Water Quality Management Plan

For:

Ottawa Logistics Center

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:

LINK LOGISTICS REAL ESTATE.
3401 ETIWANDA AVENUE, LEASING OFFICE
JURUPA VALLEY, CA 91752
(909) 233-9035

Prepared by:

DAVID EVANS AND ASSOCIATES INC.

18484 OUTER HIGHWAY 18 NORTH, Suite 225
APPLE VALLEY, CA
(760) 524-9100

Submittal Date: August 2021

Revision Date: January 2022

Approval Date:______________________

Project Owner's Certification

This Water Quality Management Plan (WQMP) has been prepared for Link Logistics Real Estate by David Evans and Associates Inc. The WQMP is intended to comply with the requirements of the City of Victorville and the Phase II Small MS4 General Permit for the Mojave River Watershed and the NPDES Areawide Stormwater Program requiring the preparation of a WQMP. 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 San Bernardino County's Municipal Storm Water Management Program and the intent of the NPDES Permit for San Bernardino County and the incorporated cities of San Bernardino County within the Santa Ana Region. Once the undersigned transfers its interest in the property, its successors in interest and the city/county shall be notified of the transfer. The new owner will be informed of its responsibility under this WQMP. A copy of the approved WQMP shall be available on the subject site in perpetuity.

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

.

Project Data			
Permit/Application Number(s):	TBD	Grading Permit Number(s):	
Tract/Parcel Map Number(s):		Building Permit Number(s):	
CUP, SUP, and/or APN (Specify Lot Numbers if Portions of Tract):			3090-551-02, 04 thru 07: 3090-411-01Thru 05 3090-401-05 thru 08 3090-531-02 thru 04

Owner's Signature			
Owner Name: Tom Cruikshank			
Title	Senior Vice President		
Company	LINK LOGISTICS REAL ESTATE		
Address	3401 ETIWANDA AVENUE, LEASING OFFICE JURUPA VALLEY, CA 91752		
Email			
Telephone #	(909) 233-9035		
Signature		Date	

Preparer's Certification

Project Data			
Permit/Application Number(s):		Grading Permit Number(s):	
Tract/Parcel Map Number(s):		Building Permit Number(s):	
CUP, SUP, and/or APN (Specify Lot Numbers if Portions of Tract):			3090-551-02, 04 thru 07: 3090-411-01Thru 05 3090-401-05 thru 08 3090-531-02 thru 04

"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 Regional Water Quality Control Board Order No. R8-2010-0036."

Engineer: Bret Thorpe, PE		PE Stamp Below
Title	Project Manager	
Company	David Evans and Associates	
Address	18484 Outer Highway 18 North, Suite 225, Apple Valley, CA 92307	
Email	bthorpe@deainc.com	
Telephone #	909-481-5750	
Signature		
Date		

Table of Contents

Forms

Section 1 Discretionary Permit(s)

<table>
<tr><th colspan="6">Form 1-1 Project Information</th></tr>
<tr><td colspan="2">Project Name</td><td colspan="4">Ottawa Logistics Center</td></tr>
<tr><td colspan="2">Project Owner Contact Name:</td><td colspan="4"></td></tr>
<tr><td>Mailing Address:</td><td>3401 ETIWANDA AVENUE, LEASING OFFICE
JURUPA VALLEY, CA 91752</td><td>E-mail Address:</td><td></td><td>Telephone:</td><td></td></tr>
<tr><td colspan="2">Permit/Application Number(s):</td><td colspan="2"></td><td>Tract/Parcel Map Number(s):</td><td></td></tr>
<tr><td colspan="2">Additional Information/
Comments:</td><td colspan="4"></td></tr>
<tr><td colspan="2">Description of Project:</td><td colspan="4">Development of 51.92-Acre site for a 996,520 square foot warehouse. The development includes two bioswales and two Stormtech underground detention basins</td></tr>
<tr><td colspan="2">Provide summary of Conceptual WQMP conditions (if previously submitted and approved). Attach complete copy.</td><td colspan="4">Comply with MS4 permit.</td></tr>
</table>

Section 2 Project Description

2.1 Project Information

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

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

Form 2.1-1 Description of Proposed Project

1 Development Category (Select all that apply):			
☐ Significant re-development involving the addition or replacement of 5,000 ft^2 or more of impervious surface on an already developed site	☒ New development involving the creation of 10,000 ft^2 or more of impervious surface collectively over entire site	☐ Automotive repair shops with standard industrial classification (SIC) codes 5013, 5014, 5541, 7532- 7534, 7536-7539	☐ Restaurants (with SIC code 5812) where the land area of development is 5,000 ft^2 or more
☐ Hillside developments of 5,000 ft^2 or more which are located on areas with known erosive soil conditions or where the natural slope is 25 percent or more	☐ Developments of 2,500 ft^2 of impervious surface or more adjacent to (within 200 ft) or discharging directly into environmentally sensitive areas or waterbodies listed on the CWA Section 303(d) list of impaired waters.	☐ Parking lots of 5,000 ft^2 or more exposed to storm water	☐ Retail gasoline outlets that are either 5,000 ft^2 or more, or have a projected average daily traffic of 100 or more vehicles per day
☐ Non-Priority / Non-Category Project *May require source control LID BMPs and other LIP requirements. Please consult with local jurisdiction on specific requirements*.			

2 Project Area (ft2):	2,261,652	3 Number of Dwelling Units:	NA	4 SIC Code:	4225

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

6 Does Project include roads? Yes ☐ No ☒ *If yes, ensure that applicable requirements for transportation projects are addressed (see Appendix A of TGD for WQMP)*

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:
LINK LOGISTICS REAL ESTATE. **3401 ETIWANDA AVENUE, LEASING OFFICE** **JURUPA VALLEY, CA 91752**

2.3 Potential Stormwater Pollutants

Determine and describe expected stormwater pollutants of concern based on land uses and site activities (refer to Table 3-3 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 ☒	
Nutrients - Phosphorous	E ☐	N ☒	
Nutrients - Nitrogen	E ☐	N ☒	
Noxious Aquatic Plants	E ☐	N ☒	
Sediment	E ☒	N ☐	
Metals	E ☒	N ☐	
Oil and Grease	E ☒	N ☐	
Trash/Debris	E ☒	N ☐	
Pesticides / Herbicides	E ☒	N ☐	
Organic Compounds	E ☐	N ☒	
Other:	E ☐	N ☐	
Other:	E ☐	N ☐	
Other:	E ☐	N ☐	
Other:	E ☐	N ☐	
Other:	E ☐	N ☐	

2.4 Water Quality Credits

A water quality credit program is applicable for certain types of development projects if it is not feasible to meet the requirements for on-site LID. Proponents for eligible projects, as described below, can apply for water quality credits that would reduce project obligations for selecting and sizing other treatment BMP or participating in other alternative compliance programs. Refer to Section 6.2 in the TGD for WQMP to determine if water quality credits are applicable for the project.

Form 2.4-1 Water Quality Credits			
1 Project Types that Qualify for Water Quality Credits: *Select all that apply*			
☐ Redevelopment projects that reduce the overall impervious footprint of the project site. [Credit = % impervious reduced]	Higher density development projects ☐Vertical density [20%] ☐7 units/ acre [5%]	☐ Mixed use development, (combination of residential, commercial, industrial, office, institutional, or other land uses which incorporate design principles that demonstrate environmental benefits not realized through single use projects) [20%]	☐Brownfield redevelopment (redevelop real property complicated by presence or potential of hazardous contaminants) [25%]
☐ Redevelopment projects in established historic district, historic preservation area, or similar significant core city center areas [10%]	☐ Transit-oriented developments (mixed use residential or commercial area designed to maximize access to public transportation) [20%]	☐ In-fill projects (conversion of empty lots & other underused spaces < 5 acres, substantially surrounded by urban land uses, into more beneficially used spaces, such as residential or commercial areas) [10%]	☐ Live-Work developments (variety of developments designed to support residential and vocational needs) [20%]
2 Total Credit % *(Total all credit percentages up to a maximum allowable credit of 50 percent)*			
Description of Water Quality Credit Eligibility (if applicable)			

Section 3 Site and Watershed Description

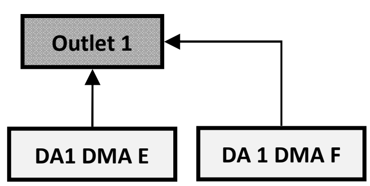
Describe the project site conditions that will facilitate the selection of BMP through an analysis of the physical conditions and limitations of the site and its receiving waters. Identify distinct drainage areas (DA) that collect flow from a portion of the site and describe how runoff from each DA (and sub-watershed 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.***

Form 3-1 Site Location and Hydrologic Features

Site coordinates *take GPS measurement at approximate center of site*	Latitude 34.4942	Longitude -117.2867	Thomas Bros Map page 4386

[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*



Example only – modify for project specific WQMP using additional form

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 E to Outlet 1	Area drains to an underground Detention basin. Overflows will drain into proposed 96" stormdrain and conveyed north east to outlet no. 1
DA1 DMA F to Outlet 1	Area drains to proposed vegetated bioswales on the east and west sides of the site. The remainder of the area and vegetative bioswale overflows will drain into a second underground Detention Basin and overflows will drain to outlet no. 1

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)	689,986	1,043,905	267,844	253,967
2 Existing site impervious area (ft^2)	0	0	0	0
3 Antecedent moisture condition *For desert areas, use* *http://www.sbcounty.gov/dpw/floodcontrol/pdf/20100412_map.pdf*	2	2	2	2
4 Hydrologic soil group *Refer to Watershed Mapping Tool – http://permitrack.sbcounty.gov/wap/*	A	A	A	A
5 Longest flowpath length (ft)	1,039	1,766	1,175	330
6 Longest flowpath slope (ft/ft)	0.021	0.028	0.38	0.051
7 Current land cover type(s) *Select from Fig C-3 of Hydrology Manual*	Open brush	Open brush	Open brush	Open brush
8 Pre-developed pervious area condition: *Based on the extent of wet season vegetated cover good >75%; Fair 50-75%; Poor <50% Attach photos of site to support rating*	poor	poor	poor	poor

Form 3-2 Existing Hydrologic Characteristics for Drainage 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 *Refer to Watershed Mapping Tool – http://permitrack.sbcounty.gov/wap/*				
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 Watershed Mapping Tool -* *http://permitrack.sbcounty.gov/wap/* *See 'Drainage Facilities" link at this website*	Mojave River
Applicable TMDLs *Refer to Local Implementation Plan*	Flourides, Sulfates
303(d) listed impairments *Refer to Local Implementation Plan and Watershed Mapping Tool –* *http://permitrack.sbcounty.gov/wap/ and State Water Resources Control Board website – http://www.waterboards.ca.gov/santaana/water_issues/programs/tmdl/index.shtml*	none
Environmentally Sensitive Areas (ESA) *Refer to Watershed Mapping Tool –* *http://permitrack.sbcounty.gov/wap/*	none
Unlined Downstream Water Bodies *Refer to Watershed Mapping Tool –* *http://permitrack.sbcounty.gov/wap/*	none
Hydrologic Conditions of Concern	☒ Yes *Complete Hydrologic Conditions of Concern (HCOC) Assessment. Include Forms 4.2-2 through Form 4.2-5 and Hydromodification BMP Form 4.3-10 in submittal* ☐ No
Watershed–based BMP included in a RWQCB approved WAP	☐ Yes *Attach verification of regional BMP evaluation criteria in WAP* • *More Effective than On-site LID* • *Remaining Capacity for Project DCV* • *Upstream of any Water of the US* • *Operational at Project Completion* • *Long-Term Maintenance Plan* ☒ No

Section 4 Best Management Practices (BMP)

4.1 Source Control BMP

4.1.1 Pollution Prevention

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.

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 storm water. The property owner will be familiar with the contents of this document and the BMPs used on the site
N2	Activity Restrictions	☒	☐	The property owner/or tenants shall control the discharge of the stormwater pollutants from this site through activity restrictions.
N3	Landscape Management BMPs	☒	☐	The property owner and landscape maintenance contractors will practice on going landscape maintenance BMPs consistent with applicable local ordinances and will regular inspect the irrigation system for signs of erosion or sediment debris buildup and clean/repair as needed.
N4	BMP Maintenance	☒	☐	The property owner/or tenants will maintain all post construction BMPs consistent with the O&M plan described in section 5 of this document (Form 5-1).
N5	Title 22 CCR Compliance (How development will comply)	☒	☐	Storage of hazardous materials or waste on site must comply will all Title 22 CCR regulations
N6	Local Water Quality Ordinances	☒	☐	The owner shall comply with the City of Victorville's Stormwater Ordinance through the implementation of BMPs.
N7	Spill Contingency Plan	☒	☐	Per Building O&M
N8	Underground Storage Tank Compliance	☐	☒	No storage underground
N9	Hazardous Materials Disclosure Compliance	☐	☒	No hazardous materials onsite

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	☒	☐	This site will comply with the uniform fire code
N11	Litter/Debris Control Program	☒	☐	Litter and debris will be removed and disposed of properly. The owner shall be responsible for trash and litter to be swept from the site and dumped into a City approved dumpster with lids.
N12	Employee Training	☒	☐	The owner should familiar with onsite BMPs and necessary maintenance required by the city and provide it's maintenance employees with training.
N13	Housekeeping of Loading Docks	☒	☐	Sweeping of loading docks biannually
N14	Catch Basin Inspection Program	☒	☐	Catch Basin to be inspected before and after rainy season
N15	Vacuum Sweeping of Private Streets and Parking Lots	☒	☐	Site to be swept twice a year at a minimum
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	☒	☐	SWPPP to be developed to comply with construction general permit

Form 4.1-2 Structural Source Control BMPs

Identifier	Name	Check One		Describe BMP Implementation OR, If not applicable, state reason
		Included	Not Applicable	
S1	Provide storm drain system stencilling and signage (CASQA New Development BMP Handbook SD-13)	☒	☐	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 outdoors.
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 containers.
S4	Use efficient irrigation systems & landscape design, water conservation, smart controllers, and source control (Statewide Model Landscape Ordinance; CASQA New Development BMP Handbook SD-12)	☒	☐	Irrigation systems will be designed to each landscaped area's specific water need. Irrigation controls shall include rain-triggered shutoff devices to prevent irrigation after precipitation.
S5	Finish grade of landscaped areas at a minimum of 1-2 inches below top of curb, sidewalk, or pavement	☒	☐	Landscaped areas shall be below a minimum of 1" to 2" below the top of curb or walk.
S6	Protect slopes and channels and provide energy dissipation (CASQA New Development BMP Handbook SD-10)	☒	☐	Vegetative swale and storm drain outlet will be designed with rip-rap or energy dissipaters
S7	Covered dock areas (CASQA New Development BMP Handbook SD-31)	☐	☒	Not used
S8	Covered maintenance bays with spill containment plans (CASQA New Development BMP Handbook SD-31)	☐	☒	No maintenance bays proposed within new development
S9	Vehicle wash areas with spill containment plans (CASQA New Development BMP Handbook SD-33)	☐	☒	No vehicle wash areas proposed within new development
S10	Covered outdoor processing areas (CASQA New Development BMP Handbook SD-36)	☐	☒	No outdoor processing areas within new development

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 equipment wash areas proposed within new development
S12	Fueling areas (CASQA New Development BMP Handbook SD-30)	☐	☒	No fueling areas proposed within new development
S13	Hillside landscaping (CASQA New Development BMP Handbook SD-10)	☐	☒	No hillside landscaping area within new development
S14	Wash water control for food preparation areas	☐	☒	No food preparation areas
S15	Community car wash racks (CASQA New Development BMP Handbook SD-33)	☐	☒	No Community car wash

4.1.2 Preventative LID Site Design Practices

Site design practices associated with new LID requirements in the MS4 Permit should be considered in the earliest phases of a project. Preventative site design practices can result in smaller DCV for LID BMP and hydromodification control BMP by reducing runoff generation. 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 Preventative LID 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:
Maximize natural infiltration capacity: Yes ☐ No ☒ Explanation: With the use of two bioswales and 2 underground detention basins
Preserve existing drainage patterns and time of concentration: Yes ☐ No ☒ Explanation: Too difficult with the existing site. Detention basins, bioswales and longer drainages courses will provide sufficient mitigation.
Disconnect impervious areas: Yes ☒ No ☐ Explanation: The east and west parking areas will drain into bioswales.
Protect existing vegetation and sensitive areas: Yes ☐ No ☒ Explanation: None to protect
Re-vegetate disturbed areas: Yes ☐ No ☒ Explanation: Not practical. The developed site will have landscaping.
Minimize unnecessary compaction in stormwater retention/infiltration basin/trench areas: Yes ☒ No ☐ Explanation:
Utilize vegetated drainage swales in place of underground piping or imperviously lined swales: Yes ☒ No ☐ Explanation:
Stake off areas that will be used for landscaping to minimize compaction during construction : Yes ☐ No ☒ Explanation: Site requires a lot of grading consisting of fills and cuts and not feasible.

4.2 Project Performance Criteria

The purpose of this section of the Project WQMP is to establish targets for post-development hydrology based on performance criteria specified in the 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 of any downstream waterbody segments with a HCOC. ***If the project has more than one outlet for stormwater runoff, then complete additional versions of these forms for each DA / outlet.***

Methods applied in the following forms include:

- For LID BMP Design Capture Volume (DCV), the San Bernardino County Stormwater Program requires use of the P_6 method (MS4 Permit Section XI.D.6a.ii) – Form 4.2-1
- For HCOC pre- and post-development hydrologic calculation, the San Bernardino County Stormwater Program 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 HCOC performance criteria.

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

<table>
<tr><th colspan="3">Form 4.2-1 LID BMP Performance Criteria for Design Capture Volume (DA E)</th></tr>
<tr><td>¹ Project area DA 1 (ft²): 910,500</td><td>² Imperviousness after applying preventative site design practices (Imp%): 0.84</td><td>³ Runoff Coefficient (Rc): _0.62
R_c = 0.858(Imp%)^3-0.78(Imp%)^2+0.774(Imp%)+0.04</td></tr>
<tr><td colspan="3">⁴ Determine 1-hour rainfall depth for a 2-year return period P_{2yr-1hr} (in): 0.358 http://hdsc.nws.noaa.gov/hdsc/pfds/sa/sca_pfds.html</td></tr>
<tr><td colspan="3">⁵ Compute P₆, Mean 6-hr Precipitation (inches): 0.443
P₆ = Item 4 *C₁, where C₁ is a function of site climatic region specified in Form 3-1 Item 1 (Valley = 1.4807; Mountain = 1.909; Desert = 1.2371)</td></tr>
<tr><td colspan="2">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.</td><td>24-hrs ☐
48-hrs ☒</td></tr>
<tr><td colspan="3">⁷ Compute design capture volume, DCV (ft³): 40,908
DCV = 1/12 * [Item 1* Item 3 *Item 5 * C₂], where C₂ 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</td></tr>
</table>

Form 4.2-1 LID BMP Performance Criteria for Design Capture Volume (DA - F)		
1 Project area DA F (ft^2): 1,351,152	2 Imperviousness after applying preventative site design practices (Imp%): 84	3 Runoff Coefficient (Rc): _0.62 *R_c = 0.858(Imp%)^3-0.78(Imp%)^2+0.774(Imp%)+0.04*
4 Determine 1-hour rainfall depth for a 2-year return period $P_{2yr\text{-}1hr}$ (in): 0.358 http://hdsc.nws.noaa.gov/hdsc/pfds/sa/sca_pfds.html		
5 Compute P_6, Mean 6-hr Precipitation (inches): 0.44 *P_6 = Item 4 *C_1, where C_1 is a function of site climatic region specified in Form 3-1 Item 1 (Valley = 1.4807; Mountain = 1.909; Desert = 1.2371)*		
6 Drawdown Rate *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): 60,707 *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*		

DA-E, DVC = 40,908 CF
DA-F, DCV= 60,707 CF
Total DCV for Project site = 101,616 CF

Form 4.2-2 Summary of HCOC Assessment (DA 1)

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

Go to: *http://permitrack.sbcounty.gov/wap/*

If "Yes", then complete HCOC assessment of site hydrology for 2yr storm event using Forms 4.2-3 through 4.2-5 and insert results below

(Forms 4.2-3 through 4.2-5 may be replaced by computer software analysis based on the San Bernardino County Hydrology Manual)

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

Condition	Runoff Volume (ft^3)	Time of Concentration (min)	Peak Runoff (cfs)
Pre-developed	**1** 208,478 *Form 4.2-3 Item 12*	**2** 29.7 *Form 4.2-4 Item 13*	**3** 61.01 *Form 4.2-5 Item 10*
Post-developed	**4** 338,047 *Form 4.2-3 Item 13*	**5** 34.1 *Form 4.2-4 Item 14*	**6** 42.5 *Form 4.2-5 Item 14*
Difference	**7** *129,569* *Item 4 – Item 1*	**8** -4.4 *Item 2 – Item 5*	**9** -15.5 *Item 6 – Item 3*
Difference (as % of pre-developed)	**10** *62%* *Item 7 / Item 1*	**11** -14.8 *%* *Item 8 / Item 2*	**12** -25.4 *%* *Item 9 / Item 3*

Note: Time of concentration and Q peaks are lower in the developed condition due to the longer time of concentration. See summary table in Appendix D HCOC Analysis.

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

Weighted Curve Number Determination for: <u>Pre</u>-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)		See Unit Hydrographs in Appendix D						
3a DMA Area, ft² *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: <u>Post</u>-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, ft² *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 2 yr, 24 hr storm (in): 1.36
Go to: http://hdsc.nws.noaa.gov/hdsc/pfds/sa/sca_pfds.html

12 Pre-developed Volume (ft³): 4.786 ac.ft
*V_{pre} =(1 / 12) * (Item sum of Item 3) * [(Item 11 – Item 9)^2 / ((Item 11 – Item 9 + Item 7)*

13 Post-developed Volume (ft³): 7.7605 ac.ft
*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 HCOC Requirement, (ft³): 2.9745 ac.ft = 129,569 CF
*V_{HCOC} = (Item 13 * 0.95) – Item 12*

4.3.1 Site Design Hydrologic Source Control BMP

Section XI.E. of the Permit emphasizes the use of LID preventative measures; and the use of LID HSC BMPs reduces the portion of the DCV that must be addressed in downstream BMPs. Therefore, all applicable HSC 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 HSC, if a project cannot feasibly meet BMP sizing requirements or cannot fully address HCOCs, feasibility of all applicable HSC 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 HSC BMP. Refer to Section 5.4.1 in the TGD for more detailed guidance.

Form 4.3-2 Site Design Hydrologic Source Control 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 1 DMA BMP Type Bioswale	DA 2 DMA BMP Type	DA DMA BMP Type *(Use additional forms for more BMPs)*
2 Total impervious area draining to pervious area (ft^2)	138,956	161,607	
3 Ratio of pervious area receiving runoff to impervious area	0.07	0.05	
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*	4,053	3,366	
5 Sum of retention volume achieved from impervious area dispersion (ft^3): 7,401 *$V_{retention}$ =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 1 DMA 1 BMP Type Bioswale	DA 2 DMA 2 BMP Type Bioswale	DA DMA BMP Type *(Use additional forms for more BMPs)*
7 Ponding surface area (ft^2)	1,959	1,374	
8 Ponding depth (ft)	0	0	
9 Surface area of amended soil/gravel (ft^2)	1,959	1,374	
10 Average depth of amended soil/gravel (ft)	2	2	
11 Average porosity of amended soil/gravel	0.4	0.4	
12 Retention volume achieved from on-lot infiltration (ft^3) *$V_{retention}$ = (Item 7 *Item 8) + (Item 9 * Item 10 * Item 11)*	1,567	1,099	
13 Runoff volume retention from on-lot infiltration (ft^3): 2,666 *$V_{retention}$ =Sum of Item 12 for all BMPs*			

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

14 Implementation of evapotranspiration BMP (green, brown, or blue roofs): Yes ☐ No ☒ *If yes, complete Items 15-20. If no, proceed to Item 21*	DA DMA BMP Type	DA DMA BMP Type	DA DMA BMP Type *(Use additional forms for more BMPs)*
15 Rooftop area planned for ET BMP (ft^2)			
16 Average wet season ET demand (in/day) *Use local values, typical ~ 0.1*			
17 Daily ET demand (ft^3/day) *Item 15 * (Item 16 / 12)*			
18 Drawdown time (hrs) *Copy Item 6 in Form 4.2-1*			
19 Retention Volume (ft^3) *$V_{retention}$ = Item 17 * (Item 18 / 24)*			
20 Runoff volume retention from evapotranspiration BMPs (ft^3):	*$V_{retention}$ =Sum of Item 19 for all BMPs*		
21 Implementation of Street Trees: Yes ☐ No ☒ *If yes, complete Items 22-25. If no, proceed to Item 26*	DA DMA BMP Type	DA DMA BMP Type	DA DMA BMP Type *(Use additional forms for more BMPs)*
22 Number of Street Trees			
23 Average canopy cover over impervious area (ft^2)			
24 Runoff volume retention from street trees (ft^3) *$V_{retention}$ = Item 22 * Item 23 * (0.05/12) assume runoff retention of 0.05 inches*			
25 Runoff volume retention from street tree BMPs (ft^3):	*$V_{retention}$ = Sum of Item 24 for all BMPs*		
26 Implementation of residential rain barrel/cisterns: Yes ☐ No ☒ *If yes, complete Items 27-29; If no, proceed to Item 30*	DA DMA BMP Type	DA DMA BMP Type	DA DMA BMP Type *(Use additional forms for more BMPs)*
27 Number of rain barrels/cisterns			
28 Runoff volume retention from rain barrels/cisterns (ft^3) *$V_{retention}$ = Item 27 * 3*			
29 Runoff volume retention from residential rain barrels/Cisterns (ft3):	*$V_{retention}$ =Sum of Item 28 for all BMPs*		
30 Total Retention Volume from Site Design Hydrologic Source Control BMPs: 10,067 *Sum of Items 5, 13, 20, 25 and 29*			

Form 4.2-4 HCOC 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*								

See Unit Hydrographs in Appendix D

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 HCOC requirement (min): $T_{C\text{-}HCOC}$ *= (Item 13 * 0.95) – Item 14*

Form 4.2-5 HCOC 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 - 0.6 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)*		See Unit Hydrographs in Appendix D					
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 HCOC Requirement (cfs): *$Q_{p\text{-}HCOC}$ = (Item 14 * 0.95) – Item 10*		

4.3 Project Conformance Analysis

Complete the following forms for each project site DA to document that the proposed LID BMPs conform to the project DCV developed to meet performance criteria specified in the 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 MS4 Permit (see Section 5.3.1 in the TGD for WQMP). The forms compute the following for on-site LID BMP:

- Site Design and Hydrologic Source Controls (Form 4.3-2)
- Retention and Infiltration (Form 4.3-3)
- Harvested and Use (Form 4.3-4) or
- Biotreatment (Form 4.3-5).

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 5.3.2.1 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 Forms 4.3-2 and 4.3-4 to determine the feasibility of applicable HSC and harvest and use 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 HSC 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 LID HSC, retention and infiltration, and harvest and use BMPs are unable to mitigate the entire DCV, then biotreatment BMPs may be implemented by the project proponent. If biotreatment BMPs are used, then they must be sized to provide sufficient capacity for effective treatment of the remainder of the volume-based performance criteria that cannot be achieved with LID BMPs (TGD for WQMP Section 5.4.4.2). **Under no circumstances shall any portion of the DCV be released from the site without effective mitigation and/or treatment**.

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 eight feet from building foundations or an alternative setback.
- A study certified by a geotechnical professional or an available watershed study determines that stormwater infiltration would result in significantly increased risks of geotechnical hazards.

If Yes, Provide basis: (attach)

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

If Yes, Provide basis: (attach)

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

If Yes, Provide basis: (attach)

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

If Yes, Provide basis: (attach)

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

If Yes, Provide basis: (attach)

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

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

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

4.3.2 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 D 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 5.5.1 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).

.

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

1 Remaining LID DCV not met by site design HSC BMP (ft^3): 119,502 *V_{unmet} = Form 4.2-1 Item 7 - Form 4.3-2 Item 30*

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 D 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*	52,958	78,137	

16 Total Retention Volume from LID Infiltration BMPs: 131,095 *(Sum of Items 14 and 15 for all infiltration BMP included in plan)*

17 Fraction of DCV achieved with infiltration BMP: 100% *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.

4.3.3 Harvest and Use BMP

Harvest and use BMP may be considered if the full LID DCV cannot be met by maximizing infiltration BMPs. Use Form 4.3-4 to compute on-site retention of runoff from proposed harvest and use BMPs.

Volume retention estimates for harvest and use BMPs are sensitive to the on-site demand for captured stormwater. Since irrigation water demand is low in the wet season, when most rainfall events occur in San Bernardino County, the volume of water that can be used within a specified drawdown period is relatively low. The bottom portion of Form 4.3-4 facilitates the necessary computations to show infeasibility if a minimum incremental benefit of 40 percent of the LID DCV would not be achievable with MEP implementation of on-site harvest and use of stormwater (Section 5.5.4 of the TGD for WQMP).

Form 4.3-4 Harvest and Use BMPs (DA 1)			
1 Remaining LID DCV not met by site design HSC or infiltration BMP (ft^3): *V_{unmet} = Form 4.2-1 Item 7 - Form 4.3-2 Item 30 – Form 4.3-3 Item 16*			
BMP Type(s) *Compute runoff volume retention from proposed harvest and use BMP (Select BMPs from Table 5-4 of the 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 Describe cistern or runoff detention facility			
3 Storage volume for proposed detention type (ft^3) *Volume of cistern*			
4 Landscaped area planned for use of harvested stormwater (ft^2)			
5 Average wet season daily irrigation demand (in/day) Use local values, typical ~ 0.1 in/day			
6 Daily water demand (ft^3/day) *Item 4 * (Item 5 / 12)*			
7 Drawdown time (hrs) *Copy Item 6 from Form 4.2-1*			
8 Retention Volume (ft^3) *$V_{retention}$ = Minimum of (Item 3) or (Item 6 * (Item 7 / 24))*			
9 Total Retention Volume (ft^3) from Harvest and Use BMP *Sum of Item 8 for all harvest and use BMP included in plan*			
10 Is the full DCV retained with a combination of LID HSC, retention and infiltration, and harvest & use BMPs? Yes ☐ No ☐ *If yes, demonstrate conformance using Form 4.3-10. If no, then re-evaluate combinations of all LID BMP and optimize their implementation such that the maximum portion of the DCV is retained on-site (using a single BMP type or combination of BMP types). If the full DCV cannot be mitigated after this optimization process, proceed to Section 4.3.4.*			

4.3.4 Biotreatment BMP

Biotreatment BMPs may be considered if the full LID DCV cannot be met by maximizing retention and infiltration, and harvest and use BMPs. 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 4.3-5 to summarize the potential for volume based and/or flow based biotreatment options to biotreat the remaining unmet LID DCV w. Biotreatment computations are included as follows:

- Use Form 4.3-6 to compute biotreatment in small volume based biotreatment BMP (e.g. bioretention w/underdrains);
- Use Form 4.3-7 to compute biotreatment in large volume based biotreatment BMP (e.g. constructed wetlands);
- Use Form 4.3-8 to compute sizing criteria for flow-based biotreatment BMP (e.g. bioswales)

Form 4.3-5 Selection and Evaluation of Biotreatment BMP (DA 1)		
1 Remaining LID DCV not met by site design HSC, infiltration, or harvest and use BMP for potential biotreatment (ft³): *Form 4.2-1 Item 7 - Form 4.3-2 Item 30 – Form 4.3-3 Item 16- Form 4.3-4 Item 9*	List pollutants of concern *Copy from Form 2.3-1.*	
2 Biotreatment BMP Selected	Volume-based biotreatment *Use Forms 4.3-6 and 4.3-7 to compute treated volume*	Flow-based biotreatment *Use Form 4.3-8 to compute treated volume*
(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)	☐ 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 (ft³): *Form 4.3-6 Item 15 + Form 4.3-7 Item 13*	4 Compute remaining LID DCV with implementation of volume based biotreatment BMP (ft³): *Item 1 – Item 3*	5 Remaining fraction of LID DCV for sizing flow based biotreatment BMP: % *Item 4 / Item 1*
6 Flow-based biotreatment BMP capacity provided (cfs): *Use Figure 5-2 of the TGD for WQMP to determine flow capacity required to provide biotreatment of remaining percentage of unmet LID DCV (Item 5), for the project's precipitation zone (Form 3-1 Item 1)*		
7 Metrics for MEP determination: • Provided a WQMP with the portion of site area used for suite of LID BMP equal to minimum thresholds in Table 5-7 of the TGD for WQMP for the proposed category of development: ☐ *If maximized on-site retention BMPs is feasible for partial capture, then LID BMP implementation must be optimized to retain and infiltrate the maximum portion of the DCV possible within the prescribed minimum effective area. The remaining portion of the DCV shall then be mitigated using biotreatment BMP.*		

Form 4.3-6 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 DMA BMP Type	DA DMA BMP Type	DA DMA BMP Type *(Use additional forms for more BMPs)*
1 Pollutants addressed with BMP *List all pollutant of concern that will be effectively reduced through specific Unit Operations and Processes described in Table 5-5 of the TGD for WQMP*			
2 Amended soil infiltration rate *Typical ~ 5.0*			
3 Amended soil infiltration safety factor *Typical ~ 2.0*			
4 Amended soil design percolation rate (in/hr) *P_{design} = Item 2 / Item 3*			
5 Ponded water drawdown time (hr) *Copy Item 6 from Form 4.2-1*			
6 Maximum ponding depth (ft) *see Table 5-6 of the TGD for WQMP for reference to BMP design details*			
7 Ponding Depth (ft) *d_{BMP} = Minimum of (1/12 * Item 4 * Item 5) or Item 6*			
8 Amended soil surface area (ft^2)			
9 Amended soil depth (ft) *see Table 5-6 of the TGD for WQMP for reference to BMP design details*			
10 Amended soil porosity, *n*			
11 Gravel depth (ft) *see Table 5-6 of the TGD for WQMP for reference to BMP design details*			
12 Gravel porosity, *n*			
13 Duration of storm as basin is filling (hrs) *Typical ~ 3hrs*			
14 Biotreated Volume (ft^3) *$V_{biotreated}$ = Item 8 * [(Item 7/2) + (Item 9 * Item 10) +(Item 11 * Item 12) + (Item 13 * (Item 4 / 12))]*			
15 Total biotreated volume from bioretention and/or planter box with underdrains BMP: *Sum of Item 14 for all volume-based BMPs included in this form*			

Form 4.3-7 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 4.3-8 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 4.3-9 to demonstrate how on-site LID DCV is met with proposed site design hydrologic source control, infiltration, harvest and use, 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 4.3-9 Conformance Summary and Alternative Compliance Volume Estimate (DA 1)
1 Total LID DCV for the Project DA-1 (ft^3): 101,616 *Copy Item 7 in Form 4.2-1*
2 On-site retention with site design hydrologic source control LID BMP (ft^3): 9,400 *Copy Item 30 in Form 4.3-2*
3 On-site retention with LID infiltration BMP (ft^3): 131,095 *Copy Item 16 in Form 4.3-3*
4 On-site retention with LID harvest and use BMP (ft^3): *Copy Item 9 in Form 4.3-4*
5 On-site biotreatment with volume based biotreatment BMP (ft^3): *Copy Item 3 in Form 4.3-5*
6 Flow capacity provided by flow based biotreatment BMP (cfs): *Copy Item 6 in Form 4.3-5*
7 LID BMP performance criteria are achieved if answer to any of the following is “Yes”: • Full retention of LID DCV with site design HSC, infiltration, or harvest and use BMP: Yes ☒ No ☐ *If yes, sum of Items 2, 3, and 4 is greater than Item 1* • Combination of on-site retention BMPs for a portion of the LID DCV and volume-based biotreatment BMP that address all pollutants of concern for the remaining LID DCV: Yes ☐ No ☐ *If yes, a) sum of Items 2, 3, 4, and 5 is greater than Item 1, and Items 2, 3 and 4 are maximized; or b) Item 6 is greater than Form 4.3--5 Item 6 and Items 2, 3 and 4 are maximized* ▪ On-site retention and infiltration is determined to be infeasible and biotreatment BMP provide biotreatment for all pollutants of concern for full LID DCV: Yes ☐ No ☐ *If yes, Form 4.3-1 Items 7 and 8 were both checked yes*
8 If the LID DCV is not achieved by any of these means, then the project may be allowed to develop an alternative compliance plan. Check box that describes the scenario which caused the need for alternative compliance: • Combination of HSC, retention and infiltration, harvest and use, and biotreatment BMPs provide less than full LID DCV capture: ☐ *Checked yes for Form 4.3-5 Item 7, Item 6 is zero, and sum of Items 2, 3, 4, and 5 is less than Item 1. If so, apply water quality credits and calculate volume for alternative compliance, V_{alt} = (Item 1 – Item 2 – Item 3 – Item 4 – Item 5) * (100 - Form 2.4-1 Item 2)%* • An approved Watershed Action Plan (WAP) demonstrates that water quality and hydrologic impacts of urbanization are more effective when managed in at an off-site facility: ☐ *Attach appropriate WAP section, including technical documentation, showing effectiveness comparisons for the project site and regional watershed*

4.3.6 Hydromodification Control BMP

Use Form 4.3-10 to compute the remaining runoff volume retention, after LID BMP are implemented, needed to address HCOC, and the increase in time of concentration and decrease in peak runoff necessary to meet targets for protection of waterbodies with a potential HCOC. Describe hydromodification control BMP that address HCOC, which may include off-site BMP and/or in-stream controls. Section 5.6 of the TGD for WQMP provides additional details on selection and evaluation of hydromodification control BMP.

Form 4.3-10 Hydromodification Control BMPs (DA 1)

1 Volume reduction needed for HCOC performance criteria (ft^3): 129,569 *(Form 4.2-2 Item 4 * 0.95) – Form 4.2-2 Item 1*	**2** On-site retention with site design hydrologic source control, infiltration, and harvest and use LID BMP (ft^3): 140,495 *Sum of Form 4.3-9 Items 2, 3, and 4* *Evaluate option to increase implementation of on-site retention in Forms 4.3-2, 4.3-3, and 4.3-4 in excess of LID DCV toward achieving HCOC volume reduction*
3 Remaining volume for HCOC volume capture (ft^3): 0 *Item 1 – Item 2*	**4** Volume capture provided by incorporating additional on-site or off-site retention BMPs (ft^3): *Existing downstream BMP may be used to demonstrate additional volume capture (if so, attach to this WQMP a hydrologic analysis showing how the additional volume would be retained during a 2-yr storm event for the regional watershed)*

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

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

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

- Demonstrate increase in time of concentration achieved by proposed LID site design, LID BMP, and additional on-site or off-site retention BMP ☒
  BMP upstream of a waterbody segment with a potential HCOC may be used to demonstrate increased time of concentration through hydrograph attenuation (if so, show that the hydraulic residence time provided in BMP for a 2-year storm event is equal or greater than the addition time of concentration requirement in Form 4.2-4 Item 15)
- Increase time of concentration by preserving pre-developed flow path and/or increase travel time by reducing slope and increasing cross-sectional area and roughness for proposed on-site conveyance facilities ☐
- Incorporate appropriate in-stream controls for downstream waterbody segment to prevent impacts due to hydromodification, in a plan approved and signed by a licensed engineer in the State of California ☐

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

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

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

Section 5 Inspection and Maintenance Responsibility for Post Construction BMP

All BMP 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 may require a Maintenance Agreement (consult the jurisdiction's LIP). If a Maintenance Agreement is required, it must also be attached to the WQMP.

Form 5-1 BMP Inspection and Maintenance (use additional forms as necessary)

BMP	Reponsible Party(s)	Inspection/ Maintenance Activities Required	Minimum Frequency of Activities
Bioswales	LINK LOGISTICS REAL ESTATE	Implement - Mowing, Trimming, Pruning practices to prevent discharges of landscape waste into on-site retention structures. Control fertilizer, herbicide & pesticide applications to prevent stormwater contamination	Monthly
Underground detention basins	LINK LOGISTICS REAL ESTATE	Inspect the underground Arch via the access manhole, for accumulated sediment and debris levels and cleanout solids when > 6" build up occurs. Inspect for standing water with 48 hours of heavy rain events to ensure proper drawdown. Clean and flush underground systems to restore free drainage	Annually, and after heavy rains
Signage & Stencil	LINK LOGISTICS REAL ESTATE	Clean the stencil/signage surface to remove any excess dirt. Re-paint if necessary.	Annually
Catch basins	LINK LOGISTICS REAL ESTATE	Inspect catchment area for an excessive sediment, trash, and/or debris accumulation on surface. Inspect inlet for excessive sediment, trash, and/or debris accumulation. Litter, leaves and debris should be removed from inlet to reduce risk of outlet clogging.	Annually, and after heavy rains
Litter Control	LINK LOGISTICS REAL ESTATE	Maintain roofed waste collection areas and vacuum-sweep drive aisles and parking areas to remove potential stormwater	Weekly/Monthly

		contamination before anticipated storm events.	
Landscape Areas	LINK LOGISTICS REAL ESTATE	Implement - Mowing, Trimming, Pruning practices to prevent discharges of landscape waste into on-site retention structures. Control fertilizer, herbicide & pesticide applications to prevent stormwater contamination	Weekly
Irrigation System	LINK LOGISTICS REAL ESTATE	Check and repair the irrigation system property functioning and verify there are no leaks or runoff from landscape areas. Adjust irrigation heads and system run time as necessary to prevent overwatering of vegetation, overspray or run-off from landscape	Weekly
Trash Enclosures	LINK LOGISTICS REAL ESTATE	Empty trash receptacles. Clean the areas around enclosures by sweeping and /or mopping to prevent discharges 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 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

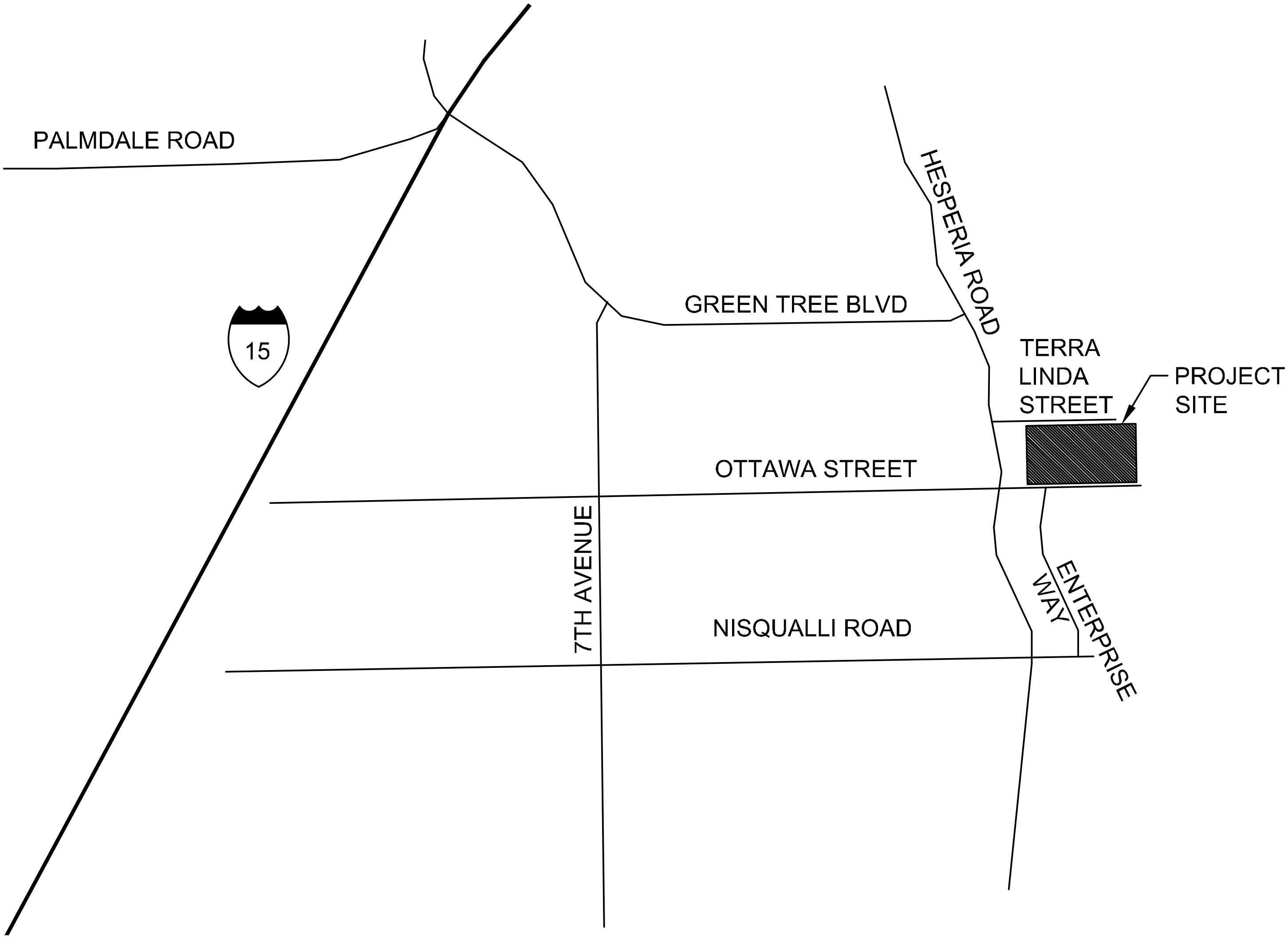
Attach all O&M Plans and Maintenance Agreements for BMP to the WQMP.

6.4 Other Supporting Documentation

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

Appendix A

- Vicinity Map



VICINITY MAP

N.T.S.

DAVID EVANS AND ASSOCIATES INC.
14297 Cajon Avenue Suite 101
Victorville California 92392-2335
Phone: 760.524.9100

VICINITY MAP

CITY OF VICTORVILLE

Appendix B

- WQMP Site Plan

LEGEND:

- HYDROLOGY BOUNDARY
- FLOWLINE
- DRAINAGE AREA ID (A)
- TOTAL ACREAGE (7.96)
- FLOW DIRECTION
- CONCENTRATION/NODE ID (FS ELEVATION / INV ELEVATION)
- AC PAVEMENT
- CONCRETE PAVEMENT
- BIO-SWALE AREA
- GRADE SLOPE AREA

N

100 0 100 200
scale 1"= 100' feet

Undeveloped Unit Hydrograph Method *							
Area ID	Area (ac)	SCS	TC (hour)	Q10 (cfs)	Volume 10-yr	Q100 (cfs)	Volume 100-yr
A	16.05	84	0.252	18.71	1.43	35.8	3.057
B	22.99	83	0.192	28.1	2.52	53.3	4.2528
C	7.62	75	0.233	8.05	0.4451	16	1.0955
D	5.26	80	0.19	6.2	0.3906	12.1	0.8874
Total	51.92				4.786		9.2927

See existing condition map in the Hydrology report

Developed Unit Hydrograph Method							
Area ID	Area (ac)	SCS	TC (hour)	Q10 (cfs)	Volume 10-yr	Q100 (cfs)	Volume 100-yr
E	20.9	65	0.568	17.8	3.2367	32	5.3347
F	31.02	58	0.61	24.7	4.4972	44.93	7.7925
Total	51.92				7.7339		13.127

Total Site Area = 51.92 acres
10-year Pre vs Post = 7.734-4.786 = 2.948 ac.ft = 128,415 CF
Area E HCOC = 51,692 CF
Area F HCOC = 76,723 CF
Detention Basin No. 1 Provides 52,958 CF
Detention Basin No. 2 Provides 78,137 CF
Site design provides 9,400 CF
Total LID provided = 140,495 CF

DAVID EVANS AND ASSOCIATES INC.
18484 Outer Highway 18 N Suite 225
Apple Valley California 92307
Phone: 760.524.9100
SSchubert@deainc.com

IN THE CITY OF VICTORVILLE
OTTAWA STREET LOGISTICS CENTER

WQMP SITE PLAN EXHIBIT

FILE NO.
DRAWING NO.
SH. 1 OF 1

Plot Date: 1/4/2022 3:23 PM By: Jose Aguilar File: P:\S\SPACMIRL00030600\INFO\0670\Reports\WQMP\CAD\B_1_WQMP Exhibit.dwg
Save Date: 1/4/2022 2:56 PM By: Jfa

Appendix C

- LID sizing calculations

LID Sizing Calculations

DVC= 1/12 x Area x Rc x P6 x C2 = DVC volume

Area E = 910,500 SF
Area F = 1,351,152 SF
% Impervious of site = 0.84
Rc = 0.6198
P6 = 0.443
C2 = 1.963 for 48-hour drawdown rate

DVC Area E = 52,162 x 0.6198 x 0.443 x 1.963 = 40,908 CF

DVC Area F = 1,351,152 x 0.6198 x 0.443 x 1.963 = 60,707 CF

Unit Hydrograph summary

Undeveloped Unit Hydrograph Method

Area ID	Area (ac)	SCS	TC (hour)	Q10 (cfs)	Volume 10-yr (ac.ft)	Q100 (cfs)	Volume 100-yr (ac.ft)
A	16.05	84	0.252	18.71	1.43	35.8	3.057
B	22.99	83	0.192	28.1	2.52	53.3	4.2528
C	7.62	75	0.233	8.05	0.4451	16.0	1.0955
D	5.26	80	0.19	6.2	0.3906	12.1	0.8874
Total	51.92				4.786		9.2927

Developed Unit Hydrograph Method

Area ID	Area (ac)	SCS	TC (hour)	Q10 (cfs)	Volume 10-yr (ac.ft)	Q100 (cfs)	Volume 100-yr (ac.ft)
E	20.90	65	0.568	17.8	3.2367	32.0	5.3347
F	31.02	58	0.61	24.7	4.4972	44.93	7.7925
Total	51.92				7.7339		13.1272

10-year Pre vs Post = 7.734-4.786 = 2.948 ac.ft = 128,415 CF
Area E HCOC = 51,692 CF
Area F HCOC = 76,723 CF
Detention Basin No. 1 Provides 52,958 CF
Detention Basin No. 2 Provides 78,137 CF
Site design provides 9,400 CF
Total LID provided = 140,495 CF

Appendix D

- HCOC Analysis

Unit Hydrograph summary

Undeveloped Unit Hydrograph Method

Area ID	Area (ac)	SCS	TC (hour)	Q10 (cfs)	Volume 10-yr (ac.ft)	Q100 (cfs)	Volume 100-yr (ac.ft)
A	16.05	84	0.252	18.71	1.43	35.8	3.057
B	22.99	83	0.192	28.1	2.52	53.3	4.2528
C	7.62	75	0.233	8.05	0.4451	16.0	1.0955
D	5.26	80	0.19	6.2	0.3906	12.1	0.8874
Total	**51.92**			61.01	**4.786**	117.2	**9.2927**

Developed Unit Hydrograph Method

Area ID	Area (ac)	SCS	TC (hour)	Q10 (cfs)	Volume 10-yr (ac.ft)	Q100 (cfs)	Volume 100-yr (ac.ft)
E	20.90	65	0.568	17.8	3.2367	32.0	5.3347
F	31.02	58	0.61	24.7	4.4972	44.93	7.7925
Total	**51.92**			42.5	**7.7339**	76.9	**13.1272**
10-year Pre vs Post = 7.734-4.786 = 2.948 ac.ft = 128,415 CF							

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

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

                Study date  08/03/21

++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
------------------------------------------------------------------------

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


Program License Serial Number 6385

--------------------------------------------------------------------
Space Center
undeveloped 10-year
Area A


