PRELIMINARY WQMP REPORT

In the City of Victorville, CA

TENTATIVE TRACT MAP NO. 20525

Prepared for:
Mojave Amethyst 40, LP(Owner)
Three Arch Investment Corp. (General Partner)
David Michelson (President)
17802 Lakeside Haven Drive
Cypress, Texas 77433
December 20, 2022

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MOJAVE RIVER WATERSHED

PRELIMINARY
Water Quality Management Plan
For:

TENTATIVE TRACT MAP NO. 20525

APN 0394-031-02, 0394-031-03 & 0394-031-04

Prepared for: Mojave Amethyst 40, L.P.(Owner)
Three Arch Investment Corp. (General
Partner) David Michelson (President)
17802 Lakeside Haven Drive
Cypress, Texas 77433
Phone: (949) 322-6983

Prepared by:
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Submittal Date: December 20, 2022

Revision No. and Date: 150021.0183PWQMP1STRED/03-15-22

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

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

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

Final Approval Date:______________________

Project Owner's Certification

This Mojave River Watershed Water Quality Management Plan (WQMP) has been prepared for Insert Owner/Developer Name by Ludwig Engineering Associates, Inc. The WQMP is intended to comply with the requirements of the County of San Bernardino and the Phase II Small MS4 General Permit for the Mojave River Watershed. The undersigned, while it owns the subject property, is responsible for the implementation of the provisions of this plan and will ensure that this plan is amended as appropriate to reflect up-to-date conditions on the site consistent with the Phase II Small MS4 Permit and the intent of San Bernardino County (unincorporated areas of Phelan, Oak Hills, Spring Valley Lake and Victorville) and the incorporated cities of Hesperia and Victorville and the Town of Apple Valley. Once the undersigned transfers its interest in the property, its successors in interest and the city/county/town shall be notified of the transfer. The new owner will be informed of its responsibility under this WQMP. A copy of the approved WQMP shall be available on the subject site in perpetuity.

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

Project Data

Permit/Application Number(s):	TBD	Grading Permit Number(s):	TBD
Tract/Parcel Map Number(s):	20525	Building Permit Number(s):	TBD
CUP, SUP, and/or APN (Specify Lot Numbers if Portions of Tract):			APN 0394-031-02, 0394-031-03, 0394-031-04

Owner's Signature

Owner Name: David Michelson

Title	Owner/Developer		
Company	Three Arch Investment Corp.1 / MOJAVE/AMETHYST 40, L.P		
Address	17802 Lakeside Haven Drive, Cypress, Texas 77433		
Email	drmichelson48@gmail.com		
Telephone #	(949) 322-6983		
Signature	Michelson	Date	1/7/2023

Preparer's Certification

Project Data			
Permit/Application Number(s):	TBD	Grading Permit Number(s):	TBD
Tract/Parcel Map Number(s):	20525	Building Permit Number(s):	TBD
CUP, SUP, and/or APN (Specify Lot Numbers if Portions of Tract):			APN 0394-031-02, APN 0394-031- 03, APN 0394-031-04

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

Engineer: Jeffrey Martin Ashbaker		PE Stamp Below
Title	Vice President	REGISTERED PROFESSIONAL ENGINEER JEFFREY MARTIN ASHBAKER No. 91606 CIVIL STATE OF CALIFORNIA
Company	Ludwig Engineering Associates, Inc.	
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Signature	Jeffrey Martin Ashbaker	
Date	01-17-23	

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SECTION 1

Section I – Introduction

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

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

Section 1 Discretionary Permit(s)

Form 1-1 Project Information

Project Name	Tract Map No. 20525				
Project Owner Contact Name:	David Michelson				
Mailing Address:	17802 Lakeside Haven Drive, Cypress, Texas 77433	E-mail Address:	drmichelson48@gmail.com	Telephone:	(949) 322-6983
Permit/Application Number(s):		Tract/Parcel Map Number(s): TR. 20525	APN 0394-031-02, APN 0394-031-03, APN 0394-031-04		
Additional Information/ Comments:	The entire tract will be draining Northerly and Westerly to a water quality basin to store 2yr-24hr storm event and mitigate the difference between the Pre and Post 10yr volume runoff. The proposed subdivision site lies within the south Lahontan Hydrological basin planning area (SL) Region 6 and Mojave Hydrologic Unit 628.20, Upper Mojave HA				
Description of Project:	Tentative Tract No. 20525 is located at the N.E. corner of Amethyst Road and Mojave Drive in the City of Victorville, State of California, also within the S.W. one- quarter of Section 12, T5N, R5W, S.B.M., County of San Bernardino, California. This development for Tract 20525 (30.1 Acres) will construct 108 single-family dwelling units with Lots "A" through "C" as LMAD areas, Lot "D" as the WQMP Basin and Lot "E" as a community park site. The site is divided into two (2) drainage area ("A" and "B") as shown on the attached Pre-development Drainage Maps. During the Pre-submittal stage with the City, Engineering Staff directed us to " Combine" Drainage Area "A" with Drainage Area "B" and have only one WQMP/Detention Basin at the N.W. corner of the Tract (Low Point). Area's "A"(S.E. portion) has 14.09 acres of pre-development area that flows 22.7cfs (Q100-24hrs) towards the City's E-04 Master Plan Facility. Area "B"(N.W. portion) has 15.11 acres of pre-development area that flows 25.9cfs (Q100-24hrs) towards the City's E-05 Master Plan Facility. Post-development inflow (30.1 acres) into Basin No.1 has 60.2cfs (Q100-24hrs) going in and outflow of 22.2cfs (Q100-24hrs) for reduction of 3.7cfs to E-05 Master Plan Facility.				

Provide summary of Conceptual WQMP conditions (if previously submitted and approved). Attach complete copy.	

SECTION 2

Section 2 Project Description

2.1 Project Information

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

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

2.1.1 Project Sizing Categorization

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

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

Form 2.1-1 Description of Proposed Project

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

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

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

2 Project Area (ft2):	1,262,804.40	3 Number of Dwelling Units:	108	4 SIC Code:	1521

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

2.2 Property Ownership/Management

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

Form 2.2-1 Property Ownership/Management

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

Presently the Developer will be responsible for all BMP's Operation & Maintenance and as specified in Section 5 of this report. Afterwards no homeowners or property owners will be formed. Each individual homeowner will be responsible for management and maintenance of down-spouts, drainage swales, and all storm drain features within the property. The City of Victorville will be responsible for the water quality Basin operation and maintenance.
The owner listed below will be responsible for long-term maintenance of WQMP stormwater facilities.

Mohave Amethyst 40, LP (Owner)
Three Arch Investment Corp.(General Partner)
David Michelson, President
17802 Lakeside Haven Drive
Cypress, Texas 77433
(949) 322-6983

2.3 Potential Stormwater Pollutants

Best Management Practices (BMP) measures for pollutant generating activities and sources shall be designed consistent with recommendations from the CASQA Stormwater BMP Handbook for New Development and Redevelopment (or an equivalent manual). Pollutant generating activities must be considered when determining the overall pollutants of concern for the Project as presented in Form2.3-1.

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

Form 2.3-1 Pollutants of Concern

Pollutant	Please check: E=Expected, N=Not Expected		Additional Information and Comments
Pathogens (Bacterial / Virus)	E ☒	N ☐	Expected per Table 3-2 in the TGD for WQMP. Sources include animal waste.
Nutrients - Phosphorous	E ☒	N ☐	Expected per Table 3-2 in the TGD for WQMP. Sources from urban runoff include fertilizers and eroded soils
Nutrients - Nitrogen	E ☒	N ☐	Expected per Table 3-2 in the TGD for WQMP. Sources from urban runoff include fertilizers and eroded soils
Noxious Aquatic Plants	E ☐	N ☒	Only on Landscaping areas: Receiving waters: No drainage facilities located within 2 miles of site.
Sediment	E ☒	N ☐	Expected per Table 3-2 in the TGD for WQMP. Sources include eroded soils.
Metals	E ☐	N ☒	
Oil and Grease	E ☒	N ☐	Vehicular traffic on public streets. Receiving waters; No drainage facilities located within 2 miles of site. Mojave River
Trash/Debris	E ☒	N ☐	Residents and public use. Receiving waters; No drainage facilities located within 2 miles of site. Mojave River
Pesticides / Herbicides	E ☒	N ☐	Landscape activities. Receiving waters; No drainage facilities located within 2 miles of site. Mojave River
Organic Compounds	E ☒	N ☐	Only on Landscaped Areas Receiving waters, No drainage facilities located within 2 miles of site. Mojave River
Other: Oxygen Demanding Compound	E ☒	N ☐	Only on Landscaped Areas Receiving waters, No drainage facilities located within 2 miles of site. Mojave River
Other:	E ☐	N ☐	
Other:	E ☐	N ☐	

SECTION 3

Section 3 Site and Watershed Description

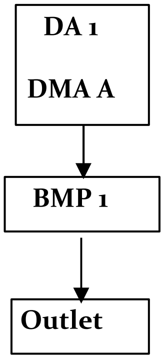
Describe the project site conditions that will facilitate the selection of BMPs through an analysis of the physical conditions and limitations of the site and its receiving waters. Identify distinct drainage areas (DA) that collect flow from a portion of the site and describe how runoff from each DA (and sub-watershed Drainage Management Areas (DMAs)) is conveyed to the site outlet(s). Refer to Section 3.2 in the TGD for WQMP. The form below is provided as an example. Then complete Forms 3.2 and 3.3 for each DA on the project site. ***If the project has more than one drainage area for stormwater management, then complete additional versions of these forms for each DA / outlet. A map presenting the DMAs must be included as an appendix to the WQMP document.***

Form 3-1 Site Location and Hydrologic Features

Site coordinates *take GPS measurement at approximate center of site*	Latitude 34°31'51.496"N	Longitude 117°21'46.143"W	Thomas Bros Map page 4295

1 San Bernardino County climatic region: ☒ Desert

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



Conveyance	Briefly describe on-site drainage features to convey runoff that is not retained within a DMA
DA1 DMA C flows to DA1 DMA A	*Ex. Bioretention overflow to vegetated bioswale with 4' bottom width, 5:1 side slopes and bed slope of 0.01. Conveys runoff for 1000' through DMA 1 to existing catch basin on SE corner of property*
DA1 DMA A to Outlet 1	All Runoff conveys through interior streets to a low point near northwest project corner, then into 2-catch basin, through 36" RCP to 173' x 55' (bottom) Infiltration Basin for DMA A. The basin has 3:1 side slope and is 6' deep. The outflow structure is a 10'wide x 4" high concrete underparkway drain. The emergency overflow is an 18'wide x 1'deep concrete spillway with 5:1 side slope. The outflow and overflow structures outlet onto Amethyst Road and eventually to the E-05 Facility per Victorville Master Plan od Drainage (VMPD).
DA1 DMA B to Outlet 1	

Form 3-2 Existing Hydrologic Characteristics (DA 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)	658,191.60			
2 Existing site impervious area (ft^2)	0			
3 Antecedent moisture condition *For desert areas, use* *http://www.sbcounty.gov/dpw/floodcontrol/pdf/20100412_map.pdf*	2			
4 Hydrologic soil group *Refer to Watershed Mapping Tool – http://sbcounty.permitrack.com/WAP*	C			
5 Longest flowpath length (ft)	1930			
6 Longest flowpath slope (ft/ft)	0.0199			
7 Current land cover type(s) *Select from Fig C-3 of Hydrology Manual*	Natural Fair 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*	Fair			

Form 3-2 Existing Hydrologic Characteristics (DA 2)

For Drainage Area 2's sub-watershed DMA, provide the following characteristics	DMA A	DMA B	DMA C	DMA D
1 DMA drainage area (ft^2)	604,612.8			
2 Existing site impervious area (ft^2)	0			
3 Antecedent moisture condition *For desert areas, use http://www.sbcounty.gov/dpw/floodcontrol/pdf/20100412_map.pdf*	2			
4 Hydrologic soil group *Refer to Watershed Mapping Tool – http://sbcounty.permitrack.com/WAP*	C			
5 Longest flowpath length (ft)	1100			
6 Longest flowpath slope (ft/ft)	0.0177			
7 Current land cover type(s) *Select from Fig C-3 of Hydrology Manual*	Natural Fair 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*	Fair			

Form 3-3 Watershed Description for Drainage Area

Receiving waters Refer to SWRCB site: http://www.waterboards.ca.gov/water_issues/programs/tmdl/integrated2010.shtml	Drainage facilities located within 1.2 miles northeast of site. El Evado Channel, Mojave River.
Applicable TMDLs *http://www.waterboards.ca.gov/water_issues/programs/tmdl/integrated2010.shtml*	None
303(d) listed impairments *http://www.waterboards.ca.gov/water_issues/programs/tmdl/integrated2010.shtml*	None
Environmentally Sensitive Areas (ESA) *Refer to Watershed Mapping Tool –* *http://sbcounty.permitrack.com/WAP*	Desert Tortoise Habitat Cat 3, Mojave Ground Squirrel
Hydromodification Assessment	☒ Yes, *Complete Hydromodification Assessment. Include Forms 4.2-2 through Form 4.2-5 and Hydromodification BMP Form 4.3-9 in submittal* ☐ No

SECTION 4

Section 4 Best Management Practices (BMP)

4.1 Source Control BMPs and Site Design BMP Measures

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

4.1.1 Source Control BMPs

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

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

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

Form 4.1-1 Non-Structural Source Control BMPs

Identifier	Name	Check One		Describe BMP Implementation OR, if not applicable, state reason
		Included	Not Applicable	
N1	Education of Property Owners, Tenants and Occupants on Stormwater BMPs	☒	☐	Upon final walk through of new homes with homeowners, the developer will provide educational pamphlets published by California regional water Quality Control Board - Santa Ana Region, or other appropriate sources.
N2	Activity Restrictions	☒	☐	The types of activities allowed within the Project will be limited to those allowed by the City of Victorville codes, regulations, and zoning ordinances.
N3	Landscape Management BMPs	☒	☐	Landscape plans will be consistent with the City of Victorville requirements for water conservation vegetation. Utilizing programmable irrigation systems, and/or rain shut off sensors to the maximum extent practicable.
N4	BMP Maintenance	☒	☐	Maintenance of BMPs implemented at the project shall be performed at the frequency prescribed in this WQMP Form 5-1. Records of inspections and maintenance shall be maintained by the Owner and documented with the WQMP and shall be available for review upon request.
N5	Title 22 CCR Compliance (How development will comply)	☒	☐	No hazardous materials to be allowed for this project
N6	Local Water Quality Ordinances	☒	☐	Homeowners to abide by the State, County and Local Water Ordinances, provide with educational material and pamphlets
N7	Spill Contingency Plan	☐	☒	Any spills of chemicals shall be properly cleaned up and the waste properly disposed of per all State, County and Local requirements. See SC-11 Educational Material Section.
N8	Underground Storage Tank Compliance	☐	☒	No storage tanks to be allowed for this project
N9	Hazardous Materials Disclosure Compliance	☐	☒	No hazardous materials to be allowed for this 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	
N10	Uniform Fire Code Implementation	☒	☐	As Required per City of Victorville Fire Department
N11	Litter/Debris Control Program	☒	☐	Private waste receptacles will be place at the curb collection per local waste collection service provider. Educational material also will be provided for homeowners.
N12	Employee Training	☐	☒	No employees, private residence
N13	Housekeeping of Loading Docks	☐	☒	Project does not feature any loading docks
N14	Catch Basin Inspection Program	☒	☐	Inspection per City Engineering Department
N15	Vacuum Sweeping of Private Streets and Parking Lots	☐	☒	There are no private streets
N16	Other Non-structural Measures for Public Agency Projects	☐	☒	N/A
N17	Comply with all other applicable NPDES permits	☒	☐	As Required

Form 4.1-2 Structural Source Control BMPs

Identifier	Name	Check One		Describe BMP Implementation OR, If not applicable, state reason
		Included	Not Applicable	
S1	Provide storm drain system stenciling and signage (CASQA New Development BMP Handbook SD-13)	☒	☐	SD Stenciling (4" circular Plastic "No Dumping, Drains to the Ocean" marker, with adhesive installation) will be provided by the developer and maintained by the County of San Bernardino.
S2	Design and construct outdoor material storage areas to reduce pollution introduction (CASQA New Development BMP Handbook SD-34)	☐	☒	No outdoor material storage proposed. Private waste receptacles will be place at the curb collection by local waste collection service provider.
S3	Design and construct trash and waste storage areas to reduce pollution introduction (CASQA New Development BMP Handbook SD-32)	☐	☒	Homeowners to use covered bins
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)	☒	☐	Owner shall follow SD-12 Fact Sheet included in 6.4 of this WQMP. and educational material pamphlets provided
S5	Finish grade of landscaped areas at a minimum of 1-2 inches below top of curb, sidewalk, or pavement	☐	☒	To Maximum Extent Practicable
S6	Protect slopes and channels and provide energy dissipation (CASQA New Development BMP Handbook SD-10)	☒	☐	See SD-10 per educational material pamphlets provided (Vegetated Swales, ground cover at slopes Rock at Trenches etc.)
S7	Covered dock areas (CASQA New Development BMP Handbook SD-31)	☐	☒	Project does not Feature any Dock Areas
S8	Covered maintenance bays with spill containment plans (CASQA New Development BMP Handbook SD-31)	☐	☒	Not Feature per this project
S9	Vehicle wash areas with spill containment plans (CASQA New Development BMP Handbook SD-33)	☐	☒	The Project does not feature any wash areas.
S10	Covered outdoor processing areas (CASQA New Development BMP Handbook SD-36)	☐	☒	Not Feature per this project

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)	☐	☒	The Project does not feature any wash areas
S12	Fueling areas (CASQA New Development BMP Handbook SD-30)	☐	☒	The Project does not feature any fueling areas
S13	Hillside landscaping (CASQA New Development BMP Handbook SD-10)	☐	☒	No hillside landscaping per this project
S14	Wash water control for food preparation areas	☐	☒	The Project does not feature any food preparation areas
S15	Community car wash racks (CASQA New Development BMP Handbook SD-33)	☐	☒	The Project does not feature any community car wash racks

4.1.2 Site Design BMPs

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

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

Describe site design and drainage plan including:

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

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

Form 4.1-3 Site Design Practices Checklist

Site Design Practices
If yes, explain how preventative site design practice is addressed in project site plan. If no, other LID BMPs must be selected to meet targets

Minimize impervious areas: Yes ☒ No ☐
Explanation: By landscaping as much as possible along walkways and driveways and property boundary to serve as permeable areas.

Maximize natural infiltration capacity; Including improvement and maintenance of soil: Yes ☐ No ☒
Explanation: Proposed detention/infiltration Basin

Preserve existing drainage patterns and time of concentration: Yes ☐ No ☒
Explanation: The project retains stormwater on-site and releases less than the predevelopment flows into the same historic drainage pattern.

Disconnect impervious areas. Including rerouting of rooftop drainage pipes to drain stormwater to storage or infiltration BMPs instead of to storm drain: Yes ☐ No ☒
Explanation: Direct roof and walkways storm flows to adjacent landscaped areas, and or drainage swales to MEP

Use of Porous Pavement.: Yes ☐ No ☒
Explanation: Not cost effective, also prone to failure to clogging from desert sand.

Protect existing vegetation and sensitive areas: Yes ☐ No ☒
Explanation: There is no existing vegetation, sensitive areas to be taken care in approval process

Re-vegetate disturbed areas. Including planting and preservation of drought tolerant vegetation: Yes ☒ No ☐
Explanation: MEP

Minimize unnecessary compaction in stormwater retention/infiltration basin/trench areas: Yes ☐ No ☒
Explanation: No compaction for basin, scarify surface

Utilize naturalized/rock-lined drainage swales in place of underground piping or imperviously lined swales: Yes ☐ No ☒
Explanation: To the MEP

Stake off areas that will be used for landscaping to minimize compaction during construction: Yes ☐ No ☒
Explanation: To the MEP

Use of Rain Barrels and Cisterns, Including the use of on-site water collection systems.: Yes ☐ No ☒
Explanation: Not for this WQMP.

Stream Setbacks. Includes a specified distance from an adjacent steam: : Yes ☒ No ☐
Explanation: There are no adjacent streams.

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

San Bernardino County Special Districts:

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

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

Mojave Water Agency:

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

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

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

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

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

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

4.2 Treatment BMPs

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

4.2.1 Project Specific Hydrology Characterization

The purpose of this section of the Project WQMP is to establish targets for post-development hydrology based on performance criteria specified in Section E.12.e.ii.c and Section E.12.f of the Phase II Small MS4 Permit. These targets include runoff volume for water quality control (referred to as LID design capture volume), and runoff volume, time of concentration, and peak runoff for protection from hydromodification.

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

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

Methods applied in the following forms include:

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

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

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

[1] Project area DA 1 (ft^2): 1,262,804.40	[2] Imperviousness after applying preventative site design practices (Imp%): 48.2	[3] Runoff Coefficient (Rc): _0.328 *$R_c = 0.858(Imp\%)^{\wedge 3}-0.78(Imp\%)^{\wedge 2}+0.774(Imp\%)+0.04$*

[4] Determine 1-hour rainfall depth for a 2-year return period $P_{2yr\text{-}1hr}$ (in): 0.392 http://hdsc.nws.noaa.gov/hdsc/pfds/sa/sca_pfds.html

[5] Compute P_6, Mean 6-hr Precipitation (inches): 0.452

*P_6 = Item 4 *C_1, where C_1 is a function of site climatic region specified in Form 3-1 Item 1 (Desert = 1.2371)*

[6] Drawdown Rate *Use 48 hours as the default condition. Selection and use of the 24 hour drawdown time condition is subject to approval by the local jurisdiction. The necessary BMP footprint is a function of drawdown time. While shorter drawdown times reduce the performance criteria for LID BMP design capture volume, the depth of water that can be stored is also reduced.*	24-hrs ☐ 48-hrs ☒

[7] Compute design capture volume, DCV (ft^3): 30,577.03

*DCV = 1/12 * [Item 1* Item 3 *Item 5 * C_2], where C_2 is a function of drawdown rate (24-hr = 1.582; 48-hr = 1.963)*

Compute separate DCV for each outlet from the project site per schematic drawn in Form 3-1 Item 2

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

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

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

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

Condition	Runoff Volume (ft^3)	Time of Concentration (min)	Peak Runoff (cfs)
Pre-developed	**1** 21,264 *Form 4.2-3 Item 12*	**2** 14.44 *Form 4.2-4 Item 13*	**3** 12.19 *Form 4.2-5 Item 10*
Post-developed	**4** 3,816.58 *Form 4.2-3 Item 13*	**5** 18.35 *Form 4.2-4 Item 14*	**6** 23.36 *Form 4.2-5 Item 14*
Difference	**7** *-17,447.42* *Item 4 – Item 1*	**8** *-3.91* *Item 2 – Item 5*	**9** *11.2* *Item 6 – Item 3*
Difference (as % of pre-developed)	**10** *-82.05%* *Item 7 / Item 1*	**11** *-27.08%* *Item 8 / Item 2*	**12** *91.88%* *Item 9 / Item 3*

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

Weighted Curve Number Determination for: Pre-developed DA	DMA A	DMA B	DMA C	DMA D	DMA E	DMA F	DMA G	DMA H
1a Land Cover type	Natural Fair Open Brush							
2a Hydrologic Soil Group (HSG)	A, B							
3a DMA Area, ft^2 *sum of areas of DMA should equal area of DA*	658,191.6							
4a Curve Number (CN) *use Items 1 and 2 to select the appropriate CN from Appendix C-2 of the TGD for WQMP*	71.2							
Weighted Curve Number Determination for: Post-developed DA	DMA A	DMA B	DMA C	DMA D	DMA E	DMA F	DMA G	DMA H
1b Land Cover type	3-4 UPA							
2b Hydrologic Soil Group (HSG)	A, B, C							
3b DMA Area, ft^2 *sum of areas of DMA should equal area of DA*	1,262,804.4							
4b Curve Number (CN) *use Items 5 and 6 to select the appropriate CN from Appendix C-2 of the TGD for WQMP*	54.1							

5 Pre-Developed area-weighted CN: 71.2	**7** Pre-developed soil storage capacity, S (in): 4.04 *S = (1000 / Item 5) - 10*	**9** Initial abstraction, I_a (in): 0.81 *I_a = 0.2 * Item 7*
6 Post-Developed area-weighted CN: 54.1	**8** Post-developed soil storage capacity, S (in): 8.48 *S = (1000 / Item 6) - 10*	**10** Initial abstraction, I_a (in): 1.70 *I_a = 0.2 * Item 8*

11 Precipitation for 10 yr, 24 hr storm (in): 2.27
Go to: http://hdsc.nws.noaa.gov/hdsc/pfds/sa/sca_pfds.html

12 Pre-developed Volume (ft^3): 21,264.0
*V_{pre} =(1 / 12) * (Item sum of Item 3) * [(Item 11 – Item 9)^2 / ((Item 11 – Item 9 + Item 7)*

13 Post-developed Volume (ft^3): 3,816.58
*V_{pre} =(1 / 12) * (Item sum of Item 3) * [(Item 11 – Item 10)^2 / ((Item 11 – Item 10 + Item 8)*

14 Volume Reduction needed to meet hydromodification requirement, (ft^3): -17,638.27
*Vhydro = (Item 13 * 0.95) – Item 12*

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

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

Variables	Pre-developed DA1 *Use additional forms if there are more than 4 DMA*				Post-developed DA1 *Use additional forms if there are more than 4 DMA*			
	DMA A	DMA B	DMA C	DMA D	DMA A	DMA B	DMA C	DMA D
1 Length of flowpath (ft) *Use Form 3-2 Item 5 for pre-developed condition*	1,930				2,345			
2 Change in elevation (ft)	38.4				33.90			
3 Slope (ft/ft), *S_o= Item 2 / Item 1*	0.0199				0.0144			
4 Land cover	Open Brush				3-4 du/ac			
5 Initial DMA Time of Concentration (min) *Appendix C-1 of the TGD for WQMP*	23.9				17.7			
6 Length of conveyance from DMA outlet to project site outlet (ft) *May be zero if DMA outlet is at project site outlet*	0				0			
7 Cross-sectional area of channel (ft^2)	8.84				13.96			
8 Wetted perimeter of channel (ft)	41.00				52.59			
9 Manning's roughness of channel (n)	0.022				0.015			
10 Channel flow velocity (ft/sec) *V_{fps} = (1.49 / Item 9) * (Item 7/Item 8)$^{\wedge 0.67}$ * (Item 3)$^{\wedge 0.5}$*	4.50				3.64			
11 Travel time to outlet (min) *T_t = Item 6 / (Item 10 * 60)*	0				0			
12 Total time of concentration (min) *T_c = Item 5 + Item 11*	23.9				17.7			

13 Pre-developed time of concentration (min): 23.9 *Minimum of Item 12 pre-developed DMA*

14 Post-developed time of concentration (min): 17.7 *Minimum of Item 12 post-developed DMA*

15 Additional time of concentration needed to meet hydromodification requirement (min): 5.0 *$T_{C-Hydro}$ = (Item 13 * 0.95) – Item 14*

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

Compute peak runoff for pre- and post-developed conditions

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

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

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

Compute peak runoff for pre- and post-developed conditions

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

8 Pre-developed Q_p at T_c for DMA A:
*Q_p = Item 6_{DMAA} + [Item 6_{DMAB} * (Item 1_{DMAA} - Item 5_{DMAB})/(Item 1_{DMAB} - Item 5_{DMAB})* Item $7_{DMAA/2}$] + [Item 6_{DMAC} * (Item 1_{DMAA} - Item 5_{DMAC})/(Item 1_{DMAC} - Item 5_{DMAC})* Item $7_{DMAA/3}$]*

9 Pre-developed Q_p at T_c for DMA B:
*Q_p = Item 6_{DMAB} + [Item 6_{DMAA} * (Item 1_{DMAB} - Item 5_{DMAA})/(Item 1_{DMAA} - Item 5_{DMAA})* Item $7_{DMAB/1}$] + [Item 6_{DMAC} * (Item 1_{DMAB} - Item 5_{DMAC})/(Item 1_{DMAC} - Item 5_{DMAC})* Item $7_{DMAB/3}$]*

10 Pre-developed Q_p at T_c for DMA C:
*Q_p = Item 6_{DMAC} + [Item 6_{DMAA} * (Item 1_{DMAC} - Item 5_{DMAA})/(Item 1_{DMAA} - Item 5_{DMAA})* Item $7_{DMAC/1}$] + [Item 6_{DMAB} * (Item 1_{DMAC} - Item 5_{DMAB})/(Item 1_{DMAB} – Item 5_{DMAB})* Item $7_{DMAC/2}$]*

10 Peak runoff from pre-developed condition confluence analysis (cfs): *Maximum of Item 8, 9, and 10 (including additional forms as needed)*

11 Post-developed Q_p at T_c for DMA A:
Same as Item 8 for post-developed values

12 Post-developed Q_p at T_c for DMA B:
Same as Item 9 for post-developed values

13 Post-developed Q_p at T_c for DMA C:
Same as Item 10 for post-developed values

14 Peak runoff from post-developed condition confluence analysis (cfs): *Maximum of Item 11, 12, and 13 (including additional forms as needed)*

15 Peak runoff reduction needed to meet Hydromodification Requirement (cfs): *$Q_{p-hydro}$= (Item 14 * 0.95) – Item 10*

4.3 BMP Selection and Sizing

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

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

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

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

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

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

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

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

4.3.1 Exceptions to Requirements for Bioretention Facilities

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

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

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

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

Form 4.3-1 Infiltration BMP Feasibility (DA 1)

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

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

If Yes, Provide basis: (attach)

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

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

If Yes, Provide basis: (attach)

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

If Yes, Provide basis: (attach)

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

If Yes, Provide basis: (attach)

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

If Yes, Provide basis: (attach)

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

If Yes, Provide basis: (attach)

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

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

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

4.3.2 Site Design BMP

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

Form 4.3-2 Site Design BMPs (DA1)

1 Implementation of Impervious Area Dispersion BMP (i.e. routing runoff from impervious to pervious areas), excluding impervious areas planned for routing to on-lot infiltration BMP: Yes ☐ No ☒ *If yes, complete Items 2-5; If no, proceed to Item 6*	DA DMA BMP Type	DA DMA BMP Type	DA DMA BMP Type *(Use additional forms for more BMPs)*
2 Total impervious area draining to pervious area (ft^2)			
3 Ratio of pervious area receiving runoff to impervious area			
4 Retention volume achieved from impervious area dispersion (ft^3) *V = Item2 * Item 3 * (0.5/12), assuming retention of 0.5 inches of runoff*			
5 Sum of retention volume achieved from impervious area dispersion (ft^3): $V_{retention}$ *=Sum of Item 4 for all BMPs*			
6 Implementation of Localized On-lot Infiltration BMPs (e.g. on-lot rain gardens): Yes ☐ No ☒ *If yes, complete Items 7-13 for aggregate of all on-lot infiltration BMP in each DA; If no, proceed to Item 14*	DA DMA BMP Type	DA DMA BMP Type	DA DMA BMP Type *(Use additional forms for more BMPs)*
7 Ponding surface area (ft^2)			
8 Ponding depth (ft) (min. 0.5 ft.)			
9 Surface area of amended soil/gravel (ft^2)			
10 Average depth of amended soil/gravel (ft) (min. 1 ft.)			
11 Average porosity of amended soil/gravel			
12 Retention volume achieved from on-lot infiltration (ft^3) $V_{retention}$ *= (Item 7 *Item 8) + (Item 9 * Item 10 * Item 11)*			
13 Runoff volume retention from on-lot infiltration (ft^3): $V_{retention}$ *=Sum of Item 12 for all BMPs*			
14 Implementation of Street Trees: Yes ☐ No ☒ *If yes, complete Items 14-18. If no, proceed to Item 19*	DA DMA BMP Type	DA DMA BMP Type	DA DMA BMP Type *(Use additional forms for more BMPs)*

Form 4.3-2 Site Design BMPs (DA1)

15 Number of Street Trees			
16 Average canopy cover over impervious area (ft^2)			
17 Runoff volume retention from street trees (ft^3) *$V_{retention}$ = Item 15 * Item 16 * (0.05/12) assume runoff retention of 0.05 inches*			

18 Runoff volume retention from street tree BMPs (ft^3): 0 *$V_{retention}$ = Sum of Item 17 for all BMPs*

19 Total Retention Volume from Site Design BMPs: 0 *Sum of Items 5, 13 and 18*

4.3.3 Infiltration BMPs

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

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

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

4.3.3.1 Allowed Variations for Special Site Conditions

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

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

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

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

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

.

