MOJAVE RIVER WATERSHED

Water Quality Management Plan

For:

TRUCK PARKING CENTER

SAN BERNARDINO COUNTY

WHERE APPLICABLE, INSERT GRADING PERMIT NO., BUILDING PERMIT NO., TRACT NUMBER, LAND DEVELOPMENT FILE NO., CUP, SUP AND/OR APN (SPECIFY LOT NUMBERS IF SITE IS A PORTION OF A TRACT)

Prepared for:

TRUCK PARKING *CENTER*

Prepared by:

SRD Design Studio, Inc.

10501 Wilshire Blvd.#608

Los Angeles, CA, 90211

424 279-0909

Submittal Date: Insert Initial Submittal Date

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

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

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

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

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

Final Approval Date:_____

This project is a 2.9-acre gross on-site area located in the City of Hesperia within the Mojave River Watershed boundary. The project is bounded by Highway 395, located on the project's east side, and Oro Grande Wash on the west side. The Northside of the project is the aqueduct, and the south side of the project is Freeway 15 and the railroad. The site is vacant with scattered debris and native desert in the existing condition.

The project is intended to develop 126,324 square feet of a truck parking in the proposed condition. The project plan includes streets, parking, roofs, and landscape areas.

Run-off in the proposed condition drains from South to North. The run-off from the parking area will sheet flow into the proposed catch basins through inserted filters and drain to proposed bioretention basins via storm pipes.

To address the site's water quality to treat the runoff volume, one bioretention basin are designed located in the East side of the project. According to the Geotechnical report, the infiltration rate of the site at proposed basins is 0.22 in/hr, and 0.29 in/hr, which is lower than the county recommended infiltration rate for infiltration basins. The proposed bioretention basins will capture the storm runoff from the site and treat it through engineering soil. The proposed landscape areas and trees are also employed to accommodate the stormwater treatment strategies.

In compliance with San Bernardino County, Mojave Watershed Technical Guidance Water Quality Management Plans addressed the potential for causing or contributing to Hydromodification for the project development. The table below shows the results based on the CivilD computer analysis for existing, proposed, and mitigated conditions:

Existing Condition 100 yr-24 hr

Drainage Area (Node)	Area (ac)	Q 100yr-24 hour (cfs)
Node 1 to Node 2	3.0	6.18

Proposed Condition 100 yr-24 hr

Drainage Area	Area (ac)	Q 100yr-24 hour (cfs)
Node 1 to Node 2	3.0	6.21

Mitigated Condition 100 yr-24 hr

Drainage Area (Node)	Area (ac)	Q 100yr-24 hour (cfs)
Node 2	3.0	6.1

Project Owner's Certification

This Mojave River Watershed Water Quality Management Plan (WQMP) has been prepared for Serrano Pointe Commerce Center by SRD Design Studio. The WQMP is intended to comply with the requirements of the City of Hesperia 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 San Bernardino County (unincorporated areas of Phelan, Oak Hills, Spring Valley Lake and Victorville) and the incorporated cities of Hesperia and Victorville and the Town of Apple Valley. Once the undersigned transfers its interest in the property, its successors in interest and the city/county/town 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):	XXX-XXXX	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):			306455101, 306455102,306455103, 306455104, 306455105, 306455106, 306455107 ,306455108, 306456106

Owner's Signature		
Owner Name:		
Title	Serrano pointe Commerce Center	
Company	SRD Design Studio	
Address	10501 Wilshire Blvd#608	
Email		
Telephone #	(424)2790-909	
Signature	Date	07/05/2023

Preparer's Certification

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):			306456106

"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 the California State Water Resources Control Board Order No. 2013-0001-DWQ.

Engineer: DAVID GOLKAR		PE Stamp Below
Title	PROJECT MANAGER	
Company	SRD DESIGN STUDIO	
Address	10501 Whilshire Blvd.# 608 Los Angeles CA 90211	
Email	administration@srd.com	
Telephone #	(424) 279-0909	
Signature		
Date		

Table of Contents

Forms

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). 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					
Project Owner Contact Name:	David Golkar				
Mailing Address:	10501 Whilshire Blvd # 608 Los Angeles CA 90211	E-mail Address:	administration@srd.com	Telephone:	(424) 279-0909
Permit/Application Number(s):	TBD		Tract/Parcel Map Number(s):		
Additional Information/ Comments:					
Description of Project:	The project is located within the City of Hesperia, along Highway 395 on the east side and Oro Grande Wash on the Westside. Latitude: 34°25'1.50"N, Longitude:117°24'6.17"W The project site is proposed to develop 127827.6 square feet of truck parking, buildings and Bioretention Basin. This development will include , parking, and landscape areas. The project is a " Priority Project and will require a WQMP."				
Provide summary of Conceptual WQMP conditions (if previously submitted and approved). Attach complete copy.	The Project site is a 2.9-acre gross on-site area. Currently, the site is vacant and covered with scattered debris and native desert. The topography of the site consists of two ridges in the east side and west side. The development will consist of 98444.6 square feet of truck parking in the proposed condition. This development will include parking, office, storage, maintenance building, and landscape areas. The proposed condition majority of the site will drain from south to north. The roof runoff of the parkings will direct to the landscape area via area drain to swale and convey to the street. The site runoff will be directed to the curb gutter and collected into the proposed catch basins through insert filters then via storm drain pipe routed to the proposed Bioretention basin in the East side of the project. The proposed bioretention basin will capture and treat the storm runoff from the site and the BMP's practice in this project. The proposed landscaped areas are also employed to accommodate the stormwater treatment strategies.				

Section 2 Project Description

2.1 Project Information

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

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

2.1.1 Project Sizing Categorization

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

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

Form 2.1-1 Description of Proposed Project

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

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

☐ Site Design Only (Project Total Square Feet > 2,500 but < 5,000 sq.ft.) *Will require source control Site Design Measures. Use the "PCMP" Template. Do not use this WQMP Template.*

2 Project Area (ft2):	127827.6	**3** Number of Dwelling Units:		**4** SIC Code:	

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

2.2 Property Ownership/Management

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

Form 2.2-1 Property Ownership/Management

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

2.3 Potential Stormwater Pollutants

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

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

Form 2.3-1 Pollutants of Concern

Pollutant	Please check: E=Expected, N=Not Expected		Additional Information and Comments
Pathogens (Bacterial / Virus)	E ☒	N ☐	Wild Bird and pet Waste, Garbage, Food Waste, Animals, Restroom
Nutrients - Phosphorous	E ☒	N ☐	Fertilizers, Waste & Garbage, Landscaped area
Nutrients - Nitrogen	E ☒	N ☐	potential Source- Landscape, Fertilizer, Food Waste, Garbage
Noxious Aquatic Plants	E ☐	N ☒	N/A
Sediment	E ☒	N ☐	Solid materials/ suspended solids from land surface is expected in addition to sediments from erosion, Landscaped area & undeveloped areas.
Metals	E ☒	N ☐	Metal polluntants expected from vehicles in the street & drivewyas
Oil and Grease	E ☒	N ☐	The surface area of the parking lot and drive-thru will contribute to pollution from leaking vehicles and grease for production.
Trash/Debris	E ☒	N ☐	The surface area of the parking lot and drive-thru will contribute to pollution from leaking vehicles and grease for production.
Pesticides / Herbicides	E ☒	N ☐	Expected pollutants from maintenance of the site landscape area are expected.
Organic Compounds	E ☒	N ☐	The use of cleaning solvents/ chemicals and maintenance of landscape areas will contribute to pollution from organic compounds.
Other:	E ☐	N ☐	
Other:	E ☐	N ☐	
Other:	E ☐	N ☐	

Section 3 Site and Watershed Description

Describe the project site conditions that will facilitate the selection of BMPs 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	Longitude	Thomas Bros Map page

1 San Bernardino County climatic region: ☒ Desert

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

Conveyance	Briefly describe on-site drainage features to convey runoff that is not retained within a DMA
DA1 DMA C flows to DA1 DMA A	*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*
DA1 DMA A to Outlet 1	Site surface runoff will be directed into proposed catch basins. All catch Basins are designed with filter inserts for the first treatment. After the filter insert, the runoff will drain to the on-site storm drain pipe then flow to the proposed bioretention basin, the proposed LID device for the development. The overflow that goes over the spillway from the basin convey to Oro Grande Wash through the pipe. The treated from the bottom of the basin is also conveyed to the Oro Grande Wash through the pipe.
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)	127827.6			
2 Existing site impervious area (ft^2)	0			
3 Antecedent moisture condition *For desert areas, use http://www.sbcounty.gov/dpw/floodcontrol/pdf/20100412_map.pdf*	2			
4 Hydrologic soil group *Refer to County Hydrology Manual Addendum for Arid Regions – http://www.sbcounty.gov/dpw/floodcontrol/pdf/20100412_addendum.pdf*	A			
5 Longest flowpath length (ft)	670			
6 Longest flowpath slope (ft/ft)	.16			
7 Current land cover type(s) *Select from Fig C-3 of Hydrology Manual*	Natural Cover Barren			
8 Pre-developed pervious area condition: *Based on the extent of wet season vegetated cover good >75%; Fair 50-75%; Poor <50%* ***Attach photos of site to support rating***	Poor			

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 Existing site impervious area (ft^2)				
3 Antecedent moisture condition *For desert areas, use http://www.sbcounty.gov/dpw/floodcontrol/pdf/20100412_map.pdf*				
4 Hydrologic soil group *County Hydrology Manual Addendum for Arid Regions – http://www.sbcounty.gov/dpw/floodcontrol/pdf/20100412_addendum.pdf*				
5 Longest flowpath length (ft)				
6 Longest flowpath slope (ft/ft)				
7 Current land cover type(s) *Select from Fig C-3 of Hydrology Manual*				
8 Pre-developed pervious area condition: *Based on the extent of wet season vegetated cover good >75%; Fair 50-75%; Poor <50% Attach photos of site to support rating*				

Form 3-3 Watershed Description for Drainage Area

Receiving waters Refer to SWRCB site: http://www.waterboards.ca.gov/water_issues/programs/tmdl/integrated2010.shtml	Mojave River
Applicable TMDLs *http://www.waterboards.ca.gov/water_issues/programs/tmdl/integrated2010.shtml*	None
303(d) listed impairments *http://www.waterboards.ca.gov/water_issues/programs/tmdl/integrated2010.shtml*	Mojave River Mohave Forks Reservoir Outlet to upper Narros Fluride
Environmentally Sensitive Areas (ESA) *Refer to Watershed Mapping Tool – http://sbcounty.permitrack.com/WAP*	Southwestern Willow Flycatcher Desert Tortoise Habitat cat 3 Mojave Ground Squirrel
Hydromodification Assessment	☒ Yes *Complete Hydromodification Assessment. Include Forms 4.2-2 through Form 4.2-5 and Hydromodification BMP Form 4.3-9 in submittal.* ☐ No

Section 4 Best Management Practices (BMP)

4.1 Source Control BMPs and Site Design BMP Measures

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

4.1.1 Source Control BMPs

Non-structural and structural source control BMP 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 corresponds 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	☒	☐	General information will be provided to the owner on housekeeping practices that contribute to the protection of stormwater. The property owners will be familiar with the contents of this document and the BMPs used on the site. The owners will provide educational materials to tenants (if applicable) on BMPs and housekeeping practices that contribute to the protection of stormwater
N2	Activity Restrictions	☒	☐	The property owner shall control the discharge of stormwater pollutants from this site through activity restrictions. Restrictions shall be provided to all new occupants. Enforcement of activity restrictions shall be ongoing during the operation of the project site.
N3	Landscape Management BMPs	☒	☐	The property owner and landscape maintenance contractors will practice ongoing landscape maintenance BMPs consistent with applicable local ordinances. They will regularly inspect the irrigation system for signs of erosion or sediment debris buildup and clean/repair as needed.
N4	BMP Maintenance	☒	☐	The city of Hesperia will maintain post-construction public BMPs consistent with the O&M plan described in section 5 of this document (from 5-1). The property owner shall maintain BMPs.
N5	Title 22 CCR Compliance (How development will comply)	☒	☐	Storage of hazardous materials or waste on-site must comply with all Title 22 CCR regulations.
N6	Local Water Quality Ordinances	☒	☐	The owner shall comply with the City of Hesperia's Stormwater Ordinance by implementing BMPs.
N7	Spill Contingency Plan	☒	☐	Building operators shall prepare specific plans based on materials onsite for the cleanup of spills. Plans shall mandate stockpiling 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	☒	☐	N/A
N9	Hazardous Materials Disclosure Compliance	☒	☐	N/A

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	☒	☐	The site shall conform to the building code requirements for fire safety implementation and all fire code requirements, regardless of product stored.
N11	Litter/Debris Control Program	☒	☐	The owner shall be responsible for trash and litter to be swept from the site and dumped into a City approved dumpster with lids. The owner shall contract with the city of Hesperia or local trash collector to empty dumpsters on a weekly basis.
N12	Employee Training	☒	☐	The owners will be familiar with onsite BMPs and the necessary maintenance required by the city. The owner will check with the city and country at least once a year to obtain new updated educational materials and provide these materials to tenants..
N13	Housekeeping of Loading Docks	☐	☒	No loading docks in this project
N14	Catch Basin Inspection Program	☒	☐	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 by the city of Hesperia.
N15	Vacuum Sweeping of Private Streets and Parking Lots	☒	☐	Street & Parking areas will be swept regularly using a vacuum-assisted sweeper. The 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	☐	☒	project is not classified as a public agency project
N17	Comply with all other applicable NPDES permits	☒	☐	The developer will comply with the California statewide Construction General Permit during construction, and all future occupants of the site shall comply with the statewide General Stormwater Permit requirement.

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 stenciling and signage (CASQA New Development BMP Handbook SD-13)	☒	☐	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)	☐	☒	This development does not include the storage of materials outdoor.
S3	Design and construct trash and waste storage areas to reduce pollution introduction (CASQA New Development BMP Handbook SD-32)	☒	☐	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 the container.s
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)	☒	☐	The irrigation system will be designed for each landscape 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	☒	☐	Landscaped areas shall be below a minimum of 1" to 2" below the top of the curb or walk.
S6	Protect slopes and channels and provide energy dissipation (CASQA New Development BMP Handbook SD-10)	☒	☐	Project plans will include source Control BMPs to decrease the potential for erosion of slopes, channels, and storm drain outlets. Slopes runoff will be conveyed safely from the top of slopes 1. All manufactured slopes within the project will be landscaped and protected 2. Prior to slope landscaping shlopes shall be stabilized per the SWPP
S7	Covered dock areas (CASQA New Development BMP Handbook SD-31)	☐	☒	No docks are proposed within the new development.
S8	Covered maintenance bays with spill containment plans (CASQA New Development BMP Handbook SD-31)	☐	☒	No vehicle wash areas are proposed within the new development.

S9	Vehicle wash areas with spill containment plans (CASQA New Development BMP Handbook SD-33)	☐	☒	No processing areas are proposed within the new development.
S10	Covered outdoor processing areas (CASQA New Development BMP Handbook SD-36)	☐	☐	Cover of enclosed area that would be most significant sources of pollutants would likely contribute to the street and the storm conveyance system.

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)	☐	☒	No wash area on site. The owner will not allow outdoor processing areas on this site.
S12	Fueling areas (CASQA New Development BMP Handbook SD-30)	☐	☒	No fueling area onsite, and the owner will not allow a fueling area on this site.
S13	Hillside landscaping (CASQA New Development BMP Handbook SD-10)	☐	☒	No hillside project
S14	Wash water control for food preparation areas	☐	☒	No food prepration area on site
S15	Community car wash racks (CASQA New Development BMP Handbook SD-33)	☐	☒	No community car wash racks on site

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 BMP measures can result in smaller Design Capture Volume (DCV) to be managed by both LID and hydromodification control BMPs by reducing runoff generation.

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

Describe site design and drainage plan including:

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

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

Form 4.1-3 Site Design Practices Checklist
Site Design Practices *If yes, explain how preventative site design practice is addressed in project site plan. If no, other LID BMPs must be selected to meet targets*
Minimize impervious areas: Yes ☒ No ☐ Explanation: Landscape areas increase the pervious area and decrease impervious areas.
Maximize natural infiltration capacity; Including improvement and maintenance of soil: Yes ☒ No ☐ Explanation: The bioretention basin system will have natural soil, no compaction.
Preserve existing drainage patterns and time of concentration: Yes ☐ No ☒ Explanation: After development, the time of concentration direction will flow the proposed design drainage pattent.
Disconnect impervious areas. Including rerouting of rooftop drainage pipes to drain stormwater to storage or infiltration BMPs instead of to storm drain: Yes ☒ No ☐ Explanation: Landscape area next to buildings are disconnect the impervious areas.
Use of Porous Pavement.: Yes ☐ No ☒ Explanation: This project is not proposing porous pavement
Protect existing vegetation and sensitive areas: Yes ☐ No ☒ Explanation: There is no significant existing vegetation and sensitive areas to protect
Re-vegetate disturbed areas. Including planting and preservation of drought tolerant vegetation. : Yes ☐ No ☒ Explanation: There is no re-vegetation areas on site.
Minimize unnecessary compaction in stormwater retention/infiltration basin/trench areas: Yes ☒ No ☐ Explanation: There is no compactions under the bottom of underground bioretention system

Utilize naturalized/rock-lined drainage swales in place of underground piping or imperviously lined swales: Yes ☐ No ☒ Explanation: Not apply to this project
Stake off areas that will be used for landscaping to minimize compaction during construction : Yes ☐ No ☒ Explanation: The landscape areas are too small
Use of Rain Barrels and Cisterns, Including the use of on-site water collection systems.: Yes ☐ No ☒ Explanation: Using basin for LID devices, No Barrels are signed to the system.
Stream Setbacks. Includes a specified distance from an adjacent steam: : Yes ☐ No ☒ Explanation: No stream near the project

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 BMPs and Site Design BMP measures, any remaining runoff from impervious DMAs must be directed to one or more on-site, treatment BMPs (LID or biotreatment) designed to infiltrate, evapotranspiration, and/or bio retain 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 Section E.12.e.ii.c and Section E.12.f of the Phase II Small MS4 Permit. These targets include runoff volume for water quality control (referred to as LID design capture volume), and runoff volume, time of concentration, and peak runoff for protection from hydromodification.

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

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

Methods applied in the following forms include:

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

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

Form 4.2-1 LID BMP Performance Criteria for Design Capture Volume (DA 1)		
[1] Project area DA 1 (ft^2): 127,827.6	[2] Imperviousness after applying preventative site design practices (Imp%): .89	[3] Runoff Coefficient (Rc): _.7 *$R_c = 0.858(Imp\%)^{\wedge 3}-0.78(Imp\%)^{\wedge 2}+0.774(Imp\%)+0.04$*
[4] Determine 1-hour rainfall depth for a 2-year return period $P_{2yr\text{-}1hr}$ (in): .46 *http://hdsc.nws.noaa.gov/hdsc/pfds/sa/sca_pfds.html*		
[5] Compute P_6, Mean 6-hr Precipitation (inches): .69 *P_6 = Item 4 *C_1, where C_1 is a function of site climatic region specified in Form 3-1 Item 1 (Desert = 1.2371)*		
[6] Drawdown Rate *Use 48 hours as the default condition. Selection and use of the 24 hour drawdown time condition is subject to approval by the local jurisdiction. The necessary BMP footprint is a function of drawdown time. While shorter drawdown times reduce the performance criteria for LID BMP design capture volume, the depth of water that can be stored is also reduced.*		24-hrs ☐ 48-hrs ☒
[7] Compute design capture volume, DCV (ft^3): 10,583 *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 ☒ No ☐

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

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

Condition	Runoff Volume (ft^3)	Time of Concentration (min)	Peak Runoff (cfs)
Pre-developed	[1] 33,976 *Form 4.2-3 Item 12*	[2] 14.2 min *Form 4.2-4 Item 13*	[3] 5.4 *Form 4.2-5 Item 10*
Post-developed	[4] 34,412 *Form 4.2-3 Item 13*	[5] 7.8 *Form 4.2-4 Item 14*	[6] 3.6 *Form 4.2-5 Item 14*
Difference	[7] *435* *Item 4 – Item 1*	[8] *6.4* *Item 2 – Item 5*	[9] *1.8* *Item 6 – Item 3*
Difference (as % of pre-developed)	[10] *1.3%* *Item 7 / Item 1*	[11] *45%* *Item 8 / Item 2*	[12] *-33%* *Item 9 / Item 3*

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

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

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

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

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

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

Form 4.2-4 Hydromodification Assessment for Time of Concentration (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 *Use additional forms if there are more than 4 DMA*				Post-developed DA1 *Use additional forms if there are more than 4 DMA*			
	DMA A	DMA B	DMA C	DMA D	DMA A	DMA B	DMA C	DMA D
1 Length of flowpath (ft) *Use Form 3-2 Item 5 for pre-developed condition*								
2 Change in elevation (ft)								
3 Slope (ft/ft), *S_o = Item 2 / Item 1*								
4 Land cover								
5 Initial DMA Time of Concentration (min) *Appendix C-1 of the TGD for WQMP*								
6 Length of conveyance from DMA outlet to project site outlet (ft) *May be zero if DMA outlet is at project site outlet*								
7 Cross-sectional area of channel (ft^2)								
8 Wetted perimeter of channel (ft)								
9 Manning's roughness of channel (n)								
10 Channel flow velocity (ft/sec) *V_{fps} = (1.49 / Item 9) * (Item 7/Item 8)^0.67 * (Item 3)^0.5*								
11 Travel time to outlet (min) *T_t = Item 6 / (Item 10 * 60)*								
12 Total time of concentration (min) *T_c = Item 5 + Item 11*								
13 Pre-developed time of concentration (min): *Minimum of Item 12 pre-developed DMA*								
14 Post-developed time of concentration (min): *Minimum of Item 12 post-developed DMA*								
15 Additional time of concentration needed to meet hydromodification requirement (min): *$T_{C\text{-}Hydro}$ = (Item 13 * 0.95) – Item 14*								

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

Compute peak runoff for pre- and post-developed conditions

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

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

4.3 BMP Selection and Sizing

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

- Site Design Measures (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 combination 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
[1] Would infiltration BMP pose significant risk for groundwater related concerns? Yes ☐ No ☒ *Refer to Section 5.3.2.1 of the TGD for WQMP*
If Yes, Provide basis: (attach)
[2] Would installation of infiltration BMP significantly increase the risk of geotechnical hazards? Yes ☐ No ☒ (Yes, if the answer to any of the following questions is yes, as established by a geotechnical expert): • The location is less than 50 feet away from slopes steeper than 15 percent • The location is less than ten feet from building foundations or an alternative setback. • A study certified by a geotechnical professional or an available watershed study determines that stormwater infiltration would result in significantly increased risks of geotechnical hazards.
If Yes, Provide basis: (attach)
[3] Would infiltration of runoff on a Project site violate downstream water rights? Yes ☐ No ☒
If Yes, Provide basis: (attach)
[4] Is proposed infiltration facility located on hydrologic soil group (HSG) D soils or does the site geotechnical investigation indicate presence of soil characteristics, which support categorization as D soils? Yes ☐ No ☒
If Yes, Provide basis: (attach)
[5] Is the design infiltration rate, after accounting for safety factor of 2.0, below proposed facility less than 0.3 in/hr (accounting for soil amendments)? Yes ☒ No ☐
If Yes, Provide basis: (attach)
[6] Would on-site infiltration or reduction of runoff over pre-developed conditions be partially or fully inconsistent with watershed management strategies as defined in the WAP, or impair beneficial uses? Yes ☐ No ☒ *See Section 3.5 of the TGD for WQMP and WAP*
If Yes, Provide basis: (attach)
[7] Any answer from Item 1 through Item 3 is "Yes": Yes ☐ No ☒ *If yes, infiltration of any volume is not feasible onsite. Proceed to Form 4.3-4, Selection and Evaluation of Biotreatment BMP.* *If no, then proceed to Item 8 below.* [8] Any answer from Item 4 through Item 6 is "Yes": Yes ☒ No ☐ *If yes, infiltration is permissible but is not required to be considered. Proceed to Form 4.3-2, Site Design BMP.* *If no, then proceed to Item 9, below.* [9] All answers to Item 1 through Item 6 are "No": *Infiltration of the full DCV is potentially feasible, LID infiltration BMP must be designed to infiltrate the full DCV to the MEP.* *Proceed to Form 4.3-2, Site Design BMPs.*

4.3.2 Site Design BMP

Section E.12.e. of the Small Phase II MS4 Permit emphasizes the use of LID preventative measures; and the use of Site Design Measures reduces the portion of the DCV that must be addressed in downstream BMPs. Therefore, all applicable Site Design Measures 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 ☐ No ☒ *If yes, complete Items 2-5; If no, proceed to Item 6*	DA DMA BMP Type	DA DMA BMP Type	DA DMA BMP Type *(Use additional forms for more BMPs)*
2 Total impervious area draining to pervious area (ft^2)			
3 Ratio of pervious area receiving runoff to impervious area			
4 Retention volume achieved from impervious area dispersion (ft^3) *V = Item2 * Item 3 * (0.5/12), assuming retention of 0.5 inches of runoff*			
5 Sum of retention volume achieved from impervious area dispersion (ft^3):		$V_{retention}$ *=Sum of Item 4 for all BMPs*	
6 Implementation of Localized On-lot Infiltration BMPs (e.g. on-lot rain gardens): Yes ☐ No ☒ *If yes, complete Items 7-13 for aggregate of all on-lot infiltration BMP in each DA; If no, proceed to Item 14*	DA DMA BMP Type	DA DMA BMP Type	DA DMA BMP Type *(Use additional forms for more BMPs)*
7 Ponding surface area (ft^2)			
8 Ponding depth (ft) (min. 0.5 ft.)			
9 Surface area of amended soil/gravel (ft^2)			
10 Average depth of amended soil/gravel (ft) (min. 1 ft.)			
11 Average porosity of amended soil/gravel			
12 Retention volume achieved from on-lot infiltration (ft^3) $V_{retention}$ *= (Item 7 *Item 8) + (Item 9 * Item 10 * Item 11)*			
13 Runoff volume retention from on-lot infiltration (ft^3):		$V_{retention}$ *=Sum of Item 12 for all BMPs*	

Form 4.3-2 Site Design BMPs (DA 1)

Form 4.3-2 cont. Site Design BMPs (DA 1)

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

4.3.3 Infiltration BMPs

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

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

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

4.3.3.1 Allowed Variations for Special Site Conditions

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

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

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

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

4) Facilities serving high-risk areas such as fueling stations, truck stops, auto repairs, and heavy industrial sites may be required to provide adequate pretreatment to address pollutants of concern unless these high-risk areas are isolated from storm water runoff or bioretention areas with no chance of spill migration.

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

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

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

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

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

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

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

4.3.4 Biotreatment BMP

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

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

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

Form 4.3-4 Selection and Evaluation of Biotreatment BMP (DA 1)

1 Remaining LID DCV not met by site design , or infiltration, BMP for potential biotreatment (ft^3): 10583 *Form 4.2-1 Item 7 - Form 4.3-2 Item 19 – Form 4.3-3 Item 16*	List pollutants of concern *Copy from Form 2.3-1.* Pathogen, Nutrients (phosphorous, Nitrogen) sediment, Metals, Oil and Grease, Trash/Debris, Pesticides/Herbicides, Organic Compounds	
2 Biotreatment BMP Selected *(Select biotreatment BMP(s) necessary to ensure all pollutants of concern are addressed through Unit Operations and Processes, described in Table 5-5 of the TGD for WQMP)*	Volume-based biotreatment *Use Forms 4.3-5 and 4.3-6 to compute treated volume*	Flow-based biotreatment *Use Form 4.3-7 to compute treated flow*
	☒ Bioretention with underdrain ☐ Planter box with underdrain ☐ Constructed wetlands ☐ Wet extended detention ☐ Dry extended detention	☐ Vegetated swale ☐ Vegetated filter strip ☐ Proprietary biotreatment
3 Volume biotreated in volume based biotreatment BMP (ft^3): 10,721 *Form 4.3-5 Item 15 + Form 4.3-6 Item 13*	**4** Compute remaining LID DCV with implementation of volume based biotreatment BMP (ft^3): -138 *Item 1 – Item 3*	**5** Remaining fraction of LID DCV for sizing flow based biotreatment BMP: -11% *Item 4 / Item 1*
6 Flow-based biotreatment BMP capacity provided (cfs): *Use Figure 5-2 of the TGD for WQMP to determine flow capacity required to provide biotreatment of remaining percentage of unmet LID DCV (Item 5), for the project's precipitation zone (Form 3-1 Item 1)*		
7 Metrics for MEP determination: • Provided a WQMP with the portion of site area used for suite of LID BMP equal to minimum thresholds in Table 5-7 of the TGD for WQMP for the proposed category of development: ☐ *If maximized on-site retention BMPs is feasible for partial capture, then LID BMP implementation must be optimized to retain and infiltrate the maximum portion of the DCV possible within the prescribed minimum effective area. The remaining portion of the DCV shall then be mitigated using biotreatment BMP.*		

Form 4.3-5 Volume Based Biotreatment (DA 1) – Bioretention and Planter Boxes with Underdrains

Biotreatment BMP Type *(Bioretention w/underdrain, planter box w/underdrain, other comparable BMP)*	DA 1 DMA A BMP Type Bioretentin Basin 1	DA DMA BMP Type	DA DMA BMP Type *(Use additional forms for more BMPs)*
1 Pollutants addressed with BMP *List all pollutant of concern that will be effectively reduced through specific Unit Operations and Processes described in Table 5-5 of the TGD for WQMP*			
2 Amended soil infiltration rate *Typical ~ 5.0*	.5		
3 Amended soil infiltration safety factor *Typical ~ 2.0*	2		
4 Amended soil design percolation rate (in/hr) P_{design} *= Item 2 / Item 3*	.25		
5 Ponded water drawdown time (hr) *Copy Item 6 from Form 4.2-1*	48		
6 Maximum ponding depth (ft) *see Table 5-6 of the TGD for WQMP for reference to BMP design details*			
7 Ponding Depth (ft) d_{BMP} *= Minimum of (1/12 * Item 4 * Item 5) or Item 6*	2.5		
8 Amended soil surface area (ft^2)	3532		
9 Amended soil depth (ft) *see Table 5-6 of the TGD for WQMP for reference to BMP design details*	3		
10 Amended soil porosity, *n*	.25		
11 Gravel depth (ft) *see Table 5-6 of the TGD for WQMP for reference to BMP design details*	2		
12 Gravel porosity, *n*	.33		
13 Duration of storm as basin is filling (hrs) *Typical ~ 3hrs*	3		
14 Biotreated Volume (ft^3) $V_{biotreated}$ *= Item 8 * [(Item 7/2) + (Item 9 * Item 10) +(Item 11 * Item 12) + (Item 13 * (Item 4 / 12))]*	10,721		
15 Total biotreated volume from bioretention and/or planter box with underdrains BMP: 10,721 *Sum of Item 14 for all volume-based BMPs included in this form*			

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

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

Form 4.3-7 Flow Based Biotreatment (DA 1)

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

4.3.5 Conformance Summary

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

Form 4.3-8 Conformance Summary and Alternative Compliance Volume Estimate (DA 1)

1 Total LID DCV for the Project DA-1 (ft^3): 10,583 *Copy Item 7 in Form 4.2-1*

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

3 On-site retention with LID infiltration BMP (ft^3): 0 *Copy Item 16 in Form 4.3-3*

4 On-site biotreatment with volume based biotreatment BMP (ft^3): 10,721 *Copy Item 3 in Form 4.3-4*

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

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

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

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

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

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

4.3.6 Hydromodification Control BMP

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

Form 4.3-9 Hydromodification Control BMPs (DA 1)

1 Volume reduction needed for hydromodification performance criteria (ft^3): -1284 *(Form 4.2-2 Item 4 * 0.95) – Form 4.2-2 Item 1*	**2** On-site retention with site design and infiltration, BMP (ft^3): 10,721 *Sum of Form 4.3-8 Items 2, 3, and 4. Evaluate option to increase implementation of on-site retention in Forms 4.3-2, 4.3-3, and 4.3-4 in excess of LID DCV toward achieving hydromodification volume reduction*
3 Remaining volume for hydromodification volume capture (ft^3): -9437 *Item 1 – Item 2*	**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 ☐ No ☒

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

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

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

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

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

4.4 Alternative Compliance Plan (if applicable)

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

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

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

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

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

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

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

Section 5 Inspection and Maintenance Responsibility for Post Construction BMP

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

Note that at time of Project construction completion, the Maintenance Agreement must be completed, signed, notarized and submitted to the County Stormwater 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
Bioretenti on basin	By the City of Hesperia	Inspect the basin for accumulated sediment and debris levels and cleanout solids when >6" build-up occurs. Inspect for standing water with 48 hours of heavy rain outlet pipe to restore free drainage.	Annually, and after heavy rains
signage & stencil	By the City of Hesperia	Clean the stencil/signage surface to remove any excess dirt. Re-paint of necessary.	Annually
Catch basins/ insert filter	By the City of Hesperia	Inspect catchment area for excessive sediment, trash, and/or debris accumulation of surface. Inspect inlet for excessive sediments, trash, and/or debris accumulation. Litter, leaves, and debris should be removed from the insert filter to reduce the risk of outlet clogging. Replace the insert filters as needed.	Annually, and after heavy rai
Litter Controlo	By the City of Hesperia	Vacuum-sweep streets to remove potential stormwater contamination before anticipated storm events.	Weekly/Monthly
Landscape Areas	By owner & future owner	Implement-Mowing, trimming, Pruning practices to prevent discharges of landscape waste into on-site retention structures. Control fertilizer, Herbicide & pesticide applications to	Weekly

		prevent stormwater contamination.	
Irrigation System	By owner & future owner	Check and repair the irrigation system property functioning and verify there are no leaks or run-off from landscape areas. Adjust irrigation heads and system run time as necessary to prevent overwatering of vegetation, overspray, or run-off from the landscape.	Weekly
Trash Enclosures	By owner & future owner	Empty trash receptacle.Clean the areas around enclosures by sweeping and/ or mopping to prevent discharge of cleanup water.	Weekly

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 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 Agreements for BMP to the WQMP.

6.4 Other Supporting Documentation

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

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

Study date 06/26/23

++

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

Program License Serial Number 6472

100-Year 24 Hour Flood Unit Hydrograph
Existing Condition

Storm Event Year = 100

Antecedent Moisture Condition = 3

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 100		
3.00	1	1.32
Rainfall data for year 100		
3.00	6	3.11
Rainfall data for year 100		
3.00	24	6.42

++

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

SCS curve No.(AMCII)	SCS curve NO.(AMC 3)	Area (Ac.)	Area Fraction	Fp(Fig C6) (In/Hr)	Ap (dec.)	Fm (In/Hr)
67.0	84.6	3.00	1.000	0.290	1.000	0.290

Area-averaged adjusted loss rate Fm (In/Hr) = 0.290

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

Area (Ac.)	Area Fract	SCS CN (AMC2)	SCS CN (AMC3)	S	Pervious Yield Fr
3.00	1.000	67.0	84.6	1.82	0.725

Area-averaged catchment yield fraction, Y = 0.725
Area-averaged low loss fraction, Yb = 0.275
Direct entry of lag time by user
++
Watershed area = 3.00(Ac.)
Catchment Lag time = 0.230 hours
Unit interval = 5.000 minutes
Unit interval percentage of lag time = 36.2319
Hydrograph baseflow = 0.00(CFS)
Average maximum watershed loss rate(Fm) = 0.290(In/Hr)
Average low loss rate fraction (Yb) = 0.275 (decimal)
VALLEY UNDEVELOPED S-Graph Selected
Computed peak 5-minute rainfall = 0.489(In)
Computed peak 30-minute rainfall = 1.000(In)
Specified peak 1-hour rainfall = 1.320(In)
Computed peak 3-hour rainfall = 2.232(In)
Specified peak 6-hour rainfall = 3.110(In)
Specified peak 24-hour rainfall = 6.420(In)

Rainfall depth area reduction factors:
Using a total area of 3.00(Ac.) (Ref: fig. E-4)

5-minute factor = 1.000 Adjusted rainfall = 0.488(In)
30-minute factor = 1.000 Adjusted rainfall = 1.000(In)
1-hour factor = 1.000 Adjusted rainfall = 1.320(In)
3-hour factor = 1.000 Adjusted rainfall = 2.232(In)
6-hour factor = 1.000 Adjusted rainfall = 3.110(In)
24-hour factor = 1.000 Adjusted rainfall = 6.420(In)

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

Interval Number	'S' Graph Mean values	Unit Hydrograph ((CFS))
(K = 36.28 (CFS))		
1	3.766	1.366
2	18.758	5.439
3	43.017	8.802
4	62.169	6.948
5	72.030	3.578
6	77.776	2.085
7	82.033	1.544
8	85.364	1.209
9	87.961	0.942
10	90.119	0.783
11	91.839	0.624

12	93.233	0.506
13	94.381	0.416
14	95.468	0.395
15	96.358	0.323
16	97.106	0.272
17	97.747	0.232
18	98.277	0.192
19	98.703	0.155
20	99.065	0.131
21	99.428	0.131
22	99.790	0.131
23	100.000	0.076

Peak Unit Number	Adjusted mass rainfall (In)	Unit rainfall (In)
1	0.4885	0.4885
2	0.6445	0.1561
3	0.7580	0.1135
4	0.8505	0.0924
5	0.9299	0.0794
6	1.0002	0.0703
7	1.0638	0.0636
8	1.1222	0.0584
9	1.1764	0.0541
10	1.2270	0.0506
11	1.2747	0.0477
12	1.3198	0.0451
13	1.3713	0.0515
14	1.4208	0.0495
15	1.4685	0.0477
16	1.5146	0.0460
17	1.5591	0.0446
18	1.6023	0.0432
19	1.6443	0.0420
20	1.6852	0.0408
21	1.7250	0.0398
22	1.7638	0.0388
23	1.8017	0.0379
24	1.8388	0.0371
25	1.8750	0.0363
26	1.9105	0.0355
27	1.9454	0.0348
28	1.9795	0.0341
29	2.0130	0.0335
30	2.0459	0.0329
31	2.0783	0.0323
32	2.1101	0.0318
33	2.1414	0.0313
34	2.1722	0.0308
35	2.2025	0.0303
36	2.2324	0.0299
37	2.2618	0.0294
38	2.2909	0.0290
39	2.3195	0.0286
40	2.3478	0.0283
41	2.3757	0.0279
42	2.4032	0.0275

43	2.4304	0.0272
44	2.4573	0.0269
45	2.4838	0.0266
46	2.5101	0.0262
47	2.5360	0.0260
48	2.5617	0.0257
49	2.5871	0.0254
50	2.6122	0.0251
51	2.6371	0.0249
52	2.6617	0.0246
53	2.6861	0.0244
54	2.7102	0.0241
55	2.7341	0.0239
56	2.7577	0.0237
57	2.7812	0.0234
58	2.8044	0.0232
59	2.8274	0.0230
60	2.8503	0.0228
61	2.8729	0.0226
62	2.8953	0.0224
63	2.9176	0.0222
64	2.9396	0.0221
65	2.9615	0.0219
66	2.9832	0.0217
67	3.0047	0.0215
68	3.0261	0.0214
69	3.0473	0.0212
70	3.0683	0.0210
71	3.0892	0.0209
72	3.1100	0.0207
73	3.1325	0.0225
74	3.1548	0.0224
75	3.1771	0.0222
76	3.1991	0.0221
77	3.2211	0.0219
78	3.2429	0.0218
79	3.2646	0.0217
80	3.2861	0.0215
81	3.3075	0.0214
82	3.3288	0.0213
83	3.3500	0.0212
84	3.3710	0.0210
85	3.3919	0.0209
86	3.4127	0.0208
87	3.4334	0.0207
88	3.4540	0.0206
89	3.4745	0.0205
90	3.4948	0.0204
91	3.5151	0.0202
92	3.5352	0.0201
93	3.5552	0.0200
94	3.5752	0.0199
95	3.5950	0.0198
96	3.6148	0.0197
97	3.6344	0.0196
98	3.6539	0.0195
99	3.6734	0.0194

100	3.6927	0.0194
101	3.7120	0.0193
102	3.7312	0.0192
103	3.7502	0.0191
104	3.7692	0.0190
105	3.7881	0.0189
106	3.8070	0.0188
107	3.8257	0.0187
108	3.8443	0.0187
109	3.8629	0.0186
110	3.8814	0.0185
111	3.8998	0.0184
112	3.9181	0.0183
113	3.9364	0.0183
114	3.9546	0.0182
115	3.9727	0.0181
116	3.9907	0.0180
117	4.0086	0.0179
118	4.0265	0.0179
119	4.0443	0.0178
120	4.0621	0.0177
121	4.0797	0.0177
122	4.0973	0.0176
123	4.1148	0.0175
124	4.1323	0.0175
125	4.1497	0.0174
126	4.1670	0.0173
127	4.1843	0.0173
128	4.2015	0.0172
129	4.2186	0.0171
130	4.2357	0.0171
131	4.2527	0.0170
132	4.2696	0.0169
133	4.2865	0.0169
134	4.3033	0.0168
135	4.3201	0.0168
136	4.3368	0.0167
137	4.3534	0.0166
138	4.3700	0.0166
139	4.3865	0.0165
140	4.4030	0.0165
141	4.4194	0.0164
142	4.4358	0.0164
143	4.4521	0.0163
144	4.4683	0.0163
145	4.4845	0.0162
146	4.5007	0.0161
147	4.5168	0.0161
148	4.5328	0.0160
149	4.5488	0.0160
150	4.5647	0.0159
151	4.5806	0.0159
152	4.5964	0.0158
153	4.6122	0.0158
154	4.6280	0.0157
155	4.6436	0.0157
156	4.6593	0.0156

157	4.6749	0.0156
158	4.6904	0.0155
159	4.7059	0.0155
160	4.7214	0.0155
161	4.7368	0.0154
162	4.7521	0.0154
163	4.7675	0.0153
164	4.7827	0.0153
165	4.7979	0.0152
166	4.8131	0.0152
167	4.8283	0.0151
168	4.8434	0.0151
169	4.8584	0.0151
170	4.8734	0.0150
171	4.8884	0.0150
172	4.9033	0.0149
173	4.9182	0.0149
174	4.9330	0.0148
175	4.9478	0.0148
176	4.9626	0.0148
177	4.9773	0.0147
178	4.9920	0.0147
179	5.0067	0.0146
180	5.0213	0.0146
181	5.0358	0.0146
182	5.0504	0.0145
183	5.0648	0.0145
184	5.0793	0.0145
185	5.0937	0.0144
186	5.1081	0.0144
187	5.1224	0.0143
188	5.1367	0.0143
189	5.1510	0.0143
190	5.1652	0.0142
191	5.1794	0.0142
192	5.1936	0.0142
193	5.2077	0.0141
194	5.2218	0.0141
195	5.2359	0.0141
196	5.2499	0.0140
197	5.2639	0.0140
198	5.2778	0.0140
199	5.2917	0.0139
200	5.3056	0.0139
201	5.3195	0.0139
202	5.3333	0.0138
203	5.3471	0.0138
204	5.3608	0.0138
205	5.3746	0.0137
206	5.3883	0.0137
207	5.4019	0.0137
208	5.4155	0.0136
209	5.4291	0.0136
210	5.4427	0.0136
211	5.4562	0.0135
212	5.4697	0.0135
213	5.4832	0.0135

214	5.4967	0.0134
215	5.5101	0.0134
216	5.5235	0.0134
217	5.5368	0.0134
218	5.5501	0.0133
219	5.5634	0.0133
220	5.5767	0.0133
221	5.5899	0.0132
222	5.6032	0.0132
223	5.6163	0.0132
224	5.6295	0.0132
225	5.6426	0.0131
226	5.6557	0.0131
227	5.6688	0.0131
228	5.6818	0.0130
229	5.6948	0.0130
230	5.7078	0.0130
231	5.7208	0.0130
232	5.7337	0.0129
233	5.7466	0.0129
234	5.7595	0.0129
235	5.7724	0.0129
236	5.7852	0.0128
237	5.7980	0.0128
238	5.8108	0.0128
239	5.8235	0.0128
240	5.8363	0.0127
241	5.8490	0.0127
242	5.8616	0.0127
243	5.8743	0.0127
244	5.8869	0.0126
245	5.8995	0.0126
246	5.9121	0.0126
247	5.9247	0.0126
248	5.9372	0.0125
249	5.9497	0.0125
250	5.9622	0.0125
251	5.9746	0.0125
252	5.9871	0.0124
253	5.9995	0.0124
254	6.0119	0.0124
255	6.0242	0.0124
256	6.0366	0.0123
257	6.0489	0.0123
258	6.0612	0.0123
259	6.0734	0.0123
260	6.0857	0.0122
261	6.0979	0.0122
262	6.1101	0.0122
263	6.1223	0.0122
264	6.1345	0.0122
265	6.1466	0.0121
266	6.1587	0.0121
267	6.1708	0.0121
268	6.1829	0.0121
269	6.1949	0.0121
270	6.2070	0.0120

271	6.2190	0.0120
272	6.2310	0.0120
273	6.2429	0.0120
274	6.2549	0.0119
275	6.2668	0.0119
276	6.2787	0.0119
277	6.2906	0.0119
278	6.3024	0.0119
279	6.3143	0.0118
280	6.3261	0.0118
281	6.3379	0.0118
282	6.3497	0.0118
283	6.3615	0.0118
284	6.3732	0.0117
285	6.3849	0.0117
286	6.3966	0.0117
287	6.4083	0.0117
288	6.4200	0.0117

Unit Period (number)	Unit Rainfall (In)	Unit Soil-Loss (In)	Effective Rainfall (In)
1	0.0117	0.0032	0.0085
2	0.0117	0.0032	0.0085
3	0.0117	0.0032	0.0085
4	0.0117	0.0032	0.0085
5	0.0118	0.0032	0.0085
6	0.0118	0.0032	0.0086
7	0.0118	0.0033	0.0086
8	0.0119	0.0033	0.0086
9	0.0119	0.0033	0.0086
10	0.0119	0.0033	0.0086
11	0.0120	0.0033	0.0087
12	0.0120	0.0033	0.0087
13	0.0120	0.0033	0.0087
14	0.0121	0.0033	0.0087
15	0.0121	0.0033	0.0088
16	0.0121	0.0033	0.0088
17	0.0122	0.0033	0.0088
18	0.0122	0.0033	0.0088
19	0.0122	0.0034	0.0089
20	0.0122	0.0034	0.0089
21	0.0123	0.0034	0.0089
22	0.0123	0.0034	0.0089
23	0.0124	0.0034	0.0090
24	0.0124	0.0034	0.0090
25	0.0124	0.0034	0.0090
26	0.0125	0.0034	0.0090
27	0.0125	0.0034	0.0091
28	0.0125	0.0034	0.0091
29	0.0126	0.0035	0.0091
30	0.0126	0.0035	0.0091
31	0.0127	0.0035	0.0092
32	0.0127	0.0035	0.0092
33	0.0127	0.0035	0.0092
34	0.0128	0.0035	0.0092