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

        Storm Event Year = 10

        Antecedent Moisture Condition = 2

 English (in-lb) Input Units Used

 English Rainfall Data (Inches) Input Values Used

 English Units used in output format




Area averaged rainfall intensity isohyetal data:
        Sub-Area        Duration        Isohyetal
        (Ac.)            (hours)          (In)
Rainfall data for year 10
            16.05            1           0.62
--------------------------------------------------------------------
Rainfall data for year 10
            16.05            6           1.27
--------------------------------------------------------------------
Rainfall data for year 10
            16.05           24           2.23
--------------------------------------------------------------------
```

++

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

SCS curve No.(AMCII)	SCS curve NO.(AMC 2)	Area (Ac.)	Area Fraction	Fp(Fig C6) (In/Hr)	Ap (dec.)	Fm (In/Hr)
84.0	84.0	16.05	1.000	0.301	1.000	0.301

Area-averaged adjusted loss rate Fm (In/Hr) = 0.301

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

Area (Ac.)	Area Fract	SCS CN (AMC2)	SCS CN (AMC2)	S	Pervious Yield Fr
16.05	1.000	84.0	84.0	1.90	0.408

Area-averaged catchment yield fraction, Y = 0.408
Area-averaged low loss fraction, Yb = 0.592
User entry of time of concentration = 0.252 (hours)
++
Watershed area = 16.05(Ac.)
Catchment Lag time = 0.202 hours
Unit interval = 5.000 minutes
Unit interval percentage of lag time = 41.3360
Hydrograph baseflow = 0.00(CFS)
Average maximum watershed loss rate(Fm) = 0.301(In/Hr)
Average low loss rate fraction (Yb) = 0.592 (decimal)
DESERT S-Graph Selected
Computed peak 5-minute rainfall = 0.293(In)
Computed peak 30-minute rainfall = 0.502(In)
Specified peak 1-hour rainfall = 0.618(In)
Computed peak 3-hour rainfall = 0.961(In)
Specified peak 6-hour rainfall = 1.270(In)
Specified peak 24-hour rainfall = 2.230(In)

Rainfall depth area reduction factors:
Using a total area of 16.05(Ac.) (Ref: fig. E-4)

5-minute factor = 0.999 Adjusted rainfall = 0.293(In)
30-minute factor = 0.999 Adjusted rainfall = 0.502(In)
1-hour factor = 0.999 Adjusted rainfall = 0.618(In)
3-hour factor = 1.000 Adjusted rainfall = 0.961(In)
6-hour factor = 1.000 Adjusted rainfall = 1.270(In)
24-hour factor = 1.000 Adjusted rainfall = 2.230(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 = 194.10 (CFS))	
1	2.897	5.624
2	20.229	33.642
3	51.022	59.771
4	66.916	30.850
5	75.856	17.354
6	81.756	11.452
7	86.053	8.341
8	89.272	6.248
9	91.629	4.575
10	93.556	3.741
11	95.055	2.908
12	96.259	2.338
13	97.199	1.824
14	97.865	1.292
15	98.303	0.851
16	98.788	0.942
17	99.284	0.962
18	99.646	0.703
19	100.000	0.687

Peak Unit Number	Adjusted mass rainfall (In)	Unit rainfall (In)
1	0.2930	0.2930
2	0.3608	0.0677
3	0.4074	0.0467
4	0.4441	0.0367
5	0.4749	0.0308
6	0.5016	0.0267
7	0.5253	0.0237
8	0.5468	0.0215
9	0.5665	0.0197
10	0.5847	0.0182
11	0.6016	0.0170
12	0.6175	0.0159
13	0.6378	0.0202
14	0.6571	0.0193
15	0.6756	0.0185
16	0.6934	0.0178
17	0.7105	0.0171
18	0.7270	0.0165
19	0.7430	0.0160
20	0.7585	0.0155
21	0.7736	0.0150
22	0.7882	0.0146
23	0.8024	0.0142

24	0.8163	0.0139
25	0.8298	0.0135
26	0.8430	0.0132
27	0.8560	0.0129
28	0.8686	0.0126
29	0.8809	0.0124
30	0.8930	0.0121
31	0.9049	0.0119
32	0.9165	0.0116
33	0.9280	0.0114
34	0.9392	0.0112
35	0.9502	0.0110
36	0.9611	0.0108
37	0.9717	0.0106
38	0.9822	0.0105
39	0.9925	0.0103
40	1.0026	0.0102
41	1.0126	0.0100
42	1.0225	0.0099
43	1.0322	0.0097
44	1.0418	0.0096
45	1.0513	0.0095
46	1.0606	0.0093
47	1.0698	0.0092
48	1.0789	0.0091
49	1.0879	0.0090
50	1.0968	0.0089
51	1.1055	0.0088
52	1.1142	0.0087
53	1.1228	0.0086
54	1.1312	0.0085
55	1.1396	0.0084
56	1.1479	0.0083
57	1.1561	0.0082
58	1.1642	0.0081
59	1.1722	0.0080
60	1.1802	0.0079
61	1.1880	0.0079
62	1.1958	0.0078
63	1.2036	0.0077
64	1.2112	0.0076
65	1.2188	0.0076
66	1.2263	0.0075
67	1.2337	0.0074
68	1.2411	0.0074
69	1.2484	0.0073
70	1.2556	0.0072
71	1.2628	0.0072
72	1.2699	0.0071
73	1.2771	0.0071

74	1.2841	0.0071
75	1.2912	0.0070
76	1.2981	0.0070
77	1.3050	0.0069
78	1.3119	0.0069
79	1.3187	0.0068
80	1.3255	0.0068
81	1.3322	0.0067
82	1.3388	0.0067
83	1.3454	0.0066
84	1.3520	0.0066
85	1.3585	0.0065
86	1.3650	0.0065
87	1.3714	0.0064
88	1.3778	0.0064
89	1.3841	0.0063
90	1.3904	0.0063
91	1.3967	0.0063
92	1.4029	0.0062
93	1.4090	0.0062
94	1.4152	0.0061
95	1.4213	0.0061
96	1.4273	0.0061
97	1.4333	0.0060
98	1.4393	0.0060
99	1.4453	0.0059
100	1.4512	0.0059
101	1.4571	0.0059
102	1.4629	0.0058
103	1.4687	0.0058
104	1.4745	0.0058
105	1.4802	0.0057
106	1.4859	0.0057
107	1.4916	0.0057
108	1.4973	0.0056
109	1.5029	0.0056
110	1.5085	0.0056
111	1.5140	0.0056
112	1.5195	0.0055
113	1.5250	0.0055
114	1.5305	0.0055
115	1.5359	0.0054
116	1.5414	0.0054
117	1.5467	0.0054
118	1.5521	0.0054
119	1.5574	0.0053
120	1.5627	0.0053
121	1.5680	0.0053
122	1.5732	0.0053
123	1.5785	0.0052

124	1.5837	0.0052
125	1.5888	0.0052
126	1.5940	0.0051
127	1.5991	0.0051
128	1.6042	0.0051
129	1.6093	0.0051
130	1.6144	0.0051
131	1.6194	0.0050
132	1.6244	0.0050
133	1.6294	0.0050
134	1.6343	0.0050
135	1.6393	0.0049
136	1.6442	0.0049
137	1.6491	0.0049
138	1.6540	0.0049
139	1.6588	0.0049
140	1.6637	0.0048
141	1.6685	0.0048
142	1.6733	0.0048
143	1.6781	0.0048
144	1.6828	0.0048
145	1.6876	0.0047
146	1.6923	0.0047
147	1.6970	0.0047
148	1.7017	0.0047
149	1.7063	0.0047
150	1.7110	0.0046
151	1.7156	0.0046
152	1.7202	0.0046
153	1.7248	0.0046
154	1.7293	0.0046
155	1.7339	0.0046
156	1.7384	0.0045
157	1.7429	0.0045
158	1.7474	0.0045
159	1.7519	0.0045
160	1.7564	0.0045
161	1.7608	0.0045
162	1.7653	0.0044
163	1.7697	0.0044
164	1.7741	0.0044
165	1.7785	0.0044
166	1.7829	0.0044
167	1.7872	0.0044
168	1.7915	0.0043
169	1.7959	0.0043
170	1.8002	0.0043
171	1.8045	0.0043
172	1.8087	0.0043
173	1.8130	0.0043

174	1.8173	0.0042
175	1.8215	0.0042
176	1.8257	0.0042
177	1.8299	0.0042
178	1.8341	0.0042
179	1.8383	0.0042
180	1.8425	0.0042
181	1.8466	0.0042
182	1.8507	0.0041
183	1.8549	0.0041
184	1.8590	0.0041
185	1.8631	0.0041
186	1.8672	0.0041
187	1.8712	0.0041
188	1.8753	0.0041
189	1.8793	0.0040
190	1.8834	0.0040
191	1.8874	0.0040
192	1.8914	0.0040
193	1.8954	0.0040
194	1.8994	0.0040
195	1.9033	0.0040
196	1.9073	0.0040
197	1.9112	0.0039
198	1.9152	0.0039
199	1.9191	0.0039
200	1.9230	0.0039
201	1.9269	0.0039
202	1.9308	0.0039
203	1.9347	0.0039
204	1.9385	0.0039
205	1.9424	0.0039
206	1.9462	0.0038
207	1.9501	0.0038
208	1.9539	0.0038
209	1.9577	0.0038
210	1.9615	0.0038
211	1.9653	0.0038
212	1.9691	0.0038
213	1.9728	0.0038
214	1.9766	0.0038
215	1.9803	0.0037
216	1.9841	0.0037
217	1.9878	0.0037
218	1.9915	0.0037
219	1.9952	0.0037
220	1.9989	0.0037
221	2.0026	0.0037
222	2.0063	0.0037
223	2.0099	0.0037

224	2.0136	0.0037
225	2.0172	0.0036
226	2.0209	0.0036
227	2.0245	0.0036
228	2.0281	0.0036
229	2.0317	0.0036
230	2.0353	0.0036
231	2.0389	0.0036
232	2.0425	0.0036
233	2.0461	0.0036
234	2.0496	0.0036
235	2.0532	0.0036
236	2.0567	0.0035
237	2.0602	0.0035
238	2.0638	0.0035
239	2.0673	0.0035
240	2.0708	0.0035
241	2.0743	0.0035
242	2.0778	0.0035
243	2.0813	0.0035
244	2.0847	0.0035
245	2.0882	0.0035
246	2.0917	0.0035
247	2.0951	0.0034
248	2.0986	0.0034
249	2.1020	0.0034
250	2.1054	0.0034
251	2.1088	0.0034
252	2.1122	0.0034
253	2.1156	0.0034
254	2.1190	0.0034
255	2.1224	0.0034
256	2.1258	0.0034
257	2.1292	0.0034
258	2.1325	0.0034
259	2.1359	0.0034
260	2.1392	0.0033
261	2.1426	0.0033
262	2.1459	0.0033
263	2.1492	0.0033
264	2.1525	0.0033
265	2.1558	0.0033
266	2.1591	0.0033
267	2.1624	0.0033
268	2.1657	0.0033
269	2.1690	0.0033
270	2.1723	0.0033
271	2.1755	0.0033
272	2.1788	0.0033
273	2.1820	0.0032

274	2.1853	0.0032
275	2.1885	0.0032
276	2.1917	0.0032
277	2.1950	0.0032
278	2.1982	0.0032
279	2.2014	0.0032
280	2.2046	0.0032
281	2.2078	0.0032
282	2.2110	0.0032
283	2.2142	0.0032
284	2.2173	0.0032
285	2.2205	0.0032
286	2.2237	0.0032
287	2.2268	0.0032
288	2.2300	0.0031

Unit Period (number)	Unit Rainfall (In)	Unit Soil-Loss (In)	Effective Rainfall (In)
1	0.0031	0.0019	0.0013
2	0.0032	0.0019	0.0013
3	0.0032	0.0019	0.0013
4	0.0032	0.0019	0.0013
5	0.0032	0.0019	0.0013
6	0.0032	0.0019	0.0013
7	0.0032	0.0019	0.0013
8	0.0032	0.0019	0.0013
9	0.0032	0.0019	0.0013
10	0.0032	0.0019	0.0013
11	0.0032	0.0019	0.0013
12	0.0033	0.0019	0.0013
13	0.0033	0.0019	0.0013
14	0.0033	0.0019	0.0013
15	0.0033	0.0019	0.0013
16	0.0033	0.0020	0.0013
17	0.0033	0.0020	0.0014
18	0.0033	0.0020	0.0014
19	0.0033	0.0020	0.0014
20	0.0033	0.0020	0.0014
21	0.0034	0.0020	0.0014
22	0.0034	0.0020	0.0014
23	0.0034	0.0020	0.0014
24	0.0034	0.0020	0.0014
25	0.0034	0.0020	0.0014
26	0.0034	0.0020	0.0014
27	0.0034	0.0020	0.0014
28	0.0034	0.0020	0.0014
29	0.0035	0.0020	0.0014
30	0.0035	0.0021	0.0014

31	0.0035	0.0021	0.0014
32	0.0035	0.0021	0.0014
33	0.0035	0.0021	0.0014
34	0.0035	0.0021	0.0014
35	0.0035	0.0021	0.0014
36	0.0035	0.0021	0.0014
37	0.0036	0.0021	0.0015
38	0.0036	0.0021	0.0015
39	0.0036	0.0021	0.0015
40	0.0036	0.0021	0.0015
41	0.0036	0.0021	0.0015
42	0.0036	0.0021	0.0015
43	0.0036	0.0022	0.0015
44	0.0037	0.0022	0.0015
45	0.0037	0.0022	0.0015
46	0.0037	0.0022	0.0015
47	0.0037	0.0022	0.0015
48	0.0037	0.0022	0.0015
49	0.0037	0.0022	0.0015
50	0.0037	0.0022	0.0015
51	0.0038	0.0022	0.0015
52	0.0038	0.0022	0.0015
53	0.0038	0.0022	0.0016
54	0.0038	0.0023	0.0016
55	0.0038	0.0023	0.0016
56	0.0038	0.0023	0.0016
57	0.0039	0.0023	0.0016
58	0.0039	0.0023	0.0016
59	0.0039	0.0023	0.0016
60	0.0039	0.0023	0.0016
61	0.0039	0.0023	0.0016
62	0.0039	0.0023	0.0016
63	0.0040	0.0023	0.0016
64	0.0040	0.0024	0.0016
65	0.0040	0.0024	0.0016
66	0.0040	0.0024	0.0016
67	0.0040	0.0024	0.0017
68	0.0041	0.0024	0.0017
69	0.0041	0.0024	0.0017
70	0.0041	0.0024	0.0017
71	0.0041	0.0024	0.0017
72	0.0041	0.0024	0.0017
73	0.0042	0.0025	0.0017
74	0.0042	0.0025	0.0017
75	0.0042	0.0025	0.0017
76	0.0042	0.0025	0.0017
77	0.0042	0.0025	0.0017
78	0.0043	0.0025	0.0017
79	0.0043	0.0025	0.0018
80	0.0043	0.0025	0.0018

81	0.0043	0.0026	0.0018
82	0.0044	0.0026	0.0018
83	0.0044	0.0026	0.0018
84	0.0044	0.0026	0.0018
85	0.0044	0.0026	0.0018
86	0.0045	0.0026	0.0018
87	0.0045	0.0027	0.0018
88	0.0045	0.0027	0.0018
89	0.0045	0.0027	0.0019
90	0.0046	0.0027	0.0019
91	0.0046	0.0027	0.0019
92	0.0046	0.0027	0.0019
93	0.0046	0.0027	0.0019
94	0.0047	0.0028	0.0019
95	0.0047	0.0028	0.0019
96	0.0047	0.0028	0.0019
97	0.0048	0.0028	0.0019
98	0.0048	0.0028	0.0020
99	0.0048	0.0028	0.0020
100	0.0048	0.0029	0.0020
101	0.0049	0.0029	0.0020
102	0.0049	0.0029	0.0020
103	0.0049	0.0029	0.0020
104	0.0050	0.0029	0.0020
105	0.0050	0.0030	0.0020
106	0.0050	0.0030	0.0021
107	0.0051	0.0030	0.0021
108	0.0051	0.0030	0.0021
109	0.0051	0.0030	0.0021
110	0.0052	0.0031	0.0021
111	0.0052	0.0031	0.0021
112	0.0053	0.0031	0.0021
113	0.0053	0.0031	0.0022
114	0.0053	0.0032	0.0022
115	0.0054	0.0032	0.0022
116	0.0054	0.0032	0.0022
117	0.0055	0.0032	0.0022
118	0.0055	0.0033	0.0022
119	0.0056	0.0033	0.0023
120	0.0056	0.0033	0.0023
121	0.0056	0.0033	0.0023
122	0.0057	0.0034	0.0023
123	0.0057	0.0034	0.0023
124	0.0058	0.0034	0.0024
125	0.0058	0.0035	0.0024
126	0.0059	0.0035	0.0024
127	0.0059	0.0035	0.0024
128	0.0060	0.0035	0.0024
129	0.0061	0.0036	0.0025
130	0.0061	0.0036	0.0025

131	0.0062	0.0037	0.0025
132	0.0062	0.0037	0.0025
133	0.0063	0.0037	0.0026
134	0.0063	0.0037	0.0026
135	0.0064	0.0038	0.0026
136	0.0065	0.0038	0.0026
137	0.0066	0.0039	0.0027
138	0.0066	0.0039	0.0027
139	0.0067	0.0040	0.0027
140	0.0068	0.0040	0.0028
141	0.0069	0.0041	0.0028
142	0.0069	0.0041	0.0028
143	0.0070	0.0042	0.0029
144	0.0071	0.0042	0.0029
145	0.0071	0.0042	0.0029
146	0.0072	0.0042	0.0029
147	0.0073	0.0043	0.0030
148	0.0074	0.0044	0.0030
149	0.0075	0.0044	0.0031
150	0.0076	0.0045	0.0031
151	0.0077	0.0046	0.0032
152	0.0078	0.0046	0.0032
153	0.0079	0.0047	0.0032
154	0.0080	0.0047	0.0033
155	0.0082	0.0048	0.0033
156	0.0083	0.0049	0.0034
157	0.0085	0.0050	0.0035
158	0.0086	0.0051	0.0035
159	0.0088	0.0052	0.0036
160	0.0089	0.0052	0.0036
161	0.0091	0.0054	0.0037
162	0.0092	0.0054	0.0038
163	0.0095	0.0056	0.0039
164	0.0096	0.0057	0.0039
165	0.0099	0.0058	0.0040
166	0.0100	0.0059	0.0041
167	0.0103	0.0061	0.0042
168	0.0105	0.0062	0.0043
169	0.0108	0.0064	0.0044
170	0.0110	0.0065	0.0045
171	0.0114	0.0068	0.0047
172	0.0116	0.0069	0.0048
173	0.0121	0.0072	0.0049
174	0.0124	0.0073	0.0050
175	0.0129	0.0076	0.0053
176	0.0132	0.0078	0.0054
177	0.0139	0.0082	0.0057
178	0.0142	0.0084	0.0058
179	0.0150	0.0089	0.0061
180	0.0155	0.0092	0.0063

181	0.0165	0.0098	0.0068
182	0.0171	0.0101	0.0070
183	0.0185	0.0109	0.0076
184	0.0193	0.0114	0.0079
185	0.0159	0.0094	0.0065
186	0.0170	0.0100	0.0069
187	0.0197	0.0116	0.0080
188	0.0215	0.0127	0.0088
189	0.0267	0.0158	0.0109
190	0.0308	0.0182	0.0126
191	0.0467	0.0250	0.0216
192	0.0677	0.0250	0.0427
193	0.2930	0.0250	0.2680
194	0.0367	0.0217	0.0150
195	0.0237	0.0140	0.0097
196	0.0182	0.0108	0.0074
197	0.0202	0.0120	0.0083
198	0.0178	0.0105	0.0073
199	0.0160	0.0095	0.0065
200	0.0146	0.0087	0.0060
201	0.0135	0.0080	0.0055
202	0.0126	0.0075	0.0052
203	0.0119	0.0070	0.0048
204	0.0112	0.0066	0.0046
205	0.0106	0.0063	0.0043
206	0.0102	0.0060	0.0041
207	0.0097	0.0057	0.0040
208	0.0093	0.0055	0.0038
209	0.0090	0.0053	0.0037
210	0.0087	0.0051	0.0035
211	0.0084	0.0050	0.0034
212	0.0081	0.0048	0.0033
213	0.0079	0.0047	0.0032
214	0.0076	0.0045	0.0031
215	0.0074	0.0044	0.0030
216	0.0072	0.0043	0.0030
217	0.0071	0.0042	0.0029
218	0.0070	0.0041	0.0028
219	0.0068	0.0040	0.0028
220	0.0067	0.0039	0.0027
221	0.0065	0.0039	0.0027
222	0.0064	0.0038	0.0026
223	0.0063	0.0037	0.0026
224	0.0061	0.0036	0.0025
225	0.0060	0.0036	0.0025
226	0.0059	0.0035	0.0024
227	0.0058	0.0034	0.0024
228	0.0057	0.0034	0.0023
229	0.0056	0.0033	0.0023
230	0.0055	0.0033	0.0023

231	0.0054	0.0032	0.0022
232	0.0054	0.0032	0.0022
233	0.0053	0.0031	0.0022
234	0.0052	0.0031	0.0021
235	0.0051	0.0030	0.0021
236	0.0051	0.0030	0.0021
237	0.0050	0.0029	0.0020
238	0.0049	0.0029	0.0020
239	0.0049	0.0029	0.0020
240	0.0048	0.0028	0.0020
241	0.0047	0.0028	0.0019
242	0.0047	0.0028	0.0019
243	0.0046	0.0027	0.0019
244	0.0046	0.0027	0.0019
245	0.0045	0.0027	0.0018
246	0.0045	0.0026	0.0018
247	0.0044	0.0026	0.0018
248	0.0044	0.0026	0.0018
249	0.0043	0.0026	0.0018
250	0.0043	0.0025	0.0017
251	0.0042	0.0025	0.0017
252	0.0042	0.0025	0.0017
253	0.0042	0.0025	0.0017
254	0.0041	0.0024	0.0017
255	0.0041	0.0024	0.0017
256	0.0040	0.0024	0.0016
257	0.0040	0.0024	0.0016
258	0.0040	0.0023	0.0016
259	0.0039	0.0023	0.0016
260	0.0039	0.0023	0.0016
261	0.0039	0.0023	0.0016
262	0.0038	0.0023	0.0016
263	0.0038	0.0022	0.0015
264	0.0038	0.0022	0.0015
265	0.0037	0.0022	0.0015
266	0.0037	0.0022	0.0015
267	0.0037	0.0022	0.0015
268	0.0036	0.0022	0.0015
269	0.0036	0.0021	0.0015
270	0.0036	0.0021	0.0015
271	0.0036	0.0021	0.0015
272	0.0035	0.0021	0.0014
273	0.0035	0.0021	0.0014
274	0.0035	0.0021	0.0014
275	0.0034	0.0020	0.0014
276	0.0034	0.0020	0.0014
277	0.0034	0.0020	0.0014
278	0.0034	0.0020	0.0014
279	0.0034	0.0020	0.0014
280	0.0033	0.0020	0.0014

```
281               0.0033           0.0020              0.0014
282               0.0033           0.0019              0.0013
283               0.0033           0.0019              0.0013
284               0.0032           0.0019              0.0013
285               0.0032           0.0019              0.0013
286               0.0032           0.0019              0.0013
287               0.0032           0.0019              0.0013
288               0.0032           0.0019              0.0013
--------------------------------------------------------------------
--------------------------------------------------------------------
Total soil rain loss =      1.15(In)
Total effective rainfall =      1.08(In)
Peak flow rate in flood hydrograph =     18.71(CFS)
---------------------------------------------------------------------
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
                    24 - H O U R    S T O R M
               R u n o f f     H y d r o g r a p h
--------------------------------------------------------------------
            Hydrograph in   5   Minute intervals ((CFS))

--------------------------------------------------------------------
Time(h+m) Volume Ac.Ft   Q(CFS)  0        5.0      10.0      15.0      20.0
-----------------------------------------------------------------------
  0+ 5       0.0000      0.01  Q         |         |         |         |
  0+10       0.0004      0.05  Q         |         |         |         |
  0+15       0.0013      0.13  Q         |         |         |         |
  0+20       0.0024      0.17  Q         |         |         |         |
  0+25       0.0037      0.19  Q         |         |         |         |
  0+30       0.0052      0.21  Q         |         |         |         |
  0+35       0.0067      0.22  Q         |         |         |         |
  0+40       0.0082      0.23  Q         |         |         |         |
  0+45       0.0098      0.23  Q         |         |         |         |
  0+50       0.0114      0.24  Q         |         |         |         |
  0+55       0.0131      0.24  Q         |         |         |         |
  1+ 0       0.0148      0.25  Q         |         |         |         |
  1+ 5       0.0165      0.25  Q         |         |         |         |
  1+10       0.0183      0.25  Q         |         |         |         |
  1+15       0.0200      0.25  Q         |         |         |         |
  1+20       0.0218      0.26  Q         |         |         |         |
  1+25       0.0235      0.26  Q         |         |         |         |
  1+30       0.0253      0.26  Q         |         |         |         |
  1+35       0.0271      0.26  Q         |         |         |         |
  1+40       0.0289      0.26  Q         |         |         |         |
  1+45       0.0307      0.26  Q         |         |         |         |
  1+50       0.0326      0.26  Q         |         |         |         |
  1+55       0.0344      0.26  Q         |         |         |         |
  2+ 0       0.0362      0.27  QV        |         |         |         |
  2+ 5       0.0381      0.27  QV        |         |         |         |
  2+10       0.0399      0.27  QV        |         |         |         |
  2+15       0.0417      0.27  QV        |         |         |         |
```

```
2+20       0.0436      0.27  QV         |         |         |         |
2+25       0.0455      0.27  QV         |         |         |         |
2+30       0.0473      0.27  QV         |         |         |         |
2+35       0.0492      0.27  QV         |         |         |         |
2+40       0.0511      0.27  QV         |         |         |         |
2+45       0.0530      0.27  QV         |         |         |         |
2+50       0.0549      0.28  QV         |         |         |         |
2+55       0.0568      0.28  QV         |         |         |         |
3+ 0       0.0587      0.28  QV         |         |         |         |
3+ 5       0.0606      0.28  QV         |         |         |         |
3+10       0.0625      0.28  QV         |         |         |         |
3+15       0.0645      0.28  QV         |         |         |         |
3+20       0.0664      0.28  QV         |         |         |         |
3+25       0.0684      0.28  QV         |         |         |         |
3+30       0.0703      0.28  QV         |         |         |         |
3+35       0.0723      0.28  Q V        |         |         |         |
3+40       0.0742      0.29  Q V        |         |         |         |
3+45       0.0762      0.29  Q V        |         |         |         |
3+50       0.0782      0.29  Q V        |         |         |         |
3+55       0.0802      0.29  Q V        |         |         |         |
4+ 0       0.0822      0.29  Q V        |         |         |         |
4+ 5       0.0842      0.29  Q V        |         |         |         |
4+10       0.0862      0.29  Q V        |         |         |         |
4+15       0.0883      0.29  Q V        |         |         |         |
4+20       0.0903      0.30  Q V        |         |         |         |
4+25       0.0923      0.30  Q V        |         |         |         |
4+30       0.0944      0.30  Q V        |         |         |         |
4+35       0.0964      0.30  Q V        |         |         |         |
4+40       0.0985      0.30  Q V        |         |         |         |
4+45       0.1006      0.30  Q V        |         |         |         |
4+50       0.1027      0.30  Q V        |         |         |         |
4+55       0.1048      0.30  Q V        |         |         |         |
5+ 0       0.1069      0.31  Q V        |         |         |         |
5+ 5       0.1090      0.31  Q  V       |         |         |         |
5+10       0.1111      0.31  Q  V       |         |         |         |
5+15       0.1132      0.31  Q  V       |         |         |         |
5+20       0.1154      0.31  Q  V       |         |         |         |
5+25       0.1175      0.31  Q  V       |         |         |         |
5+30       0.1197      0.31  Q  V       |         |         |         |
5+35       0.1219      0.32  Q  V       |         |         |         |
5+40       0.1240      0.32  Q  V       |         |         |         |
5+45       0.1262      0.32  Q  V       |         |         |         |
5+50       0.1284      0.32  Q  V       |         |         |         |
5+55       0.1306      0.32  Q  V       |         |         |         |
6+ 0       0.1329      0.32  Q  V       |         |         |         |
6+ 5       0.1351      0.32  Q  V       |         |         |         |
6+10       0.1373      0.33  Q  V       |         |         |         |
6+15       0.1396      0.33  Q  V       |         |         |         |
6+20       0.1419      0.33  Q  V       |         |         |         |
6+25       0.1441      0.33  Q   V      |         |         |         |
```

```
  6+30      0.1464      0.33  Q   V     |         |         |         |
  6+35      0.1487      0.33  Q   V     |         |         |         |
  6+40      0.1510      0.34  Q   V     |         |         |         |
  6+45      0.1534      0.34  Q   V     |         |         |         |
  6+50      0.1557      0.34  Q   V     |         |         |         |
  6+55      0.1580      0.34  Q   V     |         |         |         |
  7+ 0      0.1604      0.34  Q   V     |         |         |         |
  7+ 5      0.1628      0.34  Q   V     |         |         |         |
  7+10      0.1652      0.35  Q   V     |         |         |         |
  7+15      0.1676      0.35  Q   V     |         |         |         |
  7+20      0.1700      0.35  Q   V     |         |         |         |
  7+25      0.1724      0.35  Q   V     |         |         |         |
  7+30      0.1748      0.35  Q   V     |         |         |         |
  7+35      0.1773      0.36  Q   V     |         |         |         |
  7+40      0.1798      0.36  Q   V     |         |         |         |
  7+45      0.1822      0.36  Q    V    |         |         |         |
  7+50      0.1847      0.36  Q    V    |         |         |         |
  7+55      0.1872      0.36  Q    V    |         |         |         |
  8+ 0      0.1898      0.37  Q    V    |         |         |         |
  8+ 5      0.1923      0.37  Q    V    |         |         |         |
  8+10      0.1949      0.37  Q    V    |         |         |         |
  8+15      0.1974      0.37  Q    V    |         |         |         |
  8+20      0.2000      0.38  Q    V    |         |         |         |
  8+25      0.2026      0.38  Q    V    |         |         |         |
  8+30      0.2052      0.38  Q    V    |         |         |         |
  8+35      0.2079      0.38  Q    V    |         |         |         |
  8+40      0.2105      0.39  Q    V    |         |         |         |
  8+45      0.2132      0.39  Q    V    |         |         |         |
  8+50      0.2159      0.39  Q    V    |         |         |         |
  8+55      0.2186      0.39  Q     V   |         |         |         |
  9+ 0      0.2213      0.40  Q     V   |         |         |         |
  9+ 5      0.2240      0.40  Q     V   |         |         |         |
  9+10      0.2268      0.40  Q     V   |         |         |         |
  9+15      0.2296      0.40  Q     V   |         |         |         |
  9+20      0.2324      0.41  Q     V   |         |         |         |
  9+25      0.2352      0.41  Q     V   |         |         |         |
  9+30      0.2380      0.41  Q     V   |         |         |         |
  9+35      0.2409      0.42  Q     V   |         |         |         |
  9+40      0.2438      0.42  Q     V   |         |         |         |
  9+45      0.2467      0.42  Q     V   |         |         |         |
  9+50      0.2496      0.42  Q     V   |         |         |         |
  9+55      0.2526      0.43  Q      V  |         |         |         |
 10+ 0      0.2555      0.43  Q      V  |         |         |         |
 10+ 5      0.2585      0.43  Q      V  |         |         |         |
 10+10      0.2615      0.44  Q      V  |         |         |         |
 10+15      0.2646      0.44  Q      V  |         |         |         |
 10+20      0.2676      0.45  Q      V  |         |         |         |
 10+25      0.2707      0.45  Q      V  |         |         |         |
 10+30      0.2739      0.45  Q      V  |         |         |         |
 10+35      0.2770      0.46  Q      V  |         |         |         |
```

```
10+40       0.2802      0.46  Q      V  |         |         |         |
10+45       0.2834      0.46  Q      V  |         |         |         |
10+50       0.2866      0.47  Q      V  |         |         |         |
10+55       0.2899      0.47  Q       V |         |         |         |
11+ 0       0.2931      0.48  Q       V |         |         |         |
11+ 5       0.2965      0.48  Q       V |         |         |         |
11+10       0.2998      0.49  Q       V |         |         |         |
11+15       0.3032      0.49  Q       V |         |         |         |
11+20       0.3066      0.50  Q       V |         |         |         |
11+25       0.3101      0.50  |Q      V |         |         |         |
11+30       0.3135      0.51  |Q      V |         |         |         |
11+35       0.3171      0.51  |Q      V |         |         |         |
11+40       0.3206      0.52  |Q      V |         |         |         |
11+45       0.3242      0.52  |Q       V|         |         |         |
11+50       0.3279      0.53  |Q       V|         |         |         |
11+55       0.3315      0.53  |Q       V|         |         |         |
12+ 0       0.3352      0.54  |Q       V|         |         |         |
12+ 5       0.3390      0.55  |Q       V|         |         |         |
12+10       0.3428      0.55  |Q       V|         |         |         |
12+15       0.3466      0.56  |Q       V|         |         |         |
12+20       0.3505      0.56  |Q       V|         |         |         |
12+25       0.3544      0.57  |Q       V|         |         |         |
12+30       0.3584      0.58  |Q       V|         |         |         |
12+35       0.3624      0.58  |Q        V         |         |         |
12+40       0.3665      0.59  |Q        V         |         |         |
12+45       0.3706      0.60  |Q        V         |         |         |
12+50       0.3748      0.61  |Q        V         |         |         |
12+55       0.3790      0.62  |Q        V         |         |         |
13+ 0       0.3833      0.62  |Q        V         |         |         |
13+ 5       0.3877      0.63  |Q        V         |         |         |
13+10       0.3921      0.64  |Q        V         |         |         |
13+15       0.3966      0.65  |Q        |V        |         |         |
13+20       0.4012      0.67  |Q        |V        |         |         |
13+25       0.4059      0.68  |Q        |V        |         |         |
13+30       0.4106      0.69  |Q        |V        |         |         |
13+35       0.4155      0.70  |Q        |V        |         |         |
13+40       0.4204      0.71  |Q        |V        |         |         |
13+45       0.4254      0.73  |Q        |V        |         |         |
13+50       0.4305      0.74  |Q        |V        |         |         |
13+55       0.4357      0.76  |Q        | V       |         |         |
14+ 0       0.4410      0.77  |Q        | V       |         |         |
14+ 5       0.4465      0.79  |Q        | V       |         |         |
14+10       0.4520      0.81  |Q        | V       |         |         |
14+15       0.4577      0.83  |Q        | V       |         |         |
14+20       0.4636      0.85  |Q        | V       |         |         |
14+25       0.4696      0.87  |Q        |  V      |         |         |
14+30       0.4757      0.89  |Q        |  V      |         |         |
14+35       0.4821      0.92  |Q        |  V      |         |         |
14+40       0.4886      0.95  |Q        |  V      |         |         |
14+45       0.4953      0.98  |Q        |  V      |         |         |
```

```
14+50       0.5023      1.01  | Q       |  V      |         |         |
14+55       0.5095      1.05  | Q       |   V     |         |         |
15+ 0       0.5169      1.08  | Q       |   V     |         |         |
15+ 5       0.5247      1.13  | Q       |   V     |         |         |
15+10       0.5328      1.18  | Q       |   V     |         |         |
15+15       0.5413      1.23  | Q       |    V    |         |         |
15+20       0.5502      1.29  | Q       |    V    |         |         |
15+25       0.5595      1.35  | Q       |    V    |         |         |
15+30       0.5689      1.36  | Q       |    V    |         |         |
15+35       0.5781      1.33  | Q       |     V   |         |         |
15+40       0.5875      1.38  | Q       |     V   |         |         |
15+45       0.5978      1.48  | Q       |     V   |         |         |
15+50       0.6091      1.65  |  Q      |     V   |         |         |
15+55       0.6224      1.92  |  Q      |      V  |         |         |
16+ 0       0.6398      2.54  |    Q    |      V  |         |         |
16+ 5       0.6754      5.16  |         Q       V |         |         |
16+10       0.7644     12.93  |         |         |V   Q    |         |
16+15       0.8933     18.71  |         |         |   V     |      Q  |
16+20       0.9680     10.85  |         |         |Q    V   |         |
16+25       1.0156      6.91  |         |  Q      |       V |         |
16+30       1.0505      5.08  |         Q         |        V|         |
16+35       1.0787      4.10  |       Q |         |        V|         |
16+40       1.1020      3.38  |     Q   |         |         V         |
16+45       1.1212      2.79  |    Q    |         |         |V        |
16+50       1.1379      2.43  |   Q     |         |         |V        |
16+55       1.1524      2.10  |   Q     |         |         | V       |
17+ 0       1.1651      1.84  |  Q      |         |         | V       |
17+ 5       1.1762      1.62  |  Q      |         |         | V       |
17+10       1.1859      1.40  | Q       |         |         | V       |
17+15       1.1944      1.23  | Q       |         |         |  V      |
17+20       1.2026      1.20  | Q       |         |         |  V      |
17+25       1.2105      1.15  | Q       |         |         |  V      |
17+30       1.2176      1.03  | Q       |         |         |  V      |
17+35       1.2243      0.97  |Q        |         |         |   V     |
17+40       1.2295      0.76  |Q        |         |         |   V     |
17+45       1.2345      0.72  |Q        |         |         |   V     |
17+50       1.2392      0.69  |Q        |         |         |   V     |
17+55       1.2439      0.67  |Q        |         |         |   V     |
18+ 0       1.2483      0.65  |Q        |         |         |   V     |
18+ 5       1.2526      0.63  |Q        |         |         |   V     |
18+10       1.2568      0.61  |Q        |         |         |   V     |
18+15       1.2609      0.59  |Q        |         |         |    V    |
18+20       1.2649      0.58  |Q        |         |         |    V    |
18+25       1.2688      0.56  |Q        |         |         |    V    |
18+30       1.2726      0.55  |Q        |         |         |    V    |
18+35       1.2763      0.54  |Q        |         |         |    V    |
18+40       1.2799      0.53  |Q        |         |         |    V    |
18+45       1.2835      0.52  |Q        |         |         |    V    |
18+50       1.2870      0.50  |Q        |         |         |    V    |
18+55       1.2904      0.49  Q         |         |         |    V    |
```

```
19+ 0       1.2937      0.49  Q         |         |         |    V    |
19+ 5       1.2970      0.48  Q         |         |         |     V   |
19+10       1.3002      0.47  Q         |         |         |     V   |
19+15       1.3034      0.46  Q         |         |         |     V   |
19+20       1.3065      0.45  Q         |         |         |     V   |
19+25       1.3095      0.44  Q         |         |         |     V   |
19+30       1.3125      0.44  Q         |         |         |     V   |
19+35       1.3155      0.43  Q         |         |         |     V   |
19+40       1.3184      0.42  Q         |         |         |     V   |
19+45       1.3213      0.42  Q         |         |         |     V   |
19+50       1.3241      0.41  Q         |         |         |     V   |
19+55       1.3269      0.41  Q         |         |         |     V   |
20+ 0       1.3297      0.40  Q         |         |         |     V   |
20+ 5       1.3324      0.39  Q         |         |         |      V  |
20+10       1.3351      0.39  Q         |         |         |      V  |
20+15       1.3377      0.38  Q         |         |         |      V  |
20+20       1.3403      0.38  Q         |         |         |      V  |
20+25       1.3429      0.37  Q         |         |         |      V  |
20+30       1.3454      0.37  Q         |         |         |      V  |
20+35       1.3480      0.37  Q         |         |         |      V  |
20+40       1.3505      0.36  Q         |         |         |      V  |
20+45       1.3529      0.36  Q         |         |         |      V  |
20+50       1.3553      0.35  Q         |         |         |      V  |
20+55       1.3577      0.35  Q         |         |         |      V  |
21+ 0       1.3601      0.35  Q         |         |         |      V  |
21+ 5       1.3625      0.34  Q         |         |         |      V  |
21+10       1.3648      0.34  Q         |         |         |      V  |
21+15       1.3671      0.33  Q         |         |         |      V  |
21+20       1.3694      0.33  Q         |         |         |       V |
21+25       1.3717      0.33  Q         |         |         |       V |
21+30       1.3739      0.32  Q         |         |         |       V |
21+35       1.3761      0.32  Q         |         |         |       V |
21+40       1.3783      0.32  Q         |         |         |       V |
21+45       1.3805      0.32  Q         |         |         |       V |
21+50       1.3826      0.31  Q         |         |         |       V |
21+55       1.3848      0.31  Q         |         |         |       V |
22+ 0       1.3869      0.31  Q         |         |         |       V |
22+ 5       1.3890      0.30  Q         |         |         |       V |
22+10       1.3911      0.30  Q         |         |         |       V |
22+15       1.3931      0.30  Q         |         |         |       V |
22+20       1.3952      0.30  Q         |         |         |       V |
22+25       1.3972      0.29  Q         |         |         |       V |
22+30       1.3992      0.29  Q         |         |         |       V |
22+35       1.4012      0.29  Q         |         |         |       V |
22+40       1.4032      0.29  Q         |         |         |       V |
22+45       1.4052      0.29  Q         |         |         |        V|
22+50       1.4071      0.28  Q         |         |         |        V|
22+55       1.4091      0.28  Q         |         |         |        V|
23+ 0       1.4110      0.28  Q         |         |         |        V|
23+ 5       1.4129      0.28  Q         |         |         |        V|
```

23+10	1.4148	0.27	Q	|	|	|	V|
23+15	1.4167	0.27	Q	|	|	|	V|
23+20	1.4185	0.27	Q	|	|	|	V|
23+25	1.4204	0.27	Q	|	|	|	V|
23+30	1.4222	0.27	Q	|	|	|	V|
23+35	1.4240	0.27	Q	|	|	|	V|
23+40	1.4259	0.26	Q	|	|	|	V|
23+45	1.4277	0.26	Q	|	|	|	V|
23+50	1.4294	0.26	Q	|	|	|	V|
23+55	1.4312	0.26	Q	|	|	|	V|
24+ 0	1.4330	0.26	Q	|	|	|	V|

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

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

                Study date  08/03/21

++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
------------------------------------------------------------------------

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


Program License Serial Number 6385

---------------------------------------------------------------------
Space Center
undeveloped 10-year
Area B


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

        Storm Event Year = 10

        Antecedent Moisture Condition = 2

 English (in-lb) Input Units Used

 English Rainfall Data (Inches) Input Values Used

 English Units used in output format




Area averaged rainfall intensity isohyetal data:
        Sub-Area        Duration        Isohyetal
        (Ac.)            (hours)         (In)
Rainfall data for year 10
            22.99            1           0.62
--------------------------------------------------------------------
Rainfall data for year 10
            22.99            6           1.27
--------------------------------------------------------------------
Rainfall data for year 10
            22.99           24           2.23
--------------------------------------------------------------------
```

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++

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


SCS curve  SCS curve     Area     Area     Fp(Fig C6)    Ap      Fm
No.(AMCII) NO.(AMC 2)    (Ac.)    Fraction     (In/Hr)  (dec.)   (In/Hr)
 83.0      83.0         22.99      1.000     0.318    1.000    0.318

Area-averaged adjusted loss rate Fm (In/Hr) =  0.318

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

Area       Area          SCS CN    SCS CN      S     Pervious
 (Ac.)      Fract         (AMC2)    (AMC2)           Yield Fr
    22.99   1.000         83.0      83.0       2.05     0.384

Area-averaged catchment yield fraction, Y =  0.384
Area-averaged low loss fraction, Yb =  0.616
User entry of time of concentration  =   0.192 (hours)
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Watershed area =      22.99(Ac.)
Catchment Lag time =   0.154 hours
Unit interval =   5.000 minutes
Unit interval percentage of lag time = 54.2535
Hydrograph baseflow =     0.00(CFS)
Average maximum watershed loss rate(Fm) =  0.318(In/Hr)
Average low loss rate fraction (Yb) = 0.457 (decimal)
Note: user entry of the Yb value
DESERT S-Graph Selected
Computed peak 5-minute rainfall =  0.293(In)
Computed peak 30-minute rainfall =  0.502(In)
Specified peak 1-hour rainfall =  0.618(In)
Computed peak 3-hour rainfall =  0.961(In)
Specified peak 6-hour rainfall =  1.270(In)
Specified peak 24-hour rainfall =  2.230(In)


Rainfall depth area reduction factors:
Using a total area of      22.99(Ac.) (Ref: fig. E-4)

5-minute factor = 0.999     Adjusted rainfall =  0.293(In)
30-minute factor = 0.999    Adjusted rainfall =  0.501(In)
1-hour factor = 0.999       Adjusted rainfall =  0.617(In)
3-hour factor = 1.000       Adjusted rainfall =  0.961(In)
6-hour factor = 1.000       Adjusted rainfall =  1.270(In)
24-hour factor = 1.000      Adjusted rainfall =  2.230(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 = 278.04 (CFS))	
1	4.582	12.739
2	35.377	85.622
3	64.099	79.856
4	76.427	34.276
5	83.603	19.953
6	88.449	13.475
7	91.682	8.988
8	94.097	6.714
9	95.871	4.933
10	97.167	3.603
11	97.993	2.295
12	98.587	1.653
13	99.237	1.805
14	99.703	1.296
15	100.000	0.827

Peak Unit Number	Adjusted mass rainfall (In)	Unit rainfall (In)
1	0.2929	0.2929
2	0.3606	0.0677
3	0.4073	0.0466
4	0.4440	0.0367
5	0.4747	0.0307
6	0.5014	0.0267
7	0.5252	0.0237
8	0.5466	0.0215
9	0.5663	0.0197
10	0.5845	0.0182
11	0.6014	0.0170
12	0.6173	0.0159
13	0.6376	0.0202
14	0.6569	0.0193
15	0.6754	0.0185
16	0.6932	0.0178
17	0.7103	0.0171
18	0.7269	0.0165
19	0.7429	0.0160
20	0.7584	0.0155
21	0.7734	0.0151
22	0.7881	0.0146
23	0.8023	0.0142
24	0.8162	0.0139
25	0.8297	0.0135
26	0.8429	0.0132

27	0.8559	0.0129
28	0.8685	0.0126
29	0.8808	0.0124
30	0.8930	0.0121
31	0.9048	0.0119
32	0.9165	0.0116
33	0.9279	0.0114
34	0.9391	0.0112
35	0.9502	0.0110
36	0.9610	0.0108
37	0.9717	0.0106
38	0.9821	0.0105
39	0.9924	0.0103
40	1.0026	0.0102
41	1.0126	0.0100
42	1.0225	0.0099
43	1.0322	0.0097
44	1.0418	0.0096
45	1.0512	0.0095
46	1.0606	0.0093
47	1.0698	0.0092
48	1.0789	0.0091
49	1.0878	0.0090
50	1.0967	0.0089
51	1.1055	0.0088
52	1.1142	0.0087
53	1.1227	0.0086
54	1.1312	0.0085
55	1.1396	0.0084
56	1.1479	0.0083
57	1.1561	0.0082
58	1.1642	0.0081
59	1.1722	0.0080
60	1.1801	0.0079
61	1.1880	0.0079
62	1.1958	0.0078
63	1.2035	0.0077
64	1.2112	0.0076
65	1.2187	0.0076
66	1.2262	0.0075
67	1.2337	0.0074
68	1.2411	0.0074
69	1.2484	0.0073
70	1.2556	0.0072
71	1.2628	0.0072
72	1.2699	0.0071
73	1.2770	0.0071
74	1.2841	0.0071
75	1.2911	0.0070
76	1.2981	0.0070

77	1.3050	0.0069
78	1.3119	0.0069
79	1.3187	0.0068
80	1.3254	0.0068
81	1.3321	0.0067
82	1.3388	0.0067
83	1.3454	0.0066
84	1.3520	0.0066
85	1.3585	0.0065
86	1.3649	0.0065
87	1.3714	0.0064
88	1.3777	0.0064
89	1.3841	0.0063
90	1.3904	0.0063
91	1.3966	0.0063
92	1.4028	0.0062
93	1.4090	0.0062
94	1.4151	0.0061
95	1.4212	0.0061
96	1.4273	0.0061
97	1.4333	0.0060
98	1.4393	0.0060
99	1.4452	0.0059
100	1.4512	0.0059
101	1.4570	0.0059
102	1.4629	0.0058
103	1.4687	0.0058
104	1.4745	0.0058
105	1.4802	0.0057
106	1.4859	0.0057
107	1.4916	0.0057
108	1.4972	0.0056
109	1.5029	0.0056
110	1.5084	0.0056
111	1.5140	0.0056
112	1.5195	0.0055
113	1.5250	0.0055
114	1.5305	0.0055
115	1.5359	0.0054
116	1.5413	0.0054
117	1.5467	0.0054
118	1.5521	0.0054
119	1.5574	0.0053
120	1.5627	0.0053
121	1.5680	0.0053
122	1.5732	0.0053
123	1.5784	0.0052
124	1.5836	0.0052
125	1.5888	0.0052
126	1.5940	0.0052

127	1.5991	0.0051
128	1.6042	0.0051
129	1.6093	0.0051
130	1.6143	0.0051
131	1.6194	0.0050
132	1.6244	0.0050
133	1.6294	0.0050
134	1.6343	0.0050
135	1.6393	0.0049
136	1.6442	0.0049
137	1.6491	0.0049
138	1.6540	0.0049
139	1.6588	0.0049
140	1.6637	0.0048
141	1.6685	0.0048
142	1.6733	0.0048
143	1.6780	0.0048
144	1.6828	0.0048
145	1.6875	0.0047
146	1.6923	0.0047
147	1.6970	0.0047
148	1.7016	0.0047
149	1.7063	0.0047
150	1.7109	0.0046
151	1.7156	0.0046
152	1.7202	0.0046
153	1.7247	0.0046
154	1.7293	0.0046
155	1.7339	0.0046
156	1.7384	0.0045
157	1.7429	0.0045
158	1.7474	0.0045
159	1.7519	0.0045
160	1.7564	0.0045
161	1.7608	0.0045
162	1.7653	0.0044
163	1.7697	0.0044
164	1.7741	0.0044
165	1.7785	0.0044
166	1.7828	0.0044
167	1.7872	0.0044
168	1.7915	0.0043
169	1.7958	0.0043
170	1.8002	0.0043
171	1.8044	0.0043
172	1.8087	0.0043
173	1.8130	0.0043
174	1.8172	0.0042
175	1.8215	0.0042
176	1.8257	0.0042

177	1.8299	0.0042
178	1.8341	0.0042
179	1.8383	0.0042
180	1.8424	0.0042
181	1.8466	0.0042
182	1.8507	0.0041
183	1.8548	0.0041
184	1.8590	0.0041
185	1.8630	0.0041
186	1.8671	0.0041
187	1.8712	0.0041
188	1.8753	0.0041
189	1.8793	0.0040
190	1.8833	0.0040
191	1.8874	0.0040
192	1.8914	0.0040
193	1.8954	0.0040
194	1.8993	0.0040
195	1.9033	0.0040
196	1.9073	0.0040
197	1.9112	0.0039
198	1.9151	0.0039
199	1.9191	0.0039
200	1.9230	0.0039
201	1.9269	0.0039
202	1.9308	0.0039
203	1.9346	0.0039
204	1.9385	0.0039
205	1.9424	0.0039
206	1.9462	0.0038
207	1.9500	0.0038
208	1.9539	0.0038
209	1.9577	0.0038
210	1.9615	0.0038
211	1.9653	0.0038
212	1.9690	0.0038
213	1.9728	0.0038
214	1.9766	0.0038
215	1.9803	0.0037
216	1.9840	0.0037
217	1.9878	0.0037
218	1.9915	0.0037
219	1.9952	0.0037
220	1.9989	0.0037
221	2.0026	0.0037
222	2.0062	0.0037
223	2.0099	0.0037
224	2.0136	0.0037
225	2.0172	0.0036
226	2.0208	0.0036

227	2.0245	0.0036
228	2.0281	0.0036
229	2.0317	0.0036
230	2.0353	0.0036
231	2.0389	0.0036
232	2.0425	0.0036
233	2.0460	0.0036
234	2.0496	0.0036
235	2.0531	0.0036
236	2.0567	0.0035
237	2.0602	0.0035
238	2.0638	0.0035
239	2.0673	0.0035
240	2.0708	0.0035
241	2.0743	0.0035
242	2.0778	0.0035
243	2.0813	0.0035
244	2.0847	0.0035
245	2.0882	0.0035
246	2.0917	0.0035
247	2.0951	0.0034
248	2.0985	0.0034
249	2.1020	0.0034
250	2.1054	0.0034
251	2.1088	0.0034
252	2.1122	0.0034
253	2.1156	0.0034
254	2.1190	0.0034
255	2.1224	0.0034
256	2.1258	0.0034
257	2.1291	0.0034
258	2.1325	0.0034
259	2.1359	0.0034
260	2.1392	0.0033
261	2.1425	0.0033
262	2.1459	0.0033
263	2.1492	0.0033
264	2.1525	0.0033
265	2.1558	0.0033
266	2.1591	0.0033
267	2.1624	0.0033
268	2.1657	0.0033
269	2.1690	0.0033
270	2.1722	0.0033
271	2.1755	0.0033
272	2.1788	0.0033
273	2.1820	0.0032
274	2.1853	0.0032
275	2.1885	0.0032
276	2.1917	0.0032

277	2.1949	0.0032
278	2.1982	0.0032
279	2.2014	0.0032
280	2.2046	0.0032
281	2.2078	0.0032
282	2.2109	0.0032
283	2.2141	0.0032
284	2.2173	0.0032
285	2.2205	0.0032
286	2.2236	0.0032
287	2.2268	0.0032
288	2.2299	0.0031

Unit Period (number)	Unit Rainfall (In)	Unit Soil-Loss (In)	Effective Rainfall (In)
1	0.0031	0.0014	0.0017
2	0.0032	0.0014	0.0017
3	0.0032	0.0014	0.0017
4	0.0032	0.0015	0.0017
5	0.0032	0.0015	0.0017
6	0.0032	0.0015	0.0017
7	0.0032	0.0015	0.0017
8	0.0032	0.0015	0.0017
9	0.0032	0.0015	0.0018
10	0.0032	0.0015	0.0018
11	0.0032	0.0015	0.0018
12	0.0033	0.0015	0.0018
13	0.0033	0.0015	0.0018
14	0.0033	0.0015	0.0018
15	0.0033	0.0015	0.0018
16	0.0033	0.0015	0.0018
17	0.0033	0.0015	0.0018
18	0.0033	0.0015	0.0018
19	0.0033	0.0015	0.0018
20	0.0033	0.0015	0.0018
21	0.0034	0.0015	0.0018
22	0.0034	0.0015	0.0018
23	0.0034	0.0015	0.0018
24	0.0034	0.0015	0.0018
25	0.0034	0.0016	0.0019
26	0.0034	0.0016	0.0019
27	0.0034	0.0016	0.0019
28	0.0034	0.0016	0.0019
29	0.0035	0.0016	0.0019
30	0.0035	0.0016	0.0019
31	0.0035	0.0016	0.0019
32	0.0035	0.0016	0.0019
33	0.0035	0.0016	0.0019

34	0.0035	0.0016	0.0019
35	0.0035	0.0016	0.0019
36	0.0035	0.0016	0.0019
37	0.0036	0.0016	0.0019
38	0.0036	0.0016	0.0019
39	0.0036	0.0016	0.0019
40	0.0036	0.0016	0.0020
41	0.0036	0.0017	0.0020
42	0.0036	0.0017	0.0020
43	0.0036	0.0017	0.0020
44	0.0037	0.0017	0.0020
45	0.0037	0.0017	0.0020
46	0.0037	0.0017	0.0020
47	0.0037	0.0017	0.0020
48	0.0037	0.0017	0.0020
49	0.0037	0.0017	0.0020
50	0.0037	0.0017	0.0020
51	0.0038	0.0017	0.0020
52	0.0038	0.0017	0.0021
53	0.0038	0.0017	0.0021
54	0.0038	0.0017	0.0021
55	0.0038	0.0018	0.0021
56	0.0038	0.0018	0.0021
57	0.0039	0.0018	0.0021
58	0.0039	0.0018	0.0021
59	0.0039	0.0018	0.0021
60	0.0039	0.0018	0.0021
61	0.0039	0.0018	0.0021
62	0.0039	0.0018	0.0021
63	0.0040	0.0018	0.0022
64	0.0040	0.0018	0.0022
65	0.0040	0.0018	0.0022
66	0.0040	0.0018	0.0022
67	0.0040	0.0018	0.0022
68	0.0041	0.0019	0.0022
69	0.0041	0.0019	0.0022
70	0.0041	0.0019	0.0022
71	0.0041	0.0019	0.0022
72	0.0041	0.0019	0.0022
73	0.0042	0.0019	0.0023
74	0.0042	0.0019	0.0023
75	0.0042	0.0019	0.0023
76	0.0042	0.0019	0.0023
77	0.0042	0.0019	0.0023
78	0.0043	0.0019	0.0023
79	0.0043	0.0020	0.0023
80	0.0043	0.0020	0.0023
81	0.0043	0.0020	0.0024
82	0.0044	0.0020	0.0024
83	0.0044	0.0020	0.0024

84	0.0044	0.0020	0.0024
85	0.0044	0.0020	0.0024
86	0.0045	0.0020	0.0024
87	0.0045	0.0020	0.0024
88	0.0045	0.0021	0.0024
89	0.0045	0.0021	0.0025
90	0.0046	0.0021	0.0025
91	0.0046	0.0021	0.0025
92	0.0046	0.0021	0.0025
93	0.0046	0.0021	0.0025
94	0.0047	0.0021	0.0025
95	0.0047	0.0021	0.0026
96	0.0047	0.0022	0.0026
97	0.0048	0.0022	0.0026
98	0.0048	0.0022	0.0026
99	0.0048	0.0022	0.0026
100	0.0048	0.0022	0.0026
101	0.0049	0.0022	0.0026
102	0.0049	0.0022	0.0027
103	0.0049	0.0023	0.0027
104	0.0050	0.0023	0.0027
105	0.0050	0.0023	0.0027
106	0.0050	0.0023	0.0027
107	0.0051	0.0023	0.0028
108	0.0051	0.0023	0.0028
109	0.0052	0.0024	0.0028
110	0.0052	0.0024	0.0028
111	0.0052	0.0024	0.0028
112	0.0053	0.0024	0.0029
113	0.0053	0.0024	0.0029
114	0.0053	0.0024	0.0029
115	0.0054	0.0025	0.0029
116	0.0054	0.0025	0.0029
117	0.0055	0.0025	0.0030
118	0.0055	0.0025	0.0030
119	0.0056	0.0025	0.0030
120	0.0056	0.0026	0.0030
121	0.0056	0.0026	0.0031
122	0.0057	0.0026	0.0031
123	0.0057	0.0026	0.0031
124	0.0058	0.0026	0.0031
125	0.0058	0.0027	0.0032
126	0.0059	0.0027	0.0032
127	0.0059	0.0027	0.0032
128	0.0060	0.0027	0.0032
129	0.0061	0.0028	0.0033
130	0.0061	0.0028	0.0033
131	0.0062	0.0028	0.0034
132	0.0062	0.0028	0.0034
133	0.0063	0.0029	0.0034

134	0.0063	0.0029	0.0034
135	0.0064	0.0029	0.0035
136	0.0065	0.0030	0.0035
137	0.0066	0.0030	0.0036
138	0.0066	0.0030	0.0036
139	0.0067	0.0031	0.0036
140	0.0068	0.0031	0.0037
141	0.0069	0.0031	0.0037
142	0.0069	0.0032	0.0038
143	0.0070	0.0032	0.0038
144	0.0071	0.0032	0.0038
145	0.0071	0.0033	0.0039
146	0.0072	0.0033	0.0039
147	0.0073	0.0033	0.0040
148	0.0074	0.0034	0.0040
149	0.0075	0.0034	0.0041
150	0.0076	0.0035	0.0041
151	0.0077	0.0035	0.0042
152	0.0078	0.0036	0.0042
153	0.0079	0.0036	0.0043
154	0.0080	0.0037	0.0044
155	0.0082	0.0037	0.0045
156	0.0083	0.0038	0.0045
157	0.0085	0.0039	0.0046
158	0.0086	0.0039	0.0047
159	0.0088	0.0040	0.0048
160	0.0089	0.0041	0.0048
161	0.0091	0.0042	0.0049
162	0.0092	0.0042	0.0050
163	0.0095	0.0043	0.0051
164	0.0096	0.0044	0.0052
165	0.0099	0.0045	0.0054
166	0.0100	0.0046	0.0054
167	0.0103	0.0047	0.0056
168	0.0105	0.0048	0.0057
169	0.0108	0.0050	0.0059
170	0.0110	0.0050	0.0060
171	0.0114	0.0052	0.0062
172	0.0116	0.0053	0.0063
173	0.0121	0.0055	0.0066
174	0.0124	0.0056	0.0067
175	0.0129	0.0059	0.0070
176	0.0132	0.0060	0.0072
177	0.0139	0.0063	0.0075
178	0.0142	0.0065	0.0077
179	0.0151	0.0069	0.0082
180	0.0155	0.0071	0.0084
181	0.0165	0.0076	0.0090
182	0.0171	0.0078	0.0093
183	0.0185	0.0085	0.0101

184	0.0193	0.0088	0.0105
185	0.0159	0.0073	0.0086
186	0.0170	0.0077	0.0092
187	0.0197	0.0090	0.0107
188	0.0215	0.0098	0.0117
189	0.0267	0.0122	0.0145
190	0.0307	0.0140	0.0167
191	0.0466	0.0213	0.0253
192	0.0677	0.0265	0.0412
193	0.2929	0.0265	0.2664
194	0.0367	0.0168	0.0199
195	0.0237	0.0108	0.0129
196	0.0182	0.0083	0.0099
197	0.0202	0.0092	0.0110
198	0.0178	0.0081	0.0097
199	0.0160	0.0073	0.0087
200	0.0146	0.0067	0.0079
201	0.0135	0.0062	0.0074
202	0.0126	0.0058	0.0069
203	0.0119	0.0054	0.0064
204	0.0112	0.0051	0.0061
205	0.0106	0.0049	0.0058
206	0.0102	0.0046	0.0055
207	0.0097	0.0044	0.0053
208	0.0093	0.0043	0.0051
209	0.0090	0.0041	0.0049
210	0.0087	0.0040	0.0047
211	0.0084	0.0038	0.0045
212	0.0081	0.0037	0.0044
213	0.0079	0.0036	0.0043
214	0.0076	0.0035	0.0042
215	0.0074	0.0034	0.0040
216	0.0072	0.0033	0.0039
217	0.0071	0.0033	0.0039
218	0.0070	0.0032	0.0038
219	0.0068	0.0031	0.0037
220	0.0067	0.0030	0.0036
221	0.0065	0.0030	0.0035
222	0.0064	0.0029	0.0035
223	0.0063	0.0029	0.0034
224	0.0061	0.0028	0.0033
225	0.0060	0.0028	0.0033
226	0.0059	0.0027	0.0032
227	0.0058	0.0027	0.0032
228	0.0057	0.0026	0.0031
229	0.0056	0.0026	0.0030
230	0.0055	0.0025	0.0030
231	0.0054	0.0025	0.0030
232	0.0054	0.0024	0.0029
233	0.0053	0.0024	0.0029

234	0.0052	0.0024	0.0028
235	0.0051	0.0023	0.0028
236	0.0051	0.0023	0.0027
237	0.0050	0.0023	0.0027
238	0.0049	0.0022	0.0027
239	0.0049	0.0022	0.0026
240	0.0048	0.0022	0.0026
241	0.0047	0.0022	0.0026
242	0.0047	0.0021	0.0025
243	0.0046	0.0021	0.0025
244	0.0046	0.0021	0.0025
245	0.0045	0.0021	0.0025
246	0.0045	0.0020	0.0024
247	0.0044	0.0020	0.0024
248	0.0044	0.0020	0.0024
249	0.0043	0.0020	0.0023
250	0.0043	0.0020	0.0023
251	0.0042	0.0019	0.0023
252	0.0042	0.0019	0.0023
253	0.0042	0.0019	0.0023
254	0.0041	0.0019	0.0022
255	0.0041	0.0019	0.0022
256	0.0040	0.0018	0.0022
257	0.0040	0.0018	0.0022
258	0.0040	0.0018	0.0021
259	0.0039	0.0018	0.0021
260	0.0039	0.0018	0.0021
261	0.0039	0.0018	0.0021
262	0.0038	0.0017	0.0021
263	0.0038	0.0017	0.0021
264	0.0038	0.0017	0.0020
265	0.0037	0.0017	0.0020
266	0.0037	0.0017	0.0020
267	0.0037	0.0017	0.0020
268	0.0036	0.0017	0.0020
269	0.0036	0.0016	0.0020
270	0.0036	0.0016	0.0019
271	0.0036	0.0016	0.0019
272	0.0035	0.0016	0.0019
273	0.0035	0.0016	0.0019
274	0.0035	0.0016	0.0019
275	0.0034	0.0016	0.0019
276	0.0034	0.0016	0.0019
277	0.0034	0.0016	0.0018
278	0.0034	0.0015	0.0018
279	0.0034	0.0015	0.0018
280	0.0033	0.0015	0.0018
281	0.0033	0.0015	0.0018
282	0.0033	0.0015	0.0018
283	0.0033	0.0015	0.0018

284	0.0032	0.0015	0.0018
285	0.0032	0.0015	0.0017
286	0.0032	0.0015	0.0017
287	0.0032	0.0015	0.0017
288	0.0032	0.0014	0.0017

Total soil rain loss = 0.91(In)
Total effective rainfall = 1.32(In)
Peak flow rate in flood hydrograph = 28.08(CFS)

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

Hydrograph in 5 Minute intervals ((CFS))

