0.124
43.22	0.900	98.0	98.0	0.20	0.894

Area-averaged catchment yield fraction, Y = 0.817

Area-averaged low loss fraction, Yb = 0.183

User entry of time of concentration = 0.220 (hours)

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Watershed area = 48.02(Ac.)

Catchment Lag time = 0.176 hours

Unit interval = 5.000 minutes

Unit interval percentage of lag time = 47.4347

Hydrograph baseflow = 0.00(CFS)

Average maximum watershed loss rate(Fm) = 0.055(In/Hr)

Average low loss rate fraction (Yb) = 0.183 (decimal)

DESERT S-Graph Selected

Computed peak 5-minute rainfall = 0.289(In)

Computed peak 30-minute rainfall = 0.495(In)

Specified peak 1-hour rainfall = 0.609(In)

Computed peak 3-hour rainfall = 0.942(In)

Specified peak 6-hour rainfall = 1.240(In)

Specified peak 24-hour rainfall = 2.130(In)

Rainfall depth area reduction factors:

Using a total area of 48.02(Ac.) (Ref: fig. E-4)

5-minute factor = 0.998 Adjusted rainfall = 0.288(In)

30-minute factor = 0.998 Adjusted rainfall = 0.494(In)

1-hour factor = 0.998 Adjusted rainfall = 0.608(In)

3-hour factor = 1.000 Adjusted rainfall = 0.942(In)

6-hour factor = 1.000 Adjusted rainfall = 1.240(In)

24-hour factor = 1.000 Adjusted rainfall = 2.130(In)

U n i t H y d r o g r a p h

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Interval Number	'S' Graph Mean values	Unit Hydrograph ((CFS))

(K = 580.74 (CFS))		
1	3.632	21.094
2	27.477	138.475
3	58.120	177.956
4	71.962	80.389
5	79.999	46.673
6	85.309	30.840
7	89.148	22.291
8	91.848	15.686
9	93.964	12.287
10	95.571	9.334
11	96.810	7.191
12	97.688	5.100
13	98.235	3.179
14	98.784	3.190
15	99.346	3.259
16	99.720	2.176
17	100.000	1.625

Peak Unit Number	Adjusted mass rainfall (In)	Unit rainfall (In)

1	0.2883	0.2883
2	0.3550	0.0666
3	0.4009	0.0459
4	0.4370	0.0361
5	0.4673	0.0303
6	0.4935	0.0263
7	0.5169	0.0234
8	0.5380	0.0211
9	0.5574	0.0194
10	0.5753	0.0179
11	0.5920	0.0167
12	0.6076	0.0157
13	0.6273	0.0197
14	0.6461	0.0188
15	0.6642	0.0180
16	0.6815	0.0173
17	0.6981	0.0167
18	0.7142	0.0161
19	0.7298	0.0156
20	0.7449	0.0151
21	0.7595	0.0146
22	0.7737	0.0142
23	0.7875	0.0138
24	0.8010	0.0135
25	0.8142	0.0131

26	0.8270	0.0128
27	0.8395	0.0125
28	0.8518	0.0123
29	0.8638	0.0120
30	0.8755	0.0118
31	0.8871	0.0115
32	0.8983	0.0113
33	0.9094	0.0111
34	0.9203	0.0109
35	0.9310	0.0107
36	0.9415	0.0105
37	0.9518	0.0103
38	0.9620	0.0101
39	0.9719	0.0100
40	0.9818	0.0098
41	0.9914	0.0097
42	1.0010	0.0095
43	1.0104	0.0094
44	1.0196	0.0093
45	1.0288	0.0091
46	1.0378	0.0090
47	1.0467	0.0089
48	1.0555	0.0088
49	1.0641	0.0087
50	1.0727	0.0086
51	1.0812	0.0085
52	1.0895	0.0084
53	1.0978	0.0083
54	1.1060	0.0082
55	1.1141	0.0081
56	1.1221	0.0080
57	1.1300	0.0079
58	1.1378	0.0078
59	1.1456	0.0077
60	1.1532	0.0077
61	1.1608	0.0076
62	1.1683	0.0075
63	1.1758	0.0074
64	1.1832	0.0074
65	1.1905	0.0073
66	1.1977	0.0072
67	1.2049	0.0072
68	1.2120	0.0071
69	1.2190	0.0070
70	1.2260	0.0070
71	1.2329	0.0069
72	1.2398	0.0069
73	1.2465	0.0067
74	1.2531	0.0066
75	1.2597	0.0066

76	1.2663	0.0065
77	1.2727	0.0065
78	1.2792	0.0064
79	1.2855	0.0064
80	1.2919	0.0063
81	1.2981	0.0063
82	1.3044	0.0062
83	1.3106	0.0062
84	1.3167	0.0061
85	1.3228	0.0061
86	1.3289	0.0061
87	1.3349	0.0060
88	1.3408	0.0060
89	1.3468	0.0059
90	1.3526	0.0059
91	1.3585	0.0058
92	1.3643	0.0058
93	1.3701	0.0058
94	1.3758	0.0057
95	1.3815	0.0057
96	1.3871	0.0057
97	1.3928	0.0056
98	1.3984	0.0056
99	1.4039	0.0056
100	1.4094	0.0055
101	1.4149	0.0055
102	1.4204	0.0055
103	1.4258	0.0054
104	1.4312	0.0054
105	1.4365	0.0054
106	1.4419	0.0053
107	1.4471	0.0053
108	1.4524	0.0053
109	1.4576	0.0052
110	1.4628	0.0052
111	1.4680	0.0052
112	1.4732	0.0051
113	1.4783	0.0051
114	1.4834	0.0051
115	1.4885	0.0051
116	1.4935	0.0050
117	1.4985	0.0050
118	1.5035	0.0050
119	1.5084	0.0050
120	1.5134	0.0049
121	1.5183	0.0049
122	1.5232	0.0049
123	1.5280	0.0049
124	1.5329	0.0048
125	1.5377	0.0048

126	1.5425	0.0048
127	1.5472	0.0048
128	1.5520	0.0047
129	1.5567	0.0047
130	1.5614	0.0047
131	1.5661	0.0047
132	1.5707	0.0047
133	1.5754	0.0046
134	1.5800	0.0046
135	1.5846	0.0046
136	1.5892	0.0046
137	1.5937	0.0046
138	1.5982	0.0045
139	1.6027	0.0045
140	1.6072	0.0045
141	1.6117	0.0045
142	1.6162	0.0045
143	1.6206	0.0044
144	1.6250	0.0044
145	1.6294	0.0044
146	1.6338	0.0044
147	1.6381	0.0044
148	1.6425	0.0043
149	1.6468	0.0043
150	1.6511	0.0043
151	1.6554	0.0043
152	1.6597	0.0043
153	1.6639	0.0043
154	1.6682	0.0042
155	1.6724	0.0042
156	1.6766	0.0042
157	1.6808	0.0042
158	1.6849	0.0042
159	1.6891	0.0042
160	1.6932	0.0041
161	1.6973	0.0041
162	1.7015	0.0041
163	1.7055	0.0041
164	1.7096	0.0041
165	1.7137	0.0041
166	1.7177	0.0040
167	1.7218	0.0040
168	1.7258	0.0040
169	1.7298	0.0040
170	1.7338	0.0040
171	1.7377	0.0040
172	1.7417	0.0040
173	1.7457	0.0039
174	1.7496	0.0039
175	1.7535	0.0039

176	1.7574	0.0039
177	1.7613	0.0039
178	1.7652	0.0039
179	1.7690	0.0039
180	1.7729	0.0039
181	1.7767	0.0038
182	1.7806	0.0038
183	1.7844	0.0038
184	1.7882	0.0038
185	1.7919	0.0038
186	1.7957	0.0038
187	1.7995	0.0038
188	1.8032	0.0037
189	1.8070	0.0037
190	1.8107	0.0037
191	1.8144	0.0037
192	1.8181	0.0037
193	1.8218	0.0037
194	1.8255	0.0037
195	1.8292	0.0037
196	1.8328	0.0037
197	1.8365	0.0036
198	1.8401	0.0036
199	1.8437	0.0036
200	1.8473	0.0036
201	1.8509	0.0036
202	1.8545	0.0036
203	1.8581	0.0036
204	1.8617	0.0036
205	1.8652	0.0036
206	1.8688	0.0035
207	1.8723	0.0035
208	1.8758	0.0035
209	1.8793	0.0035
210	1.8828	0.0035
211	1.8863	0.0035
212	1.8898	0.0035
213	1.8933	0.0035
214	1.8968	0.0035
215	1.9002	0.0035
216	1.9037	0.0034
217	1.9071	0.0034
218	1.9105	0.0034
219	1.9139	0.0034
220	1.9173	0.0034
221	1.9207	0.0034
222	1.9241	0.0034
223	1.9275	0.0034
224	1.9309	0.0034
225	1.9342	0.0034

226	1.9376	0.0034
227	1.9409	0.0033
228	1.9443	0.0033
229	1.9476	0.0033
230	1.9509	0.0033
231	1.9542	0.0033
232	1.9575	0.0033
233	1.9608	0.0033
234	1.9641	0.0033
235	1.9673	0.0033
236	1.9706	0.0033
237	1.9739	0.0033
238	1.9771	0.0032
239	1.9803	0.0032
240	1.9836	0.0032
241	1.9868	0.0032
242	1.9900	0.0032
243	1.9932	0.0032
244	1.9964	0.0032
245	1.9996	0.0032
246	2.0028	0.0032
247	2.0060	0.0032
248	2.0091	0.0032
249	2.0123	0.0032
250	2.0154	0.0032
251	2.0186	0.0031
252	2.0217	0.0031
253	2.0248	0.0031
254	2.0280	0.0031
255	2.0311	0.0031
256	2.0342	0.0031
257	2.0373	0.0031
258	2.0404	0.0031
259	2.0434	0.0031
260	2.0465	0.0031
261	2.0496	0.0031
262	2.0526	0.0031
263	2.0557	0.0031
264	2.0588	0.0030
265	2.0618	0.0030
266	2.0648	0.0030
267	2.0679	0.0030
268	2.0709	0.0030
269	2.0739	0.0030
270	2.0769	0.0030
271	2.0799	0.0030
272	2.0829	0.0030
273	2.0859	0.0030
274	2.0888	0.0030
275	2.0918	0.0030

276	2.0948	0.0030
277	2.0977	0.0030
278	2.1007	0.0030
279	2.1036	0.0029
280	2.1066	0.0029
281	2.1095	0.0029
282	2.1124	0.0029
283	2.1154	0.0029
284	2.1183	0.0029
285	2.1212	0.0029
286	2.1241	0.0029
287	2.1270	0.0029
288	2.1299	0.0029

Unit Period (number)	Unit Rainfall (In)	Unit Soil-Loss (In)	Effective Rainfall (In)
1	0.0029	0.0005	0.0024
2	0.0029	0.0005	0.0024
3	0.0029	0.0005	0.0024
4	0.0029	0.0005	0.0024
5	0.0029	0.0005	0.0024
6	0.0029	0.0005	0.0024
7	0.0029	0.0005	0.0024
8	0.0030	0.0005	0.0024
9	0.0030	0.0005	0.0024
10	0.0030	0.0005	0.0024
11	0.0030	0.0005	0.0024
12	0.0030	0.0005	0.0024
13	0.0030	0.0006	0.0025
14	0.0030	0.0006	0.0025
15	0.0030	0.0006	0.0025
16	0.0030	0.0006	0.0025
17	0.0030	0.0006	0.0025
18	0.0031	0.0006	0.0025
19	0.0031	0.0006	0.0025
20	0.0031	0.0006	0.0025
21	0.0031	0.0006	0.0025
22	0.0031	0.0006	0.0025
23	0.0031	0.0006	0.0025
24	0.0031	0.0006	0.0025
25	0.0031	0.0006	0.0026
26	0.0031	0.0006	0.0026
27	0.0032	0.0006	0.0026
28	0.0032	0.0006	0.0026
29	0.0032	0.0006	0.0026
30	0.0032	0.0006	0.0026
31	0.0032	0.0006	0.0026
32	0.0032	0.0006	0.0026

33	0.0032	0.0006	0.0026
34	0.0032	0.0006	0.0026
35	0.0033	0.0006	0.0027
36	0.0033	0.0006	0.0027
37	0.0033	0.0006	0.0027
38	0.0033	0.0006	0.0027
39	0.0033	0.0006	0.0027
40	0.0033	0.0006	0.0027
41	0.0033	0.0006	0.0027
42	0.0033	0.0006	0.0027
43	0.0034	0.0006	0.0027
44	0.0034	0.0006	0.0028
45	0.0034	0.0006	0.0028
46	0.0034	0.0006	0.0028
47	0.0034	0.0006	0.0028
48	0.0034	0.0006	0.0028
49	0.0034	0.0006	0.0028
50	0.0035	0.0006	0.0028
51	0.0035	0.0006	0.0028
52	0.0035	0.0006	0.0028
53	0.0035	0.0006	0.0029
54	0.0035	0.0006	0.0029
55	0.0035	0.0006	0.0029
56	0.0035	0.0007	0.0029
57	0.0036	0.0007	0.0029
58	0.0036	0.0007	0.0029
59	0.0036	0.0007	0.0029
60	0.0036	0.0007	0.0029
61	0.0036	0.0007	0.0030
62	0.0036	0.0007	0.0030
63	0.0037	0.0007	0.0030
64	0.0037	0.0007	0.0030
65	0.0037	0.0007	0.0030
66	0.0037	0.0007	0.0030
67	0.0037	0.0007	0.0031
68	0.0037	0.0007	0.0031
69	0.0038	0.0007	0.0031
70	0.0038	0.0007	0.0031
71	0.0038	0.0007	0.0031
72	0.0038	0.0007	0.0031
73	0.0039	0.0007	0.0031
74	0.0039	0.0007	0.0032
75	0.0039	0.0007	0.0032
76	0.0039	0.0007	0.0032
77	0.0039	0.0007	0.0032
78	0.0039	0.0007	0.0032
79	0.0040	0.0007	0.0032
80	0.0040	0.0007	0.0033
81	0.0040	0.0007	0.0033
82	0.0040	0.0007	0.0033

83	0.0041	0.0007	0.0033
84	0.0041	0.0007	0.0033
85	0.0041	0.0008	0.0034
86	0.0041	0.0008	0.0034
87	0.0042	0.0008	0.0034
88	0.0042	0.0008	0.0034
89	0.0042	0.0008	0.0034
90	0.0042	0.0008	0.0034
91	0.0043	0.0008	0.0035
92	0.0043	0.0008	0.0035
93	0.0043	0.0008	0.0035
94	0.0043	0.0008	0.0035
95	0.0044	0.0008	0.0036
96	0.0044	0.0008	0.0036
97	0.0044	0.0008	0.0036
98	0.0044	0.0008	0.0036
99	0.0045	0.0008	0.0037
100	0.0045	0.0008	0.0037
101	0.0045	0.0008	0.0037
102	0.0046	0.0008	0.0037
103	0.0046	0.0008	0.0037
104	0.0046	0.0008	0.0038
105	0.0047	0.0009	0.0038
106	0.0047	0.0009	0.0038
107	0.0047	0.0009	0.0039
108	0.0047	0.0009	0.0039
109	0.0048	0.0009	0.0039
110	0.0048	0.0009	0.0039
111	0.0049	0.0009	0.0040
112	0.0049	0.0009	0.0040
113	0.0049	0.0009	0.0040
114	0.0050	0.0009	0.0041
115	0.0050	0.0009	0.0041
116	0.0050	0.0009	0.0041
117	0.0051	0.0009	0.0042
118	0.0051	0.0009	0.0042
119	0.0052	0.0009	0.0042
120	0.0052	0.0010	0.0043
121	0.0053	0.0010	0.0043
122	0.0053	0.0010	0.0043
123	0.0054	0.0010	0.0044
124	0.0054	0.0010	0.0044
125	0.0055	0.0010	0.0045
126	0.0055	0.0010	0.0045
127	0.0056	0.0010	0.0045
128	0.0056	0.0010	0.0046
129	0.0057	0.0010	0.0046
130	0.0057	0.0010	0.0047
131	0.0058	0.0011	0.0047
132	0.0058	0.0011	0.0047

133	0.0059	0.0011	0.0048
134	0.0059	0.0011	0.0048
135	0.0060	0.0011	0.0049
136	0.0061	0.0011	0.0049
137	0.0061	0.0011	0.0050
138	0.0062	0.0011	0.0051
139	0.0063	0.0012	0.0051
140	0.0063	0.0012	0.0052
141	0.0064	0.0012	0.0052
142	0.0065	0.0012	0.0053
143	0.0066	0.0012	0.0054
144	0.0066	0.0012	0.0054
145	0.0069	0.0013	0.0056
146	0.0069	0.0013	0.0057
147	0.0070	0.0013	0.0058
148	0.0071	0.0013	0.0058
149	0.0072	0.0013	0.0059
150	0.0073	0.0013	0.0060
151	0.0074	0.0014	0.0061
152	0.0075	0.0014	0.0061
153	0.0077	0.0014	0.0063
154	0.0077	0.0014	0.0063
155	0.0079	0.0015	0.0065
156	0.0080	0.0015	0.0065
157	0.0082	0.0015	0.0067
158	0.0083	0.0015	0.0068
159	0.0085	0.0016	0.0069
160	0.0086	0.0016	0.0070
161	0.0088	0.0016	0.0072
162	0.0089	0.0016	0.0073
163	0.0091	0.0017	0.0075
164	0.0093	0.0017	0.0076
165	0.0095	0.0017	0.0078
166	0.0097	0.0018	0.0079
167	0.0100	0.0018	0.0081
168	0.0101	0.0019	0.0083
169	0.0105	0.0019	0.0086
170	0.0107	0.0020	0.0087
171	0.0111	0.0020	0.0091
172	0.0113	0.0021	0.0092
173	0.0118	0.0022	0.0096
174	0.0120	0.0022	0.0098
175	0.0125	0.0023	0.0102
176	0.0128	0.0024	0.0105
177	0.0135	0.0025	0.0110
178	0.0138	0.0025	0.0113
179	0.0146	0.0027	0.0119
180	0.0151	0.0028	0.0123
181	0.0161	0.0030	0.0131
182	0.0167	0.0031	0.0136

183	0.0180	0.0033	0.0147
184	0.0188	0.0034	0.0154
185	0.0157	0.0029	0.0128
186	0.0167	0.0031	0.0136
187	0.0194	0.0035	0.0158
188	0.0211	0.0039	0.0173
189	0.0263	0.0046	0.0217
190	0.0303	0.0046	0.0257
191	0.0459	0.0046	0.0413
192	0.0666	0.0046	0.0621
193	0.2883	0.0046	0.2838
194	0.0361	0.0046	0.0316
195	0.0234	0.0043	0.0191
196	0.0179	0.0033	0.0146
197	0.0197	0.0036	0.0161
198	0.0173	0.0032	0.0141
199	0.0156	0.0029	0.0127
200	0.0142	0.0026	0.0116
201	0.0131	0.0024	0.0107
202	0.0123	0.0022	0.0100
203	0.0115	0.0021	0.0094
204	0.0109	0.0020	0.0089
205	0.0103	0.0019	0.0084
206	0.0098	0.0018	0.0080
207	0.0094	0.0017	0.0077
208	0.0090	0.0017	0.0074
209	0.0087	0.0016	0.0071
210	0.0084	0.0015	0.0068
211	0.0081	0.0015	0.0066
212	0.0078	0.0014	0.0064
213	0.0076	0.0014	0.0062
214	0.0074	0.0014	0.0060
215	0.0072	0.0013	0.0059
216	0.0070	0.0013	0.0057
217	0.0067	0.0012	0.0055
218	0.0065	0.0012	0.0053
219	0.0064	0.0012	0.0052
220	0.0062	0.0011	0.0051
221	0.0061	0.0011	0.0050
222	0.0060	0.0011	0.0049
223	0.0058	0.0011	0.0048
224	0.0057	0.0011	0.0047
225	0.0056	0.0010	0.0046
226	0.0055	0.0010	0.0045
227	0.0054	0.0010	0.0044
228	0.0053	0.0010	0.0043
229	0.0052	0.0010	0.0043
230	0.0051	0.0009	0.0042
231	0.0051	0.0009	0.0041
232	0.0050	0.0009	0.0041

233	0.0049	0.0009	0.0040
234	0.0048	0.0009	0.0040
235	0.0048	0.0009	0.0039
236	0.0047	0.0009	0.0038
237	0.0046	0.0008	0.0038
238	0.0046	0.0008	0.0037
239	0.0045	0.0008	0.0037
240	0.0045	0.0008	0.0036
241	0.0044	0.0008	0.0036
242	0.0043	0.0008	0.0035
243	0.0043	0.0008	0.0035
244	0.0042	0.0008	0.0035
245	0.0042	0.0008	0.0034
246	0.0041	0.0008	0.0034
247	0.0041	0.0008	0.0033
248	0.0040	0.0007	0.0033
249	0.0040	0.0007	0.0033
250	0.0040	0.0007	0.0032
251	0.0039	0.0007	0.0032
252	0.0039	0.0007	0.0032
253	0.0038	0.0007	0.0031
254	0.0038	0.0007	0.0031
255	0.0038	0.0007	0.0031
256	0.0037	0.0007	0.0030
257	0.0037	0.0007	0.0030
258	0.0037	0.0007	0.0030
259	0.0036	0.0007	0.0030
260	0.0036	0.0007	0.0029
261	0.0036	0.0007	0.0029
262	0.0035	0.0006	0.0029
263	0.0035	0.0006	0.0029
264	0.0035	0.0006	0.0028
265	0.0034	0.0006	0.0028
266	0.0034	0.0006	0.0028
267	0.0034	0.0006	0.0028
268	0.0034	0.0006	0.0027
269	0.0033	0.0006	0.0027
270	0.0033	0.0006	0.0027
271	0.0033	0.0006	0.0027
272	0.0032	0.0006	0.0027
273	0.0032	0.0006	0.0026
274	0.0032	0.0006	0.0026
275	0.0032	0.0006	0.0026
276	0.0032	0.0006	0.0026
277	0.0031	0.0006	0.0026
278	0.0031	0.0006	0.0025
279	0.0031	0.0006	0.0025
280	0.0031	0.0006	0.0025
281	0.0030	0.0006	0.0025
282	0.0030	0.0006	0.0025

283	0.0030	0.0005	0.0024
284	0.0030	0.0005	0.0024
285	0.0030	0.0005	0.0024
286	0.0029	0.0005	0.0024
287	0.0029	0.0005	0.0024
288	0.0029	0.0005	0.0024

Total soil rain loss = 0.33(In)
Total effective rainfall = 1.80(In)
Peak flow rate in flood hydrograph = 64.41(CFS)

++++
24 - H O U R S T O R M
R u n o f f H y d r o g r a p h

Hydrograph in 5 Minute intervals ((CFS))

Time(h+m)	Volume Ac.Ft	Q(CFS)	0	17.5	35.0	52.5	70.0
0+ 5	0.0003	0.05	Q				
0+10	0.0029	0.38	Q				
0+15	0.0084	0.80	Q				
0+20	0.0152	0.99	Q				
0+25	0.0228	1.10	Q				
0+30	0.0310	1.18	Q				
0+35	0.0395	1.24	Q				
0+40	0.0483	1.28	Q				
0+45	0.0573	1.31	Q				
0+50	0.0665	1.34	Q				
0+55	0.0758	1.36	Q				
1+ 0	0.0853	1.37	Q				
1+ 5	0.0948	1.39	Q				
1+10	0.1045	1.40	Q				
1+15	0.1142	1.41	Q				
1+20	0.1240	1.42	Q				
1+25	0.1338	1.43	Q				
1+30	0.1437	1.43	Q				
1+35	0.1536	1.44	Q				
1+40	0.1635	1.44	Q				
1+45	0.1735	1.45	Q				
1+50	0.1835	1.45	QV				
1+55	0.1936	1.46	QV				
2+ 0	0.2037	1.46	QV				
2+ 5	0.2138	1.47	QV				
2+10	0.2239	1.47	QV				
2+15	0.2341	1.48	QV				
2+20	0.2444	1.49	QV				
2+25	0.2546	1.49	QV				

2+30	0.2649	1.50	QV
2+35	0.2753	1.50	QV
2+40	0.2857	1.51	QV
2+45	0.2961	1.51	QV
2+50	0.3065	1.52	QV
2+55	0.3170	1.52	QV
3+ 0	0.3276	1.53	QV
3+ 5	0.3382	1.54	QV
3+10	0.3488	1.54	QV
3+15	0.3595	1.55	QV
3+20	0.3702	1.55	Q V
3+25	0.3809	1.56	Q V
3+30	0.3917	1.57	Q V
3+35	0.4025	1.57	Q V
3+40	0.4134	1.58	Q V
3+45	0.4243	1.59	Q V
3+50	0.4353	1.59	Q V
3+55	0.4463	1.60	Q V
4+ 0	0.4573	1.60	Q V
4+ 5	0.4684	1.61	Q V
4+10	0.4796	1.62	Q V
4+15	0.4908	1.63	Q V
4+20	0.5020	1.63	Q V
4+25	0.5133	1.64	Q V
4+30	0.5246	1.65	Q V
4+35	0.5360	1.65	Q V
4+40	0.5475	1.66	Q V
4+45	0.5589	1.67	Q V
4+50	0.5705	1.67	Q V
4+55	0.5821	1.68	Q V
5+ 0	0.5937	1.69	Q V
5+ 5	0.6054	1.70	Q V
5+10	0.6171	1.71	Q V
5+15	0.6289	1.71	Q V
5+20	0.6408	1.72	Q V
5+25	0.6527	1.73	Q V
5+30	0.6647	1.74	Q V
5+35	0.6767	1.75	Q V
5+40	0.6888	1.75	Q V
5+45	0.7009	1.76	Q V
5+50	0.7131	1.77	Q V
5+55	0.7253	1.78	Q V
6+ 0	0.7377	1.79	Q V
6+ 5	0.7500	1.80	Q V
6+10	0.7625	1.81	Q V
6+15	0.7750	1.81	Q V
6+20	0.7875	1.82	Q V
6+25	0.8002	1.83	Q V
6+30	0.8129	1.84	Q V
6+35	0.8256	1.85	Q V

6+40	0.8384	1.86	Q	V
6+45	0.8513	1.87	Q	V
6+50	0.8643	1.88	Q	V
6+55	0.8773	1.89	Q	V
7+ 0	0.8904	1.90	Q	V
7+ 5	0.9036	1.91	Q	V
7+10	0.9168	1.92	Q	V
7+15	0.9302	1.93	Q	V
7+20	0.9436	1.95	Q	V
7+25	0.9570	1.96	Q	V
7+30	0.9706	1.97	Q	V
7+35	0.9842	1.98	Q	V
7+40	0.9979	1.99	Q	V
7+45	1.0117	2.00	Q	V
7+50	1.0256	2.01	Q	V
7+55	1.0395	2.03	Q	V
8+ 0	1.0536	2.04	Q	V
8+ 5	1.0677	2.05	Q	V
8+10	1.0819	2.06	Q	V
8+15	1.0962	2.08	Q	V
8+20	1.1106	2.09	Q	V
8+25	1.1251	2.10	Q	V
8+30	1.1397	2.12	Q	V
8+35	1.1544	2.13	Q	V
8+40	1.1692	2.15	Q	V
8+45	1.1840	2.16	Q	V
8+50	1.1990	2.17	Q	V
8+55	1.2141	2.19	Q	V
9+ 0	1.2293	2.20	Q	V
9+ 5	1.2446	2.22	Q	V
9+10	1.2600	2.24	Q	V
9+15	1.2755	2.25	Q	V
9+20	1.2911	2.27	Q	V
9+25	1.3068	2.28	Q	V
9+30	1.3227	2.30	Q	V
9+35	1.3386	2.32	Q	V
9+40	1.3547	2.34	Q	V
9+45	1.3709	2.35	Q	V
9+50	1.3873	2.37	Q	V
9+55	1.4038	2.39	Q	V
10+ 0	1.4204	2.41	Q	V
10+ 5	1.4371	2.43	Q	V
10+10	1.4540	2.45	Q	V
10+15	1.4710	2.47	Q	V
10+20	1.4882	2.49	Q	V
10+25	1.5055	2.51	Q	V
10+30	1.5229	2.54	Q	V
10+35	1.5406	2.56	Q	V
10+40	1.5583	2.58	Q	V
10+45	1.5763	2.60	Q	V

10+50	1.5944	2.63	Q	V			
10+55	1.6126	2.65	Q	V			
11+ 0	1.6311	2.68	Q	V			
11+ 5	1.6497	2.70	Q	V			
11+10	1.6685	2.73	Q	V			
11+15	1.6875	2.76	Q	V			
11+20	1.7067	2.79	Q	V			
11+25	1.7261	2.81	Q	V			
11+30	1.7457	2.84	Q	V			
11+35	1.7655	2.87	Q	V			
11+40	1.7855	2.91	Q	V			
11+45	1.8057	2.94	Q	V			
11+50	1.8262	2.97	Q	V			
11+55	1.8469	3.01	Q	V			
12+ 0	1.8678	3.04	Q	V			
12+ 5	1.8890	3.08	Q	V			
12+10	1.9106	3.13	Q	V			
12+15	1.9325	3.19	Q	V			
12+20	1.9548	3.23	Q	V			
12+25	1.9774	3.28	Q	V			
12+30	2.0003	3.33	Q	V			
12+35	2.0235	3.37	Q	V			
12+40	2.0471	3.42	Q	V			
12+45	2.0710	3.47	Q	V			
12+50	2.0952	3.52	Q	V			
12+55	2.1198	3.57	Q	V			
13+ 0	2.1448	3.63	Q	V			
13+ 5	2.1702	3.68	Q	V			
13+10	2.1960	3.74	Q	V			
13+15	2.2222	3.81	Q	V			
13+20	2.2488	3.87	Q	V			
13+25	2.2759	3.94	Q	V			
13+30	2.3035	4.01	Q	V			
13+35	2.3316	4.08	Q	V			
13+40	2.3603	4.16	Q	V			
13+45	2.3895	4.24	Q	V			
13+50	2.4192	4.32	Q	V			
13+55	2.4496	4.41	Q	V			
14+ 0	2.4807	4.51	Q	V			
14+ 5	2.5125	4.61	Q	V			
14+10	2.5450	4.72	Q	V			
14+15	2.5784	4.85	Q	V			
14+20	2.6126	4.97	Q	V			
14+25	2.6478	5.11	Q	V			
14+30	2.6839	5.25	Q	V			
14+35	2.7211	5.40	Q	V			
14+40	2.7594	5.57	Q	V			
14+45	2.7990	5.75	Q	V			
14+50	2.8399	5.94	Q	V			
14+55	2.8823	6.16	Q	V			

15+ 0	2.9264	6.39	Q		V			
15+ 5	2.9722	6.66	Q		V			
15+10	3.0201	6.95	Q		V			
15+15	3.0703	7.29	Q		V			
15+20	3.1231	7.67	Q		V			
15+25	3.1784	8.02	Q		V			
15+30	3.2333	7.97	Q		V			
15+35	3.2873	7.84	Q		V			
15+40	3.3439	8.22	Q		V			
15+45	3.4054	8.93	Q		V			
15+50	3.4747	10.07	Q		V			
15+55	3.5572	11.98	Q		V			
16+ 0	3.6660	15.79		Q		V		
16+ 5	3.8503	26.75			Q	V		
16+10	4.2461	57.47				V		Q
16+15	4.6897	64.41					V	Q
16+20	4.9457	37.18			Q		V	
16+25	5.1219	25.58			Q		V	
16+30	5.2584	19.83		Q			V	
16+35	5.3728	16.61		Q			V	
16+40	5.4685	13.89			Q		V	
16+45	5.5516	12.07					V	
16+50	5.6241	10.52					V	
16+55	5.6880	9.28					V	
17+ 0	5.7442	8.16		Q			V	
17+ 5	5.7938	7.21		Q			V	
17+10	5.8406	6.79		Q			V	
17+15	5.8848	6.42		Q			V	
17+20	5.9247	5.79		Q			V	
17+25	5.9612	5.31		Q			V	
17+30	5.9932	4.64	Q				V	
17+35	6.0236	4.42	Q				V	
17+40	6.0528	4.23	Q				V	
17+45	6.0808	4.07	Q				V	
17+50	6.1078	3.92	Q				V	
17+55	6.1339	3.79	Q				V	
18+ 0	6.1591	3.66	Q				V	
18+ 5	6.1835	3.55	Q				V	
18+10	6.2072	3.43	Q				V	
18+15	6.2301	3.32	Q				V	
18+20	6.2523	3.23	Q				V	
18+25	6.2739	3.14	Q				V	
18+30	6.2950	3.06	Q				V	
18+35	6.3156	2.99	Q				V	
18+40	6.3357	2.92	Q				V	
18+45	6.3554	2.86	Q				V	
18+50	6.3746	2.80	Q				V	
18+55	6.3935	2.74	Q				V	
19+ 0	6.4120	2.69	Q				V	
19+ 5	6.4302	2.63	Q				V	

19+10	6.4480	2.59	Q				V
19+15	6.4655	2.54	Q				V
19+20	6.4827	2.50	Q				V
19+25	6.4996	2.45	Q				V
19+30	6.5162	2.41	Q				V
19+35	6.5325	2.38	Q				V
19+40	6.5487	2.34	Q				V
19+45	6.5645	2.30	Q				V
19+50	6.5802	2.27	Q				V
19+55	6.5956	2.24	Q				V
20+ 0	6.6108	2.21	Q				V
20+ 5	6.6258	2.18	Q				V
20+10	6.6405	2.15	Q				V
20+15	6.6551	2.12	Q				V
20+20	6.6695	2.09	Q				V
20+25	6.6838	2.07	Q				V
20+30	6.6978	2.04	Q				V
20+35	6.7117	2.02	Q				V
20+40	6.7254	1.99	Q				V
20+45	6.7390	1.97	Q				V
20+50	6.7524	1.95	Q				V
20+55	6.7656	1.92	Q				V
21+ 0	6.7787	1.90	Q				V
21+ 5	6.7917	1.88	Q				V
21+10	6.8045	1.86	Q				V
21+15	6.8172	1.84	Q				V
21+20	6.8298	1.82	Q				V
21+25	6.8422	1.81	Q				V
21+30	6.8545	1.79	Q				V
21+35	6.8667	1.77	Q				V
21+40	6.8788	1.75	Q				V
21+45	6.8908	1.74	Q				V
21+50	6.9026	1.72	Q				V
21+55	6.9144	1.71	Q				V
22+ 0	6.9260	1.69	Q				V
22+ 5	6.9375	1.68	Q				V
22+10	6.9490	1.66	Q				V
22+15	6.9603	1.65	Q				V
22+20	6.9716	1.63	Q				V
22+25	6.9827	1.62	Q				V
22+30	6.9938	1.61	Q				V
22+35	7.0047	1.59	Q				V
22+40	7.0156	1.58	Q				V
22+45	7.0264	1.57	Q				V
22+50	7.0371	1.55	Q				V
22+55	7.0477	1.54	Q				V
23+ 0	7.0583	1.53	Q				V
23+ 5	7.0687	1.52	Q				V
23+10	7.0791	1.51	Q				V
23+15	7.0894	1.50	Q				V

23+20	7.0996	1.49	Q				V
23+25	7.1098	1.47	Q				V
23+30	7.1199	1.46	Q				V
23+35	7.1299	1.45	Q				V
23+40	7.1398	1.44	Q				V
23+45	7.1497	1.43	Q				V
23+50	7.1595	1.42	Q				V
23+55	7.1693	1.41	Q				V
24+ 0	7.1789	1.41	Q				V

U n i t H y d r o g r a p h A n a l y s i s

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Study date 08/06/22

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San Bernardino County Synthetic Unit Hydrology Method
Manual date - August 1986

Program License Serial Number 6385

IEN
Area C
10-year Developed

Storm Event Year = 10

Antecedent Moisture Condition = 2

English (in-lb) Input Units Used

English Rainfall Data (Inches) Input Values Used

English Units used in output format

Area averaged rainfall intensity isohyetal data:

Sub-Area (Ac.)	Duration (hours)	Isohyetal (In)
Rainfall data for year 10		
38.57	1	0.61

Rainfall data for year 10		
38.57	6	1.24

Rainfall data for year 10		
38.57	24	2.13

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***** Area-averaged max loss rate, Fm *****

SCS curve No.(AMCII)	SCS curve NO.(AMC 2)	Area (Ac.)	Area Fraction	Fp(Fig C6) (In/Hr)	Ap (dec.)	Fm (In/Hr)
69.0	69.0	38.57	1.000	0.548	0.100	0.055

Area-averaged adjusted loss rate Fm (In/Hr) = 0.055

***** Area-Averaged low loss rate fraction, Yb *****

Area (Ac.)	Area Fract	SCS CN (AMC2)	SCS CN (AMC2)	S	Pervious Yield Fr
3.86	0.100	69.0	69.0	4.49	0.124
34.71	0.900	98.0	98.0	0.20	0.894

Area-averaged catchment yield fraction, Y = 0.817

Area-averaged low loss fraction, Yb = 0.183

User entry of time of concentration = 0.208 (hours)

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Watershed area = 38.57(Ac.)