35	0.0128	0.0035	0.0093
36	0.0128	0.0035	0.0093
37	0.0129	0.0035	0.0093
38	0.0129	0.0035	0.0094
39	0.0130	0.0036	0.0094
40	0.0130	0.0036	0.0094
41	0.0130	0.0036	0.0095
42	0.0131	0.0036	0.0095
43	0.0131	0.0036	0.0095
44	0.0132	0.0036	0.0095
45	0.0132	0.0036	0.0096
46	0.0132	0.0036	0.0096
47	0.0133	0.0037	0.0096
48	0.0133	0.0037	0.0097
49	0.0134	0.0037	0.0097
50	0.0134	0.0037	0.0097
51	0.0135	0.0037	0.0098
52	0.0135	0.0037	0.0098
53	0.0136	0.0037	0.0098
54	0.0136	0.0037	0.0099
55	0.0137	0.0038	0.0099
56	0.0137	0.0038	0.0099
57	0.0138	0.0038	0.0100
58	0.0138	0.0038	0.0100
59	0.0139	0.0038	0.0100
60	0.0139	0.0038	0.0101
61	0.0140	0.0038	0.0101
62	0.0140	0.0038	0.0101
63	0.0141	0.0039	0.0102
64	0.0141	0.0039	0.0102
65	0.0142	0.0039	0.0103
66	0.0142	0.0039	0.0103
67	0.0143	0.0039	0.0103
68	0.0143	0.0039	0.0104
69	0.0144	0.0039	0.0104
70	0.0144	0.0040	0.0105
71	0.0145	0.0040	0.0105
72	0.0145	0.0040	0.0105
73	0.0146	0.0040	0.0106
74	0.0146	0.0040	0.0106
75	0.0147	0.0040	0.0107
76	0.0148	0.0041	0.0107
77	0.0148	0.0041	0.0108
78	0.0149	0.0041	0.0108
79	0.0150	0.0041	0.0109
80	0.0150	0.0041	0.0109
81	0.0151	0.0041	0.0109
82	0.0151	0.0042	0.0110
83	0.0152	0.0042	0.0110
84	0.0153	0.0042	0.0111
85	0.0154	0.0042	0.0111
86	0.0154	0.0042	0.0112
87	0.0155	0.0043	0.0112
88	0.0155	0.0043	0.0113
89	0.0156	0.0043	0.0113
90	0.0157	0.0043	0.0114
91	0.0158	0.0043	0.0114

92	0.0158	0.0044	0.0115
93	0.0159	0.0044	0.0116
94	0.0160	0.0044	0.0116
95	0.0161	0.0044	0.0117
96	0.0161	0.0044	0.0117
97	0.0163	0.0045	0.0118
98	0.0163	0.0045	0.0118
99	0.0164	0.0045	0.0119
100	0.0165	0.0045	0.0119
101	0.0166	0.0046	0.0120
102	0.0166	0.0046	0.0121
103	0.0168	0.0046	0.0122
104	0.0168	0.0046	0.0122
105	0.0169	0.0047	0.0123
106	0.0170	0.0047	0.0123
107	0.0171	0.0047	0.0124
108	0.0172	0.0047	0.0125
109	0.0173	0.0048	0.0126
110	0.0174	0.0048	0.0126
111	0.0175	0.0048	0.0127
112	0.0176	0.0048	0.0128
113	0.0177	0.0049	0.0129
114	0.0178	0.0049	0.0129
115	0.0179	0.0049	0.0130
116	0.0180	0.0050	0.0131
117	0.0182	0.0050	0.0132
118	0.0183	0.0050	0.0132
119	0.0184	0.0051	0.0134
120	0.0185	0.0051	0.0134
121	0.0187	0.0051	0.0135
122	0.0187	0.0051	0.0136
123	0.0189	0.0052	0.0137
124	0.0190	0.0052	0.0138
125	0.0192	0.0053	0.0139
126	0.0193	0.0053	0.0140
127	0.0194	0.0053	0.0141
128	0.0195	0.0054	0.0142
129	0.0197	0.0054	0.0143
130	0.0198	0.0054	0.0144
131	0.0200	0.0055	0.0145
132	0.0201	0.0055	0.0146
133	0.0204	0.0056	0.0148
134	0.0205	0.0056	0.0148
135	0.0207	0.0057	0.0150
136	0.0208	0.0057	0.0151
137	0.0210	0.0058	0.0153
138	0.0212	0.0058	0.0153
139	0.0214	0.0059	0.0155
140	0.0215	0.0059	0.0156
141	0.0218	0.0060	0.0158
142	0.0219	0.0060	0.0159
143	0.0222	0.0061	0.0161
144	0.0224	0.0061	0.0162
145	0.0207	0.0057	0.0150
146	0.0209	0.0057	0.0151
147	0.0212	0.0058	0.0154
148	0.0214	0.0059	0.0155

149	0.0217	0.0060	0.0157
150	0.0219	0.0060	0.0159
151	0.0222	0.0061	0.0161
152	0.0224	0.0062	0.0163
153	0.0228	0.0063	0.0166
154	0.0230	0.0063	0.0167
155	0.0234	0.0064	0.0170
156	0.0237	0.0065	0.0172
157	0.0241	0.0066	0.0175
158	0.0244	0.0067	0.0177
159	0.0249	0.0068	0.0180
160	0.0251	0.0069	0.0182
161	0.0257	0.0071	0.0186
162	0.0260	0.0071	0.0188
163	0.0266	0.0073	0.0193
164	0.0269	0.0074	0.0195
165	0.0275	0.0076	0.0200
166	0.0279	0.0077	0.0202
167	0.0286	0.0079	0.0208
168	0.0290	0.0080	0.0211
169	0.0299	0.0082	0.0217
170	0.0303	0.0083	0.0220
171	0.0313	0.0086	0.0227
172	0.0318	0.0087	0.0231
173	0.0329	0.0090	0.0239
174	0.0335	0.0092	0.0243
175	0.0348	0.0096	0.0252
176	0.0355	0.0098	0.0258
177	0.0371	0.0102	0.0269
178	0.0379	0.0104	0.0275
179	0.0398	0.0109	0.0289
180	0.0408	0.0112	0.0296
181	0.0432	0.0119	0.0313
182	0.0446	0.0122	0.0323
183	0.0477	0.0131	0.0346
184	0.0495	0.0136	0.0359
185	0.0451	0.0124	0.0327
186	0.0477	0.0131	0.0346
187	0.0541	0.0149	0.0393
188	0.0584	0.0160	0.0423
189	0.0703	0.0193	0.0510
190	0.0794	0.0218	0.0576
191	0.1135	0.0242	0.0893
192	0.1561	0.0242	0.1319
193	0.4885	0.0242	0.4643
194	0.0924	0.0242	0.0683
195	0.0636	0.0175	0.0461
196	0.0506	0.0139	0.0367
197	0.0515	0.0142	0.0374
198	0.0460	0.0127	0.0334
199	0.0420	0.0115	0.0305
200	0.0388	0.0107	0.0282
201	0.0363	0.0100	0.0263
202	0.0341	0.0094	0.0248
203	0.0323	0.0089	0.0235
204	0.0308	0.0085	0.0223
205	0.0294	0.0081	0.0214

206	0.0283	0.0078	0.0205
207	0.0272	0.0075	0.0197
208	0.0262	0.0072	0.0190
209	0.0254	0.0070	0.0184
210	0.0246	0.0068	0.0178
211	0.0239	0.0066	0.0173
212	0.0232	0.0064	0.0168
213	0.0226	0.0062	0.0164
214	0.0221	0.0061	0.0160
215	0.0215	0.0059	0.0156
216	0.0210	0.0058	0.0153
217	0.0225	0.0062	0.0163
218	0.0221	0.0061	0.0160
219	0.0217	0.0060	0.0157
220	0.0213	0.0058	0.0154
221	0.0209	0.0057	0.0152
222	0.0206	0.0057	0.0149
223	0.0202	0.0056	0.0147
224	0.0199	0.0055	0.0145
225	0.0196	0.0054	0.0142
226	0.0194	0.0053	0.0140
227	0.0191	0.0052	0.0138
228	0.0188	0.0052	0.0136
229	0.0186	0.0051	0.0135
230	0.0183	0.0050	0.0133
231	0.0181	0.0050	0.0131
232	0.0179	0.0049	0.0130
233	0.0177	0.0049	0.0128
234	0.0175	0.0048	0.0127
235	0.0173	0.0047	0.0125
236	0.0171	0.0047	0.0124
237	0.0169	0.0046	0.0122
238	0.0167	0.0046	0.0121
239	0.0165	0.0045	0.0120
240	0.0164	0.0045	0.0119
241	0.0162	0.0044	0.0117
242	0.0160	0.0044	0.0116
243	0.0159	0.0044	0.0115
244	0.0157	0.0043	0.0114
245	0.0156	0.0043	0.0113
246	0.0155	0.0042	0.0112
247	0.0153	0.0042	0.0111
248	0.0152	0.0042	0.0110
249	0.0151	0.0041	0.0109
250	0.0149	0.0041	0.0108
251	0.0148	0.0041	0.0107
252	0.0147	0.0040	0.0106
253	0.0146	0.0040	0.0106
254	0.0145	0.0040	0.0105
255	0.0143	0.0039	0.0104
256	0.0142	0.0039	0.0103
257	0.0141	0.0039	0.0102
258	0.0140	0.0039	0.0102
259	0.0139	0.0038	0.0101
260	0.0138	0.0038	0.0100
261	0.0137	0.0038	0.0100
262	0.0136	0.0037	0.0099

263	0.0135	0.0037	0.0098
264	0.0134	0.0037	0.0098
265	0.0134	0.0037	0.0097
266	0.0133	0.0036	0.0096
267	0.0132	0.0036	0.0096
268	0.0131	0.0036	0.0095
269	0.0130	0.0036	0.0094
270	0.0129	0.0036	0.0094
271	0.0129	0.0035	0.0093
272	0.0128	0.0035	0.0093
273	0.0127	0.0035	0.0092
274	0.0126	0.0035	0.0092
275	0.0126	0.0034	0.0091
276	0.0125	0.0034	0.0091
277	0.0124	0.0034	0.0090
278	0.0123	0.0034	0.0090
279	0.0123	0.0034	0.0089
280	0.0122	0.0034	0.0089
281	0.0121	0.0033	0.0088
282	0.0121	0.0033	0.0088
283	0.0120	0.0033	0.0087
284	0.0119	0.0033	0.0087
285	0.0119	0.0033	0.0086
286	0.0118	0.0032	0.0086
287	0.0118	0.0032	0.0085
288	0.0117	0.0032	0.0085

Total soil rain loss = 1.63(In)
Total effective rainfall = 4.79(In)
Peak flow rate in flood hydrograph = 6.18(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	2.5	5.0	7.5	10.0
0+ 5	0.0001	0.01	Q				
0+10	0.0005	0.06	Q				
0+15	0.0014	0.13	Q				
0+20	0.0027	0.19	Q				
0+25	0.0042	0.22	Q				
0+30	0.0059	0.24	Q				
0+35	0.0076	0.25	VQ				
0+40	0.0095	0.26	VQ				
0+45	0.0113	0.27	VQ				
0+50	0.0133	0.28	VQ				
0+55	0.0152	0.29	VQ				
1+ 0	0.0173	0.29	VQ				
1+ 5	0.0193	0.30	VQ				
1+10	0.0214	0.30	VQ				
1+15	0.0235	0.30	VQ				
1+20	0.0256	0.31	VQ				

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1+25       0.0277      0.31  VQ        |         |         |         |
1+30       0.0298      0.31  VQ        |         |         |         |
1+35       0.0320      0.31  |Q        |         |         |         |
1+40       0.0342      0.32  |Q        |         |         |         |
1+45       0.0364      0.32  |Q        |         |         |         |
1+50       0.0386      0.32  |Q        |         |         |         |
1+55       0.0408      0.32  |Q        |         |         |         |
2+ 0       0.0430      0.32  |Q        |         |         |         |
2+ 5       0.0452      0.32  |Q        |         |         |         |
2+10       0.0475      0.32  |Q        |         |         |         |
2+15       0.0497      0.33  |Q        |         |         |         |
2+20       0.0520      0.33  |Q        |         |         |         |
2+25       0.0542      0.33  |Q        |         |         |         |
2+30       0.0565      0.33  |Q        |         |         |         |
2+35       0.0587      0.33  |Q        |         |         |         |
2+40       0.0610      0.33  |QV       |         |         |         |
2+45       0.0633      0.33  |QV       |         |         |         |
2+50       0.0656      0.33  |QV       |         |         |         |
2+55       0.0679      0.33  |QV       |         |         |         |
3+ 0       0.0702      0.33  |QV       |         |         |         |
3+ 5       0.0725      0.33  |QV       |         |         |         |
3+10       0.0748      0.34  |QV       |         |         |         |
3+15       0.0771      0.34  |QV       |         |         |         |
3+20       0.0794      0.34  |QV       |         |         |         |
3+25       0.0817      0.34  |QV       |         |         |         |
3+30       0.0841      0.34  |QV       |         |         |         |
3+35       0.0864      0.34  |QV       |         |         |         |
3+40       0.0888      0.34  |QV       |         |         |         |
3+45       0.0911      0.34  |Q V      |         |         |         |
3+50       0.0935      0.34  |Q V      |         |         |         |
3+55       0.0959      0.35  |Q V      |         |         |         |
4+ 0       0.0983      0.35  |Q V      |         |         |         |
4+ 5       0.1007      0.35  |Q V      |         |         |         |
4+10       0.1031      0.35  |Q V      |         |         |         |
4+15       0.1055      0.35  |Q V      |         |         |         |
4+20       0.1079      0.35  |Q V      |         |         |         |
4+25       0.1103      0.35  |Q V      |         |         |         |
4+30       0.1127      0.35  |Q V      |         |         |         |
4+35       0.1152      0.35  |Q V      |         |         |         |
4+40       0.1176      0.36  |Q V      |         |         |         |
4+45       0.1201      0.36  |Q  V     |         |         |         |
4+50       0.1226      0.36  |Q  V     |         |         |         |
4+55       0.1250      0.36  |Q  V     |         |         |         |
5+ 0       0.1275      0.36  |Q  V     |         |         |         |
5+ 5       0.1300      0.36  |Q  V     |         |         |         |
5+10       0.1325      0.36  |Q  V     |         |         |         |
5+15       0.1350      0.36  |Q  V     |         |         |         |
5+20       0.1375      0.37  |Q  V     |         |         |         |
5+25       0.1401      0.37  |Q  V     |         |         |         |
5+30       0.1426      0.37  |Q  V     |         |         |         |
5+35       0.1451      0.37  |Q  V     |         |         |         |
5+40       0.1477      0.37  |Q  V     |         |         |         |
5+45       0.1503      0.37  |Q   V    |         |         |         |
5+50       0.1528      0.37  |Q   V    |         |         |         |
5+55       0.1554      0.38  |Q   V    |         |         |         |
6+ 0       0.1580      0.38  |Q   V    |         |         |         |
6+ 5       0.1606      0.38  |Q   V    |         |         |         |
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 6+10       0.1632      0.38  |Q   V    |          |          |          |
 6+15       0.1658      0.38  |Q   V    |          |          |          |
 6+20       0.1685      0.38  |Q   V    |          |          |          |
 6+25       0.1711      0.38  |Q   V    |          |          |          |
 6+30       0.1738      0.39  |Q   V    |          |          |          |
 6+35       0.1764      0.39  |Q   V    |          |          |          |
 6+40       0.1791      0.39  |Q   V    |          |          |          |
 6+45       0.1818      0.39  |Q    V   |          |          |          |
 6+50       0.1845      0.39  |Q    V   |          |          |          |
 6+55       0.1872      0.39  |Q    V   |          |          |          |
 7+ 0       0.1899      0.40  |Q    V   |          |          |          |
 7+ 5       0.1927      0.40  |Q    V   |          |          |          |
 7+10       0.1954      0.40  |Q    V   |          |          |          |
 7+15       0.1982      0.40  |Q    V   |          |          |          |
 7+20       0.2009      0.40  |Q    V   |          |          |          |
 7+25       0.2037      0.40  |Q    V   |          |          |          |
 7+30       0.2065      0.41  |Q    V   |          |          |          |
 7+35       0.2093      0.41  |Q    V   |          |          |          |
 7+40       0.2121      0.41  |Q     V  |          |          |          |
 7+45       0.2150      0.41  |Q     V  |          |          |          |
 7+50       0.2178      0.41  |Q     V  |          |          |          |
 7+55       0.2207      0.41  |Q     V  |          |          |          |
 8+ 0       0.2235      0.42  |Q     V  |          |          |          |
 8+ 5       0.2264      0.42  |Q     V  |          |          |          |
 8+10       0.2293      0.42  |Q     V  |          |          |          |
 8+15       0.2322      0.42  |Q     V  |          |          |          |
 8+20       0.2352      0.43  |Q     V  |          |          |          |
 8+25       0.2381      0.43  |Q     V  |          |          |          |
 8+30       0.2411      0.43  |Q      V |          |          |          |
 8+35       0.2440      0.43  |Q      V |          |          |          |
 8+40       0.2470      0.43  |Q      V |          |          |          |
 8+45       0.2500      0.44  |Q      V |          |          |          |
 8+50       0.2530      0.44  |Q      V |          |          |          |
 8+55       0.2561      0.44  |Q      V |          |          |          |
 9+ 0       0.2591      0.44  |Q      V |          |          |          |
 9+ 5       0.2622      0.45  |Q      V |          |          |          |
 9+10       0.2653      0.45  |Q      V |          |          |          |
 9+15       0.2684      0.45  |Q      V |          |          |          |
 9+20       0.2715      0.45  |Q       V|          |          |          |
 9+25       0.2746      0.46  |Q       V|          |          |          |
 9+30       0.2778      0.46  |Q       V|          |          |          |
 9+35       0.2810      0.46  |Q       V|          |          |          |
 9+40       0.2842      0.46  |Q       V|          |          |          |
 9+45       0.2874      0.47  |Q       V|          |          |          |
 9+50       0.2906      0.47  |Q       V|          |          |          |
 9+55       0.2938      0.47  |Q       V|          |          |          |
10+ 0       0.2971      0.47  |Q       V|          |          |          |
10+ 5       0.3004      0.48  |Q        V          |          |          |
10+10       0.3037      0.48  |Q        V          |          |          |
10+15       0.3070      0.48  |Q        V          |          |          |
10+20       0.3104      0.49  |Q        V          |          |          |
10+25       0.3138      0.49  |Q        V          |          |          |
10+30       0.3172      0.49  |Q        V          |          |          |
10+35       0.3206      0.50  |Q        V          |          |          |
10+40       0.3240      0.50  | Q       V          |          |          |
10+45       0.3275      0.50  | Q       V          |          |          |
10+50       0.3310      0.51  | Q       |V         |          |          |
```

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10+55       0.3345      0.51  | Q       |V        |         |         |
11+ 0       0.3381      0.51  | Q       |V        |         |         |
11+ 5       0.3416      0.52  | Q       |V        |         |         |
11+10       0.3452      0.52  | Q       |V        |         |         |
11+15       0.3489      0.53  | Q       |V        |         |         |
11+20       0.3525      0.53  | Q       |V        |         |         |
11+25       0.3562      0.54  | Q       |V        |         |         |
11+30       0.3599      0.54  | Q       | V       |         |         |
11+35       0.3637      0.54  | Q       | V       |         |         |
11+40       0.3674      0.55  | Q       | V       |         |         |
11+45       0.3713      0.55  | Q       | V       |         |         |
11+50       0.3751      0.56  | Q       | V       |         |         |
11+55       0.3790      0.56  | Q       | V       |         |         |
12+ 0       0.3829      0.57  | Q       | V       |         |         |
12+ 5       0.3868      0.57  | Q       | V       |         |         |
12+10       0.3907      0.57  | Q       |  V      |         |         |
12+15       0.3946      0.56  | Q       |  V      |         |         |
12+20       0.3985      0.56  | Q       |  V      |         |         |
12+25       0.4023      0.56  | Q       |  V      |         |         |
12+30       0.4062      0.56  | Q       |  V      |         |         |
12+35       0.4101      0.57  | Q       |  V      |         |         |
12+40       0.4140      0.57  | Q       |  V      |         |         |
12+45       0.4180      0.58  | Q       |  V      |         |         |
12+50       0.4220      0.58  | Q       |   V     |         |         |
12+55       0.4261      0.59  | Q       |   V     |         |         |
13+ 0       0.4302      0.60  | Q       |   V     |         |         |
13+ 5       0.4343      0.60  | Q       |   V     |         |         |
13+10       0.4385      0.61  | Q       |   V     |         |         |
13+15       0.4428      0.62  | Q       |   V     |         |         |
13+20       0.4471      0.63  | Q       |   V     |         |         |
13+25       0.4515      0.64  | Q       |    V    |         |         |
13+30       0.4559      0.64  | Q       |    V    |         |         |
13+35       0.4604      0.65  | Q       |    V    |         |         |
13+40       0.4650      0.66  | Q       |    V    |         |         |
13+45       0.4696      0.68  | Q       |    V    |         |         |
13+50       0.4744      0.69  | Q       |    V    |         |         |
13+55       0.4792      0.70  | Q       |     V   |         |         |
14+ 0       0.4841      0.71  | Q       |     V   |         |         |
14+ 5       0.4891      0.73  | Q       |     V   |         |         |
14+10       0.4942      0.74  | Q       |     V   |         |         |
14+15       0.4994      0.75  |  Q      |     V   |         |         |
14+20       0.5047      0.77  |  Q      |     V   |         |         |
14+25       0.5101      0.79  |  Q      |      V  |         |         |
14+30       0.5156      0.81  |  Q      |      V  |         |         |
14+35       0.5213      0.83  |  Q      |      V  |         |         |
14+40       0.5272      0.85  |  Q      |      V  |         |         |
14+45       0.5331      0.87  |  Q      |      V  |         |         |
14+50       0.5393      0.89  |  Q      |       V |         |         |
14+55       0.5456      0.92  |  Q      |       V |         |         |
15+ 0       0.5522      0.95  |  Q      |       V |         |         |
15+ 5       0.5590      0.98  |  Q      |       V |         |         |
15+10       0.5660      1.02  |   Q     |       V |         |         |
15+15       0.5733      1.06  |   Q     |        V|         |         |
15+20       0.5809      1.10  |   Q     |        V|         |         |
15+25       0.5888      1.15  |   Q     |        V|         |         |
15+30       0.5969      1.17  |   Q     |        V|         |         |
15+35       0.6051      1.19  |   Q     |         V         |         |
```

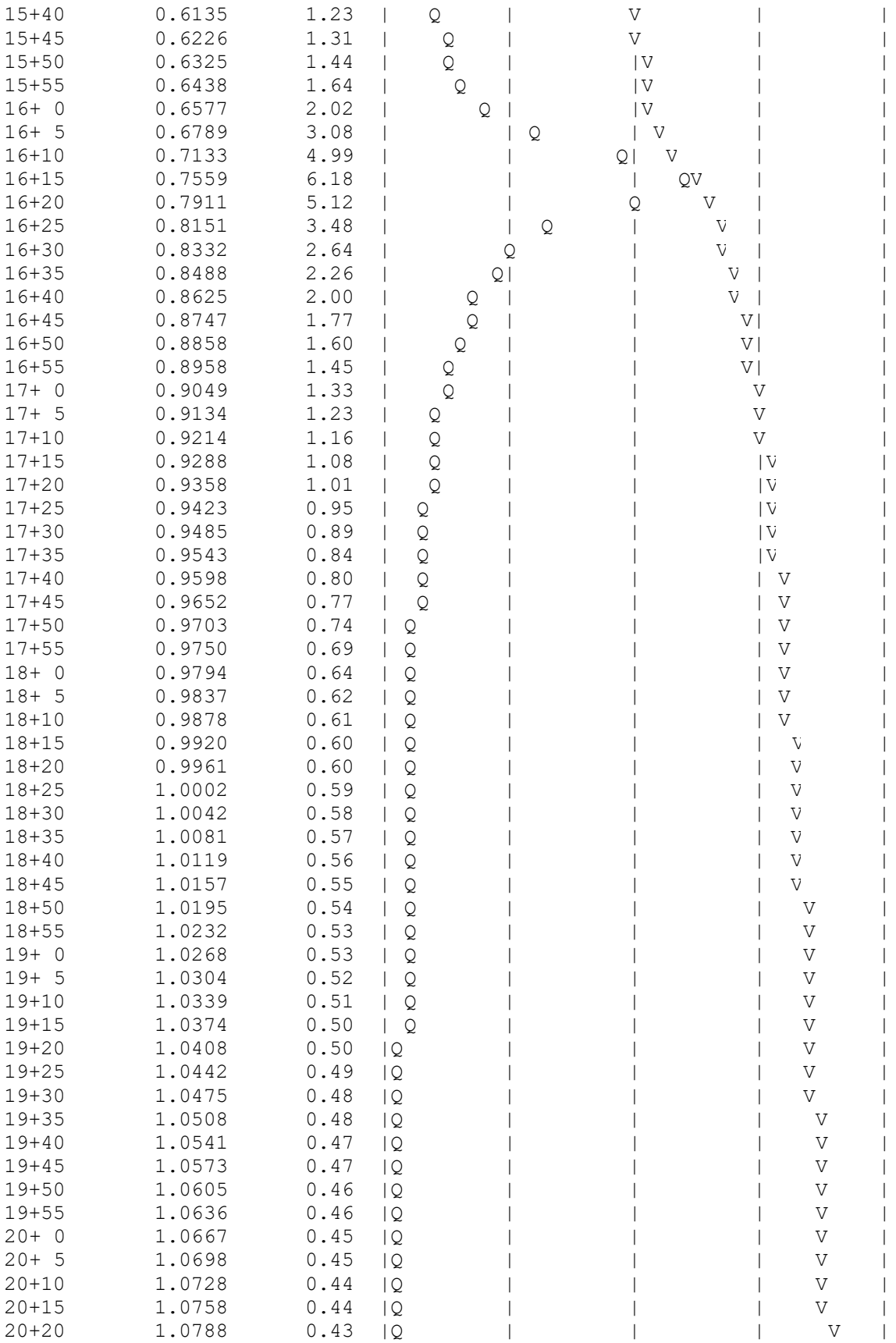

20+25	1.0818	0.43	|Q	|	|	|	V |
20+30	1.0847	0.42	|Q	|	|	|	V |
20+35	1.0876	0.42	|Q	|	|	|	V |
20+40	1.0904	0.42	|Q	|	|	|	V |
20+45	1.0933	0.41	|Q	|	|	|	V |
20+50	1.0961	0.41	|Q	|	|	|	V |
20+55	1.0989	0.40	|Q	|	|	|	V |
21+ 0	1.1016	0.40	|Q	|	|	|	V |
21+ 5	1.1044	0.40	|Q	|	|	|	V |
21+10	1.1071	0.39	|Q	|	|	|	V |
21+15	1.1098	0.39	|Q	|	|	|	V |
21+20	1.1124	0.39	|Q	|	|	|	V |
21+25	1.1151	0.38	|Q	|	|	|	V |
21+30	1.1177	0.38	|Q	|	|	|	V |
21+35	1.1203	0.38	|Q	|	|	|	V |
21+40	1.1229	0.38	|Q	|	|	|	V |
21+45	1.1255	0.37	|Q	|	|	|	V |
21+50	1.1280	0.37	|Q	|	|	|	V |
21+55	1.1305	0.37	|Q	|	|	|	V |
22+ 0	1.1331	0.36	|Q	|	|	|	V |
22+ 5	1.1355	0.36	|Q	|	|	|	V |
22+10	1.1380	0.36	|Q	|	|	|	V |
22+15	1.1405	0.36	|Q	|	|	|	V |
22+20	1.1429	0.35	|Q	|	|	|	V |
22+25	1.1454	0.35	|Q	|	|	|	V |
22+30	1.1478	0.35	|Q	|	|	|	V |
22+35	1.1502	0.35	|Q	|	|	|	V |
22+40	1.1525	0.35	|Q	|	|	|	V |
22+45	1.1549	0.34	|Q	|	|	|	V |
22+50	1.1572	0.34	|Q	|	|	|	V |
22+55	1.1596	0.34	|Q	|	|	|	V |
23+ 0	1.1619	0.34	|Q	|	|	|	V |
23+ 5	1.1642	0.33	|Q	|	|	|	V |
23+10	1.1665	0.33	|Q	|	|	|	V |
23+15	1.1688	0.33	|Q	|	|	|	V|
23+20	1.1710	0.33	|Q	|	|	|	V|
23+25	1.1733	0.33	|Q	|	|	|	V|
23+30	1.1755	0.33	|Q	|	|	|	V|
23+35	1.1778	0.32	|Q	|	|	|	V|
23+40	1.1800	0.32	|Q	|	|	|	V|
23+45	1.1822	0.32	|Q	|	|	|	V|
23+50	1.1844	0.32	|Q	|	|	|	V|
23+55	1.1866	0.32	|Q	|	|	|	V|
24+ 0	1.1887	0.31	|Q	|	|	|	V|
24+ 5	1.1908	0.30	|Q	|	|	|	V|
24+10	1.1925	0.25	|Q	|	|	|	V|
24+15	1.1938	0.18	Q	|	|	|	V|
24+20	1.1946	0.12	Q	|	|	|	V|
24+25	1.1952	0.09	Q	|	|	|	V|
24+30	1.1957	0.07	Q	|	|	|	V|
24+35	1.1961	0.06	Q	|	|	|	V|
24+40	1.1964	0.05	Q	|	|	|	V|
24+45	1.1967	0.04	Q	|	|	|	V|
24+50	1.1969	0.03	Q	|	|	|	V|
24+55	1.1970	0.03	Q	|	|	|	V|
25+ 0	1.1972	0.02	Q	|	|	|	V|
25+ 5	1.1973	0.02	Q	|	|	|	V|

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

Study date 06/03/23

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

Program License Serial Number 6472

100-Year 24 Hour Flood Unit Hydrograph
To the Basin Area C

Storm Event Year = 100

Antecedent Moisture Condition = 3

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 100		
3.00	1	1.32
Rainfall data for year 100		
3.00	6	3.11
Rainfall data for year 100		
3.00	24	6.42

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

SCS curve No.(AMCII)	SCS curve NO.(AMC 3)	Area (Ac.)	Area Fraction	Fp(Fig C6) (In/Hr)	Ap (dec.)	Fm (In/Hr)
32.0	52.0	3.00	1.000	0.785	0.100	0.079

Area-averaged adjusted loss rate Fm (In/Hr) = 0.079

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

Area (Ac.)	Area Fract	SCS CN (AMC2)	SCS CN (AMC3)	S	Pervious Yield Fr
0.30	0.100	32.0	52.0	9.23	0.236
2.70	0.900	98.0	98.0	0.20	0.963

Area-averaged catchment yield fraction, Y = 0.890
Area-averaged low loss fraction, Yb = 0.110
User entry of time of concentration = 0.130 (hours)
++
Watershed area = 3.00(Ac.)
Catchment Lag time = 0.104 hours
Unit interval = 10.000 minutes
Unit interval percentage of lag time = 160.2564
Hydrograph baseflow = 0.00(CFS)
Average maximum watershed loss rate(Fm) = 0.079(In/Hr)
Average low loss rate fraction (Yb) = 0.110 (decimal)
VALLEY UNDEVELOPED S-Graph Selected
Computed peak 5-minute rainfall = 0.489(In)
Computed peak 30-minute rainfall = 1.000(In)
Specified peak 1-hour rainfall = 1.320(In)
Computed peak 3-hour rainfall = 2.232(In)
Specified peak 6-hour rainfall = 3.110(In)
Specified peak 24-hour rainfall = 6.420(In)

Rainfall depth area reduction factors:
Using a total area of 3.00(Ac.) (Ref: fig. E-4)

5-minute factor = 1.000 Adjusted rainfall = 0.488(In)
30-minute factor = 1.000 Adjusted rainfall = 1.000(In)
1-hour factor = 1.000 Adjusted rainfall = 1.320(In)
3-hour factor = 1.000 Adjusted rainfall = 2.232(In)
6-hour factor = 1.000 Adjusted rainfall = 3.110(In)
24-hour factor = 1.000 Adjusted rainfall = 6.420(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 = 18.14 (CFS))		
1	35.568	6.452
2	81.816	8.390
3	92.435	1.926
4	97.006	0.829
5	100.000	0.543

Peak Unit Number	Adjusted mass rainfall (In)	Unit rainfall (In)
1	0.6445	0.1561

2	0.8505	0.0924
3	1.0002	0.0703
4	1.1222	0.0584
5	1.2270	0.0506
6	1.3198	0.0451
7	1.4208	0.0495
8	1.5146	0.0460
9	1.6023	0.0432
10	1.6852	0.0408
11	1.7638	0.0388
12	1.8388	0.0371
13	1.9105	0.0355
14	1.9795	0.0341
15	2.0459	0.0329
16	2.1101	0.0318
17	2.1722	0.0308
18	2.2324	0.0299
19	2.2909	0.0290
20	2.3478	0.0283
21	2.4032	0.0275
22	2.4573	0.0269
23	2.5101	0.0262
24	2.5617	0.0257
25	2.6122	0.0251
26	2.6617	0.0246
27	2.7102	0.0241
28	2.7577	0.0237
29	2.8044	0.0232
30	2.8503	0.0228
31	2.8953	0.0224
32	2.9396	0.0221
33	2.9832	0.0217
34	3.0261	0.0214
35	3.0683	0.0210
36	3.1100	0.0207
37	3.1548	0.0224
38	3.1991	0.0221
39	3.2429	0.0218
40	3.2861	0.0215
41	3.3288	0.0213
42	3.3710	0.0210
43	3.4127	0.0208
44	3.4540	0.0206
45	3.4948	0.0204
46	3.5352	0.0201
47	3.5752	0.0199
48	3.6148	0.0197
49	3.6539	0.0195
50	3.6927	0.0194
51	3.7312	0.0192
52	3.7692	0.0190
53	3.8070	0.0188
54	3.8443	0.0187
55	3.8814	0.0185
56	3.9181	0.0183
57	3.9546	0.0182
58	3.9907	0.0180

59	4.0265	0.0179
60	4.0621	0.0177
61	4.0973	0.0176
62	4.1323	0.0175
63	4.1670	0.0173
64	4.2015	0.0172
65	4.2357	0.0171
66	4.2696	0.0169
67	4.3033	0.0168
68	4.3368	0.0167
69	4.3700	0.0166
70	4.4030	0.0165
71	4.4358	0.0164
72	4.4683	0.0163
73	4.5007	0.0161
74	4.5328	0.0160
75	4.5647	0.0159
76	4.5964	0.0158
77	4.6280	0.0157
78	4.6593	0.0156
79	4.6904	0.0155
80	4.7214	0.0155
81	4.7521	0.0154
82	4.7827	0.0153
83	4.8131	0.0152
84	4.8434	0.0151
85	4.8734	0.0150
86	4.9033	0.0149
87	4.9330	0.0148
88	4.9626	0.0148
89	4.9920	0.0147
90	5.0213	0.0146
91	5.0504	0.0145
92	5.0793	0.0145
93	5.1081	0.0144
94	5.1367	0.0143
95	5.1652	0.0142
96	5.1936	0.0142
97	5.2218	0.0141
98	5.2499	0.0140
99	5.2778	0.0140
100	5.3056	0.0139
101	5.3333	0.0138
102	5.3608	0.0138
103	5.3883	0.0137
104	5.4155	0.0136
105	5.4427	0.0136
106	5.4697	0.0135
107	5.4967	0.0134
108	5.5235	0.0134
109	5.5501	0.0133
110	5.5767	0.0133
111	5.6032	0.0132
112	5.6295	0.0132
113	5.6557	0.0131
114	5.6818	0.0130
115	5.7078	0.0130

116	5.7337	0.0129
117	5.7595	0.0129
118	5.7852	0.0128
119	5.8108	0.0128
120	5.8363	0.0127
121	5.8616	0.0127
122	5.8869	0.0126
123	5.9121	0.0126
124	5.9372	0.0125
125	5.9622	0.0125
126	5.9871	0.0124
127	6.0119	0.0124
128	6.0366	0.0123
129	6.0612	0.0123
130	6.0857	0.0122
131	6.1101	0.0122
132	6.1345	0.0122
133	6.1587	0.0121
134	6.1829	0.0121
135	6.2070	0.0120
136	6.2310	0.0120
137	6.2549	0.0119
138	6.2787	0.0119
139	6.3024	0.0119
140	6.3261	0.0118
141	6.3497	0.0118
142	6.3732	0.0117
143	6.3966	0.0117
144	6.4200	0.0117

Unit Period (number)	Unit Rainfall (In)	Unit Soil-Loss (In)	Effective Rainfall (In)
1	0.0233	0.0026	0.0208
2	0.0235	0.0026	0.0209
3	0.0236	0.0026	0.0210
4	0.0237	0.0026	0.0211
5	0.0238	0.0026	0.0212
6	0.0240	0.0026	0.0213
7	0.0241	0.0026	0.0214
8	0.0242	0.0027	0.0216
9	0.0243	0.0027	0.0217
10	0.0245	0.0027	0.0218
11	0.0246	0.0027	0.0219
12	0.0247	0.0027	0.0220
13	0.0249	0.0027	0.0222
14	0.0250	0.0027	0.0223
15	0.0252	0.0028	0.0224
16	0.0253	0.0028	0.0225
17	0.0255	0.0028	0.0227
18	0.0256	0.0028	0.0228
19	0.0258	0.0028	0.0230
20	0.0260	0.0029	0.0231
21	0.0261	0.0029	0.0232
22	0.0263	0.0029	0.0234
23	0.0264	0.0029	0.0235

24	0.0266	0.0029	0.0237
25	0.0268	0.0029	0.0239
26	0.0270	0.0030	0.0240
27	0.0272	0.0030	0.0242
28	0.0274	0.0030	0.0243
29	0.0275	0.0030	0.0245
30	0.0277	0.0030	0.0247
31	0.0279	0.0031	0.0249
32	0.0281	0.0031	0.0251
33	0.0284	0.0031	0.0252
34	0.0286	0.0031	0.0254
35	0.0288	0.0032	0.0256
36	0.0290	0.0032	0.0258
37	0.0292	0.0032	0.0260
38	0.0295	0.0032	0.0262
39	0.0297	0.0033	0.0265
40	0.0300	0.0033	0.0267
41	0.0302	0.0033	0.0269
42	0.0305	0.0033	0.0271
43	0.0308	0.0034	0.0274
44	0.0310	0.0034	0.0276
45	0.0313	0.0034	0.0279
46	0.0316	0.0035	0.0281
47	0.0319	0.0035	0.0284
48	0.0322	0.0035	0.0287
49	0.0326	0.0036	0.0290
50	0.0329	0.0036	0.0293
51	0.0332	0.0036	0.0296
52	0.0336	0.0037	0.0299
53	0.0339	0.0037	0.0302
54	0.0343	0.0038	0.0306
55	0.0347	0.0038	0.0309
56	0.0351	0.0039	0.0313
57	0.0355	0.0039	0.0316
58	0.0360	0.0040	0.0320
59	0.0364	0.0040	0.0324
60	0.0369	0.0041	0.0328
61	0.0374	0.0041	0.0333
62	0.0379	0.0042	0.0337
63	0.0384	0.0042	0.0342
64	0.0390	0.0043	0.0347
65	0.0396	0.0043	0.0352
66	0.0402	0.0044	0.0358
67	0.0408	0.0045	0.0363
68	0.0415	0.0046	0.0369
69	0.0422	0.0046	0.0376
70	0.0430	0.0047	0.0382
71	0.0437	0.0048	0.0389
72	0.0446	0.0049	0.0397
73	0.0416	0.0046	0.0371
74	0.0426	0.0047	0.0379
75	0.0436	0.0048	0.0388
76	0.0447	0.0049	0.0398
77	0.0458	0.0050	0.0408
78	0.0471	0.0052	0.0419
79	0.0485	0.0053	0.0432
80	0.0500	0.0055	0.0445

81	0.0516	0.0057	0.0460
82	0.0534	0.0059	0.0476
83	0.0554	0.0061	0.0493
84	0.0577	0.0063	0.0513
85	0.0602	0.0066	0.0536
86	0.0631	0.0069	0.0562
87	0.0664	0.0073	0.0591
88	0.0703	0.0077	0.0626
89	0.0750	0.0082	0.0667
90	0.0806	0.0089	0.0718
91	0.0878	0.0096	0.0781
92	0.0972	0.0107	0.0865
93	0.0928	0.0102	0.0826
94	0.1125	0.0124	0.1001
95	0.1498	0.0131	0.1367
96	0.2696	0.0131	0.2565
97	0.5809	0.0131	0.5678
98	0.1143	0.0125	0.1017
99	0.0976	0.0107	0.0869
100	0.0808	0.0089	0.0719
101	0.0704	0.0077	0.0627
102	0.0631	0.0069	0.0562
103	0.0577	0.0063	0.0514
104	0.0535	0.0059	0.0476
105	0.0500	0.0055	0.0445
106	0.0471	0.0052	0.0419
107	0.0447	0.0049	0.0398
108	0.0426	0.0047	0.0379
109	0.0446	0.0049	0.0397
110	0.0430	0.0047	0.0382
111	0.0415	0.0046	0.0369
112	0.0402	0.0044	0.0358
113	0.0390	0.0043	0.0347
114	0.0379	0.0042	0.0337
115	0.0369	0.0041	0.0328
116	0.0360	0.0040	0.0320
117	0.0351	0.0039	0.0313
118	0.0343	0.0038	0.0306
119	0.0336	0.0037	0.0299
120	0.0329	0.0036	0.0293
121	0.0322	0.0035	0.0287
122	0.0316	0.0035	0.0281
123	0.0310	0.0034	0.0276
124	0.0305	0.0033	0.0271
125	0.0300	0.0033	0.0267
126	0.0295	0.0032	0.0262
127	0.0290	0.0032	0.0258
128	0.0286	0.0031	0.0254
129	0.0281	0.0031	0.0251
130	0.0277	0.0030	0.0247
131	0.0274	0.0030	0.0243
132	0.0270	0.0030	0.0240
133	0.0266	0.0029	0.0237
134	0.0263	0.0029	0.0234
135	0.0260	0.0029	0.0231
136	0.0256	0.0028	0.0228
137	0.0253	0.0028	0.0225

138	0.0250	0.0027	0.0223
139	0.0247	0.0027	0.0220
140	0.0245	0.0027	0.0218
141	0.0242	0.0027	0.0216
142	0.0240	0.0026	0.0213
143	0.0237	0.0026	0.0211
144	0.0235	0.0026	0.0209

Total soil rain loss = 0.63(In)
Total effective rainfall = 5.79(In)
Peak flow rate in flood hydrograph = 6.21(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 10 Minute intervals ((CFS))

Time(h+m)	Volume Ac.Ft	Q(CFS)	0	2.5	5.0	7.5	10.0
0+10	0.0018	0.13	Q				
0+20	0.0061	0.31	VQ				
0+30	0.0109	0.35	VQ				
0+40	0.0160	0.37	VQ				
0+50	0.0213	0.38	VQ				
1+ 0	0.0266	0.38	VQ				
1+10	0.0319	0.39	VQ				
1+20	0.0373	0.39	Q				
1+30	0.0427	0.39	|Q				
1+40	0.0481	0.39	|Q				
1+50	0.0535	0.40	|Q				
2+ 0	0.0590	0.40	|Q				
2+10	0.0645	0.40	|Q				
2+20	0.0701	0.40	|Q				
2+30	0.0756	0.40	|QV				
2+40	0.0812	0.41	|QV				
2+50	0.0869	0.41	|QV				
3+ 0	0.0925	0.41	|QV				
3+10	0.0983	0.41	|QV				
3+20	0.1040	0.42	|QV				
3+30	0.1098	0.42	|Q V				
3+40	0.1156	0.42	|Q V				
3+50	0.1214	0.42	|Q V				
4+ 0	0.1273	0.43	|Q V				
4+10	0.1332	0.43	|Q V				
4+20	0.1392	0.43	|Q V				
4+30	0.1452	0.44	|Q V				
4+40	0.1512	0.44	|Q V				
4+50	0.1573	0.44	|Q V				
5+ 0	0.1635	0.45	|Q V				
5+10	0.1696	0.45	|Q V				
5+20	0.1759	0.45	|Q V				
5+30	0.1821	0.45	|Q V				
5+40	0.1884	0.46	|Q V				
5+50	0.1948	0.46	|Q V				