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

1 Remaining LID DCV not met by site design BMP (ft^3): 30,577.03 *V_{unmet} = Form 4.2-1 Item 7 - Form 4.3-2 Item19*

BMP Type *Use columns to the right to compute runoff volume retention from proposed infiltration BMP (select BMP from Table 5-4 in TGD for WQMP) - Use additional forms for more BMPs*	DA 1 DMA A BMP Type Infiltration Basin	DA DMA BMP Type	DA DMA BMP Type *(Use additional forms for more BMPs)*
2 Infiltration rate of underlying soils (in/hr) *See Section 5.4.2 and Appendix C of the TGD for WQMP for minimum requirements for assessment methods*	3.73		
3 Infiltration safety factor *See TGD Section 5.4.2 and Appendix D*	2		
4 Design percolation rate (in/hr) *P_{design} = Item 2 / Item 3*	1.87		
5 Ponded water drawdown time (hr) *Copy Item 6 in Form 4.2-1*	48		
6 Maximum ponding depth (ft) *BMP specific, see Table 5-4 of the TGD for WQMP for BMP design details*	7.48		
7 Ponding Depth (ft) *d_{BMP} = Minimum of (1/12*Item 4*Item 5) or Item 6*	7.48		
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*	8,211		
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*	0.0		
10 Amended soil porosity	0.0		
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*	0.0		
12 Gravel porosity	0.40		
13 Duration of storm as basin is filling (hrs) *Typical ~ 3hrs*	3		
14 Above Ground Retention Volume (ft^3) *$V_{retention}$ = Item 8 * [Item7 + (Item 9 * Item 10) + (Item 11 * Item 12) + (Item 13 * (Item 4 / 12))]*	78,553		
15 Underground Retention Volume (ft^3) *Volume determined using manufacturer's specifications and calculations*	0.0		

16 Total Retention Volume from LID Infiltration BMPs: 78,552.73 *(Sum of Items 14 and 15 for all infiltration BMP included in plan)*

17 Fraction of DCV achieved with infiltration BMP: 256.9 % *Retention% = Item 16 / Form 4.2-1 Item 7*

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

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

4.3.4 Biotreatment BMP

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

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

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

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

1 Remaining LID DCV not met by site design , or infiltration, BMP for potential biotreatment (ft^3): *Form 4.2-1 Item 7 - Form 4.3-2 Item 19 – Form 4.3-3 Item 16*	List pollutants of concern *Copy from Form 2.3-1.*

2 Biotreatment BMP Selected *(Select biotreatment BMP(s) necessary to ensure all pollutants of concern are addressed through Unit Operations and Processes, described in Table 5-5 of the TGD for WQMP)*	Volume-based biotreatment *Use Forms 4.3-5 and 4.3-6 to compute treated volume*	Flow-based biotreatment *Use Form 4.3-7 to compute treated flow*
	☐ Bioretention with underdrain ☐ Planter box with underdrain ☐ Constructed wetlands ☐ Wet extended detention ☐ Dry extended detention	☐ Vegetated swale ☐ Vegetated filter strip ☐ Proprietary biotreatment

3 Volume biotreated in volume based biotreatment BMP (ft^3): *Form 4.3-5 Item 15 + Form 4.3-6 Item 13*	4 Compute remaining LID DCV with implementation of volume based biotreatment BMP (ft^3): *Item 1 – Item 3*	5 Remaining fraction of LID DCV for sizing flow based biotreatment BMP: % *Item 4 / Item 1*

6 Flow-based biotreatment BMP capacity provided (cfs): *Use Figure 5-2 of the TGD for WQMP to determine flow capacity required to provide biotreatment of remaining percentage of unmet LID DCV (Item 5), for the project's precipitation zone (Form 3-1 Item 1)*

7 Metrics for MEP determination:

- Provided a WQMP with the portion of site area used for suite of LID BMP equal to minimum thresholds in Table 5-7 of the TGD for WQMP for the proposed category of development: ☐ *If maximized on-site retention BMPs is feasible for partial capture, then LID BMP implementation must be optimized to retain and infiltrate the maximum portion of the DCV possible within the prescribed minimum effective area. The remaining portion of the DCV shall then be mitigated using biotreatment BMP.*

Form 4.3-5 Volume Based Biotreatment (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 4.3-6 Volume Based Biotreatment (DA 1)
Constructed Wetlands and Extended Detention

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

Form 4.3-7 Flow Based Biotreatment (DA 1)

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

4.3.5 Conformance Summary

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

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

1 Total LID DCV for the Project DA-1 (ft^3): 30,577.03 *Copy Item 7 in Form 4.2-1*

2 On-site retention with site design BMP (ft^3): 0.0 *Copy Item18 in Form 4.3-2*

3 On-site retention with LID infiltration BMP (ft^3): 78,552.74 *Copy Item 16 in Form 4.3-3*

4 On-site biotreatment with volume based biotreatment BMP (ft^3): 0.0 *Copy Item 3 in Form 4.3-4*

5 Flow capacity provided by flow based biotreatment BMP (cfs): 0.0 *Copy Item 6 in Form 4.3-4*

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

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

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

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

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

4.3.6 Hydromodification Control BMP

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

Form 4.3-9 Hydromodification Control BMPs (DA 1)

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

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

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

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

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

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

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

4.4 Alternative Compliance Plan (ifapplicable)

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

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

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

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

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

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

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

SECTION 5

Section 5 Inspection and Maintenance Responsibility for Post Construction BMP

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

Note that at time of Project construction completion, the Maintenance Agreement must be completed, signed, notarized and submitted to the County Stormwater Department

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

BMP	Responsible Party(s)	Inspection/ Maintenance Activities Required	Minimum Frequency of Activities
Infiltration Basin	City	Maintain adjacent areas. Remove clippings from landscape maintenance activities. Remove trash and debris. Check for ponding 48-hours after storm events. If ponding is found 48-hours after storm events then scarify the bottom of the basin.	Every two weeks, or as often as necessary to maintain a pleasant appearance, three days after maior storm events.
Catch Basin Insert Filter	City	Clean/Replace/Repair as needed to ensure proper function. Replace oil absorbent pouch as needed (when the filter media turns grey or black).	Before & after rainy season (Oct-May) & after each storm events
Irrigation System	Owner	Replace/ repair leaky or broken sprinkler check for over watering and adjust as needed	As needed
Landscape areas	Owner	Mow, weed, trim, and remove accumulation of Trash and debris	Twice a Month
Storm Drain Piping	City	Inspection and Sediment Removal	Yearly prior to rainy season
Street Sweeping	Owner	Will be vacuum swept at least quarterly of each year including prior storm season (Oct.1- April30 each year) in the later summer or early fall, to reduce the amount of sediment, garden waste and trash entering infiltration/water quality basin.	Quarterly of each year

Section 6 WQMP Attachments

6.1. Site Plan and Drainage Plan

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

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

6.2 Electronic Data Submittal

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

6.3 Post Construction

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

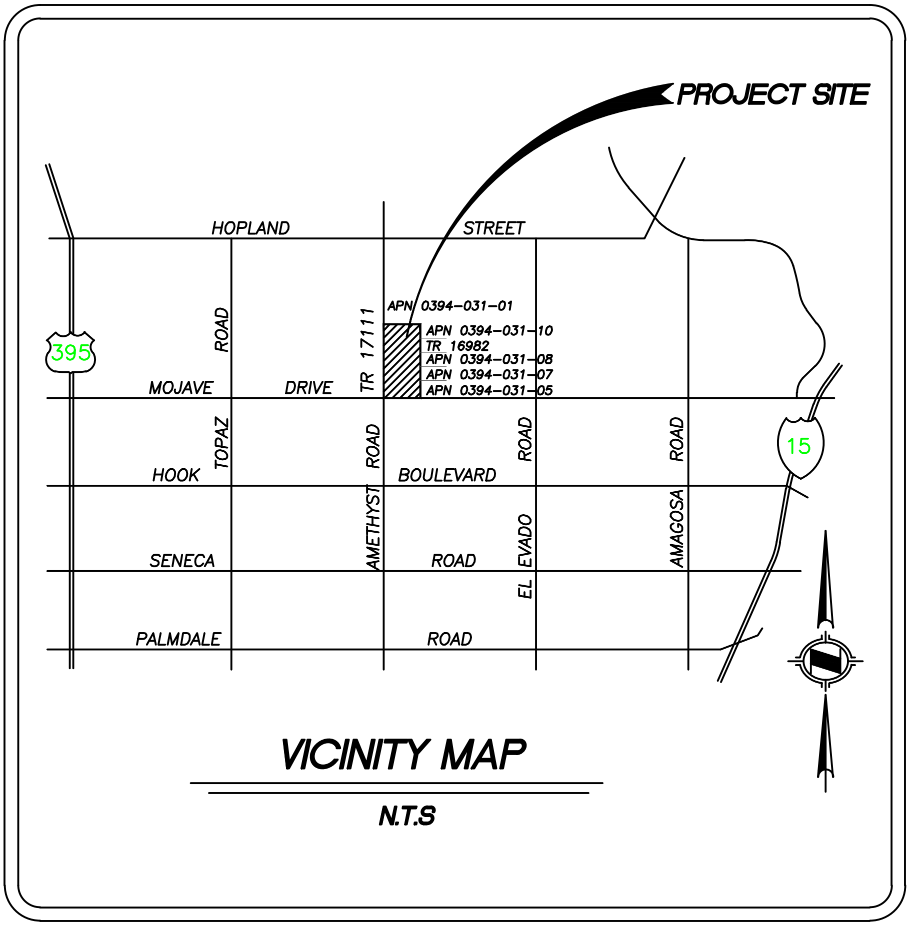
6.4 Other Supporting Documentation

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

SECTION 6.1

Attachment 1 – Site/Drainage Plan

MAPS



VICINITY MAP

N.T.S

Ludwig Engineering
ASSOCIATES, INC.

Civil Engineering • Surveying • Planning

109 East Third Street
San Bernardino, CA 92410
Phone: 909-884-8217
Fax: 909-889-0153

5890 Hwy. 95, Ste. B
Fort Mohave, AZ 88426
Phone: 928-768-1857
Fax: 928-768-7086

15252 Seneca Rd.
Victorville, CA 92392
Phone: 760-951-7676
Fax: 760-241-0573

2126 McCulloch Blvd., Ste. 8
Lake Havasu City, AZ 86403
Phone: 928-680-6060
Fax: 928-854-6530

TR 20525

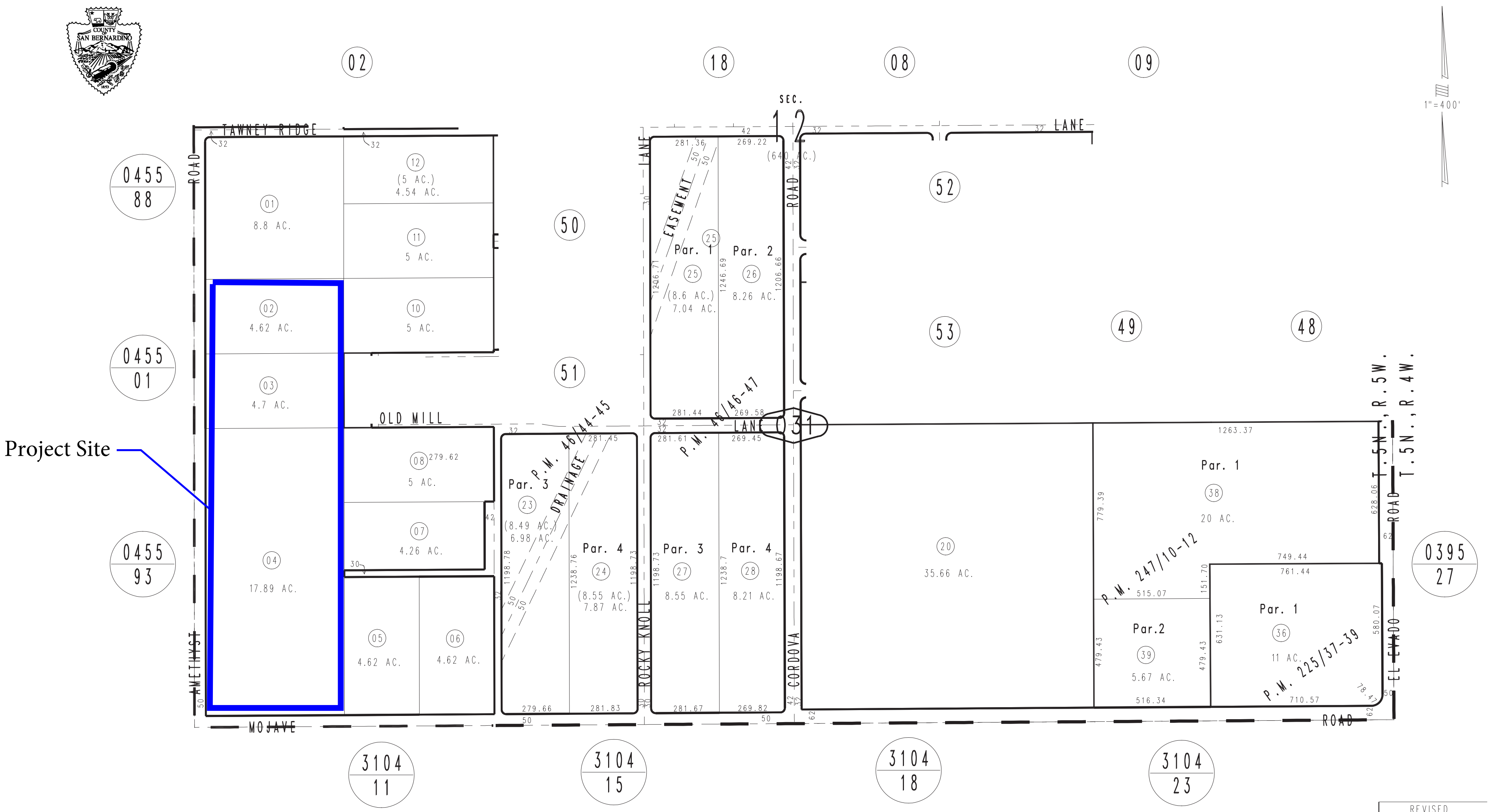
CITY OF VICTORVILLE

THIS MAP IS FOR THE PURPOSE OF AD VALOREM TAXATION ONLY.

Ptn. S.1/2 Sec.12, T.5N.,R.5W., S.B.B.&M.

City of Victorville
Tax Rate Area
12209

0394– 03



Parcel Map No. 19746, P.M. 247/10-12
Ptn. Parcel Map No. 18813, P.M. 225/37-39
Ptn. Parcel Map No. 3755, P.M. 46/44-45
Parcel Map No. 3754, P.M. 46/46-47

March 2004

Assessor's Map
Book 0394 Page 03
San Bernardino County

REVISED
12/07/20 RU
02/02/21 GW

IN THE CITY OF VICTORVILLE,
COUNTY OF SAN BERNARDINO, CALIFORNIA

TENTATIVE TRACT MAP No. 20525

WATER QUALITY MANAGEMENT PLAN

December 20, 2022

FORM 4.1-1 NON-STRUCTURAL SOURCE CONTROL BMPs:

- ① N1 - EDUCATION OF PROPERTY OWNERS, TENANTS AND OCCUPANTS ON STORMWATER BMPs
- ② N2 - ACTIVITY RESTRICTIONS
- ③ N3 - LANDSCAPE MANAGEMENT BMP's
- ④ N4 - BMP MAINTENANCE
- ⑤ N5 - TITLE 22 CCR COMPLIANCE
- ⑥ N6 - LOCAL WATER QUALITY ORDINANCES
- ⑦ N10 - UNIFORM FIRE CODE IMPLEMENTATION
- ⑧ N11 - LITTER/DEBRIS CONTROL PROGRAM
- ⑨ N14 - CATCH BASIN INSPECTION PROGRAM
- ⑩ N17- COMPLY WITH ALL OTHER APPLICABLE NPDES PERMITS

FORM 4.1-2 STRUCTURAL SOURCE CONTROL BMPs:

- ⑪ S1 - PROVIDE STORM DRAIN SYSTEM STENCILING AND SIGNAGE (CASQA NEW DEVELOPMENT BMP HANDBOOK SD-13)
- ⑫ S4 - USE EFFICIENT IRRIGATION SYSTEM AND LANDSCAPE DESIGN, WATER CONSERVATION, SMART CONTROLLERS, SOURCE CONTROL (CASQA NEW DEVELOPMENT BMP HANDBOOK SD-12)
- ⑬ S6 - PROTECT SLOPES AND PROVIDE ENERGY DISSIPATION (CASQA NEW DEVELOPMENT BMP HANDBOOK SD-10)

PROPOSED TREATMENT CONTROL BMP'S:

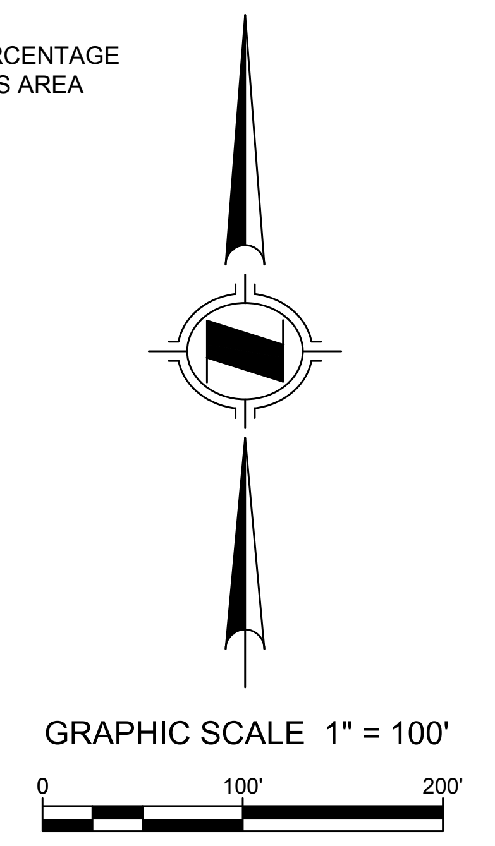
- BMP 1 INFILTRATION BASIN TO RETAIN THE DESIGN CAPTURE VOLUME
- BMP 2 PROVIDE LABELING AT STORM DRAIN INLETS AND CATCH BASINS WITH A PROHIBITIVE LANGUAGE "NO DUMPING DRAINS TO STREAM" Per CASQA SD-13.
- BMP 3 CATCH BASIN INSERT

PROPOSED PROJECT IMPROVEMENTS:

- 1 PROPOSED CONCRETE PAVEMENT
- 2 PROPOSED ASPHALT PAVEMENT
- 3 PROPOSED FENCE

LEGEND

▬	DRAINAGE AREAS
— · · —	SITE BOUNDARY
▨	PROPOSED CONCRETE PAVEMENT
🟦	PROPOSED BUILDING
▨	PROPOSED A/C PAVING AREAS
🟩	PROPOSED LANDSCAPING AREAS
DA1-A	INDICATES DRAINAGE AREA NUMBER
28.99 AC	INDICATES TOTAL AREA
48.18% IMP	INDICATES PERCENTAGE OF IMPERVIOUS AREA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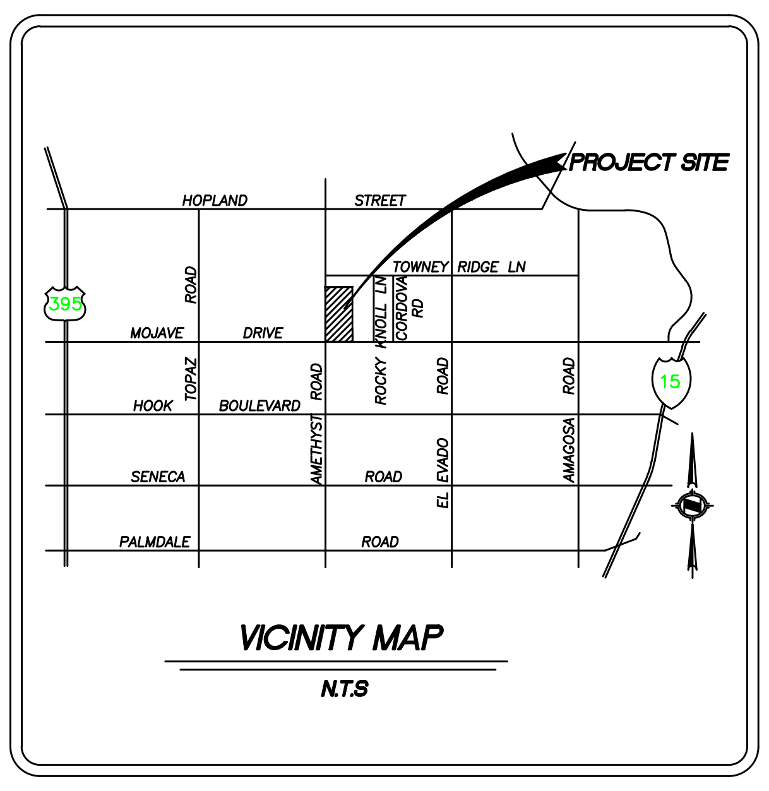
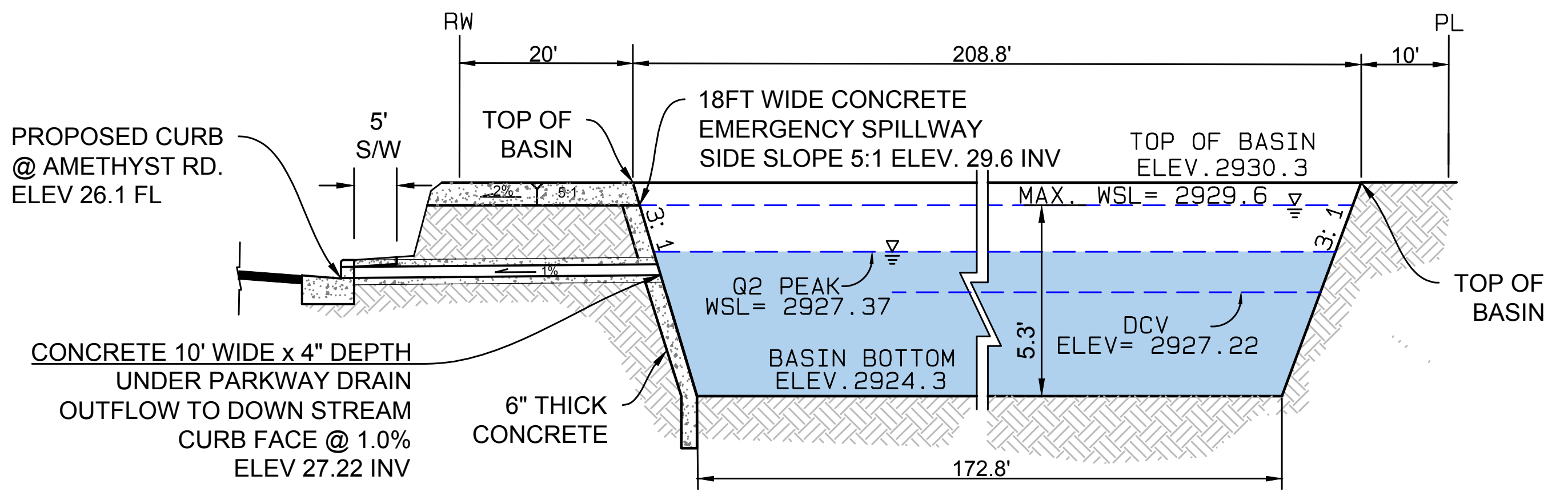


VICINITY MAP
N.T.S

DA - 1 (BASIN No.1) AREA= 1,262,804.40 SF
IMP. = 48.18%
IMPERVIOUS:
BLDG: 108 x 2400 = 259,200 SF
DRIVEWAY: 108 x 384 = 41,472 SF
PAVE ROAD,
SIDEWALK, C & G: 307,789 SF
TOTAL IMP.= 608,461 SF
PERVIOUS:
LANDSCAPE: 654,343.4 SF

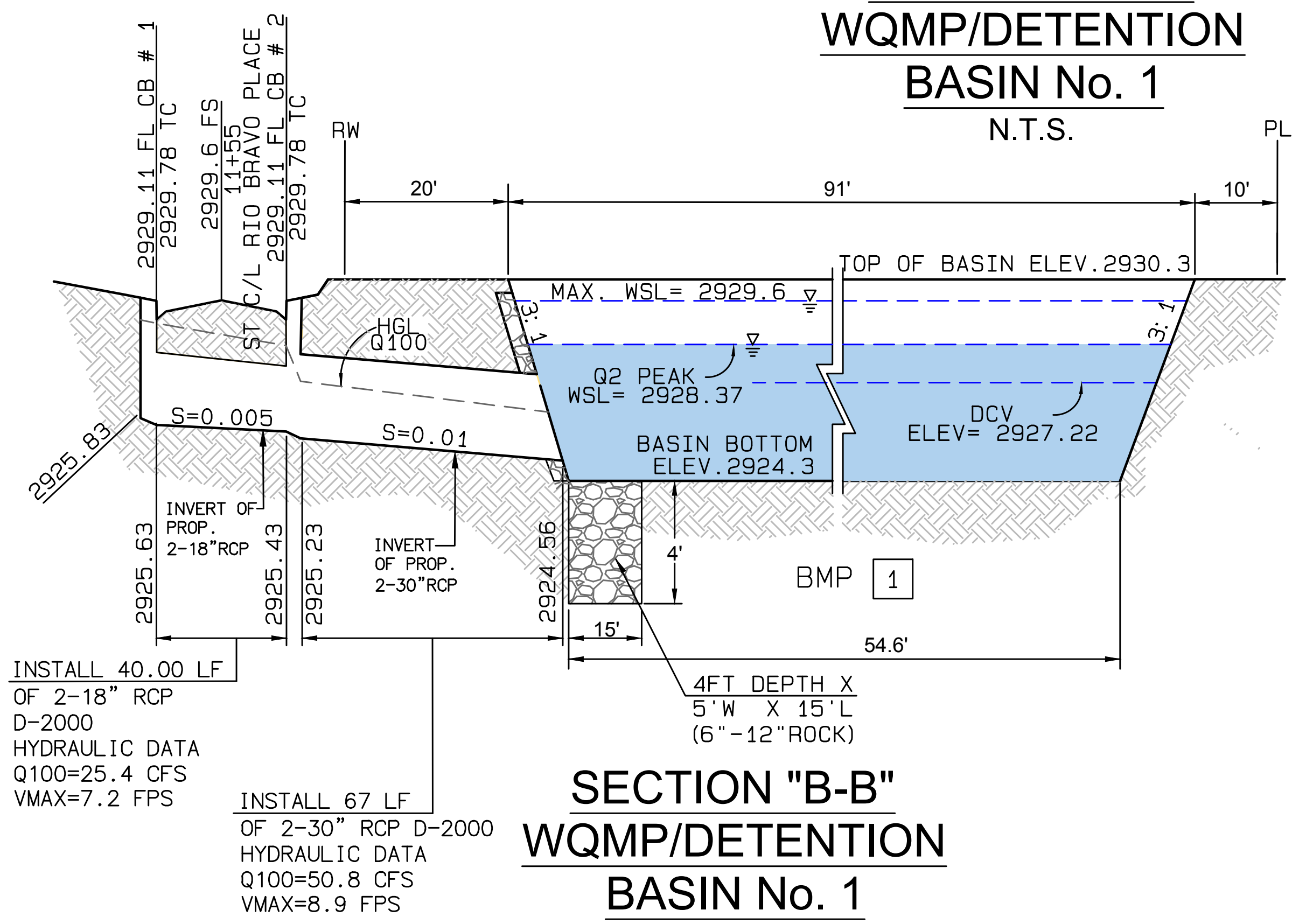
DCV= 30,577.03 CU.FT.



BMP 1

SECTION "A-A" WQMP/DETENTION BASIN No. 1

N.T.S.



BMP 1

SECTION "B-B" WQMP/DETENTION BASIN No. 1

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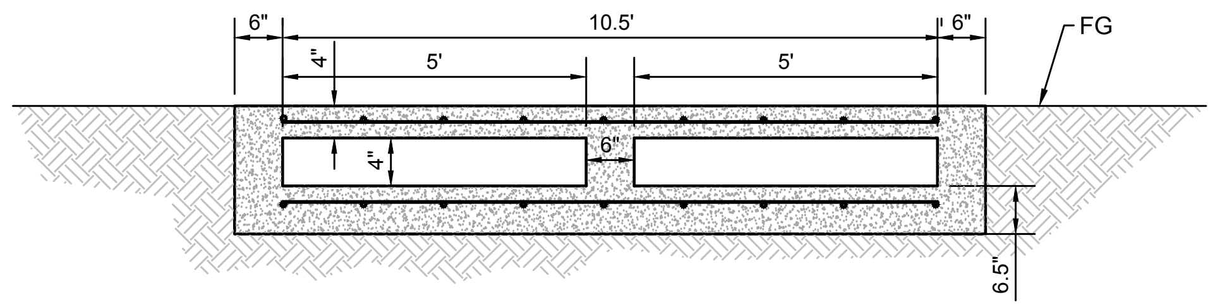
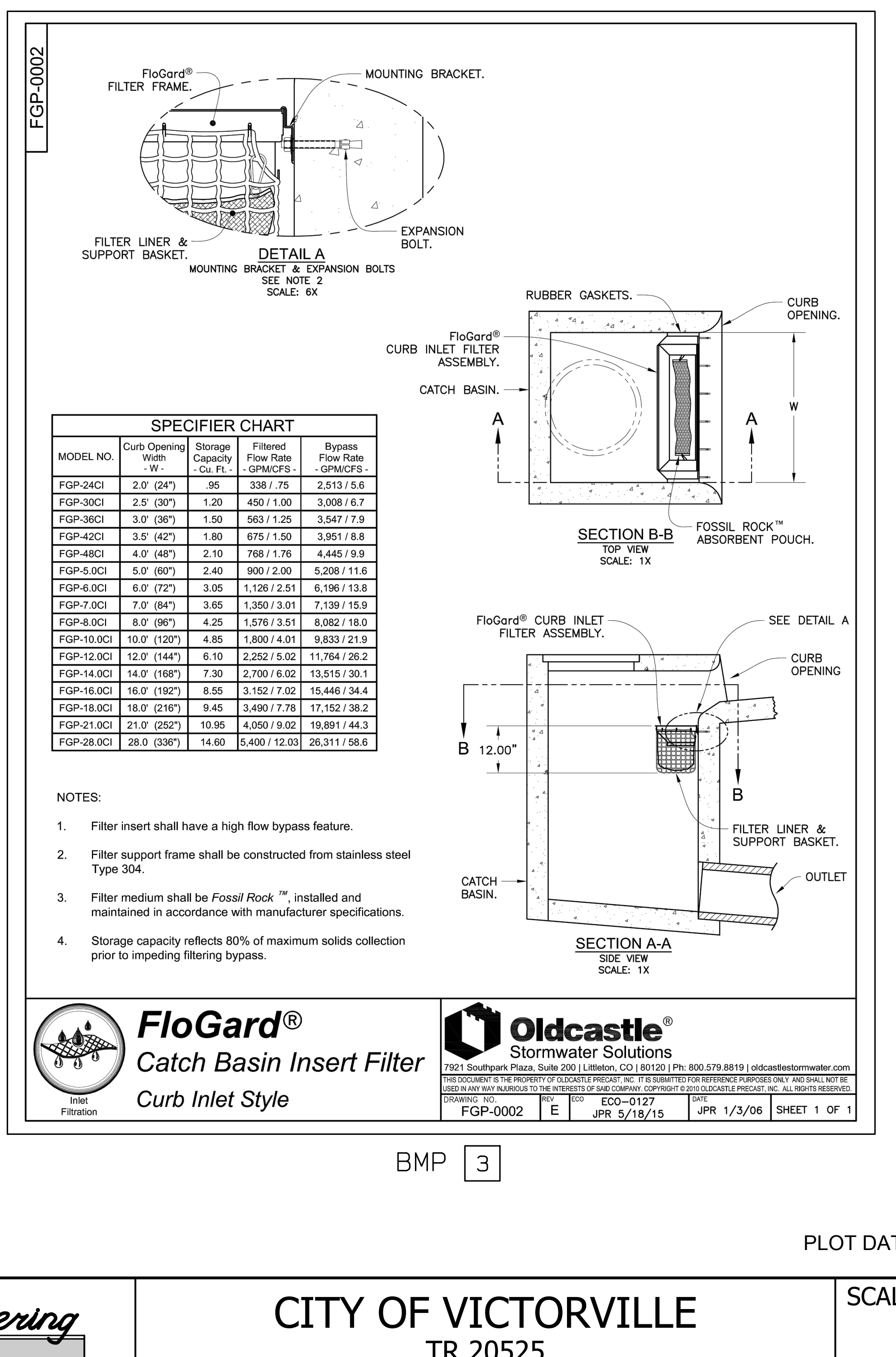


TYPICAL PARKWAY DRAIN OUTLET STRUCTURE SECTION

NOT TO SCALE

OUTLET STRUCTURE AS PER SAN BERNARDINO COUNTY TRANS. DEPT. STD. 210A



SPECIFIER CHART

MODEL NO.	Curb Opening Width - W -	Storage Capacity - Cu. Ft. -	Filtered Flow Rate - GPM/CFS -	Bypass Flow Rate - GPM/CFS -
FGP-24CI	2.0' (24")	.95	338 / .75	2,513 / 5.6
FGP-30CI	2.5' (30")	1.20	450 / 1.00	3,008 / 6.7
FGP-36CI	3.0' (36")	1.50	563 / 1.25	3,547 / 7.9
FGP-42CI	3.5' (42")	1.80	675 / 1.50	3,951 / 8.8
FGP-48CI	4.0' (48")	2.10	768 / 1.76	4,445 / 9.9
FGP-5.0CI	5.0' (60")	2.40	900 / 2.00	5,208 / 11.6
FGP-6.0CI	6.0' (72")	3.05	1,126 / 2.51	6,196 / 13.8
FGP-7.0CI	7.0' (84")	3.65	1,350 / 3.01	7,139 / 15.9
FGP-8.0CI	8.0' (96")	4.25	1,576 / 3.51	8,082 / 18.0
FGP-10.0CI	10.0' (120")	4.85	1,800 / 4.01	9,833 / 21.9
FGP-12.0CI	12.0' (144")	6.10	2,252 / 5.02	11,764 / 26.2
FGP-14.0CI	14.0' (168")	7.30	2,700 / 6.02	13,515 / 30.1
FGP-16.0CI	16.0' (192")	8.55	3.152 / 7.02	15,446 / 34.4
FGP-18.0CI	18.0' (216")	9.45	3,490 / 7.78	17,152 / 38.2
FGP-21.0CI	21.0' (252")	10.95	4,050 / 9.02	19,891 / 44.3
FGP-28.0CI	28.0 (336")	14.60	5,400 / 12.03	26,311 / 58.6

NOTES:

1. Filter insert shall have a high flow bypass feature.
2. Filter support frame shall be constructed from stainless steel Type 304.
3. Filter medium shall be *Fossil Rock* ™, installed and maintained in accordance with manufacturer specifications.
4. Storage capacity reflects 80% of maximum solids collection prior to impeding filtering bypass.

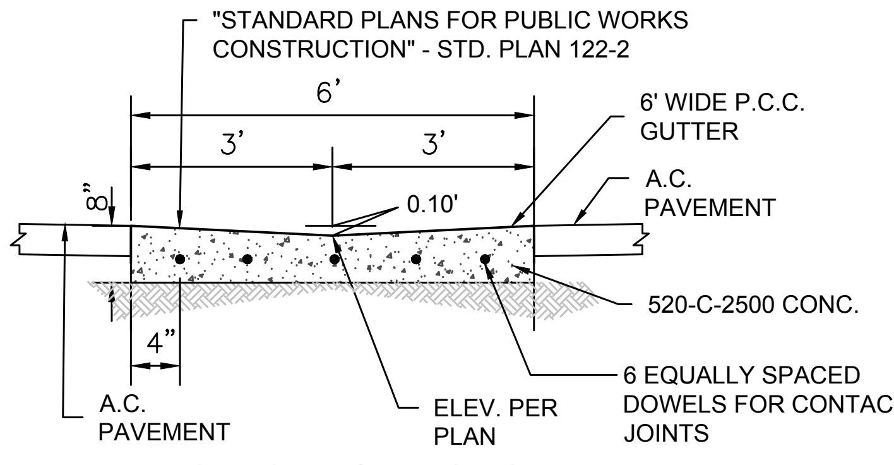
FloGard®
Catch Basin Insert Filter
Curb Inlet Style
Inlet Filtration

Oldcastle®
Stormwater Solutions
7921 Southpark Plaza, Suite 200 | Littleton, CO | 80120 | Ph: 800.579.8819 | oldcastlestormwater.com

DRAWING NO.	REV	ECO	DATE	
FGP-0002	E	ECO-0127 JPR 5/18/15	JPR 1/3/06	SHEET 1 OF 1

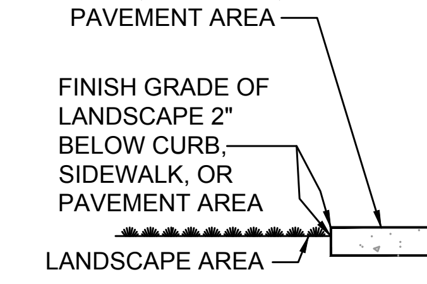
BMP 3

BMP 2



SECTION C-C

N.T.S.