Catchment Lag time = 0.166 hours

Unit interval = 5.000 minutes

Unit interval percentage of lag time = 50.0801

Hydrograph baseflow = 0.00(CFS)

Average maximum watershed loss rate(Fm) = 0.055(In/Hr)

Average low loss rate fraction (Yb) = 0.183 (decimal)

DESERT S-Graph Selected

Computed peak 5-minute rainfall = 0.289(In)

Computed peak 30-minute rainfall = 0.495(In)

Specified peak 1-hour rainfall = 0.609(In)

Computed peak 3-hour rainfall = 0.942(In)

Specified peak 6-hour rainfall = 1.240(In)

Specified peak 24-hour rainfall = 2.130(In)

Rainfall depth area reduction factors:

Using a total area of 38.57(Ac.) (Ref: fig. E-4)

5-minute factor = 0.998 Adjusted rainfall = 0.288(In)

30-minute factor = 0.998 Adjusted rainfall = 0.494(In)

1-hour factor = 0.998 Adjusted rainfall = 0.608(In)

3-hour factor = 1.000 Adjusted rainfall = 0.942(In)

6-hour factor = 1.000 Adjusted rainfall = 1.240(In)

24-hour factor = 1.000 Adjusted rainfall = 2.130(In)

U n i t H y d r o g r a p h

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Interval Number	'S' Graph Mean values	Unit Hydrograph ((CFS))

(K = 466.46 (CFS))		
1	3.973	18.532
2	30.607	124.236
3	60.634	140.065
4	73.829	61.548
5	81.493	35.748
6	86.639	24.002
7	90.205	16.637
8	92.803	12.116
9	94.773	9.192
10	96.270	6.981
11	97.365	5.109
12	98.059	3.238
13	98.612	2.579
14	99.213	2.803
15	99.664	2.102
16	100.000	1.570

Peak Unit Number	Adjusted mass rainfall (In)	Unit rainfall (In)

1	0.2885	0.2885
2	0.3551	0.0667
3	0.4011	0.0459
4	0.4372	0.0362
5	0.4675	0.0303
6	0.4938	0.0263
7	0.5171	0.0234
8	0.5383	0.0211
9	0.5576	0.0194
10	0.5755	0.0179
11	0.5922	0.0167
12	0.6079	0.0157
13	0.6276	0.0197
14	0.6464	0.0188
15	0.6644	0.0180
16	0.6817	0.0173
17	0.6984	0.0167
18	0.7144	0.0161
19	0.7300	0.0156
20	0.7451	0.0151
21	0.7597	0.0146
22	0.7739	0.0142
23	0.7877	0.0138
24	0.8012	0.0135
25	0.8143	0.0131
26	0.8271	0.0128

27	0.8397	0.0125
28	0.8519	0.0123
29	0.8639	0.0120
30	0.8756	0.0117
31	0.8871	0.0115
32	0.8984	0.0113
33	0.9095	0.0111
34	0.9204	0.0109
35	0.9311	0.0107
36	0.9416	0.0105
37	0.9519	0.0103
38	0.9620	0.0101
39	0.9720	0.0100
40	0.9818	0.0098
41	0.9915	0.0097
42	1.0010	0.0095
43	1.0104	0.0094
44	1.0197	0.0093
45	1.0288	0.0091
46	1.0378	0.0090
47	1.0467	0.0089
48	1.0555	0.0088
49	1.0642	0.0087
50	1.0728	0.0086
51	1.0812	0.0085
52	1.0896	0.0084
53	1.0979	0.0083
54	1.1060	0.0082
55	1.1141	0.0081
56	1.1221	0.0080
57	1.1300	0.0079
58	1.1379	0.0078
59	1.1456	0.0077
60	1.1533	0.0077
61	1.1609	0.0076
62	1.1684	0.0075
63	1.1758	0.0074
64	1.1832	0.0074
65	1.1905	0.0073
66	1.1978	0.0072
67	1.2049	0.0072
68	1.2120	0.0071
69	1.2191	0.0070
70	1.2261	0.0070
71	1.2330	0.0069
72	1.2399	0.0069
73	1.2465	0.0067
74	1.2532	0.0066
75	1.2598	0.0066
76	1.2663	0.0065

77	1.2728	0.0065
78	1.2792	0.0064
79	1.2856	0.0064
80	1.2919	0.0063
81	1.2982	0.0063
82	1.3044	0.0062
83	1.3106	0.0062
84	1.3167	0.0061
85	1.3228	0.0061
86	1.3289	0.0061
87	1.3349	0.0060
88	1.3409	0.0060
89	1.3468	0.0059
90	1.3527	0.0059
91	1.3585	0.0058
92	1.3643	0.0058
93	1.3701	0.0058
94	1.3758	0.0057
95	1.3815	0.0057
96	1.3872	0.0057
97	1.3928	0.0056
98	1.3984	0.0056
99	1.4039	0.0056
100	1.4095	0.0055
101	1.4149	0.0055
102	1.4204	0.0055
103	1.4258	0.0054
104	1.4312	0.0054
105	1.4366	0.0054
106	1.4419	0.0053
107	1.4472	0.0053
108	1.4524	0.0053
109	1.4577	0.0052
110	1.4629	0.0052
111	1.4681	0.0052
112	1.4732	0.0051
113	1.4783	0.0051
114	1.4834	0.0051
115	1.4885	0.0051
116	1.4935	0.0050
117	1.4985	0.0050
118	1.5035	0.0050
119	1.5085	0.0050
120	1.5134	0.0049
121	1.5183	0.0049
122	1.5232	0.0049
123	1.5281	0.0049
124	1.5329	0.0048
125	1.5377	0.0048
126	1.5425	0.0048

127	1.5473	0.0048
128	1.5520	0.0047
129	1.5567	0.0047
130	1.5614	0.0047
131	1.5661	0.0047
132	1.5708	0.0047
133	1.5754	0.0046
134	1.5800	0.0046
135	1.5846	0.0046
136	1.5892	0.0046
137	1.5937	0.0046
138	1.5983	0.0045
139	1.6028	0.0045
140	1.6073	0.0045
141	1.6117	0.0045
142	1.6162	0.0045
143	1.6206	0.0044
144	1.6250	0.0044
145	1.6294	0.0044
146	1.6338	0.0044
147	1.6382	0.0044
148	1.6425	0.0043
149	1.6468	0.0043
150	1.6511	0.0043
151	1.6554	0.0043
152	1.6597	0.0043
153	1.6640	0.0043
154	1.6682	0.0042
155	1.6724	0.0042
156	1.6766	0.0042
157	1.6808	0.0042
158	1.6850	0.0042
159	1.6891	0.0042
160	1.6933	0.0041
161	1.6974	0.0041
162	1.7015	0.0041
163	1.7056	0.0041
164	1.7097	0.0041
165	1.7137	0.0041
166	1.7178	0.0040
167	1.7218	0.0040
168	1.7258	0.0040
169	1.7298	0.0040
170	1.7338	0.0040
171	1.7378	0.0040
172	1.7417	0.0040
173	1.7457	0.0039
174	1.7496	0.0039
175	1.7535	0.0039
176	1.7574	0.0039

177	1.7613	0.0039
178	1.7652	0.0039
179	1.7691	0.0039
180	1.7729	0.0039
181	1.7768	0.0038
182	1.7806	0.0038
183	1.7844	0.0038
184	1.7882	0.0038
185	1.7920	0.0038
186	1.7958	0.0038
187	1.7995	0.0038
188	1.8033	0.0037
189	1.8070	0.0037
190	1.8107	0.0037
191	1.8144	0.0037
192	1.8181	0.0037
193	1.8218	0.0037
194	1.8255	0.0037
195	1.8292	0.0037
196	1.8328	0.0037
197	1.8365	0.0036
198	1.8401	0.0036
199	1.8437	0.0036
200	1.8473	0.0036
201	1.8509	0.0036
202	1.8545	0.0036
203	1.8581	0.0036
204	1.8617	0.0036
205	1.8652	0.0036
206	1.8688	0.0035
207	1.8723	0.0035
208	1.8758	0.0035
209	1.8794	0.0035
210	1.8829	0.0035
211	1.8864	0.0035
212	1.8898	0.0035
213	1.8933	0.0035
214	1.8968	0.0035
215	1.9002	0.0035
216	1.9037	0.0034
217	1.9071	0.0034
218	1.9105	0.0034
219	1.9140	0.0034
220	1.9174	0.0034
221	1.9208	0.0034
222	1.9241	0.0034
223	1.9275	0.0034
224	1.9309	0.0034
225	1.9343	0.0034
226	1.9376	0.0034

227	1.9409	0.0033
228	1.9443	0.0033
229	1.9476	0.0033
230	1.9509	0.0033
231	1.9542	0.0033
232	1.9575	0.0033
233	1.9608	0.0033
234	1.9641	0.0033
235	1.9674	0.0033
236	1.9706	0.0033
237	1.9739	0.0033
238	1.9771	0.0032
239	1.9804	0.0032
240	1.9836	0.0032
241	1.9868	0.0032
242	1.9900	0.0032
243	1.9932	0.0032
244	1.9964	0.0032
245	1.9996	0.0032
246	2.0028	0.0032
247	2.0060	0.0032
248	2.0091	0.0032
249	2.0123	0.0032
250	2.0155	0.0032
251	2.0186	0.0031
252	2.0217	0.0031
253	2.0249	0.0031
254	2.0280	0.0031
255	2.0311	0.0031
256	2.0342	0.0031
257	2.0373	0.0031
258	2.0404	0.0031
259	2.0435	0.0031
260	2.0465	0.0031
261	2.0496	0.0031
262	2.0527	0.0031
263	2.0557	0.0031
264	2.0588	0.0030
265	2.0618	0.0030
266	2.0649	0.0030
267	2.0679	0.0030
268	2.0709	0.0030
269	2.0739	0.0030
270	2.0769	0.0030
271	2.0799	0.0030
272	2.0829	0.0030
273	2.0859	0.0030
274	2.0889	0.0030
275	2.0918	0.0030
276	2.0948	0.0030

277	2.0978	0.0030
278	2.1007	0.0030
279	2.1037	0.0029
280	2.1066	0.0029
281	2.1095	0.0029
282	2.1125	0.0029
283	2.1154	0.0029
284	2.1183	0.0029
285	2.1212	0.0029
286	2.1241	0.0029
287	2.1270	0.0029
288	2.1299	0.0029

Unit Period (number)	Unit Rainfall (In)	Unit Soil-Loss (In)	Effective Rainfall (In)
1	0.0029	0.0005	0.0024
2	0.0029	0.0005	0.0024
3	0.0029	0.0005	0.0024
4	0.0029	0.0005	0.0024
5	0.0029	0.0005	0.0024
6	0.0029	0.0005	0.0024
7	0.0029	0.0005	0.0024
8	0.0030	0.0005	0.0024
9	0.0030	0.0005	0.0024
10	0.0030	0.0005	0.0024
11	0.0030	0.0005	0.0024
12	0.0030	0.0005	0.0024
13	0.0030	0.0006	0.0025
14	0.0030	0.0006	0.0025
15	0.0030	0.0006	0.0025
16	0.0030	0.0006	0.0025
17	0.0030	0.0006	0.0025
18	0.0031	0.0006	0.0025
19	0.0031	0.0006	0.0025
20	0.0031	0.0006	0.0025
21	0.0031	0.0006	0.0025
22	0.0031	0.0006	0.0025
23	0.0031	0.0006	0.0025
24	0.0031	0.0006	0.0025
25	0.0031	0.0006	0.0026
26	0.0031	0.0006	0.0026
27	0.0032	0.0006	0.0026
28	0.0032	0.0006	0.0026
29	0.0032	0.0006	0.0026
30	0.0032	0.0006	0.0026
31	0.0032	0.0006	0.0026
32	0.0032	0.0006	0.0026
33	0.0032	0.0006	0.0026

34	0.0032	0.0006	0.0026
35	0.0033	0.0006	0.0027
36	0.0033	0.0006	0.0027
37	0.0033	0.0006	0.0027
38	0.0033	0.0006	0.0027
39	0.0033	0.0006	0.0027
40	0.0033	0.0006	0.0027
41	0.0033	0.0006	0.0027
42	0.0033	0.0006	0.0027
43	0.0034	0.0006	0.0027
44	0.0034	0.0006	0.0028
45	0.0034	0.0006	0.0028
46	0.0034	0.0006	0.0028
47	0.0034	0.0006	0.0028
48	0.0034	0.0006	0.0028
49	0.0034	0.0006	0.0028
50	0.0035	0.0006	0.0028
51	0.0035	0.0006	0.0028
52	0.0035	0.0006	0.0028
53	0.0035	0.0006	0.0029
54	0.0035	0.0006	0.0029
55	0.0035	0.0006	0.0029
56	0.0035	0.0007	0.0029
57	0.0036	0.0007	0.0029
58	0.0036	0.0007	0.0029
59	0.0036	0.0007	0.0029
60	0.0036	0.0007	0.0029
61	0.0036	0.0007	0.0030
62	0.0036	0.0007	0.0030
63	0.0037	0.0007	0.0030
64	0.0037	0.0007	0.0030
65	0.0037	0.0007	0.0030
66	0.0037	0.0007	0.0030
67	0.0037	0.0007	0.0031
68	0.0037	0.0007	0.0031
69	0.0038	0.0007	0.0031
70	0.0038	0.0007	0.0031
71	0.0038	0.0007	0.0031
72	0.0038	0.0007	0.0031
73	0.0039	0.0007	0.0031
74	0.0039	0.0007	0.0032
75	0.0039	0.0007	0.0032
76	0.0039	0.0007	0.0032
77	0.0039	0.0007	0.0032
78	0.0039	0.0007	0.0032
79	0.0040	0.0007	0.0032
80	0.0040	0.0007	0.0033
81	0.0040	0.0007	0.0033
82	0.0040	0.0007	0.0033
83	0.0041	0.0007	0.0033

84	0.0041	0.0007	0.0033
85	0.0041	0.0008	0.0034
86	0.0041	0.0008	0.0034
87	0.0042	0.0008	0.0034
88	0.0042	0.0008	0.0034
89	0.0042	0.0008	0.0034
90	0.0042	0.0008	0.0034
91	0.0043	0.0008	0.0035
92	0.0043	0.0008	0.0035
93	0.0043	0.0008	0.0035
94	0.0043	0.0008	0.0035
95	0.0044	0.0008	0.0036
96	0.0044	0.0008	0.0036
97	0.0044	0.0008	0.0036
98	0.0044	0.0008	0.0036
99	0.0045	0.0008	0.0037
100	0.0045	0.0008	0.0037
101	0.0045	0.0008	0.0037
102	0.0046	0.0008	0.0037
103	0.0046	0.0008	0.0037
104	0.0046	0.0008	0.0038
105	0.0047	0.0009	0.0038
106	0.0047	0.0009	0.0038
107	0.0047	0.0009	0.0039
108	0.0047	0.0009	0.0039
109	0.0048	0.0009	0.0039
110	0.0048	0.0009	0.0039
111	0.0049	0.0009	0.0040
112	0.0049	0.0009	0.0040
113	0.0049	0.0009	0.0040
114	0.0050	0.0009	0.0041
115	0.0050	0.0009	0.0041
116	0.0050	0.0009	0.0041
117	0.0051	0.0009	0.0042
118	0.0051	0.0009	0.0042
119	0.0052	0.0009	0.0042
120	0.0052	0.0010	0.0043
121	0.0053	0.0010	0.0043
122	0.0053	0.0010	0.0043
123	0.0054	0.0010	0.0044
124	0.0054	0.0010	0.0044
125	0.0055	0.0010	0.0045
126	0.0055	0.0010	0.0045
127	0.0056	0.0010	0.0045
128	0.0056	0.0010	0.0046
129	0.0057	0.0010	0.0046
130	0.0057	0.0010	0.0047
131	0.0058	0.0011	0.0047
132	0.0058	0.0011	0.0047
133	0.0059	0.0011	0.0048

134	0.0059	0.0011	0.0048
135	0.0060	0.0011	0.0049
136	0.0061	0.0011	0.0049
137	0.0061	0.0011	0.0050
138	0.0062	0.0011	0.0051
139	0.0063	0.0012	0.0051
140	0.0063	0.0012	0.0052
141	0.0064	0.0012	0.0052
142	0.0065	0.0012	0.0053
143	0.0066	0.0012	0.0054
144	0.0066	0.0012	0.0054
145	0.0069	0.0013	0.0056
146	0.0069	0.0013	0.0057
147	0.0070	0.0013	0.0058
148	0.0071	0.0013	0.0058
149	0.0072	0.0013	0.0059
150	0.0073	0.0013	0.0060
151	0.0074	0.0014	0.0061
152	0.0075	0.0014	0.0061
153	0.0077	0.0014	0.0063
154	0.0077	0.0014	0.0063
155	0.0079	0.0015	0.0065
156	0.0080	0.0015	0.0065
157	0.0082	0.0015	0.0067
158	0.0083	0.0015	0.0068
159	0.0085	0.0016	0.0069
160	0.0086	0.0016	0.0070
161	0.0088	0.0016	0.0072
162	0.0089	0.0016	0.0073
163	0.0091	0.0017	0.0075
164	0.0093	0.0017	0.0076
165	0.0095	0.0017	0.0078
166	0.0097	0.0018	0.0079
167	0.0100	0.0018	0.0081
168	0.0101	0.0019	0.0083
169	0.0105	0.0019	0.0086
170	0.0107	0.0020	0.0087
171	0.0111	0.0020	0.0090
172	0.0113	0.0021	0.0092
173	0.0117	0.0022	0.0096
174	0.0120	0.0022	0.0098
175	0.0125	0.0023	0.0102
176	0.0128	0.0024	0.0105
177	0.0135	0.0025	0.0110
178	0.0138	0.0025	0.0113
179	0.0146	0.0027	0.0119
180	0.0151	0.0028	0.0123
181	0.0161	0.0029	0.0131
182	0.0167	0.0031	0.0136
183	0.0180	0.0033	0.0147

184	0.0188	0.0034	0.0154
185	0.0157	0.0029	0.0128
186	0.0167	0.0031	0.0136
187	0.0194	0.0035	0.0158
188	0.0211	0.0039	0.0173
189	0.0263	0.0046	0.0217
190	0.0303	0.0046	0.0257
191	0.0459	0.0046	0.0414
192	0.0667	0.0046	0.0621
193	0.2885	0.0046	0.2839
194	0.0362	0.0046	0.0316
195	0.0234	0.0043	0.0191
196	0.0179	0.0033	0.0146
197	0.0197	0.0036	0.0161
198	0.0173	0.0032	0.0141
199	0.0156	0.0029	0.0127
200	0.0142	0.0026	0.0116
201	0.0131	0.0024	0.0107
202	0.0123	0.0022	0.0100
203	0.0115	0.0021	0.0094
204	0.0109	0.0020	0.0089
205	0.0103	0.0019	0.0084
206	0.0098	0.0018	0.0080
207	0.0094	0.0017	0.0077
208	0.0090	0.0017	0.0074
209	0.0087	0.0016	0.0071
210	0.0084	0.0015	0.0068
211	0.0081	0.0015	0.0066
212	0.0078	0.0014	0.0064
213	0.0076	0.0014	0.0062
214	0.0074	0.0014	0.0060
215	0.0072	0.0013	0.0059
216	0.0070	0.0013	0.0057
217	0.0067	0.0012	0.0055
218	0.0065	0.0012	0.0053
219	0.0064	0.0012	0.0052
220	0.0062	0.0011	0.0051
221	0.0061	0.0011	0.0050
222	0.0060	0.0011	0.0049
223	0.0058	0.0011	0.0048
224	0.0057	0.0011	0.0047
225	0.0056	0.0010	0.0046
226	0.0055	0.0010	0.0045
227	0.0054	0.0010	0.0044
228	0.0053	0.0010	0.0043
229	0.0052	0.0010	0.0043
230	0.0051	0.0009	0.0042
231	0.0051	0.0009	0.0041
232	0.0050	0.0009	0.0041
233	0.0049	0.0009	0.0040

234	0.0048	0.0009	0.0040
235	0.0048	0.0009	0.0039
236	0.0047	0.0009	0.0038
237	0.0046	0.0008	0.0038
238	0.0046	0.0008	0.0037
239	0.0045	0.0008	0.0037
240	0.0045	0.0008	0.0036
241	0.0044	0.0008	0.0036
242	0.0043	0.0008	0.0035
243	0.0043	0.0008	0.0035
244	0.0042	0.0008	0.0035
245	0.0042	0.0008	0.0034
246	0.0041	0.0008	0.0034
247	0.0041	0.0008	0.0033
248	0.0040	0.0007	0.0033
249	0.0040	0.0007	0.0033
250	0.0040	0.0007	0.0032
251	0.0039	0.0007	0.0032
252	0.0039	0.0007	0.0032
253	0.0038	0.0007	0.0031
254	0.0038	0.0007	0.0031
255	0.0038	0.0007	0.0031
256	0.0037	0.0007	0.0030
257	0.0037	0.0007	0.0030
258	0.0037	0.0007	0.0030
259	0.0036	0.0007	0.0030
260	0.0036	0.0007	0.0029
261	0.0036	0.0007	0.0029
262	0.0035	0.0006	0.0029
263	0.0035	0.0006	0.0029
264	0.0035	0.0006	0.0028
265	0.0034	0.0006	0.0028
266	0.0034	0.0006	0.0028
267	0.0034	0.0006	0.0028
268	0.0034	0.0006	0.0027
269	0.0033	0.0006	0.0027
270	0.0033	0.0006	0.0027
271	0.0033	0.0006	0.0027
272	0.0032	0.0006	0.0027
273	0.0032	0.0006	0.0026
274	0.0032	0.0006	0.0026
275	0.0032	0.0006	0.0026
276	0.0032	0.0006	0.0026
277	0.0031	0.0006	0.0026
278	0.0031	0.0006	0.0025
279	0.0031	0.0006	0.0025
280	0.0031	0.0006	0.0025
281	0.0030	0.0006	0.0025
282	0.0030	0.0006	0.0025
283	0.0030	0.0005	0.0024

284	0.0030	0.0005	0.0024
285	0.0030	0.0005	0.0024
286	0.0029	0.0005	0.0024
287	0.0029	0.0005	0.0024
288	0.0029	0.0005	0.0024

 Total soil rain loss = 0.33(In)
 Total effective rainfall = 1.80(In)
 Peak flow rate in flood hydrograph = 51.01(CFS)

+++++
 24 - H O U R S T O R M
 R u n o f f H y d r o g r a p h

Hydrograph in 5 Minute intervals ((CFS))

Time(h+m)	Volume	Ac.Ft	Q(CFS)	0	15.0	30.0	45.0	60.0
0+ 5	0.0003		0.04	Q				
0+10	0.0026		0.34	Q				
0+15	0.0072		0.67	Q				
0+20	0.0128		0.82	Q				
0+25	0.0191		0.90	Q				
0+30	0.0257		0.96	Q				
0+35	0.0326		1.00	Q				
0+40	0.0397		1.04	Q				
0+45	0.0470		1.06	Q				
0+50	0.0545		1.08	Q				
0+55	0.0620		1.10	Q				
1+ 0	0.0697		1.11	Q				
1+ 5	0.0774		1.12	Q				
1+10	0.0851		1.13	Q				
1+15	0.0930		1.14	Q				
1+20	0.1009		1.14	Q				
1+25	0.1088		1.15	Q				
1+30	0.1167		1.15	Q				
1+35	0.1247		1.16	Q				
1+40	0.1327		1.16	Q				
1+45	0.1407		1.16	Q				
1+50	0.1487		1.17	QV				
1+55	0.1568		1.17	QV				
2+ 0	0.1649		1.18	QV				
2+ 5	0.1730		1.18	QV				
2+10	0.1812		1.19	QV				
2+15	0.1894		1.19	QV				
2+20	0.1976		1.19	QV				
2+25	0.2059		1.20	QV				
2+30	0.2142		1.20	QV				

2+35	0.2225	1.21	QV
2+40	0.2308	1.21	QV
2+45	0.2392	1.22	QV
2+50	0.2476	1.22	QV
2+55	0.2560	1.23	QV
3+ 0	0.2645	1.23	QV
3+ 5	0.2730	1.23	QV
3+10	0.2815	1.24	QV
3+15	0.2901	1.24	Q V
3+20	0.2987	1.25	Q V
3+25	0.3074	1.25	Q V
3+30	0.3160	1.26	Q V
3+35	0.3247	1.26	Q V
3+40	0.3335	1.27	Q V
3+45	0.3422	1.27	Q V
3+50	0.3511	1.28	Q V
3+55	0.3599	1.28	Q V
4+ 0	0.3688	1.29	Q V
4+ 5	0.3777	1.30	Q V
4+10	0.3867	1.30	Q V
4+15	0.3957	1.31	Q V
4+20	0.4047	1.31	Q V
4+25	0.4138	1.32	Q V
4+30	0.4229	1.32	Q V
4+35	0.4320	1.33	Q V
4+40	0.4412	1.33	Q V
4+45	0.4505	1.34	Q V
4+50	0.4597	1.35	Q V
4+55	0.4690	1.35	Q V
5+ 0	0.4784	1.36	Q V
5+ 5	0.4878	1.36	Q V
5+10	0.4972	1.37	Q V
5+15	0.5067	1.38	Q V
5+20	0.5162	1.38	Q V
5+25	0.5258	1.39	Q V
5+30	0.5354	1.40	Q V
5+35	0.5451	1.40	Q V
5+40	0.5548	1.41	Q V
5+45	0.5646	1.42	Q V
5+50	0.5744	1.42	Q V
5+55	0.5842	1.43	Q V
6+ 0	0.5941	1.44	Q V
6+ 5	0.6040	1.44	Q V
6+10	0.6140	1.45	Q V
6+15	0.6241	1.46	Q V
6+20	0.6342	1.47	Q V
6+25	0.6443	1.47	Q V
6+30	0.6545	1.48	Q V
6+35	0.6648	1.49	Q V
6+40	0.6751	1.50	Q V

6+45	0.6855	1.50	Q	V				
6+50	0.6959	1.51	Q	V				
6+55	0.7064	1.52	Q	V				
7+ 0	0.7169	1.53	Q	V				
7+ 5	0.7275	1.54	Q	V				
7+10	0.7381	1.55	Q	V				
7+15	0.7489	1.56	Q	V				
7+20	0.7596	1.56	Q	V				
7+25	0.7705	1.57	Q	V				
7+30	0.7814	1.58	Q	V				
7+35	0.7923	1.59	Q	V				
7+40	0.8033	1.60	Q	V				
7+45	0.8144	1.61	Q	V				
7+50	0.8256	1.62	Q	V				
7+55	0.8368	1.63	Q	V				
8+ 0	0.8481	1.64	Q	V				
8+ 5	0.8594	1.65	Q	V				
8+10	0.8709	1.66	Q	V				
8+15	0.8824	1.67	Q	V				
8+20	0.8939	1.68	Q	V				
8+25	0.9056	1.69	Q	V				
8+30	0.9173	1.70	Q	V				
8+35	0.9291	1.71	Q	V				
8+40	0.9410	1.73	Q	V				
8+45	0.9530	1.74	Q	V				
8+50	0.9650	1.75	Q	V				
8+55	0.9771	1.76	Q	V				
9+ 0	0.9893	1.77	Q	V				
9+ 5	1.0016	1.78	Q	V				
9+10	1.0140	1.80	Q	V				
9+15	1.0265	1.81	Q	V				
9+20	1.0390	1.82	Q	V				
9+25	1.0517	1.84	Q	V				
9+30	1.0644	1.85	Q	V				
9+35	1.0773	1.86	Q	V				
9+40	1.0902	1.88	Q	V				
9+45	1.1033	1.89	Q	V				
9+50	1.1164	1.91	Q	V				
9+55	1.1297	1.92	Q	V				
10+ 0	1.1430	1.94	Q	V				
10+ 5	1.1565	1.95	Q	V				
10+10	1.1700	1.97	Q	V				
10+15	1.1837	1.99	Q	V				
10+20	1.1975	2.00	Q	V				
10+25	1.2115	2.02	Q	V				
10+30	1.2255	2.04	Q	V				
10+35	1.2397	2.06	Q	V				
10+40	1.2540	2.08	Q	V				
10+45	1.2684	2.09	Q	V				
10+50	1.2829	2.11	Q	V				

10+55	1.2976	2.13	Q	V			
11+ 0	1.3125	2.15	Q	V			
11+ 5	1.3275	2.18	Q	V			
11+10	1.3426	2.20	Q	V			
11+15	1.3579	2.22	Q	V			
11+20	1.3733	2.24	Q	V			
11+25	1.3889	2.26	Q	V			
11+30	1.4047	2.29	Q	V			
11+35	1.4206	2.31	Q	V			
11+40	1.4367	2.34	Q	V			
11+45	1.4530	2.36	Q	V			
11+50	1.4694	2.39	Q	V			
11+55	1.4861	2.42	Q	V			
12+ 0	1.5030	2.45	Q	V			
12+ 5	1.5200	2.48	Q	V			
12+10	1.5374	2.52	Q	V			
12+15	1.5550	2.56	Q	V			
12+20	1.5730	2.60	Q	V			
12+25	1.5912	2.64	Q	V			
12+30	1.6096	2.68	Q	V			
12+35	1.6283	2.71	Q	V			
12+40	1.6473	2.75	Q	V			
12+45	1.6665	2.79	Q	V			
12+50	1.6860	2.83	Q	V			
12+55	1.7058	2.88	Q	V			
13+ 0	1.7259	2.92	Q	V			
13+ 5	1.7464	2.97	Q	V			
13+10	1.7671	3.01	Q	V			
13+15	1.7882	3.06	Q	V			
13+20	1.8097	3.12	Q	V			
13+25	1.8315	3.17	Q	V			
13+30	1.8537	3.23	Q	V			
13+35	1.8764	3.29	Q	V			
13+40	1.8994	3.35	Q	V			
13+45	1.9229	3.41	Q	V			
13+50	1.9469	3.48	Q	V			
13+55	1.9714	3.56	Q	V			
14+ 0	1.9965	3.63	Q	V			
14+ 5	2.0221	3.72	Q	V			
14+10	2.0483	3.81	Q	V			
14+15	2.0752	3.90	Q	V			
14+20	2.1028	4.01	Q	V			
14+25	2.1311	4.11	Q	V			
14+30	2.1602	4.23	Q	V			
14+35	2.1902	4.35	Q	V			
14+40	2.2211	4.49	Q	V			
14+45	2.2530	4.63	Q	V			
14+50	2.2860	4.79	Q	V			
14+55	2.3202	4.97	Q	V			
15+ 0	2.3558	5.16	Q	V			

15+ 5	2.3928	5.37	Q		V			
15+10	2.4315	5.62	Q		V			
15+15	2.4720	5.89	Q		V			
15+20	2.5147	6.20	Q		V			
15+25	2.5594	6.48	Q		V			
15+30	2.6035	6.40	Q		V			
15+35	2.6469	6.31	Q		V			
15+40	2.6927	6.65	Q		V			
15+45	2.7425	7.23	Q		V			
15+50	2.7991	8.21	Q	Q	V			
15+55	2.8665	9.79	Q	Q	V			
16+ 0	2.9565	13.07		Q	V			
16+ 5	3.1110	22.43			Q	V		
16+10	3.4517	49.48				V	Q	Q
16+15	3.8030	51.01				V		Q
16+20	4.0024	28.95			Q	V		
16+25	4.1398	19.94		Q		V		
16+30	4.2473	15.61		Q		V		
16+35	4.3363	12.92		Q		V		
16+40	4.4114	10.91		Q		V		
16+45	4.4762	9.41		Q		V		
16+50	4.5327	8.20		Q		V		
16+55	4.5820	7.17		Q		V		
17+ 0	4.6251	6.26		Q		V		
17+ 5	4.6645	5.72	Q				V	
17+10	4.7019	5.43	Q				V	
17+15	4.7359	4.93	Q				V	
17+20	4.7668	4.49	Q				V	
17+25	4.7935	3.87	Q				V	
17+30	4.8188	3.67	Q				V	
17+35	4.8429	3.51	Q				V	
17+40	4.8661	3.37	Q				V	
17+45	4.8884	3.24	Q				V	
17+50	4.9099	3.12	Q				V	
17+55	4.9307	3.02	Q				V	
18+ 0	4.9508	2.92	Q				V	
18+ 5	4.9703	2.83	Q				V	
18+10	4.9892	2.74	Q				V	
18+15	5.0075	2.65	Q				V	
18+20	5.0252	2.58	Q				V	
18+25	5.0425	2.51	Q				V	
18+30	5.0594	2.45	Q				V	
18+35	5.0758	2.39	Q				V	
18+40	5.0919	2.34	Q				V	
18+45	5.1076	2.28	Q				V	
18+50	5.1230	2.24	Q				V	
18+55	5.1381	2.19	Q				V	
19+ 0	5.1529	2.15	Q				V	
19+ 5	5.1675	2.11	Q				V	
19+10	5.1817	2.07	Q				V	

19+15	5.1957	2.03	Q				V
19+20	5.2095	2.00	Q				V
19+25	5.2230	1.97	Q				V
19+30	5.2363	1.93	Q				V
19+35	5.2494	1.90	Q				V
19+40	5.2623	1.87	Q				V
19+45	5.2750	1.85	Q				V
19+50	5.2876	1.82	Q				V
19+55	5.2999	1.79	Q				V
20+ 0	5.3121	1.77	Q				V
20+ 5	5.3241	1.74	Q				V
20+10	5.3359	1.72	Q				V
20+15	5.3476	1.70	Q				V
20+20	5.3592	1.68	Q				V
20+25	5.3706	1.66	Q				V
20+30	5.3818	1.63	Q				V
20+35	5.3930	1.62	Q				V
20+40	5.4040	1.60	Q				V
20+45	5.4148	1.58	Q				V
20+50	5.4256	1.56	Q				V
20+55	5.4362	1.54	Q				V
21+ 0	5.4467	1.53	Q				V
21+ 5	5.4571	1.51	Q				V
21+10	5.4674	1.49	Q				V
21+15	5.4776	1.48	Q				V
21+20	5.4876	1.46	Q				V
21+25	5.4976	1.45	Q				V
21+30	5.5075	1.43	Q				V
21+35	5.5173	1.42	Q				V
21+40	5.5269	1.41	Q				V
21+45	5.5365	1.39	Q				V
21+50	5.5460	1.38	Q				V
21+55	5.5555	1.37	Q				V
22+ 0	5.5648	1.36	Q				V
22+ 5	5.5740	1.34	Q				V
22+10	5.5832	1.33	Q				V
22+15	5.5923	1.32	Q				V
22+20	5.6013	1.31	Q				V
22+25	5.6103	1.30	Q				V
22+30	5.6191	1.29	Q				V
22+35	5.6279	1.28	Q				V
22+40	5.6366	1.27	Q				V
22+45	5.6453	1.26	Q				V
22+50	5.6539	1.25	Q				V
22+55	5.6624	1.24	Q				V
23+ 0	5.6709	1.23	Q				V
23+ 5	5.6792	1.22	Q				V
23+10	5.6876	1.21	Q				V
23+15	5.6958	1.20	Q				V
23+20	5.7040	1.19	Q				V

23+25	5.7122	1.18	Q				V
23+30	5.7203	1.17	Q				V
23+35	5.7283	1.17	Q				V
23+40	5.7363	1.16	Q				V
23+45	5.7442	1.15	Q				V
23+50	5.7521	1.14	Q				V
23+55	5.7599	1.13	Q				V
24+ 0	5.7677	1.13	Q				V

U n i t H y d r o g r a p h A n a l y s i s

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Study date 08/06/22

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San Bernardino County Synthetic Unit Hydrology Method
Manual date - August 1986

Program License Serial Number 6385

IEN
Area D
10-year Developed

Storm Event Year = 10

Antecedent Moisture Condition = 2

English (in-lb) Input Units Used

English Rainfall Data (Inches) Input Values Used

English Units used in output format

Area averaged rainfall intensity isohyetal data:

Sub-Area (Ac.)	Duration (hours)	Isohyetal (In)
Rainfall data for year 10		
37.56	1	0.61

Rainfall data for year 10		
37.56	6	1.24

Rainfall data for year 10		
37.56	24	2.13

+++++

***** Area-averaged max loss rate, Fm *****

SCS curve No.(AMCII)	SCS curve NO.(AMC 2)	Area (Ac.)	Area Fraction	Fp(Fig C6) (In/Hr)	Ap (dec.)	Fm (In/Hr)
69.0	69.0	37.56	1.000	0.548	0.100	0.055

Area-averaged adjusted loss rate Fm (In/Hr) = 0.055

***** Area-Averaged low loss rate fraction, Yb *****

Area (Ac.)	Area Fract	SCS CN (AMC2)	SCS CN (AMC2)	S	Pervious Yield Fr
3.76	0.100	69.0	69.0	4.49	0.124
33.80	0.900	98.0	98.0	0.20	0.894

Area-averaged catchment yield fraction, Y = 0.817

Area-averaged low loss fraction, Yb = 0.183

User entry of time of concentration = 0.184 (hours)

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Watershed area = 37.56(Ac.)