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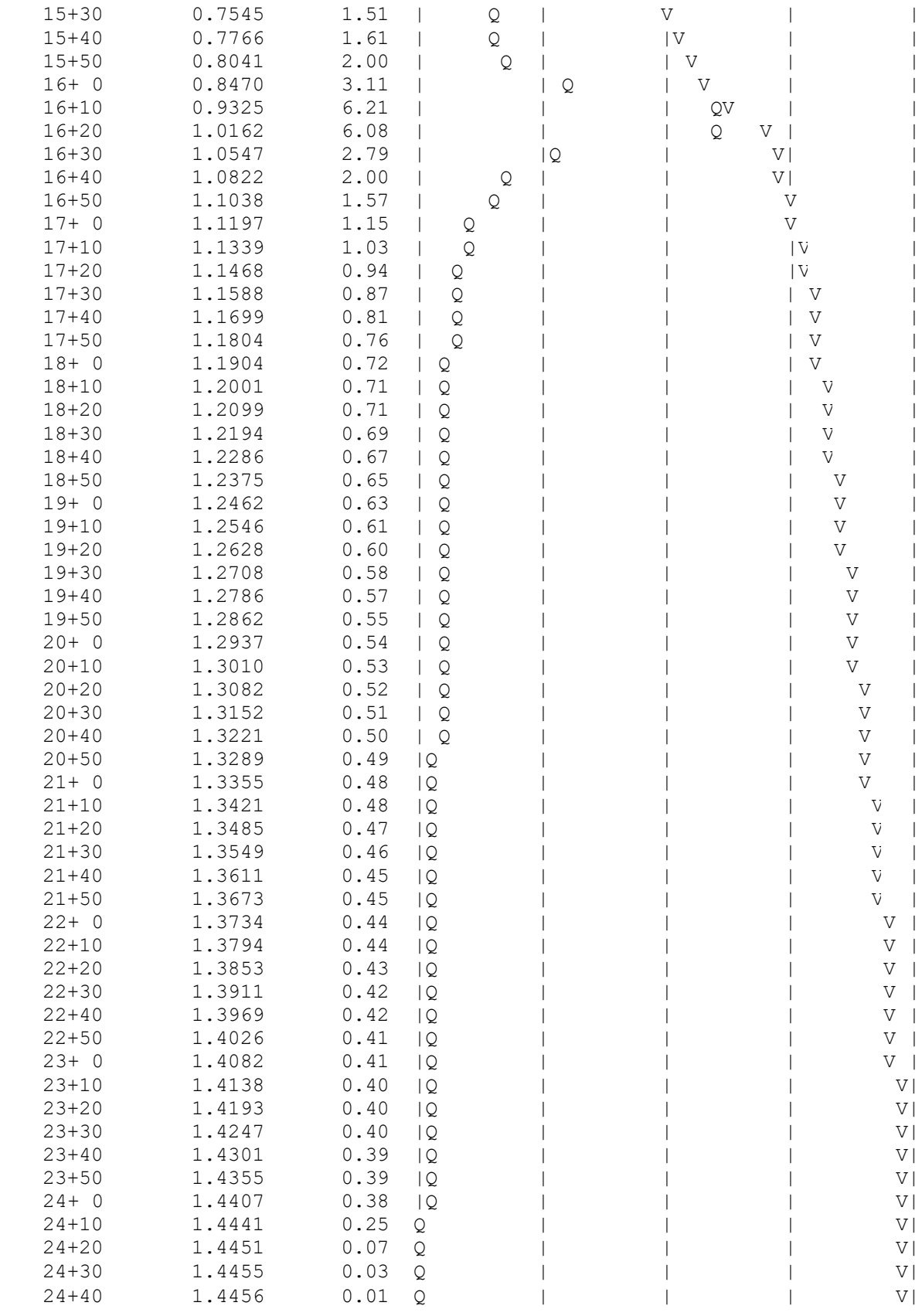
 6+ 0       0.2012      0.47  |Q   V    |          |          |          |
 6+10       0.2077      0.47  |Q   V    |          |          |          |
 6+20       0.2142      0.47  |Q   V    |          |          |          |
 6+30       0.2207      0.48  |Q    V   |          |          |          |
 6+40       0.2273      0.48  |Q    V   |          |          |          |
 6+50       0.2340      0.48  |Q    V   |          |          |          |
 7+ 0       0.2407      0.49  |Q    V   |          |          |          |
 7+10       0.2475      0.49  |Q    V   |          |          |          |
 7+20       0.2544      0.50  |Q     V  |          |          |          |
 7+30       0.2613      0.50  | Q    V  |          |          |          |
 7+40       0.2683      0.51  | Q    V  |          |          |          |
 7+50       0.2753      0.51  | Q    V  |          |          |          |
 8+ 0       0.2824      0.52  | Q    V  |          |          |          |
 8+10       0.2896      0.52  | Q     V |          |          |          |
 8+20       0.2968      0.53  | Q     V |          |          |          |
 8+30       0.3042      0.53  | Q     V |          |          |          |
 8+40       0.3115      0.54  | Q     V |          |          |          |
 8+50       0.3190      0.54  | Q     V |          |          |          |
 9+ 0       0.3266      0.55  | Q      V|          |          |          |
 9+10       0.3342      0.55  | Q      V|          |          |          |
 9+20       0.3420      0.56  | Q      V|          |          |          |
 9+30       0.3498      0.57  | Q      V|          |          |          |
 9+40       0.3577      0.57  | Q      V|          |          |          |
 9+50       0.3657      0.58  | Q       V          |          |          |
10+ 0       0.3738      0.59  | Q       V          |          |          |
10+10       0.3820      0.60  | Q       V          |          |          |
10+20       0.3903      0.60  | Q       V          |          |          |
10+30       0.3988      0.61  | Q        V         |          |          |
10+40       0.4073      0.62  | Q        |V         |          |          |
10+50       0.4160      0.63  | Q        |V         |          |          |
11+ 0       0.4248      0.64  | Q        |V         |          |          |
11+10       0.4338      0.65  | Q        | V        |          |          |
11+20       0.4429      0.66  | Q        | V        |          |          |
11+30       0.4521      0.67  | Q        | V        |          |          |
11+40       0.4615      0.68  | Q        | V        |          |          |
11+50       0.4711      0.69  | Q        |  V       |          |          |
12+ 0       0.4808      0.71  | Q        |  V       |          |          |
12+10       0.4905      0.70  | Q        |  V       |          |          |
12+20       0.4999      0.68  | Q        |  V       |          |          |
12+30       0.5095      0.69  | Q        |   V      |          |          |
12+40       0.5192      0.71  | Q        |   V      |          |          |
12+50       0.5292      0.72  | Q        |   V      |          |          |
13+ 0       0.5394      0.74  | Q        |   V      |          |          |
13+10       0.5499      0.76  |  Q       |    V     |          |          |
13+20       0.5607      0.79  |  Q       |    V     |          |          |
13+30       0.5719      0.81  |  Q       |    V     |          |          |
13+40       0.5834      0.84  |  Q       |     V    |          |          |
13+50       0.5953      0.87  |  Q       |     V    |          |          |
14+ 0       0.6077      0.90  |  Q       |     V    |          |          |
14+10       0.6206      0.94  |  Q       |      V   |          |          |
14+20       0.6341      0.98  |  Q       |      V   |          |          |
14+30       0.6482      1.03  |   Q      |      V   |          |          |
14+40       0.6631      1.08  |   Q      |       V  |          |          |
14+50       0.6789      1.15  |   Q      |       V  |          |          |
15+ 0       0.6957      1.22  |   Q      |        V|          |          |
15+10       0.7139      1.32  |    Q     |        V|          |          |
15+20       0.7337      1.44  |    Q     |         V          |          |
```


15+30 0.7545 1.51
15+40 0.7766 1.61
15+50 0.8041 2.00
16+ 0 0.8470 3.11
16+10 0.9325 6.21
16+20 1.0162 6.08
16+30 1.0547 2.79
16+40 1.0822 2.00
16+50 1.1038 1.57
17+ 0 1.1197 1.15
17+10 1.1339 1.03
17+20 1.1468 0.94
17+30 1.1588 0.87
17+40 1.1699 0.81
17+50 1.1804 0.76
18+ 0 1.1904 0.72
18+10 1.2001 0.71
18+20 1.2099 0.71
18+30 1.2194 0.69
18+40 1.2286 0.67
18+50 1.2375 0.65
19+ 0 1.2462 0.63
19+10 1.2546 0.61
19+20 1.2628 0.60
19+30 1.2708 0.58
19+40 1.2786 0.57
19+50 1.2862 0.55
20+ 0 1.2937 0.54
20+10 1.3010 0.53
20+20 1.3082 0.52
20+30 1.3152 0.51
20+40 1.3221 0.50
20+50 1.3289 0.49
21+ 0 1.3355 0.48
21+10 1.3421 0.48
21+20 1.3485 0.47
21+30 1.3549 0.46
21+40 1.3611 0.45
21+50 1.3673 0.45
22+ 0 1.3734 0.44
22+10 1.3794 0.44
22+20 1.3853 0.43
22+30 1.3911 0.42
22+40 1.3969 0.42
22+50 1.4026 0.41
23+ 0 1.4082 0.41
23+10 1.4138 0.40
23+20 1.4193 0.40
23+30 1.4247 0.40
23+40 1.4301 0.39
23+50 1.4355 0.39
24+ 0 1.4407 0.38
24+10 1.4441 0.25
24+20 1.4451 0.07
24+30 1.4455 0.03
24+40 1.4456 0.01

25+10	1.1974	0.01	Q	|	|	|	V|
25+15	1.1975	0.01	Q	|	|	|	V|
25+20	1.1975	0.01	Q	|	|	|	V|
25+25	1.1976	0.01	Q	|	|	|	V|
25+30	1.1976	0.01	Q	|	|	|	V|
25+35	1.1977	0.00	Q	|	|	|	V|
25+40	1.1977	0.00	Q	|	|	|	V|
25+45	1.1977	0.00	Q	|	|	|	V|
25+50	1.1977	0.00	Q	|	|	|	V

Storage Capacity
Hesperia Area "A" Basin
6/26/2023

Elevation	Basin Depth	Contour Interval	Area (Sq. Ft.)	Mean Area (Sq. Ft.)	Mean volume (Acres.Ft.)	Total Volume (Ac. Ft.)
3,622.00	-		3,532.00			
		1.00		3,532.00	0.03	
3,623.00	1.00		3,532.00		-	0.03
		1.00		3,532.00	0.03	
3,624.00	2.00		3,532.00		-	0.05
		1.00		3,532.00	0.02	
3,625.00	3.00		3,532.00		-	0.07
		1.00		3,532.00	0.02	
3,626.00	4.00		3,532.00		-	0.09
		1.00		3,532.00	0.02	
3,627.00	5.00		3,532.00		-	0.11
		0.50		3,737.59	0.04	
3,627.50	5.50		3,943.18		-	0.16
		0.50		4,157.17	0.05	
3,628.00	6.00		4,371.16		-	0.20
		0.50		4,593.66	0.05	
3,628.50	6.50		4,816.15		-	0.26
		0.50		5,047.12	0.06	
3,629.00	7.00		5,278.08			0.32
		1.00		5,765.36	0.13	
3,630.00	8.00		6,252.64			0.45
		1.00		6,773.63	0.16	
3,631.00	9.00		7,294.61		-	0.60
		1.00		7,849.22	0.18	
3,632.00	10.00	-	8,403.83			0.78
		1.00		8,992.01	0.21	
3,633.00	11.00	-	9,580.18			0.99

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DEPTH vs OUTFLOW CALCULATIONS

DARA "Area A" Depth vs Outflow Calculation

	Holes	Holes	Holes	Holes	Holes	Holes	Holes	Holes	Slots	Slots	Weir	
No. of Holes & Slots →	1	1	1	3	3	3	0	0	0	0	1	← No. of Weir
	Hole C	Hole C	Hole C	Hole C	Hole C	Hole C	Hole C	Hole C	Slot C	Slot C	Weir C	
Discharge Coefficient →	0.66	0.66	0.66	0.66	0.66	0.66	0.66	0.66	0.66		3.33	← Weir Coefficient
	Hole FL	Hole FL	Hole FL	Hole FL	Hole FL	Hole FL	Hole FL	Hole FL	Slot FL	Slot FL	Dist to Weir	
Distance of Holes to Basin Bottom (in) →	84	106	119	72	76	80	0	0	0	0	102	← Distance of Top of Weir to Basin Bottom (in)
	Hole R	Hole R	Hole R	Hole R	Hole R	Hole R	Hole R	Hole R	Area	Area	eir Length (	
Hole Radius (in) Slots Area (sq ft) →	3	3	3	0	0	0	0	0	0	0	24	← Riser Perimeter (ft) = 2(6)+2(6)
	Cen Elev	Cen Elev	Cen Elev	Cen Elev	Cen Elev	Cen Elev	Cen Elev	Cen Elev	Cen Ele	Cen Elev	Weir Elev	
Hole Centerline Elev (ft) →	3629.25	3631.08	3632.17	3628.00	3628.33	3628.67	3622.00	3622.00			3630.50	← Top of Riser Elevation (ft)

Elevation	Depth	asin Volum	Outflow											
3622.00	0	0	0.00											
3623.00	1.00	0.030	0.00	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
3624.00	2.00	0.050	0.00	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
3625.00	3.00	0.070	0.00	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
3626.00	4.00	0.090	0.00	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
3627.00	5.00	0.110	0.00	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
3627.50	5.50	0.160	0.00	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
3628.00	6.00	0.200	0.00	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
3628.50	6.50	0.260	0.00	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
3629.00	7.00	0.320	0.00	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
3630.00	8.00	0.450	0.90	0.9002	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
3631.00	9.00	0.600	29.63	1.3750	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	28.2560
3632.00	10.00	0.780	149.54	1.7237	0.9952	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	146.8224
3633.00	11.00	0.990	320.31	2.0129	1.4390	0.9489	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	315.9115

[Σ Flows (Holes + Weir)] (Outflow through Holes) (Outflow through Slots)

Note:

1. Orifice outflow is based on:
   $Q=CA(2gH)^{0.5}$
   where:
   C = Coefficient, 0.66 used here
   A = Orifice Area
   H = Headwater, Elevation of Water to Cen. of Orifice
2. Slot outflow is based on:
   $Q=CA(2gH)^{0.5}$
   where:
   C = Coefficient, 0.66 used here
   A = Slot Area (sq.ft.)
   H = Headwater, Elevation of Water to Cen. of Slot
3. Weir flow is based on:
   $Q=CLH^{1.5}$
   where:
   C = Coefficient, 3.33 used here
   L = Weir Length, Riser Pipe Perimeter was used here
   H = Headwater, Elevation of Water to Top of Weir

FLOOD HYDROGRAPH ROUTING PROGRAM

Study date: 06/26/23

100-Year 24 Hour Routing Condition

Program License Serial Number 6472

********** HYDROGRAPH INFORMATION **********

From study/file name: areac100.rte
**********HYDROGRAPH DATA**********
Number of intervals = 148
Time interval = 10.0 (Min.)
Maximum/Peak flow rate = 6.207 (CFS)
Total volume = 1.446 (Ac.Ft)
Status of hydrographs being held in storage

	Stream 1	Stream 2	Stream 3	Stream 4	Stream 5
Peak (CFS)	0.000	0.000	0.000	0.000	0.000
Vol (Ac.Ft)	0.000	0.000	0.000	0.000	0.000

****

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Process from Point/Station 6.000 to Point/Station 6.000
**** RETARDING BASIN ROUTING ****

User entry of depth-outflow-storage data

Total number of inflow hydrograph intervals = 148
Hydrograph time unit = 10.000 (Min.)
Initial depth in storage basin = 0.00(Ft.)

Initial basin depth = 0.00 (Ft.)
Initial basin storage = 0.00 (Ac.Ft)
Initial basin outflow = 0.00 (CFS)

Depth vs. Storage and Depth vs. Discharge data:

Basin Depth (Ft.)	Storage (Ac.Ft)	Outflow (CFS)	(S-O*dt/2) (Ac.Ft)	(S+O*dt/2) (Ac.Ft)
0.000	0.000	0.000	0.000	0.000
1.000	0.030	0.001	0.030	0.030
2.000	0.050	0.001	0.050	0.050
3.000	0.070	0.001	0.070	0.070
4.000	0.090	0.001	0.090	0.090

5.000	0.110	0.001	0.110	0.110
5.500	0.160	0.001	0.160	0.160
6.000	0.200	0.001	0.200	0.200
6.500	0.260	0.001	0.260	0.260
7.000	0.320	0.010	0.320	0.320
8.000	0.450	0.900	0.444	0.456
9.000	0.600	29.630	0.396	0.804
10.000	0.780	149.540	-0.250	1.810
11.000	0.990	320.310	-1.216	3.196

Hydrograph Detention Basin Routing

Graph values: 'I'= unit inflow; 'O'=outflow at time shown

Time (Hours)	Inflow (CFS)	Outflow (CFS)	Storage (Ac.Ft)	.0	1.6	3.10	4.66	6.21	Depth (Ft.)
0.167	0.13	0.00	0.001	O	|	|	|	|	0.03
0.333	0.31	0.00	0.004	OI	|	|	|	|	0.13
0.500	0.35	0.00	0.009	OI	|	|	|	|	0.28
0.667	0.37	0.00	0.013	OI	|	|	|	|	0.45
0.833	0.38	0.00	0.019	OI	|	|	|	|	0.62
1.000	0.38	0.00	0.024	OI	|	|	|	|	0.80
1.167	0.39	0.00	0.029	OI	|	|	|	|	0.97
1.333	0.39	0.00	0.035	O I	|	|	|	|	1.23
1.500	0.39	0.00	0.040	O I	|	|	|	|	1.50
1.667	0.39	0.00	0.045	O I	|	|	|	|	1.77
1.833	0.40	0.00	0.051	O I	|	|	|	|	2.04
2.000	0.40	0.00	0.056	O I	|	|	|	|	2.31
2.167	0.40	0.00	0.062	O I	|	|	|	|	2.58
2.333	0.40	0.00	0.067	O I	|	|	|	|	2.86
2.500	0.40	0.00	0.073	O I	|	|	|	|	3.14
2.667	0.41	0.00	0.078	O I	|	|	|	|	3.41
2.833	0.41	0.00	0.084	O I	|	|	|	|	3.69
3.000	0.41	0.00	0.090	O I	|	|	|	|	3.98
3.167	0.41	0.00	0.095	O I	|	|	|	|	4.26
3.333	0.42	0.00	0.101	O I	|	|	|	|	4.55
3.500	0.42	0.00	0.107	O I	|	|	|	|	4.83
3.667	0.42	0.00	0.112	O I	|	|	|	|	5.02
3.833	0.42	0.00	0.118	O I	|	|	|	|	5.08
4.000	0.43	0.00	0.124	O I	|	|	|	|	5.14
4.167	0.43	0.00	0.130	O I	|	|	|	|	5.20
4.333	0.43	0.00	0.136	O I	|	|	|	|	5.26
4.500	0.44	0.00	0.142	O I	|	|	|	|	5.32
4.667	0.44	0.00	0.148	O I	|	|	|	|	5.38
4.833	0.44	0.00	0.154	O I	|	|	|	|	5.44
5.000	0.45	0.00	0.160	O I	|	|	|	|	5.50
5.167	0.45	0.00	0.166	O I	|	|	|	|	5.58
5.333	0.45	0.00	0.172	O I	|	|	|	|	5.65
5.500	0.45	0.00	0.179	O I	|	|	|	|	5.73
5.667	0.46	0.00	0.185	O I	|	|	|	|	5.81
5.833	0.46	0.00	0.191	O I	|	|	|	|	5.89
6.000	0.47	0.00	0.198	O I	|	|	|	|	5.97
6.167	0.47	0.00	0.204	O I	|	|	|	|	6.03
6.333	0.47	0.00	0.210	O I	|	|	|	|	6.09
6.500	0.48	0.00	0.217	O I	|	|	|	|	6.14
6.667	0.48	0.00	0.224	O I	|	|	|	|	6.20

6.833	0.48	0.00	0.230	O I	|	|	|	6.25
7.000	0.49	0.00	0.237	O I	|	|	|	6.31
7.167	0.49	0.00	0.244	O I	|	|	|	6.36
7.333	0.50	0.00	0.250	O I	|	|	|	6.42
7.500	0.50	0.00	0.257	O I	|	|	|	6.48
7.667	0.51	0.00	0.264	O I	|	|	|	6.53
7.833	0.51	0.00	0.271	O I	|	|	|	6.59
8.000	0.52	0.00	0.278	O I	|	|	|	6.65
8.167	0.52	0.00	0.285	O I	|	|	|	6.71
8.333	0.53	0.01	0.292	O I	|	|	|	6.77
8.500	0.53	0.01	0.300	O I	|	|	|	6.83
8.667	0.54	0.01	0.307	O I	|	|	|	6.89
8.833	0.54	0.01	0.314	O I	|	|	|	6.95
9.000	0.55	0.02	0.322	O I	|	|	|	7.01
9.167	0.55	0.07	0.328	O I	|	|	|	7.07
9.333	0.56	0.11	0.335	O I	|	|	|	7.11
9.500	0.57	0.15	0.341	O I	|	|	|	7.16
9.667	0.57	0.19	0.346	O I	|	|	|	7.20
9.833	0.58	0.23	0.351	|OI	|	|	|	7.24
10.000	0.59	0.26	0.356	|O I	|	|	|	7.28
10.167	0.60	0.29	0.361	|O I	|	|	|	7.31
10.333	0.60	0.32	0.365	|O I	|	|	|	7.34
10.500	0.61	0.34	0.369	|O I	|	|	|	7.37
10.667	0.62	0.37	0.372	|O I	|	|	|	7.40
10.833	0.63	0.39	0.376	| OI	|	|	|	7.43
11.000	0.64	0.41	0.379	| OI	|	|	|	7.45
11.167	0.65	0.43	0.382	| OI	|	|	|	7.48
11.333	0.66	0.45	0.385	| OI	|	|	|	7.50
11.500	0.67	0.47	0.388	| OI	|	|	|	7.52
11.667	0.68	0.49	0.390	| OI	|	|	|	7.54
11.833	0.69	0.51	0.393	| OI	|	|	|	7.56
12.000	0.71	0.53	0.395	| OI	|	|	|	7.58
12.167	0.70	0.54	0.398	| OI	|	|	|	7.60
12.333	0.68	0.56	0.400	| OI	|	|	|	7.61
12.500	0.69	0.57	0.401	| OI	|	|	|	7.63
12.667	0.71	0.58	0.403	| OI	|	|	|	7.64
12.833	0.72	0.59	0.405	| O	|	|	|	7.65
13.000	0.74	0.60	0.407	| O	|	|	|	7.67
13.167	0.76	0.62	0.409	| O	|	|	|	7.68
13.333	0.79	0.63	0.411	| OI	|	|	|	7.70
13.500	0.81	0.65	0.413	| OI	|	|	|	7.72
13.667	0.84	0.66	0.415	| OI	|	|	|	7.73
13.833	0.87	0.68	0.418	| OI	|	|	|	7.75
14.000	0.90	0.70	0.420	| OI	|	|	|	7.77
14.167	0.94	0.72	0.423	| OI	|	|	|	7.80
14.333	0.98	0.74	0.427	| O I	|	|	|	7.82
14.500	1.03	0.76	0.430	| O I	|	|	|	7.85
14.667	1.08	0.79	0.434	| OI	|	|	|	7.88
14.833	1.15	0.82	0.438	| OI	|	|	|	7.91
15.000	1.22	0.85	0.443	| O I	|	|	|	7.95
15.167	1.32	0.89	0.448	| O I	|	|	|	7.99
15.333	1.44	1.32	0.452	| OI|	|	|	|	8.01
15.500	1.51	1.49	0.453	| O|	|	|	|	8.02
15.667	1.61	1.57	0.453	| O	|	|	|	8.02
15.833	2.00	1.84	0.455	| |OI	|	|	|	8.03
16.000	3.11	2.65	0.459	| | O I	|	|	|	8.06
16.167	6.21	4.93	0.471	| | |	|O	I		8.14

16.333	6.08	6.31	0.478					IO	8.19
16.500	2.79	4.18	0.467			I	O		8.11
16.667	2.00	2.15	0.457		IO				8.04
16.833	1.57	1.73	0.454		O				8.03
17.000	1.15	1.31	0.452	IO					8.01
17.167	1.03	1.06	0.451	O					8.01
17.333	0.94	0.97	0.450	IO					8.00
17.500	0.87	0.90	0.450	O					8.00
17.667	0.81	0.89	0.449	O					7.99
17.833	0.76	0.88	0.448	IO					7.98
18.000	0.72	0.87	0.446	IO					7.97
18.167	0.71	0.86	0.444	IO					7.95
18.333	0.71	0.84	0.442	IO					7.94
18.500	0.69	0.83	0.440	IO					7.92
18.667	0.67	0.82	0.438	IO					7.91
18.833	0.65	0.80	0.436	IO					7.89
19.000	0.63	0.79	0.434	IO					7.87
19.167	0.61	0.77	0.431	O					7.86
19.333	0.60	0.76	0.429	O					7.84
19.500	0.58	0.74	0.427	IO					7.82
19.667	0.57	0.73	0.425	IO					7.81
19.833	0.55	0.71	0.423	IO					7.79
20.000	0.54	0.70	0.420	IO					7.77
20.167	0.53	0.68	0.418	IO					7.76
20.333	0.52	0.67	0.416	IO					7.74
20.500	0.51	0.65	0.414	IO					7.72
20.667	0.50	0.64	0.412	IO					7.71
20.833	0.49	0.63	0.410	IO					7.69
21.000	0.48	0.62	0.408	IO					7.68
21.167	0.48	0.60	0.407	IO					7.67
21.333	0.47	0.59	0.405	IO					7.65
21.500	0.46	0.58	0.403	O					7.64
21.667	0.45	0.57	0.402	O					7.63
21.833	0.45	0.56	0.400	O					7.62
22.000	0.44	0.55	0.399	O					7.60
22.167	0.44	0.54	0.397	O					7.59
22.333	0.43	0.53	0.396	O					7.58
22.500	0.42	0.52	0.394	O					7.57
22.667	0.42	0.51	0.393	O					7.56
22.833	0.41	0.50	0.392	O					7.55
23.000	0.41	0.49	0.391	O					7.54
23.167	0.40	0.49	0.390	O					7.54
23.333	0.40	0.48	0.388	O					7.53
23.500	0.40	0.47	0.387	O					7.52
23.667	0.39	0.46	0.386	O					7.51
23.833	0.39	0.46	0.385	IO					7.50
24.000	0.38	0.45	0.384	IO					7.50
24.167	0.25	0.44	0.383	IO					7.48
24.333	0.07	0.41	0.379	I O					7.45
24.500	0.03	0.38	0.374	IO					7.42
24.667	0.01	0.35	0.369	IO					7.38
24.833	0.00	0.32	0.365	IO					7.35
25.000	0.00	0.29	0.361	IO					7.31
25.167	0.00	0.26	0.357	IO					7.28
25.333	0.00	0.24	0.353	IO					7.26
25.500	0.00	0.22	0.350	IO					7.23
25.667	0.00	0.20	0.347	IO					7.21

25.833	0.00	0.18	0.345	O				7.19
26.000	0.00	0.16	0.342	O				7.17
26.167	0.00	0.15	0.340	O				7.16
26.333	0.00	0.14	0.338	O				7.14
26.500	0.00	0.12	0.337	O				7.13
26.667	0.00	0.11	0.335	O				7.11
26.833	0.00	0.10	0.333	O				7.10
27.000	0.00	0.09	0.332	O				7.09
27.167	0.00	0.08	0.331	O				7.08
27.333	0.00	0.08	0.330	O				7.08
27.500	0.00	0.07	0.329	O				7.07
27.667	0.00	0.06	0.328	O				7.06
27.833	0.00	0.06	0.327	O				7.05
28.000	0.00	0.05	0.326	O				7.05
28.167	0.00	0.05	0.326	O				7.04
28.333	0.00	0.04	0.325	O				7.04
28.500	0.00	0.04	0.324	O				7.03
28.667	0.00	0.04	0.324	O				7.03
28.833	0.00	0.03	0.323	O				7.03
29.000	0.00	0.03	0.323	O				7.02
29.167	0.00	0.03	0.323	O				7.02
29.333	0.00	0.02	0.322	O				7.02
29.500	0.00	0.02	0.322	O				7.01
29.667	0.00	0.02	0.322	O				7.01
29.833	0.00	0.02	0.321	O				7.01
30.000	0.00	0.02	0.321	O				7.01
30.167	0.00	0.02	0.321	O				7.01
30.333	0.00	0.01	0.321	O				7.00
30.500	0.00	0.01	0.320	O				7.00
30.667	0.00	0.01	0.320	O				7.00
30.833	0.00	0.01	0.320	O				7.00
31.000	0.00	0.01	0.320	O				7.00
31.167	0.00	0.01	0.320	O				7.00
31.333	0.00	0.01	0.320	O				7.00
31.500	0.00	0.01	0.320	O				7.00
31.667	0.00	0.01	0.319	O				6.99
31.833	0.00	0.01	0.319	O				6.99
32.000	0.00	0.01	0.319	O				6.99
32.167	0.00	0.01	0.319	O				6.99
32.333	0.00	0.01	0.319	O				6.99
32.500	0.00	0.01	0.319	O				6.99
32.667	0.00	0.01	0.319	O				6.99
32.833	0.00	0.01	0.318	O				6.99
33.000	0.00	0.01	0.318	O				6.99
33.167	0.00	0.01	0.318	O				6.98
33.333	0.00	0.01	0.318	O				6.98
33.500	0.00	0.01	0.318	O				6.98
33.667	0.00	0.01	0.318	O				6.98
33.833	0.00	0.01	0.318	O				6.98
34.000	0.00	0.01	0.318	O				6.98
34.167	0.00	0.01	0.317	O				6.98
34.333	0.00	0.01	0.317	O				6.98
34.500	0.00	0.01	0.317	O				6.98
34.667	0.00	0.01	0.317	O				6.97
34.833	0.00	0.01	0.317	O				6.97
35.000	0.00	0.01	0.317	O				6.97
35.167	0.00	0.01	0.317	O				6.97

35.333	0.00	0.01	0.316	O	|	|	|	6.97
35.500	0.00	0.01	0.316	O	|	|	|	6.97
35.667	0.00	0.01	0.316	O	|	|	|	6.97
35.833	0.00	0.01	0.316	O	|	|	|	6.97
36.000	0.00	0.01	0.316	O	|	|	|	6.97
36.167	0.00	0.01	0.316	O	|	|	|	6.97
36.333	0.00	0.01	0.316	O	|	|	|	6.96
36.500	0.00	0.01	0.316	O	|	|	|	6.96
36.667	0.00	0.01	0.315	O	|	|	|	6.96
36.833	0.00	0.01	0.315	O	|	|	|	6.96
37.000	0.00	0.01	0.315	O	|	|	|	6.96
37.167	0.00	0.01	0.315	O	|	|	|	6.96
37.333	0.00	0.01	0.315	O	|	|	|	6.96
37.500	0.00	0.01	0.315	O	|	|	|	6.96
37.667	0.00	0.01	0.315	O	|	|	|	6.96
37.833	0.00	0.01	0.315	O	|	|	|	6.95
38.000	0.00	0.01	0.314	O	|	|	|	6.95
38.167	0.00	0.01	0.314	O	|	|	|	6.95
38.333	0.00	0.01	0.314	O	|	|	|	6.95
38.500	0.00	0.01	0.314	O	|	|	|	6.95
38.667	0.00	0.01	0.314	O	|	|	|	6.95
38.833	0.00	0.01	0.314	O	|	|	|	6.95
39.000	0.00	0.01	0.314	O	|	|	|	6.95
39.167	0.00	0.01	0.314	O	|	|	|	6.95
39.333	0.00	0.01	0.313	O	|	|	|	6.95
39.500	0.00	0.01	0.313	O	|	|	|	6.94
39.667	0.00	0.01	0.313	O	|	|	|	6.94
39.833	0.00	0.01	0.313	O	|	|	|	6.94
40.000	0.00	0.01	0.313	O	|	|	|	6.94
40.167	0.00	0.01	0.313	O	|	|	|	6.94
40.333	0.00	0.01	0.313	O	|	|	|	6.94
40.500	0.00	0.01	0.313	O	|	|	|	6.94
40.667	0.00	0.01	0.312	O	|	|	|	6.94
40.833	0.00	0.01	0.312	O	|	|	|	6.94
41.000	0.00	0.01	0.312	O	|	|	|	6.93
41.167	0.00	0.01	0.312	O	|	|	|	6.93
41.333	0.00	0.01	0.312	O	|	|	|	6.93
41.500	0.00	0.01	0.312	O	|	|	|	6.93
41.667	0.00	0.01	0.312	O	|	|	|	6.93
41.833	0.00	0.01	0.312	O	|	|	|	6.93
42.000	0.00	0.01	0.311	O	|	|	|	6.93
42.167	0.00	0.01	0.311	O	|	|	|	6.93
42.333	0.00	0.01	0.311	O	|	|	|	6.93
42.500	0.00	0.01	0.311	O	|	|	|	6.93
42.667	0.00	0.01	0.311	O	|	|	|	6.92
42.833	0.00	0.01	0.311	O	|	|	|	6.92
43.000	0.00	0.01	0.311	O	|	|	|	6.92
43.167	0.00	0.01	0.311	O	|	|	|	6.92
43.333	0.00	0.01	0.311	O	|	|	|	6.92
43.500	0.00	0.01	0.310	O	|	|	|	6.92
43.667	0.00	0.01	0.310	O	|	|	|	6.92
43.833	0.00	0.01	0.310	O	|	|	|	6.92
44.000	0.00	0.01	0.310	O	|	|	|	6.92
44.167	0.00	0.01	0.310	O	|	|	|	6.92
44.333	0.00	0.01	0.310	O	|	|	|	6.91
44.500	0.00	0.01	0.310	O	|	|	|	6.91
44.667	0.00	0.01	0.310	O	|	|	|	6.91

44.833	0.00	0.01	0.309	O	|	|	|	|	6.91
45.000	0.00	0.01	0.309	O	|	|	|	|	6.91
45.167	0.00	0.01	0.309	O	|	|	|	|	6.91
45.333	0.00	0.01	0.309	O	|	|	|	|	6.91
45.500	0.00	0.01	0.309	O	|	|	|	|	6.91
45.667	0.00	0.01	0.309	O	|	|	|	|	6.91
45.833	0.00	0.01	0.309	O	|	|	|	|	6.91
46.000	0.00	0.01	0.309	O	|	|	|	|	6.91
46.167	0.00	0.01	0.309	O	|	|	|	|	6.90
46.333	0.00	0.01	0.308	O	|	|	|	|	6.90
46.500	0.00	0.01	0.308	O	|	|	|	|	6.90
46.667	0.00	0.01	0.308	O	|	|	|	|	6.90
46.833	0.00	0.01	0.308	O	|	|	|	|	6.90
47.000	0.00	0.01	0.308	O	|	|	|	|	6.90
47.167	0.00	0.01	0.308	O	|	|	|	|	6.90
47.333	0.00	0.01	0.308	O	|	|	|	|	6.90
47.500	0.00	0.01	0.308	O	|	|	|	|	6.90
47.667	0.00	0.01	0.308	O	|	|	|	|	6.90
47.833	0.00	0.01	0.307	O	|	|	|	|	6.90
48.000	0.00	0.01	0.307	O	|	|	|	|	6.89
48.167	0.00	0.01	0.307	O	|	|	|	|	6.89
48.333	0.00	0.01	0.307	O	|	|	|	|	6.89
48.500	0.00	0.01	0.307	O	|	|	|	|	6.89
48.667	0.00	0.01	0.307	O	|	|	|	|	6.89
48.833	0.00	0.01	0.307	O	|	|	|	|	6.89
49.000	0.00	0.01	0.307	O	|	|	|	|	6.89
49.167	0.00	0.01	0.307	O	|	|	|	|	6.89
49.333	0.00	0.01	0.306	O	|	|	|	|	6.89
49.500	0.00	0.01	0.306	O	|	|	|	|	6.89
49.667	0.00	0.01	0.306	O	|	|	|	|	6.88
49.833	0.00	0.01	0.306	O	|	|	|	|	6.88
50.000	0.00	0.01	0.306	O	|	|	|	|	6.88
50.167	0.00	0.01	0.306	O	|	|	|	|	6.88
50.333	0.00	0.01	0.306	O	|	|	|	|	6.88
50.500	0.00	0.01	0.306	O	|	|	|	|	6.88
50.667	0.00	0.01	0.306	O	|	|	|	|	6.88
50.833	0.00	0.01	0.305	O	|	|	|	|	6.88
51.000	0.00	0.01	0.305	O	|	|	|	|	6.88
51.167	0.00	0.01	0.305	O	|	|	|	|	6.88
51.333	0.00	0.01	0.305	O	|	|	|	|	6.88
51.500	0.00	0.01	0.305	O	|	|	|	|	6.87
51.667	0.00	0.01	0.305	O	|	|	|	|	6.87
51.833	0.00	0.01	0.305	O	|	|	|	|	6.87
52.000	0.00	0.01	0.305	O	|	|	|	|	6.87
52.167	0.00	0.01	0.305	O	|	|	|	|	6.87
52.333	0.00	0.01	0.304	O	|	|	|	|	6.87
52.500	0.00	0.01	0.304	O	|	|	|	|	6.87
52.667	0.00	0.01	0.304	O	|	|	|	|	6.87
52.833	0.00	0.01	0.304	O	|	|	|	|	6.87
53.000	0.00	0.01	0.304	O	|	|	|	|	6.87
53.167	0.00	0.01	0.304	O	|	|	|	|	6.87
53.333	0.00	0.01	0.304	O	|	|	|	|	6.87
53.500	0.00	0.01	0.304	O	|	|	|	|	6.86
53.667	0.00	0.01	0.304	O	|	|	|	|	6.86
53.833	0.00	0.01	0.304	O	|	|	|	|	6.86
54.000	0.00	0.01	0.303	O	|	|	|	|	6.86
54.167	0.00	0.01	0.303	O	|	|	|	|	6.86

54.333	0.00	0.01	0.303	O	|	|	|	|	6.86
54.500	0.00	0.01	0.303	O	|	|	|	|	6.86
54.667	0.00	0.01	0.303	O	|	|	|	|	6.86
54.833	0.00	0.01	0.303	O	|	|	|	|	6.86
55.000	0.00	0.01	0.303	O	|	|	|	|	6.86
55.167	0.00	0.01	0.303	O	|	|	|	|	6.86
55.333	0.00	0.01	0.303	O	|	|	|	|	6.86
55.500	0.00	0.01	0.302	O	|	|	|	|	6.85
55.667	0.00	0.01	0.302	O	|	|	|	|	6.85
55.833	0.00	0.01	0.302	O	|	|	|	|	6.85
56.000	0.00	0.01	0.302	O	|	|	|	|	6.85
56.167	0.00	0.01	0.302	O	|	|	|	|	6.85
56.333	0.00	0.01	0.302	O	|	|	|	|	6.85
56.500	0.00	0.01	0.302	O	|	|	|	|	6.85
56.667	0.00	0.01	0.302	O	|	|	|	|	6.85
56.833	0.00	0.01	0.302	O	|	|	|	|	6.85
57.000	0.00	0.01	0.302	O	|	|	|	|	6.85
57.167	0.00	0.01	0.301	O	|	|	|	|	6.85
57.333	0.00	0.01	0.301	O	|	|	|	|	6.84
57.500	0.00	0.01	0.301	O	|	|	|	|	6.84
57.667	0.00	0.01	0.301	O	|	|	|	|	6.84
57.833	0.00	0.01	0.301	O	|	|	|	|	6.84
58.000	0.00	0.01	0.301	O	|	|	|	|	6.84
58.167	0.00	0.01	0.301	O	|	|	|	|	6.84
58.333	0.00	0.01	0.301	O	|	|	|	|	6.84
58.500	0.00	0.01	0.301	O	|	|	|	|	6.84
58.667	0.00	0.01	0.301	O	|	|	|	|	6.84
58.833	0.00	0.01	0.301	O	|	|	|	|	6.84
59.000	0.00	0.01	0.300	O	|	|	|	|	6.84
59.167	0.00	0.01	0.300	O	|	|	|	|	6.84
59.333	0.00	0.01	0.300	O	|	|	|	|	6.84
59.500	0.00	0.01	0.300	O	|	|	|	|	6.83
59.667	0.00	0.01	0.300	O	|	|	|	|	6.83
59.833	0.00	0.01	0.300	O	|	|	|	|	6.83
60.000	0.00	0.01	0.300	O	|	|	|	|	6.83
60.167	0.00	0.01	0.300	O	|	|	|	|	6.83
60.333	0.00	0.01	0.300	O	|	|	|	|	6.83
60.500	0.00	0.01	0.300	O	|	|	|	|	6.83
60.667	0.00	0.01	0.299	O	|	|	|	|	6.83
60.833	0.00	0.01	0.299	O	|	|	|	|	6.83
61.000	0.00	0.01	0.299	O	|	|	|	|	6.83
61.167	0.00	0.01	0.299	O	|	|	|	|	6.83
61.333	0.00	0.01	0.299	O	|	|	|	|	6.83
61.500	0.00	0.01	0.299	O	|	|	|	|	6.82
61.667	0.00	0.01	0.299	O	|	|	|	|	6.82
61.833	0.00	0.01	0.299	O	|	|	|	|	6.82
62.000	0.00	0.01	0.299	O	|	|	|	|	6.82
62.167	0.00	0.01	0.299	O	|	|	|	|	6.82
62.333	0.00	0.01	0.299	O	|	|	|	|	6.82
62.500	0.00	0.01	0.298	O	|	|	|	|	6.82
62.667	0.00	0.01	0.298	O	|	|	|	|	6.82
62.833	0.00	0.01	0.298	O	|	|	|	|	6.82
63.000	0.00	0.01	0.298	O	|	|	|	|	6.82
63.167	0.00	0.01	0.298	O	|	|	|	|	6.82
63.333	0.00	0.01	0.298	O	|	|	|	|	6.82
63.500	0.00	0.01	0.298	O	|	|	|	|	6.82
63.667	0.00	0.01	0.298	O	|	|	|	|	6.81

63.833	0.00	0.01	0.298	O	|	|	|	|	6.81
64.000	0.00	0.01	0.298	O	|	|	|	|	6.81
64.167	0.00	0.01	0.297	O	|	|	|	|	6.81
64.333	0.00	0.01	0.297	O	|	|	|	|	6.81
64.500	0.00	0.01	0.297	O	|	|	|	|	6.81
64.667	0.00	0.01	0.297	O	|	|	|	|	6.81
64.833	0.00	0.01	0.297	O	|	|	|	|	6.81
65.000	0.00	0.01	0.297	O	|	|	|	|	6.81
65.167	0.00	0.01	0.297	O	|	|	|	|	6.81
65.333	0.00	0.01	0.297	O	|	|	|	|	6.81
65.500	0.00	0.01	0.297	O	|	|	|	|	6.81
65.667	0.00	0.01	0.297	O	|	|	|	|	6.81
65.833	0.00	0.01	0.297	O	|	|	|	|	6.80
66.000	0.00	0.01	0.296	O	|	|	|	|	6.80
66.167	0.00	0.01	0.296	O	|	|	|	|	6.80
66.333	0.00	0.01	0.296	O	|	|	|	|	6.80
66.500	0.00	0.01	0.296	O	|	|	|	|	6.80
66.667	0.00	0.01	0.296	O	|	|	|	|	6.80
66.833	0.00	0.01	0.296	O	|	|	|	|	6.80
67.000	0.00	0.01	0.296	O	|	|	|	|	6.80
67.167	0.00	0.01	0.296	O	|	|	|	|	6.80
67.333	0.00	0.01	0.296	O	|	|	|	|	6.80
67.500	0.00	0.01	0.296	O	|	|	|	|	6.80
67.667	0.00	0.01	0.296	O	|	|	|	|	6.80
67.833	0.00	0.01	0.296	O	|	|	|	|	6.80
68.000	0.00	0.01	0.295	O	|	|	|	|	6.80
68.167	0.00	0.01	0.295	O	|	|	|	|	6.79
68.333	0.00	0.01	0.295	O	|	|	|	|	6.79
68.500	0.00	0.01	0.295	O	|	|	|	|	6.79
68.667	0.00	0.01	0.295	O	|	|	|	|	6.79
68.833	0.00	0.01	0.295	O	|	|	|	|	6.79
69.000	0.00	0.01	0.295	O	|	|	|	|	6.79
69.167	0.00	0.01	0.295	O	|	|	|	|	6.79
69.333	0.00	0.01	0.295	O	|	|	|	|	6.79
69.500	0.00	0.01	0.295	O	|	|	|	|	6.79
69.667	0.00	0.01	0.295	O	|	|	|	|	6.79
69.833	0.00	0.01	0.294	O	|	|	|	|	6.79
70.000	0.00	0.01	0.294	O	|	|	|	|	6.79
70.167	0.00	0.01	0.294	O	|	|	|	|	6.79
70.333	0.00	0.01	0.294	O	|	|	|	|	6.79
70.500	0.00	0.01	0.294	O	|	|	|	|	6.78
70.667	0.00	0.01	0.294	O	|	|	|	|	6.78
70.833	0.00	0.01	0.294	O	|	|	|	|	6.78
71.000	0.00	0.01	0.294	O	|	|	|	|	6.78
71.167	0.00	0.01	0.294	O	|	|	|	|	6.78
71.333	0.00	0.01	0.294	O	|	|	|	|	6.78
71.500	0.00	0.01	0.294	O	|	|	|	|	6.78
71.667	0.00	0.01	0.294	O	|	|	|	|	6.78
71.833	0.00	0.01	0.293	O	|	|	|	|	6.78
72.000	0.00	0.01	0.293	O	|	|	|	|	6.78
72.167	0.00	0.01	0.293	O	|	|	|	|	6.78
72.333	0.00	0.01	0.293	O	|	|	|	|	6.78
72.500	0.00	0.01	0.293	O	|	|	|	|	6.78
72.667	0.00	0.01	0.293	O	|	|	|	|	6.78
72.833	0.00	0.01	0.293	O	|	|	|	|	6.77
73.000	0.00	0.01	0.293	O	|	|	|	|	6.77
73.167	0.00	0.01	0.293	O	|	|	|	|	6.77

73.333	0.00	0.01	0.293	O	|	|	|	|	6.77
73.500	0.00	0.01	0.293	O	|	|	|	|	6.77
73.667	0.00	0.01	0.293	O	|	|	|	|	6.77
73.833	0.00	0.01	0.293	O	|	|	|	|	6.77
74.000	0.00	0.01	0.292	O	|	|	|	|	6.77
74.167	0.00	0.01	0.292	O	|	|	|	|	6.77
74.333	0.00	0.01	0.292	O	|	|	|	|	6.77
74.500	0.00	0.01	0.292	O	|	|	|	|	6.77
74.667	0.00	0.01	0.292	O	|	|	|	|	6.77
74.833	0.00	0.01	0.292	O	|	|	|	|	6.77
75.000	0.00	0.01	0.292	O	|	|	|	|	6.77
75.167	0.00	0.01	0.292	O	|	|	|	|	6.77
75.333	0.00	0.01	0.292	O	|	|	|	|	6.76
75.500	0.00	0.01	0.292	O	|	|	|	|	6.76
75.667	0.00	0.01	0.292	O	|	|	|	|	6.76
75.833	0.00	0.01	0.292	O	|	|	|	|	6.76
76.000	0.00	0.01	0.291	O	|	|	|	|	6.76
76.167	0.00	0.01	0.291	O	|	|	|	|	6.76
76.333	0.00	0.01	0.291	O	|	|	|	|	6.76
76.500	0.00	0.01	0.291	O	|	|	|	|	6.76
76.667	0.00	0.01	0.291	O	|	|	|	|	6.76
76.833	0.00	0.01	0.291	O	|	|	|	|	6.76
77.000	0.00	0.01	0.291	O	|	|	|	|	6.76
77.167	0.00	0.01	0.291	O	|	|	|	|	6.76
77.333	0.00	0.01	0.291	O	|	|	|	|	6.76
77.500	0.00	0.01	0.291	O	|	|	|	|	6.76
77.667	0.00	0.01	0.291	O	|	|	|	|	6.76
77.833	0.00	0.01	0.291	O	|	|	|	|	6.76
78.000	0.00	0.01	0.291	O	|	|	|	|	6.75
78.167	0.00	0.01	0.290	O	|	|	|	|	6.75
78.333	0.00	0.01	0.290	O	|	|	|	|	6.75
78.500	0.00	0.01	0.290	O	|	|	|	|	6.75
78.667	0.00	0.01	0.290	O	|	|	|	|	6.75
78.833	0.00	0.01	0.290	O	|	|	|	|	6.75
79.000	0.00	0.01	0.290	O	|	|	|	|	6.75
79.167	0.00	0.01	0.290	O	|	|	|	|	6.75
79.333	0.00	0.01	0.290	O	|	|	|	|	6.75
79.500	0.00	0.01	0.290	O	|	|	|	|	6.75
79.667	0.00	0.01	0.290	O	|	|	|	|	6.75
79.833	0.00	0.01	0.290	O	|	|	|	|	6.75
80.000	0.00	0.01	0.290	O	|	|	|	|	6.75
80.167	0.00	0.01	0.290	O	|	|	|	|	6.75
80.333	0.00	0.01	0.289	O	|	|	|	|	6.75
80.500	0.00	0.01	0.289	O	|	|	|	|	6.74
80.667	0.00	0.01	0.289	O	|	|	|	|	6.74
80.833	0.00	0.01	0.289	O	|	|	|	|	6.74
81.000	0.00	0.01	0.289	O	|	|	|	|	6.74
81.167	0.00	0.01	0.289	O	|	|	|	|	6.74
81.333	0.00	0.01	0.289	O	|	|	|	|	6.74
81.500	0.00	0.01	0.289	O	|	|	|	|	6.74
81.667	0.00	0.01	0.289	O	|	|	|	|	6.74
81.833	0.00	0.01	0.289	O	|	|	|	|	6.74
82.000	0.00	0.01	0.289	O	|	|	|	|	6.74
82.167	0.00	0.01	0.289	O	|	|	|	|	6.74
82.333	0.00	0.01	0.289	O	|	|	|	|	6.74
82.500	0.00	0.01	0.289	O	|	|	|	|	6.74
82.667	0.00	0.01	0.288	O	|	|	|	|	6.74

82.833	0.00	0.01	0.288	O	|	|	|	|	6.74
83.000	0.00	0.01	0.288	O	|	|	|	|	6.74
83.167	0.00	0.01	0.288	O	|	|	|	|	6.74
83.333	0.00	0.01	0.288	O	|	|	|	|	6.73
83.500	0.00	0.01	0.288	O	|	|	|	|	6.73
83.667	0.00	0.01	0.288	O	|	|	|	|	6.73
83.833	0.00	0.01	0.288	O	|	|	|	|	6.73
84.000	0.00	0.01	0.288	O	|	|	|	|	6.73
84.167	0.00	0.01	0.288	O	|	|	|	|	6.73
84.333	0.00	0.01	0.288	O	|	|	|	|	6.73
84.500	0.00	0.01	0.288	O	|	|	|	|	6.73
84.667	0.00	0.01	0.288	O	|	|	|	|	6.73
84.833	0.00	0.01	0.288	O	|	|	|	|	6.73
85.000	0.00	0.01	0.287	O	|	|	|	|	6.73
85.167	0.00	0.01	0.287	O	|	|	|	|	6.73
85.333	0.00	0.01	0.287	O	|	|	|	|	6.73
85.500	0.00	0.01	0.287	O	|	|	|	|	6.73
85.667	0.00	0.01	0.287	O	|	|	|	|	6.73
85.833	0.00	0.01	0.287	O	|	|	|	|	6.73
86.000	0.00	0.01	0.287	O	|	|	|	|	6.73
86.167	0.00	0.01	0.287	O	|	|	|	|	6.72
86.333	0.00	0.01	0.287	O	|	|	|	|	6.72
86.500	0.00	0.01	0.287	O	|	|	|	|	6.72
86.667	0.00	0.01	0.287	O	|	|	|	|	6.72
86.833	0.00	0.01	0.287	O	|	|	|	|	6.72
87.000	0.00	0.00	0.287	O	|	|	|	|	6.72
87.167	0.00	0.00	0.287	O	|	|	|	|	6.72
87.333	0.00	0.00	0.286	O	|	|	|	|	6.72
87.500	0.00	0.00	0.286	O	|	|	|	|	6.72
87.667	0.00	0.00	0.286	O	|	|	|	|	6.72
87.833	0.00	0.00	0.286	O	|	|	|	|	6.72
88.000	0.00	0.00	0.286	O	|	|	|	|	6.72
88.167	0.00	0.00	0.286	O	|	|	|	|	6.72
88.333	0.00	0.00	0.286	O	|	|	|	|	6.72
88.500	0.00	0.00	0.286	O	|	|	|	|	6.72
88.667	0.00	0.00	0.286	O	|	|	|	|	6.72
88.833	0.00	0.00	0.286	O	|	|	|	|	6.72
89.000	0.00	0.00	0.286	O	|	|	|	|	6.71
89.167	0.00	0.00	0.286	O	|	|	|	|	6.71
89.333	0.00	0.00	0.286	O	|	|	|	|	6.71
89.500	0.00	0.00	0.286	O	|	|	|	|	6.71
89.667	0.00	0.00	0.286	O	|	|	|	|	6.71
89.833	0.00	0.00	0.285	O	|	|	|	|	6.71
90.000	0.00	0.00	0.285	O	|	|	|	|	6.71
90.167	0.00	0.00	0.285	O	|	|	|	|	6.71
90.333	0.00	0.00	0.285	O	|	|	|	|	6.71
90.500	0.00	0.00	0.285	O	|	|	|	|	6.71
90.667	0.00	0.00	0.285	O	|	|	|	|	6.71
90.833	0.00	0.00	0.285	O	|	|	|	|	6.71
91.000	0.00	0.00	0.285	O	|	|	|	|	6.71
91.167	0.00	0.00	0.285	O	|	|	|	|	6.71
91.333	0.00	0.00	0.285	O	|	|	|	|	6.71
91.500	0.00	0.00	0.285	O	|	|	|	|	6.71
91.667	0.00	0.00	0.285	O	|	|	|	|	6.71
91.833	0.00	0.00	0.285	O	|	|	|	|	6.71
92.000	0.00	0.00	0.285	O	|	|	|	|	6.71
92.167	0.00	0.00	0.285	O	|	|	|	|	6.70

92.333	0.00	0.00	0.284	O				6.70
92.500	0.00	0.00	0.284	O				6.70
92.667	0.00	0.00	0.284	O				6.70
92.833	0.00	0.00	0.284	O				6.70
93.000	0.00	0.00	0.284	O				6.70
93.167	0.00	0.00	0.284	O				6.70
93.333	0.00	0.00	0.284	O				6.70
93.500	0.00	0.00	0.284	O				6.70
93.667	0.00	0.00	0.284	O				6.70
93.833	0.00	0.00	0.284	O				6.70
94.000	0.00	0.00	0.284	O				6.70
94.167	0.00	0.00	0.284	O				6.70
94.333	0.00	0.00	0.284	O				6.70
94.500	0.00	0.00	0.284	O				6.70
94.667	0.00	0.00	0.284	O				6.70
94.833	0.00	0.00	0.284	O				6.70
95.000	0.00	0.00	0.283	O				6.70
95.167	0.00	0.00	0.283	O				6.70
95.333	0.00	0.00	0.283	O				6.69
95.500	0.00	0.00	0.283	O				6.69
95.667	0.00	0.00	0.283	O				6.69
95.833	0.00	0.00	0.283	O				6.69
96.000	0.00	0.00	0.283	O				6.69
96.167	0.00	0.00	0.283	O				6.69
96.333	0.00	0.00	0.283	O				6.69
96.500	0.00	0.00	0.283	O				6.69
96.667	0.00	0.00	0.283	O				6.69
96.833	0.00	0.00	0.283	O				6.69
97.000	0.00	0.00	0.283	O				6.69
97.167	0.00	0.00	0.283	O				6.69
97.333	0.00	0.00	0.283	O				6.69
97.500	0.00	0.00	0.283	O				6.69
97.667	0.00	0.00	0.282	O				6.69
97.833	0.00	0.00	0.282	O				6.69
98.000	0.00	0.00	0.282	O				6.69
98.167	0.00	0.00	0.282	O				6.69
98.333	0.00	0.00	0.282	O				6.69
98.500	0.00	0.00	0.282	O				6.68
98.667	0.00	0.00	0.282	O				6.68
98.833	0.00	0.00	0.282	O				6.68
99.000	0.00	0.00	0.282	O				6.68
99.167	0.00	0.00	0.282	O				6.68
99.333	0.00	0.00	0.282	O				6.68
99.500	0.00	0.00	0.282	O				6.68
99.667	0.00	0.00	0.282	O				6.68
99.833	0.00	0.00	0.282	O				6.68
100.000	0.00	0.00	0.282	O				6.68
100.167	0.00	0.00	0.282	O				6.68
100.333	0.00	0.00	0.282	O				6.68
100.500	0.00	0.00	0.281	O				6.68
100.667	0.00	0.00	0.281	O				6.68
100.833	0.00	0.00	0.281	O				6.68
101.000	0.00	0.00	0.281	O				6.68
101.167	0.00	0.00	0.281	O				6.68
101.333	0.00	0.00	0.281	O				6.68
101.500	0.00	0.00	0.281	O				6.68
101.667	0.00	0.00	0.281	O				6.68

101.833	0.00	0.00	0.281	O	|	|	|	|	6.68
102.000	0.00	0.00	0.281	O	|	|	|	|	6.67
102.167	0.00	0.00	0.281	O	|	|	|	|	6.67
102.333	0.00	0.00	0.281	O	|	|	|	|	6.67
102.500	0.00	0.00	0.281	O	|	|	|	|	6.67
102.667	0.00	0.00	0.281	O	|	|	|	|	6.67
102.833	0.00	0.00	0.281	O	|	|	|	|	6.67
103.000	0.00	0.00	0.281	O	|	|	|	|	6.67
103.167	0.00	0.00	0.281	O	|	|	|	|	6.67
103.333	0.00	0.00	0.281	O	|	|	|	|	6.67
103.500	0.00	0.00	0.280	O	|	|	|	|	6.67
103.667	0.00	0.00	0.280	O	|	|	|	|	6.67
103.833	0.00	0.00	0.280	O	|	|	|	|	6.67
104.000	0.00	0.00	0.280	O	|	|	|	|	6.67
104.167	0.00	0.00	0.280	O	|	|	|	|	6.67
104.333	0.00	0.00	0.280	O	|	|	|	|	6.67
104.500	0.00	0.00	0.280	O	|	|	|	|	6.67
104.667	0.00	0.00	0.280	O	|	|	|	|	6.67
104.833	0.00	0.00	0.280	O	|	|	|	|	6.67
105.000	0.00	0.00	0.280	O	|	|	|	|	6.67
105.167	0.00	0.00	0.280	O	|	|	|	|	6.67
105.333	0.00	0.00	0.280	O	|	|	|	|	6.67
105.500	0.00	0.00	0.280	O	|	|	|	|	6.66
105.667	0.00	0.00	0.280	O	|	|	|	|	6.66
105.833	0.00	0.00	0.280	O	|	|	|	|	6.66
106.000	0.00	0.00	0.280	O	|	|	|	|	6.66
106.167	0.00	0.00	0.280	O	|	|	|	|	6.66
106.333	0.00	0.00	0.280	O	|	|	|	|	6.66
106.500	0.00	0.00	0.279	O	|	|	|	|	6.66
106.667	0.00	0.00	0.279	O	|	|	|	|	6.66
106.833	0.00	0.00	0.279	O	|	|	|	|	6.66
107.000	0.00	0.00	0.279	O	|	|	|	|	6.66
107.167	0.00	0.00	0.279	O	|	|	|	|	6.66
107.333	0.00	0.00	0.279	O	|	|	|	|	6.66
107.500	0.00	0.00	0.279	O	|	|	|	|	6.66
107.667	0.00	0.00	0.279	O	|	|	|	|	6.66
107.833	0.00	0.00	0.279	O	|	|	|	|	6.66
108.000	0.00	0.00	0.279	O	|	|	|	|	6.66
108.167	0.00	0.00	0.279	O	|	|	|	|	6.66
108.333	0.00	0.00	0.279	O	|	|	|	|	6.66
108.500	0.00	0.00	0.279	O	|	|	|	|	6.66
108.667	0.00	0.00	0.279	O	|	|	|	|	6.66
108.833	0.00	0.00	0.279	O	|	|	|	|	6.66
109.000	0.00	0.00	0.279	O	|	|	|	|	6.66
109.167	0.00	0.00	0.279	O	|	|	|	|	6.66
109.333	0.00	0.00	0.279	O	|	|	|	|	6.65
109.500	0.00	0.00	0.279	O	|	|	|	|	6.65
109.667	0.00	0.00	0.278	O	|	|	|	|	6.65
109.833	0.00	0.00	0.278	O	|	|	|	|	6.65
110.000	0.00	0.00	0.278	O	|	|	|	|	6.65
110.167	0.00	0.00	0.278	O	|	|	|	|	6.65
110.333	0.00	0.00	0.278	O	|	|	|	|	6.65
110.500	0.00	0.00	0.278	O	|	|	|	|	6.65
110.667	0.00	0.00	0.278	O	|	|	|	|	6.65
110.833	0.00	0.00	0.278	O	|	|	|	|	6.65
111.000	0.00	0.00	0.278	O	|	|	|	|	6.65
111.167	0.00	0.00	0.278	O	|	|	|	|	6.65

111.333	0.00	0.00	0.278	O	|	|	|	| 6.65
111.500	0.00	0.00	0.278	O	|	|	|	| 6.65
111.667	0.00	0.00	0.278	O	|	|	|	| 6.65
111.833	0.00	0.00	0.278	O	|	|	|	| 6.65
112.000	0.00	0.00	0.278	O	|	|	|	| 6.65
112.167	0.00	0.00	0.278	O	|	|	|	| 6.65
112.333	0.00	0.00	0.278	O	|	|	|	| 6.65
112.500	0.00	0.00	0.278	O	|	|	|	| 6.65
112.667	0.00	0.00	0.278	O	|	|	|	| 6.65
112.833	0.00	0.00	0.277	O	|	|	|	| 6.65
113.000	0.00	0.00	0.277	O	|	|	|	| 6.65
113.167	0.00	0.00	0.277	O	|	|	|	| 6.64
113.333	0.00	0.00	0.277	O	|	|	|	| 6.64
113.500	0.00	0.00	0.277	O	|	|	|	| 6.64
113.667	0.00	0.00	0.277	O	|	|	|	| 6.64
113.833	0.00	0.00	0.277	O	|	|	|	| 6.64
114.000	0.00	0.00	0.277	O	|	|	|	| 6.64
114.167	0.00	0.00	0.277	O	|	|	|	| 6.64
114.333	0.00	0.00	0.277	O	|	|	|	| 6.64
114.500	0.00	0.00	0.277	O	|	|	|	| 6.64
114.667	0.00	0.00	0.277	O	|	|	|	| 6.64
114.833	0.00	0.00	0.277	O	|	|	|	| 6.64
115.000	0.00	0.00	0.277	O	|	|	|	| 6.64
115.167	0.00	0.00	0.277	O	|	|	|	| 6.64
115.333	0.00	0.00	0.277	O	|	|	|	| 6.64
115.500	0.00	0.00	0.277	O	|	|	|	| 6.64
115.667	0.00	0.00	0.277	O	|	|	|	| 6.64
115.833	0.00	0.00	0.277	O	|	|	|	| 6.64
116.000	0.00	0.00	0.277	O	|	|	|	| 6.64
116.167	0.00	0.00	0.277	O	|	|	|	| 6.64
116.333	0.00	0.00	0.276	O	|	|	|	| 6.64
116.500	0.00	0.00	0.276	O	|	|	|	| 6.64
116.667	0.00	0.00	0.276	O	|	|	|	| 6.64
116.833	0.00	0.00	0.276	O	|	|	|	| 6.64
117.000	0.00	0.00	0.276	O	|	|	|	| 6.64
117.167	0.00	0.00	0.276	O	|	|	|	| 6.64
117.333	0.00	0.00	0.276	O	|	|	|	| 6.63
117.500	0.00	0.00	0.276	O	|	|	|	| 6.63
117.667	0.00	0.00	0.276	O	|	|	|	| 6.63
117.833	0.00	0.00	0.276	O	|	|	|	| 6.63
118.000	0.00	0.00	0.276	O	|	|	|	| 6.63
118.167	0.00	0.00	0.276	O	|	|	|	| 6.63
118.333	0.00	0.00	0.276	O	|	|	|	| 6.63
118.500	0.00	0.00	0.276	O	|	|	|	| 6.63
118.667	0.00	0.00	0.276	O	|	|	|	| 6.63
118.833	0.00	0.00	0.276	O	|	|	|	| 6.63
119.000	0.00	0.00	0.276	O	|	|	|	| 6.63
119.167	0.00	0.00	0.276	O	|	|	|	| 6.63
119.333	0.00	0.00	0.276	O	|	|	|	| 6.63
119.500	0.00	0.00	0.276	O	|	|	|	| 6.63
119.667	0.00	0.00	0.276	O	|	|	|	| 6.63
119.833	0.00	0.00	0.275	O	|	|	|	| 6.63
120.000	0.00	0.00	0.275	O	|	|	|	| 6.63
120.167	0.00	0.00	0.275	O	|	|	|	| 6.63
120.333	0.00	0.00	0.275	O	|	|	|	| 6.63
120.500	0.00	0.00	0.275	O	|	|	|	| 6.63
120.667	0.00	0.00	0.275	O	|	|	|	| 6.63

120.833	0.00	0.00	0.275	O	|	|	|	| 6.63
121.000	0.00	0.00	0.275	O	|	|	|	| 6.63
121.167	0.00	0.00	0.275	O	|	|	|	| 6.63
121.333	0.00	0.00	0.275	O	|	|	|	| 6.63
121.500	0.00	0.00	0.275	O	|	|	|	| 6.63
121.667	0.00	0.00	0.275	O	|	|	|	| 6.62
121.833	0.00	0.00	0.275	O	|	|	|	| 6.62
122.000	0.00	0.00	0.275	O	|	|	|	| 6.62
122.167	0.00	0.00	0.275	O	|	|	|	| 6.62
122.333	0.00	0.00	0.275	O	|	|	|	| 6.62
122.500	0.00	0.00	0.275	O	|	|	|	| 6.62
122.667	0.00	0.00	0.275	O	|	|	|	| 6.62
122.833	0.00	0.00	0.275	O	|	|	|	| 6.62
123.000	0.00	0.00	0.275	O	|	|	|	| 6.62
123.167	0.00	0.00	0.275	O	|	|	|	| 6.62
123.333	0.00	0.00	0.275	O	|	|	|	| 6.62
123.500	0.00	0.00	0.274	O	|	|	|	| 6.62
123.667	0.00	0.00	0.274	O	|	|	|	| 6.62
123.833	0.00	0.00	0.274	O	|	|	|	| 6.62
124.000	0.00	0.00	0.274	O	|	|	|	| 6.62
124.167	0.00	0.00	0.274	O	|	|	|	| 6.62
124.333	0.00	0.00	0.274	O	|	|	|	| 6.62
124.500	0.00	0.00	0.274	O	|	|	|	| 6.62
124.667	0.00	0.00	0.274	O	|	|	|	| 6.62
124.833	0.00	0.00	0.274	O	|	|	|	| 6.62
125.000	0.00	0.00	0.274	O	|	|	|	| 6.62
125.167	0.00	0.00	0.274	O	|	|	|	| 6.62
125.333	0.00	0.00	0.274	O	|	|	|	| 6.62
125.500	0.00	0.00	0.274	O	|	|	|	| 6.62
125.667	0.00	0.00	0.274	O	|	|	|	| 6.62
125.833	0.00	0.00	0.274	O	|	|	|	| 6.62
126.000	0.00	0.00	0.274	O	|	|	|	| 6.62
126.167	0.00	0.00	0.274	O	|	|	|	| 6.62
126.333	0.00	0.00	0.274	O	|	|	|	| 6.61
126.500	0.00	0.00	0.274	O	|	|	|	| 6.61
126.667	0.00	0.00	0.274	O	|	|	|	| 6.61
126.833	0.00	0.00	0.274	O	|	|	|	| 6.61
127.000	0.00	0.00	0.274	O	|	|	|	| 6.61
127.167	0.00	0.00	0.274	O	|	|	|	| 6.61
127.333	0.00	0.00	0.274	O	|	|	|	| 6.61
127.500	0.00	0.00	0.273	O	|	|	|	| 6.61
127.667	0.00	0.00	0.273	O	|	|	|	| 6.61
127.833	0.00	0.00	0.273	O	|	|	|	| 6.61
128.000	0.00	0.00	0.273	O	|	|	|	| 6.61
128.167	0.00	0.00	0.273	O	|	|	|	| 6.61
128.333	0.00	0.00	0.273	O	|	|	|	| 6.61
128.500	0.00	0.00	0.273	O	|	|	|	| 6.61
128.667	0.00	0.00	0.273	O	|	|	|	| 6.61
128.833	0.00	0.00	0.273	O	|	|	|	| 6.61
129.000	0.00	0.00	0.273	O	|	|	|	| 6.61
129.167	0.00	0.00	0.273	O	|	|	|	| 6.61
129.333	0.00	0.00	0.273	O	|	|	|	| 6.61
129.500	0.00	0.00	0.273	O	|	|	|	| 6.61
129.667	0.00	0.00	0.273	O	|	|	|	| 6.61
129.833	0.00	0.00	0.273	O	|	|	|	| 6.61
130.000	0.00	0.00	0.273	O	|	|	|	| 6.61
130.167	0.00	0.00	0.273	O	|	|	|	| 6.61

130.333	0.00	0.00	0.273	O				6.61
130.500	0.00	0.00	0.273	O				6.61
130.667	0.00	0.00	0.273	O				6.61
130.833	0.00	0.00	0.273	O				6.61
131.000	0.00	0.00	0.273	O				6.61
131.167	0.00	0.00	0.273	O				6.60
131.333	0.00	0.00	0.273	O				6.60
131.500	0.00	0.00	0.272	O				6.60
131.667	0.00	0.00	0.272	O				6.60
131.833	0.00	0.00	0.272	O				6.60
132.000	0.00	0.00	0.272	O				6.60
132.167	0.00	0.00	0.272	O				6.60
132.333	0.00	0.00	0.272	O				6.60
132.500	0.00	0.00	0.272	O				6.60
132.667	0.00	0.00	0.272	O				6.60
132.833	0.00	0.00	0.272	O				6.60
133.000	0.00	0.00	0.272	O				6.60
133.167	0.00	0.00	0.272	O				6.60
133.333	0.00	0.00	0.272	O				6.60
133.500	0.00	0.00	0.272	O				6.60
133.667	0.00	0.00	0.272	O				6.60
133.833	0.00	0.00	0.272	O				6.60
134.000	0.00	0.00	0.272	O				6.60
134.167	0.00	0.00	0.272	O				6.60
134.333	0.00	0.00	0.272	O				6.60
134.500	0.00	0.00	0.272	O				6.60
134.667	0.00	0.00	0.272	O				6.60
134.833	0.00	0.00	0.272	O				6.60
135.000	0.00	0.00	0.272	O				6.60
135.167	0.00	0.00	0.272	O				6.60
135.333	0.00	0.00	0.272	O				6.60
135.500	0.00	0.00	0.272	O				6.60
135.667	0.00	0.00	0.272	O				6.60
135.833	0.00	0.00	0.271	O				6.60
136.000	0.00	0.00	0.271	O				6.60
136.167	0.00	0.00	0.271	O				6.60
136.333	0.00	0.00	0.271	O				6.59
136.500	0.00	0.00	0.271	O				6.59
136.667	0.00	0.00	0.271	O				6.59
136.833	0.00	0.00	0.271	O				6.59
137.000	0.00	0.00	0.271	O				6.59
137.167	0.00	0.00	0.271	O				6.59
137.333	0.00	0.00	0.271	O				6.59
137.500	0.00	0.00	0.271	O				6.59
137.667	0.00	0.00	0.271	O				6.59
137.833	0.00	0.00	0.271	O				6.59
138.000	0.00	0.00	0.271	O				6.59
138.167	0.00	0.00	0.271	O				6.59
138.333	0.00	0.00	0.271	O				6.59
138.500	0.00	0.00	0.271	O				6.59
138.667	0.00	0.00	0.271	O				6.59
138.833	0.00	0.00	0.271	O				6.59
139.000	0.00	0.00	0.271	O				6.59
139.167	0.00	0.00	0.271	O				6.59
139.333	0.00	0.00	0.271	O				6.59
139.500	0.00	0.00	0.271	O				6.59
139.667	0.00	0.00	0.271	O				6.59

139.833	0.00	0.00	0.271	O	|	|	|	| 6.59
140.000	0.00	0.00	0.271	O	|	|	|	| 6.59
140.167	0.00	0.00	0.271	O	|	|	|	| 6.59
140.333	0.00	0.00	0.271	O	|	|	|	| 6.59
140.500	0.00	0.00	0.270	O	|	|	|	| 6.59
140.667	0.00	0.00	0.270	O	|	|	|	| 6.59
140.833	0.00	0.00	0.270	O	|	|	|	| 6.59
141.000	0.00	0.00	0.270	O	|	|	|	| 6.59
141.167	0.00	0.00	0.270	O	|	|	|	| 6.59
141.333	0.00	0.00	0.270	O	|	|	|	| 6.59
141.500	0.00	0.00	0.270	O	|	|	|	| 6.59
141.667	0.00	0.00	0.270	O	|	|	|	| 6.59
141.833	0.00	0.00	0.270	O	|	|	|	| 6.58
142.000	0.00	0.00	0.270	O	|	|	|	| 6.58
142.167	0.00	0.00	0.270	O	|	|	|	| 6.58
142.333	0.00	0.00	0.270	O	|	|	|	| 6.58
142.500	0.00	0.00	0.270	O	|	|	|	| 6.58
142.667	0.00	0.00	0.270	O	|	|	|	| 6.58
142.833	0.00	0.00	0.270	O	|	|	|	| 6.58
143.000	0.00	0.00	0.270	O	|	|	|	| 6.58
143.167	0.00	0.00	0.270	O	|	|	|	| 6.58
143.333	0.00	0.00	0.270	O	|	|	|	| 6.58
143.500	0.00	0.00	0.270	O	|	|	|	| 6.58
143.667	0.00	0.00	0.270	O	|	|	|	| 6.58
143.833	0.00	0.00	0.270	O	|	|	|	| 6.58
144.000	0.00	0.00	0.270	O	|	|	|	| 6.58
144.167	0.00	0.00	0.270	O	|	|	|	| 6.58
144.333	0.00	0.00	0.270	O	|	|	|	| 6.58
144.500	0.00	0.00	0.270	O	|	|	|	| 6.58
144.667	0.00	0.00	0.270	O	|	|	|	| 6.58
144.833	0.00	0.00	0.270	O	|	|	|	| 6.58
145.000	0.00	0.00	0.270	O	|	|	|	| 6.58
145.167	0.00	0.00	0.270	O	|	|	|	| 6.58
145.333	0.00	0.00	0.269	O	|	|	|	| 6.58
145.500	0.00	0.00	0.269	O	|	|	|	| 6.58
145.667	0.00	0.00	0.269	O	|	|	|	| 6.58
145.833	0.00	0.00	0.269	O	|	|	|	| 6.58
146.000	0.00	0.00	0.269	O	|	|	|	| 6.58
146.167	0.00	0.00	0.269	O	|	|	|	| 6.58
146.333	0.00	0.00	0.269	O	|	|	|	| 6.58
146.500	0.00	0.00	0.269	O	|	|	|	| 6.58
146.667	0.00	0.00	0.269	O	|	|	|	| 6.58
146.833	0.00	0.00	0.269	O	|	|	|	| 6.58
147.000	0.00	0.00	0.269	O	|	|	|	| 6.58
147.167	0.00	0.00	0.269	O	|	|	|	| 6.58
147.333	0.00	0.00	0.269	O	|	|	|	| 6.58
147.500	0.00	0.00	0.269	O	|	|	|	| 6.58
147.667	0.00	0.00	0.269	O	|	|	|	| 6.58
147.833	0.00	0.00	0.269	O	|	|	|	| 6.57
148.000	0.00	0.00	0.269	O	|	|	|	| 6.57
148.167	0.00	0.00	0.269	O	|	|	|	| 6.57
148.333	0.00	0.00	0.269	O	|	|	|	| 6.57
148.500	0.00	0.00	0.269	O	|	|	|	| 6.57
148.667	0.00	0.00	0.269	O	|	|	|	| 6.57
148.833	0.00	0.00	0.269	O	|	|	|	| 6.57
149.000	0.00	0.00	0.269	O	|	|	|	| 6.57
149.167	0.00	0.00	0.269	O	|	|	|	| 6.57

149.333	0.00	0.00	0.269	O	|	|	|	|	6.57
149.500	0.00	0.00	0.269	O	|	|	|	|	6.57
149.667	0.00	0.00	0.269	O	|	|	|	|	6.57
149.833	0.00	0.00	0.269	O	|	|	|	|	6.57
150.000	0.00	0.00	0.269	O	|	|	|	|	6.57
150.167	0.00	0.00	0.269	O	|	|	|	|	6.57
150.333	0.00	0.00	0.269	O	|	|	|	|	6.57
150.500	0.00	0.00	0.268	O	|	|	|	|	6.57
150.667	0.00	0.00	0.268	O	|	|	|	|	6.57
150.833	0.00	0.00	0.268	O	|	|	|	|	6.57
151.000	0.00	0.00	0.268	O	|	|	|	|	6.57
151.167	0.00	0.00	0.268	O	|	|	|	|	6.57
151.333	0.00	0.00	0.268	O	|	|	|	|	6.57
151.500	0.00	0.00	0.268	O	|	|	|	|	6.57
151.667	0.00	0.00	0.268	O	|	|	|	|	6.57
151.833	0.00	0.00	0.268	O	|	|	|	|	6.57
152.000	0.00	0.00	0.268	O	|	|	|	|	6.57
152.167	0.00	0.00	0.268	O	|	|	|	|	6.57
152.333	0.00	0.00	0.268	O	|	|	|	|	6.57
152.500	0.00	0.00	0.268	O	|	|	|	|	6.57
152.667	0.00	0.00	0.268	O	|	|	|	|	6.57
152.833	0.00	0.00	0.268	O	|	|	|	|	6.57
153.000	0.00	0.00	0.268	O	|	|	|	|	6.57
153.167	0.00	0.00	0.268	O	|	|	|	|	6.57
153.333	0.00	0.00	0.268	O	|	|	|	|	6.57
153.500	0.00	0.00	0.268	O	|	|	|	|	6.57
153.667	0.00	0.00	0.268	O	|	|	|	|	6.57
153.833	0.00	0.00	0.268	O	|	|	|	|	6.57
154.000	0.00	0.00	0.268	O	|	|	|	|	6.57
154.167	0.00	0.00	0.268	O	|	|	|	|	6.57
154.333	0.00	0.00	0.268	O	|	|	|	|	6.56
154.500	0.00	0.00	0.268	O	|	|	|	|	6.56
154.667	0.00	0.00	0.268	O	|	|	|	|	6.56
154.833	0.00	0.00	0.268	O	|	|	|	|	6.56
155.000	0.00	0.00	0.268	O	|	|	|	|	6.56
155.167	0.00	0.00	0.268	O	|	|	|	|	6.56
155.333	0.00	0.00	0.268	O	|	|	|	|	6.56
155.500	0.00	0.00	0.268	O	|	|	|	|	6.56
155.667	0.00	0.00	0.268	O	|	|	|	|	6.56
155.833	0.00	0.00	0.268	O	|	|	|	|	6.56
156.000	0.00	0.00	0.267	O	|	|	|	|	6.56
156.167	0.00	0.00	0.267	O	|	|	|	|	6.56
156.333	0.00	0.00	0.267	O	|	|	|	|	6.56
156.500	0.00	0.00	0.267	O	|	|	|	|	6.56
156.667	0.00	0.00	0.267	O	|	|	|	|	6.56
156.833	0.00	0.00	0.267	O	|	|	|	|	6.56
157.000	0.00	0.00	0.267	O	|	|	|	|	6.56
157.167	0.00	0.00	0.267	O	|	|	|	|	6.56
157.333	0.00	0.00	0.267	O	|	|	|	|	6.56
157.500	0.00	0.00	0.267	O	|	|	|	|	6.56
157.667	0.00	0.00	0.267	O	|	|	|	|	6.56
157.833	0.00	0.00	0.267	O	|	|	|	|	6.56
158.000	0.00	0.00	0.267	O	|	|	|	|	6.56
158.167	0.00	0.00	0.267	O	|	|	|	|	6.56
158.333	0.00	0.00	0.267	O	|	|	|	|	6.56
158.500	0.00	0.00	0.267	O	|	|	|	|	6.56
158.667	0.00	0.00	0.267	O	|	|	|	|	6.56

158.833	0.00	0.00	0.267	O	|	|	|	|	6.56
159.000	0.00	0.00	0.267	O	|	|	|	|	6.56
159.167	0.00	0.00	0.267	O	|	|	|	|	6.56
159.333	0.00	0.00	0.267	O	|	|	|	|	6.56
159.500	0.00	0.00	0.267	O	|	|	|	|	6.56
159.667	0.00	0.00	0.267	O	|	|	|	|	6.56
159.833	0.00	0.00	0.267	O	|	|	|	|	6.56
160.000	0.00	0.00	0.267	O	|	|	|	|	6.56
160.167	0.00	0.00	0.267	O	|	|	|	|	6.56
160.333	0.00	0.00	0.267	O	|	|	|	|	6.56
160.500	0.00	0.00	0.267	O	|	|	|	|	6.56
160.667	0.00	0.00	0.267	O	|	|	|	|	6.56
160.833	0.00	0.00	0.267	O	|	|	|	|	6.56
161.000	0.00	0.00	0.267	O	|	|	|	|	6.56
161.167	0.00	0.00	0.267	O	|	|	|	|	6.56
161.333	0.00	0.00	0.267	O	|	|	|	|	6.55
161.500	0.00	0.00	0.267	O	|	|	|	|	6.55
161.667	0.00	0.00	0.267	O	|	|	|	|	6.55
161.833	0.00	0.00	0.266	O	|	|	|	|	6.55
162.000	0.00	0.00	0.266	O	|	|	|	|	6.55
162.167	0.00	0.00	0.266	O	|	|	|	|	6.55
162.333	0.00	0.00	0.266	O	|	|	|	|	6.55
162.500	0.00	0.00	0.266	O	|	|	|	|	6.55
162.667	0.00	0.00	0.266	O	|	|	|	|	6.55
162.833	0.00	0.00	0.266	O	|	|	|	|	6.55
163.000	0.00	0.00	0.266	O	|	|	|	|	6.55
163.167	0.00	0.00	0.266	O	|	|	|	|	6.55
163.333	0.00	0.00	0.266	O	|	|	|	|	6.55
163.500	0.00	0.00	0.266	O	|	|	|	|	6.55
163.667	0.00	0.00	0.266	O	|	|	|	|	6.55
163.833	0.00	0.00	0.266	O	|	|	|	|	6.55
164.000	0.00	0.00	0.266	O	|	|	|	|	6.55
164.167	0.00	0.00	0.266	O	|	|	|	|	6.55
164.333	0.00	0.00	0.266	O	|	|	|	|	6.55
164.500	0.00	0.00	0.266	O	|	|	|	|	6.55
164.667	0.00	0.00	0.266	O	|	|	|	|	6.55
164.833	0.00	0.00	0.266	O	|	|	|	|	6.55
165.000	0.00	0.00	0.266	O	|	|	|	|	6.55
165.167	0.00	0.00	0.266	O	|	|	|	|	6.55
165.333	0.00	0.00	0.266	O	|	|	|	|	6.55
165.500	0.00	0.00	0.266	O	|	|	|	|	6.55
165.667	0.00	0.00	0.266	O	|	|	|	|	6.55
165.833	0.00	0.00	0.266	O	|	|	|	|	6.55
166.000	0.00	0.00	0.266	O	|	|	|	|	6.55
166.167	0.00	0.00	0.266	O	|	|	|	|	6.55
166.333	0.00	0.00	0.266	O	|	|	|	|	6.55
166.500	0.00	0.00	0.266	O	|	|	|	|	6.55
166.667	0.00	0.00	0.266	O	|	|	|	|	6.55
166.833	0.00	0.00	0.266	O	|	|	|	|	6.55
167.000	0.00	0.00	0.266	O	|	|	|	|	6.55
167.167	0.00	0.00	0.266	O	|	|	|	|	6.55
167.333	0.00	0.00	0.266	O	|	|	|	|	6.55
167.500	0.00	0.00	0.266	O	|	|	|	|	6.55
167.667	0.00	0.00	0.266	O	|	|	|	|	6.55
167.833	0.00	0.00	0.266	O	|	|	|	|	6.55
168.000	0.00	0.00	0.266	O	|	|	|	|	6.55
168.167	0.00	0.00	0.265	O	|	|	|	|	6.55

168.333	0.00	0.00	0.265	O	|	|	|	|	6.55
168.500	0.00	0.00	0.265	O	|	|	|	|	6.55
168.667	0.00	0.00	0.265	O	|	|	|	|	6.55
168.833	0.00	0.00	0.265	O	|	|	|	|	6.54
169.000	0.00	0.00	0.265	O	|	|	|	|	6.54
169.167	0.00	0.00	0.265	O	|	|	|	|	6.54
169.333	0.00	0.00	0.265	O	|	|	|	|	6.54
169.500	0.00	0.00	0.265	O	|	|	|	|	6.54
169.667	0.00	0.00	0.265	O	|	|	|	|	6.54
169.833	0.00	0.00	0.265	O	|	|	|	|	6.54
170.000	0.00	0.00	0.265	O	|	|	|	|	6.54
170.167	0.00	0.00	0.265	O	|	|	|	|	6.54
170.333	0.00	0.00	0.265	O	|	|	|	|	6.54
170.500	0.00	0.00	0.265	O	|	|	|	|	6.54
170.667	0.00	0.00	0.265	O	|	|	|	|	6.54
170.833	0.00	0.00	0.265	O	|	|	|	|	6.54
171.000	0.00	0.00	0.265	O	|	|	|	|	6.54
171.167	0.00	0.00	0.265	O	|	|	|	|	6.54
171.333	0.00	0.00	0.265	O	|	|	|	|	6.54
171.500	0.00	0.00	0.265	O	|	|	|	|	6.54
171.667	0.00	0.00	0.265	O	|	|	|	|	6.54
171.833	0.00	0.00	0.265	O	|	|	|	|	6.54
172.000	0.00	0.00	0.265	O	|	|	|	|	6.54
172.167	0.00	0.00	0.265	O	|	|	|	|	6.54
172.333	0.00	0.00	0.265	O	|	|	|	|	6.54
172.500	0.00	0.00	0.265	O	|	|	|	|	6.54
172.667	0.00	0.00	0.265	O	|	|	|	|	6.54
172.833	0.00	0.00	0.265	O	|	|	|	|	6.54
173.000	0.00	0.00	0.265	O	|	|	|	|	6.54
173.167	0.00	0.00	0.265	O	|	|	|	|	6.54
173.333	0.00	0.00	0.265	O	|	|	|	|	6.54
173.500	0.00	0.00	0.265	O	|	|	|	|	6.54
173.667	0.00	0.00	0.265	O	|	|	|	|	6.54
173.833	0.00	0.00	0.265	O	|	|	|	|	6.54
174.000	0.00	0.00	0.265	O	|	|	|	|	6.54
174.167	0.00	0.00	0.265	O	|	|	|	|	6.54
174.333	0.00	0.00	0.265	O	|	|	|	|	6.54
174.500	0.00	0.00	0.265	O	|	|	|	|	6.54
174.667	0.00	0.00	0.265	O	|	|	|	|	6.54
174.833	0.00	0.00	0.265	O	|	|	|	|	6.54
175.000	0.00	0.00	0.265	O	|	|	|	|	6.54
175.167	0.00	0.00	0.264	O	|	|	|	|	6.54
175.333	0.00	0.00	0.264	O	|	|	|	|	6.54
175.500	0.00	0.00	0.264	O	|	|	|	|	6.54
175.667	0.00	0.00	0.264	O	|	|	|	|	6.54
175.833	0.00	0.00	0.264	O	|	|	|	|	6.54
176.000	0.00	0.00	0.264	O	|	|	|	|	6.54
176.167	0.00	0.00	0.264	O	|	|	|	|	6.54
176.333	0.00	0.00	0.264	O	|	|	|	|	6.54
176.500	0.00	0.00	0.264	O	|	|	|	|	6.54
176.667	0.00	0.00	0.264	O	|	|	|	|	6.54
176.833	0.00	0.00	0.264	O	|	|	|	|	6.54
177.000	0.00	0.00	0.264	O	|	|	|	|	6.54
177.167	0.00	0.00	0.264	O	|	|	|	|	6.54
177.333	0.00	0.00	0.264	O	|	|	|	|	6.53
177.500	0.00	0.00	0.264	O	|	|	|	|	6.53
177.667	0.00	0.00	0.264	O	|	|	|	|	6.53

177.833	0.00	0.00	0.264	O	|	|	|	|	6.53
178.000	0.00	0.00	0.264	O	|	|	|	|	6.53
178.167	0.00	0.00	0.264	O	|	|	|	|	6.53
178.333	0.00	0.00	0.264	O	|	|	|	|	6.53
178.500	0.00	0.00	0.264	O	|	|	|	|	6.53
178.667	0.00	0.00	0.264	O	|	|	|	|	6.53
178.833	0.00	0.00	0.264	O	|	|	|	|	6.53
179.000	0.00	0.00	0.264	O	|	|	|	|	6.53
179.167	0.00	0.00	0.264	O	|	|	|	|	6.53
179.333	0.00	0.00	0.264	O	|	|	|	|	6.53
179.500	0.00	0.00	0.264	O	|	|	|	|	6.53
179.667	0.00	0.00	0.264	O	|	|	|	|	6.53
179.833	0.00	0.00	0.264	O	|	|	|	|	6.53
180.000	0.00	0.00	0.264	O	|	|	|	|	6.53
180.167	0.00	0.00	0.264	O	|	|	|	|	6.53
180.333	0.00	0.00	0.264	O	|	|	|	|	6.53
180.500	0.00	0.00	0.264	O	|	|	|	|	6.53
180.667	0.00	0.00	0.264	O	|	|	|	|	6.53
180.833	0.00	0.00	0.264	O	|	|	|	|	6.53
181.000	0.00	0.00	0.264	O	|	|	|	|	6.53
181.167	0.00	0.00	0.264	O	|	|	|	|	6.53
181.333	0.00	0.00	0.264	O	|	|	|	|	6.53
181.500	0.00	0.00	0.264	O	|	|	|	|	6.53
181.667	0.00	0.00	0.264	O	|	|	|	|	6.53
181.833	0.00	0.00	0.264	O	|	|	|	|	6.53
182.000	0.00	0.00	0.264	O	|	|	|	|	6.53
182.167	0.00	0.00	0.264	O	|	|	|	|	6.53
182.333	0.00	0.00	0.264	O	|	|	|	|	6.53
182.500	0.00	0.00	0.264	O	|	|	|	|	6.53
182.667	0.00	0.00	0.263	O	|	|	|	|	6.53
182.833	0.00	0.00	0.263	O	|	|	|	|	6.53
183.000	0.00	0.00	0.263	O	|	|	|	|	6.53
183.167	0.00	0.00	0.263	O	|	|	|	|	6.53
183.333	0.00	0.00	0.263	O	|	|	|	|	6.53
183.500	0.00	0.00	0.263	O	|	|	|	|	6.53
183.667	0.00	0.00	0.263	O	|	|	|	|	6.53
183.833	0.00	0.00	0.263	O	|	|	|	|	6.53
184.000	0.00	0.00	0.263	O	|	|	|	|	6.53
184.167	0.00	0.00	0.263	O	|	|	|	|	6.53
184.333	0.00	0.00	0.263	O	|	|	|	|	6.53
184.500	0.00	0.00	0.263	O	|	|	|	|	6.53
184.667	0.00	0.00	0.263	O	|	|	|	|	6.53
184.833	0.00	0.00	0.263	O	|	|	|	|	6.53
185.000	0.00	0.00	0.263	O	|	|	|	|	6.53
185.167	0.00	0.00	0.263	O	|	|	|	|	6.53
185.333	0.00	0.00	0.263	O	|	|	|	|	6.53
185.500	0.00	0.00	0.263	O	|	|	|	|	6.53
185.667	0.00	0.00	0.263	O	|	|	|	|	6.53
185.833	0.00	0.00	0.263	O	|	|	|	|	6.53
186.000	0.00	0.00	0.263	O	|	|	|	|	6.53
186.167	0.00	0.00	0.263	O	|	|	|	|	6.53
186.333	0.00	0.00	0.263	O	|	|	|	|	6.53
186.500	0.00	0.00	0.263	O	|	|	|	|	6.53
186.667	0.00	0.00	0.263	O	|	|	|	|	6.53
186.833	0.00	0.00	0.263	O	|	|	|	|	6.52
187.000	0.00	0.00	0.263	O	|	|	|	|	6.52
187.167	0.00	0.00	0.263	O	|	|	|	|	6.52

187.333	0.00	0.00	0.263	O					6.52
187.500	0.00	0.00	0.263	O					6.52
187.667	0.00	0.00	0.263	O					6.52
187.833	0.00	0.00	0.263	O					6.52
188.000	0.00	0.00	0.263	O					6.52
188.167	0.00	0.00	0.263	O					6.52
188.333	0.00	0.00	0.263	O					6.52
188.500	0.00	0.00	0.263	O					6.52
188.667	0.00	0.00	0.263	O					6.52
188.833	0.00	0.00	0.263	O					6.52
189.000	0.00	0.00	0.263	O					6.52
189.167	0.00	0.00	0.263	O					6.52
189.333	0.00	0.00	0.263	O					6.52
189.500	0.00	0.00	0.263	O					6.52
189.667	0.00	0.00	0.263	O					6.52
189.833	0.00	0.00	0.263	O					6.52
190.000	0.00	0.00	0.263	O					6.52
190.167	0.00	0.00	0.263	O					6.52
190.333	0.00	0.00	0.263	O					6.52
190.500	0.00	0.00	0.263	O					6.52
190.667	0.00	0.00	0.263	O					6.52
190.833	0.00	0.00	0.263	O					6.52
191.000	0.00	0.00	0.262	O					6.52
191.167	0.00	0.00	0.262	O					6.52
191.333	0.00	0.00	0.262	O					6.52
191.500	0.00	0.00	0.262	O					6.52
191.667	0.00	0.00	0.262	O					6.52
191.833	0.00	0.00	0.262	O					6.52
192.000	0.00	0.00	0.262	O					6.52
192.167	0.00	0.00	0.262	O					6.52
192.333	0.00	0.00	0.262	O					6.52
192.500	0.00	0.00	0.262	O					6.52
192.667	0.00	0.00	0.262	O					6.52
192.833	0.00	0.00	0.262	O					6.52
193.000	0.00	0.00	0.262	O					6.52
193.167	0.00	0.00	0.262	O					6.52
193.333	0.00	0.00	0.262	O					6.52
193.500	0.00	0.00	0.262	O					6.52
193.667	0.00	0.00	0.262	O					6.52
193.833	0.00	0.00	0.262	O					6.52
194.000	0.00	0.00	0.262	O					6.52
194.167	0.00	0.00	0.262	O					6.52
194.333	0.00	0.00	0.262	O					6.52
194.500	0.00	0.00	0.262	O					6.52
194.667	0.00	0.00	0.262	O					6.52
194.833	0.00	0.00	0.262	O					6.52
195.000	0.00	0.00	0.262	O					6.52
195.167	0.00	0.00	0.262	O					6.52
195.333	0.00	0.00	0.262	O					6.52
195.500	0.00	0.00	0.262	O					6.52
195.667	0.00	0.00	0.262	O					6.52
195.833	0.00	0.00	0.262	O					6.52
196.000	0.00	0.00	0.262	O					6.52
196.167	0.00	0.00	0.262	O					6.52
196.333	0.00	0.00	0.262	O					6.52
196.500	0.00	0.00	0.262	O					6.52
196.667	0.00	0.00	0.262	O					6.52

196.833	0.00	0.00	0.262	O	|	|	|	|	6.52
197.000	0.00	0.00	0.262	O	|	|	|	|	6.52
197.167	0.00	0.00	0.262	O	|	|	|	|	6.52
197.333	0.00	0.00	0.262	O	|	|	|	|	6.52
197.500	0.00	0.00	0.262	O	|	|	|	|	6.51
197.667	0.00	0.00	0.262	O	|	|	|	|	6.51
197.833	0.00	0.00	0.262	O	|	|	|	|	6.51
198.000	0.00	0.00	0.262	O	|	|	|	|	6.51
198.167	0.00	0.00	0.262	O	|	|	|	|	6.51
198.333	0.00	0.00	0.262	O	|	|	|	|	6.51
198.500	0.00	0.00	0.262	O	|	|	|	|	6.51
198.667	0.00	0.00	0.262	O	|	|	|	|	6.51
198.833	0.00	0.00	0.262	O	|	|	|	|	6.51
199.000	0.00	0.00	0.262	O	|	|	|	|	6.51
199.167	0.00	0.00	0.262	O	|	|	|	|	6.51
199.333	0.00	0.00	0.262	O	|	|	|	|	6.51
199.500	0.00	0.00	0.262	O	|	|	|	|	6.51
199.667	0.00	0.00	0.262	O	|	|	|	|	6.51
199.833	0.00	0.00	0.262	O	|	|	|	|	6.51
200.000	0.00	0.00	0.262	O	|	|	|	|	6.51
200.167	0.00	0.00	0.262	O	|	|	|	|	6.51
200.333	0.00	0.00	0.261	O	|	|	|	|	6.51
200.500	0.00	0.00	0.261	O	|	|	|	|	6.51
200.667	0.00	0.00	0.261	O	|	|	|	|	6.51
200.833	0.00	0.00	0.261	O	|	|	|	|	6.51
201.000	0.00	0.00	0.261	O	|	|	|	|	6.51
201.167	0.00	0.00	0.261	O	|	|	|	|	6.51
201.333	0.00	0.00	0.261	O	|	|	|	|	6.51
201.500	0.00	0.00	0.261	O	|	|	|	|	6.51
201.667	0.00	0.00	0.261	O	|	|	|	|	6.51
201.833	0.00	0.00	0.261	O	|	|	|	|	6.51
202.000	0.00	0.00	0.261	O	|	|	|	|	6.51
202.167	0.00	0.00	0.261	O	|	|	|	|	6.51
202.333	0.00	0.00	0.261	O	|	|	|	|	6.51
202.500	0.00	0.00	0.261	O	|	|	|	|	6.51
202.667	0.00	0.00	0.261	O	|	|	|	|	6.51
202.833	0.00	0.00	0.261	O	|	|	|	|	6.51
203.000	0.00	0.00	0.261	O	|	|	|	|	6.51
203.167	0.00	0.00	0.261	O	|	|	|	|	6.51
203.333	0.00	0.00	0.261	O	|	|	|	|	6.51
203.500	0.00	0.00	0.261	O	|	|	|	|	6.51
203.667	0.00	0.00	0.261	O	|	|	|	|	6.51
203.833	0.00	0.00	0.261	O	|	|	|	|	6.51
204.000	0.00	0.00	0.261	O	|	|	|	|	6.51
204.167	0.00	0.00	0.261	O	|	|	|	|	6.51
204.333	0.00	0.00	0.261	O	|	|	|	|	6.51
204.500	0.00	0.00	0.261	O	|	|	|	|	6.51
204.667	0.00	0.00	0.261	O	|	|	|	|	6.51
204.833	0.00	0.00	0.261	O	|	|	|	|	6.51
205.000	0.00	0.00	0.261	O	|	|	|	|	6.51
205.167	0.00	0.00	0.261	O	|	|	|	|	6.51
205.333	0.00	0.00	0.261	O	|	|	|	|	6.51
205.500	0.00	0.00	0.261	O	|	|	|	|	6.51
205.667	0.00	0.00	0.261	O	|	|	|	|	6.51
205.833	0.00	0.00	0.261	O	|	|	|	|	6.51
206.000	0.00	0.00	0.261	O	|	|	|	|	6.51
206.167	0.00	0.00	0.261	O	|	|	|	|	6.51

206.333	0.00	0.00	0.261	O				6.51
206.500	0.00	0.00	0.261	O				6.51
206.667	0.00	0.00	0.261	O				6.51
206.833	0.00	0.00	0.261	O				6.51
207.000	0.00	0.00	0.261	O				6.51
207.167	0.00	0.00	0.261	O				6.51
207.333	0.00	0.00	0.261	O				6.51
207.500	0.00	0.00	0.261	O				6.51
207.667	0.00	0.00	0.261	O				6.51
207.833	0.00	0.00	0.261	O				6.51
208.000	0.00	0.00	0.261	O				6.51
208.167	0.00	0.00	0.261	O				6.51
208.333	0.00	0.00	0.261	O				6.51
208.500	0.00	0.00	0.261	O				6.51
208.667	0.00	0.00	0.261	O				6.51
208.833	0.00	0.00	0.261	O				6.51
209.000	0.00	0.00	0.261	O				6.51
209.167	0.00	0.00	0.261	O				6.51
209.333	0.00	0.00	0.261	O				6.51
209.500	0.00	0.00	0.261	O				6.51
209.667	0.00	0.00	0.261	O				6.51
209.833	0.00	0.00	0.261	O				6.50
210.000	0.00	0.00	0.261	O				6.50
210.167	0.00	0.00	0.261	O				6.50
210.333	0.00	0.00	0.261	O				6.50
210.500	0.00	0.00	0.261	O				6.50
210.667	0.00	0.00	0.261	O				6.50
210.833	0.00	0.00	0.261	O				6.50
211.000	0.00	0.00	0.260	O				6.50
211.167	0.00	0.00	0.260	O				6.50
211.333	0.00	0.00	0.260	O				6.50
211.500	0.00	0.00	0.260	O				6.50
211.667	0.00	0.00	0.260	O				6.50
211.833	0.00	0.00	0.260	O				6.50
212.000	0.00	0.00	0.260	O				6.50
212.167	0.00	0.00	0.260	O				6.50
212.333	0.00	0.00	0.260	O				6.50
212.500	0.00	0.00	0.260	O				6.50
212.667	0.00	0.00	0.260	O				6.50
212.833	0.00	0.00	0.260	O				6.50
213.000	0.00	0.00	0.260	O				6.50
213.167	0.00	0.00	0.260	O				6.50
213.333	0.00	0.00	0.260	O				6.50
213.500	0.00	0.00	0.260	O				6.50
213.667	0.00	0.00	0.260	O				6.50
213.833	0.00	0.00	0.260	O				6.50
214.000	0.00	0.00	0.260	O				6.50
214.167	0.00	0.00	0.260	O				6.50
214.333	0.00	0.00	0.260	O				6.50
214.500	0.00	0.00	0.260	O				6.50
214.667	0.00	0.00	0.260	O				6.50
214.833	0.00	0.00	0.260	O				6.50
215.000	0.00	0.00	0.260	O				6.50
215.167	0.00	0.00	0.260	O				6.50
215.333	0.00	0.00	0.260	O				6.50
215.500	0.00	0.00	0.260	O				6.50
215.667	0.00	0.00	0.260	O				6.50

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215.833    0.00    0.00      0.260  O       |       |       |       |     6.50
216.000    0.00    0.00      0.260  O       |       |       |       |     6.50
216.167    0.00    0.00      0.260  O       |       |       |       |     6.50
216.333    0.00    0.00      0.260  O       |       |       |       |     6.50
216.500    0.00    0.00      0.260  O       |       |       |       |     6.50
216.667    0.00    0.00      0.260  O       |       |       |       |     6.50
216.833    0.00    0.00      0.260  O       |       |       |       |     6.50

      Remaining water in basin =    0.26 (Ac.Ft)

      ****************************HYDROGRAPH DATA****************************
                  Number of intervals =  1301
                  Time interval =   10.0 (Min.)
                  Maximum/Peak flow rate =        6.311 (CFS)
                  Total volume =       1.186 (Ac.Ft)
            Status of hydrographs being held in storage
                        Stream 1  Stream 2  Stream 3  Stream 4  Stream 5
            Peak (CFS)      0.000     0.000     0.000     0.000     0.000
            Vol (Ac.Ft)     0.000     0.000     0.000     0.000     0.000
      ************************************************************************

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

      ++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
      Process from Point/Station        2.000 to Point/Station        3.000
      **** STREAM ROUTING SCS CONVEX METHOD ****
      ________________________________________________________________________
      HYDROGRAPH STREAM ROUTING DATA:
      Length of stream =   1265.00 (Ft.)
      Elevation difference =   52.00 (Ft.)
      Slope of channel =  0.041107 (Vert/Horiz)
      Channel type - Pipe


      Pipe length  =  1265.00(Ft.)    Elevation difference =  52.00(Ft.)
      Manning's N = 0.013   No. of pipes = 1
      Pipe evaluation using mean flow rate of hydrograph
      Required pipe flow  =     0.438(CFS)
      Nearest computed pipe diameter  =      6.00(In.)
      Calculated individual pipe flow  =     0.438(CFS)
      Normal flow depth in pipe =    2.58(In.)
      Flow top width inside pipe =    5.94(In.)
      Critical Depth =    0.34(Ft.)
      Pipe flow velocity =      5.42(Ft/s)
      Travel time through pipe = 3.89 min.


      Pipe length  =  1265.00(Ft.)    Elevation difference =  52.00(Ft.)
      Manning's N = 0.013   No. of pipes = 1
      Pipe evaluation using maximum flow rate of hydrograph
      Required pipe flow  =     6.311(CFS)
      Nearest computed pipe diameter  =     12.00(In.)
      Calculated individual pipe flow  =     6.311(CFS)
      Normal flow depth in pipe =    8.68(In.)
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Flow top width inside pipe =   10.73(In.)
Critical depth could not be calculated.
Pipe flow velocity =     10.37(Ft/s)
Travel time through pipe =    2.03 min.


********************** SCS CONVEX CHANNEL ROUTING *********************
Convex method of stream routing  data items:
Using equation: Outflow =
O(t+dt) = (1-c*)O(t+dt-dt*) + Input(c*)
        where c* = 1 - (1-c)^e and dt = c(length)/velocity
        c(v/v+1.7) =   0.8591   Travel time =   2.03 (min.)
      dt*(unit time interval) =  10.00(min.),  e=    4.1488
      dt(routing time-step) =   1.75 (min.),   c* =   0.9997

Output hydrograph delayed by 0  unit time increments


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
                  P R I N T  O F  S T O R M
                R u n o f f     H y d r o g r a p h
----------------------------------------------------------------------------------
            Hydrograph in  10   Minute intervals (CFS)
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Time(h+m)	Out = O(CFS)	In = I	0	1.6	3.2	4.7	6.3
0+10	0.0000	0.00	O	|	|	|	|
0+20	0.0001	0.00	O	|	|	|	|
0+30	0.0003	0.00	O	|	|	|	|
0+40	0.0004	0.00	O	|	|	|	|
0+50	0.0006	0.00	O	|	|	|	|
1+ 0	0.0008	0.00	O	|	|	|	|
1+10	0.0009	0.00	O	|	|	|	|
1+20	0.0010	0.00	O	|	|	|	|
1+30	0.0010	0.00	O	|	|	|	|
1+40	0.0010	0.00	O	|	|	|	|
1+50	0.0010	0.00	O	|	|	|	|
2+ 0	0.0010	0.00	O	|	|	|	|
2+10	0.0010	0.00	O	|	|	|	|
2+20	0.0010	0.00	O	|	|	|	|
2+30	0.0010	0.00	O	|	|	|	|
2+40	0.0010	0.00	O	|	|	|	|
2+50	0.0010	0.00	O	|	|	|	|
3+ 0	0.0010	0.00	O	|	|	|	|
3+10	0.0010	0.00	O	|	|	|	|
3+20	0.0010	0.00	O	|	|	|	|
3+30	0.0010	0.00	O	|	|	|	|
3+40	0.0010	0.00	O	|	|	|	|
3+50	0.0010	0.00	O	|	|	|	|
4+ 0	0.0010	0.00	O	|	|	|	|
4+10	0.0010	0.00	O	|	|	|	|
4+20	0.0010	0.00	O	|	|	|	|
4+30	0.0010	0.00	O	|	|	|	|
4+40	0.0010	0.00	O	|	|	|	|
4+50	0.0010	0.00	O	|	|	|	|
5+ 0	0.0010	0.00	O	|	|	|	|

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 5+10       0.0010      0.00  O         |          |          |          |
 5+20       0.0010      0.00  O         |          |          |          |
 5+30       0.0010      0.00  O         |          |          |          |
 5+40       0.0010      0.00  O         |          |          |          |
 5+50       0.0010      0.00  O         |          |          |          |
 6+ 0       0.0010      0.00  O         |          |          |          |
 6+10       0.0010      0.00  O         |          |          |          |
 6+20       0.0010      0.00  O         |          |          |          |
 6+30       0.0010      0.00  O         |          |          |          |
 6+40       0.0010      0.00  O         |          |          |          |
 6+50       0.0010      0.00  O         |          |          |          |
 7+ 0       0.0010      0.00  O         |          |          |          |
 7+10       0.0010      0.00  O         |          |          |          |
 7+20       0.0010      0.00  O         |          |          |          |
 7+30       0.0010      0.00  O         |          |          |          |
 7+40       0.0015      0.00  O         |          |          |          |
 7+50       0.0025      0.00  O         |          |          |          |
 8+ 0       0.0035      0.00  O         |          |          |          |
 8+10       0.0046      0.00  O         |          |          |          |
 8+20       0.0057      0.01  O         |          |          |          |
 8+30       0.0068      0.01  O         |          |          |          |
 8+40       0.0078      0.01  O         |          |          |          |
 8+50       0.0089      0.01  O         |          |          |          |
 9+ 0       0.0183      0.02  O         |          |          |          |
 9+10       0.0598      0.07  O         |          |          |          |
 9+20       0.1045      0.11  O         |          |          |          |
 9+30       0.1458      0.15  O         |          |          |          |
 9+40       0.1840      0.19  |O        |          |          |          |
 9+50       0.2194      0.23  |O        |          |          |          |
10+ 0       0.2522      0.26  |O        |          |          |          |
10+10       0.2828      0.29  |O        |          |          |          |
10+20       0.3113      0.32  |OI       |          |          |          |
10+30       0.3379      0.34  | O       |          |          |          |
10+40       0.3629      0.37  | O       |          |          |          |
10+50       0.3864      0.39  | O       |          |          |          |
11+ 0       0.4087      0.41  | O       |          |          |          |
11+10       0.4298      0.43  | O       |          |          |          |
11+20       0.4499      0.45  | O       |          |          |          |
11+30       0.4692      0.47  | O       |          |          |          |
11+40       0.4877      0.49  |  O      |          |          |          |
11+50       0.5056      0.51  |  O      |          |          |          |
12+ 0       0.5230      0.53  |  O      |          |          |          |
12+10       0.5392      0.54  |  O      |          |          |          |
12+20       0.5532      0.56  |  O      |          |          |          |
12+30       0.5655      0.57  |  O      |          |          |          |
12+40       0.5775      0.58  |  O      |          |          |          |
12+50       0.5896      0.59  |  O      |          |          |          |
13+ 0       0.6023      0.60  |  O      |          |          |          |
13+10       0.6155      0.62  |  O      |          |          |          |
13+20       0.6294      0.63  |  OI     |          |          |          |
13+30       0.6442      0.65  |   O     |          |          |          |
13+40       0.6599      0.66  |   O     |          |          |          |
13+50       0.6767      0.68  |   O     |          |          |          |
14+ 0       0.6948      0.70  |   O     |          |          |          |
14+10       0.7143      0.72  |   O     |          |          |          |
14+20       0.7355      0.74  |   O     |          |          |          |
14+30       0.7588      0.76  |   O     |          |          |          |
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14+40       0.7845      0.79  |   OI    |          |          |          |
14+50       0.8131      0.82  |    O    |          |          |          |
15+ 0       0.8454      0.85  |    O    |          |          |          |
15+10       0.8824      0.89  |    O    |          |          |          |
15+20       1.2445      1.32  |      OI |          |          |          |
15+30       1.4638      1.49  |        O|          |          |          |
15+40       1.5536      1.57  |        O|          |          |          |
15+50       1.7881      1.84  |         |O         |          |          |
16+ 0       2.5085      2.65  |         |    OI    |          |          |
16+10       4.5349      4.93  |         |          |       O  |I         |
16+20       6.0699      6.31  |         |          |          |        O I
16+30       4.5532      4.18  |         |          |     I O  |          |
16+40       2.5063      2.15  |         |  I O     |          |          |
16+50       1.8061      1.73  |         IO         |          |          |
17+ 0       1.3840      1.31  |       O |          |          |          |
17+10       1.1059      1.06  |     IO  |          |          |          |
17+20       0.9888      0.97  |     O   |          |          |          |
17+30       0.9123      0.90  |    O    |          |          |          |
17+40       0.8947      0.89  |    O    |          |          |          |
17+50       0.8857      0.88  |    O    |          |          |          |
18+ 0       0.8734      0.87  |    O    |          |          |          |
18+10       0.8596      0.86  |    O    |          |          |          |
18+20       0.8462      0.84  |    O    |          |          |          |
18+30       0.8331      0.83  |    O    |          |          |          |
18+40       0.8194      0.82  |    O    |          |          |          |
18+50       0.8052      0.80  |    O    |          |          |          |
19+ 0       0.7905      0.79  |   IO    |          |          |          |
19+10       0.7755      0.77  |   O     |          |          |          |
19+20       0.7603      0.76  |   O     |          |          |          |
19+30       0.7450      0.74  |   O     |          |          |          |
19+40       0.7298      0.73  |   O     |          |          |          |
19+50       0.7147      0.71  |   O     |          |          |          |
20+ 0       0.6999      0.70  |   O     |          |          |          |
20+10       0.6854      0.68  |   O     |          |          |          |
20+20       0.6711      0.67  |   O     |          |          |          |
20+30       0.6572      0.65  |   O     |          |          |          |
20+40       0.6437      0.64  |   O     |          |          |          |
20+50       0.6306      0.63  |  O      |          |          |          |
21+ 0       0.6179      0.62  |  O      |          |          |          |
21+10       0.6056      0.60  |  O      |          |          |          |
21+20       0.5937      0.59  |  O      |          |          |          |
21+30       0.5822      0.58  |  O      |          |          |          |
21+40       0.5711      0.57  |  O      |          |          |          |
21+50       0.5604      0.56  |  O      |          |          |          |
22+ 0       0.5500      0.55  |  O      |          |          |          |
22+10       0.5401      0.54  |  O      |          |          |          |
22+20       0.5305      0.53  |  O      |          |          |          |
22+30       0.5212      0.52  |  O      |          |          |          |
22+40       0.5123      0.51  |  O      |          |          |          |
22+50       0.5038      0.50  |  O      |          |          |          |
23+ 0       0.4955      0.49  |  O      |          |          |          |
23+10       0.4876      0.49  |  O      |          |          |          |
23+20       0.4799      0.48  |  O      |          |          |          |
23+30       0.4725      0.47  | O       |          |          |          |
23+40       0.4654      0.46  | O       |          |          |          |
23+50       0.4586      0.46  | O       |          |          |          |
24+ 0       0.4520      0.45  | O       |          |          |          |
```