LANDSCAPE TO HARDSCAPE (TYPICAL)

NOT TO SCALE

PLOT DATE: December 20, 2022

JEFFREY MARTIN ASHBAKER
No. 91606
CIVIL

REV.	DESCRIPTION	DATE	BY

Ludwig Engineering
ASSOCIATES, INC.
Civil Engineering • Surveying • Planning

109 East Third Street
San Bernardino, CA 92410
Phone: 909-884-8217
Fax: 909-341-7447

5890 Hwy. 95, Ste. B
Fort Mohave, AZ 88426
Phone: 928-768-1857
Fax: 928-768-7086

15252 Seneca Rd.
Victorville, CA 92392
Phone: 760-951-7676
Fax: 760-241-0573

2126 McCulloch Blvd., Ste. 8
Lake Havasu City, AZ 86403
Phone: 928-680-6060
Fax: 928-854-6530

CITY OF VICTORVILLE
TR 20525
W.Q.M.P. PLAN

CLIENT:
THREE ARCH INVESTMENT CORP.1
17802 LAKESIDE HAVEN DRIVE, CYPRESS, TEXAS 77433

DESIGNED BY:	DRAWN BY:	CHECKED BY:
BW	LC	JA

SCALE 1" = 100'

SHEET 1 OF 1

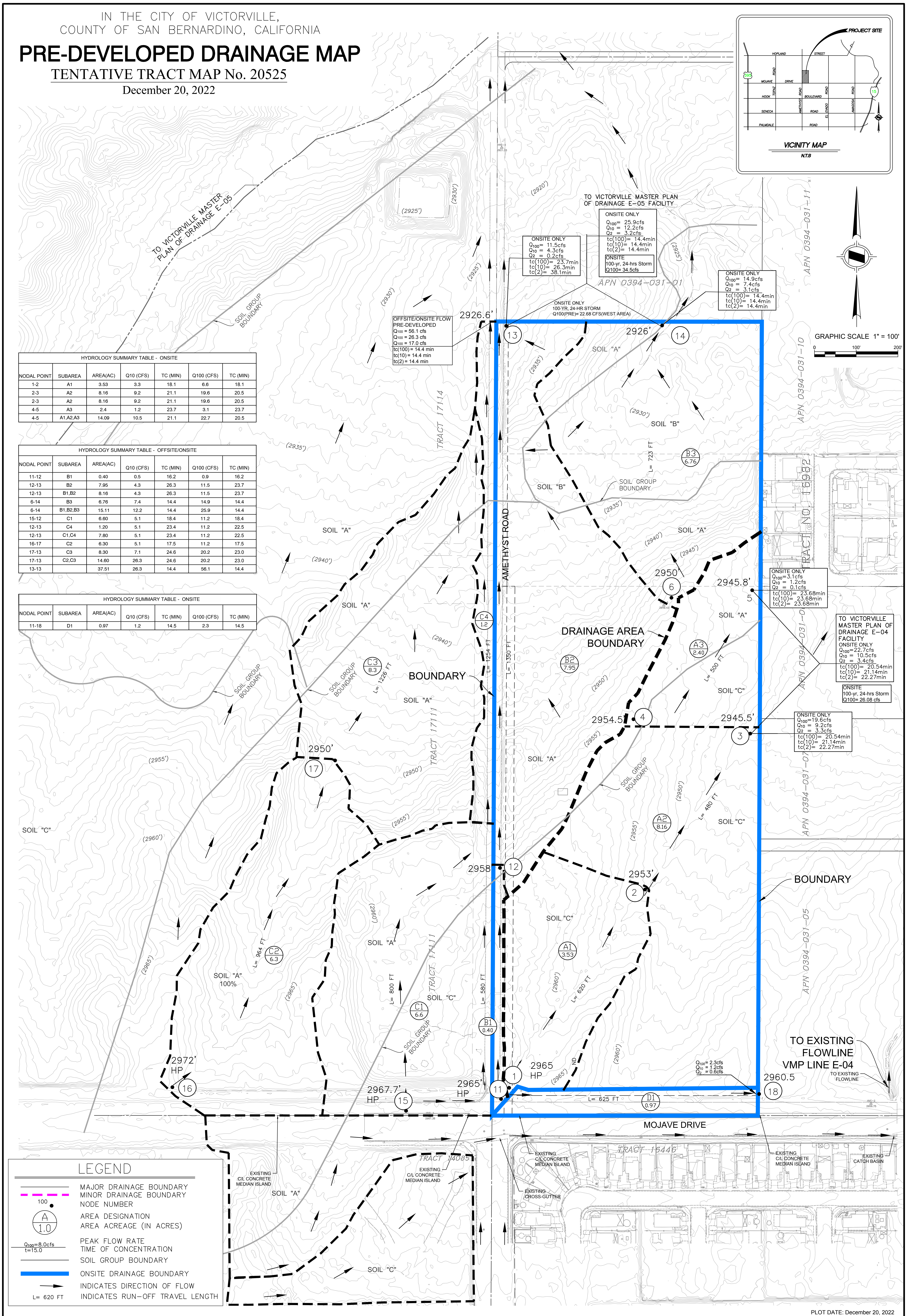
W-1

IN THE CITY OF VICTORVILLE,
COUNTY OF SAN BERNARDINO, CALIFORNIA

PRE-DEVELOPED DRAINAGE MAP

TENTATIVE TRACT MAP No. 20525

December 20, 2022



HYDROLOGY SUMMARY TABLE - ONSITE						
NODAL POINT	SUBAREA	AREA(AC)	Q10 (CFS)	TC (MIN)	Q100 (CFS)	TC (MIN)
1-2	A1	3.53	3.3	18.1	6.6	18.1
2-3	A2	8.16	9.2	21.1	19.6	20.5
2-3	A2	8.16	9.2	21.1	19.6	20.5
4-5	A3	2.4	1.2	23.7	3.1	23.7
4-5	A1,A2,A3	14.09	10.5	21.1	22.7	20.5

HYDROLOGY SUMMARY TABLE - OFFSITE/ONSITE						
NODAL POINT	SUBAREA	AREA(AC)	Q10 (CFS)	TC (MIN)	Q100 (CFS)	TC (MIN)
11-12	B1	0.40	0.5	16.2	0.9	16.2
12-13	B2	7.95	4.3	26.3	11.5	23.7
12-13	B1,B2	8.16	4.3	26.3	11.5	23.7
6-14	B3	6.76	7.4	14.4	14.9	14.4
6-14	B1,B2,B3	15.11	12.2	14.4	25.9	14.4
15-12	C1	6.60	5.1	18.4	11.2	18.4
12-13	C4	1.20	5.1	23.4	11.2	22.5
12-13	C1,C4	7.80	5.1	23.4	11.2	22.5
16-17	C2	6.30	5.1	17.5	11.2	17.5
17-13	C3	8.30	7.1	24.6	20.2	23.0
17-13	C2,C3	14.60	26.3	24.6	20.2	23.0
13-13		37.51	26.3	14.4	56.1	14.4

HYDROLOGY SUMMARY TABLE - ONSITE						
NODAL POINT	SUBAREA	AREA(AC)	Q10 (CFS)	TC (MIN)	Q100 (CFS)	TC (MIN)
11-18	D1	0.97	1.2	14.5	2.3	14.5

LEGEND

—	MAJOR DRAINAGE BOUNDARY
- - -	MINOR DRAINAGE BOUNDARY
100 ●	NODE NUMBER
A / 1.0	AREA DESIGNATION AREA ACREAGE (IN ACRES)
Q_{100}=8.0cfs / t=15.0	PEAK FLOW RATE TIME OF CONCENTRATION
—	SOIL GROUP BOUNDARY
▬	ONSITE DRAINAGE BOUNDARY
→	INDICATES DIRECTION OF FLOW
L= 620 FT	INDICATES RUN-OFF TRAVEL LENGTH

PLOT DATE: December 20, 2022

JEFFREY MARTIN ASHBAKER
No. 91606

REV.	DESCRIPTION	DATE	BY

Ludwig Engineering ASSOCIATES, INC.
Civil Engineering • Surveying • Planning

109 East Third Street
San Bernardino, CA 92410
Phone: 909-884-8217
Fax: 909-341-7447

5890 Hwy. 95, Ste. B
Fort Mohave, AZ 88426
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15252 Seneca Rd.
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2126 McCulloch Blvd., Ste. 8
Lake Havasu City, AZ 86403
Phone: 928-680-6060
Fax: 928-854-6530

CITY OF VICTORVILLE
TR 20525
DRAINAGE MAP

CLIENT:
THREE ARCH INVESTMENT CORP.1
17802 LAKESIDE HAVEN DRIVE, CYPRESS, TEXAS 77433

DESIGNED BY: BW
DRAWN BY: LC
CHECKED BY: JA

SCALE 1" = 100'
SHEET 1 OF 2
D-1

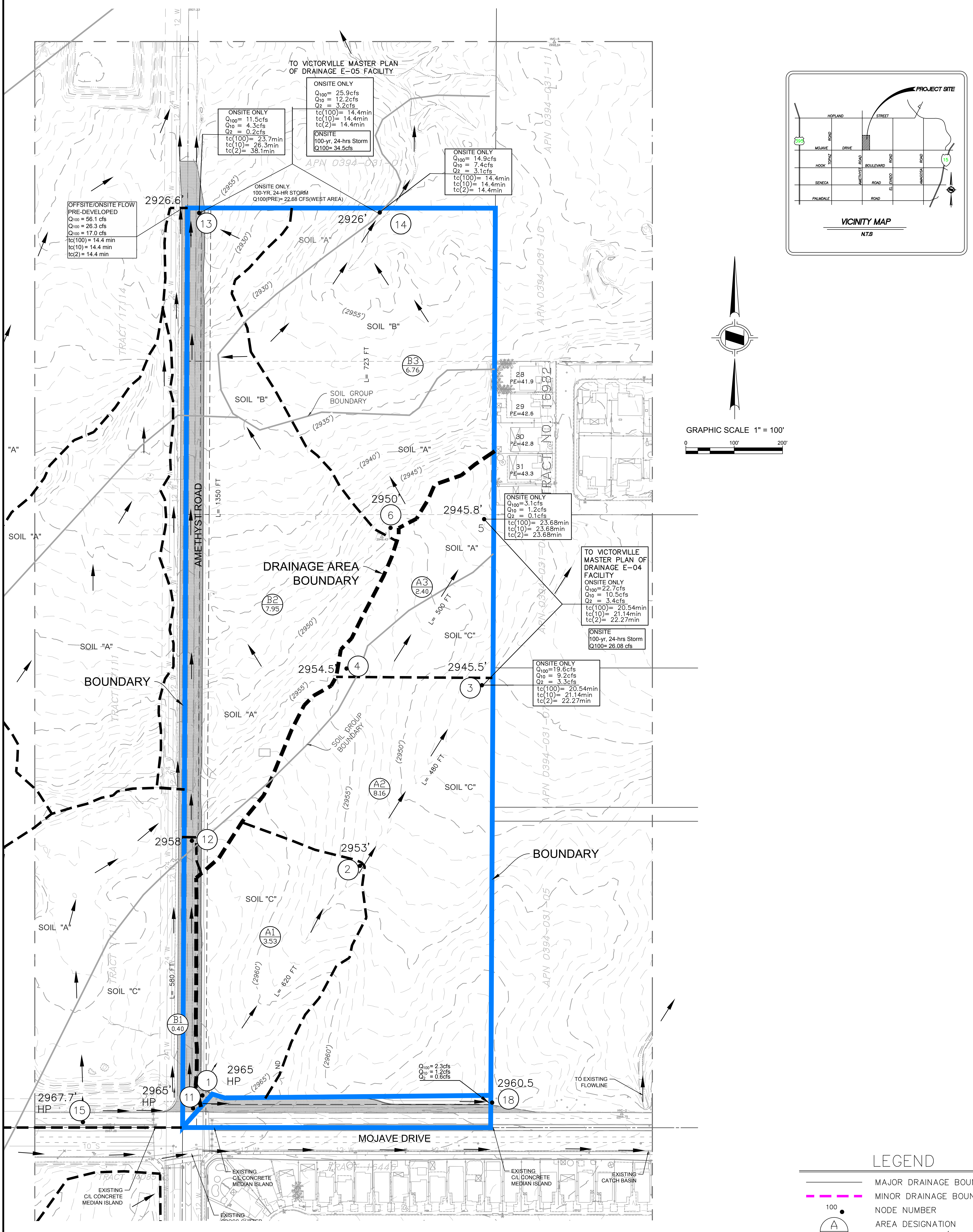
PLOT STYLE: NCS US Standard.stb PROJECT LOCATION & NAME: V:\plans\TR. 17839 Michelson\Engineering\Drainage\ACAD\20525(17839)_Offsite_Onsite Predeveloped Drainage Map_12-20-22.dwg PLOT TIME: Tuesday, December 20, 2022 3:50:10 PM LAYOUT: OFFSITE-ONSITE

IN THE CITY OF VICTORVILLE,
COUNTY OF SAN BERNARDINO, CALIFORNIA

TENTATIVE TRACT MAP No. 20525

PRE-DEVELOPED DRAINAGE MAP

December 20, 2022



LEGEND

—	MAJOR DRAINAGE BOUNDARY
- - -	MINOR DRAINAGE BOUNDARY
100 ●	NODE NUMBER
A 1.0	AREA DESIGNATION AREA ACREAGE (IN ACRES)
Q_{100}=8.0cfs t=15.0	PEAK FLOW RATE TIME OF CONCENTRATION
—	SOIL GROUP BOUNDARY
—	ONSITE DRAINAGE BOUNDARY
←	INDICATES DIRECTION OF FLOW
L= 620 FT	INDICATES RUN-OFF TRAVEL LENGTH

PLOT DATE: December 20, 2022

REV.	DESCRIPTION	DATE	BY

JEFFREY MARTIN ASHBAKER
No. 91606
CIVIL

Ludwig Engineering
ASSOCIATES, INC.
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CITY OF VICTORVILLE
TR 20525
DRAINAGE MAP

CLIENT:
THREE ARCH INVESTMENT CORP.1
17802 LAKESIDE HAVEN DRIVE, CYPRESS, TEXAS 77433

DESIGNED BY:	DRAWN BY:	CHECKED BY:
BW	LC	JA

SCALE
1" = 100'

SHEET
1
OF
2

D-1

PLOT STYLE: NCS US Standard.stb PROJECT LOCATION & NAME: V:\plans\TR. 17839 Michelson\Engineering\Drainage\ACAD\20525(17839)_Offsite_Onsite Predeveloped Drainage Map_12-20-22.dwg PLOT TIME: Tuesday, December 20, 2022 3:51:46 PM LAYOUT: PRE

IN THE CITY OF VICTORVILLE,
COUNTY OF SAN BERNARDINO, CALIFORNIA

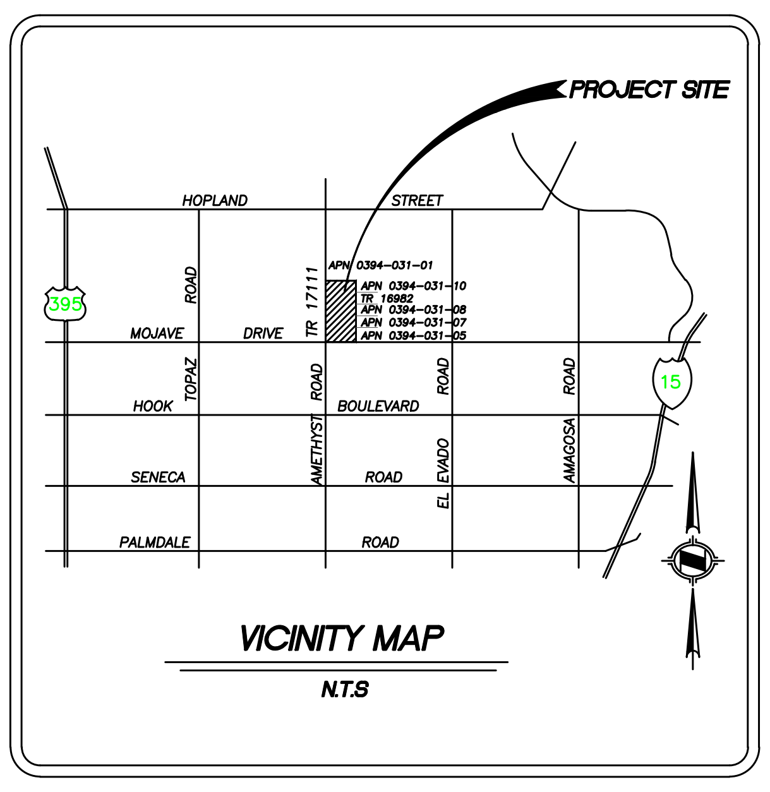
POST DEVELOPED DRAINAGE MAP

TENTATIVE TRACT MAP No. 20525

December 20, 2022

LEGEND

━━━	MAJOR DRAINAGE BOUNDARY
━ ━ ━	MINOR DRAINAGE BOUNDARY
100 ●	NODE NUMBER
Ⓐ 1.0	AREA DESIGNATION AREA ACREAGE (IN ACRES)
Q_{100}=8.0cfs t=15.0	PEAK FLOW RATE TIME OF CONCENTRATION
───	SOIL GROUP BOUNDARY
━━━	ONSITE DRAINAGE BOUNDARY
←	INDICATES DIRECTION OF ONSITE FLOW
→	INDICATES DIRECTION OF OFFSITE FLOW
L= 620 FT	INDICATES RUN-OFF TRAVEL LENGTH



GRAPHIC SCALE 1" = 100'

0 100' 200'

WQMP/DETENTION BASIN - STAGE STORAGE TABLE						
ELEV	AREA (sq. ft.)	DEPT H (ft)	AVG END INC. VOL. (cu. ft.)	AVG END TOTAL VOL. (cu. ft.)	AVG END INC. VOL. (ac. ft.)	AVG END TOTAL VOL. (ac. ft.)
2924.3	8,148.46	N/A	N/A	0.00	N/A	0.00
2925.3	9,685.74	1.000	8917.10	8917.10	0.205	0.205
2926.3	11,296.90	1.000	10491.32	19408.42	0.241	0.446
2927.3	12,977.94	1.000	12137.42	31545.84	0.279	0.724
2928.3	14,732.49	1.000	13855.21	45401.05	0.318	1.042
2929.3	16,559.08	1.000	15645.78	61046.83	0.359	1.401
2930.3	18,452.73	1.000	17505.91	78552.74	0.402	1.803

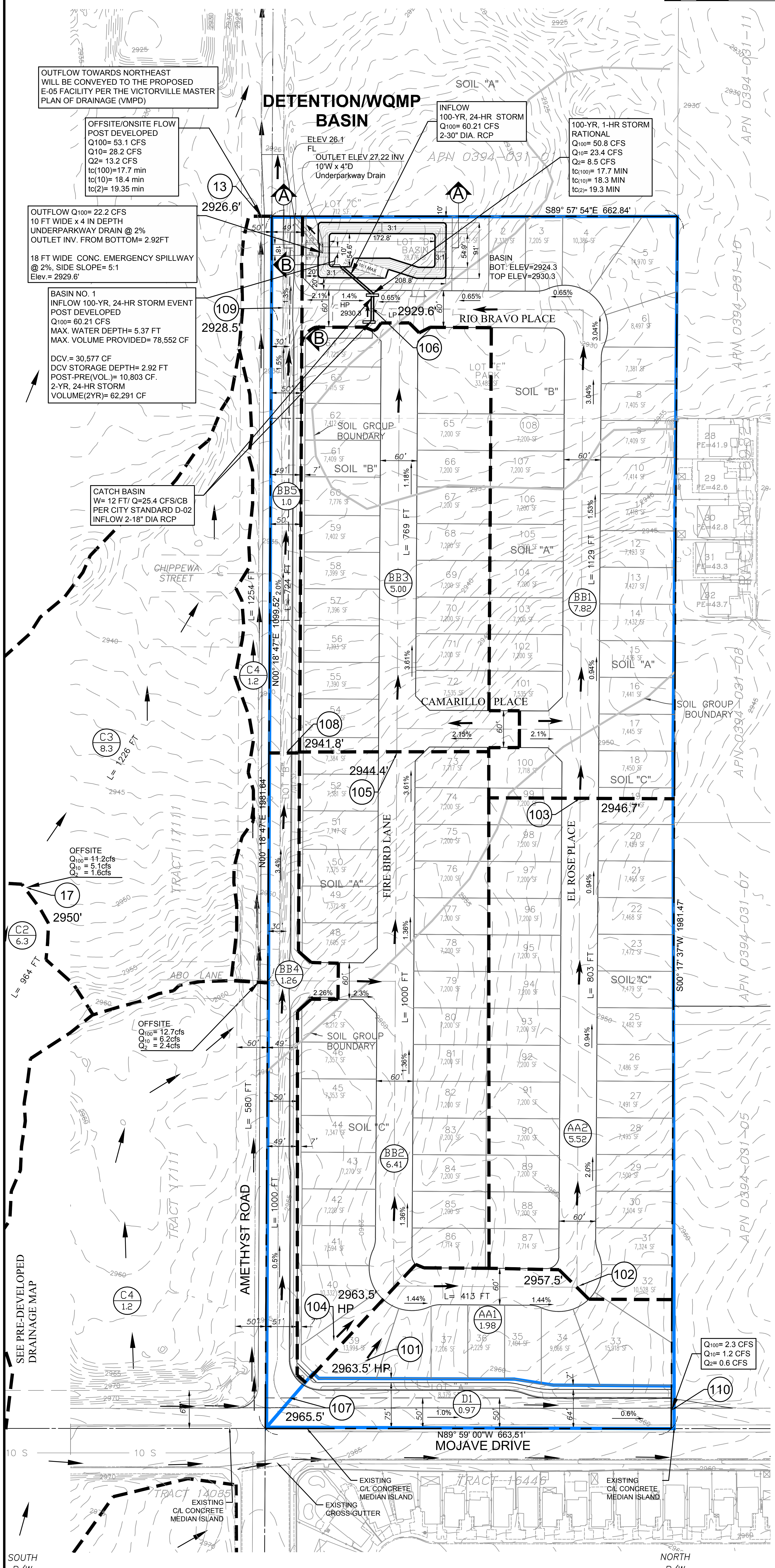
DA - 1 (BASIN No.1) AREA= 1,262,804.40 SF

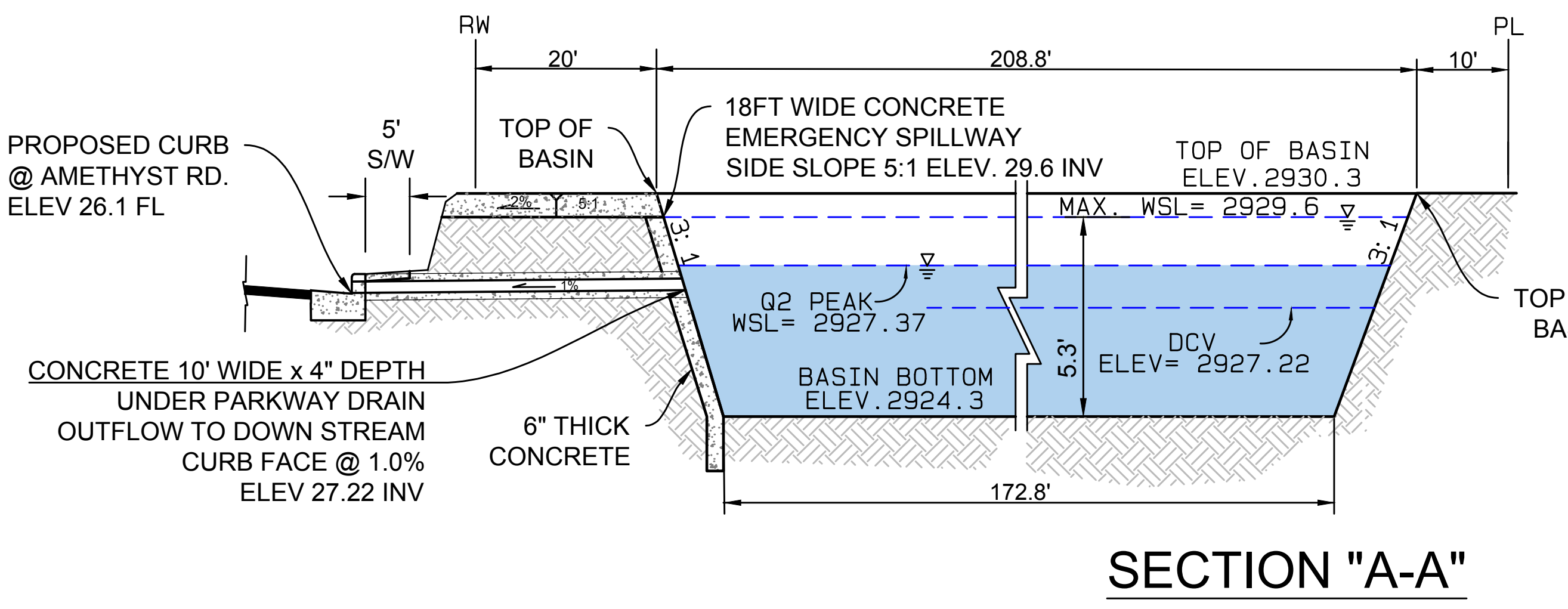
IMP. = 48.18%
IMPERVIOUS:
BLDG: 108 x 2400 = 259,200 SF
DRIVEWAY: 108 x 384 = 41,472 SF
PAVE ROAD,
SIDEWALK, C & G: 307,789 SF
TOTAL IMP.= 608,461 SF
PERVIOUS:
LANDSCAPE: 654,343.4 SF

DCV= 30,577 CU.FT.

HYDROLOGY SUMMARY TABLE - ONSITE						
NODAL POINT	SUBAREA	AREA(AC)	Q10 (CFS)	TC (MIN)	Q100 (CFS)	TC (MIN)
101-102	AA1	1.98	3.1	10.7	5.8	10.7
102-103	AA2	5.52	8.5	15.9	16.9	15.1
103-106	BB1	7.82	11.6	21.9	26.1	20.1
103-106	AA1,AA2,BB1	15.32	7.3	14.4	14.4	14.4
104-105	BB2	6.41	7.3	14.4	14.4	14.4
105-106	BB3	5.00	9.7	18.4	21.0	17.7
105-106	BB2,BB3	11.41	1.5	13.8	2.9	13.8
107-108	BB4	1.26	1.5	13.8	2.9	13.8
108-106	BB5	1.0	2.0	19.2	4.2	18.4
106-106		28.99	23.4	18.3	50.8	17.7
106-13	BASIN	12.2	14.4	17.0	22.2	17.7
16-17	C2	6.3	5.1	17.5	11.2	17.5
17-13	C3	8.3	7.7	24.6	20.2	23.0
17-13	C2,C3	14.6	7.7	24.6	20.2	23.0
15-12	C1	6.6	5.1	18.4	11.2	18.4
12-13	C4	1.2	5.1	22.9	11.2	22.1
12-13	C1,C4	7.8	5.1	22.9	11.2	22.1
13-13		51.39	28.2	18.4	53.1	14.4

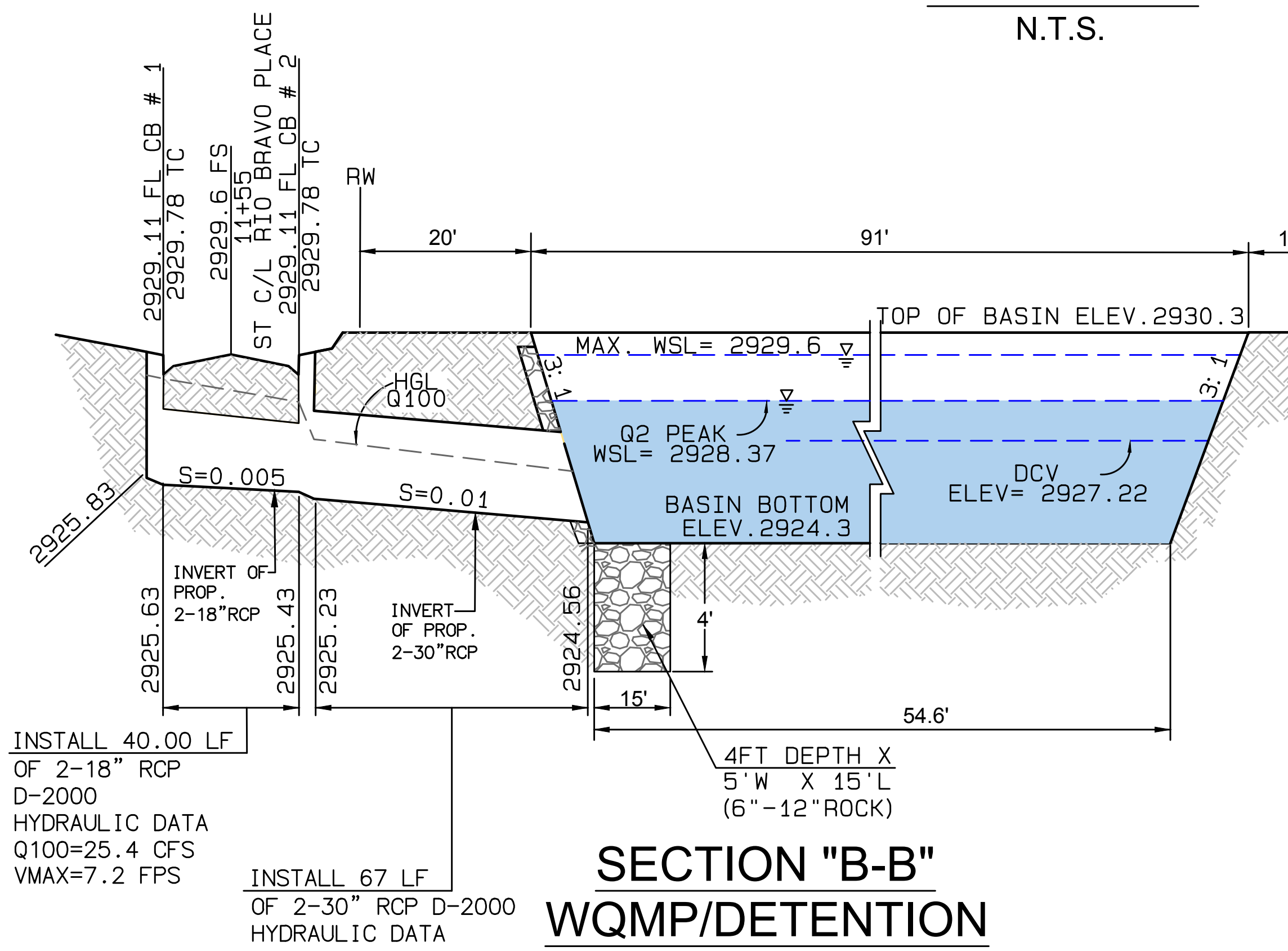
HYDROLOGY SUMMARY TABLE - ONSITE						
NODAL POINT	SUBAREA	AREA(AC)	Q10 (CFS)	TC (MIN)	Q100 (CFS)	TC (MIN)
107-110	D1	0.97	1.2	14.5	2.3	14.5





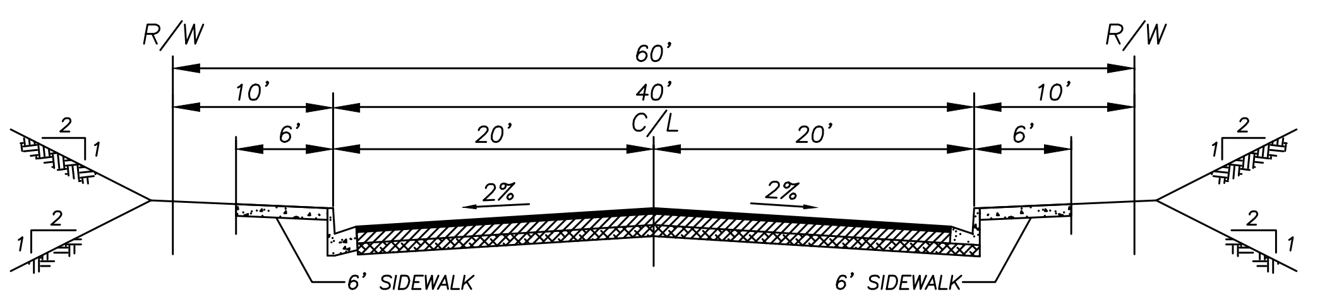
SECTION "A-A"
WQMP/DETENTION
BASIN No. 1

N.T.S.



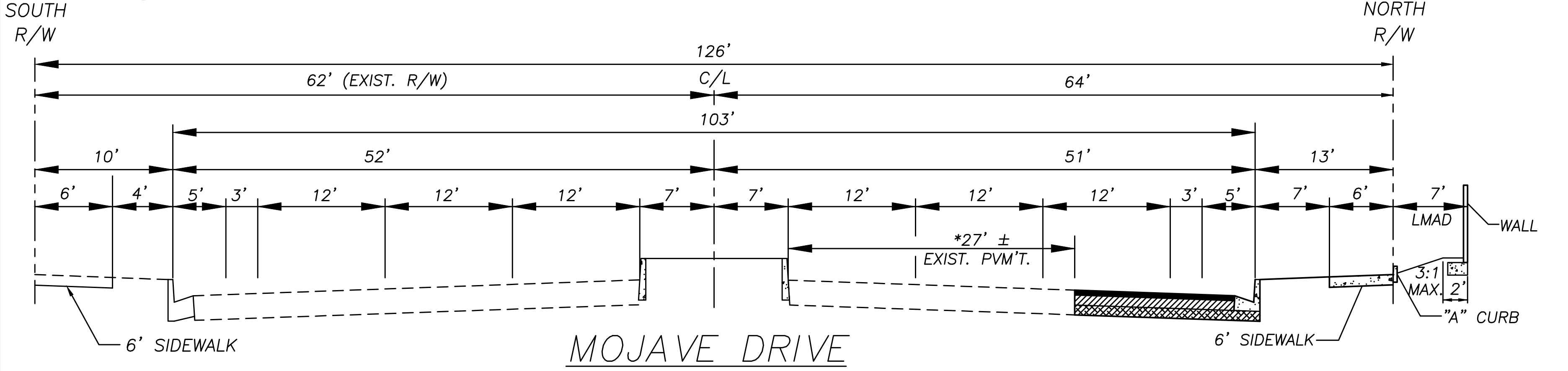
SECTION "B-B"
WQMP/DETENTION
BASIN No. 1

N.T.S.

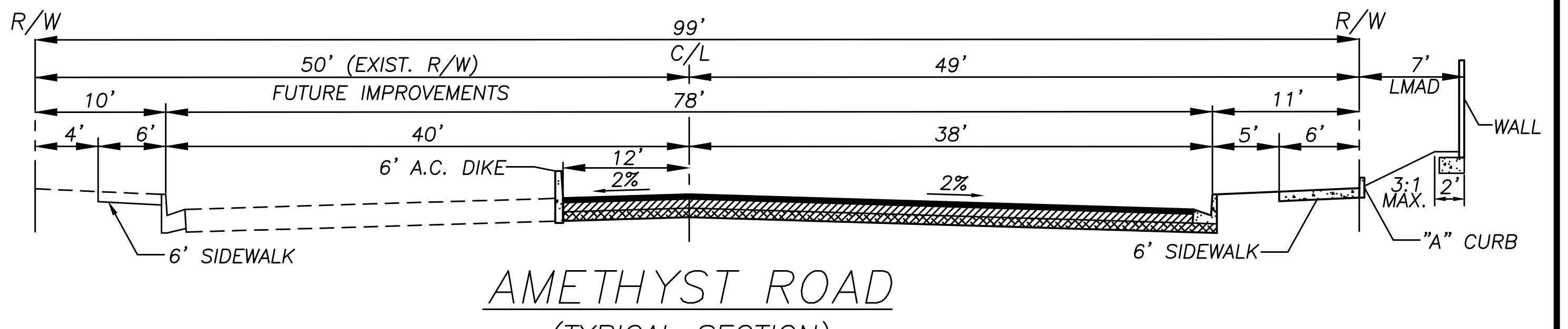


ABO LANE EAST, RIO BRAVO PLACE, FIRE BIRD LANE
ABIENTO STREET, CAMARILLO PLACE & EL ROSE PLACE

(PUBLIC)
NTS



MOJAVE DRIVE
(TYPICAL SECTION)
NTS



AMETHYST ROAD
(TYPICAL SECTION)
NTS

PLOT DATE: December 20, 2022

JEFFREY MARTIN ASHBAKER
No. 91606

REV.	DESCRIPTION	DATE	BY

Ludwig Engineering
ASSOCIATES, INC.
Civil Engineering • Surveying • Planning

109 East Third Street
San Bernardino, CA 92410
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CITY OF VICTORVILLE
TR 20525
DRAINAGE MAP

CLIENT:
THREE ARCH INVESTMENT CORP.1
17802 LAKESIDE HAVEN DRIVE, CYPRESS, TEXAS 77433

DESIGNED BY:	DRAWN BY:	CHECKED BY:
BW	LC	JA

SCALE 1" = 100'

SHEET 2 OF 2

D-1

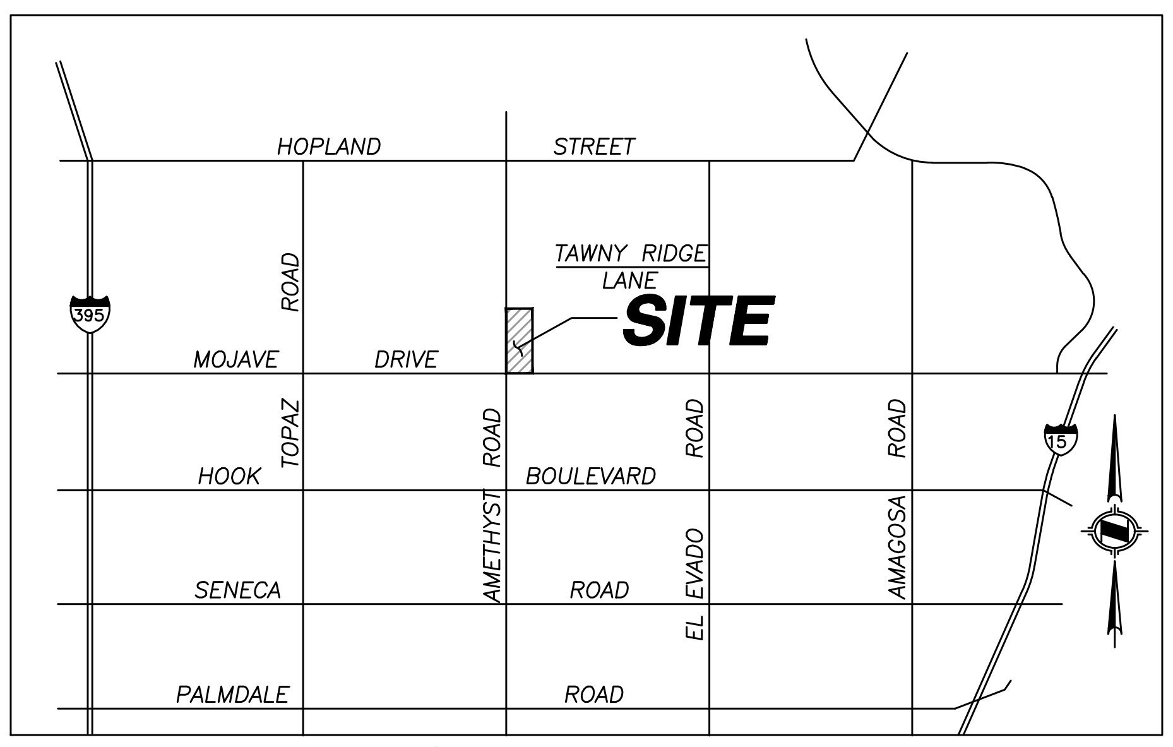
PLOT STYLE: NCS US Standard.stb PROJECT LOCATION & NAME: V:\plans\TR 17839 Michelson\Engineering\Drainage\ACAD\20525(17839)_Postdeveloped Drainage Map_12-20-22.dwg PLOT TIME: Tuesday, December 20, 2022 3:42:23 PM LAYOUT: POST

IN THE CITY OF VICTORVILLE,
COUNTY OF SAN BERNARDINO, CALIFORNIA

TENTATIVE TRACT MAP
No. 20525

BEING THE WEST HALF OF THE WEST HALF OF THE SOUTHWEST QUARTER OF SECTION 12, TOWNSHIP 5 NORTH, RANGE 5 WEST, S.B.M., IN THE COUNTY OF SAN BERNARDINO, STATE OF CALIFORNIA ACCORDING TO THE OFFICIAL PLAT THEREOF. EXCEPTING THE NORTHWEST ONE–QUARTER OF THE NORTHWEST ONE–QUARTER OF THE SOUTHWEST ONE–QUARTER OF SAID SECTION 12.