Catchment Lag time = 0.147 hours

Unit interval = 5.000 minutes

Unit interval percentage of lag time = 56.6123

Hydrograph baseflow = 0.00(CFS)

Average maximum watershed loss rate(Fm) = 0.055(In/Hr)

Average low loss rate fraction (Yb) = 0.183 (decimal)

DESERT S-Graph Selected

Computed peak 5-minute rainfall = 0.289(In)

Computed peak 30-minute rainfall = 0.495(In)

Specified peak 1-hour rainfall = 0.609(In)

Computed peak 3-hour rainfall = 0.942(In)

Specified peak 6-hour rainfall = 1.240(In)

Specified peak 24-hour rainfall = 2.130(In)

Rainfall depth area reduction factors:

Using a total area of 37.56(Ac.) (Ref: fig. E-4)

5-minute factor = 0.998 Adjusted rainfall = 0.288(In)

30-minute factor = 0.998 Adjusted rainfall = 0.494(In)

1-hour factor = 0.998 Adjusted rainfall = 0.608(In)

3-hour factor = 1.000 Adjusted rainfall = 0.942(In)

6-hour factor = 1.000 Adjusted rainfall = 1.240(In)

24-hour factor = 1.000 Adjusted rainfall = 2.130(In)

U n i t H y d r o g r a p h

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Interval Number	'S' Graph Mean values	Unit Hydrograph ((CFS))

(K = 454.24 (CFS))		
1	4.973	22.590
2	37.958	149.829
3	65.824	126.579
4	77.737	54.117
5	84.689	31.575
6	89.324	21.055
7	92.440	14.153
8	94.734	10.424
9	96.405	7.589
10	97.562	5.257
11	98.253	3.139
12	98.912	2.994
13	99.526	2.788
14	100.000	2.152

Peak Unit Number	Adjusted mass rainfall (In)	Unit rainfall (In)

1	0.2885	0.2885
2	0.3551	0.0667
3	0.4011	0.0459
4	0.4372	0.0362
5	0.4675	0.0303
6	0.4938	0.0263
7	0.5172	0.0234
8	0.5383	0.0211
9	0.5577	0.0194
10	0.5756	0.0179
11	0.5923	0.0167
12	0.6079	0.0157
13	0.6276	0.0197
14	0.6464	0.0188
15	0.6644	0.0180
16	0.6817	0.0173
17	0.6984	0.0167
18	0.7145	0.0161
19	0.7300	0.0156
20	0.7451	0.0151
21	0.7597	0.0146
22	0.7739	0.0142
23	0.7877	0.0138
24	0.8012	0.0135
25	0.8143	0.0131
26	0.8271	0.0128
27	0.8397	0.0125
28	0.8519	0.0122

29	0.8639	0.0120
30	0.8756	0.0117
31	0.8872	0.0115
32	0.8984	0.0113
33	0.9095	0.0111
34	0.9204	0.0109
35	0.9311	0.0107
36	0.9416	0.0105
37	0.9519	0.0103
38	0.9620	0.0101
39	0.9720	0.0100
40	0.9818	0.0098
41	0.9915	0.0097
42	1.0010	0.0095
43	1.0104	0.0094
44	1.0197	0.0093
45	1.0288	0.0091
46	1.0378	0.0090
47	1.0467	0.0089
48	1.0555	0.0088
49	1.0642	0.0087
50	1.0728	0.0086
51	1.0812	0.0085
52	1.0896	0.0084
53	1.0979	0.0083
54	1.1060	0.0082
55	1.1141	0.0081
56	1.1221	0.0080
57	1.1300	0.0079
58	1.1379	0.0078
59	1.1456	0.0077
60	1.1533	0.0077
61	1.1609	0.0076
62	1.1684	0.0075
63	1.1758	0.0074
64	1.1832	0.0074
65	1.1905	0.0073
66	1.1978	0.0072
67	1.2049	0.0072
68	1.2120	0.0071
69	1.2191	0.0070
70	1.2261	0.0070
71	1.2330	0.0069
72	1.2399	0.0069
73	1.2465	0.0067
74	1.2532	0.0066
75	1.2598	0.0066
76	1.2663	0.0065
77	1.2728	0.0065
78	1.2792	0.0064

79	1.2856	0.0064
80	1.2919	0.0063
81	1.2982	0.0063
82	1.3044	0.0062
83	1.3106	0.0062
84	1.3167	0.0061
85	1.3228	0.0061
86	1.3289	0.0061
87	1.3349	0.0060
88	1.3409	0.0060
89	1.3468	0.0059
90	1.3527	0.0059
91	1.3585	0.0058
92	1.3643	0.0058
93	1.3701	0.0058
94	1.3758	0.0057
95	1.3815	0.0057
96	1.3872	0.0057
97	1.3928	0.0056
98	1.3984	0.0056
99	1.4039	0.0056
100	1.4095	0.0055
101	1.4150	0.0055
102	1.4204	0.0055
103	1.4258	0.0054
104	1.4312	0.0054
105	1.4366	0.0054
106	1.4419	0.0053
107	1.4472	0.0053
108	1.4524	0.0053
109	1.4577	0.0052
110	1.4629	0.0052
111	1.4681	0.0052
112	1.4732	0.0051
113	1.4783	0.0051
114	1.4834	0.0051
115	1.4885	0.0051
116	1.4935	0.0050
117	1.4985	0.0050
118	1.5035	0.0050
119	1.5085	0.0050
120	1.5134	0.0049
121	1.5183	0.0049
122	1.5232	0.0049
123	1.5281	0.0049
124	1.5329	0.0048
125	1.5377	0.0048
126	1.5425	0.0048
127	1.5473	0.0048
128	1.5520	0.0047

129	1.5568	0.0047
130	1.5614	0.0047
131	1.5661	0.0047
132	1.5708	0.0047
133	1.5754	0.0046
134	1.5800	0.0046
135	1.5846	0.0046
136	1.5892	0.0046
137	1.5937	0.0046
138	1.5983	0.0045
139	1.6028	0.0045
140	1.6073	0.0045
141	1.6117	0.0045
142	1.6162	0.0045
143	1.6206	0.0044
144	1.6250	0.0044
145	1.6294	0.0044
146	1.6338	0.0044
147	1.6382	0.0044
148	1.6425	0.0043
149	1.6468	0.0043
150	1.6511	0.0043
151	1.6554	0.0043
152	1.6597	0.0043
153	1.6640	0.0043
154	1.6682	0.0042
155	1.6724	0.0042
156	1.6766	0.0042
157	1.6808	0.0042
158	1.6850	0.0042
159	1.6891	0.0042
160	1.6933	0.0041
161	1.6974	0.0041
162	1.7015	0.0041
163	1.7056	0.0041
164	1.7097	0.0041
165	1.7137	0.0041
166	1.7178	0.0040
167	1.7218	0.0040
168	1.7258	0.0040
169	1.7298	0.0040
170	1.7338	0.0040
171	1.7378	0.0040
172	1.7417	0.0040
173	1.7457	0.0039
174	1.7496	0.0039
175	1.7535	0.0039
176	1.7574	0.0039
177	1.7613	0.0039
178	1.7652	0.0039

179	1.7691	0.0039
180	1.7729	0.0039
181	1.7768	0.0038
182	1.7806	0.0038
183	1.7844	0.0038
184	1.7882	0.0038
185	1.7920	0.0038
186	1.7958	0.0038
187	1.7995	0.0038
188	1.8033	0.0037
189	1.8070	0.0037
190	1.8107	0.0037
191	1.8144	0.0037
192	1.8181	0.0037
193	1.8218	0.0037
194	1.8255	0.0037
195	1.8292	0.0037
196	1.8328	0.0037
197	1.8365	0.0036
198	1.8401	0.0036
199	1.8437	0.0036
200	1.8473	0.0036
201	1.8509	0.0036
202	1.8545	0.0036
203	1.8581	0.0036
204	1.8617	0.0036
205	1.8652	0.0036
206	1.8688	0.0035
207	1.8723	0.0035
208	1.8758	0.0035
209	1.8794	0.0035
210	1.8829	0.0035
211	1.8864	0.0035
212	1.8898	0.0035
213	1.8933	0.0035
214	1.8968	0.0035
215	1.9002	0.0035
216	1.9037	0.0034
217	1.9071	0.0034
218	1.9105	0.0034
219	1.9140	0.0034
220	1.9174	0.0034
221	1.9208	0.0034
222	1.9242	0.0034
223	1.9275	0.0034
224	1.9309	0.0034
225	1.9343	0.0034
226	1.9376	0.0034
227	1.9410	0.0033
228	1.9443	0.0033

229	1.9476	0.0033
230	1.9509	0.0033
231	1.9542	0.0033
232	1.9575	0.0033
233	1.9608	0.0033
234	1.9641	0.0033
235	1.9674	0.0033
236	1.9706	0.0033
237	1.9739	0.0033
238	1.9771	0.0032
239	1.9804	0.0032
240	1.9836	0.0032
241	1.9868	0.0032
242	1.9900	0.0032
243	1.9932	0.0032
244	1.9964	0.0032
245	1.9996	0.0032
246	2.0028	0.0032
247	2.0060	0.0032
248	2.0091	0.0032
249	2.0123	0.0032
250	2.0155	0.0032
251	2.0186	0.0031
252	2.0217	0.0031
253	2.0249	0.0031
254	2.0280	0.0031
255	2.0311	0.0031
256	2.0342	0.0031
257	2.0373	0.0031
258	2.0404	0.0031
259	2.0435	0.0031
260	2.0465	0.0031
261	2.0496	0.0031
262	2.0527	0.0031
263	2.0557	0.0031
264	2.0588	0.0030
265	2.0618	0.0030
266	2.0649	0.0030
267	2.0679	0.0030
268	2.0709	0.0030
269	2.0739	0.0030
270	2.0769	0.0030
271	2.0799	0.0030
272	2.0829	0.0030
273	2.0859	0.0030
274	2.0889	0.0030
275	2.0918	0.0030
276	2.0948	0.0030
277	2.0978	0.0030
278	2.1007	0.0030

279	2.1037	0.0029
280	2.1066	0.0029
281	2.1095	0.0029
282	2.1125	0.0029
283	2.1154	0.0029
284	2.1183	0.0029
285	2.1212	0.0029
286	2.1241	0.0029
287	2.1270	0.0029
288	2.1299	0.0029

Unit Period (number)	Unit Rainfall (In)	Unit Soil-Loss (In)	Effective Rainfall (In)
1	0.0029	0.0005	0.0024
2	0.0029	0.0005	0.0024
3	0.0029	0.0005	0.0024
4	0.0029	0.0005	0.0024
5	0.0029	0.0005	0.0024
6	0.0029	0.0005	0.0024
7	0.0029	0.0005	0.0024
8	0.0030	0.0005	0.0024
9	0.0030	0.0005	0.0024
10	0.0030	0.0005	0.0024
11	0.0030	0.0005	0.0024
12	0.0030	0.0005	0.0024
13	0.0030	0.0006	0.0025
14	0.0030	0.0006	0.0025
15	0.0030	0.0006	0.0025
16	0.0030	0.0006	0.0025
17	0.0030	0.0006	0.0025
18	0.0031	0.0006	0.0025
19	0.0031	0.0006	0.0025
20	0.0031	0.0006	0.0025
21	0.0031	0.0006	0.0025
22	0.0031	0.0006	0.0025
23	0.0031	0.0006	0.0025
24	0.0031	0.0006	0.0025
25	0.0031	0.0006	0.0026
26	0.0031	0.0006	0.0026
27	0.0032	0.0006	0.0026
28	0.0032	0.0006	0.0026
29	0.0032	0.0006	0.0026
30	0.0032	0.0006	0.0026
31	0.0032	0.0006	0.0026
32	0.0032	0.0006	0.0026
33	0.0032	0.0006	0.0026
34	0.0032	0.0006	0.0026
35	0.0033	0.0006	0.0027

36	0.0033	0.0006	0.0027
37	0.0033	0.0006	0.0027
38	0.0033	0.0006	0.0027
39	0.0033	0.0006	0.0027
40	0.0033	0.0006	0.0027
41	0.0033	0.0006	0.0027
42	0.0033	0.0006	0.0027
43	0.0034	0.0006	0.0027
44	0.0034	0.0006	0.0028
45	0.0034	0.0006	0.0028
46	0.0034	0.0006	0.0028
47	0.0034	0.0006	0.0028
48	0.0034	0.0006	0.0028
49	0.0034	0.0006	0.0028
50	0.0035	0.0006	0.0028
51	0.0035	0.0006	0.0028
52	0.0035	0.0006	0.0028
53	0.0035	0.0006	0.0029
54	0.0035	0.0006	0.0029
55	0.0035	0.0006	0.0029
56	0.0035	0.0007	0.0029
57	0.0036	0.0007	0.0029
58	0.0036	0.0007	0.0029
59	0.0036	0.0007	0.0029
60	0.0036	0.0007	0.0029
61	0.0036	0.0007	0.0030
62	0.0036	0.0007	0.0030
63	0.0037	0.0007	0.0030
64	0.0037	0.0007	0.0030
65	0.0037	0.0007	0.0030
66	0.0037	0.0007	0.0030
67	0.0037	0.0007	0.0031
68	0.0037	0.0007	0.0031
69	0.0038	0.0007	0.0031
70	0.0038	0.0007	0.0031
71	0.0038	0.0007	0.0031
72	0.0038	0.0007	0.0031
73	0.0039	0.0007	0.0031
74	0.0039	0.0007	0.0032
75	0.0039	0.0007	0.0032
76	0.0039	0.0007	0.0032
77	0.0039	0.0007	0.0032
78	0.0039	0.0007	0.0032
79	0.0040	0.0007	0.0032
80	0.0040	0.0007	0.0033
81	0.0040	0.0007	0.0033
82	0.0040	0.0007	0.0033
83	0.0041	0.0007	0.0033
84	0.0041	0.0007	0.0033
85	0.0041	0.0008	0.0034

86	0.0041	0.0008	0.0034
87	0.0042	0.0008	0.0034
88	0.0042	0.0008	0.0034
89	0.0042	0.0008	0.0034
90	0.0042	0.0008	0.0034
91	0.0043	0.0008	0.0035
92	0.0043	0.0008	0.0035
93	0.0043	0.0008	0.0035
94	0.0043	0.0008	0.0035
95	0.0044	0.0008	0.0036
96	0.0044	0.0008	0.0036
97	0.0044	0.0008	0.0036
98	0.0044	0.0008	0.0036
99	0.0045	0.0008	0.0037
100	0.0045	0.0008	0.0037
101	0.0045	0.0008	0.0037
102	0.0046	0.0008	0.0037
103	0.0046	0.0008	0.0037
104	0.0046	0.0008	0.0038
105	0.0047	0.0009	0.0038
106	0.0047	0.0009	0.0038
107	0.0047	0.0009	0.0039
108	0.0047	0.0009	0.0039
109	0.0048	0.0009	0.0039
110	0.0048	0.0009	0.0039
111	0.0049	0.0009	0.0040
112	0.0049	0.0009	0.0040
113	0.0049	0.0009	0.0040
114	0.0050	0.0009	0.0041
115	0.0050	0.0009	0.0041
116	0.0050	0.0009	0.0041
117	0.0051	0.0009	0.0042
118	0.0051	0.0009	0.0042
119	0.0052	0.0009	0.0042
120	0.0052	0.0010	0.0043
121	0.0053	0.0010	0.0043
122	0.0053	0.0010	0.0043
123	0.0054	0.0010	0.0044
124	0.0054	0.0010	0.0044
125	0.0055	0.0010	0.0045
126	0.0055	0.0010	0.0045
127	0.0056	0.0010	0.0045
128	0.0056	0.0010	0.0046
129	0.0057	0.0010	0.0046
130	0.0057	0.0010	0.0047
131	0.0058	0.0011	0.0047
132	0.0058	0.0011	0.0047
133	0.0059	0.0011	0.0048
134	0.0059	0.0011	0.0048
135	0.0060	0.0011	0.0049

136	0.0061	0.0011	0.0049
137	0.0061	0.0011	0.0050
138	0.0062	0.0011	0.0051
139	0.0063	0.0012	0.0051
140	0.0063	0.0012	0.0052
141	0.0064	0.0012	0.0052
142	0.0065	0.0012	0.0053
143	0.0066	0.0012	0.0054
144	0.0066	0.0012	0.0054
145	0.0069	0.0013	0.0056
146	0.0069	0.0013	0.0057
147	0.0070	0.0013	0.0058
148	0.0071	0.0013	0.0058
149	0.0072	0.0013	0.0059
150	0.0073	0.0013	0.0060
151	0.0074	0.0014	0.0061
152	0.0075	0.0014	0.0061
153	0.0077	0.0014	0.0063
154	0.0077	0.0014	0.0063
155	0.0079	0.0015	0.0065
156	0.0080	0.0015	0.0065
157	0.0082	0.0015	0.0067
158	0.0083	0.0015	0.0068
159	0.0085	0.0016	0.0069
160	0.0086	0.0016	0.0070
161	0.0088	0.0016	0.0072
162	0.0089	0.0016	0.0073
163	0.0091	0.0017	0.0075
164	0.0093	0.0017	0.0076
165	0.0095	0.0017	0.0078
166	0.0097	0.0018	0.0079
167	0.0100	0.0018	0.0081
168	0.0101	0.0019	0.0083
169	0.0105	0.0019	0.0086
170	0.0107	0.0020	0.0087
171	0.0111	0.0020	0.0090
172	0.0113	0.0021	0.0092
173	0.0117	0.0022	0.0096
174	0.0120	0.0022	0.0098
175	0.0125	0.0023	0.0102
176	0.0128	0.0024	0.0105
177	0.0135	0.0025	0.0110
178	0.0138	0.0025	0.0113
179	0.0146	0.0027	0.0119
180	0.0151	0.0028	0.0123
181	0.0161	0.0029	0.0131
182	0.0167	0.0031	0.0136
183	0.0180	0.0033	0.0147
184	0.0188	0.0034	0.0154
185	0.0157	0.0029	0.0128

186	0.0167	0.0031	0.0136
187	0.0194	0.0036	0.0158
188	0.0211	0.0039	0.0173
189	0.0263	0.0046	0.0217
190	0.0303	0.0046	0.0257
191	0.0459	0.0046	0.0414
192	0.0667	0.0046	0.0621
193	0.2885	0.0046	0.2839
194	0.0362	0.0046	0.0316
195	0.0234	0.0043	0.0191
196	0.0179	0.0033	0.0146
197	0.0197	0.0036	0.0161
198	0.0173	0.0032	0.0141
199	0.0156	0.0029	0.0127
200	0.0142	0.0026	0.0116
201	0.0131	0.0024	0.0107
202	0.0122	0.0022	0.0100
203	0.0115	0.0021	0.0094
204	0.0109	0.0020	0.0089
205	0.0103	0.0019	0.0084
206	0.0098	0.0018	0.0080
207	0.0094	0.0017	0.0077
208	0.0090	0.0017	0.0074
209	0.0087	0.0016	0.0071
210	0.0084	0.0015	0.0068
211	0.0081	0.0015	0.0066
212	0.0078	0.0014	0.0064
213	0.0076	0.0014	0.0062
214	0.0074	0.0014	0.0060
215	0.0072	0.0013	0.0059
216	0.0070	0.0013	0.0057
217	0.0067	0.0012	0.0055
218	0.0065	0.0012	0.0053
219	0.0064	0.0012	0.0052
220	0.0062	0.0011	0.0051
221	0.0061	0.0011	0.0050
222	0.0060	0.0011	0.0049
223	0.0058	0.0011	0.0048
224	0.0057	0.0011	0.0047
225	0.0056	0.0010	0.0046
226	0.0055	0.0010	0.0045
227	0.0054	0.0010	0.0044
228	0.0053	0.0010	0.0043
229	0.0052	0.0010	0.0043
230	0.0051	0.0009	0.0042
231	0.0051	0.0009	0.0041
232	0.0050	0.0009	0.0041
233	0.0049	0.0009	0.0040
234	0.0048	0.0009	0.0040
235	0.0048	0.0009	0.0039

236	0.0047	0.0009	0.0038
237	0.0046	0.0008	0.0038
238	0.0046	0.0008	0.0037
239	0.0045	0.0008	0.0037
240	0.0045	0.0008	0.0036
241	0.0044	0.0008	0.0036
242	0.0043	0.0008	0.0035
243	0.0043	0.0008	0.0035
244	0.0042	0.0008	0.0035
245	0.0042	0.0008	0.0034
246	0.0041	0.0008	0.0034
247	0.0041	0.0008	0.0033
248	0.0040	0.0007	0.0033
249	0.0040	0.0007	0.0033
250	0.0040	0.0007	0.0032
251	0.0039	0.0007	0.0032
252	0.0039	0.0007	0.0032
253	0.0038	0.0007	0.0031
254	0.0038	0.0007	0.0031
255	0.0038	0.0007	0.0031
256	0.0037	0.0007	0.0030
257	0.0037	0.0007	0.0030
258	0.0037	0.0007	0.0030
259	0.0036	0.0007	0.0030
260	0.0036	0.0007	0.0029
261	0.0036	0.0007	0.0029
262	0.0035	0.0006	0.0029
263	0.0035	0.0006	0.0029
264	0.0035	0.0006	0.0028
265	0.0034	0.0006	0.0028
266	0.0034	0.0006	0.0028
267	0.0034	0.0006	0.0028
268	0.0034	0.0006	0.0027
269	0.0033	0.0006	0.0027
270	0.0033	0.0006	0.0027
271	0.0033	0.0006	0.0027
272	0.0032	0.0006	0.0027
273	0.0032	0.0006	0.0026
274	0.0032	0.0006	0.0026
275	0.0032	0.0006	0.0026
276	0.0032	0.0006	0.0026
277	0.0031	0.0006	0.0026
278	0.0031	0.0006	0.0025
279	0.0031	0.0006	0.0025
280	0.0031	0.0006	0.0025
281	0.0030	0.0006	0.0025
282	0.0030	0.0006	0.0025
283	0.0030	0.0005	0.0024
284	0.0030	0.0005	0.0024
285	0.0030	0.0005	0.0024

286	0.0029	0.0005	0.0024
287	0.0029	0.0005	0.0024
288	0.0029	0.0005	0.0024

Total soil rain loss = 0.33(In)
Total effective rainfall = 1.80(In)
Peak flow rate in flood hydrograph = 55.36(CFS)

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24 - H O U R S T O R M
R u n o f f H y d r o g r a p h

Hydrograph in 5 Minute intervals ((CFS))

Time(h+m)	Volume Ac.Ft	Q(CFS)	0	15.0	30.0	45.0	60.0
0+ 5	0.0004	0.05	Q				
0+10	0.0032	0.41	Q				
0+15	0.0080	0.71	Q				
0+20	0.0138	0.84	Q				
0+25	0.0201	0.91	Q				
0+30	0.0267	0.97	Q				
0+35	0.0337	1.00	Q				
0+40	0.0408	1.03	Q				
0+45	0.0480	1.05	Q				
0+50	0.0554	1.07	Q				
0+55	0.0628	1.08	Q				
1+ 0	0.0703	1.09	Q				
1+ 5	0.0779	1.10	Q				
1+10	0.0855	1.11	Q				
1+15	0.0931	1.11	Q				
1+20	0.1008	1.12	Q				
1+25	0.1085	1.12	Q				
1+30	0.1163	1.12	Q				
1+35	0.1240	1.13	Q				
1+40	0.1318	1.13	Q				
1+45	0.1397	1.14	Q				
1+50	0.1475	1.14	QV				
1+55	0.1554	1.14	QV				
2+ 0	0.1633	1.15	QV				
2+ 5	0.1712	1.15	QV				
2+10	0.1792	1.16	QV				
2+15	0.1872	1.16	QV				
2+20	0.1952	1.16	QV				
2+25	0.2032	1.17	QV				
2+30	0.2113	1.17	QV				
2+35	0.2194	1.18	QV				
2+40	0.2275	1.18	QV				

2+45	0.2357	1.19	QV
2+50	0.2439	1.19	QV
2+55	0.2521	1.19	QV
3+ 0	0.2604	1.20	QV
3+ 5	0.2687	1.20	QV
3+10	0.2770	1.21	QV
3+15	0.2854	1.21	Q V
3+20	0.2937	1.22	Q V
3+25	0.3022	1.22	Q V
3+30	0.3106	1.23	Q V
3+35	0.3191	1.23	Q V
3+40	0.3276	1.24	Q V
3+45	0.3362	1.24	Q V
3+50	0.3448	1.25	Q V
3+55	0.3534	1.25	Q V
4+ 0	0.3621	1.26	Q V
4+ 5	0.3708	1.26	Q V
4+10	0.3795	1.27	Q V
4+15	0.3883	1.27	Q V
4+20	0.3971	1.28	Q V
4+25	0.4059	1.28	Q V
4+30	0.4148	1.29	Q V
4+35	0.4237	1.30	Q V
4+40	0.4327	1.30	Q V
4+45	0.4417	1.31	Q V
4+50	0.4508	1.31	Q V
4+55	0.4598	1.32	Q V
5+ 0	0.4690	1.32	Q V
5+ 5	0.4781	1.33	Q V
5+10	0.4873	1.34	Q V
5+15	0.4966	1.34	Q V
5+20	0.5059	1.35	Q V
5+25	0.5152	1.36	Q V
5+30	0.5246	1.36	Q V
5+35	0.5340	1.37	Q V
5+40	0.5435	1.37	Q V
5+45	0.5530	1.38	Q V
5+50	0.5626	1.39	Q V
5+55	0.5722	1.39	Q V
6+ 0	0.5818	1.40	Q V
6+ 5	0.5915	1.41	Q V
6+10	0.6013	1.42	Q V
6+15	0.6111	1.42	Q V
6+20	0.6209	1.43	Q V
6+25	0.6308	1.44	Q V
6+30	0.6408	1.45	Q V
6+35	0.6508	1.45	Q V
6+40	0.6608	1.46	Q V
6+45	0.6710	1.47	Q V
6+50	0.6811	1.48	Q V

6+55	0.6913	1.48	Q	V
7+ 0	0.7016	1.49	Q	V
7+ 5	0.7119	1.50	Q	V
7+10	0.7223	1.51	Q	V
7+15	0.7328	1.52	Q	V
7+20	0.7433	1.53	Q	V
7+25	0.7539	1.53	Q	V
7+30	0.7645	1.54	Q	V
7+35	0.7752	1.55	Q	V
7+40	0.7859	1.56	Q	V
7+45	0.7968	1.57	Q	V
7+50	0.8076	1.58	Q	V
7+55	0.8186	1.59	Q	V
8+ 0	0.8296	1.60	Q	V
8+ 5	0.8407	1.61	Q	V
8+10	0.8518	1.62	Q	V
8+15	0.8631	1.63	Q	V
8+20	0.8744	1.64	Q	V
8+25	0.8857	1.65	Q	V
8+30	0.8972	1.66	Q	V
8+35	0.9087	1.67	Q	V
8+40	0.9203	1.68	Q	V
8+45	0.9320	1.69	Q	V
8+50	0.9437	1.71	Q	V
8+55	0.9555	1.72	Q	V
9+ 0	0.9675	1.73	Q	V
9+ 5	0.9795	1.74	Q	V
9+10	0.9915	1.75	Q	V
9+15	1.0037	1.77	Q	V
9+20	1.0160	1.78	Q	V
9+25	1.0283	1.79	Q	V
9+30	1.0408	1.81	Q	V
9+35	1.0533	1.82	Q	V
9+40	1.0659	1.83	Q	V
9+45	1.0787	1.85	Q	V
9+50	1.0915	1.86	Q	V
9+55	1.1044	1.88	Q	V
10+ 0	1.1175	1.89	Q	V
10+ 5	1.1306	1.91	Q	V
10+10	1.1439	1.92	Q	V
10+15	1.1572	1.94	Q	V
10+20	1.1707	1.96	Q	V
10+25	1.1843	1.97	Q	V
10+30	1.1980	1.99	Q	V
10+35	1.2119	2.01	Q	V
10+40	1.2258	2.03	Q	V
10+45	1.2399	2.05	Q	V
10+50	1.2541	2.07	Q	V
10+55	1.2685	2.08	Q	V
11+ 0	1.2830	2.10	Q	V

11+ 5	1.2976	2.12	Q	V			
11+10	1.3124	2.15	Q	V			
11+15	1.3273	2.17	Q	V			
11+20	1.3424	2.19	Q	V			
11+25	1.3577	2.21	Q	V			
11+30	1.3731	2.24	Q	V			
11+35	1.3886	2.26	Q	V			
11+40	1.4044	2.29	Q	V			
11+45	1.4203	2.31	Q	V			
11+50	1.4364	2.34	Q	V			
11+55	1.4526	2.36	Q	V			
12+ 0	1.4691	2.39	Q	V			
12+ 5	1.4858	2.42	Q	V			
12+10	1.5028	2.47	Q	V			
12+15	1.5201	2.51	Q	V			
12+20	1.5376	2.55	Q	V			
12+25	1.5554	2.58	Q	V			
12+30	1.5735	2.62	Q	V			
12+35	1.5918	2.66	Q	V			
12+40	1.6103	2.69	Q	V			
12+45	1.6291	2.73	Q	V			
12+50	1.6482	2.77	Q	V			
12+55	1.6676	2.81	Q	V			
13+ 0	1.6873	2.86	Q	V			
13+ 5	1.7073	2.90	Q	V			
13+10	1.7276	2.95	Q	V			
13+15	1.7483	3.00	Q	V			
13+20	1.7693	3.05	Q	V			
13+25	1.7907	3.10	Q	V			
13+30	1.8124	3.16	Q	V			
13+35	1.8346	3.22	Q	V			
13+40	1.8572	3.28	Q	V			
13+45	1.8802	3.34	Q	V			
13+50	1.9037	3.41	Q	V			
13+55	1.9277	3.49	Q	V			
14+ 0	1.9523	3.56	Q	V			
14+ 5	1.9774	3.64	Q	V			
14+10	2.0031	3.74	Q	V			
14+15	2.0295	3.83	Q	V			
14+20	2.0566	3.93	Q	V			
14+25	2.0844	4.04	Q	V			
14+30	2.1130	4.16	Q	V			
14+35	2.1424	4.27	Q	V			
14+40	2.1728	4.41	Q	V			
14+45	2.2042	4.55	Q	V			
14+50	2.2367	4.72	Q	V			
14+55	2.2703	4.89	Q	V			
15+ 0	2.3054	5.09	Q	V			
15+ 5	2.3418	5.29	Q	V			
15+10	2.3800	5.54	Q	V			

15+15	2.4200	5.81	Q		V			
15+20	2.4623	6.13	Q		V			
15+25	2.5063	6.39	Q		V			
15+30	2.5491	6.22	Q		V			
15+35	2.5917	6.18	Q		V			
15+40	2.6370	6.58	Q		V			
15+45	2.6865	7.18	Q		V			
15+50	2.7433	8.25	Q		V			
15+55	2.8116	9.92	Q		V			
16+ 0	2.9050	13.57		Q	V			
16+ 5	3.0709	24.09			Q	V		
16+10	3.4522	55.36				V		Q
16+15	3.7769	47.14				V	Q	
16+20	3.9583	26.34			Q		V	
16+25	4.0838	18.22				Q	V	
16+30	4.1828	14.37		Q			V	
16+35	4.2641	11.81		Q			V	
16+40	4.3330	10.01		Q			V	
16+45	4.3919	8.55		Q			V	
16+50	4.4425	7.35		Q			V	
16+55	4.4862	6.33		Q			V	
17+ 0	4.5266	5.88	Q				V	
17+ 5	4.5641	5.44	Q				V	
17+10	4.5979	4.91	Q				V	
17+15	4.6260	4.09	Q				V	
17+20	4.6525	3.85	Q				V	
17+25	4.6777	3.66	Q				V	
17+30	4.7018	3.50	Q				V	
17+35	4.7249	3.35	Q				V	
17+40	4.7470	3.22	Q				V	
17+45	4.7684	3.10	Q				V	
17+50	4.7890	2.99	Q				V	
17+55	4.8090	2.90	Q				V	
18+ 0	4.8283	2.81	Q				V	
18+ 5	4.8470	2.72	Q				V	
18+10	4.8652	2.63	Q				V	
18+15	4.8828	2.55	Q				V	
18+20	4.8999	2.48	Q				V	
18+25	4.9165	2.42	Q				V	
18+30	4.9328	2.36	Q				V	
18+35	4.9486	2.30	Q				V	
18+40	4.9642	2.25	Q				V	
18+45	4.9793	2.21	Q				V	
18+50	4.9942	2.16	Q				V	
18+55	5.0088	2.12	Q				V	
19+ 0	5.0231	2.08	Q				V	
19+ 5	5.0371	2.04	Q				V	
19+10	5.0509	2.00	Q				V	
19+15	5.0645	1.97	Q				V	
19+20	5.0778	1.93	Q				V	

19+25	5.0909	1.90	Q				V
19+30	5.1038	1.87	Q				V
19+35	5.1165	1.84	Q				V
19+40	5.1290	1.81	Q				V
19+45	5.1413	1.79	Q				V
19+50	5.1534	1.76	Q				V
19+55	5.1654	1.74	Q				V
20+ 0	5.1772	1.71	Q				V
20+ 5	5.1888	1.69	Q				V
20+10	5.2003	1.67	Q				V
20+15	5.2116	1.65	Q				V
20+20	5.2228	1.62	Q				V
20+25	5.2338	1.60	Q				V
20+30	5.2448	1.58	Q				V
20+35	5.2555	1.57	Q				V
20+40	5.2662	1.55	Q				V
20+45	5.2767	1.53	Q				V
20+50	5.2872	1.51	Q				V
20+55	5.2975	1.50	Q				V
21+ 0	5.3076	1.48	Q				V
21+ 5	5.3177	1.46	Q				V
21+10	5.3277	1.45	Q				V
21+15	5.3376	1.43	Q				V
21+20	5.3474	1.42	Q				V
21+25	5.3570	1.41	Q				V
21+30	5.3666	1.39	Q				V
21+35	5.3761	1.38	Q				V
21+40	5.3855	1.36	Q				V
21+45	5.3948	1.35	Q				V
21+50	5.4040	1.34	Q				V
21+55	5.4132	1.33	Q				V
22+ 0	5.4222	1.32	Q				V
22+ 5	5.4312	1.30	Q				V
22+10	5.4401	1.29	Q				V
22+15	5.4490	1.28	Q				V
22+20	5.4577	1.27	Q				V
22+25	5.4664	1.26	Q				V
22+30	5.4750	1.25	Q				V
22+35	5.4835	1.24	Q				V
22+40	5.4920	1.23	Q				V
22+45	5.5004	1.22	Q				V
22+50	5.5087	1.21	Q				V
22+55	5.5170	1.20	Q				V
23+ 0	5.5252	1.19	Q				V
23+ 5	5.5334	1.18	Q				V
23+10	5.5415	1.17	Q				V
23+15	5.5495	1.17	Q				V
23+20	5.5575	1.16	Q				V
23+25	5.5654	1.15	Q				V
23+30	5.5732	1.14	Q				V

23+35	5.5810	1.13	Q				V
23+40	5.5888	1.13	Q				V
23+45	5.5965	1.12	Q				V
23+50	5.6041	1.11	Q				V
23+55	5.6117	1.10	Q				V
24+ 0	5.6193	1.10	Q				V

Appendix E

Soils Information

USDA Soils information



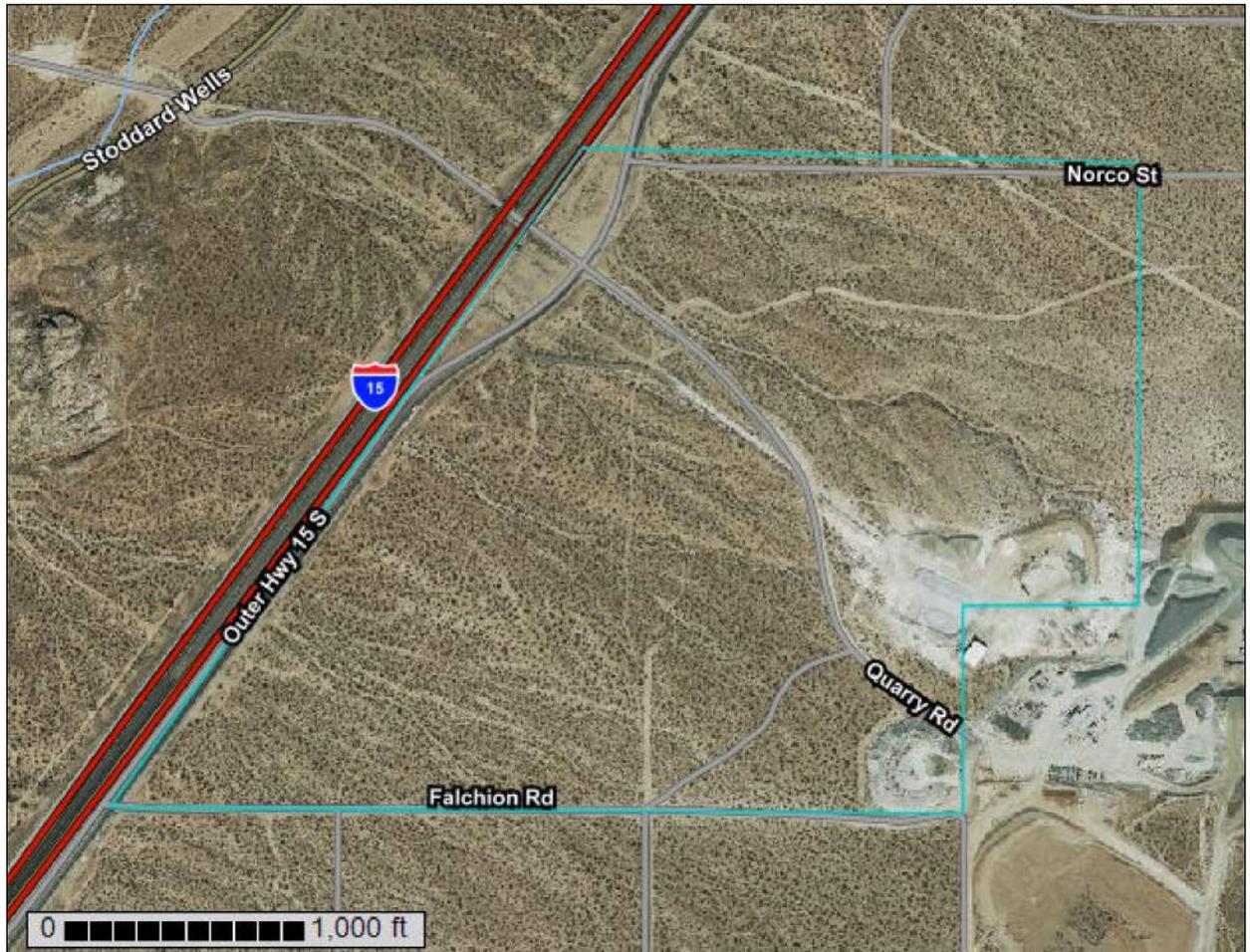
United States
Department of
Agriculture

NRCS

Natural
Resources
Conservation
Service

A product of the National
Cooperative Soil Survey,
a joint effort of the United
States Department of
Agriculture and other
Federal agencies, State
agencies including the
Agricultural Experiment
Stations, and local
participants

Custom Soil Resource Report for San Bernardino County, California, Mojave River Area



Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (<http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/>) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (<https://offices.sc.egov.usda.gov/locator/app?agency=nrcs>) or your NRCS State Soil Scientist (http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2_053951).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Web Soil Survey, the site for official soil survey information.

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How Soil Surveys Are Made

Soil surveys are made to provide information about the soils and miscellaneous areas in a specific area. They include a description of the soils and miscellaneous areas and their location on the landscape and tables that show soil properties and limitations affecting various uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They observed and described many soil profiles. A soil profile is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed or from the surface down to bedrock. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

Currently, soils are mapped according to the boundaries of major land resource areas (MLRAs). MLRAs are geographically associated land resource units that share common characteristics related to physiography, geology, climate, water resources, soils, biological resources, and land uses (USDA, 2006). Soil survey areas typically consist of parts of one or more MLRA.

The soils and miscellaneous areas in a survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept, or model, of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil

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scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

The objective of soil mapping is not to delineate pure map unit components; the objective is to separate the landscape into landforms or landform segments that have similar use and management requirements. Each map unit is defined by a unique combination of soil components and/or miscellaneous areas in predictable proportions. Some components may be highly contrasting to the other components of the map unit. The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The delineation of such landforms and landform segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

Soil scientists make many field observations in the process of producing a soil map. The frequency of observation is dependent upon several factors, including scale of mapping, intensity of mapping, design of map units, complexity of the landscape, and experience of the soil scientist. Observations are made to test and refine the soil-landscape model and predictions and to verify the classification of the soils at specific locations. Once the soil-landscape model is refined, a significantly smaller number of measurements of individual soil properties are made and recorded. These measurements may include field measurements, such as those for color, depth to bedrock, and texture, and laboratory measurements, such as those for content of sand, silt, clay, salt, and other components. Properties of each soil typically vary from one point to another across the landscape.