24+10	0.4407	0.44	| O	|	|	|	|
24+20	0.4176	0.41	| O	|	|	|	|
24+30	0.3861	0.38	| O	|	|	|	|
24+40	0.3536	0.35	| O	|	|	|	|
24+50	0.3225	0.32	| O	|	|	|	|
25+ 0	0.2936	0.29	|O	|	|	|	|
25+10	0.2671	0.26	|O	|	|	|	|
25+20	0.2431	0.24	|O	|	|	|	|
25+30	0.2212	0.22	|O	|	|	|	|
25+40	0.2013	0.20	|O	|	|	|	|
25+50	0.1831	0.18	|O	|	|	|	|
26+ 0	0.1666	0.16	|O	|	|	|	|
26+10	0.1516	0.15	O	|	|	|	|
26+20	0.1380	0.14	O	|	|	|	|
26+30	0.1256	0.12	O	|	|	|	|
26+40	0.1142	0.11	O	|	|	|	|
26+50	0.1040	0.10	O	|	|	|	|
27+ 0	0.0946	0.09	O	|	|	|	|
27+10	0.0861	0.08	O	|	|	|	|
27+20	0.0783	0.08	O	|	|	|	|
27+30	0.0713	0.07	O	|	|	|	|
27+40	0.0649	0.06	O	|	|	|	|
27+50	0.0590	0.06	O	|	|	|	|
28+ 0	0.0537	0.05	O	|	|	|	|
28+10	0.0489	0.05	O	|	|	|	|
28+20	0.0445	0.04	O	|	|	|	|
28+30	0.0405	0.04	O	|	|	|	|
28+40	0.0368	0.04	O	|	|	|	|
28+50	0.0335	0.03	O	|	|	|	|
29+ 0	0.0305	0.03	O	|	|	|	|
29+10	0.0277	0.03	O	|	|	|	|
29+20	0.0252	0.02	O	|	|	|	|
29+30	0.0230	0.02	O	|	|	|	|
29+40	0.0209	0.02	O	|	|	|	|
29+50	0.0190	0.02	O	|	|	|	|
30+ 0	0.0173	0.02	O	|	|	|	|
30+10	0.0157	0.02	O	|	|	|	|
30+20	0.0143	0.01	O	|	|	|	|
30+30	0.0130	0.01	O	|	|	|	|
30+40	0.0119	0.01	O	|	|	|	|
30+50	0.0108	0.01	O	|	|	|	|
31+ 0	0.0101	0.01	O	|	|	|	|
31+10	0.0100	0.01	O	|	|	|	|
31+20	0.0100	0.01	O	|	|	|	|
31+30	0.0099	0.01	O	|	|	|	|
31+40	0.0099	0.01	O	|	|	|	|
31+50	0.0099	0.01	O	|	|	|	|
32+ 0	0.0099	0.01	O	|	|	|	|
32+10	0.0099	0.01	O	|	|	|	|
32+20	0.0098	0.01	O	|	|	|	|
32+30	0.0098	0.01	O	|	|	|	|
32+40	0.0098	0.01	O	|	|	|	|
32+50	0.0098	0.01	O	|	|	|	|
33+ 0	0.0098	0.01	O	|	|	|	|
33+10	0.0097	0.01	O	|	|	|	|
33+20	0.0097	0.01	O	|	|	|	|
33+30	0.0097	0.01	O	|	|	|	|