LUDWIG ENGINEERING   DECEMBER 2022



VICINITY MAP

PROJECT SUMMARY

1. GROSS ACREAGE: 30.1 ACRES
2. NET ACREAGE: 20.87 ACRES
3. PROPOSED DENSITY: 3.85 DU/AC
4. MINIMUM LOT AREA: 7,200 S.F.
5. AVERAGE LOT AREA: 7,692 S.F.
6. MINIMUM LOT DIMENSION FOR INTERIOR LOT: 60'x120'
7. MINIMUM LOT DIMENSION FOR CORNER LOT: 65'x120'

LAND USE SUMMARY

LOT No.	LAND USE	AREAS
A, B, C, D & E	LETTER LOTS (LMAD, PARK & BASIN)	1.80 ACRES
1–108	SINGLE FAMILY RESIDENTIAL LOTS	19.07 ACRES
ROADS	ROADS	9.23 ACRES
TOTAL		30.1 ACRES

EASEMENTS

Ⓐ REFERS TO AN EASEMENT IN FAVOR OF IAN FREEBAIRN–SMITH FOR ROAD AND INCIDENTAL PURPOSES RECORDED DECEMBER 13, 1967 IN BOOK 6940, PAGE 679 OF OFFICIAL RECORDS.

Ⓑ REFERS TO AN EASEMENT IN FAVOR OF THE CITY OF VICTORVILLE FOR PUBLIC ROAD, HIGHWAY AND INCIDENTAL PURPOSES RECORDED FEBRUARY 05, 1992 AS INSTRUMENT NO. 92–041866 OF OFFICIAL RECORDS.

Ⓒ REFERS TO AN OFFER OF DEDICATION OF THE CITY OF VICTORVILLE FOR STREETS, HIGHWAYS, SEWER, DRAINAGE, PUBLIC UTILITIES AND INCIDENTAL PURPOSES RECORDED MAY 01, 1989 AS INSTRUMENT NO. 89–154377 OF OFFICIAL RECORDS.

Ⓓ REFERS TO AN EASEMENT IN FAVOR OF GEMINI MANAGEMENT COMPANY FOR ROAD AND INCIDENTAL PURPOSES RECORDED DECEMBER 13, 1967 IN BOOK 7120, PAGE 464 OF OFFICIAL RECORDS.

Ⓔ REFERS TO AN OFFER OF DEDICATION OF THE CITY OF VICTORVILLE FOR HIGHWAY, ROAD AND INCIDENTAL PURPOSES RECORDED OCTOBER 29, 1986 AS INSTRUMENT NO. 86–319270 OF OFFICIAL RECORDS.

Ⓕ REFERS TO AN EASEMENT IN FAVOR OF THE CITY OF VICTORVILLE FOR PUBLIC ROAD, HIGHWAY AND INCIDENTAL PURPOSES RECORDED MARCH 24, 1992 AS INSTRUMENT NO. 92–125359 OF OFFICIAL RECORDS.

NOTES

1. AP MAP NOS. 0394–031–02, 0394–031–03 & 0394–031–04
2. EXISTING LAND USE: VACANT
3. PROPOSED LAND USE: RESIDENTIAL
4. EXISTING GENERAL PLAN: LOW DENSITY RESIDENTIAL
5. EXISTING ZONING: R–1T (4) SINGLE FAMILY TRANSITIONAL
6. PROPOSED ZONING: R–1T (4) SINGLE FAMILY TRANSITIONAL
7. STREETS: PUBLIC
8. LOTS 1–109. ARE SINGLE FAMILY RESIDENTIAL, LOTS D & E ARE BASIN & PARK
9. TOTAL LOTS: 109 NUMBERED LOTS AND 5 LETTERED LOTS
10. SCHOOL DISTRICTS: VICTOR ELEMENTARY SCHOOL DISTRICT AND VICTOR VALLEY UNION HIGH SCHOOL DISTRICT
11. THOMAS BROTHERS REFERENCE, SAN BERNARDINO 2005: PAGE 4295, G5 & G6
12. SETBACKS: FRONT YARD = 20'; SIDE YARD = 5'; STREET SIDE YARD = 10; REAR YARD = 20'
13. A 7 FOOT WIDE LMAD WILL BE DEDICATED ALONG AMETHYST ROAD AND MOJAVE DRIVE.

DATE 12–14–22
W.O. MI–0508
GROSS AREA 30.1 AC. +/–
CONTOUR INTERVAL 1'
TOTAL LOTS 108 NUMBERED, 5 LETTER

UTILITIES

WATER	CITY OF VICTORVILLE	(760) 245–6424
SEWER	CITY OF VICTORVILLE	(760) 955–5087
GAS	SOUTHWEST GAS CORPORATION	(760) 241–9321
ELECTRIC	SOUTHERN CALIFORNIA EDISON COMPANY	(800) 655–4555
TELEPHONE	VERIZON CALIFORNIA, INC.	(800) 483–5000
CABLE T.V.	CHARTER COMMUNICATION	(760) 241–7848

BENCHMARK

CITY OF VICTORVILLE B.M., V–214

BEING A 3" BRASS CAP IN SOUTH TOP OF CURB AT INTERSECTION OF MOJAVE DRIVE AND AMETHYST ROAD @ 2 FEET WEST OF SOUTHWEST BCR

ELEVATION: 2967.28

PREPARED FOR:

THREE ARCH INVESTMENT CORP.1
17802 LAKESIDE HAVEN DRIVE
CYPRESS, TEXAS, 77433
DAVID MICHELSON: (949)322–6983

PROPERTY OWNER:

1. *APN. 0394–031–02,03,04*
   MOJAVE AMETHYST 40, L.P.
   17802 LAKESIDE HAVEN DRIVE
   CYPRESS, TX 77433

DATE

JEFFREY MARTIN ASHBAKER, P.E. 91606

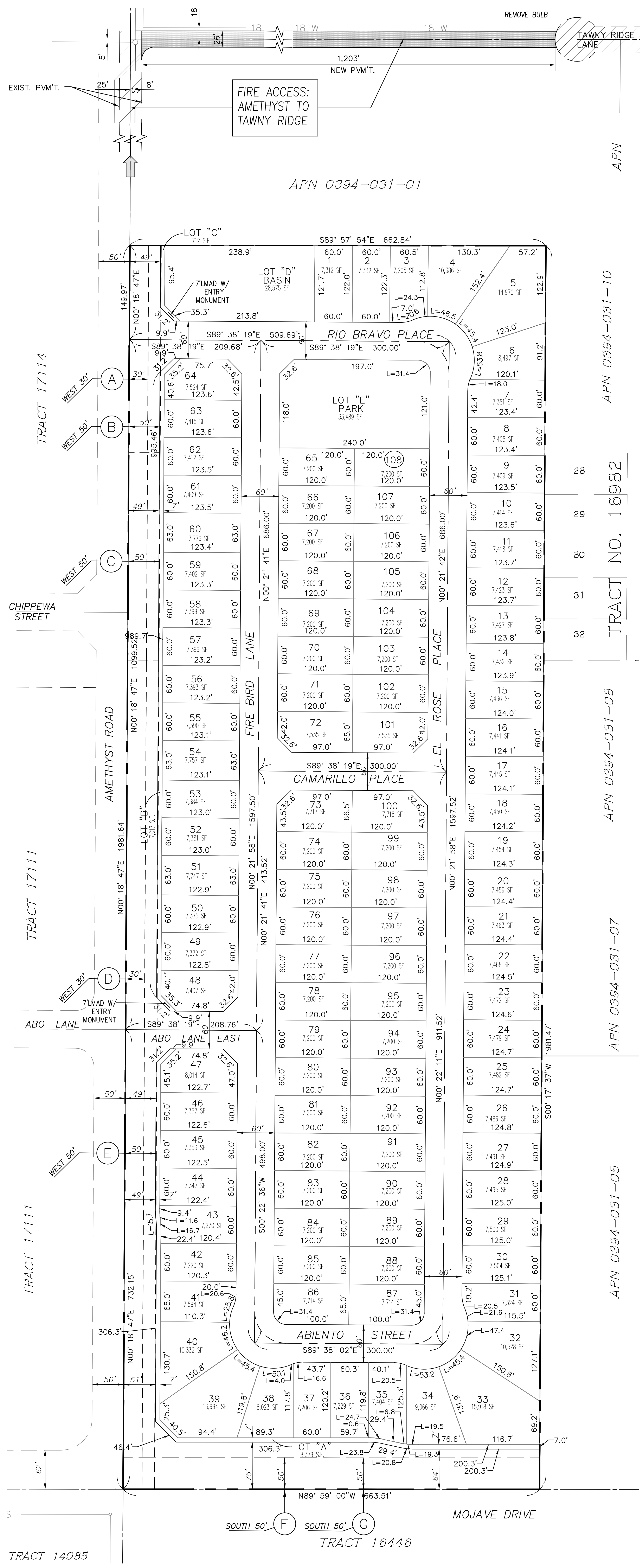
REGISTERED PROFESSIONAL ENGINEER
JEFFREY MARTIN ASHBAKER
No. 91606
CIVIL
STATE OF CALIFORNIA

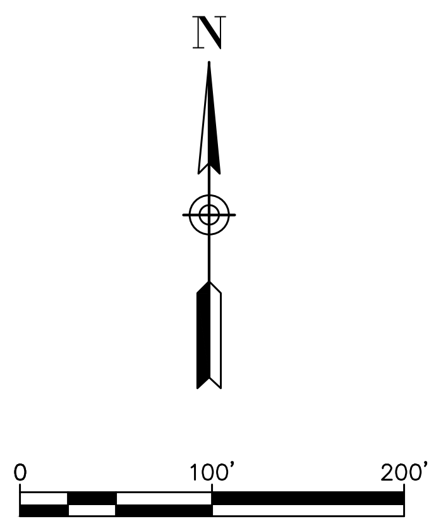
LOT SUMMARY TABLE

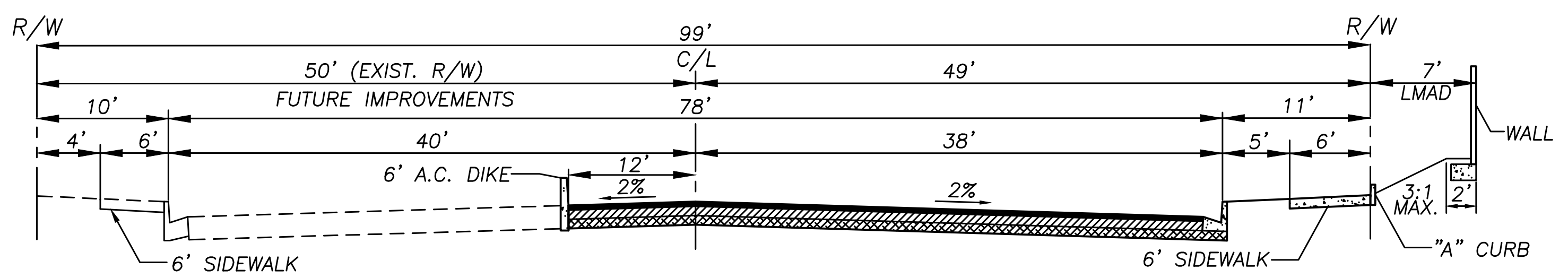
AREAS
(7,200 S.F. MIN)

LOT NO.	GROSS SQ.FT	LOT NO.	GROSS SQ.FT	LOT NO.	GROSS SQ.FT	LOT NO.	GROSS SQ.FT
1	7,312	31	7,324	61	7,409	91	7,200
2	7,332	32	10,528	62	7,412	92	7,200
3	7,205	33	15,918	63	7,415	93	7,200
4	10,386	34	9,066	64	7,524	94	7,200
5	14,970	35	7,404	65	7,200	95	7,200
6	8,497	36	7,229	66	7,200	96	7,200
7	7,381	37	7,206	67	7,200	97	7,200
8	7,405	38	8,023	68	7,200	98	7,200
9	7,409	39	13,994	69	7,200	99	7,200
10	7,414	40	10,332	70	7,200	100	7,718
11	7,418	41	7,594	71	7,200	101	7,535
12	7,423	42	7,220	72	7,535	102	7,200
13	7,427	43	7,270	73	7,717	103	7,200
14	7,432	44	7,347	74	7,200	104	7,200
15	7,436	45	7,353	75	7,200	105	7,200
16	7,441	46	7,357	76	7,200	106	7,200
17	7,445	47	8,014	77	7,200	107	7,200
18	7,450	48	7,407	78	7,200	108	7,200
19	7,454	49	7,372	79	7,200	–	–
20	7,459	50	7,375	80	7,200	–	–
21	7,463	51	7,747	81	7,200	–	–
22	7,468	52	7,381	82	7,200	–	–
23	7,472	53	7,384	83	7,200	–	–
24	7,479	54	7,757	84	7,200	–	–
25	7,482	55	7,390	85	7,200	LETTER LOTS	
26	7,486	56	7,393	86	7,714	"A"	8,576
27	7,491	57	7,396	87	7,714	"B"	7,413
28	7,495	58	7,399	88	7,200	"C"	910
29	7,500	59	7,402	89	7,200	"D"	28,578
30	7,504	60	7,776	90	7,200	"E"	33,489

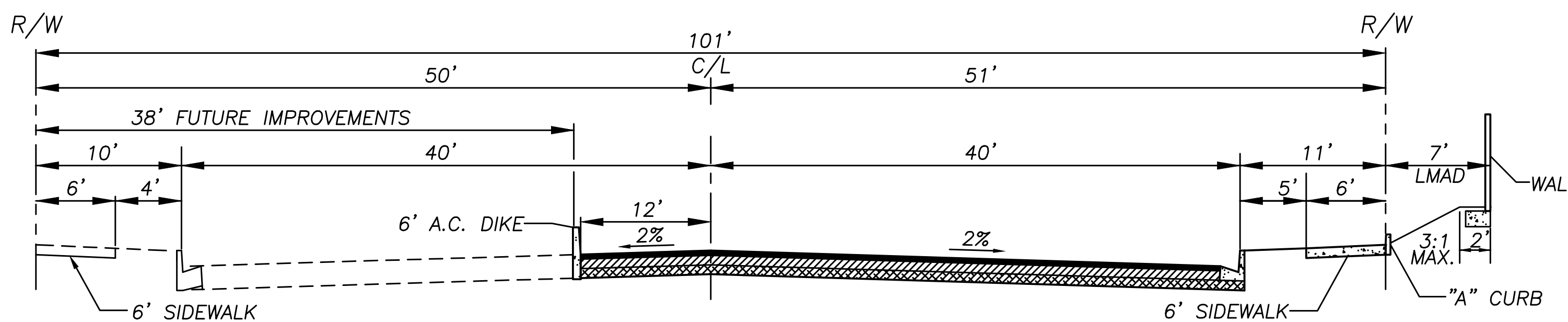
LOTS – 108	830,188 S.F.
LETTER LOTS – 5	78,966 S.F.
TOTAL LOTS – 113	908,956 S.F.
TOTAL	20.87 Acres
AVERAGE – RESIDENTIAL LOTS	7,692 S.F.



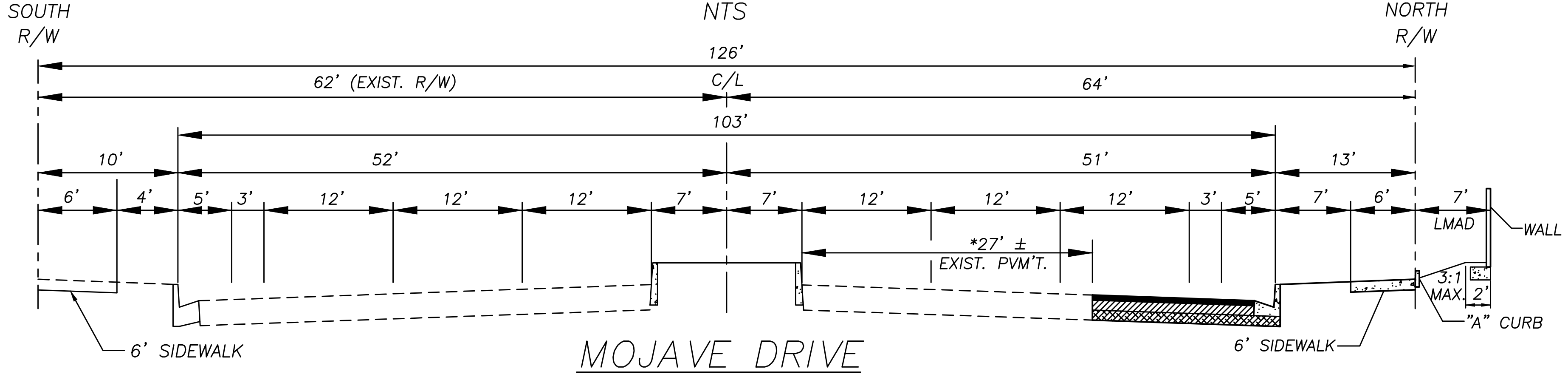




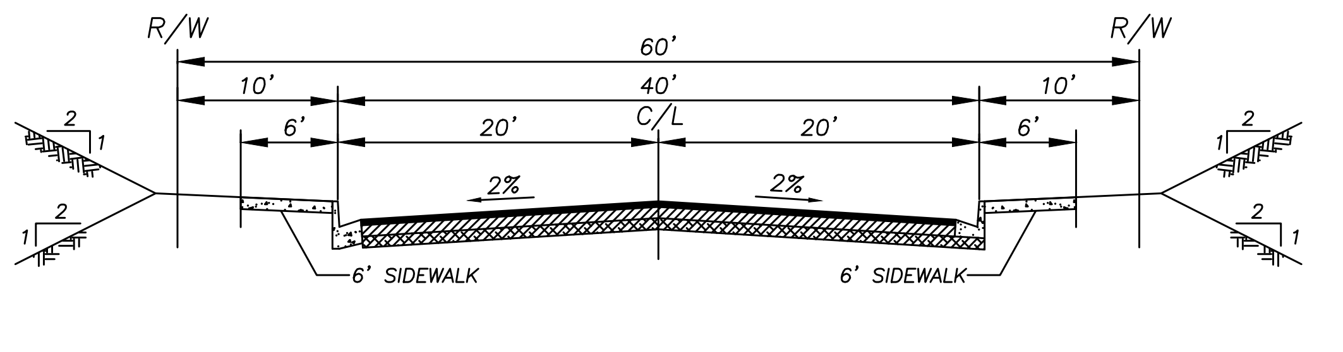
AMETHYST ROAD
(TYPICAL SECTION)
NTS



AMETHYST ROAD
(TRANSITION AT INTERSECTION)
NTS

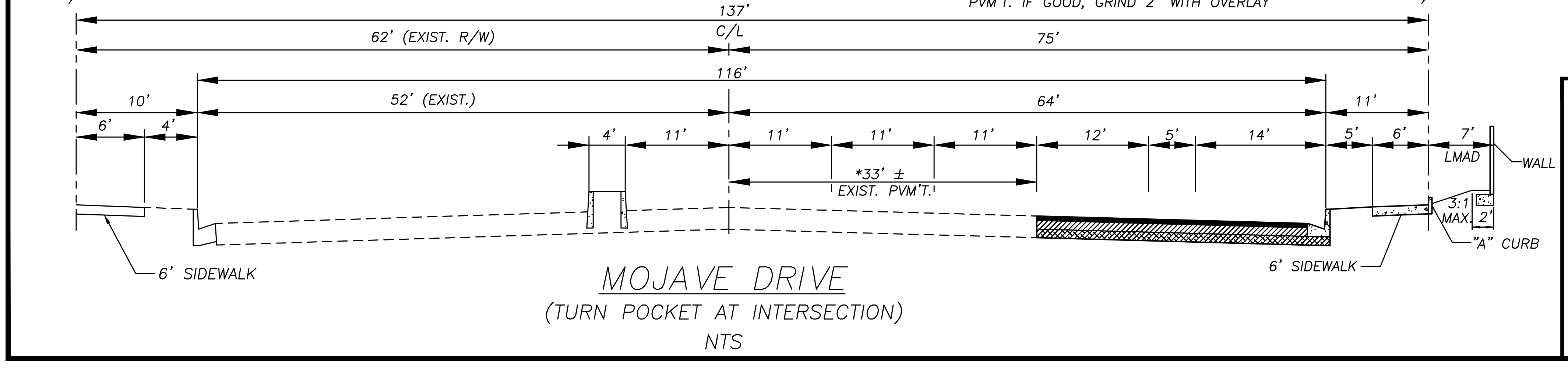


MOJAVE DRIVE
(TYPICAL SECTION)
NTS



ABO LANE EAST, RIO BRAVO PLACE, FIRE BIRD LANE
ABIENTO STREET, CAMARILLO PLACE & EL ROSE PLACE
(PUBLIC)
NTS

*MOJAVE DRIVE PAVING – EXIST. PVM'T. (N.SIDE) TO BE MIN. 7" A.C. OVER 10" CAB. IF NOT AT MIN., R&R EXIST. PVM'T. IF GOOD, GRIND 2" WITH OVERLAY



MOJAVE DRIVE
(TURN POCKET AT INTERSECTION)
NTS

Ludwig Engineering
ASSOCIATES, INC.
Civil Engineering • Surveying • Planning

109 East Third Street
San Bernardino, CA 92410
Phone: 909-884-8217
Fax: 909-889-0153

5890 Hwy. 95, Ste. B
Fort Mohave, AZ 88426
Phone: 928-768-1857
Fax: 928-768-7086

15252 Seneca Rd.
Victorville, CA 92392
Phone: 760-951-7676
Fax: 760-241-0573

2126 McCulloch Blvd., Ste. 8
Lake Havasu City, AZ 86403
Phone: 928-680-6060
Fax: 928-854-6530

AMETHYST ROAD AND
MOJAVE DRIVE

BOUNDARY & LOTTING
TTM NO. 20525

DATE: AUGUST 2022

SHEET 1 OF 3

PROJECT NUMBER
MI-0508


PROJECT SITE
TR. 20525
Amethyst Rd.
Mojave Rd.
ONLY
ONLY
Mojave Dr
ROAD CLOSED


Amethyst Rd.
PROJECT SITE
TR 20525
Mojave Dr.

TR 20525

Looking Westerly @ corner of Old Mill Ln & Valley High Ln

SECTION **6.2**

Attachment 2 - Electronic Data Submittal

This is a digital submittal. A separate electronic copy will not be provided.

WQMP Project Report

County of San Bernardino Stormwater Program

Santa Ana River Watershed Geodatabase

Tuesday, October 26, 2021

Note: The information provided in this report and on the Stormwater Geodatabase for the County of San Bernardino Stormwater Program is intended to provide basic guidance in the preparation of the applicant's Water Quality Management Plan (WQMP) and should not be relied upon without independent verification.

Project Site Parcel Number(s):	039403104, 039403101, 039403103, 039403102
Project Site Acreage:	37.465
HCOC Exempt Area:	No
Closest Receiving Waters: (Applicant to verify based on local drainage facilities and topography.)	**System Number** - **Facility Name** - El Evado Channel **Owner** - OTHERS
Closest channel segment's susceptibility to Hydromodification:	EHM
Highest downstream hydromodification susceptibility:	NULL
Is this drainage segment subject to TMDLs?	No
Are there downstream drainage segments subject to TMDLs?	No
Is this drainage segment a 303d listed stream?	No
Are there 303d listed streams downstream?	No
Are there unlined downstream waterbodies?	No
Project Site Onsite Soil Group(s):	A, B
Environmentally Sensitive Areas within 200':	DESERT TORTOISE HABITAT CAT 3,MOJAVE GROUND SQUIRREL
Groundwater Depth (FT):	No data available
Parcels with potential septic tanks within 1000':	No
Known Groundwater Contamination Plumes within 1000':	No
Studies and Reports Related to Project Site:	

Worksheet H: Factor of Safety and Design Infiltration Rate and Worksheet

Factor Category		Factor Description	Assigned Weight (w)	Factor Value (v)	Product (p) p = w x v
A	Suitability Assessment	Soil assessment methods	0.25	1.00	0.25
		Predominant soil texture	0.25	1.00	0.25
		Site soil variability	0.25	1.00	0.25
		Depth to groundwater / impervious layer	0.25	1.00	0.25
		Suitability Assessment Safety Factor, $S_A = \Sigma p$			1.00
B	Design	Tributary area size	0.25	3.00	0.75
		Level of pretreatment/ expected sediment loads	0.25	2.00	0.50
		Redundancy	0.25	2.00	0.50
		Compaction during construction	0.25	1.00	0.25
		Design Safety Factor, $S_B = \Sigma p$			2.00

Combined Safety Factor, $S_{Total} = S_A \times S_B$	2.00
Observed Infiltration Rate, inch/hr, $K_{observed}$ (corrected for test-specific bias)	3.73
Design Infiltration Rate, in/hr, $K_{DESIGN} = K_{Observed} / S_{Total}$	1.87

Supporting Data

Briefly describe infiltration test and provide reference to test forms: For BMP-1 Infiltration Test Done Hilltop Geotechnical, Inc.

Testing was performed in general accordance with the most current Technical Guidance Document Appendices for infiltration rate evaluation protocol. An 8” diameter bore hole was drilled using a hollow stem truck-mounted auger on March 18, 2022. The test location was shown on Plate No. 1. The bottom of the bore hole was chosen to represent the proposed basin bottom elevation of the infiltration surface. The bottom of the bore hole was converted into test hole by filling with 2 inches of gravel before placing a 3” sleeved PVC perforated pipe. The test hole was pre-soaked by filling the hole with clear water from a 250-gallon water tank and observed while the water infiltrated the surface. The water was allowed to drop and recorded for approximately 25 minutes for 2 readings. After the two 25-minute readings, it was determined the sandy soil test procedures would follow due to the water level change exceeding 6 inches in both 25-minute readings. Therefore, testing was performed for a minimum of one hour. Readings were taken in 10-minute intervals. The water level and depth of boring were read after each reading with the tape measure from the outside of the casing at a fixed location, then recorded on the percolation data sheet.

Three additional bore hole tests were conducted on **October 28, 2022** since the grading plan was revised for infiltration basin. Three 6-inch diameter bore holes were drilled using a hand auger to 8 to 10 feet below the existing grade at the selected areas, which were approximately depths to the bottom of the proposed infiltration basin. The bottom of the bore hole was converted into test hole by filling with 2 inches of gravel before placing a 3” sleeved PVC perforated pipe. The test hole was pre-soaked by filling the hole with clear water from a 250-gallon water tank and observed while the water infiltrated the surface. The water was allowed to drop and recorded for approximately 25 minutes for 2 readings. After the two 25-minute readings, it was determined the sandy soil test procedures would follow due to the water level change exceeding 6 inches in both 25-minute readings. Therefore, testing was performed for a minimum of one hour. Readings were taken in 10-minute intervals. The water level and depth of boring were read after each reading with a water level indicator from the outside of the casing at a fixed location, then recorded on the percolation data sheet.

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

DA-1

UPDATE REPORT OF INFILTRATION FEASIBILITY STUDY, TENTATIVE TRACT MAP NO. 20525, APN 0394-031-02, 03, 04
NORTHEAST CORNER OF MOJAVE DRIVE AND AMETHYST ROAD
CITY OF VICTORVILLE
SAN BERNARDINO COUNTY, CALIFORNIA

PROJECT NO.: 1448-01
REPORT NO.: 4

NOVEMBER 28, 2022

SUBMITTED TO:

MOJAVE AMETHYST 40, L.P.
17802 LAKESIDE HAVEN DRIVE
CYPRESS, TEXAS 77433

PREPARED BY:

HILLTOP GEOTECHNICAL, INC.
786 SOUTH GIFFORD AVENUE
SAN BERNARDINO, CA 92408

HILLTOP GEOTECHNICAL
INCORPORATED

786 S. GIFFORD AVENUE • SAN BERNARDINO • CA 92408
Phone **909-890-9079** • FAX 909-890-9055
hilltopg@hgeotech.com

November 28, 2022

Mojave Amethyst 40, L.P.
17802 Lakeside Haven Drive
Cypress, Texas 77433

Project No.:1448-01
Report No.: 4

Attention: Mr. David Michelson

Subject: **Update Report of Infiltration Feasibility Study, Tentative Tract Map No. 20525, APN 0394-031-02, 03, 04, Northeast Corner of Mojave Drive and Amethyst Road, City of Victorville, San Bernardino County, California.**

References:

1. **Ludwig Engineering Associates, Inc.**, January 2022, *Tentative Tract Map No. 20525, APN 0394-031-02, 03, 04,* Scale 1" = 100'.

2. **San Bernardino County**, May 19, 2011, *Technical Guidance Document Appendices, Appendix VII, Infiltration Rate Evaluation Protocol and Factor of Safety Recommendations*, VII-1 through VII-36.

3. **Hilltop Geotechnical, Inc.**, April 21, 2022, *Report of Preliminary Geotechnical / Geologic Study, Tentative Tract Map No. 20525, APN 0394-031-02, 03, 04, Northeast Corner of Mojave Drive and Amethyst Road, City of Victorville, San Bernardino County, California.* Project No.: 1448-01, Report No.: 2.

4. **Hilltop Geotechnical, Inc.**, April 21, 2022, *Report of Infiltration Feasibility Study, Tentative Tract Map No. 20525, APN 0394-031-02, 03, 04, Northeast Corner of Mojave Drive and Amethyst Road, City of Victorville, San Bernardino County, California.* Project No.: 1448-01, Report No.: 3.

In accordance with your request, **Hilltop Geotechnical, Inc.** has performed infiltration tests on the proposed water catch basins on the southeastern and northwestern portion of the subject site in the City of Victorville, San Bernardino County, California. The findings and conclusions were presented in Referenced report No. 4. This update report was revised from Referenced report No. 4 in response to the review comments issued from the City of Victorville consulting company.

The findings of this study indicate that the tested area is suitable for the proposed infiltration basins provided the recommendations presented in the attached report are incorporated into design of the project and implemented during construction of the project.

We appreciate the opportunity to provide geotechnical services on this project. Should you have any questions regarding this submittal, please do not hesitate to contact us.

Respectfully submitted,
HILLTOP GEOTECHNICAL, INC.

Shaofu Chen
C76834
CIVIL

Luis Gomez
Staff Geologist

S. Mack Chen, P.E C76834, C.E.G. 2688
Principal Engineer/Geologist

Distribution: (1) Addressee pdf copy via E-Mail
Mr. David Michelson (drmichelson48@gmail.com)

Shaofu Chen
2688

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APPENDIX A

Plate No. 1	Test Pit Locations and OWTS Layout
Plate No. 2	Subsurface Exploration Legend
Plate Nos. 3-7	Exploratory Trench Logs
Plate Nos. 8-17	Infiltration Test Results

UPDATE REPORT OF INFILTRATION FEASIBILITY STUDY,
TENTATIVE TRACT MAP NO. 20525, APN 0394-031-02, 03, 04
NORTHEAST CORNER OF
MOJAVE DRIVE AND AMETHYST ROAD
CITY OF VICTORVILLE
SAN BERNARDINO COUNTY, CALIFORNIA

1. INTRODUCTION

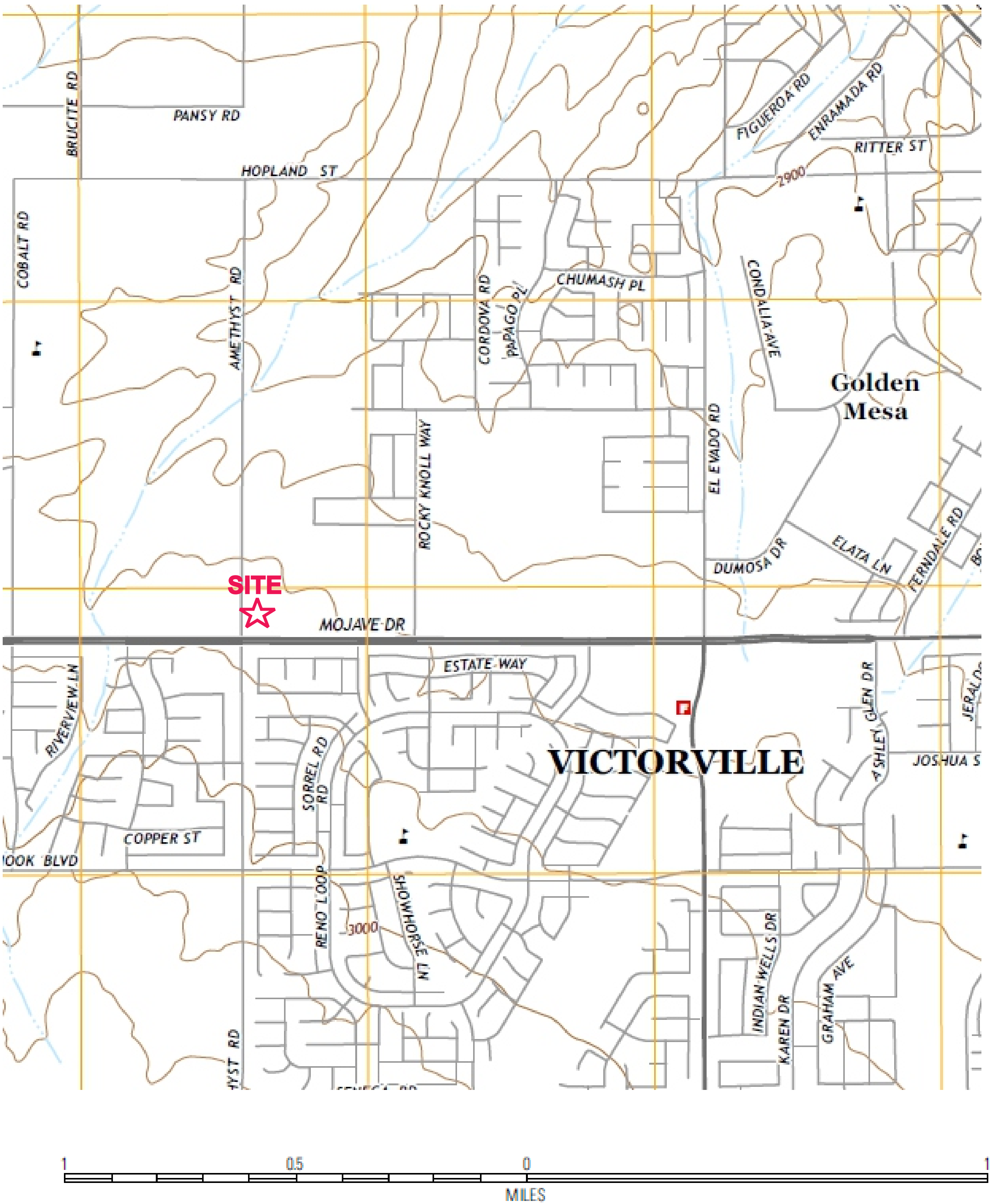
The subject site is located on the northeast corner of Mojave Drive and Amethyst Road in the City of Victorville, San Bernardino County, California. The general location of the subject site is indicated on the 'Site Location Map,' Figure No. 1. The subject site is proposed for a residential development consisting of approximately 108 single-family residences with connecting streets to main throughway (Amethyst Road) located to west of the parcel.