Observations for map unit components are aggregated to develop ranges of characteristics for the components. The aggregated values are presented. Direct measurements do not exist for every property presented for every map unit component. Values for some properties are estimated from combinations of other properties.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and

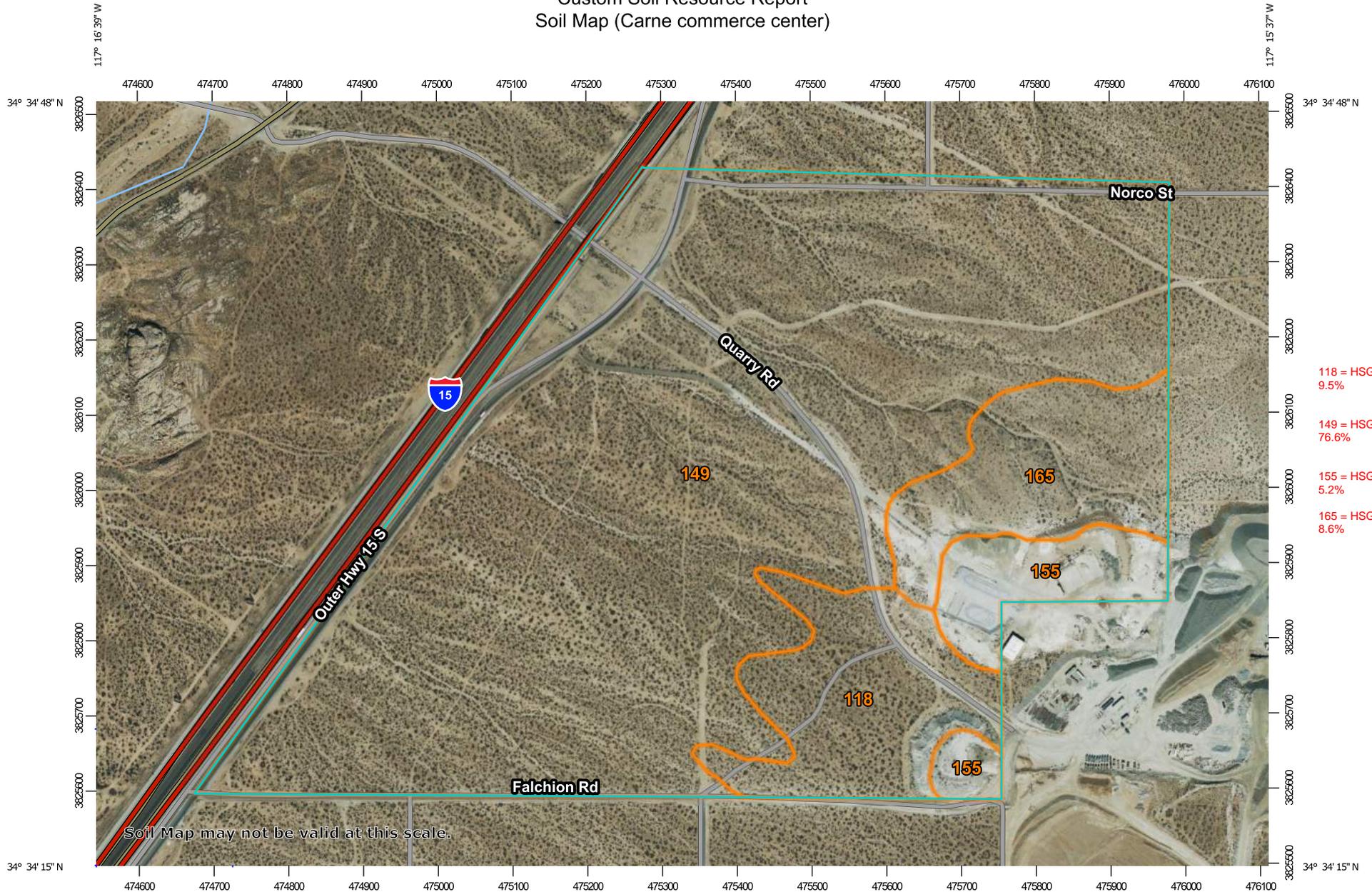
Custom Soil Resource Report

identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

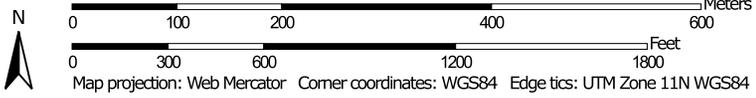
Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

Custom Soil Resource Report Soil Map (Carne commerce center)



Map Scale: 1:7,170 if printed on A landscape (11" x 8.5") sheet.



MAP LEGEND

Area of Interest (AOI)

 Area of Interest (AOI)

Soils

 Soil Map Unit Polygons

 Soil Map Unit Lines

 Soil Map Unit Points

Special Point Features

-  Blowout
-  Borrow Pit
-  Clay Spot
-  Closed Depression
-  Gravel Pit
-  Gravelly Spot
-  Landfill
-  Lava Flow
-  Marsh or swamp
-  Mine or Quarry
-  Miscellaneous Water
-  Perennial Water
-  Rock Outcrop
-  Saline Spot
-  Sandy Spot
-  Severely Eroded Spot
-  Sinkhole
-  Slide or Slip
-  Sodic Spot

-  Spoil Area
-  Stony Spot
-  Very Stony Spot
-  Wet Spot
-  Other
-  Special Line Features

Water Features

 Streams and Canals

Transportation

-  Rails
-  Interstate Highways
-  US Routes
-  Major Roads
-  Local Roads

Background

 Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
 Web Soil Survey URL:
 Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: San Bernardino County, California, Mojave River Area
 Survey Area Data: Version 13, Sep 13, 2021

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Mar 27, 2021—May 24, 2021

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background

MAP LEGEND

MAP INFORMATION

imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend (Carne commerce center)

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI	
118	CAJON-ARIZO COMPLEX, 2 TO 15 PERCENT SLOPES*	18.4	9.5%	HSG = A
149	MIRAGE-JOSHUA COMPLEX, 2 TO 5 PERCENT SLOPES*	147.5	76.6%	HSG = C
155	PITS	10.1	5.2%	HSG = ?
165	TRIGGER-SPARKHULE-ROCK OUTCROP ASSOCIATION, STEEP*	16.6	8.6%	HSG = D
Totals for Area of Interest		192.5	100.0%	

Map Unit Descriptions (Carne commerce center)

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

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The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

San Bernardino County, California, Mojave River Area

118—CAJON-ARIZO COMPLEX, 2 TO 15 PERCENT SLOPES*

Map Unit Setting

National map unit symbol: hkrq
Elevation: 2,800 to 3,300 feet
Mean annual precipitation: 3 to 6 inches
Mean annual air temperature: 59 to 66 degrees F
Frost-free period: 180 to 290 days
Farmland classification: Not prime farmland

Map Unit Composition

Cajon, gravelly surface, and similar soils: 55 percent
Arizo and similar soils: 30 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Cajon, Gravelly Surface

Setting

Landform: Alluvial fans
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium derived from granite sources

Typical profile

H1 - 0 to 6 inches: gravelly sand
H2 - 6 to 60 inches: gravelly sand

Properties and qualities

Slope: 2 to 15 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat excessively drained
Capacity of the most limiting layer to transmit water (Ksat): High to very high (5.95 to 19.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: Rare
Frequency of ponding: None
Calcium carbonate, maximum content: 1 percent
Available water supply, 0 to 60 inches: Very low (about 3.0 inches)

Interpretive groups

Land capability classification (irrigated): 4s
Land capability classification (nonirrigated): 7e
Hydrologic Soil Group: A
Ecological site: R030XF028CA - COBBLY SANDY
Hydric soil rating: No

Description of Arizo

Setting

Landform: Alluvial fans
Landform position (two-dimensional): Backslope

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Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium derived from granite sources

Typical profile

H1 - 0 to 6 inches: gravelly loamy sand
H2 - 6 to 60 inches: extremely gravelly loamy coarse sand

Properties and qualities

Slope: 2 to 9 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Excessively drained
Capacity of the most limiting layer to transmit water (Ksat): High to very high (5.95 to 19.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: NoneOccasional
Frequency of ponding: None
Calcium carbonate, maximum content: 15 percent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: Low (about 3.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7w
Hydrologic Soil Group: A
Ecological site: R030XF025CA - GRAVELLY COARSE LOAMY
Hydric soil rating: No

Minor Components

Helendale

Percent of map unit: 4 percent
Hydric soil rating: No

Bryman

Percent of map unit: 4 percent
Hydric soil rating: No

Joshua

Percent of map unit: 4 percent
Hydric soil rating: No

Cajon, clayey substratum

Percent of map unit: 3 percent

149—MIRAGE-JOSHUA COMPLEX, 2 TO 5 PERCENT SLOPES*

Map Unit Setting

National map unit symbol: hksq
Elevation: 2,600 to 3,400 feet

Custom Soil Resource Report

Mean annual precipitation: 3 to 5 inches
Mean annual air temperature: 63 to 66 degrees F
Frost-free period: 200 to 290 days
Farmland classification: Not prime farmland

Map Unit Composition

Mirage and similar soils: 50 percent
Joshua and similar soils: 30 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Mirage

Setting

Landform: Fan remnants
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Interfluve
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium derived from granite sources

Typical profile

H1 - 0 to 5 inches: sandy loam
H2 - 5 to 21 inches: gravelly sandy clay loam
H3 - 21 to 39 inches: gravelly sandy loam
H4 - 39 to 60 inches: gravelly loamy sand

Properties and qualities

Slope: 2 to 5 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.57 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 5 percent
Maximum salinity: Strongly saline (16.0 mmhos/cm)
Available water supply, 0 to 60 inches: Very low (about 2.6 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7e
Hydrologic Soil Group: C
Ecological site: R030XG024CA - DESERT PAVEMENT
Hydric soil rating: No

Description of Joshua

Setting

Landform: Fan remnants
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Interfluve
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium derived from mixed sources

Custom Soil Resource Report

Typical profile

H1 - 0 to 3 inches: loam

H2 - 3 to 20 inches: gravelly sandy clay loam

H3 - 20 to 55 inches: very gravelly loamy coarse sand

Properties and qualities

Slope: 2 to 5 percent

Depth to restrictive feature: More than 80 inches

Drainage class: Well drained

Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)

Depth to water table: More than 80 inches

Frequency of flooding: None

Frequency of ponding: None

Calcium carbonate, maximum content: 5 percent

Maximum salinity: Slightly saline to strongly saline (4.0 to 16.0 mmhos/cm)

Available water supply, 0 to 60 inches: Low (about 3.2 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 7e

Hydrologic Soil Group: C

Ecological site: R030XG024CA - DESERT PAVEMENT

Hydric soil rating: No

Minor Components

Unnamed soils

Percent of map unit: 10 percent

Hydric soil rating: No

Nebona

Percent of map unit: 5 percent

Hydric soil rating: No

Cuddeback

Percent of map unit: 5 percent

Hydric soil rating: No

155—PITS

Map Unit Composition

Pits: 85 percent

Minor components: 15 percent

Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Pits

Setting

Landform: Stream terraces, alluvial fans

Custom Soil Resource Report

Landform position (two-dimensional): Backslope, footslope
Landform position (three-dimensional): Mountainflank, side slope, tread
Down-slope shape: Linear
Across-slope shape: Linear

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8s
Hydric soil rating: No

Minor Components

Arizo

Percent of map unit: 5 percent
Hydric soil rating: No

Cajon

Percent of map unit: 3 percent
Hydric soil rating: No

Yermo

Percent of map unit: 2 percent
Hydric soil rating: No

Riverwash

Percent of map unit: 2 percent
Landform: Channels
Hydric soil rating: Yes

Trigger

Percent of map unit: 1 percent
Hydric soil rating: No

Sparkhule

Percent of map unit: 1 percent
Hydric soil rating: No

Rock outcrop

Percent of map unit: 1 percent
Hydric soil rating: No

165—TRIGGER-SPARKHULE-ROCK OUTCROP ASSOCIATION, STEEP*

Map Unit Setting

National map unit symbol: hkt7
Elevation: 650 to 4,500 feet
Mean annual precipitation: 3 to 5 inches
Mean annual air temperature: 59 to 66 degrees F
Frost-free period: 180 to 290 days
Farmland classification: Not prime farmland

Map Unit Composition

Trigger and similar soils: 40 percent
Sparkhule and similar soils: 30 percent

Custom Soil Resource Report

Rock outcrop: 30 percent

Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Trigger

Setting

Landform: Hills

Landform position (two-dimensional): Summit

Landform position (three-dimensional): Crest

Down-slope shape: Convex

Across-slope shape: Convex

Parent material: Residuum weathered from calcareous conglomerate

Typical profile

H1 - 0 to 12 inches: gravelly sandy loam

H2 - 12 to 22 inches: unweathered bedrock

Properties and qualities

Slope: 30 to 40 percent

Depth to restrictive feature: 10 to 18 inches to lithic bedrock

Drainage class: Well drained

Capacity of the most limiting layer to transmit water (Ksat): High (1.98 to 5.95 in/hr)

Depth to water table: More than 80 inches

Frequency of flooding: None

Frequency of ponding: None

Calcium carbonate, maximum content: 5 percent

Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)

Available water supply, 0 to 60 inches: Very low (about 1.2 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 7e

Hydrologic Soil Group: D

Ecological site: R030XF033CA - GRAVELLY LOAM

Hydric soil rating: No

Description of Sparkhule

Setting

Landform: Hills

Landform position (two-dimensional): Backslope

Landform position (three-dimensional): Base slope

Down-slope shape: Concave

Across-slope shape: Concave

Parent material: Colluvium derived from and/or residuum weathered from dacite

Typical profile

H1 - 0 to 2 inches: gravelly sandy loam

H2 - 2 to 18 inches: gravelly sandy clay loam

H3 - 18 to 28 inches: unweathered bedrock

Properties and qualities

Slope: 20 to 30 percent

Depth to restrictive feature: 14 to 20 inches to lithic bedrock

Drainage class: Well drained

Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.57 in/hr)

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Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: Very low (about 2.4 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7e
Hydrologic Soil Group: D
Ecological site: R030XF033CA - GRAVELLY LOAM
Hydric soil rating: No

Description of Rock Outcrop

Setting

Landform: Hills
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Concave
Across-slope shape: Concave

Typical profile

H1 - 0 to 60 inches: unweathered bedrock

Properties and qualities

Slope: 20 to 40 percent
Depth to restrictive feature: 0 inches to lithic bedrock
Available water supply, 0 to 60 inches: Very low (about 0.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8s
Hydric soil rating: No

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Custom Soil Resource Report

United States Department of Agriculture, Natural Resources Conservation Service. National soil survey handbook, title 430-VI. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/scientists/?cid=nrcs142p2_054242

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Appendix F

- BMP Fact Sheets

Section 3

Source Control BMPs

3.1 Introduction

This section provides a description of specific source control Best Management Practices (BMPs) for activities related to municipal operations. As noted in Sections 1 and 2, municipal fixed facilities conduct activities that have the potential to generate pollutants. The source control BMPs in this section address these activities (see Table 3-1).

In addition, municipalities conduct various field programs where activities may occur and create pollutants. BMPs for these field programs and associated activities are listed in Table 3-2.

Table 3-1 Municipal Fixed Facility BMPs	
Non-Stormwater Management	
SC-10	Non-Stormwater Discharges
SC-11	Spill Prevention, Control and Cleanup
Vehicle and Equipment Management	
SC-20	Vehicle and Equipment Fueling
SC-21	Vehicle and Equipment Cleaning
SC-22	Vehicle and Equipment Repair
Material and Waste Management	
SC-30	Outdoor Loading/Unloading
SC-31	Outdoor Container Storage
SC-32	Outdoor Equipment Maintenance
SC-33	Outdoor Storage of Raw Materials
SC-34	Waste Handling and Disposal
Building and Grounds Management	
SC-41	Building and Grounds Maintenance
SC-43	Parking/Storage Area Maintenance
Over Water Activities	
SC-50	Over Water Activities
General Stormwater Management	
SC-60	Housekeeping Practices
SC-61	Safer Alternative Products

Table 3-2 Municipal Field Program BMPs	
SC-70	Road and Street Maintenance
SC-71	Plaza and Sidewalk Cleaning
SC-72	Fountains & Pools Maintenance
SC-73	Landscape Maintenance
SC-74	Drainage System Maintenance
SC-75	Waste Handling and Disposal
SC-76	Water and Sewer Utility Maintenance

3.2 Fact Sheet Format

Each BMP fact sheet is a short document that gives all the information about a particular BMP. Typically, each fact sheet contains the information outlined in Figure 3-1. Completed fact sheets for each of the activities listed in Tables 3-1 and 3-2 are provided in Section 3.3.

The fact sheets also contain side bar presentations with information on BMP objectives and targeted constituents.

The information provided in each fact sheet is extensive and may not be applicable to all municipal operations. The readers may find it helpful to modify and simplify the BMP fact sheets to better reflect their existing operations.

3.3 BMP Fact Sheets

BMP fact sheets for fixed facilities activities and field programs follow. The BMP fact sheets are individually page numbered and are suitable for photocopying and inclusions in stormwater quality management plans. Fresh copies of the fact sheets can be individually downloaded from the California Stormwater BMP Handbook website at <http://www.cabmphandbooks.com>

SC-xx Example Fact Sheet	
<u>Description of the BMP</u>	
<u>Approach</u>	
Pollution Prevention	
Suggested Protocols	
Training	
Spill Response and Prevention	
Other Considerations	
<u>Requirements</u>	
Costs	
Maintenance	
<u>Supplemental Information</u>	
Further Details on the BMP	
Examples	
<u>References and Resources</u>	

Figure 3-1
Example Fact Sheet

Site Design & Landscape Planning SD-10



Design Objectives

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

Description

Each project site possesses unique topographic, hydrologic, and vegetative features, some of which are more suitable for development than others. Integrating and incorporating appropriate landscape planning methodologies into the project design is the most effective action that can be done to minimize surface and groundwater contamination from stormwater.

Approach

Landscape planning should couple consideration of land suitability for urban uses with consideration of community goals and projected growth. Project plan designs should conserve natural areas to the extent possible, maximize natural water storage and infiltration opportunities, and protect slopes and channels.

Suitable Applications

Appropriate applications include residential, commercial and industrial areas planned for development or redevelopment.

Design Considerations

Design requirements for site design and landscapes planning should conform to applicable standards and specifications of agencies with jurisdiction and be consistent with applicable General Plan and Local Area Plan policies.



SD-10 Site Design & Landscape Planning

Designing New Installations

Begin the development of a plan for the landscape unit with attention to the following general principles:

- Formulate the plan on the basis of clearly articulated community goals. Carefully identify conflicts and choices between retaining and protecting desired resources and community growth.
- Map and assess land suitability for urban uses. Include the following landscape features in the assessment: wooded land, open unwooded land, steep slopes, erosion-prone soils, foundation suitability, soil suitability for waste disposal, aquifers, aquifer recharge areas, wetlands, floodplains, surface waters, agricultural lands, and various categories of urban land use. When appropriate, the assessment can highlight outstanding local or regional resources that the community determines should be protected (e.g., a scenic area, recreational area, threatened species habitat, farmland, fish run). Mapping and assessment should recognize not only these resources but also additional areas needed for their sustenance.

Project plan designs should conserve natural areas to the extent possible, maximize natural water storage and infiltration opportunities, and protect slopes and channels.

Conserve Natural Areas during Landscape Planning

If applicable, the following items are required and must be implemented in the site layout during the subdivision design and approval process, consistent with applicable General Plan and Local Area Plan policies:

- Cluster development on least-sensitive portions of a site while leaving the remaining land in a natural undisturbed condition.
- Limit clearing and grading of native vegetation at a site to the minimum amount needed to build lots, allow access, and provide fire protection.
- Maximize trees and other vegetation at each site by planting additional vegetation, clustering tree areas, and promoting the use of native and/or drought tolerant plants.
- Promote natural vegetation by using parking lot islands and other landscaped areas.
- Preserve riparian areas and wetlands.

Maximize Natural Water Storage and Infiltration Opportunities Within the Landscape Unit

- Promote the conservation of forest cover. Building on land that is already deforested affects basin hydrology to a lesser extent than converting forested land. Loss of forest cover reduces interception storage, detention in the organic forest floor layer, and water losses by evapotranspiration, resulting in large peak runoff increases and either their negative effects or the expense of countering them with structural solutions.
- Maintain natural storage reservoirs and drainage corridors, including depressions, areas of permeable soils, swales, and intermittent streams. Develop and implement policies and

Site Design & Landscape Planning SD-10

regulations to discourage the clearing, filling, and channelization of these features. Utilize them in drainage networks in preference to pipes, culverts, and engineered ditches.

- Evaluating infiltration opportunities by referring to the stormwater management manual for the jurisdiction and pay particular attention to the selection criteria for avoiding groundwater contamination, poor soils, and hydrogeological conditions that cause these facilities to fail. If necessary, locate developments with large amounts of impervious surfaces or a potential to produce relatively contaminated runoff away from groundwater recharge areas.

Protection of Slopes and Channels during Landscape Design

- Convey runoff safely from the tops of slopes.
- Avoid disturbing steep or unstable slopes.
- Avoid disturbing natural channels.
- Stabilize disturbed slopes as quickly as possible.
- Vegetate slopes with native or drought tolerant vegetation.
- Control and treat flows in landscaping and/or other controls prior to reaching existing natural drainage systems.
- Stabilize temporary and permanent channel crossings as quickly as possible, and ensure that increases in run-off velocity and frequency caused by the project do not erode the channel.
- Install energy dissipaters, such as riprap, at the outlets of new storm drains, culverts, conduits, or channels that enter unlined channels in accordance with applicable specifications to minimize erosion. Energy dissipaters shall be installed in such a way as to minimize impacts to receiving waters.
- Line on-site conveyance channels where appropriate, to reduce erosion caused by increased flow velocity due to increases in tributary impervious area. The first choice for linings should be grass or some other vegetative surface, since these materials not only reduce runoff velocities, but also provide water quality benefits from filtration and infiltration. If velocities in the channel are high enough to erode grass or other vegetative linings, riprap, concrete, soil cement, or geo-grid stabilization are other alternatives.
- Consider other design principles that are 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.

SD-10 Site Design & Landscape Planning

Redevelopment may present significant opportunity to add features which had not previously been implemented. Examples include incorporation of depressions, areas of permeable soils, and swales in newly redeveloped areas. While some site constraints may exist due to the status of already existing infrastructure, opportunities should not be missed to maximize infiltration, slow runoff, reduce impervious areas, disconnect directly connected impervious areas.

Other Resources

A Manual for the Standard Urban Stormwater Mitigation Plan (SUSMP), Los Angeles County Department of Public Works, May 2002.

Stormwater Management Manual for Western Washington, Washington State Department of Ecology, August 2001.

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.

Spill Prevention, Control & Cleanup SC-11



Objectives

- Cover
- Contain
- Educate
- Reduce/Minimize
- Product Substitution

Description

Spills and leaks, if not properly controlled, can adversely impact the storm drain system and receiving waters. Due to the type of work or the materials involved, many activities that occur either at a municipal facility or as a part of municipal field programs have the potential for accidental spills and leaks. Proper spill response planning and preparation can enable municipal employees to effectively respond to problems when they occur and minimize the discharge of pollutants to the environment.

Approach

- An effective spill response and control plan should include:
 - Spill/leak prevention measures;
 - Spill response procedures;
 - Spill cleanup procedures;
 - Reporting; and
 - Training
- A well thought out and implemented plan can prevent pollutants from entering the storm drainage system and can be used as a tool for training personnel to prevent and control future spills as well.

Pollution Prevention

- Develop and implement a Spill Prevention Control and Response Plan. The plan should include:

Targeted Constituents

Sediment	
Nutrients	<input checked="" type="checkbox"/>
Trash	
Metals	<input checked="" type="checkbox"/>
Bacteria	
Oil and Grease	<input checked="" type="checkbox"/>
Organics	<input checked="" type="checkbox"/>
Oxygen Demanding	<input checked="" type="checkbox"/>



SC-11 Spill Prevention, Control & Cleanup

- A description of the facility, the address, activities and materials involved
- Identification of key spill response personnel
- Identification of the potential spill areas or operations prone to spills/leaks
- Identification of which areas should be or are bermed to contain spills/leaks
- Facility map identifying the key locations of areas, activities, materials, structural BMPs, etc.
- Material handling procedures
- Spill response procedures including:
 - Assessment of the site and potential impacts
 - Containment of the material
 - Notification of the proper personnel and evacuation procedures
 - Clean up of the site
 - Disposal of the waste material and
 - Proper record keeping
- Product substitution – use less toxic materials (i.e. use water based paints instead of oil based paints)
- Recycle, reclaim, or reuse materials whenever possible. This will reduce the amount of materials that are brought into the facility or into the field.

Suggested Protocols

Spill/Leak Prevention Measures

- If possible, move material handling indoors, under cover, or away from storm drains or sensitive water bodies.
- Properly label all containers so that the contents are easily identifiable.
- Berm storage areas so that if a spill or leak occurs, the material is contained.
- Cover outside storage areas either with a permanent structure or with a seasonal one such as a tarp so that rain can not come into contact with the materials.
- Check containers (and any containment sumps) often for leaks and spills. Replace containers that are leaking, corroded, or otherwise deteriorating with containers in good condition. Collect all spilled liquids and properly dispose of them.

Spill Prevention, Control & Cleanup SC-11

- Store, contain and transfer liquid materials in such a manner that if the container is ruptured or the contents spilled, they will not discharge, flow or be washed into the storm drainage system, surface waters, or groundwater.
- Place drip pans or absorbent materials beneath all mounted taps and at all potential drip and spill locations during the filling and unloading of containers. Any collected liquids or soiled absorbent materials should be reused/recycled or properly disposed of.
- For field programs, only transport the minimum amount of material needed for the daily activities and transfer materials between containers at a municipal yard where leaks and spill are easier to control.
- If paved, sweep and clean storage areas monthly, do not use water to hose down the area unless all of the water will be collected and disposed of properly.
- Install a spill control device (such as a tee section) in any catch basins that collect runoff from any storage areas if the materials stored are oil, gas, or other materials that separate from and float on water. This will allow for easier cleanup if a spill occurs.
- If necessary, protect catch basins while conducting field activities so that if a spill occurs, the material will be contained.

Training

- Educate employees about spill prevention, spill response and cleanup on a routine basis.
- Well-trained employees can reduce human errors that lead to accidental releases or spills:
 - The employees should have the tools and knowledge to immediately begin cleaning up a spill if one should occur.
 - Employees should be familiar with the Spill Prevention Control and Countermeasure Plan if one is available.
- Training of staff from all municipal departments should focus on recognizing and reporting potential or current spills/leaks and who they should contact.
- Employees responsible for aboveground storage tanks and liquid transfers for large bulk containers should be thoroughly familiar with the Spill Prevention Control and Countermeasure Plan and the plan should be readily available.

Spill Response and Prevention

- Identify key spill response personnel and train employees on who they are.
- Store and maintain appropriate spill cleanup materials in a clearly marked location near storage areas; and train employees to ensure familiarity with the site's spill control plan and/or proper spill cleanup procedures.
- Locate spill cleanup materials, such as absorbents, where they will be readily accessible (e.g. near storage and maintenance areas, on field trucks).

SC-11 Spill Prevention, Control & Cleanup

- Follow the Spill Prevention Control and Countermeasure Plan if one is available.
- If a spill occurs, notify the key spill response personnel immediately. If the material is unknown or hazardous, the local fire department may also need to be contacted.
- If safe to do so, attempt to contain the material and block the nearby storm drains so that the area impacted is minimized. If the material is unknown or hazardous wait for properly trained personnel to contain the materials.
- Perform an assessment of the area where the spill occurred and the downstream area that it could impact. Relay this information to the key spill response and clean up personnel.

Spill Cleanup Procedures

- Small non-hazardous spills
 - Use a rag, damp cloth or absorbent materials for general clean up of liquids
 - Use brooms or shovels for the general clean up of dry materials
 - If water is used, it must be collected and properly disposed of. The wash water can not be allowed to enter the storm drain.
 - Dispose of any waste materials properly
 - Clean or dispose of any equipment used to clean up the spill properly
- Large non-hazardous spills
 - Use absorbent materials for general clean up of liquids
 - Use brooms, shovels or street sweepers for the general clean up of dry materials
 - If water is used, it must be collected and properly disposed of. The wash water can not be allowed to enter the storm drain.
 - Dispose of any waste materials properly
 - Clean or dispose of any equipment used to clean up the spill properly
- For hazardous or very large spills, a private cleanup company or Hazmat team may need to be contacted to assess the situation and conduct the cleanup and disposal of the materials.
- Chemical cleanups of material can be achieved with the use of absorbents, gels, and foams. Remove the adsorbent materials promptly and dispose of according to regulations.
- 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.

Reporting

- Report any spills immediately to the identified key municipal spill response personnel.

Spill Prevention, Control & Cleanup SC-11

- Report spills in accordance with applicable reporting laws. Spills that pose an immediate threat to human health or the environment must be reported immediately to the Office of Emergency Service (OES)
- Spills that pose an immediate threat to human health or the environment may also need to be reported within 24 hours to the Regional Water Quality Control Board.
- 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)
- After the spill has been contained and cleaned up, a detailed report about the incident should be generated and kept on file (see the section on Reporting below). The incident may also be used in briefing staff about proper procedures

Other Considerations

- 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 Plan (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, if permitted to do so, prohibiting any hard connections to the storm drain.

Requirements

Costs

- 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 wastes, contaminated soil and water is very expensive

Maintenance

- This BMP has no major administrative or staffing requirements. However, 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 response and containment of a spill. A good record keeping system helps the municipality minimize incident recurrence, correctly respond with appropriate containment and 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 drain.

SC-11 Spill Prevention, Control & Cleanup

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
- 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:

- The date and time the inspection was performed
- Name of the inspector
- Items inspected
- Problems noted
- Corrective action required
- 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.

Examples

The City of Palo Alto includes spill prevention and control as a major element of its highly effective program for municipal vehicle maintenance shops.

References and Resources

King County Stormwater Pollution Control Manual - <http://dnr.metrokc.gov/wlr/dss/spcm.htm>

Orange County Stormwater Program

http://www.ocwatersheds.com/stormwater/swp_introduction.asp

San Diego Stormwater Co-permittees Jurisdictional Urban Runoff Management Program (URMP)

<http://www.projectcleanwater.org/pdf/Model%20Program%20Municipal%20Facilities.pdf>



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.



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

Redeveloping Existing Installations

Various jurisdictional stormwater management and mitigation plans (SUSMP, WQMP, etc.) define "redevelopment" in terms of amounts of additional impervious area, increases in gross floor area and/or exterior construction, and land disturbing activities with structural or impervious surfaces. The definition of "redevelopment" must be consulted to determine whether or not the requirements for new development apply to areas intended for redevelopment. If the definition applies, the steps outlined under "designing new installations" above should be followed.

Other Resources

A Manual for the Standard Urban Stormwater Mitigation Plan (SUSMP), Los Angeles County Department of Public Works, May 2002.

Model Standard Urban Storm Water Mitigation Plan (SUSMP) for San Diego County, Port of San Diego, and Cities in San Diego County, February 14, 2002.

Model Water Quality Management Plan (WQMP) for County of Orange, Orange County Flood Control District, and the Incorporated Cities of Orange County, Draft February 2003.

Ventura Countywide Technical Guidance Manual for Stormwater Quality Control Measures, July 2002.



Design Objectives

- Maximize Infiltration
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- Prohibit Dumping of Improper Materials
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- 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



– 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.

- 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.



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.

Pollution Prevention

- Switch to non-toxic chemicals for maintenance when possible.
- Choose cleaning agents that can be recycled.
- Encourage proper lawn management and landscaping, including use of native vegetation.

Objectives

- Cover
- Contain
- Educate
- Reduce/Minimize
- Product Substitution

Targeted Constituents

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



SC-41 Building & Grounds Maintenance

- 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.

Suggested Protocols

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.

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.

Building & Grounds Maintenance SC-41

- 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

- 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.
- 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.
- Dispose of empty pesticide containers according to the instructions on the container label.

SC-41 Building & Grounds Maintenance

- 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.

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.

Training

- 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 nature of the staff.

Spill Response and Prevention

- 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.

Other Considerations

Alternative pest/weed controls may not be available, suitable, or effective in many cases.

Requirements

Costs

- Cost will vary depending on the type and size of facility.
- Overall costs should be low in comparison to other BMPs.

Maintenance

Sweep paved areas regularly to collect loose particles. Wipe up spills with rags and other absorbent material immediately, do not hose down the area to a storm drain.

Supplemental Information

Further Detail of the BMP

Fire Sprinkler Line Flushing

Building 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, polyphosphates 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

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

Clark County Storm Water Pollution Control Manual
<http://www.co.clark.wa.us/pubworks/bmpman.pdf>

King County Storm Water Pollution Control Manual <http://dnr.metrokc.gov/wlr/dss/spcm.htm>

Mobile Cleaners Pilot Program: Final Report. 1997. Bay Area Stormwater Management Agencies Association (BASMAA). <http://www.basmaa.org/>

Pollution from Surface Cleaning Folder. 1996. Bay Area Stormwater Management Agencies Association (BASMAA). <http://www.basmaa.org/>

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

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

Parking/Storage Area Maintenance SC-43



Description

Parking lots and storage areas 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/storage areas and include using good housekeeping practices, following appropriate cleaning BMPs, and training employees.

Approach

The goal of this program is to ensure stormwater pollution prevention practices are considered when conducting activities on or around parking areas and storage 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.

Pollution Prevention

- Encourage alternative designs and maintenance strategies for impervious parking lots. (See New Development and Redevelopment BMP Handbook)
- Keep accurate maintenance logs to evaluate BMP implementation.

Objectives

- Cover
- Contain
- Educate
- Reduce/Minimize
- Product Substitution

Targeted Constituents

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



SC-43 Parking/Storage Area Maintenance

Suggested Protocols

General

- Keep the parking and storage areas clean and orderly. Remove debris in a timely fashion.
- Allow 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.
- Discharge soapy water remaining in mop or wash buckets to the sanitary sewer through a sink, toilet, clean-out, or wash area with drain.

Controlling Litter

- Post “No Littering” signs and enforce anti-litter laws.
- Provide an adequate number of litter receptacles.
- Clean out and cover litter receptacles frequently to prevent spillage.
- Provide trash receptacles in parking lots to discourage litter.
- Routinely sweep, shovel, and dispose of litter in the trash.

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.
- 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.
 - Dispose of parking lot sweeping debris and dirt at a landfill.
- 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.

Parking/Storage Area Maintenance SC-43

- Do not allow discharges to the storm drain.
- Vacuum/pump discharges to a tank or discharge to sanitary sewer.
- Appropriately dispose of spilled materials and absorbents.

Surface Repair

- 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, 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.

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.

Training

- 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.

Spill Response and Prevention

- 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.

Other Considerations

Limitations related to sweeping activities at large parking facilities may include high equipment costs, the need for sweeper operator training, and the inability of current sweeper technology to remove oil and grease.

SC-43 Parking/Storage Area Maintenance

Requirements

Costs

Cleaning/sweeping costs can be quite large. Construction and maintenance of stormwater structural controls can be quite expensive as well.

Maintenance

- Sweep parking lot regularly to minimize cleaning with water.
- Clean out oil/water/sand separators regularly, especially after heavy storms.
- Clean parking facilities regularly to prevent accumulated wastes and pollutants from being discharged into conveyance systems during rainy conditions.

Supplemental Information

Further Detail of the BMP

Surface Repair

Apply concrete, asphalt, and seal coat during dry weather to prevent contamination from contacting stormwater runoff. Where applicable, cover and seal nearby storm drain inlets (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. Only use only as much water as is necessary for dust control to avoid runoff.

References and Resources

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

Clark County Storm Water Pollution Control Manual
<http://www.co.clark.wa.us/pubworks/bmpman.pdf>

King County Storm Water Pollution Control Manual <http://dnr.metrokc.gov/wlr/dss/spcm.htm>

Pollution from Surface Cleaning Folder. 1996. Bay Area Stormwater Management Agencies Association (BASMAA). <http://www.basmaa.org/>

Oregon Association of Clean Water Agencies. Oregon Municipal Stormwater Toolbox for Maintenance Practices. June 1998.

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

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

Description

Promote efficient and safe housekeeping practices (storage, use, and cleanup) when handling potentially harmful materials such as fertilizers, pesticides, cleaning solutions, paint products, automotive products, and swimming pool chemicals. Related information is provided in BMP fact sheets SC-11 Spill Prevention, Control & Cleanup and SC-34 Waste Handling & Disposal.

Approach

Pollution Prevention

- Purchase only the amount of material that will be needed for foreseeable use. In most cases this will result in cost savings in both purchasing and disposal. See SC-61 Safer Alternative Products for additional information.
- Be aware of new products that may do the same job with less environmental risk and for less or the equivalent cost. Total cost must be used here; this includes purchase price, transportation costs, storage costs, use related costs, clean up costs and disposal costs.

Suggested Protocols

General

- Keep work sites clean and orderly. Remove debris in a timely fashion. Sweep the area.
- Dispose of wash water, sweepings, and sediments, properly.
- Recycle or dispose of fluids properly.
- Establish a daily checklist of office, yard and plant areas to confirm cleanliness and adherence to proper storage and security. Specific employees should be assigned specific inspection responsibilities and given the authority to remedy any problems found.
- Post waste disposal charts in appropriate locations detailing for each waste its hazardous nature (poison, corrosive, flammable), prohibitions on its disposal (dumpster, drain, sewer) and the recommended disposal method (recycle, sewer, burn, storage, landfill).
- Summarize the chosen BMPs applicable to your operation and post them in appropriate conspicuous places.

Objectives

- Cover
- Contain
- Educate
- Reduce/Minimize
- Product Substitution

Targeted Constituents

Sediment	<input checked="" type="checkbox"/>
Nutrients	<input checked="" type="checkbox"/>
Trash	<input checked="" type="checkbox"/>
Metals	<input checked="" type="checkbox"/>
Bacteria	<input checked="" type="checkbox"/>
Oil and Grease	<input checked="" type="checkbox"/>
Organics	<input checked="" type="checkbox"/>
Oxygen Demanding	<input checked="" type="checkbox"/>



- Require a signed checklist from every user of any hazardous material detailing amount taken, amount used, amount returned and disposal of spent material.
- Do a before audit of your site to establish baseline conditions and regular subsequent audits to note any changes and whether conditions are improving or deteriorating.
- Keep records of water, air and solid waste quantities and quality tests and their disposition.
- Maintain a mass balance of incoming, outgoing and on hand materials so you know when there are unknown losses that need to be tracked down and accounted for.
- Use and reward employee suggestions related to BMPs, hazards, pollution reduction, work place safety, cost reduction, alternative materials and procedures, recycling and disposal.
- Have, and review regularly, a contingency plan for spills, leaks, weather extremes etc. Make sure all employees know about it and what their role is so that it comes into force automatically.

Training

- Train all employees, management, office, yard, manufacturing, field and clerical in BMPs and pollution prevention and make them accountable.
- Train municipal employees who handle potentially harmful materials in good housekeeping practices.
- Train personnel who use pesticides in the proper use of the pesticides. The California Department of Pesticide Regulation license pesticide dealers, certify pesticide applicators and conduct onsite inspections.
- Train employees and contractors in proper techniques for spill containment and cleanup. The employee should have the tools and knowledge to immediately begin cleaning up a spill if one should occur.

Spill Response and Prevention

- Refer to SC-11, Spill Prevention, Control & Cleanup.
- Keep your Spill Prevention Control and Countermeasure (SPCC) plan up-to-date, and implement accordingly.
- Have spill cleanup materials readily available and in a known location.
- Cleanup spills immediately and use dry methods if possible.
- Properly dispose of spill cleanup material.

Other Considerations

- There are no major limitations to this best management practice.
- There are no regulatory requirements to this BMP. Existing regulations already require municipalities to properly store, use, and dispose of hazardous materials

Requirements

Costs

- Minimal cost associated with this BMP. Implementation of good housekeeping practices may result in cost savings as these procedures may reduce the need for more costly BMPs.