Time(h+m)	Volume Ac.Ft	Q(CFS)	0	7.5	15.0	22.5	30.0
0+ 5	0.0001	0.02	Q	|	|	|	|
0+10	0.0013	0.17	Q	|	|	|	|
0+15	0.0034	0.31	Q	|	|	|	|
0+20	0.0059	0.36	Q	|	|	|	|
0+25	0.0087	0.40	Q	|	|	|	|
0+30	0.0116	0.42	Q	|	|	|	|
0+35	0.0146	0.44	Q	|	|	|	|
0+40	0.0178	0.45	Q	|	|	|	|
0+45	0.0210	0.46	Q	|	|	|	|
0+50	0.0242	0.47	Q	|	|	|	|
0+55	0.0275	0.48	Q	|	|	|	|
1+ 0	0.0308	0.48	Q	|	|	|	|
1+ 5	0.0341	0.49	Q	|	|	|	|
1+10	0.0375	0.49	Q	|	|	|	|
1+15	0.0409	0.49	Q	|	|	|	|
1+20	0.0443	0.49	Q	|	|	|	|
1+25	0.0477	0.50	Q	|	|	|	|
1+30	0.0511	0.50	Q	|	|	|	|
1+35	0.0546	0.50	Q	|	|	|	|
1+40	0.0580	0.50	Q	|	|	|	|
1+45	0.0615	0.50	Q	|	|	|	|
1+50	0.0650	0.50	QV	|	|	|	|
1+55	0.0684	0.51	QV	|	|	|	|
2+ 0	0.0719	0.51	QV	|	|	|	|
2+ 5	0.0755	0.51	QV	|	|	|	|
2+10	0.0790	0.51	QV	|	|	|	|
2+15	0.0825	0.51	QV	|	|	|	|
2+20	0.0861	0.51	QV	|	|	|	|
2+25	0.0896	0.52	QV	|	|	|	|
2+30	0.0932	0.52	QV	|	|	|	|

```
2+35       0.0968      0.52  QV         |         |         |         |
2+40       0.1004      0.52  QV         |         |         |         |
2+45       0.1040      0.52  QV         |         |         |         |
2+50       0.1076      0.53  QV         |         |         |         |
2+55       0.1112      0.53  QV         |         |         |         |
3+ 0       0.1149      0.53  QV         |         |         |         |
3+ 5       0.1186      0.53  QV         |         |         |         |
3+10       0.1222      0.53  QV         |         |         |         |
3+15       0.1259      0.54  QV         |         |         |         |
3+20       0.1296      0.54  Q V        |         |         |         |
3+25       0.1334      0.54  Q V        |         |         |         |
3+30       0.1371      0.54  Q V        |         |         |         |
3+35       0.1408      0.54  Q V        |         |         |         |
3+40       0.1446      0.55  Q V        |         |         |         |
3+45       0.1484      0.55  Q V        |         |         |         |
3+50       0.1522      0.55  Q V        |         |         |         |
3+55       0.1560      0.55  Q V        |         |         |         |
4+ 0       0.1598      0.56  Q V        |         |         |         |
4+ 5       0.1636      0.56  Q V        |         |         |         |
4+10       0.1675      0.56  Q V        |         |         |         |
4+15       0.1714      0.56  Q V        |         |         |         |
4+20       0.1753      0.56  Q V        |         |         |         |
4+25       0.1792      0.57  Q V        |         |         |         |
4+30       0.1831      0.57  Q V        |         |         |         |
4+35       0.1870      0.57  Q V        |         |         |         |
4+40       0.1910      0.57  Q  V       |         |         |         |
4+45       0.1949      0.58  Q  V       |         |         |         |
4+50       0.1989      0.58  Q  V       |         |         |         |
4+55       0.2029      0.58  Q  V       |         |         |         |
5+ 0       0.2070      0.58  Q  V       |         |         |         |
5+ 5       0.2110      0.59  Q  V       |         |         |         |
5+10       0.2150      0.59  Q  V       |         |         |         |
5+15       0.2191      0.59  Q  V       |         |         |         |
5+20       0.2232      0.59  Q  V       |         |         |         |
5+25       0.2273      0.60  Q  V       |         |         |         |
5+30       0.2315      0.60  Q  V       |         |         |         |
5+35       0.2356      0.60  Q  V       |         |         |         |
5+40       0.2398      0.61  Q  V       |         |         |         |
5+45       0.2440      0.61  Q  V       |         |         |         |
5+50       0.2482      0.61  Q  V       |         |         |         |
5+55       0.2524      0.61  Q  V       |         |         |         |
6+ 0       0.2567      0.62  Q   V      |         |         |         |
6+ 5       0.2609      0.62  Q   V      |         |         |         |
6+10       0.2652      0.62  Q   V      |         |         |         |
6+15       0.2695      0.63  Q   V      |         |         |         |
6+20       0.2739      0.63  Q   V      |         |         |         |
6+25       0.2782      0.63  Q   V      |         |         |         |
6+30       0.2826      0.64  Q   V      |         |         |         |
6+35       0.2870      0.64  Q   V      |         |         |         |
6+40       0.2914      0.64  Q   V      |         |         |         |
```

```
 6+45       0.2959      0.65  Q   V      |         |         |         |
 6+50       0.3003      0.65  Q   V      |         |         |         |
 6+55       0.3048      0.65  Q   V      |         |         |         |
 7+ 0       0.3093      0.66  Q   V      |         |         |         |
 7+ 5       0.3139      0.66  Q   V      |         |         |         |
 7+10       0.3184      0.66  Q     V    |         |         |         |
 7+15       0.3230      0.67  Q     V    |         |         |         |
 7+20       0.3276      0.67  Q     V    |         |         |         |
 7+25       0.3323      0.67  Q     V    |         |         |         |
 7+30       0.3370      0.68  Q     V    |         |         |         |
 7+35       0.3416      0.68  Q     V    |         |         |         |
 7+40       0.3464      0.69  Q     V    |         |         |         |
 7+45       0.3511      0.69  Q     V    |         |         |         |
 7+50       0.3559      0.69  Q     V    |         |         |         |
 7+55       0.3607      0.70  Q     V    |         |         |         |
 8+ 0       0.3655      0.70  Q     V    |         |         |         |
 8+ 5       0.3704      0.71  Q     V    |         |         |         |
 8+10       0.3753      0.71  Q     V    |         |         |         |
 8+15       0.3802      0.71  Q      V   |         |         |         |
 8+20       0.3851      0.72  Q      V   |         |         |         |
 8+25       0.3901      0.72  Q      V   |         |         |         |
 8+30       0.3951      0.73  Q      V   |         |         |         |
 8+35       0.4002      0.73  Q      V   |         |         |         |
 8+40       0.4053      0.74  Q      V   |         |         |         |
 8+45       0.4104      0.74  Q      V   |         |         |         |
 8+50       0.4155      0.75  Q      V   |         |         |         |
 8+55       0.4207      0.75  |Q     V   |         |         |         |
 9+ 0       0.4259      0.76  |Q     V   |         |         |         |
 9+ 5       0.4312      0.76  |Q     V   |         |         |         |
 9+10       0.4365      0.77  |Q     V   |         |         |         |
 9+15       0.4418      0.77  |Q     V   |         |         |         |
 9+20       0.4471      0.78  |Q      V  |         |         |         |
 9+25       0.4525      0.78  |Q      V  |         |         |         |
 9+30       0.4580      0.79  |Q      V  |         |         |         |
 9+35       0.4635      0.80  |Q      V  |         |         |         |
 9+40       0.4690      0.80  |Q      V  |         |         |         |
 9+45       0.4745      0.81  |Q      V  |         |         |         |
 9+50       0.4801      0.81  |Q      V  |         |         |         |
 9+55       0.4858      0.82  |Q      V  |         |         |         |
10+ 0       0.4915      0.83  |Q      V  |         |         |         |
10+ 5       0.4972      0.83  |Q      V  |         |         |         |
10+10       0.5030      0.84  |Q      V  |         |         |         |
10+15       0.5088      0.85  |Q       V |         |         |         |
10+20       0.5147      0.85  |Q       V |         |         |         |
10+25       0.5206      0.86  |Q       V |         |         |         |
10+30       0.5266      0.87  |Q       V |         |         |         |
10+35       0.5327      0.88  |Q       V |         |         |         |
10+40       0.5387      0.88  |Q       V |         |         |         |
10+45       0.5449      0.89  |Q       V |         |         |         |
10+50       0.5511      0.90  |Q       V |         |         |         |
```

```
10+55       0.5573      0.91  |Q      V |         |         |         |
11+ 0       0.5636      0.92  |Q      V |         |         |         |
11+ 5       0.5700      0.92  |Q       V|         |         |         |
11+10       0.5764      0.93  |Q       V|         |         |         |
11+15       0.5829      0.94  |Q       V|         |         |         |
11+20       0.5895      0.95  |Q       V|         |         |         |
11+25       0.5961      0.96  |Q       V|         |         |         |
11+30       0.6028      0.97  |Q       V|         |         |         |
11+35       0.6096      0.98  |Q       V|         |         |         |
11+40       0.6164      0.99  |Q       V|         |         |         |
11+45       0.6233      1.00  |Q       V|         |         |         |
11+50       0.6303      1.01  |Q       V|         |         |         |
11+55       0.6374      1.03  |Q        V         |         |         |
12+ 0       0.6445      1.04  |Q        V         |         |         |
12+ 5       0.6517      1.05  |Q        V         |         |         |
12+10       0.6590      1.06  |Q        V         |         |         |
12+15       0.6664      1.07  |Q        V         |         |         |
12+20       0.6738      1.08  |Q        V         |         |         |
12+25       0.6814      1.09  |Q        V         |         |         |
12+30       0.6890      1.11  |Q        V         |         |         |
12+35       0.6967      1.12  |Q        |V        |         |         |
12+40       0.7045      1.14  |Q        |V        |         |         |
12+45       0.7125      1.15  |Q        |V        |         |         |
12+50       0.7205      1.17  |Q        |V        |         |         |
12+55       0.7287      1.19  |Q        |V        |         |         |
13+ 0       0.7370      1.20  |Q        |V        |         |         |
13+ 5       0.7454      1.22  |Q        |V        |         |         |
13+10       0.7540      1.24  |Q        |V        |         |         |
13+15       0.7627      1.26  |Q        | V       |         |         |
13+20       0.7715      1.28  |Q        | V       |         |         |
13+25       0.7805      1.31  |Q        | V       |         |         |
13+30       0.7897      1.33  |Q        | V       |         |         |
13+35       0.7990      1.35  |Q        | V       |         |         |
13+40       0.8085      1.38  |Q        | V       |         |         |
13+45       0.8182      1.41  |Q        | V       |         |         |
13+50       0.8281      1.44  |Q        |  V      |         |         |
13+55       0.8381      1.46  |Q        |  V      |         |         |
14+ 0       0.8485      1.50  |Q        |  V      |         |         |
14+ 5       0.8590      1.53  | Q       |  V      |         |         |
14+10       0.8698      1.57  | Q       |  V      |         |         |
14+15       0.8809      1.61  | Q       |  V      |         |         |
14+20       0.8922      1.65  | Q       |   V     |         |         |
14+25       0.9039      1.69  | Q       |   V     |         |         |
14+30       0.9159      1.74  | Q       |   V     |         |         |
14+35       0.9282      1.79  | Q       |   V     |         |         |
14+40       0.9409      1.85  | Q       |   V     |         |         |
14+45       0.9540      1.91  | Q       |    V    |         |         |
14+50       0.9676      1.97  | Q       |    V    |         |         |
14+55       0.9817      2.04  | Q       |    V    |         |         |
15+ 0       0.9963      2.12  | Q       |    V    |         |         |
```

```
15+ 5       1.0115      2.21  | Q       |    V    |         |         |
15+10       1.0275      2.31  |  Q      |     V   |         |         |
15+15       1.0442      2.42  |  Q      |     V   |         |         |
15+20       1.0618      2.56  |  Q      |     V   |         |         |
15+25       1.0801      2.66  |  Q      |      V  |         |         |
15+30       1.0980      2.60  |  Q      |      V  |         |         |
15+35       1.1156      2.56  |  Q      |      V  |         |         |
15+40       1.1343      2.71  |  Q      |      V  |         |         |
15+45       1.1546      2.95  |  Q      |       V |         |         |
15+50       1.1777      3.35  |   Q     |       V |         |         |
15+55       1.2049      3.94  |    Q    |        V|         |         |
16+ 0       1.2407      5.20  |     Q   |        V|         |         |
16+ 5       1.3114     10.27  |         |  Q      V         |         |
16+10       1.5048     28.08  |         |         |  V      |      Q  |
16+15       1.6816     25.66  |         |         |     V   |   Q     |
16+20       1.7748     13.54  |         |       Q |       V |         |
16+25       1.8374      9.10  |         | Q       |        V|         |
16+30       1.8859      7.04  |        Q|         |        V|         |
16+35       1.9247      5.63  |      Q  |         |         V         |
16+40       1.9573      4.73  |     Q   |         |         V         |
16+45       1.9848      4.00  |    Q    |         |         |V        |
16+50       2.0084      3.42  |   Q     |         |         |V        |
16+55       2.0283      2.89  |  Q      |         |         | V       |
17+ 0       2.0460      2.57  |  Q      |         |         | V       |
17+ 5       2.0628      2.45  |  Q      |         |         | V       |
17+10       2.0779      2.19  | Q       |         |         | V       |
17+15       2.0912      1.94  | Q       |         |         |  V      |
17+20       2.1025      1.64  | Q       |         |         |  V      |
17+25       2.1132      1.55  | Q       |         |         |  V      |
17+30       2.1234      1.48  |Q        |         |         |  V      |
17+35       2.1332      1.42  |Q        |         |         |  V      |
17+40       2.1426      1.36  |Q        |         |         |  V      |
17+45       2.1516      1.31  |Q        |         |         |  V      |
17+50       2.1604      1.27  |Q        |         |         |   V     |
17+55       2.1688      1.23  |Q        |         |         |   V     |
18+ 0       2.1770      1.19  |Q        |         |         |   V     |
18+ 5       2.1850      1.16  |Q        |         |         |   V     |
18+10       2.1927      1.13  |Q        |         |         |   V     |
18+15       2.2003      1.10  |Q        |         |         |   V     |
18+20       2.2077      1.07  |Q        |         |         |   V     |
18+25       2.2149      1.05  |Q        |         |         |   V     |
18+30       2.2220      1.03  |Q        |         |         |    V    |
18+35       2.2289      1.00  |Q        |         |         |    V    |
18+40       2.2357      0.98  |Q        |         |         |    V    |
18+45       2.2423      0.96  |Q        |         |         |    V    |
18+50       2.2488      0.94  |Q        |         |         |    V    |
18+55       2.2551      0.92  |Q        |         |         |    V    |
19+ 0       2.2614      0.91  |Q        |         |         |    V    |
19+ 5       2.2675      0.89  |Q        |         |         |    V    |
19+10       2.2735      0.88  |Q        |         |         |    V    |
```

```
19+15       2.2795      0.86  |Q        |         |         |    V    |
19+20       2.2853      0.85  |Q        |         |         |     V   |
19+25       2.2910      0.83  |Q        |         |         |     V   |
19+30       2.2967      0.82  |Q        |         |         |     V   |
19+35       2.3022      0.81  |Q        |         |         |     V   |
19+40       2.3077      0.80  |Q        |         |         |     V   |
19+45       2.3131      0.78  |Q        |         |         |     V   |
19+50       2.3184      0.77  |Q        |         |         |     V   |
19+55       2.3237      0.76  |Q        |         |         |     V   |
20+ 0       2.3288      0.75  |Q        |         |         |     V   |
20+ 5       2.3340      0.74  Q         |         |         |     V   |
20+10       2.3390      0.73  Q         |         |         |     V   |
20+15       2.3440      0.72  Q         |         |         |      V  |
20+20       2.3489      0.71  Q         |         |         |      V  |
20+25       2.3537      0.71  Q         |         |         |      V  |
20+30       2.3585      0.70  Q         |         |         |      V  |
20+35       2.3633      0.69  Q         |         |         |      V  |
20+40       2.3680      0.68  Q         |         |         |      V  |
20+45       2.3726      0.67  Q         |         |         |      V  |
20+50       2.3772      0.67  Q         |         |         |      V  |
20+55       2.3817      0.66  Q         |         |         |      V  |
21+ 0       2.3862      0.65  Q         |         |         |      V  |
21+ 5       2.3907      0.64  Q         |         |         |      V  |
21+10       2.3951      0.64  Q         |         |         |      V  |
21+15       2.3994      0.63  Q         |         |         |      V  |
21+20       2.4037      0.63  Q         |         |         |      V  |
21+25       2.4080      0.62  Q         |         |         |       V |
21+30       2.4122      0.61  Q         |         |         |       V |
21+35       2.4164      0.61  Q         |         |         |       V |
21+40       2.4205      0.60  Q         |         |         |       V |
21+45       2.4246      0.60  Q         |         |         |       V |
21+50       2.4287      0.59  Q         |         |         |       V |
21+55       2.4328      0.59  Q         |         |         |       V |
22+ 0       2.4368      0.58  Q         |         |         |       V |
22+ 5       2.4407      0.58  Q         |         |         |       V |
22+10       2.4447      0.57  Q         |         |         |       V |
22+15       2.4486      0.57  Q         |         |         |       V |
22+20       2.4524      0.56  Q         |         |         |       V |
22+25       2.4563      0.56  Q         |         |         |       V |
22+30       2.4601      0.55  Q         |         |         |       V |
22+35       2.4638      0.55  Q         |         |         |       V |
22+40       2.4676      0.54  Q         |         |         |       V |
22+45       2.4713      0.54  Q         |         |         |        V|
22+50       2.4750      0.54  Q         |         |         |        V|
22+55       2.4787      0.53  Q         |         |         |        V|
23+ 0       2.4823      0.53  Q         |         |         |        V|
23+ 5       2.4859      0.52  Q         |         |         |        V|
23+10       2.4895      0.52  Q         |         |         |        V|
23+15       2.4930      0.52  Q         |         |         |        V|
23+20       2.4966      0.51  Q         |         |         |        V|
```

```
   23+25        2.5001       0.51  Q          |          |          |        V|
   23+30        2.5036       0.51  Q          |          |          |        V|
   23+35        2.5070       0.50  Q          |          |          |        V|
   23+40        2.5104       0.50  Q          |          |          |        V|
   23+45        2.5139       0.50  Q          |          |          |        V|
   23+50        2.5172       0.49  Q          |          |          |        V|
   23+55        2.5206       0.49  Q          |          |          |        V|
   24+ 0        2.5240       0.49  Q          |          |          |        V|
-----------------------------------------------------------------------
```

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

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

                Study date  08/03/21

++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
------------------------------------------------------------------------

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


Program License Serial Number 6385

---------------------------------------------------------------------
Space Center
undeveloped 10-year
Area C

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

        Storm Event Year = 10

        Antecedent Moisture Condition = 2

 English (in-lb) Input Units Used

 English Rainfall Data (Inches) Input Values Used

 English Units used in output format



Area averaged rainfall intensity isohyetal data:
        Sub-Area        Duration        Isohyetal
        (Ac.)            (hours)         (In)
Rainfall data for year 10
             7.62            1           0.62
--------------------------------------------------------------------
Rainfall data for year 10
             7.62            6           1.27
--------------------------------------------------------------------
Rainfall data for year 10
             7.62           24           2.23
--------------------------------------------------------------------
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
```

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


SCS curve  SCS curve     Area     Area     Fp(Fig C6)    Ap      Fm
No.(AMCII) NO.(AMC 2)    (Ac.)    Fraction    (In/Hr)  (dec.)   (In/Hr)
 75.0      75.0          7.62      1.000     0.453    1.000    0.453

Area-averaged adjusted loss rate Fm (In/Hr) =  0.453

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

Area       Area          SCS CN    SCS CN      S     Pervious
 (Ac.)      Fract         (AMC2)    (AMC2)           Yield Fr
     7.62   1.000         75.0      75.0       3.33     0.224

Area-averaged catchment yield fraction, Y =  0.224
Area-averaged low loss fraction, Yb =  0.776
User entry of time of concentration  =   0.233 (hours)
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Watershed area =       7.62(Ac.)
Catchment Lag time =   0.186 hours
Unit interval =   5.000 minutes
Unit interval percentage of lag time = 44.7067
Hydrograph baseflow =     0.00(CFS)
Average maximum watershed loss rate(Fm) =  0.453(In/Hr)
Average low loss rate fraction (Yb) = 0.776 (decimal)
DESERT S-Graph Selected
Computed peak 5-minute rainfall =  0.293(In)
Computed peak 30-minute rainfall =  0.502(In)
Specified peak 1-hour rainfall =  0.618(In)
Computed peak 3-hour rainfall =  0.961(In)
Specified peak 6-hour rainfall =  1.270(In)
Specified peak 24-hour rainfall =  2.230(In)


Rainfall depth area reduction factors:
Using a total area of       7.62(Ac.) (Ref: fig. E-4)

5-minute factor = 1.000     Adjusted rainfall =  0.293(In)
30-minute factor = 1.000    Adjusted rainfall =  0.502(In)
1-hour factor = 1.000       Adjusted rainfall =  0.618(In)
3-hour factor = 1.000       Adjusted rainfall =  0.961(In)
6-hour factor = 1.000       Adjusted rainfall =  1.270(In)
24-hour factor = 1.000      Adjusted rainfall =  2.230(In)
---------------------------------------------------------------------

                        U n i t  H y d r o g r a p h
+++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Interval          'S' Graph          Unit Hydrograph
```

Number	Mean values	((CFS))
	(K = 92.15 (CFS))	
1	3.294	3.035
2	24.225	19.289
3	55.190	28.536
4	69.857	13.516
5	78.269	7.752
6	83.811	5.107
7	87.902	3.770
8	90.765	2.639
9	93.006	2.065
10	94.740	1.598
11	96.104	1.257
12	97.148	0.962
13	97.872	0.667
14	98.350	0.441
15	98.879	0.487
16	99.400	0.481
17	99.735	0.309
18	100.000	0.244

Peak Unit Number	Adjusted mass rainfall (In)	Unit rainfall (In)
1	0.2931	0.2931
2	0.3609	0.0678
3	0.4076	0.0467
4	0.4443	0.0367
5	0.4751	0.0308
6	0.5018	0.0267
7	0.5255	0.0238
8	0.5470	0.0215
9	0.5667	0.0197
10	0.5849	0.0182
11	0.6019	0.0170
12	0.6178	0.0159
13	0.6380	0.0202
14	0.6573	0.0193
15	0.6758	0.0185
16	0.6936	0.0178
17	0.7107	0.0171
18	0.7272	0.0165
19	0.7432	0.0160
20	0.7587	0.0155
21	0.7738	0.0150
22	0.7884	0.0146
23	0.8026	0.0142
24	0.8165	0.0139
25	0.8300	0.0135

26	0.8432	0.0132
27	0.8561	0.0129
28	0.8687	0.0126
29	0.8810	0.0123
30	0.8931	0.0121
31	0.9050	0.0119
32	0.9166	0.0116
33	0.9280	0.0114
34	0.9393	0.0112
35	0.9503	0.0110
36	0.9611	0.0108
37	0.9717	0.0106
38	0.9822	0.0105
39	0.9925	0.0103
40	1.0027	0.0102
41	1.0127	0.0100
42	1.0226	0.0099
43	1.0323	0.0097
44	1.0419	0.0096
45	1.0513	0.0095
46	1.0606	0.0093
47	1.0699	0.0092
48	1.0789	0.0091
49	1.0879	0.0090
50	1.0968	0.0089
51	1.1056	0.0088
52	1.1142	0.0087
53	1.1228	0.0086
54	1.1313	0.0085
55	1.1396	0.0084
56	1.1479	0.0083
57	1.1561	0.0082
58	1.1642	0.0081
59	1.1723	0.0080
60	1.1802	0.0079
61	1.1881	0.0079
62	1.1959	0.0078
63	1.2036	0.0077
64	1.2112	0.0076
65	1.2188	0.0076
66	1.2263	0.0075
67	1.2337	0.0074
68	1.2411	0.0074
69	1.2484	0.0073
70	1.2557	0.0072
71	1.2628	0.0072
72	1.2700	0.0071
73	1.2771	0.0071
74	1.2842	0.0071
75	1.2912	0.0070

76	1.2982	0.0070
77	1.3051	0.0069
78	1.3119	0.0069
79	1.3187	0.0068
80	1.3255	0.0068
81	1.3322	0.0067
82	1.3388	0.0067
83	1.3455	0.0066
84	1.3520	0.0066
85	1.3585	0.0065
86	1.3650	0.0065
87	1.3714	0.0064
88	1.3778	0.0064
89	1.3841	0.0063
90	1.3904	0.0063
91	1.3967	0.0063
92	1.4029	0.0062
93	1.4091	0.0062
94	1.4152	0.0061
95	1.4213	0.0061
96	1.4274	0.0061
97	1.4334	0.0060
98	1.4394	0.0060
99	1.4453	0.0059
100	1.4512	0.0059
101	1.4571	0.0059
102	1.4629	0.0058
103	1.4687	0.0058
104	1.4745	0.0058
105	1.4803	0.0057
106	1.4860	0.0057
107	1.4916	0.0057
108	1.4973	0.0056
109	1.5029	0.0056
110	1.5085	0.0056
111	1.5140	0.0056
112	1.5196	0.0055
113	1.5251	0.0055
114	1.5305	0.0055
115	1.5360	0.0054
116	1.5414	0.0054
117	1.5468	0.0054
118	1.5521	0.0054
119	1.5575	0.0053
120	1.5628	0.0053
121	1.5680	0.0053
122	1.5733	0.0052
123	1.5785	0.0052
124	1.5837	0.0052
125	1.5889	0.0052

126	1.5940	0.0051
127	1.5992	0.0051
128	1.6043	0.0051
129	1.6093	0.0051
130	1.6144	0.0051
131	1.6194	0.0050
132	1.6244	0.0050
133	1.6294	0.0050
134	1.6344	0.0050
135	1.6393	0.0049
136	1.6442	0.0049
137	1.6491	0.0049
138	1.6540	0.0049
139	1.6589	0.0049
140	1.6637	0.0048
141	1.6685	0.0048
142	1.6733	0.0048
143	1.6781	0.0048
144	1.6829	0.0048
145	1.6876	0.0047
146	1.6923	0.0047
147	1.6970	0.0047
148	1.7017	0.0047
149	1.7063	0.0047
150	1.7110	0.0046
151	1.7156	0.0046
152	1.7202	0.0046
153	1.7248	0.0046
154	1.7294	0.0046
155	1.7339	0.0046
156	1.7385	0.0045
157	1.7430	0.0045
158	1.7475	0.0045
159	1.7520	0.0045
160	1.7564	0.0045
161	1.7609	0.0044
162	1.7653	0.0044
163	1.7697	0.0044
164	1.7741	0.0044
165	1.7785	0.0044
166	1.7829	0.0044
167	1.7872	0.0044
168	1.7916	0.0043
169	1.7959	0.0043
170	1.8002	0.0043
171	1.8045	0.0043
172	1.8088	0.0043
173	1.8130	0.0043
174	1.8173	0.0042
175	1.8215	0.0042

176	1.8257	0.0042
177	1.8300	0.0042
178	1.8341	0.0042
179	1.8383	0.0042
180	1.8425	0.0042
181	1.8466	0.0042
182	1.8508	0.0041
183	1.8549	0.0041
184	1.8590	0.0041
185	1.8631	0.0041
186	1.8672	0.0041
187	1.8713	0.0041
188	1.8753	0.0041
189	1.8794	0.0040
190	1.8834	0.0040
191	1.8874	0.0040
192	1.8914	0.0040
193	1.8954	0.0040
194	1.8994	0.0040
195	1.9034	0.0040
196	1.9073	0.0040
197	1.9113	0.0039
198	1.9152	0.0039
199	1.9191	0.0039
200	1.9230	0.0039
201	1.9269	0.0039
202	1.9308	0.0039
203	1.9347	0.0039
204	1.9386	0.0039
205	1.9424	0.0039
206	1.9463	0.0038
207	1.9501	0.0038
208	1.9539	0.0038
209	1.9577	0.0038
210	1.9615	0.0038
211	1.9653	0.0038
212	1.9691	0.0038
213	1.9728	0.0038
214	1.9766	0.0038
215	1.9804	0.0037
216	1.9841	0.0037
217	1.9878	0.0037
218	1.9915	0.0037
219	1.9952	0.0037
220	1.9989	0.0037
221	2.0026	0.0037
222	2.0063	0.0037
223	2.0100	0.0037
224	2.0136	0.0037
225	2.0173	0.0036

226	2.0209	0.0036
227	2.0245	0.0036
228	2.0281	0.0036
229	2.0317	0.0036
230	2.0353	0.0036
231	2.0389	0.0036
232	2.0425	0.0036
233	2.0461	0.0036
234	2.0496	0.0036
235	2.0532	0.0036
236	2.0567	0.0035
237	2.0603	0.0035
238	2.0638	0.0035
239	2.0673	0.0035
240	2.0708	0.0035
241	2.0743	0.0035
242	2.0778	0.0035
243	2.0813	0.0035
244	2.0848	0.0035
245	2.0882	0.0035
246	2.0917	0.0035
247	2.0951	0.0034
248	2.0986	0.0034
249	2.1020	0.0034
250	2.1054	0.0034
251	2.1089	0.0034
252	2.1123	0.0034
253	2.1157	0.0034
254	2.1191	0.0034
255	2.1224	0.0034
256	2.1258	0.0034
257	2.1292	0.0034
258	2.1326	0.0034
259	2.1359	0.0034
260	2.1392	0.0033
261	2.1426	0.0033
262	2.1459	0.0033
263	2.1492	0.0033
264	2.1526	0.0033
265	2.1559	0.0033
266	2.1592	0.0033
267	2.1625	0.0033
268	2.1657	0.0033
269	2.1690	0.0033
270	2.1723	0.0033
271	2.1756	0.0033
272	2.1788	0.0033
273	2.1821	0.0032
274	2.1853	0.0032
275	2.1885	0.0032

276	2.1918	0.0032
277	2.1950	0.0032
278	2.1982	0.0032
279	2.2014	0.0032
280	2.2046	0.0032
281	2.2078	0.0032
282	2.2110	0.0032
283	2.2142	0.0032
284	2.2173	0.0032
285	2.2205	0.0032
286	2.2237	0.0032
287	2.2268	0.0032
288	2.2300	0.0031

Unit Period (number)	Unit Rainfall (In)	Unit Soil-Loss (In)	Effective Rainfall (In)
1	0.0031	0.0024	0.0007
2	0.0032	0.0024	0.0007
3	0.0032	0.0025	0.0007
4	0.0032	0.0025	0.0007
5	0.0032	0.0025	0.0007
6	0.0032	0.0025	0.0007
7	0.0032	0.0025	0.0007
8	0.0032	0.0025	0.0007
9	0.0032	0.0025	0.0007
10	0.0032	0.0025	0.0007
11	0.0032	0.0025	0.0007
12	0.0033	0.0025	0.0007
13	0.0033	0.0025	0.0007
14	0.0033	0.0025	0.0007
15	0.0033	0.0026	0.0007
16	0.0033	0.0026	0.0007
17	0.0033	0.0026	0.0007
18	0.0033	0.0026	0.0007
19	0.0033	0.0026	0.0007
20	0.0033	0.0026	0.0007
21	0.0034	0.0026	0.0008
22	0.0034	0.0026	0.0008
23	0.0034	0.0026	0.0008
24	0.0034	0.0026	0.0008
25	0.0034	0.0026	0.0008
26	0.0034	0.0027	0.0008
27	0.0034	0.0027	0.0008
28	0.0034	0.0027	0.0008
29	0.0035	0.0027	0.0008
30	0.0035	0.0027	0.0008
31	0.0035	0.0027	0.0008
32	0.0035	0.0027	0.0008

33	0.0035	0.0027	0.0008
34	0.0035	0.0027	0.0008
35	0.0035	0.0027	0.0008
36	0.0035	0.0028	0.0008
37	0.0036	0.0028	0.0008
38	0.0036	0.0028	0.0008
39	0.0036	0.0028	0.0008
40	0.0036	0.0028	0.0008
41	0.0036	0.0028	0.0008
42	0.0036	0.0028	0.0008
43	0.0036	0.0028	0.0008
44	0.0037	0.0028	0.0008
45	0.0037	0.0029	0.0008
46	0.0037	0.0029	0.0008
47	0.0037	0.0029	0.0008
48	0.0037	0.0029	0.0008
49	0.0037	0.0029	0.0008
50	0.0037	0.0029	0.0008
51	0.0038	0.0029	0.0008
52	0.0038	0.0029	0.0008
53	0.0038	0.0029	0.0009
54	0.0038	0.0030	0.0009
55	0.0038	0.0030	0.0009
56	0.0038	0.0030	0.0009
57	0.0039	0.0030	0.0009
58	0.0039	0.0030	0.0009
59	0.0039	0.0030	0.0009
60	0.0039	0.0030	0.0009
61	0.0039	0.0031	0.0009
62	0.0039	0.0031	0.0009
63	0.0040	0.0031	0.0009
64	0.0040	0.0031	0.0009
65	0.0040	0.0031	0.0009
66	0.0040	0.0031	0.0009
67	0.0040	0.0031	0.0009
68	0.0041	0.0031	0.0009
69	0.0041	0.0032	0.0009
70	0.0041	0.0032	0.0009
71	0.0041	0.0032	0.0009
72	0.0041	0.0032	0.0009
73	0.0042	0.0032	0.0009
74	0.0042	0.0032	0.0009
75	0.0042	0.0033	0.0009
76	0.0042	0.0033	0.0009
77	0.0042	0.0033	0.0010
78	0.0043	0.0033	0.0010
79	0.0043	0.0033	0.0010
80	0.0043	0.0033	0.0010
81	0.0043	0.0034	0.0010
82	0.0044	0.0034	0.0010

83	0.0044	0.0034	0.0010
84	0.0044	0.0034	0.0010
85	0.0044	0.0034	0.0010
86	0.0044	0.0035	0.0010
87	0.0045	0.0035	0.0010
88	0.0045	0.0035	0.0010
89	0.0045	0.0035	0.0010
90	0.0046	0.0035	0.0010
91	0.0046	0.0036	0.0010
92	0.0046	0.0036	0.0010
93	0.0046	0.0036	0.0010
94	0.0047	0.0036	0.0010
95	0.0047	0.0036	0.0011
96	0.0047	0.0037	0.0011
97	0.0048	0.0037	0.0011
98	0.0048	0.0037	0.0011
99	0.0048	0.0037	0.0011
100	0.0048	0.0038	0.0011
101	0.0049	0.0038	0.0011
102	0.0049	0.0038	0.0011
103	0.0049	0.0038	0.0011
104	0.0050	0.0039	0.0011
105	0.0050	0.0039	0.0011
106	0.0050	0.0039	0.0011
107	0.0051	0.0039	0.0011
108	0.0051	0.0040	0.0011
109	0.0051	0.0040	0.0012
110	0.0052	0.0040	0.0012
111	0.0052	0.0041	0.0012
112	0.0052	0.0041	0.0012
113	0.0053	0.0041	0.0012
114	0.0053	0.0041	0.0012
115	0.0054	0.0042	0.0012
116	0.0054	0.0042	0.0012
117	0.0055	0.0042	0.0012
118	0.0055	0.0043	0.0012
119	0.0056	0.0043	0.0012
120	0.0056	0.0043	0.0012
121	0.0056	0.0044	0.0013
122	0.0057	0.0044	0.0013
123	0.0057	0.0045	0.0013
124	0.0058	0.0045	0.0013
125	0.0058	0.0045	0.0013
126	0.0059	0.0046	0.0013
127	0.0059	0.0046	0.0013
128	0.0060	0.0046	0.0013
129	0.0061	0.0047	0.0014
130	0.0061	0.0047	0.0014
131	0.0062	0.0048	0.0014
132	0.0062	0.0048	0.0014

133	0.0063	0.0049	0.0014
134	0.0063	0.0049	0.0014
135	0.0064	0.0050	0.0014
136	0.0065	0.0050	0.0014
137	0.0066	0.0051	0.0015
138	0.0066	0.0051	0.0015
139	0.0067	0.0052	0.0015
140	0.0068	0.0052	0.0015
141	0.0069	0.0053	0.0015
142	0.0069	0.0054	0.0015
143	0.0070	0.0054	0.0016
144	0.0071	0.0055	0.0016
145	0.0071	0.0055	0.0016
146	0.0072	0.0056	0.0016
147	0.0073	0.0057	0.0016
148	0.0074	0.0057	0.0016
149	0.0075	0.0058	0.0017
150	0.0076	0.0059	0.0017
151	0.0077	0.0060	0.0017
152	0.0078	0.0060	0.0017
153	0.0079	0.0062	0.0018
154	0.0080	0.0062	0.0018
155	0.0082	0.0064	0.0018
156	0.0083	0.0064	0.0019
157	0.0085	0.0066	0.0019
158	0.0086	0.0066	0.0019
159	0.0088	0.0068	0.0020
160	0.0089	0.0069	0.0020
161	0.0091	0.0071	0.0020
162	0.0092	0.0071	0.0021
163	0.0095	0.0073	0.0021
164	0.0096	0.0074	0.0021
165	0.0099	0.0077	0.0022
166	0.0100	0.0078	0.0022
167	0.0103	0.0080	0.0023
168	0.0105	0.0081	0.0023
169	0.0108	0.0084	0.0024
170	0.0110	0.0086	0.0025
171	0.0114	0.0089	0.0026
172	0.0116	0.0090	0.0026
173	0.0121	0.0094	0.0027
174	0.0123	0.0096	0.0028
175	0.0129	0.0100	0.0029
176	0.0132	0.0102	0.0030
177	0.0139	0.0108	0.0031
178	0.0142	0.0110	0.0032
179	0.0150	0.0117	0.0034
180	0.0155	0.0120	0.0035
181	0.0165	0.0128	0.0037
182	0.0171	0.0133	0.0038

183	0.0185	0.0144	0.0041
184	0.0193	0.0150	0.0043
185	0.0159	0.0124	0.0036
186	0.0170	0.0132	0.0038
187	0.0197	0.0153	0.0044
188	0.0215	0.0167	0.0048
189	0.0267	0.0207	0.0060
190	0.0308	0.0239	0.0069
191	0.0467	0.0362	0.0104
192	0.0678	0.0377	0.0300
193	0.2931	0.0377	0.2554
194	0.0367	0.0285	0.0082
195	0.0238	0.0184	0.0053
196	0.0182	0.0141	0.0041
197	0.0202	0.0157	0.0045
198	0.0178	0.0138	0.0040
199	0.0160	0.0124	0.0036
200	0.0146	0.0113	0.0033
201	0.0135	0.0105	0.0030
202	0.0126	0.0098	0.0028
203	0.0119	0.0092	0.0027
204	0.0112	0.0087	0.0025
205	0.0106	0.0083	0.0024
206	0.0102	0.0079	0.0023
207	0.0097	0.0075	0.0022
208	0.0093	0.0072	0.0021
209	0.0090	0.0070	0.0020
210	0.0087	0.0067	0.0019
211	0.0084	0.0065	0.0019
212	0.0081	0.0063	0.0018
213	0.0079	0.0061	0.0018
214	0.0076	0.0059	0.0017
215	0.0074	0.0058	0.0017
216	0.0072	0.0056	0.0016
217	0.0071	0.0055	0.0016
218	0.0070	0.0054	0.0016
219	0.0068	0.0053	0.0015
220	0.0067	0.0052	0.0015
221	0.0065	0.0051	0.0015
222	0.0064	0.0050	0.0014
223	0.0063	0.0049	0.0014
224	0.0061	0.0048	0.0014
225	0.0060	0.0047	0.0013
226	0.0059	0.0046	0.0013
227	0.0058	0.0045	0.0013
228	0.0057	0.0044	0.0013
229	0.0056	0.0044	0.0013
230	0.0055	0.0043	0.0012
231	0.0054	0.0042	0.0012
232	0.0054	0.0042	0.0012

233	0.0053	0.0041	0.0012
234	0.0052	0.0040	0.0012
235	0.0051	0.0040	0.0011
236	0.0051	0.0039	0.0011
237	0.0050	0.0039	0.0011
238	0.0049	0.0038	0.0011
239	0.0049	0.0038	0.0011
240	0.0048	0.0037	0.0011
241	0.0047	0.0037	0.0011
242	0.0047	0.0036	0.0010
243	0.0046	0.0036	0.0010
244	0.0046	0.0035	0.0010
245	0.0045	0.0035	0.0010
246	0.0045	0.0035	0.0010
247	0.0044	0.0034	0.0010
248	0.0044	0.0034	0.0010
249	0.0043	0.0034	0.0010
250	0.0043	0.0033	0.0010
251	0.0042	0.0033	0.0009
252	0.0042	0.0033	0.0009
253	0.0042	0.0032	0.0009
254	0.0041	0.0032	0.0009
255	0.0041	0.0032	0.0009
256	0.0040	0.0031	0.0009
257	0.0040	0.0031	0.0009
258	0.0040	0.0031	0.0009
259	0.0039	0.0030	0.0009
260	0.0039	0.0030	0.0009
261	0.0039	0.0030	0.0009
262	0.0038	0.0030	0.0009
263	0.0038	0.0029	0.0008
264	0.0038	0.0029	0.0008
265	0.0037	0.0029	0.0008
266	0.0037	0.0029	0.0008
267	0.0037	0.0028	0.0008
268	0.0036	0.0028	0.0008
269	0.0036	0.0028	0.0008
270	0.0036	0.0028	0.0008
271	0.0036	0.0028	0.0008
272	0.0035	0.0027	0.0008
273	0.0035	0.0027	0.0008
274	0.0035	0.0027	0.0008
275	0.0034	0.0027	0.0008
276	0.0034	0.0027	0.0008
277	0.0034	0.0026	0.0008
278	0.0034	0.0026	0.0008
279	0.0034	0.0026	0.0008
280	0.0033	0.0026	0.0007
281	0.0033	0.0026	0.0007
282	0.0033	0.0026	0.0007

```
283               0.0033           0.0025               0.0007
284               0.0032           0.0025               0.0007
285               0.0032           0.0025               0.0007
286               0.0032           0.0025               0.0007
287               0.0032           0.0025               0.0007
288               0.0032           0.0025               0.0007
--------------------------------------------------------------------
--------------------------------------------------------------------
Total soil rain loss =      1.53(In)
Total effective rainfall =      0.70(In)
Peak flow rate in flood hydrograph =      8.05(CFS)
---------------------------------------------------------------------
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
                    24 - H O U R    S T O R M
               R u n o f f     H y d r o g r a p h
--------------------------------------------------------------------
            Hydrograph in   5   Minute intervals ((CFS))

--------------------------------------------------------------------
Time(h+m) Volume Ac.Ft   Q(CFS)  0        2.5       5.0       7.5      10.0
-----------------------------------------------------------------------
  0+ 5       0.0000      0.00  Q         |         |         |         |
  0+10       0.0001      0.02  Q         |         |         |         |
  0+15       0.0004      0.04  Q         |         |         |         |
  0+20       0.0007      0.05  Q         |         |         |         |
  0+25       0.0010      0.05  Q         |         |         |         |
  0+30       0.0014      0.05  Q         |         |         |         |
  0+35       0.0018      0.06  Q         |         |         |         |
  0+40       0.0022      0.06  Q         |         |         |         |
  0+45       0.0026      0.06  Q         |         |         |         |
  0+50       0.0031      0.06  Q         |         |         |         |
  0+55       0.0035      0.06  Q         |         |         |         |
  1+ 0       0.0040      0.06  Q         |         |         |         |
  1+ 5       0.0044      0.07  Q         |         |         |         |
  1+10       0.0049      0.07  Q         |         |         |         |
  1+15       0.0053      0.07  Q         |         |         |         |
  1+20       0.0058      0.07  Q         |         |         |         |
  1+25       0.0062      0.07  Q         |         |         |         |
  1+30       0.0067      0.07  Q         |         |         |         |
  1+35       0.0072      0.07  Q         |         |         |         |
  1+40       0.0077      0.07  Q         |         |         |         |
  1+45       0.0081      0.07  Q         |         |         |         |
  1+50       0.0086      0.07  Q         |         |         |         |
  1+55       0.0091      0.07  Q         |         |         |         |
  2+ 0       0.0096      0.07  Q         |         |         |         |
  2+ 5       0.0100      0.07  Q         |         |         |         |
  2+10       0.0105      0.07  Q         |         |         |         |
  2+15       0.0110      0.07  Q         |         |         |         |
  2+20       0.0115      0.07  QV        |         |         |         |
  2+25       0.0120      0.07  QV        |         |         |         |
```

```
 2+30        0.0124       0.07  QV         |          |          |          |
 2+35        0.0129       0.07  QV         |          |          |          |
 2+40        0.0134       0.07  QV         |          |          |          |
 2+45        0.0139       0.07  QV         |          |          |          |
 2+50        0.0144       0.07  QV         |          |          |          |
 2+55        0.0149       0.07  QV         |          |          |          |
 3+ 0        0.0154       0.07  QV         |          |          |          |
 3+ 5        0.0159       0.07  QV         |          |          |          |
 3+10        0.0164       0.07  QV         |          |          |          |
 3+15        0.0169       0.07  QV         |          |          |          |
 3+20        0.0174       0.07  QV         |          |          |          |
 3+25        0.0179       0.07  QV         |          |          |          |
 3+30        0.0184       0.07  QV         |          |          |          |
 3+35        0.0189       0.07  QV         |          |          |          |
 3+40        0.0195       0.07  QV         |          |          |          |
 3+45        0.0200       0.07  QV         |          |          |          |
 3+50        0.0205       0.08  QV         |          |          |          |
 3+55        0.0210       0.08  QV         |          |          |          |
 4+ 0        0.0215       0.08  QV         |          |          |          |
 4+ 5        0.0220       0.08  QV         |          |          |          |
 4+10        0.0226       0.08  Q V        |          |          |          |
 4+15        0.0231       0.08  Q V        |          |          |          |
 4+20        0.0236       0.08  Q V        |          |          |          |
 4+25        0.0242       0.08  Q V        |          |          |          |
 4+30        0.0247       0.08  Q V        |          |          |          |
 4+35        0.0252       0.08  Q V        |          |          |          |
 4+40        0.0258       0.08  Q V        |          |          |          |
 4+45        0.0263       0.08  Q V        |          |          |          |
 4+50        0.0269       0.08  Q V        |          |          |          |
 4+55        0.0274       0.08  Q V        |          |          |          |
 5+ 0        0.0279       0.08  Q V        |          |          |          |
 5+ 5        0.0285       0.08  Q V        |          |          |          |
 5+10        0.0291       0.08  Q V        |          |          |          |
 5+15        0.0296       0.08  Q V        |          |          |          |
 5+20        0.0302       0.08  Q V        |          |          |          |
 5+25        0.0307       0.08  Q V        |          |          |          |
 5+30        0.0313       0.08  Q V        |          |          |          |
 5+35        0.0319       0.08  Q V        |          |          |          |
 5+40        0.0324       0.08  Q V        |          |          |          |
 5+45        0.0330       0.08  Q V        |          |          |          |
 5+50        0.0336       0.08  Q  V       |          |          |          |
 5+55        0.0341       0.08  Q  V       |          |          |          |
 6+ 0        0.0347       0.08  Q  V       |          |          |          |
 6+ 5        0.0353       0.08  Q  V       |          |          |          |
 6+10        0.0359       0.08  Q  V       |          |          |          |
 6+15        0.0365       0.09  Q  V       |          |          |          |
 6+20        0.0371       0.09  Q  V       |          |          |          |
 6+25        0.0377       0.09  Q  V       |          |          |          |
 6+30        0.0383       0.09  Q  V       |          |          |          |
 6+35        0.0389       0.09  Q  V       |          |          |          |
```

6+40	0.0395	0.09	Q	V
6+45	0.0401	0.09	Q	V
6+50	0.0407	0.09	Q	V
6+55	0.0413	0.09	Q	V
7+ 0	0.0419	0.09	Q	V
7+ 5	0.0425	0.09	Q	V
7+10	0.0431	0.09	Q	V
7+15	0.0438	0.09	Q	V
7+20	0.0444	0.09	Q	V
7+25	0.0450	0.09	Q	V
7+30	0.0457	0.09	Q	V
7+35	0.0463	0.09	Q	V
7+40	0.0469	0.09	Q	V
7+45	0.0476	0.09	Q	V
7+50	0.0482	0.09	Q	V
7+55	0.0489	0.09	Q	V
8+ 0	0.0495	0.10	Q	V
8+ 5	0.0502	0.10	Q	V
8+10	0.0509	0.10	Q	V
8+15	0.0515	0.10	Q	V
8+20	0.0522	0.10	Q	V
8+25	0.0529	0.10	Q	V
8+30	0.0536	0.10	Q	V
8+35	0.0543	0.10	Q	V
8+40	0.0550	0.10	Q	V
8+45	0.0557	0.10	Q	V
8+50	0.0564	0.10	Q	V
8+55	0.0571	0.10	Q	V
9+ 0	0.0578	0.10	Q	V
9+ 5	0.0585	0.10	Q	V
9+10	0.0592	0.10	Q	V
9+15	0.0599	0.11	Q	V
9+20	0.0607	0.11	Q	V
9+25	0.0614	0.11	Q	V
9+30	0.0621	0.11	Q	V
9+35	0.0629	0.11	Q	V
9+40	0.0636	0.11	Q	V
9+45	0.0644	0.11	Q	V
9+50	0.0651	0.11	Q	V
9+55	0.0659	0.11	Q	V
10+ 0	0.0667	0.11	Q	V
10+ 5	0.0675	0.11	Q	V
10+10	0.0683	0.11	Q	V
10+15	0.0690	0.12	Q	V
10+20	0.0698	0.12	Q	V
10+25	0.0707	0.12	Q	V
10+30	0.0715	0.12	Q	V
10+35	0.0723	0.12	Q	V
10+40	0.0731	0.12	Q	V
10+45	0.0739	0.12	Q	V

```
10+50       0.0748      0.12  Q     V   |         |         |         |
10+55       0.0756      0.12  Q     V   |         |         |         |
11+ 0       0.0765      0.12  Q     V   |         |         |         |
11+ 5       0.0774      0.13  Q     V   |         |         |         |
11+10       0.0782      0.13  Q      V  |         |         |         |
11+15       0.0791      0.13  Q      V  |         |         |         |
11+20       0.0800      0.13  Q      V  |         |         |         |
11+25       0.0809      0.13  Q      V  |         |         |         |
11+30       0.0818      0.13  Q      V  |         |         |         |
11+35       0.0827      0.13  Q      V  |         |         |         |
11+40       0.0837      0.13  Q      V  |         |         |         |
11+45       0.0846      0.14  Q      V  |         |         |         |
11+50       0.0855      0.14  Q      V  |         |         |         |
11+55       0.0865      0.14  Q      V  |         |         |         |
12+ 0       0.0875      0.14  Q      V  |         |         |         |
12+ 5       0.0885      0.14  Q      V  |         |         |         |
12+10       0.0894      0.14  Q       V |         |         |         |
12+15       0.0904      0.15  Q       V |         |         |         |
12+20       0.0915      0.15  Q       V |         |         |         |
12+25       0.0925      0.15  Q       V |         |         |         |
12+30       0.0935      0.15  Q       V |         |         |         |
12+35       0.0946      0.15  Q       V |         |         |         |
12+40       0.0956      0.15  Q       V |         |         |         |
12+45       0.0967      0.16  Q       V |         |         |         |
12+50       0.0978      0.16  Q       V |         |         |         |
12+55       0.0989      0.16  Q       V |         |         |         |
13+ 0       0.1000      0.16  Q       V |         |         |         |
13+ 5       0.1012      0.17  Q        V|         |         |         |
13+10       0.1023      0.17  Q        V|         |         |         |
13+15       0.1035      0.17  Q        V|         |         |         |
13+20       0.1047      0.17  Q        V|         |         |         |
13+25       0.1059      0.18  Q        V|         |         |         |
13+30       0.1072      0.18  Q        V|         |         |         |
13+35       0.1084      0.18  Q        V|         |         |         |
13+40       0.1097      0.19  Q        V|         |         |         |
13+45       0.1110      0.19  Q        V|         |         |         |
13+50       0.1123      0.19  Q         V         |         |         |
13+55       0.1137      0.20  Q         V         |         |         |
14+ 0       0.1151      0.20  Q         V         |         |         |
14+ 5       0.1165      0.21  Q         V         |         |         |
14+10       0.1180      0.21  Q         V         |         |         |
14+15       0.1195      0.22  Q         V         |         |         |
14+20       0.1210      0.22  Q         V         |         |         |
14+25       0.1226      0.23  Q         V         |         |         |
14+30       0.1242      0.23  Q         |V        |         |         |
14+35       0.1258      0.24  Q         |V        |         |         |
14+40       0.1275      0.25  Q         |V        |         |         |
14+45       0.1293      0.26  |Q        |V        |         |         |
14+50       0.1311      0.26  |Q        |V        |         |         |
14+55       0.1330      0.27  |Q        |V        |         |         |
```

```
15+ 0       0.1350      0.28  |Q        | V       |         |         |
15+ 5       0.1370      0.30  |Q        | V       |         |         |
15+10       0.1391      0.31  |Q        | V       |         |         |
15+15       0.1414      0.32  |Q        | V       |         |         |
15+20       0.1437      0.34  |Q        | V       |         |         |
15+25       0.1462      0.36  |Q        |  V      |         |         |
15+30       0.1486      0.35  |Q        |  V      |         |         |
15+35       0.1510      0.35  |Q        |  V      |         |         |
15+40       0.1535      0.36  |Q        |  V      |         |         |
15+45       0.1562      0.39  |Q        |  V      |         |         |
15+50       0.1592      0.44  |Q        |   V     |         |         |
15+55       0.1627      0.51  | Q       |   V     |         |         |
16+ 0       0.1674      0.69  | Q       |   V     |         |         |
16+ 5       0.1803      1.87  |      Q  |     V   |         |         |
16+10       0.2223      6.09  |         |        V|   Q     |         |
16+15       0.2778      8.05  |         |         |   V     |  Q      |
16+20       0.3064      4.16  |         |     Q   |      V  |         |
16+25       0.3243      2.59  |         Q         |        V|         |
16+30       0.3369      1.84  |      Q  |         |         V         |
16+35       0.3469      1.45  |    Q    |         |         |V        |
16+40       0.3547      1.12  |   Q     |         |         |V        |
16+45       0.3611      0.93  |  Q      |         |         | V       |
16+50       0.3664      0.78  |  Q      |         |         | V       |
16+55       0.3710      0.66  | Q       |         |         |  V      |
17+ 0       0.3748      0.56  | Q       |         |         |  V      |
17+ 5       0.3780      0.46  |Q        |         |         |  V      |
17+10       0.3807      0.39  |Q        |         |         |   V     |
17+15       0.3833      0.38  |Q        |         |         |   V     |
17+20       0.3858      0.36  |Q        |         |         |   V     |
17+25       0.3879      0.31  |Q        |         |         |   V     |
17+30       0.3898      0.27  |Q        |         |         |   V     |
17+35       0.3911      0.20  Q         |         |         |    V    |
17+40       0.3925      0.19  Q         |         |         |    V    |
17+45       0.3937      0.19  Q         |         |         |    V    |
17+50       0.3950      0.18  Q         |         |         |    V    |
17+55       0.3962      0.17  Q         |         |         |    V    |
18+ 0       0.3973      0.17  Q         |         |         |    V    |
18+ 5       0.3984      0.16  Q         |         |         |    V    |
18+10       0.3995      0.16  Q         |         |         |    V    |
18+15       0.4005      0.15  Q         |         |         |    V    |
18+20       0.4016      0.15  Q         |         |         |    V    |
18+25       0.4026      0.15  Q         |         |         |     V   |
18+30       0.4036      0.14  Q         |         |         |     V   |
18+35       0.4045      0.14  Q         |         |         |     V   |
18+40       0.4055      0.14  Q         |         |         |     V   |
18+45       0.4064      0.13  Q         |         |         |     V   |
18+50       0.4073      0.13  Q         |         |         |     V   |
18+55       0.4082      0.13  Q         |         |         |     V   |
19+ 0       0.4090      0.13  Q         |         |         |     V   |
19+ 5       0.4099      0.12  Q         |         |         |     V   |
```

```
19+10       0.4107      0.12  Q         |         |         |     V   |
19+15       0.4115      0.12  Q         |         |         |     V   |
19+20       0.4123      0.12  Q         |         |         |     V   |
19+25       0.4131      0.11  Q         |         |         |     V   |
19+30       0.4139      0.11  Q         |         |         |      V  |
19+35       0.4147      0.11  Q         |         |         |      V  |
19+40       0.4154      0.11  Q         |         |         |      V  |
19+45       0.4162      0.11  Q         |         |         |      V  |
19+50       0.4169      0.11  Q         |         |         |      V  |
19+55       0.4176      0.10  Q         |         |         |      V  |
20+ 0       0.4183      0.10  Q         |         |         |      V  |
20+ 5       0.4190      0.10  Q         |         |         |      V  |
20+10       0.4197      0.10  Q         |         |         |      V  |
20+15       0.4204      0.10  Q         |         |         |      V  |
20+20       0.4211      0.10  Q         |         |         |      V  |
20+25       0.4218      0.10  Q         |         |         |      V  |
20+30       0.4224      0.10  Q         |         |         |      V  |
20+35       0.4231      0.09  Q         |         |         |      V  |
20+40       0.4237      0.09  Q         |         |         |      V  |
20+45       0.4243      0.09  Q         |         |         |       V |
20+50       0.4250      0.09  Q         |         |         |       V |
20+55       0.4256      0.09  Q         |         |         |       V |
21+ 0       0.4262      0.09  Q         |         |         |       V |
21+ 5       0.4268      0.09  Q         |         |         |       V |
21+10       0.4274      0.09  Q         |         |         |       V |
21+15       0.4280      0.09  Q         |         |         |       V |
21+20       0.4286      0.09  Q         |         |         |       V |
21+25       0.4292      0.09  Q         |         |         |       V |
21+30       0.4298      0.08  Q         |         |         |       V |
21+35       0.4304      0.08  Q         |         |         |       V |
21+40       0.4309      0.08  Q         |         |         |       V |
21+45       0.4315      0.08  Q         |         |         |       V |
21+50       0.4321      0.08  Q         |         |         |       V |
21+55       0.4326      0.08  Q         |         |         |       V |
22+ 0       0.4332      0.08  Q         |         |         |       V |
22+ 5       0.4337      0.08  Q         |         |         |       V |
22+10       0.4342      0.08  Q         |         |         |       V |
22+15       0.4348      0.08  Q         |         |         |       V |
22+20       0.4353      0.08  Q         |         |         |       V |
22+25       0.4358      0.08  Q         |         |         |        V|
22+30       0.4364      0.08  Q         |         |         |        V|
22+35       0.4369      0.08  Q         |         |         |        V|
22+40       0.4374      0.07  Q         |         |         |        V|
22+45       0.4379      0.07  Q         |         |         |        V|
22+50       0.4384      0.07  Q         |         |         |        V|
22+55       0.4389      0.07  Q         |         |         |        V|
23+ 0       0.4394      0.07  Q         |         |         |        V|
23+ 5       0.4399      0.07  Q         |         |         |        V|
23+10       0.4404      0.07  Q         |         |         |        V|
23+15       0.4409      0.07  Q         |         |         |        V|
```

```
   23+20        0.4414      0.07  Q          |          |          |        V|
   23+25        0.4419      0.07  Q          |          |          |        V|
   23+30        0.4423      0.07  Q          |          |          |        V|
   23+35        0.4428      0.07  Q          |          |          |        V|
   23+40        0.4433      0.07  Q          |          |          |        V|
   23+45        0.4437      0.07  Q          |          |          |        V|
   23+50        0.4442      0.07  Q          |          |          |        V|
   23+55        0.4447      0.07  Q          |          |          |        V|
   24+ 0        0.4451      0.07  Q          |          |          |        V|
-----------------------------------------------------------------------
```

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

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

                Study date  08/03/21

++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
------------------------------------------------------------------------

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


Program License Serial Number 6385

---------------------------------------------------------------------
Space Center
undeveloped 10-year
Area D