2. SITE DESCRIPTION

The subject property comprises approximately 27.2 acres and was approximately rectangular in shape. The subject property is bounded by an existing partial tract of residential buildings to the east along with vacant lots, a vacant lot to the north, Amethyst Road to the west, and by Mojave Drive to the south. The site was generally vacant with no structures. At the time of the field study, the site contained moderate vegetation of various sized Mojave Desert shrubs and weeds such as creosote bushes and cholla bushes. On-site drainage was accomplished by sheet flow toward the northwest and northeast.

3. LOCATIONS OF INFILTRATION TESTING

Infiltration testing was conducted in the locations specified on the infiltration test location plan provided by Ludwig Engineering Associates, Inc. on the southeast portion and northwest portion of the site at depths of approximately 2 feet and 13 feet below the existing site grades respectively, which correspond to the proposed bottom elevations of the proposed infiltration basins on March 18, 2022. One test at the southeast portion of the site was conducted using a double ring infiltrometer. Due to the dense nature of the materials encountered, the



Source: Copied from USGS Topo Map-
Victorville, Quadrangle 2015

HILLTOP GEOTECHNICAL
INCORPORATED

SITE LOCATION MAP

Northeast Corner of Mojave Drive and Amethyst Road
APN 0394-031-02, 03, 04, Victorville, CA 92394

By: MC	Date: 11/2022
Project No.: 1448-01.4	**Plate No. 1**

rings were pushed into the ground using a truck mounted drill rig approximately 3.75 inches in the southeast test pit. The other test at the northwest portion utilized a boring excavated by a drill rig to a depth of 13 feet below ground surface. The approximate infiltration test locations are shown on the 'Infiltration Test Location Plan,' Plate No. 1. However, based on the latest version of site plan provided by Ludwig Engineering Associates, Inc., the proposed infiltration basin at the southeast portion was eliminated; and the originally proposed infiltration basin at the northwest portion was enlarged from 18,232 to 28,776 square feet. Per the San Bernardino County Technical Guidance Document Appendices, a minimum of four tests are required at the area of the proposed infiltration basin. Since one infiltration test was conducted on March 18, 2022, additional three infiltration tests were conducted at the proposed infiltration basin on October 28, 2022. Three additional boreholes were drilled to 8 to 10 feet below the existing ground surface at the proposed infiltration basin, which were shown on Plate No. 1.

4. SOIL CHARACTERISTICS OF THE SUBJECT SITE

a. Per visual observation, the soil characteristics for the subject site are considered as moderate to fast infiltration rates.

b. There was no visible evidence of shallow groundwater or impervious bedrock materials.

c. Groundwater was not encountered in the exploratory excavations performed by **HGI**, Reference No. 3 to the maximum depth explored of approximately 16.5 feet below existing ground surface. Current depth to groundwater data for the site area was available through the **USGS internet web site** (https://maps.waterdata.usgs.gov/mapper). The depth to groundwater in USGS Well No. 005N004W30E002S, located approximately 2.6 miles southeast of the site, was 330.2 feet below surface on May 7, 2018. The surface elevation of this well is approximately 238 feet lower (topographically) than that of the site. Based on this information, the current depth to static groundwater beneath the site is estimated to be greater than fifty feet and should not be considered a factor for infiltration system design.

d. Tests performed agreed with visual evidence except for one test conducted on March 18, 2022.

e. The natural slope of the ground surface above the proposed water infiltration areas are less than a 2.0 percent gradient.

f. Soil conditions for the on-site water infiltration systems were feasible in the proposed infiltration basin area.

Soil Profile

- Infiltration Test No. 1: Infiltration test (P-1) was in the southeastern portion of the site and was tested in native alluvial deposits at a depth of approximately 2 feet. Alluvium was encountered to the maximum testing depth of 13 feet at this location. The alluvium encountered was a light brown, fine to medium sand with trace of gravel (SM). The bottom of the test was classified in general accordance with the Unified Soil Classification System as a SM. No water was encountered within the subsurface at the tested depth.

- Infiltration Test Nos. 2 to 5: Infiltration test (P-2) was conducted at a depth of 13 feet below the existing site grade in the northwest portion of the subject site. A truck mounted drill rig was used for the excavation and backfill process on March 18, 2022. Alluvium extended from the surface to the bottom testing depth of 13 feet and was classified as a light brown, silty, fine to coarse sand (SM) that contained trace amounts of gravel. The bottom of the test was classified in general accordance with the Unified Soil Classification System as a SM. Infiltration tests P-3 through P-5 were drilled to depths ranging from 8 to 10 feet, which were approximately at bottom of the proposed infiltration basins. The soils encountered at those three borings consist of dark yellowish brown silty fine to medium sand in slightly moist and medium dense. The soil boring logs were shown on Plate Nos. 3 through 7.
- After testing was conducted the borings were backfilled with excavated materials.

- No large plants or roots were encountered in the infiltration test areas.

- There were no wet or saturated soils at depth encountered in the infiltration test areas.

- No groundwater was encountered within our infiltrometer test areas.

5. INFILTRATION TESTING

5.1 INFILTRATION TEST USING DOUBLE RING INFILTROMETER TESTING PROCEDURES

Testing was performed in general accordance with the latest version of the ASTM D3385 procedures. This method consists of driving two (2) open cylinders, one inside the other, into the ground, partially filling the rings with water, maintaining the water at a constant level, and measuring the volume of water required to maintain the constant level. The steel rings used for this project had nominal inside diameters of 12.25 inches and 23.75 inches. The volume of water added to the inner ring to maintain a constant liquid level was the measure of the volume of liquid that infiltrates into the soil. The volume infiltrated during timed intervals was converted to an incremental infiltration velocity expressed in centimeters per hour, and the results were plotted on a graph versus elapsed time, as shown on Plate Nos. 8 & 9 attached to the rear of this report.

Test locations and depths were identified and selected per Reference No 1, ‘Precise Grading Plan.’ The drill rig was used to excavate the testing location to an approximate depth of 2 feet with the bottom of the excavation having an area of similar diameter of the rings. The outer and inner infiltrometer rings were then pushed into the ground using the drill rig to an approximate depth of 4 inches and 4.5 inches into the subsurface. Upon excavation, hand tools were used to prepare a smooth, flat test site free of loose, disturbed, and smeared soils.

Clear municipal water was poured into the rings while using an open palmed hand to prevent splashing and disturbance of the soil boundary. The pre-selected water test depth was approximately 6.0 inches (15.24cm). Water levels were maintained within 5.0 millimeters of this depth during the test by periodic additions from 1000 milliliter graduated cylinder. No significant wind occurred on the day of testing.

5.2 INFILTRATION TEST RESULTS VIA DOUBLE-RING INFILTROMETER

The calculated average and steady state rates of the inner-ring infiltration rates and outer-ring infiltration rates can be found below in the tabled results.

Table 1 - Infiltration Test Results via Double Ring Infiltrometer

	Average Inner Ring Infiltration Rate		**Average Outer Ring Infiltration Rate**	
	cm/hr	**in/hr**	**cm/hr**	**in/hr**
P-1	15.05	5.93	14.16	5.51

	Steady State Inner Ring Infiltration Rate		**Steady State Outer Ring Infiltration Rate**	
	cm/hr	**in/hr**	**cm/hr**	**in/hr**
P-1	5.79	2.28	5.92	2.33

5.3 BOREHOLE PERCOLATION TEST PROCEDURES

Testing was performed in general accordance with the most current Technical Guidance Document Appendices for infiltration rate evaluation protocol. An 8” diameter bore hole was drilled using a hollow stem truck-mounted auger on March 18, 2022. The test location was shown on Plate No. 1. The bottom of the bore hole was chosen to represent the proposed basin bottom elevation of the infiltration surface. The bottom of the bore hole was converted into test hole by filling with 2 inches of gravel before placing a 3” sleeved PVC perforated pipe. The test hole was pre-soaked by filling the hole with clear water from a 250-gallon water tank and observed while the water infiltrated the surface. The water was allowed to drop and recorded for approximately 25 minutes for 2 readings. After the two 25-minute readings, it was determined the sandy soil test procedures would follow due to the water level change exceeding 6 inches in both 25-minute readings. Therefore, testing was performed for a minimum of one hour. Readings were taken in 10-minute intervals. The water level and depth of boring were read after each reading with the tape measure from the outside of the casing at a fixed location, then recorded on the percolation data sheet.

Three additional bore hole tests were conducted on October 28, 2022 since the grading plan was revised for infiltration basin. Three 6-inch diameter bore holes were drilled using a hand auger to 8 to 10 feet below the existing grade at the selected areas, which were approximately depths to the bottom of the proposed infiltration basin. The bottom of the bore hole was converted into test hole by filling with 2 inches of gravel before placing a 3” sleeved PVC perforated pipe. The test hole was pre-soaked by filling the hole with clear water from a 250-gallon water tank and observed while the water infiltrated the surface. The water was allowed to drop and recorded for approximately 25 minutes for 2 readings. After the two 25-minute readings, it was determined the sandy soil test procedures would follow due to the water level change exceeding 6 inches in both 25-minute readings. Therefore, testing was performed for a minimum of one hour. Readings were taken in 10-minute intervals. The water level and depth of boring were read after each reading with a water level indicator from the outside of the casing at a fixed location, then recorded on the percolation data sheet.

5.4 PERCOLATION TEST RESULTS

Detailed percolation test results, in general accordance with San Bernardino County Technical Guidance Document Appendix VII 3.8, are included in Appendix ‘A’ as Plate Nos. 10 through 17.

Conversion of Percolation Test Result to an Infiltration Rate (I_t) was calculated from the following equation (Porchet Method):

$$I_t = \frac{\Delta H(60r)}{\Delta t(r+2H_{avg})}$$

Where

I_t - tested infiltration rate

ΔH - change in height over the time interval (inches).

r - test hole radius (inches).

Δt - time interval (minutes).

H_{avg} - average head height over the time interval (inches).

The percolation test results were converted into infiltration rates using Porchet Method as above. The slowest infiltration rates were tabulated as follows.

Table 2 - Infiltration Test Results via Percolation Tests

Infiltration Test Hole No.	Initial Test Hole Depth (to bottom of hole, feet)	Soil Classification	Infiltration Rate (in/hr.)	Recommended Infiltration Design Rate w/ a safety factor of 2.
P-2	13.0	SM	1.04	0.52
P-3	8.0	SM	4.54	2.27
P-4	9.0	SM	4.89	2.445
P-5	10.0	SM	4.46	2.23

6.0 DISCUSSION

The site was located within an area characterized by silty fine to medium grained sands. The rates presented above are generally consistent with the soil classifications in each area tested except for test hole P-2. Test hole P-2 was drilled by a hollow stem auger on March 18, 2022. It may be partially smeared by the auger.

Field infiltration tests are subject to many factors that affect the infiltration rate, including soil texture, the condition of the soil surface, soil-moisture tension or the degree of saturation, the temperature of the water and soil, the percentage of entrapped air in the soil, and the head of the applied water.

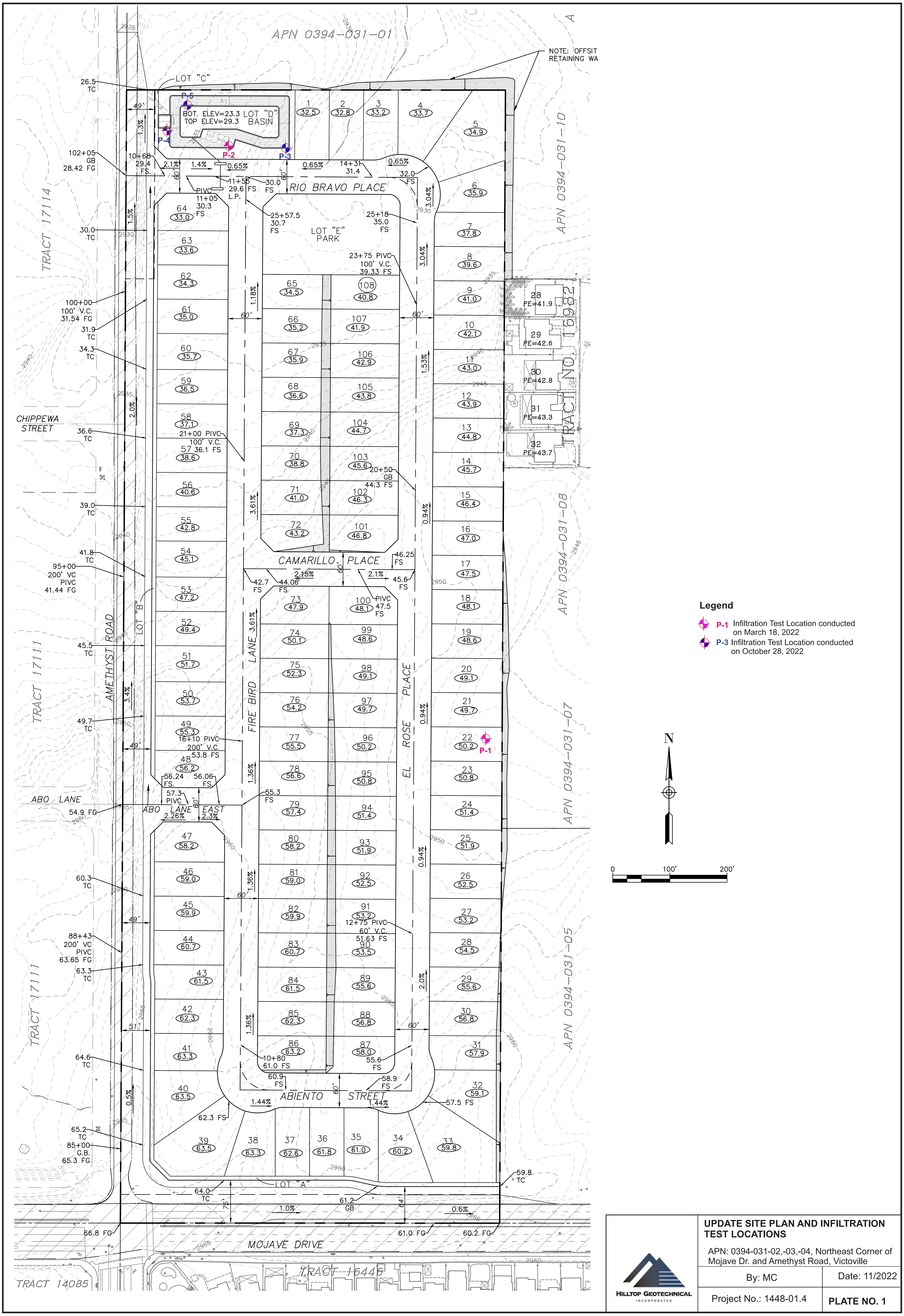
7.0 INFILTRATION BASIN RECOMMENDATIONS

Since the grading plan has been revised, the previously proposed infiltration basin area at the southeast portion of the site where test location P-1 was located was eliminated from the update grading plan, infiltration rate obtained from test location P-1 is excluded for recommendations of infiltration rates. Based on four infiltration test results obtained from test holes P-2 through P-5, An average infiltration rate is: (0.52+2.27+2.445+2.23)/4=1.87 inches/hour. The design infiltration rate of **1.87 inches/hour** is recommended for the proposed infiltration basin design. Per the obtained infiltration rate, the proposed basin bottom can be classified as the hydrology soil classification of Group B. The proposed infiltration basin is feasible for the subject site. The Project Civil Engineer should evaluate this information for final infiltration design.

Caution should be used in determining a percolation rate for any proposed infiltration basin or structure. Eventual siltation, water-borne silt from irrigation and precipitation runoff, and the accumulation of organic material in surface soils due to landscape grass and plant growth, can drastically reduce percolation rates over time. We recommend that suitable methods to prevent siltation be considered in the project design.

8.0 CLOSURE

Findings of this report were prepared in accordance with generally accepted professional engineering principles and practice in the field of soil mechanics. The conclusions are based on results of field exploration and testing. If conditions are encountered during construction that appear to be different than those indicated by this report, this firm should be notified.



UPDATE SITE PLAN AND INFILTRATION TEST LOCATIONS

APN: 0394-031-02,-03,-04, Northeast Corner of Mojave Dr. and Amethyst Road, Victoville

HILLTOP GEOTECHNICAL INCORPORATED

By: MC

Date: 11/2022

Project No.: 1448-01.4

PLATE NO. 1

SUBSURFACE EXPLORATION LEGEND

UNIFIED SOIL CLASSIFICATION SYSTEM
Visual-Manual Procedure (ASTM D2488-09a)

MAJOR DIVISIONS			GROUP SYMBOLS	TYPICAL NAMES
Coarse-Grained Soils* More than 50 % Retained on No. 200 Sieve	Gravels 50 % or more of Coarse Fraction Retained on No. 4 Sieve	Clean Gravels	GW	Well Graded Gravels and Gravel-Sand Mixtures, Little or no Fines
			GP	Poorly Graded Gravels and Gravel-Sand Mixtures, Little or no Fines
		Gravels with Fines	GM	Silty Gravels, Gravel-Sand-Silt Mixtures**
			GC	Clayey Gravel, Gravel-Sand-Clay Mixtures**
	Sands More than 50 % of Coarse Fraction Passes No. 4 Sieve	Clean Sands	SW	Well Graded Sands and Gravely Sands, Little or no Fines
			SP	Poorly Graded Sands and Gravelly Sands, Little or no Fines
		Sands with Fines	SM	Silty Sands, Sand-Silt Mixtures**
			SC	Clayey Sands, Sand-Clay Mixtures**
Fine Grained Soils* 50 % or more Passes No. 200 Sieve	Silts and Clays Liquid Limits 50 % or less		ML	Inorganic Silts, Sandy Silts, Rock Flour
			CL	Inorganic Clays of Low to Medium Plasticity, Gravelly Clays, Sandy Clays, Silty Clays, Lean Clays
			OL	Organic Silts and Organic silty Clays of Low Plasticity
	Silts and Clays Liquid Limits Greater than 50 %		MH	Inorganic Silts, Micaceous or Diatomaceous silts, Plastic Silts
			CH	Inorganic Clays of High Plasticity, Fat Clays
			OH	Organic Clays of Medium to High Plasticity
Highly Organic Soils			PT	Peat, Muck, or Other Highly Organic Soils

CONSISTENCY / RELATIVE DENSITY

CRITERIA

Reference: 'Foundation Engineering', Peck, Hansen, Thornburn, 2nd Edition.

Standard Penetration Test
Granular Soils

Penetration Resistance, N, (Blows / Foot)	Relative Density
0 - 4	Very Loose
5 - 10	Loose
11 - 30	Medium Dense
31 - 50	Dense
> 50	Very Dense

Standard Penetration Test
Cohesive Soils

Penetration Resistance, N, (Blows / Foot)	Consistency	Unconfined Compressive Strength, (Tons / Sq. Ft.)
< 2	Very Soft	< 0.25
2 - 4	Soft	0.25 - 0.5
5 - 8	Firm (Medium Stiff)	0.5 - 1.0
9 - 15	Stiff	1.0 - 2.0
16 - 30	Very Stiff	2.0 - 4.0
> 31	Hard	> 4.0

* Based on material passing the 3-inch sieve.

** More than 12% passing the No. 200 sieve; 5% to 12% passing No. 200 sieve requires use of duel symbols (i.e., SP-SM., GP-GM, SP-SC, GP-GC, etc.); Border line classifications are designated as CH/Cl, GM/SM, SP/SW, etc.

U.S. Standard Sieve Size 12" 3" 3/4" #4 #10 #40 #200

Unified Soil Classification Designation	Boulders	Cobbles	Gravel		Sand			Silt and Clay
			Coarse	Fine	Coarse	Medium	Fine	

Moisture Condition

Dry	Absence of moisture, dusty, dry to the touch.
Moist	Damp but no visible moisture.
Wet	Visible free water, usually below the water table.

Material Quantity

Trace	< 5 %
Few	5 - 10%
Little	15 - 25%
Some	30 - 45 %
Mostly	50-100%

Other Symbols

C - Core Sample
S - SPT Sample
B - Bulk Sample
CK - Chunk Sample
R - Ring Sample
N - Nuclear Gauge Test
∇ - Water Table

HILLTOP GEOTECHNICAL
INCORPORATED

SUBSURFACE EXPLORATION LOG
BORING NO. P-1

Project Name:	Mojave & Amethyst 40, L.P.				
Project No.	1448-01	Date:	3/18/2022	Logged By:	AB
Type of Rig:	Hollow-Stem Auger	Drive Wt.:	140 lb	Elevation:	2940 ± 25
Drill Hole Dia.:	8 in.	Drop:	30 in.	Depth of Boring (ft.):	2.0

Depth (ft.)	Sample Type	Penetration Resistance	Soil Classification	Dry Density (lb/ft3)	Moisture Content (%)	Lithology	Groundwater	Description
								ALLUVIUM (0 to 2'): Silty fine to medium sand, trace gravel; Slightly moist; Dark yellowish brown; Medium dense.
1								
2								Bottom of excavation 2 feet. No groundwater encountered. Converted to P-1, backfilled when testing completed.
3								
4								
5								
6								
7								
8								
9								
10								
11								
12								
13								
14								
15								
16								
17								
18								
19								
20								
21								
22								
23								
24								
25								

S - SPT Sample R - Ring Sample B - Bulk Sample N - Nuclear Gauge Test D - Disturbed Sample

N.R. - No Recovery

Plate No. 3

Hilltop Geotechnical Incorporated

SUBSURFACE EXPLORATION LOG
BORING NO. P-2

Project Name:	Mojave & Amethyst 40, L.P.				
Project No.	1448-01	Date:	3/18/2022	Logged By:	AB
Type of Rig:	Hollow-Stem Auger	Drive Wt.:	140 lb	Elevation:	2940 ± 25
Drill Hole Dia.:	8 in.	Drop:	30 in.	Depth of Boring (ft.):	13.0

Depth (ft.)	Sample Type	Penetration Resistance	Soil Classification	Dry Density (lb/ft3)	Moisture Content (%)	Lithology	Groundwater	Description
0								ALLUVIUM (0 to 13') Silty fine to medium sand, trace gravel; Slightly moist; Dark yellowish brown; Medium dense.
1								
2								
3								
4								
5								
6								
7								
8								
9								
10								
11								
12								
13								Bottom of boring 13 feet. No groundwater encountered. Converted to P-2, backfilled when testing completed.
14								
15								
16								
17								
18								
19								
20								
21								
22								
23								
24								
25								

S - SPT Sample R - Ring Sample B - Bulk Sample N - Nuclear Gauge Test D - Disturbed Sample

N.R. - No Recovery

HILLTOP GEOTECHNICAL INCORPORATED

SUBSURFACE EXPLORATION LOG
BORING NO. P-3

Project Name: Mojave & Amethyst 40, L.P.
Project No. 1448-01 Date: 10/28/2022 Logged By: LG
Type of Rig: Hollow-Stem Auger Drive Wt.: 140 lb Elevation: 2940 ± 25
Drill Hole Dia.: 8 in. Drop: 30 in. Depth of Boring (ft.): 8.0

Depth (ft.)	Sample Type	Penetration Resistance	Soil Classification	Dry Density (lb/ft3)	Moisture Content (%)	Lithology	Groundwater	Description
								ALLUVIUM: Silty fine to medium sand, trace gravel; Slightly moist; Dark yellowish brown; Medium dense.
1								
2								
3								
4								
5								
6								
7								
8								Bottom of boring terminated at 8 feet. No groundwater encountered. Converted to P-1, minor caving observed at 2 feet.
9								
10								
11								
12								
13								
14								
15								
16								
17								
18								
19								
20								
21								
22								
23								
24								
25								

S - SPT Sample R - Ring Sample B - Bulk Sample N - Nuclear Gauge Test D - Disturbed Sample
N.R. - No Recovery

HILLTOP GEOTECHNICAL
INCORPORATED

SUBSURFACE EXPLORATION LOG
BORING NO. P-4

Project Name:	Mojave & Amethyst 40, L.P.				
Project No.	1448-01	Date:	10/28/2022	Logged By:	LG
Type of Rig:	Hollow-Stem Auger	Drive Wt.:	140 lb	Elevation:	2940 ± 25
Drill Hole Dia.:	8 in.	Drop:	30 in.	Depth of Boring (ft.):	9.0

Depth (ft.)	Sample Type	Penetration Resistance	Soil Classification	Dry Density (lb/ft3)	Moisture Content (%)	Lithology	Groundwater	Description
								ALLUVIUM: Silty fine to medium sand, trace gravel; Slightly moist; Dark yellowish brown; Medium dense.
1								
2								
3								
4								
5								
6								
7								
8								
9								Bottom of boring terminated at 9 feet. No groundwater encountered. Converted to P-2, minor caving observed at 3 feet.
10								
11								
12								
13								
14								
15								
16								
17								
18								
19								
20								
21								
22								
23								
24								
25								

S - SPT Sample R - Ring Sample B - Bulk Sample N - Nuclear Gauge Test D - Disturbed Sample

N.R. - No Recovery

Plate No. 6

HILLTOP GEOTECHNICAL
INCORPORATED

SUBSURFACE EXPLORATION LOG
BORING NO. P-5

Project Name: Mojave & Amethyst 40, L.P.

Project No.	1448-01	Date:	10/28/2022	Logged By:	LG
Type of Rig:	Hollow-Stem Auger	Drive Wt.:	140 lb	Elevation:	2940 ± 25
Drill Hole Dia.:	8 in.	Drop:	30 in.	Depth of Boring (ft.):	10.0

Depth (ft.)	Sample Type	Penetration Resistance	Soil Classification	Dry Density (lb/ft3)	Moisture Content (%)	Lithology	Groundwater	Description
								ALLUVIUM: Silty fine to medium sand, trace gravel; Slightly moist; Dark yellowish brown; Medium dense.
1								
2								
3								
4								
5								
6								
7								
8								
9								
10								Bottom of boring terminated at 10 feet. No groundwater encountered. Converted to P-3, minor caving observed at 3 feet.
11								
12								
13								
14								
15								
16								
17								
18								
19								
20								
21								
22								
23								
24								
25								

S - SPT Sample R - Ring Sample B - Bulk Sample N - Nuclear Gauge Test D - Disturbed Sample

N.R. - No Recovery

Plate No. 7

INFILTROMETER TEST **P-1** DATE OF TEST 18-Mar-22 DEPTH OF

PROJECT IDENTIFICATION: 1448-01.4 AREA(CM2) LIQUID (CM)

TEST LOCATION: 2 feet bgs East INNER 760 INNER 40.6

LIQUID USED: Municipal H20 OUTER 2856.7 OUTER 40.6

TESTED BY AB LIQUID LEVEL MAINTAINED USING: __X__ MANUAL ADDITIONS (VISUAL)

DEPTH TO WATER TABLE: INNER RING AVERAGE RATE CM/H **15.05** IN/H **5.93**

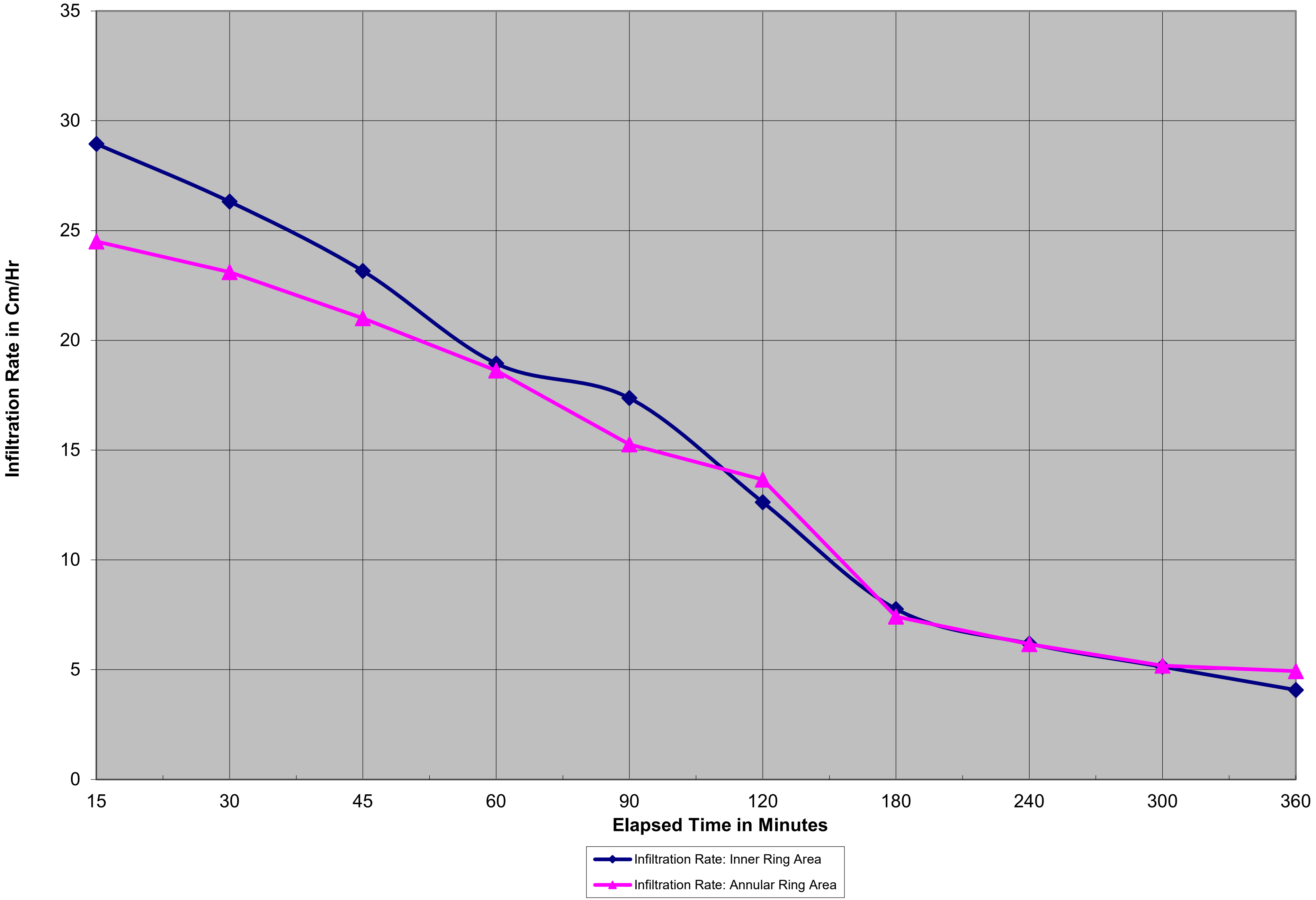
OUTER RING AVERAGE RATE CM/H **13.98** IN/H **5.51**

Note: Inner ring potential goper hole.