Maintenance

- Ongoing maintenance required to keep a clean site. Level of effort is a function of site size and type of activities.

Supplemental Information

Further Detail of the BMP

- The California Integrated Waste Management Board's Recycling Hotline, 1-800-553-2962, provides information on household hazardous waste collection programs and facilities.

Examples

There are a number of communities with effective programs. The most pro-active include Santa Clara County and the City of Palo Alto, the City and County of San Francisco, and the Municipality of Metropolitan Seattle (Metro).

References and Resources

British Columbia Lake Stewardship Society. Best Management Practices to Protect Water Quality from Non-Point Source Pollution. March 2000.

<http://www.nalms.org/bclss/bmphome.html#bmp>

King County Stormwater Pollution Control Manual - <http://dnr.metrokc.gov/wlr/dss/spcm.htm>

Model Urban Runoff Program: A How-To Guide for Developing Urban Runoff Programs for Small Municipalities, Prepared by City of Monterey, City of Santa Cruz, California Coastal Commission, Monterey Bay National Marine Sanctuary, Association of Monterey Bay Area Governments, Woodward-Clyde, Central Coast Regional Water Quality Control Board. July, 1998, Revised by California Coastal Commission, February 2002.

Orange County Stormwater Program

http://www.ocwatersheds.com/stormwater/swp_introduction.asp

San Mateo STOPPP - (<http://stoppp.tripod.com/bmp.html>)

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.

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.

Design Objectives

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



- 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.

Appendix G

- Educational Materials



The Updated Model Water Efficient Landscape Ordinance

CALIFORNIA DEPARTMENT OF WATER RESOURCES

Landscapes are essential to the quality of life in California. They provide areas for recreation, enhance the environment, clean the air and water, prevent erosion, offer fire protection and replace ecosystems lost to development.

California's economic prosperity and environmental quality are dependant on an adequate supply of water for beneficial uses. In California, about half of the urban water used is for landscape irrigation. Ensuring **efficient landscapes** in new developments and reducing water waste in existing landscapes are the most cost-effective ways to stretch our limited water supplies and ensure that we continue to have sufficient water for California to prosper.

The Water Conservation in Landscaping Act of 2006 (Assembly Bill 1881, Laird) requires cities, counties, and charter cities and charter counties, to adopt landscape water conservation ordinances by January 1, 2010. Pursuant to this law, the Department of Water Resources (DWR) has prepared a Model Water Efficient Landscape Ordinance (Model Ordinance) for use by local agencies. The Model Ordinance was approved by the Office of Administrative Law on September 10, 2009. The Model Ordinance became effective on September 10.

All local agencies must adopt a water efficient landscape ordinance by **January 1, 2010**. The local agencies may adopt the state Model Ordinance, or craft an ordinance to fit local conditions. In addition, several local agencies may collaborate and craft a region-wide ordinance. In any case, the adopted ordinance must be as effective as the Model Ordinance in regard to water conservation.

For more information, please visit our web site at <http://www.water.ca.gov/wateruseefficiency/landscapeordinance/>



Important points to consider...



Water purveyors have an important role.

The enabling statute was directed to local agencies that make land use decisions and approve land development. Active participation by water purveyors can make the implementation, enforcement and follow-up actions of an ordinance more effective.

Most new and rehabilitated landscapes are subject to a water efficient landscape ordinance. Public landscapes and private development projects including developer installed single family and multi-family residential landscapes with at least 2500 sq. ft. of landscape area are subject to the Model Ordinance .

Homeowner provided landscaping at single family and multi-family homes are subject to the Model Ordinance if the landscape area is at least 5000 sq. ft

Existing landscapes are also subject to the Model Ordinance.

Water waste is common in landscapes that are poorly designed or not well maintained. Water waste (from runoff, overspray, low head drainage, leaks and excessive amounts of applied irrigation water in landscapes is prohibited by Section 2, Article X of the California Constitution.

Any landscape installed prior to January 1, 2010, that is at least one acre in size may be subject to irrigation audits, irrigation surveys or water use analysis programs for evaluating irrigation system performance and adherence to the Maximum Applied Water Allowance as defined in the 1992 Model Ordinance with an Evapotranspiration Adjustment Factor (ETAF) of 0.8. Local agencies and water purveyors (designated by the local agency) may institute these or other programs to increase efficiency in existing landscapes.

All new landscapes will be assigned a water budget.

The water budget approach is a provision in the statute that ensures a landscape is allowed sufficient water. There are two water budgets in the Model Ordinance; the Maximum Applied Water Allowance (MAWA) and the Estimated Total Water Use (ETWU).

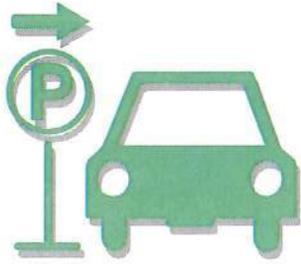
The MAWA, is the water budget used for compliance and is an annual water allowance based on landscape area, local evapotranspiration and ETAF of 0.7. The ETWU is an annual water use estimation for design purposes and is based on the water needs of the plants actually chosen for a given landscape. The ETWU may not exceed the MAWA.

Water efficient landscapes offer multiple benefits.

Water efficient landscapes will stretch our limited water supplies. Other benefits include reduced irrigation runoff, reduced pollution of waterways, less property damage, less green waste, increased drought resistance and a smaller carbon footprint.

The Department of Water Resources will offer technical assistance.

The Department plans to offer a series of workshops, publications and other assistance for successful adoption and implementation of the Model Ordinance or local water efficient landscape ordinances. Information regarding these resources may be found on the DWR website: <http://www.water.ca.gov/wateruseefficiency/landscapeordinance/> Questions on the Model Ordinance may be sent by e-mail to DWR staff at: mweo@water.ca.gov.



R-3 AUTOMOBILE PARKING

Parked automobiles may contribute pollutants to the storm drain because poorly maintained vehicles may leak fluids containing hydrocarbons, metals, and other pollutants. In addition, heavily soiled automobiles may drop clods of dirt onto the parking surface, contributing to the sediment load when runoff is present. During rain events, or wash-down activities, the pollutants may be carried into the storm drain system. The pollution prevention activities outlined in this fact sheets are used to prevent the discharge of pollutants to the storm drain system.

The activities outlined in this fact sheet target the following pollutants:	
Sediment	x
Nutrients	
Bacteria	
Foaming Agents	
Metals	X
Hydrocarbons	X
Hazardous Materials	x
Pesticides and Herbicides	
Other	

Think before parking your car. Remember - The ocean starts at your front door.

Required Activities

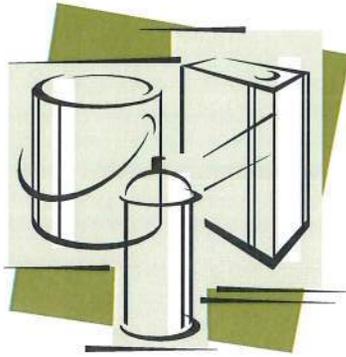
- If required, vehicles have to be removed from the street during designated street sweeping/cleaning times.
- If the automobile is leaking, place a pan or similar collection device under the automobile, until such time as the leak may be repaired.
- Use dry cleaning methods to remove any materials deposited by vehicles (e.g. adsorbents for fluid leaks, sweeping for soil clod deposits).

Recommended Activities

- Park automobiles over permeable surfaces (e.g. gravel, or porous cement).
- Limit vehicle parking to covered areas.
- Perform routine maintenance to minimize fluid leaks, and maximize fuel efficiency.

For additional information contact:
County of Orange, **OC Watershed**

Main: (714) 955-0600/ 24hr Water Pollution Discharge Hotline 1-877-89-SPILL
or visit our website at: www.ocwatersheds.com



R-7 HOUSEHOLD HAZARDOUS WASTE

Household hazardous wastes (HHW) are defined as waste materials which are typically found in homes or similar sources, which exhibit characteristics such as: corrosivity, ignitability, reactivity, and/or toxicity, or are listed as hazardous materials by EPA.

List of most common HHW products:

Drain openers
Oven cleaners
Wood and metal cleaners and polishes
Automotive oil and fuel additives
Grease and rust solvents
Carburetor and fuel injection cleaners
Starter fluids
Batteries
Paint Thinners
Paint strippers and removers
Adhesives
Herbicides
Pesticides
Fungicides/wood preservatives

Many types of waste can be recycled, however options for each waste type are limited. Recycling is always preferable to disposal of unwanted materials. All gasoline, antifreeze, waste oil, and lead-acid batteries can be recycled. Latex and oil-based paint can be reused, as well as recycled. Materials that cannot be reused or recycled should be disposed of at a properly permitted landfill.

Think before disposing of any household hazardous waste. Remember - The ocean starts at your front door.

The activities outlined in this fact sheet target the following pollutants:

Sediment	
Nutrients	
Bacteria	
Foaming Agents	x
Metals	x
Hydrocarbons	x
Hazardous Materials	x
Pesticides and Herbicides	x
Other	x



Required Activities

- Dispose of HHW at a local collection facility. Call (714) 834-6752 for the household hazardous waste center closest to your area.
- Household hazardous materials must be stored indoors or under cover, and in closed and labeled containers.
- If safe, contain, clean up, and properly dispose all household hazardous waste spills. If an unsafe condition exists, call 911 to activate the proper response team.

Recommended Activities

- Use non-hazardous or less-hazardous products.
- Participate in HHW reuse and recycling. Call (714) 834-6752 for the participating household hazardous waste centers.

The California Integrated Waste Management Board has a Recycling Hotline (800) 553-2962, that provides information and recycling locations for used oil.

For additional information contact:

County of Orange, **OC Watershed**

Main: (714) 955-0600/ 24hr Water Pollution Discharge Hotline 1-877-89-SPILL

or visit our website at: www.ocwatersheds.com



R-8 WATER CONSERVATION

Excessive irrigation and/or the overuse of water is often the most significant factor in transporting pollutants to the storm drain system. Pollutants from a wide variety of sources including automobile repair and maintenance, automobile washing, automobile parking, home and garden care activities and pet care may dissolve in the water and be transported to the storm drain. In addition, particles and materials coated with fertilizers and pesticides may be suspended in the flow and be transported to the storm drain.

Hosing off outside areas to wash them down not only consumes large quantities of water, but also transports any pollutants, sediments, and waste to the storm drain system. The pollution prevention activities outlined in this fact sheets are used to prevent the discharge of pollutants to the storm drain system.

The activities outlined in this fact sheet target the following pollutants:	
Sediment	x
Nutrients	x
Bacteria	x
Foaming Agents	x
Metals	x
Hydrocarbons	x
Hazardous Materials	x
Pesticides and Herbicides	x
Other	x

Think before using water. Remember - The ocean starts at your front door.

Required Activities

- Irrigation systems must be properly adjusted to reflect seasonal water needs.
- Do not hose off outside surfaces to clean, sweep with a broom instead.

Recommended Activities

- Fix any leaking faucets and eliminate unnecessary water sources.
- Use xeriscaping and drought tolerant landscaping to reduce the watering needs.
- Do not over watering lawns or gardens. Over watering wastes water and promotes diseases.
- Use a bucket to re-soak sponges/rags while washing automobiles and other items outdoors. Use hose only for rinsing.
- Wash automobiles at a commercial car wash employing water recycling.

For additional information contact:

County of Orange, **OC Watershed**

Main: (714) 955-0600/ 24hr Water Pollution Discharge Hotline 1-877-89-SPILL

or visit our website at: www.ocwatersheds.com



FP-2

LANDSCAPE MAINTENANCE

The model procedures described below focus on minimizing the discharge of pesticides and fertilizers, landscape waste, trash, debris, and other pollutants to the storm drain system and receiving waters. Landscape maintenance practices may involve one or more of the following activities:

- 1. Mowing, Trimming/Weeding, and Planting**
- 2. Irrigation**
- 3. Fertilizer and Pesticide Management**
- 4. Managing Landscape Waste**
- 5. Erosion Control**

POLLUTION PREVENTION:

Pollution prevention measures have been considered and incorporated in the model procedures. Implementation of these measures may be more effective and reduce or eliminate the need to implement other more complicated or costly procedures. Possible pollution prevention measures for landscape maintenance include:

- Implement an integrated pest management (IPM) program. IPM is a sustainable approach to managing pests by combining biological, cultural, physical, and chemical tools. Refer to Appendix D, Fertilizer and Pesticide Management Guidance for further details.
- Choose low water using flowers, trees, shrubs, and groundcover.
- Appropriate maintenance (i.e. properly timed fertilizing, weeding, pest control, and pruning) will preserve the landscapes water efficiency.
- Once per year, educate municipal staff on pollution prevention measures.

MODEL PROCEDURES:

1. Mowing, Trimming/Weeding, and Planting

Mowing, Trimming/Weeding

- ✓ Whenever possible, use mechanical methods of vegetation removal rather than applying herbicides. Use hand weeding where practical.

FP-2

- ✓ When conducting mechanical or manual weed control, avoid loosening the soil, which could erode into streams or storm drains.
- ✓ Use coarse textured mulches or geotextiles to suppress weed growth and reduce the use of herbicides.
- ✓ Do not blow or rake leaves, etc. into the street or place yard waste in gutters or on dirt shoulders. Sweep up any leaves, litter or residue in gutters or on street.
- ✓ Collect lawn and garden clippings, pruning waste, tree trimmings, and weeds. Chip if necessary, and compost or dispose of at a landfill (see waste management section of this procedure sheet).
- ✓ Place temporarily stockpiled material away from watercourses, and berm or cover stockpiles to prevent material releases to storm drains.

Planting

- ✓ Where feasible, retain and/or plant selected native vegetation whose features are determined to be beneficial. Native vegetation usually requires less maintenance (e.g., irrigation, fertilizer) than planting ornamental vegetation.
- ✓ When planting or replanting consider using low water use groundcovers.

OPTIONAL:

- Careful soil mixing and layering techniques using a topsoil mix or composted organic material can be used as an effective measure to reduce herbicide use and watering.

2. Irrigation

- ✓ Utilize water delivery rates that do not exceed the infiltration rate of the soil.
- ✓ Use timers appropriately or a drip system to prevent runoff and then only irrigate as much as is needed.
- ✓ 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.
- ✓ Where practical, use automatic timers to minimize runoff.
- ✓ Use popup sprinkler heads in areas with a lot of activity or where there is a chance the pipes may be broken. Consider the use of mechanisms that reduce water flow to sprinkler heads if broken.
- ✓ If re-claimed water is used for irrigation, ensure that there is no runoff from the landscaped area(s).
- ✓ If bailing of muddy water is required (e.g. when repairing a water line leak), do not put it in the storm drain; pour over landscaped areas.

3. Fertilizer and Pesticide Management

Usage

- ✓ Utilize a comprehensive management system that incorporates integrated pest management techniques.
- ✓ 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.
- ✓ Educate and train employees on use of pesticides and in pesticide application techniques to prevent pollution.
- ✓ Pesticide application must be under the supervision of a California qualified pesticide applicator.
- ✓ When applicable use the least toxic pesticides that will do the job. Avoid use of copper-based pesticides if possible.
- ✓ Do not mix or prepare pesticides or fertilizers for application near storm drains.
- ✓ Prepare the minimum amount of pesticide needed for the job and use the lowest rate that will effectively control the pest.
- ✓ Employ techniques to minimize off-target application (e.g. spray drift) of pesticides, including consideration of alternative application techniques.
- ✓ Calibrate fertilizer and pesticide application equipment to avoid excessive application.
- ✓ Periodically test soils for determining proper fertilizer use.
- ✓ Sweep pavement and sidewalk if fertilizer is spilled on these surfaces before applying irrigation water.
- ✓ Inspect pesticide/fertilizer equipment and transportation vehicles daily.
- ✓ Refer to Appendix D for further guidance on Fertilizer and Pesticide management

OPTIONAL:

- Work fertilizers into the soil rather than dumping or broadcasting them onto the surface.
- Use beneficial insects where possible to control pests (green lacewings, ladybugs, praying mantis, ground beetles, parasitic nematodes, trichogramma wasps, seedhead weevils, and spiders prey on detrimental pest species).
- Use slow release fertilizers whenever possible to minimize leaching.

Scheduling

- ✓ Do not use pesticides if rain is expected within 24 hours.
- ✓ Apply pesticides only when wind speeds are low (less than 5 mph).

Disposal

- ✓ Purchase only the amount of pesticide that you can reasonably use in a given time period (month or year depending on the product).
- ✓ Triple rinse containers, and use rinse water as product. Dispose of unused pesticide as hazardous waste.
- ✓ Dispose of empty pesticide containers according to the instructions on the container label.

4. Managing Landscape Waste

Also see Waste Handling and Disposal procedure sheet

- ✓ Compost leaves, sticks, or other collected vegetation or dispose of at a permitted landfill. Do not dispose of collected vegetation into waterways or storm drainage systems.
- ✓ Place temporarily stockpiled material away from watercourses and storm drain inlets, and berm or cover stockpiles to prevent material releases to the storm drain system.
- ✓ Reduce the use of high nitrogen fertilizers that produce excess growth requiring more frequent mowing or trimming.
- ✓ Inspection of drainage facilities should be conducted to detect illegal dumping of clippings/cuttings in or near these facilities. Materials found should be picked up and properly disposed of.
- ✓ Landscape wastes in and around storm drain inlets should be avoided by either using bagging equipment or by manually picking up the material.

5. Erosion Control

Also see Waste Handling and Disposal procedure sheet

- ✓ Maintain vegetative cover on medians and embankments to prevent soil erosion. Apply mulch or leave clippings to serve as additional cover for soil stabilization and to reduce the velocity of storm water runoff.
- ✓ Minimize the use of disking as a means of vegetation management because the practice may result in erodable barren soil.
- ✓ Confine excavated materials to pervious surfaces away from storm drain inlets, sidewalks, pavement, and ditches. Material must be covered if rain is expected.

LIMITATIONS:

Alternative pest/weed controls may not be available, suitable, or effective in every case.



FP-6

WATER AND SEWER UTILITY OPERATION AND MAINTENANCE

Although the operation and maintenance of public utilities are not considered themselves a chronic source of stormwater pollution, some activities and accidents can result in the discharge of pollutants that can pose a threat to both human health and the quality of receiving waters if they enter the storm drain system. Activities associated with the operation and maintenance of water and sewer utilities to prevent and handle such incidents include the following:

- 1. Water Line Maintenance**
- 2. Sanitary Sewer Maintenance**
- 3. Spill/Leak/Overflow Control, Response, and Containment**

Cities that do not provide maintenance of water and sewer utilities should coordinate with the contracting agency responsible for these activities and ensure that these model procedures are followed.

POLLUTION PREVENTION:

Pollution prevention measures have been considered and incorporated in the model procedures. Implementation of these measures may be more effective and reduce or eliminate the need to implement other more complicated or costly procedures. Possible pollution prevention measures for water and sewer utility operation and maintenance include:

- Inspect potential non-storm water discharge flow paths and clear/cleanup any debris or pollutants found (i.e. remove trash, leaves, sediment, and wipe up liquids, including oil spills).
- Once per year, educate municipal staff on pollution prevention measures.

MODEL PROCEDURES:

1. Water Line Maintenance

Procedures can be employed to reduce pollutants from discharges associated with water utility operation and maintenance activities. Planned discharges may include fire hydrant testing, flushing water supply mains after new construction, flushing lines due to complaints of taste and odor, dewatering mains for maintenance work. Unplanned discharges from treated, recycled water, raw water, and groundwater systems operation and maintenance activities can occur from water main breaks, sheared fire hydrants, equipment malfunction, and operator error.

Planned Discharges

- ✓ For planned discharges use one of the following options:
 - Reuse water for dust suppression, irrigation, or construction compaction
 - Discharge to the sanitary sewer system with approval
 - Discharge to the storm drain system or to a creek using applicable pollution control measures listed below (this option is ONLY applicable to uncontaminated pumped ground water, water line flushing, fire hydrant testing and flushing, discharges from potable water sources other than water main breaks) and may require a permit from the Regional Water Quality Control Board.
- ✓ If water is discharged to a storm drain inlet (catch basin), control measures must be put in place to control potential pollutants (i.e. sediment, chlorine, etc.). Examples of some storm drain inlet protection options include:
 - Silt fence – appropriate where the inlet drains a relatively flat area.
 - Gravel and wire mesh sediment filter – Appropriate where concentrated flows are expected.
 - Wooden weir and fabric – use at curb inlets where a compact installation is desired.
- ✓ Prior to discharge, inspect discharge flow path and clear/cleanup any debris or pollutants found (i.e. remove trash, leaves, sediment, and wipe up liquids, including oil spills).
- ✓ Select appropriate pollution control measure(s) considering the receiving system (i.e. curb inlet, drop inlet, culvert, creek, etc.) and ensure that the control device(s) fit properly.

- ✓ General design considerations for inlet protection devices include the following:
 - The device should be constructed such that cleaning and disposal of trapped sediment is made easy, while minimizing interference with discharge activities.
 - Devices should be constructed so that any standing water resulting from the discharge will not cause excessive inconvenience or flooding/damage to adjacent land or structures.
- ✓ The effectiveness of control devices must be monitored during the discharge period and any necessary repairs or modifications made as needed.

OPTIONAL:

- Sediment removal may be enhanced by placing filter fabric, gravel bags, etc. at storm drain inlets.

Unplanned Discharges

- ✓ Stop the discharge as quickly as possible by turning off water source.
- ✓ Inspect flow path of the discharged water:
 - Control erosion along the flow path.
 - Identify areas that may produce significant sediment or gullies, use sandbags to redirect the flow.
 - Identify erodible areas which may need to be repaired or protected during subsequent repairs or corrective actions
- ✓ If repairs or corrective action will cause additional discharges of water, select the appropriate procedures for erosion control, chlorine residual, turbidity, and chemical additives. Prevent potential pollutants from entering the flow path and ensure that no additional discharged water enters storm drain inlets.

2. Sanitary Sewer Maintenance

Applicable to municipalities who own and operated a sewage collection system. Facilities that are covered under this program include sanitary sewer pipes and pump stations owned and operated by the Permittee. The owner of the sanitary sewer facilities is the entity responsible for carrying out this prevention and response program.

Sewer System Cleaning

- ✓ Sewer lines should be cleaned on a regular basis to remove grease, grit, and other debris that may lead to sewer backups.
- ✓ Establish routine maintenance program. Cleaning should be conducted at an established minimum frequency and more frequently for problem areas such as restaurants that are identified
- ✓ Cleaning activities may require removal of tree roots and other identified obstructions.

Preventative and Corrective Maintenance

- ✓ During routine maintenance and inspection note the condition of sanitary sewer structures and identify areas that need repair or maintenance. Items to note may include the following:
 - cracked/deteriorating pipes
 - leaking joints/seals at manhole
 - frequent line plugs
 - line generally flows at or near capacity
 - suspected infiltration or exfiltration
- ✓ Document suggestions and requests for repair and report the information to the appropriate manager or supervisor.
- ✓ Prioritize repairs based on the nature and severity of the problem. Immediate clearing of blockage or repair is required where an overflow is currently occurring or for urgent problems that may cause an imminent overflow (e.g. pump station failures, sewer line ruptures, sewer line blockages). These repairs may be temporary until scheduled or capital improvements can be completed.
- ✓ Review previous sewer maintenance records to help identify "hot spots" or areas with frequent maintenance problems and locations of potential system failure.

3. Spill/Leak/Overflow Control, Response, and Containment

Control

Also see Drainage System procedures sheet

- ✓ Refer to countywide *Illicit Discharge Detection and Elimination Program*. Components of this program include:
 - Investigation/inspection and follow-up
 - Elimination of illicit discharges and connections
 - Enforcement of ordinances
 - Respond to sewage spills

- Facilitate public reporting of illicit discharges and connections. A citizen's hotline for reporting observed overflow conditions should be established to supplement the field screening efforts being conducted by the Principal Permittee.

Response and Containment

- ✓ Establish lead department/agency responsible for spill response and containment. Provide coordination within departments.
- ✓ When a spill, leak, and/or overflow occurs, keep sewage from entering the storm drain system to the maximum extent practicable by covering or blocking storm drain inlets or by containing and diverting the sewage away from open channels and other storm drain facilities (using sandbags, inflatable dams, etc.).
- ✓ If a spill reaches the storm drain notify County of Orange Health Care Agency through Control One at (714) 628-7208.
- ✓ Remove the sewage using vacuum equipment or use other measures to divert it back to the sanitary sewer system.
- ✓ Record required information at the spill site.
- ✓ Perform field tests as necessary to determine the source of the spill.
- ✓ Develop additional notification procedures regarding spill reporting as needed.

LIMITATIONS:

Private property access rights needed to perform testing along storm drain right-of-ways. Requirements of municipal ordinance authority for suspected source verification testing necessary for guaranteed rights of entry.

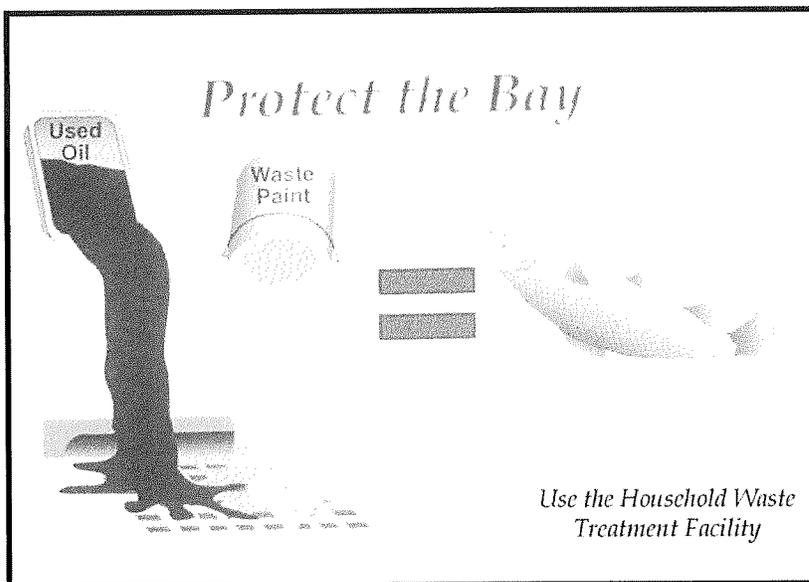
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Los Angeles County Stormwater Quality. Public Agency Activities Model Program. On-line:
http://ladpw.org/wmd/npdes/public_TC.cfm

Santa Clara Valley Urban Runoff Pollution Prevention Program. 1997 Urban Runoff Management Plan. September 1997, updated October 2000.

Santa Clara Valley Urban Runoff Pollution Prevention Program. Water Utility Pollution Prevention Plan.



Graphic by: Margie Winter

Description

Non-stormwater discharges are those flows that do not consist entirely of stormwater. For municipalities non-stormwater discharges present themselves in two situations. One is from fixed facilities owned and/or operated by the municipality. The other situation is non-stormwater discharges that are discovered during the normal operation of a field program. Some non-stormwater discharges do not include pollutants and may be discharged to the storm drain. 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 car washing, and surface cleaning. However, there are certain non-stormwater discharges that pose environmental concern. These discharges may originate from illegal dumping or from internal floor drains, appliances, industrial processes, sinks, and toilets that are connected to the nearby storm drainage system. These discharges (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. The ultimate goal is to effectively eliminate non-stormwater discharges to the stormwater drainage system through implementation of measures to detect, correct, and enforce against illicit connections and illegal discharges.

Approach

The municipality must address non-stormwater discharges from its fixed facilities by assessing the types of non-stormwater discharges and implementing BMPs for the discharges determined to pose environmental concern. For field programs the field staff must be

Objectives

- Contain
- Educate
- Reduce/Minimize

Targeted Constituents

Sediment	✓
Nutrients	✓
Trash	✓
Metals	✓
Bacteria	✓
Oil and Grease	✓
Organics	✓
Oxygen Demanding	✓



trained to now what to look for regarding non-stormwater discharges and the procedures to follow in investigating the detected discharges.

Suggested Protocols**Fixed Facility***General*

- Post “No Dumping” signs with a phone number for reporting dumping and disposal. Signs should also indicate fines and penalties for illegal dumping.
- Stencil storm drains, where applicable, to prevent illegal disposal of pollutants. Storm drain inlets should have messages such as “Dump No Waste Drains to Stream” stenciled next to them to warn against ignorant or intentional dumping of pollutants into the storm drainage system.
- Landscaping and beautification efforts of hot spots might 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.

Illicit Connections

- Locate discharges from the fixed facility drainage system to the municipal storm drain system through review of “as-built” piping schematics.
- Use techniques such as smoke testing, dye testing and television camera inspection (as noted below) to verify physical connections.
- Isolate problem areas and plug illicit discharge points.

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 several days following the end of a storm and groundwater may infiltrate the underground stormwater collection system. Also, non-stormwater discharges are often intermittent and may require periodic inspections.

Review Infield Piping

- Review the “as-built” piping schematic as a way to determine if there are any connections to the stormwater collection system.
- Inspect the path of floor drains in older buildings.

Smoke Testing

- Smoke testing of wastewater and stormwater collection systems is used to detect connections between the two systems.

- During dry weather the stormwater collection system is filled with smoke and then traced to sources. The appearance of smoke at the base of a toilet indicates that there may be a connection between the sanitary and the stormwater system.

Dye Testing

- A dye test can be performed by simply releasing a dye into either your sanitary or process wastewater system and examining the discharge points from the stormwater collection system for discoloration.

TV Inspection of Storm Sewer

- TV Cameras can be employed to visually identify illicit connections to the fixed facility storm drain system.

Illegal Dumping

- Regularly inspect and clean up hot spots and other storm drainage areas where illegal dumping and disposal occurs.
- Clean up spills on paved surfaces 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 fact sheet SC-11 Spill Prevention, Control, and Clean Up.

Field Program

General

- Develop clear protocols and lines of communication for effectively prohibiting non-stormwater discharges, especially ones that involve more than one jurisdiction and those that are not classified as hazardous, which are often not responded to as effectively as they need to be.
- Stencil storm drains, where applicable, to prevent illegal disposal of pollutants. Storm drain inlets should have messages such as “Dump No Waste Drains to Stream” stenciled next to them to warn against ignorant or intentional dumping of pollutants into the storm drainage system.
- See SC-74 Stormwater Drainage System Maintenance for additional information.

Field Inspection

- Regularly inspect and clean up hot spots and other storm drainage areas where illegal dumping and disposal occurs.
- During routine field program maintenance field staff should look for evidence of illegal discharges or illicit connection:
 - Is there evidence of spills such as paints, discoloring, etc.
 - Are there any odors associated with the drainage system
 - Record locations of apparent illegal discharges/illicit connections and notify appropriate investigating agency.
- If trained, conduct field investigation of non-stormwater discharges to determine whether they pose a threat to water quality.

Recommended Complaint Investigation Equipment

- Field Screening Analysis
 - pH paper or meter
 - Commercial stormwater pollutant screening kit that can detect for reactive phosphorus, nitrate nitrogen, ammonium nitrogen, specific conductance, and turbidity
 - Sample jars
 - Sample collection pole
 - A tool to remove access hole covers
- Laboratory Analysis
 - Sample cooler
 - Ice
 - Sample jars and labels
 - Chain of custody forms.
- Documentation
 - Camera
 - Notebook
 - Pens
 - Notice of Violation forms

- Educational materials

Reporting

- 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 onsite drainage points observed.
- Maintain documentation of illicit connection and illegal dumping incidents, including significant conditionally exempt discharges that are not properly managed.

Enforcement

- Educate the responsible party if identified on the impacts of their actions, explain the stormwater requirements, and provide information regarding Best Management Practices (BMP), as appropriate. Initiate follow-up and/or enforcement procedures.
- If an illegal discharge is traced to a commercial, residential or industrial source, conduct the following activities or coordinate the following activities with the appropriate agency:
 - Contact the responsible party to discuss methods of eliminating the non-stormwater discharge, including disposal options, recycling, and possible discharge to the sanitary sewer (if within POTW limits).
 - Provide information regarding BMPs to the responsible party, where appropriate.
 - Begin enforcement procedures, if appropriate.
 - Continue inspection and follow-up activities until the illicit discharge activity has ceased.
- If an illegal discharge is traced to a commercial or industrial activity, coordinate information on the discharge with the jurisdiction's commercial and industrial facility inspection program.

Training

- Train technical staff to identify and document illegal dumping incidents.
- 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 if one should occur. Employees should be familiar with the Spill Prevention Control and Countermeasure Plan.
- Train employees to identify non-stormwater discharges and report them to the appropriate departments.
- Train staff who have the authority to conduct surveillance and inspections, and write citations for those caught illegally dumping.

- Train municipal staff responsible for surveillance and inspection 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).
- Educate the identified responsible party on the impacts of his or her actions.

Spill Response and Prevention

- See SC-11 Spill Prevention Control and Clean Up

Other Considerations

- The elimination of illegal dumping is dependent on the availability, convenience, and cost of alternative means of disposal. The cost of fees for dumping at a proper waste disposal facility are often more than the fine for an illegal dumping offense, thereby discouraging people from complying with the law. The absence of routine or affordable pickup service for trash and recyclables in some communities also encourages illegal dumping. A lack of understanding regarding applicable laws or the inadequacy of existing laws may also contribute to the problem.
- Municipal codes should include sections prohibiting the discharge of soil, debris, refuse, hazardous wastes, and other pollutants into the storm drain system.
- Many facilities do not have accurate, up-to-date schematic drawings.
- Can be difficult to locate illicit connections especially if there is groundwater infiltration.

Requirements***Costs***

- Eliminating illicit connections can be expensive especially if structural modifications are required such re-plumbing cross connections under an existing slab.
- Minor cost to train field crews regarding the identification of non-stormwater discharges. The primary cost is for a fully integrated program to identify and eliminate illicit connections and illegal dumping. However, by combining with other municipal programs (i.e. pretreatment program) cost may be lowered.
- Municipal cost for containment and disposal may be borne by the discharger.

Maintenance

Not applicable

Supplemental Information

Further Detail of the BMP

What constitutes a “non-stormwater” discharge?

- Non-stormwater discharges are discharges not made up entirely of stormwater and include water used directly in the manufacturing process (process wastewater), air conditioning condensate and coolant, non-contact cooling water, cooling equipment condensate, outdoor secondary containment water, vehicle and equipment wash water, landscape irrigation, sink and drinking fountain wastewater, sanitary wastes, or other wastewaters.

Permit Requirements

- Current municipal NPDES permits require municipalities to effectively prohibit non-stormwater discharges unless authorized by a separate NPDES permit or allowed in accordance with the current NPDES permit conditions. Typically the current permits allow certain non-stormwater discharges in the storm drain system as long as the discharges are not significant sources of pollutants. In this context the following non-stormwater discharges are typically allowed:
 - Diverted stream flows;
 - Rising found waters;
 - Uncontaminated ground water infiltration (as defined at 40 CFR 35.2005(20));
 - Uncontaminated pumped ground water;
 - Foundation drains;
 - Springs;
 - Water from crawl space pumps;
 - Footing drains;
 - Air conditioning condensation;
 - Flows from riparian habitats and wetlands;
 - Water line and hydrant flushing ;
 - Landscape irrigation;
 - Planned and unplanned discharges from potable water sources;
 - Irrigation water;
 - Individual residential car washing; and
 - Lawn watering.

Municipal facilities subject to industrial general permit requirements must include a certification that the stormwater collection system has been tested or evaluated for the presence of non-stormwater discharges. The state's General Industrial Stormwater Permit requires that non-stormwater discharges be eliminated prior to implementation of the facility's SWPPP.

Illegal Dumping

- 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)
 - Responsible parties

Outreach

One of the keys to success of reducing or eliminating illegal dumping is increasing the number of people on the street who are aware of the problem and who have the tools to at least identify the incident, if not correct it. There are a number of ways of accomplishing this:

- Train municipal staff from all departments (public works, utilities, street cleaning, parks and recreation, industrial waste inspection, hazardous waste inspection, sewer maintenance) to recognize and report the incidents.
- Deputize municipal staff who may come into contact with illegal dumping with the authority to write illegal dumping tickets for offenders caught in the act (see below).
- Educate the public. As many as 3 out of 4 people do not understand that in most communities the storm drain does not go to the wastewater treatment plant. Unfortunately, with the heavy emphasis in recent years on public education about solid waste management, including recycling and household hazardous waste, the sewer system (both storm and sanitary) has been the likely recipient of cross-media transfers of waste.
- Provide the public with a mechanism for reporting incidents such as a hot line and/or door hanger (see below).
- Help areas where incidents occur more frequently set up environmental watch programs (like crime watch programs).
- Train volunteers to notice and report the presence and suspected source of an observed pollutant to the appropriate public agency.

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 - Individual residential car washing; and
 - Lawn watering.

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Storm Drain Stenciling

- Stencil storm drain inlets with a message to prohibit illegal dumpings, especially in areas with waste handling facilities.
- Encourage public reporting of improper waste disposal by a HOTLINE number stenciled onto the storm drain inlet.
- See Supplemental Information section of this fact sheet for further detail on stenciling program approach.

Oil Recycling

- Contract collection and hauling of used oil to a private licensed used oil hauler/recycler.
- Comply with all applicable state and federal regulations regarding storage, handling, and transport of petroleum products.
- Create procedures for collection such as; collection locations and schedule, acceptable containers, and maximum amounts accepted.
- The California Integrated Waste Management Board has a Recycling Hotline, (800) 553-2962, that provides information and recycling locations for used oil.

Household Hazardous Waste

- Provide household hazardous waste (HHW) collection facilities. Several types of collection approaches are available including permanent, periodic, or mobile centers, curbside collection, or a combination of these systems.

Training

- Train municipal employees and contractors in proper and consistent methods for waste disposal.
- Train municipal employees to recognize and report illegal dumping.
- Train employees and subcontractors in proper hazardous waste management.

Spill Response and Prevention

- Refer to SC-11, Spill Prevention, Control & Cleanup
- Have spill cleanup materials readily available and in a known location.
- Cleanup spills immediately and use dry methods if possible.
- Properly dispose of spill cleanup material.

Other Considerations

- Federal Regulations (RCRA, SARA, CERCLA) and state regulations exist regarding the disposal of hazardous waste.
- Municipalities are required to have a used oil recycling and a HHW element within their integrate waste management plan.
- Significant liability issues are involved with the collection, handling, and disposal of HHW.

Examples

The City of Palo Alto has developed a public participation program for reporting dumping violations. When a concerned citizen or public employee encounters evidence of illegal dumping, a door hanger (similar in format to hotel “Do Not Disturb” signs) is placed on the front doors in the neighborhood. The door hanger notes that a violation has occurred in the neighborhood, informs the reader why illegal dumping is a problem, and notes that illegal dumping carries a significant financial penalty. Information is also provided on what citizens can do as well as contact numbers for more information or to report a violation.

The Port of Long Beach has a state of the art database incorporating storm drain infrastructure, potential pollutant sources, facility management practices, and a pollutant tracking system.