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

        Storm Event Year = 10

        Antecedent Moisture Condition = 2

 English (in-lb) Input Units Used

 English Rainfall Data (Inches) Input Values Used

 English Units used in output format




Area averaged rainfall intensity isohyetal data:
        Sub-Area        Duration        Isohyetal
        (Ac.)            (hours)         (In)
Rainfall data for year 10
             5.26            1           0.62
--------------------------------------------------------------------
Rainfall data for year 10
             5.26            6           1.27
--------------------------------------------------------------------
Rainfall data for year 10
             5.26           24           2.23
--------------------------------------------------------------------
```

++

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

SCS curve No.(AMCII)	SCS curve NO.(AMC 2)	Area (Ac.)	Area Fraction	Fp(Fig C6) (In/Hr)	Ap (dec.)	Fm (In/Hr)
80.0	80.0	5.26	1.000	0.370	1.000	0.370

Area-averaged adjusted loss rate Fm (In/Hr) = 0.370

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

Area (Ac.)	Area Fract	SCS CN (AMC2)	SCS CN (AMC2)	S	Pervious Yield Fr
5.26	1.000	80.0	80.0	2.50	0.317

Area-averaged catchment yield fraction, Y = 0.317
Area-averaged low loss fraction, Yb = 0.683
User entry of time of concentration =   0.190 (hours)
++
Watershed area =   5.26(Ac.)
Catchment Lag time =   0.152 hours
Unit interval =   5.000 minutes
Unit interval percentage of lag time = 54.8246
Hydrograph baseflow =   0.00(CFS)
Average maximum watershed loss rate(Fm) = 0.370(In/Hr)
Average low loss rate fraction (Yb) = 0.683 (decimal)
DESERT S-Graph Selected
Computed peak 5-minute rainfall = 0.294(In)
Computed peak 30-minute rainfall = 0.504(In)
Specified peak 1-hour rainfall = 0.620(In)
Computed peak 3-hour rainfall = 0.962(In)
Specified peak 6-hour rainfall = 1.270(In)
Specified peak 24-hour rainfall = 2.230(In)

Rainfall depth area reduction factors:
Using a total area of   5.26(Ac.) (Ref: fig. E-4)

5-minute factor = 1.000   Adjusted rainfall = 0.294(In)
30-minute factor = 1.000   Adjusted rainfall = 0.503(In)
1-hour factor = 1.000   Adjusted rainfall = 0.620(In)
3-hour factor = 1.000   Adjusted rainfall = 0.962(In)
6-hour factor = 1.000   Adjusted rainfall = 1.270(In)
24-hour factor = 1.000   Adjusted rainfall = 2.230(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 = 63.61 (CFS))	
1	4.674	2.973
2	36.009	19.933
3	64.533	18.145
4	76.752	7.773
5	83.874	4.531
6	88.669	3.050
7	91.870	2.036
8	94.256	1.518
9	96.007	1.114
10	97.272	0.805
11	98.057	0.499
12	98.666	0.388
13	99.315	0.413
14	99.751	0.277
15	100.000	0.159

Peak Unit Number	Adjusted mass rainfall (In)	Unit rainfall (In)
1	0.2941	0.2941
2	0.3621	0.0680
3	0.4089	0.0468
4	0.4458	0.0369
5	0.4767	0.0309
6	0.5035	0.0268
7	0.5273	0.0238
8	0.5489	0.0216
9	0.5686	0.0197
10	0.5869	0.0183
11	0.6039	0.0170
12	0.6198	0.0160
13	0.6400	0.0202
14	0.6593	0.0193
15	0.6778	0.0185
16	0.6955	0.0177
17	0.7126	0.0171
18	0.7291	0.0165
19	0.7451	0.0160
20	0.7605	0.0155
21	0.7755	0.0150
22	0.7901	0.0146
23	0.8043	0.0142
24	0.8181	0.0138
25	0.8316	0.0135
26	0.8448	0.0132
27	0.8576	0.0129

28	0.8702	0.0126
29	0.8825	0.0123
30	0.8946	0.0121
31	0.9064	0.0118
32	0.9180	0.0116
33	0.9294	0.0114
34	0.9405	0.0112
35	0.9515	0.0110
36	0.9623	0.0108
37	0.9729	0.0106
38	0.9834	0.0104
39	0.9936	0.0103
40	1.0038	0.0101
41	1.0137	0.0100
42	1.0236	0.0098
43	1.0332	0.0097
44	1.0428	0.0096
45	1.0522	0.0094
46	1.0615	0.0093
47	1.0707	0.0092
48	1.0797	0.0091
49	1.0887	0.0089
50	1.0975	0.0088
51	1.1063	0.0087
52	1.1149	0.0086
53	1.1234	0.0085
54	1.1319	0.0084
55	1.1402	0.0083
56	1.1485	0.0083
57	1.1566	0.0082
58	1.1647	0.0081
59	1.1727	0.0080
60	1.1806	0.0079
61	1.1884	0.0078
62	1.1962	0.0078
63	1.2039	0.0077
64	1.2115	0.0076
65	1.2190	0.0075
66	1.2265	0.0075
67	1.2339	0.0074
68	1.2413	0.0073
69	1.2485	0.0073
70	1.2557	0.0072
71	1.2629	0.0071
72	1.2700	0.0071
73	1.2771	0.0071
74	1.2842	0.0071
75	1.2912	0.0070
76	1.2982	0.0070
77	1.3051	0.0069

78	1.3119	0.0069
79	1.3187	0.0068
80	1.3255	0.0068
81	1.3322	0.0067
82	1.3389	0.0067
83	1.3455	0.0066
84	1.3520	0.0066
85	1.3585	0.0065
86	1.3650	0.0065
87	1.3714	0.0064
88	1.3778	0.0064
89	1.3841	0.0063
90	1.3904	0.0063
91	1.3967	0.0063
92	1.4029	0.0062
93	1.4091	0.0062
94	1.4152	0.0061
95	1.4213	0.0061
96	1.4274	0.0061
97	1.4334	0.0060
98	1.4394	0.0060
99	1.4453	0.0059
100	1.4512	0.0059
101	1.4571	0.0059
102	1.4629	0.0058
103	1.4688	0.0058
104	1.4745	0.0058
105	1.4803	0.0057
106	1.4860	0.0057
107	1.4917	0.0057
108	1.4973	0.0056
109	1.5029	0.0056
110	1.5085	0.0056
111	1.5141	0.0056
112	1.5196	0.0055
113	1.5251	0.0055
114	1.5305	0.0055
115	1.5360	0.0054
116	1.5414	0.0054
117	1.5468	0.0054
118	1.5521	0.0054
119	1.5575	0.0053
120	1.5628	0.0053
121	1.5680	0.0053
122	1.5733	0.0052
123	1.5785	0.0052
124	1.5837	0.0052
125	1.5889	0.0052
126	1.5940	0.0051
127	1.5992	0.0051

128	1.6043	0.0051
129	1.6093	0.0051
130	1.6144	0.0051
131	1.6194	0.0050
132	1.6244	0.0050
133	1.6294	0.0050
134	1.6344	0.0050
135	1.6393	0.0049
136	1.6443	0.0049
137	1.6492	0.0049
138	1.6540	0.0049
139	1.6589	0.0049
140	1.6637	0.0048
141	1.6685	0.0048
142	1.6733	0.0048
143	1.6781	0.0048
144	1.6829	0.0048
145	1.6876	0.0047
146	1.6923	0.0047
147	1.6970	0.0047
148	1.7017	0.0047
149	1.7064	0.0047
150	1.7110	0.0046
151	1.7156	0.0046
152	1.7202	0.0046
153	1.7248	0.0046
154	1.7294	0.0046
155	1.7339	0.0046
156	1.7385	0.0045
157	1.7430	0.0045
158	1.7475	0.0045
159	1.7520	0.0045
160	1.7564	0.0045
161	1.7609	0.0044
162	1.7653	0.0044
163	1.7697	0.0044
164	1.7741	0.0044
165	1.7785	0.0044
166	1.7829	0.0044
167	1.7872	0.0044
168	1.7916	0.0043
169	1.7959	0.0043
170	1.8002	0.0043
171	1.8045	0.0043
172	1.8088	0.0043
173	1.8131	0.0043
174	1.8173	0.0042
175	1.8215	0.0042
176	1.8258	0.0042
177	1.8300	0.0042

178	1.8342	0.0042
179	1.8383	0.0042
180	1.8425	0.0042
181	1.8466	0.0042
182	1.8508	0.0041
183	1.8549	0.0041
184	1.8590	0.0041
185	1.8631	0.0041
186	1.8672	0.0041
187	1.8713	0.0041
188	1.8753	0.0041
189	1.8794	0.0040
190	1.8834	0.0040
191	1.8874	0.0040
192	1.8914	0.0040
193	1.8954	0.0040
194	1.8994	0.0040
195	1.9034	0.0040
196	1.9073	0.0040
197	1.9113	0.0039
198	1.9152	0.0039
199	1.9191	0.0039
200	1.9230	0.0039
201	1.9269	0.0039
202	1.9308	0.0039
203	1.9347	0.0039
204	1.9386	0.0039
205	1.9424	0.0039
206	1.9463	0.0038
207	1.9501	0.0038
208	1.9539	0.0038
209	1.9577	0.0038
210	1.9615	0.0038
211	1.9653	0.0038
212	1.9691	0.0038
213	1.9729	0.0038
214	1.9766	0.0038
215	1.9804	0.0037
216	1.9841	0.0037
217	1.9878	0.0037
218	1.9915	0.0037
219	1.9952	0.0037
220	1.9989	0.0037
221	2.0026	0.0037
222	2.0063	0.0037
223	2.0100	0.0037
224	2.0136	0.0037
225	2.0173	0.0036
226	2.0209	0.0036
227	2.0245	0.0036

228	2.0281	0.0036
229	2.0318	0.0036
230	2.0353	0.0036
231	2.0389	0.0036
232	2.0425	0.0036
233	2.0461	0.0036
234	2.0497	0.0036
235	2.0532	0.0036
236	2.0567	0.0035
237	2.0603	0.0035
238	2.0638	0.0035
239	2.0673	0.0035
240	2.0708	0.0035
241	2.0743	0.0035
242	2.0778	0.0035
243	2.0813	0.0035
244	2.0848	0.0035
245	2.0882	0.0035
246	2.0917	0.0035
247	2.0952	0.0034
248	2.0986	0.0034
249	2.1020	0.0034
250	2.1055	0.0034
251	2.1089	0.0034
252	2.1123	0.0034
253	2.1157	0.0034
254	2.1191	0.0034
255	2.1225	0.0034
256	2.1258	0.0034
257	2.1292	0.0034
258	2.1326	0.0034
259	2.1359	0.0034
260	2.1393	0.0033
261	2.1426	0.0033
262	2.1459	0.0033
263	2.1492	0.0033
264	2.1526	0.0033
265	2.1559	0.0033
266	2.1592	0.0033
267	2.1625	0.0033
268	2.1657	0.0033
269	2.1690	0.0033
270	2.1723	0.0033
271	2.1756	0.0033
272	2.1788	0.0033
273	2.1821	0.0032
274	2.1853	0.0032
275	2.1885	0.0032
276	2.1918	0.0032
277	2.1950	0.0032

278	2.1982	0.0032
279	2.2014	0.0032
280	2.2046	0.0032
281	2.2078	0.0032
282	2.2110	0.0032
283	2.2142	0.0032
284	2.2174	0.0032
285	2.2205	0.0032
286	2.2237	0.0032
287	2.2268	0.0032
288	2.2300	0.0031

Unit Period (number)	Unit Rainfall (In)	Unit Soil-Loss (In)	Effective Rainfall (In)
1	0.0031	0.0021	0.0010
2	0.0032	0.0022	0.0010
3	0.0032	0.0022	0.0010
4	0.0032	0.0022	0.0010
5	0.0032	0.0022	0.0010
6	0.0032	0.0022	0.0010
7	0.0032	0.0022	0.0010
8	0.0032	0.0022	0.0010
9	0.0032	0.0022	0.0010
10	0.0032	0.0022	0.0010
11	0.0032	0.0022	0.0010
12	0.0033	0.0022	0.0010
13	0.0033	0.0022	0.0010
14	0.0033	0.0022	0.0010
15	0.0033	0.0022	0.0010
16	0.0033	0.0023	0.0010
17	0.0033	0.0023	0.0011
18	0.0033	0.0023	0.0011
19	0.0033	0.0023	0.0011
20	0.0033	0.0023	0.0011
21	0.0034	0.0023	0.0011
22	0.0034	0.0023	0.0011
23	0.0034	0.0023	0.0011
24	0.0034	0.0023	0.0011
25	0.0034	0.0023	0.0011
26	0.0034	0.0023	0.0011
27	0.0034	0.0023	0.0011
28	0.0034	0.0023	0.0011
29	0.0035	0.0024	0.0011
30	0.0035	0.0024	0.0011
31	0.0035	0.0024	0.0011
32	0.0035	0.0024	0.0011
33	0.0035	0.0024	0.0011
34	0.0035	0.0024	0.0011

35	0.0035	0.0024	0.0011
36	0.0035	0.0024	0.0011
37	0.0036	0.0024	0.0011
38	0.0036	0.0024	0.0011
39	0.0036	0.0025	0.0011
40	0.0036	0.0025	0.0011
41	0.0036	0.0025	0.0011
42	0.0036	0.0025	0.0012
43	0.0036	0.0025	0.0012
44	0.0037	0.0025	0.0012
45	0.0037	0.0025	0.0012
46	0.0037	0.0025	0.0012
47	0.0037	0.0025	0.0012
48	0.0037	0.0025	0.0012
49	0.0037	0.0026	0.0012
50	0.0037	0.0026	0.0012
51	0.0038	0.0026	0.0012
52	0.0038	0.0026	0.0012
53	0.0038	0.0026	0.0012
54	0.0038	0.0026	0.0012
55	0.0038	0.0026	0.0012
56	0.0038	0.0026	0.0012
57	0.0039	0.0026	0.0012
58	0.0039	0.0026	0.0012
59	0.0039	0.0027	0.0012
60	0.0039	0.0027	0.0012
61	0.0039	0.0027	0.0012
62	0.0039	0.0027	0.0013
63	0.0040	0.0027	0.0013
64	0.0040	0.0027	0.0013
65	0.0040	0.0027	0.0013
66	0.0040	0.0027	0.0013
67	0.0040	0.0028	0.0013
68	0.0041	0.0028	0.0013
69	0.0041	0.0028	0.0013
70	0.0041	0.0028	0.0013
71	0.0041	0.0028	0.0013
72	0.0041	0.0028	0.0013
73	0.0042	0.0028	0.0013
74	0.0042	0.0029	0.0013
75	0.0042	0.0029	0.0013
76	0.0042	0.0029	0.0013
77	0.0042	0.0029	0.0013
78	0.0043	0.0029	0.0014
79	0.0043	0.0029	0.0014
80	0.0043	0.0029	0.0014
81	0.0043	0.0030	0.0014
82	0.0044	0.0030	0.0014
83	0.0044	0.0030	0.0014
84	0.0044	0.0030	0.0014

85	0.0044	0.0030	0.0014
86	0.0044	0.0030	0.0014
87	0.0045	0.0031	0.0014
88	0.0045	0.0031	0.0014
89	0.0045	0.0031	0.0014
90	0.0046	0.0031	0.0014
91	0.0046	0.0031	0.0015
92	0.0046	0.0031	0.0015
93	0.0046	0.0032	0.0015
94	0.0047	0.0032	0.0015
95	0.0047	0.0032	0.0015
96	0.0047	0.0032	0.0015
97	0.0048	0.0032	0.0015
98	0.0048	0.0033	0.0015
99	0.0048	0.0033	0.0015
100	0.0048	0.0033	0.0015
101	0.0049	0.0033	0.0015
102	0.0049	0.0033	0.0016
103	0.0049	0.0034	0.0016
104	0.0050	0.0034	0.0016
105	0.0050	0.0034	0.0016
106	0.0050	0.0034	0.0016
107	0.0051	0.0035	0.0016
108	0.0051	0.0035	0.0016
109	0.0051	0.0035	0.0016
110	0.0052	0.0035	0.0016
111	0.0052	0.0036	0.0017
112	0.0052	0.0036	0.0017
113	0.0053	0.0036	0.0017
114	0.0053	0.0036	0.0017
115	0.0054	0.0037	0.0017
116	0.0054	0.0037	0.0017
117	0.0055	0.0037	0.0017
118	0.0055	0.0038	0.0017
119	0.0056	0.0038	0.0018
120	0.0056	0.0038	0.0018
121	0.0056	0.0039	0.0018
122	0.0057	0.0039	0.0018
123	0.0057	0.0039	0.0018
124	0.0058	0.0039	0.0018
125	0.0058	0.0040	0.0019
126	0.0059	0.0040	0.0019
127	0.0059	0.0041	0.0019
128	0.0060	0.0041	0.0019
129	0.0061	0.0041	0.0019
130	0.0061	0.0042	0.0019
131	0.0062	0.0042	0.0020
132	0.0062	0.0042	0.0020
133	0.0063	0.0043	0.0020
134	0.0063	0.0043	0.0020

135	0.0064	0.0044	0.0020
136	0.0065	0.0044	0.0021
137	0.0066	0.0045	0.0021
138	0.0066	0.0045	0.0021
139	0.0067	0.0046	0.0021
140	0.0068	0.0046	0.0021
141	0.0069	0.0047	0.0022
142	0.0069	0.0047	0.0022
143	0.0070	0.0048	0.0022
144	0.0071	0.0048	0.0022
145	0.0071	0.0048	0.0022
146	0.0071	0.0049	0.0023
147	0.0073	0.0050	0.0023
148	0.0073	0.0050	0.0023
149	0.0075	0.0051	0.0024
150	0.0075	0.0051	0.0024
151	0.0077	0.0052	0.0024
152	0.0078	0.0053	0.0025
153	0.0079	0.0054	0.0025
154	0.0080	0.0055	0.0025
155	0.0082	0.0056	0.0026
156	0.0083	0.0056	0.0026
157	0.0084	0.0058	0.0027
158	0.0085	0.0058	0.0027
159	0.0087	0.0060	0.0028
160	0.0088	0.0060	0.0028
161	0.0091	0.0062	0.0029
162	0.0092	0.0063	0.0029
163	0.0094	0.0064	0.0030
164	0.0096	0.0065	0.0030
165	0.0098	0.0067	0.0031
166	0.0100	0.0068	0.0032
167	0.0103	0.0070	0.0033
168	0.0104	0.0071	0.0033
169	0.0108	0.0074	0.0034
170	0.0110	0.0075	0.0035
171	0.0114	0.0078	0.0036
172	0.0116	0.0079	0.0037
173	0.0121	0.0082	0.0038
174	0.0123	0.0084	0.0039
175	0.0129	0.0088	0.0041
176	0.0132	0.0090	0.0042
177	0.0138	0.0094	0.0044
178	0.0142	0.0097	0.0045
179	0.0150	0.0102	0.0048
180	0.0155	0.0106	0.0049
181	0.0165	0.0113	0.0052
182	0.0171	0.0117	0.0054
183	0.0185	0.0126	0.0059
184	0.0193	0.0132	0.0061

185	0.0160	0.0109	0.0051
186	0.0170	0.0116	0.0054
187	0.0197	0.0135	0.0063
188	0.0216	0.0147	0.0068
189	0.0268	0.0183	0.0085
190	0.0309	0.0211	0.0098
191	0.0468	0.0308	0.0160
192	0.0680	0.0308	0.0372
193	0.2941	0.0308	0.2633
194	0.0369	0.0252	0.0117
195	0.0238	0.0163	0.0076
196	0.0183	0.0125	0.0058
197	0.0202	0.0138	0.0064
198	0.0177	0.0121	0.0056
199	0.0160	0.0109	0.0051
200	0.0146	0.0100	0.0046
201	0.0135	0.0092	0.0043
202	0.0126	0.0086	0.0040
203	0.0118	0.0081	0.0038
204	0.0112	0.0076	0.0035
205	0.0106	0.0072	0.0034
206	0.0101	0.0069	0.0032
207	0.0097	0.0066	0.0031
208	0.0093	0.0063	0.0029
209	0.0089	0.0061	0.0028
210	0.0086	0.0059	0.0027
211	0.0083	0.0057	0.0026
212	0.0081	0.0055	0.0026
213	0.0078	0.0053	0.0025
214	0.0076	0.0052	0.0024
215	0.0074	0.0051	0.0023
216	0.0072	0.0049	0.0023
217	0.0071	0.0049	0.0023
218	0.0070	0.0048	0.0022
219	0.0068	0.0046	0.0022
220	0.0067	0.0045	0.0021
221	0.0065	0.0044	0.0021
222	0.0064	0.0044	0.0020
223	0.0063	0.0043	0.0020
224	0.0061	0.0042	0.0019
225	0.0060	0.0041	0.0019
226	0.0059	0.0040	0.0019
227	0.0058	0.0040	0.0018
228	0.0057	0.0039	0.0018
229	0.0056	0.0038	0.0018
230	0.0055	0.0038	0.0018
231	0.0054	0.0037	0.0017
232	0.0054	0.0037	0.0017
233	0.0053	0.0036	0.0017
234	0.0052	0.0035	0.0016

235	0.0051	0.0035	0.0016
236	0.0051	0.0035	0.0016
237	0.0050	0.0034	0.0016
238	0.0049	0.0034	0.0016
239	0.0049	0.0033	0.0015
240	0.0048	0.0033	0.0015
241	0.0047	0.0032	0.0015
242	0.0047	0.0032	0.0015
243	0.0046	0.0032	0.0015
244	0.0046	0.0031	0.0014
245	0.0045	0.0031	0.0014
246	0.0045	0.0030	0.0014
247	0.0044	0.0030	0.0014
248	0.0044	0.0030	0.0014
249	0.0043	0.0030	0.0014
250	0.0043	0.0029	0.0014
251	0.0042	0.0029	0.0013
252	0.0042	0.0029	0.0013
253	0.0042	0.0028	0.0013
254	0.0041	0.0028	0.0013
255	0.0041	0.0028	0.0013
256	0.0040	0.0028	0.0013
257	0.0040	0.0027	0.0013
258	0.0040	0.0027	0.0013
259	0.0039	0.0027	0.0012
260	0.0039	0.0027	0.0012
261	0.0039	0.0026	0.0012
262	0.0038	0.0026	0.0012
263	0.0038	0.0026	0.0012
264	0.0038	0.0026	0.0012
265	0.0037	0.0025	0.0012
266	0.0037	0.0025	0.0012
267	0.0037	0.0025	0.0012
268	0.0036	0.0025	0.0012
269	0.0036	0.0025	0.0011
270	0.0036	0.0024	0.0011
271	0.0036	0.0024	0.0011
272	0.0035	0.0024	0.0011
273	0.0035	0.0024	0.0011
274	0.0035	0.0024	0.0011
275	0.0034	0.0024	0.0011
276	0.0034	0.0023	0.0011
277	0.0034	0.0023	0.0011
278	0.0034	0.0023	0.0011
279	0.0034	0.0023	0.0011
280	0.0033	0.0023	0.0011
281	0.0033	0.0023	0.0010
282	0.0033	0.0022	0.0010
283	0.0033	0.0022	0.0010
284	0.0032	0.0022	0.0010

```
      285              0.0032           0.0022             0.0010
      286              0.0032           0.0022             0.0010
      287              0.0032           0.0022             0.0010
      288              0.0032           0.0022             0.0010
      ----------------------------------------------------------------------
      ----------------------------------------------------------------------
      Total soil rain loss =      1.34(In)
      Total effective rainfall =      0.89(In)
      Peak flow rate in flood hydrograph =      6.20(CFS)
      ----------------------------------------------------------------------
      ++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
                          24 - H O U R   S T O R M
                     R u n o f f     H y d r o g r a p h
      ----------------------------------------------------------------------
                  Hydrograph in   5   Minute intervals ((CFS))

      ----------------------------------------------------------------------
Time(h+m) Volume Ac.Ft   Q(CFS)  0        2.5       5.0       7.5      10.0
-----------------------------------------------------------------------
  0+ 5       0.0000      0.00  Q         |         |         |         |
  0+10       0.0002      0.02  Q         |         |         |         |
  0+15       0.0005      0.04  Q         |         |         |         |
  0+20       0.0008      0.05  Q         |         |         |         |
  0+25       0.0012      0.05  Q         |         |         |         |
  0+30       0.0016      0.06  Q         |         |         |         |
  0+35       0.0020      0.06  Q         |         |         |         |
  0+40       0.0024      0.06  Q         |         |         |         |
  0+45       0.0028      0.06  Q         |         |         |         |
  0+50       0.0032      0.06  Q         |         |         |         |
  0+55       0.0037      0.06  Q         |         |         |         |
  1+ 0       0.0041      0.06  Q         |         |         |         |
  1+ 5       0.0046      0.06  Q         |         |         |         |
  1+10       0.0050      0.07  Q         |         |         |         |
  1+15       0.0055      0.07  Q         |         |         |         |
  1+20       0.0059      0.07  Q         |         |         |         |
  1+25       0.0064      0.07  Q         |         |         |         |
  1+30       0.0068      0.07  Q         |         |         |         |
  1+35       0.0073      0.07  Q         |         |         |         |
  1+40       0.0078      0.07  Q         |         |         |         |
  1+45       0.0082      0.07  Q         |         |         |         |
  1+50       0.0087      0.07  Q         |         |         |         |
  1+55       0.0092      0.07  Q         |         |         |         |
  2+ 0       0.0096      0.07  Q         |         |         |         |
  2+ 5       0.0101      0.07  QV        |         |         |         |
  2+10       0.0106      0.07  QV        |         |         |         |
  2+15       0.0110      0.07  QV        |         |         |         |
  2+20       0.0115      0.07  QV        |         |         |         |
  2+25       0.0120      0.07  QV        |         |         |         |
  2+30       0.0125      0.07  QV        |         |         |         |
  2+35       0.0129      0.07  QV        |         |         |         |
```

```
 2+40        0.0134      0.07  QV         |         |         |         |
 2+45        0.0139      0.07  QV         |         |         |         |
 2+50        0.0144      0.07  QV         |         |         |         |
 2+55        0.0149      0.07  QV         |         |         |         |
 3+ 0        0.0154      0.07  QV         |         |         |         |
 3+ 5        0.0159      0.07  QV         |         |         |         |
 3+10        0.0164      0.07  QV         |         |         |         |
 3+15        0.0168      0.07  QV         |         |         |         |
 3+20        0.0173      0.07  QV         |         |         |         |
 3+25        0.0178      0.07  QV         |         |         |         |
 3+30        0.0183      0.07  QV         |         |         |         |
 3+35        0.0188      0.07  QV         |         |         |         |
 3+40        0.0193      0.07  QV         |         |         |         |
 3+45        0.0198      0.07  Q V        |         |         |         |
 3+50        0.0204      0.07  Q V        |         |         |         |
 3+55        0.0209      0.07  Q V        |         |         |         |
 4+ 0        0.0214      0.07  Q V        |         |         |         |
 4+ 5        0.0219      0.07  Q V        |         |         |         |
 4+10        0.0224      0.07  Q V        |         |         |         |
 4+15        0.0229      0.08  Q V        |         |         |         |
 4+20        0.0234      0.08  Q V        |         |         |         |
 4+25        0.0240      0.08  Q V        |         |         |         |
 4+30        0.0245      0.08  Q V        |         |         |         |
 4+35        0.0250      0.08  Q V        |         |         |         |
 4+40        0.0255      0.08  Q V        |         |         |         |
 4+45        0.0261      0.08  Q V        |         |         |         |
 4+50        0.0266      0.08  Q V        |         |         |         |
 4+55        0.0271      0.08  Q V        |         |         |         |
 5+ 0        0.0277      0.08  Q V        |         |         |         |
 5+ 5        0.0282      0.08  Q V        |         |         |         |
 5+10        0.0288      0.08  Q V        |         |         |         |
 5+15        0.0293      0.08  Q V        |         |         |         |
 5+20        0.0299      0.08  Q  V       |         |         |         |
 5+25        0.0304      0.08  Q  V       |         |         |         |
 5+30        0.0310      0.08  Q  V       |         |         |         |
 5+35        0.0315      0.08  Q  V       |         |         |         |
 5+40        0.0321      0.08  Q  V       |         |         |         |
 5+45        0.0326      0.08  Q  V       |         |         |         |
 5+50        0.0332      0.08  Q  V       |         |         |         |
 5+55        0.0338      0.08  Q  V       |         |         |         |
 6+ 0        0.0343      0.08  Q  V       |         |         |         |
 6+ 5        0.0349      0.08  Q  V       |         |         |         |
 6+10        0.0355      0.08  Q  V       |         |         |         |
 6+15        0.0360      0.08  Q  V       |         |         |         |
 6+20        0.0366      0.08  Q  V       |         |         |         |
 6+25        0.0372      0.08  Q  V       |         |         |         |
 6+30        0.0378      0.08  Q  V       |         |         |         |
 6+35        0.0384      0.09  Q  V       |         |         |         |
 6+40        0.0390      0.09  Q  V       |         |         |         |
 6+45        0.0396      0.09  Q   V      |         |         |         |
```

```
  6+50        0.0402       0.09  Q    V      |          |          |          |
  6+55        0.0408       0.09  Q    V      |          |          |          |
  7+ 0        0.0414       0.09  Q    V      |          |          |          |
  7+ 5        0.0420       0.09  Q    V      |          |          |          |
  7+10        0.0426       0.09  Q    V      |          |          |          |
  7+15        0.0432       0.09  Q    V      |          |          |          |
  7+20        0.0438       0.09  Q    V      |          |          |          |
  7+25        0.0444       0.09  Q    V      |          |          |          |
  7+30        0.0451       0.09  Q    V      |          |          |          |
  7+35        0.0457       0.09  Q    V      |          |          |          |
  7+40        0.0463       0.09  Q    V      |          |          |          |
  7+45        0.0469       0.09  Q    V      |          |          |          |
  7+50        0.0476       0.09  Q    V      |          |          |          |
  7+55        0.0482       0.09  Q    V      |          |          |          |
  8+ 0        0.0489       0.09  Q    V      |          |          |          |
  8+ 5        0.0495       0.09  Q     V     |          |          |          |
  8+10        0.0502       0.09  Q     V     |          |          |          |
  8+15        0.0508       0.10  Q     V     |          |          |          |
  8+20        0.0515       0.10  Q     V     |          |          |          |
  8+25        0.0522       0.10  Q     V     |          |          |          |
  8+30        0.0528       0.10  Q     V     |          |          |          |
  8+35        0.0535       0.10  Q     V     |          |          |          |
  8+40        0.0542       0.10  Q     V     |          |          |          |
  8+45        0.0549       0.10  Q     V     |          |          |          |
  8+50        0.0556       0.10  Q     V     |          |          |          |
  8+55        0.0562       0.10  Q     V     |          |          |          |
  9+ 0        0.0569       0.10  Q     V     |          |          |          |
  9+ 5        0.0576       0.10  Q     V     |          |          |          |
  9+10        0.0584       0.10  Q     V     |          |          |          |
  9+15        0.0591       0.10  Q      V    |          |          |          |
  9+20        0.0598       0.10  Q      V    |          |          |          |
  9+25        0.0605       0.10  Q      V    |          |          |          |
  9+30        0.0612       0.11  Q      V    |          |          |          |
  9+35        0.0620       0.11  Q      V    |          |          |          |
  9+40        0.0627       0.11  Q      V    |          |          |          |
  9+45        0.0634       0.11  Q      V    |          |          |          |
  9+50        0.0642       0.11  Q      V    |          |          |          |
  9+55        0.0650       0.11  Q      V    |          |          |          |
 10+ 0        0.0657       0.11  Q      V    |          |          |          |
 10+ 5        0.0665       0.11  Q      V    |          |          |          |
 10+10        0.0673       0.11  Q      V    |          |          |          |
 10+15        0.0680       0.11  Q      V    |          |          |          |
 10+20        0.0688       0.11  Q       V   |          |          |          |
 10+25        0.0696       0.12  Q       V   |          |          |          |
 10+30        0.0704       0.12  Q       V   |          |          |          |
 10+35        0.0712       0.12  Q       V   |          |          |          |
 10+40        0.0720       0.12  Q       V   |          |          |          |
 10+45        0.0729       0.12  Q       V   |          |          |          |
 10+50        0.0737       0.12  Q       V   |          |          |          |
 10+55        0.0745       0.12  Q       V   |          |          |          |
```

```
11+ 0       0.0754      0.12  Q      V  |         |         |         |
11+ 5       0.0762      0.12  Q      V  |         |         |         |
11+10       0.0771      0.12  Q      V  |         |         |         |
11+15       0.0779      0.13  Q      V  |         |         |         |
11+20       0.0788      0.13  Q       V |         |         |         |
11+25       0.0797      0.13  Q       V |         |         |         |
11+30       0.0806      0.13  Q       V |         |         |         |
11+35       0.0815      0.13  Q       V |         |         |         |
11+40       0.0824      0.13  Q       V |         |         |         |
11+45       0.0833      0.13  Q       V |         |         |         |
11+50       0.0843      0.14  Q       V |         |         |         |
11+55       0.0852      0.14  Q       V |         |         |         |
12+ 0       0.0862      0.14  Q       V |         |         |         |
12+ 5       0.0871      0.14  Q       V |         |         |         |
12+10       0.0881      0.14  Q       V |         |         |         |
12+15       0.0891      0.14  Q        V|         |         |         |
12+20       0.0901      0.14  Q        V|         |         |         |
12+25       0.0911      0.15  Q        V|         |         |         |
12+30       0.0921      0.15  Q        V|         |         |         |
12+35       0.0931      0.15  Q        V|         |         |         |
12+40       0.0942      0.15  Q        V|         |         |         |
12+45       0.0952      0.15  Q        V|         |         |         |
12+50       0.0963      0.16  Q        V|         |         |         |
12+55       0.0974      0.16  Q        V|         |         |         |
13+ 0       0.0985      0.16  Q         V         |         |         |
13+ 5       0.0996      0.16  Q         V         |         |         |
13+10       0.1008      0.17  Q         V         |         |         |
13+15       0.1019      0.17  Q         V         |         |         |
13+20       0.1031      0.17  Q         V         |         |         |
13+25       0.1043      0.17  Q         V         |         |         |
13+30       0.1055      0.18  Q         V         |         |         |
13+35       0.1067      0.18  Q         V         |         |         |
13+40       0.1080      0.18  Q         |V        |         |         |
13+45       0.1093      0.19  Q         |V        |         |         |
13+50       0.1106      0.19  Q         |V        |         |         |
13+55       0.1120      0.20  Q         |V        |         |         |
14+ 0       0.1133      0.20  Q         |V        |         |         |
14+ 5       0.1147      0.20  Q         |V        |         |         |
14+10       0.1162      0.21  Q         |V        |         |         |
14+15       0.1177      0.21  Q         | V       |         |         |
14+20       0.1192      0.22  Q         | V       |         |         |
14+25       0.1207      0.23  Q         | V       |         |         |
14+30       0.1223      0.23  Q         | V       |         |         |
14+35       0.1240      0.24  Q         | V       |         |         |
14+40       0.1257      0.25  Q         | V       |         |         |
14+45       0.1274      0.25  |Q        |  V      |         |         |
14+50       0.1292      0.26  |Q        |  V      |         |         |
14+55       0.1311      0.27  |Q        |  V      |         |         |
15+ 0       0.1330      0.28  |Q        |  V      |         |         |
15+ 5       0.1351      0.29  |Q        |  V      |         |         |
```

```
15+10       0.1372      0.31  |Q        |   V     |         |         |
15+15       0.1394      0.32  |Q        |   V     |         |         |
15+20       0.1418      0.34  |Q        |   V     |         |         |
15+25       0.1442      0.36  |Q        |   V     |         |         |
15+30       0.1466      0.35  |Q        |   V     |         |         |
15+35       0.1490      0.34  |Q        |    V    |         |         |
15+40       0.1515      0.36  |Q        |    V    |         |         |
15+45       0.1542      0.40  |Q        |    V    |         |         |
15+50       0.1573      0.45  |Q        |     V   |         |         |
15+55       0.1610      0.53  | Q       |     V   |         |         |
16+ 0       0.1662      0.76  |  Q      |     V   |         |         |
16+ 5       0.1800      1.99  |      Q  |       V |         |         |
16+10       0.2226      6.20  |         |         | V Q     |         |
16+15       0.2603      5.47  |         |         |Q    V   |         |
16+20       0.2789      2.70  |         Q         |       V |         |
16+25       0.2909      1.74  |     Q   |         |        V|         |
16+30       0.2998      1.29  |    Q    |         |         V         |
16+35       0.3066      0.99  |  Q      |         |         |V        |
16+40       0.3122      0.81  |  Q      |         |         |V        |
16+45       0.3167      0.66  | Q       |         |         | V       |
16+50       0.3205      0.55  | Q       |         |         | V       |
16+55       0.3235      0.44  |Q        |         |         |  V      |
17+ 0       0.3262      0.39  |Q        |         |         |  V      |
17+ 5       0.3288      0.37  |Q        |         |         |  V      |
17+10       0.3310      0.32  |Q        |         |         |  V      |
17+15       0.3328      0.27  |Q        |         |         |  V      |
17+20       0.3343      0.22  Q         |         |         |   V     |
17+25       0.3358      0.21  Q         |         |         |   V     |
17+30       0.3371      0.20  Q         |         |         |   V     |
17+35       0.3384      0.19  Q         |         |         |   V     |
17+40       0.3397      0.18  Q         |         |         |   V     |
17+45       0.3409      0.17  Q         |         |         |   V     |
17+50       0.3420      0.17  Q         |         |         |   V     |
17+55       0.3432      0.16  Q         |         |         |    V    |
18+ 0       0.3442      0.16  Q         |         |         |    V    |
18+ 5       0.3453      0.15  Q         |         |         |    V    |
18+10       0.3463      0.15  Q         |         |         |    V    |
18+15       0.3474      0.15  Q         |         |         |    V    |
18+20       0.3483      0.14  Q         |         |         |    V    |
18+25       0.3493      0.14  Q         |         |         |    V    |
18+30       0.3502      0.14  Q         |         |         |    V    |
18+35       0.3512      0.13  Q         |         |         |    V    |
18+40       0.3521      0.13  Q         |         |         |    V    |
18+45       0.3530      0.13  Q         |         |         |     V   |
18+50       0.3538      0.13  Q         |         |         |     V   |
18+55       0.3547      0.12  Q         |         |         |     V   |
19+ 0       0.3555      0.12  Q         |         |         |     V   |
19+ 5       0.3563      0.12  Q         |         |         |     V   |
19+10       0.3571      0.12  Q         |         |         |     V   |
19+15       0.3579      0.11  Q         |         |         |     V   |
```

```
19+20       0.3587      0.11  Q         |         |         |     V   |
19+25       0.3595      0.11  Q         |         |         |     V   |
19+30       0.3602      0.11  Q         |         |         |     V   |
19+35       0.3610      0.11  Q         |         |         |     V   |
19+40       0.3617      0.11  Q         |         |         |     V   |
19+45       0.3624      0.10  Q         |         |         |      V  |
19+50       0.3631      0.10  Q         |         |         |      V  |
19+55       0.3638      0.10  Q         |         |         |      V  |
20+ 0       0.3645      0.10  Q         |         |         |      V  |
20+ 5       0.3652      0.10  Q         |         |         |      V  |
20+10       0.3659      0.10  Q         |         |         |      V  |
20+15       0.3665      0.10  Q         |         |         |      V  |
20+20       0.3672      0.10  Q         |         |         |      V  |
20+25       0.3678      0.09  Q         |         |         |      V  |
20+30       0.3685      0.09  Q         |         |         |      V  |
20+35       0.3691      0.09  Q         |         |         |      V  |
20+40       0.3697      0.09  Q         |         |         |      V  |
20+45       0.3704      0.09  Q         |         |         |      V  |
20+50       0.3710      0.09  Q         |         |         |      V  |
20+55       0.3716      0.09  Q         |         |         |      V  |
21+ 0       0.3722      0.09  Q         |         |         |      V  |
21+ 5       0.3728      0.09  Q         |         |         |       V |
21+10       0.3734      0.09  Q         |         |         |       V |
21+15       0.3739      0.08  Q         |         |         |       V |
21+20       0.3745      0.08  Q         |         |         |       V |
21+25       0.3751      0.08  Q         |         |         |       V |
21+30       0.3757      0.08  Q         |         |         |       V |
21+35       0.3762      0.08  Q         |         |         |       V |
21+40       0.3768      0.08  Q         |         |         |       V |
21+45       0.3773      0.08  Q         |         |         |       V |
21+50       0.3779      0.08  Q         |         |         |       V |
21+55       0.3784      0.08  Q         |         |         |       V |
22+ 0       0.3789      0.08  Q         |         |         |       V |
22+ 5       0.3795      0.08  Q         |         |         |       V |
22+10       0.3800      0.08  Q         |         |         |       V |
22+15       0.3805      0.08  Q         |         |         |       V |
22+20       0.3810      0.08  Q         |         |         |       V |
22+25       0.3815      0.07  Q         |         |         |       V |
22+30       0.3821      0.07  Q         |         |         |        V|
22+35       0.3826      0.07  Q         |         |         |        V|
22+40       0.3831      0.07  Q         |         |         |        V|
22+45       0.3836      0.07  Q         |         |         |        V|
22+50       0.3840      0.07  Q         |         |         |        V|
22+55       0.3845      0.07  Q         |         |         |        V|
23+ 0       0.3850      0.07  Q         |         |         |        V|
23+ 5       0.3855      0.07  Q         |         |         |        V|
23+10       0.3860      0.07  Q         |         |         |        V|
23+15       0.3865      0.07  Q         |         |         |        V|
23+20       0.3869      0.07  Q         |         |         |        V|
23+25       0.3874      0.07  Q         |         |         |        V|
```

```
     23+30       0.3879      0.07  Q          |          |          |        V|
     23+35       0.3883      0.07  Q          |          |          |        V|
     23+40       0.3888      0.07  Q          |          |          |        V|
     23+45       0.3892      0.07  Q          |          |          |        V|
     23+50       0.3897      0.07  Q          |          |          |        V|
     23+55       0.3901      0.07  Q          |          |          |        V|
     24+ 0       0.3906      0.06  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 08/04/21

++

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

Program License Serial Number 6385

Space Center
Developed 10-year
Area E

Storm Event Year = 10

Antecedent Moisture Condition = 2

English (in-lb) Input Units Used

English Rainfall Data (Inches) Input Values Used

English Units used in output format

Area averaged rainfall intensity isohyetal data:

Sub-Area (Ac.)	Duration (hours)	Isohyetal (In)
Rainfall data for year 10		
20.90	1	0.62
Rainfall data for year 10		
20.90	6	1.27
Rainfall data for year 10		
20.90	24	2.23

++

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


SCS curve  SCS curve     Area     Area     Fp(Fig C6)    Ap      Fm
No.(AMCII) NO.(AMC 2)    (Ac.)    Fraction     (In/Hr)  (dec.)   (In/Hr)
 65.0      65.0         20.90      1.000     0.608    0.160    0.097

Area-averaged adjusted loss rate Fm (In/Hr) =  0.097

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

Area       Area          SCS CN    SCS CN      S     Pervious
 (Ac.)      Fract         (AMC2)    (AMC2)           Yield Fr
     3.34   0.160         65.0      65.0       5.38     0.091
    17.56   0.840         98.0      98.0       0.20     0.898

Area-averaged catchment yield fraction, Y =  0.769
Area-averaged low loss fraction, Yb =  0.231
User entry of time of concentration  =   0.192 (hours)
+++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Watershed area =      20.90(Ac.)
Catchment Lag time =   0.154 hours
Unit interval =   5.000 minutes
Unit interval percentage of lag time = 54.2535
Hydrograph baseflow =     0.00(CFS)
Average maximum watershed loss rate(Fm) =  0.097(In/Hr)
Average low loss rate fraction (Yb) = 0.178 (decimal)
Note: user entry of the Yb value
DESERT S-Graph Selected
Computed peak 5-minute rainfall =  0.293(In)
Computed peak 30-minute rainfall =  0.502(In)
Specified peak 1-hour rainfall =  0.618(In)
Computed peak 3-hour rainfall =  0.961(In)
Specified peak 6-hour rainfall =  1.270(In)
Specified peak 24-hour rainfall =  2.230(In)


Rainfall depth area reduction factors:
Using a total area of      20.90(Ac.) (Ref: fig. E-4)

5-minute factor = 0.999     Adjusted rainfall =  0.293(In)
30-minute factor = 0.999    Adjusted rainfall =  0.501(In)
1-hour factor = 0.999       Adjusted rainfall =  0.617(In)
3-hour factor = 1.000       Adjusted rainfall =  0.961(In)
6-hour factor = 1.000       Adjusted rainfall =  1.270(In)
24-hour factor = 1.000      Adjusted rainfall =  2.230(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 = 252.76 (CFS))	
1	4.582	11.581
2	35.377	77.838
3	64.099	72.597
4	76.427	31.160
5	83.603	18.139
6	88.449	12.250
7	91.682	8.171
8	94.097	6.104
9	95.871	4.485
10	97.167	3.276
11	97.993	2.086
12	98.587	1.503
13	99.237	1.641
14	99.703	1.178
15	100.000	0.752

Peak Unit Number	Adjusted mass rainfall (In)	Unit rainfall (In)
1	0.2930	0.2930
2	0.3607	0.0677
3	0.4073	0.0467
4	0.4440	0.0367
5	0.4748	0.0307
6	0.5015	0.0267
7	0.5252	0.0237
8	0.5467	0.0215
9	0.5663	0.0197
10	0.5845	0.0182
11	0.6015	0.0170
12	0.6174	0.0159
13	0.6376	0.0202
14	0.6569	0.0193
15	0.6755	0.0185
16	0.6932	0.0178
17	0.7104	0.0171
18	0.7269	0.0165
19	0.7429	0.0160
20	0.7584	0.0155
21	0.7735	0.0151
22	0.7881	0.0146
23	0.8024	0.0142
24	0.8162	0.0139
25	0.8298	0.0135
26	0.8430	0.0132

27	0.8559	0.0129
28	0.8685	0.0126
29	0.8809	0.0124
30	0.8930	0.0121
31	0.9049	0.0119
32	0.9165	0.0116
33	0.9279	0.0114
34	0.9392	0.0112
35	0.9502	0.0110
36	0.9610	0.0108
37	0.9717	0.0106
38	0.9821	0.0105
39	0.9925	0.0103
40	1.0026	0.0102
41	1.0126	0.0100
42	1.0225	0.0099
43	1.0322	0.0097
44	1.0418	0.0096
45	1.0512	0.0095
46	1.0606	0.0093
47	1.0698	0.0092
48	1.0789	0.0091
49	1.0879	0.0090
50	1.0967	0.0089
51	1.1055	0.0088
52	1.1142	0.0087
53	1.1227	0.0086
54	1.1312	0.0085
55	1.1396	0.0084
56	1.1479	0.0083
57	1.1561	0.0082
58	1.1642	0.0081
59	1.1722	0.0080
60	1.1802	0.0079
61	1.1880	0.0079
62	1.1958	0.0078
63	1.2035	0.0077
64	1.2112	0.0076
65	1.2188	0.0076
66	1.2263	0.0075
67	1.2337	0.0074
68	1.2411	0.0074
69	1.2484	0.0073
70	1.2556	0.0072
71	1.2628	0.0072
72	1.2699	0.0071
73	1.2771	0.0071
74	1.2841	0.0071
75	1.2911	0.0070
76	1.2981	0.0070

77	1.3050	0.0069
78	1.3119	0.0069
79	1.3187	0.0068
80	1.3254	0.0068
81	1.3321	0.0067
82	1.3388	0.0067
83	1.3454	0.0066
84	1.3520	0.0066
85	1.3585	0.0065
86	1.3649	0.0065
87	1.3714	0.0064
88	1.3777	0.0064
89	1.3841	0.0063
90	1.3904	0.0063
91	1.3966	0.0063
92	1.4028	0.0062
93	1.4090	0.0062
94	1.4152	0.0061
95	1.4213	0.0061
96	1.4273	0.0061
97	1.4333	0.0060
98	1.4393	0.0060
99	1.4453	0.0059
100	1.4512	0.0059
101	1.4570	0.0059
102	1.4629	0.0058
103	1.4687	0.0058
104	1.4745	0.0058
105	1.4802	0.0057
106	1.4859	0.0057
107	1.4916	0.0057
108	1.4972	0.0056
109	1.5029	0.0056
110	1.5084	0.0056
111	1.5140	0.0056
112	1.5195	0.0055
113	1.5250	0.0055
114	1.5305	0.0055
115	1.5359	0.0054
116	1.5413	0.0054
117	1.5467	0.0054
118	1.5521	0.0054
119	1.5574	0.0053
120	1.5627	0.0053
121	1.5680	0.0053
122	1.5732	0.0053
123	1.5785	0.0052
124	1.5837	0.0052
125	1.5888	0.0052
126	1.5940	0.0052

127	1.5991	0.0051
128	1.6042	0.0051
129	1.6093	0.0051
130	1.6143	0.0051
131	1.6194	0.0050
132	1.6244	0.0050
133	1.6294	0.0050
134	1.6343	0.0050
135	1.6393	0.0049
136	1.6442	0.0049
137	1.6491	0.0049
138	1.6540	0.0049
139	1.6588	0.0049
140	1.6637	0.0048
141	1.6685	0.0048
142	1.6733	0.0048
143	1.6781	0.0048
144	1.6828	0.0048
145	1.6875	0.0047
146	1.6923	0.0047
147	1.6970	0.0047
148	1.7016	0.0047
149	1.7063	0.0047
150	1.7109	0.0046
151	1.7156	0.0046
152	1.7202	0.0046
153	1.7248	0.0046
154	1.7293	0.0046
155	1.7339	0.0046
156	1.7384	0.0045
157	1.7429	0.0045
158	1.7474	0.0045
159	1.7519	0.0045
160	1.7564	0.0045
161	1.7608	0.0045
162	1.7653	0.0044
163	1.7697	0.0044
164	1.7741	0.0044
165	1.7785	0.0044
166	1.7828	0.0044
167	1.7872	0.0044
168	1.7915	0.0043
169	1.7959	0.0043
170	1.8002	0.0043
171	1.8045	0.0043
172	1.8087	0.0043
173	1.8130	0.0043
174	1.8172	0.0042
175	1.8215	0.0042
176	1.8257	0.0042

177	1.8299	0.0042
178	1.8341	0.0042
179	1.8383	0.0042
180	1.8424	0.0042
181	1.8466	0.0042
182	1.8507	0.0041
183	1.8548	0.0041
184	1.8590	0.0041
185	1.8631	0.0041
186	1.8671	0.0041
187	1.8712	0.0041
188	1.8753	0.0041
189	1.8793	0.0040
190	1.8833	0.0040
191	1.8874	0.0040
192	1.8914	0.0040
193	1.8954	0.0040
194	1.8993	0.0040
195	1.9033	0.0040
196	1.9073	0.0040
197	1.9112	0.0039
198	1.9152	0.0039
199	1.9191	0.0039
200	1.9230	0.0039
201	1.9269	0.0039
202	1.9308	0.0039
203	1.9347	0.0039
204	1.9385	0.0039
205	1.9424	0.0039
206	1.9462	0.0038
207	1.9500	0.0038
208	1.9539	0.0038
209	1.9577	0.0038
210	1.9615	0.0038
211	1.9653	0.0038
212	1.9690	0.0038
213	1.9728	0.0038
214	1.9766	0.0038
215	1.9803	0.0037
216	1.9840	0.0037
217	1.9878	0.0037
218	1.9915	0.0037
219	1.9952	0.0037
220	1.9989	0.0037
221	2.0026	0.0037
222	2.0062	0.0037
223	2.0099	0.0037
224	2.0136	0.0037
225	2.0172	0.0036
226	2.0208	0.0036

227	2.0245	0.0036
228	2.0281	0.0036
229	2.0317	0.0036
230	2.0353	0.0036
231	2.0389	0.0036
232	2.0425	0.0036
233	2.0460	0.0036
234	2.0496	0.0036
235	2.0532	0.0036
236	2.0567	0.0035
237	2.0602	0.0035
238	2.0638	0.0035
239	2.0673	0.0035
240	2.0708	0.0035
241	2.0743	0.0035
242	2.0778	0.0035
243	2.0813	0.0035
244	2.0847	0.0035
245	2.0882	0.0035
246	2.0917	0.0035
247	2.0951	0.0034
248	2.0985	0.0034
249	2.1020	0.0034
250	2.1054	0.0034
251	2.1088	0.0034
252	2.1122	0.0034
253	2.1156	0.0034
254	2.1190	0.0034
255	2.1224	0.0034
256	2.1258	0.0034
257	2.1292	0.0034
258	2.1325	0.0034
259	2.1359	0.0034
260	2.1392	0.0033
261	2.1425	0.0033
262	2.1459	0.0033
263	2.1492	0.0033
264	2.1525	0.0033
265	2.1558	0.0033
266	2.1591	0.0033
267	2.1624	0.0033
268	2.1657	0.0033
269	2.1690	0.0033
270	2.1723	0.0033
271	2.1755	0.0033
272	2.1788	0.0033
273	2.1820	0.0032
274	2.1853	0.0032
275	2.1885	0.0032
276	2.1917	0.0032

277	2.1950	0.0032
278	2.1982	0.0032
279	2.2014	0.0032
280	2.2046	0.0032
281	2.2078	0.0032
282	2.2110	0.0032
283	2.2141	0.0032
284	2.2173	0.0032
285	2.2205	0.0032
286	2.2236	0.0032
287	2.2268	0.0032
288	2.2299	0.0031

Unit Period (number)	Unit Rainfall (In)	Unit Soil-Loss (In)	Effective Rainfall (In)
1	0.0031	0.0006	0.0026
2	0.0032	0.0006	0.0026
3	0.0032	0.0006	0.0026
4	0.0032	0.0006	0.0026
5	0.0032	0.0006	0.0026
6	0.0032	0.0006	0.0026
7	0.0032	0.0006	0.0026
8	0.0032	0.0006	0.0026
9	0.0032	0.0006	0.0027
10	0.0032	0.0006	0.0027
11	0.0032	0.0006	0.0027
12	0.0033	0.0006	0.0027
13	0.0033	0.0006	0.0027
14	0.0033	0.0006	0.0027
15	0.0033	0.0006	0.0027
16	0.0033	0.0006	0.0027
17	0.0033	0.0006	0.0027
18	0.0033	0.0006	0.0027
19	0.0033	0.0006	0.0027
20	0.0033	0.0006	0.0028
21	0.0034	0.0006	0.0028
22	0.0034	0.0006	0.0028
23	0.0034	0.0006	0.0028
24	0.0034	0.0006	0.0028
25	0.0034	0.0006	0.0028
26	0.0034	0.0006	0.0028
27	0.0034	0.0006	0.0028
28	0.0034	0.0006	0.0028
29	0.0035	0.0006	0.0028
30	0.0035	0.0006	0.0029
31	0.0035	0.0006	0.0029
32	0.0035	0.0006	0.0029
33	0.0035	0.0006	0.0029

34	0.0035	0.0006	0.0029
35	0.0035	0.0006	0.0029
36	0.0035	0.0006	0.0029
37	0.0036	0.0006	0.0029
38	0.0036	0.0006	0.0029
39	0.0036	0.0006	0.0030
40	0.0036	0.0006	0.0030
41	0.0036	0.0006	0.0030
42	0.0036	0.0006	0.0030
43	0.0036	0.0006	0.0030
44	0.0037	0.0006	0.0030
45	0.0037	0.0007	0.0030
46	0.0037	0.0007	0.0030
47	0.0037	0.0007	0.0030
48	0.0037	0.0007	0.0031
49	0.0037	0.0007	0.0031
50	0.0037	0.0007	0.0031
51	0.0038	0.0007	0.0031
52	0.0038	0.0007	0.0031
53	0.0038	0.0007	0.0031
54	0.0038	0.0007	0.0031
55	0.0038	0.0007	0.0032
56	0.0038	0.0007	0.0032
57	0.0039	0.0007	0.0032
58	0.0039	0.0007	0.0032
59	0.0039	0.0007	0.0032
60	0.0039	0.0007	0.0032
61	0.0039	0.0007	0.0032
62	0.0039	0.0007	0.0032
63	0.0040	0.0007	0.0033
64	0.0040	0.0007	0.0033
65	0.0040	0.0007	0.0033
66	0.0040	0.0007	0.0033
67	0.0040	0.0007	0.0033
68	0.0041	0.0007	0.0033
69	0.0041	0.0007	0.0034
70	0.0041	0.0007	0.0034
71	0.0041	0.0007	0.0034
72	0.0041	0.0007	0.0034
73	0.0042	0.0007	0.0034
74	0.0042	0.0007	0.0034
75	0.0042	0.0007	0.0035
76	0.0042	0.0007	0.0035
77	0.0042	0.0008	0.0035
78	0.0043	0.0008	0.0035
79	0.0043	0.0008	0.0035
80	0.0043	0.0008	0.0035
81	0.0043	0.0008	0.0036
82	0.0044	0.0008	0.0036
83	0.0044	0.0008	0.0036

84	0.0044	0.0008	0.0036
85	0.0044	0.0008	0.0036
86	0.0045	0.0008	0.0037
87	0.0045	0.0008	0.0037
88	0.0045	0.0008	0.0037
89	0.0045	0.0008	0.0037
90	0.0046	0.0008	0.0037
91	0.0046	0.0008	0.0038
92	0.0046	0.0008	0.0038
93	0.0046	0.0008	0.0038
94	0.0047	0.0008	0.0038
95	0.0047	0.0008	0.0039
96	0.0047	0.0008	0.0039
97	0.0048	0.0008	0.0039
98	0.0048	0.0008	0.0039
99	0.0048	0.0009	0.0040
100	0.0048	0.0009	0.0040
101	0.0049	0.0009	0.0040
102	0.0049	0.0009	0.0040
103	0.0049	0.0009	0.0041
104	0.0050	0.0009	0.0041
105	0.0050	0.0009	0.0041
106	0.0050	0.0009	0.0041
107	0.0051	0.0009	0.0042
108	0.0051	0.0009	0.0042
109	0.0052	0.0009	0.0042
110	0.0052	0.0009	0.0043
111	0.0052	0.0009	0.0043
112	0.0053	0.0009	0.0043
113	0.0053	0.0009	0.0044
114	0.0053	0.0009	0.0044
115	0.0054	0.0010	0.0044
116	0.0054	0.0010	0.0044
117	0.0055	0.0010	0.0045
118	0.0055	0.0010	0.0045
119	0.0056	0.0010	0.0046
120	0.0056	0.0010	0.0046
121	0.0056	0.0010	0.0046
122	0.0057	0.0010	0.0047
123	0.0057	0.0010	0.0047
124	0.0058	0.0010	0.0047
125	0.0058	0.0010	0.0048
126	0.0059	0.0010	0.0048
127	0.0059	0.0011	0.0049
128	0.0060	0.0011	0.0049
129	0.0061	0.0011	0.0050
130	0.0061	0.0011	0.0050
131	0.0062	0.0011	0.0051
132	0.0062	0.0011	0.0051
133	0.0063	0.0011	0.0052

134	0.0063	0.0011	0.0052
135	0.0064	0.0011	0.0053
136	0.0065	0.0011	0.0053
137	0.0066	0.0012	0.0054
138	0.0066	0.0012	0.0054
139	0.0067	0.0012	0.0055
140	0.0068	0.0012	0.0056
141	0.0069	0.0012	0.0056
142	0.0069	0.0012	0.0057
143	0.0070	0.0012	0.0058
144	0.0071	0.0013	0.0058
145	0.0071	0.0013	0.0059
146	0.0072	0.0013	0.0059
147	0.0073	0.0013	0.0060
148	0.0074	0.0013	0.0061
149	0.0075	0.0013	0.0062
150	0.0076	0.0013	0.0062
151	0.0077	0.0014	0.0063
152	0.0078	0.0014	0.0064
153	0.0079	0.0014	0.0065
154	0.0080	0.0014	0.0066
155	0.0082	0.0015	0.0067
156	0.0083	0.0015	0.0068
157	0.0085	0.0015	0.0070
158	0.0086	0.0015	0.0070
159	0.0088	0.0016	0.0072
160	0.0089	0.0016	0.0073
161	0.0091	0.0016	0.0075
162	0.0092	0.0016	0.0076
163	0.0095	0.0017	0.0078
164	0.0096	0.0017	0.0079
165	0.0099	0.0018	0.0081
166	0.0100	0.0018	0.0082
167	0.0103	0.0018	0.0085
168	0.0105	0.0019	0.0086
169	0.0108	0.0019	0.0089
170	0.0110	0.0020	0.0091
171	0.0114	0.0020	0.0094
172	0.0116	0.0021	0.0096
173	0.0121	0.0022	0.0100
174	0.0124	0.0022	0.0102
175	0.0129	0.0023	0.0106
176	0.0132	0.0023	0.0109
177	0.0139	0.0025	0.0114
178	0.0142	0.0025	0.0117
179	0.0151	0.0027	0.0124
180	0.0155	0.0028	0.0128
181	0.0165	0.0029	0.0136
182	0.0171	0.0030	0.0141
183	0.0185	0.0033	0.0152

184	0.0193	0.0034	0.0159
185	0.0159	0.0028	0.0131
186	0.0170	0.0030	0.0139
187	0.0197	0.0035	0.0162
188	0.0215	0.0038	0.0177
189	0.0267	0.0047	0.0220
190	0.0307	0.0055	0.0253
191	0.0467	0.0081	0.0385
192	0.0677	0.0081	0.0596
193	0.2930	0.0081	0.2849
194	0.0367	0.0065	0.0302
195	0.0237	0.0042	0.0195
196	0.0182	0.0032	0.0150
197	0.0202	0.0036	0.0166
198	0.0178	0.0032	0.0146
199	0.0160	0.0028	0.0132
200	0.0146	0.0026	0.0120
201	0.0135	0.0024	0.0111
202	0.0126	0.0022	0.0104
203	0.0119	0.0021	0.0098
204	0.0112	0.0020	0.0092
205	0.0106	0.0019	0.0088
206	0.0102	0.0018	0.0084
207	0.0097	0.0017	0.0080
208	0.0093	0.0017	0.0077
209	0.0090	0.0016	0.0074
210	0.0087	0.0015	0.0071
211	0.0084	0.0015	0.0069
212	0.0081	0.0014	0.0067
213	0.0079	0.0014	0.0065
214	0.0076	0.0014	0.0063
215	0.0074	0.0013	0.0061
216	0.0072	0.0013	0.0060
217	0.0071	0.0013	0.0059
218	0.0070	0.0012	0.0057
219	0.0068	0.0012	0.0056
220	0.0067	0.0012	0.0055
221	0.0065	0.0012	0.0054
222	0.0064	0.0011	0.0052
223	0.0063	0.0011	0.0051
224	0.0061	0.0011	0.0050
225	0.0060	0.0011	0.0050
226	0.0059	0.0011	0.0049
227	0.0058	0.0010	0.0048
228	0.0057	0.0010	0.0047
229	0.0056	0.0010	0.0046
230	0.0055	0.0010	0.0045
231	0.0054	0.0010	0.0045
232	0.0054	0.0010	0.0044
233	0.0053	0.0009	0.0043