Increment No.	DATE	TIME START= 08:50 AM HR: MM	ELAPSED TIME/ INCREMENT MIN	FLOW READINGS INNER FLOW CM3	OUTER FLOW CM3	LIQUID TEMP. F	INCREMENTAL INFILTRATION RATE INNER CM/H	ANNULAR CM/H	INCREMENTAL INFILTRATION RATE INNER IN/H	ANNULAR IN/H	GROUND TEMP = 87 F @ DEPTH OF 12 INCHES AIR TEMP, WEATHER
1	18-Mar-2022	9:40	15	5,500	17,500	76	28.95	24.50	11.41	9.65	70, Sunny
2	18-Mar-2022	10:00	15	5,000	16,500	77	26.32	23.10	10.37	9.10	70, Sunny
3	18-Mar-2022	10:20	15	4,400	15,000	77	23.16	21.00	9.12	8.28	70, Sunny
4	18-Mar-2022	10:40	15	3,600	13,300	78	18.95	18.62	7.47	7.34	73, Sunny
5	18-Mar-2022	11:10	30	6,600	21,800	78	17.37	15.26	6.84	6.01	74, Sunny
6	18-Mar-2022	11:40	30	4,800	19,500	79	12.63	13.65	4.98	5.38	78, Sunny
7	18-Mar-2022	12:40	60	5,900	21,200	80	7.76	7.42	3.06	2.92	82, Sunny
8	18-Mar-2022	13:40	60	4,700	17,600	82	6.18	6.16	2.44	2.43	84, Sunny
9	18-Mar-2022	14:40	60	3,900	14,800	83	5.13	5.18	2.02	2.04	90, Sunny
10	18-Mar-2022	15:40	60	3,100	14,100	85	4.08	4.94	1.61	1.94	85, Sunny

	CM/H Annular	CM/H Inner	IN/H Annular	IN/H Inner
Steady State Rates:	5.92	5.79	2.33	2.28

Infiltration Graph via Double Rings: Infiltration Rate vs. Time
P-1



Infiltration Rate vs. Time for P-1

HILLTOP GEOTECHNICAL
INCORPORATED

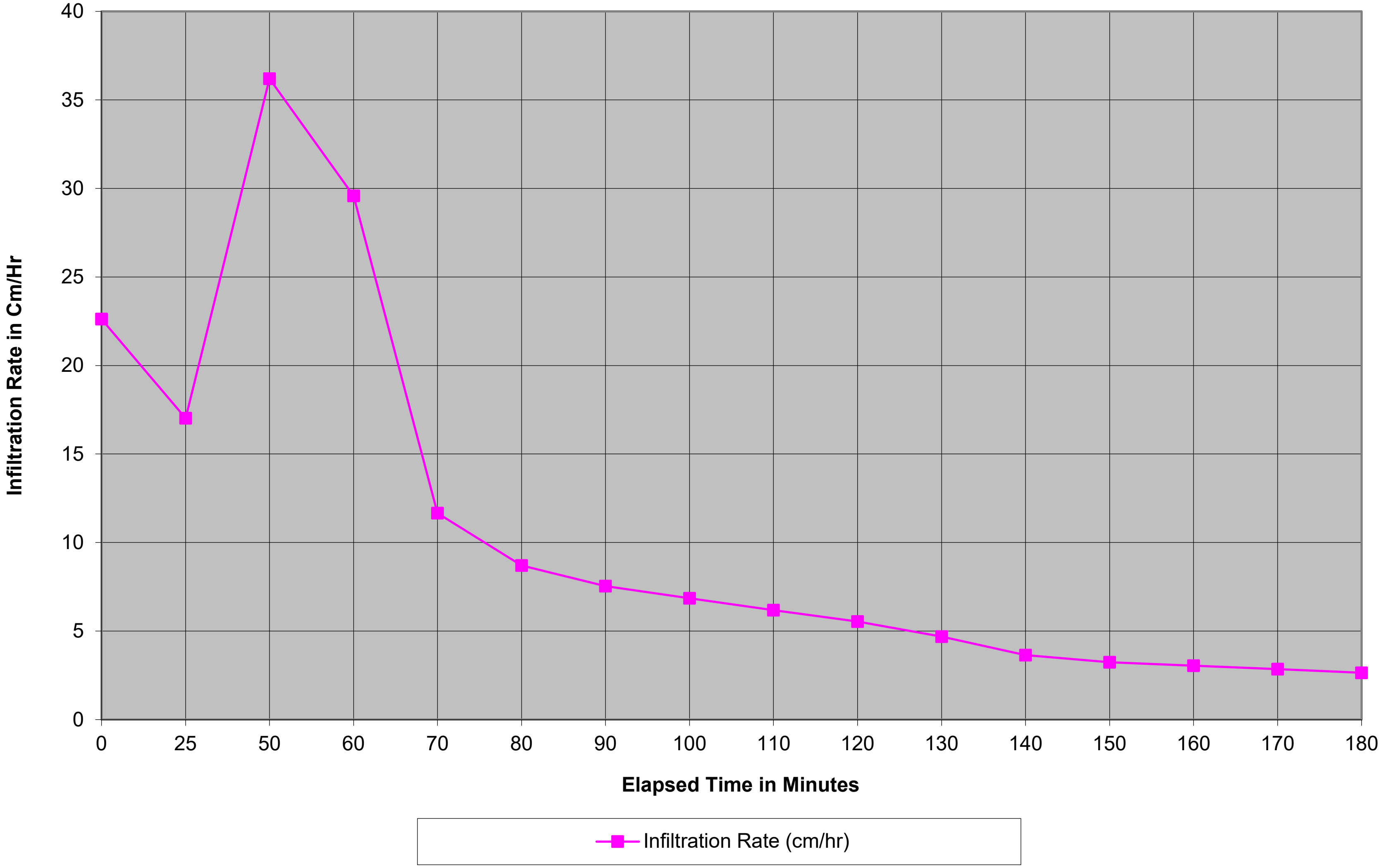
PERCOLATION DATA SHEET

Project Name:	Mojave & Amethyst 40, L.P.	Project Number:	1448-01.4
Test Hole Number:	P-2	Date Tested:	3/18/22
Depth of Boring in feet:	13.0	Tested By:	AB
Radius of boring feet:	0.67	Hours Presaturation	0.83

Depth of Bottom (ft) Outter	Time Initial	Time Final	Time Interval (minutes)	Depth of Water - Initial (ft)	Depth of Water - Final (ft)	Change in Water Level (ft)	$H_{average}$ (ft)	Rate, It (In/Hr)	Rate, It (Cm/Hr)
13.00	0:00	0:25	25.0	3.00	13.00	10.00	5.00	8.91	22.62
13.00	0:00	0:25	25.0	3.00	11.55	8.55	5.73	6.70	17.03
13.00	0:00	0:10	10.0	3.00	10.75	7.75	6.13	14.25	36.20
13.00	0:00	0:10	10.0	3.00	9.80	6.80	6.60	11.65	29.59
13.00	0:00	0:10	10.0	5.00	7.70	2.70	6.65	4.59	11.66
13.00	0:00	0:10	10.0	5.00	7.10	2.10	6.95	3.42	8.70
13.00	0:00	0:10	10.0	5.00	6.85	1.85	7.08	2.97	7.53
13.00	0:00	0:10	10.0	5.00	6.70	1.70	7.15	2.70	6.85
13.00	0:00	0:10	10.0	5.00	6.55	1.55	7.23	2.44	6.19
13.00	0:00	0:10	10.0	5.00	6.40	1.40	7.30	2.18	5.53
13.00	0:00	0:10	10.0	5.00	6.20	1.20	7.40	1.84	4.68
13.00	0:00	0:10	10.0	5.00	5.95	0.95	7.53	1.44	3.65
13.00	0:00	0:10	10.0	5.00	5.85	0.85	7.58	1.28	3.24
13.00	0:00	0:10	10.0	5.00	5.80	0.80	7.60	1.20	3.04
13.00	0:00	0:10	10.0	5.00	5.75	0.75	7.63	1.12	2.84
13.00	0:00	0:10	10.0	5.00	5.70	0.70	7.65	1.04	2.65

Plate No. 10

Infiltration Graph via Percolation Test: Infiltration Rate vs. Time



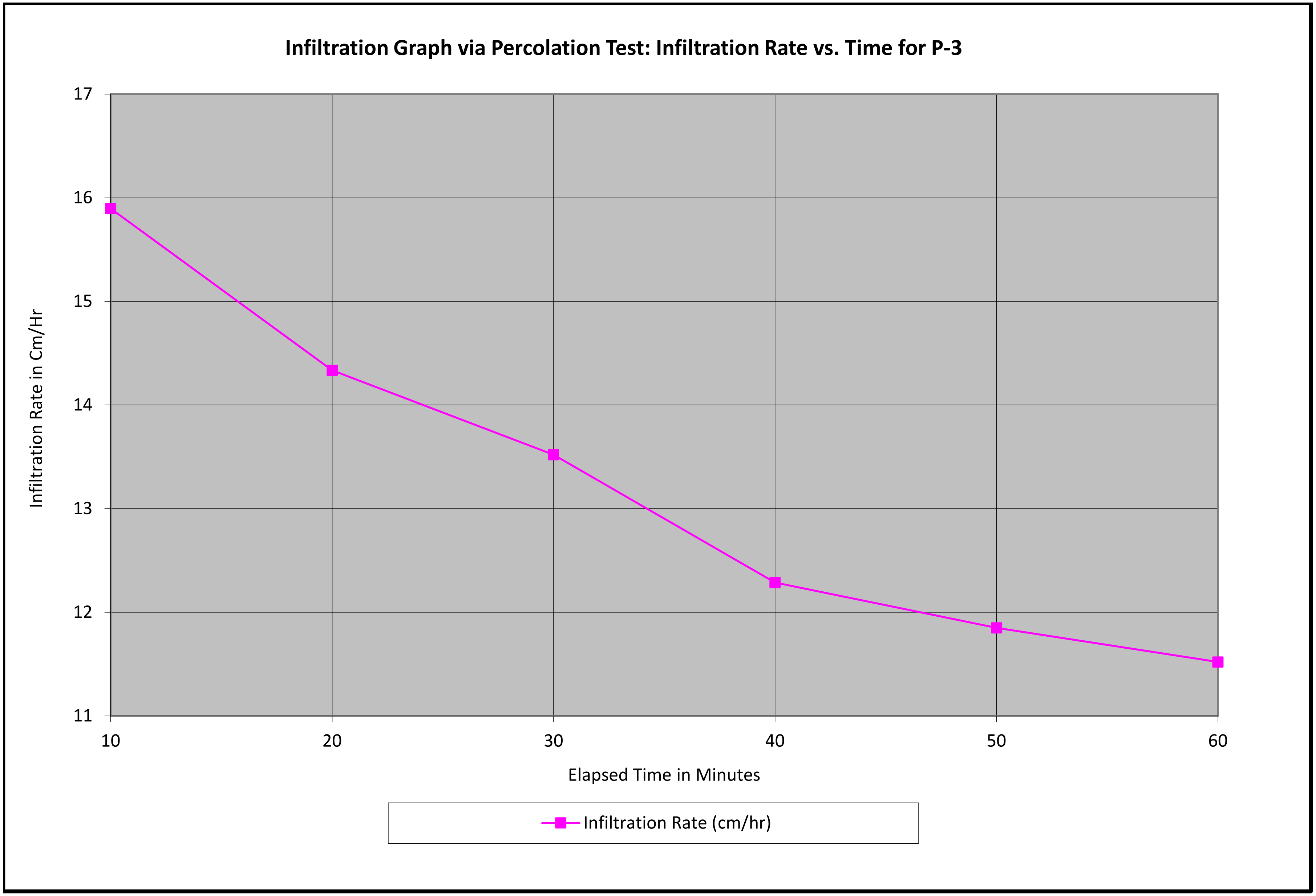
Infiltration Rate vs. Time for P-2

HILLTOP GEOTECHNICAL
INCORPORATED

PERCOLATION DATA SHEET

Project Name:	Mojave & Amethyst 40 LP	Project Number:	1448-01.4
Test Hole Number:	P-3	Date Tested:	10/28/22
Depth of Boring in feet:	8.0	Tested By:	LG
Radius of boring feet:	0.50	Hours Presaturation	0.83

Depth of Bottom (ft) Outter	Time Initial	Time Final	Time Interval (minutes)	Depth of Water - Initial (ft)	Depth of Water - Final (ft)	Change in Water Level (ft)	$H_{average}$ (ft)	Rate, It (In/Hr)	Rate, It (Cm/Hr)
8.00	1:30	1:55	25.0	0.00	6.27	6.27	4.87	5.83	14.80
8.00	1:55	2:20	25.0	0.00	5.54	5.54	5.23	4.80	12.20
8.00	2:20	2:30	10.0	0.00	3.44	3.44	6.28	6.26	15.90
8.00	2:30	2:40	10.0	0.00	3.17	3.17	6.42	5.64	14.34
8.00	2:40	2:50	10.0	0.00	3.02	3.02	6.49	5.32	13.52
8.00	2:50	3:00	10.0	0.00	2.79	2.79	6.60	4.84	12.29
8.00	3:00	3:10	10.0	0.00	2.71	2.71	6.65	4.67	11.85
8.00	3:10	3:20	10.0	0.00	2.65	2.65	6.68	4.54	11.52



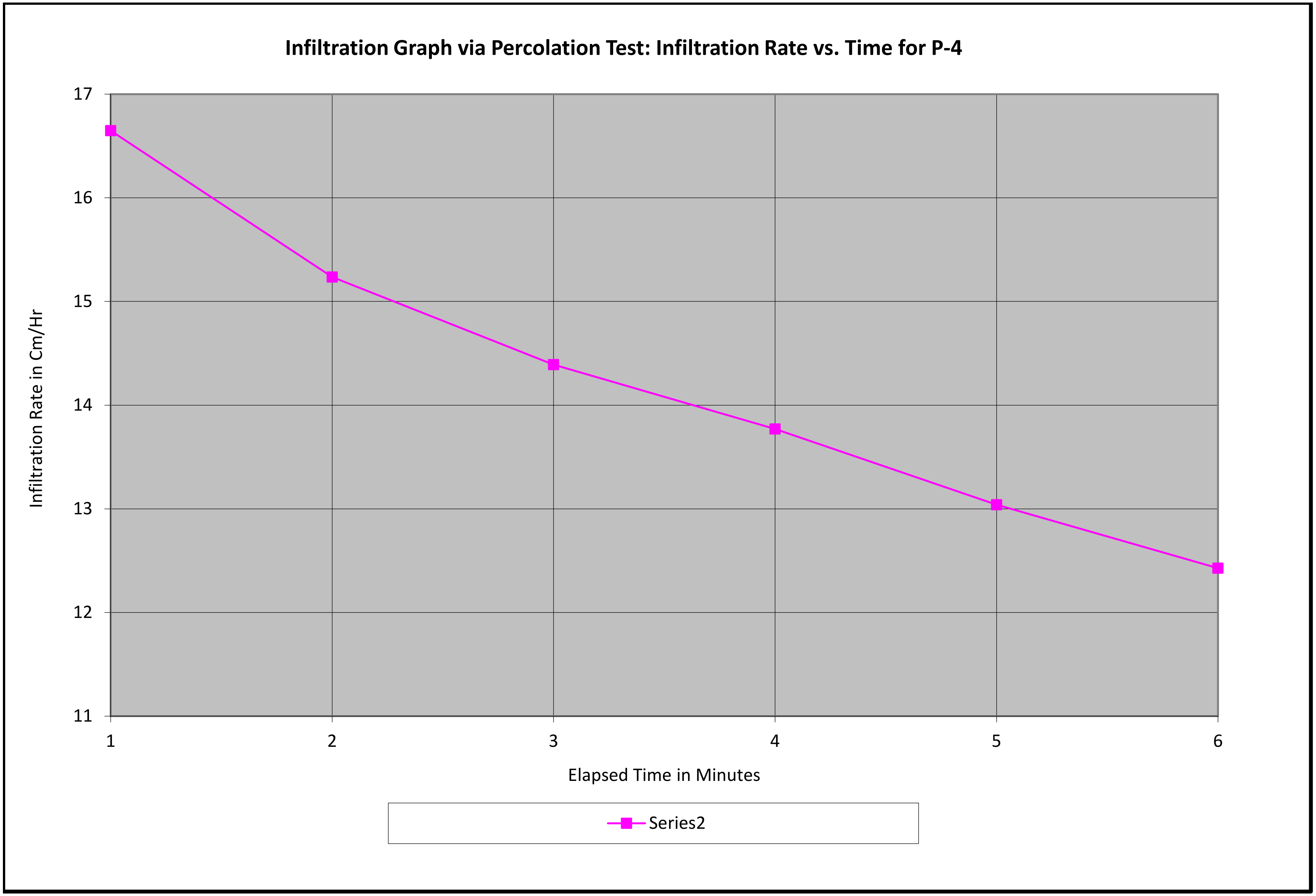
Infiltration Rate vs. Time Graph
P-3

PERCOLATION DATA SHEET

Project Name:	Mojave & Amethyst 40 LP	Project Number:	1448-01.4
Test Hole Number:	P-4	Date Tested:	10/28/22
Depth of Boring in feet:	9.0	Tested By:	LG
Radius of boring feet:	0.50	Hours Presaturation	0.83

Depth of Bottom (ft) Outter	Time Initial	Time Final	Time Interval (minutes)	Depth of Water - Initial (ft)	Depth of Water - Final (ft)	Change in Water Level (ft)	$H_{average}$ (ft)	Rate, It (In/Hr)	Rate, It (Cm/Hr)
9.00	1:32	1:57	25.0	0.00	7.06	7.06	5.47	5.87	14.91
9.00	1:57	2:22	25.0	0.00	6.40	6.40	5.80	5.02	12.76
9.00	2:22	2:32	10.0	0.00	4.00	4.00	7.00	6.55	16.65
9.00	2:32	2:42	10.0	0.00	3.73	3.73	7.14	6.00	15.24
9.00	2:42	2:52	10.0	0.00	3.56	3.56	7.22	5.67	14.39
9.00	2:52	3:02	10.0	0.00	3.44	3.44	7.28	5.42	13.77
9.00	3:02	3:12	10.0	0.00	3.29	3.29	7.36	5.13	13.04
9.00	3:12	3:22	10.0	0.00	3.16	3.16	7.42	4.89	12.43

Plate No. 14


Infiltration Graph via Percolation Test: Infiltration Rate vs. Time for P-4
Infiltration Rate in Cm/Hr
17
16
15
14
13
12
11
1
2
3
4
5
6
Elapsed Time in Minutes
Series2

PERCOLATION DATA SHEET

Project Name: Mojave & Amethyst 40 LP

Project Number: 1448-01.4

Test Hole Number: P-5

Date Tested: 10/28/22

Depth of Boring in feet: 10.0

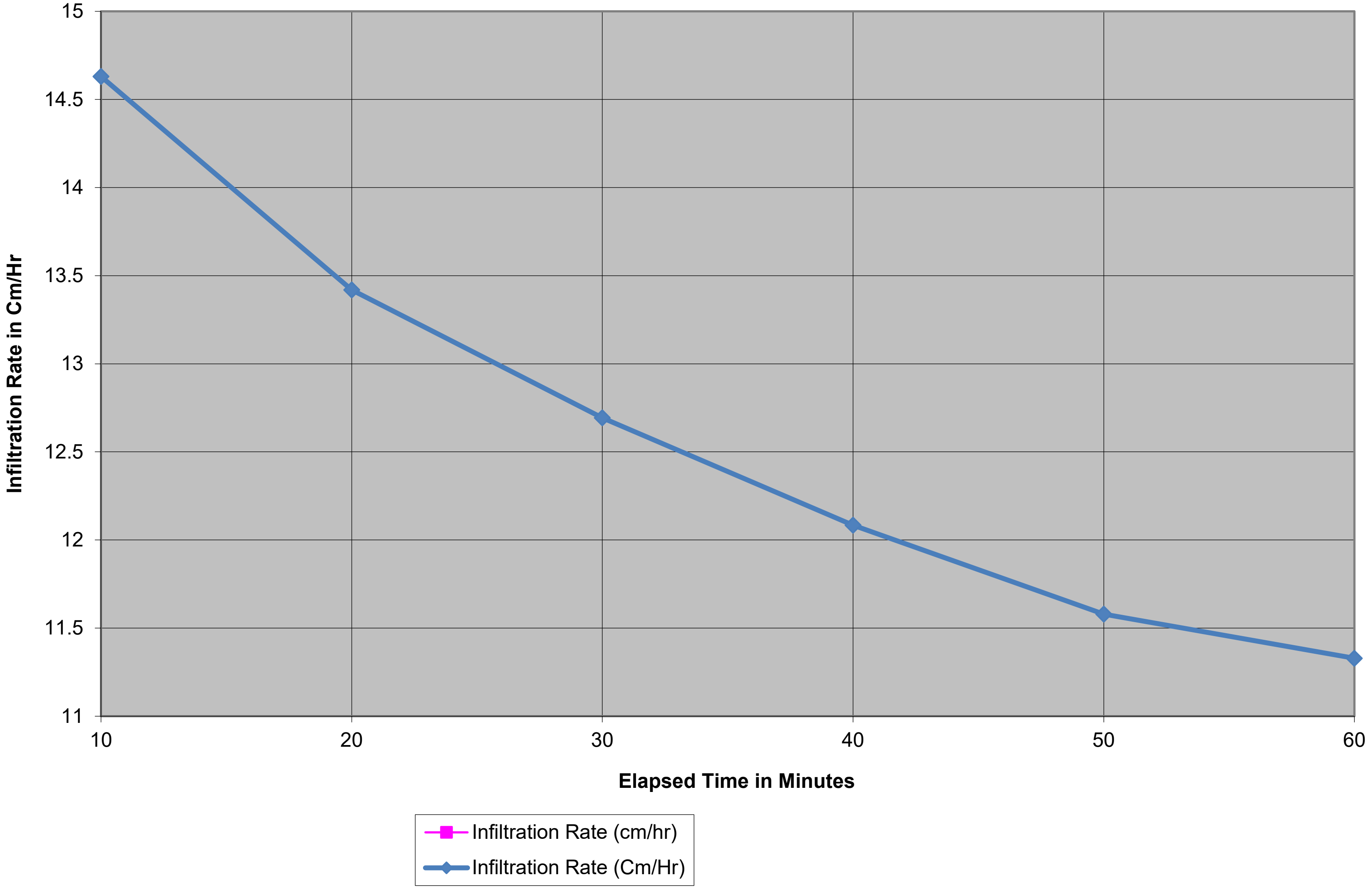
Tested By: LG

Radius of boring feet: 0.50

Hours Presaturation 0.83

Depth of Bottom (ft) Outter	Time Initial	Time Final	Time Interval (minutes)	Depth of Water - Initial (ft)	Depth of Water - Final (ft)	Change in Water Level (ft)	$H_{average}$ (ft)	Rate, It (In/Hr)	Rate, It (Cm/Hr)
10.00	1:32	1:57	25.0	0.00	7.06	7.06	6.47	5.00	12.69
10.00	1:57	2:22	25.0	0.00	6.40	6.40	6.80	4.31	10.95
10.00	2:22	2:32	10.0	0.00	4.00	4.00	8.00	5.76	14.63
10.00	2:32	2:42	10.0	0.00	3.73	3.73	8.14	5.28	13.42
10.00	2:42	2:52	10.0	0.00	3.56	3.56	8.22	5.00	12.69
10.00	2:52	3:02	10.0	0.00	3.42	3.42	8.29	4.76	12.08
10.00	3:02	3:12	10.0	0.00	3.30	3.30	8.35	4.56	11.58
10.00	3:12	3:22	10.0	0.00	3.24	3.24	8.38	4.46	11.33

Infiltration Graph via Percolation Test: Infiltration Rate vs. Time for P-5



ATTACHMENT C

REPORT OF INFILTRATION FEASIBILITY STUDY, TENTATIVE TRACT MAP NO. 20525, APN 0394-031-02, 03, 04
NORTHEAST CORNER OF MOJAVE DRIVE AND AMETHYST ROAD
CITY OF VICTORVILLE
SAN BERNARDINO COUNTY, CALIFORNIA

PROJECT NO.: 1448-01
REPORT NO.: 3

APRIL 21, 2022

SUBMITTED TO:

MOJAVE AMETHYST 40, L.P.
17802 LAKESIDE HAVEN DRIVE
CYPRESS, TEXAS 77433

PREPARED BY:

HILLTOP GEOTECHNICAL, INC.
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April 21, 2022

Mojave Amethyst 40, L.P.
17802 Lakeside Haven Drive
Cypress, Texas 77433

Project No.:1448-01
Report No.: 3

Attention: Mr. David Michelson

Subject: **Report of Infiltration Feasibility Study, Tentative Tract Map No. 20525, APN 0394-031-02, 03, 04, Northeast Corner of Mojave Drive and Amethyst Road, City of Victorville, San Bernardino County, California.**

References:

1. **Ludwig Engineering Associates, Inc.**, January 2022, *Tentative Tract Map No. 20525, APN 0394-031-02, 03, 04,* Scale 1" = 100'.

2. **San Bernardino County**, May 19, 2011, *Technical Guidance Document Appendices, Appendix VII, Infiltration Rate Evaluation Protocol and Factor of Safety Recommendations*, VII-1 through VII-36.

3. **Hilltop Geotechnical, Inc.**, April 21, 2022, *Report of Preliminary Geotechnical / Geologic Study, Tentative Tract Map No. 20525, APN 0394-031-02, 03, 04, Northeast Corner of Mojave Drive and Amethyst Road, City of Victorville, San Bernardino County, California.* Project No.: 1448-01, Report No.: 2.

In accordance with your request, **Hilltop Geotechnical, Inc.** has performed infiltration tests on the proposed water catch basins on the southeastern and northwestern portion of the subject site in the City of Victorville, San Bernardino County, California. Submitted herein are results of the findings and conclusions.

The findings of this study indicate that the project site is suitable for the proposed infiltration basins provided the recommendations presented in the attached report are incorporated into design of the project and implemented during construction of the project.

We appreciate the opportunity to provide geotechnical services on this project. Should you have any questions regarding this submittal, please do not hesitate to contact us.

Respectfully submitted,
HILLTOP GEOTECHNICAL, INC.

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Attachments:
Infiltration Test Location Plan....................................Plate No. 1
Summary of Infiltrometer Results..........................Plate Nos. 2-3
Graph of Infiltrometer Results...............................Plate Nos. 4-5
Percolation Boring Logs...Plate Nos. 6-7

Distribution:
(1) Addressee pdf copy via E-Mail
Mr. David Michelson (drmichelson48@gmail.com)

REPORT OF INFILTRATION FEASIBILITY STUDY,
TENTATIVE TRACT MAP NO. 20525, APN 0394-031-02, 03, 04
NORTHEAST CORNER OF
MOJAVE DRIVE AND AMETHYST ROAD
CITY OF VICTORVILLE
SAN BERNARDINO COUNTY, CALIFORNIA

LOCATION OF THE PROJECT SITE

This report presents the results of our infiltration testing conducted on the subject site for two (2) locations on the southeast and northwest portions of the property. The site is located on the northeast corner of Mojave Drive and Amethyst Road in the City of Victorville, San Bernardino County, California. The general location of the subject site is indicated on the 'Site Location Map,' Figure No. 1.

SITE DESCRIPTION

The site was generally vacant with no structures. At the time of the field study, the site contained moderate vegetation of various sized Mojave Desert shrubs and weeds such as creosote bushes and cholla bushes. On-site drainage was accomplished by sheet flow toward the northwest and northeast.

LOCATION OF INFILTRATION TESTING

Infiltration testing was conducted in the locations specified on the infiltration test location plan provided by Ludwig Engineering on the southeast portion and northwest portion of the site at depths of approximately 2 feet and 13 feet below the existing site grades respectively, which correspond to the proposed bottom elevations of the proposed infiltration basins. One test at the southeast portion of the site was conducted using a double ring infiltrometer. Due to the dense nature of the materials encountered, the rings were pushed into the ground using a truck mounted drill rig approximately 3.75 inches in the southeast test pit. The other test at the northwest portion utilized a boring excavated by a drill rig to a depth of 13 feet below ground surface. The approximate infiltration test locations are shown on the 'Infiltration Test Location Plan,' Plate No. 1.

SOIL CHARACTERISTICS OF THE SUBJECT SITE

- The soil characteristics for the subject site are defined as moderate to fast.

- There was no visible evidence of shallow groundwater or impervious bedrock materials.

- Groundwater was not encountered in the exploratory excavations performed by **HGI**, Reference No. 3 to the maximum depth explored of approximately 16.5 feet below existing ground surface. Current depth to groundwater data for the site area was available through the **USGS internet web site** (https://maps.waterdata.usgs.gov/mapper). The depth to groundwater in USGS Well No. 005N004W30E002S, located approximately 2.6 miles southeast of the site, was 330.2 feet below surface on May 7, 2018. The surface elevation of this well is approximately 238 feet lower (topographically) than that of the site. Based on this information, the current depth to static groundwater beneath the site is estimated to be greater than fifty feet and should not be considered a factor for infiltration system design.

- Tests performed agreed with visual evidence.

- The natural slope of the ground surface above the proposed water infiltration areas are less than a 2.0 percent gradient.

- Soil conditions for the on-site, water infiltration systems were acceptable in both tested areas.

Soil Profile

- Percolation Test No. 1: Infiltration test (P-1) was in the southeastern portion of the site and was tested in native alluvial deposits at a depth of approximately 2 feet. Alluvium was encountered to the maximum testing depth of 13 feet at this location. The alluvium encountered was a light brown, fine to medium sand with trace of gravel (SM). The bottom of the test was classified in general accordance with the Unified Soil Classification System as a SM. No water was encountered within the subsurface at the tested depth.

- Percolation Test No. 2: Infiltration test (P-2) was conducted at a depth of 13 feet below the existing site grade in the northwest portion of the subject site. A truck mounted drill rig was used for the excavation and backfill process. Alluvium extended from the surface to the bottom testing depth of 13 feet and was classified as a light brown, silty, fine to coarse sand (SM) that contained trace amounts of gravel. The bottom of the test was classified in general accordance with the Unified Soil Classification System as a SM.

- After testing was conducted the borings were backfilled with excavated materials.

- No large plants or roots were encountered in the infiltration test areas.

- There were no wet or saturated soils at depth encountered in the infiltration test areas.

- No groundwater was encountered within our infiltrometer test areas.

INFILTRATION TEST USING DOUBLE RING INFILTROMETER TESTING PROCEDURES

Testing was performed in general accordance with the latest version of the ASTM D3385 procedures. This method consists of driving two (2) open cylinders, one inside the other, into the ground, partially filling the rings with water, maintaining the water at a constant level, and measuring the volume of water required to maintain the constant level. The steel rings used for this project had nominal inside diameters of 12.25 inches and 23.75 inches. The volume of water added to the inner ring to maintain a constant liquid level was the measure of the volume of liquid that infiltrates into the soil. The volume infiltrated during timed intervals was converted to an incremental infiltration velocity expressed in centimeters per hour, and the results were plotted on a graph versus elapsed time, as shown on Plate Nos. 2 & 4 attached to the rear of this report.

Test locations and depths were identified and selected per Reference No 1, ‘Precise Grading Plan.’ The drill rig was used to excavate the testing location to an approximate depth of 2 feet with the bottom of the excavation having an area of similar diameter of the rings. The outer and inner infiltrometer rings were then pushed into the ground using the drill rig to an approximate depth of 4 inches and 4.5 inches into the subsurface. Upon excavation, hand tools were used to prepare a smooth, flat test site free of loose, disturbed, and smeared soils.

Clear municipal water was poured into the rings while using an open palmed hand to prevent splashing and disturbance of the soil boundary. The pre-selected water test depth was approximately 6.0 inches (15.24cm). Water levels were maintained within 5.0 millimeters of this depth during the test by periodic additions from 1000 milliliter graduated cylinder. No significant wind occurred on the day of testing.

PERCOLATION TEST RESULTS VIA DOUBLE-RING INFILTROMETER

The calculated average and steady state rates of the inner-ring infiltration rates and outer-ring infiltration rates can be found below in the tabled results.

	Average Inner Ring Infiltration Rate		**Average Outer Ring Infiltration Rate**	
	cm/hr	**in/hr**	**cm/hr**	**in/hr**
P-1	15.05	5.93	14.16	5.51

	Steady State Inner Ring Infiltration Rate		**Steady State Outer Ring Infiltration Rate**	
	cm/hr	**in/hr**	**cm/hr**	**in/hr**
P-1	5.79	2.28	5.92	2.33

TEST PIT PERCOLATION TEST PROCEDURES

Testing was performed in general accordance with the most current Technical Guidance Document Appendices for infiltration rate evaluation protocol. This method consisted of drilling an 8” diameter bore hole using a hollow stem truck-mounted auger. The bottom of the test hole was chosen to represent the proposed bottom elevation of the infiltration surface. The bottom of the test hole was filled with 2 inches of gravel before placing a 3” sleeved PVC perforated pipe. The test hole was pre-soaked by filling the hole with clear water from a 250-gallon water tank and observed while the water infiltrated the surface. The water was allowed to drop and recorded for approximately 25 minutes for 2 readings. After the two 25-minute readings, it was determined the sandy soil test procedures would follow due to the water level change exceeding 6 inches in both 25-minute readings. Therefore, testing was performed for a minimum of one hour. Readings were taken in 10-minute intervals. The water level and depth of boring were read after each reading with the tape measure from the outside of the casing at a fixed location, then recorded on the percolation data sheet.

PERCOLATION TEST RESULTS

Detailed percolation test results, in general accordance with San Bernardino County Technical Guidance Document Appendix VII, are included in Appendix 'A' as Plate Nos. 3 and 5. Following are tabulated results of the percolation testing:

Conversion of Percolation Test Result to an Infiltration Rate (I_t) was calculated from the following equation:

$$I_t = \frac{\Delta H(60r)}{\Delta t(r+2H_{avg})}$$

Where

I_t - tested infiltration rate

ΔH - change in height over the time interval (inches).

r - test hole radius (inches).

Δt - time interval (minutes).

H_{avg} - average head height over the time interval (inches).

Table 1 - Infiltration Test Results

Infiltration Test Hole No.	Initial Test Hole Depth (to bottom of hole)	Soil Classification	Infiltration Rate (in/hr.)	Recommended Infiltration Design Rate w/ a safety factor of 2.
P-2	13.0	SM	1.04	0.52

DISCUSSION

The site was located within an area characterized by silty fine to medium grained sands. The rates presented above are generally consistent with the soil classifications in each area tested. Slightly faster infiltrometer rates were obtained in infiltration test P-1 likely due to the depth of the test in relation to the degree of cementation. Given most of the site is underlain by silty sands, the rates were moderate to fast. From our exploratory excavations from Reference No. 3 and the findings of this study, the soil conditions appear to be finer grained with an increase of finer grained particles at from the surface grade to approximately fifteen feet.

Field infiltration tests are subject to many factors that affect the infiltration rate, including soil texture, the condition of the soil surface, soil-moisture tension or the degree of saturation, the temperature of the water and soil, the percentage of entrapped air in the soil, and the head of the applied water.

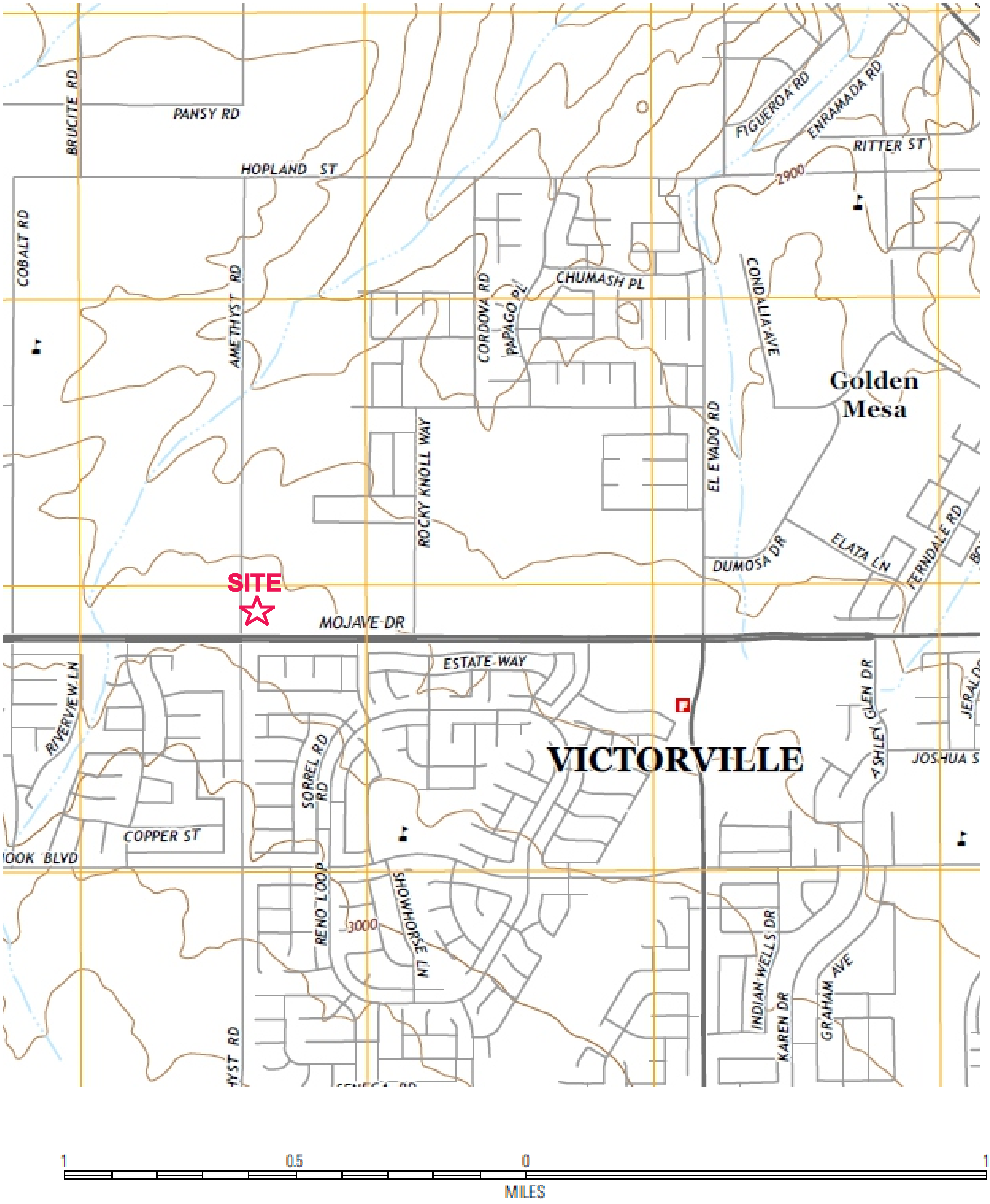
INFILTRATION BASIN RECOMMENDATIONS

Infiltration testing in the proposed infiltration areas indicated infiltration rates that appear to be consistent with respect to their respective on-site soil classification. The design infiltration rate of **1.14 inches/hour** at test location P-1 is recommended. The design infiltration rate of **0.52 inches/hour** at test location P-2 is recommended. The Project Civil Engineer should evaluate this information for final infiltration design.

Caution should be used in determining a percolation rate for any proposed infiltration basin or structure. Eventual siltation, water-borne silt from irrigation and precipitation runoff, and the accumulation of organic material in surface soils due to landscape grass and plant growth, can drastically reduce percolation rates over time. We recommend that suitable methods to prevent siltation be considered in the project design.

CLOSURE

Findings of this report were prepared in accordance with generally accepted professional engineering principles and practice in the field of soil mechanics. The conclusions are based on results of field exploration and testing. If conditions are encountered during construction that appear to be different than those indicated by this report, this firm should be notified.