33+40	0.0097	0.01	O				
33+50	0.0097	0.01	O				
34+ 0	0.0096	0.01	O				
34+10	0.0096	0.01	O				
34+20	0.0096	0.01	O				
34+30	0.0096	0.01	O				
34+40	0.0096	0.01	O				
34+50	0.0095	0.01	O				
35+ 0	0.0095	0.01	O				
35+10	0.0095	0.01	O				
35+20	0.0095	0.01	O				
35+30	0.0095	0.01	O				
35+40	0.0094	0.01	O				
35+50	0.0094	0.01	O				
36+ 0	0.0094	0.01	O				
36+10	0.0094	0.01	O				
36+20	0.0094	0.01	O				
36+30	0.0093	0.01	O				
36+40	0.0093	0.01	O				
36+50	0.0093	0.01	O				
37+ 0	0.0093	0.01	O				
37+10	0.0093	0.01	O				
37+20	0.0092	0.01	O				
37+30	0.0092	0.01	O				
37+40	0.0092	0.01	O				
37+50	0.0092	0.01	O				
38+ 0	0.0092	0.01	O				
38+10	0.0091	0.01	O				
38+20	0.0091	0.01	O				
38+30	0.0091	0.01	O				
38+40	0.0091	0.01	O				
38+50	0.0091	0.01	O				
39+ 0	0.0091	0.01	O				
39+10	0.0090	0.01	O				
39+20	0.0090	0.01	O				
39+30	0.0090	0.01	O				
39+40	0.0090	0.01	O				
39+50	0.0090	0.01	O				
40+ 0	0.0089	0.01	O				
40+10	0.0089	0.01	O				
40+20	0.0089	0.01	O				
40+30	0.0089	0.01	O				
40+40	0.0089	0.01	O				
40+50	0.0088	0.01	O				
41+ 0	0.0088	0.01	O				
41+10	0.0088	0.01	O				
41+20	0.0088	0.01	O				
41+30	0.0088	0.01	O				
41+40	0.0088	0.01	O				
41+50	0.0087	0.01	O				
42+ 0	0.0087	0.01	O				
42+10	0.0087	0.01	O				
42+20	0.0087	0.01	O				
42+30	0.0087	0.01	O				
42+40	0.0086	0.01	O				
42+50	0.0086	0.01	O				
43+ 0	0.0086	0.01	O				

43+10	0.0086	0.01	O				
43+20	0.0086	0.01	O				
43+30	0.0086	0.01	O				
43+40	0.0085	0.01	O				
43+50	0.0085	0.01	O				
44+ 0	0.0085	0.01	O				
44+10	0.0085	0.01	O				
44+20	0.0085	0.01	O				
44+30	0.0085	0.01	O				
44+40	0.0084	0.01	O				
44+50	0.0084	0.01	O				
45+ 0	0.0084	0.01	O				
45+10	0.0084	0.01	O				
45+20	0.0084	0.01	O				
45+30	0.0084	0.01	O				
45+40	0.0083	0.01	O				
45+50	0.0083	0.01	O				
46+ 0	0.0083	0.01	O				
46+10	0.0083	0.01	O				
46+20	0.0083	0.01	O				
46+30	0.0082	0.01	O				
46+40	0.0082	0.01	O				
46+50	0.0082	0.01	O				
47+ 0	0.0082	0.01	O				
47+10	0.0082	0.01	O				
47+20	0.0082	0.01	O				
47+30	0.0081	0.01	O				
47+40	0.0081	0.01	O				
47+50	0.0081	0.01	O				
48+ 0	0.0081	0.01	O				
48+10	0.0081	0.01	O				
48+20	0.0081	0.01	O				
48+30	0.0080	0.01	O				
48+40	0.0080	0.01	O				
48+50	0.0080	0.01	O				
49+ 0	0.0080	0.01	O				
49+10	0.0080	0.01	O				
49+20	0.0080	0.01	O				
49+30	0.0079	0.01	O				
49+40	0.0079	0.01	O				
49+50	0.0079	0.01	O				
50+ 0	0.0079	0.01	O				
50+10	0.0079	0.01	O				
50+20	0.0079	0.01	O				
50+30	0.0078	0.01	O				
50+40	0.0078	0.01	O				
50+50	0.0078	0.01	O				
51+ 0	0.0078	0.01	O				
51+10	0.0078	0.01	O				
51+20	0.0078	0.01	O				
51+30	0.0078	0.01	O				
51+40	0.0077	0.01	O				
51+50	0.0077	0.01	O				
52+ 0	0.0077	0.01	O				
52+10	0.0077	0.01	O				
52+20	0.0077	0.01	O				
52+30	0.0077	0.01	O				

52+40	0.0076	0.01	O				
52+50	0.0076	0.01	O				
53+ 0	0.0076	0.01	O				
53+10	0.0076	0.01	O				
53+20	0.0076	0.01	O				
53+30	0.0076	0.01	O				
53+40	0.0075	0.01	O				
53+50	0.0075	0.01	O				
54+ 0	0.0075	0.01	O				
54+10	0.0075	0.01	O				
54+20	0.0075	0.01	O				
54+30	0.0075	0.01	O				
54+40	0.0075	0.01	O				
54+50	0.0074	0.01	O				
55+ 0	0.0074	0.01	O				
55+10	0.0074	0.01	O				
55+20	0.0074	0.01	O				
55+30	0.0074	0.01	O				
55+40	0.0074	0.01	O				
55+50	0.0073	0.01	O				
56+ 0	0.0073	0.01	O				
56+10	0.0073	0.01	O				
56+20	0.0073	0.01	O				
56+30	0.0073	0.01	O				
56+40	0.0073	0.01	O				
56+50	0.0073	0.01	O				
57+ 0	0.0072	0.01	O				
57+10	0.0072	0.01	O				
57+20	0.0072	0.01	O				
57+30	0.0072	0.01	O				
57+40	0.0072	0.01	O				
57+50	0.0072	0.01	O				
58+ 0	0.0072	0.01	O				
58+10	0.0071	0.01	O				
58+20	0.0071	0.01	O				
58+30	0.0071	0.01	O				
58+40	0.0071	0.01	O				
58+50	0.0071	0.01	O				
59+ 0	0.0071	0.01	O				
59+10	0.0070	0.01	O				
59+20	0.0070	0.01	O				
59+30	0.0070	0.01	O				
59+40	0.0070	0.01	O				
59+50	0.0070	0.01	O				
60+ 0	0.0070	0.01	O				
60+10	0.0070	0.01	O				
60+20	0.0069	0.01	O				
60+30	0.0069	0.01	O				
60+40	0.0069	0.01	O				
60+50	0.0069	0.01	O				
61+ 0	0.0069	0.01	O				
61+10	0.0069	0.01	O				
61+20	0.0069	0.01	O				
61+30	0.0068	0.01	O				
61+40	0.0068	0.01	O				
61+50	0.0068	0.01	O				
62+ 0	0.0068	0.01	O				

62+10	0.0068	0.01	O				
62+20	0.0068	0.01	O				
62+30	0.0068	0.01	O				
62+40	0.0068	0.01	O				
62+50	0.0067	0.01	O				
63+ 0	0.0067	0.01	O				
63+10	0.0067	0.01	O				
63+20	0.0067	0.01	O				
63+30	0.0067	0.01	O				
63+40	0.0067	0.01	O				
63+50	0.0067	0.01	O				
64+ 0	0.0066	0.01	O				
64+10	0.0066	0.01	O				
64+20	0.0066	0.01	O				
64+30	0.0066	0.01	O				
64+40	0.0066	0.01	O				
64+50	0.0066	0.01	O				
65+ 0	0.0066	0.01	O				
65+10	0.0065	0.01	O				
65+20	0.0065	0.01	O				
65+30	0.0065	0.01	O				
65+40	0.0065	0.01	O				
65+50	0.0065	0.01	O				
66+ 0	0.0065	0.01	O				
66+10	0.0065	0.01	O				
66+20	0.0065	0.01	O				
66+30	0.0064	0.01	O				
66+40	0.0064	0.01	O				
66+50	0.0064	0.01	O				
67+ 0	0.0064	0.01	O				
67+10	0.0064	0.01	O				
67+20	0.0064	0.01	O				
67+30	0.0064	0.01	O				
67+40	0.0063	0.01	O				
67+50	0.0063	0.01	O				
68+ 0	0.0063	0.01	O				
68+10	0.0063	0.01	O				
68+20	0.0063	0.01	O				
68+30	0.0063	0.01	O				
68+40	0.0063	0.01	O				
68+50	0.0063	0.01	O				
69+ 0	0.0062	0.01	O				
69+10	0.0062	0.01	O				
69+20	0.0062	0.01	O				
69+30	0.0062	0.01	O				
69+40	0.0062	0.01	O				
69+50	0.0062	0.01	O				
70+ 0	0.0062	0.01	O				
70+10	0.0062	0.01	O				
70+20	0.0061	0.01	O				
70+30	0.0061	0.01	O				
70+40	0.0061	0.01	O				
70+50	0.0061	0.01	O				
71+ 0	0.0061	0.01	O				
71+10	0.0061	0.01	O				
71+20	0.0061	0.01	O				
71+30	0.0061	0.01	O				

71+40	0.0060	0.01	O				
71+50	0.0060	0.01	O				
72+ 0	0.0060	0.01	O				
72+10	0.0060	0.01	O				
72+20	0.0060	0.01	O				
72+30	0.0060	0.01	O				
72+40	0.0060	0.01	O				
72+50	0.0060	0.01	O				
73+ 0	0.0059	0.01	O				
73+10	0.0059	0.01	O				
73+20	0.0059	0.01	O				
73+30	0.0059	0.01	O				
73+40	0.0059	0.01	O				
73+50	0.0059	0.01	O				
74+ 0	0.0059	0.01	O				
74+10	0.0059	0.01	O				
74+20	0.0058	0.01	O				
74+30	0.0058	0.01	O				
74+40	0.0058	0.01	O				
74+50	0.0058	0.01	O				
75+ 0	0.0058	0.01	O				
75+10	0.0058	0.01	O				
75+20	0.0058	0.01	O				
75+30	0.0058	0.01	O				
75+40	0.0057	0.01	O				
75+50	0.0057	0.01	O				
76+ 0	0.0057	0.01	O				
76+10	0.0057	0.01	O				
76+20	0.0057	0.01	O				
76+30	0.0057	0.01	O				
76+40	0.0057	0.01	O				
76+50	0.0057	0.01	O				
77+ 0	0.0057	0.01	O				
77+10	0.0056	0.01	O				
77+20	0.0056	0.01	O				
77+30	0.0056	0.01	O				
77+40	0.0056	0.01	O				
77+50	0.0056	0.01	O				
78+ 0	0.0056	0.01	O				
78+10	0.0056	0.01	O				
78+20	0.0056	0.01	O				
78+30	0.0055	0.01	O				
78+40	0.0055	0.01	O				
78+50	0.0055	0.01	O				
79+ 0	0.0055	0.01	O				
79+10	0.0055	0.01	O				
79+20	0.0055	0.01	O				
79+30	0.0055	0.01	O				
79+40	0.0055	0.01	O				
79+50	0.0055	0.01	O				
80+ 0	0.0054	0.01	O				
80+10	0.0054	0.01	O				
80+20	0.0054	0.01	O				
80+30	0.0054	0.01	O				
80+40	0.0054	0.01	O				
80+50	0.0054	0.01	O				
81+ 0	0.0054	0.01	O				

81+10	0.0054	0.01	O				
81+20	0.0054	0.01	O				
81+30	0.0053	0.01	O				
81+40	0.0053	0.01	O				
81+50	0.0053	0.01	O				
82+ 0	0.0053	0.01	O				
82+10	0.0053	0.01	O				
82+20	0.0053	0.01	O				
82+30	0.0053	0.01	O				
82+40	0.0053	0.01	O				
82+50	0.0053	0.01	O				
83+ 0	0.0052	0.01	O				
83+10	0.0052	0.01	O				
83+20	0.0052	0.01	O				
83+30	0.0052	0.01	O				
83+40	0.0052	0.01	O				
83+50	0.0052	0.01	O				
84+ 0	0.0052	0.01	O				
84+10	0.0052	0.01	O				
84+20	0.0052	0.01	O				
84+30	0.0051	0.01	O				
84+40	0.0051	0.01	O				
84+50	0.0051	0.01	O				
85+ 0	0.0051	0.01	O				
85+10	0.0051	0.01	O				
85+20	0.0051	0.01	O				
85+30	0.0051	0.01	O				
85+40	0.0051	0.01	O				
85+50	0.0051	0.01	O				
86+ 0	0.0051	0.01	O				
86+10	0.0050	0.01	O				
86+20	0.0050	0.01	O				
86+30	0.0050	0.01	O				
86+40	0.0050	0.01	O				
86+50	0.0050	0.01	O				
87+ 0	0.0050	0.00	O				
87+10	0.0050	0.00	O				
87+20	0.0050	0.00	O				
87+30	0.0050	0.00	O				
87+40	0.0050	0.00	O				
87+50	0.0049	0.00	O				
88+ 0	0.0049	0.00	O				
88+10	0.0049	0.00	O				
88+20	0.0049	0.00	O				
88+30	0.0049	0.00	O				
88+40	0.0049	0.00	O				
88+50	0.0049	0.00	O				
89+ 0	0.0049	0.00	O				
89+10	0.0049	0.00	O				
89+20	0.0049	0.00	O				
89+30	0.0048	0.00	O				
89+40	0.0048	0.00	O				
89+50	0.0048	0.00	O				
90+ 0	0.0048	0.00	O				
90+10	0.0048	0.00	O				
90+20	0.0048	0.00	O				
90+30	0.0048	0.00	O				

90+40	0.0048	0.00	O	|	|	|	|
90+50	0.0048	0.00	O	|	|	|	|
91+ 0	0.0048	0.00	O	|	|	|	|
91+10	0.0047	0.00	O	|	|	|	|
91+20	0.0047	0.00	O	|	|	|	|
91+30	0.0047	0.00	O	|	|	|	|
91+40	0.0047	0.00	O	|	|	|	|
91+50	0.0047	0.00	O	|	|	|	|
92+ 0	0.0047	0.00	O	|	|	|	|
92+10	0.0047	0.00	O	|	|	|	|
92+20	0.0047	0.00	O	|	|	|	|
92+30	0.0047	0.00	O	|	|	|	|
92+40	0.0047	0.00	O	|	|	|	|
92+50	0.0046	0.00	O	|	|	|	|
93+ 0	0.0046	0.00	O	|	|	|	|
93+10	0.0046	0.00	O	|	|	|	|
93+20	0.0046	0.00	O	|	|	|	|
93+30	0.0046	0.00	O	|	|	|	|
93+40	0.0046	0.00	O	|	|	|	|
93+50	0.0046	0.00	O	|	|	|	|
94+ 0	0.0046	0.00	O	|	|	|	|
94+10	0.0046	0.00	O	|	|	|	|
94+20	0.0046	0.00	O	|	|	|	|
94+30	0.0045	0.00	O	|	|	|	|
94+40	0.0045	0.00	O	|	|	|	|
94+50	0.0045	0.00	O	|	|	|	|
95+ 0	0.0045	0.00	O	|	|	|	|
95+10	0.0045	0.00	O	|	|	|	|
95+20	0.0045	0.00	O	|	|	|	|
95+30	0.0045	0.00	O	|	|	|	|
95+40	0.0045	0.00	O	|	|	|	|
95+50	0.0045	0.00	O	|	|	|	|
96+ 0	0.0045	0.00	O	|	|	|	|
96+10	0.0045	0.00	O	|	|	|	|
96+20	0.0044	0.00	O	|	|	|	|
96+30	0.0044	0.00	O	|	|	|	|
96+40	0.0044	0.00	O	|	|	|	|
96+50	0.0044	0.00	O	|	|	|	|
97+ 0	0.0044	0.00	O	|	|	|	|
97+10	0.0044	0.00	O	|	|	|	|
97+20	0.0044	0.00	O	|	|	|	|
97+30	0.0044	0.00	O	|	|	|	|
97+40	0.0044	0.00	O	|	|	|	|
97+50	0.0044	0.00	O	|	|	|	|
98+ 0	0.0044	0.00	O	|	|	|	|
98+10	0.0043	0.00	O	|	|	|	|
98+20	0.0043	0.00	O	|	|	|	|
98+30	0.0043	0.00	O	|	|	|	|
98+40	0.0043	0.00	O	|	|	|	|
98+50	0.0043	0.00	O	|	|	|	|
99+ 0	0.0043	0.00	O	|	|	|	|
99+10	0.0043	0.00	O	|	|	|	|
99+20	0.0043	0.00	O	|	|	|	|
99+30	0.0043	0.00	O	|	|	|	|
99+40	0.0043	0.00	O	|	|	|	|
99+50	0.0043	0.00	O	|	|	|	|
100+ 0	0.0042	0.00	O	|	|	|	|

100+10	0.0042	0.00	O				
100+20	0.0042	0.00	O				
100+30	0.0042	0.00	O				
100+40	0.0042	0.00	O				
100+50	0.0042	0.00	O				
101+ 0	0.0042	0.00	O				
101+10	0.0042	0.00	O				
101+20	0.0042	0.00	O				
101+30	0.0042	0.00	O				
101+40	0.0042	0.00	O				
101+50	0.0042	0.00	O				
102+ 0	0.0041	0.00	O				
102+10	0.0041	0.00	O				
102+20	0.0041	0.00	O				
102+30	0.0041	0.00	O				
102+40	0.0041	0.00	O				
102+50	0.0041	0.00	O				
103+ 0	0.0041	0.00	O				
103+10	0.0041	0.00	O				
103+20	0.0041	0.00	O				
103+30	0.0041	0.00	O				
103+40	0.0041	0.00	O				
103+50	0.0041	0.00	O				
104+ 0	0.0040	0.00	O				
104+10	0.0040	0.00	O				
104+20	0.0040	0.00	O				
104+30	0.0040	0.00	O				
104+40	0.0040	0.00	O				
104+50	0.0040	0.00	O				
105+ 0	0.0040	0.00	O				
105+10	0.0040	0.00	O				
105+20	0.0040	0.00	O				
105+30	0.0040	0.00	O				
105+40	0.0040	0.00	O				
105+50	0.0040	0.00	O				
106+ 0	0.0039	0.00	O				
106+10	0.0039	0.00	O				
106+20	0.0039	0.00	O				
106+30	0.0039	0.00	O				
106+40	0.0039	0.00	O				
106+50	0.0039	0.00	O				
107+ 0	0.0039	0.00	O				
107+10	0.0039	0.00	O				
107+20	0.0039	0.00	O				
107+30	0.0039	0.00	O				
107+40	0.0039	0.00	O				
107+50	0.0039	0.00	O				
108+ 0	0.0038	0.00	O				
108+10	0.0038	0.00	O				
108+20	0.0038	0.00	O				
108+30	0.0038	0.00	O				
108+40	0.0038	0.00	O				
108+50	0.0038	0.00	O				
109+ 0	0.0038	0.00	O				
109+10	0.0038	0.00	O				
109+20	0.0038	0.00	O				
109+30	0.0038	0.00	O				

109+40	0.0038	0.00	O				
109+50	0.0038	0.00	O				
110+ 0	0.0038	0.00	O				
110+10	0.0037	0.00	O				
110+20	0.0037	0.00	O				
110+30	0.0037	0.00	O				
110+40	0.0037	0.00	O				
110+50	0.0037	0.00	O				
111+ 0	0.0037	0.00	O				
111+10	0.0037	0.00	O				
111+20	0.0037	0.00	O				
111+30	0.0037	0.00	O				
111+40	0.0037	0.00	O				
111+50	0.0037	0.00	O				
112+ 0	0.0037	0.00	O				
112+10	0.0037	0.00	O				
112+20	0.0036	0.00	O				
112+30	0.0036	0.00	O				
112+40	0.0036	0.00	O				
112+50	0.0036	0.00	O				
113+ 0	0.0036	0.00	O				
113+10	0.0036	0.00	O				
113+20	0.0036	0.00	O				
113+30	0.0036	0.00	O				
113+40	0.0036	0.00	O				
113+50	0.0036	0.00	O				
114+ 0	0.0036	0.00	O				
114+10	0.0036	0.00	O				
114+20	0.0036	0.00	O				
114+30	0.0036	0.00	O				
114+40	0.0035	0.00	O				
114+50	0.0035	0.00	O				
115+ 0	0.0035	0.00	O				
115+10	0.0035	0.00	O				
115+20	0.0035	0.00	O				
115+30	0.0035	0.00	O				
115+40	0.0035	0.00	O				
115+50	0.0035	0.00	O				
116+ 0	0.0035	0.00	O				
116+10	0.0035	0.00	O				
116+20	0.0035	0.00	O				
116+30	0.0035	0.00	O				
116+40	0.0035	0.00	O				
116+50	0.0034	0.00	O				
117+ 0	0.0034	0.00	O				
117+10	0.0034	0.00	O				
117+20	0.0034	0.00	O				
117+30	0.0034	0.00	O				
117+40	0.0034	0.00	O				
117+50	0.0034	0.00	O				
118+ 0	0.0034	0.00	O				
118+10	0.0034	0.00	O				
118+20	0.0034	0.00	O				
118+30	0.0034	0.00	O				
118+40	0.0034	0.00	O				
118+50	0.0034	0.00	O				
119+ 0	0.0034	0.00	O				

119+10	0.0034	0.00	O	|	|	|	|
119+20	0.0033	0.00	O	|	|	|	|
119+30	0.0033	0.00	O	|	|	|	|
119+40	0.0033	0.00	O	|	|	|	|
119+50	0.0033	0.00	O	|	|	|	|
120+ 0	0.0033	0.00	O	|	|	|	|
120+10	0.0033	0.00	O	|	|	|	|
120+20	0.0033	0.00	O	|	|	|	|
120+30	0.0033	0.00	O	|	|	|	|
120+40	0.0033	0.00	O	|	|	|	|
120+50	0.0033	0.00	O	|	|	|	|
121+ 0	0.0033	0.00	O	|	|	|	|
121+10	0.0033	0.00	O	|	|	|	|
121+20	0.0033	0.00	O	|	|	|	|
121+30	0.0033	0.00	O	|	|	|	|
121+40	0.0032	0.00	O	|	|	|	|
121+50	0.0032	0.00	O	|	|	|	|
122+ 0	0.0032	0.00	O	|	|	|	|
122+10	0.0032	0.00	O	|	|	|	|
122+20	0.0032	0.00	O	|	|	|	|
122+30	0.0032	0.00	O	|	|	|	|
122+40	0.0032	0.00	O	|	|	|	|
122+50	0.0032	0.00	O	|	|	|	|
123+ 0	0.0032	0.00	O	|	|	|	|
123+10	0.0032	0.00	O	|	|	|	|
123+20	0.0032	0.00	O	|	|	|	|
123+30	0.0032	0.00	O	|	|	|	|
123+40	0.0032	0.00	O	|	|	|	|
123+50	0.0032	0.00	O	|	|	|	|
124+ 0	0.0032	0.00	O	|	|	|	|
124+10	0.0031	0.00	O	|	|	|	|
124+20	0.0031	0.00	O	|	|	|	|
124+30	0.0031	0.00	O	|	|	|	|
124+40	0.0031	0.00	O	|	|	|	|
124+50	0.0031	0.00	O	|	|	|	|
125+ 0	0.0031	0.00	O	|	|	|	|
125+10	0.0031	0.00	O	|	|	|	|
125+20	0.0031	0.00	O	|	|	|	|
125+30	0.0031	0.00	O	|	|	|	|
125+40	0.0031	0.00	O	|	|	|	|
125+50	0.0031	0.00	O	|	|	|	|
126+ 0	0.0031	0.00	O	|	|	|	|
126+10	0.0031	0.00	O	|	|	|	|
126+20	0.0031	0.00	O	|	|	|	|
126+30	0.0031	0.00	O	|	|	|	|
126+40	0.0031	0.00	O	|	|	|	|
126+50	0.0030	0.00	O	|	|	|	|
127+ 0	0.0030	0.00	O	|	|	|	|
127+10	0.0030	0.00	O	|	|	|	|
127+20	0.0030	0.00	O	|	|	|	|
127+30	0.0030	0.00	O	|	|	|	|
127+40	0.0030	0.00	O	|	|	|	|
127+50	0.0030	0.00	O	|	|	|	|
128+ 0	0.0030	0.00	O	|	|	|	|
128+10	0.0030	0.00	O	|	|	|	|
128+20	0.0030	0.00	O	|	|	|	|
128+30	0.0030	0.00	O	|	|	|	|

128+40	0.0030	0.00	O				
128+50	0.0030	0.00	O				
129+ 0	0.0030	0.00	O				
129+10	0.0030	0.00	O				
129+20	0.0030	0.00	O				
129+30	0.0029	0.00	O				
129+40	0.0029	0.00	O				
129+50	0.0029	0.00	O				
130+ 0	0.0029	0.00	O				
130+10	0.0029	0.00	O				
130+20	0.0029	0.00	O				
130+30	0.0029	0.00	O				
130+40	0.0029	0.00	O				
130+50	0.0029	0.00	O				
131+ 0	0.0029	0.00	O				
131+10	0.0029	0.00	O				
131+20	0.0029	0.00	O				
131+30	0.0029	0.00	O				
131+40	0.0029	0.00	O				
131+50	0.0029	0.00	O				
132+ 0	0.0029	0.00	O				
132+10	0.0029	0.00	O				
132+20	0.0028	0.00	O				
132+30	0.0028	0.00	O				
132+40	0.0028	0.00	O				
132+50	0.0028	0.00	O				
133+ 0	0.0028	0.00	O				
133+10	0.0028	0.00	O				
133+20	0.0028	0.00	O				
133+30	0.0028	0.00	O				
133+40	0.0028	0.00	O				
133+50	0.0028	0.00	O				
134+ 0	0.0028	0.00	O				
134+10	0.0028	0.00	O				
134+20	0.0028	0.00	O				
134+30	0.0028	0.00	O				
134+40	0.0028	0.00	O				
134+50	0.0028	0.00	O				
135+ 0	0.0028	0.00	O				
135+10	0.0027	0.00	O				
135+20	0.0027	0.00	O				
135+30	0.0027	0.00	O				
135+40	0.0027	0.00	O				
135+50	0.0027	0.00	O				
136+ 0	0.0027	0.00	O				
136+10	0.0027	0.00	O				
136+20	0.0027	0.00	O				
136+30	0.0027	0.00	O				
136+40	0.0027	0.00	O				
136+50	0.0027	0.00	O				
137+ 0	0.0027	0.00	O				
137+10	0.0027	0.00	O				
137+20	0.0027	0.00	O				
137+30	0.0027	0.00	O				
137+40	0.0027	0.00	O				
137+50	0.0027	0.00	O				
138+ 0	0.0027	0.00	O				

138+10	0.0026	0.00	O	|	|	|	|
138+20	0.0026	0.00	O	|	|	|	|
138+30	0.0026	0.00	O	|	|	|	|
138+40	0.0026	0.00	O	|	|	|	|
138+50	0.0026	0.00	O	|	|	|	|
139+ 0	0.0026	0.00	O	|	|	|	|
139+10	0.0026	0.00	O	|	|	|	|
139+20	0.0026	0.00	O	|	|	|	|
139+30	0.0026	0.00	O	|	|	|	|
139+40	0.0026	0.00	O	|	|	|	|
139+50	0.0026	0.00	O	|	|	|	|

**********HYDROGRAPH DATA**********

Number of intervals = 1302
Time interval = 10.0 (Min.)
Maximum/Peak flow rate = 6.070 (CFS)
Total volume = 1.186 (Ac.Ft)

Status of hydrographs being held in storage

	Stream 1	Stream 2	Stream 3	Stream 4	Stream 5
Peak (CFS)	0.000	0.000	0.000	0.000	0.000
Vol (Ac.Ft)	0.000	0.000	0.000	0.000	0.000

****

Appendix II

Education Material

The Updated Model Water Efficient Landscape Ordinance

CA 1-0RNIA OI-PARTMl-.111 Of WAit.!! RlSOURCI-S

Landscapes are essential to the qualityof lifein California. They provideareas for recreation, enhance the environment, clean the air and water, prevent erosion, offer lire protection and replace ecosystemslost to development.