The State Department of Fish and Game has a hotline for reporting violations called CalTIP (1-800-952-5400). The phone number may be used to report any violation of a Fish and Game code (illegal dumping, poaching, etc.).

The California Department of Toxic Substances Control’s Waste Alert Hotline, 1-800-69TOXIC, can be used to report hazardous waste violations.

References and Resources

<http://www.stormwatercenter.net/>

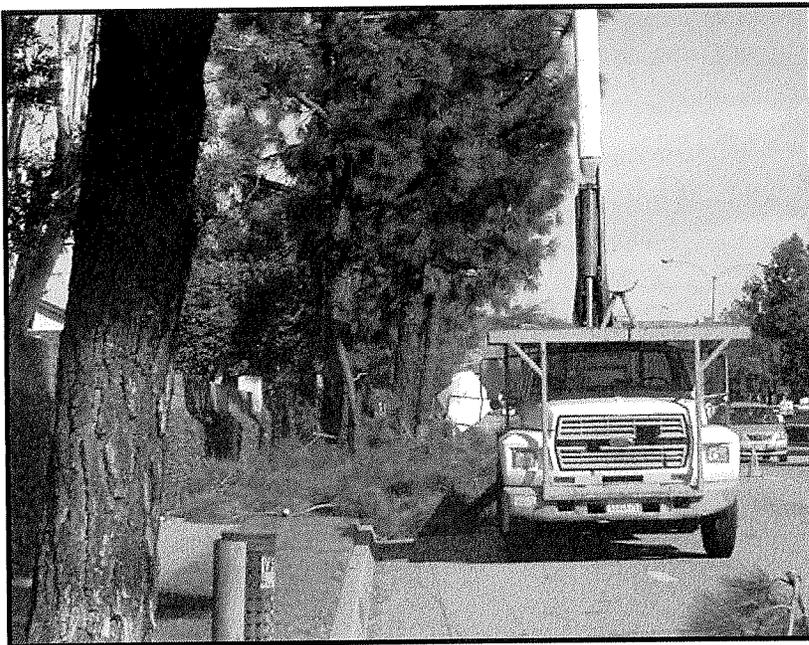
California’s Nonpoint Source Program Plan <http://www.co.clark.wa.us/pubworks/bmpman.pdf>

King County Stormwater Pollution Control Manual - <http://dnr.metrokc.gov/wlr/dss/spcm.htm>

Orange County Stormwater Program,
http://www.ocwatersheds.com/stormwater/swp_introduction.asp

San Diego Stormwater Co-permittees Jurisdictional Urban Runoff Management Program
(<http://www.projectcleanwater.org>)

Santa Clara Valley Urban Runoff Pollution Prevention Program
http://www.scvurppp-w2k.com/pdf%20documents/PS_ICID.PDF



Description

Landscape maintenance activities include vegetation removal; herbicide and insecticide application; fertilizer application; watering; and other gardening and lawn care practices. Vegetation control typically involves a combination of chemical (herbicide) application and mechanical methods. All of these maintenance practices have the potential to contribute pollutants to the storm drain system. The major objectives of this BMP are to minimize the discharge of pesticides, herbicides and fertilizers to the storm drain system and receiving waters; prevent the disposal of landscape waste into the storm drain system by collecting and properly disposing of clippings and cuttings, and educating employees and the public.

Approach

Pollution Prevention

- Implement an integrated pest management (IPM) program. IPM is a sustainable approach to managing pests by combining biological, cultural, physical, and chemical tools.
- Choose low water using flowers, trees, shrubs, and groundcover.
- Consider alternative landscaping techniques such as naturescaping and xeriscaping.
- Conduct appropriate maintenance (i.e. properly timed fertilizing, weeding, pest control, and pruning) to help preserve the landscapes water efficiency.

Objectives

- Contain
- Educate
- Reduce/Minimize
- Product Substitution

Targeted Constituents

Sediment	<input checked="" type="checkbox"/>
Nutrients	<input checked="" type="checkbox"/>
Trash	<input checked="" type="checkbox"/>
Metals	
Bacteria	
Oil and Grease	
Organics	
Oxygen Demanding	<input checked="" type="checkbox"/>



- Consider grass cycling (grass cycling is the natural recycling of grass by leaving the clippings on the lawn when mowing. Grass clippings decompose quickly and release valuable nutrients back into the lawn).

Suggested Protocols***Mowing, Trimming, and Weeding***

- Whenever possible use mechanical methods of vegetation removal (e.g mowing with tractor-type or push mowers, hand cutting with gas or electric powered weed trimmers) rather than applying herbicides. Use hand weeding where practical.
- Avoid loosening the soil when conducting mechanical or manual weed control, this could lead to erosion. Use mulch or other erosion control measures when soils are exposed.
- Performing mowing at optimal times. Mowing should not be performed if significant rain events are predicted.
- Mulching mowers may be recommended for certain flat areas. Other techniques may be employed to minimize mowing such as selective vegetative planting using low maintenance grasses and shrubs.
- Collect lawn and garden clippings, pruning waste, tree trimmings, and weeds. Chip if necessary, and compost or dispose of at a landfill (see waste management section of this fact sheet).
- Place temporarily stockpiled material away from watercourses, and berm or cover stockpiles to prevent material releases to storm drains.

Planting

- Determine existing native vegetation features (location, species, size, function, importance) and consider the feasibility of protecting them. Consider elements such as their effect on drainage and erosion, hardiness, maintenance requirements, and possible conflicts between preserving vegetation and the resulting maintenance needs.
- Retain and/or plant selected native vegetation whose features are determined to be beneficial, where feasible. Native vegetation usually requires less maintenance (e.g., irrigation, fertilizer) than planting new vegetation.
- Consider using low water use groundcovers when planting or replanting.

Waste Management

- Compost leaves, sticks, or other collected vegetation or dispose of at a permitted landfill. Do not dispose of collected vegetation into waterways or storm drainage systems.
- Place temporarily stockpiled material away from watercourses and storm drain inlets, and berm or cover stockpiles to prevent material releases to the storm drain system.
- Reduce the use of high nitrogen fertilizers that produce excess growth requiring more frequent mowing or trimming.

- Avoid landscape wastes in and around storm drain inlets by either using bagging equipment or by manually picking up the material.

Irrigation

- Where practical, use automatic timers to minimize runoff.
- Use popup sprinkler heads in areas with a lot of activity or where there is a chance the pipes may be broken. Consider the use of mechanisms that reduce water flow to sprinkler heads if broken.
- Ensure that there is no runoff from the landscaped area(s) if re-claimed water is used for irrigation.
- If bailing of muddy water is required (e.g. when repairing a water line leak), do not put it in the storm drain; pour over landscaped areas.
- Irrigate slowly or pulse irrigate to prevent runoff and then only irrigate as much as is needed.
- Apply water at rates that do not exceed the infiltration rate of the soil.

Fertilizer and Pesticide Management

- Utilize a comprehensive management system that incorporates integrated pest management (IPM) techniques. There are many methods and types of IPM, including the following:
 - Mulching can be used to prevent weeds where turf is absent, fencing installed to keep rodents out, and netting used to keep birds and insects away from leaves and fruit.
 - Visible insects can be removed by hand (with gloves or tweezers) and placed in soapy water or vegetable oil. Alternatively, insects can be sprayed off the plant with water or in some cases vacuumed off of larger plants.
 - Store-bought traps, such as species-specific, pheromone-based traps or colored sticky cards, can be used.
 - Slugs can be trapped in small cups filled with beer that are set in the ground so the slugs can get in easily.
 - In cases where microscopic parasites, such as bacteria and fungi, are causing damage to plants, the affected plant material can be removed and disposed of (pruning equipment should be disinfected with bleach to prevent spreading the disease organism).
 - Small mammals and birds can be excluded using fences, netting, tree trunk guards.
 - Beneficial organisms, such as bats, birds, green lacewings, ladybugs, praying mantis, ground beetles, parasitic nematodes, trichogramma wasps, seed head weevils, and spiders that prey on detrimental pest species can be promoted.
- 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 pesticides only if there is an actual pest problem (not on a regular preventative schedule).
- Do not use pesticides if rain is expected. Apply pesticides only when wind speeds are low (less than 5 mph).
- Do not mix or prepare pesticides for application near storm drains.
- Prepare the minimum amount of pesticide needed for the job and use the lowest rate that will effectively control the pest.
- Employ techniques to minimize off-target application (e.g. spray drift) of pesticides, including consideration of alternative application techniques.
- Fertilizers should be worked into the soil rather than dumped or broadcast onto the surface.
- Calibrate fertilizer and pesticide application equipment to avoid excessive application.
- Periodically test soils for determining proper fertilizer use.
- Sweep pavement and sidewalk if fertilizer is spilled on these surfaces before applying irrigation water.
- Purchase only the amount of pesticide that you can reasonably use in a given time period (month or year depending on the product).
- Triple rinse containers, and use rinse water as product. Dispose of unused pesticide as hazardous waste.
- Dispose of empty pesticide containers according to the instructions on the container label.

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.
- Inspect pesticide/fertilizer equipment and transportation vehicles daily.

Training

- Educate and train employees on use of pesticides and in pesticide application techniques to prevent pollution. Pesticide application must be under the supervision of a California qualified pesticide applicator.
- Train/encourage municipal maintenance crews to use IPM techniques for managing public green areas.
- Annually train employees within departments responsible for pesticide application on the appropriate portions of the agency's IPM Policy, SOPs, and BMPs, and the latest IPM techniques.

- Employees who are not authorized and trained to apply pesticides should be periodically (at least annually) informed that they cannot use over-the-counter pesticides in or around the workplace.
- Use a training log or similar method to document training.

Spill Response and Prevention

- Refer to SC-11, Spill Prevention, Control & Cleanup
- Have spill cleanup materials readily available and in a known location
- Cleanup spills immediately and use dry methods if possible.
- Properly dispose of spill cleanup material.

Other Considerations

- The Federal Pesticide, Fungicide, and Rodenticide Act and California Title 3, Division 6, Pesticides and Pest Control Operations place strict controls over pesticide application and handling and specify training, annual refresher, and testing requirements. The regulations generally cover: a list of approved pesticides and selected uses, updated regularly; general application information; equipment use and maintenance procedures; and record keeping. The California Department of Pesticide Regulations and the County Agricultural Commission coordinate and maintain the licensing and certification programs. All public agency employees who apply pesticides and herbicides in “agricultural use” areas such as parks, golf courses, rights-of-way and recreation areas should be properly certified in accordance with state regulations. Contracts for landscape maintenance should include similar requirements.
- All employees who handle pesticides should be familiar with the most recent material safety data sheet (MSDS) files.
- Municipalities do not have the authority to regulate the use of pesticides by school districts, however the California Healthy Schools Act of 2000 (AB 2260) has imposed requirements on California school districts regarding pesticide use in schools. Posting of notification prior to the application of pesticides is now required, and IPM is stated as the preferred approach to pest management in schools.

Requirements

Costs

Additional training of municipal employees will be required to address IPM techniques and BMPs. IPM methods will likely increase labor cost for pest control which may be offset by lower chemical costs.

Maintenance

Not applicable

Supplemental Information***Further Detail of the BMP******Waste Management***

Composting is one of the better disposal alternatives if locally available. Most municipalities either have or are planning yard waste composting facilities as a means of reducing the amount of waste going to the landfill. Lawn clippings from municipal maintenance programs as well as private sources would probably be compatible with most composting facilities

Contractors and Other Pesticide Users

Municipal agencies should develop and implement a process to ensure that any contractor employed to conduct pest control and pesticide application on municipal property engages in pest control methods consistent with the IPM Policy adopted by the agency. Specifically, municipalities should require contractors to follow the agency's IPM policy, SOPs, and BMPs; provide evidence to the agency of having received training on current IPM techniques when feasible; provide documentation of pesticide use on agency property to the agency in a timely manner.

References and Resources

King County Stormwater Pollution Control Manual. Best Management Practices for Businesses. 1995. King County Surface Water Management. July. On-line: <http://dnr.metrokc.gov/wlr/dss/spcm.htm>

Los Angeles County Stormwater Quality Model Programs. Public Agency Activities http://ladpw.org/wmd/npdes/model_links.cfm

Model Urban Runoff Program: A How-To Guide for Developing Urban Runoff Programs for Small Municipalities. Prepared by City of Monterey, City of Santa Cruz, California Coastal Commission, Monterey Bay National Marine Sanctuary, Association of Monterey Bay Area Governments, Woodward-Clyde, Central Coast Regional Water Quality Control Board. July. 1998.

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United States Environmental Protection Agency (USEPA). 2002. Pollution Prevention/Good Housekeeping for Municipal Operations Landscaping and Lawn Care. Office of Water. Office of Wastewater Management. On-line: http://www.epa.gov/npdes/menuofbmps/poll_8.htm

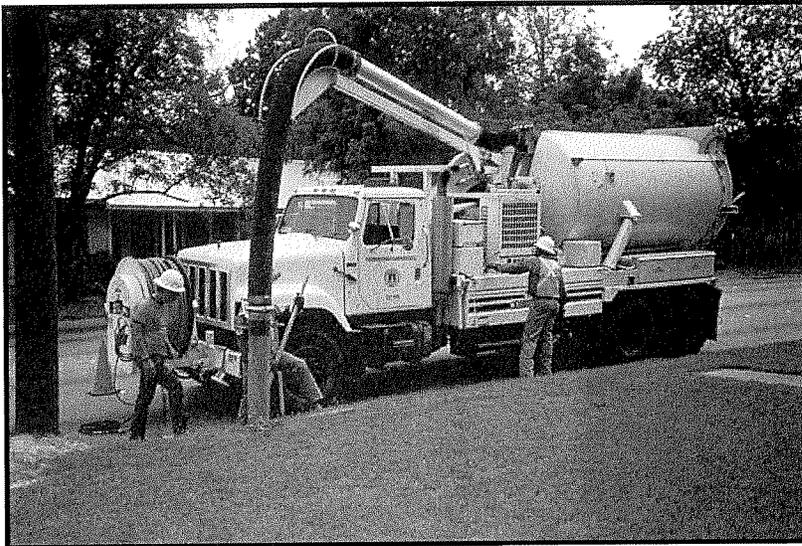


Photo Credit: Geoff Brosseau

Description

As a consequence of its function, the stormwater conveyance system collects and transports urban runoff that may contain certain pollutants. Maintaining catch basins, stormwater inlets, and other stormwater conveyance structures on a regular basis will remove pollutants, prevent clogging of the downstream conveyance system, restore catch basins' sediment trapping capacity, and ensure the system functions properly hydraulically to avoid flooding.

Approach

Suggested Protocols

Catch Basins/Inlet Structures

- Municipal staff should regularly inspect facilities to ensure 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.
 - Stenciling of catch basins and inlets (see SC-75 Waste Handling and Disposal).
- Clean catch basins, storm drain inlets, and other conveyance structures in high pollutant load areas just before the wet season to remove sediments and debris accumulated during the summer.

Objectives

- Contain
- Educate
- Reduce/Minimize

Targeted Constituents

Sediment	<input checked="" type="checkbox"/>
Nutrients	<input checked="" type="checkbox"/>
Trash	<input checked="" type="checkbox"/>
Metals	<input checked="" type="checkbox"/>
Bacteria	<input checked="" type="checkbox"/>
Oil and Grease	<input checked="" type="checkbox"/>
Organics	<input checked="" type="checkbox"/>
Oxygen Demanding	<input checked="" type="checkbox"/>



- Conduct inspections more frequently during the wet season for problem areas where sediment or trash accumulates more often. Clean and repair as needed.
- Keep accurate logs of the number of catch basins cleaned.
- Record the amount of waste collected.
- 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 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 of. Do not dewater near a storm drain or stream.
- Except for small communities with relatively few catch basins that may be cleaned manually, most municipalities will require mechanical cleaners such as eductors, vacuums, or bucket loaders.

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 flushed effluent and pump to the sanitary sewer for treatment.

Pump Stations

- Clean all storm drain pump stations prior to the wet season to remove silt and trash.
- Do not allow discharge from cleaning a storm drain pump station or other facility to reach the storm drain system.
- Conduct quarterly routine maintenance at each pump station.
- Inspect, clean, and repair as necessary all outlet structures prior to the wet season.
- Sample collected sediments to determine if landfill disposal is possible, or illegal discharges in the watershed are occurring.

Open Channel

- Consider modification of storm channel characteristics to improve channel hydraulics, to increase pollutant removals, and to 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 (emphasis added) state of any river, stream, or lake in California, must enter into a Stream or Lake Alteration Agreement with the Department of Fish and Game. 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 Federal Corps of Engineers and USFWS

Illicit Connections and Discharges

- During routine maintenance of conveyance system and drainage structures field staff should look for evidence of illegal discharges or illicit connections:
 - Is there evidence of spills such as paints, discoloring, etc.
 - Are there any odors associated with the drainage system
 - Record locations of apparent illegal discharges/illicit connections
 - Track flows back to potential dischargers and conduct aboveground inspections. This can be done through visual inspection of up gradient manholes or alternate techniques including zinc chloride smoke testing, fluorometric dye testing, physical inspection testing, or television camera inspection.
 - Once the origin of flow is established, require illicit discharger to eliminate the discharge.
- Stencil storm drains, where applicable, to prevent illegal disposal of pollutants. Storm drain inlets should have messages such as “Dump No Waste Drains to Stream” 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.

Illegal Dumping

- Regularly inspect and clean up hot spots and other storm drainage areas 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)
 - 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.

- The State Department of Fish and Game has a hotline for reporting violations called Cal TIP (1-800-952-5400). The phone number may be used to report any violation of a Fish and Game code (illegal dumping, poaching, etc.).
- The California Department of Toxic Substances Control's Waste Alert Hotline, 1-800-69TOXIC, can be used to report hazardous waste violations.

Training

- Train crews in proper maintenance activities, including record keeping and disposal.
- Only properly trained individuals are allowed to handle hazardous materials/wastes.
- Train municipal employees from all departments (public works, utilities, street cleaning, parks and recreation, industrial waste inspection, hazardous waste inspection, sewer maintenance) to recognize and report illegal dumping.
- Train municipal employees and educate businesses, contractors, and the general public in proper and consistent methods for disposal.
- Train municipal staff regarding non-stormwater discharges (See SC-10 Non-Stormwater Discharges).

Spill Response and Prevention

- Refer to SC-11, Prevention, Control & Cleanup
- Have spill cleanup materials readily available and in a known location.
- Cleanup spills immediately and use dry methods if possible.
- Properly dispose of spill cleanup material.

Other Considerations

- Cleanup 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.
- 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, liquid/sediment disposal, and disposal of flushed effluent to sanitary sewer may be prohibited in some areas.
- Regulations may include adoption of substantial penalties for illegal dumping and disposal.
- Municipal codes should include sections prohibiting the discharge of soil, debris, refuse, hazardous wastes, and other pollutants into the storm drain system.
- Private property access rights may be needed to track illegal discharges up gradient.

- Requirements of municipal ordinance authority for suspected source verification testing for illicit connections necessary for guaranteed rights of entry.

Requirements

Costs

- An aggressive catch basin cleaning program could require a significant capital and O&M budget. A careful study of cleaning effectiveness should be undertaken before increased cleaning is implemented. Catch basin cleaning costs are less expensive if vacuum street sweepers are available; cleaning catch basins manually can cost approximately twice as much as cleaning the basins with a vacuum attached to a sweeper.
- 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. Encouraging reporting of illicit discharges by employees can offset costs by saving expense on inspectors and directing resources more efficiently. Some programs have used funds available from “environmental fees” or special assessment districts to fund their illicit connection elimination programs.

Maintenance

- Two-person teams may be required to clean catch basins with vector trucks.
- Identifying illicit discharges requires teams of at least two people (volunteers can be used), plus administrative personnel, depending on the complexity of the storm sewer system.
- Arrangements must be made for proper disposal of collected wastes.
- Requires technical staff to detect and investigate illegal dumping violations, and to coordinate public education.

Supplemental Information

Further Detail of the BMP

Storm Drain flushing

Sanitary sewer flushing is a common maintenance activity used to improve pipe hydraulics and to remove pollutants in sanitary sewer systems. The same principles that make sanitary sewer flushing effective can be used to flush storm drains. Flushing may be designed to hydraulically convey accumulated material to strategic locations, such as to an open channel, to another point where flushing will be initiated, or over to the sanitary sewer and on to 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. The 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, releasing the backed up water and resulting in the cleaning of the storm drain segment.

To further reduce the impacts of stormwater pollution, a second inflatable device, placed well downstream, may be used to re-collect 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 re-collect 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 percent for organics and 55-65 percent 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 or that fire hydrant line flushing coincide with storm drain flushing.

Flow Management

Flow management has been one of the principal motivations for designing urban stream corridors in the past. Such needs may or may not be compatible with the stormwater quality goals in the stream corridor.

Downstream flood peaks can be suppressed by reducing through flow velocity. This can be accomplished by reducing gradient with grade control structures or increasing roughness with boulders, dense vegetation, or complex banks forms. Reducing velocity correspondingly increases flood height, so all such measures have a natural association with floodplain open space. Flood elevations laterally adjacent to the stream can be lowered by increasing through flow velocity.

However, increasing velocity increases flooding downstream and inherently conflicts with channel stability and human safety. Where topography permits, another way to lower flood elevation is to lower the level of the floodway with drop structures into a large but subtly excavated bowl where flood flows we allowed to spread out.

Stream Corridor Planning

Urban streams receive and convey stormwater flows from developed or developing watersheds. Planning of stream corridors thus interacts with urban stormwater management programs. If local programs are intended to control or protect downstream environments by managing flows delivered to the channels, then it is logical that such programs should be supplemented by management of the materials, forms, and uses of the downstream riparian corridor. Any proposal for steam alteration or management should be investigated for its potential flow and stability effects on upstream, downstream, and laterally adjacent areas. The timing and rate of flow from various tributaries can combine in complex ways to alter flood hazards. Each section of channel is unique, influenced by its own distribution of roughness elements, management activities, and stream responses.

Flexibility to adapt to stream features and behaviors as they evolve must be included in stream reclamation planning. The amenity and ecology of streams may be enhanced through the landscape design options of 1) corridor reservation, 2) bank treatment, 3) geomorphic restoration, and 4) grade control.

Corridor reservation - Reserving stream corridors and valleys to accommodate natural stream meandering, aggradation, degradation, and over bank flows allows streams to find their own form and generate less ongoing erosion. In California, open stream corridors in recent urban developments have produced recreational open space, irrigation of streamside plantings, and the aesthetic amenity of flowing water.

Bank treatment - The use of armoring, vegetative cover, and flow deflection may be used to influence a channel's form, stability, and biotic habitat. To prevent bank erosion, armoring can be done with rigid construction materials, such as concrete, masonry, wood planks and logs, riprap, and gabions. Concrete linings have been criticized because of their lack of provision of biotic habitat. In contrast, riprap and gabions make relatively porous and flexible linings. Boulders, placed in the bed reduce velocity and erosive power.

Riparian vegetation can stabilize the banks of streams that are at or near a condition of equilibrium. Binding networks of roots increase bank shear strength. During flood flows, resilient vegetation is forced into erosion-inhibiting mats. The roughness of vegetation leads to lower velocity, further reducing erosive effects. Structural flow deflection can protect banks from erosion or alter fish habitat. By concentrating flow, a deflector causes a pool to be scoured in the bed.

Geomorphic restoration – Restoration refers to alteration of disturbed streams so their form and behavior emulate those of undisturbed streams. Natural meanders are retained, with grading to gentle slopes on the inside of curves to allow point bars and riffle-pool sequences to develop. Trees are retained to provide scenic quality, biotic productivity, and roots for bank stabilization, supplemented by plantings where necessary.

A restorative approach can be successful where the stream is already approaching equilibrium. However, if upstream urbanization continues new flow regimes will be generated that could disrupt the equilibrium of the treated system.

Grade Control - A grade control structure is a level shelf of a permanent material, such as stone, masonry, or concrete, over which stream water flows. A grade control structure is called a sill, weir, or drop structure, depending on the relation of its invert elevation to upstream and downstream channels.

A sill is installed at the preexisting channel bed elevation to prevent upstream migration of nick points. It establishes a firm base level below which the upstream channel can not erode.

A weir or check dam is installed with invert above the preexisting bed elevation. A weir raises the local base level of the stream and causes aggradation upstream. The gradient, velocity, and erosive potential of the stream channel are reduced. A drop structure lowers the downstream invert below its preexisting elevation, reducing downstream gradient and velocity. Weirs and drop structure control erosion by dissipating energy and reducing slope velocity.

When carefully applied, grade control structures can be highly versatile in establishing human and environmental benefits in stabilized channels. To be successful, application of grade control structures should be guided by analysis of the stream system both upstream and downstream from the area to be reclaimed.

Examples

The California Department of Water Resources began the Urban Stream Restoration Program in 1985. The program provides grant funds to municipalities and community groups to implement stream restoration projects. The projects reduce damages from streambank and watershed instability and floods while restoring streams' aesthetic, recreational, and fish and wildlife values.

In Buena Vista Park, upper floodway slopes are gentle and grassed to achieve continuity of usable park land across the channel of small boulders at the base of the slopes.

The San Diego River is a large, vegetative lined channel, which was planted in a variety of species to support riparian wildlife while stabilizing the steep banks of the floodway.

References and Resources

Ferguson, B.K. 1991. Urban Stream Reclamation, p. 324-322, *Journal of Soil and Water Conservation*.

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Model Urban Runoff Program: A How-To Guide for Developing Urban Runoff Programs for Small Municipalities. Prepared by City of Monterey, City of Santa Cruz, California Coastal Commission, Monterey Bay National Marine Sanctuary, Association of Monterey Bay Area Governments, Woodward-Clyde, Central Coast Regional Water Quality Control Board. July. 1998.

Orange County Stormwater Program
http://www.ocwatersheds.com/StormWater/swp_introduction.asp

Santa Clara Valley Urban Runoff Pollution Prevention Program. 1997 Urban Runoff Management Plan. September 1997, updated October 2000.

San Diego Stormwater Co-permittees Jurisdictional Urban Runoff Management Program (URMP) Municipal Activities Model Program Guidance. 2001. Project Clean Water. November.

United States Environmental Protection Agency (USEPA). 1999. Stormwater Management Fact Sheet Non-stormwater Discharges to Storm Sewers. EPA 832-F-99-022. Office of Water, Washington, D.C. September.

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United States Environmental Protection Agency (USEPA). 2002. Pollution Prevention/Good Housekeeping for Municipal Operations Illegal Dumping Control. On line:
http://www.epa.gov/npdes/menuofbmps/poll_7.htm

United States Environmental Protection Agency (USEPA). 2002. Pollution Prevention/Good Housekeeping for Municipal Operations Storm Drain System Cleaning. On line:
http://www.epa.gov/npdes/menuofbmps/poll_16.htm

Appendix H

- Maintenance Manual & Covenant Agreement

Inland Empire North Logistics Center

For

FGFW IV LLC
150 N. Market Street
Wichita, KS 67206
(702) 330-1715

Attn.

OPERATION AND MAINTENANCE MANUAL

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6. BMP Fact Sheets A

7. WQMP Exhibit B

1. Discussion

The long-term operation and maintenance of storm water management systems at the Inland Empire North Logistics Center property is critical to BMP performance as its design and construction. Proper operation and maintenance practices are outlined in this plan and will ensure that the BMPs will continue to remove and reduce sources of pollutants effectively over the long-term, and therefore, improve water quality. Without proper maintenance, BMPs are likely to fail and no longer provide the necessary Storm water treatment. Common maintenance issues that are encountered include:

- Maintenance that occurs too infrequently
- Owners not understanding the long-term financial burden for the maintenance of a storm water system
- Lack of the knowledge on the maintenance needs of the system and
- Conflicts between municipalities and landowners on who is responsible for maintenance of a storm water system.

Project Owner: FGFW IV LLC
150 N. Market Street
Wichita, KS 67206
(702) 330-1715

To address these issues the following sections have been developed for the project owner

Maintenance Frequency

Maintenance frequency is outlined in Form 5-1. This form clearly identifies required inspection activities, the maintenance schedule, and directs provider to use a log sheet to document inspections and maintenance activities. There is the potential that a Town or Regional Board inspector could visit this site and request owner to provide Maintenance records.

BMP Fact Sheets

BMP Fact sheets are provided to supplement BMP maintenance background and provide general knowledge on BMPs.

Maintenance Agreement

The maintenance agreement clearly identifies the project owner as the entity responsible for BMP maintenance and associated costs.

Reference Material

Reference material covers proprietary information for BMPs and recommended maintenance activities.

Inspection and Maintenance Log

The inspection and maintenance log provide a form to document inspections and maintenance. This form is a sample form and other forms can be used as long as they provide the minimum information outlined in this sample log.

WQMP Exhibit

The WQMP exhibit illustrates the spatial distribution of BMPS throughout the site and can be cross-referenced with Form 5-1 to identify where maintenance activities are expected to occur onsite.

2. Inspection and Maintenance Log

2. Inspection and Maintenance Responsibility Form 5-1

Form 5-1 BMP Inspection and Maintenance (use additional forms as necessary)			
BMP	Responsible Party(s)	Inspection/ Maintenance Activities Required	Minimum Frequency of Activities
Site Design on-lot infiltration	FGFW IV, LLC	Inspect Basin for trash, buildup of sediment and weeds. Clean out weeds and trash, remove sediment build up. Maintain landscaping around sides and adjacent area.	Twice yearly, April and October suggested.
Underground infiltration	FGFW IV, LLC	Inspect and Flush debris and sediment after major storms. . Ensure outflow orifices are clear of debris.	Minimum once yearly and after a major rainstorm.
Storm drain and Catch basin stenciling	FGFW IV, LLC	Inspect catch basins, check for illicit dumping or spills, Inspect storm drain for trash and sediment. Clean if necessary. Refresh stenciling if needed.	Once yearly prior to rainy season
Parking lot sweeping	FGFW IV, LLC	Inspect for spills, oil drips and trash. Clean any spills, oil immediately. Inspect for accumulation of dirt/dust. Sweep parking as needed.	Monthly
Catch basin inserts	FGFW IV, LLC	Inspect for trash and debris and check the oil absorbing pillow.	Twice a year.
Irrigation and Landscaping	FGFW IV, LLC	Maintain landscaping, replace dead material. Inspect irrigation, fix and repair leaks.	Weekly to monthly.
Trash Enclosures	FGFW IV, LLC	Inspect and clean trash and debris. Do not wash area. Ensure lids are closed and enclosure properly maintained.	Weekly

Anticipated yearly BMP Maintenance costs are \$50,000.00/year

2. Inspection and Maintenance Log

3. Inspection and Maintenance Log

Proprietary BMP Inspections and Maintenance Checklist

Site Name: _____ Owner Change since last inspection? Y N

Location: _____

Owner Name: _____

Address: _____ Phone Number _____

Site Status: _____

Date: _____ Time: _____ Site conditions: _____

*Inspection Frequency Key: A=annual; M=monthly; S=after major storms. **BOLD** = recommended frequency*

Inspection Items	Inspection Frequency	Inspected? (Yes/No)	Maintenance Needed? (Yes/No)	Comments/Description
Debris Removal				
Adjacent area free of debris?	A / M / S			
Inlets and Outlets free of debris?	A / M / S			
Facility (internally) free of debris?	A / M / S			
Vegetation				
Surroundng area fully stabilized? (no evidence of material eroding into sand filter)	A / M / S			
Grass mowed?	A / M / S			
Water Retention (where required)				
Water holding chambers at normal pool?	A / M / S			
Evidence of erosion?	A / M / S			
Sediment Deposition				
Filtration chamber free of sediments?	A / M / S			
Sedimentation chamber not more than 50% full?	A / M / S			
Structural Components				
Any evidence of structural deterioration?	A / M / S			
Grates in good condition?	A / M / S			
Spalling or cracking of structural parts?	A / M / S			
Outlet/Overflow Spillway				
Other				
Noticeable odors?	A / M / S			
Any evidence of filter(s) clogging?	A / M / S			
Evidence of flow bypassing facility?	A / M / S			

Inspector Comments: _____

Overall Condition of Facility: : Acceptable Unacceptable

If any of the above Inspection items are checked "Yes" for "Maintenance Needed", list Maintenance actions and their completion dates below:

Maintenance Action Needed	Due Date

The next routine inspection is scheduled for approximately: _____

Inspected by: (signature) _____

Inspected by: (printed) _____

4. Maintenance Agreement

RECORDING REQUESTED BY:

Town of Apple Valley
Apple Valley, Ca 92307

AND WHEN RECORDED MAIL TO:

Town of Apple Valley
Engineering Department
14955 Dale Evans Pkwy
Apple Valley, CA 92307

SPACE ABOVE THIS LINE FOR RECORDER'S USE

**COVENANT AND AGREEMENT REGARDING WATER QUALITY
MANAGEMENT PLAN AND STORMWATER BEST MANAGEMENT
PRACTICES TRANSFER, ACCESS AND MAINTENANCE**

THIS PAGE ADDED TO PROVIDE ADEQUATE SPACE FOR RECORDING INFORMATION

**Covenant and Agreement Regarding Water Quality Management Plan and Stormwater
Best Management Practices
Transfer, Access and Maintenance**

OWNER NAME: FGFW IV, LLC

PROPERTY ADDRESS: _____

APN: 0472-231-08

THIS AGREEMENT is made and entered into in

_____, California, this _____ day of

_____, by and between

_____, hereinafter

referred to as Owner, and the Town of Apple Valley, a political subdivision of the State of California, hereinafter referred to as “the Town”;

WHEREAS, the Owner owns real property (“Property”) in the Town, State of California, more specifically described in Exhibit “A” and depicted in Exhibit “B”, each of which exhibits is attached hereto and incorporated herein by this reference; and

WHEREAS, at the time of initial approval of development project known as

_____ within the Property described herein, the Town required the project to employ Best Management Practices, hereinafter referred to as “BMPs,” to minimize pollutants in urban runoff; and

WHEREAS, the Owner has chosen to install and/or implement BMPs as described in the Water Quality Management Plan, dated _____, on file with the Town and incorporated herein by this reference, hereinafter referred to as “WQMP”, to minimize pollutants in urban runoff and to minimize other adverse impacts of urban runoff; and

WHEREAS, said WQMP has been certified by the Owner and reviewed and approved by the Town; and

WHEREAS, the Owner is aware that periodic and continuous maintenance, including, but not necessarily limited to, filter material replacement and sediment removal, is required to assure peak performance of all BMPs in the WQMP and that, furthermore, such maintenance activity will require compliance with all Local, State, or Federal laws and regulations, including those

pertaining to confined space and waste disposal methods, in effect at the time such maintenance occurs.

NOW THEREFORE, it is mutually stipulated and agreed as follows:

1. Owner shall comply with the WQMP.
2. All maintenance or replacement of BMPs proposed as part of the WQMP are the sole responsibility of the Owner in accordance with the terms of this Agreement.
3. Owner hereby provides the Town's designee complete access, of any duration, to the BMPs and their immediate vicinity at any time, upon reasonable notice, or in the event of emergency, as determined by the Town of Apple Valley, no advance notice, for the purpose of inspection, sampling, testing of the BMPs, and in case of emergency, to undertake all necessary repairs or other preventative measures at owner's expense as provided in paragraph 5 below. The Town shall make every effort at all times to minimize or avoid interference with Owner's use of the Property. Denial of access to any premises or facility that contains WQMP features is a breach of this Agreement and may also be a violation of the County's Pollutant Discharge Elimination System regulations, which on the effective date of this Agreement are found in County Code Sections 35.0101 et seq. If there is reasonable cause to believe that an illicit discharge or breach of this Agreement is occurring on the premises then the authorized enforcement agency may seek issuance of a search warrant from any court of competent jurisdiction in addition to other enforcement actions. Owner recognizes that the Town may perform routine and regular inspections, as well as emergency inspections, of the BMPs. Owner or Owner's successors or assigns shall pay Town for all costs incurred by Town in the inspection, sampling, testing of the BMPs within thirty (30) calendar days of Town's invoice.
4. Owner shall use its best efforts diligently to maintain all BMPs in a manner assuring peak performance at all times. All reasonable precautions shall be exercised by Owner and Owner's representative or contractor in the removal and extraction of any material(s) from the BMPs and the ultimate disposal of the material(s) in a manner consistent with all relevant laws and regulations in effect at the time. As may be requested from time to time by the Town, the Owner shall provide the Town with documentation identifying the material(s) removed, the quantity, and disposal destination), testing construction or reconstruction.
5. In the event Owner, or its successors or assigns, fails to accomplish the necessary maintenance contemplated by this Agreement, within five (5) business days of being given written notice by the Town, the Town is hereby authorized to cause any maintenance necessary to be done and charge the entire cost and expense against the Property and/or to the Owner or Owner's successors or assigns, including administrative costs, attorneys fees and interest thereon at the maximum rate authorized by the Town Code from the date of the notice of expense until paid in full. Owner or Owner's successors or assigns shall pay Town within thirty (30) calendar days of Town's invoice.
6. The Town may require the owner to post security in form and for a time period satisfactory to the Town to guarantee the performance of the obligations stated herein. Should the Owner fail to perform the obligations under the Agreement, the Town may, in the case of a cash bond, act for the Owner using the proceeds from it, or in the case of a surety bond, require the surety(ies) to perform the obligations of this Agreement.

7. The Town agrees, from time to time, within ten (10) business days after request of Owner, to execute and deliver to Owner, or Owner's designee, an estoppel certificate requested by Owner, stating that this Agreement is in full force and effect, and that Owner is not in default hereunder with regard to any maintenance or payment obligations (or specifying in detail the nature of Owner's default). Owner shall pay all costs and expenses incurred by the Town in its investigation of whether to issue an estoppel certificate within thirty (30) calendar days after receipt of a Town invoice and prior to the Town's issuance of such certificate. Where the Town cannot issue an estoppel certificate, Owner shall pay the Town within thirty (30) calendar days of receipt of a Town invoice.
8. Owner shall not change any BMPs identified in the WQMP without an amendment to this Agreement approved by authorized representatives of both the Town and the Owner.
9. The Town and Owner shall comply with all applicable laws, ordinances, rules, regulations, court orders and government agency orders now or hereinafter in effect in carrying out the terms of this Agreement. If a provision of this Agreement is terminated or held to be invalid, illegal or unenforceable, the validity, legality and enforceability of the remaining provisions shall remain in full effect.
10. In addition to any remedy available to Town under this Agreement, if Owner violates any term of this Agreement and does not cure the violation within the time already provided in this Agreement, or, if not provided, within thirty (30) calendar days, or within such time authorized by the Town if said cure reasonably requires more than the subject time, the Town may bring an action at law or in equity in a court of competent jurisdiction to enforce compliance by the Owner with the terms of this Agreement. In such action, the Town may recover any damages to which the Town may be entitled for the violation, enjoin the violation by temporary or permanent injunction without the necessity of proving actual damages or the inadequacy of otherwise available legal remedies, or obtain other equitable relief, including, but not limited to, the restoration of the Property and/or the BMPs identified in the WQMP to the condition in which it/they existed prior to any such violation or injury.
11. This Agreement shall be recorded in the Office of the Recorder of San Bernardino County, California, at the expense of the Owner and shall constitute notice to all successors and assigns of the title to said Property of the obligation herein set forth, and also a lien in such amount as will fully reimburse the Town, including interest as herein above set forth, subject to foreclosure in event of default in payment.
12. In event of legal action occasioned by any default or action of the Owner, or its successors or assigns, then the Owner and its successors or assigns agree(s) to hold the Town harmless and pay all costs incurred by the Town in enforcing the terms of this Agreement, including reasonable attorney's fees and costs, and that the same shall become a part of the lien against said Property.
13. It is the intent of the parties hereto that burdens and benefits herein undertaken shall constitute covenants that run with said Property and constitute a lien there against.
14. The obligations herein undertaken shall be binding upon the heirs, successors, executors, administrators and assigns of the parties hereto. The term "Owner" shall include not only the present Owner, but also its heirs, successors, executors, administrators, and assigns. Owner shall notify any successor to title of all or part of the Property about the existence of

this Agreement. Owner shall provide such notice prior to such successor obtaining an interest in all or part of the Property. Owner shall provide a copy of such notice to the Town at the same time such notice is provided to the successor.