Source: Copied from USGS Topo Map-
Victorville, Quadrangle 2015

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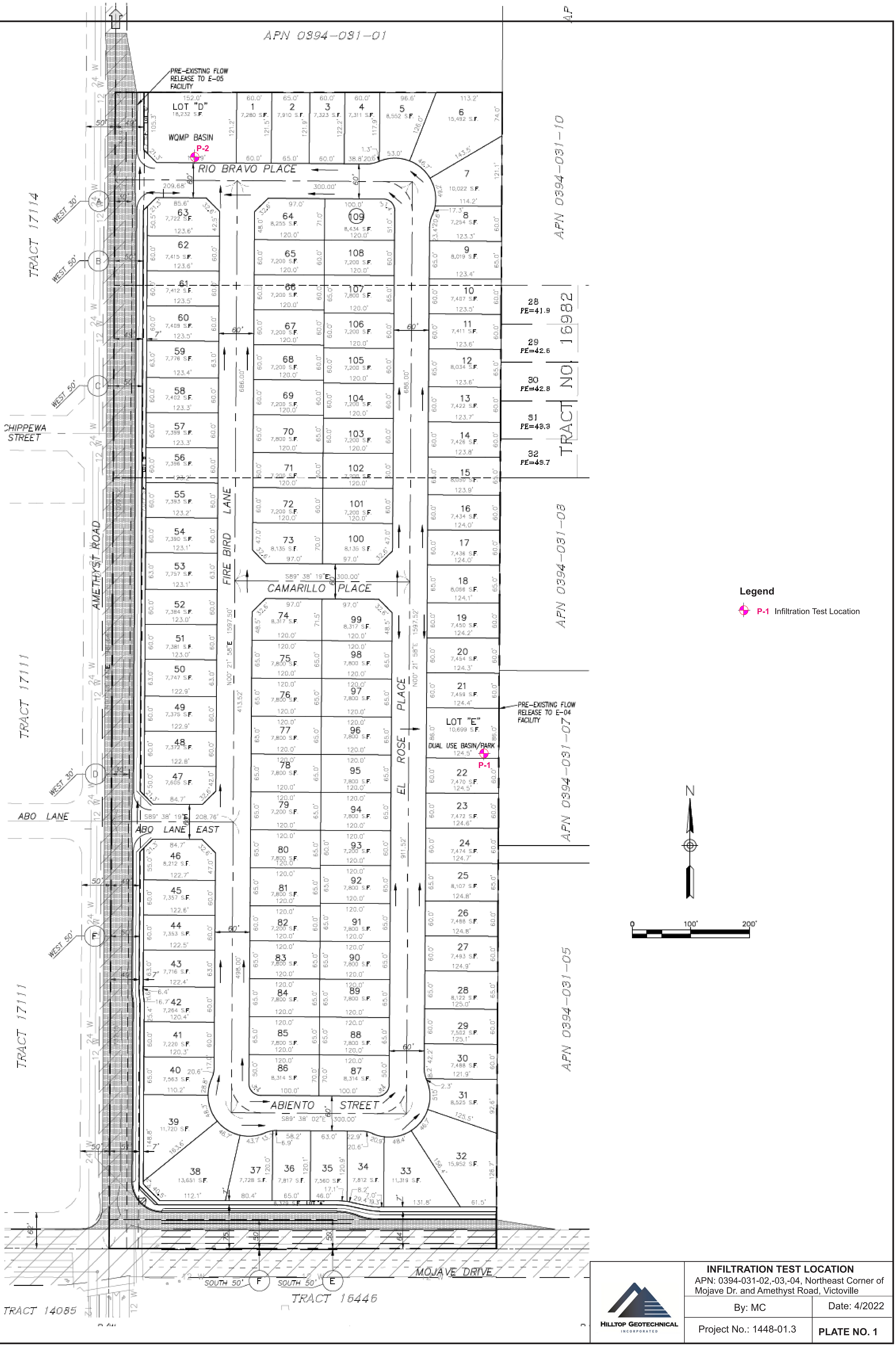
SITE LOCATION MAP

Northeast Corner of Mojave Drive and Amethyst Road
APN 0394-031-02, 03, 04, Victorville, CA 92394

By: MC	Date: 3/2022
Project No.: 1448-01.1	**Figure 1**



Legend

P-1 Infiltration Test Location

INFILTRATION TEST LOCATION

APN: 0394-031-02,-03,-04, Northeast Corner of Mojave Dr. and Amethyst Road, Victoville

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By: MC

Date: 4/2022

Project No.: 1448-01.3

PLATE NO. 1

INFILTROMETER TEST **P-1** DATE OF TEST 18-Mar-22 DEPTH OF
PROJECT IDENTIFICATION: 1448-01.3 AREA(CM2) LIQUID (CM)
TEST LOCATION: 2 feet bgs East INNER 760 INNER 40.6
LIQUID USED: Municipal H20 OUTER 2856.7 OUTER 40.6
TESTED BY AB LIQUID LEVEL MAINTAINED USING: __X__ MANUAL ADDITIONS (VISUAL)
DEPTH TO WATER TABLE: INNER RING AVERAGE RATE CM/H **15.05** IN/H **5.93**
OUTER RING AVERAGE RATE CM/H **13.98** IN/H **5.51**

Note: Inner ring potential goper hole.

Increment No.	DATE	TIME START= 08:50 AM HR: MM	ELAPSED TIME/ INCREMENT MIN	FLOW READINGS INNER FLOW CM3	FLOW READINGS OUTER FLOW CM3	LIQUID TEMP. F	INCREMENTAL INFILTRATION RATE INNER CM/H	INCREMENTAL INFILTRATION RATE ANNULAR CM/H	INCREMENTAL INFILTRATION RATE INNER IN/H	INCREMENTAL INFILTRATION RATE ANNULAR IN/H	GROUND TEMP = 87 F @ DEPTH OF 12 INCHES AIR TEMP, WEATHER
1	18-Mar-2022	9:40	15	5,500	17,500	76	28.95	24.50	11.41	9.65	70, Sunny
2	18-Mar-2022	10:00	15	5,000	16,500	77	26.32	23.10	10.37	9.10	70, Sunny
3	18-Mar-2022	10:20	15	4,400	15,000	77	23.16	21.00	9.12	8.28	70, Sunny
4	18-Mar-2022	10:40	15	3,600	13,300	78	18.95	18.62	7.47	7.34	73, Sunny
5	18-Mar-2022	11:10	30	6,600	21,800	78	17.37	15.26	6.84	6.01	74, Sunny
6	18-Mar-2022	11:40	30	4,800	19,500	79	12.63	13.65	4.98	5.38	78, Sunny
7	18-Mar-2022	12:40	60	5,900	21,200	80	7.76	7.42	3.06	2.92	82, Sunny
8	18-Mar-2022	13:40	60	4,700	17,600	82	6.18	6.16	2.44	2.43	84, Sunny
9	18-Mar-2022	14:40	60	3,900	14,800	83	5.13	5.18	2.02	2.04	90, Sunny
10	18-Mar-2022	15:40	60	3,100	14,100	85	4.08	4.94	1.61	1.94	85, Sunny

	CM/H Annular	CM/H Inner	IN/H Annular	IN/H Inner
Steady State Rates:	5.92	5.79	2.33	2.28

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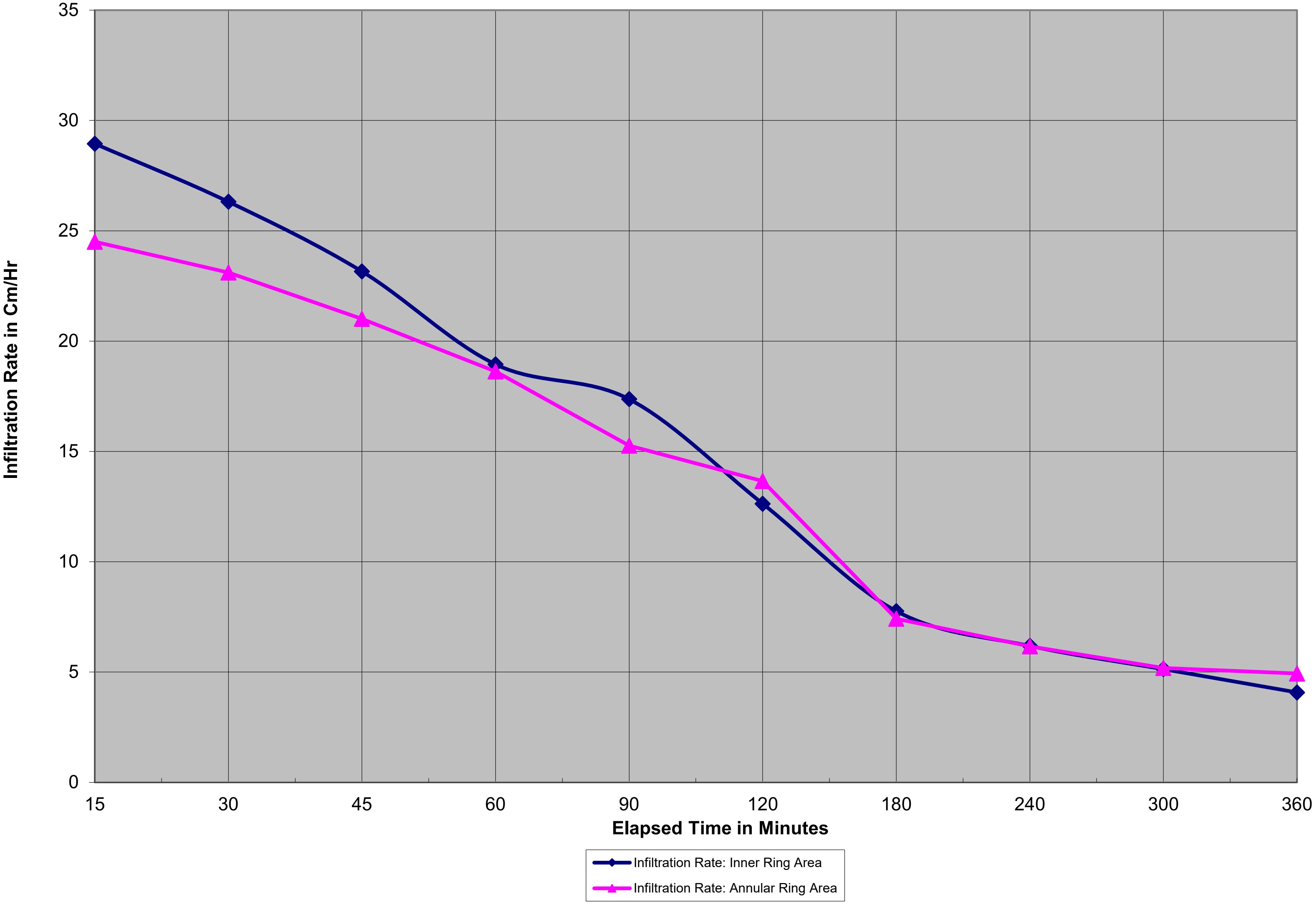
PERCOLATION DATA SHEET

Project Name:	Mojave & Amethyst 40, L.P.	Project Number:	1448-01.3
Test Hole Number:	P-2	Date Tested:	3/18/22
Depth of Boring in feet:	13.0	Tested By:	AB
Radius of boring feet:	0.33	Hours Presaturation	0.83

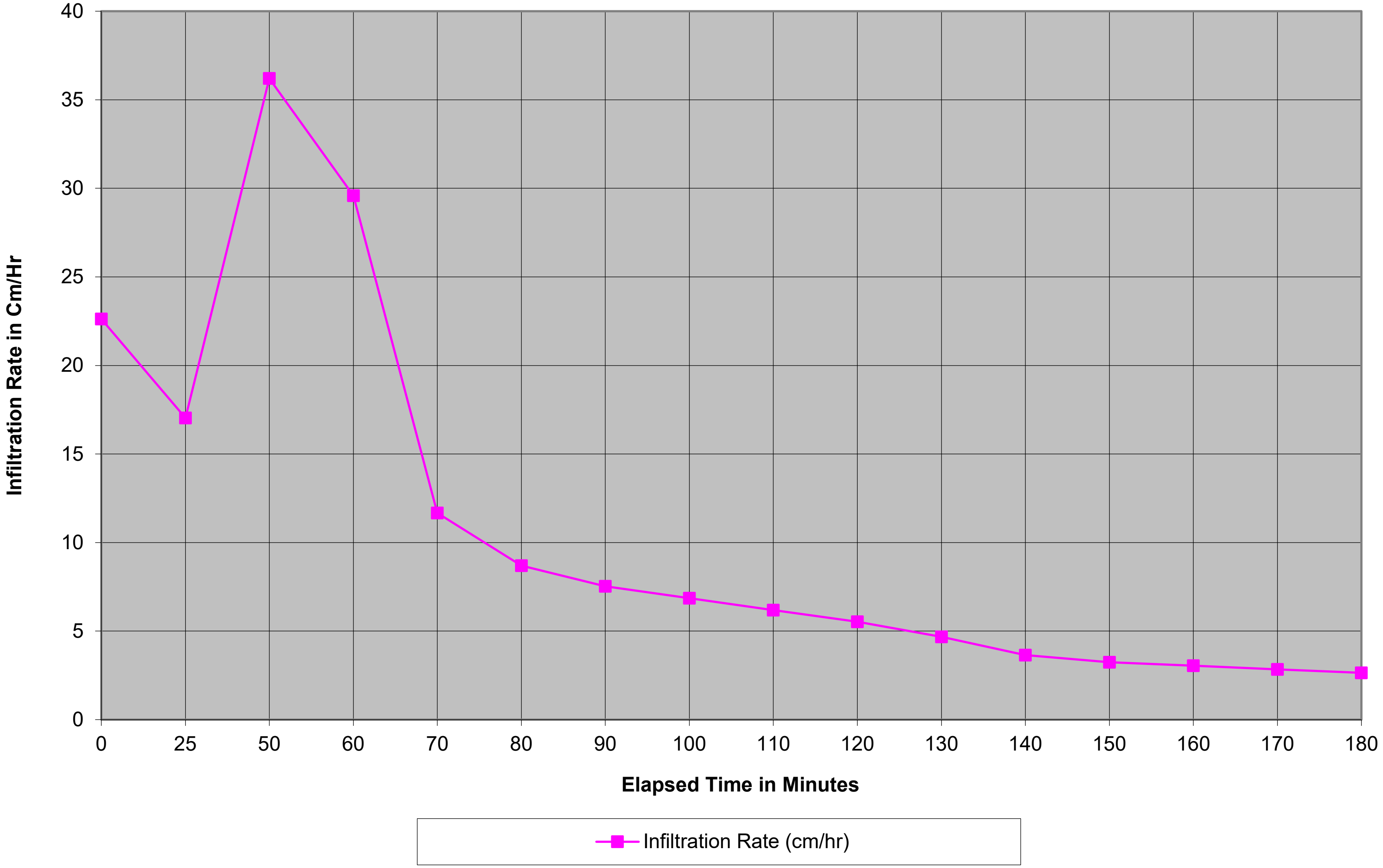
Depth of Bottom (ft) Outter	Time Initial	Time Final	Time Interval (minutes)	Depth of Water - Initial (ft)	Depth of Water - Final (ft)	Change in Water Level (ft)	$H_{average}$ (ft)	Rate, It (In/Hr)	Rate, It (Cm/Hr)
13.00	0:00	0:25	25.0	3.00	13.00	10.00	5.00	8.91	22.62
13.00	0:00	0:25	25.0	3.00	11.55	8.55	5.73	6.70	17.03
13.00	0:00	0:10	10.0	3.00	10.75	7.75	6.13	14.25	36.20
13.00	0:00	0:10	10.0	3.00	9.80	6.80	6.60	11.65	29.59
13.00	0:00	0:10	10.0	5.00	7.70	2.70	6.65	4.59	11.66
13.00	0:00	0:10	10.0	5.00	7.10	2.10	6.95	3.42	8.70
13.00	0:00	0:10	10.0	5.00	6.85	1.85	7.08	2.97	7.53
13.00	0:00	0:10	10.0	5.00	6.70	1.70	7.15	2.70	6.85
13.00	0:00	0:10	10.0	5.00	6.55	1.55	7.23	2.44	6.19
13.00	0:00	0:10	10.0	5.00	6.40	1.40	7.30	2.18	5.53
13.00	0:00	0:10	10.0	5.00	6.20	1.20	7.40	1.84	4.68
13.00	0:00	0:10	10.0	5.00	5.95	0.95	7.53	1.44	3.65
13.00	0:00	0:10	10.0	5.00	5.85	0.85	7.58	1.28	3.24
13.00	0:00	0:10	10.0	5.00	5.80	0.80	7.60	1.20	3.04
13.00	0:00	0:10	10.0	5.00	5.75	0.75	7.63	1.12	2.84
13.00	0:00	0:10	10.0	5.00	5.70	0.70	7.65	1.04	2.65

Infiltration Graph via Double Rings: Infiltration Rate vs. Time
P-1



INFITROMETER TEST P-1

Infiltration Graph via Percolation Test: Infiltration Rate vs. Time



Infiltrometer Graph
P-2

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SUBSURFACE EXPLORATION LOG
BORING NO. P-1

Project Name: Mojave & Amethyst 40, L.P.

Project No.	1448-01.3	Date:	3/18/2022	Logged By:	AB
Type of Rig:	Hollow-Stem Auger	Drive Wt.:	140 lb	Elevation:	2940 ± 25
Drill Hole Dia.:	8 in.	Drop:	30 in.	Depth of Boring (ft.):	2.0

Depth (ft.)	Sample Type	Penetration Resistance	Soil Classification	Dry Density (Ib/ft3)	Moisture Content (%)	Lithology	Groundwater	Description
1								ALLUVIUM (0 to 2'): Silty fine to medium sand, trace gravel; Slightly moist; Dark yellowish brown; Medium dense.
2								Bottom of excavation 2 feet. No groundwater encountered. Converted to P-1, backfilled when testing completed.
3								
4								
5								
6								
7								
8								
9								
10								
11								
12								
13								
14								
15								
16								
17								
18								
19								
20								
21								
22								
23								
24								
25								

S - SPT Sample R - Ring Sample B - Bulk Sample N - Nuclear Gauge Test D - Disturbed Sample

N.R. - No Recovery

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SUBSURFACE EXPLORATION LOG
BORING NO. P-2

Project Name:	Mojave & Amethyst 40, L.P.				
Project No.	1448-01.3	Date:	3/18/2022	Logged By:	AB
Type of Rig:	Hollow-Stem Auger	Drive Wt.:	140 lb	Elevation:	2940 ± 25
Drill Hole Dia.:	8 in.	Drop:	30 in.	Depth of Boring (ft.):	13.0

Depth (ft.)	Sample Type	Penetration Resistance	Soil Classification	Dry Density (Ib/ft3)	Moisture Content (%)	Lithology	Groundwater	Description
								ALLUVIUM (0 to 13') Silty fine to medium sand, trace gravel; Slightly moist; Dark yellowish brown; Medium dense.
1								
2								
3								
4								
5								
6								
7								
8								
9								
10								
11								
12								
13								Bottom of boring 13 feet. No groundwater encountered. Converted to P-2, backfilled when testing completed.
14								
15								
16								
17								
18								
19								
20								
21								
22								
23								
24								
25								

S - SPT Sample R - Ring Sample B - Bulk Sample N - Nuclear Gauge Test D - Disturbed Sample

N.R. - No Recovery

Form 4.2-1 LID BMP Performance Criteria for Design Capture Volume

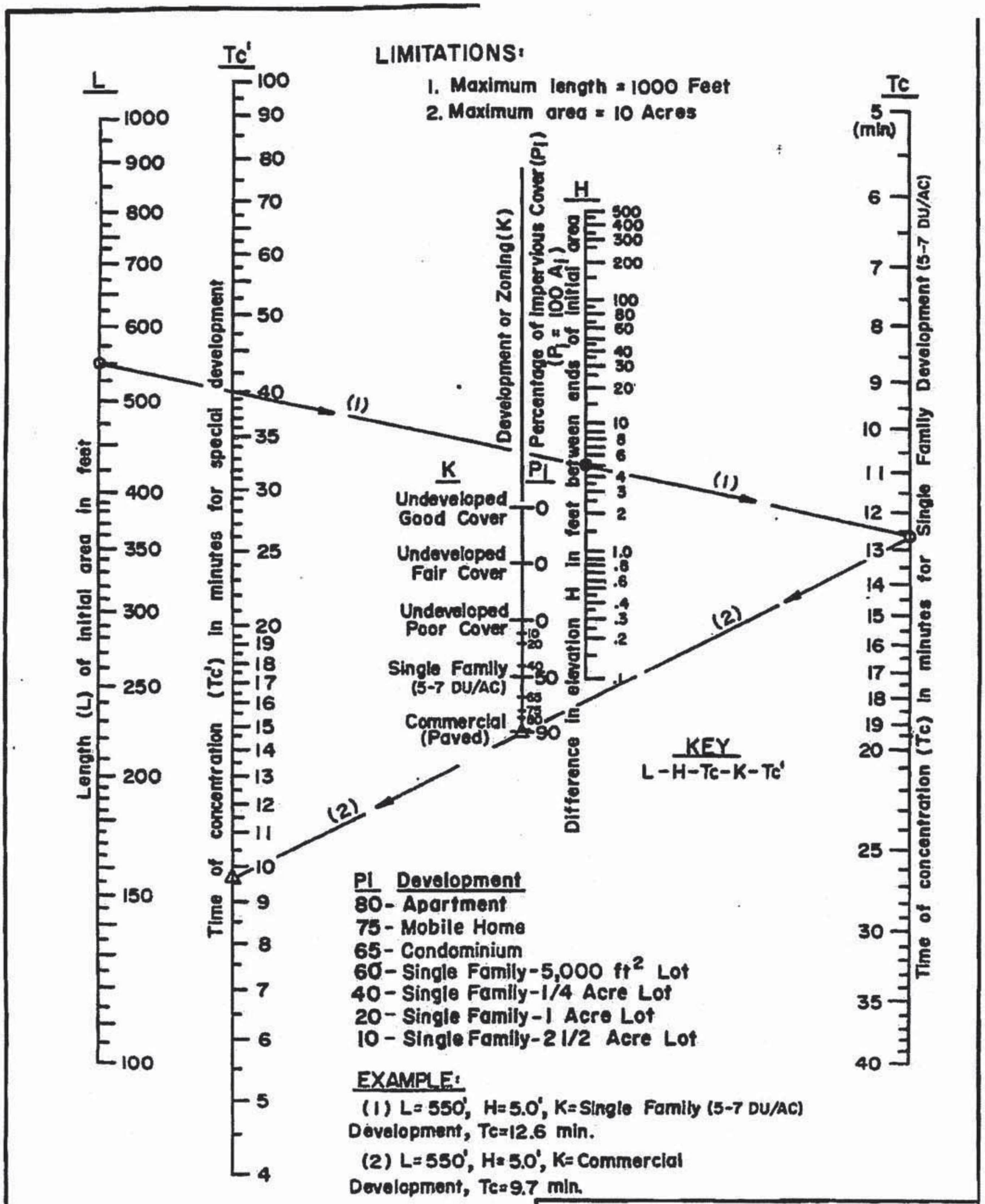
🟨	User Input
🟥	User to Verify
🟦	Results

17839 DA1 (NORTHWEST)

1	Project area **DA 1** (ft^2):	1,262,804.40	ft^2
2	Imperviousness after applying preventative site design practices (Imp%):	0.482	Decimal %
3	Runoff Coefficient (Rc): *$R_c = 0.858(Imp\%)^{\wedge 3} -0.78(Imp\%)^{\wedge 2} +0.774(Imp\%)+0.04$*	0.328	
4	Determine 1-hour rainfall depth for a 2-year return period P2yr-1hr (in):	0.365	in
5	Compute P6, Mean 6-hr Precipitation (inches): *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)*	0.452	(**Note:** Change the equation to use the correct value for the zone you are in)
6	Drawdown Rate	48	hrs
7	Compute design capture volume, DCV (ft3): *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*	30,577.03	ft^3

Appendix C – San Bernardino County Hydrology Manual (Selected Figures)

Appendix C-1 – SB County Hydrology Manual Figure D-1, Time of Concentration Nomograph



LIMITATIONS:

1. Maximum length = 1000 Feet
2. Maximum area = 10 Acres

PI	Development
80	Apartment
75	Mobile Home
65	Condominium
60	Single Family-5,000 ft² Lot
40	Single Family-1/4 Acre Lot
20	Single Family-1 Acre Lot
10	Single Family-2 1/2 Acre Lot

EXAMPLE:

(1) L = 550', H = 5.0', K = Single Family (5-7 DU/AC) Development, Tc = 12.6 min.

(2) L = 550', H = 5.0', K = Commercial Development, Tc = 9.7 min.

SAN BERNARDINO COUNTY

HYDROLOGY MANUAL

TIME OF CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA

Figure D-1

Appendix C - 2 – SB County Hydrology Manual Figure C-3, Curve Numbers of Hydrologic Soil

Curve (1) Numbers of Hydrologic Soil-Cover Complexes For Pervious Areas-AMC II

Cover Type (3)	Quality of Cover (2)	Soil Group			
		A	B	C	D
NATURAL COVERS -					
Barren (Rockland, eroded and graded land)		78	86	91	93
Chaparral, Broadleaf (Manzonita, ceanothus and scrub oak)	Poor	53	70	80	85
	Fair	40	63	75	81
	Good	31	57	71	78
Chaparral, Narrowleaf (Chamise and redshank)	Poor	71	82	88	91
	Fair	55	72	81	86
Grass, Annual or Perennial	Poor	67	78	86	89
	Fair	50	69	79	84
	Good	38	61	74	80
Meadows or Cienegas (Areas with seasonally high water table, principal vegetation is sod forming grass)	Poor	63	77	85	88
	Fair	51	70	80	84
	Good	30	58	71	78
Open Brush (Soft wood shrubs - buckwheat, sage, etc.)	Poor	62	76	84	88
	Fair	46	66	77	83
	Good	41	63	75	81
Woodland (Coniferous or broadleaf trees predominate. Canopy density is at least 50 percent.)	Poor	45	66	77	83
	Fair	36	60	73	79
	Good	25	55	70	77
Woodland, Grass (Coniferous or broadleaf trees with canopy density from 20 to 50 percent)	Poor	57	73	82	86
	Fair	44	65	77	82
	Good	33	58	72	79
URBAN COVERS -					
Residential or Commercial Landscaping (Lawn, shrubs, etc.)	Good	32	56	69	75
Turf (Irrigated and mowed grass)	Poor	58	74	83	87
	Fair	44	65	77	82
	Good	33	58	72	79
AGRICULTURAL COVERS -					
Fallow (Land plowed but not tilled or seeded)		77	86	91	94

SAN BERNARDINO COUNTY

HYDROLOGY MANUAL

**CURVE NUMBERS
FOR
PERVIOUS AREAS**

Figure C-3 (1 of 2)

Curve (1) Numbers of Hydrologic Soil-Cover Complexes For Pervious Areas-AMC II

Cover Type (3)	Quality of Cover (2)	Soil Group A	B	C	D
AGRICULTURAL COVERS (Continued)					
Legumes, Close Seeded	Poor	66	77	85	89
(Alfalfa, sweetclover, timothy, etc.)	Good	58	72	81	85
Orchards, Evergreen	Poor	57	73	82	86
(Citrus, avocados, etc.)	Fair	44	65	77	82
	Good	33	58	72	79
Pasture, Dryland	Poor	68	79	86	89
(Annual grasses)	Fair	49	69	79	84
	Good	39	61	74	80
Pasture, Irrigated	Poor	58	74	83	87
(Legumes and perennial grass)	Fair	44	65	77	82
	Good	33	58	72	79
Row Crops	Poor	72	81	88	91
(Field crops - tomatoes, sugar beets, etc.)	Good	67	78	85	89
Small grain	Poor	65	76	84	88
(Wheat, oats, barley, etc.)	Good	63	75	83	87

Notes:

1. All curve numbers are for Antecedent Moisture Condition (AMC) II.
2. Quality of cover definitions:

   Poor-Heavily grazed, regularly burned areas, or areas of high burn potential. Less than 50 percent of the ground surface is protected by plant cover or brush and tree canopy.

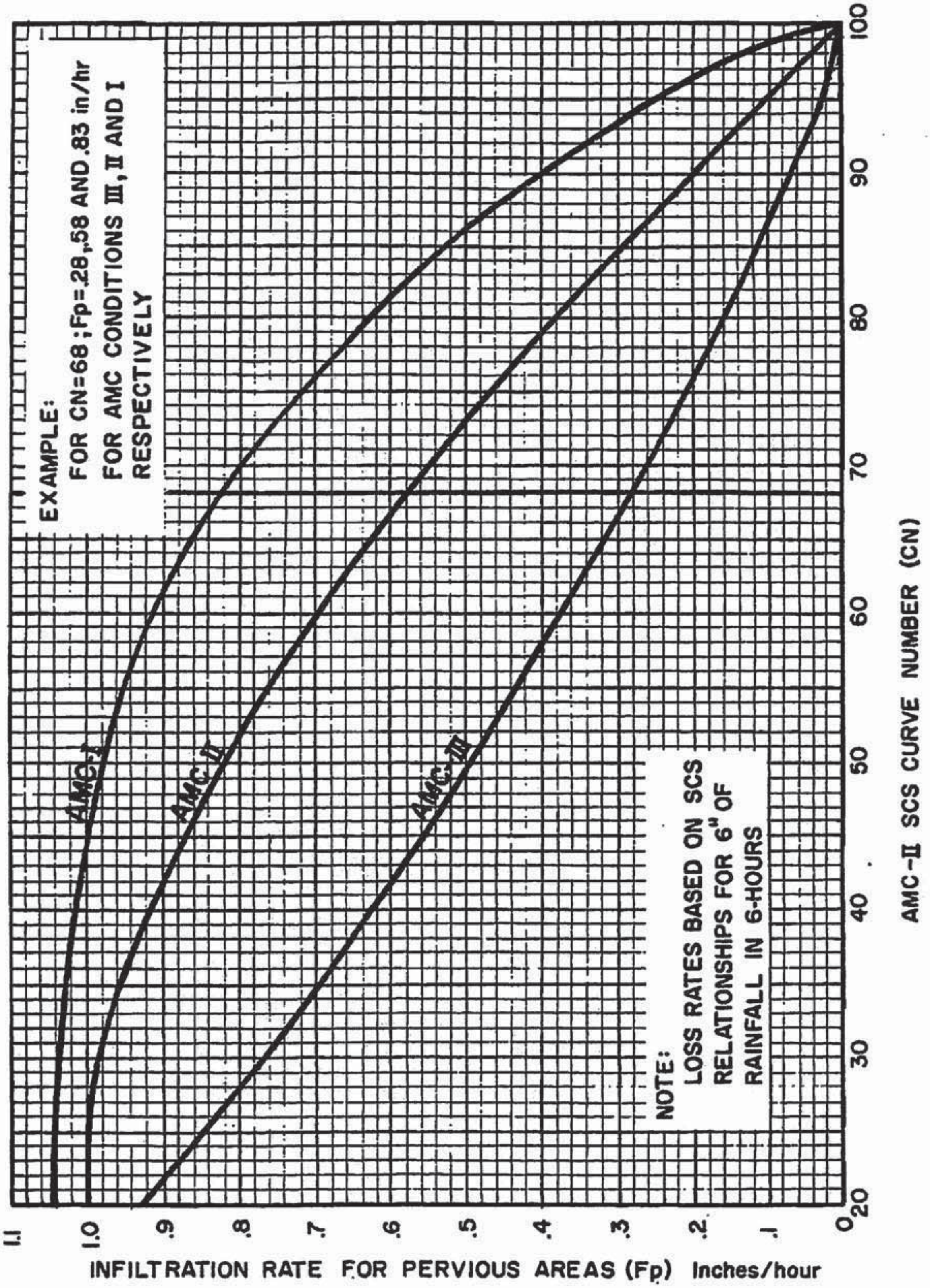
   Fair-Moderate cover with 50 percent to 75 percent of the ground surface protected.

   Good-Heavy or dense cover with more than 75 percent of the ground surface protected.
3. See Figure C-2 for definition of cover types.

CURVE NUMBERS
FOR
PERVIOUS AREAS

Figure C-3 (2 of 2)

Appendix C - 3 – SB County Hydrology Manual Figure C-6, Infiltration Rate for Pervious Areas versus SCS Curve Numbers

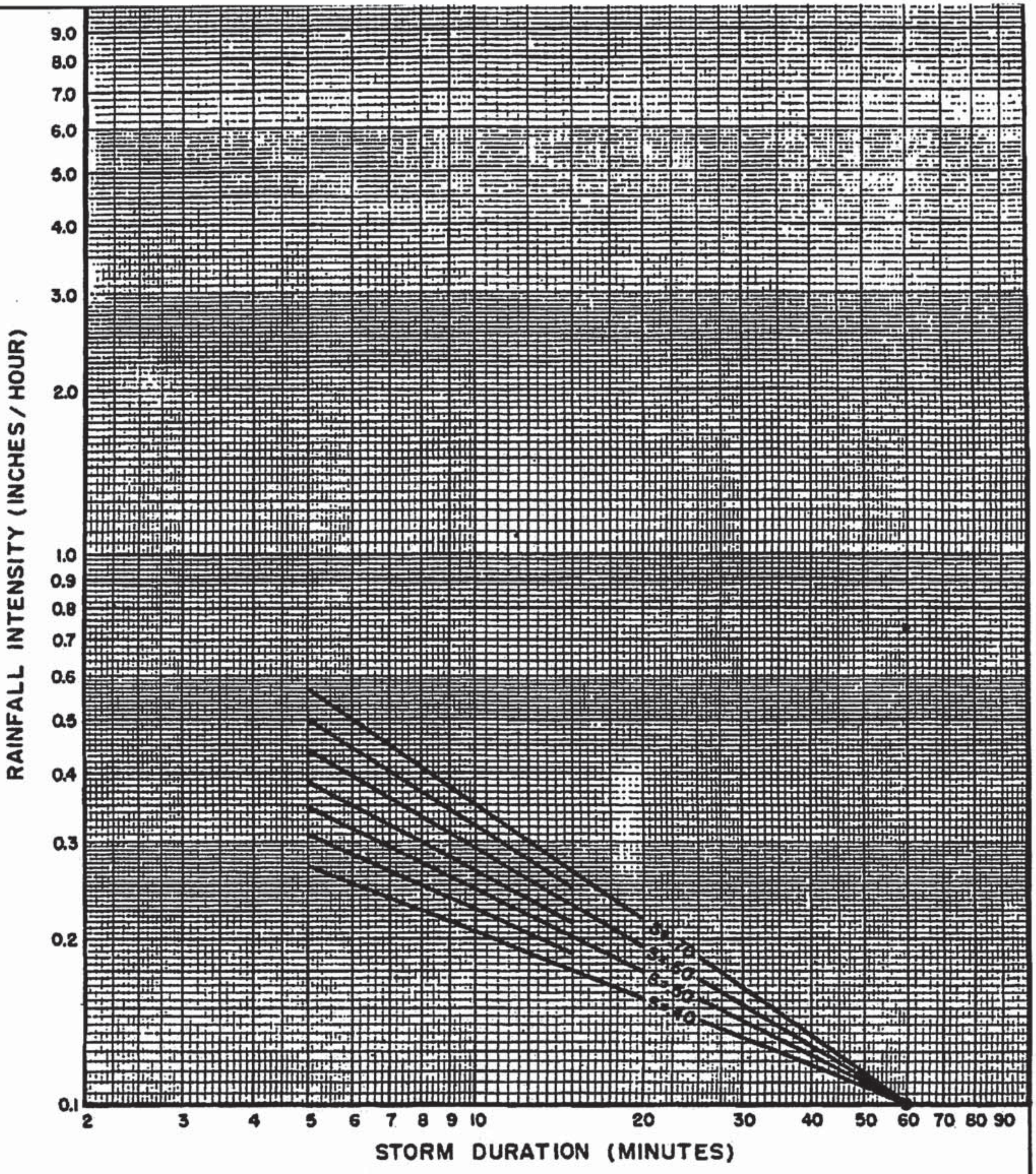


SAN BERNARDINO COUNTY
HYDROLOGY MANUAL

INFILTRATION RATE FO
PERVIOUS AREAS VERSUS
SCS CURVE NUMBERS

Figure C-6

Appendix C - 4 – SB County Hydrology Manual Figure D-3, Intensity – Duration Curves Calculation Sheet



DESIGN STORM FREQUENCY =_____ YEARS

ONE HOUR POINT RAINFALL =_____ INCHES

LOG-LOG SLOPE =_____

PROJECT LOCATION =________________

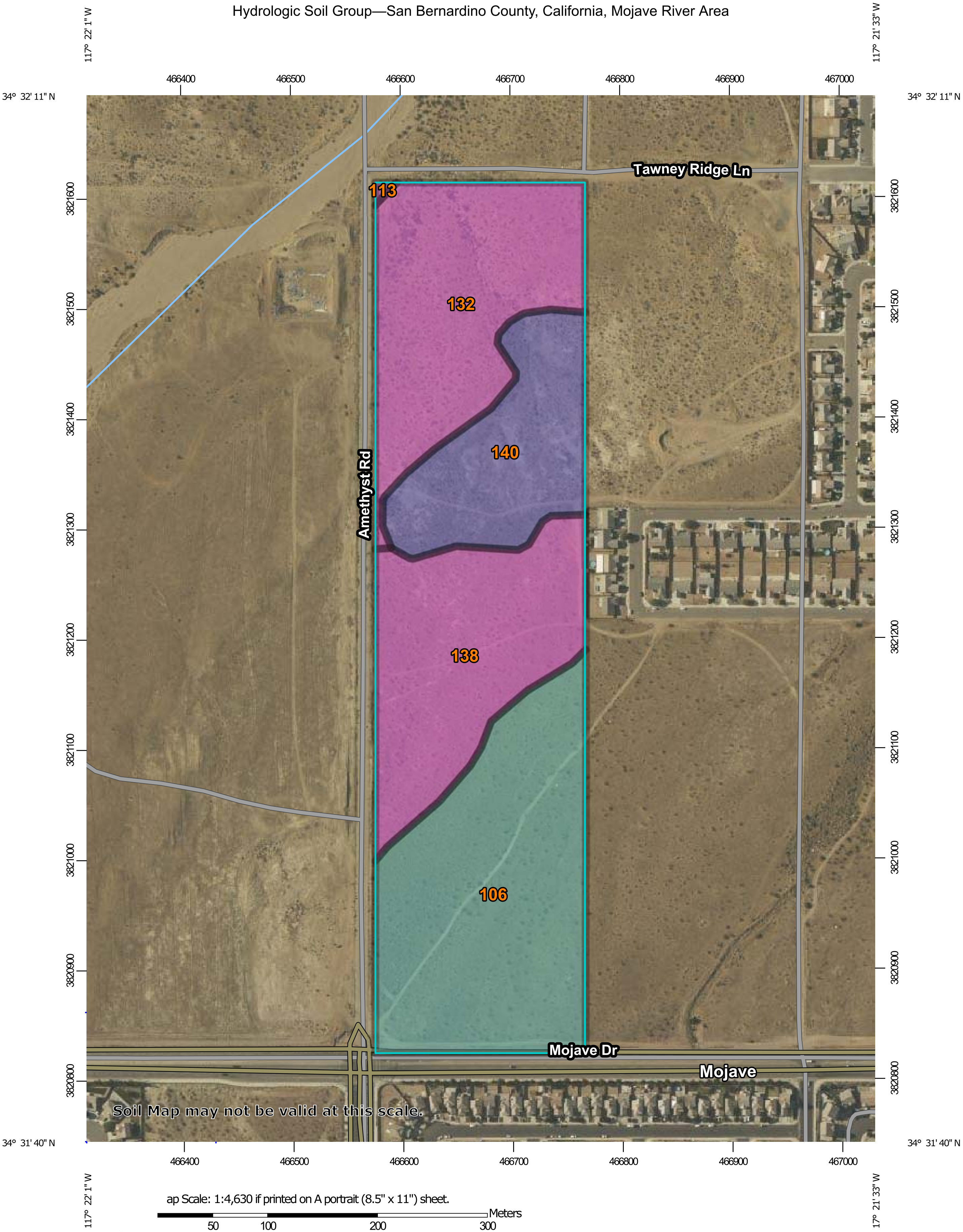
SAN BERNARDINO COUNTY

HYDROLOGY MANUAL

INTENSITY - DURATION CURVES CALCULATION SHEET

FIGURE D-3

Hydrologic Soil Group—San Bernardino County, California, Mojave River Area



ap Scale: 1:4,630 if printed on A portrait (8.5" x 11") sheet.