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

TheWater Conservation in Landscaping Act of 2006(Assembly 81111881, Laird) requirescities. counties, andcharter citiesandcharter counties, to adopt landscape water conservation ordinances by January 1, 2010. Pursuant to this law, the Department of Water Resources(DWR) hasprepared a Model Water Efficient Landscape Ordinance (Model Ordinance) for *use* by local agencaes.. The Model Ordinance wasapproved by the Officeof AdministrativeLaw on September 10, 2009.The ModelOrdinance became effective on September 10.

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

For mQtc-inform-,1eon. plt•a visitourweb siteat
htlp:J/www.wator.ca.govAvateru seeff iciency/landscapeordlnanee/

O\VR OW.Jhl't' 2009

Important points to consider...

Wator purvoyors havo an important role.

The Qnabling statute was directed to local agencies thcit make land use decisions and approve land development. A<tivrcticipatiOI\ bywater puNC)'OfS can make the Implementation, enforcement and follow-up actions of an ordinance *mote*effective.

Most newand rehabilitated landscapes aresubject to a water e.fficlent landscape ordinance. Poblic landscapes and private development projects including devcloperlnst:c1lled slngle famllyand muttl-famlly resldentlal landm1pes with at least 2500 sq.ft.oflandscape area aresubject to the ModelOrdinance.

Homeowner prOVided landscaping at single family and multi-family homes arc subject to the ModelOrdinance ifthe lands pe area isat least 5000 sq.ft

Existing landscapos aro also subject to the Model Ordinance.

Water waste iscommon in landscapes that arc poorly designed or not well maintained.Water waste (from runoff, overspray, low head drain:ige, leaksand excessive amounts ofapplied irtigation water in landscapesis prohibited by Section 2, Article X of the CaliforniaConstitution.

Any landscape installed prior to January1, 2010, that isat least one acre in si.2.e may be subject to irrigation audits, irrigation surveys or water useanalysis programs forevaluating irrigation !. tC?m pe,fonnance and adhNC?ncC? to the Maximum Applied WaterAllowance as defined in the 1992 Model Ordinance with an Evapotranspiration Adjustment Factor (ETAF) of 0.8. Localagenciesand water purveyors (desigll3ted by th localagency) may iMtitut these oroth r programs to increase efficiency in existing landscapes.

All new landscapes will be assigned a watet'budget.

The water budget approach isa provision in the statute that ensures a landscape isallowed sufficient water.There are t\vowater budgets in the ModelOrdinance;the Maximum Applied Water Allowance (MAWA) and the Estimated Total Water Use(ETWU).

The MAWA. is the water budget used forcompliance and isanannualwater allowance based on landscape area, local evapotranspiration and ETAFof 0.7.The rnvu isan annualwater useestimation fordesign purposes and is based on the water needsof the plants actualtychosen fora given landscape.The ETWU may notexceed the MAWA.

Water efficient landscapes offermultiple benefits.

Waterefficient landscapes willstretch ourlimited water supplies. Other benefits indude reduced irrigation runoff, reduced poflution of waterways, less propertydamage, less green waste, increased drought resistance and asmaller carbon footprint.

The Department of Water Resources will **offer tec:hnical assistc1nce.**

The Department plans to *offer* a seriesof workshops, publications and other assistance forsuccessful adoptionand implementation of the ModefOrdinance or localwater efficient landscape ordinances. Information regarding these resources maybe found on the DWR website: http://www.water.ca.gov/wateruseefficiency/landscapeordinance/ Questions on the Model Ordinance may be sent by e-mailto DWR staffat mweo@water.ca.gov.

R-3
AUTOMOBILE PARKING

Pa1·ked automobiles may conb·ibute pollutants to the storm drain because poody maintained vehicles may leak fluids rontaining hydrocarbons, metals, and other pollutants. In addition, heavily soiled automobiles may dropclods of dirt onto the parkit,g surface, contributing to the sediment load when runoff is present. Duriny, rain events, or wash-down activities, the pollutants may be carried into the storm d1·ain system. The pollution prevention activities ouU.iJ,ed in this fact sheets are used lo prevent the diS<'harge of pollutants to the storm drain system.

The activities outlined in this fact sheet target the following pollutants:	
Sediment	x
Nulrieols	
Bacteria	
FoaminQ MM!s	
M81als	X
Hvdrocalboos	X
Hazaroous Materials	x
Pesticides a, Herl>icides	
Other	

Think before parkit,g your car. Remember -The ocean starts al your front door.

Required Activities

- If required, vehiclC!s have to be removed from the street during designated street sweeping/deaning Umes.
- If UH? automobile is leaking. place a pan or similar collection device w,der the automobile, until such time as the leak may be repaired.
- Use dry cleaning meU1ods lo remove any materials deposited by vehicles (e.g. adsorbents for fluid leaks, sweeping for soil clod deposits).

Recommended Activities

- J'ark automobiles over permeable surfaces (e.g. gravel, or porous cement).
- Llmil vehicle parking to covel'ed areas.
- Perform routine maintenance lo minimize fluid leaks, ai,d maxin fuel efficiency.

For additional information contact:
County of Oral1ge, OC Watershed
Main:(714} 965-0600/ 24hr Water Pollutioo I)(scharge Hotfine1-877-89-SPILL
or visit our website at:www.ocwater.;heds.com

R-7
HOUSEHOLD HAZARDOUS WASTE

JIousehold hazardous wastes (HHVv) are defined as vn,.stc materials which are typkally found in homes or similar sources, which exhibit characteristics such as: corrosivity, ignitability, reactivity, ru1d/ot toxicity, or arc lisled *as* hazardous materials by EPA.

The activitiC$ outlillcd in thisfoct sheet tsrget the following eolh.rt.1nts:	–
Sedinent	
Nutrients	
&cteria	–
Foaminohlents	)(
Metals	)(
HvdrocM>Ons	L_
Haurdous Materials	)(
Pesticioosand Herbicides	)(
Ottle.r	)(

List *ot* most common HHV/ products:

Drain Oi)enEtS
0180 ®a'lelS
Woocl andmetalo s aad pdishc$
Ai.t.o.'OOUteoilaOOfuel.Mldf..•,es
G,ea-.e**md** rustso "'°I.S
Ca11lure10, 'ld fuel t.jeotion deaners
&a1ertulds
ies
Pant Thr.nelS
Pant strippersa-idrema,ers
Ad'ICSh'<lS
Herticid
Pest>odes
Fungicides/woodpicservalr,'CS

Many types of waste can be recycled, however options for each waste type are limited. Recycling is always prefarabk to disposal of w1wanted materials. All gasoline, antifree7.e, waste oil, and lead-acid batteries can be recycled. Late.x and oil-based paint can be reused, as well as recycled. Materials U\at cannol be reused or recycled should be disposed of at a properly permitted landfill.

R£ cycL £ UsED O I l.

Th.i.t'1< before disposing of any household hazardous was le. Remember - The ocean starts al your front door.

Required Activities

- Dispose of HHW at a local collection facility. Call (714) 8:34-6752 for the household ha7.ardous waste center closest to your area.
- Household ha7.ardous materials must bestored indoors or under cover, and in closed and labeled containers.
- If safe, contain, clean up, and properly dispose all household ha7.ardous waste spills. If an m1safe condition exists, call 911 Lo activate the proper response team.

Recommended Activities

- Use non-hazardous or less-ha7.ardous produrts.
- Participate in HHW reuse and recycling. Call (714) 834.--0752 for the participatin3 household hazardous waste centers.

T{l(lcas, :aA e<M1 'dSl9M!'rl <'tBoe.qit.tlfa '<»'i!l [''9 *(800, -2961.* ti\;(/;\'f'A'ide3 ▾ *Md (c'Ct'CCllg* /resffoos*l!lf* rm,dol.

For additional Information contact:
County 0: Orange, OC Watershed
Main:(714) 955-0600124hrWater PollullonDl harge Hotfne1-877 9-SPILL
or vlslt our webslieat:www.ocwa1ersheds.com

R-8
WATER CONSERVATION

The activities outlinedin this fact sheet targe.t the following pollutants:	
Sediment	x
Nutrients	x
Baciefla	x
FoaminaAoents	x
Mellm	...L_
Hydrocarbons	x
Hazll"doos Mateflas	x
Peslickles d Herbicides	x
Other	x

Excessive irrigation and/or theoveruse of water is often U,e most sig,.tificant factor in transporting pollutants to the storm drain system. Pollutants from a wide variety of sources including automobile repair and mai1,renance, automobHe wasl ng, automobile parking, home and garden rare activities and pet care may dissolve in the wah!r and l>e transported to u,estorm drain. ln addition, particles and materials coated with fertili7.ers and pesticides may besuspended in the flow and be transported to the storm drain.

Hosing *of{* outside areas towash them down not only consumes large quantities of water, but also transports any pollutants, sectiments, and waste to the storm drain sysrem. The pollution prevention activities outlined in this fact sheets are used to prcve1,t thedischa1·ge of pollutants to the storm drain system.

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

Required Activities

- irrigation systems must be properly adjusted to reAect seasonal water needs.
- Do not hose off outside surfaces to dean, sweep wiU, a broom instead.

Recommended Activities

- fix any leaking faucets and eliminate unne<essary water sources.
- Use xcroscaping and drought tolemnt landscaping to reduce the watering needs.
- Do not over watcriI,g lawns or gardens. Over wateru,g v.rastes water and promotes diseases.
- Use a bucket to re-soak sponges/rags whJle v.rashing automobiles and other items outdoors. Use hose only for rinsing.
- \Nash automobiles at a commercial car wash employing water recycling.

For additional inform:itlon contact:
County of Orange, OC Watershed
Main: {714) 955-0000/ 24hr Water Pollution Discharge Hotline 1-877-89-SPILL
or visit ourwebsiteat: www.ocwatersheds.com

FP-2

LANDSCAPE MAINTENANCE

The model procedures described below focus on minimizing the dlsdlarge 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 moreof the foUowfng activities:

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

POLLUTION PREVENTION:

lionpravenlloomeasureshavebeenooosideredandtncorporated Intilemodelprocedures.Implernenla1iofIor thesemeasuresmay bemoreeffective andredooeofeliminatetheneedtolmplemeMothermora compllcaledor cOS1lyprocedures. P06'SiblepolXlliM pre\-entk>measures forlandscapemainlenanoeinclude:

- Implemel\l aniltegraled pest management (1PM)program. 1PMis asushmableapproachto managingpestsby combining biological, C\4\Jral,physical,andchemicall . RefertoAppemflx D,FertilizerandPes1icideManagemeflIGuidancefOf'further details.
- ctioose towwa1eruS'ilgHowers, trees,shrubs,andgroullOOO\-er.
- Appropriatem.tntsnance O.e.properlyUrned fertilizl!VJw. eeding, pestOOf'ltrol,andpruning) \\ill preserve the landscapeswater efficiency.
- Onceper)'ear, educatemunicipalstaff onpoluUonpreYenllonres.

MODEL PROCEDURES:

1. Mowing, Trimming/Weeding, and Planting

Mowing, Trimming/Weeding

Whenever possible.usemechanicalme1hodsOrvegetationren¥Walra1her thanapp)yitghert>icides. Use handweedingwherepractica.

Whencol'lducting mechankat ormanual weed control, avoid loosening the so\whxihcoulderodeintostreams**or**s1osmdrains.

Usecoarse textured mulctiesorgeolexliles tosuppress weedgroMhand reducetheuseorherbicides.

Donotblow or rakeleaves, etc.inlolhe street**or**placeyard wasle ingutters oron<1stshoulders. Sweep upanyleaves, lilfer orresidues**i** gul1ers or**oo** stJeeL

Collect l!v1,t1 andgardenclippings, prunillQwaste, treelJimmings, **and** weeds. Chipi neoessary, andcompostordispose ofatalandfill(seewaste management section of!tisprocedu**r**esheet).

Ptace temporarily stodcpiled material*&N* from waleroou s. aridbermor coverstockpileslo pre\'Eflt**m**aterial rel stostormdrains.

Planting

Where feasible,relainand/orplant semaat na(jye v elation whose featuresaredelermiledtobebeooficia1. Nali\-evegetationusually requires less maintenance (e.g.,irrigation, rertiizer)Ulanplanting ornamental vegeta1ion.

Whenplanting orreplanting oon.slderusing*bN* wa<erusegroondCO\-ers.

OPTIONAL:

- CareflA sol**nixing alld** layeringlectlniquesusingatopsoillllllXoroomposled organic materialcan beusedas aneffeotivemeasure toreduceherbicide use and waterifl9.

2. Irrigation

Ulilize water delivery rates tl-.atdonolexceed thelnfilralionrats of the soil.

Use timers appropfialety ora <ftip systemloprovel'A runoff andthenooly irrigate as muchasisneeded.

Inspect l alionsys{emperiodically toensure thatllle rfgliamoontof waler lsbeingapplied andlhatexcess! llllloffisnol oc0.1rmg. Mlrvnizeexcess wateMg,and repairl&aks inlhelrr,;iaUonsystemassoon aslheyare obseNed.

Wherepr tlca1,use automati: timers10minimize runoff.

Usepopupsprin lerheadsInaraasWithalOtof aoli'tity or w e there is **a** chance thepipesmaybeb en. Consider lh.euseof mechanisms that reduce wa\erflowloSprinllleiheads ifbroken.

Ifre-claimed water*is*used for inigaoon,ensure thatthereisno n11ott from 1helandscapedarea(s).

If bailing of *nwddywater* isrequired (e.g.whenrepairingawater lineteak), donolpulit in the s1oml<train;pour overlandscaped areas.

3. Fertilizer and Pesticide Management

Usage

Uffize ac:ompreflensivemat1agemeflt s emthat lncorpora1es lntegra',ed pestmanagement lechnKl')es.

Follow ;ii **eral,**sw.e,aOOklcallawsandregulations goY8ming tt use. S1o,age, anddisposalofrertmersand peslicides andtrainingofapplicators andpestoontrol advisors.

E<Ncate andtrainempbyees onuseofpes1icldes andinpeslicile awlica1ion techrvques topreventpollullon.

PesUdde applicallon must be underlllesupervisionof aCalifoolia qu 6ed pesticide i!Jlf)llca1or.

\'hlenapplicat>:uesethe least toxicpestk:ldes **that**wllldotheJob. A,ut use ofoower-tiased pesticidesif possible.

nolmixorprepa-e pesb'cides **or** fertiftzers forapplication near5'orm dralI\S.

Prepare themlrimllllamo111t ofpesllcide Aeeded for theJobandusethe lowestratetl\alwineffectively a,ntrolhe pest

Employtechniques tominimize off-targetapplicaoon **(e.g.**spraydrift) **of** pesliooes, includilg consideration ofallemaliveappkatbn technques.

C braleJertnzerand**pes11clde**al)plica!loneqlfcimen1*to* a,'Oldexcessive application.

Periodically lestsoilsfordetermil\ilg properfertilizeruse.

Sweep paY-ament cllldsidewalk iflertifa:er isspi12d onthesesurfaces before applyi irogall>nwater.

Inspect pes1icideltertiizefeqll4)f11enl andlranspo lon vehklesdally.

ReferloAwendix DforfurtherguidoooeonFertilizerandPestiooe mariagement

OPTIONAL:

- Work fertiliz:ersintothesoil rather thandumpingorbroadcas!lng themonto theswface.
- Usebene«blalInsects,•,herepossblelocontrolpests(enlaoe\\;ngs. ladyoogs,prayingrnanlis,gro111d beetles,p;,asilicnematodes, lri:hogramma wa&l)S, edhead weevils, and spiders prey ondetrimental pest species).
- Use slowreleas9 fertilizers \\tieneverpossible to mlrimze leachlng.

Schedullng

Donolusepesticidesifrain isexpected within24hours.

ApplypesUddes only\\tlenvAndspeedsare **low**(lesstllan5mph).

Disposal

Purchaseonly theamountofpesooide tllalyoucanreasonablyuseina given timepefiod(momhoryeardepending onthepmcllrct).

Triplerinseooolaiflers, anduserinsewaler asproduct. Dispose ofunused pesticide ashazardous waste.

Dlsposeof ef11)typesticide containers accordilg lotheinstructiollSon the oootailerlabel.

4. Managing Landscape Waste

Compos1lea\ies,sticks,orolher collecied vegelalion ordisposeof at a permittedlandf1J. Dono1disposeof cofededve a1lonlnlowalerways or stormdrainage syslems.

AlsoseaWsslo HsrrcHing Md ***Dispo$al proc*** *sheet*

Place temporarilyslo ledmaterialaway fromwaterCOtJrses andstoirn drainiliets,andbermorCO'MstockpiIes topreventmaleriareleases tothe stonndrainsystem.

Reduoetheuseof highnilrogen fertilizetS!hat produce excessgrowth requiriDgmorefrequentmowilgorlrimmifl9.

Inspectionofdranage facilitiesshouldbeconductedlodetect illegal dumpng ofofppl s/cuttingsinor ne.1rthesefacil les. Materials loond shouki bepi.d<ed up and propertydisposed of.

Laooscapewastesinandarouoo stormdrainilletsshook! beavoidedby either usingbaggingequipmoot orbymaooallypicking thematerial.

S. Erosion Control

Maintain v lvecoveronmedians aoo embankml!fltstopreve11lsoil eroskm. Applymulchor lea-.--celipf)ings tosem asaddilional *cover* forsoil slabi aoo toreduce lhevelocity of stormwalerroooff.

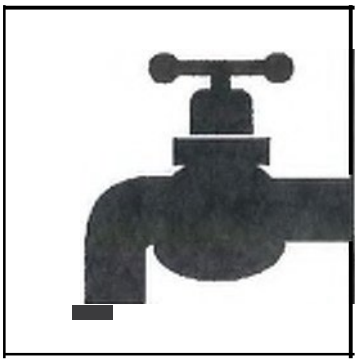
AJs.otee W.iste *Handi'vJg andDispo.sal prrxedure sh t*

Minimize1heuseof disking asameansof vegetationmanagement because U'lepracticemayresinerodablebarren soil.

Confineexcavated m erjalslo pervious surfacesawayfromslormdrill lnle4s.sidewalks, pavement, andditches. MaterialmustbeCO'teredifrailis expected.

LIMITATIONS:

Alternative peStlweeclcontrolsmayno!beavailabE, su'J.able, oreffeciiw lneverycase.



FP-6

WATER AND SEWER UTILITY OPERATION AND MAINTENANCE

Although the operation and maintenance of public utilities are notconsidered themselves a chronic sou.-oe of stormwater pollution, some activities and accidents can reS\llt 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 drainsystem. Activittes associated with theoperation and maintenanee 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 C.Ontrol, Respons:e, and COntainment

Cities that do notprovide maintenance of water and sewer utilities should coordinate with the contracting agency responsible for these activities and ensure thatthese model procedures are followed.

POLLUTION PREVENTION:

PollulionPfeven1ionrnec3S\Jres havebeenccnsilered andv,c::orporatedinthemodelprocedures.Implemer.lalion*of* ltlesemeasuresmay be moreerfetliveandreduce01 ellmlnate theneedIOi emenlolhermorecomplicatedor costly procedures. Possiblepollution preveMion measures rorwalerand utilityopera1ionand maintenance Include:

- fr,spectpotentialnon-stom,waterdischargeflowpalhsand aearfcieaoop any debrisor pollutants fO\lld(i.e.remove trash,lea\'es,sedimen andwipeupliquids, lnckldlngoil spills).
- Onceper year,educate muni:ipal staffonpollulionprevenUonmeaStJres.

MODEL PROCEDURES:

1. Water Line Maintenance

Prooedures canbeemployedtoreducepollutants fromdischarges associated wtth waler utJlily operation and maintemmce activities. Planned dischargesmayIncludefirehydrant t•tlng,flushing water supply mainsafterne.w oonstructlon, flushingtines duetocomplaintsof tasteandodor, dewaterlngmains for malnten!rlcewor1<. Unplanned dischargesfrom trea1ed, recycled water,raw waler,cllld groundwater systemsoperation andm.intenanceactivities can oocm from walermain breaks,sheared fire hydrants, equipment malfimctlon, and operatorerror.

Planned Discharges

Forplanlll!ddischargesuseoneofl.he followingoptions:

- Reuse waterfordust suppression,irriga1ion.orconsiruclion compaction
- Oscharge lothesanilary sewer system ffllapprov-al
- Olscharge totheSlorm drainsystem or toacreek usingapplicable pollu0ooamtrolrooasuraslisted below(I.hisoptionisONLY applk:able louncontaminatedpumped gro1J1d water, waterline flushmg, firehydrant tes1iAg andflushillg,dischargesfromJ>O'al)le v er sourcesotherthanwalermainbreaks) andmayrequirea permitfrom theRegiona1Water Quality Control Boan:!.

Ifwalerisdischarged toast0m1dralninlet(catch basin), controlmeasures must be putIn tocontrol potentialpottutanls*6, e.*sedimeflt,chlorile, etc.). Exanples of somestormdraininlet protection oplioliSi lude:

- Slit ,ence- appropriate wllsre theiiwtdraillSarela1ivaly flatarea.
- Graveland wire meshsediment filter-Appropriate where concentra1ed flows aree)q'lected.
- Wooden weir andfabric- use alC\JrbInle-\s'i\tlerea compact Installationisdesired.

Prior todistllcfge, inspectdiscflargeOowpath andclearlctean *any* debrls or po1!u\allts found(I.e.remove trasha, ves,sedimenL **and**Vfipe llquids, iidudingoil spills).

Select apprOf)rialepollulioncontrolmeasure(s) consklering thereceiving sys1em(i.e.ooroInlet.dropfnlel.culvert,creek.e1c.) andensll8 that the controldevlce(s) fitproperty.

Generaldesigncoos«fera1lons forinletprotecilondevicesIncwde the following:

- Thedeviceshoutlbeconstructed such thatcleanilgandd'°JSJ)Osal oftrappedsediment ismadeeasy,Yitlileminimizinginterference wi1hcl.SCharge activities.
- Devices sholif beconslructed so that*any* s1aoolng water resl.t1ing fromthedisoharge willnotcauseacesSi\-e inconvenienceor floodir,91<famagetoadjacentlandofstructures.

Thee:tectivaless of controldevioesmustbe monitoredduring thedischarge periodandanynecESSary repairs ormocifications made asnlllilded.

OPTIONAL:

- Sedimentremovalmay beenhillcedbyplacingfillerfabric,glo'Yelbags, etc. atS1ormdrain Ir&!ts.

Unplanned Discharges

Stoplhedischarge asquickly asposst>le byttKnlogoff wa!er soorce.

Inspect now pathofthedischarged water:

- Controlerosionaloog theflow path.
- Identify areas ttialmayproduce sgJJifica11t sedimefllorgullies,use sandbagstoredirectthefl0w.
- Idenlify erod areaswhichmayneed to berepaired or ecled duoogsubsequent repairs orcorrective actions

Ifrepairso; cooeclive actionwillcause additionaldischargesorwater.se1ect theapproprta procedures forerosioncontrot chlorine resfduat, turlidlty, and chemical additives. Preventpotential p tar,ts fromenterlns the fbw path andensw-e thatnoaddltk>na discharged water enle,sstonndrain troots.

2. Sanitary Sewer Maintenance

AppUcable tomunlclpalltleswho ownandoperated a sewagecollection system. Facilitiesthatare coveredunderthlsprogram Includesanltwy sewerpipesand pumpstationsowned andoperated by thePermlttee. Theownerofthesanitary sewer facllitlesIs theentityresponsible forcarrying out this prevenllonandresponseprogram.

Sewer System Cleaning

Sewerlinesshooldbec anedonaregular IJ.asis toremovegrease,grit, andotherdebris thatmayleadtosewerbackllps.

Estabfish routine mall\ter.ance program.Cleaning shouldbeconducted atan esla ishedmlnimt.mfrequency andmore frequen1lyforproblem areassuch asreslauranlS that areIdentified

Cleaning activitiesmayrequireremovaloftree rootsandotherkfentified ob ruclions.

Preventatlve and CorrectlvoMaintenance

Durifl grootilemalnlenaooeaf'ld lnspecilonnote theconditionofsanitary sirwerstructures alldIdentify areasUlalneed repair ormaintenance. Items tonote *may*lndude thefollowing:

- cra.ct.edfdetenorctrigplpes
- aking joinlslse at mantv.ite
- frequent lineplugs
- lilegenerally flows at**or**near capacity
- suspectedinfillra!Soonrexfillrali>n

Document suggestions andrequests forrepair andreport *the*information to theapproprlatemanageror supeMSOr.

Prioritize repawsbased onthenarure andseverity of theproblem. tmmedlaleclearing ofblockageorrepair isrequiredv.tlereari overflowis amenUy occurringorforurgent problems thatmaycause animminent overflow(e.g.pumpstation failures,sewerinerup1ures,se-Nerine blockages). These repairs may be temporaryunlitsctleduh:d orcap al improvements canbeoomp2ted.

Rev'iew previous sewermaintenancerecords loh idelltny'hot spo1s·or areasViithfrequE!flt mantenaooeproblems aoo locar«1ns ofpotantial system failure.

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

Control

A seeOra1n8fJS Sy.sram procedlires sheet

Refer tocountywide /u'CJ?*Discharge D..oJecrio.nand EJjmiJ1alion Progrzm.* Components ofthisprogramioclooe:

- InvesUgalioMrls,pectionaOOfoJlow-up
- Elirninalion**of**ill'd1dischargesant1coooedioos
- Enforcement exordlrn111ces
- Respond10sewagespills

- Facililate poo!icrepoftingofilfcildischargesandoonnectioll5. A citizen'shoUine for re1)0r1ing oosierved overflowcordilionsshould bees1a ished tos plemeril the fieldscreeningeffortsbeing coooucled by thePliflcipalPemllee.

Response and Containment

Establish lead departmenVagencyrespcmsib1e **k>r**spnresponse Bild conl.ainment. Providecoordirla1ion Yrittindepartments.

Whena sp]J,leak, aoo'oro\dW ocxurs.keep sewagefromentering lhe s1ofmdrainsys(emlo themioom\Jm extenl **praciicabae** byoo\'ftfingof blockillgslormdraininlels orb'/cootaminganddiveftilg thesewage*away* rromopencharinelsando11Mfslormdrainracllitles (us1119 sandbags, Inflatabledams.etc.).

traspillreachesthestormdrainnotifyCoonlyof Orange He lll Care Agency lhrough ControlOooat(714)628-7208.

Ref'OO',e lhesev e using vacu1.tnequipme or useothermeasures lo divertil back lo the sat1ilafy sewersystem.

Recororeqllledinformationat thespillsite.

Perform fieldtestsasnecessaiy lodeterminethesot1rce of thesjXIL

Oevebp additionalnoaflcaUonprocedures regarolng spillrepo,tlng as needed.

LIMITATIONS:

Prlvaeproperty accessrightsneededto penonntestingalongstormdrain righ4-0f•ways. Requirements ofmunlclpal omlnanceaulhorltyforsuspectedsource vetificalionlestrig necessaiy forguaran1eed rl tsofentry.

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Los AngelesCoonlySlormwaterQuality. Pu cAgencyAaivitiesModel Program. OA-ine: hl1p:/J1adpw.Ofg/wmd/npdes/public_TC.dm

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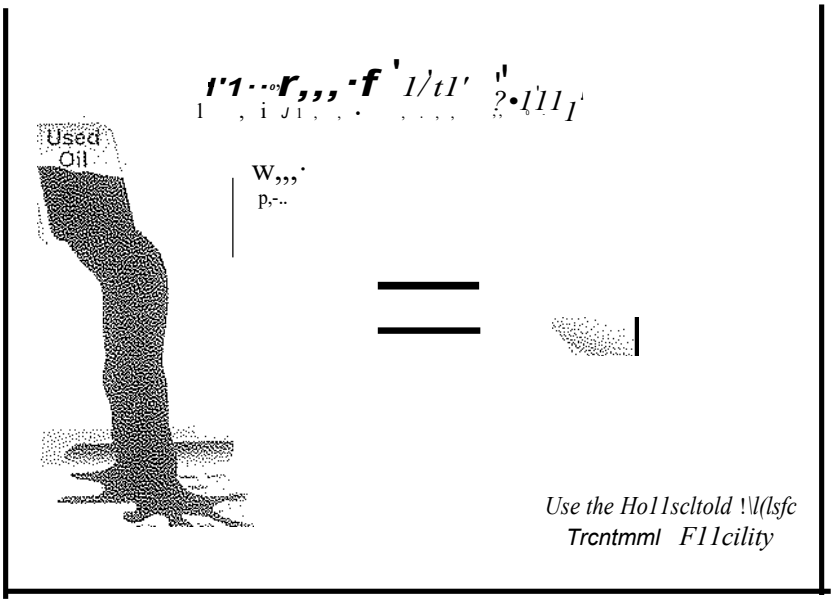
SaMaCln Va'ooy Urban RunofP ollullonPrevenlion Program. Waler UlilltyPollutionPrevefltkln Plan.

Non-Stormwater Discharges SC-10



Graphic by: Margie Winter

Objectives

- Contain
- Educate
- Reduce/Minimize

Targeted Constituents

Sediment
Nutrients
Trash
Metals
Bacteria
Oil and Grease
Organics
Oxygen Demanding

Description

Non-stormwater discharges are those flows that do not consist entirely of stormwater. For municipalities non-stormv-,rater discharges present themselves in two situations. One is from fixed facilities ov-med 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 ,vaters, 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

CASQA California Stormwater Quality Association

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

Suggested Pl'otocols

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 VVaste 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.

Visllal 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.

11 During dry weather the stormwater collection system is filled vvith 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 maybe 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

111 Regularly inspect and clean up hot spots and other storm drainage areas ,vhere 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 pe1formed, 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 POTWlimits).

  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.

T1·aining

- 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

Ot-her 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 vvith 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.

- 1\-lunicipal 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-storm-water" discharge?

- Non-stormwater discharges are discharges not made up entirely of stormwater and include water used directly in the manufactu1ing 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 stormovater 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 we 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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  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.

Storm Drain Stenciling

- Stencil storm drain inlets ½'ith a message to prohibit illegal dumpings, especially in areas ,vith 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 ,,,'ith all applicable state and federal regulations regarding storage, handling, and transp01t 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.

Ilousehold 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 (1-800-9.52-5400). 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 repo1t hazardous waste violations.

References and Resources

http://vvww.stormwatercenter.net/

California's Nonpoint Source Program Plan http://www.co.clar:k.wa.us/pubworks/bmpman.pdf

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

Orange County Stormwater Program,
http://wv,;rw.ocwatersheds.com/stormwater/swp_introduction.asp

San Diego Stormwater Co-permittees Jurisdictional Urban Runoff Management Program
(http:/j\vww.projectcleanwater.org)

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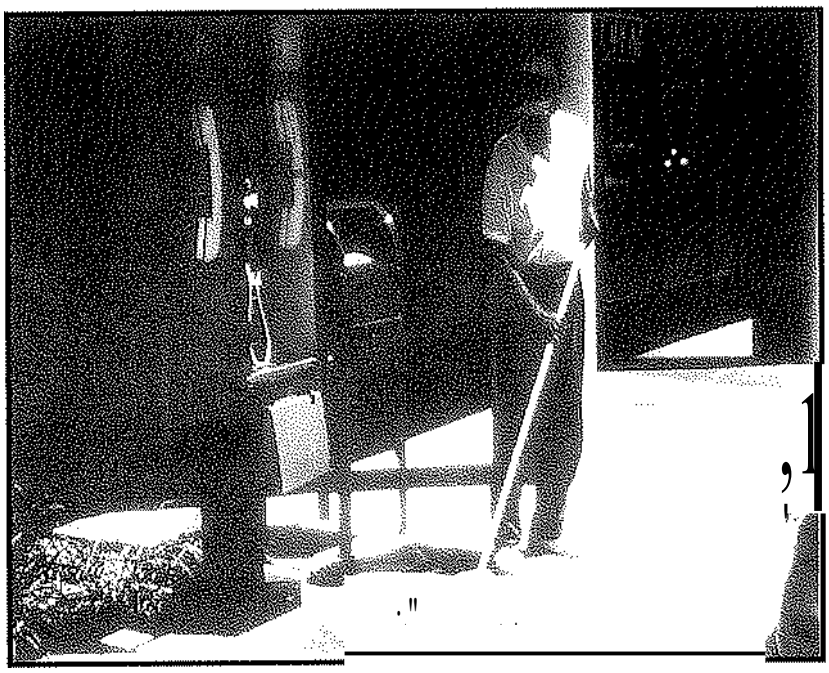
http: //1,vww.scvurppp-w2k.com/pdf%2odocuments/PS_ICID.PDF

Plaza and Sidewalk Clec1r1ing

SC-71



Objectives

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

Targeted Constituents

Sediment	0
Nutrients	0
Trash	0
Metals	0
Bacteria	0
Oil and Grease	0
Organics	0
Oxygen Demanding	0

Description

Pollutants on sidewalks and other pedestrian traffic areas and plazas are typically due to littering and vehicle use. This fact sheet describes good housekeeping practices that can be incorporated into the municipality's existing cleaning and maintenance program.

Approach

Pollution Prevention

- Use dry cleaning methods whenever practical for surface cleaning activities.
- Use the least toxic materials available (e.g. water based paints, gels or sprays for graffiti removal).

Suggested Protocols

Surface Cleaning

- Regularly broom (dry) sweep sidewalk, plaza and parking lot areas to minimize cleaning with water.
- D1y cleanup first (sweep, collect, and dispose of debris and trash) when cleaning sidewalks or plazas, then wash v,rith or without soap.
- Block the storm drain or contain runoff when cleaning with water. Discharge wash water to landscaping or collect water and pump to a tank or discharge to sanitary sewer if allowed. (Permission may be required from local sanitation district.)

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a Block the storm drain or contain runoff when washing parking areas, driveways or drive-throughs. Use absorbents to pick up oil; then dry sweep. Clean with or ,vithout soap. Collect water and pump to a tank or discharge to sanitaiy sewer if allowed. Street Repair and Maintenance.

Graffiti Removal

■ Avoid graffiti abatement activities during rain events.

• Implement the procedures under Painting and Paint Removal in SC-70 Roads, Streets, and Highway Operation and Maintenance fact sheet when graffiti is removed by painting over.

■ Direct runoff from sand blasting and high pressure washing (with no cleaning agents) into a dirt or landscaped area after treating \vith an appropriate filtering device.

■ Plug nearby storm drain inlets and vacuum/pump wash water to the sanitary sewer if authorized to do so if a graffiti abatement method generates wash water containing a cleaning compound (such as high pressure washing with a cleaning compound). Ensure that a non-hazardous cleaning compound is used or dispose as hazardous waste, as appropriate.

Surface Removal and Repair

• Schedule smface removal activities for dry weather if possible.

• Avoid creating excess dust when breaking asphalt or concrete.

• Take measures to protect nearby storm drain inlets prior to breaking up asphalt or concrete (e.g. place hay bales or sand bags around inlets). Clean afterwards by sweeping up as much material as possible.

• Designate an area for clean up and proper disposal of excess materials.

• Remove and recycle as much of the broken pavement as possible to avoid contact with rainfall and stormwater runoff.

• When making saw cuts in pavement, use as little water as possible. Cover each storm drain inlet completely ,vith filter fabric during the sawing operation and contain the slurry by placing straw bales, sandbags, or gravel dams around the inlets. After the liquid drains or evaporates, shovel or vacuum the slurry residue from the pavement or gutter and remove from site.

• Always dry sweep first to clean up tracked dirt. Use a street sweeper or vacuum truck. Do not dump vacuumed liquid in storm drains. Once dry sweeping is complete, the area may be hosed down if needed. Wash water should be directed to landscaping or collected and pumped to the sanitary sewer if allowed.

Concrete Installation and Repair

• Schedule asphalt and concrete activities for dry weather.

111 Take measures to protect any nearby storm drain inlets and adjacent watercourses, prior to breaking up asphalt or concrete (e.g. place san bags around inlets or work areas).

- Limit the amount of fresh concrete or cement mortar mixed, mix only what is needed for the job.
- Store concrete materials under cover, away from drainage areas. Secure bags of cement after they are open. Be sure to keep wind-blown cement powder away from streets, gutters, storm drains, rainfall, and runoff.
- Return leftover materials to the transit mixer. Dispose of small amounts of hardened excess concrete, grout, and mortar in the trash.
- Do not wash sweepings from exposed aggregate concrete into the street or storm drain. Collect and return svveepings to aggregate base stockpile, or dispose in the trash.
- Protect applications of fresh concrete from rainfall and runoff until the material has dried.
- Do not allow excess concrete to be dumped onsite, except in designated areas.
- Wash concrete trucks off site or in designated areas on site designed to preclude discharge of wash water to drainage system.

Controlling Litt-er

- Post "No Littering" signs and enforce anti-litter laws.
- Provide litter receptacles in busy, high pedestrian traffic areas of the community, at recreational facilities, and at community events.
- Cover litter receptacles and clean out frequently to prevent leaking/spillage or overflow.
- Clean parking lots on a regular basis with a street sweeper.

Training

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

Spill Response and Prevention

- Refer to SC-n, 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.

Othe1· Considerations

- Limitations related to sweeping activities at large parking facilities may include current sweeper technology to remove oil and grease.
- Surface cleaning activities that require discharges to the local sewering agency will require coordination v-.ⁱi.th the agency.
- Arrangements for disposal of the swept material collected must be made, as well as accurate tracking of the areas swept and the frequency of sweeping.

Requirements

Costs

- The largest expenditures for sweeping and cleaning of sidewalks, plazas, and parking lots are in staffing and equipment. Sweeping of these areas should be incorporated into street sweeping programs to reduce costs.

Maintenance

Not applicable

Supplemental Information

Further Detail of the BMP

Community education, such as informing residents about their options for recycling and waste disposal, as well as the consequences oflittering, can instill a sense of citizen responsibility and potentially reduce the amount of maintenance required by the municipality.

Additional BMPs that should be considered for parking lot areas include:

- Allow sheet runoff to flow into biofi.lters (vegetated strip and swale) and infiltration devices.
- Utilize sand filters or oleophilic collectors for oily waste in low concentrations.
- Arrange rooftop drains to prevent drainage directly onto paved surfaces.
- Design lot to include semi-permeable hardscape.
- Structural BMPs such as storm drain inlet filters can be very effective in reducing the amount of pollutants discharged from parking facilities during periods of rain.

References and Resources

Bay Area Stormwater Management Agencies Association (BASMAA). 1996. Pollution From Smface Cleaning Folder http://www.basmaa.org

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, 1'.fonterey Bay National Marine Sanctuary, Association of Monterey Bay Area Governments, Woodward-Clyde, Central Coast Regional Water Quality Control Board. July. 1998.

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

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landscape Ma intenance

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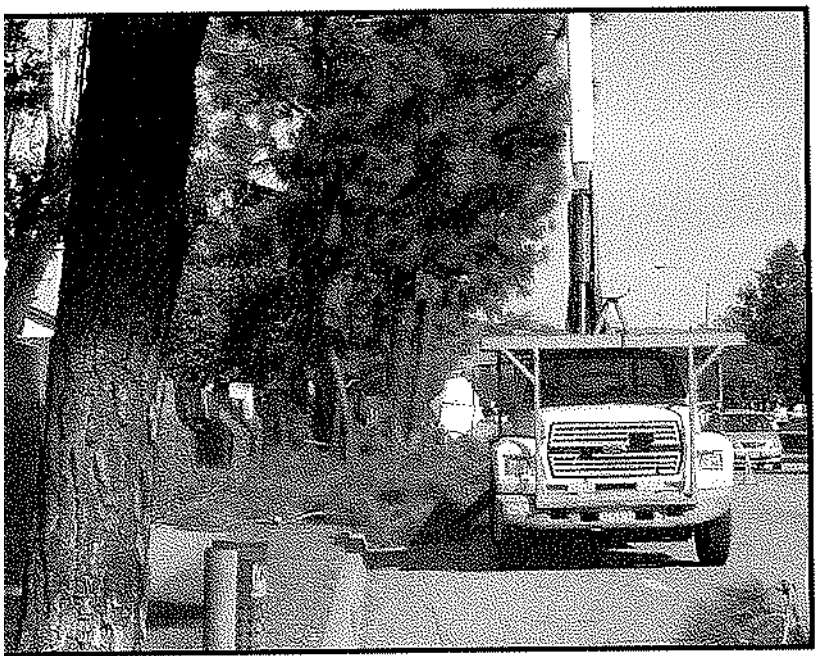

Objectives

- Contain
- Educate
- Reduce/Minimize
- Product Substitution

Targeted Constituents

Sediment	0
Nutrients	0
Trash	0
Metals	
Bacteria	
Oil and Grease	
Organics	
Oxygen Demanding	0

Description

Landscape maintenance activities include vegetation removal; herbicide and insecticide application; fertilizer application; watering; and other gardening and la1,vn 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 oflandscape 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. IP11 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 nahirescaping and xeriscaping.
- Conduct appropriate maintenance (i.e. properly timed fertilizing, weeding, pest control, and pruning) to help preserve the landscapes water efficiency.

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

Suggesl'ed Protocols

Mowing, Trimming, and Weeding

- \Vhenever possible use mechanical methods of vegetation removal (e.g nmwing with tractor-type or push mowers, hand cutting ""1.th 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 ,vhen soils are exposed.
- Performing mowing at optimal times. tfowing 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 ,veeds. 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.

Wasl'e 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.

11 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 nmoff.
- Use popup sprinkler heads in areas \vith a lot of activity or where there is a chance the pipes may be broken. Consider the use of mechanisms that reduce vvater 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 sluwly or pulse irrigate to prevent runoff and then only irrigate as much as is needed.
- Apply v-mter at rates that do not exceed the infiltration rate of the soil.

F'ertilize1· 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 follmving:

  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 oflarger 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 (prnning 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 lacev-rings, 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 ,vheu wind speeds are low (less than S 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 fe1tilizer 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 a5 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 ,"lithin 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 know in 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 \.vith 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.

- IVIunicipalities do not have the authority to regulate the use of pesticides by school districts, however the California Healthy Schools Act of 2000 (AB 2260) hasimposed 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 1PM techniques and BMPs. IPJl..1 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 iflocally available. Most municipalities either have or are planning yard waste composting facilities as a means of reducing the amount of v-mste going to the landfill. Lavvn 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.

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Drainage System Maintenance SC-74

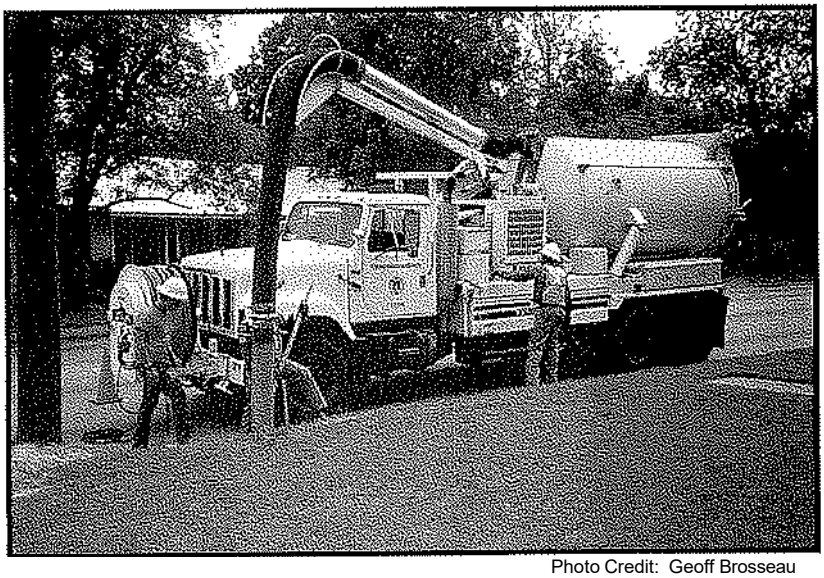

Photo Credit: Geoff Brosseau

Objectives

- Contain
- Educate
- Reduce/Minimize

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 v-rill remove pollutants, prevent clogging of the dm.vnstream conveyance system, restore catch basins' sediment trapping capacity, and ensure the system functions properly hydraulically to avoid flooding.

Targeted Constituents

Sediment	0
Nutrients	0
Trash	0
Metals	0
Bacteria	0
Oil and Grease	0
Organics	0
Oxygen Demanding	0

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.