15. Time is of the essence in the performance of this Agreement.
16. Any notice to a party required or called for in this Agreement shall be served in person, or by deposit in the U.S. Mail, first class postage prepaid, to the address set forth below. Notice(s) shall be deemed effective upon receipt, or seventy-two (72) hours after deposit in the U.S. Mail, whichever is earlier. A party may change a notice address only by providing written notice thereof to the other party.
17. Owner agrees to indemnify, defend (with counsel reasonably approved by the Town) and hold harmless the Town and its authorized officers, employees, agents and volunteers from any and all claims, actions, losses, damages, and/or liability arising out of this Agreement from any cause whatsoever, including the acts, errors or omissions of any person and for any costs or expenses incurred by the Town on account of any claim except where such indemnification is prohibited by law. This indemnification provision shall apply regardless of the existence or degree of fault of indemnitees. The Owner's indemnification obligation applies to the Town's "active" as well as "passive" negligence but does not apply to the Town's "sole negligence" or "willful misconduct" within the meaning of Civil Code Section 2782, or to any claims, actions, losses, damages, and/or liabilities, to the extent caused by the acts or omissions of any third party contractors undertaking any work (other than field inspections) or other maintenance on the Property on behalf of the Town under this Agreement..

[REMAINDER OF THIS PAGE INTENTIONALLY LEFT BLANK]

IF TO TOWN :

IF TO OWNER:

Town Manager _____

14955 Dale Evans Parkway _____

Apple Valley, CA 92307 _____

IN WITNESS THEREOF, the parties hereto have affixed their signatures as of the date first written above.

OWNER:

Company/Trust: FGFW IV, LLC _____

FOR: Maintenance Agreement, dated _____

Signature: _____

_____, for the

Name: _____

project known as

Title: _____

Inland Empire Logistics Center

Date: _____

(APN) 0472-231-08,

OWNER:

Company/Trust: _____

As described in the WQMP dated _____

Signature: _____

Name: _____

Title: _____

Date: _____

NOTARIES ON FOLLOWING PAGE

A notary acknowledgement is required for recordation.

ACCEPTED BY:

DOUGLAS B. ROBERTSON, TOWN MANAGER

Date: _____

Attachment: Notary Acknowledgement

ATTACHMENT 1
Notary Acknowledgement)

EXHIBIT A
(Legal Description)

Parcels 1 and 2 of PM 20625, as recorded in book,xxxx, pages xxxx, San Bernardino County, California

EXHIBIT B
(Map/illustration)

5. Reference Material

The following is the Town of Apple Valleys Annual Self Certification Form to be completed and submitted to the Town every year by June 30th.



Town of Apple Valley Engineering
Department 14955 Dale Evans
Parkway Apple Valley, CA 92307
(760) 240-7000

Structural Post-Construction BMPs Annual Self-Certification Form

This self-certification form must be completed by the site owner/operator annually by June 30th of each year to be in compliance with the Town's Storm Water ordinances and NDPEs Permit Order No. 2013-0001-DWQ. The purpose of this form is to verify the effectiveness of structural post-construction best management practices (BMPs) in removing pollutants of concern from storm water runoff and/or reducing hydromodification impacts as designed and to verify the maintenance of BMPs.

Date Prepared:

Parcel No.:

Site Name:

Tract No.:

Site Address:

Site Owner/Operator:

Phone:

FIELD OBSERVATIONS AND MAINTENANCE

Please list and describe observations of the condition, maintenance plan and maintenance frequency of structural post-construction BMPs on site. Please attach proof of maintenance performed, if applicable.

BMP 1:

Latitude:

Longitude:

Observations:

Maintenance Plan:

Maintenance Frequency:

BMP 2:

Latitude:

Longitude:

Observations:

Maintenance Plan:

Maintenance Frequency:

BMP 3:

Latitude:

Longitude:

Observations:

Maintenance Plan:

Maintenance Frequency:

BMP 4:

Latitude:

Longitude:

Observations:

Maintenance Plan:

Maintenance Frequency:

BMP 5:

Latitude:

Longitude:

Observations:

Maintenance Plan:

Maintenance Frequency:

BMP 6:

Latitude:

Longitude:

Observations:

Maintenance Plan:

Maintenance Frequency:

*If needed, please attach pages for additional BMPs

CERTIFICATION:

As the owner/operator responsible for the above site, I certify that I have inspected all structural post construction BMPs required per the approved Permit No. 2013-0001-DWQ and all BMP's are effective and maintained.

Signature:

Date of Signature:

Printed Name:

Title:

Phone Number:

6. BMP Fact Sheets

Section 3

Source Control BMPs

3.1 Introduction

This section provides a description of specific source control Best Management Practices (BMPs) for activities related to municipal operations. As noted in Sections 1 and 2, municipal fixed facilities conduct activities that have the potential to generate pollutants. The source control BMPs in this section address these activities (see Table 3-1).

In addition, municipalities conduct various field programs where activities may occur and create pollutants. BMPs for these field programs and associated activities are listed in Table 3-2.

Table 3-1 Municipal Fixed Facility BMPs	
Non-Stormwater Management	
SC-10	Non-Stormwater Discharges
SC-11	Spill Prevention, Control and Cleanup
Vehicle and Equipment Management	
SC-20	Vehicle and Equipment Fueling
SC-21	Vehicle and Equipment Cleaning
SC-22	Vehicle and Equipment Repair
Material and Waste Management	
SC-30	Outdoor Loading/Unloading
SC-31	Outdoor Container Storage
SC-32	Outdoor Equipment Maintenance
SC-33	Outdoor Storage of Raw Materials
SC-34	Waste Handling and Disposal
Building and Grounds Management	
SC-41	Building and Grounds Maintenance
SC-43	Parking/Storage Area Maintenance
Over Water Activities	
SC-50	Over Water Activities
General Stormwater Management	
SC-60	Housekeeping Practices
SC-61	Safer Alternative Products

Table 3-2 Municipal Field Program BMPs	
SC-70	Road and Street Maintenance
SC-71	Plaza and Sidewalk Cleaning
SC-72	Fountains & Pools Maintenance
SC-73	Landscape Maintenance
SC-74	Drainage System Maintenance
SC-75	Waste Handling and Disposal
SC-76	Water and Sewer Utility Maintenance

3.2 Fact Sheet Format

Each BMP fact sheet is a short document that gives all the information about a particular BMP. Typically, each fact sheet contains the information outlined in Figure 3-1. Completed fact sheets for each of the activities listed in Tables 3-1 and 3-2 are provided in Section 3.3.

The fact sheets also contain side bar presentations with information on BMP objectives and targeted constituents.

The information provided in each fact sheet is extensive and may not be applicable to all municipal operations. The readers may find it helpful to modify and simplify the BMP fact sheets to better reflect their existing operations.

3.3 BMP Fact Sheets

BMP fact sheets for fixed facilities activities and field programs follow. The BMP fact sheets are individually page numbered and are suitable for photocopying and inclusions in stormwater quality management plans. Fresh copies of the fact sheets can be individually downloaded from the California Stormwater BMP Handbook website at <http://www.cabmphandbooks.com>

SC-xx Example Fact Sheet	
<u>Description of the BMP</u>	
<u>Approach</u>	
	Pollution Prevention
	Suggested Protocols
	Training
	Spill Response and Prevention
	Other Considerations
<u>Requirements</u>	
	Costs
	Maintenance
<u>Supplemental Information</u>	
	Further Details on the BMP
	Examples
<u>References and Resources</u>	

Figure 3-1
Example Fact Sheet

Section 3

Source Control BMPs

3.1 Introduction

This section provides a description of specific source control Best Management Practices (BMPs) for activities related to municipal operations. As noted in Sections 1 and 2, municipal fixed facilities conduct activities that have the potential to generate pollutants. The source control BMPs in this section address these activities (see Table 3-1).

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Table 3-1 Municipal Fixed Facility BMPs	
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SC-20	Vehicle and Equipment Fueling
SC-21	Vehicle and Equipment Cleaning
SC-22	Vehicle and Equipment Repair
Material and Waste Management	
SC-30	Outdoor Loading/Unloading
SC-31	Outdoor Container Storage
SC-32	Outdoor Equipment Maintenance
SC-33	Outdoor Storage of Raw Materials
SC-34	Waste Handling and Disposal
Building and Grounds Management	
SC-41	Building and Grounds Maintenance
SC-43	Parking/Storage Area Maintenance
Over Water Activities	
SC-50	Over Water Activities
General Stormwater Management	
SC-60	Housekeeping Practices
SC-61	Safer Alternative Products

Table 3-2 Municipal Field Program BMPs	
SC-70	Road and Street Maintenance
SC-71	Plaza and Sidewalk Cleaning
SC-72	Fountains & Pools Maintenance
SC-73	Landscape Maintenance
SC-74	Drainage System Maintenance
SC-75	Waste Handling and Disposal
SC-76	Water and Sewer Utility Maintenance

3.2 Fact Sheet Format

Each BMP fact sheet is a short document that gives all the information about a particular BMP. Typically, each fact sheet contains the information outlined in Figure 3-1. Completed fact sheets for each of the activities listed in Tables 3-1 and 3-2 are provided in Section 3.3.

The fact sheets also contain side bar presentations with information on BMP objectives and targeted constituents.

The information provided in each fact sheet is extensive and may not be applicable to all municipal operations. The readers may find it helpful to modify and simplify the BMP fact sheets to better reflect their existing operations.

3.3 BMP Fact Sheets

BMP fact sheets for fixed facilities activities and field programs follow. The BMP fact sheets are individually page numbered and are suitable for photocopying and inclusions in stormwater quality management plans. Fresh copies of the fact sheets can be individually downloaded from the California Stormwater BMP Handbook website at <http://www.cabmphandbooks.com>

SC-xx Example Fact Sheet
<u>Description of the BMP</u>
<u>Approach</u>
Pollution Prevention
Suggested Protocols
Training
Spill Response and Prevention
Other Considerations
<u>Requirements</u>
Costs
Maintenance
<u>Supplemental Information</u>
Further Details on the BMP
Examples
<u>References and Resources</u>

Figure 3-1
Example Fact Sheet

Site Design & Landscape Planning SD-10



Design Objectives

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

Description

Each project site possesses unique topographic, hydrologic, and vegetative features, some of which are more suitable for development than others. Integrating and incorporating appropriate landscape planning methodologies into the project design is the most effective action that can be done to minimize surface and groundwater contamination from stormwater.

Approach

Landscape planning should couple consideration of land suitability for urban uses with consideration of community goals and projected growth. Project plan designs should conserve natural areas to the extent possible, maximize natural water storage and infiltration opportunities, and protect slopes and channels.

Suitable Applications

Appropriate applications include residential, commercial and industrial areas planned for development or redevelopment.

Design Considerations

Design requirements for site design and landscapes planning should conform to applicable standards and specifications of agencies with jurisdiction and be consistent with applicable General Plan and Local Area Plan policies.



SD-10 Site Design & Landscape Planning

Designing New Installations

Begin the development of a plan for the landscape unit with attention to the following general principles:

- Formulate the plan on the basis of clearly articulated community goals. Carefully identify conflicts and choices between retaining and protecting desired resources and community growth.
- Map and assess land suitability for urban uses. Include the following landscape features in the assessment: wooded land, open unwooded land, steep slopes, erosion-prone soils, foundation suitability, soil suitability for waste disposal, aquifers, aquifer recharge areas, wetlands, floodplains, surface waters, agricultural lands, and various categories of urban land use. When appropriate, the assessment can highlight outstanding local or regional resources that the community determines should be protected (e.g., a scenic area, recreational area, threatened species habitat, farmland, fish run). Mapping and assessment should recognize not only these resources but also additional areas needed for their sustenance.

Project plan designs should conserve natural areas to the extent possible, maximize natural water storage and infiltration opportunities, and protect slopes and channels.

Conserve Natural Areas during Landscape Planning

If applicable, the following items are required and must be implemented in the site layout during the subdivision design and approval process, consistent with applicable General Plan and Local Area Plan policies:

- Cluster development on least-sensitive portions of a site while leaving the remaining land in a natural undisturbed condition.
- Limit clearing and grading of native vegetation at a site to the minimum amount needed to build lots, allow access, and provide fire protection.
- Maximize trees and other vegetation at each site by planting additional vegetation, clustering tree areas, and promoting the use of native and/or drought tolerant plants.
- Promote natural vegetation by using parking lot islands and other landscaped areas.
- Preserve riparian areas and wetlands.

Maximize Natural Water Storage and Infiltration Opportunities Within the Landscape Unit

- Promote the conservation of forest cover. Building on land that is already deforested affects basin hydrology to a lesser extent than converting forested land. Loss of forest cover reduces interception storage, detention in the organic forest floor layer, and water losses by evapotranspiration, resulting in large peak runoff increases and either their negative effects or the expense of countering them with structural solutions.
- Maintain natural storage reservoirs and drainage corridors, including depressions, areas of permeable soils, swales, and intermittent streams. Develop and implement policies and

Site Design & Landscape Planning SD-10

regulations to discourage the clearing, filling, and channelization of these features. Utilize them in drainage networks in preference to pipes, culverts, and engineered ditches.

- Evaluating infiltration opportunities by referring to the stormwater management manual for the jurisdiction and pay particular attention to the selection criteria for avoiding groundwater contamination, poor soils, and hydrogeological conditions that cause these facilities to fail. If necessary, locate developments with large amounts of impervious surfaces or a potential to produce relatively contaminated runoff away from groundwater recharge areas.

Protection of Slopes and Channels during Landscape Design

- Convey runoff safely from the tops of slopes.
- Avoid disturbing steep or unstable slopes.
- Avoid disturbing natural channels.
- Stabilize disturbed slopes as quickly as possible.
- Vegetate slopes with native or drought tolerant vegetation.
- Control and treat flows in landscaping and/or other controls prior to reaching existing natural drainage systems.
- Stabilize temporary and permanent channel crossings as quickly as possible, and ensure that increases in run-off velocity and frequency caused by the project do not erode the channel.
- Install energy dissipaters, such as riprap, at the outlets of new storm drains, culverts, conduits, or channels that enter unlined channels in accordance with applicable specifications to minimize erosion. Energy dissipaters shall be installed in such a way as to minimize impacts to receiving waters.
- Line on-site conveyance channels where appropriate, to reduce erosion caused by increased flow velocity due to increases in tributary impervious area. The first choice for linings should be grass or some other vegetative surface, since these materials not only reduce runoff velocities, but also provide water quality benefits from filtration and infiltration. If velocities in the channel are high enough to erode grass or other vegetative linings, riprap, concrete, soil cement, or geo-grid stabilization are other alternatives.
- Consider other design principles that are 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.

SD-10 Site Design & Landscape Planning

Redevelopment may present significant opportunity to add features which had not previously been implemented. Examples include incorporation of depressions, areas of permeable soils, and swales in newly redeveloped areas. While some site constraints may exist due to the status of already existing infrastructure, opportunities should not be missed to maximize infiltration, slow runoff, reduce impervious areas, disconnect directly connected impervious areas.

Other Resources

A Manual for the Standard Urban Stormwater Mitigation Plan (SUSMP), Los Angeles County Department of Public Works, May 2002.

Stormwater Management Manual for Western Washington, Washington State Department of Ecology, August 2001.

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.

Spill Prevention, Control & Cleanup SC-11



Objectives

- Cover
- Contain
- Educate
- Reduce/Minimize
- Product Substitution

Description

Spills and leaks, if not properly controlled, can adversely impact the storm drain system and receiving waters. Due to the type of work or the materials involved, many activities that occur either at a municipal facility or as a part of municipal field programs have the potential for accidental spills and leaks. Proper spill response planning and preparation can enable municipal employees to effectively respond to problems when they occur and minimize the discharge of pollutants to the environment.

Approach

- An effective spill response and control plan should include:
 - Spill/leak prevention measures;
 - Spill response procedures;
 - Spill cleanup procedures;
 - Reporting; and
 - Training
- A well thought out and implemented plan can prevent pollutants from entering the storm drainage system and can be used as a tool for training personnel to prevent and control future spills as well.

Pollution Prevention

- Develop and implement a Spill Prevention Control and Response Plan. The plan should include:

Targeted Constituents

Sediment	
Nutrients	<input checked="" type="checkbox"/>
Trash	
Metals	<input checked="" type="checkbox"/>
Bacteria	
Oil and Grease	<input checked="" type="checkbox"/>
Organics	<input checked="" type="checkbox"/>
Oxygen Demanding	<input checked="" type="checkbox"/>



SC-11 Spill Prevention, Control & Cleanup

- A description of the facility, the address, activities and materials involved
- Identification of key spill response personnel
- Identification of the potential spill areas or operations prone to spills/leaks
- Identification of which areas should be or are bermed to contain spills/leaks
- Facility map identifying the key locations of areas, activities, materials, structural BMPs, etc.
- Material handling procedures
- Spill response procedures including:
 - Assessment of the site and potential impacts
 - Containment of the material
 - Notification of the proper personnel and evacuation procedures
 - Clean up of the site
 - Disposal of the waste material and
 - Proper record keeping
- Product substitution – use less toxic materials (i.e. use water based paints instead of oil based paints)
- Recycle, reclaim, or reuse materials whenever possible. This will reduce the amount of materials that are brought into the facility or into the field.

Suggested Protocols

Spill/Leak Prevention Measures

- If possible, move material handling indoors, under cover, or away from storm drains or sensitive water bodies.
- Properly label all containers so that the contents are easily identifiable.
- Berm storage areas so that if a spill or leak occurs, the material is contained.
- Cover outside storage areas either with a permanent structure or with a seasonal one such as a tarp so that rain can not come into contact with the materials.
- Check containers (and any containment sumps) often for leaks and spills. Replace containers that are leaking, corroded, or otherwise deteriorating with containers in good condition. Collect all spilled liquids and properly dispose of them.

Spill Prevention, Control & Cleanup SC-11

- Store, contain and transfer liquid materials in such a manner that if the container is ruptured or the contents spilled, they will not discharge, flow or be washed into the storm drainage system, surface waters, or groundwater.
- Place drip pans or absorbent materials beneath all mounted taps and at all potential drip and spill locations during the filling and unloading of containers. Any collected liquids or soiled absorbent materials should be reused/recycled or properly disposed of.
- For field programs, only transport the minimum amount of material needed for the daily activities and transfer materials between containers at a municipal yard where leaks and spill are easier to control.
- If paved, sweep and clean storage areas monthly, do not use water to hose down the area unless all of the water will be collected and disposed of properly.
- Install a spill control device (such as a tee section) in any catch basins that collect runoff from any storage areas if the materials stored are oil, gas, or other materials that separate from and float on water. This will allow for easier cleanup if a spill occurs.
- If necessary, protect catch basins while conducting field activities so that if a spill occurs, the material will be contained.

Training

- Educate employees about spill prevention, spill response and cleanup on a routine basis.
- Well-trained employees can reduce human errors that lead to accidental releases or spills:
 - The employees should have the tools and knowledge to immediately begin cleaning up a spill if one should occur.
 - Employees should be familiar with the Spill Prevention Control and Countermeasure Plan if one is available.
- Training of staff from all municipal departments should focus on recognizing and reporting potential or current spills/leaks and who they should contact.
- Employees responsible for aboveground storage tanks and liquid transfers for large bulk containers should be thoroughly familiar with the Spill Prevention Control and Countermeasure Plan and the plan should be readily available.

Spill Response and Prevention

- Identify key spill response personnel and train employees on who they are.
- Store and maintain appropriate spill cleanup materials in a clearly marked location near storage areas; and train employees to ensure familiarity with the site's spill control plan and/or proper spill cleanup procedures.
- Locate spill cleanup materials, such as absorbents, where they will be readily accessible (e.g. near storage and maintenance areas, on field trucks).

SC-11 Spill Prevention, Control & Cleanup

- Follow the Spill Prevention Control and Countermeasure Plan if one is available.
- If a spill occurs, notify the key spill response personnel immediately. If the material is unknown or hazardous, the local fire department may also need to be contacted.
- If safe to do so, attempt to contain the material and block the nearby storm drains so that the area impacted is minimized. If the material is unknown or hazardous wait for properly trained personnel to contain the materials.
- Perform an assessment of the area where the spill occurred and the downstream area that it could impact. Relay this information to the key spill response and clean up personnel.

Spill Cleanup Procedures

- Small non-hazardous spills
 - Use a rag, damp cloth or absorbent materials for general clean up of liquids
 - Use brooms or shovels for the general clean up of dry materials
 - If water is used, it must be collected and properly disposed of. The wash water can not be allowed to enter the storm drain.
 - Dispose of any waste materials properly
 - Clean or dispose of any equipment used to clean up the spill properly
- Large non-hazardous spills
 - Use absorbent materials for general clean up of liquids
 - Use brooms, shovels or street sweepers for the general clean up of dry materials
 - If water is used, it must be collected and properly disposed of. The wash water can not be allowed to enter the storm drain.
 - Dispose of any waste materials properly
 - Clean or dispose of any equipment used to clean up the spill properly
- For hazardous or very large spills, a private cleanup company or Hazmat team may need to be contacted to assess the situation and conduct the cleanup and disposal of the materials.
- Chemical cleanups of material can be achieved with the use of absorbents, gels, and foams. Remove the adsorbent materials promptly and dispose of according to regulations.
- 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.

Reporting

- Report any spills immediately to the identified key municipal spill response personnel.

Spill Prevention, Control & Cleanup SC-11

- Report spills in accordance with applicable reporting laws. Spills that pose an immediate threat to human health or the environment must be reported immediately to the Office of Emergency Service (OES)
- Spills that pose an immediate threat to human health or the environment may also need to be reported within 24 hours to the Regional Water Quality Control Board.
- 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)
- After the spill has been contained and cleaned up, a detailed report about the incident should be generated and kept on file (see the section on Reporting below). The incident may also be used in briefing staff about proper procedures

Other Considerations

- 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 Plan (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, if permitted to do so, prohibiting any hard connections to the storm drain.

Requirements

Costs

- 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 wastes, contaminated soil and water is very expensive

Maintenance

- This BMP has no major administrative or staffing requirements. However, 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 response and containment of a spill. A good record keeping system helps the municipality minimize incident recurrence, correctly respond with appropriate containment and 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 drain.

SC-11 Spill Prevention, Control & Cleanup

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
- 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:

- The date and time the inspection was performed
- Name of the inspector
- Items inspected
- Problems noted
- Corrective action required
- 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.

Examples

The City of Palo Alto includes spill prevention and control as a major element of its highly effective program for municipal vehicle maintenance shops.

References and Resources

King County Stormwater Pollution Control Manual - <http://dnr.metrokc.gov/wlr/dss/spcm.htm>

Orange County Stormwater Program

http://www.ocwatersheds.com/stormwater/swp_introduction.asp

San Diego Stormwater Co-permittees Jurisdictional Urban Runoff Management Program (URMP)

<http://www.projectcleanwater.org/pdf/Model%20Program%20Municipal%20Facilities.pdf>



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.



- 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.

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Design Objectives

- Maximize Infiltration
- Provide Retention
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- 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



– 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.

- 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.

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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.

Pollution Prevention

- Switch to non-toxic chemicals for maintenance when possible.
- Choose cleaning agents that can be recycled.
- Encourage proper lawn management and landscaping, including use of native vegetation.

Objectives

- Cover
- Contain
- Educate
- Reduce/Minimize
- Product Substitution

Targeted Constituents

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



SC-41 Building & Grounds Maintenance

- 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.

Suggested Protocols

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.

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.

Building & Grounds Maintenance **SC-41**

- 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

- 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.
- 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.
- Dispose of empty pesticide containers according to the instructions on the container label.

SC-41 Building & Grounds Maintenance

- 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.

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.

Training

- 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 nature of the staff.

Spill Response and Prevention

- 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.

Other Considerations

Alternative pest/weed controls may not be available, suitable, or effective in many cases.

Requirements

Costs

- Cost will vary depending on the type and size of facility.
- Overall costs should be low in comparison to other BMPs.

Maintenance

Sweep paved areas regularly to collect loose particles. Wipe up spills with rags and other absorbent material immediately, do not hose down the area to a storm drain.

Supplemental Information

Further Detail of the BMP

Fire Sprinkler Line Flushing

Building 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, polyphosphates 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

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

Clark County Storm Water Pollution Control Manual
<http://www.co.clark.wa.us/pubworks/bmpman.pdf>

King County Storm Water Pollution Control Manual <http://dnr.metrokc.gov/wlr/dss/spcm.htm>

Mobile Cleaners Pilot Program: Final Report. 1997. Bay Area Stormwater Management Agencies Association (BASMAA). <http://www.basmaa.org/>

Pollution from Surface Cleaning Folder. 1996. Bay Area Stormwater Management Agencies Association (BASMAA). <http://www.basmaa.org/>

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

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

Parking/Storage Area Maintenance SC-43



Description

Parking lots and storage areas 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/storage areas and include using good housekeeping practices, following appropriate cleaning BMPs, and training employees.

Approach

The goal of this program is to ensure stormwater pollution prevention practices are considered when conducting activities on or around parking areas and storage 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.

Pollution Prevention

- Encourage alternative designs and maintenance strategies for impervious parking lots. (See New Development and Redevelopment BMP Handbook)
- Keep accurate maintenance logs to evaluate BMP implementation.

Objectives

- Cover
- Contain
- Educate
- Reduce/Minimize
- Product Substitution

Targeted Constituents

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



SC-43 Parking/Storage Area Maintenance

Suggested Protocols

General

- Keep the parking and storage areas clean and orderly. Remove debris in a timely fashion.
- Allow 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.
- Discharge soapy water remaining in mop or wash buckets to the sanitary sewer through a sink, toilet, clean-out, or wash area with drain.

Controlling Litter

- Post “No Littering” signs and enforce anti-litter laws.
- Provide an adequate number of litter receptacles.
- Clean out and cover litter receptacles frequently to prevent spillage.
- Provide trash receptacles in parking lots to discourage litter.
- Routinely sweep, shovel, and dispose of litter in the trash.

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.
- 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.
 - Dispose of parking lot sweeping debris and dirt at a landfill.
- 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.

Parking/Storage Area Maintenance SC-43

- Do not allow discharges to the storm drain.
- Vacuum/pump discharges to a tank or discharge to sanitary sewer.
- Appropriately dispose of spilled materials and absorbents.

Surface Repair

- 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, 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.

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.

Training

- 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.

Spill Response and Prevention

- 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.

Other Considerations

Limitations related to sweeping activities at large parking facilities may include high equipment costs, the need for sweeper operator training, and the inability of current sweeper technology to remove oil and grease.

SC-43 Parking/Storage Area Maintenance

Requirements

Costs

Cleaning/sweeping costs can be quite large. Construction and maintenance of stormwater structural controls can be quite expensive as well.

Maintenance

- Sweep parking lot regularly to minimize cleaning with water.
- Clean out oil/water/sand separators regularly, especially after heavy storms.
- Clean parking facilities regularly to prevent accumulated wastes and pollutants from being discharged into conveyance systems during rainy conditions.

Supplemental Information

Further Detail of the BMP

Surface Repair

Apply concrete, asphalt, and seal coat during dry weather to prevent contamination from contacting stormwater runoff. Where applicable, cover and seal nearby storm drain inlets (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. Only use only as much water as is necessary for dust control to avoid runoff.

References and Resources

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

Clark County Storm Water Pollution Control Manual
<http://www.co.clark.wa.us/pubworks/bmpman.pdf>

King County Storm Water Pollution Control Manual <http://dnr.metrokc.gov/wlr/dss/spcm.htm>

Pollution from Surface Cleaning Folder. 1996. Bay Area Stormwater Management Agencies Association (BASMAA). <http://www.basmaa.org/>

Oregon Association of Clean Water Agencies. Oregon Municipal Stormwater Toolbox for Maintenance Practices. June 1998.

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

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

Description

Promote efficient and safe housekeeping practices (storage, use, and cleanup) when handling potentially harmful materials such as fertilizers, pesticides, cleaning solutions, paint products, automotive products, and swimming pool chemicals. Related information is provided in BMP fact sheets SC-11 Spill Prevention, Control & Cleanup and SC-34 Waste Handling & Disposal.

Approach

Pollution Prevention

- Purchase only the amount of material that will be needed for foreseeable use. In most cases this will result in cost savings in both purchasing and disposal. See SC-61 Safer Alternative Products for additional information.
- Be aware of new products that may do the same job with less environmental risk and for less or the equivalent cost. Total cost must be used here; this includes purchase price, transportation costs, storage costs, use related costs, clean up costs and disposal costs.

Suggested Protocols

General

- Keep work sites clean and orderly. Remove debris in a timely fashion. Sweep the area.
- Dispose of wash water, sweepings, and sediments, properly.
- Recycle or dispose of fluids properly.
- Establish a daily checklist of office, yard and plant areas to confirm cleanliness and adherence to proper storage and security. Specific employees should be assigned specific inspection responsibilities and given the authority to remedy any problems found.
- Post waste disposal charts in appropriate locations detailing for each waste its hazardous nature (poison, corrosive, flammable), prohibitions on its disposal (dumpster, drain, sewer) and the recommended disposal method (recycle, sewer, burn, storage, landfill).
- Summarize the chosen BMPs applicable to your operation and post them in appropriate conspicuous places.

Objectives

- Cover
- Contain
- Educate
- Reduce/Minimize
- Product Substitution

Targeted Constituents

Sediment	<input checked="" type="checkbox"/>
Nutrients	<input checked="" type="checkbox"/>
Trash	<input checked="" type="checkbox"/>
Metals	<input checked="" type="checkbox"/>
Bacteria	<input checked="" type="checkbox"/>
Oil and Grease	<input checked="" type="checkbox"/>
Organics	<input checked="" type="checkbox"/>
Oxygen Demanding	<input checked="" type="checkbox"/>



- Require a signed checklist from every user of any hazardous material detailing amount taken, amount used, amount returned and disposal of spent material.
- Do a before audit of your site to establish baseline conditions and regular subsequent audits to note any changes and whether conditions are improving or deteriorating.
- Keep records of water, air and solid waste quantities and quality tests and their disposition.
- Maintain a mass balance of incoming, outgoing and on hand materials so you know when there are unknown losses that need to be tracked down and accounted for.
- Use and reward employee suggestions related to BMPs, hazards, pollution reduction, work place safety, cost reduction, alternative materials and procedures, recycling and disposal.
- Have, and review regularly, a contingency plan for spills, leaks, weather extremes etc. Make sure all employees know about it and what their role is so that it comes into force automatically.

Training

- Train all employees, management, office, yard, manufacturing, field and clerical in BMPs and pollution prevention and make them accountable.
- Train municipal employees who handle potentially harmful materials in good housekeeping practices.
- Train personnel who use pesticides in the proper use of the pesticides. The California Department of Pesticide Regulation license pesticide dealers, certify pesticide applicators and conduct onsite inspections.
- Train employees and contractors in proper techniques for spill containment and cleanup. The employee should have the tools and knowledge to immediately begin cleaning up a spill if one should occur.

Spill Response and Prevention

- Refer to SC-11, Spill Prevention, Control & Cleanup.
- Keep your Spill Prevention Control and Countermeasure (SPCC) plan up-to-date, and implement accordingly.
- Have spill cleanup materials readily available and in a known location.
- Cleanup spills immediately and use dry methods if possible.
- Properly dispose of spill cleanup material.

Other Considerations

- There are no major limitations to this best management practice.
- There are no regulatory requirements to this BMP. Existing regulations already require municipalities to properly store, use, and dispose of hazardous materials

Requirements

Costs

- Minimal cost associated with this BMP. Implementation of good housekeeping practices may result in cost savings as these procedures may reduce the need for more costly BMPs.

Maintenance

- Ongoing maintenance required to keep a clean site. Level of effort is a function of site size and type of activities.

Supplemental Information

Further Detail of the BMP

- The California Integrated Waste Management Board's Recycling Hotline, 1-800-553-2962, provides information on household hazardous waste collection programs and facilities.

Examples

There are a number of communities with effective programs. The most pro-active include Santa Clara County and the City of Palo Alto, the City and County of San Francisco, and the Municipality of Metropolitan Seattle (Metro).

References and Resources

British Columbia Lake Stewardship Society. Best Management Practices to Protect Water Quality from Non-Point Source Pollution. March 2000.

<http://www.nalms.org/bclss/bmphome.html#bmp>

King County Stormwater Pollution Control Manual - <http://dnr.metrokc.gov/wlr/dss/spcm.htm>

Model Urban Runoff Program: A How-To Guide for Developing Urban Runoff Programs for Small Municipalities, Prepared by City of Monterey, City of Santa Cruz, California Coastal Commission, Monterey Bay National Marine Sanctuary, Association of Monterey Bay Area Governments, Woodward-Clyde, Central Coast Regional Water Quality Control Board. July, 1998, Revised by California Coastal Commission, February 2002.

Orange County Stormwater Program

http://www.ocwatersheds.com/stormwater/swp_introduction.asp

San Mateo STOPPP - (<http://stoppp.tripod.com/bmp.html>)

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.

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.

Design Objectives

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



- 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.

7. WQMP Exhibit

Appendix I

Storm Tech reports



Basin A

User Inputs

Chamber Model:	MC-7200
Outlet Control Structure:	Yes
Project Name:	IENLC
Engineer:	N/A
Project Location:	California
Measurement Type:	Imperial
Required Storage Volume:	226051 cubic ft.
Stone Porosity:	40%
Stone Foundation Depth:	9 in.
Stone Above Chambers:	12 in.
Average Cover Over Chambers:	24 in.
Design Constraint Dimensions:	(200 ft. x 330 ft.)

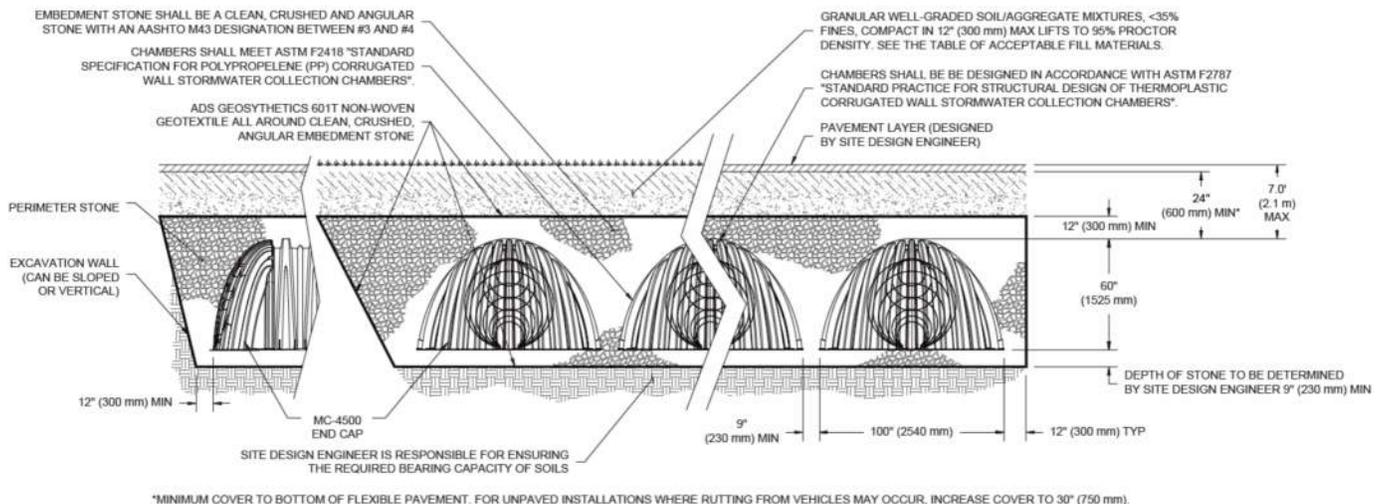
Results

System Volume and Bed Size

Installed Storage Volume:	227391.99 cubic ft.
Storage Volume Per Chamber:	175.90 cubic ft.
Number Of Chambers Required:	825
Number Of End Caps Required:	36
Chamber Rows:	18
Maximum Length:	315.17 ft.
Maximum Width:	165.35 ft.
Approx. Bed Size Required:	51654.92 square ft.

System Components

Amount Of Stone Required:	7486.34 cubic yards
Volume Of Excavation (Not Including Fill):	12913.73 cubic yards
Total Non-woven Geotextile Required:	14647.02 square yards
Woven Geotextile Required (excluding Isolator Row):	191.10 square yards
Woven Geotextile Required (Isolator Row):	720.26 square yards
Total Woven Geotextile Required:	911.36 square yards





Basin B

User Inputs

Chamber Model:	MC-7200
Outlet Control Structure:	Yes
Project Name:	IENLC
Engineer:	N/A
Project Location:	California
Measurement Type:	Imperial
Required Storage Volume:	228960 cubic ft.
Stone Porosity:	40%
Stone Foundation Depth:	9 in.
Stone Above Chambers:	12 in.
Average Cover Over Chambers:	24 in.
Design Constraint Dimensions:	(200 ft. x 330 ft.)