234	0.0052	0.0009	0.0043
235	0.0051	0.0009	0.0042
236	0.0051	0.0009	0.0042
237	0.0050	0.0009	0.0041
238	0.0049	0.0009	0.0040
239	0.0049	0.0009	0.0040
240	0.0048	0.0009	0.0039
241	0.0047	0.0008	0.0039
242	0.0047	0.0008	0.0038
243	0.0046	0.0008	0.0038
244	0.0046	0.0008	0.0038
245	0.0045	0.0008	0.0037
246	0.0045	0.0008	0.0037
247	0.0044	0.0008	0.0036
248	0.0044	0.0008	0.0036
249	0.0043	0.0008	0.0036
250	0.0043	0.0008	0.0035
251	0.0042	0.0008	0.0035
252	0.0042	0.0007	0.0034
253	0.0042	0.0007	0.0034
254	0.0041	0.0007	0.0034
255	0.0041	0.0007	0.0033
256	0.0040	0.0007	0.0033
257	0.0040	0.0007	0.0033
258	0.0040	0.0007	0.0033
259	0.0039	0.0007	0.0032
260	0.0039	0.0007	0.0032
261	0.0039	0.0007	0.0032
262	0.0038	0.0007	0.0031
263	0.0038	0.0007	0.0031
264	0.0038	0.0007	0.0031
265	0.0037	0.0007	0.0031
266	0.0037	0.0007	0.0030
267	0.0037	0.0007	0.0030
268	0.0036	0.0006	0.0030
269	0.0036	0.0006	0.0030
270	0.0036	0.0006	0.0029
271	0.0036	0.0006	0.0029
272	0.0035	0.0006	0.0029
273	0.0035	0.0006	0.0029
274	0.0035	0.0006	0.0029
275	0.0034	0.0006	0.0028
276	0.0034	0.0006	0.0028
277	0.0034	0.0006	0.0028
278	0.0034	0.0006	0.0028
279	0.0034	0.0006	0.0028
280	0.0033	0.0006	0.0027
281	0.0033	0.0006	0.0027
282	0.0033	0.0006	0.0027
283	0.0033	0.0006	0.0027

```
      284              0.0032           0.0006              0.0027
      285              0.0032           0.0006              0.0026
      286              0.0032           0.0006              0.0026
      287              0.0032           0.0006              0.0026
      288              0.0032           0.0006              0.0026
      --------------------------------------------------------------------
      --------------------------------------------------------------------
      Total soil rain loss =      0.35(In)
      Total effective rainfall =      1.88(In)
      Peak flow rate in flood hydrograph =     29.23(CFS)
      ---------------------------------------------------------------------
      ++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
                          24 - H O U R   S T O R M
                     R u n o f f    H y d r o g r a p h
      --------------------------------------------------------------------
                 Hydrograph in   5   Minute intervals ((CFS))

      --------------------------------------------------------------------
Time(h+m) Volume Ac.Ft   Q(CFS)  0        7.5      15.0      22.5      30.0
-----------------------------------------------------------------------
  0+ 5       0.0002      0.03  Q         |         |         |         |
  0+10       0.0018      0.23  Q         |         |         |         |
  0+15       0.0047      0.42  Q         |         |         |         |
  0+20       0.0082      0.50  Q         |         |         |         |
  0+25       0.0119      0.55  Q         |         |         |         |
  0+30       0.0160      0.58  Q         |         |         |         |
  0+35       0.0201      0.61  Q         |         |         |         |
  0+40       0.0244      0.62  Q         |         |         |         |
  0+45       0.0288      0.64  Q         |         |         |         |
  0+50       0.0333      0.65  Q         |         |         |         |
  0+55       0.0378      0.66  Q         |         |         |         |
  1+ 0       0.0424      0.66  Q         |         |         |         |
  1+ 5       0.0470      0.67  Q         |         |         |         |
  1+10       0.0516      0.67  Q         |         |         |         |
  1+15       0.0563      0.68  Q         |         |         |         |
  1+20       0.0610      0.68  Q         |         |         |         |
  1+25       0.0657      0.68  Q         |         |         |         |
  1+30       0.0704      0.68  Q         |         |         |         |
  1+35       0.0751      0.69  Q         |         |         |         |
  1+40       0.0799      0.69  Q         |         |         |         |
  1+45       0.0846      0.69  QV        |         |         |         |
  1+50       0.0894      0.69  QV        |         |         |         |
  1+55       0.0942      0.70  QV        |         |         |         |
  2+ 0       0.0990      0.70  QV        |         |         |         |
  2+ 5       0.1039      0.70  QV        |         |         |         |
  2+10       0.1087      0.70  QV        |         |         |         |
  2+15       0.1136      0.71  QV        |         |         |         |
  2+20       0.1185      0.71  QV        |         |         |         |
  2+25       0.1234      0.71  QV        |         |         |         |
  2+30       0.1283      0.71  QV        |         |         |         |
```

```
2+35       0.1332      0.72  QV        |         |         |         |
2+40       0.1382      0.72  QV        |         |         |         |
2+45       0.1431      0.72  QV        |         |         |         |
2+50       0.1481      0.72  QV        |         |         |         |
2+55       0.1531      0.73  QV        |         |         |         |
3+ 0       0.1581      0.73  QV        |         |         |         |
3+ 5       0.1632      0.73  QV        |         |         |         |
3+10       0.1683      0.74  Q V       |         |         |         |
3+15       0.1733      0.74  Q V       |         |         |         |
3+20       0.1784      0.74  Q V       |         |         |         |
3+25       0.1836      0.74  Q V       |         |         |         |
3+30       0.1887      0.75  Q V       |         |         |         |
3+35       0.1939      0.75  Q V       |         |         |         |
3+40       0.1990      0.75  |QV       |         |         |         |
3+45       0.2042      0.76  |QV       |         |         |         |
3+50       0.2095      0.76  |QV       |         |         |         |
3+55       0.2147      0.76  |QV       |         |         |         |
4+ 0       0.2200      0.76  |QV       |         |         |         |
4+ 5       0.2253      0.77  |QV       |         |         |         |
4+10       0.2306      0.77  |QV       |         |         |         |
4+15       0.2359      0.77  |QV       |         |         |         |
4+20       0.2412      0.78  |QV       |         |         |         |
4+25       0.2466      0.78  |Q V      |         |         |         |
4+30       0.2520      0.78  |Q V      |         |         |         |
4+35       0.2574      0.79  |Q V      |         |         |         |
4+40       0.2629      0.79  |Q V      |         |         |         |
4+45       0.2683      0.79  |Q V      |         |         |         |
4+50       0.2738      0.80  |Q V      |         |         |         |
4+55       0.2793      0.80  |Q V      |         |         |         |
5+ 0       0.2849      0.80  |Q V      |         |         |         |
5+ 5       0.2904      0.81  |Q V      |         |         |         |
5+10       0.2960      0.81  |Q V      |         |         |         |
5+15       0.3016      0.81  |Q V      |         |         |         |
5+20       0.3073      0.82  |Q V      |         |         |         |
5+25       0.3129      0.82  |Q V      |         |         |         |
5+30       0.3186      0.83  |Q V      |         |         |         |
5+35       0.3243      0.83  |Q V      |         |         |         |
5+40       0.3301      0.83  |Q  V     |         |         |         |
5+45       0.3358      0.84  |Q  V     |         |         |         |
5+50       0.3416      0.84  |Q  V     |         |         |         |
5+55       0.3474      0.85  |Q  V     |         |         |         |
6+ 0       0.3533      0.85  |Q  V     |         |         |         |
6+ 5       0.3592      0.85  |Q  V     |         |         |         |
6+10       0.3651      0.86  |Q  V     |         |         |         |
6+15       0.3710      0.86  |Q  V     |         |         |         |
6+20       0.3770      0.87  |Q  V     |         |         |         |
6+25       0.3830      0.87  |Q  V     |         |         |         |
6+30       0.3890      0.87  |Q  V     |         |         |         |
6+35       0.3951      0.88  |Q  V     |         |         |         |
6+40       0.4011      0.88  |Q  V     |         |         |         |
```

```
  6+45          0.4073       0.89 |Q  V     |         |         |         |
  6+50          0.4134       0.89 |Q   V    |         |         |         |
  6+55          0.4196       0.90 |Q   V    |         |         |         |
  7+ 0          0.4258       0.90 |Q   V    |         |         |         |
  7+ 5          0.4321       0.91 |Q   V    |         |         |         |
  7+10          0.4383       0.91 |Q   V    |         |         |         |
  7+15          0.4447       0.92 |Q   V    |         |         |         |
  7+20          0.4510       0.92 |Q   V    |         |         |         |
  7+25          0.4574       0.93 |Q   V    |         |         |         |
  7+30          0.4638       0.93 |Q   V    |         |         |         |
  7+35          0.4703       0.94 |Q   V    |         |         |         |
  7+40          0.4768       0.94 |Q   V    |         |         |         |
  7+45          0.4833       0.95 |Q   V    |         |         |         |
  7+50          0.4899       0.95 |Q   V    |         |         |         |
  7+55          0.4965       0.96 |Q    V   |         |         |         |
  8+ 0          0.5031       0.97 |Q    V   |         |         |         |
  8+ 5          0.5098       0.97 |Q    V   |         |         |         |
  8+10          0.5166       0.98 |Q    V   |         |         |         |
  8+15          0.5233       0.98 |Q    V   |         |         |         |
  8+20          0.5301       0.99 |Q    V   |         |         |         |
  8+25          0.5370       1.00 |Q    V   |         |         |         |
  8+30          0.5439       1.00 |Q    V   |         |         |         |
  8+35          0.5509       1.01 |Q    V   |         |         |         |
  8+40          0.5578       1.02 |Q    V   |         |         |         |
  8+45          0.5649       1.02 |Q    V   |         |         |         |
  8+50          0.5720       1.03 |Q    V   |         |         |         |
  8+55          0.5791       1.04 |Q     V  |         |         |         |
  9+ 0          0.5863       1.04 |Q     V  |         |         |         |
  9+ 5          0.5935       1.05 |Q     V  |         |         |         |
  9+10          0.6008       1.06 |Q     V  |         |         |         |
  9+15          0.6081       1.06 |Q     V  |         |         |         |
  9+20          0.6155       1.07 |Q     V  |         |         |         |
  9+25          0.6229       1.08 |Q     V  |         |         |         |
  9+30          0.6304       1.09 |Q     V  |         |         |         |
  9+35          0.6379       1.10 |Q     V  |         |         |         |
  9+40          0.6455       1.10 |Q     V  |         |         |         |
  9+45          0.6532       1.11 |Q     V  |         |         |         |
  9+50          0.6609       1.12 |Q      V |         |         |         |
  9+55          0.6687       1.13 |Q      V |         |         |         |
 10+ 0          0.6765       1.14 |Q      V |         |         |         |
 10+ 5          0.6844       1.15 |Q      V |         |         |         |
 10+10          0.6924       1.16 |Q      V |         |         |         |
 10+15          0.7004       1.17 |Q      V |         |         |         |
 10+20          0.7085       1.18 |Q      V |         |         |         |
 10+25          0.7167       1.18 |Q      V |         |         |         |
 10+30          0.7249       1.20 |Q      V |         |         |         |
 10+35          0.7332       1.21 |Q      V |         |         |         |
 10+40          0.7416       1.22 |Q       V|         |         |         |
 10+45          0.7500       1.23 |Q       V|         |         |         |
 10+50          0.7586       1.24 |Q       V|         |         |         |
```

```
10+55       0.7672      1.25  |Q       V|         |         |         |
11+ 0       0.7758      1.26  |Q       V|         |         |         |
11+ 5       0.7846      1.27  |Q       V|         |         |         |
11+10       0.7935      1.29  |Q       V|         |         |         |
11+15       0.8024      1.30  |Q       V|         |         |         |
11+20       0.8114      1.31  |Q       V|         |         |         |
11+25       0.8205      1.32  |Q        V         |         |         |
11+30       0.8298      1.34  |Q        V         |         |         |
11+35       0.8391      1.35  |Q        V         |         |         |
11+40       0.8485      1.37  |Q        V         |         |         |
11+45       0.8580      1.38  |Q        V         |         |         |
11+50       0.8676      1.40  |Q        V         |         |         |
11+55       0.8773      1.41  |Q        V         |         |         |
12+ 0       0.8872      1.43  |Q        V         |         |         |
12+ 5       0.8971      1.44  |Q        V         |         |         |
12+10       0.9071      1.46  |Q        |V        |         |         |
12+15       0.9173      1.47  |Q        |V        |         |         |
12+20       0.9275      1.49  |Q        |V        |         |         |
12+25       0.9379      1.51  | Q       |V        |         |         |
12+30       0.9484      1.52  | Q       |V        |         |         |
12+35       0.9590      1.54  | Q       |V        |         |         |
12+40       0.9698      1.57  | Q       |V        |         |         |
12+45       0.9807      1.59  | Q       |V        |         |         |
12+50       0.9918      1.61  | Q       | V       |         |         |
12+55       1.0031      1.63  | Q       | V       |         |         |
13+ 0       1.0145      1.66  | Q       | V       |         |         |
13+ 5       1.0261      1.68  | Q       | V       |         |         |
13+10       1.0378      1.71  | Q       | V       |         |         |
13+15       1.0498      1.74  | Q       | V       |         |         |
13+20       1.0620      1.77  | Q       | V       |         |         |
13+25       1.0744      1.80  | Q       |  V      |         |         |
13+30       1.0870      1.83  | Q       |  V      |         |         |
13+35       1.0998      1.86  | Q       |  V      |         |         |
13+40       1.1129      1.90  | Q       |  V      |         |         |
13+45       1.1262      1.94  | Q       |  V      |         |         |
13+50       1.1398      1.98  | Q       |  V      |         |         |
13+55       1.1537      2.02  | Q       |   V     |         |         |
14+ 0       1.1679      2.06  | Q       |   V     |         |         |
14+ 5       1.1824      2.11  | Q       |   V     |         |         |
14+10       1.1973      2.16  | Q       |   V     |         |         |
14+15       1.2125      2.21  | Q       |   V     |         |         |
14+20       1.2281      2.27  |  Q      |   V     |         |         |
14+25       1.2442      2.33  |  Q      |    V    |         |         |
14+30       1.2607      2.40  |  Q      |    V    |         |         |
14+35       1.2776      2.46  |  Q      |    V    |         |         |
14+40       1.2951      2.54  |  Q      |    V    |         |         |
14+45       1.3132      2.62  |  Q      |     V   |         |         |
14+50       1.3319      2.71  |  Q      |     V   |         |         |
14+55       1.3512      2.81  |  Q      |     V   |         |         |
15+ 0       1.3714      2.92  |  Q      |     V   |         |         |
```

```
15+ 5       1.3923      3.04  |   Q     |      V  |         |         |
15+10       1.4143      3.18  |   Q     |      V  |         |         |
15+15       1.4372      3.33  |   Q     |      V  |         |         |
15+20       1.4615      3.52  |   Q     |      V  |         |         |
15+25       1.4867      3.67  |   Q     |       V |         |         |
15+30       1.5113      3.57  |   Q     |       V |         |         |
15+35       1.5356      3.53  |   Q     |       V |         |         |
15+40       1.5613      3.73  |   Q     |        V|         |         |
15+45       1.5893      4.06  |    Q    |        V|         |         |
15+50       1.6211      4.62  |     Q   |        V|         |         |
15+55       1.6585      5.43  |      Q  |         V         |         |
16+ 0       1.7077      7.14  |        Q|         V         |         |
16+ 5       1.7942     12.57  |         |     Q   |V        |         |
16+10       1.9955     29.23  |         |         |   V     |       Q |
16+15       2.1789     26.63  |         |         |     V   |    Q    |
16+20       2.2815     14.89  |         |        Q|      V  |         |
16+25       2.3527     10.34  |         |  Q      |       V |         |
16+30       2.4093      8.21  |         Q         |        V|         |
16+35       2.4558      6.76  |        Q|         |        V|         |
16+40       2.4956      5.78  |      Q  |         |         V         |
16+45       2.5298      4.97  |     Q   |         |         V         |
16+50       2.5595      4.31  |    Q    |         |         |V        |
16+55       2.5852      3.73  |   Q     |         |         |V        |
17+ 0       2.6083      3.35  |   Q     |         |         |V        |
17+ 5       2.6302      3.17  |   Q     |         |         | V       |
17+10       2.6499      2.87  |  Q      |         |         | V       |
17+15       2.6677      2.58  |  Q      |         |         | V       |
17+20       2.6832      2.25  |  Q      |         |         | V       |
17+25       2.6979      2.14  | Q       |         |         | V       |
17+30       2.7119      2.04  | Q       |         |         |  V      |
17+35       2.7254      1.96  | Q       |         |         |  V      |
17+40       2.7383      1.88  | Q       |         |         |  V      |
17+45       2.7508      1.81  | Q       |         |         |  V      |
17+50       2.7628      1.75  | Q       |         |         |  V      |
17+55       2.7745      1.69  | Q       |         |         |  V      |
18+ 0       2.7857      1.64  | Q       |         |         |   V     |
18+ 5       2.7967      1.59  | Q       |         |         |   V     |
18+10       2.8074      1.55  | Q       |         |         |   V     |
18+15       2.8178      1.51  | Q       |         |         |   V     |
18+20       2.8280      1.48  |Q        |         |         |   V     |
18+25       2.8379      1.44  |Q        |         |         |   V     |
18+30       2.8476      1.41  |Q        |         |         |   V     |
18+35       2.8571      1.38  |Q        |         |         |   V     |
18+40       2.8664      1.35  |Q        |         |         |    V    |
18+45       2.8756      1.32  |Q        |         |         |    V    |
18+50       2.8845      1.30  |Q        |         |         |    V    |
18+55       2.8933      1.27  |Q        |         |         |    V    |
19+ 0       2.9019      1.25  |Q        |         |         |    V    |
19+ 5       2.9103      1.23  |Q        |         |         |    V    |
19+10       2.9186      1.20  |Q        |         |         |    V    |
```

19+15	2.9268	1.18	Q			V
19+20	2.9348	1.16	Q			V
19+25	2.9427	1.15	Q			V
19+30	2.9504	1.13	Q			V
19+35	2.9581	1.11	Q			V
19+40	2.9656	1.09	Q			V
19+45	2.9731	1.08	Q			V
19+50	2.9804	1.06	Q			V
19+55	2.9876	1.05	Q			V
20+ 0	2.9947	1.03	Q			V
20+ 5	3.0017	1.02	Q			V
20+10	3.0087	1.01	Q			V
20+15	3.0155	0.99	Q			V
20+20	3.0223	0.98	Q			V
20+25	3.0290	0.97	Q			V
20+30	3.0356	0.96	Q			V
20+35	3.0421	0.95	Q			V
20+40	3.0486	0.94	Q			V
20+45	3.0550	0.93	Q			V
20+50	3.0613	0.92	Q			V
20+55	3.0675	0.91	Q			V
21+ 0	3.0737	0.90	Q			V
21+ 5	3.0798	0.89	Q			V
21+10	3.0859	0.88	Q			V
21+15	3.0918	0.87	Q			V
21+20	3.0978	0.86	Q			V
21+25	3.1036	0.85	Q			V
21+30	3.1095	0.84	Q			V
21+35	3.1152	0.84	Q			V
21+40	3.1209	0.83	Q			V
21+45	3.1266	0.82	Q			V
21+50	3.1322	0.81	Q			V
21+55	3.1378	0.81	Q			V
22+ 0	3.1433	0.80	Q			V
22+ 5	3.1487	0.79	Q			V
22+10	3.1541	0.79	Q			V
22+15	3.1595	0.78	Q			V
22+20	3.1648	0.77	Q			V
22+25	3.1701	0.77	Q			V
22+30	3.1753	0.76	Q			V
22+35	3.1805	0.75	Q			V
22+40	3.1857	0.75	Q			V
22+45	3.1908	0.74	Q			V
22+50	3.1959	0.74	Q			V
22+55	3.2009	0.73	Q			V
23+ 0	3.2059	0.73	Q			V
23+ 5	3.2109	0.72	Q			V
23+10	3.2158	0.72	Q			V
23+15	3.2207	0.71	Q			V
23+20	3.2256	0.71	Q			V

```
     23+25       3.2304      0.70  Q           |          |          |        V|
     23+30       3.2352      0.70  Q           |          |          |        V|
     23+35       3.2400      0.69  Q           |          |          |        V|
     23+40       3.2447      0.69  Q           |          |          |        V|
     23+45       3.2494      0.68  Q           |          |          |        V|
     23+50       3.2541      0.68  Q           |          |          |        V|
     23+55       3.2587      0.67  Q           |          |          |        V|
     24+ 0       3.2633      0.67  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 08/04/21

++

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

Program License Serial Number 6385

Space Center
developed 10-year
Area F

Storm Event Year = 10

Antecedent Moisture Condition = 2

English (in-lb) Input Units Used

English Rainfall Data (Inches) Input Values Used

English Units used in output format

Area averaged rainfall intensity isohyetal data:

Sub-Area (Ac.)	Duration (hours)	Isohyetal (In)
Rainfall data for year 10		
31.02	1	0.62
Rainfall data for year 10		
31.02	6	1.27
Rainfall data for year 10		
31.02	24	2.23

++

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


SCS curve  SCS curve     Area     Area     Fp(Fig C6)    Ap      Fm
No.(AMCII) NO.(AMC 2)    (Ac.)    Fraction     (In/Hr)  (dec.)   (In/Hr)
 58.0      58.0         31.02      1.000     0.707    0.160    0.113

Area-averaged adjusted loss rate Fm (In/Hr) =  0.113

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

Area       Area          SCS CN    SCS CN      S     Pervious
 (Ac.)      Fract         (AMC2)    (AMC2)           Yield Fr
     4.96   0.160         58.0      58.0       7.24     0.034
    26.06   0.840         98.0      98.0       0.20     0.898

Area-averaged catchment yield fraction, Y =  0.760
Area-averaged low loss fraction, Yb =  0.240
User entry of time of concentration  =   0.610 (hours)
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Watershed area =      31.02(Ac.)
Catchment Lag time =   0.488 hours
Unit interval =   5.000 minutes
Unit interval percentage of lag time = 17.0765
Hydrograph baseflow =     0.00(CFS)
Average maximum watershed loss rate(Fm) =  0.113(In/Hr)
Average low loss rate fraction (Yb) = 0.240 (decimal)
DESERT S-Graph Selected
Computed peak 5-minute rainfall =  0.293(In)
Computed peak 30-minute rainfall =  0.502(In)
Specified peak 1-hour rainfall =  0.618(In)
Computed peak 3-hour rainfall =  0.961(In)
Specified peak 6-hour rainfall =  1.270(In)
Specified peak 24-hour rainfall =  2.230(In)


Rainfall depth area reduction factors:
Using a total area of      31.02(Ac.) (Ref: fig. E-4)

5-minute factor = 0.999     Adjusted rainfall =  0.293(In)
30-minute factor = 0.999    Adjusted rainfall =  0.501(In)
1-hour factor = 0.999       Adjusted rainfall =  0.617(In)
3-hour factor = 1.000       Adjusted rainfall =  0.961(In)
6-hour factor = 1.000       Adjusted rainfall =  1.270(In)
24-hour factor = 1.000      Adjusted rainfall =  2.230(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 = 375.15 (CFS))	
1	0.800	3.003
2	3.500	10.126
3	8.087	17.208
4	17.130	33.928
5	32.658	58.253
6	46.060	50.275
7	55.521	35.496
8	62.196	25.040
9	67.209	18.806
10	71.354	15.551
11	74.745	12.719
12	77.666	10.960
13	80.076	9.041
14	82.191	7.934
15	84.029	6.893
16	85.710	6.307
17	87.240	5.739
18	88.575	5.011
19	89.655	4.050
20	90.648	3.724
21	91.586	3.523
22	92.423	3.138
23	93.206	2.937
24	93.929	2.712
25	94.525	2.236
26	95.105	2.178
27	95.657	2.071
28	96.110	1.697
29	96.554	1.666
30	96.962	1.533
31	97.275	1.173
32	97.582	1.153
33	97.847	0.992
34	98.021	0.652
35	98.191	0.641
36	98.375	0.688
37	98.580	0.768
38	98.784	0.769
39	98.989	0.769
40	99.194	0.769
41	99.399	0.769
42	99.554	0.582
43	99.661	0.400
44	99.768	0.400
45	99.874	0.400

46	100.000	0.200

Peak Unit Number	Adjusted mass rainfall (In)	Unit rainfall (In)
1	0.2928	0.2928
2	0.3605	0.0677
3	0.4071	0.0466
4	0.4438	0.0367
5	0.4746	0.0307
6	0.5012	0.0267
7	0.5250	0.0237
8	0.5464	0.0215
9	0.5661	0.0197
10	0.5843	0.0182
11	0.6012	0.0169
12	0.6171	0.0159
13	0.6373	0.0202
14	0.6567	0.0193
15	0.6752	0.0185
16	0.6930	0.0178
17	0.7101	0.0171
18	0.7267	0.0166
19	0.7427	0.0160
20	0.7582	0.0155
21	0.7733	0.0151
22	0.7879	0.0146
23	0.8022	0.0142
24	0.8161	0.0139
25	0.8296	0.0135
26	0.8428	0.0132
27	0.8557	0.0129
28	0.8684	0.0126
29	0.8807	0.0124
30	0.8929	0.0121
31	0.9048	0.0119
32	0.9164	0.0117
33	0.9278	0.0114
34	0.9391	0.0112
35	0.9501	0.0110
36	0.9610	0.0109
37	0.9716	0.0106
38	0.9821	0.0105
39	0.9924	0.0103
40	1.0026	0.0102
41	1.0126	0.0100
42	1.0224	0.0099
43	1.0321	0.0097
44	1.0417	0.0096
45	1.0512	0.0095
46	1.0605	0.0093

47	1.0697	0.0092
48	1.0788	0.0091
49	1.0878	0.0090
50	1.0967	0.0089
51	1.1054	0.0088
52	1.1141	0.0087
53	1.1227	0.0086
54	1.1312	0.0085
55	1.1395	0.0084
56	1.1478	0.0083
57	1.1560	0.0082
58	1.1641	0.0081
59	1.1722	0.0080
60	1.1801	0.0079
61	1.1880	0.0079
62	1.1958	0.0078
63	1.2035	0.0077
64	1.2111	0.0076
65	1.2187	0.0076
66	1.2262	0.0075
67	1.2337	0.0074
68	1.2410	0.0074
69	1.2483	0.0073
70	1.2556	0.0072
71	1.2628	0.0072
72	1.2699	0.0071
73	1.2770	0.0071
74	1.2841	0.0071
75	1.2911	0.0070
76	1.2981	0.0070
77	1.3050	0.0069
78	1.3118	0.0069
79	1.3186	0.0068
80	1.3254	0.0068
81	1.3321	0.0067
82	1.3388	0.0067
83	1.3454	0.0066
84	1.3519	0.0066
85	1.3584	0.0065
86	1.3649	0.0065
87	1.3713	0.0064
88	1.3777	0.0064
89	1.3840	0.0063
90	1.3903	0.0063
91	1.3966	0.0063
92	1.4028	0.0062
93	1.4090	0.0062
94	1.4151	0.0061
95	1.4212	0.0061
96	1.4273	0.0061

97	1.4333	0.0060
98	1.4393	0.0060
99	1.4452	0.0059
100	1.4511	0.0059
101	1.4570	0.0059
102	1.4628	0.0058
103	1.4687	0.0058
104	1.4744	0.0058
105	1.4802	0.0057
106	1.4859	0.0057
107	1.4916	0.0057
108	1.4972	0.0056
109	1.5028	0.0056
110	1.5084	0.0056
111	1.5140	0.0056
112	1.5195	0.0055
113	1.5250	0.0055
114	1.5304	0.0055
115	1.5359	0.0054
116	1.5413	0.0054
117	1.5467	0.0054
118	1.5520	0.0054
119	1.5574	0.0053
120	1.5627	0.0053
121	1.5679	0.0053
122	1.5732	0.0053
123	1.5784	0.0052
124	1.5836	0.0052
125	1.5888	0.0052
126	1.5939	0.0052
127	1.5991	0.0051
128	1.6042	0.0051
129	1.6092	0.0051
130	1.6143	0.0051
131	1.6193	0.0050
132	1.6243	0.0050
133	1.6293	0.0050
134	1.6343	0.0050
135	1.6392	0.0049
136	1.6442	0.0049
137	1.6491	0.0049
138	1.6539	0.0049
139	1.6588	0.0049
140	1.6636	0.0048
141	1.6684	0.0048
142	1.6732	0.0048
143	1.6780	0.0048
144	1.6828	0.0048
145	1.6875	0.0047
146	1.6922	0.0047

147	1.6969	0.0047
148	1.7016	0.0047
149	1.7063	0.0047
150	1.7109	0.0046
151	1.7155	0.0046
152	1.7201	0.0046
153	1.7247	0.0046
154	1.7293	0.0046
155	1.7338	0.0046
156	1.7384	0.0045
157	1.7429	0.0045
158	1.7474	0.0045
159	1.7519	0.0045
160	1.7563	0.0045
161	1.7608	0.0045
162	1.7652	0.0044
163	1.7696	0.0044
164	1.7740	0.0044
165	1.7784	0.0044
166	1.7828	0.0044
167	1.7872	0.0044
168	1.7915	0.0043
169	1.7958	0.0043
170	1.8001	0.0043
171	1.8044	0.0043
172	1.8087	0.0043
173	1.8130	0.0043
174	1.8172	0.0042
175	1.8214	0.0042
176	1.8257	0.0042
177	1.8299	0.0042
178	1.8341	0.0042
179	1.8382	0.0042
180	1.8424	0.0042
181	1.8466	0.0042
182	1.8507	0.0041
183	1.8548	0.0041
184	1.8589	0.0041
185	1.8630	0.0041
186	1.8671	0.0041
187	1.8712	0.0041
188	1.8752	0.0041
189	1.8793	0.0040
190	1.8833	0.0040
191	1.8873	0.0040
192	1.8913	0.0040
193	1.8953	0.0040
194	1.8993	0.0040
195	1.9033	0.0040
196	1.9072	0.0040

197	1.9112	0.0039
198	1.9151	0.0039
199	1.9190	0.0039
200	1.9230	0.0039
201	1.9269	0.0039
202	1.9307	0.0039
203	1.9346	0.0039
204	1.9385	0.0039
205	1.9423	0.0039
206	1.9462	0.0038
207	1.9500	0.0038
208	1.9538	0.0038
209	1.9576	0.0038
210	1.9614	0.0038
211	1.9652	0.0038
212	1.9690	0.0038
213	1.9728	0.0038
214	1.9765	0.0038
215	1.9803	0.0037
216	1.9840	0.0037
217	1.9877	0.0037
218	1.9915	0.0037
219	1.9952	0.0037
220	1.9989	0.0037
221	2.0025	0.0037
222	2.0062	0.0037
223	2.0099	0.0037
224	2.0135	0.0037
225	2.0172	0.0036
226	2.0208	0.0036
227	2.0244	0.0036
228	2.0281	0.0036
229	2.0317	0.0036
230	2.0353	0.0036
231	2.0389	0.0036
232	2.0424	0.0036
233	2.0460	0.0036
234	2.0496	0.0036
235	2.0531	0.0036
236	2.0567	0.0035
237	2.0602	0.0035
238	2.0637	0.0035
239	2.0672	0.0035
240	2.0708	0.0035
241	2.0743	0.0035
242	2.0777	0.0035
243	2.0812	0.0035
244	2.0847	0.0035
245	2.0882	0.0035
246	2.0916	0.0035

247	2.0951	0.0034
248	2.0985	0.0034
249	2.1019	0.0034
250	2.1054	0.0034
251	2.1088	0.0034
252	2.1122	0.0034
253	2.1156	0.0034
254	2.1190	0.0034
255	2.1224	0.0034
256	2.1258	0.0034
257	2.1291	0.0034
258	2.1325	0.0034
259	2.1358	0.0034
260	2.1392	0.0033
261	2.1425	0.0033
262	2.1458	0.0033
263	2.1492	0.0033
264	2.1525	0.0033
265	2.1558	0.0033
266	2.1591	0.0033
267	2.1624	0.0033
268	2.1657	0.0033
269	2.1690	0.0033
270	2.1722	0.0033
271	2.1755	0.0033
272	2.1787	0.0033
273	2.1820	0.0032
274	2.1852	0.0032
275	2.1885	0.0032
276	2.1917	0.0032
277	2.1949	0.0032
278	2.1981	0.0032
279	2.2013	0.0032
280	2.2045	0.0032
281	2.2077	0.0032
282	2.2109	0.0032
283	2.2141	0.0032
284	2.2173	0.0032
285	2.2205	0.0032
286	2.2236	0.0032
287	2.2268	0.0032
288	2.2299	0.0031

Unit Period (number)	Unit Rainfall (In)	Unit Soil-Loss (In)	Effective Rainfall (In)
1	0.0031	0.0008	0.0024
2	0.0032	0.0008	0.0024
3	0.0032	0.0008	0.0024

4	0.0032	0.0008	0.0024
5	0.0032	0.0008	0.0024
6	0.0032	0.0008	0.0024
7	0.0032	0.0008	0.0024
8	0.0032	0.0008	0.0024
9	0.0032	0.0008	0.0025
10	0.0032	0.0008	0.0025
11	0.0032	0.0008	0.0025
12	0.0033	0.0008	0.0025
13	0.0033	0.0008	0.0025
14	0.0033	0.0008	0.0025
15	0.0033	0.0008	0.0025
16	0.0033	0.0008	0.0025
17	0.0033	0.0008	0.0025
18	0.0033	0.0008	0.0025
19	0.0033	0.0008	0.0025
20	0.0033	0.0008	0.0025
21	0.0034	0.0008	0.0026
22	0.0034	0.0008	0.0026
23	0.0034	0.0008	0.0026
24	0.0034	0.0008	0.0026
25	0.0034	0.0008	0.0026
26	0.0034	0.0008	0.0026
27	0.0034	0.0008	0.0026
28	0.0034	0.0008	0.0026
29	0.0035	0.0008	0.0026
30	0.0035	0.0008	0.0026
31	0.0035	0.0008	0.0026
32	0.0035	0.0008	0.0027
33	0.0035	0.0008	0.0027
34	0.0035	0.0008	0.0027
35	0.0035	0.0008	0.0027
36	0.0035	0.0009	0.0027
37	0.0036	0.0009	0.0027
38	0.0036	0.0009	0.0027
39	0.0036	0.0009	0.0027
40	0.0036	0.0009	0.0027
41	0.0036	0.0009	0.0027
42	0.0036	0.0009	0.0028
43	0.0036	0.0009	0.0028
44	0.0037	0.0009	0.0028
45	0.0037	0.0009	0.0028
46	0.0037	0.0009	0.0028
47	0.0037	0.0009	0.0028
48	0.0037	0.0009	0.0028
49	0.0037	0.0009	0.0028
50	0.0037	0.0009	0.0028
51	0.0038	0.0009	0.0029
52	0.0038	0.0009	0.0029
53	0.0038	0.0009	0.0029

54	0.0038	0.0009	0.0029
55	0.0038	0.0009	0.0029
56	0.0038	0.0009	0.0029
57	0.0039	0.0009	0.0029
58	0.0039	0.0009	0.0029
59	0.0039	0.0009	0.0030
60	0.0039	0.0009	0.0030
61	0.0039	0.0009	0.0030
62	0.0039	0.0009	0.0030
63	0.0040	0.0010	0.0030
64	0.0040	0.0010	0.0030
65	0.0040	0.0010	0.0030
66	0.0040	0.0010	0.0031
67	0.0040	0.0010	0.0031
68	0.0041	0.0010	0.0031
69	0.0041	0.0010	0.0031
70	0.0041	0.0010	0.0031
71	0.0041	0.0010	0.0031
72	0.0041	0.0010	0.0031
73	0.0042	0.0010	0.0032
74	0.0042	0.0010	0.0032
75	0.0042	0.0010	0.0032
76	0.0042	0.0010	0.0032
77	0.0042	0.0010	0.0032
78	0.0043	0.0010	0.0032
79	0.0043	0.0010	0.0033
80	0.0043	0.0010	0.0033
81	0.0043	0.0010	0.0033
82	0.0044	0.0010	0.0033
83	0.0044	0.0011	0.0033
84	0.0044	0.0011	0.0033
85	0.0044	0.0011	0.0034
86	0.0045	0.0011	0.0034
87	0.0045	0.0011	0.0034
88	0.0045	0.0011	0.0034
89	0.0045	0.0011	0.0034
90	0.0046	0.0011	0.0035
91	0.0046	0.0011	0.0035
92	0.0046	0.0011	0.0035
93	0.0046	0.0011	0.0035
94	0.0047	0.0011	0.0035
95	0.0047	0.0011	0.0036
96	0.0047	0.0011	0.0036
97	0.0048	0.0011	0.0036
98	0.0048	0.0011	0.0036
99	0.0048	0.0012	0.0037
100	0.0048	0.0012	0.0037
101	0.0049	0.0012	0.0037
102	0.0049	0.0012	0.0037
103	0.0049	0.0012	0.0038

104	0.0050	0.0012	0.0038
105	0.0050	0.0012	0.0038
106	0.0050	0.0012	0.0038
107	0.0051	0.0012	0.0039
108	0.0051	0.0012	0.0039
109	0.0052	0.0012	0.0039
110	0.0052	0.0012	0.0039
111	0.0052	0.0013	0.0040
112	0.0053	0.0013	0.0040
113	0.0053	0.0013	0.0040
114	0.0053	0.0013	0.0040
115	0.0054	0.0013	0.0041
116	0.0054	0.0013	0.0041
117	0.0055	0.0013	0.0042
118	0.0055	0.0013	0.0042
119	0.0056	0.0013	0.0042
120	0.0056	0.0013	0.0042
121	0.0056	0.0014	0.0043
122	0.0057	0.0014	0.0043
123	0.0057	0.0014	0.0044
124	0.0058	0.0014	0.0044
125	0.0058	0.0014	0.0044
126	0.0059	0.0014	0.0045
127	0.0059	0.0014	0.0045
128	0.0060	0.0014	0.0045
129	0.0061	0.0015	0.0046
130	0.0061	0.0015	0.0046
131	0.0062	0.0015	0.0047
132	0.0062	0.0015	0.0047
133	0.0063	0.0015	0.0048
134	0.0063	0.0015	0.0048
135	0.0064	0.0015	0.0049
136	0.0065	0.0016	0.0049
137	0.0066	0.0016	0.0050
138	0.0066	0.0016	0.0050
139	0.0067	0.0016	0.0051
140	0.0068	0.0016	0.0051
141	0.0069	0.0016	0.0052
142	0.0069	0.0017	0.0053
143	0.0070	0.0017	0.0053
144	0.0071	0.0017	0.0054
145	0.0071	0.0017	0.0054
146	0.0072	0.0017	0.0055
147	0.0073	0.0018	0.0056
148	0.0074	0.0018	0.0056
149	0.0075	0.0018	0.0057
150	0.0076	0.0018	0.0058
151	0.0077	0.0019	0.0059
152	0.0078	0.0019	0.0059
153	0.0079	0.0019	0.0060

154	0.0080	0.0019	0.0061
155	0.0082	0.0020	0.0062
156	0.0083	0.0020	0.0063
157	0.0085	0.0020	0.0064
158	0.0086	0.0021	0.0065
159	0.0088	0.0021	0.0067
160	0.0089	0.0021	0.0067
161	0.0091	0.0022	0.0069
162	0.0092	0.0022	0.0070
163	0.0095	0.0023	0.0072
164	0.0096	0.0023	0.0073
165	0.0099	0.0024	0.0075
166	0.0100	0.0024	0.0076
167	0.0103	0.0025	0.0078
168	0.0105	0.0025	0.0080
169	0.0109	0.0026	0.0082
170	0.0110	0.0027	0.0084
171	0.0114	0.0027	0.0087
172	0.0117	0.0028	0.0089
173	0.0121	0.0029	0.0092
174	0.0124	0.0030	0.0094
175	0.0129	0.0031	0.0098
176	0.0132	0.0032	0.0100
177	0.0139	0.0033	0.0105
178	0.0142	0.0034	0.0108
179	0.0151	0.0036	0.0114
180	0.0155	0.0037	0.0118
181	0.0166	0.0040	0.0126
182	0.0171	0.0041	0.0130
183	0.0185	0.0044	0.0141
184	0.0193	0.0046	0.0147
185	0.0159	0.0038	0.0121
186	0.0169	0.0041	0.0129
187	0.0197	0.0047	0.0149
188	0.0215	0.0052	0.0163
189	0.0267	0.0064	0.0203
190	0.0307	0.0074	0.0233
191	0.0466	0.0094	0.0372
192	0.0677	0.0094	0.0583
193	0.2928	0.0094	0.2834
194	0.0367	0.0088	0.0279
195	0.0237	0.0057	0.0180
196	0.0182	0.0044	0.0138
197	0.0202	0.0049	0.0154
198	0.0178	0.0043	0.0135
199	0.0160	0.0038	0.0122
200	0.0146	0.0035	0.0111
201	0.0135	0.0033	0.0103
202	0.0126	0.0030	0.0096
203	0.0119	0.0029	0.0090

204	0.0112	0.0027	0.0085
205	0.0106	0.0026	0.0081
206	0.0102	0.0024	0.0077
207	0.0097	0.0023	0.0074
208	0.0093	0.0022	0.0071
209	0.0090	0.0022	0.0068
210	0.0087	0.0021	0.0066
211	0.0084	0.0020	0.0064
212	0.0081	0.0019	0.0062
213	0.0079	0.0019	0.0060
214	0.0076	0.0018	0.0058
215	0.0074	0.0018	0.0057
216	0.0072	0.0017	0.0055
217	0.0071	0.0017	0.0054
218	0.0070	0.0017	0.0053
219	0.0068	0.0016	0.0052
220	0.0067	0.0016	0.0051
221	0.0065	0.0016	0.0049
222	0.0064	0.0015	0.0048
223	0.0063	0.0015	0.0048
224	0.0061	0.0015	0.0047
225	0.0060	0.0014	0.0046
226	0.0059	0.0014	0.0045
227	0.0058	0.0014	0.0044
228	0.0057	0.0014	0.0043
229	0.0056	0.0013	0.0043
230	0.0055	0.0013	0.0042
231	0.0054	0.0013	0.0041
232	0.0054	0.0013	0.0041
233	0.0053	0.0013	0.0040
234	0.0052	0.0012	0.0040
235	0.0051	0.0012	0.0039
236	0.0051	0.0012	0.0038
237	0.0050	0.0012	0.0038
238	0.0049	0.0012	0.0037
239	0.0049	0.0012	0.0037
240	0.0048	0.0012	0.0036
241	0.0047	0.0011	0.0036
242	0.0047	0.0011	0.0036
243	0.0046	0.0011	0.0035
244	0.0046	0.0011	0.0035
245	0.0045	0.0011	0.0034
246	0.0045	0.0011	0.0034
247	0.0044	0.0011	0.0034
248	0.0044	0.0010	0.0033
249	0.0043	0.0010	0.0033
250	0.0043	0.0010	0.0033
251	0.0042	0.0010	0.0032
252	0.0042	0.0010	0.0032
253	0.0042	0.0010	0.0032

254	0.0041	0.0010	0.0031
255	0.0041	0.0010	0.0031
256	0.0040	0.0010	0.0031
257	0.0040	0.0010	0.0030
258	0.0040	0.0010	0.0030
259	0.0039	0.0009	0.0030
260	0.0039	0.0009	0.0030
261	0.0039	0.0009	0.0029
262	0.0038	0.0009	0.0029
263	0.0038	0.0009	0.0029
264	0.0038	0.0009	0.0029
265	0.0037	0.0009	0.0028
266	0.0037	0.0009	0.0028
267	0.0037	0.0009	0.0028
268	0.0036	0.0009	0.0028
269	0.0036	0.0009	0.0027
270	0.0036	0.0009	0.0027
271	0.0036	0.0009	0.0027
272	0.0035	0.0008	0.0027
273	0.0035	0.0008	0.0027
274	0.0035	0.0008	0.0026
275	0.0034	0.0008	0.0026
276	0.0034	0.0008	0.0026
277	0.0034	0.0008	0.0026
278	0.0034	0.0008	0.0026
279	0.0034	0.0008	0.0025
280	0.0033	0.0008	0.0025
281	0.0033	0.0008	0.0025
282	0.0033	0.0008	0.0025
283	0.0033	0.0008	0.0025
284	0.0032	0.0008	0.0025
285	0.0032	0.0008	0.0024
286	0.0032	0.0008	0.0024
287	0.0032	0.0008	0.0024
288	0.0032	0.0008	0.0024

```
--------------------------------------------------------------------
--------------------------------------------------------------------
Total soil rain loss =      0.47(In)
Total effective rainfall =      1.76(In)
Peak flow rate in flood hydrograph =     24.67(CFS)
---------------------------------------------------------------------
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
                    24 - H O U R    S T O R M
               R u n o f f     H y d r o g r a p h
--------------------------------------------------------------------
            Hydrograph in   5   Minute intervals ((CFS))

--------------------------------------------------------------------
Time(h+m) Volume Ac.Ft   Q(CFS)  0        7.5      15.0      22.5      30.0
-----------------------------------------------------------------------
```

```
0+ 5        0.0000      0.01  Q         |         |         |         |
0+10        0.0003      0.03  Q         |         |         |         |
0+15        0.0008      0.07  Q         |         |         |         |
0+20        0.0018      0.15  Q         |         |         |         |
0+25        0.0038      0.29  Q         |         |         |         |
0+30        0.0067      0.41  Q         |         |         |         |
0+35        0.0102      0.50  Q         |         |         |         |
0+40        0.0140      0.56  Q         |         |         |         |
0+45        0.0182      0.61  Q         |         |         |         |
0+50        0.0227      0.65  Q         |         |         |         |
0+55        0.0274      0.68  Q         |         |         |         |
1+ 0        0.0323      0.71  Q         |         |         |         |
1+ 5        0.0373      0.73  Q         |         |         |         |
1+10        0.0425      0.75  VQ        |         |         |         |
1+15        0.0478      0.77  VQ        |         |         |         |
1+20        0.0533      0.79  VQ        |         |         |         |
1+25        0.0588      0.81  VQ        |         |         |         |
1+30        0.0645      0.82  VQ        |         |         |         |
1+35        0.0702      0.83  VQ        |         |         |         |
1+40        0.0761      0.85  VQ        |         |         |         |
1+45        0.0820      0.86  VQ        |         |         |         |
1+50        0.0879      0.87  VQ        |         |         |         |
1+55        0.0940      0.88  VQ        |         |         |         |
2+ 0        0.1001      0.89  VQ        |         |         |         |
2+ 5        0.1062      0.90  VQ        |         |         |         |
2+10        0.1125      0.90  VQ        |         |         |         |
2+15        0.1187      0.91  |Q        |         |         |         |
2+20        0.1251      0.92  |Q        |         |         |         |
2+25        0.1314      0.93  |Q        |         |         |         |
2+30        0.1379      0.93  |Q        |         |         |         |
2+35        0.1443      0.94  |Q        |         |         |         |
2+40        0.1508      0.94  |Q        |         |         |         |
2+45        0.1574      0.95  |Q        |         |         |         |
2+50        0.1640      0.96  |Q        |         |         |         |
2+55        0.1706      0.96  |Q        |         |         |         |
3+ 0        0.1772      0.97  |Q        |         |         |         |
3+ 5        0.1839      0.97  |Q        |         |         |         |
3+10        0.1906      0.98  |Q        |         |         |         |
3+15        0.1974      0.98  |Q        |         |         |         |
3+20        0.2042      0.99  |Q        |         |         |         |
3+25        0.2110      0.99  |Q        |         |         |         |
3+30        0.2179      1.00  |Q        |         |         |         |
3+35        0.2248      1.00  |Q        |         |         |         |
3+40        0.2317      1.01  |QV       |         |         |         |
3+45        0.2387      1.01  |QV       |         |         |         |
3+50        0.2457      1.02  |QV       |         |         |         |
3+55        0.2527      1.02  |QV       |         |         |         |
4+ 0        0.2598      1.02  |QV       |         |         |         |
4+ 5        0.2669      1.03  |QV       |         |         |         |
4+10        0.2740      1.03  |QV       |         |         |         |
```

4+15	0.2811	1.04	QV			
4+20	0.2883	1.04	QV			
4+25	0.2955	1.04	QV			
4+30	0.3027	1.05	QV			
4+35	0.3100	1.05	QV			
4+40	0.3172	1.06	QV			
4+45	0.3245	1.06	QV			
4+50	0.3319	1.07	QV			
4+55	0.3393	1.07	QV			
5+ 0	0.3467	1.08	Q V			
5+ 5	0.3541	1.08	Q V			
5+10	0.3616	1.08	Q V			
5+15	0.3691	1.09	Q V			
5+20	0.3766	1.09	Q V			
5+25	0.3842	1.10	Q V			
5+30	0.3918	1.10	Q V			
5+35	0.3994	1.11	Q V			
5+40	0.4071	1.11	Q V			
5+45	0.4148	1.12	Q V			
5+50	0.4225	1.12	Q V			
5+55	0.4303	1.13	Q V			
6+ 0	0.4381	1.13	Q V			
6+ 5	0.4459	1.14	Q V			
6+10	0.4538	1.14	Q V			
6+15	0.4617	1.15	Q V			
6+20	0.4697	1.15	Q V			
6+25	0.4777	1.16	Q V			
6+30	0.4857	1.17	Q V			
6+35	0.4938	1.17	Q V			
6+40	0.5019	1.18	Q V			
6+45	0.5100	1.18	Q V			
6+50	0.5182	1.19	Q V			
6+55	0.5264	1.20	Q V			
7+ 0	0.5347	1.20	Q V			
7+ 5	0.5430	1.21	Q V			
7+10	0.5514	1.21	Q V			
7+15	0.5598	1.22	Q V			
7+20	0.5682	1.23	Q V			
7+25	0.5767	1.23	Q V			
7+30	0.5852	1.24	Q V			
7+35	0.5938	1.25	Q V			
7+40	0.6025	1.25	Q V			
7+45	0.6111	1.26	Q V			
7+50	0.6199	1.27	Q V			
7+55	0.6286	1.27	Q V			
8+ 0	0.6375	1.28	Q V			
8+ 5	0.6463	1.29	Q V			
8+10	0.6552	1.30	Q V			
8+15	0.6642	1.30	Q V			
8+20	0.6733	1.31	Q V			

```
 8+25       0.6823      1.32  |Q   V    |         |         |         |
 8+30       0.6915      1.33  |Q    V   |         |         |         |
 8+35       0.7007      1.33  |Q    V   |         |         |         |
 8+40       0.7099      1.34  |Q    V   |         |         |         |
 8+45       0.7192      1.35  |Q    V   |         |         |         |
 8+50       0.7286      1.36  |Q    V   |         |         |         |
 8+55       0.7380      1.37  |Q    V   |         |         |         |
 9+ 0       0.7475      1.38  |Q    V   |         |         |         |
 9+ 5       0.7570      1.39  |Q    V   |         |         |         |
 9+10       0.7666      1.39  |Q    V   |         |         |         |
 9+15       0.7763      1.40  |Q    V   |         |         |         |
 9+20       0.7861      1.41  |Q    V   |         |         |         |
 9+25       0.7959      1.42  |Q    V   |         |         |         |
 9+30       0.8057      1.43  |Q     V  |         |         |         |
 9+35       0.8157      1.44  |Q     V  |         |         |         |
 9+40       0.8257      1.45  |Q     V  |         |         |         |
 9+45       0.8357      1.46  |Q     V  |         |         |         |
 9+50       0.8459      1.47  |Q     V  |         |         |         |
 9+55       0.8561      1.48  |Q     V  |         |         |         |
10+ 0       0.8664      1.50  |Q     V  |         |         |         |
10+ 5       0.8768      1.51  | Q    V  |         |         |         |
10+10       0.8872      1.52  | Q    V  |         |         |         |
10+15       0.8978      1.53  | Q    V  |         |         |         |
10+20       0.9084      1.54  | Q    V  |         |         |         |
10+25       0.9191      1.55  | Q     V |         |         |         |
10+30       0.9299      1.57  | Q     V |         |         |         |
10+35       0.9407      1.58  | Q     V |         |         |         |
10+40       0.9517      1.59  | Q     V |         |         |         |
10+45       0.9627      1.60  | Q     V |         |         |         |
10+50       0.9739      1.62  | Q     V |         |         |         |
10+55       0.9851      1.63  | Q     V |         |         |         |
11+ 0       0.9965      1.65  | Q     V |         |         |         |
11+ 5       1.0079      1.66  | Q     V |         |         |         |
11+10       1.0194      1.67  | Q     V |         |         |         |
11+15       1.0311      1.69  | Q      V|         |         |         |
11+20       1.0428      1.71  | Q      V|         |         |         |
11+25       1.0547      1.72  | Q      V|         |         |         |
11+30       1.0666      1.74  | Q      V|         |         |         |
11+35       1.0787      1.75  | Q      V|         |         |         |
11+40       1.0909      1.77  | Q      V|         |         |         |
11+45       1.1033      1.79  | Q      V|         |         |         |
11+50       1.1157      1.81  | Q      V|         |         |         |
11+55       1.1283      1.83  | Q      V|         |         |         |
12+ 0       1.1410      1.85  | Q       V         |         |         |
12+ 5       1.1538      1.87  | Q       V         |         |         |
12+10       1.1668      1.88  | Q       V         |         |         |
12+15       1.1799      1.91  | Q       V         |         |         |
12+20       1.1932      1.92  | Q       V         |         |         |
12+25       1.2066      1.94  | Q       V         |         |         |
12+30       1.2201      1.96  | Q       V         |         |         |
```

```
12+35       1.2338      1.99  | Q       V         |         |         |
12+40       1.2476      2.01  | Q       V         |         |         |
12+45       1.2616      2.03  | Q       |V        |         |         |
12+50       1.2758      2.06  | Q       |V        |         |         |
12+55       1.2902      2.09  | Q       |V        |         |         |
13+ 0       1.3047      2.11  | Q       |V        |         |         |
13+ 5       1.3195      2.14  | Q       |V        |         |         |
13+10       1.3344      2.17  | Q       |V        |         |         |
13+15       1.3496      2.20  | Q       |V        |         |         |
13+20       1.3650      2.23  | Q       |V        |         |         |
13+25       1.3806      2.27  |  Q      | V       |         |         |
13+30       1.3965      2.30  |  Q      | V       |         |         |
13+35       1.4126      2.34  |  Q      | V       |         |         |
13+40       1.4290      2.38  |  Q      | V       |         |         |
13+45       1.4456      2.42  |  Q      | V       |         |         |
13+50       1.4626      2.46  |  Q      | V       |         |         |
13+55       1.4799      2.51  |  Q      | V       |         |         |
14+ 0       1.4974      2.55  |  Q      |  V      |         |         |
14+ 5       1.5154      2.60  |  Q      |  V      |         |         |
14+10       1.5337      2.66  |  Q      |  V      |         |         |
14+15       1.5523      2.71  |  Q      |  V      |         |         |
14+20       1.5714      2.77  |  Q      |  V      |         |         |
14+25       1.5909      2.83  |  Q      |  V      |         |         |
14+30       1.6109      2.90  |  Q      |   V     |         |         |
14+35       1.6314      2.97  |  Q      |   V     |         |         |
14+40       1.6523      3.05  |   Q     |   V     |         |         |
14+45       1.6739      3.13  |   Q     |   V     |         |         |
14+50       1.6960      3.22  |   Q     |   V     |         |         |
14+55       1.7188      3.31  |   Q     |    V    |         |         |
15+ 0       1.7423      3.41  |   Q     |    V    |         |         |
15+ 5       1.7666      3.53  |   Q     |    V    |         |         |
15+10       1.7918      3.65  |   Q     |    V    |         |         |
15+15       1.8178      3.79  |    Q    |    V    |         |         |
15+20       1.8449      3.94  |    Q    |     V   |         |         |
15+25       1.8731      4.10  |    Q    |     V   |         |         |
15+30       1.9024      4.25  |    Q    |     V   |         |         |
15+35       1.9327      4.40  |    Q    |     V   |         |         |
15+40       1.9638      4.52  |     Q   |      V  |         |         |
15+45       1.9954      4.58  |     Q   |      V  |         |         |
15+50       2.0280      4.74  |     Q   |      V  |         |         |
15+55       2.0630      5.08  |     Q   |       V |         |         |
16+ 0       2.1021      5.68  |      Q  |       V |         |         |
16+ 5       2.1525      7.31  |        Q|       V |         |         |
16+10       2.2224     10.16  |         |  Q     V|         |         |
16+15       2.3142     13.33  |         |      Q  V         |         |
16+20       2.4428     18.67  |         |         |V  Q     |         |
16+25       2.6127     24.67  |         |         | V       | Q       |
16+30       2.7641     21.98  |         |         |   V    Q|         |
16+35       2.8835     17.35  |         |         |  Q V    |         |
16+40       2.9793     13.91  |         |       Q |     V   |         |
```