- 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 sanitaiy 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 steam 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, Depaitment 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 \vith 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 knmvn 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.

- **a** 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 manual1y 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 ¼1.th vactor 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 stonnwater 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 ,vith 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 ,vith 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 ,vith 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, dov•mstream, 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, masomy, 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 inve1t 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 dmvnstream 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 he 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 aid watershed instability arid floods while restoring streams' aesthetic, recreational, and fish and ,vildlife 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 v.ildlife vvhile stabilizing the steep banks of the tloodway.

References and Resources

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http://www.ocwatersheds.com/StormWater/svvp introduction.asp

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

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Site Design & Landscape Pl nning SD-10

Design Objectives

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Prohibit **DumpslQ of** Improper Materials

Contain Pollutants

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Description

Each project site possesses unique topographic, l1ydrologic> and vegetative features. some of which are moresuitable for development than others. Integrating and incorporating appropriate landscape planning methodologies into the project design is the most effective action that can bedoneto minimire surface and gl'Olmdwater contamination from stormwater.

Approach

Landscape planning should couple consideration of land suitability for urban uses with consideration of community goals and projected growll1. Project plan designsshould conserve natural areas to the tent possible, m natural water storage and infiltration opportunities, and protect slopes and channels.

Suitable Applications

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

Design Considerations

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

SD-10 Site Design & Landscape Plc1r1rtil"lg

Designing New Installations

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

- Formulate the plan on the basis of clearly articulated community goals. Carefully identify conflicts and choices behveen 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. \Vhen appropriate, the assessment can highlight outstanding local or regional resources that the community determines should be protected (e.g., a scenic area, recreational area, tlu-eatened species habitat, farmland, fish nm). 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 Nah1ral Areas during Landscape Planning

If applica.ble, 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 cleruing ru1d grading of native vegetation at a site to the mininrnm amount needed to build lots, alfow access, and provide fire protection.
- Maximize h·ees 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 pru·king lot islands and other landscaped areas.
- Preserve riprui.an areas and wetlru1ds.

.M aximize Nahiml YVate1· Storage and Infiltration Opportunities Within the Landscape Unit

- Promote the conservation of forest cover. Building on land that isalready deforested affects basin hydrology to a lesser eA'tent than convetting forested land. Loss of forest cover reduces interception storage, detention in the organic forest floor layer, ru1d \\.'ater losses by evapotranspiration, resulting in lru·ge peak runoff increases and either tl1eir negative effects or tl1e e:iq)ense of countering them with structural solutions.
- Maintain nahnal storage reservoirs and drainage corridors, including depressions, areas of permeable soils, swales, and intermittent streams. Develop and implement policies and

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 oppmtunities by referring to the stomrwater management manual for the juiisdiction 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 surlaces or a potential to produce relatively contaminated mnoff away from groundwater recharge areas.

Protection of Slopes and Clla1111els d1wing 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 flmvs 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 flmv velocity due to increases in tributaiy 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 jmisdictional stonnwater 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 acti\ities with struchrral or impervious surfaces. The definition of" redevelopment" must be consulted to determine ·whether or not the requirements for new development apply to ru·eas intended for redevelopment. If the definition applies, the steps outlined under "designing ne\v installations" above should be followed.

Redevelopment may present significant opportunity to add features which had not previously been implemented. E..xamples include incorporation of depressions, areas of permeable soils, and swales in newly redeveloped areas. 'i1Vhile some site consh·aints may exist due to the status of already existing infrastructure, oppmtunities should not be missed to maximize infilh·ation, slow runoff, reduce impervious areas, disconnect directly connected impervious areas.

Other Resources

A Manual for the Standard Urban Stormwater :ti-litigation Plan (SUSMP), Los Angeles County Depa1tment 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.

Roof Runoff Controls

SD-11

Rein Garden

Design Objectives

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Description

Vruious roof nmoff controls are available to addressstonnwater that drains off rooftops. Theobjective is to reduce the total volume and rate of runoff from individual lots>aJld retain the pollutants on site that may be picked up from roofing materials and atm05pheric deposition. Roof runoff controls consist of directing thel'oof runoff awayfrom paved areas and mitigating flowto the storm drain system through one of several general approaches: cistem_s or min barrels; dry wells or infiltration trenches; pop-up emitters, and foundation planting. Thefirst tlll'ee approaches require the roof runoff to be contained iu a gutter and downspout system. Foundation planting provides a vegetated strip under thedrip line of tl)e roof.

Approach

Design of individual lotsfor single-family homes as well as lots for higher density residential and commercial sn·uctures should consider site design provisions for containing and infiltrating roof nmoff or directing roof 111110ft to vegetative swales or buffer areas. Retained water can be reused for watering gardens, lawns, and trees. Benefits to tlte environment include reduced demand for potable water used for irrigation, improved stonnwater quality. increased groundwater recharge> decreased runoff volume and peak flows> and decreased flooding potential.

Suitable Applications

Appropriate applications include residential> commercial and indusnial areas planned for development or redevelopment.

Design Considerations

Designing New Installations

Cisterus or Rain Barrels

One method of addressing roof runoff is todirect roof downspouts to cistems or rain ban·els. A cistern is an above gi·ound storage vessel with either a manually operated valve or n pcnuanently open outlet. Roof runoff is tempora1ily stored and then released forinigat-ion or infiltration between storms. The munber of rain

barrels needed is a function of the rooftop area. Some lmv impact developers recommend that every house have at least 2 rain barrels, with a minimum storage capacity of 1000 liters. Roof barrels serve several purposes including mitigating the first flush from the roof ,vhich has a high volume, amount of contaminants, and thermal load. Several types of rain barrels are commercially available. Consideration must be given to selecting rain barrels that are vector proof and childproof. In addition, some barrels are designed lvith a bypass valve that filters out grit and other contaminants and routes overflow to a soak-away pit or rain garden.

If the cistern has an operable valve, the valve can be closed to store stonmvater for irrigation or infiltration between stotms. This system requires continual monitoring by the resident or grounds crews, but provides greater flexibility in water storage and metering. If a cistern is provided with an operable valve and water is stored inside for long periods, the cistern must be covered to prevent mosquitoes from breeding.

A cistern system with a permanently open outlet can also provide for metering sto11nwater 11moff. If the cistern outlet is significantly smaller than the size of the downspout inlet (say¼ to 1/2 inch diameter), runoff will build up inside the cistern during storms, and will empty out slowly after peak intensities subside. Tiris is a feasible v,ray to mitigate tl1e peak flow increases caused by rooftop impenious land coverage, especially for the frequent, small storms.

Dry wells and Infiltration Trenches

Roof downspouts can be directed to dry wells or infiltration trenches. A dry well is constrncted by excavating a hole in the ground and filling it \\ith anopen graded aggregate, and allowing the water to fill the dry ,veil and infiltrate after the storm event. An1mderground connection from the downspout conveys ,vater into the dry well, allmving it to be stored in the voids. To minimize sedimentation from lateral soil movement, the sides and top of the stone storage matrix can be wrapped in a penueable filter fabric, though the bottom may remain open. A perforated observation pipe can be inse1ted vertically into the dry well to allow for inspection and maintenance.

In practice, dry wells receiving runoff from single roof downspouts have been successful over long periods because they contain ve1y little sediment. They must be sized according to the amount of rooftop runoff received, but are typically 4 to 5 feet square, and 2 to 3 feet deep, with a minimum of 1-foot soil cover over the top (maximum depth of 10 feet).

To protect the foundation, dry wells must be set away from the building at least 10 feet. They must be installed in solids that accommodate infiltration. In poorly drained soils, dry wells have ve1ylimited feasibility.

Infiltration trenches function in a similar manner and would be particularly effective for larger roof areas. An infiltration trench is a long, narrow, rock-filled trench with no outlet that receives stormwater runoff. These are described under Treatment Conb·ols.

Pop-up Drainage Emitter

Roof downspouts can be directed to an underground pipe that daylights some distance from the building foundation, releasing the roof runoff through a pop-up emitter. Similru· to a pop-up i11-igation head, the emitter only opens when there is flow from the roof. The emitter remains flush to the ground during dry pe1-iods, for ease oflawn or landscape maintenru1ce.

Foundarion Planting

Landscape planting can be provided around the baseto allowincreased oppo1tunities for stormwater infiln·ation and protect the soil from erosion caused byconcentrated sheet flow coming off theroof. Foundation plantings can reduce the physical impact of water on tJ1e soil nnd provide a subswface matlix of roots that encourage infiltration. '111eseplantings must be sturdy enough to tolerate theheavy runoff sheet flows> and periodic soilsaturation.

Redeveloping Existing Installations

Various jwisdictional stormwater management and mitigation plans (SUSMP> WQMP>etc.) define"redevelopment"in terms of amounts of additional im rvious ai-ea> increases in gross floorarea and/or e.'cterior construction> and land disturbing Activities with structural or inlpervious swfaoes. TI1e definition of"' redevelopment'"must beconsulted to dete.nnine whether or not the requirements for new development apply to nreAs intended for redevelopment. If the definition applies, the steps ouUined under "designing new installations· aboveshould be followed.

Supplemental Information

Examples

- City of Ottawa's Water Links Surface -Water Quality Protection Program
- City of Toronto Downspout Disoonnection Progmm
- Cityof Boston, 'MA, Rain Barrel Demonstration Program

Other Resources

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Low Impact Urban Design Tools, LowImpact Developmei1t Design Center> Beltsville>!\ID. www.lid-stonnwAter.uel

Start at the Somce>Bay Area Stormwater Managemei1t Agencies Association,1999 Edition

Effi ient Irrigation SD-12

Design Objectives

M&.lOmizeln1iltmtion

@ Provide R ention

@ SlowRunoff

MinimizetmpeMOUS Land Coverage

Prolvb1l Ot.rnpiog of roper Ma1erials

Cootain Polutarits

CcfeclandConvey

Description

bTigation water provided tolandscRped areas may result in e.'l:cess inigation water being conveyed intostormwater dl'8inage systems.

Approach

Project plan designs for development and redevelopment should include application methods of in-igation water that minimize nmoff of e.\:cess irrigation water into the stormwater conveyance system.

Suitable Applications

Appropriate applications include residentinl> commercial and indusnial areas pla1med for development or redevelopment. (Detacl1ed residential single-family homes are typically excluded from thisrequirement.)

Design Considerations

Designing New Installations

TI1efollowing methods to reduce excessive irrigation runoff should be considered, and incorporated and implemented where detem1foed applicable nnd feasible by the Permittee:

- Employ rain-triggeredshutoffdevices to prevent inigation after precipitation.
- Design irrigation systems to each landscape area's specific water requirements.
- Include design featuring flow reducers or shutoffvalves triggered bya pressure drop to control water loss in the event of broken sprinkler heads or lines.
- hnplement landscape plans consistent with County or City water conservation resolutions>which may include provision of water sensors, programmable irrigation times (for sl,ort cycles), etc.

- Design timing and application methods of irrigation water to minimize the runoff of excess inigation water into the storm water drainage system.

- Group plants with similar lVater requirements in order to reduce excess inigation runoff and promote srnface 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 barlier along the property boundary and intelior 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 grmvth

- Employ other comparable, equally effective methods to reduce irligation water runoff.

Redeveloping Existing Installations

Variousjmisdictional stonnwatermanagement and mitigation plans (SUSl'v!P, ,,VQMP, 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. TI1e 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 folfowed.

Other Resources

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

l\Iodel Standard Urban Stonn Water Mitigation Plan (SUSMP) for San Diego County, Port of San Diego, and Cities in San Diego County, February 14, 2002.

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

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

Storm Drain Signage SD-13

Design **Objectives**

- Mamiize Infiltr8tion
- ProvideRe1e11tioo
- SlowRunoff
- **Minimize** ImperviousLand Cov8fc){le
- It] Prohibit Oumpt of Improper Materials
- Cootrun PollultInts
- Coiled and Coovey

Description

Wnste materials dumped jntostorm di-ain inlets can havesevere impacts on receiving and grotmd waters. Pooting notices reg31·diug discl1arge prohibitions at storm drain in.letscan prevent waste dumping. Storm di-ain signs and stencils 31•ehighly visible souroe oontrols that are typically placed directly adjacent to stonn drain inlets.

Approach

Thestencil or affixed sign contains a brief statement tl1at prohibits dumping of improper materials into the urban runoff conveyance system. Storm drnin messages havebecome a popular method of alerting the publicabout tl1e effects of and the prohibitions against waste disposal.

Suitable Applications

Stencils and sjgus alert the public to thedestination of pollutants discharged to the storm di·ain. Signs are appropriate in residential, commercial, and industrial areas, ns well as any other area where contributions or dumping tostorm drains is likely.

Design Considerations

Storm drain message markers or placards 31·e recommended at all storm di-a.in inletswithin the boundary of a development project. The marker should be placed in clear sight facing toward anyone approacl1ing tl1e inletfrom either side. All storm drain inlet locations should be identified on thedevelopment sitemap.

Designing New Installations

·nie following methods should be considered for inclusion in the project design and show on project plans:

- Provide stenciling or labeling of allstonn drain inlets and catch basins, constructed or modified, withfa the proje-ct m·ea witl1 prohibitive language. Examples include "NO Dl.ThiPING

- 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

Va1iousjurisdictional stonnwater management and mitigation plans (SUSMP, WQMP, etc.) define "redevelopment" in terms of amounts of additional impervious area, increases in gross floor area and/or extelior construction, and land disturbing activities with sh·uctural or impervious smfaces. If the project meets the definition of "redevelopment", then the requirements stated 1mder" designing new installations" above should be includedin 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 rest1iction 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 drnins as patt of their outreach program.

Other Resources

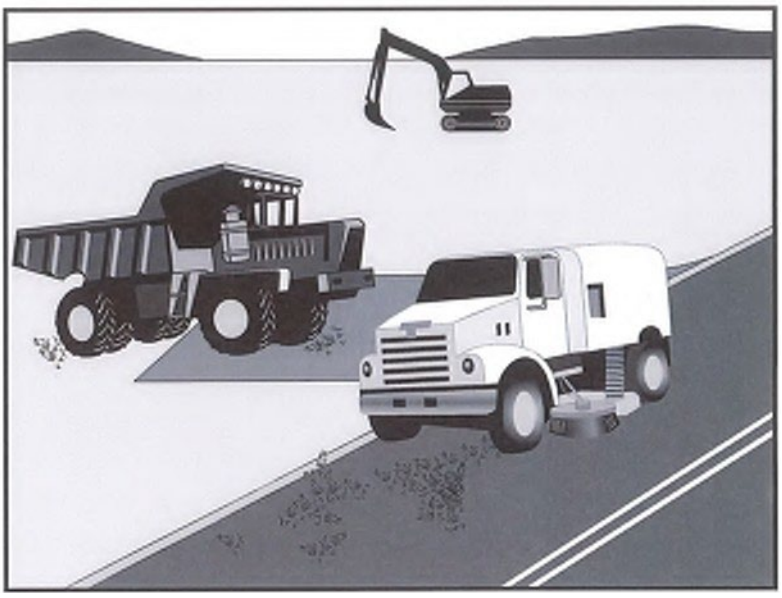
A Manual for the Standard Urban Stom1water 1·1itigation Plan (SUSI\'IP), Los Angeles Comity Depaitment of Public Works, 1.fay 2002.

1fodel Standard Urban Storm \Vater Mitigation Plan (SUSMP) for San Diego County, Po1t of San Diego, and Cities in San Diego County, Februa1y 14, 2002.

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

Ventura Countywide Teclmical Guidance Manual for Stor:mwater Quality Control Measures, July 2002.

Street Sweeping and Vacuuming SE-7



Categories

EC	Er0$i0n Cor.1rol	
SE	Sediment Control	
TC	Tracking Control	6Zf
WE	V\\od Etooiott Cor.trol	
NS	Non-Stomiwaler Menegement Ccotrol	
WJ.t	Wasle Management and Ma1eria'5Pol'moo Coolrol	

Legend:

0 **Primary Objective**

!BI **Secondary Objective**

Targeted Constituents

Sediment	0
Nutrients	
Trash	0
Metals	
Bacietia	
OilandGrease	0
nics	

Potential Alternatives

None

Description and Purpose

Street sweepingand vacuuming include.<, use of self-propelled and walk-behind equipment to remove sediment from streets and roadways, and to clean paved surfaces in preparation for final paving. Sweeping and vacuuming prevents sediment from the project site from entering storm drains or receiving waters.

Suitable Applications

Sweepingand vacuuming a.resuitable anywhere sediment is tracked from the project site onto public or private paved street.<; and roads, typically at points of egress. Sweeping and vacuuming arealso applicable during preparation of paved surfaces for final paving.

Limitations

Sweeping and vacuuming may not beeffective when sediment is wet or when tracked soil is caked (caked soil may need to be scraped loose).

Implementation

- Controlling the number of **points** where vehicles can leave thesite will allow sweeping and vacuuming efforts to be focused, and perhaps save money.
- Inspect potential sediment tracking locations daily.
- Visible sediment tracking should beswept or vacuumed on a daily basis.
- Do not u.<;e kick brooms or sweeper attachments. These tend tospread the dirt rather than remove it.

111 If not mixed with debris or trash, consider incorporating the removed sediment back into the project

Costs

Rental rates for self-propelled s\veepers vary depending on hopper size and duration of rental. Expect rental rates from $58/hour (3 yd³ hopper) to $88/hour (9 yd³ hopper), plus operator costs. Hourly production rates vary·with the amount of area to be swept and amount of sediment. Match the hopper size to the area and expect sediment load to minimize time spent dumping.

Inspection and Maintenance

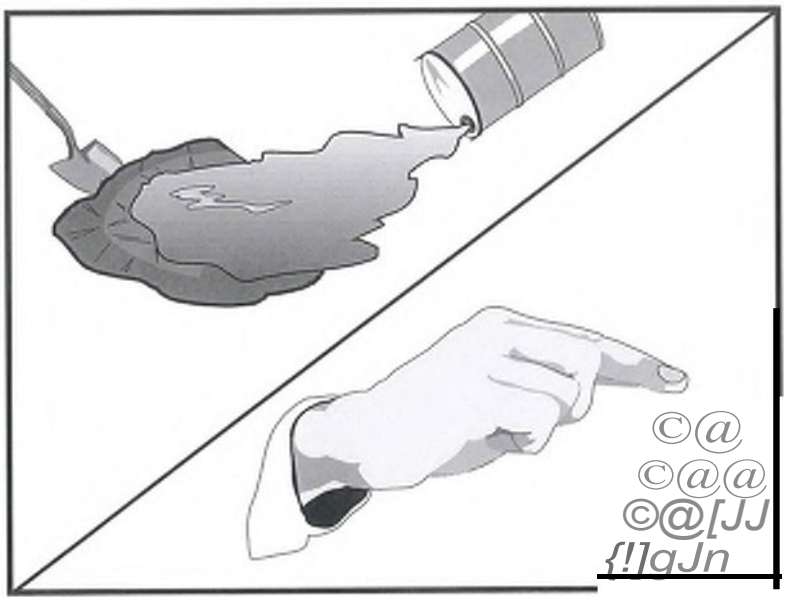
- Inspect BMPs in accordance ivith General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BlVIPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.
- When actively in use, points of ingress and egress must be inspected daily.
- ½7hen tracked or spilled sediment is observed outside the construction limits, it must be removed at least daily. More frequent removal, even continuous removal, may be required in some jurisdictions.
- Be careful not to sweep up any unknown substance or any object that maybe potentially hazardous.
- Adjust brooms frequently; maximize efficiency of sweeping operations.
- After sweeping is finished, properly dispose of S\\'eeper wastes at an approved dumpsite.

References

Stormwater Quality Handbooks - Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), November 2000.

Labor Surcharge and Equipment Rental Rates, State of California Depmtment of Transportation (Caltrans), April 1, 2002 - March 31, 2003.

Spill Prevention and Control WM-4



Categories

EC	Erosion Control
SE	Sediment Coo!rol
TC	Tracking Control
VIE	WindErosion Control
N	troll-Sklmlwate, Mel\8gemeflt Control
WM	Vt Managemelt and IA.term.Pdlution Control 0

Legend:

@ **Primary Objective**

I&I **Scc:ond;:,ry Objective**

Targeted Constituents

Sedime,it	0
Nutrlen	@
Trash	**0**
Metals	0
Bacteria	
a1and Grease	0
Otganics	0

Potential Alternatives

None

Description and Purpose

Prevent or reduce the discharge of pollutants lo drainage systems or watercourses from leaks and spills by reducing the chance for spills, stopping the source of spills, containing and cleaning up spills, properly disposing of spill materials, and training employees.

This be..5l management practice covers only spill prevention and control. However, WM-1, Materials Delivery and Storage, and WM-2, Material Use, also contain useful information, particularly on spill prevention. .For infonnation on wastes, see the waste management BMPs in this section.

Suitable Applications

This 8MP is suitable for all construction projects. Spill control procedures are implemented anytime chemicals or hazardous substances are stored ou **the** construction site, including the following materials:

- Soil stabili;,,crs/binders
- Dust palliatives
- Herbicides
- Growth inhibitors
- Fertifo,.ers
- Deicing/anti-icing chemicals

- Fuels
- Lubricants
- Other petroleum distillates

Limitations

- In some cases it may be necessary to use a private spill cleanup company.
- This BMP applies to spills caused by the contractor and subcontractors.
- Procedures and practices presented in this BMP are general. Contractor should identify appropriate practices for the specific materials used or stored onsite

Implementation

The follmving steps·will help reduce the stormwater impacts ofleaks and spills:

Education

- Be mvare that different materials pollute in different amounts. Make sure that each employee knows what a "significant spill" is for each material they use, and what is the appropriate response for "significant" and "insignificant" spills.
- Educate employees and subcontractors on potential dangers to humans and the environment from spills and leaks.
- Hold regular meetings to discuss and reinforce appropriate disposal procedures (incorporate into regular safety meetings).
- Establish a continuing education program to indoctrinate new employees.
- Have contractor's superintendent or representative oversee and enforce proper spill prevention and control measures.

General Measures

- To the extent that the work can be accomplished safely, spills of oil, petroleum products, substances listed under 40 CFR parts 110,117, and 302, and sanitary and septic wastes should be contained and cleaned up immediately.
- Store hazardous materials and wastes in covered containers and protect from vandalism.
- Place a stockpile of spill cleanup materials 1,vhere it will be readily accessible.
- Train employees in spill prevention and cleanup.
- Designate responsible individuals to oversee and enforce control measures.
- Spills should be covered and protected from stormwater runon during rainfall to the extent that it doesn't compromise clean up activities.
- Do not bury or \Vash spills with water.

- Store and dispose of used clean up materials, contaminated materials, and recovered spill material that is no longer suitable for the intended purpose in conformance with the provisions in applicable BMPs.
- Do not allovv water used for cleaning and decontamination to enter storm drains or 'Watercourses. Collect and dispose of contaminated water in accordance v.rith WM-10, Liquid Waste Management.
- Contain water owrflow or minor 'Nater spillage and do not allmv it to discharge into drainage facilities or watercourses.
- Place proper storage, cleanup, and spill reporting instructions for hazardous materials stored or used on the project site in an open, conspicuous, and accessible location,
- Keep waste storage areas clean, well organized, and equipped ·with ample cleanup supplies as appropriate for the materials being stored. Perimeter controls, containment structures, covers, and liners should be repaired or replaced as needed to maintain proper function.

Cleanup

- Clean up leaks and spills immediately.
- Use a rag for small spills on paved surfaces, 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 either a certified laundry (rags) or disposed of as hazardous waste.
- Never hose down or bury dry material spills. Clean up as much of the material as possible and dispose of properly. See the ·waste management BMPs in this section for specific information.

Minor Spills

- Minor spills typically involve small quantities of oil, gasoline, paint, etc. which can be controlled by the first responder at the discovery of the spill.
- Use absorbent materials on small spills rather than hosing dow11 or burying the spill.
- Absorbent materials should be promptly removed and disposed of properly.
- Follow the practice below for a minor spill:

  Contain the spread of the spill.

  Recover spilled materials.

  Clean the contaminated area and properly dispose of contaminated materials.

Semi-Significant Spills

- Semi-significant spills still can be controlled by the first responder along with the aid of other personnel such as laborers and the foreman, etc. This response may require the cessation of all other activities.

11 Spills should be cleaned up immediately:

Contain spread of the spill.

Notify the project foreman immediately.

If the spill occurs on paved or impermeable surfaces, clean up using "dry" methods (absorbent materials, cat litter and/or rags). Contain the spill by encircling \•\ith absorbent materials and do not let the spill spread widely.

If the spill occurs in dirt areas, immediately contain the spill by constmcting an ea1then dike. Dig up and properly dispose of contaminated soil.

If the spill occurs during rain, cover spill ·with tarps or other material to prevent contaminating runoff.

Significant/Hazardous Spills

- For significant or hazardous spills that cannot be controlled by personnel in the immediate vicinity, the following steps should be taken:

Notify the local emergency response by dialing 911. In addition to 911, the contractor will notify the proper county officials. It is the contractor's responsibility to have all emergency phone numbers at the construction site.

Notify the Governor's Office of Emergency Services Warning Center, (916) 845-8911.

For spills of federal reportable quantities, in conformance with the requirements in 40 CFR parts 110,119, and 302, the contractor should notify the National Response Center at (800) 424-8802.

Notification should first be made by telephone and follO'wed up ·with a written report.

The services of a spills contractor or a Haz-Mat team should be obtained immediately. Construction personnel should not attempt to clean up until the appropriate and qualified staffs have arrived at the job site.

Other agencies which may need to be consulted include, but are not limited to, the Fire Department, the Public Works Department, the Coast Guard, the Highway Patrol, the City/County Police Department, Department of Toxic Substances, California Division of Oil and Gas, Cal/OSHA, etc.

Reporting

- Repmt significant spills to local agencies, such as the Fire Depmtment; they can assist in cleanup.
- Federal regulations require that any significant oil spill into a water body or onto an adjoining shoreline be reported to the National Response Center (NRC) at 800-424-8802 (24 hours).

Use the follov,ing measures related to specific activities:

Vehicle and Equipment Maintenance

- If maintenance must occur onsite, use a designated area and a secondary containment, located mvay from drainage courses, to prewnt the runon of stormwater and the runoff of spills.
- Regularly inspect onsite vehicles and equipment for leaks and repair immediately
- Check incoming vehicles and equipment (including delivery trucks, and employee and subcontractor vehicles) for leaking oil and fluids. Do not allm•\' leaking vehicles or equipment onsite.
- Always use secondary containment, such as a drain pan or drop cloth, to catch spills or leaks when removing or changing fluids.
- Place drip pans or absorbent materials under paving equipment when not in use.
- Use absorbent materials on small spills rather than hosing dmvn or burying the spill. Remove the absorbent materials promptly and dispose of properly.
- Promptly transfer used fluids to the proper ·waste or recycling drums. Don't leave full drip pans or other open containers lying around
- Oil filters disposed of in trashcans or dumpsters can leak oil and pollute stormwater. Place the oil filter in a funnel over a waste oil-recycling drum to drain excess oil before disposal. Oil filters can also be recycled. Ask the oil supplier or recycler about recycling oil filters.
- Store cracked batteries in a non-leaking secondary container. Do this with all cracked batteries even if you think all the acid has drained out. If you drop a battery, treat it as if it is cracked. Put it into the containment area until you are sure it is not leaking.

Vehicle and Equipment Fueling

- If fueling must occur onsite, use designate areas, located away from drainage courses, to prevent the runon of stormwater and the runoff of spills.
- Discourage "topping off' of fuel tanks.
- Always use secondary containment, such as a drain pan,·when fueling to catch spills/ leaks.

Costs

Prevention of leaks and spills is inexpensive. Treatment and/ or disposal of contaminated soil or ,vater can be quite expensive.

Inspection and Maintenance

- Inspect and verify that activity-based BMPs are in place prior to the commencement of associated activities. VVhile activities associated v-:ith the BMP are under Nay, inspect BIVIPs in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.

11 Inspect BMPs subject to non-stormwater discharge daily while non-stormwater discharges occur.

■ Keep ample supplies of spill control and cleanup materials onsite, near storage, unloading, and maintenance areas.

a Update your spill prevention and control plan and stock cleanup materials as changes occur in the types of chemicals onsite.

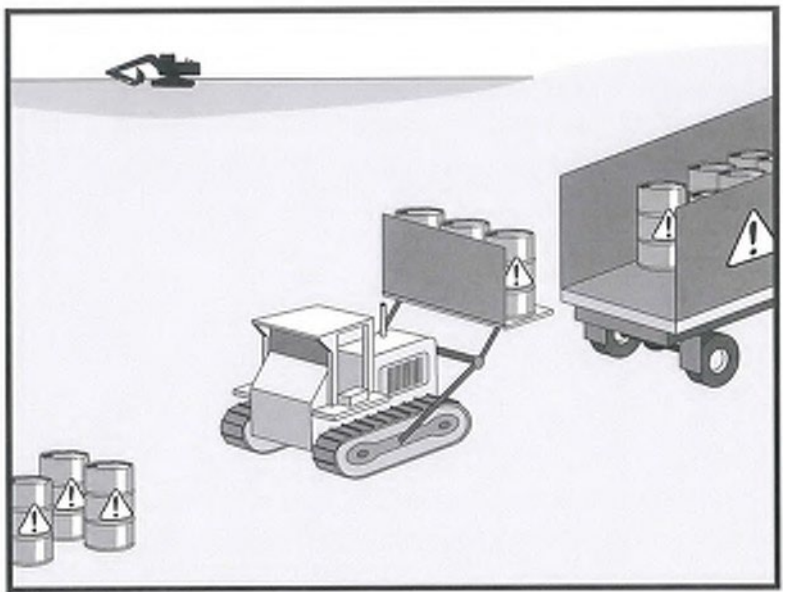
References

Blueprint for a Clean Bay: Best Management Practices to Prevent Stormwater Pollution from Construction Related Activities; Santa Clara Valley Nonpoint Source Pollution Control Program, 1995.

Stormwater Quality Handbooks - Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), November 2000.

Stormwater Management for Construction Activities; Developing Pollution Prevention Plans and Best Management Practice, EPA 832-R-92005; USEPA, April 1992.

Hazardous Waste Management WM-6



Categories

EC	Erosion *Control*
SE	Se<iment Con1rol
TC	Tradong Con1rol
WE	*W.tid* Eros;:,n Control
N	Non-Stormwater Mansgemenl Coolrol
WM	WasteMa,agement *Md* MatmalsP-Olllltx,n Coo1ta

Legend:

0 **Primary Objective**

!BI **Secondary Objective**

Description and Purpose

Prevent or reduce the discharge of pollutants to stonnwater from hazardous waste through proper material use, waste dispOSlil, and training of employees and subcontractors.

Suitable Applications

This best management practice (BMP) applies to all construction projects. Ha1.ardous waste management practices are implemented on construction projects that generate waste from the use of:

- Petroleum Products
- Asphalt Products
- Concrete Curing Compounds
- Pesticides
- Palliatives
- Acids
- Septic Wastes
- Paints
- Stains
- Solvents
- Wood Preservatives
- Roofing Tar
- Any materials deemed a hazardous waste in California, Title 22 Division 4.5, or listed in 40 CFR Parts no, 117, 261, or 302

Targeted Constituents

Se<iment	
Nutrients	0
Trasti	0
Me1als	0
Bacteria	0
Ol and Grease	0
Orgoolcs	0

Potential Alternatives

tlone

CASQA

C'.A.LSOINUSTCJL\tW.UU

In addition, sites vvith existing structures may contain wastes, 'Nhich must be disposed of in accordance with federal, state, and local regulations. These wastes include:

- Sandblasting grit mixed with lead-, cadmium-, or chromium-based paints
- Asbestos
- PCBs (particularly in older transformers)

Limitations

- Hazardous waste that cannot be reused or recycled must be disposed of by a licensed hazardous waste hauler.
- Nothing in this BMP relieves the contractor from responsibility for compliance with federal, state, and local laws regarding storage, handling, transpmtation, and disposal of hazardous ·wastes.
- This BMP does not cover aerially deposited lead (ADL) soils. For ADL soils refer to WM-7, Contaminated Soil Management.

Implementation

The follov,,ing steps will help reduce stornnvater pollution from hazardous ·wastes:

***Material** Use*

- Wastes should be stored in sealed containers constructed of a suitable material and should be labeled as required by Title 22 CCR, Division 4.5 and 49 CFR Parts 172,173,178, and 179.
- All hazardous waste should be stored, transported, and disposed as required in Title 22 CCR, Division 4.5 and 49 CFR 261-263.
- Waste containers should be stored in temporary containment facilities that should comply with the following requirements:

  Temporary containment facility should provide for a spill containment volume equal to 1.5 times the volume of all containers able to contain precipitation from a 25 year storm event, plus the greater of 10% of the aggregate volume of all containers or 100% of the capacity of the largest tank -within its boundary, whichever is greater.

  Temporary containment facility should be impervious to the materials stored there for a minimum contact time of 72 hours.

  Temporary containment facilities should be maintained free of accumulated rainwater and spills. In the event of spills or leaks, accumulated rainwater and spills should be placed into drums after each rainfall. These liquids should be handled as a hazardous waste unless testing determines them to be non-hazardous. Non-hazardous liquids should be sent to an approved disposal site.

  Sufficient separation should be provided between stored containers to allow for spill cleanup and emergency response access.

Incompatible materials, such as chlorine and ammonia, should not be stored in the same temporary containment facility.

Throughout the rainy season, temporary containment facilities should be covered during non-working days, and prior to rain events. Covered facilities may include use of plastic tarps for small facilities or constructed roofs with overhangs.

- Drums should not be overfilled and wastes should not be mixed.
- Unless watertight, containers of dry waste should be stored on pallets.
- Do not over-apply herbicides and pesticides. Prepare only the amount needed. Follow the recommended usage instructions. Over application is expensive and environmentally harmful. Apply surface dressings in several smaller applications, as opposed to one large application. Allow time for infiltration and avoid excess material being carried offsite by runoff. Do not apply these chemicals just before it rains. People applying pesticides must be certified in accordance with federal and state regulations.
- Paint brushes and equipment for water and oil based paints should be cleaned within a contained area and should not be allowed to contaminate site soils, watercourses, or drainage systems. Waste paints, thinners, solvents, residues, and sludges that cannot be recycled or reused should be disposed of as hazardous waste. When thoroughly dry, latex paint and paint cans, used brushes, rags, absorbent materials, and drop cloths should be disposed of as solid waste.
- Do not clean out brushes or rinse paint containers into the dirt, street, gutter, storm drain, or stream. "Paint out" brushes as much as possible. Rinse water-based paints to the sanitary sewer. Filter and reuse thinners and solvents. Dispose of excess oil-based paints and sludge as hazardous waste.
- The following actions should be taken with respect to temporary contaminant:

  Ensure that adequate hazardous waste storage volume is available.

  Ensure that hazardous waste collection containers are conveniently located.

  Designate hazardous waste storage areas onsite away from storm drains or watercourses and away from moving vehicles and equipment to prevent accidental spills.

  Minimize production or generation of hazardous materials and hazardous waste on the job site.

  Use containment berms in fueling and maintenance areas and where the potential for spills is high.

  Segregate potentially hazardous waste from non-hazardous construction site debris.

  Keep liquid or semi-liquid hazardous waste in appropriate containers (closed drums or similar) and under cover.

Clearly label all hazardous ·waste containers ·with the waste being stored and the date of accumulation.

Place hazardous waste containers in secondmy containment.

Do not allow potentially hazardous waste materials to accumulate on the ground.

Do not mix \.vastes.

Use all of the product before disposing of the container.

Do not remove the original product label; it contains important safety and disposal information.

Waste Recycling Disposal

- Select designated hazardous waste collection areas onsite.
- Hazardous materials and wastes should be stored in covered containers and protected from vandalism.
- Place hazardous \Vaste containers in secondary containment.
- Do not mix \Vastes, this can cause chemical reactions, making recycling impossible and complicating disposal.
- Recycle any useful materials such as used oil or water-based paint.
- Make sure that toxic liquid wastes (used oils, solvents, and paints) and chemicals (acids, pesticides, additives, curing compounds) are not disposed of in dumpsters designated for construction debris.
- Arrange for regular waste collection before containers overflow.
- Make sure that hazardous \Vaste (e.g., excess oil-based paint and sludge) is collected, removed, and disposed of only at authorized disposal areas.

Disposal Procedures

- Waste should be disposed ofby a licensed hazardous waste transporter at an authorized and licensed disposal facility or recycling facility utilizing properly completed Uniform Hazardous Waste Manifest forms.
- A Department of Health Services certified laboratory should sample waste to determine the appropriate disposal facility.
- Properly dispose of rainwater in secondary containment that mayhave mixed \\ith hazardous ·waste.
- Attention is directed to "Hazardous Material", "Contaminated Material", and "Aerially Deposited Lead" of the contract documents regarding the handling and disposal of hazardous materials.

Education

- Educate employees and subcontractors on hazardous ·waste storage and disposal procedures.
- Educate employees and subcontractors on potential dangers to humans and the environment from hazardous wastes.
- Instruct employees and subcontractors on safety procedures for common construction site hazardous wastes.
- Instruct employees and subcontractors in identification of hazardous and solid ,vaste.
- Hold regular meetings to discuss and reinforce hazardous ·waste management procedures (incorporate into regular safety meetings).
- The contractor's superintendent or representative should oversee and enforce proper hazardous ,vaste management procedures and practices.
- Make sure that hazardous waste is collected, removed, and disposed of only at authorized disposal areas.
- Warning signs should be placed in areas recently treated ,vith chemicals.
- Place a stockpile of spill cleanup materials where it will be readily accessible.
- If a container does spill, clean up immediately.

Costs

All of the above are low cost measures.

***Inspection and* Maintenance**

- Inspect and verify that activity-based BMPs are in place prior to the commencement of associated activities. VVhile activities associated 1Nith the BMP are under way, inspect BMPs in accordance ,vith General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events..
- Inspect BMPs subject to non-stormwater discharge daily while non-stormwater discharges occur
- Hazardous vmste should be regularly collected.
- A foreman or construction supervisor should monitor onsite hazardous vmste storage and disposal procedures.
- Waste storage areas should be kept clean, well organized, and equipped with ample cleanup supplies as appropriate for the materials being stored.
- Perimeter controls, containment structures, covers, and liners should be repaired or replaced as needed to maintain proper function.

- Hazardous spills should be cleaned up and reported in conformance 1,vith the applicable :Material Safety Data Sheet (MSDS) and the instructions posted at the project site.
- The National Response Center, at (Boo) 424-8802, should be notified of spills of federal reportable quantities in conformance with the requirements in 40 CFR parts 110, 117, and 302. Also notify the Governors Office of Emergency Services Warning Center at (916) 845-8911.
- A copy of the hazardous ·waste manifests should be provided.

References

Blueprint for a Clean Bay: Best Management Practices to Prevent Stormwater Pollution from Construction Related Activities; Santa Clara Valley Nonpoint Source Pollution Control Program, 1995.

Processes, Procedures and Methods to Control Pollution Resulting from All Construction Activity, 430/9-73-007, USEPA, 1973.

Stormwater Quality Handbooks - Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), November 2000.

Stormwater :Management for Construction Activities; Developing Pollution Prevention Plans and Best Management Practice, EPA.832-R-92005; USEPA, April 1992.

Bioretention TC-32

Design Considerations

- Soil for Infiltration
- Tributary Area
- Slope
- Aesthetics
- Environmental Side-effects

Description

The bioretention best management practice (BMP) functions as a soil and plant-based filtration device that removes pollutants through a variety of physical, biological, and chemical treatment processes. These facilities normally consist of a grass buffer strip, sand bed, ponding area, organic layer or mulch layer, planting soil, and plants. The runoff's velocity is reduced by passing over or through buffer strip and subsequently distributed evenly along a ponding area. Exfiltration of the stored water in the bioretention area planting soil into the underlying soils occurs over a period of days.

Targeted Constituents

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

Legend ***(Removal Effectiveness)***

- • Low
- ▲ Medium
- ■ High

California Experience

None documented. Bioretention has been used as a stormwater BMP since 1992. In addition to Prince George's County, MD and Alexandria, VA, bioretention has been used successfully at urban and suburban areas in Montgomery County, MD; Baltimore County, MD; Chesterfield County, VA; Prince William County, VA; Smith Mountain Lake State Park, VA; and Cary, NC.

Advantages

- Bioretention provides stormwater treatment that enhances the quality of downstream water bodies by temporarily storing runoff in the BMP and releasing it over a period of four days to the receiving water (EPA, 1999).
- The vegetation provides shade and wind breaks, absorbs noise, and improves an area's landscape.

Limitations

- The bioretention BMP is not recommended for areas with slopes greater than 20% or where mature tree removal would

CASQA California Stormwater Quality Association

be required since clogging may result, particularly if the BMP receives runoff with high sediment loads (EPA, 1999).

- Bioretention is not a suitable BMP at locations where the water table is within 6 feet of the ground surface and where the surrounding soil stratum is unstable.
- By design, bioretention BMPs have the potential to create very attractive habitats for mosquitoes and other vectors because of highly organic, often heavily vegetated areas mixed with shallow water.
- In cold climates the soil may freeze, preventing runoff from infiltrating into the planting soil.

Design and Sizing Guidelines

- The bioretention area should be sized to capture the design storm runoff.
- In areas where the native soil permeability is less than 0.5 in/hr an underdrain should be provided.
- Recommended minimum dimensions are 15 feet by 40 feet, although the preferred width is 25 feet. Excavated depth should be 4 feet.
- Area should drain completely within 72 hours.
- Approximately 1 tree or shrub per 50 ft^2 of bioretention area should be included.
- Cover area with about 3 inches of mulch.

Construction/Inspection Considerations

Bioretention area should not be established until contributing watershed is stabilized.

Performance

Bioretention removes stormwater pollutants through physical and biological processes, including adsorption, filtration, plant uptake, microbial activity, decomposition, sedimentation and volatilization (EPA, 1999). Adsorption is the process whereby particulate pollutants attach to soil (e.g., clay) or vegetation surfaces. Adequate contact time between the surface and pollutant must be provided for in the design of the system for this removal process to occur. Thus, the infiltration rate of the soils must not exceed those specified in the design criteria or pollutant removal may decrease. Pollutants removed by adsorption include metals, phosphorus, and hydrocarbons. Filtration occurs as runoff passes through the bioretention area media, such as the sand bed, ground cover, and planting soil.

Common particulates removed from stormwater include particulate organic matter, phosphorus, and suspended solids. Biological processes that occur in wetlands result in pollutant uptake by plants and microorganisms in the soil. Plant growth is sustained by the uptake of nutrients from the soils, with woody plants locking up these nutrients through the seasons. Microbial activity within the soil also contributes to the removal of nitrogen and organic matter. Nitrogen is removed by nitrifying and denitrifying bacteria, while aerobic bacteria are responsible for the decomposition of the organic matter. Microbial processes require oxygen and can result in depleted oxygen levels if the bioretention area is not adequately

aerated. Sedimentation occurs in the swale or ponding area as the velocity slows and solids fall out of suspension.

The removal effectiveness of bioretention has been studied during field and laboratory studies conducted by the University of Maryland (Davis et al, 1998). During these experiments, synthetic stormwater runoff was pumped through several laboratory and field bioretention areas to simulate typical storm events in Prince George's County, MD. Removal rates for heavy metals and nutrients are shown in Table 1.

Table 1 Laboratory and Estimated Bioretention Davis et al. (1998); PGDER (1993)

Pollutant	Removal Rate
Total Phosphorus	70-83%
Metals (Cu, Zn, Pb)	93-98%
TKN	68-80%
Total Suspended Solids	90%
Organics	90%
Bacteria	90%

Results for both the laboratory and field experiments were similar for each of the pollutants analyzed. Doubling or halving the influent pollutant levels had little effect on the effluent pollutants concentrations (Davis et al, 1998).

The microbial activity and plant uptake occurring in the bioretention area will likely result in higher removal rates than those determined for infiltration BMPs.

Siting Criteria

Bioretention BMPs are generally used to treat stormwater from impervious surfaces at commercial, residential, and industrial areas (EPA, 1999). Implementation of bioretention for stormwater management is ideal for median strips, parking lot islands, and swales. Moreover, the runoff in these areas can be designed to either divert directly into the bioretention area or convey into the bioretention area by a curb and gutter collection system.

The best location for bioretention areas is upland from inlets that receive sheet flow from graded areas and at areas that will be excavated (EPA, 1999). In order to maximize treatment effectiveness, the site must be graded in such a way that minimizes erosive conditions as sheet flow is conveyed to the treatment area. Locations where a bioretention area can be readily incorporated into the site plan without further environmental damage are preferred. Furthermore, to effectively minimize sediment loading in the treatment area, bioretention only should be used in stabilized drainage areas.

Additional Design Guidelines

The layout of the bioretention area is determined after site constraints such as location of utilities, underlying soils, existing vegetation, and drainage are considered (EPA, 1999). Sites with loamy sand soils are especially appropriate for bioretention because the excavated soil can be backfilled and used as the planting soil, thus eliminating the cost of importing planting soil.

The use of bioretention may not be feasible given an unstable surrounding soil stratum, soils with clay content greater than 25 percent, a site with slopes greater than 20 percent, and/or a site with mature trees that would be removed during construction of the BMP.

Bioretention can be designed to be off-line or on-line of the existing drainage system (EPA, 1999). The drainage area for a bioretention area should be between 0.1 and 0.4 hectares (0.25 and 1.0 acres). Larger drainage areas may require multiple bioretention areas. Furthermore, the maximum drainage area for a bioretention area is determined by the expected rainfall intensity and runoff rate. Stabilized areas may erode when velocities are greater than 5 feet per second (1.5 meter per second). The designer should determine the potential for erosive conditions at the site.

The size of the bioretention area, which is a function of the drainage area and the runoff generated from the area is sized to capture the water quality volume.

The recommended minimum dimensions of the bioretention area are 15 feet (4.6 meters) wide by 40 feet (12.2 meters) long, where the minimum width allows enough space for a dense, randomly-distributed area of trees and shrubs to become established. Thus replicating a natural forest and creating a microclimate, thereby enabling the bioretention area to tolerate the effects of heat stress, acid rain, runoff pollutants, and insect and disease infestations which landscaped areas in urban settings typically are unable to tolerate. The preferred width is 25 feet (7.6 meters), with a length of twice the width. Essentially, any facilities wider than 20 feet (6.1 meters) should be twice as long as they are wide, which promotes the distribution of flow and decreases the chances of concentrated flow.

In order to provide adequate storage and prevent water from standing for excessive periods of time the ponding depth of the bioretention area should not exceed 6 inches (15 centimeters). Water should not be left to stand for more than 72 hours. A restriction on the type of plants that can be used may be necessary due to some plants' water intolerance. Furthermore, if water is left standing for longer than 72 hours mosquitoes and other insects may start to breed.

The appropriate planting soil should be backfilled into the excavated bioretention area. Planting soils should be sandy loam, loamy sand, or loam texture with a clay content ranging from 10 to 25 percent.

Generally the soil should have infiltration rates greater than 0.5 inches (1.25 centimeters) per hour, which is typical of sandy loams, loamy sands, or loams. The pH of the soil should range between 5.5 and 6.5, where pollutants such as organic nitrogen and phosphorus can be adsorbed by the soil and microbial activity can flourish. Additional requirements for the planting soil include a 1.5 to 3 percent organic content and a maximum 500 ppm concentration of soluble salts.