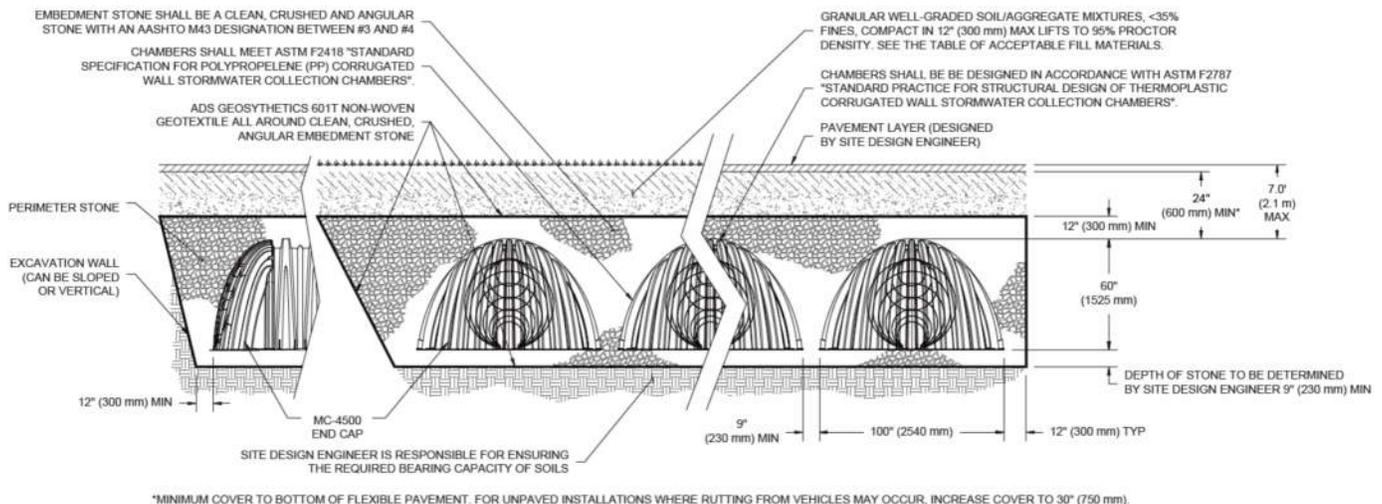
Results

System Volume and Bed Size

Installed Storage Volume:	230364.13 cubic ft.
Storage Volume Per Chamber:	175.90 cubic ft.
Number Of Chambers Required:	836
Number Of End Caps Required:	36
Chamber Rows:	18
Maximum Length:	321.76 ft.
Maximum Width:	165.35 ft.
Approx. Bed Size Required:	52325.74 square ft.

System Components

Amount Of Stone Required:	7582.38 cubic yards
Volume Of Excavation (Not Including Fill):	13081.43 cubic yards
Total Non-woven Geotextile Required:	14837.77 square yards
Woven Geotextile Required (excluding Isolator Row):	191.10 square yards
Woven Geotextile Required (Isolator Row):	735.64 square yards
Total Woven Geotextile Required:	926.74 square yards





Basin C

User Inputs

Chamber Model:	MC-7200
Outlet Control Structure:	Yes
Project Name:	IENLC
Engineer:	N/A
Project Location:	California
Measurement Type:	Imperial
Required Storage Volume:	183902 cubic ft.
Stone Porosity:	40%
Stone Foundation Depth:	9 in.
Stone Above Chambers:	12 in.
Average Cover Over Chambers:	24 in.
Design Constraint Dimensions:	(250 ft. x 250 ft.)

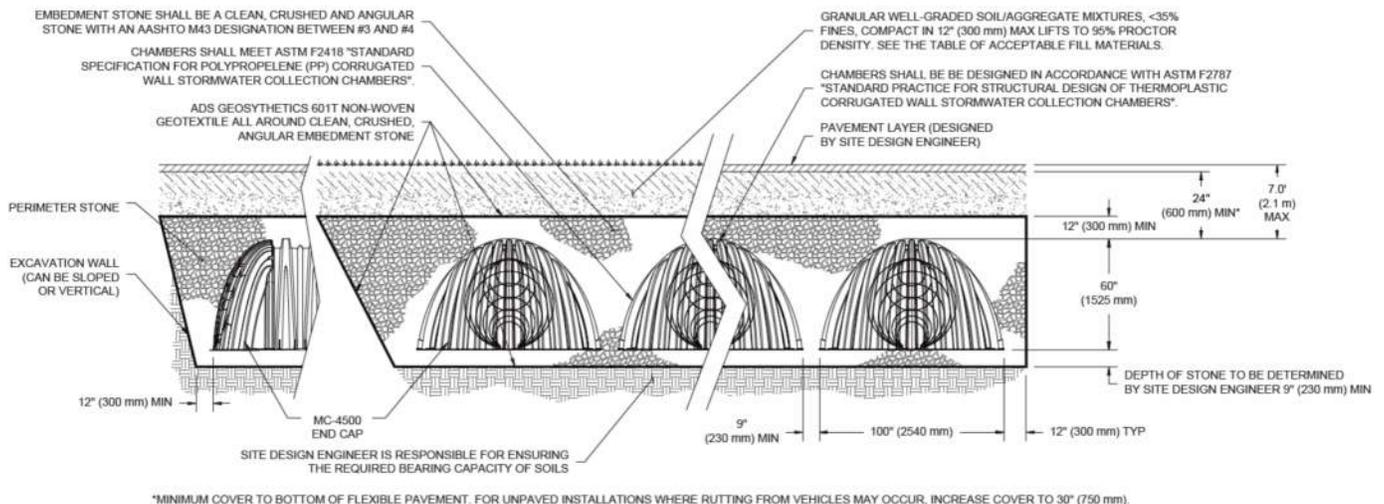
Results

System Volume and Bed Size

Installed Storage Volume:	185342.76 cubic ft.
Storage Volume Per Chamber:	175.90 cubic ft.
Number Of Chambers Required:	668
Number Of End Caps Required:	38
Chamber Rows:	19
Maximum Length:	249.25 ft.
Maximum Width:	174.43 ft.
Approx. Bed Size Required:	42200.53 square ft.

System Components

Amount Of Stone Required:	6142.64 cubic yards
Volume Of Excavation (Not Including Fill):	10550.13 cubic yards
Total Non-woven Geotextile Required:	12023.55 square yards
Woven Geotextile Required (excluding Isolator Row):	191.10 square yards
Woven Geotextile Required (Isolator Row):	566.46 square yards
Total Woven Geotextile Required:	757.56 square yards





Basin D

User Inputs

Chamber Model:	MC-7200
Outlet Control Structure:	Yes
Project Name:	
Engineer:	N/A
Project Location:	
Measurement Type:	Imperial
Required Storage Volume:	179086 cubic ft.
Stone Porosity:	40%
Stone Foundation Depth:	9 in.
Stone Above Chambers:	12 in.
Average Cover Over Chambers:	24 in.
Design Constraint Dimensions:	(175 ft. x 243 ft.)

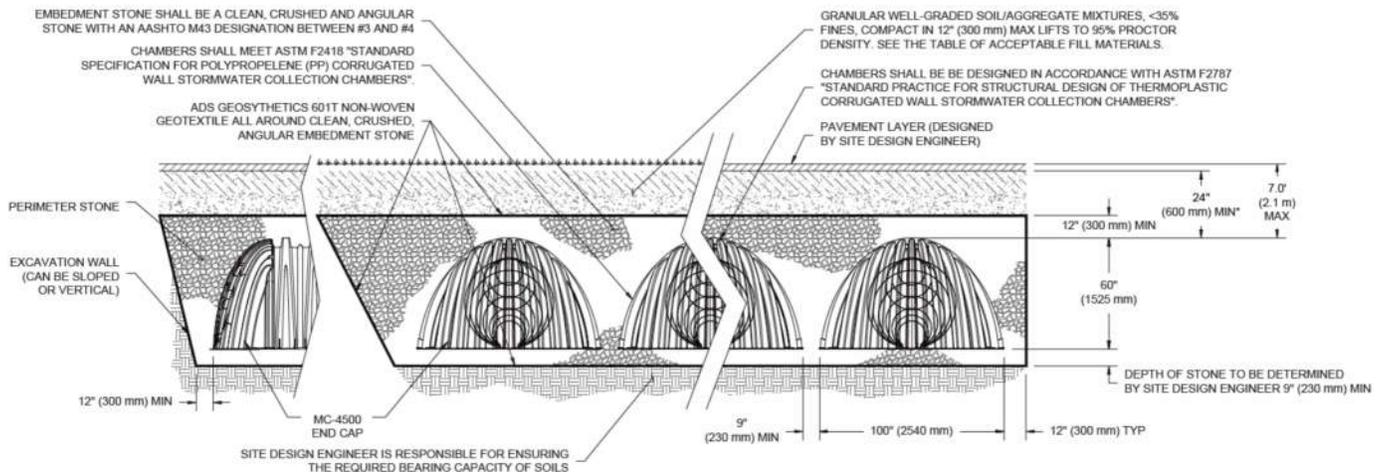
Results

System Volume and Bed Size

Installed Storage Volume:	180500.22 cubic ft.
Storage Volume Per Chamber:	175.90 cubic ft.
Number Of Chambers Required:	650
Number Of End Caps Required:	38
Chamber Rows:	19
Maximum Length:	242.66 ft.
Maximum Width:	174.43 ft.
Approx. Bed Size Required:	41110.60 square ft.

System Components

Amount Of Stone Required:	5988 cubic yards
Volume Of Excavation (Not Including Fill):	10278 cubic yards
Total Non-woven Geotextile Required:	11722 square yards
Woven Geotextile Required (excluding Isolator Row):	192 square yards
Woven Geotextile Required (Isolator Row):	552 square yards
Total Woven Geotextile Required:	743 square yards



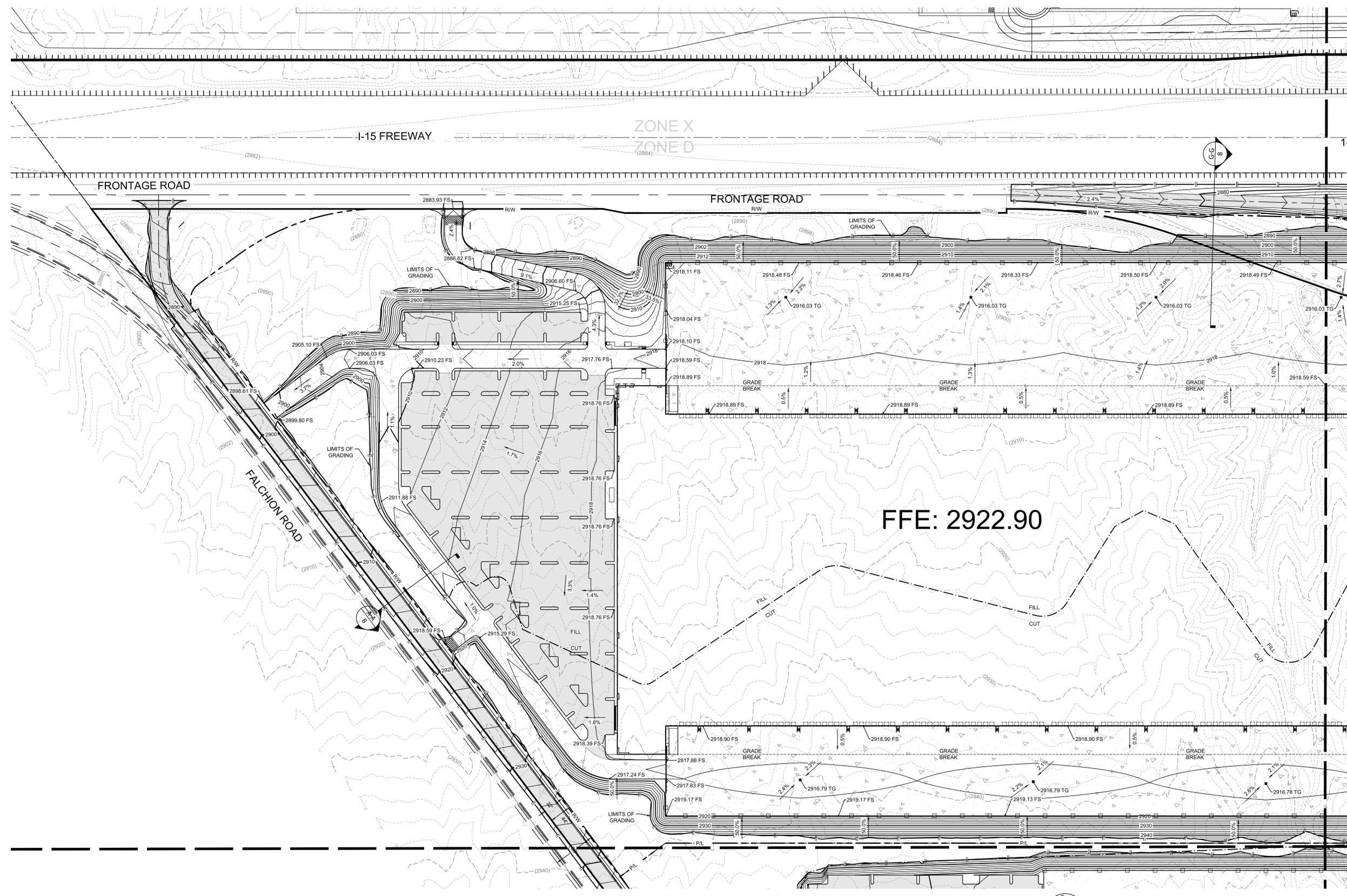
*MINIMUM COVER TO BOTTOM OF FLEXIBLE PAVEMENT. FOR UNPAVED INSTALLATIONS WHERE RUTTING FROM VEHICLES MAY OCCUR, INCREASE COVER TO 30" (750 mm).

Appendix J

Geotechnical Report **TBD**

Appendix K

Grading Plans



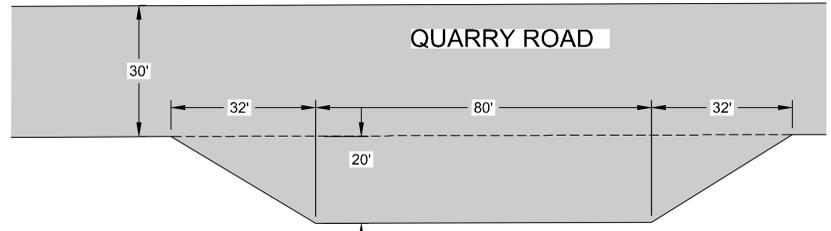
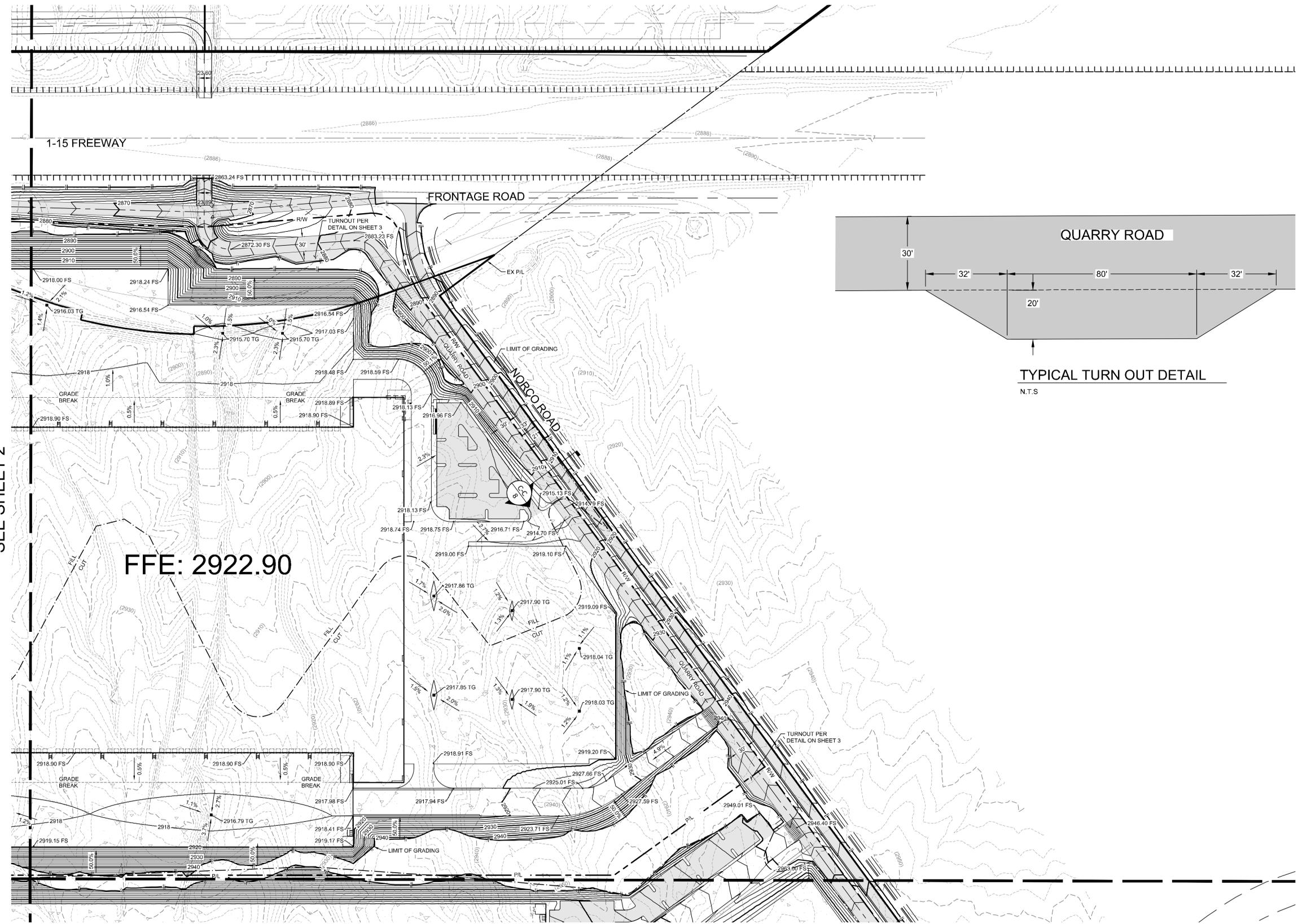
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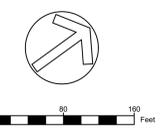
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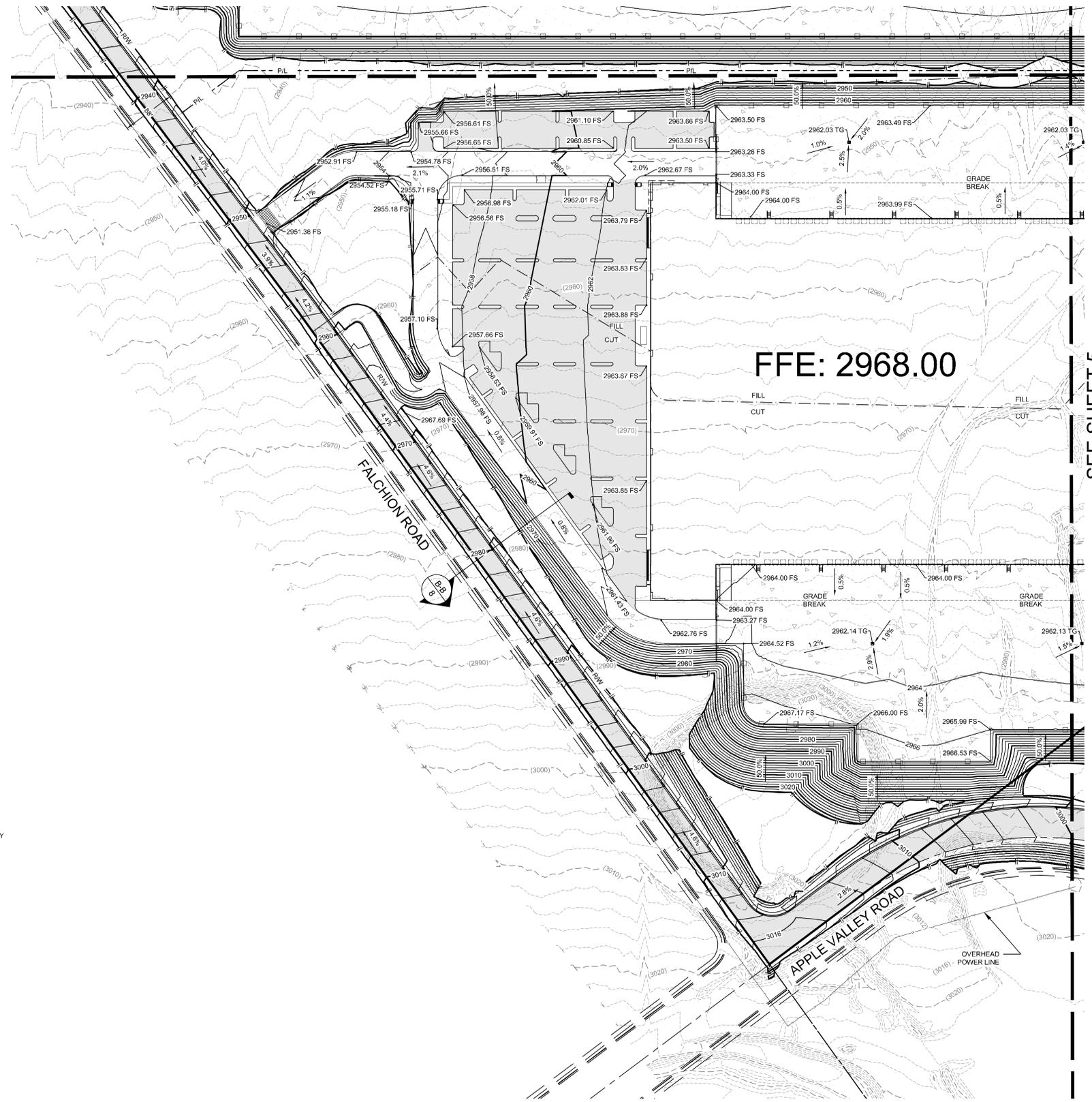
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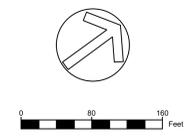
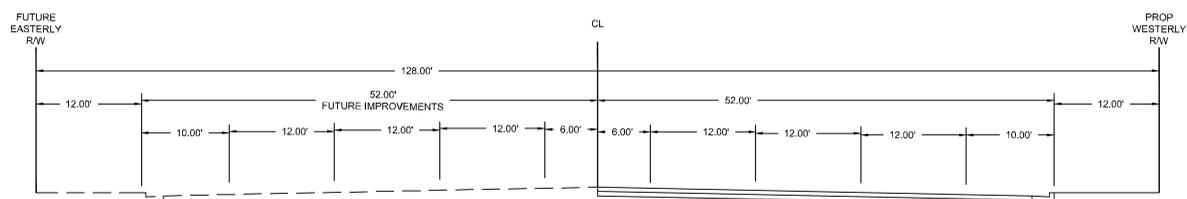
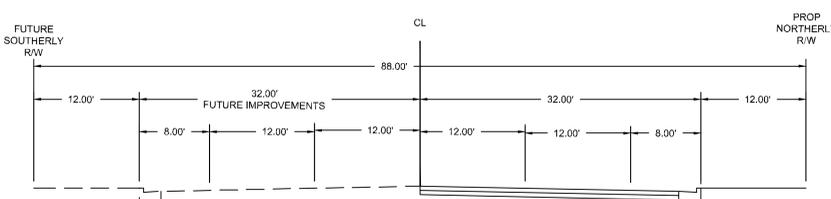
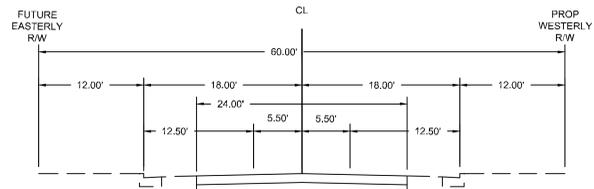
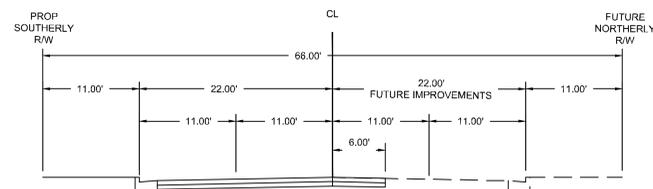
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SEE SHEET 2

SEE SHEET 5



FFE: 2968.00



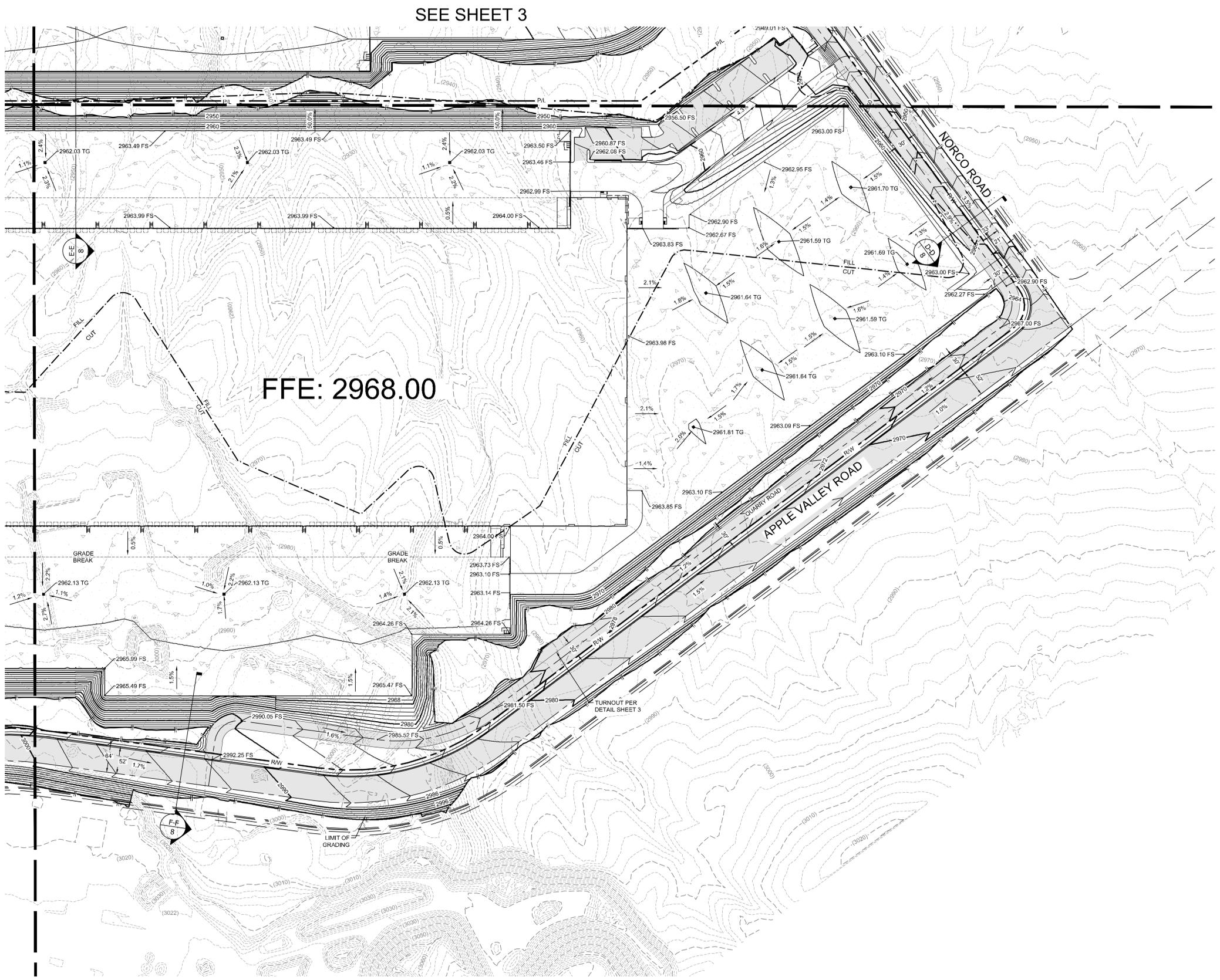
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 Checked by: Vessio Mello; Date: 7/22/2022 9:29 PM
 Drawn by: Vessio Mello; Date: 7/22/2022 9:29 PM

NO.	DATE	REVISION

CHECKED BY: _____
 DESIGNED BY: _____
 DRAWN BY: _____
 FIRST SUBMITTAL DATE: _____
 PROJECT NO: **FGFW0000-0001**

NO.	DATE	REVISION

CHECKED BY:	DESIGNED BY:
FIRST SUBMITTAL DATE:	DRAWN BY:
PROJECT NO:	FGFW0000-0001

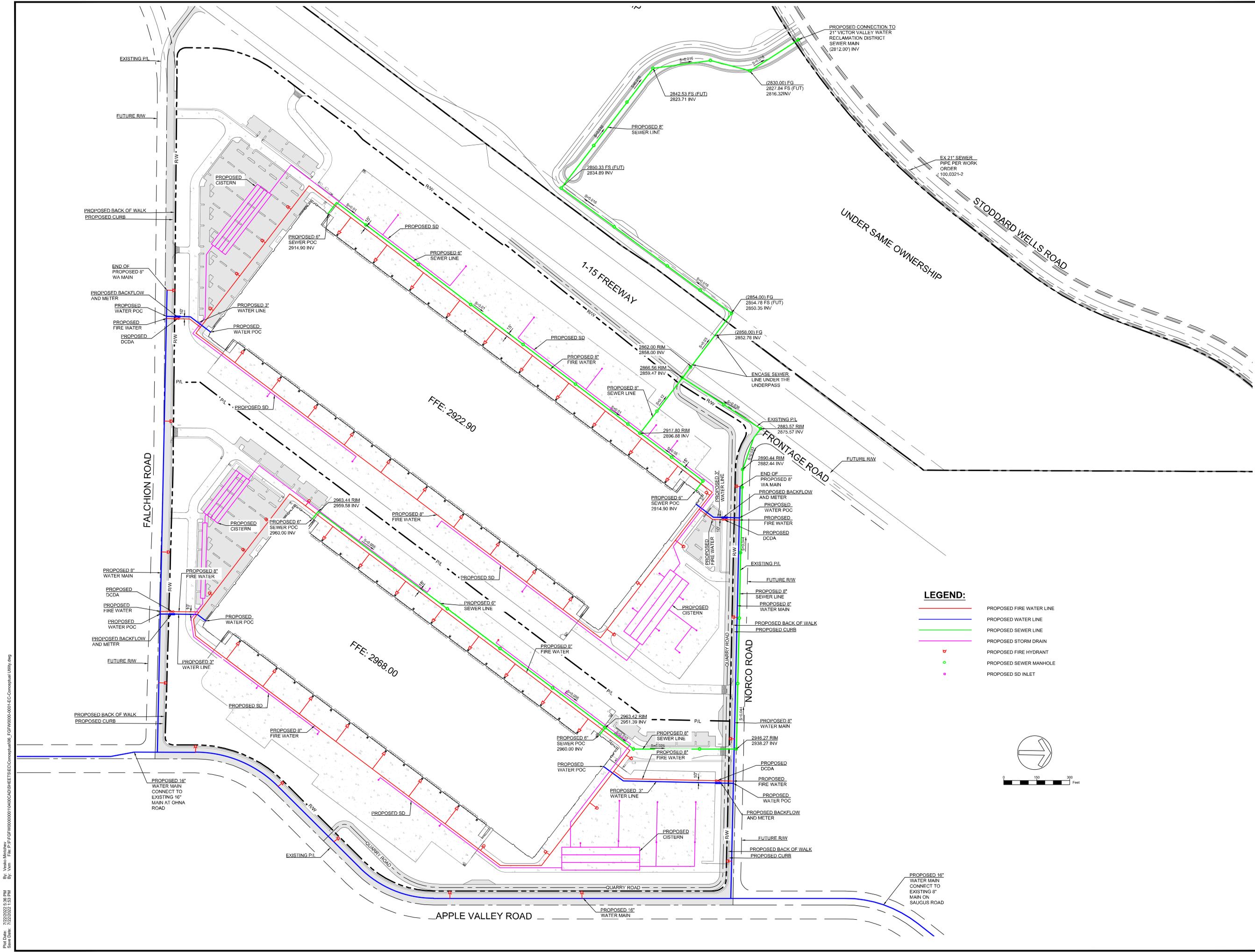


SEE SHEET 3

SEE SHEET 4

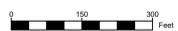
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 By: Vessio Melillo
 Project: FGFW V, LLC
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LEGEND:

- PROPOSED FIRE WATER LINE
- PROPOSED WATER LINE
- PROPOSED SEWER LINE
- PROPOSED STORM DRAIN
- PROPOSED FIRE HYDRANT
- PROPOSED SEWER MANHOLE
- PROPOSED SD INLET

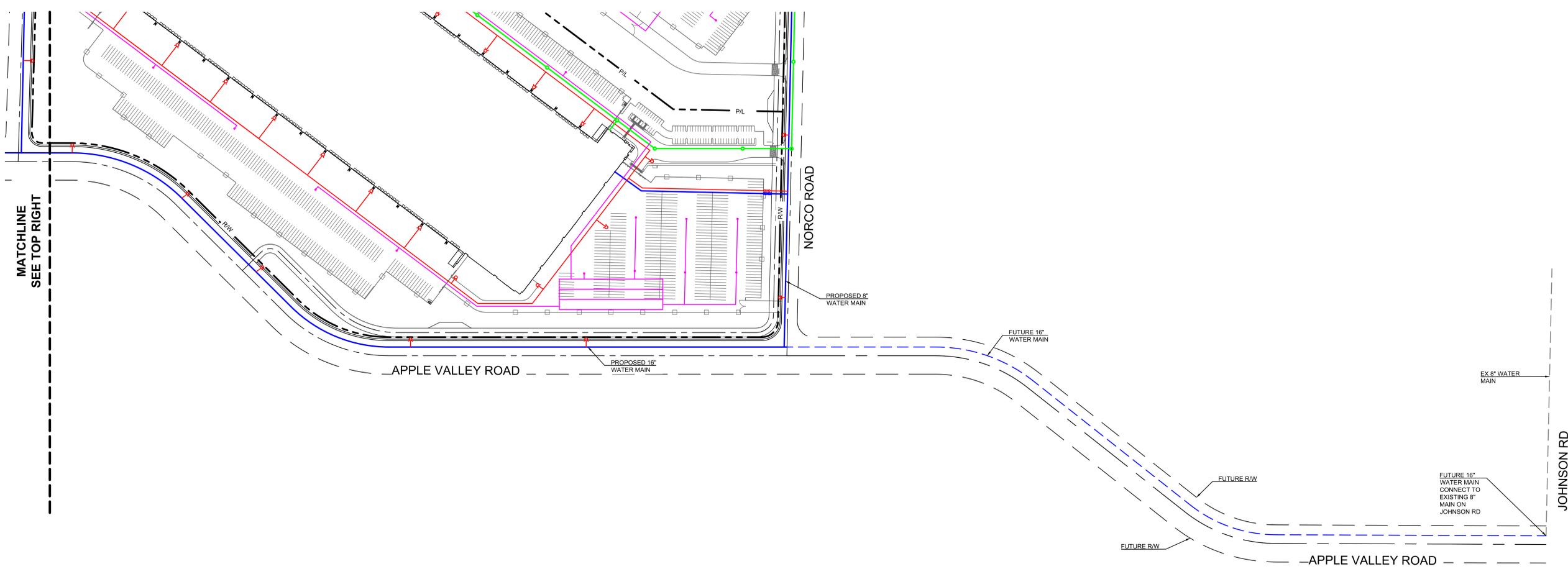
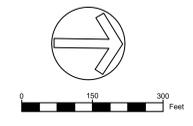
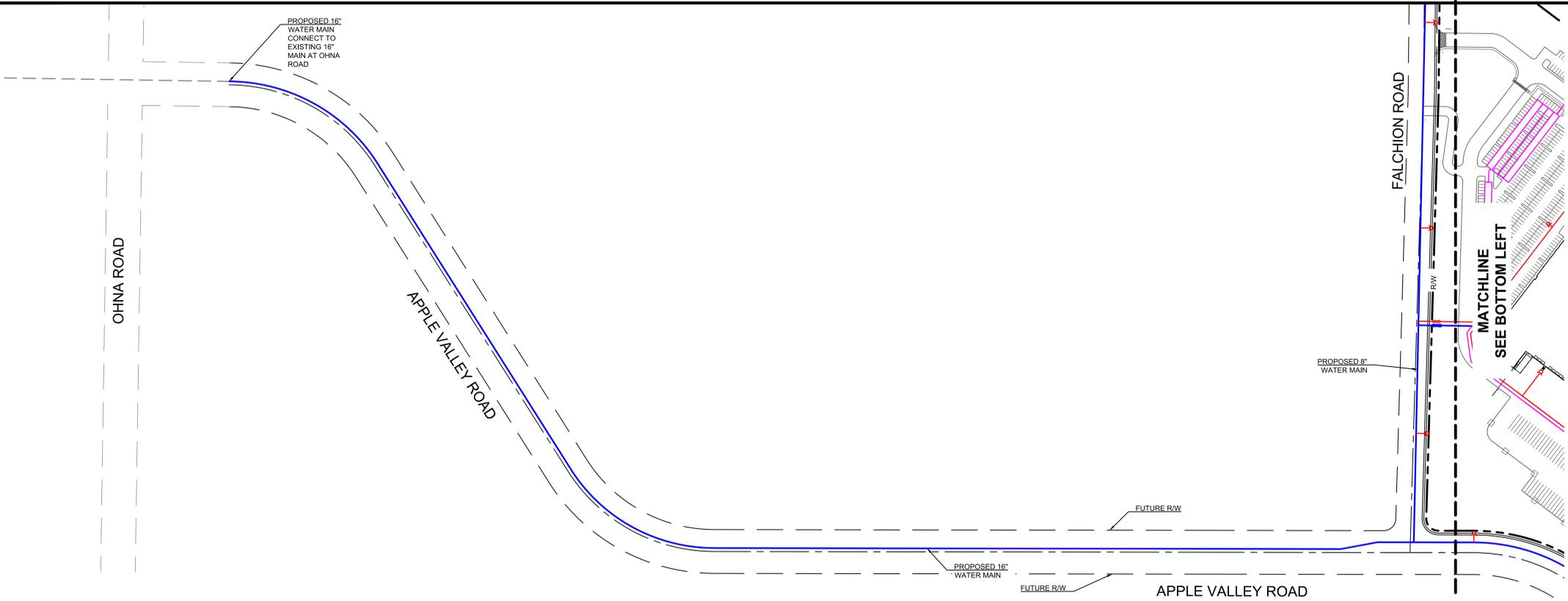


By: Vessio Ferrero
 Date: 7/22/2022 9:26 AM
 Scale: 1" = 100'

REVIEWED BY: SSCP63
 NO. DATE REVISION
 DATE: SSCP64
 BY: CK

CHECKED BY:
 DESIGNED BY:
 DRAWN BY:
 FIRST SUBMITTAL DATE:
 PROJECT NO.
FGFW0000-0001
 SHEET NO.
6 OF 8

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 By: Vlado Petrovic





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INLAND EMPIRE NORTH LOGISTICS CENTER
 FGFW IV, LLC
OFFSITE UTILITY PLAN

APPLE VALLEY, CA 92307
 SHEET NO. **7 OF 8**

NO.	DATE	REVISION	BY	CK

CHECKED BY: _____
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 DRAWN BY: _____
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 PROJECT NO. **FGFW0000-0001**
 SHEET NO. **7 OF 8**