```
16+45       3.0605      11.79  |         |    Q    |     V   |         |
16+50       3.1328      10.50  |         |  Q      |      V  |         |
16+55       3.1973       9.36  |         | Q       |       V |         |
17+ 0       3.2559       8.51  |         |Q        |       V |         |
17+ 5       3.3088       7.68  |         Q         |        V|         |
17+10       3.3576       7.09  |        Q|         |        V|         |
17+15       3.4028       6.55  |       Q |         |        V|         |
17+20       3.4452       6.15  |       Q |         |         V         |
17+25       3.4849       5.77  |      Q  |         |         V         |
17+30       3.5218       5.36  |      Q  |         |         V         |
17+35       3.5558       4.93  |     Q   |         |         |V        |
17+40       3.5880       4.67  |     Q   |         |         |V        |
17+45       3.6187       4.46  |    Q    |         |         |V        |
17+50       3.6478       4.22  |    Q    |         |         | V       |
17+55       3.6755       4.03  |    Q    |         |         | V       |
18+ 0       3.7020       3.84  |    Q    |         |         | V       |
18+ 5       3.7268       3.61  |   Q     |         |         | V       |
18+10       3.7508       3.48  |   Q     |         |         | V       |
18+15       3.7739       3.35  |   Q     |         |         |  V      |
18+20       3.7957       3.16  |   Q     |         |         |  V      |
18+25       3.8167       3.06  |   Q     |         |         |  V      |
18+30       3.8370       2.94  |  Q      |         |         |  V      |
18+35       3.8560       2.76  |  Q      |         |         |  V      |
18+40       3.8744       2.68  |  Q      |         |         |   V     |
18+45       3.8921       2.56  |  Q      |         |         |   V     |
18+50       3.9086       2.41  |  Q      |         |         |   V     |
18+55       3.9248       2.35  |  Q      |         |         |   V     |
19+ 0       3.9408       2.32  |  Q      |         |         |   V     |
19+ 5       3.9565       2.29  |  Q      |         |         |   V     |
19+10       3.9720       2.24  | Q       |         |         |   V     |
19+15       3.9871       2.20  | Q       |         |         |    V    |
19+20       4.0019       2.15  | Q       |         |         |    V    |
19+25       4.0163       2.10  | Q       |         |         |    V    |
19+30       4.0301       2.00  | Q       |         |         |    V    |
19+35       4.0432       1.91  | Q       |         |         |    V    |
19+40       4.0560       1.86  | Q       |         |         |    V    |
19+45       4.0685       1.82  | Q       |         |         |    V    |
19+50       4.0804       1.72  | Q       |         |         |    V    |
19+55       4.0916       1.63  | Q       |         |         |    V    |
20+ 0       4.1026       1.60  | Q       |         |         |     V   |
20+ 5       4.1135       1.57  | Q       |         |         |     V   |
20+10       4.1241       1.54  | Q       |         |         |     V   |
20+15       4.1345       1.52  | Q       |         |         |     V   |
20+20       4.1448       1.49  |Q        |         |         |     V   |
20+25       4.1549       1.47  |Q        |         |         |     V   |
20+30       4.1649       1.45  |Q        |         |         |     V   |
20+35       4.1747       1.43  |Q        |         |         |     V   |
20+40       4.1844       1.40  |Q        |         |         |     V   |
20+45       4.1939       1.39  |Q        |         |         |     V   |
20+50       4.2033       1.37  |Q        |         |         |     V   |
```

20+55	4.2126	1.35	Q			V	
21+ 0	4.2218	1.33	Q			V	
21+ 5	4.2309	1.32	Q			V	
21+10	4.2398	1.30	Q			V	
21+15	4.2487	1.28	Q			V	
21+20	4.2574	1.27	Q			V	
21+25	4.2660	1.26	Q			V	
21+30	4.2746	1.24	Q			V	
21+35	4.2830	1.23	Q			V	
21+40	4.2914	1.21	Q			V	
21+45	4.2997	1.20	Q			V	
21+50	4.3079	1.19	Q			V	
21+55	4.3160	1.18	Q			V	
22+ 0	4.3240	1.17	Q			V	
22+ 5	4.3320	1.15	Q			V	
22+10	4.3399	1.14	Q			V	
22+15	4.3477	1.13	Q			V	
22+20	4.3554	1.12	Q			V	
22+25	4.3631	1.11	Q			V	
22+30	4.3707	1.10	Q			V	
22+35	4.3782	1.09	Q			V	
22+40	4.3856	1.08	Q			V	
22+45	4.3930	1.07	Q			V	
22+50	4.4004	1.06	Q			V	
22+55	4.4077	1.06	Q			V	
23+ 0	4.4149	1.05	Q			V	
23+ 5	4.4220	1.04	Q			V	
23+10	4.4291	1.03	Q			V	
23+15	4.4362	1.02	Q			V	
23+20	4.4432	1.01	Q			V	
23+25	4.4501	1.01	Q			V	
23+30	4.4570	1.00	Q			V	
23+35	4.4638	0.99	Q			V	
23+40	4.4706	0.98	Q			V	
23+45	4.4773	0.98	Q			V	
23+50	4.4840	0.97	Q			V	
23+55	4.4906	0.96	Q			V	
24+ 0	4.4972	0.96	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 08/04/21

++

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

Program License Serial Number 6385

Space Center
Developed 100-year
Area E

Storm Event Year = 100

Antecedent Moisture Condition = 2

English (in-lb) Input Units Used

English Rainfall Data (Inches) Input Values Used

English Units used in output format

Area averaged rainfall intensity isohyetal data:

Sub-Area (Ac.)	Duration (hours)	Isohyetal (In)
Rainfall data for year 100		
20.90	1	1.09
Rainfall data for year 100		
20.90	6	2.09
Rainfall data for year 100		
20.90	24	3.64

++

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

SCS curve No.(AMCII)	SCS curve NO.(AMC 2)	Area (Ac.)	Area Fraction	Fp(Fig C6) (In/Hr)	Ap (dec.)	Fm (In/Hr)
65.0	65.0	20.90	1.000	0.608	0.160	0.097

Area-averaged adjusted loss rate Fm (In/Hr) = 0.097

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

Area (Ac.)	Area Fract	SCS CN (AMC2)	SCS CN (AMC2)	S	Pervious Yield Fr
3.34	0.160	65.0	65.0	5.38	0.227
17.56	0.840	98.0	98.0	0.20	0.936

Area-averaged catchment yield fraction, Y = 0.822
Area-averaged low loss fraction, Yb = 0.178
User entry of time of concentration =   0.192 (hours)
++
Watershed area =   20.90(Ac.)
Catchment Lag time =   0.154 hours
Unit interval =   5.000 minutes
Unit interval percentage of lag time = 54.2535
Hydrograph baseflow =   0.00(CFS)
Average maximum watershed loss rate(Fm) = 0.097(In/Hr)
Average low loss rate fraction (Yb) = 0.178 (decimal)
DESERT S-Graph Selected
Computed peak 5-minute rainfall = 0.517(In)
Computed peak 30-minute rainfall = 0.885(In)
Specified peak 1-hour rainfall = 1.090(In)
Computed peak 3-hour rainfall = 1.625(In)
Specified peak 6-hour rainfall = 2.090(In)
Specified peak 24-hour rainfall = 3.640(In)

Rainfall depth area reduction factors:
Using a total area of   20.90(Ac.) (Ref: fig. E-4)

5-minute factor = 0.999   Adjusted rainfall = 0.517(In)
30-minute factor = 0.999   Adjusted rainfall = 0.884(In)
1-hour factor = 0.999   Adjusted rainfall = 1.089(In)
3-hour factor = 1.000   Adjusted rainfall = 1.625(In)
6-hour factor = 1.000   Adjusted rainfall = 2.090(In)
24-hour factor = 1.000   Adjusted rainfall = 3.640(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 = 252.76 (CFS))	
1	4.582	11.581
2	35.377	77.838
3	64.099	72.597
4	76.427	31.160
5	83.603	18.139
6	88.449	12.250
7	91.682	8.171
8	94.097	6.104
9	95.871	4.485
10	97.167	3.276
11	97.993	2.086
12	98.587	1.503
13	99.237	1.641
14	99.703	1.178
15	100.000	0.752

Peak Unit Number	Adjusted mass rainfall (In)	Unit rainfall (In)
1	0.5167	0.5167
2	0.6361	0.1194
3	0.7184	0.0823
4	0.7832	0.0648
5	0.8374	0.0542
6	0.8845	0.0471
7	0.9264	0.0419
8	0.9642	0.0379
9	0.9989	0.0347
10	1.0310	0.0321
11	1.0609	0.0299
12	1.0889	0.0281
13	1.1211	0.0322
14	1.1518	0.0307
15	1.1811	0.0293
16	1.2092	0.0281
17	1.2362	0.0270
18	1.2622	0.0260
19	1.2873	0.0251
20	1.3115	0.0243
21	1.3350	0.0235
22	1.3578	0.0228
23	1.3800	0.0222
24	1.4015	0.0216
25	1.4225	0.0210
26	1.4430	0.0205
27	1.4630	0.0200

28	1.4825	0.0195
29	1.5015	0.0191
30	1.5202	0.0186
31	1.5384	0.0183
32	1.5563	0.0179
33	1.5738	0.0175
34	1.5910	0.0172
35	1.6079	0.0169
36	1.6245	0.0166
37	1.6408	0.0163
38	1.6567	0.0160
39	1.6725	0.0157
40	1.6879	0.0155
41	1.7031	0.0152
42	1.7181	0.0150
43	1.7329	0.0148
44	1.7474	0.0145
45	1.7617	0.0143
46	1.7759	0.0141
47	1.7898	0.0139
48	1.8035	0.0137
49	1.8171	0.0136
50	1.8305	0.0134
51	1.8437	0.0132
52	1.8568	0.0131
53	1.8697	0.0129
54	1.8824	0.0127
55	1.8950	0.0126
56	1.9075	0.0124
57	1.9198	0.0123
58	1.9319	0.0122
59	1.9440	0.0120
60	1.9559	0.0119
61	1.9677	0.0118
62	1.9793	0.0117
63	1.9909	0.0115
64	2.0023	0.0114
65	2.0136	0.0113
66	2.0248	0.0112
67	2.0359	0.0111
68	2.0469	0.0110
69	2.0578	0.0109
70	2.0686	0.0108
71	2.0793	0.0107
72	2.0899	0.0106
73	2.1014	0.0116
74	2.1129	0.0115
75	2.1243	0.0114
76	2.1356	0.0113
77	2.1468	0.0112

78	2.1579	0.0111
79	2.1689	0.0110
80	2.1799	0.0109
81	2.1907	0.0109
82	2.2015	0.0108
83	2.2122	0.0107
84	2.2229	0.0106
85	2.2334	0.0106
86	2.2439	0.0105
87	2.2543	0.0104
88	2.2646	0.0103
89	2.2749	0.0103
90	2.2851	0.0102
91	2.2952	0.0101
92	2.3053	0.0101
93	2.3153	0.0100
94	2.3252	0.0099
95	2.3351	0.0099
96	2.3449	0.0098
97	2.3546	0.0097
98	2.3643	0.0097
99	2.3740	0.0096
100	2.3835	0.0096
101	2.3930	0.0095
102	2.4025	0.0095
103	2.4119	0.0094
104	2.4212	0.0093
105	2.4305	0.0093
106	2.4398	0.0092
107	2.4490	0.0092
108	2.4581	0.0091
109	2.4672	0.0091
110	2.4762	0.0090
111	2.4852	0.0090
112	2.4941	0.0089
113	2.5030	0.0089
114	2.5119	0.0088
115	2.5207	0.0088
116	2.5294	0.0088
117	2.5381	0.0087
118	2.5468	0.0087
119	2.5554	0.0086
120	2.5640	0.0086
121	2.5725	0.0085
122	2.5810	0.0085
123	2.5894	0.0084
124	2.5978	0.0084
125	2.6062	0.0084
126	2.6145	0.0083
127	2.6228	0.0083

128	2.6311	0.0082
129	2.6393	0.0082
130	2.6474	0.0082
131	2.6556	0.0081
132	2.6637	0.0081
133	2.6717	0.0081
134	2.6797	0.0080
135	2.6877	0.0080
136	2.6957	0.0080
137	2.7036	0.0079
138	2.7115	0.0079
139	2.7193	0.0078
140	2.7271	0.0078
141	2.7349	0.0078
142	2.7427	0.0077
143	2.7504	0.0077
144	2.7581	0.0077
145	2.7657	0.0077
146	2.7733	0.0076
147	2.7809	0.0076
148	2.7885	0.0076
149	2.7960	0.0075
150	2.8035	0.0075
151	2.8110	0.0075
152	2.8184	0.0074
153	2.8258	0.0074
154	2.8332	0.0074
155	2.8405	0.0073
156	2.8479	0.0073
157	2.8551	0.0073
158	2.8624	0.0073
159	2.8696	0.0072
160	2.8769	0.0072
161	2.8840	0.0072
162	2.8912	0.0072
163	2.8983	0.0071
164	2.9054	0.0071
165	2.9125	0.0071
166	2.9196	0.0071
167	2.9266	0.0070
168	2.9336	0.0070
169	2.9406	0.0070
170	2.9475	0.0070
171	2.9544	0.0069
172	2.9613	0.0069
173	2.9682	0.0069
174	2.9751	0.0069
175	2.9819	0.0068
176	2.9887	0.0068
177	2.9955	0.0068

178	3.0023	0.0068
179	3.0090	0.0067
180	3.0157	0.0067
181	3.0224	0.0067
182	3.0291	0.0067
183	3.0357	0.0067
184	3.0424	0.0066
185	3.0490	0.0066
186	3.0556	0.0066
187	3.0621	0.0066
188	3.0687	0.0065
189	3.0752	0.0065
190	3.0817	0.0065
191	3.0882	0.0065
192	3.0946	0.0065
193	3.1011	0.0064
194	3.1075	0.0064
195	3.1139	0.0064
196	3.1203	0.0064
197	3.1266	0.0064
198	3.1330	0.0063
199	3.1393	0.0063
200	3.1456	0.0063
201	3.1519	0.0063
202	3.1582	0.0063
203	3.1644	0.0062
204	3.1706	0.0062
205	3.1769	0.0062
206	3.1831	0.0062
207	3.1892	0.0062
208	3.1954	0.0062
209	3.2015	0.0061
210	3.2077	0.0061
211	3.2138	0.0061
212	3.2198	0.0061
213	3.2259	0.0061
214	3.2320	0.0061
215	3.2380	0.0060
216	3.2440	0.0060
217	3.2500	0.0060
218	3.2560	0.0060
219	3.2620	0.0060
220	3.2679	0.0060
221	3.2739	0.0059
222	3.2798	0.0059
223	3.2857	0.0059
224	3.2916	0.0059
225	3.2975	0.0059
226	3.3033	0.0059
227	3.3092	0.0058

228	3.3150	0.0058
229	3.3208	0.0058
230	3.3266	0.0058
231	3.3324	0.0058
232	3.3381	0.0058
233	3.3439	0.0058
234	3.3496	0.0057
235	3.3554	0.0057
236	3.3611	0.0057
237	3.3668	0.0057
238	3.3724	0.0057
239	3.3781	0.0057
240	3.3837	0.0057
241	3.3894	0.0056
242	3.3950	0.0056
243	3.4006	0.0056
244	3.4062	0.0056
245	3.4118	0.0056
246	3.4174	0.0056
247	3.4229	0.0056
248	3.4284	0.0055
249	3.4340	0.0055
250	3.4395	0.0055
251	3.4450	0.0055
252	3.4505	0.0055
253	3.4559	0.0055
254	3.4614	0.0055
255	3.4669	0.0054
256	3.4723	0.0054
257	3.4777	0.0054
258	3.4831	0.0054
259	3.4885	0.0054
260	3.4939	0.0054
261	3.4993	0.0054
262	3.5046	0.0054
263	3.5100	0.0053
264	3.5153	0.0053
265	3.5206	0.0053
266	3.5260	0.0053
267	3.5313	0.0053
268	3.5365	0.0053
269	3.5418	0.0053
270	3.5471	0.0053
271	3.5523	0.0053
272	3.5576	0.0052
273	3.5628	0.0052
274	3.5680	0.0052
275	3.5732	0.0052
276	3.5784	0.0052
277	3.5836	0.0052

278	3.5888	0.0052
279	3.5939	0.0052
280	3.5991	0.0052
281	3.6042	0.0051
282	3.6094	0.0051
283	3.6145	0.0051
284	3.6196	0.0051
285	3.6247	0.0051
286	3.6298	0.0051
287	3.6348	0.0051
288	3.6399	0.0051

Unit Period (number)	Unit Rainfall (In)	Unit Soil-Loss (In)	Effective Rainfall (In)
1	0.0051	0.0009	0.0042
2	0.0051	0.0009	0.0042
3	0.0051	0.0009	0.0042
4	0.0051	0.0009	0.0042
5	0.0051	0.0009	0.0042
6	0.0051	0.0009	0.0042
7	0.0052	0.0009	0.0042
8	0.0052	0.0009	0.0043
9	0.0052	0.0009	0.0043
10	0.0052	0.0009	0.0043
11	0.0052	0.0009	0.0043
12	0.0052	0.0009	0.0043
13	0.0053	0.0009	0.0043
14	0.0053	0.0009	0.0043
15	0.0053	0.0009	0.0044
16	0.0053	0.0009	0.0044
17	0.0053	0.0009	0.0044
18	0.0053	0.0010	0.0044
19	0.0054	0.0010	0.0044
20	0.0054	0.0010	0.0044
21	0.0054	0.0010	0.0044
22	0.0054	0.0010	0.0045
23	0.0054	0.0010	0.0045
24	0.0055	0.0010	0.0045
25	0.0055	0.0010	0.0045
26	0.0055	0.0010	0.0045
27	0.0055	0.0010	0.0045
28	0.0055	0.0010	0.0046
29	0.0056	0.0010	0.0046
30	0.0056	0.0010	0.0046
31	0.0056	0.0010	0.0046
32	0.0056	0.0010	0.0046
33	0.0057	0.0010	0.0046
34	0.0057	0.0010	0.0047

35	0.0057	0.0010	0.0047
36	0.0057	0.0010	0.0047
37	0.0057	0.0010	0.0047
38	0.0058	0.0010	0.0047
39	0.0058	0.0010	0.0048
40	0.0058	0.0010	0.0048
41	0.0058	0.0010	0.0048
42	0.0058	0.0010	0.0048
43	0.0059	0.0010	0.0048
44	0.0059	0.0010	0.0048
45	0.0059	0.0011	0.0049
46	0.0059	0.0011	0.0049
47	0.0060	0.0011	0.0049
48	0.0060	0.0011	0.0049
49	0.0060	0.0011	0.0050
50	0.0060	0.0011	0.0050
51	0.0061	0.0011	0.0050
52	0.0061	0.0011	0.0050
53	0.0061	0.0011	0.0050
54	0.0061	0.0011	0.0050
55	0.0062	0.0011	0.0051
56	0.0062	0.0011	0.0051
57	0.0062	0.0011	0.0051
58	0.0062	0.0011	0.0051
59	0.0063	0.0011	0.0052
60	0.0063	0.0011	0.0052
61	0.0063	0.0011	0.0052
62	0.0064	0.0011	0.0052
63	0.0064	0.0011	0.0053
64	0.0064	0.0011	0.0053
65	0.0065	0.0011	0.0053
66	0.0065	0.0012	0.0053
67	0.0065	0.0012	0.0054
68	0.0065	0.0012	0.0054
69	0.0066	0.0012	0.0054
70	0.0066	0.0012	0.0054
71	0.0067	0.0012	0.0055
72	0.0067	0.0012	0.0055
73	0.0067	0.0012	0.0055
74	0.0067	0.0012	0.0055
75	0.0068	0.0012	0.0056
76	0.0068	0.0012	0.0056
77	0.0069	0.0012	0.0056
78	0.0069	0.0012	0.0057
79	0.0069	0.0012	0.0057
80	0.0070	0.0012	0.0057
81	0.0070	0.0012	0.0058
82	0.0070	0.0012	0.0058
83	0.0071	0.0013	0.0058
84	0.0071	0.0013	0.0058

85	0.0072	0.0013	0.0059
86	0.0072	0.0013	0.0059
87	0.0072	0.0013	0.0060
88	0.0073	0.0013	0.0060
89	0.0073	0.0013	0.0060
90	0.0073	0.0013	0.0060
91	0.0074	0.0013	0.0061
92	0.0074	0.0013	0.0061
93	0.0075	0.0013	0.0062
94	0.0075	0.0013	0.0062
95	0.0076	0.0013	0.0062
96	0.0076	0.0014	0.0063
97	0.0077	0.0014	0.0063
98	0.0077	0.0014	0.0063
99	0.0078	0.0014	0.0064
100	0.0078	0.0014	0.0064
101	0.0079	0.0014	0.0065
102	0.0079	0.0014	0.0065
103	0.0080	0.0014	0.0066
104	0.0080	0.0014	0.0066
105	0.0081	0.0014	0.0067
106	0.0081	0.0014	0.0067
107	0.0082	0.0015	0.0067
108	0.0082	0.0015	0.0068
109	0.0083	0.0015	0.0068
110	0.0084	0.0015	0.0069
111	0.0084	0.0015	0.0069
112	0.0085	0.0015	0.0070
113	0.0086	0.0015	0.0071
114	0.0086	0.0015	0.0071
115	0.0087	0.0015	0.0072
116	0.0088	0.0016	0.0072
117	0.0088	0.0016	0.0073
118	0.0089	0.0016	0.0073
119	0.0090	0.0016	0.0074
120	0.0090	0.0016	0.0074
121	0.0091	0.0016	0.0075
122	0.0092	0.0016	0.0076
123	0.0093	0.0017	0.0076
124	0.0093	0.0017	0.0077
125	0.0095	0.0017	0.0078
126	0.0095	0.0017	0.0078
127	0.0096	0.0017	0.0079
128	0.0097	0.0017	0.0080
129	0.0098	0.0017	0.0081
130	0.0099	0.0018	0.0081
131	0.0100	0.0018	0.0082
132	0.0101	0.0018	0.0083
133	0.0102	0.0018	0.0084
134	0.0103	0.0018	0.0084

135	0.0104	0.0018	0.0086
136	0.0105	0.0019	0.0086
137	0.0106	0.0019	0.0087
138	0.0107	0.0019	0.0088
139	0.0109	0.0019	0.0089
140	0.0109	0.0019	0.0090
141	0.0111	0.0020	0.0091
142	0.0112	0.0020	0.0092
143	0.0114	0.0020	0.0094
144	0.0115	0.0020	0.0094
145	0.0106	0.0019	0.0087
146	0.0107	0.0019	0.0088
147	0.0109	0.0019	0.0090
148	0.0110	0.0020	0.0090
149	0.0112	0.0020	0.0092
150	0.0113	0.0020	0.0093
151	0.0115	0.0021	0.0095
152	0.0117	0.0021	0.0096
153	0.0119	0.0021	0.0098
154	0.0120	0.0021	0.0099
155	0.0123	0.0022	0.0101
156	0.0124	0.0022	0.0102
157	0.0127	0.0023	0.0105
158	0.0129	0.0023	0.0106
159	0.0132	0.0023	0.0109
160	0.0134	0.0024	0.0110
161	0.0137	0.0024	0.0113
162	0.0139	0.0025	0.0115
163	0.0143	0.0025	0.0118
164	0.0145	0.0026	0.0120
165	0.0150	0.0027	0.0123
166	0.0152	0.0027	0.0125
167	0.0157	0.0028	0.0129
168	0.0160	0.0028	0.0131
169	0.0166	0.0029	0.0136
170	0.0169	0.0030	0.0139
171	0.0175	0.0031	0.0144
172	0.0179	0.0032	0.0147
173	0.0186	0.0033	0.0153
174	0.0191	0.0034	0.0157
175	0.0200	0.0035	0.0164
176	0.0205	0.0036	0.0168
177	0.0216	0.0038	0.0177
178	0.0222	0.0039	0.0182
179	0.0235	0.0042	0.0193
180	0.0243	0.0043	0.0200
181	0.0260	0.0046	0.0214
182	0.0270	0.0048	0.0222
183	0.0293	0.0052	0.0241
184	0.0307	0.0054	0.0252

185	0.0281	0.0050	0.0231
186	0.0299	0.0053	0.0246
187	0.0347	0.0062	0.0285
188	0.0379	0.0067	0.0311
189	0.0471	0.0081	0.0390
190	0.0542	0.0081	0.0461
191	0.0823	0.0081	0.0742
192	0.1194	0.0081	0.1113
193	0.5167	0.0081	0.5086
194	0.0648	0.0081	0.0566
195	0.0419	0.0074	0.0344
196	0.0321	0.0057	0.0264
197	0.0322	0.0057	0.0265
198	0.0281	0.0050	0.0231
199	0.0251	0.0045	0.0206
200	0.0228	0.0041	0.0188
201	0.0210	0.0037	0.0173
202	0.0195	0.0035	0.0160
203	0.0183	0.0032	0.0150
204	0.0172	0.0031	0.0141
205	0.0163	0.0029	0.0134
206	0.0155	0.0027	0.0127
207	0.0148	0.0026	0.0121
208	0.0141	0.0025	0.0116
209	0.0136	0.0024	0.0112
210	0.0131	0.0023	0.0107
211	0.0126	0.0022	0.0104
212	0.0122	0.0022	0.0100
213	0.0118	0.0021	0.0097
214	0.0114	0.0020	0.0094
215	0.0111	0.0020	0.0091
216	0.0108	0.0019	0.0089
217	0.0116	0.0021	0.0095
218	0.0113	0.0020	0.0093
219	0.0110	0.0020	0.0091
220	0.0108	0.0019	0.0089
221	0.0106	0.0019	0.0087
222	0.0103	0.0018	0.0085
223	0.0101	0.0018	0.0083
224	0.0099	0.0018	0.0082
225	0.0097	0.0017	0.0080
226	0.0096	0.0017	0.0079
227	0.0094	0.0017	0.0077
228	0.0092	0.0016	0.0076
229	0.0091	0.0016	0.0075
230	0.0089	0.0016	0.0073
231	0.0088	0.0016	0.0072
232	0.0087	0.0015	0.0071
233	0.0085	0.0015	0.0070
234	0.0084	0.0015	0.0069

235	0.0083	0.0015	0.0068
236	0.0082	0.0015	0.0067
237	0.0081	0.0014	0.0066
238	0.0080	0.0014	0.0065
239	0.0078	0.0014	0.0065
240	0.0077	0.0014	0.0064
241	0.0077	0.0014	0.0063
242	0.0076	0.0013	0.0062
243	0.0075	0.0013	0.0061
244	0.0074	0.0013	0.0061
245	0.0073	0.0013	0.0060
246	0.0072	0.0013	0.0059
247	0.0071	0.0013	0.0059
248	0.0071	0.0013	0.0058
249	0.0070	0.0012	0.0057
250	0.0069	0.0012	0.0057
251	0.0068	0.0012	0.0056
252	0.0068	0.0012	0.0056
253	0.0067	0.0012	0.0055
254	0.0066	0.0012	0.0055
255	0.0066	0.0012	0.0054
256	0.0065	0.0012	0.0053
257	0.0064	0.0011	0.0053
258	0.0064	0.0011	0.0052
259	0.0063	0.0011	0.0052
260	0.0063	0.0011	0.0052
261	0.0062	0.0011	0.0051
262	0.0062	0.0011	0.0051
263	0.0061	0.0011	0.0050
264	0.0061	0.0011	0.0050
265	0.0060	0.0011	0.0049
266	0.0060	0.0011	0.0049
267	0.0059	0.0010	0.0049
268	0.0059	0.0010	0.0048
269	0.0058	0.0010	0.0048
270	0.0058	0.0010	0.0047
271	0.0057	0.0010	0.0047
272	0.0057	0.0010	0.0047
273	0.0056	0.0010	0.0046
274	0.0056	0.0010	0.0046
275	0.0056	0.0010	0.0046
276	0.0055	0.0010	0.0045
277	0.0055	0.0010	0.0045
278	0.0054	0.0010	0.0045
279	0.0054	0.0010	0.0044
280	0.0054	0.0010	0.0044
281	0.0053	0.0009	0.0044
282	0.0053	0.0009	0.0043
283	0.0053	0.0009	0.0043
284	0.0052	0.0009	0.0043

```
285                 0.0052           0.0009              0.0043
286                 0.0052           0.0009              0.0042
287                 0.0051           0.0009              0.0042
288                 0.0051           0.0009              0.0042
--------------------------------------------------------------------
--------------------------------------------------------------------
Total soil rain loss =      0.54(In)
Total effective rainfall =      3.10(In)
Peak flow rate in flood hydrograph =     52.73(CFS)
---------------------------------------------------------------------
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
                   24 - H O U R    S T O R M
                R u n o f f     H y d r o g r a p h
--------------------------------------------------------------------
            Hydrograph in   5   Minute intervals ((CFS))

--------------------------------------------------------------------
Time(h+m) Volume Ac.Ft   Q(CFS)  0       15.0      30.0      45.0      60.0
----------------------------------------------------------------------
  0+ 5       0.0003      0.05  Q         |         |         |         |
  0+10       0.0029      0.37  Q         |         |         |         |
  0+15       0.0076      0.68  Q         |         |         |         |
  0+20       0.0131      0.81  Q         |         |         |         |
  0+25       0.0192      0.89  Q         |         |         |         |
  0+30       0.0257      0.94  Q         |         |         |         |
  0+35       0.0324      0.98  Q         |         |         |         |
  0+40       0.0393      1.00  Q         |         |         |         |
  0+45       0.0464      1.03  Q         |         |         |         |
  0+50       0.0536      1.04  Q         |         |         |         |
  0+55       0.0609      1.06  Q         |         |         |         |
  1+ 0       0.0682      1.07  Q         |         |         |         |
  1+ 5       0.0756      1.08  Q         |         |         |         |
  1+10       0.0831      1.08  Q         |         |         |         |
  1+15       0.0906      1.09  Q         |         |         |         |
  1+20       0.0981      1.09  Q         |         |         |         |
  1+25       0.1057      1.10  Q         |         |         |         |
  1+30       0.1133      1.10  Q         |         |         |         |
  1+35       0.1209      1.11  Q         |         |         |         |
  1+40       0.1285      1.11  Q         |         |         |         |
  1+45       0.1362      1.11  QV        |         |         |         |
  1+50       0.1439      1.12  QV        |         |         |         |
  1+55       0.1516      1.12  QV        |         |         |         |
  2+ 0       0.1594      1.13  QV        |         |         |         |
  2+ 5       0.1671      1.13  QV        |         |         |         |
  2+10       0.1749      1.13  QV        |         |         |         |
  2+15       0.1828      1.14  QV        |         |         |         |
  2+20       0.1906      1.14  QV        |         |         |         |
  2+25       0.1985      1.15  QV        |         |         |         |
  2+30       0.2064      1.15  QV        |         |         |         |
  2+35       0.2144      1.15  QV        |         |         |         |
```

```
2+40       0.2223      1.16  QV        |         |         |         |
2+45       0.2303      1.16  QV        |         |         |         |
2+50       0.2384      1.17  QV        |         |         |         |
2+55       0.2464      1.17  QV        |         |         |         |
3+ 0       0.2545      1.18  QV        |         |         |         |
3+ 5       0.2627      1.18  QV        |         |         |         |
3+10       0.2708      1.18  Q V       |         |         |         |
3+15       0.2790      1.19  Q V       |         |         |         |
3+20       0.2872      1.19  Q V       |         |         |         |
3+25       0.2955      1.20  Q V       |         |         |         |
3+30       0.3037      1.20  Q V       |         |         |         |
3+35       0.3121      1.21  Q V       |         |         |         |
3+40       0.3204      1.21  Q V       |         |         |         |
3+45       0.3288      1.22  Q V       |         |         |         |
3+50       0.3372      1.22  Q V       |         |         |         |
3+55       0.3456      1.23  Q V       |         |         |         |
4+ 0       0.3541      1.23  Q V       |         |         |         |
4+ 5       0.3626      1.24  Q V       |         |         |         |
4+10       0.3712      1.24  Q V       |         |         |         |
4+15       0.3798      1.25  Q V       |         |         |         |
4+20       0.3884      1.25  Q V       |         |         |         |
4+25       0.3970      1.26  Q V       |         |         |         |
4+30       0.4057      1.26  Q  V      |         |         |         |
4+35       0.4145      1.27  Q  V      |         |         |         |
4+40       0.4232      1.27  Q  V      |         |         |         |
4+45       0.4321      1.28  Q  V      |         |         |         |
4+50       0.4409      1.28  Q  V      |         |         |         |
4+55       0.4498      1.29  Q  V      |         |         |         |
5+ 0       0.4587      1.30  Q  V      |         |         |         |
5+ 5       0.4677      1.30  Q  V      |         |         |         |
5+10       0.4767      1.31  Q  V      |         |         |         |
5+15       0.4857      1.31  Q  V      |         |         |         |
5+20       0.4948      1.32  Q  V      |         |         |         |
5+25       0.5039      1.33  Q  V      |         |         |         |
5+30       0.5131      1.33  Q  V      |         |         |         |
5+35       0.5223      1.34  Q  V      |         |         |         |
5+40       0.5316      1.34  Q  V      |         |         |         |
5+45       0.5409      1.35  Q   V     |         |         |         |
5+50       0.5502      1.36  Q   V     |         |         |         |
5+55       0.5596      1.36  Q   V     |         |         |         |
6+ 0       0.5690      1.37  Q   V     |         |         |         |
6+ 5       0.5785      1.38  Q   V     |         |         |         |
6+10       0.5880      1.38  Q   V     |         |         |         |
6+15       0.5976      1.39  Q   V     |         |         |         |
6+20       0.6072      1.40  Q   V     |         |         |         |
6+25       0.6169      1.40  Q   V     |         |         |         |
6+30       0.6266      1.41  Q   V     |         |         |         |
6+35       0.6364      1.42  Q   V     |         |         |         |
6+40       0.6462      1.43  Q   V     |         |         |         |
6+45       0.6561      1.43  Q   V     |         |         |         |
```

```
 6+50       0.6660      1.44  Q   V     |         |         |         |
 6+55       0.6760      1.45  Q    V    |         |         |         |
 7+ 0       0.6860      1.46  Q    V    |         |         |         |
 7+ 5       0.6961      1.46  Q    V    |         |         |         |
 7+10       0.7062      1.47  Q    V    |         |         |         |
 7+15       0.7164      1.48  Q    V    |         |         |         |
 7+20       0.7267      1.49  Q    V    |         |         |         |
 7+25       0.7370      1.50  Q    V    |         |         |         |
 7+30       0.7474      1.51  |Q   V    |         |         |         |
 7+35       0.7578      1.51  |Q   V    |         |         |         |
 7+40       0.7683      1.52  |Q   V    |         |         |         |
 7+45       0.7788      1.53  |Q   V    |         |         |         |
 7+50       0.7895      1.54  |Q   V    |         |         |         |
 7+55       0.8001      1.55  |Q   V    |         |         |         |
 8+ 0       0.8109      1.56  |Q    V   |         |         |         |
 8+ 5       0.8217      1.57  |Q    V   |         |         |         |
 8+10       0.8325      1.58  |Q    V   |         |         |         |
 8+15       0.8435      1.59  |Q    V   |         |         |         |
 8+20       0.8545      1.60  |Q    V   |         |         |         |
 8+25       0.8656      1.61  |Q    V   |         |         |         |
 8+30       0.8767      1.62  |Q    V   |         |         |         |
 8+35       0.8879      1.63  |Q    V   |         |         |         |
 8+40       0.8992      1.64  |Q    V   |         |         |         |
 8+45       0.9106      1.65  |Q    V   |         |         |         |
 8+50       0.9220      1.66  |Q    V   |         |         |         |
 8+55       0.9336      1.67  |Q    V   |         |         |         |
 9+ 0       0.9452      1.68  |Q     V  |         |         |         |
 9+ 5       0.9568      1.70  |Q     V  |         |         |         |
 9+10       0.9686      1.71  |Q     V  |         |         |         |
 9+15       0.9804      1.72  |Q     V  |         |         |         |
 9+20       0.9924      1.73  |Q     V  |         |         |         |
 9+25       1.0044      1.74  |Q     V  |         |         |         |
 9+30       1.0165      1.76  |Q     V  |         |         |         |
 9+35       1.0287      1.77  |Q     V  |         |         |         |
 9+40       1.0410      1.78  |Q     V  |         |         |         |
 9+45       1.0534      1.80  |Q     V  |         |         |         |
 9+50       1.0658      1.81  |Q     V  |         |         |         |
 9+55       1.0784      1.83  |Q     V  |         |         |         |
10+ 0       1.0911      1.84  |Q      V |         |         |         |
10+ 5       1.1039      1.85  |Q      V |         |         |         |
10+10       1.1167      1.87  |Q      V |         |         |         |
10+15       1.1297      1.89  |Q      V |         |         |         |
10+20       1.1428      1.90  |Q      V |         |         |         |
10+25       1.1560      1.92  |Q      V |         |         |         |
10+30       1.1694      1.93  |Q      V |         |         |         |
10+35       1.1828      1.95  |Q      V |         |         |         |
10+40       1.1963      1.97  |Q      V |         |         |         |
10+45       1.2100      1.99  |Q      V |         |         |         |
10+50       1.2238      2.00  |Q       V|         |         |         |
10+55       1.2378      2.02  |Q       V|         |         |         |
```

```
11+ 0       1.2518      2.04  |Q       V|         |         |         |
11+ 5       1.2660      2.06  |Q       V|         |         |         |
11+10       1.2803      2.08  |Q       V|         |         |         |
11+15       1.2948      2.10  |Q       V|         |         |         |
11+20       1.3094      2.12  |Q       V|         |         |         |
11+25       1.3242      2.14  |Q       V|         |         |         |
11+30       1.3391      2.17  |Q       V|         |         |         |
11+35       1.3542      2.19  |Q        V         |         |         |
11+40       1.3695      2.21  |Q        V         |         |         |
11+45       1.3849      2.24  |Q        V         |         |         |
11+50       1.4005      2.26  |Q        V         |         |         |
11+55       1.4162      2.29  |Q        V         |         |         |
12+ 0       1.4322      2.32  |Q        V         |         |         |
12+ 5       1.4482      2.33  |Q        V         |         |         |
12+10       1.4640      2.29  |Q        V         |         |         |
12+15       1.4796      2.26  |Q        V         |         |         |
12+20       1.4952      2.26  |Q        |V        |         |         |
12+25       1.5108      2.27  |Q        |V        |         |         |
12+30       1.5266      2.30  |Q        |V        |         |         |
12+35       1.5426      2.32  |Q        |V        |         |         |
12+40       1.5588      2.35  |Q        |V        |         |         |
12+45       1.5752      2.38  |Q        |V        |         |         |
12+50       1.5918      2.41  |Q        |V        |         |         |
12+55       1.6086      2.45  |Q        |V        |         |         |
13+ 0       1.6258      2.49  |Q        | V       |         |         |
13+ 5       1.6432      2.53  |Q        | V       |         |         |
13+10       1.6609      2.57  |Q        | V       |         |         |
13+15       1.6789      2.61  |Q        | V       |         |         |
13+20       1.6972      2.66  |Q        | V       |         |         |
13+25       1.7158      2.71  |Q        | V       |         |         |
13+30       1.7348      2.76  |Q        | V       |         |         |
13+35       1.7542      2.81  |Q        | V       |         |         |
13+40       1.7740      2.87  |Q        |  V      |         |         |
13+45       1.7942      2.93  |Q        |  V      |         |         |
13+50       1.8148      2.99  |Q        |  V      |         |         |
13+55       1.8359      3.06  | Q       |  V      |         |         |
14+ 0       1.8575      3.13  | Q       |  V      |         |         |
14+ 5       1.8795      3.21  | Q       |  V      |         |         |
14+10       1.9022      3.29  | Q       |   V     |         |         |
14+15       1.9255      3.38  | Q       |   V     |         |         |
14+20       1.9494      3.47  | Q       |   V     |         |         |
14+25       1.9739      3.57  | Q       |   V     |         |         |
14+30       1.9993      3.68  | Q       |   V     |         |         |
14+35       2.0254      3.79  | Q       |    V    |         |         |
14+40       2.0523      3.92  | Q       |    V    |         |         |
14+45       2.0802      4.05  | Q       |    V    |         |         |
14+50       2.1092      4.20  | Q       |    V    |         |         |
14+55       2.1392      4.36  | Q       |    V    |         |         |
15+ 0       2.1705      4.55  |  Q      |     V   |         |         |
15+ 5       2.2032      4.74  |  Q      |     V   |         |         |
```

```
15+10       2.2375      4.98  |  Q      |     V   |         |         |
15+15       2.2735      5.23  |  Q      |     V   |         |         |
15+20       2.3116      5.54  |  Q      |      V  |         |         |
15+25       2.3517      5.82  |  Q      |      V  |         |         |
15+30       2.3921      5.86  |  Q      |      V  |         |         |
15+35       2.4332      5.98  |  Q      |       V |         |         |
15+40       2.4775      6.43  |   Q     |       V |         |         |
15+45       2.5261      7.06  |   Q     |       V |         |         |
15+50       2.5819      8.10  |    Q    |        V|         |         |
15+55       2.6489      9.73  |     Q   |        V|         |         |
16+ 0       2.7400     13.22  |       Q |         V         |         |
16+ 5       2.8997     23.19  |         |    Q    |V        |         |
16+10       3.2629     52.73  |         |         |   V     |    Q    |
16+15       3.5934     47.99  |         |         |     V   |Q        |
16+20       3.7786     26.89  |         |      Q  |      V  |         |
16+25       3.9065     18.56  |         | Q       |       V |         |
16+30       4.0061     14.47  |        Q|         |        V|         |
16+35       4.0862     11.64  |      Q  |         |         V         |
16+40       4.1537      9.79  |     Q   |         |         V         |
16+45       4.2109      8.30  |    Q    |         |         |V        |
16+50       4.2598      7.11  |   Q     |         |         |V        |
16+55       4.3016      6.07  |   Q     |         |         |V        |
17+ 0       4.3388      5.40  |  Q      |         |         | V       |
17+ 5       4.3738      5.08  |  Q      |         |         | V       |
17+10       4.4050      4.54  |  Q      |         |         | V       |
17+15       4.4328      4.03  | Q       |         |         | V       |
17+20       4.4566      3.46  | Q       |         |         |  V      |
17+25       4.4791      3.26  | Q       |         |         |  V      |
17+30       4.5005      3.10  | Q       |         |         |  V      |
17+35       4.5209      2.96  |Q        |         |         |  V      |
17+40       4.5405      2.84  |Q        |         |         |  V      |
17+45       4.5592      2.73  |Q        |         |         |  V      |
17+50       4.5773      2.63  |Q        |         |         |  V      |
17+55       4.5948      2.54  |Q        |         |         |   V     |
18+ 0       4.6117      2.45  |Q        |         |         |   V     |
18+ 5       4.6281      2.39  |Q        |         |         |   V     |
18+10       4.6445      2.39  |Q        |         |         |   V     |
18+15       4.6610      2.38  |Q        |         |         |   V     |
18+20       4.6771      2.35  |Q        |         |         |   V     |
18+25       4.6930      2.31  |Q        |         |         |   V     |
18+30       4.7086      2.26  |Q        |         |         |   V     |
18+35       4.7239      2.22  |Q        |         |         |   V     |
18+40       4.7389      2.18  |Q        |         |         |    V    |
18+45       4.7536      2.14  |Q        |         |         |    V    |
18+50       4.7680      2.10  |Q        |         |         |    V    |
18+55       4.7822      2.06  |Q        |         |         |    V    |
19+ 0       4.7961      2.02  |Q        |         |         |    V    |
19+ 5       4.8097      1.98  |Q        |         |         |    V    |
19+10       4.8232      1.95  |Q        |         |         |    V    |
19+15       4.8364      1.92  |Q        |         |         |    V    |
```

```
19+20       4.8494      1.88  |Q        |         |         |    V    |
19+25       4.8621      1.85  |Q        |         |         |     V   |
19+30       4.8747      1.82  |Q        |         |         |     V   |
19+35       4.8871      1.80  |Q        |         |         |     V   |
19+40       4.8992      1.77  |Q        |         |         |     V   |
19+45       4.9113      1.74  |Q        |         |         |     V   |
19+50       4.9231      1.72  |Q        |         |         |     V   |
19+55       4.9348      1.69  |Q        |         |         |     V   |
20+ 0       4.9463      1.67  |Q        |         |         |     V   |
20+ 5       4.9576      1.65  |Q        |         |         |     V   |
20+10       4.9688      1.63  |Q        |         |         |     V   |
20+15       4.9799      1.61  |Q        |         |         |     V   |
20+20       4.9908      1.59  |Q        |         |         |     V   |
20+25       5.0016      1.57  |Q        |         |         |      V  |
20+30       5.0123      1.55  |Q        |         |         |      V  |
20+35       5.0228      1.53  |Q        |         |         |      V  |
20+40       5.0333      1.51  |Q        |         |         |      V  |
20+45       5.0436      1.50  Q         |         |         |      V  |
20+50       5.0537      1.48  Q         |         |         |      V  |
20+55       5.0638      1.46  Q         |         |         |      V  |
21+ 0       5.0738      1.45  Q         |         |         |      V  |
21+ 5       5.0837      1.43  Q         |         |         |      V  |
21+10       5.0934      1.42  Q         |         |         |      V  |
21+15       5.1031      1.40  Q         |         |         |      V  |
21+20       5.1126      1.39  Q         |         |         |      V  |
21+25       5.1221      1.38  Q         |         |         |      V  |
21+30       5.1315      1.36  Q         |         |         |       V |
21+35       5.1408      1.35  Q         |         |         |       V |
21+40       5.1500      1.34  Q         |         |         |       V |
21+45       5.1591      1.32  Q         |         |         |       V |
21+50       5.1681      1.31  Q         |         |         |       V |
21+55       5.1771      1.30  Q         |         |         |       V |
22+ 0       5.1860      1.29  Q         |         |         |       V |
22+ 5       5.1948      1.28  Q         |         |         |       V |
22+10       5.2035      1.27  Q         |         |         |       V |
22+15       5.2122      1.26  Q         |         |         |       V |
22+20       5.2207      1.25  Q         |         |         |       V |
22+25       5.2292      1.24  Q         |         |         |       V |
22+30       5.2377      1.23  Q         |         |         |       V |
22+35       5.2461      1.22  Q         |         |         |       V |
22+40       5.2544      1.21  Q         |         |         |       V |
22+45       5.2626      1.20  Q         |         |         |       V |
22+50       5.2708      1.19  Q         |         |         |        V|
22+55       5.2789      1.18  Q         |         |         |        V|
23+ 0       5.2869      1.17  Q         |         |         |        V|
23+ 5       5.2949      1.16  Q         |         |         |        V|
23+10       5.3029      1.15  Q         |         |         |        V|
23+15       5.3108      1.14  Q         |         |         |        V|
23+20       5.3186      1.14  Q         |         |         |        V|
23+25       5.3264      1.13  Q         |         |         |        V|
```

```
   23+30        5.3341      1.12  Q          |          |          |         V|
   23+35        5.3417      1.11  Q          |          |          |         V|
   23+40        5.3493      1.10  Q          |          |          |         V|
   23+45        5.3569      1.10  Q          |          |          |         V|
   23+50        5.3644      1.09  Q          |          |          |         V|
   23+55        5.3719      1.08  Q          |          |          |         V|
   24+ 0        5.3793      1.08  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 08/04/21

++

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

Program License Serial Number 6385

Space Center
Developed 100-year
Area F

Storm Event Year = 100

Antecedent Moisture Condition = 2

English (in-lb) Input Units Used

English Rainfall Data (Inches) Input Values Used

English Units used in output format

Area averaged rainfall intensity isohyetal data:

Sub-Area (Ac.)	Duration (hours)	Isohyetal (In)
Rainfall data for year 100		
31.02	1	1.09
Rainfall data for year 100		
31.02	6	2.09
Rainfall data for year 100		
31.02	24	3.64

++

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

SCS curve No.(AMCII)	SCS curve NO.(AMC 2)	Area (Ac.)	Area Fraction	Fp(Fig C6) (In/Hr)	Ap (dec.)	Fm (In/Hr)
58.0	58.0	31.02	1.000	0.707	0.160	0.113

Area-averaged adjusted loss rate Fm (In/Hr) = 0.113

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

Area (Ac.)	Area Fract	SCS CN (AMC2)	SCS CN (AMC2)	S	Pervious Yield Fr
4.96	0.160	58.0	58.0	7.24	0.140
26.06	0.840	98.0	98.0	0.20	0.936

Area-averaged catchment yield fraction, Y = 0.808
Area-averaged low loss fraction, Yb = 0.192
User entry of time of concentration =   0.610 (hours)
++
Watershed area =   31.02(Ac.)
Catchment Lag time =   0.488 hours
Unit interval =   5.000 minutes
Unit interval percentage of lag time = 17.0765
Hydrograph baseflow =   0.00(CFS)
Average maximum watershed loss rate(Fm) = 0.113(In/Hr)
Average low loss rate fraction (Yb) = 0.192 (decimal)
DESERT S-Graph Selected
Computed peak 5-minute rainfall = 0.517(In)
Computed peak 30-minute rainfall = 0.885(In)
Specified peak 1-hour rainfall = 1.090(In)
Computed peak 3-hour rainfall = 1.625(In)
Specified peak 6-hour rainfall = 2.090(In)
Specified peak 24-hour rainfall = 3.640(In)

Rainfall depth area reduction factors:
Using a total area of   31.02(Ac.) (Ref: fig. E-4)

5-minute factor = 0.999   Adjusted rainfall = 0.516(In)
30-minute factor = 0.999   Adjusted rainfall = 0.884(In)
1-hour factor = 0.999   Adjusted rainfall = 1.088(In)
3-hour factor = 1.000   Adjusted rainfall = 1.624(In)
6-hour factor = 1.000   Adjusted rainfall = 2.090(In)
24-hour factor = 1.000   Adjusted rainfall = 3.640(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 = 375.15 (CFS))	
1	0.800	3.003
2	3.500	10.126
3	8.087	17.208
4	17.130	33.928
5	32.658	58.253
6	46.060	50.275
7	55.521	35.496
8	62.196	25.040
9	67.209	18.806
10	71.354	15.551
11	74.745	12.719
12	77.666	10.960
13	80.076	9.041
14	82.191	7.934
15	84.029	6.893
16	85.710	6.307
17	87.240	5.739
18	88.575	5.011
19	89.655	4.050
20	90.648	3.724
21	91.586	3.523
22	92.423	3.138
23	93.206	2.937
24	93.929	2.712
25	94.525	2.236
26	95.105	2.178
27	95.657	2.071
28	96.110	1.697
29	96.554	1.666
30	96.962	1.533
31	97.275	1.173
32	97.582	1.153
33	97.847	0.992
34	98.021	0.652
35	98.191	0.641
36	98.375	0.688
37	98.580	0.768
38	98.784	0.769
39	98.989	0.769
40	99.194	0.769
41	99.399	0.769
42	99.554	0.582
43	99.661	0.400
44	99.768	0.400
45	99.874	0.400

46	100.000	0.200

Peak Unit Number	Adjusted mass rainfall (In)	Unit rainfall (In)
1	0.5165	0.5165
2	0.6358	0.1194
3	0.7181	0.0822
4	0.7828	0.0647
5	0.8370	0.0542
6	0.8841	0.0471
7	0.9259	0.0418
8	0.9638	0.0378
9	0.9984	0.0347
10	1.0305	0.0321
11	1.0604	0.0299
12	1.0884	0.0280
13	1.1206	0.0322
14	1.1513	0.0307
15	1.1806	0.0293
16	1.2087	0.0281
17	1.2357	0.0270
18	1.2618	0.0260
19	1.2869	0.0251
20	1.3112	0.0243
21	1.3347	0.0235
22	1.3575	0.0228
23	1.3797	0.0222
24	1.4012	0.0216
25	1.4222	0.0210
26	1.4427	0.0205
27	1.4627	0.0200
28	1.4822	0.0195
29	1.5013	0.0191
30	1.5200	0.0187
31	1.5382	0.0183
32	1.5561	0.0179
33	1.5737	0.0176
34	1.5909	0.0172
35	1.6078	0.0169
36	1.6244	0.0166
37	1.6407	0.0163
38	1.6566	0.0160
39	1.6724	0.0157
40	1.6878	0.0155
41	1.7030	0.0152
42	1.7180	0.0150
43	1.7328	0.0148
44	1.7473	0.0145
45	1.7616	0.0143
46	1.7758	0.0141

47	1.7897	0.0139
48	1.8035	0.0137
49	1.8170	0.0136
50	1.8304	0.0134
51	1.8436	0.0132
52	1.8567	0.0131
53	1.8696	0.0129
54	1.8823	0.0127
55	1.8949	0.0126
56	1.9074	0.0125
57	1.9197	0.0123
58	1.9319	0.0122
59	1.9439	0.0120
60	1.9558	0.0119
61	1.9676	0.0118
62	1.9793	0.0117
63	1.9908	0.0115
64	2.0022	0.0114
65	2.0135	0.0113
66	2.0247	0.0112
67	2.0358	0.0111
68	2.0468	0.0110
69	2.0577	0.0109
70	2.0685	0.0108
71	2.0792	0.0107
72	2.0898	0.0106
73	2.1014	0.0116
74	2.1128	0.0115
75	2.1242	0.0114
76	2.1355	0.0113
77	2.1467	0.0112
78	2.1578	0.0111
79	2.1689	0.0110
80	2.1798	0.0109
81	2.1907	0.0109
82	2.2015	0.0108
83	2.2122	0.0107
84	2.2228	0.0106
85	2.2334	0.0106
86	2.2438	0.0105
87	2.2542	0.0104
88	2.2646	0.0103
89	2.2748	0.0103
90	2.2850	0.0102
91	2.2952	0.0101
92	2.3052	0.0101
93	2.3152	0.0100
94	2.3252	0.0099
95	2.3350	0.0099
96	2.3448	0.0098

97	2.3546	0.0097
98	2.3643	0.0097
99	2.3739	0.0096
100	2.3835	0.0096
101	2.3930	0.0095
102	2.4024	0.0095
103	2.4118	0.0094
104	2.4212	0.0093
105	2.4305	0.0093
106	2.4397	0.0092
107	2.4489	0.0092
108	2.4580	0.0091
109	2.4671	0.0091
110	2.4761	0.0090
111	2.4851	0.0090
112	2.4941	0.0089
113	2.5030	0.0089
114	2.5118	0.0088
115	2.5206	0.0088
116	2.5293	0.0088
117	2.5381	0.0087
118	2.5467	0.0087
119	2.5553	0.0086
120	2.5639	0.0086
121	2.5724	0.0085
122	2.5809	0.0085
123	2.5894	0.0084
124	2.5978	0.0084
125	2.6061	0.0084
126	2.6145	0.0083
127	2.6227	0.0083
128	2.6310	0.0082
129	2.6392	0.0082
130	2.6474	0.0082
131	2.6555	0.0081
132	2.6636	0.0081
133	2.6717	0.0081
134	2.6797	0.0080
135	2.6877	0.0080
136	2.6956	0.0080
137	2.7035	0.0079
138	2.7114	0.0079
139	2.7193	0.0078
140	2.7271	0.0078
141	2.7349	0.0078
142	2.7426	0.0077
143	2.7503	0.0077
144	2.7580	0.0077
145	2.7657	0.0077
146	2.7733	0.0076

147	2.7809	0.0076
148	2.7884	0.0076
149	2.7959	0.0075
150	2.8034	0.0075
151	2.8109	0.0075
152	2.8183	0.0074
153	2.8257	0.0074
154	2.8331	0.0074
155	2.8405	0.0073
156	2.8478	0.0073
157	2.8551	0.0073
158	2.8623	0.0073
159	2.8696	0.0072
160	2.8768	0.0072
161	2.8840	0.0072
162	2.8911	0.0072
163	2.8983	0.0071
164	2.9054	0.0071
165	2.9124	0.0071
166	2.9195	0.0071
167	2.9265	0.0070
168	2.9335	0.0070
169	2.9405	0.0070
170	2.9475	0.0070
171	2.9544	0.0069
172	2.9613	0.0069
173	2.9682	0.0069
174	2.9750	0.0069
175	2.9819	0.0068
176	2.9887	0.0068
177	2.9954	0.0068
178	3.0022	0.0068
179	3.0090	0.0067
180	3.0157	0.0067
181	3.0224	0.0067
182	3.0290	0.0067
183	3.0357	0.0067
184	3.0423	0.0066
185	3.0489	0.0066
186	3.0555	0.0066
187	3.0621	0.0066
188	3.0686	0.0065
189	3.0751	0.0065
190	3.0816	0.0065
191	3.0881	0.0065
192	3.0946	0.0065
193	3.1010	0.0064
194	3.1074	0.0064
195	3.1138	0.0064
196	3.1202	0.0064

197	3.1266	0.0064
198	3.1329	0.0063
199	3.1393	0.0063
200	3.1456	0.0063
201	3.1518	0.0063
202	3.1581	0.0063
203	3.1644	0.0062
204	3.1706	0.0062
205	3.1768	0.0062
206	3.1830	0.0062
207	3.1892	0.0062
208	3.1953	0.0062
209	3.2015	0.0061
210	3.2076	0.0061
211	3.2137	0.0061
212	3.2198	0.0061
213	3.2259	0.0061
214	3.2319	0.0061
215	3.2379	0.0060
216	3.2440	0.0060
217	3.2500	0.0060
218	3.2560	0.0060
219	3.2619	0.0060
220	3.2679	0.0060
221	3.2738	0.0059
222	3.2797	0.0059
223	3.2856	0.0059
224	3.2915	0.0059
225	3.2974	0.0059
226	3.3033	0.0059
227	3.3091	0.0058
228	3.3149	0.0058
229	3.3207	0.0058
230	3.3265	0.0058
231	3.3323	0.0058
232	3.3381	0.0058
233	3.3438	0.0058
234	3.3496	0.0057
235	3.3553	0.0057
236	3.3610	0.0057
237	3.3667	0.0057
238	3.3724	0.0057
239	3.3780	0.0057
240	3.3837	0.0057
241	3.3893	0.0056
242	3.3950	0.0056
243	3.4006	0.0056
244	3.4062	0.0056
245	3.4117	0.0056
246	3.4173	0.0056

247	3.4229	0.0056
248	3.4284	0.0055
249	3.4339	0.0055
250	3.4394	0.0055
251	3.4449	0.0055
252	3.4504	0.0055
253	3.4559	0.0055
254	3.4614	0.0055
255	3.4668	0.0054
256	3.4722	0.0054
257	3.4777	0.0054
258	3.4831	0.0054
259	3.4885	0.0054
260	3.4939	0.0054
261	3.4992	0.0054
262	3.5046	0.0054
263	3.5099	0.0053
264	3.5153	0.0053
265	3.5206	0.0053
266	3.5259	0.0053
267	3.5312	0.0053
268	3.5365	0.0053
269	3.5418	0.0053
270	3.5470	0.0053
271	3.5523	0.0053
272	3.5575	0.0052
273	3.5628	0.0052
274	3.5680	0.0052
275	3.5732	0.0052
276	3.5784	0.0052
277	3.5836	0.0052
278	3.5887	0.0052
279	3.5939	0.0052
280	3.5990	0.0052
281	3.6042	0.0051
282	3.6093	0.0051
283	3.6144	0.0051
284	3.6195	0.0051
285	3.6246	0.0051
286	3.6297	0.0051
287	3.6348	0.0051
288	3.6399	0.0051

Unit Period (number)	Unit Rainfall (In)	Unit Soil-Loss (In)	Effective Rainfall (In)
1	0.0051	0.0010	0.0041
2	0.0051	0.0010	0.0041
3	0.0051	0.0010	0.0041

4	0.0051	0.0010	0.0041
5	0.0051	0.0010	0.0041
6	0.0051	0.0010	0.0042
7	0.0052	0.0010	0.0042
8	0.0052	0.0010	0.0042
9	0.0052	0.0010	0.0042
10	0.0052	0.0010	0.0042
11	0.0052	0.0010	0.0042
12	0.0052	0.0010	0.0042
13	0.0053	0.0010	0.0043
14	0.0053	0.0010	0.0043
15	0.0053	0.0010	0.0043
16	0.0053	0.0010	0.0043
17	0.0053	0.0010	0.0043
18	0.0053	0.0010	0.0043
19	0.0054	0.0010	0.0043
20	0.0054	0.0010	0.0044
21	0.0054	0.0010	0.0044
22	0.0054	0.0010	0.0044
23	0.0054	0.0010	0.0044
24	0.0055	0.0010	0.0044
25	0.0055	0.0011	0.0044
26	0.0055	0.0011	0.0044
27	0.0055	0.0011	0.0045
28	0.0055	0.0011	0.0045
29	0.0056	0.0011	0.0045
30	0.0056	0.0011	0.0045
31	0.0056	0.0011	0.0045
32	0.0056	0.0011	0.0045
33	0.0057	0.0011	0.0046
34	0.0057	0.0011	0.0046
35	0.0057	0.0011	0.0046
36	0.0057	0.0011	0.0046
37	0.0057	0.0011	0.0046
38	0.0058	0.0011	0.0046
39	0.0058	0.0011	0.0047
40	0.0058	0.0011	0.0047
41	0.0058	0.0011	0.0047
42	0.0058	0.0011	0.0047
43	0.0059	0.0011	0.0047
44	0.0059	0.0011	0.0048
45	0.0059	0.0011	0.0048
46	0.0059	0.0011	0.0048
47	0.0060	0.0011	0.0048
48	0.0060	0.0011	0.0048
49	0.0060	0.0012	0.0049
50	0.0060	0.0012	0.0049
51	0.0061	0.0012	0.0049
52	0.0061	0.0012	0.0049
53	0.0061	0.0012	0.0049

54	0.0061	0.0012	0.0050
55	0.0062	0.0012	0.0050
56	0.0062	0.0012	0.0050
57	0.0062	0.0012	0.0050
58	0.0062	0.0012	0.0051
59	0.0063	0.0012	0.0051
60	0.0063	0.0012	0.0051
61	0.0063	0.0012	0.0051
62	0.0064	0.0012	0.0051
63	0.0064	0.0012	0.0052
64	0.0064	0.0012	0.0052
65	0.0065	0.0012	0.0052
66	0.0065	0.0012	0.0052
67	0.0065	0.0012	0.0053
68	0.0065	0.0013	0.0053
69	0.0066	0.0013	0.0053
70	0.0066	0.0013	0.0053
71	0.0067	0.0013	0.0054
72	0.0067	0.0013	0.0054
73	0.0067	0.0013	0.0054
74	0.0067	0.0013	0.0054
75	0.0068	0.0013	0.0055
76	0.0068	0.0013	0.0055
77	0.0069	0.0013	0.0055
78	0.0069	0.0013	0.0056
79	0.0069	0.0013	0.0056
80	0.0070	0.0013	0.0056
81	0.0070	0.0013	0.0057
82	0.0070	0.0013	0.0057
83	0.0071	0.0014	0.0057
84	0.0071	0.0014	0.0057
85	0.0072	0.0014	0.0058
86	0.0072	0.0014	0.0058
87	0.0072	0.0014	0.0059
88	0.0073	0.0014	0.0059
89	0.0073	0.0014	0.0059
90	0.0073	0.0014	0.0059
91	0.0074	0.0014	0.0060
92	0.0074	0.0014	0.0060
93	0.0075	0.0014	0.0061
94	0.0075	0.0014	0.0061
95	0.0076	0.0015	0.0061
96	0.0076	0.0015	0.0062
97	0.0077	0.0015	0.0062
98	0.0077	0.0015	0.0062
99	0.0078	0.0015	0.0063
100	0.0078	0.0015	0.0063
101	0.0079	0.0015	0.0064
102	0.0079	0.0015	0.0064
103	0.0080	0.0015	0.0065

104	0.0080	0.0015	0.0065
105	0.0081	0.0016	0.0065
106	0.0081	0.0016	0.0066
107	0.0082	0.0016	0.0066
108	0.0082	0.0016	0.0067
109	0.0083	0.0016	0.0067
110	0.0084	0.0016	0.0068
111	0.0084	0.0016	0.0068
112	0.0085	0.0016	0.0069
113	0.0086	0.0016	0.0069
114	0.0086	0.0017	0.0070
115	0.0087	0.0017	0.0070
116	0.0088	0.0017	0.0071
117	0.0088	0.0017	0.0071
118	0.0089	0.0017	0.0072
119	0.0090	0.0017	0.0073
120	0.0090	0.0017	0.0073
121	0.0091	0.0018	0.0074
122	0.0092	0.0018	0.0074
123	0.0093	0.0018	0.0075
124	0.0093	0.0018	0.0076
125	0.0095	0.0018	0.0076
126	0.0095	0.0018	0.0077
127	0.0096	0.0018	0.0078
128	0.0097	0.0019	0.0078
129	0.0098	0.0019	0.0079
130	0.0099	0.0019	0.0080
131	0.0100	0.0019	0.0081
132	0.0101	0.0019	0.0081
133	0.0102	0.0020	0.0082
134	0.0103	0.0020	0.0083
135	0.0104	0.0020	0.0084
136	0.0105	0.0020	0.0085
137	0.0106	0.0020	0.0086
138	0.0107	0.0021	0.0087
139	0.0109	0.0021	0.0088
140	0.0109	0.0021	0.0088
141	0.0111	0.0021	0.0090
142	0.0112	0.0021	0.0091
143	0.0114	0.0022	0.0092
144	0.0115	0.0022	0.0093
145	0.0106	0.0020	0.0086
146	0.0107	0.0020	0.0086
147	0.0109	0.0021	0.0088
148	0.0110	0.0021	0.0089
149	0.0112	0.0021	0.0091
150	0.0113	0.0022	0.0091
151	0.0115	0.0022	0.0093
152	0.0117	0.0022	0.0094
153	0.0119	0.0023	0.0096

154	0.0120	0.0023	0.0097
155	0.0123	0.0024	0.0100
156	0.0125	0.0024	0.0101
157	0.0127	0.0024	0.0103
158	0.0129	0.0025	0.0104
159	0.0132	0.0025	0.0107
160	0.0134	0.0026	0.0108
161	0.0137	0.0026	0.0111
162	0.0139	0.0027	0.0113
163	0.0143	0.0027	0.0116
164	0.0145	0.0028	0.0118
165	0.0150	0.0029	0.0121
166	0.0152	0.0029	0.0123
167	0.0157	0.0030	0.0127
168	0.0160	0.0031	0.0129
169	0.0166	0.0032	0.0134
170	0.0169	0.0032	0.0137
171	0.0176	0.0034	0.0142
172	0.0179	0.0034	0.0145
173	0.0187	0.0036	0.0151
174	0.0191	0.0037	0.0154
175	0.0200	0.0038	0.0162
176	0.0205	0.0039	0.0166
177	0.0216	0.0041	0.0174
178	0.0222	0.0042	0.0179
179	0.0235	0.0045	0.0190
180	0.0243	0.0047	0.0196
181	0.0260	0.0050	0.0210
182	0.0270	0.0052	0.0218
183	0.0293	0.0056	0.0237
184	0.0307	0.0059	0.0248
185	0.0280	0.0054	0.0227
186	0.0299	0.0057	0.0242
187	0.0347	0.0066	0.0280
188	0.0378	0.0073	0.0306
189	0.0471	0.0090	0.0380
190	0.0542	0.0094	0.0448
191	0.0822	0.0094	0.0728
192	0.1194	0.0094	0.1099
193	0.5165	0.0094	0.5070
194	0.0647	0.0094	0.0553
195	0.0418	0.0080	0.0338
196	0.0321	0.0061	0.0259
197	0.0322	0.0062	0.0260
198	0.0281	0.0054	0.0227
199	0.0251	0.0048	0.0203
200	0.0228	0.0044	0.0185
201	0.0210	0.0040	0.0170
202	0.0195	0.0037	0.0158
203	0.0183	0.0035	0.0148

204	0.0172	0.0033	0.0139
205	0.0163	0.0031	0.0131
206	0.0155	0.0030	0.0125
207	0.0148	0.0028	0.0119
208	0.0141	0.0027	0.0114
209	0.0136	0.0026	0.0110
210	0.0131	0.0025	0.0106
211	0.0126	0.0024	0.0102
212	0.0122	0.0023	0.0098
213	0.0118	0.0023	0.0095
214	0.0114	0.0022	0.0092
215	0.0111	0.0021	0.0090
216	0.0108	0.0021	0.0087
217	0.0116	0.0022	0.0094
218	0.0113	0.0022	0.0091
219	0.0110	0.0021	0.0089
220	0.0108	0.0021	0.0087
221	0.0106	0.0020	0.0085
222	0.0103	0.0020	0.0084
223	0.0101	0.0019	0.0082
224	0.0099	0.0019	0.0080
225	0.0097	0.0019	0.0079
226	0.0096	0.0018	0.0077
227	0.0094	0.0018	0.0076
228	0.0092	0.0018	0.0075
229	0.0091	0.0017	0.0073
230	0.0089	0.0017	0.0072
231	0.0088	0.0017	0.0071
232	0.0087	0.0017	0.0070
233	0.0085	0.0016	0.0069
234	0.0084	0.0016	0.0068
235	0.0083	0.0016	0.0067
236	0.0082	0.0016	0.0066
237	0.0081	0.0015	0.0065
238	0.0080	0.0015	0.0064
239	0.0078	0.0015	0.0063
240	0.0077	0.0015	0.0063
241	0.0077	0.0015	0.0062
242	0.0076	0.0014	0.0061
243	0.0075	0.0014	0.0060
244	0.0074	0.0014	0.0060
245	0.0073	0.0014	0.0059
246	0.0072	0.0014	0.0058
247	0.0071	0.0014	0.0058
248	0.0071	0.0014	0.0057
249	0.0070	0.0013	0.0056
250	0.0069	0.0013	0.0056
251	0.0068	0.0013	0.0055
252	0.0068	0.0013	0.0055
253	0.0067	0.0013	0.0054

254	0.0066	0.0013	0.0054
255	0.0066	0.0013	0.0053
256	0.0065	0.0012	0.0053
257	0.0064	0.0012	0.0052
258	0.0064	0.0012	0.0052
259	0.0063	0.0012	0.0051
260	0.0063	0.0012	0.0051
261	0.0062	0.0012	0.0050
262	0.0062	0.0012	0.0050
263	0.0061	0.0012	0.0049
264	0.0061	0.0012	0.0049
265	0.0060	0.0012	0.0049
266	0.0060	0.0011	0.0048
267	0.0059	0.0011	0.0048
268	0.0059	0.0011	0.0047
269	0.0058	0.0011	0.0047
270	0.0058	0.0011	0.0047
271	0.0057	0.0011	0.0046
272	0.0057	0.0011	0.0046
273	0.0056	0.0011	0.0046
274	0.0056	0.0011	0.0045
275	0.0056	0.0011	0.0045
276	0.0055	0.0011	0.0045
277	0.0055	0.0010	0.0044
278	0.0054	0.0010	0.0044
279	0.0054	0.0010	0.0044
280	0.0054	0.0010	0.0043
281	0.0053	0.0010	0.0043
282	0.0053	0.0010	0.0043
283	0.0053	0.0010	0.0042
284	0.0052	0.0010	0.0042
285	0.0052	0.0010	0.0042
286	0.0052	0.0010	0.0042
287	0.0051	0.0010	0.0041
288	0.0051	0.0010	0.0041

```
---------------------------------------------------------------------
---------------------------------------------------------------------
Total soil rain loss =      0.58(In)
Total effective rainfall =      3.06(In)
Peak flow rate in flood hydrograph =     44.93(CFS)
----------------------------------------------------------------------
+++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
                    24 - H O U R   S T O R M
               R u n o f f     H y d r o g r a p h
---------------------------------------------------------------------
            Hydrograph in   5   Minute intervals ((CFS))

---------------------------------------------------------------------
Time(h+m) Volume Ac.Ft   Q(CFS)  0       12.5      25.0      37.5      50.0
-----------------------------------------------------------------------
```

```
0+ 5      0.0001     0.01  Q         |         |         |         |
0+10      0.0005     0.05  Q         |         |         |         |
0+15      0.0013     0.12  Q         |         |         |         |
0+20      0.0031     0.26  Q         |         |         |         |
0+25      0.0066     0.50  Q         |         |         |         |
0+30      0.0115     0.71  Q         |         |         |         |
0+35      0.0174     0.86  Q         |         |         |         |
0+40      0.0240     0.96  Q         |         |         |         |
0+45      0.0312     1.04  Q         |         |         |         |
0+50      0.0388     1.11  Q         |         |         |         |
0+55      0.0469     1.17  Q         |         |         |         |
1+ 0      0.0552     1.21  Q         |         |         |         |
1+ 5      0.0639     1.25  VQ        |         |         |         |
1+10      0.0728     1.29  VQ        |         |         |         |
1+15      0.0819     1.32  VQ        |         |         |         |
1+20      0.0912     1.35  VQ        |         |         |         |
1+25      0.1007     1.38  VQ        |         |         |         |
1+30      0.1104     1.41  VQ        |         |         |         |
1+35      0.1202     1.43  VQ        |         |         |         |
1+40      0.1302     1.45  VQ        |         |         |         |
1+45      0.1403     1.47  VQ        |         |         |         |
1+50      0.1505     1.49  VQ        |         |         |         |
1+55      0.1609     1.50  VQ        |         |         |         |
2+ 0      0.1714     1.52  VQ        |         |         |         |
2+ 5      0.1819     1.53  VQ        |         |         |         |
2+10      0.1926     1.55  VQ        |         |         |         |
2+15      0.2033     1.56   |Q       |         |         |         |
2+20      0.2141     1.57   |Q       |         |         |         |
2+25      0.2251     1.59   |Q       |         |         |         |
2+30      0.2361     1.60   |Q       |         |         |         |
2+35      0.2471     1.61   |Q       |         |         |         |
2+40      0.2583     1.62   |Q       |         |         |         |
2+45      0.2695     1.63   |Q       |         |         |         |
2+50      0.2808     1.64   |Q       |         |         |         |
2+55      0.2921     1.65   |Q       |         |         |         |
3+ 0      0.3035     1.65   |Q       |         |         |         |
3+ 5      0.3149     1.66   |Q       |         |         |         |
3+10      0.3265     1.67   |Q       |         |         |         |
3+15      0.3380     1.68   |Q       |         |         |         |
3+20      0.3497     1.69   |Q       |         |         |         |
3+25      0.3614     1.70   |Q       |         |         |         |
3+30      0.3732     1.71   |Q       |         |         |         |
3+35      0.3850     1.72   |Q       |         |         |         |
3+40      0.3969     1.73   |QV      |         |         |         |
3+45      0.4088     1.73   |QV      |         |         |         |
3+50      0.4208     1.74   |QV      |         |         |         |
3+55      0.4329     1.75   |QV      |         |         |         |
4+ 0      0.4450     1.76   |QV      |         |         |         |
4+ 5      0.4571     1.76   |QV      |         |         |         |
4+10      0.4693     1.77   |QV      |         |         |         |
```