Soil tests should be performed for every 500 cubic yards (382 cubic meters) of planting soil, with the exception of pH and organic content tests, which are required only once per bioretention area (EPA, 1999). Planting soil should be 4 inches (10.1 centimeters) deeper than the bottom of the largest root ball and 4 feet (1.2 meters) altogether. This depth will provide adequate soil for the plants' root systems to become established, prevent plant damage due to severe wind, and provide adequate moisture capacity. Most sites will require excavation in order to obtain the recommended depth.

Planting soil depths of greater than 4 feet (1.2 meters) may require additional construction practices such as shoring measures (EPA, 1999). Planting soil should be placed in 18 inches or greater lifts and lightly compacted until the desired depth is reached. Since high canopy trees may be destroyed during maintenance the bioretention area should be vegetated to resemble a terrestrial forest community ecosystem that is dominated by understory trees. Three species each of both trees and shrubs are recommended to be planted at a rate of 2500 trees and shrubs per hectare (1000 per acre). For instance, a 15 foot (4.6 meter) by 40 foot (12.2 meter) bioretention area (600 square feet or 55.75 square meters) would require 14 trees and shrubs. The shrub-to-tree ratio should be 2:1 to 3:1.

Trees and shrubs should be planted when conditions are favorable. Vegetation should be watered at the end of each day for fourteen days following its planting. Plant species tolerant of pollutant loads and varying wet and dry conditions should be used in the bioretention area.

The designer should assess aesthetics, site layout, and maintenance requirements when selecting plant species. Adjacent non-native invasive species should be identified and the designer should take measures, such as providing a soil breach to eliminate the threat of these species invading the bioretention area. Regional landscaping manuals should be consulted to ensure that the planting of the bioretention area meets the landscaping requirements established by the local authorities. The designers should evaluate the best placement of vegetation within the bioretention area. Plants should be placed at irregular intervals to replicate a natural forest. Trees should be placed on the perimeter of the area to provide shade and shelter from the wind. Trees and shrubs can be sheltered from damaging flows if they are placed away from the path of the incoming runoff. In cold climates, species that are more tolerant to cold winds, such as evergreens, should be placed in windier areas of the site.

Following placement of the trees and shrubs, the ground cover and/or mulch should be established. Ground cover such as grasses or legumes can be planted at the beginning of the growing season. Mulch should be placed immediately after trees and shrubs are planted. Two to 3 inches (5 to 7.6 cm) of commercially-available fine shredded hardwood mulch or shredded hardwood chips should be applied to the bioretention area to protect from erosion.

Maintenance

The primary maintenance requirement for bioretention areas is that of inspection and repair or replacement of the treatment area's components. Generally, this involves nothing more than the routine periodic maintenance that is required of any landscaped area. Plants that are appropriate for the site, climatic, and watering conditions should be selected for use in the bioretention cell. Appropriately selected plants will aide in reducing fertilizer, pesticide, water, and overall maintenance requirements. Bioretention system components should blend over time through plant and root growth, organic decomposition, and the development of a natural

soil horizon. These biologic and physical processes over time will lengthen the facility's life span and reduce the need for extensive maintenance.

Routine maintenance should include a biannual health evaluation of the trees and shrubs and subsequent removal of any dead or diseased vegetation (EPA, 1999). Diseased vegetation should be treated as needed using preventative and low-toxic measures to the extent possible. BMPs have the potential to create very attractive habitats for mosquitoes and other vectors because of highly organic, often heavily vegetated areas mixed with shallow water. Routine inspections for areas of standing water within the BMP and corrective measures to restore proper infiltration rates are necessary to prevent creating mosquito and other vector habitat. In addition, bioretention BMPs are susceptible to invasion by aggressive plant species such as cattails, which increase the chances of water standing and subsequent vector production if not routinely maintained.

In order to maintain the treatment area's appearance it may be necessary to prune and weed. Furthermore, mulch replacement is suggested when erosion is evident or when the site begins to look unattractive. Specifically, the entire area may require mulch replacement every two to three years, although spot mulching may be sufficient when there are random void areas. Mulch replacement should be done prior to the start of the wet season.

New Jersey's Department of Environmental Protection states in their bioretention systems standards that accumulated sediment and debris removal (especially at the inflow point) will normally be the primary maintenance function. Other potential tasks include replacement of dead vegetation, soil pH regulation, erosion repair at inflow points, mulch replenishment, unclogging the underdrain, and repairing overflow structures. There is also the possibility that the cation exchange capacity of the soils in the cell will be significantly reduced over time. Depending on pollutant loads, soils may need to be replaced within 5-10 years of construction (LID, 2000).

Cost

Construction Cost

Construction cost estimates for a bioretention area are slightly greater than those for the required landscaping for a new development (EPA, 1999). A general rule of thumb (Coffman, 1999) is that residential bioretention areas average about $3 to $4 per square foot, depending on soil conditions and the density and types of plants used. Commercial, industrial and institutional site costs can range between $10 to $40 per square foot, based on the need for control structures, curbing, storm drains and underdrains.

Retrofitting a site typically costs more, averaging $6,500 per bioretention area. The higher costs are attributed to the demolition of existing concrete, asphalt, and existing structures and the replacement of fill material with planting soil. The costs of retrofitting a commercial site in Maryland, Kettering Development, with 15 bioretention areas were estimated at $111,600.

In any bioretention area design, the cost of plants varies substantially and can account for a significant portion of the expenditures. While these cost estimates are slightly greater than those of typical landscaping treatment (due to the increased number of plantings, additional soil excavation, backfill material, use of underdrains etc.), those landscaping expenses that would be required regardless of the bioretention installation should be subtracted when determining the net cost.

Perhaps of most importance, however, the cost savings compared to the use of traditional structural stormwater conveyance systems makes bioretention areas quite attractive financially. For example, the use of bioretention can decrease the cost required for constructing stormwater conveyance systems at a site. A medical office building in Maryland was able to reduce the amount of storm drain pipe that was needed from 800 to 230 feet - a cost savings of $24,000 (PGDER, 1993). And a new residential development spent a total of approximately $100,000 using bioretention cells on each lot instead of nearly $400,000 for the traditional stormwater ponds that were originally planned (Rappahanock,). Also, in residential areas, stormwater management controls become a part of each property owner's landscape, reducing the public burden to maintain large centralized facilities.

Maintenance Cost

The operation and maintenance costs for a bioretention facility will be comparable to those of typical landscaping required for a site. Costs beyond the normal landscaping fees will include the cost for testing the soils and may include costs for a sand bed and planting soil.

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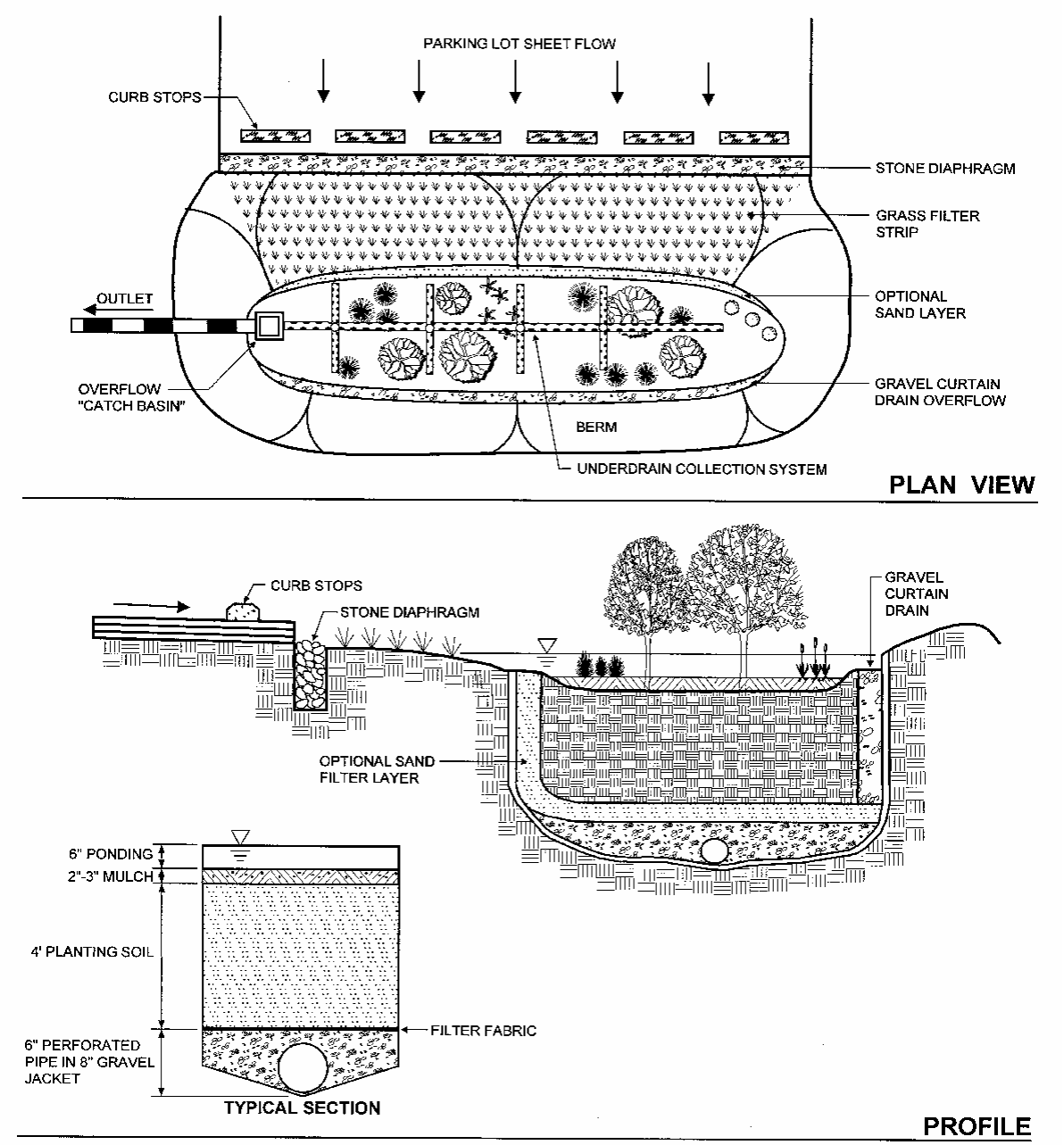


Schematic of a Bioretention Facility (MDE, 2000)

Appendix III

Soils Percolation Test

KCG KLING Consulting Group, Inc.

Infiltration Test Data Sheet

Project: 21030-00
Date: October 28, 2021

Test Hole No: KP-1
Hole Depth, D_T (inches): 60
Diameter (inches): 8
Soil Description: ~~(SM)~~

Tested Infiltration Rate[1]
~~0.22 in/hr~~

Sandy Soil Criteria Test

Trial No.	Start Time	Stop Time	Time Interval (min.)	Initial Depth to Water (ft.)	Initial Depth to Water (in.)	Final Depth to Water (ft.)	Final Depth to Water (in.)	Change in Water Level (in.)	Great than or Equal to 6"? (Y/N)
1	10.07	10.32	25	4.50	54.00	5.00	60.00	6.00	Y
2	10.35	11.00	25	4.50	54.00	5.00	60.00	6.00	Y

Trial Readings

Trial No.	Start Time	Stop Time	Time Interval (min.)	Measured Initial Depth to Water (ft.)	Initial Depth to Water (in.)	Measured Final Depth to Water (Ft.)	Final Depth to Water (in.)	Change in Water Level (in.)	Percolation Rate (min./in.)
1	11.37	11.47	10	1.50	18.00	2.00	24.00	6.00	1.67
2	11.47	11.57	10	1.50	18.00	1.90	22.80	4.80	2.08
3	11.57	12.07	10	1.55	18.60	1.95	23.40	4.80	2.08
4	12.07	12.17	10	1.50	18.00	1.90	22.80	4.80	2.08
5	12.17	12.27	10	1.50	18.00	1.80	21.60	3.60	2.78
6	12.27	12.37	10	1.50	18.00	1.70	20.40	2.40	4.17

Comments: [1]Tested infiltration rate from San Bernadino County - Infiltration Rate Evaluation Protocol and Factor of Safety Recommendation (Appendix VII - 2011) Minimum factor of safety of 3 is applied to this rate.

KCG KLING Consulting Group, Inc.

Infiltration Test Data Sheet

Project: 21031-00
Date: October 28, 2021

Test Hole No: KP-2
Hole Depth, D_T (inches): 180
Diameter (inches): 8
Soil Description: ~~(SP)~~

Tested Infiltration Rate[1]
~~0.20 in/hr~~

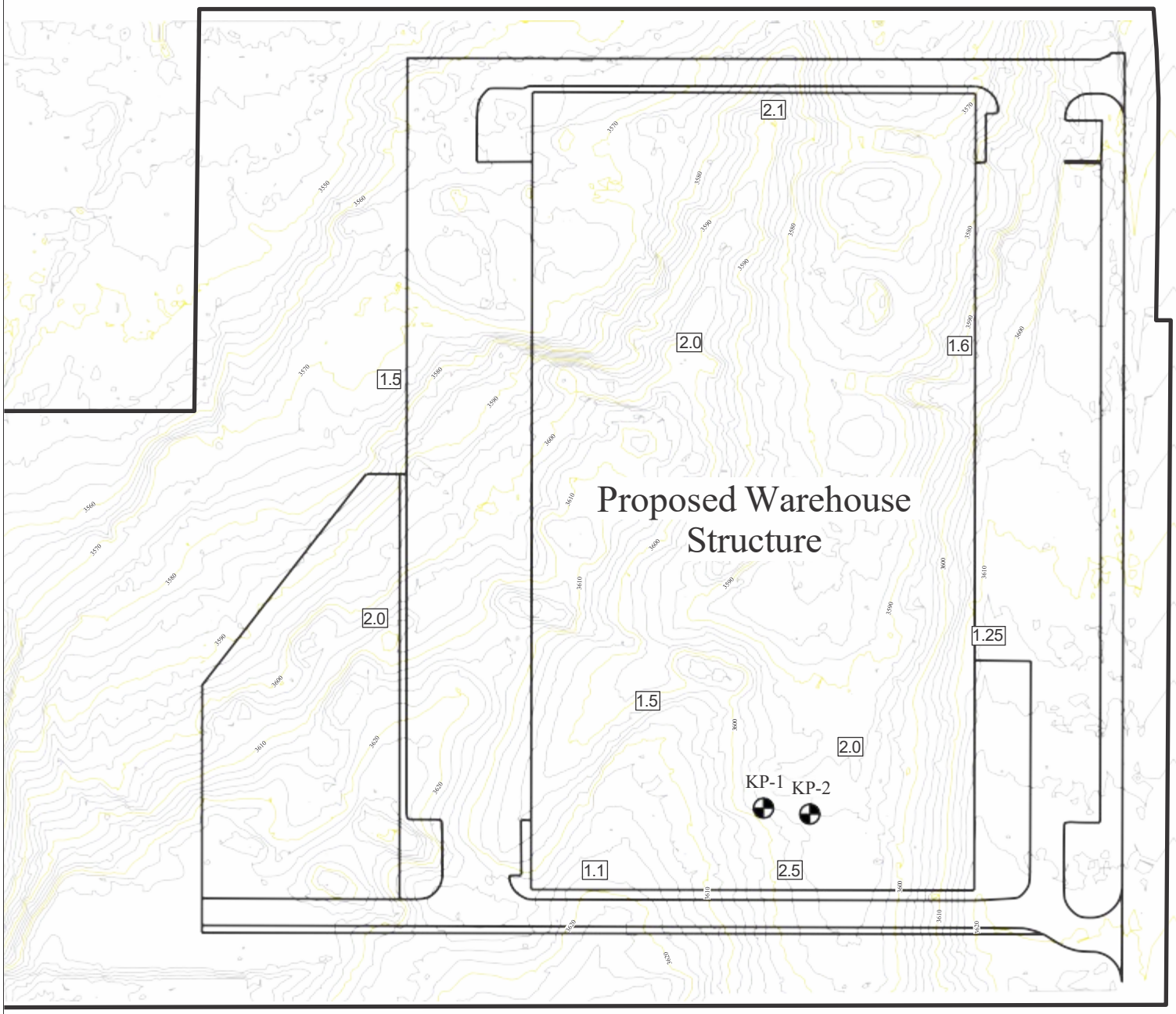
Sandy Soil Criteria Test

Trial No.	Start Time	Stop Time	Time Interval (min.)	Initial Depth to Water (ft.)	Initial Depth to Water (in.)	Final Depth to Water (ft.)	Final Depth to Water (in.)	Change in Water Level (in.)	Great than or Equal to 6"? (Y/N)
1	10:07	10:32	25	7.00	84.00	10.00	120.00	36.00	Yes
2	10:35	11:00	25	7.00	84.00	10.00	120.00	36.00	Yes

Trial Readings

Trial No.	Start Time	Stop Time	Time Interval (min.)	Measured Initial Depth to Water (ft.)	Initial Depth to Water (in.)	Measured Final Depth to Water (ft.)	Final Depth to Water (in.)	Change in Water Level (in.)	Percolation Rate (min./in.)
1	11:37	11:47	10	5.00	60.00	6.50	78.00	18.00	0.56
2	11:47	11:57	10	5.00	60.00	5.90	70.80	10.80	0.93
3	11:57	12:07	10	5.00	60.00	5.80	69.60	9.60	1.04
4	12:07	12:17	10	5.10	61.20	5.90	70.80	9.60	1.04
5	12:17	12:27	10	5.00	60.00	5.80	69.60	9.60	1.04
6	12:27	12:37	10	5.00	60.00	5.70	68.40	8.40	1.19

Comments: [1]Tested infiltration rate from Riverside County - Low Impact Development BMP Design Handbook (Appendix A- 2011)
Minimum factor of safety of 3 is applied to this rate.



Notes:

- Percolation Test Hole Location

Scale: 1'': 200'

KCG KLING Consulting Group, Inc.

Client:
SRD Design Studio

Address:
APN 3064-551-01 to 3064-551-08.,
Hesperia, CA 92344

Percolation Test Location Map

Drawn: J.H.	**Date:** 11/8/2021
P/N: 21030-00	**Figure:** 3

United States Department of Agriculture

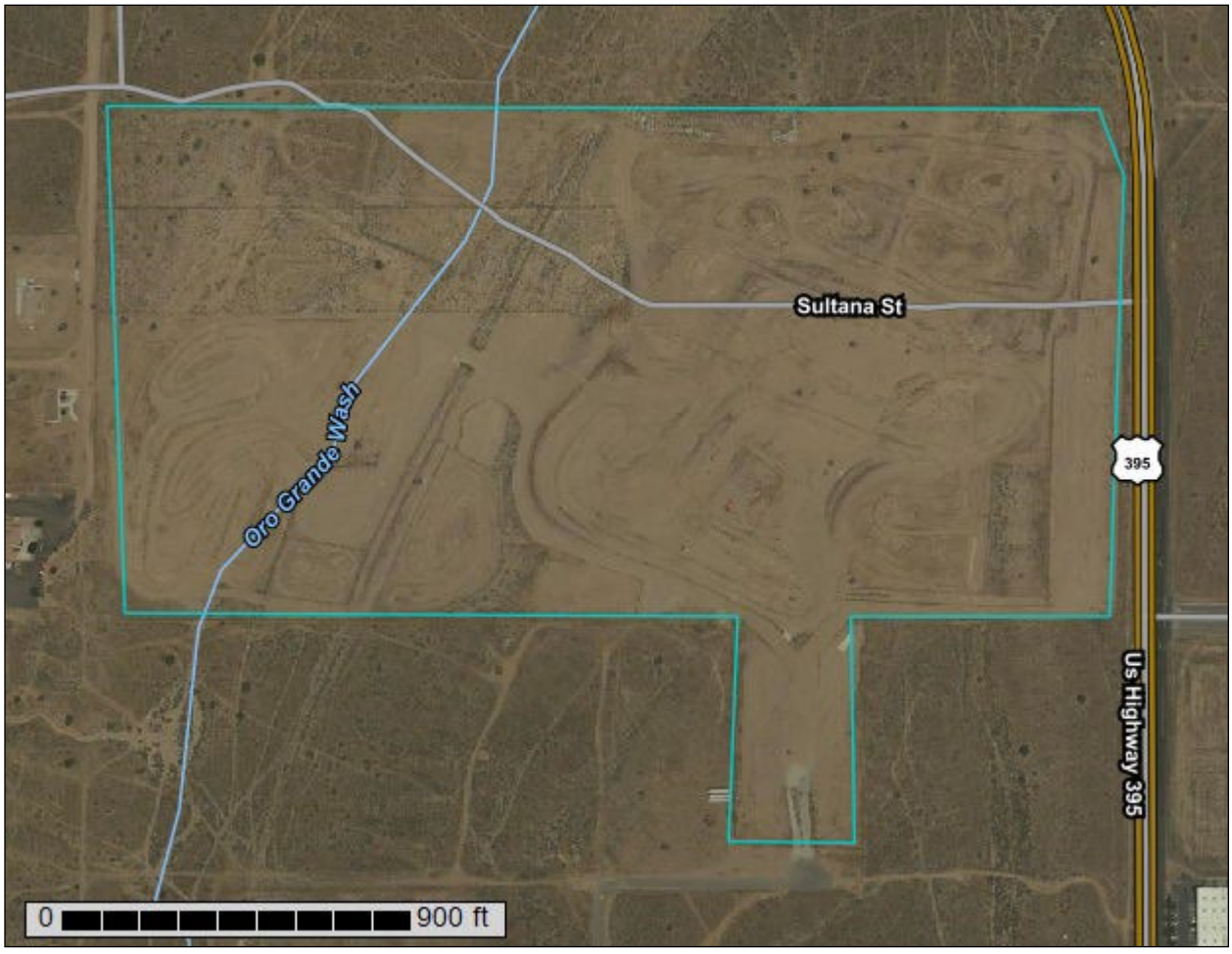
NRCS

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

Hesperia Project Preliminary Soil Report



August 19, 2021

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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Contents

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

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

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

N

Map Scale: 1:4,890 if printed on A landscape (11" x 8.5") sheet.

0 50 100 200 300 Meters

0 200 400 800 1200 Feet

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 11N WGS84

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 12, May 27, 2020

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

Date(s) aerial images were photographed: Jun 26, 2019—Jul 8, 2019

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

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
114	CAJON SAND, 9 TO 15 PERCENT SLOPES	11.7	14.4%
134	HESPERIA LOAMY FINE SAND, 2 TO 5 PERCENT SLOPES	69.8	85.6%
Totals for Area of Interest		**81.5**	**100.0%**

Map Unit Descriptions

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.

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

114—CAJON SAND, 9 TO 15 PERCENT SLOPES

Map Unit Setting

National map unit symbol: hkrl
Elevation: 1,800 to 4,000 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, slope, and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Cajon, Slope

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: sand
H2 - 6 to 42 inches: sand
H3 - 42 to 60 inches: gravelly sand

Properties and qualities

Slope: 9 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: None
Frequency of ponding: None
Calcium carbonate, maximum content: 1 percent
Available water supply, 0 to 60 inches: Low (about 4.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7e
Hydrologic Soil Group: A
Ecological site: R030XF012CA - Sandy
Hydric soil rating: No

Minor Components

Cajon, steep

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

Arizo

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

Cajon, gravelly surface

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

134—HESPERIA LOAMY FINE SAND, 2 TO 5 PERCENT SLOPES

Map Unit Setting

National map unit symbol: hks7
Elevation: 200 to 4,000 feet
Mean annual precipitation: 6 to 9 inches
Mean annual air temperature: 57 to 61 degrees F
Frost-free period: 150 to 250 days
Farmland classification: Prime farmland if irrigated

Map Unit Composition

Hesperia and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Hesperia

Setting

Landform: Fan aprons
Landform position (two-dimensional): Footslope
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: loamy fine sand
H2 - 6 to 60 inches: sandy loam, coarse sandy loam
H2 - 6 to 60 inches:

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): 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: 10 percent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: High (about 11.3 inches)

Interpretive groups

Land capability classification (irrigated): 2e
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: A
Ecological site: R030XE006CA - COARSE LOAMY
Hydric soil rating: No

Minor Components

Cajon

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

Wrightwood

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

Bull trail

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

Unnamed soils

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

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EXHIBIT B

PRECIPITATION MAPS

NOAA Atlas 14, Volume 6, Version 2
Location name: Hesperia, California, USA*
Latitude: 34.4176°, Longitude: -117.4031°
Elevation: 3597.89 ft**
* source: ESRI Maps
** source: USGS

POINT PRECIPITATION FREQUENCY ESTIMATES

Sanja Perica, Sarah Dietz, Sarah Heim, Lillian Hiner, Kazungu Maitaria, Deborah Martin, Sandra Pavlovic, Ishani Roy, Carl Trypaluk, Dale Unruh, Fenglin Yan, Michael Yekta, Tan Zhao, Geoffrey Bonnin, Daniel Brewer, Li-Chuan Chen, Tye Parzybok, John Yarchoan

NOAA, National Weather Service, Silver Spring, Maryland

PF_tabular | PF_graphical | Maps_&_aerials

PF tabular

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

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	0.088 (0.073-0.107)	0.125 (0.103-0.152)	0.173 (0.143-0.212)	0.213 (0.175-0.264)	0.269 (0.212-0.343)	0.312 (0.241-0.407)	0.356 (0.269-0.476)	0.403 (0.296-0.554)	0.467 (0.329-0.669)	0.517 (0.352-0.768)
10-min	0.126 (0.104-0.154)	0.179 (0.148-0.218)	0.248 (0.205-0.304)	0.306 (0.250-0.378)	0.385 (0.305-0.492)	0.447 (0.346-0.583)	0.511 (0.386-0.683)	0.577 (0.424-0.794)	0.669 (0.471-0.959)	0.741 (0.505-1.10)
15-min	0.152 (0.126-0.186)	0.216 (0.179-0.264)	0.300 (0.248-0.368)	0.370 (0.302-0.457)	0.466 (0.368-0.595)	0.541 (0.419-0.705)	0.618 (0.467-0.826)	0.698 (0.513-0.960)	0.809 (0.570-1.16)	0.897 (0.610-1.33)
30-min	0.230 (0.190-0.280)	0.326 (0.269-0.398)	0.453 (0.374-0.555)	0.558 (0.456-0.689)	0.703 (0.556-0.897)	0.815 (0.631-1.06)	0.932 (0.704-1.25)	1.05 (0.773-1.45)	1.22 (0.860-1.75)	1.35 (0.921-2.01)
60-min	0.326 (0.270-0.398)	0.463 (0.383-0.566)	0.644 (0.531-0.789)	0.793 (0.648-0.979)	0.998 (0.789-1.27)	1.16 (0.897-1.51)	1.32 (1.00-1.77)	1.50 (1.10-2.06)	1.73 (1.22-2.49)	1.92 (1.31-2.85)
2-hr	0.480 (0.397-0.585)	0.651 (0.538-0.795)	0.882 (0.727-1.08)	1.08 (0.879-1.33)	1.35 (1.07-1.72)	1.56 (1.21-2.04)	1.79 (1.35-2.39)	2.03 (1.49-2.79)	2.36 (1.66-3.38)	2.63 (1.79-3.90)
3-hr	0.606 (0.501-0.739)	0.810 (0.669-0.989)	1.09 (0.896-1.33)	1.32 (1.08-1.63)	1.65 (1.31-2.11)	1.92 (1.48-2.50)	2.20 (1.66-2.94)	2.49 (1.83-3.43)	2.92 (2.05-4.18)	3.26 (2.22-4.84)
6-hr	0.864 (0.715-1.06)	1.15 (0.947-1.40)	1.53 (1.26-1.87)	1.86 (1.52-2.30)	2.33 (1.84-2.97)	2.71 (2.09-3.53)	3.11 (2.35-4.16)	3.54 (2.60-4.87)	4.17 (2.94-5.97)	4.68 (3.19-6.95)
12-hr	1.13 (0.937-1.38)	1.54 (1.27-1.88)	2.09 (1.73-2.56)	2.56 (2.10-3.17)	3.24 (2.56-4.14)	3.78 (2.93-4.94)	4.36 (3.30-5.83)	4.99 (3.67-6.86)	5.89 (4.15-8.44)	6.63 (4.51-9.84)
24-hr	1.54 (1.36-1.77)	2.15 (1.90-2.48)	2.99 (2.64-3.46)	3.71 (3.25-4.32)	4.72 (4.00-5.69)	5.55 (4.60-6.82)	6.42 (5.20-8.09)	7.36 (5.80-9.53)	8.71 (6.58-11.8)	9.81 (7.17-13.7)
2-day	1.78 (1.58-2.05)	2.49 (2.21-2.87)	3.48 (3.08-4.03)	4.33 (3.80-5.05)	5.56 (4.71-6.70)	6.57 (5.45-8.07)	7.64 (6.19-9.63)	8.81 (6.94-11.4)	10.5 (7.94-14.2)	11.9 (8.70-16.6)
3-day	1.91 (1.69-2.20)	2.67 (2.37-3.08)	3.74 (3.30-4.32)	4.66 (4.09-5.44)	6.01 (5.09-7.24)	7.12 (5.91-8.75)	8.31 (6.73-10.5)	9.61 (7.57-12.5)	11.5 (8.70-15.5)	13.1 (9.57-18.3)
4-day	2.06 (1.82-2.37)	2.88 (2.55-3.33)	4.04 (3.56-4.67)	5.04 (4.41-5.87)	6.49 (5.50-7.82)	7.70 (6.39-9.47)	9.00 (7.29-11.3)	10.4 (8.21-13.5)	12.5 (9.45-16.9)	14.2 (10.4-19.9)
7-day	2.31 (2.05-2.66)	3.22 (2.85-3.71)	4.48 (3.96-5.18)	5.58 (4.88-6.50)	7.17 (6.08-8.63)	8.48 (7.04-10.4)	9.90 (8.02-12.5)	11.5 (9.02-14.8)	13.7 (10.4-18.5)	15.6 (11.4-21.8)
10-day	2.47 (2.19-2.85)	3.43 (3.04-3.96)	4.77 (4.21-5.51)	5.92 (5.18-6.90)	7.59 (6.43-9.14)	8.97 (7.44-11.0)	10.5 (8.47-13.2)	12.1 (9.52-15.6)	14.4 (10.9-19.5)	16.4 (12.0-22.9)
20-day	2.97 (2.63-3.41)	4.10 (3.63-4.73)	5.68 (5.01-6.56)	7.04 (6.16-8.20)	9.00 (7.62-10.8)	10.6 (8.81-13.0)	12.4 (10.0-15.6)	14.3 (11.2-18.5)	17.0 (12.9-23.0)	19.4 (14.2-27.1)
30-day	3.50 (3.10-4.03)	4.82 (4.26-5.55)	6.63 (5.86-7.66)	8.20 (7.18-9.55)	10.5 (8.86-12.6)	12.3 (10.2-15.1)	14.3 (11.6-18.1)	16.5 (13.0-21.4)	19.8 (15.0-26.7)	22.5 (16.4-31.4)
45-day	4.18 (3.70-4.81)	5.67 (5.02-6.54)	7.74 (6.83-8.94)	9.52 (8.33-11.1)	12.1 (10.2-14.6)	14.2 (11.8-17.5)	16.5 (13.4-20.8)	19.0 (15.0-24.7)	22.8 (17.2-30.7)	25.9 (18.9-36.2)
60-day	4.77 (4.23-5.49)	6.38 (5.65-7.35)	8.59 (7.59-9.93)	10.5 (9.20-12.2)	13.3 (11.2-16.0)	15.5 (12.9-19.1)	18.0 (14.6-22.7)	20.8 (16.4-26.9)	24.9 (18.8-33.6)	28.3 (20.7-39.6)

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

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

Please refer to NOAA Atlas 14 document for more information.

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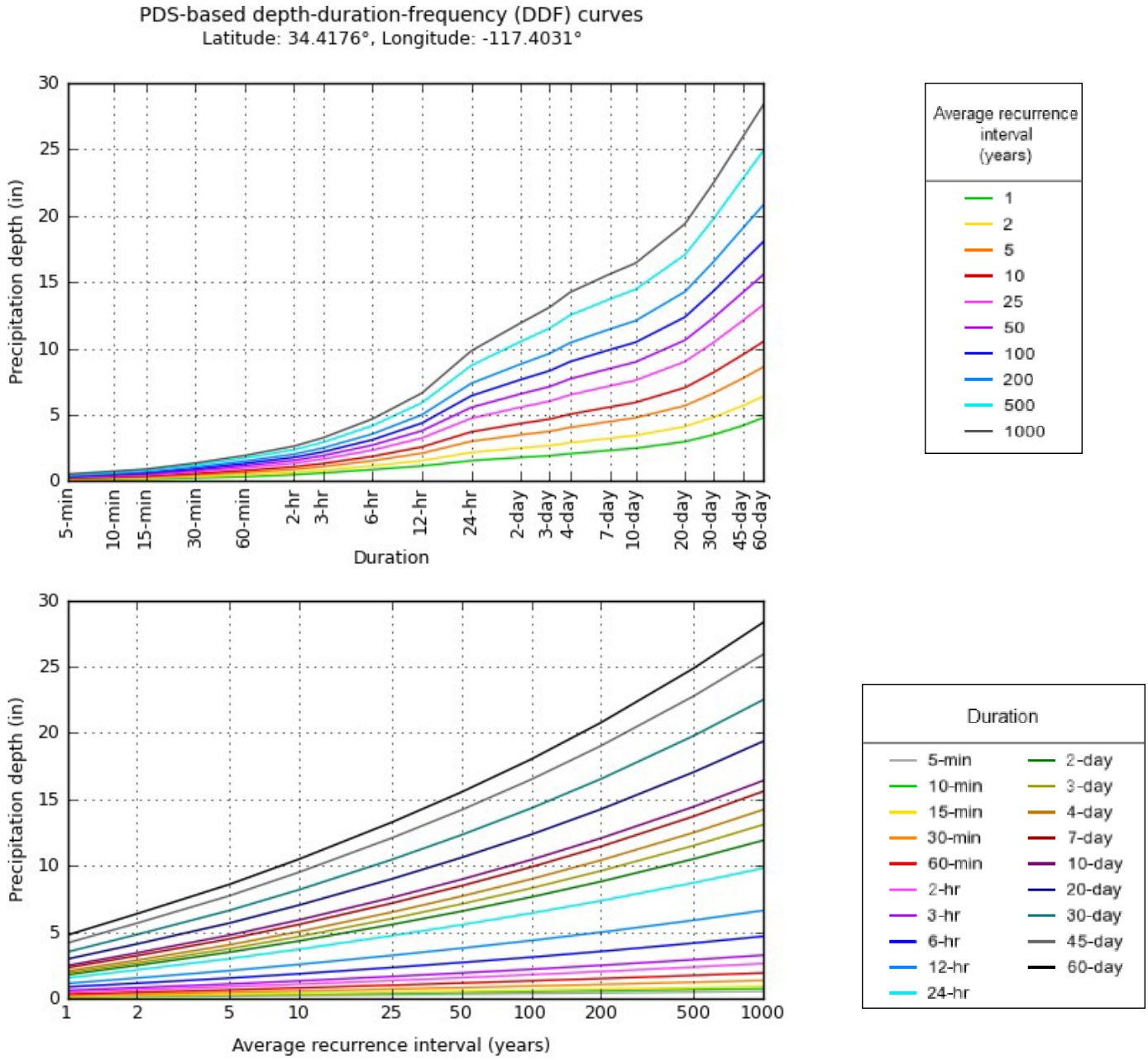
PF graphical



NOAA Atlas 14, Volume 6, Version 2

Created (GMT): Thu Aug 19 15:21:05 2021

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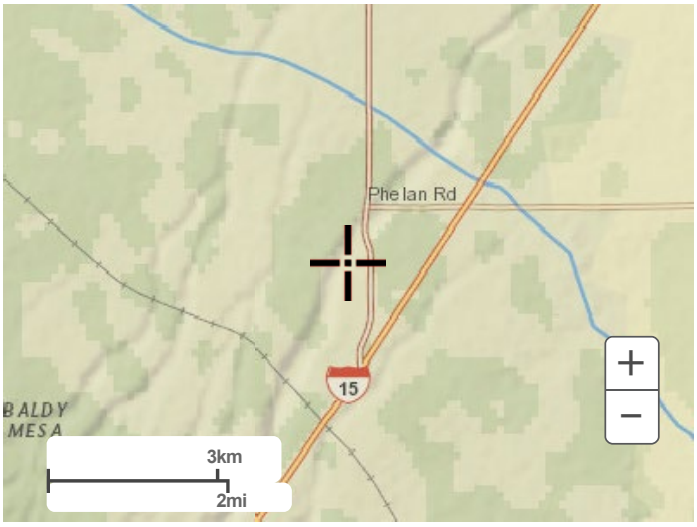
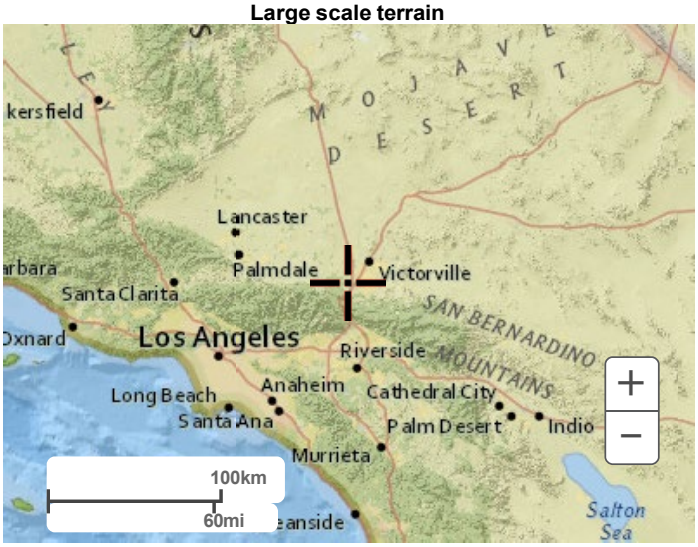
Maps & aerials

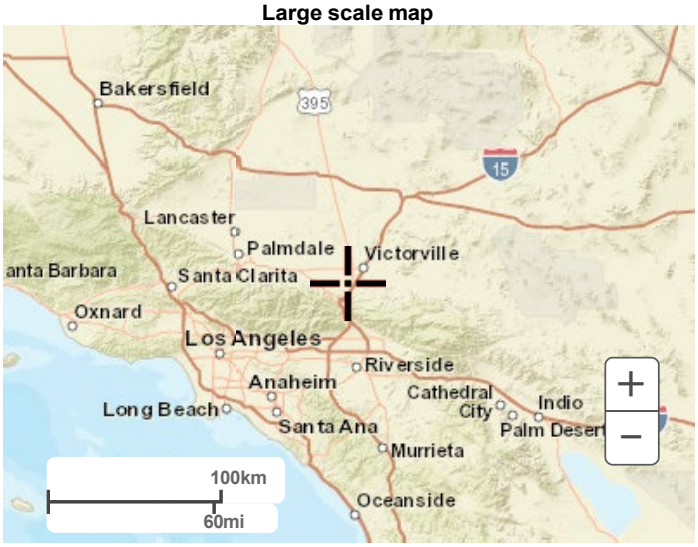
Small scale terrain



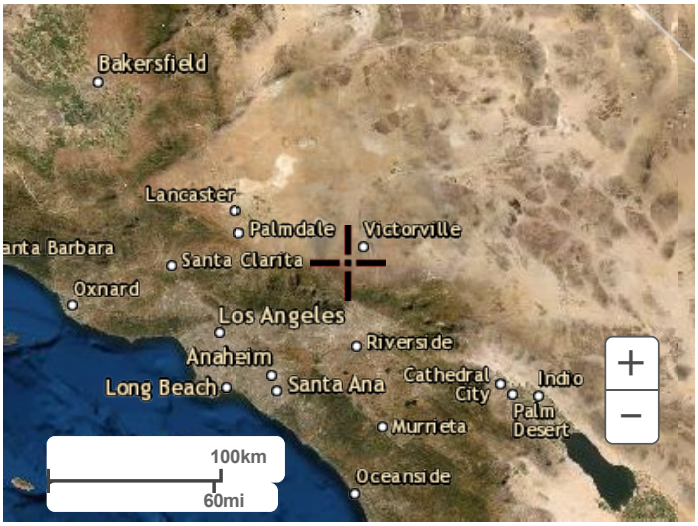
Large scale terrain



Large scale map



Large scale aerial



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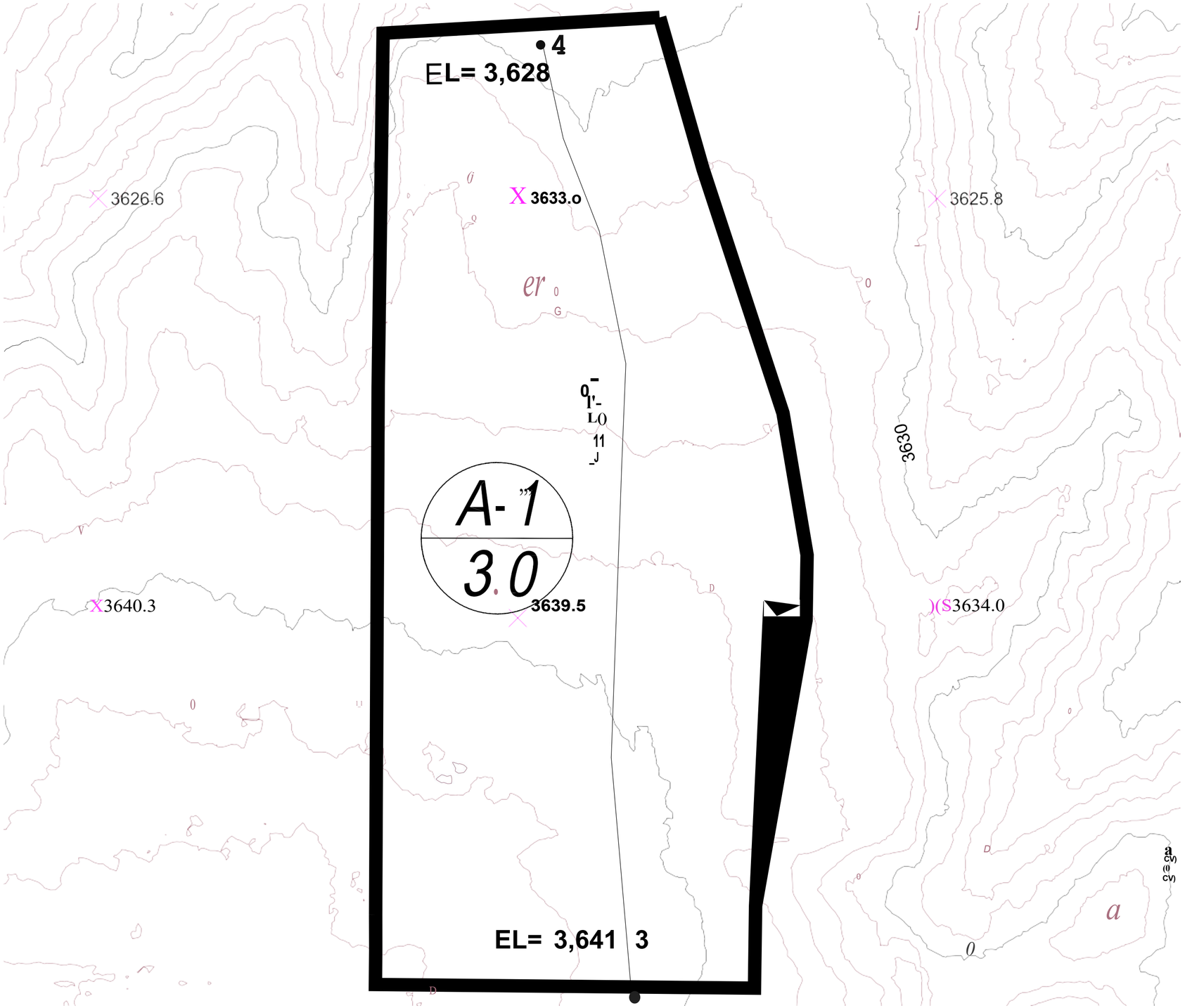
US Department of Commerce
National Oceanic and Atmospheric Administration
National Weather Service
National Water Center
1325 East West Highway
Silver Spring, MD 20910
Questions?: HDSC.Questions@noaa.gov

Disclaimer

EXISTING UNIT HYDROGRAPH HYDROLOGY MAP

IN THE CITY OF HESPERIA COUNTY OF SAN BERNARDINO, STATE OF CALIFORNIA.



LEGEND

- DRAINAGE AREA BOUNDARY
- SUBAREA BOUNDARY/DIRECTION
- STORM DRAIN
- CATCH BASIN
- TRACT BOUNDARY
- SUBAREA No. / ACREAGE
- NODE NO.
- SOIL GROUP
- Q_{10} - XXXX 10 YEAR STORM
- Q - XXXX 100 YEAR STORM
- T_c - XXX MINS. TIME OF CONCENTRATION

N

1"=30'

0 30.0 60.0 120.0 Feet

1"=30'

ENGINEER'S STATEMENT:

REGISTERED PROFESSIONAL ENGINEER DAVID J. GOLKAR No. C-054182 OF CIVIL

DAVID J. GOLKAR DATE

Prepared in the office of
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CITY OF HESPERIA

DARA INDUSTRIAL CENTER

Drawing No.

Job No.

Sheet No. 1 of 1

PROPOSED UNIT HYDROGRAPH HYDROLOGY MAP

IN THE CITY OF HESPERIA COUNTY OF SAN BERNARDINO, STATE OF CALIFORNIA.

LEGEND

- DRAINAGE AREA BOUNDARY
- SUBAREA BOUNDARY
- DRAINAGE FLOW DIRECTION
- STORM DRAIN
- CATCH BASIN
- TRACT BOUNDARY
- SUBAREA No. ACREAGE
- NODE NO.
- SOIL GROUP
- 0_{Q} = XXXX 1D YEAR STORM
- $_{Q}$ = XXXX 10O YEAR STORM
- T_{C} = XX.X MINS. TIME OF CONCENTRATION

N

1"=30'

0 30.0 60.0 120.0 Feet

1":30'

ENGINEER'S STATEMENT:

DAVID J. GOLKAR DATE

Prepared by the office of
3D Design Studio, Inc.
Planning
Engineering
Environmental
Surveying

CITY OF HESPERIA

DAHA INDUSTRIAL CENTER

Project No.
Job No.
Sheet No.

WATER QUALITY MANAGEMENT PLAN EXHIBIT

IN THE CITY OF HESPERIA COUNTY OF SAN BERNARDINO, STATE OF CALIFORNIA.

LEGEND

- CATCH BASIN
- PROPOSED STORM DRAIN
- COMMERCIAL AREA ROOF
- PARKING LOTS
- ROADS
- FLOW DIRECTION

SOURCE CONTROL BMPS

- LANDSCAPE

TREATMENT CONTROL BMPS

- BIORETENTION BASIN

ENGINEER'S STATEMENT:

DAVID J. SOLIAR — DATE

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