4+15	0.4815	1.78	QV				
4+20	0.4938	1.78	QV				
4+25	0.5061	1.79	QV				
4+30	0.5185	1.80	QV				
4+35	0.5309	1.81	QV				
4+40	0.5434	1.81	QV				
4+45	0.5560	1.82	QV				
4+50	0.5685	1.83	QV				
4+55	0.5812	1.84	QV				
5+ 0	0.5939	1.84	Q V				
5+ 5	0.6066	1.85	Q V				
5+10	0.6194	1.86	Q V				
5+15	0.6323	1.87	Q V				
5+20	0.6452	1.88	Q V				
5+25	0.6582	1.88	Q V				
5+30	0.6712	1.89	Q V				
5+35	0.6843	1.90	Q V				
5+40	0.6975	1.91	Q V				
5+45	0.7107	1.92	Q V				
5+50	0.7239	1.93	Q V				
5+55	0.7373	1.94	Q V				
6+ 0	0.7507	1.94	Q V				
6+ 5	0.7641	1.95	Q V				
6+10	0.7776	1.96	Q V				
6+15	0.7912	1.97	Q V				
6+20	0.8049	1.98	Q V				
6+25	0.8186	1.99	Q V				
6+30	0.8323	2.00	Q V				
6+35	0.8462	2.01	Q V				
6+40	0.8601	2.02	Q V				
6+45	0.8741	2.03	Q V				
6+50	0.8882	2.04	Q V				
6+55	0.9023	2.05	Q V				
7+ 0	0.9165	2.06	Q V				
7+ 5	0.9308	2.07	Q V				
7+10	0.9451	2.08	Q V				
7+15	0.9595	2.09	Q V				
7+20	0.9740	2.11	Q V				
7+25	0.9886	2.12	Q V				
7+30	1.0033	2.13	Q V				
7+35	1.0180	2.14	Q V				
7+40	1.0328	2.15	Q V				
7+45	1.0477	2.16	Q V				
7+50	1.0627	2.18	Q V				
7+55	1.0778	2.19	Q V				
8+ 0	1.0929	2.20	Q V				
8+ 5	1.1082	2.21	Q V				
8+10	1.1235	2.23	Q V				
8+15	1.1389	2.24	Q V				
8+20	1.1544	2.25	Q V				

```
 8+25       1.1700      2.27   |Q   V    |         |         |         |
 8+30       1.1857      2.28   |Q    V   |         |         |         |
 8+35       1.2015      2.29   |Q    V   |         |         |         |
 8+40       1.2174      2.31   |Q    V   |         |         |         |
 8+45       1.2334      2.32   |Q    V   |         |         |         |
 8+50       1.2495      2.34   |Q    V   |         |         |         |
 8+55       1.2657      2.35   |Q    V   |         |         |         |
 9+ 0       1.2820      2.37   |Q    V   |         |         |         |
 9+ 5       1.2984      2.38   |Q    V   |         |         |         |
 9+10       1.3149      2.40   |Q    V   |         |         |         |
 9+15       1.3316      2.41   |Q    V   |         |         |         |
 9+20       1.3483      2.43   |Q    V   |         |         |         |
 9+25       1.3652      2.45   |Q    V   |         |         |         |
 9+30       1.3821      2.46   |Q     V  |         |         |         |
 9+35       1.3992      2.48   |Q     V  |         |         |         |
 9+40       1.4164      2.50   |Q     V  |         |         |         |
 9+45       1.4337      2.52   | Q    V  |         |         |         |
 9+50       1.4512      2.53   | Q    V  |         |         |         |
 9+55       1.4688      2.55   | Q    V  |         |         |         |
10+ 0       1.4865      2.57   | Q    V  |         |         |         |
10+ 5       1.5044      2.59   | Q    V  |         |         |         |
10+10       1.5223      2.61   | Q    V  |         |         |         |
10+15       1.5405      2.63   | Q    V  |         |         |         |
10+20       1.5587      2.65   | Q    V  |         |         |         |
10+25       1.5771      2.67   | Q    V  |         |         |         |
10+30       1.5957      2.69   | Q     V |         |         |         |
10+35       1.6144      2.72   | Q     V |         |         |         |
10+40       1.6333      2.74   | Q     V |         |         |         |
10+45       1.6523      2.76   | Q     V |         |         |         |
10+50       1.6715      2.79   | Q     V |         |         |         |
10+55       1.6908      2.81   | Q     V |         |         |         |
11+ 0       1.7103      2.83   | Q     V |         |         |         |
11+ 5       1.7300      2.86   | Q     V |         |         |         |
11+10       1.7499      2.88   | Q     V |         |         |         |
11+15       1.7700      2.91   | Q     V |         |         |         |
11+20       1.7902      2.94   | Q      V|         |         |         |
11+25       1.8106      2.97   | Q      V|         |         |         |
11+30       1.8312      2.99   | Q      V|         |         |         |
11+35       1.8521      3.02   | Q      V|         |         |         |
11+40       1.8731      3.05   | Q      V|         |         |         |
11+45       1.8943      3.08   | Q      V|         |         |         |
11+50       1.9158      3.12   | Q      V|         |         |         |
11+55       1.9375      3.15   | Q      V|         |         |         |
12+ 0       1.9594      3.18   | Q      V|         |         |         |
12+ 5       1.9815      3.21   | Q       V         |         |         |
12+10       2.0038      3.24   | Q       V         |         |         |
12+15       2.0263      3.26   | Q       V         |         |         |
12+20       2.0488      3.27   | Q       V         |         |         |
12+25       2.0712      3.26   | Q       V         |         |         |
12+30       2.0937      3.25   | Q       V         |         |         |
```

```
12+35       2.1161      3.26  | Q       V         |         |         |
12+40       2.1388      3.28  | Q       V         |         |         |
12+45       2.1616      3.31  | Q       V         |         |         |
12+50       2.1846      3.34  | Q       |V        |         |         |
12+55       2.2078      3.38  | Q       |V        |         |         |
13+ 0       2.2314      3.42  | Q       |V        |         |         |
13+ 5       2.2552      3.46  | Q       |V        |         |         |
13+10       2.2793      3.50  | Q       |V        |         |         |
13+15       2.3037      3.55  | Q       |V        |         |         |
13+20       2.3285      3.60  | Q       |V        |         |         |
13+25       2.3537      3.65  | Q       |V        |         |         |
13+30       2.3793      3.71  | Q       | V       |         |         |
13+35       2.4052      3.77  |  Q      | V       |         |         |
13+40       2.4316      3.83  |  Q      | V       |         |         |
13+45       2.4585      3.90  |  Q      | V       |         |         |
13+50       2.4858      3.97  |  Q      | V       |         |         |
13+55       2.5136      4.04  |  Q      | V       |         |         |
14+ 0       2.5420      4.12  |  Q      | V       |         |         |
14+ 5       2.5710      4.20  |  Q      |  V      |         |         |
14+10       2.6006      4.29  |  Q      |  V      |         |         |
14+15       2.6308      4.39  |  Q      |  V      |         |         |
14+20       2.6617      4.49  |  Q      |  V      |         |         |
14+25       2.6933      4.59  |  Q      |  V      |         |         |
14+30       2.7257      4.71  |  Q      |  V      |         |         |
14+35       2.7590      4.83  |  Q      |  V      |         |         |
14+40       2.7932      4.96  |  Q      |   V     |         |         |
14+45       2.8283      5.10  |   Q     |   V     |         |         |
14+50       2.8645      5.25  |   Q     |   V     |         |         |
14+55       2.9018      5.42  |   Q     |   V     |         |         |
15+ 0       2.9404      5.60  |   Q     |   V     |         |         |
15+ 5       2.9803      5.80  |   Q     |    V    |         |         |
15+10       3.0217      6.01  |   Q     |    V    |         |         |
15+15       3.0648      6.25  |    Q    |    V    |         |         |
15+20       3.1096      6.52  |    Q    |    V    |         |         |
15+25       3.1565      6.81  |    Q    |     V   |         |         |
15+30       3.2054      7.10  |    Q    |     V   |         |         |
15+35       3.2565      7.41  |    Q    |     V   |         |         |
15+40       3.3095      7.71  |     Q   |     V   |         |         |
15+45       3.3645      7.98  |     Q   |      V  |         |         |
15+50       3.4225      8.41  |     Q   |      V  |         |         |
15+55       3.4854      9.14  |      Q  |      V  |         |         |
16+ 0       3.5568     10.37  |       Q |       V |         |         |
16+ 5       3.6494     13.45  |         Q       V |         |         |
16+10       3.7785     18.74  |         |   Q    V|         |         |
16+15       3.9482     24.64  |         |        QV         |         |
16+20       4.1841     34.26  |         |         |V     Q  |         |
16+25       4.4936     44.93  |         |         | V       |    Q    |
16+30       4.7697     40.10  |         |         |   V     | Q       |
16+35       4.9879     31.69  |         |         |    Q    |         |
16+40       5.1626     25.36  |         |         Q     V   |         |
```

```
16+45       5.3096     21.35  |         |      Q  |     V   |         |
16+50       5.4396     18.86  |         |    Q    |      V  |         |
16+55       5.5546     16.71  |         |  Q      |       V |         |
17+ 0       5.6588     15.12  |         | Q       |       V |         |
17+ 5       5.7522     13.57  |         Q         |        V|         |
17+10       5.8381     12.47  |        Q|         |        V|         |
17+15       5.9172     11.48  |        Q|         |         V         |
17+20       5.9911     10.74  |       Q |         |         V         |
17+25       6.0602     10.03  |       Q |         |         V         |
17+30       6.1240      9.28  |      Q  |         |         |V        |
17+35       6.1825      8.49  |     Q   |         |         |V        |
17+40       6.2377      8.02  |     Q   |         |         |V        |
17+45       6.2903      7.63  |     Q   |         |         |V        |
17+50       6.3399      7.20  |    Q    |         |         | V       |
17+55       6.3871      6.85  |    Q    |         |         | V       |
18+ 0       6.4319      6.51  |    Q    |         |         | V       |
18+ 5       6.4738      6.09  |   Q     |         |         | V       |
18+10       6.5142      5.87  |   Q     |         |         |  V      |
18+15       6.5530      5.64  |   Q     |         |         |  V      |
18+20       6.5897      5.33  |   Q     |         |         |  V      |
18+25       6.6254      5.19  |   Q     |         |         |  V      |
18+30       6.6598      5.00  |  Q      |         |         |  V      |
18+35       6.6923      4.72  |  Q      |         |         |  V      |
18+40       6.7239      4.58  |  Q      |         |         |   V     |
18+45       6.7540      4.38  |  Q      |         |         |   V     |
18+50       6.7825      4.13  |  Q      |         |         |   V     |
18+55       6.8103      4.03  |  Q      |         |         |   V     |
19+ 0       6.8377      3.98  |  Q      |         |         |   V     |
19+ 5       6.8648      3.94  |  Q      |         |         |   V     |
19+10       6.8914      3.86  |  Q      |         |         |   V     |
19+15       6.9174      3.78  |  Q      |         |         |    V    |
19+20       6.9429      3.70  | Q       |         |         |    V    |
19+25       6.9678      3.61  | Q       |         |         |    V    |
19+30       6.9915      3.44  | Q       |         |         |    V    |
19+35       7.0141      3.28  | Q       |         |         |    V    |
19+40       7.0362      3.20  | Q       |         |         |    V    |
19+45       7.0577      3.12  | Q       |         |         |    V    |
19+50       7.0780      2.95  | Q       |         |         |    V    |
19+55       7.0972      2.79  | Q       |         |         |    V    |
20+ 0       7.1161      2.74  | Q       |         |         |     V   |
20+ 5       7.1346      2.69  | Q       |         |         |     V   |
20+10       7.1527      2.64  | Q       |         |         |     V   |
20+15       7.1706      2.60  | Q       |         |         |     V   |
20+20       7.1882      2.55  | Q       |         |         |     V   |
20+25       7.2055      2.52  | Q       |         |         |     V   |
20+30       7.2226      2.48  |Q        |         |         |     V   |
20+35       7.2394      2.44  |Q        |         |         |     V   |
20+40       7.2560      2.41  |Q        |         |         |     V   |
20+45       7.2724      2.38  |Q        |         |         |     V   |
20+50       7.2885      2.34  |Q        |         |         |     V   |
```

```
   20+55       7.3045      2.31  |Q        |         |         |      V  |
   21+ 0       7.3202      2.28  |Q        |         |         |      V  |
   21+ 5       7.3357      2.26  |Q        |         |         |      V  |
   21+10       7.3511      2.23  |Q        |         |         |      V  |
   21+15       7.3663      2.20  |Q        |         |         |      V  |
   21+20       7.3813      2.18  |Q        |         |         |      V  |
   21+25       7.3961      2.15  |Q        |         |         |      V  |
   21+30       7.4108      2.13  |Q        |         |         |      V  |
   21+35       7.4253      2.11  |Q        |         |         |      V  |
   21+40       7.4397      2.09  |Q        |         |         |      V  |
   21+45       7.4539      2.06  |Q        |         |         |      V  |
   21+50       7.4679      2.04  |Q        |         |         |      V  |
   21+55       7.4819      2.02  |Q        |         |         |      V  |
   22+ 0       7.4957      2.00  |Q        |         |         |       V |
   22+ 5       7.5093      1.98  |Q        |         |         |       V |
   22+10       7.5228      1.96  |Q        |         |         |       V |
   22+15       7.5362      1.94  |Q        |         |         |       V |
   22+20       7.5495      1.93  |Q        |         |         |       V |
   22+25       7.5626      1.91  |Q        |         |         |       V |
   22+30       7.5756      1.89  |Q        |         |         |       V |
   22+35       7.5885      1.87  |Q        |         |         |       V |
   22+40       7.6013      1.86  |Q        |         |         |       V |
   22+45       7.6140      1.84  |Q        |         |         |       V |
   22+50       7.6266      1.83  |Q        |         |         |       V |
   22+55       7.6391      1.81  |Q        |         |         |       V |
   23+ 0       7.6514      1.80  |Q        |         |         |       V |
   23+ 5       7.6637      1.78  |Q        |         |         |       V |
   23+10       7.6759      1.77  |Q        |         |         |       V |
   23+15       7.6879      1.75  |Q        |         |         |       V |
   23+20       7.6999      1.74  |Q        |         |         |        V|
   23+25       7.7118      1.73  |Q        |         |         |        V|
   23+30       7.7236      1.71  |Q        |         |         |        V|
   23+35       7.7353      1.70  |Q        |         |         |        V|
   23+40       7.7469      1.69  |Q        |         |         |        V|
   23+45       7.7584      1.67  |Q        |         |         |        V|
   23+50       7.7699      1.66  |Q        |         |         |        V|
   23+55       7.7813      1.65  |Q        |         |         |        V|
   24+ 0       7.7925      1.64  |Q        |         |         |        V|
-----------------------------------------------------------------------
```

Appendix E

- BMP Fact Sheets

Section 3
Source Control BMPs

3.1 Introduction

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

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

Table 3-1 Municipal Fixed Facility BMPs

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

Table 3-2 Municipal Field Program BMPs

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

Section 3
Source Control BMPs

3.1 Introduction

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

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

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

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

Design Objectives

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

Description

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

Approach

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

Suitable Applications

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

Design Considerations

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

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

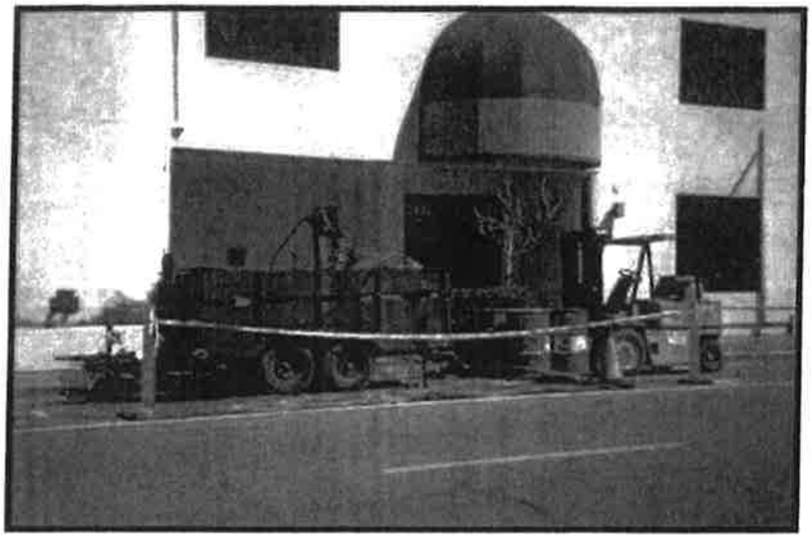
- Evaluating infiltration opportunities by referring to the stormwater management manual for the jurisdiction and pay particular attention to the selection criteria for avoiding groundwater contamination, poor soils, and hydrogeological conditions that cause these facilities to fail. If necessary, locate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

Protection of Slopes and Channels during Landscape Design

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

Redeveloping Existing Installations

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



Objectives

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

Targeted Constituents

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

Description

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

Approach

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

Pollution Prevention

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

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

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

- For field programs, only transport the minimum amount of material needed for the daily activities and transfer materials between containers at a municipal yard where leaks and spill are easier to control.

- If paved, sweep and clean storage areas monthly, do not use water to hose down the area unless all of the water will be collected and disposed of properly.

- Install a spill control device (such as a tee section) in any catch basins that collect runoff from any storage areas if the materials stored are oil, gas, or other materials that separate from and float on water. This will allow for easier cleanup if a spill occurs.

- If necessary, protect catch basins while conducting field activities so that if a spill occurs, the material will be contained.

Training

- Educate employees about spill prevention, spill response and cleanup on a routine basis.

- Well-trained employees can reduce human errors that lead to accidental releases or spills:

  - The employees should have the tools and knowledge to immediately begin cleaning up a spill if one should occur.

  - Employees should be familiar with the Spill Prevention Control and Countermeasure Plan if one is available.

- Training of staff from all municipal departments should focus on recognizing and reporting potential or current spills/leaks and who they should contact.

- Employees responsible for aboveground storage tanks and liquid transfers for large bulk containers should be thoroughly familiar with the Spill Prevention Control and Countermeasure Plan and the plan should be readily available.

Spill Response and Prevention

- Identify key spill response personnel and train employees on who they are.

- Store and maintain appropriate spill cleanup materials in a clearly marked location near storage areas; and train employees to ensure familiarity with the site's spill control plan and/or proper spill cleanup procedures.

- Locate spill cleanup materials, such as absorbents, where they will be readily accessible (e.g. near storage and maintenance areas, on field trucks).

- Report spills in accordance with applicable reporting laws. Spills that pose an immediate threat to human health or the environment must be reported immediately to the Office of Emergency Service (OES)
- Spills that pose an immediate threat to human health or the environment may also need to be reported within 24 hours to the Regional Water Quality Control Board.
- Federal regulations require that any oil spill into a water body or onto an adjoining shoreline be reported to the National Response Center (NRC) at 800-424-8802 (24 hour)
- After the spill has been contained and cleaned up, a detailed report about the incident should be generated and kept on file (see the section on Reporting below). The incident may also be used in briefing staff about proper procedures

Other Considerations

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

Requirements

Costs

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

Maintenance

- This BMP has no major administrative or staffing requirements. However, extra time is needed to properly handle and dispose of spills, which results in increased labor costs

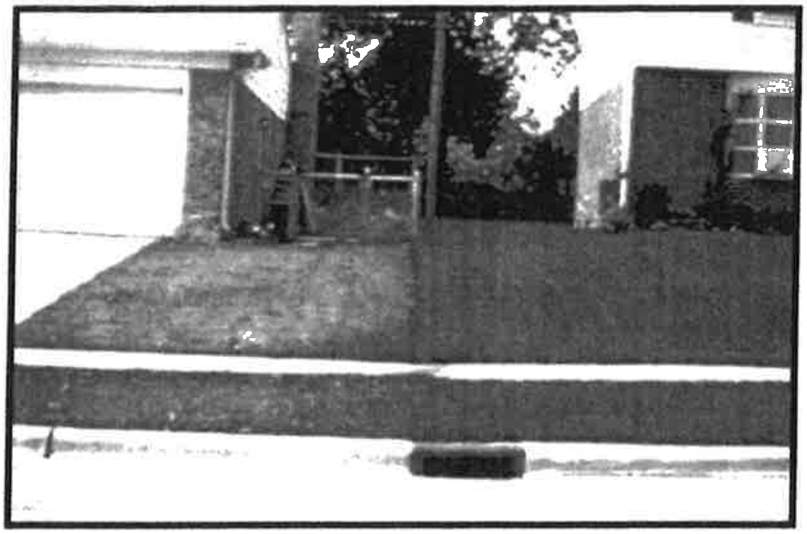
Supplemental Information

Further Detail of the BMP

Reporting

Record keeping and internal reporting represent good operating practices because they can increase the efficiency of the response and containment of a spill. A good record keeping system helps the municipality minimize incident recurrence, correctly respond with appropriate containment and cleanup activities, and comply with legal requirements.

A record keeping and reporting system should be set up for documenting spills, leaks, and other discharges, including discharges of hazardous substances in reportable quantities. Incident records describe the quality and quantity of non-stormwater discharges to the storm drain.



Design Objectives

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

Description

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

Approach

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

Suitable Applications

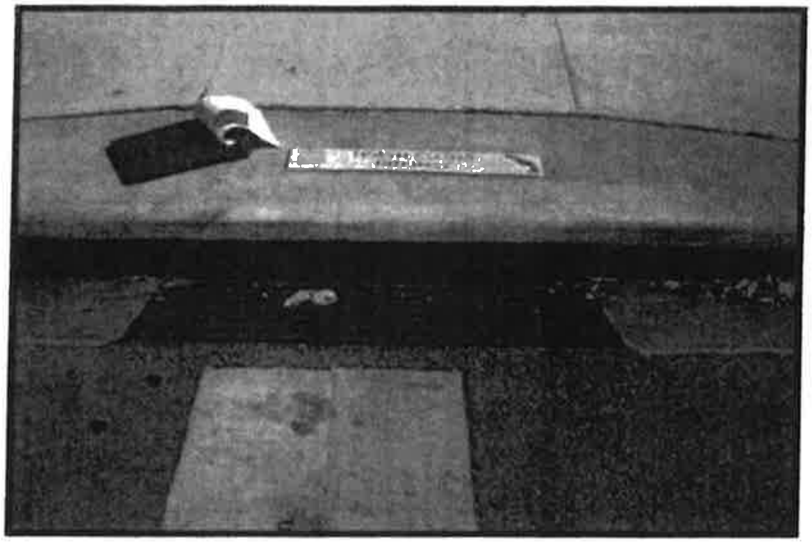
Appropriate applications include residential, commercial and industrial areas planned for development or redevelopment. (Detached residential single-family homes are typically excluded from this requirement.)

Design Considerations

Designing New Installations

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

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



Design Objectives

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

Description

Waste materials dumped into storm drain inlets can have severe impacts on receiving and ground waters. Posting notices regarding discharge prohibitions at storm drain inlets can prevent waste dumping. Storm drain signs and stencils are highly visible source controls that are typically placed directly adjacent to storm drain inlets.

Approach

The stencil or affixed sign contains a brief statement that prohibits dumping of improper materials into the urban runoff conveyance system. Storm drain messages have become a popular method of alerting the public about the effects of and the prohibitions against waste disposal.

Suitable Applications

Stencils and signs alert the public to the destination of pollutants discharged to the storm drain. Signs are appropriate in residential, commercial, and industrial areas, as well as any other area where contributions or dumping to storm drains is likely.

Design Considerations

Storm drain message markers or placards are recommended at all storm drain inlets within the boundary of a development project. The marker should be placed in clear sight facing toward anyone approaching the inlet from either side. All storm drain inlet locations should be identified on the development site map.

Designing New Installations

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

- Provide stenciling or labeling of all storm drain inlets and catch basins, constructed or modified, within the project area with prohibitive language. Examples include "NO DUMPING

CASQA

- Use lined bins or dumpsters to reduce leaking of liquid waste.
- Provide roofs, awnings, or attached lids on all trash containers to minimize direct precipitation and prevent rainfall from entering containers.
- Pave trash storage areas with an impervious surface to mitigate spills.
- Do not locate storm drains in immediate vicinity of the trash storage area.
- Post signs on all dumpsters informing users that hazardous materials are not to be disposed of therein.

Redeveloping Existing Installations

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

Additional Information

Maintenance Considerations

The integrity of structural elements that are subject to damage (i.e., screens, covers, and signs) must be maintained by the owner/operator. Maintenance agreements between the local agency and the owner/operator may be required. Some agencies will require maintenance deed restrictions to be recorded of the property title. If required by the local agency, maintenance agreements or deed restrictions must be executed by the owner/operator before improvement plans are approved.

Other Resources

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

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

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

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

- Encourage use of Integrated Pest Management techniques for pest control.

- Encourage proper onsite recycling of yard trimmings.

- Recycle residual paints, solvents, lumber, and other material as much as possible.

Suggested Protocols

Pressure Washing of Buildings, Rooftops, and Other Large Objects

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

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

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

Landscaping Activities

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

- Use mulch or other erosion control measures on exposed soils.

Building Repair, Remodeling, and Construction

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

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

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

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

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

- Use up the pesticides. Rinse containers, and use rinse water as product. Dispose of unused pesticide as hazardous waste.

- Implement storage requirements for pesticide products with guidance from the local fire department and County Agricultural Commissioner. Provide secondary containment for pesticides.

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

Training
- Educate and train employees on pesticide use and in pesticide application techniques to prevent pollution.

- Train employees and contractors in proper techniques for spill containment and cleanup.

- Be sure the frequency of training takes into account the complexity of the operations and the nature of the staff.

Spill Response and Prevention
- Keep your Spill Prevention Control and Countermeasure (SPCC) Plan up-to-date.

- Place a stockpile of spill cleanup materials, such as brooms, dustpans, and vacuum sweepers (if desired) near the storage area where it will be readily accessible.

- Have employees trained in spill containment and cleanup present during the loading/unloading of dangerous wastes, liquid chemicals, or other materials.

- Familiarize employees with the Spill Prevention Control and Countermeasure Plan.

- Clean up spills immediately.

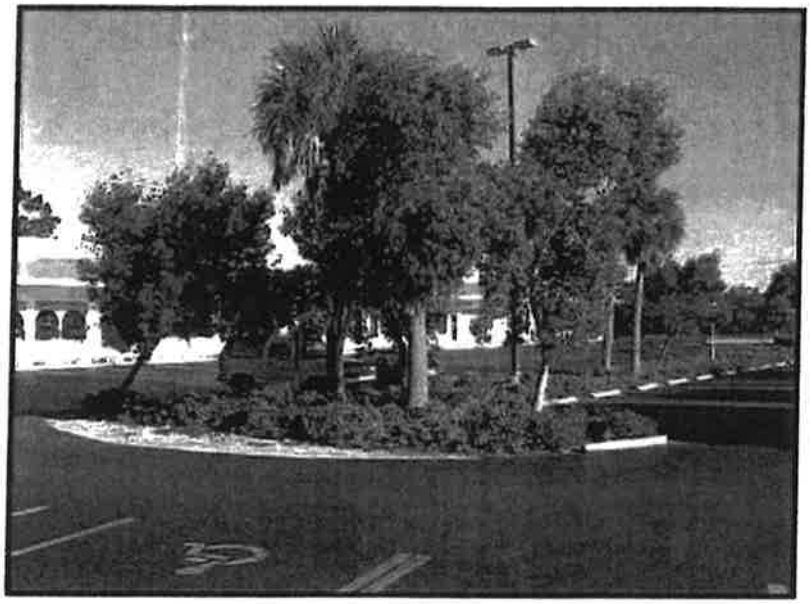
Other Considerations
Alternative pest/weed controls may not be available, suitable, or effective in many cases.

Requirements

Costs
- Cost will vary depending on the type and size of facility.

- Overall costs should be low in comparison to other BMPs.

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



Objectives

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

Targeted Constituents

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

Description

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

Approach

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

Pollution Prevention

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

CASQA California Stormwater Quality Association

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

Surface Repair

- Preheat, transfer or load hot bituminous material away from storm drain inlets.
- Apply concrete, asphalt, and seal coat during dry weather to prevent contamination from contacting stormwater runoff.
- Cover and seal nearby storm drain inlets where applicable (with waterproof material or mesh) and manholes before applying seal coat, slurry seal, etc. Leave covers in place until job is complete and all water from emulsified oil sealants has drained or evaporated. Clean any debris from these covered manholes and drains for proper disposal.
- Use only as much water as necessary for dust control, to avoid runoff.
- Catch drips from paving equipment that is not in use with pans or absorbent material placed under the machines. Dispose of collected material and absorbents properly.

Inspection

- Have designated personnel conduct inspections of parking facilities and stormwater conveyance systems associated with parking facilities on a regular basis.
- Inspect cleaning equipment/sweepers for leaks on a regular basis.

Training

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

Spill Response and Prevention

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

Other Considerations

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

Description

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

Objectives

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

Approach

Pollution Prevention

- Purchase only the amount of material that will be needed for foreseeable use. In most cases this will result in cost savings in both purchasing and disposal. See SC-61 Safer Alternative Products for additional information.

- Be aware of new products that may do the same job with less environmental risk and for less or the equivalent cost. Total cost must be used here; this includes purchase price, transportation costs, storage costs, use related costs, clean up costs and disposal costs.

Targeted Constituents

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

Suggested Protocols

General

- Keep work sites clean and orderly. Remove debris in a timely fashion. Sweep the area.

- Dispose of wash water, sweepings, and sediments, properly.

- Recycle or dispose of fluids properly.

- Establish a daily checklist of office, yard and plant areas to confirm cleanliness and adherence to proper storage and security. Specific employees should be assigned specific inspection responsibilities and given the authority to remedy any problems found.

- Post waste disposal charts in appropriate locations detailing for each waste its hazardous nature (poison, corrosive, flammable), prohibitions on its disposal (dumpster, drain, sewer) and the recommended disposal method (recycle, sewer, burn, storage, landfill).

- Summarize the chosen BMPs applicable to your operation and post them in appropriate conspicuous places.

Requirements

Costs

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

Maintenance

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

Supplemental Information

Further Detail of the BMP

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

Examples

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

References and Resources

British Columbia Lake Stewardship Society. Best Management Practices to Protect Water Quality from Non-Point Source Pollution. March 2000. http://www.nalms.org/bclss/bmphome.html#bmp

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

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

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

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

- Use lined bins or dumpsters to reduce leaking of liquid waste.
- Provide roofs, awnings, or attached lids on all trash containers to minimize direct precipitation and prevent rainfall from entering containers.
- Pave trash storage areas with an impervious surface to mitigate spills.
- Do not locate storm drains in immediate vicinity of the trash storage area.
- Post signs on all dumpsters informing users that hazardous materials are not to be disposed of therein.

Redeveloping Existing Installations

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

Additional Information

Maintenance Considerations

The integrity of structural elements that are subject to damage (i.e., screens, covers, and signs) must be maintained by the owner/operator. Maintenance agreements between the local agency and the owner/operator may be required. Some agencies will require maintenance deed restrictions to be recorded of the property title. If required by the local agency, maintenance agreements or deed restrictions must be executed by the owner/operator before improvement plans are approved.

Other Resources

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

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

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

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

User Inputs

Chamber Model:	MC-4500
Outlet Control Structure:	No
Project Name:	
Engineer:	N/A
Project Location:	California
Measurement Type:	Imperial
Required Storage Volume:	52162 cubic ft.
Stone Porosity:	40%
Stone Foundation Depth:	9 in.
Stone Above Chambers:	12 in.
Average Cover Over Chambers:	24 in.
Design Constraint Dimensions:	(70 ft. x 190 ft.)

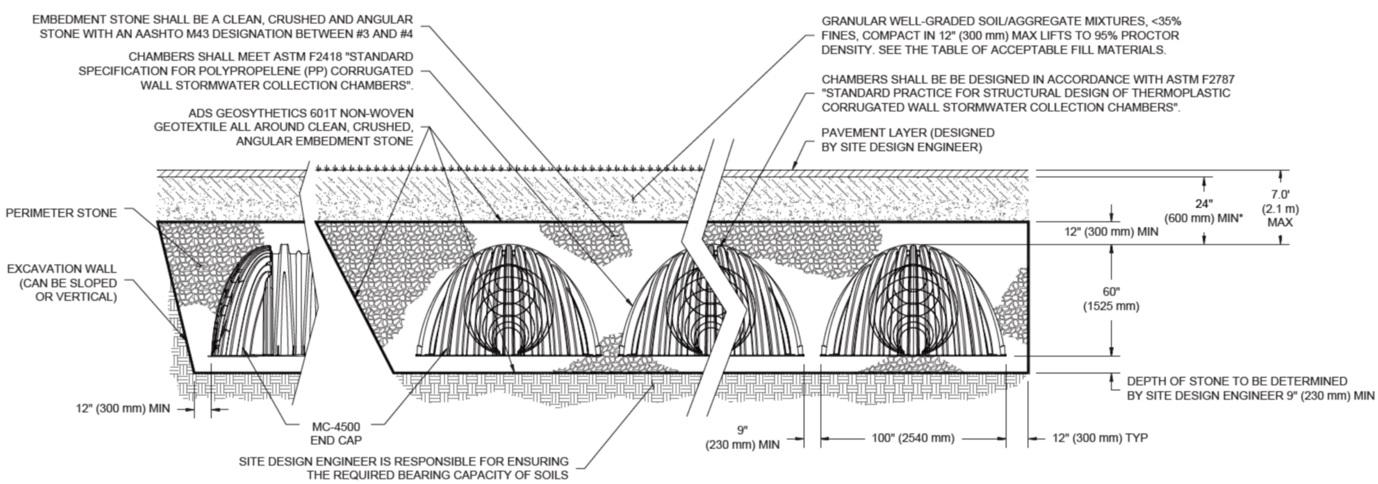
Results

System Volume and Bed Size

Installed Storage Volume:	52958.26 cubic ft.
Storage Volume Per Chamber:	106.50 cubic ft.
Number Of Chambers Required:	308
Number Of End Caps Required:	14
Chamber Rows:	7
Maximum Length:	189.05 ft.
Maximum Width:	64.83 ft.
Approx. Bed Size Required:	12201.95 square ft.

System Components

Amount Of Stone Required:	1815.12 cubic yards
Volume Of Excavation (Not Including Fill):	3050.49 cubic yards
Total Non-woven Geotextile Required:	3710.85 square yards
Woven Geotextile Required (excluding Isolator Row):	106.17 square yards
Woven Geotextile Required (Isolator Row):	425.99 square yards
Total Woven Geotextile Required:	532.16 square yards



*MINIMUM COVER TO BOTTOM OF FLEXIBLE PAVEMENT. FOR UNPAVED INSTALLATIONS WHERE RUTTING FROM VEHICLES MAY OCCUR, INCREASE COVER TO 30" (750 mm).

User Inputs

Chamber Model:	MC-4500
Outlet Control Structure:	No
Project Name:	
Engineer:	N/A
Project Location:	California
Measurement Type:	Imperial
Required Storage Volume:	77400 cubic ft.
Stone Porosity:	40%
Stone Foundation Depth:	9 in.
Stone Above Chambers:	12 in.
Average Cover Over Chambers:	24 in.
Design Constraint Dimensions:	(70 ft. x 300 ft.)

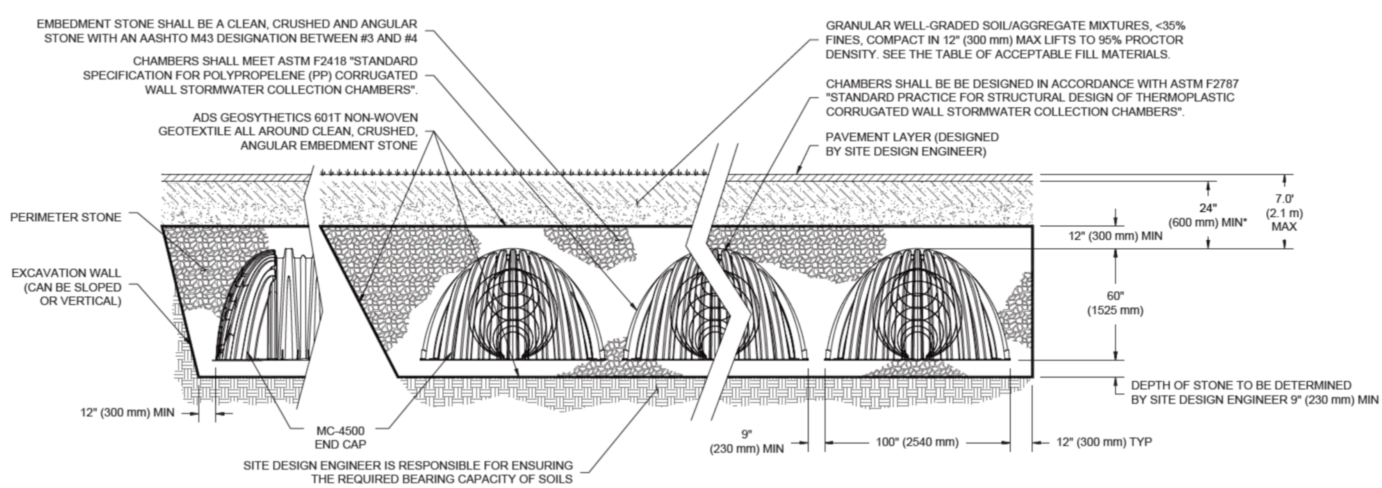
Results

System Volume and Bed Size

Installed Storage Volume:	78136.92 cubic ft.
Storage Volume Per Chamber:	106.50 cubic ft.
Number Of Chambers Required:	461
Number Of End Caps Required:	14
Chamber Rows:	7
Maximum Length:	277.60 ft.
Maximum Width:	64.83 ft.
Approx. Bed Size Required:	17906.38 square ft.

System Components

Amount Of Stone Required:	2637.72 cubic yards
Volume Of Excavation (Not Including Fill):	4476.59 cubic yards
Total Non-woven Geotextile Required:	5391.42 square yards
Woven Geotextile Required (excluding Isolator Row):	106.17 square yards
Woven Geotextile Required (Isolator Row):	632.61 square yards
Total Woven Geotextile Required:	738.77 square yards



*MINIMUM COVER TO BOTTOM OF FLEXIBLE PAVEMENT. FOR UNPAVED INSTALLATIONS WHERE RUTTING FROM VEHICLES MAY OCCUR, INCREASE COVER TO 30" (750 mm).

BIO-2: Vegetated Swale

Also known as:
- *Bioswale*
- *Biofiltration swale*
- *Grass swale*

Vegetated Swale
Source: Geosyntec Consultants

Vegetated swale filters (vegetated swales) are open, shallow channels with low-lying vegetation covering the side slopes and bottom that collect and slowly convey runoff flow to downstream discharge points. Vegetated swales provide pollutant removal through settling and filtration in the vegetation (usually grasses) lining the channels. In addition, they provide the opportunity for volume reduction through infiltration and ET, and reduce the flow velocity in addition to conveying storm water runoff. Where soil conditions allow, volume reduction in vegetated swales can be enhanced by adding a gravel drainage layer underneath the swale allowing additional flows to be retained and infiltrated. Where slopes are shallow and soil conditions limit or prohibit infiltration, an underdrain system or low flow channel for dry weather flows may be required to minimize ponding and convey treated and/or dry weather flows to an acceptable discharge point. An effective vegetated swale achieves uniform sheet flow through a densely vegetated area for a period of several minutes. The vegetation in the swale can vary depending on its location within the project area and is generally the choice of the designer, subject to the design criteria outlined in this section.

Feasibility Screening Considerations

- Swales may cause incidental infiltration; however, infiltration is not a mandatory mechanism for pollutant removal for swales and it may create hazards in some circumstances. Therefore, conditions should be evaluated to determine whether circumstances require an impermeable liner to avoid infiltration into the subsurface.

Opportunity Criteria

- Open areas are needed for vegetated swales, including, but not limited to, road shoulders, road medians, parks and athletic fields and can be constructed in residential or commercial areas.
- Site slope is less than 10 percent.
- Drainage area is ≤ 5 acres.
- Vegetated swales must not interfere with flood control functions of existing conveyance and detention structures.

OC-Specific Design Criteria and Considerations

- ☐ Swales should have a minimum bottom width of 2 feet and a maximum bottom width of 10 feet. Swale dividers should be used if the bottom width must exceed 10 feet to promote even distribution of flow across the swale. Local juridictions may require larger minimum widths based on maintenance requirements.
- ☐ The channel side slope should not exceed 2:1 (H:V) for a total swale depth of 1 foot or less. For deeper swales or mowed grass swales, the maximum channel side slope should be 3:1. Where space is constrained, swales may have vertical concrete or block walls provided that slope

stability, maintenance access and public safety considerations are met.

- [ ] The minimum swale length for biotreatment applications is 100 feet. The minimum residence time for flows in the swale is 10 minutes.
- [ ] If slope is less than 1.5%, underdrains should be provided for the length of the swale
- [ ] A gravel blanket or bedding is required around the underdrain pipe(s). At least 0.5 feet of washed aggregate must be placed below, to the top, and to the sides of the underdrain pipe(s).
- [ ] If an underdrain is included, an amended soil layer of 1 foot minimum thickness must be provided above the underdrain meeting the specifications of MISC-1: Planting/Storage Media.
- [ ] The maximum bed slope in flow direction should not exceed 6% (unles check dams are provided).
- [ ] The maximum flow velocity should not exceed 1.0 ft/sec for water quality treatment swales.
- [ ] For infrequently mowed swales, a maximum flow depth of 4 inches should be implemented. For frequently mowed turf swales, the maximum flow depth is 2 inches.
- [ ] The vegetation height should be maintained between 4 to 6 inches.
- [ ] Gradual meandering bends in the swale are desirable for aesthetic purposes and to promote slower flow and particulate settling.
- [ ] Blockages in the swale that result in uneven flow distribution and points of concentrated flow should be avoided. Blockages that should be avoided include trees, bushes, light pole piers, and utility vaults or pads.

Sizing Method for Vegetated Swales

The Design Capture Method for Flow-based BMPs should be used to determine the design flowrate for a vegetated swale. The user then selects the design flow depth and longitudinal slope and uses the sizing steps below to determine the length and width of the swale. The sizing steps are as follows:

Step 1: Determine Design Flowrate (Q)

Calculate the Design Flowrate (Q) using the Capture Efficiency Method for Flow-based BMPs (See **Appendix III.3.3**). Inputs include the time of concentration of the catchment (T_c) and the capture efficiency achieved upstream by HSCs or other BMPs.

Step 2: Estimate the Swale Bottom Width

For shallow flow depths, channel side slopes can be ignored and the bottom width can be calculated using a simplified form of Manning's formula:

$$b = (Q \times n_{WQ}) / (1.49 \times y^{1.67} \times s^{0.5})$$

Where:

b = estimated swale bottom width, ft

Q = design flowrate, cfs

n_{WQ} = Manning's roughness coefficient for shallow flow conditions, use 0.2 unless other information is available

y = design flow depth, ft (not to exceed 4 inches or 0.33 ft)

s = longitudinal slope in flow direction, ft/ft (not to exceed 0.06)

If b is between 2 and 10 feet, proceed to step 3.

If b is less than 2 feet, increase b to 2 feet and recalculate design flow depth using the following:

$y = ((Q \times n_{WQ}) / (1.49 \times b \times s^{0.5}))^{0.6}$

If b is greater than 10 feet, one of the following steps is necessary:

- Increase longitudinal slope to a maximum of 6% or 0.06, and recalculate b
- Increase design flow depth to a maximum of 4 inches or 0.33 ft, and recalculate b
- Install a divider lengthwise along swale bottom at least three-quarters of the swale length, beginning at the inlet. The swale width can be increased to 16 feet if a divider is provided.

Step 3: Determine Design Flow Velocity

Calculate the design flow velocity using the following equation:

$V_{WQ} = Q / A_{WQ}$

Where:

V_{WQ} = design flow velocity, fps

Q = design flowrate, cfs

$A_{WQ} = by + Zy^2$, cross sectional area of flow at design depth

Z = side slope length per unit height

If the design flow velocity exceeds 1 foot per second, design parameters in Step 2 should be adjusted (slope, bottom width, or design flow depth) until V_{WQ} is equal or less than 1 fps.

Step 4: Calculate Swale Length

Calculate the swale length needed to achieve a minimum hydraulic residence time of 10 minutes using the following equation:

$L = 60 \times t_{HR} \times V_{WQ}$

Where:

L = swale length, ft

t_{HR} = hydraulic residence time, min (minimum 10 minutes)

V_{WQ} = design flow velocity, fps

Step 5: If Needed, Adjust Swale Length to Site Constraints

Note that oftentimes swale length can be accomodated by providing a meandering swale. However, if swale length is too large for the site, the length can be adjusted as follows:

- Calculate the swale treatment top area (A_{top}), based on the swale length calculated in Step 4:

$A_{TOP} = (b_i + b_{SLOPE}) \times L_i$

Where:

A_{TOP} = top area (ft^2) at the design treatment depth

b_i = bottom width (ft), calculated in Step 2

b_{SLOPE} = the additional top width (ft) above the side slope for the design water depth (for 3:1 side slopes and a 4-inch water depth, b_{slope} = 2 feet)

L_i = initial length (ft) calculated in Step 4

- Use the swale top area and a reduced swale length (L_f) to increase the bottom width, using the following equation:

$L_F = A_{TOP} / (b_F + b_{SLOPE})$

Where:

L_F = reduced swale length (ft)

b_F = increased bottom width (ft)

- Recalculate V_{WQ} according to Step 3 using the revised cross-sectional area A_{WQ} based on the increased bottom width (b_F). Revise the design as necessary if the design flow velocity exceeds 1 foot per second.
- Recalculate to ensure that the 10 minute retention time is retained.

Configuration for Use in a Treatment Train

- Vegetated swales can be incorporated in a treatment train to provide enhanced water quality treatment and reductions in runoff volume and rate. For example, if a vegetated swale is placed upgradient of a dry extended detention (ED) basin, the rate and volume of water flowing to the dry ED basin can be reduced and the water quality enhanced. As another example, dry ED basins may be placed upstream a vegetated swale to reduce the size of the vegetated swale.
- Vegetated swales can be used as pretreatment for infiltration BMPs.
- If designed with an infiltration sump, vegetated "bioinfiltration" swales can provide retention and biotreatment capacity.

Additional References for Design Guidance

Los Angeles Unified School District (LAUSD) Stormwater Technical Manual, Chapter 4: http://www.laschools.org/employee/design/fs-studies-and-reports/download/white_paper_report_material/Storm_Water_Technical_Manual_2009-opt-red.pdf?version_id=76975850

Santa Barbara BMP Guidance Manual, Chapter 6: http://www.santabarbaraca.gov/NR/rdonlyres/91D1FA75-C185-491E-A882-49EE17789DF8/0/Manual_071008_Final.pdf

- County of San Diego Drainage Design Manual for design criteria, Section 5.5: http://www.co.san-diego.ca.us/dpw/floodcontrol/floodcontrolpdf/drainage-designmanual05.pdf

County of Los Angeles Low Impact Development Standards Manual, Chapter 5: http://dpw.lacounty.gov/wmd/LA_County_LID_Manual.pdf

- Los Angeles County Stormwater BMP Design and Maintenance Manual: http://dpw.lacounty.gov/DES/design_manuals/StormwaterBMPDesignandMaintenance.pdf

Appendix F

- Educational Material

IT'S A STORMWATER POLLUTION REVOLUTION!

Keeping your grass green and the Mojave River Watershed clean!

Excess fertilizer use is a major contributor to toxins entering the Mojave River - harming our natural wildlife and eventually making its way back to our faucets, hoses, drinking water and other waterways in the High Desert.

We need your help! Follow these simple steps when applying fertilizer to prevent stormwater pollution and protect our community from toxins:

- Read the label and use only as directed
- Avoid applying near driveways and gutters
- Never apply 24 hours before rain
- Store in a covered area in sealed, waterproof containers
- Buy non-toxic! They're just as effective and better for our watershed.

Fertilizer Chemistry 101

Fertilizers serve different purposes depending on what your lawn needs. Each bag has three percentages (N-P-K) of ingredients to meet your needs. Buy smart and apply safely to save money!

N Nitrogen makes for greener grass

P Phosphorus helps establish a new lawn or tree

K Potassium protects plants from temperature extremes, insects, and disease

To report illegal dumping or for more information on stormwater pollution prevention call 1 (800) 78 CRIME or visit our website at www.mojaveriver.org, Facebook at MojaveWatershed, Twitter @MojaveRiver, or Pinterest at Mojave Watershed.

MOJAVE RIVER WATERSHED GROUP

Disposal Centers

Apple Valley
13450 Nomwaket Road

Hesperia Fire Station
17443 Lemon Street

Victorville Fire Department
East of Desert Knoll Drive
on Loves Lane

Barstow Corporation Yard
900 South Avenue H

San Bernardino County
2824 East W Street
San Bernardino, CA

Don't Get Turned Away!

For hours of operation, quantity limitations and other rules and regulations, call (800) 645-9228 or visit the MRWG website at www.mojaveriver.org before dropping off materials.

IT'S A STORMWATER POLLUTION REVOLUTION!

Keeping your yard bug free and the Mojave River Watershed clean!

Excess pesticide use is a major contributor to toxins entering the Mojave River - harming our natural wildlife and eventually making its way back to our faucets, hoses, drinking water and other waterways in the High Desert.

We need your help! Follow these simple steps when applying pesticides to prevent stormwater pollution and protect our community from toxins:

- **Read the label and use only as directed**
- **Never apply 24 hours before rain**
- **Spot apply rather than blanketing an entire area**
- **Buy non-toxic! They're just as effective and better for our watershed.**

Pesticide Chemistry 101

Cost-saving alternatives are available to keep pests at bay rather than using pesticides. Try these pesticide-free tips to keep your lawn bug free, prevent stormwater pollution, and save money!

BARRIERS AND TRAPS: Collars, netting and coffee can traps capture or impede pests

TRAP PLANTS: Strategically plant plants that lure harmful insects away from plants you wish to protect. Once infested, the plant can be disposed.

BENEFICIAL INSECTS: Introduce safe insects (ladybugs, praying mantises, spiders and more!) for your garden that feed on harmful ones.

COMPANION PLANTING: Plant insect-repelling plants near ones you want to protect.

To report illegal dumping or for more information on stormwater pollution prevention call 1 (800) 78 CRIME or visit our website at www.mojaveriver.org, Facebook at MojaveWatershed, Twitter @MojaveRiver, or Pinterest at Mojave Watershed.

Disposal Centers

Apple Valley
13450 Nomwaket Road

Hesperia Fire Station
17443 Lemon Street

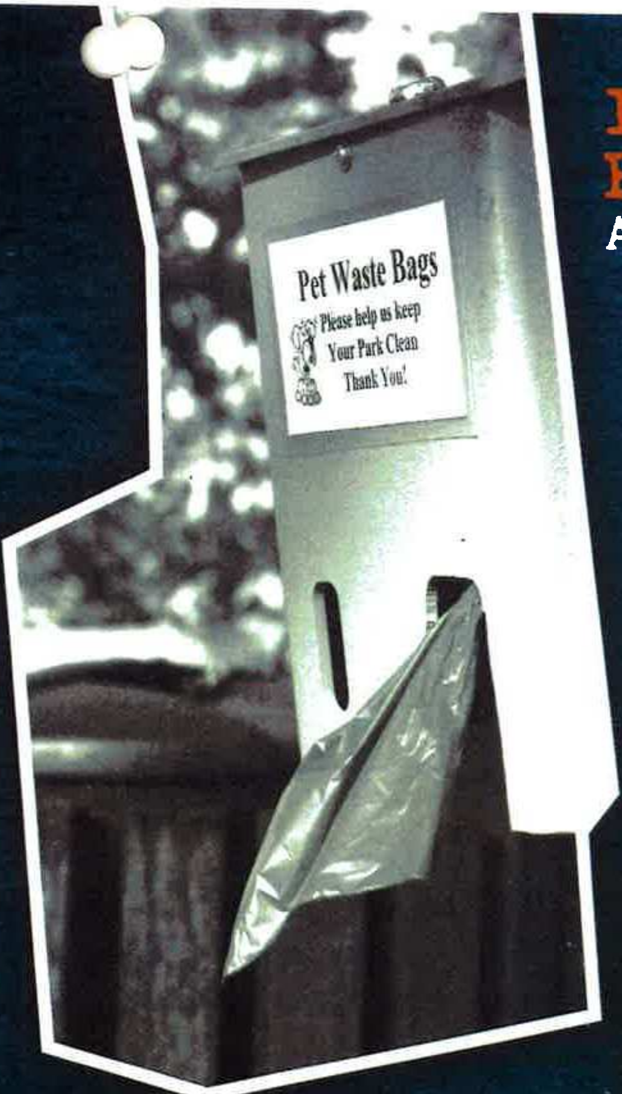
Victorville Fire Department
East of Desert Knoll Drive
on Loves Lane

Barstow Corporation Yard
900 South Avenue H

San Bernardino County
2824 East W Street
San Bernardino, CA

Don't Get Turned Away!

For hours of operation, quantity limitations and other rules and regulations, call (800) 645-9228 or visit the MRWG website at www.mojaveriver.org before dropping off materials.



IT'S A STORMWATER POLLUTION REVOLUTION!

Animal Doo-Doo is a Stormwater Don't!

Animal waste is a major contributor to toxins entering the Mojave River - harming our natural wildlife and eventually making its way back to our faucets, hoses, drinking water and other waterways in the High Desert.

We need your help! Follow these simple steps to prevent stormwater pollution and protect our community from toxins:

DOGS:

- Regularly pick up waste in the yard
- Carry disposable bags while on walks
- Waste not in plastic bags can be flushed down a toilet

CATS:

- Put waste and litter in the trash
- Wrap waste carefully to prevent spillage
- Do not flush cat waste or litter

HORSES:

- Remove soiled bedding and manure from pens at least once daily
- Deposit waste in sturdy, sealed containers
- Cover manure before a rain
- Arrange for weekly manure pick-up service
- Compost waste for personal use or donate to community gardens or nurseries

Pet Chemistry 101

Did you know pet waste is not a fertilizer? In fact, it's just theopposite! Your pet's waste contains bacteria and parasites that can create an overly nutrient rich environment causing excess weed and algae growth.

To report illegal dumping or for more information on stormwater pollution prevention call 1 (800) 78 CRIME or visit our website at www.mojaveriver.org, Facebook at MojaveWatershed, Twitter @MojaveRiver, or Pinterest at Mojave Watershed.

IT'S A STORMWATER POLLUTION REVOLUTION!

Flat or sheen? Let's keep the Mojave River Watershed clean!

Washing a paint brush and dumping rinse water in the gutter are major contributors to toxins entering the Mojave River - harming our natural wildlife and eventually making its way back to our faucets, hoses, drinking water and other waterways in the High Desert.

We need your help! Follow these simple steps when using paint to prevent stormwater pollution and protect our community from toxins:

- Store in sealed containers
- Use water-based paint whenever possible, not oil-based
- Clean water-based paint materials in the sink and oil-based paint materials with thinner
- Never clean or rinse brushes and containers in the street, gutter or near a storm drain

Paint Chemistry 101

Want your paint to last longer? Use the tips below repeatedly to maximize the effectiveness of your paint – and save money!

FLAT: Almost no shine; Good for low foot traffic areas (dining rooms & bedrooms); Hides surface irregularities

LOW-LUSTER, SATIN, OR EGGSHELL: Subtle sheen; Good for bedrooms, hallways & family rooms

SEMI-GLOSS: More gloss; More durable; Good for kids' rooms, bathrooms, & trim; More water-resistant

HIGH-GLOSS: Shiny; Good for trim, molding, doors, & cabinets; Takes abuse; Easy to clean

To report illegal dumping or for more information on stormwater pollution prevention call 1 (800) 78 CRIME or visit our website at www.mojaveriver.org, Facebook at MojaveWatershed, Twitter @MojaveRiver, or Pinterest at Mojave Watershed.

Disposal Centers

Apple Valley
13450 Nomwaket Road

Hesperia Fire Station
17443 Lemon Street

Victorville Fire Department
East of Desert Knoll Drive
on Loves Lane

Barstow Corporation Yard
900 South Avenue H

San Bernardino County
2824 East W Street
San Bernardino, CA

Don't Get Turned Away!

For hours of operation, quantity limitations and other rules and regulations, call (800) 645-9228 or visit the MRWG website at www.mojaveriver.org before dropping off materials.

IT'S A STORMWATER POLLUTION REVOLUTION!

Keeping construction sites and the Mojave River Watershed clean!

Stormwater runoff from construction sites are major contributors to toxins entering the Mojave River - harming our natural wildlife and eventually making its way back to our faucets, hoses, drinking water and other waterways in the High Desert.

We need your help! **Follow these simple steps when doing small or large-scale construction to prevent stormwater pollution and protect our community from toxins:**

- **Identify path for stormwater discharge**
- **Secure storm drain inlets with sandbags**
- **Protect slopes and channels**
- **Store materials off the ground on wooden pallets**
- **Never sweep or wash anything into a storm drain**

Installing Storm Drain Inlet Protection 101

Prevent sediment from entering a storm drain by following the simple installation and maintenance steps outlined below. Use silt fence, rock-filled bags, or block and gravel.

Installation:

Install protection prior to starting activity; Protect all inlets that may receive discharge; Design protection to handle maximum volume of water expected.

Maintenance:

Inspect frequently; Remove trapped sediment; Replace or repair protection as needed; Sweep streets, sidewalks and other paved areas regularly.

To report illegal dumping or for more information on stormwater pollution prevention call 1 (800) 78 CRIME or visit our website at www.mojaveriver.org, Facebook at MojaveWatershed, Twitter @MojaveRiver, or Pinterest at Mojave Watershed.

Disposal Centers

Apple Valley
13450 Nomwaket Road

Hesperia Fire Station
17443 Lemon Street

Victorville Fire Department
East of Desert Knoll Drive
on Loves Lane

Barstow Corporation Yard
900 South Avenue H

San Bernardino County
2824 East W Street
San Bernardino, CA

Don't Get Turned Away!

For hours of operation, quantity limitations and other rules and regulations, call (800) 645-9228 or visit the MRWG website at www.mojaveriver.org before dropping off materials.

Appendix G

- Maintenance Manual and Covenant Agreement

Ottawa Logistics Center

OPERATION
AND MAINTENANCE MANUAL

Table of Contents

1. Discussion

The long-term operation and maintenance of storm water management systems at the Ottawa Logistics Center property is critical to BMP performance as its design and construction. Proper operation and maintenance practices are outlined in this plan and will ensure that the BMPs will continue to remove and reduce sources of pollutants effectively over the long-term, and therefore, improve water quality. Without proper maintenance, BMPs are likely to fail and no longer provide the necessary Storm water treatment. Common maintenance issues that are encountered include:

- Maintenance that occurs too infrequently
- Owners not understanding the long-term financial burden for the maintenance of a storm water system
- Lack of the knowledge on the maintenance needs of the system and
- Conflicts between municipalities and landowners on who is responsible for maintenance of a storm water system.

To address these issues the following sections have been developed for the project owner

Maintenance Frequency

Maintenance frequency is outlined in Form 5-1. This form clearly identifies required inspection activities, the maintenance schedule, and directs provider to use a log sheet to document inspections and maintenance activities. There is the potential that a City or Regional Board inspector could visit this site and request owner to provide Maintenance records.

BMP Fact Sheets

BMP Fact sheets are provided to supplement BMP maintenance background and provide general knowledge on BMPs.

Maintenance Agreement

The maintenance agreement clearly identifies the project owner as the entity responsible for BMP maintenance and associated costs.

Reference Material

Reference material covers proprietary information for BMPs and recommended maintenance activities.

Inspection and Maintenance Log

The inspection and maintenance log provide a form to document inspections and maintenance. This form is a sample form and other forms can be used as long as they provide the minimum information outlined in this sample log.

WQMP Exhibit

The WQMP exhibit illustrates the spatial distribution of BMPS throughout the site and can be cross-referenced with Form 5-1 to identify where maintenance activities are expected to occur onsite.

2.Inspection and Maintenance Responsibility Form 5-1

Form 5-1 BMP Inspection and Maintenance (use additional forms as necessary)			
BMP	Reponsible Party(s)	Inspection/ Maintenance Activities Required	Minimum Frequency of Activities
Infiltration Basin	Owner	Regular inspections of system to observe sediment build up and infiltration capacity. Cleaning of accumulated trash, debris and seediment as determined by inspections. Cleaning is recommended during dry weather. See manufacturer recommendations for additional maintenance activities	Monthly and within 48 hours follwing a significant storm event to verify there is no standing water
Catch Basin /w Filter Insert	Owner	Inspect for illegal dumping and /or debris accumulation. Clean filters whenever 25% of filter capacity is exceeded by debris accumulation	At least 2 times a year and after any Storm Event
Landscape Maintenance	Owner	Maintain landscape area vegetation, slope protection and grades, adjacent to hardscape and prevent discharges of landscape maintenance waste into storm drains	Weekly
Roadways & Parking Area	Owner	Clean and remove accumulated sand and debris in parking lots and along roadway. Sweep pavement in lieu of using house or water spray. Ensure stormwater runoff is not impeded by deposit of debris and accumulated sediment by ground maintenance staff.	Inspect after wind storm or minimum monthly
Litter Control	Owner	Site to be inspected and all litter be collected and disposed of in trash containers. Inspection and maintenance to be performed by HOA	Weekly
Signage and Stencil	Owner	Clean the stencil/signage surface to remove any excess dirt Re-paint if necessary.	Annually
Bioswales	Owner	Inspect catchment area for an excessive sediment, trash, and/or debris accumulation on surface. Clean up excessive sediment, trash, and/or debris accumulation. Litter leaves and debris should be removed from Bioswale to reduce risk of well clogging. Clean grated inlet and filter inserts.	4 times Annually, and after heavy rain

3. Inspection and Maintenance Log

Detention Basin Inspections and Maintenance Checklist

Site Name: Owner Change since last inspection? Y ☐ N ☐

Location:

Owner Name:

Address: Phone Number

Site Status:

Date: Time: Site conditions:

Inspection Frequency Key: A=annual; M=monthly; S=after major storms. ***BOLD*** *= recommended frequency.*

Inspection Items	**Inspection Frequency**	**Inspected? (Yes/No)**	**Maintenance Needed? (Yes/No)**	**Comments/Description**
Embankment and Emergency Spillway				
Vegetation healthy?	**A** / M / **S**			
Erosion on embankment?	**A** / M / **S**			
Animal burrows in embankment?	**A** / M / **S**			
Cracking, sliding, bulging of dam?	**A** / M / **S**			
Drains blocked or not functioning?	**A** / M / **S**			
Leaks or seeps on embankment?	**A** / M / **S**			
Emergency spillway obstructed?	**A** / M / **S**			
Slope protection failure functional?	**A** / M / **S**			
Erosion in/around emergency spillway?	**A** / M / **S**			
Other (describe)	**A** / M / **S**			
Riser and Principal Spillway				
Low-flow orifice functional?	**A** / M / **S**			
Trash rack (Debris removal needed? Corrosion noted?)	**A** / M / **S**			
Sediment buildup in riser?	**A** / M / S			
Concrete/masonry condition (Cracks or displacement? Spalling?)	**A** / M / S			
Metal pipe in good condition?	**A** / M / S			
Control valve operation?	**A** / M / S			
Pond drain valve operation?	**A** / M / S			
Outfall channels function, not eroding?	**A** / M / S			
Other (describe)	**A** / M / S			
Sediment Forebays				
Sedimentation description				
Sediment cleanout needed (over 50% full)?	**A** / M / **S**			

Inspection Items	Inspection Frequency	Inspected? (Yes/No)	Maintenance Needed? (Yes/No)	Comments/Description
Permanent Pool Areas (if applicable)				
Undesirable vegetation growth?	A / **M** / S			
Visible pollution?	A / **M** / S			
Shoreline erosion?	A / **M** / S			
Erosion at outfalls into pond?	A / **M** / S			
Headwalls and endwalls in good condition?	A / **M** / S			
Encroachment into pond or easement area by other activities?	A / **M** / S			
Evidence of sediment accumulation?	**A** / M / S			
Dry Pond Areas (if applicable)				
Vegetation adequate?	A / **M** / S			
Undesirable vegetation or woody plant growth?	A / **M** / S			
Excessive sedimentation?	**A** / M / S			
Hazards				
Have there been complaints from residents?	A / **M** / S			
Public hazards noted?	A / **M** / S			

Inspector Comments: ____

____

____

____

Overall Condition of Facility: ☐: Acceptable ☐ Unacceptable

If any of the above Inspection items are checked “Yes” for “Maintenance Needed”, list Maintenance actions and their completion dates below:

Maintenance Action Needed	Due Date

The next routine inspection is scheduled for approximately: ____________________________

Inspected by: (signature) ____

Inspected by: (printed) ____

Bioswale
Inspections and Maintenance Checklist

Site Name: Owner Change since last inspection? Y ☐ N ☐

Location:

Owner Name:

Address: Phone Number

Site Status:

Date: Time: Site conditions:

Constructed Wetland Type: ______________________________

Inspection Frequency Key: A=annual; M=monthly; S=after major storms. ***BOLD*** *= recommended frequency.*

Inspection Items	Inspection Frequency	Inspected? (Yes/No)	Maintenance Needed? (Yes/No)	Comments/Description
Embankment and Emergency Spillway				
Vegetation healthy?	**A / M / S**			
Erosion on embankment?	**A / M / S**			
Animal burrows in embankment?	**A / M / S**			
Cracking, sliding, bulging of dam?	**A / M / S**			
Drains blocked or not functioning?	**A / M / S**			
Leaks or seeps on embankment?	**A / M / S**			
Emergency spillway obstructed?	**A / M / S**			
Slope protection failure functional?	**A / M / S**			
Erosion in/around emergency spillway?	**A / M / S**			
Other (describe)	**A / M / S**			
Riser and Principal Spillway				(describe type: concrete pipe, slotted weir, channel, etc.)
Low-flow orifice functional?	**A / M / S**			
Trash rack (Debris removal needed? Corrosion noted?)	**A / M / S**			
Sediment buildup in riser?	**A / M /** S			
Concrete/masonry condition (Cracks or displacement? Spalling?)	**A / M /** S			
Metal pipe in good condition?	**A / M /** S			
Control valve operation?	**A / M /** S			
Pond drain valve operation?	**A / M /** S			
Outfall channels function, not eroding?	**A / M /** S			
Other (describe)	**A / M /** S			
Sediment Forebays				
Sedimentation description				
Sediment cleanout needed (over 50% full)?	**A / M / S**			

Inspection Items	Inspection Frequency	Inspected? (Yes/No)	Maintenance Needed? (Yes/No)	Comments/Description
Constructed Wetland Ponding Areas (if applicable)				
Wetland vegetation present and healthy?	A / **M** / S			
Vegetation removal needed?	A / **M** / S			
Floatable debris removal needed?	A / **M** / S			
Shoreline problem?	A / **M** / S			
Erosion at outfalls into pond?	A / **M** / S			
Headwalls and endwalls in good condition?	A / **M** / S			
Encroachment into pond or easement area?	**A** / M / S			
Hazards				
Have there been complaints from residents?	A / **M** / S			
Public hazards noted?	A / **M** / S			

Inspector Comments: ____

____

____

____

Overall Condition of Facility: ☐: Acceptable ☐ Unacceptable

If any of the above Inspection items are checked "Yes" for "Maintenance Needed", list Maintenance actions and their completion dates below:

Maintenance Action Needed	Due Date

The next routine inspection is scheduled for approximately: ___________________________

Inspected by: (signature) ____

Inspected by: (printed) ____

Infiltration Trench
Inspections and Maintenance Checklist

Site Name: Owner Change since last inspection? Y ☐ N ☐

Location:

Owner Name:

Address: Phone Number

Site Status:

Date: Time: Site conditions:

Inspection Frequency Key: A=annual; M=monthly; S=after major storms. ***BOLD*** *= recommended frequency*

Inspection Items	**Inspection Frequency**	**Inspected? (Yes/No)**	**Maintenance Needed? (Yes/No)**	**Comments/Description**
Debris Removal				
Trench surface clear of debris?	A / **M** / S			
Inlets / inflow pipes free of debris?	A / **M** / S			
Overflow spillway clear of debris?	A / **M** / S			
Vegetation				
Mowing done when necessary?	A / **M** / S			
Fertilizer per specification?	A / **M** / S			
Any evidence of erosion?	A / **M** / S			
Contributing drainage area stabilized?	A / **M** / S			
Dewatering)				
Trench dewaters between storms?	A / **M** / S			
Sediment traps, forebays, or pretreatment swales				
Obviously trapping sediment?	**A** / M / S			
Greater than 50% of original storage volume remaining?	**A** / M / S			
Sediment removal of trench				
Any evidence of sedimentation in trench?	**A** / M / S			
Does sediment accumulation currently require removal?	**A** / M / S			
Inlets				
Good condition (no need for repair)?	**A** / M / S			
Any evidence of erosion?	**A** / M / S			
Outlets/overflow spillway				
Good Condition (no need for repair)?	**A** / M / S			
Any evidence of erosion?	**A** / M / S			

Inspection Items	Inspection Frequency	Inspected? (Yes/No)	Maintenance Needed? (Yes/No)	Comments/Description
Aggregate repairs				
Surface of aggregate clean?	**A** / M / S			
Top layer of stone in need of replacement?	**A** / M / S			
Trench in need of rehabilitation?	**A** / M / S			
Observation wells				
Evidence of clogging (failure to percolate)?	A / **M** / S			

Inspector Comments: ____

____

____

____

Overall Condition of Facility: ☐: Acceptable ☐ Unacceptable

If any of the above Inspection items are checked "Yes" for "Maintenance Needed", list Maintenance actions and their completion dates below:

Maintenance Action Needed	Due Date

The next routine inspection is scheduled for approximately: ____________________________

Inspected by: (signature) ____

Inspected by: (printed) ____

Enhanced Swales / Grass Channels / Filter Strips
Inspections and Maintenance Checklist

Site Name: __________ Owner Change since last inspection? Y ☐ N ☐

Location: __________

Owner Name: __________

Address: __________ Phone Number __________

Site Status: __________

Date: ______ Time: ______ Site conditions: __________

*Inspection Frequency Key: A=annual; M=monthly; S=after major storms. **BOLD** = recommended frequency*

Inspection Items	**Inspection Frequency**	**Inspected? (Yes/No)**	**Maintenance Needed? (Yes/No)**	**Comments/Description**
Debris Removal				
Facility and adjacent area free of debris?	A / **M** / S			
Inlets and Outlets free of debris?	A / **M** / S			
Any dumping of yard wastes into facility?	A / **M** / S			
Litter (branches) removed?	A / **M** / S			
Vegetation				
Surrounding area fully stabilized? (no evidence of material eroding into sand filter)	A / **M** / S			
Grass mowed?	A / **M** / S			
Plant height not less than design water depth?	A / **M** / S			
Fertilized per specification?	A / **M** / S			
Plan composition according to approved plan?	A / **M** / S			
Unauthorized or inappropriate plantings?	A / **M** / S			
Plants healthy? (no diseased or dying vegetation)	A / **M** / S			
Evidence of plants stressed from inadequate watering?	A / **M** / S			
Filtration Capacity				
Clogging from oil or grease?	A / **M** / S			
Facility dewaters between storms?	A / **M** / S			
Water Retention (where required)				
Water holding chambers at normal pool?	A / **M** / S			
Evidence of erosion?				

Inspection Items	Inspection Frequency	Inspected? (Yes/No)	Maintenance Needed? (Yes/No)	Comments/Description
Check dams and energy dissipators/sumps				
Any evidence of sedimentation built up?	**A** / M / **S**			
Are sumps grater than 50% full of sediment?	**A** / M / **S**			
Any evidence of erosion and down stream toe of drop structures?	**A** / M / **S**			
Sediment Deposition				
Swale clean of sediments?	**A** / M / S			
Sediment not more than 20% of swale design depth?	**A** / M / S			
Outlet/Overflow Spillway				
In good condition?	**A** / M / S			
Any evidence of erosion?	**A** / M / S			
Any evidence of blockages?	**A** / M / S			
Has facility been filled or blocked inappropriately?	**A** / M / S			

Inspector Comments: ____

____

____

____

Overall Condition of Facility: ☐: Acceptable ☐ Unacceptable

If any of the above Inspection items are checked "Yes" for "Maintenance Needed", list Maintenance actions and their completion dates below:

Maintenance Action Needed	Due Date

The next routine inspection is scheduled for approximately: ______________________________

Inspected by: (signature) ____

Inspected by: (printed) ____

Proprietary BMP
Inspections and Maintenance Checklist

Site Name: Owner Change since last inspection? Y ☐ N ☐

Location:

Owner Name:

Address: Phone Number

Site Status:

Date: Time: Site conditions:

*Inspection Frequency Key: A=annual; M=monthly; S=after major storms. **BOLD** = recommended frequency*

Inspection Items	**Inspection Frequency**	**Inspected? (Yes/No)**	**Maintenance Needed? (Yes/No)**	**Comments/Description**
Debris Removal				
Adjacent area free of debris?	A / **M** / S			
Inlets and Outlets free of debris?	A / **M** / S			
Facility (internally) free of debris?	A / **M** / S			
Vegetation				
Surroundng area fully stabilized? (no evidence of material eroding into sand filter)	**A** / M / S			
Grass mowed?	A / **M** / S			
Water Retention (where required)				
Water holding chambers at normal pool?	A / **M** / S			
Evidence of erosion?	A / **M** / S			
Sediment Deposition				
Filtration chamber free of sediments?	**A** / M / S			
Sedimentation chamber not more than 50% full?	**A** / M / S			
Structural Components				
Any evidence of structural deterioration?	**A** / M / S			
Grates in good condition?	**A** / M / S			
Spalling or cracking of structural parts?	**A** / M / S			
Outlet/Overflow Spillway	**A** / M / S			
Other				
Noticeable odors?	**A** / M / S			
Any evidence of filter(s) clogging?	A / **M** / S			
Evidence of flow bypassing facility?	**A** / M / S			

Inspector Comments: ____

____

____

____

Overall Condition of Facility: ☐: Acceptable ☐ Unacceptable

If any of the above Inspection items are checked “Yes” for “Maintenance Needed”, list Maintenance actions and their completion dates below:

Maintenance Action Needed	Due Date

The next routine inspection is scheduled for approximately: ___________________________

Inspected by: (signature) ____

Inspected by: (printed) ____

4. Maintenance Agreement

RECORDING REQUESTED BY:

City of Victorville
Engineering Department

AND WHEN RECORDED MAIL TO:

City of Victorville
Engineering Department
14343 Civic Drive
Victorville, CA 92392

SPACE ABOVE THIS LINE FOR RECORDER'S USE

AGREEMENT

THIS PAGE ADDED TO PROVIDE ADEQUATE SPACE FOR RECORDING INFORMATION

<u>Water Quality Management Plan and Stormwater Best Management Practices Transfer, Access and Maintenance Agreement</u>

OWNER NAME: Link Logistics Real Estate ____________________

PROPERTY ADDRESS: ____________________

APN: ____________________

THIS AGREEMENT is made and entered into in

____________________, California, this ______ day of

____________________, by and between

____________________, hereinafter

referred to as Owner, and the CITY OF VICTORVILLE, a municipal corporation, located in the County of San Bernardino, State of California, hereinafter referred to as CITY;

WHEREAS, the Owner owns real property ("Property") in the City of Victorville, State of California, more specifically described in Exhibit "A" and depicted in Exhibit "B", each of which exhibits is attached hereto and incorporated herein by this reference;

WHEREAS, at the time of initial approval of development project known as

Ottawa Logistics Center ____________________ within the Property described herein, the CITY required the project to employ Best Management Practices, hereinafter referred to as "BMPs," to minimize pollutants in urban runoff;

WHEREAS, the Owner has chosen to install and/or implement BMPs as described in the Water Quality Management Plan, on file with the CITY, hereinafter referred to as "WQMP", to minimize pollutants in urban runoff and to minimize other adverse impacts of urban runoff;

WHEREAS, said WQMP has been certified by the Owner and reviewed and approved by the City;

WHEREAS, the Owner is aware that periodic and continuous maintenance, including, but not necessarily limited to, filter material replacement and sediment removal, is required to assure peak performance of all BMPs in the WQMP and that, furthermore, such maintenance activity will require compliance with all Local, State, or Federal laws and regulations, including those pertaining to confined space and waste disposal methods, in effect at the time such maintenance occurs;

NOW THEREFORE, it is mutually stipulated and agreed as follows:

1. All maintenance or replacement of BMPs proposed as part of the WQMP are the sole responsibility of the Owner in accordance with the terms of this Agreement.

2. Owner hereby provides the City of Victorville's designee complete access, of any duration, to the BMPs and their immediate vicinity at any time, upon reasonable notice, or in the event of emergency, as determined by the City's Director of Public Works, no advance notice, for the purpose of inspection, sampling, testing of the Device, and in case of emergency, to undertake all necessary repairs or other preventative measures at owner's expense as provided in paragraph 3 below. The City shall make every effort at all times to minimize or avoid interference with Owner's use of the Property. Denial of access to any premises or facility that contains WQMP features is a violation of the City Stormwater Ordinance. If there is reasonable cause to believe that an illicit discharge or breach of the WQMP operation and maintenance commitments is occurring on the premises then the authorized enforcement agency may seek issuance of a search warrant from any court of competent jurisdiction in addition to other enforcement actions.

3. Owner shall use its best efforts diligently to maintain all BMPs in a manner assuring peak performance at all times. All reasonable precautions shall be exercised by Owner and Owner's representative or contractor in the removal and extraction of any material(s) from the BMPs and the ultimate disposal of the material(s) in a manner consistent with all relevant laws and regulations in effect at the time. As may be requested from time to time by the City, the Owner shall provide the City with documentation identifying the material(s) removed, the quantity, and disposal destination.

4. In the event Owner, or its successors or assigns, fails to accomplish the necessary maintenance contemplated by this Agreement, within five (5) days of being given written notice by the City , the City is hereby authorized to cause any maintenance necessary to be done and charge the entire cost and expense against the property and/or to the Owner or Owner's successors or assigns, including administrative costs, attorneys fees and interest thereon at the maximum rate authorized by the City Code from the date of the notice of expense until paid in full.

5. The City may require the owner to post security in form and for a time period satisfactory to the City to guarantee the performance of the obligations stated herein. Should the Owner fail to perform the obligations under the Agreement, the City may, in the case of a cash bond, act for the Owner using the proceeds from it, or in the case of a surety bond, require the sureties to perform the obligations of the Agreement. As an additional remedy, the Director of Public Works may withdraw any previous stormwater-related approval with respect to the property on which BMPs have been installed and/or implemented until such time as Owner repays to City its reasonable costs incurred in accordance with paragraph 3 above.

6. This agreement shall be recorded in the Office of the Recorder of San Bernardino County, California, at the expense of the Owner and shall constitute notice to all successors and assigns of the title to said Property of the obligation herein set forth, and also a lien in such amount as will fully reimburse the City, including interest as herein above set forth, subject to foreclosure in event of default in payment.

7. In event of legal action occasioned by any default or action of the Owner, or its successors or assigns, then the Owner and its successors or assigns agree(s) to hold the City harmless and pay all costs incurred by the City in enforcing the terms of this Agreement, including reasonable attorney's fees and costs, and that the same shall become a part of the lien against said Property.

8. It is the intent of the parties hereto that burdens and benefits herein undertaken shall constitute covenants that run with said Property and constitute a lien there against.

9. The obligations herein undertaken shall be binding upon the heirs, successors, executors, administrators and assigns of the parties hereto. The term "Owner" shall include not only the present Owner, but also its heirs, successors, executors, administrators, and assigns. Owner shall notify any successor to title of all or part of the Property about the existence of this Agreement. Owner shall provide such notice prior to such successor obtaining an interest in all or part of the Property. Owner shall provide a copy of such notice to the City at the same time such notice is provided to the successor.

10. Time is of the essence in the performance of this Agreement.

11. Any notice to a party required or called for in this Agreement shall be served in person, or by deposit in the U.S. Mail, first class postage prepaid, to the address set forth below. Notice(s) shall be deemed effective upon receipt, or seventy-two (72) hours after deposit in the U.S. Mail, whichever is earlier. A party may change a notice address only by providing written notice thereof to the other party.

12. The Owner its successors and assigns, hereby agrees to save and hold harmless the City, any of its departments, agencies, officers or employees, all of whom while working within their respective authority, from all cost, injury and damage incurred by any of the above, and from any other injury or damage to any person or property whatsoever, any of which is caused by an activity, condition or event arising out of the performance, preparation for performance or nonperformance of any provision of this agreement by the Owner, its agents, or any of its independent contractors.

IF TO CITY:
City of Victorville – Engineering Department

14343 Civic Drive,____________________

Victorville, CA 92392___________________

IF TO OWNER:
____

____

____

IN WITNESS THEREOF, the parties hereto have affixed their signatures as of the date first written above.

OWNER:

Signature: ______________________________

Name: _________________________________

Title:___________________________________

OWNER:

Signature: ______________________________

Name: _________________________________

Title:___________________________________

NOTARIES ON FOLLOWING PAGE

A notary acknowledgement is required for recordation (attach appropriate acknowledgement).

ACCEPTED BY:

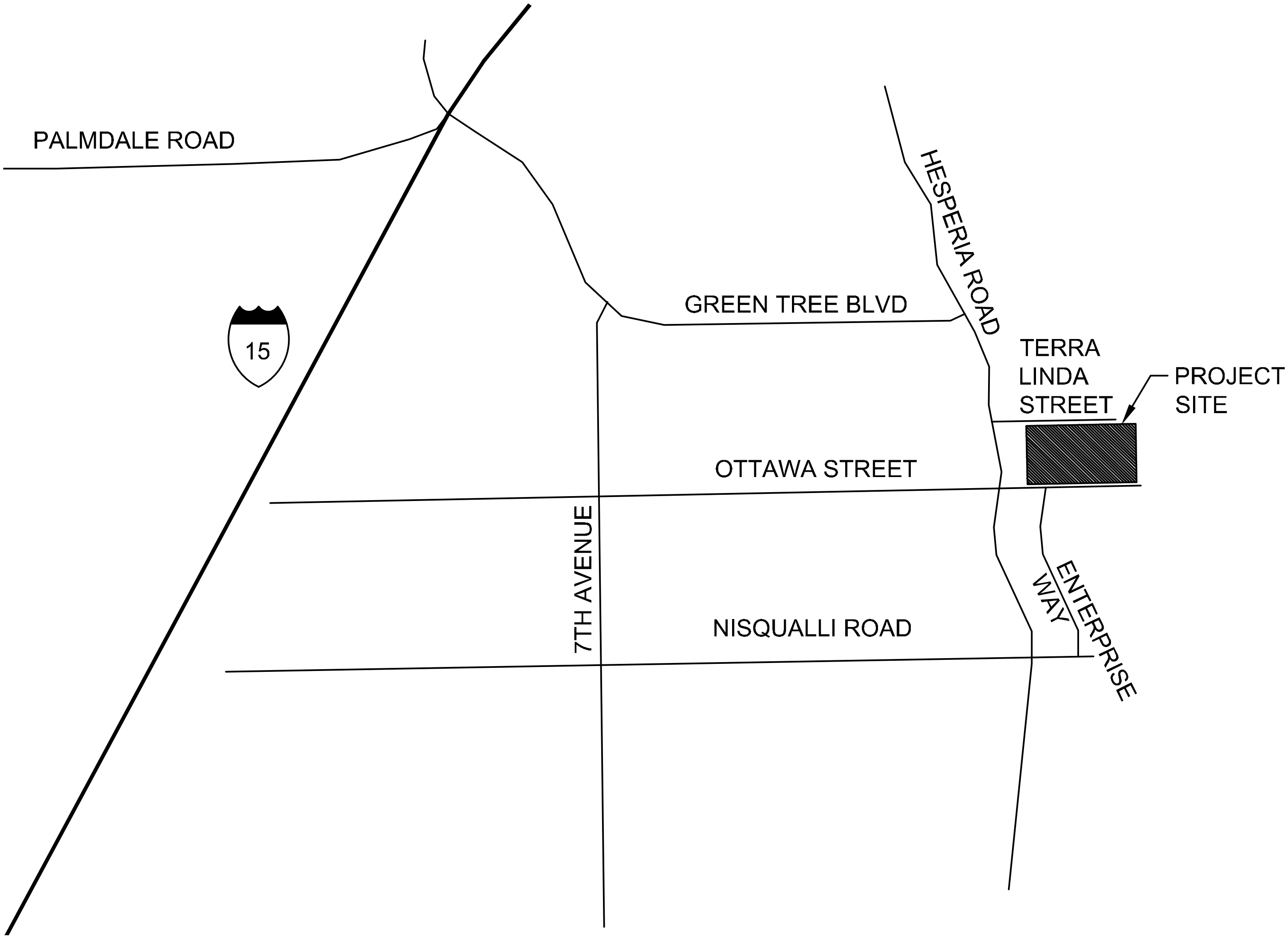
____
Brian W. Gengler., City Engineer for City of Victorville

Date: ___________________________________

Attachment: Standard Notary Acknowledgement

EXHIBIT A
(Legal Description)

EXHIBIT B
(Map/illustration)



VICINITY MAP

N.T.S.

DAVID EVANS
AND ASSOCIATES INC.
14297 Cajon Avenue Suite 101
Victorville California 92392-2335
Phone: 760.524.9100

VICINITY MAP

CITY OF
VICTORVILLE

5. Reference Material

User Inputs

Chamber Model:	MC-4500
Outlet Control Structure:	No
Project Name:	
Engineer:	N/A
Project Location:	California
Measurement Type:	Imperial
Required Storage Volume:	52162 cubic ft.
Stone Porosity:	40%
Stone Foundation Depth:	9 in.
Stone Above Chambers:	12 in.
Average Cover Over Chambers:	24 in.
Design Constraint Dimensions:	(70 ft. x 190 ft.)

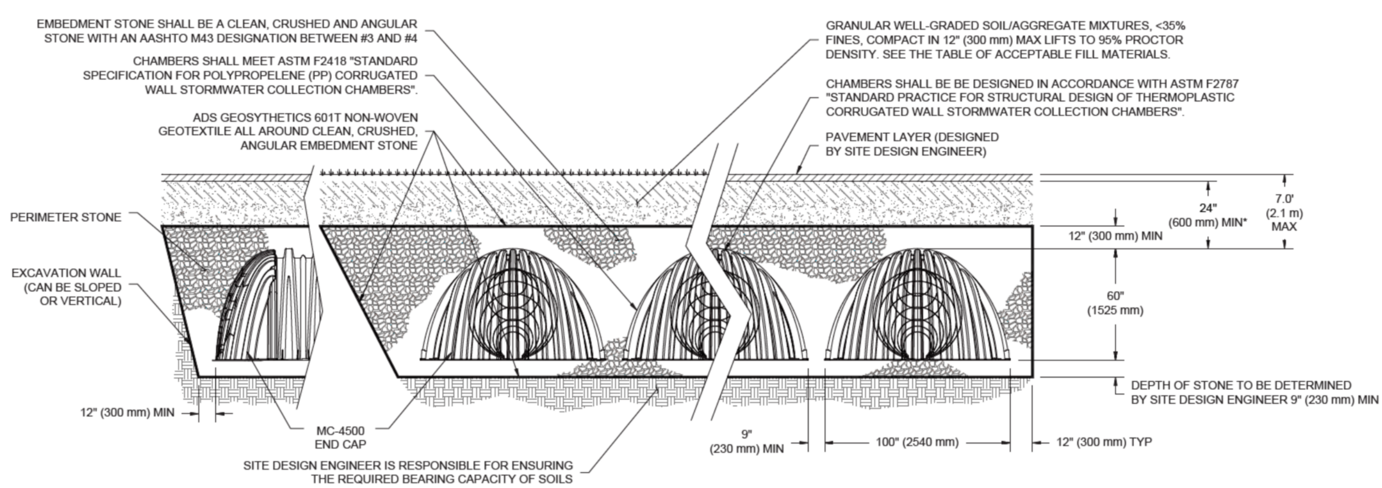
Results

System Volume and Bed Size

Installed Storage Volume:	52958.26 cubic ft.
Storage Volume Per Chamber:	106.50 cubic ft.
Number Of Chambers Required:	308
Number Of End Caps Required:	14
Chamber Rows:	7
Maximum Length:	189.05 ft.
Maximum Width:	64.83 ft.
Approx. Bed Size Required:	12201.95 square ft.

System Components

Amount Of Stone Required:	1815.12 cubic yards
Volume Of Excavation (Not Including Fill):	3050.49 cubic yards
Total Non-woven Geotextile Required:	3710.85 square yards
Woven Geotextile Required (excluding Isolator Row):	106.17 square yards
Woven Geotextile Required (Isolator Row):	425.99 square yards
Total Woven Geotextile Required:	532.16 square yards



*MINIMUM COVER TO BOTTOM OF FLEXIBLE PAVEMENT. FOR UNPAVED INSTALLATIONS WHERE RUTTING FROM VEHICLES MAY OCCUR, INCREASE COVER TO 30" (750 mm).

User Inputs

Chamber Model:	MC-4500
Outlet Control Structure:	No
Project Name:	
Engineer:	N/A
Project Location:	California
Measurement Type:	Imperial
Required Storage Volume:	77400 cubic ft.
Stone Porosity:	40%
Stone Foundation Depth:	9 in.
Stone Above Chambers:	12 in.
Average Cover Over Chambers:	24 in.
Design Constraint Dimensions:	(70 ft. x 300 ft.)

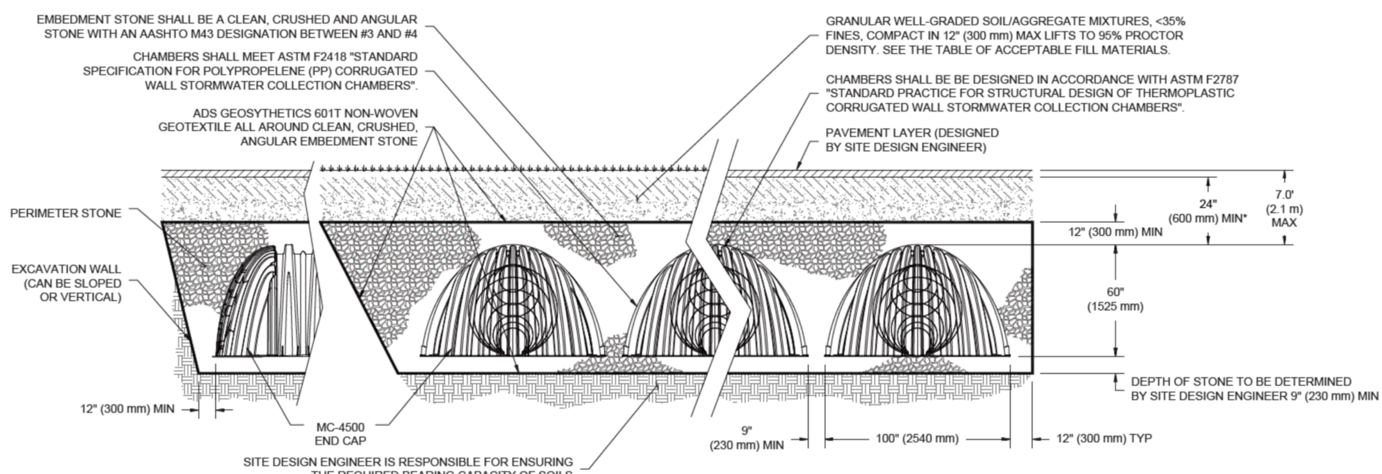
Results

System Volume and Bed Size

Installed Storage Volume:	78136.92 cubic ft.
Storage Volume Per Chamber:	106.50 cubic ft.
Number Of Chambers Required:	461
Number Of End Caps Required:	14
Chamber Rows:	7
Maximum Length:	277.60 ft.
Maximum Width:	64.83 ft.
Approx. Bed Size Required:	17906.38 square ft.

System Components

Amount Of Stone Required:	2637.72 cubic yards
Volume Of Excavation (Not Including Fill):	4476.59 cubic yards
Total Non-woven Geotextile Required:	5391.42 square yards
Woven Geotextile Required (excluding Isolator Row):	106.17 square yards
Woven Geotextile Required (Isolator Row):	632.61 square yards
Total Woven Geotextile Required:	738.77 square yards



*MINIMUM COVER TO BOTTOM OF FLEXIBLE PAVEMENT. FOR UNPAVED INSTALLATIONS WHERE RUTTING FROM VEHICLES MAY OCCUR, INCREASE COVER TO 30" (750 mm).

BIO-2: Vegetated Swale

Also known as:
- *Bioswale*
- *Biofiltration swale*
- *Grass swale*

Vegetated Swale
Source: Geosyntec Consultants

Vegetated swale filters (vegetated swales) are open, shallow channels with low-lying vegetation covering the side slopes and bottom that collect and slowly convey runoff flow to downstream discharge points. Vegetated swales provide pollutant removal through settling and filtration in the vegetation (usually grasses) lining the channels. In addition, they provide the opportunity for volume reduction through infiltration and ET, and reduce the flow velocity in addition to conveying storm water runoff. Where soil conditions allow, volume reduction in vegetated swales can be enhanced by adding a gravel drainage layer underneath the swale allowing additional flows to be retained and infiltrated. Where slopes are shallow and soil conditions limit or prohibit infiltration, an underdrain system or low flow channel for dry weather flows may be required to minimize ponding and convey treated and/or dry weather flows to an acceptable discharge point. An effective vegetated swale achieves uniform sheet flow through a densely vegetated area for a period of several minutes. The vegetation in the swale can vary depending on its location within the project area and is generally the choice of the designer, subject to the design criteria outlined in this section.

Feasibility Screening Considerations

- Swales may cause incidental infiltration; however, infiltration is not a mandatory mechanism for pollutant removal for swales and it may create hazards in some circumstances. Therefore, conditions should be evaluated to determine whether circumstances require an impermeable liner to avoid infiltration into the subsurface.

Opportunity Criteria

- Open areas are needed for vegetated swales, including, but not limited to, road shoulders, road medians, parks and athletic fields and can be constructed in residential or commercial areas.
- Site slope is less than 10 percent.
- Drainage area is ≤ 5 acres.
- Vegetated swales must not interfere with flood control functions of existing conveyance and detention structures.

OC-Specific Design Criteria and Considerations

☐ Swales should have a minimum bottom width of 2 feet and a maximum bottom width of 10 feet. Swale dividers should be used if the bottom width must exceed 10 feet to promote even distribution of flow across the swale. Local juridictions may require larger minimum widths based on maintenance requirements.

☐ The channel side slope should not exceed 2:1 (H:V) for a total swale depth of 1 foot or less. For deeper swales or mowed grass swales, the maximum channel side slope should be 3:1. Where space is constrained, swales may have vertical concrete or block walls provided that slope stability, maintenance access and public safety considerations are met.

- ☐ The minimum swale length for biotreatment applications is 100 feet. The minimum residence time for flows in the swale is 10 minutes.
- ☐ If slope is less than 1.5%, underdrains should be provided for the length of the swale
- ☐ A gravel blanket or bedding is required around the underdrain pipe(s). At least 0.5 feet of washed aggregate must be placed below, to the top, and to the sides of the underdrain pipe(s).
- ☐ If an underdrain is included, an amended soil layer of 1 foot minimum thickness must be provided above the underdrain meeting the specifications of MISC-1: Planting/Storage Media.
- ☐ The maximum bed slope in flow direction should not exceed 6% (unles check dams are provided).
- ☐ The maximum flow velocity should not exceed 1.0 ft/sec for water quality treatment swales.
- ☐ For infrequently mowed swales, a maximum flow depth of 4 inches should be implemented. For frequently mowed turf swales, the maximum flow depth is 2 inches.
- ☐ The vegetation height should be maintained between 4 to 6 inches.
- ☐ Gradual meandering bends in the swale are desirable for aesthetic purposes and to promote slower flow and particulate settling.
- ☐ Blockages in the swale that result in uneven flow distribution and points of concentrated flow should be avoided. Blockages that should be avoided include trees, bushes, light pole piers, and utility vaults or pads.

Sizing Method for Vegetated Swales

The Design Capture Method for Flow-based BMPs should be used to determine the design flowrate for a vegetated swale. The user then selects the design flow depth and longitudinal slope and uses the sizing steps below to determine the length and width of the swale. The sizing steps are as follows:

Step 1: Determine Design Flowrate (Q)

Calculate the Design Flowrate (Q) using the Capture Efficiency Method for Flow-based BMPs (See **Appendix III.3.3**). Inputs include the time of concentration of the catchment (T_c) and the capture efficiency achieved upstream by HSCs or other BMPs.

Step 2: Estimate the Swale Bottom Width

For shallow flow depths, channel side slopes can be ignored and the bottom width can be calculated using a simplified form of Manning's formula:

$$b = (Q \times n_{WQ}) / (1.49 \times y^{1.67} \times s^{0.5})$$

Where:

b = estimated swale bottom width, ft

Q = design flowrate, cfs

n_{WQ} = Manning's roughness coefficient for shallow flow conditions, use 0.2 unless other information is available

y = design flow depth, ft (not to exceed 4 inches or 0.33 ft)

s = longitudinal slope in flow direction, ft/ft (not to exceed 0.06)

If b is between 2 and 10 feet, proceed to step 3.

If b is less than 2 feet, increase b to 2 feet and recalculate design flow depth using the following:

$y = ((Q \times n_{WQ}) / (1.49 \times b \times s^{0.5}))^{0.6}$

If b is greater than 10 feet, one of the following steps is necessary:

- Increase longitudinal slope to a maximum of 6% or 0.06, and recalculate b
- Increase design flow depth to a maximum of 4 inches or 0.33 ft, and recalculate b
- Install a divider lengthwise along swale bottom at least three-quarters of the swale length, beginning at the inlet. The swale width can be increased to 16 feet if a divider is provided.

Step 3: Determine Design Flow Velocity

Calculate the design flow velocity using the following equation:

$V_{WQ} = Q / A_{WQ}$

Where:

V_{WQ} = design flow velocity, fps

Q = design flowrate, cfs

$A_{WQ} = by + Zy^2$, cross sectional area of flow at design depth

Z = side slope length per unit height

If the design flow velocity exceeds 1 foot per second, design parameters in Step 2 should be adjusted (slope, bottom width, or design flow depth) until V_{WQ} is equal or less than 1 fps.

Step 4: Calculate Swale Length

Calculate the swale length needed to achieve a minimum hydraulic residence time of 10 minutes using the following equation:

$L = 60 \times t_{HR} \times V_{WQ}$

Where:

L = swale length, ft

t_{HR} = hydraulic residence time, min (minimum 10 minutes)

V_{WQ} = design flow velocity, fps

Step 5: If Needed, Adjust Swale Length to Site Constraints

Note that oftentimes swale length can be accomodated by providing a meandering swale. However, if swale length is too large for the site, the length can be adjusted as follows:

- Calculate the swale treatment top area (A_{top}), based on the swale length calculated in Step 4:

$A_{TOP} = (b_i + b_{SLOPE}) \times L_i$

Where:

A_{TOP} = top area (ft^2) at the design treatment depth

b_i = bottom width (ft), calculated in Step 2

b_{SLOPE} = the additional top width (ft) above the side slope for the design water depth (for 3:1 side slopes and a 4-inch water depth, b_{slope} = 2 feet)

L_i = initial length (ft) calculated in Step 4

- Use the swale top area and a reduced swale length (L_f) to increase the bottom width, using the following equation:

$L_F = A_{TOP} / (b_F + b_{SLOPE})$

Where:

L_F = reduced swale length (ft)

b_F = increased bottom width (ft)

- Recalculate V_{WQ} according to Step 3 using the revised cross-sectional area A_{WQ} based on the increased bottom width (b_F). Revise the design as necessary if the design flow velocity exceeds 1 foot per second.
- Recalculate to ensure that the 10 minute retention time is retained.

Configuration for Use in a Treatment Train

- Vegetated swales can be incorporated in a treatment train to provide enhanced water quality treatment and reductions in runoff volume and rate. For example, if a vegetated swale is placed upgradient of a dry extended detention (ED) basin, the rate and volume of water flowing to the dry ED basin can be reduced and the water quality enhanced. As another example, dry ED basins may be placed upstream a vegetated swale to reduce the size of the vegetated swale.
- Vegetated swales can be used as pretreatment for infiltration BMPs.
- If designed with an infiltration sump, vegetated "bioinfiltration" swales can provide retention and biotreatment capacity.

Additional References for Design Guidance

Los Angeles Unified School District (LAUSD) Stormwater Technical Manual, Chapter 4: http://www.laschools.org/employee/design/fs-studies-and-reports/download/white_paper_report_material/Storm_Water_Technical_Manual_2009-opt-red.pdf?version_id=76975850

Santa Barbara BMP Guidance Manual, Chapter 6: http://www.santabarbaraca.gov/NR/rdonlyres/91D1FA75-C185-491E-A882-49EE17789DF8/0/Manual_071008_Final.pdf

- County of San Diego Drainage Design Manual for design criteria, Section 5.5: http://www.co.san-diego.ca.us/dpw/floodcontrol/floodcontrolpdf/drainage-designmanual05.pdf

County of Los Angeles Low Impact Development Standards Manual, Chapter 5: http://dpw.lacounty.gov/wmd/LA_County_LID_Manual.pdf

- Los Angeles County Stormwater BMP Design and Maintenance Manual: http://dpw.lacounty.gov/DES/design_manuals/StormwaterBMPDesignandMaintenance.pdf

6. BMP Fact Sheets

Section 3
Source Control BMPs

3.1 Introduction

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

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

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

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

3.2 Fact Sheet Format

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

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

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

SC-xx Example Fact Sheet

Description of the BMP

Approach

- Pollution Prevention
- Suggested Protocols
- Training
- Spill Response and Prevention
- Other Considerations

Requirements

- Costs
- Maintenance

Supplemental Information

- Further Details on the BMP
- Examples

References and Resources

Figure 3-1
Example Fact Sheet

3.3 BMP Fact Sheets

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

Section 3
Source Control BMPs

3.1 Introduction

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

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

Table 3-1 Municipal Fixed Facility BMPs

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

Table 3-2 Municipal Field Program BMPs

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

3.2 Fact Sheet Format

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

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

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

SC-xx Example Fact Sheet

Description of the BMP

Approach

- Pollution Prevention
- Suggested Protocols
- Training
- Spill Response and Prevention
- Other Considerations

Requirements

- Costs
- Maintenance

Supplemental Information

- Further Details on the BMP
- Examples

References and Resources

Figure 3-1
Example Fact Sheet

3.3 BMP Fact Sheets

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

Site Design & Landscape Planning SD-10

Design Objectives

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

Description

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

Approach

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

Suitable Applications

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

Design Considerations

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

CASQA
CALIFORNIA STORMWATER QUALITY ASSOCIATION

Designing New Installations

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

- Formulate the plan on the basis of clearly articulated community goals. Carefully identify conflicts and choices between retaining and protecting desired resources and community growth.

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

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

Conserve Natural Areas during Landscape Planning

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

- Cluster development on least-sensitive portions of a site while leaving the remaining land in a natural undisturbed condition.

- Limit clearing and grading of native vegetation at a site to the minimum amount needed to build lots, allow access, and provide fire protection.

- Maximize trees and other vegetation at each site by planting additional vegetation, clustering tree areas, and promoting the use of native and/or drought tolerant plants.

- Promote natural vegetation by using parking lot islands and other landscaped areas.

- Preserve riparian areas and wetlands.

Maximize Natural Water Storage and Infiltration Opportunities Within the Landscape Unit

- Promote the conservation of forest cover. Building on land that is already deforested affects basin hydrology to a lesser extent than converting forested land. Loss of forest cover reduces interception storage, detention in the organic forest floor layer, and water losses by evapotranspiration, resulting in large peak runoff increases and either their negative effects or the expense of countering them with structural solutions.

- Maintain natural storage reservoirs and drainage corridors, including depressions, areas of permeable soils, swales, and intermittent streams. Develop and implement policies and regulations to discourage the clearing, filling, and channelization of these features. Utilize them in drainage networks in preference to pipes, culverts, and engineered ditches.

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

Protection of Slopes and Channels during Landscape Design

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

Redeveloping Existing Installations

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

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

Other Resources

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

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

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

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

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

Spill Prevention, Control & Cleanup SC-11

Objectives

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

Targeted Constituents

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

Description

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

Approach

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

Pollution Prevention

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

CASQA
CALIFORNIA STORMWATER QUALITY ASSOCIATION

- A description of the facility, the address, activities and materials involved
- Identification of key spill response personnel
- Identification of the potential spill areas or operations prone to spills/leaks
- Identification of which areas should be or are bermed to contain spills/leaks
- Facility map identifying the key locations of areas, activities, materials, structural BMPs, etc.
- Material handling procedures
- Spill response procedures including:
  - Assessment of the site and potential impacts
  - Containment of the material
  - Notification of the proper personnel and evacuation procedures
  - Clean up of the site
  - Disposal of the waste material and
  - Proper record keeping

- Product substitution – use less toxic materials (i.e. use water based paints instead of oil based paints)
- Recycle, reclaim, or reuse materials whenever possible. This will reduce the amount of materials that are brought into the facility or into the field.

Suggested Protocols

Spill/Leak Prevention Measures

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

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

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

- For field programs, only transport the minimum amount of material needed for the daily activities and transfer materials between containers at a municipal yard where leaks and spill are easier to control.

- If paved, sweep and clean storage areas monthly, do not use water to hose down the area unless all of the water will be collected and disposed of properly.

- Install a spill control device (such as a tee section) in any catch basins that collect runoff from any storage areas if the materials stored are oil, gas, or other materials that separate from and float on water. This will allow for easier cleanup if a spill occurs.

- If necessary, protect catch basins while conducting field activities so that if a spill occurs, the material will be contained.

Training

- Educate employees about spill prevention, spill response and cleanup on a routine basis.

- Well-trained employees can reduce human errors that lead to accidental releases or spills:

  - The employees should have the tools and knowledge to immediately begin cleaning up a spill if one should occur.

  - Employees should be familiar with the Spill Prevention Control and Countermeasure Plan if one is available.

- Training of staff from all municipal departments should focus on recognizing and reporting potential or current spills/leaks and who they should contact.

- Employees responsible for aboveground storage tanks and liquid transfers for large bulk containers should be thoroughly familiar with the Spill Prevention Control and Countermeasure Plan and the plan should be readily available.

Spill Response and Prevention

- Identify key spill response personnel and train employees on who they are.

- Store and maintain appropriate spill cleanup materials in a clearly marked location near storage areas; and train employees to ensure familiarity with the site's spill control plan and/or proper spill cleanup procedures.

- Locate spill cleanup materials, such as absorbents, where they will be readily accessible (e.g. near storage and maintenance areas, on field trucks).

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

Spill Cleanup Procedures

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

Reporting

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

- Report spills in accordance with applicable reporting laws. Spills that pose an immediate threat to human health or the environment must be reported immediately to the Office of Emergency Service (OES)

- Spills that pose an immediate threat to human health or the environment may also need to be reported within 24 hours to the Regional Water Quality Control Board.

- Federal regulations require that any oil spill into a water body or onto an adjoining shoreline be reported to the National Response Center (NRC) at 800-424-8802 (24 hour)

- After the spill has been contained and cleaned up, a detailed report about the incident should be generated and kept on file (see the section on Reporting below). The incident may also be used in briefing staff about proper procedures

Other Considerations

- State regulations exist for facilities with a storage capacity of 10,000 gallons or more of petroleum to prepare a Spill Prevention Control and Countermeasure Plan (SPCC) Plan (Health & Safety Code Chapter 6.67).

- State regulations also exist for storage of hazardous materials (Health & Safety Code Chapter 6.95), including the preparation of area and business plans for emergency response to the releases or threatened releases.

- Consider requiring smaller secondary containment areas (less than 200 sq. ft.) to be connected to the sanitary sewer, if permitted to do so, prohibiting any hard connections to the storm drain.

Requirements

Costs

- Will vary depending on the size of the facility and the necessary controls.

- Prevention of leaks and spills is inexpensive. Treatment and/or disposal of wastes, contaminated soil and water is very expensive

Maintenance

- This BMP has no major administrative or staffing requirements. However, extra time is needed to properly handle and dispose of spills, which results in increased labor costs

Supplemental Information

Further Detail of the BMP

Reporting

Record keeping and internal reporting represent good operating practices because they can increase the efficiency of the response and containment of a spill. A good record keeping system helps the municipality minimize incident recurrence, correctly respond with appropriate containment and cleanup activities, and comply with legal requirements.

A record keeping and reporting system should be set up for documenting spills, leaks, and other discharges, including discharges of hazardous substances in reportable quantities. Incident records describe the quality and quantity of non-stormwater discharges to the storm drain.

These records should contain the following information:

- Date and time of the incident
- Weather conditions
- Duration of the spill/leak/discharge
- Cause of the spill/leak/discharge
- Response procedures implemented
- Persons notified
- Environmental problems associated with the spill/leak/discharge

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

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

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

Examples

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

References and Resources

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

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

San Diego Stormwater Co-permittees Jurisdictional Urban Runoff Management Program (URMP)
http://www.projectcleanwater.org/pdf/Model%20Program%20Municipal%20Facilities.pdf

Efficient Irrigation SD-12

Design Objectives

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

Description

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

Approach

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

Suitable Applications

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

Design Considerations

Designing New Installations

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

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

CASQA
CALIFORNIA STORMWATER QUALITY ASSOCIATION

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

Redeveloping Existing Installations

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

Other Resources

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

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

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

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

Storm Drain Signage SD-13

Design Objectives

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

Description

Waste materials dumped into storm drain inlets can have severe impacts on receiving and ground waters. Posting notices regarding discharge prohibitions at storm drain inlets can prevent waste dumping. Storm drain signs and stencils are highly visible source controls that are typically placed directly adjacent to storm drain inlets.

Approach

The stencil or affixed sign contains a brief statement that prohibits dumping of improper materials into the urban runoff conveyance system. Storm drain messages have become a popular method of alerting the public about the effects of and the prohibitions against waste disposal.

Suitable Applications

Stencils and signs alert the public to the destination of pollutants discharged to the storm drain. Signs are appropriate in residential, commercial, and industrial areas, as well as any other area where contributions or dumping to storm drains is likely.

Design Considerations

Storm drain message markers or placards are recommended at all storm drain inlets within the boundary of a development project. The marker should be placed in clear sight facing toward anyone approaching the inlet from either side. All storm drain inlet locations should be identified on the development site map.

Designing New Installations

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

- Provide stenciling or labeling of all storm drain inlets and catch basins, constructed or modified, within the project area with prohibitive language. Examples include "NO DUMPING

– DRAINS TO OCEAN" and/or other graphical icons to discourage illegal dumping.

- Post signs with prohibitive language and/or graphical icons, which prohibit illegal dumping at public access points along channels and creeks within the project area.

Note - Some local agencies have approved specific signage and/or storm drain message placards for use. Consult local agency stormwater staff to determine specific requirements for placard types and methods of application.

Redeveloping Existing Installations

Various jurisdictional stormwater management and mitigation plans (SUSMP, WQMP, etc.) define "redevelopment" in terms of amounts of additional impervious area, increases in gross floor area and/or exterior construction, and land disturbing activities with structural or impervious surfaces. If the project meets the definition of "redevelopment", then the requirements stated under " designing new installations" above should be included in all project design plans.

Additional Information

Maintenance Considerations

- Legibility of markers and signs should be maintained. If required by the agency with jurisdiction over the project, the owner/operator or homeowner's association should enter into a maintenance agreement with the agency or record a deed restriction upon the property title to maintain the legibility of placards or signs.

Placement

- Signage on top of curbs tends to weather and fade.

- Signage on face of curbs tends to be worn by contact with vehicle tires and sweeper brooms.

Supplemental Information

Examples

- Most MS4 programs have storm drain signage programs. Some MS4 programs will provide stencils, or arrange for volunteers to stencil storm drains as part of their outreach program.

Other Resources

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

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

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

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

- Use lined bins or dumpsters to reduce leaking of liquid waste.
- Provide roofs, awnings, or attached lids on all trash containers to minimize direct precipitation and prevent rainfall from entering containers.
- Pave trash storage areas with an impervious surface to mitigate spills.
- Do not locate storm drains in immediate vicinity of the trash storage area.
- Post signs on all dumpsters informing users that hazardous materials are not to be disposed of therein.

Redeveloping Existing Installations

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

Additional Information

Maintenance Considerations

The integrity of structural elements that are subject to damage (i.e., screens, covers, and signs) must be maintained by the owner/operator. Maintenance agreements between the local agency and the owner/operator may be required. Some agencies will require maintenance deed restrictions to be recorded of the property title. If required by the local agency, maintenance agreements or deed restrictions must be executed by the owner/operator before improvement plans are approved.

Other Resources

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

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

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

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

Objectives

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

Targeted Constituents

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

Description

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

Approach

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

Pollution Prevention

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

CASQA
California Stormwater Quality Association

- Encourage use of Integrated Pest Management techniques for pest control.
- Encourage proper onsite recycling of yard trimmings.
- Recycle residual paints, solvents, lumber, and other material as much as possible.

Suggested Protocols

Pressure Washing of Buildings, Rooftops, and Other Large Objects

- In situations where soaps or detergents are used and the surrounding area is paved, pressure washers must use a water collection device that enables collection of wash water and associated solids. A sump pump, wet vacuum or similarly effective device must be used to collect the runoff and loose materials. The collected runoff and solids must be disposed of properly.
- If soaps or detergents are not used, and the surrounding area is paved, wash runoff does not have to be collected but must be screened. Pressure washers must use filter fabric or some other type of screen on the ground and/or in the catch basin to trap the particles in wash water runoff.
- If you are pressure washing on a grassed area (with or without soap), runoff must be dispersed as sheet flow as much as possible, rather than as a concentrated stream. The wash runoff must remain on the grass and not drain to pavement.

Landscaping Activities

- Dispose of grass clippings, leaves, sticks, or other collected vegetation as garbage, or by composting. Do not dispose of collected vegetation into waterways or storm drainage systems.
- Use mulch or other erosion control measures on exposed soils.

Building Repair, Remodeling, and Construction

- Do not dump any toxic substance or liquid waste on the pavement, the ground, or toward a storm drain.
- Use ground or drop cloths underneath outdoor painting, scraping, and sandblasting work, and properly dispose of collected material daily.
- Use a ground cloth or oversized tub for activities such as paint mixing and tool cleaning.
- Clean paintbrushes and tools covered with water-based paints in sinks connected to sanitary sewers or in portable containers that can be dumped into a sanitary sewer drain. Brushes and tools covered with non-water-based paints, finishes, or other materials must be cleaned in a manner that enables collection of used solvents (e.g., paint thinner, turpentine, etc.) for recycling or proper disposal.
- Use a storm drain cover, filter fabric, or similarly effective runoff control mechanism if dust, grit, wash water, or other pollutants may escape the work area and enter a catch basin. This is particularly necessary on rainy days. The containment device(s) must be in place at the beginning of the work day, and accumulated dirty runoff and solids must be collected and disposed of before removing the containment device(s) at the end of the work day.

- If you need to de-water an excavation site, you may need to filter the water before discharging to a catch basin or off-site. If directed off-site, you should direct the water through hay bales and filter fabric or use other sediment filters or traps.

- Store toxic material under cover during precipitation events and when not in use. A cover would include tarps or other temporary cover material.

Mowing, Trimming, and Planting

- Dispose of leaves, sticks, or other collected vegetation as garbage, by composting or at a permitted landfill. Do not dispose of collected vegetation into waterways or storm drainage systems.

- Use mulch or other erosion control measures when soils are exposed.

- Place temporarily stockpiled material away from watercourses and drain inlets, and berm or cover stockpiles to prevent material releases to the storm drain system.

- Consider an alternative approach when bailing out muddy water: do not put it in the storm drain; pour over landscaped areas.

- Use hand weeding where practical.

Fertilizer and Pesticide Management

- Follow all federal, state, and local laws and regulations governing the use, storage, and disposal of fertilizers and pesticides and training of applicators and pest control advisors.

- Use less toxic pesticides that will do the job when applicable. Avoid use of copper-based pesticides if possible.

- Do not use pesticides if rain is expected.

- Do not mix or prepare pesticides for application near storm drains.

- Use the minimum amount needed for the job.

- Calibrate fertilizer distributors to avoid excessive application.

- Employ techniques to minimize off-target application (e.g., spray drift) of pesticides, including consideration of alternative application techniques.

- Apply pesticides only when wind speeds are low.

- Fertilizers should be worked into the soil rather than dumped or broadcast onto the surface.

- Irrigate slowly to prevent runoff and then only as much as is needed.

- Clean pavement and sidewalk if fertilizer is spilled on these surfaces before applying irrigation water.

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

- Use up the pesticides. Rinse containers, and use rinse water as product. Dispose of unused pesticide as hazardous waste.
- Implement storage requirements for pesticide products with guidance from the local fire department and County Agricultural Commissioner. Provide secondary containment for pesticides.

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

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

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

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

Requirements

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

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

Supplemental Information

Further Detail of the BMP

Fire Sprinkler Line Flushing

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

References and Resources

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

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

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

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

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

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

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

Parking/Storage Area Maintenance SC-43

Objectives

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

Targeted Constituents

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

Description

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

Approach

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

Pollution Prevention

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

CASQA California Stormwater Quality Association

Suggested Protocols

General

- Keep the parking and storage areas clean and orderly. Remove debris in a timely fashion.
- Allow sheet runoff to flow into biofilters (vegetated strip and swale) and/or infiltration devices.
- Utilize sand filters or oleophilic collectors for oily waste in low quantities.
- Arrange rooftop drains to prevent drainage directly onto paved surfaces.
- Design lot to include semi-permeable hardscape.
- Discharge soapy water remaining in mop or wash buckets to the sanitary sewer through a sink, toilet, clean-out, or wash area with drain.

Controlling Litter

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

Surface Cleaning

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

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

Surface Repair

- Preheat, transfer or load hot bituminous material away from storm drain inlets.
- Apply concrete, asphalt, and seal coat during dry weather to prevent contamination from contacting stormwater runoff.
- Cover and seal nearby storm drain inlets where applicable (with waterproof material or mesh) and manholes before applying seal coat, slurry seal, etc. Leave covers in place until job is complete and all water from emulsified oil sealants has drained or evaporated. Clean any debris from these covered manholes and drains for proper disposal.
- Use only as much water as necessary for dust control, to avoid runoff.
- Catch drips from paving equipment that is not in use with pans or absorbent material placed under the machines. Dispose of collected material and absorbents properly.

Inspection

- Have designated personnel conduct inspections of parking facilities and stormwater conveyance systems associated with parking facilities on a regular basis.
- Inspect cleaning equipment/sweepers for leaks on a regular basis.

Training

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

Spill Response and Prevention

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

Other Considerations

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

SC-43 Parking/Storage Area Maintenance

Requirements

Costs

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

Maintenance

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

Supplemental Information

Further Detail of the BMP

Surface Repair

Apply concrete, asphalt, and seal coat during dry weather to prevent contamination from contacting stormwater runoff. Where applicable, cover and seal nearby storm drain inlets (with waterproof material or mesh) and manholes before applying seal coat, slurry seal, etc. Leave covers in place until job is complete and all water from emulsified oil sealants has drained or evaporated. Clean any debris from these covered manholes and drains for proper disposal. Only use only as much water as is necessary for dust control to avoid runoff.

References and Resources

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

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

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

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

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

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

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

Housekeeping Practices SC-60

Objectives

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

Description

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

Approach

Pollution Prevention

- Purchase only the amount of material that will be needed for foreseeable use. In most cases this will result in cost savings in both purchasing and disposal. See SC-61 Safer Alternative Products for additional information.

- Be aware of new products that may do the same job with less environmental risk and for less or the equivalent cost. Total cost must be used here; this includes purchase price, transportation costs, storage costs, use related costs, clean up costs and disposal costs.

Suggested Protocols

General

- Keep work sites clean and orderly. Remove debris in a timely fashion. Sweep the area.

- Dispose of wash water, sweepings, and sediments, properly.

- Recycle or dispose of fluids properly.

- Establish a daily checklist of office, yard and plant areas to confirm cleanliness and adherence to proper storage and security. Specific employees should be assigned specific inspection responsibilities and given the authority to remedy any problems found.

- Post waste disposal charts in appropriate locations detailing for each waste its hazardous nature (poison, corrosive, flammable), prohibitions on its disposal (dumpster, drain, sewer) and the recommended disposal method (recycle, sewer, burn, storage, landfill).

- Summarize the chosen BMPs applicable to your operation and post them in appropriate conspicuous places.

Targeted Constituents

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

CASQA
CALIFORNIA STORMWATER QUALITY ASSOCIATION

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

Training

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

Spill Response and Prevention

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

Other Considerations

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

Requirements

Costs

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

Maintenance

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

Supplemental Information

Further Detail of the BMP

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

Examples

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

References and Resources

British Columbia Lake Stewardship Society. Best Management Practices to Protect Water Quality from Non-Point Source Pollution. March 2000. http://www.nalms.org/bclss/bmphome.html#bmp

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

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

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

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

Trash Storage Areas SD-32

Description

Trash storage areas are areas where a trash receptacle (s) are located for use as a repository for solid wastes. Stormwater runoff from areas where trash is stored or disposed of can be polluted. In addition, loose trash and debris can be easily transported by water or wind into nearby storm drain inlets, channels, and/or creeks. Waste handling operations that may be sources of stormwater pollution include dumpsters, litter control, and waste piles.

Approach

This fact sheet contains details on the specific measures required to prevent or reduce pollutants in stormwater runoff associated with trash storage and handling. Preventative measures including enclosures, containment structures, and impervious pavements to mitigate spills, should be used to reduce the likelihood of contamination.

Design Objectives

Maximize Infiltration

Provide Retention

Slow Runoff

Minimize Impervious Land Coverage

Prohibit Dumping of Improper Materials

☑ Contain Pollutants

Collect and Convey

Suitable Applications

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

Design Considerations

Design requirements for waste handling areas are governed by Building and Fire Codes, and by current local agency ordinances and zoning requirements. The design criteria described in this fact sheet are meant to enhance and be consistent with these code and ordinance requirements. Hazardous waste should be handled in accordance with legal requirements established in Title 22, California Code of Regulation.

Wastes from commercial and industrial sites are typically hauled by either public or commercial carriers that may have design or access requirements for waste storage areas. The design criteria in this fact sheet are recommendations and are not intended to be in conflict with requirements established by the waste hauler. The waste hauler should be contacted prior to the design of your site trash collection areas. Conflicts or issues should be discussed with the local agency.

Designing New Installations

Trash storage areas should be designed to consider the following structural or treatment control BMPs:

- Design trash container areas so that drainage from adjoining roofs and pavement is diverted around the area(s) to avoid run-on. This might include berming or grading the waste handling area to prevent run-on of stormwater.
- Make sure trash container areas are screened or walled to prevent off-site transport of trash.

CASQA
CALIFORNIA STORMWATER QUALITY ASSOCIATION

- Use lined bins or dumpsters to reduce leaking of liquid waste.
- Provide roofs, awnings, or attached lids on all trash containers to minimize direct precipitation and prevent rainfall from entering containers.
- Pave trash storage areas with an impervious surface to mitigate spills.
- Do not locate storm drains in immediate vicinity of the trash storage area.
- Post signs on all dumpsters informing users that hazardous materials are not to be disposed of therein.

Redeveloping Existing Installations

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

Additional Information

Maintenance Considerations

The integrity of structural elements that are subject to damage (i.e., screens, covers, and signs) must be maintained by the owner/operator. Maintenance agreements between the local agency and the owner/operator may be required. Some agencies will require maintenance deed restrictions to be recorded of the property title. If required by the local agency, maintenance agreements or deed restrictions must be executed by the owner/operator before improvement plans are approved.

Other Resources

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

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

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

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

7. WQMP Exhibit