MAP LEGEND

Area of Interest (AOI)

⬜ Area of Interest (AOI)

Soils

Soil Rating Polygons

- 🟪 A
- 🟩 A/D
- 🟦 B
- 🟫 B/D
- 🟦 C
- 🟨 C/D
- 🟥 D
- ⬜ Not rated or not available

Soil Rating Lines

- 〰 A
- 〰 A/D
- 〰 B
- 〰 B/D
- 〰 C
- 〰 C/D
- 〰 D
- 〰 Not rated or not available

Soil Rating Points

- ■ A
- ■ A/D
- ■ B
- ■ B/D
- ■ C
- ■ C/D
- ■ D
- □ Not rated or not available

Water Features

- 〰 Streams and Canals

Transportation

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

Background

- ▨ Aerial Photography

MAP INFORMATION

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

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

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

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

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

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

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

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

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

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

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
106	BRYMAN LOAMY FINE SAND, 2 TO 5 PERCENT SLOPES	C	13.1	34.9%
113	CAJON SAND, 2 TO 9 PERCENT SLOPES	A	0.0	0.1%
132	HELENDALE LOAMY SAND, 2 TO 5 PERCENT SLOPES	A	9.2	24.7%
138	KIMBERLINA LOAMY FINE SAND, COOL, 2 TO 5 PERCENT SLOPES	A	8.9	23.8%
140	LAVIC LOAMY FINE SAND	B	6.2	16.5%
Totals for Area of Interest			**37.4**	**100.0%**

Description

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The soils in the United States are assigned to four groups (A, B, C, and D) and three dual classes (A/D, B/D, and C/D). The groups are defined as follows:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

NOAA Atlas 14, Volume 6, Version 2
Location name: Victorville, California, USA*
Latitude: 34.5319°, Longitude: -117.363°
Elevation: 2947.41 ft**
* source: ESRI Maps
** source: USGS

POINT PRECIPITATION FREQUENCY ESTIMATES

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

NOAA, National Weather Service, Silver Spring, Maryland

PF_tabular | PF_graphical | Maps_&_aerials

PF tabular

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

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	**0.090** (0.075-0.111)	**0.126** (0.104-0.154)	**0.175** (0.144-0.215)	**0.216** (0.176-0.268)	**0.275** (0.217-0.352)	**0.323** (0.249-0.421)	**0.373** (0.281-0.499)	**0.427** (0.313-0.587)	**0.503** (0.354-0.721)	**0.565** (0.384-0.838)
10-min	**0.130** (0.107-0.158)	**0.180** (0.149-0.221)	**0.250** (0.206-0.308)	**0.310** (0.253-0.383)	**0.394** (0.311-0.504)	**0.462** (0.357-0.604)	**0.534** (0.403-0.715)	**0.611** (0.449-0.842)	**0.721** (0.507-1.03)	**0.809** (0.551-1.20)
15-min	**0.157** (0.129-0.192)	**0.218** (0.180-0.267)	**0.303** (0.249-0.372)	**0.375** (0.306-0.464)	**0.477** (0.376-0.610)	**0.559** (0.432-0.730)	**0.646** (0.487-0.865)	**0.739** (0.542-1.02)	**0.872** (0.614-1.25)	**0.979** (0.666-1.45)
30-min	**0.217** (0.180-0.266)	**0.303** (0.250-0.371)	**0.420** (0.346-0.516)	**0.520** (0.424-0.644)	**0.662** (0.522-0.847)	**0.776** (0.600-1.01)	**0.897** (0.677-1.20)	**1.03** (0.753-1.41)	**1.21** (0.852-1.74)	**1.36** (0.924-2.02)
60-min	**0.262** (0.216-0.320)	**0.365** (0.301-0.446)	**0.506** (0.416-0.621)	**0.626** (0.510-0.775)	**0.796** (0.628-1.02)	**0.934** (0.722-1.22)	**1.08** (0.814-1.45)	**1.24** (0.906-1.70)	**1.46** (1.02-2.09)	**1.64** (1.11-2.43)
2-hr	**0.365** (0.301-0.446)	**0.491** (0.405-0.602)	**0.666** (0.548-0.818)	**0.814** (0.664-1.01)	**1.03** (0.810-1.31)	**1.20** (0.926-1.57)	**1.38** (1.04-1.85)	**1.57** (1.15-2.17)	**1.85** (1.30-2.65)	**2.07** (1.41-3.07)
3-hr	**0.439** (0.363-0.537)	**0.585** (0.483-0.717)	**0.787** (0.647-0.966)	**0.959** (0.782-1.19)	**1.21** (0.951-1.54)	**1.40** (1.09-1.83)	**1.61** (1.22-2.16)	**1.84** (1.35-2.53)	**2.15** (1.52-3.09)	**2.41** (1.64-3.58)
6-hr	**0.591** (0.488-0.723)	**0.783** (0.646-0.959)	**1.05** (0.862-1.29)	**1.27** (1.04-1.58)	**1.59** (1.26-2.04)	**1.85** (1.43-2.42)	**2.13** (1.60-2.85)	**2.42** (1.78-3.33)	**2.83** (2.00-4.06)	**3.17** (2.15-4.70)
12-hr	**0.742** (0.613-0.908)	**1.00** (0.828-1.23)	**1.36** (1.12-1.67)	**1.66** (1.36-2.06)	**2.09** (1.65-2.67)	**2.43** (1.88-3.17)	**2.78** (2.10-3.73)	**3.16** (2.32-4.35)	**3.69** (2.60-5.30)	**4.12** (2.80-6.12)
24-hr	**0.965** (0.856-1.11)	**1.34** (1.19-1.54)	**1.85** (1.63-2.13)	**2.27** (1.99-2.64)	**2.86** (2.43-3.45)	**3.33** (2.77-4.10)	**3.82** (3.10-4.82)	**4.34** (3.42-5.63)	**5.07** (3.83-6.84)	**5.65** (4.13-7.90)
2-day	**1.08** (0.954-1.24)	**1.51** (1.34-1.74)	**2.10** (1.85-2.42)	**2.59** (2.27-3.02)	**3.28** (2.78-3.95)	**3.83** (3.18-4.71)	**4.41** (3.57-5.55)	**5.02** (3.96-6.50)	**5.88** (4.44-7.93)	**6.56** (4.79-9.17)
3-day	**1.16** (1.03-1.34)	**1.64** (1.45-1.89)	**2.29** (2.02-2.64)	**2.83** (2.48-3.30)	**3.59** (3.05-4.33)	**4.20** (3.49-5.16)	**4.84** (3.92-6.09)	**5.51** (4.34-7.14)	**6.47** (4.89-8.73)	**7.24** (5.28-10.1)
4-day	**1.24** (1.10-1.43)	**1.75** (1.55-2.01)	**2.44** (2.15-2.82)	**3.02** (2.65-3.52)	**3.83** (3.25-4.61)	**4.48** (3.72-5.50)	**5.15** (4.17-6.49)	**5.87** (4.63-7.61)	**6.88** (5.20-9.29)	**7.69** (5.62-10.7)
7-day	**1.33** (1.18-1.53)	**1.86** (1.64-2.14)	**2.58** (2.28-2.98)	**3.19** (2.79-3.72)	**4.04** (3.42-4.86)	**4.70** (3.90-5.78)	**5.39** (4.37-6.79)	**6.12** (4.82-7.93)	**7.13** (5.39-9.63)	**7.93** (5.79-11.1)
10-day	**1.40** (1.24-1.61)	**1.96** (1.73-2.25)	**2.72** (2.40-3.14)	**3.35** (2.93-3.90)	**4.23** (3.59-5.10)	**4.93** (4.09-6.06)	**5.65** (4.57-7.11)	**6.40** (5.04-8.29)	**7.44** (5.63-10.0)	**8.26** (6.03-11.5)
20-day	**1.61** (1.43-1.86)	**2.28** (2.02-2.62)	**3.19** (2.82-3.68)	**3.95** (3.46-4.60)	**5.03** (4.27-6.06)	**5.89** (4.89-7.24)	**6.78** (5.49-8.54)	**7.71** (6.07-9.98)	**8.98** (6.79-12.1)	**9.98** (7.29-13.9)
30-day	**1.83** (1.62-2.10)	**2.59** (2.29-2.98)	**3.66** (3.23-4.23)	**4.57** (4.00-5.32)	**5.87** (4.98-7.07)	**6.91** (5.74-8.50)	**7.99** (6.47-10.1)	**9.13** (7.19-11.8)	**10.7** (8.09-14.4)	**11.9** (8.71-16.7)
45-day	**2.12** (1.88-2.44)	**3.01** (2.67-3.47)	**4.29** (3.79-4.96)	**5.40** (4.73-6.29)	**7.02** (5.95-8.45)	**8.34** (6.92-10.3)	**9.72** (7.88-12.2)	**11.2** (8.82-14.5)	**13.2** (10.0-17.9)	**14.9** (10.9-20.8)
60-day	**2.33** (2.06-2.68)	**3.31** (2.93-3.81)	**4.74** (4.18-5.47)	**6.00** (5.25-6.98)	**7.86** (6.66-9.46)	**9.40** (7.80-11.6)	**11.0** (8.95-13.9)	**12.8** (10.1-16.6)	**15.3** (11.6-20.7)	**17.3** (12.6-24.2)

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

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

Please refer to NOAA Atlas 14 document for more information.

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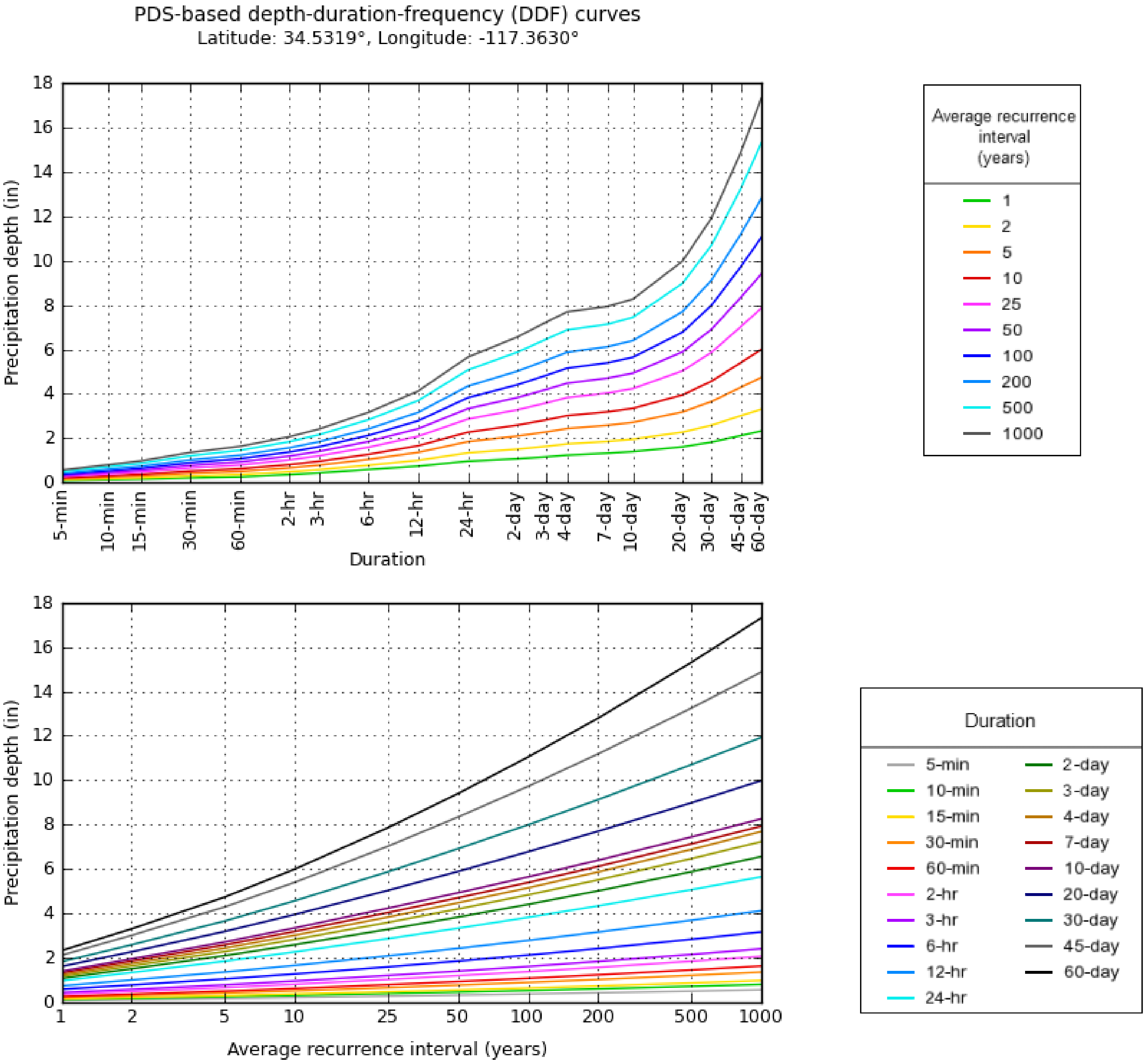
PF graphical



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Created (GMT): Tue Oct 26 17:37:13 2021

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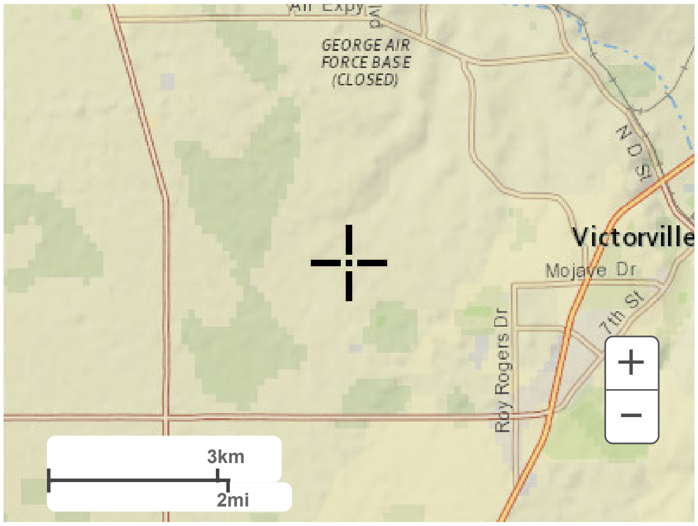
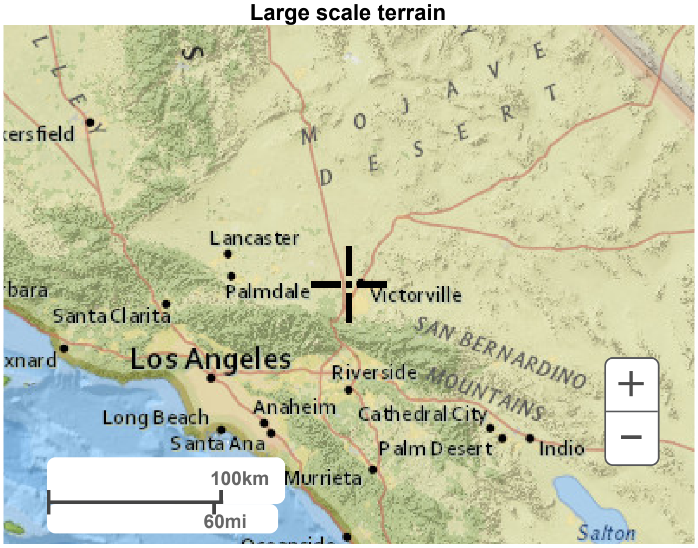
Maps & aerials

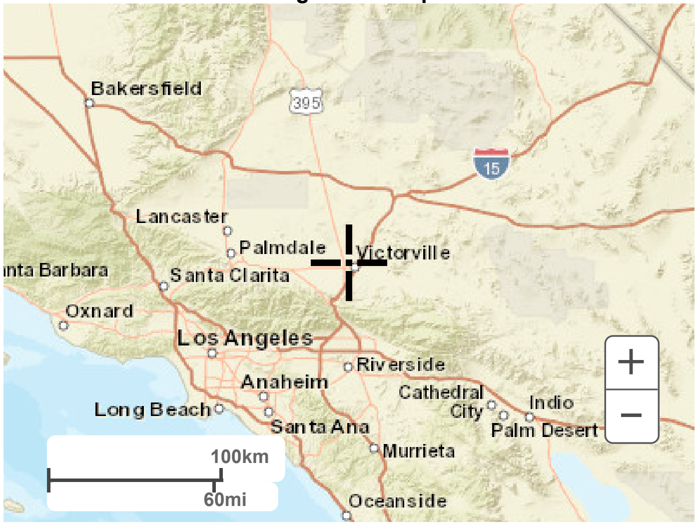
Small scale terrain



Large scale terrain



Large scale map



Large scale aerial

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

Disclaimer

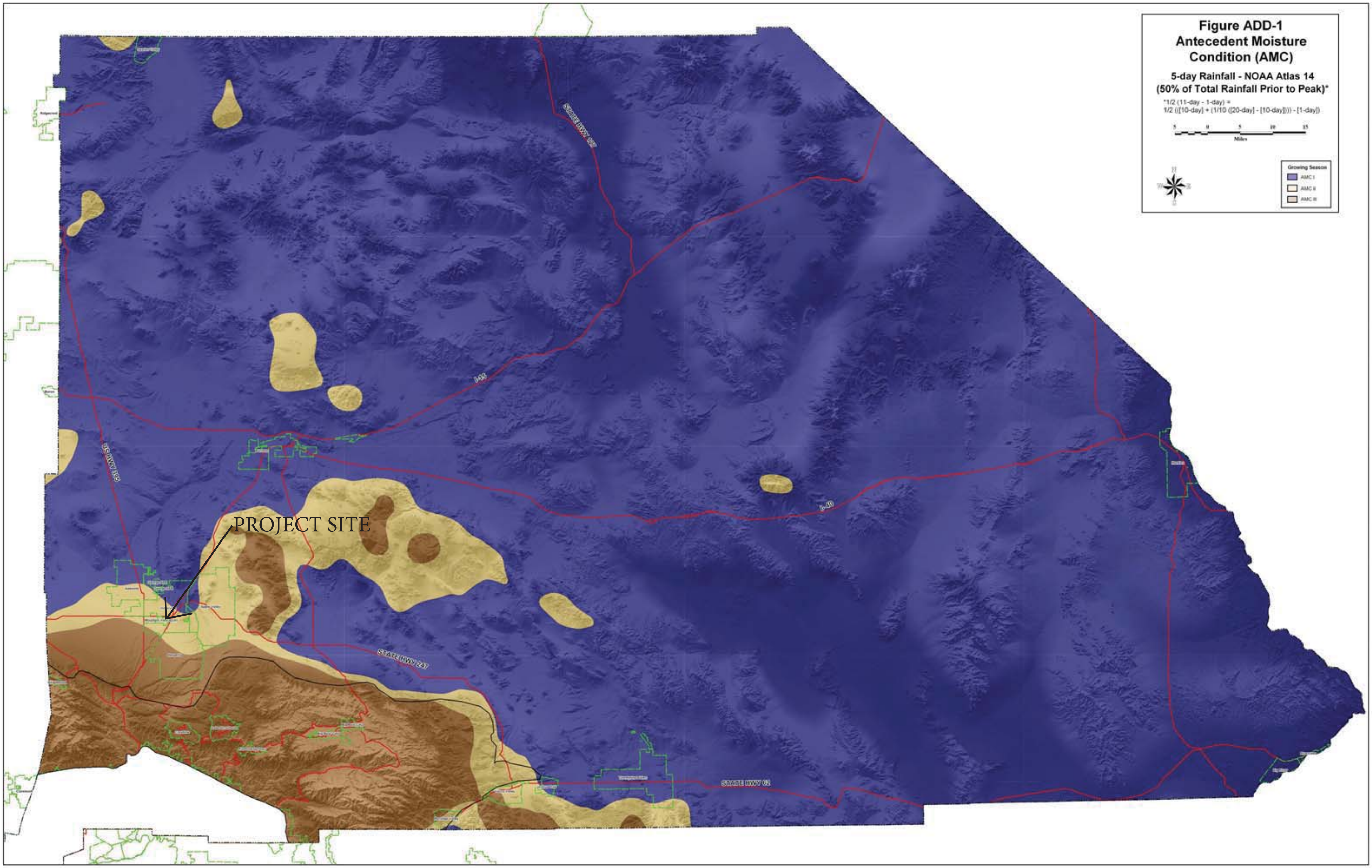
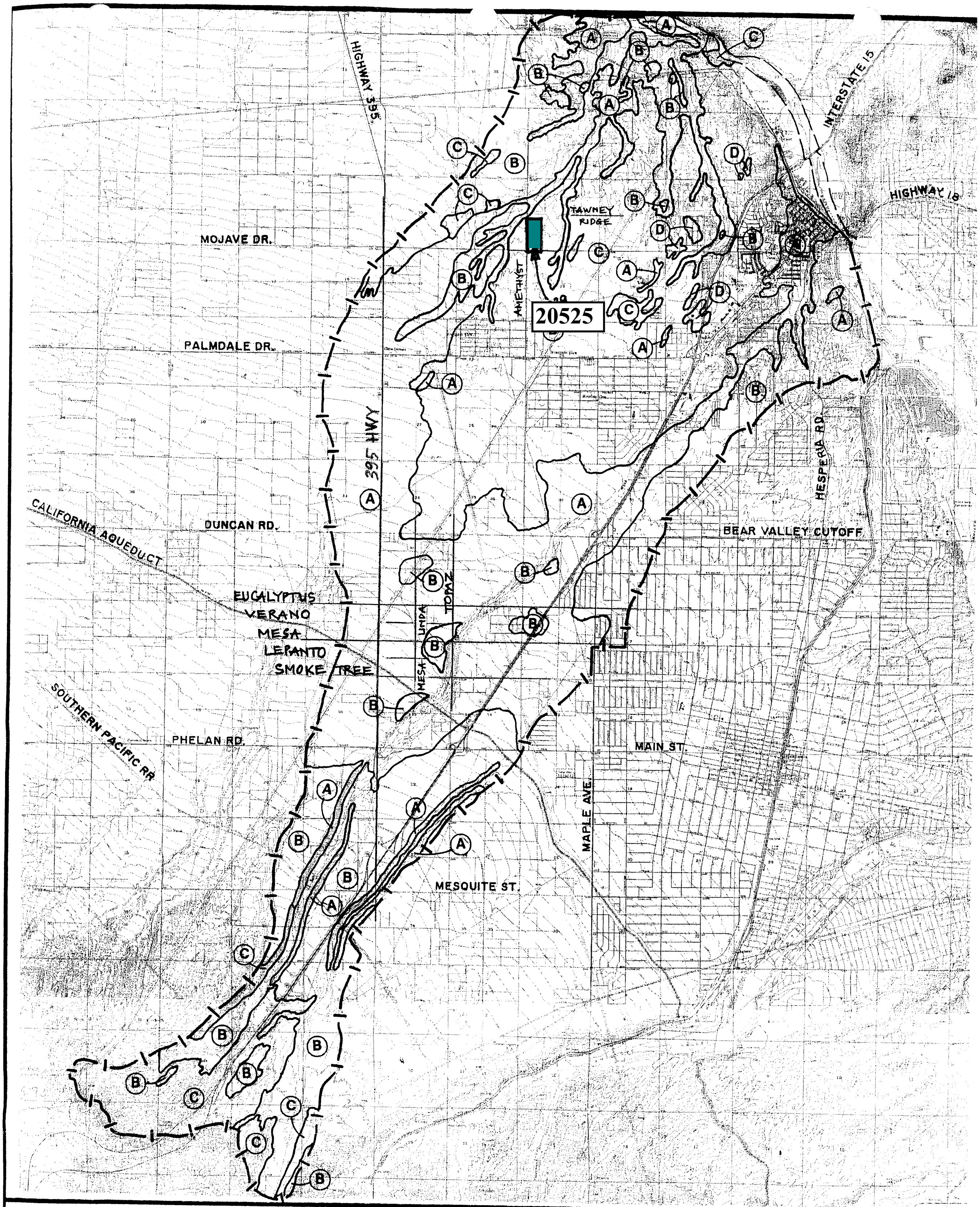


Figure ADD-1
Antecedent Moisture
Condition (AMC)

5-day Rainfall - NOAA Atlas 14
(50% of Total Rainfall Prior to Peak)*

*1/2 (11-day - 1-day) =
1/2 (([10-day] + (1/10 ([20-day] - [10-day]))) - [1-day])



LEGEND

—·|·— WATERSHED BOUNDARY

——— SOIL GROUP BOUNDARY

Ⓐ HYDROLOGIC SOIL GROUP

VICTORVILLE
MASTER PLAN
OF DRAINAGE

HYDROLOGIC SOIL GROUPS
FIGURE 4.2
4-6

W
S
SCALE
1"=10000'
WILLIAMSON & SCHMI

Curve (1) Numbers of Hydrologic Soil-Cover Complexes For Pervious Areas-AMC II

Cover Type (3)	Quality of Cover (2)	Soil Group			
		A	B	C	D
NATURAL COVERS -					
Barren (Rockland, eroded and graded land)		78	86	91	93
Chaparral, Broadleaf (Manzonita, ceanothus and scrub oak)	Poor	53	70	80	85
	Fair	40	63	75	81
	Good	31	57	71	78
Chaparral, Narrowleaf (Chamise and redshank)	Poor	71	82	88	91
	Fair	55	72	81	86
Grass, Annual or Perennial	Poor	67	78	86	89
	Fair	50	69	79	84
	Good	38	61	74	80
Meadows or Cienegas (Areas with seasonally high water table, principal vegetation is sod forming grass)	Poor	63	77	85	88
	Fair	51	70	80	84
	Good	30	58	71	78
Open Brush (Soft wood shrubs - buckwheat, sage, etc.)	Poor	62	76	84	88
	Fair	46	66	77	83
	Good	41	63	75	81
Woodland (Coniferous or broadleaf trees predominate. Canopy density is at least 50 percent.)	Poor	45	66	77	83
	Fair	36	60	73	79
	Good	25	55	70	77
Woodland, Grass (Coniferous or broadleaf trees with canopy density from 20 to 50 percent)	Poor	57	73	82	86
	Fair	44	65	77	82
	Good	33	58	72	79
URBAN COVERS -					
Residential or Commercial Landscaping (Lawn, shrubs, etc.)	Good	32	56	69	75
Turf (Irrigated and mowed grass)	Poor	58	74	83	87
	Fair	44	65	77	82
	Good	33	58	72	79
AGRICULTURAL COVERS -					
Fallow (Land plowed but not tilled or seeded)		77	86	91	94

SAN BERNARDINO COUNTY

HYDROLOGY MANUAL

CURVE NUMBERS
FOR
PERVIOUS AREAS

Curve (1) Numbers of Hydrologic Soil-Cover Complexes For Pervious Areas-AMC II

Cover Type (3)	Quality of Cover (2)	Soil Group			
		A	B	C	D
AGRICULTURAL COVERS (Continued)					
Legumes, Close Seeded (Alfalfa, sweetclover, timothy, etc.)	Poor	66	77	85	89
	Good	58	72	81	85
Orchards, Evergreen (Citrus, avocados, etc.)	Poor	57	73	82	86
	Fair	44	65	77	82
	Good	33	58	72	79
Pasture, Dryland (Annual grasses)	Poor	68	79	86	89
	Fair	49	69	79	84
	Good	39	61	74	80
Pasture, Irrigated (Legumes and perennial grass)	Poor	58	74	83	87
	Fair	44	65	77	82
	Good	33	58	72	79
Row Crops (Field crops - tomatoes, sugar beets, etc.)	Poor	72	81	88	91
	Good	67	78	85	89
Small grain (Wheat, oats, barley, etc.)	Poor	65	76	84	88
	Good	63	75	83	87

Notes:

1. All curve numbers are for Antecedent Moisture Condition (AMC) II.

2. Quality of cover definitions:

   Poor-Heavily grazed, regularly burned areas, or areas of high burn potential. Less than 50 percent of the ground surface is protected by plant cover or brush and tree canopy.

   Fair-Moderate cover with 50 percent to 75 percent of the ground surface protected.

   Good-Heavy or dense cover with more than 75 percent of the ground surface protected.

3. See Figure C-2 for definition of cover types.

SAN BERNARDINO COUNTY

HYDROLOGY MANUAL

CURVE NUMBERS
FOR
PERVIOUS AREAS

Figure C-3 (2 of 2)

TABLE C.2. Fm (in/hr) VALUES FOR TYPICAL COVER TYPES

COVER TYPE	A_p(1)	A	B	C	D
		SOIL GROUP			
NATURAL:					
Barren	1.0	0.41	0.27	0.18	0.14
Row Crops (good)	1.0	0.59	0.41	0.29	0.22
Grass (fair)	1.0	0.82	0.56	0.40	0.31
Orchards (fair)	1.0	0.88	0.62	0.43	0.34
Woodland (fair)	1.0	0.95	0.69	0.50	0.40
URBAN:					
Residential (1 DU/AC)	0.80	0.78	0.60	0.45	0.37
Residential (2 DU/AC)	0.70	0.68	0.53	0.39	0.32
Residential (4 DU/AC)	0.60	0.58	0.45	0.34	0.28
Residential (10 DU/AC)	0.40	0.39	0.30	0.22	0.18
Condominium	0.35	0.34	0.26	0.20	0.16
Mobile Home Park	0.25	0.24	0.19	0.14	0.12
Apartments	0.20	0.19	0.15	0.11	0.09
Commercial/Industrial	0.10	0.10	0.08	0.06	0.05

NOTES:

(1) Recommended a_p values from Figure C-4

(2) AMC II assumed for all Fm values

(3) CN values obtained from Figure C-3

(4) DU/AC=dwelling unit per acre

TR. 20525

ONSITE

HYDROLOGY INPUT TABLES

TR. 20525

100-year,10-year & 2-year, 1-Hours Storm Events

Rational Method Pre–Developed

```
           San Bernardino County Rational Hydrology Program

               (Hydrology Manual Date - August 1986)

 CIVILCADD/CIVILDESIGN  Engineering Software, (c) 1989-2005 Version 7.1
      Rational Hydrology Study        Date: 10/28/21
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100-YEAR, 1-HOUR RATIONAL STUDY PRE-DEVELOPED
TR 20525, CITY OF VICTORVILLE
AREA A1, A2 & A3 – Onsite Only
FILE: 17839A1A2PRE100.OUT
------------------------------------------------------------------------


Program License Serial Number 4070

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 *********   Hydrology Study Control Information **********

------------------------------------------------------------------------
Rational hydrology study storm event year is   100.0
Computed rainfall intensity:
Storm year =   100.00   1 hour rainfall =     1.080 (In.)
Slope used for rainfall intensity curve b =  0.7000
Soil antecedent moisture condition (AMC) = 2
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++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station        1.000 to Point/Station       2.000
**** INITIAL AREA EVALUATION ****
______________________________________________________________________
Soil classification AP and SCS  values input by user
USER INPUT of soil data for subarea
SCS curve number for soil(AMC 2)  = 77.00
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.420(In/Hr)
Initial subarea data:
Initial area flow distance =   620.000(Ft.)
Top (of initial area) elevation =  2965.000(Ft.)
Bottom (of initial area) elevation =  2953.000(Ft.)
Difference in elevation =    12.000(Ft.)
Slope =    0.01935  s(%)=       1.94
TC = k(0.628)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =   18.106 min.
Rainfall intensity =      2.498(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.749
Subarea runoff =      6.602(CFS)
Total initial stream area =        3.530(Ac.)
Pervious area fraction = 1.000
Initial area Fm value =    0.420(In/Hr)
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Process from Point/Station        2.000 to Point/Station        3.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
______________________________________________________________________
Estimated mean flow rate at midpoint of channel =      0.000(CFS)
Depth of flow =   0.525(Ft.), Average velocity =   3.286(Ft/s)
      ******* Irregular Channel Data ***********
-----------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
      1              0.00              1.00
      2              5.00              0.00
      3             10.00              0.00
      4             15.00              1.00
Manning's 'N' friction factor =   0.030
-----------------------------------------------------------------
Sub-Channel flow  =     13.161(CFS)
  '     '   flow top width =     10.251(Ft.)
  '     '    velocity=    3.286(Ft/s)
  '     '   area =      4.005(Sq.Ft)
  '     '   Froude number =     0.927

Upstream point elevation =  2953.000(Ft.)
Downstream point elevation =  2945.500(Ft.)
Flow length =   480.000(Ft.)
Travel time  =    2.43 min.
Time of concentration =   20.54 min.
Depth of flow =   0.525(Ft.)
Average velocity =   3.286(Ft/s)
Total irregular channel flow =    13.161(CFS)
Irregular channel normal depth above invert elev. =   0.525(Ft.)
Average velocity of channel(s) =   3.286(Ft/s)
 Adding area flow to channel
Soil classification AP and SCS  values input by user
USER INPUT of soil data for subarea
SCS curve number for soil(AMC 2)  = 77.00
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.420(In/Hr)
Rainfall intensity =      2.287(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.735
Subarea runoff =     13.041(CFS) for    8.160(Ac.)
Total runoff =     19.643(CFS)
Effective area this stream =       11.69(Ac.)
Total Study Area (Main Stream No. 1) =       11.69(Ac.)
Area averaged Fm value =    0.420(In/Hr)
Depth of flow =   0.647(Ft.), Average velocity =   3.686(Ft/s)
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Process from Point/Station       2.000 to Point/Station       3.000
**** CONFLUENCE OF MINOR STREAMS ****
_______________________________________________________________________
Along Main Stream number: 1 in normal stream number 1
Stream flow area =     11.690(Ac.)
Runoff from this stream =     19.643(CFS)
Time of concentration =   20.54 min.
Rainfall intensity =     2.287(In/Hr)
Area averaged loss rate (Fm) =    0.4202(In/Hr)
Area averaged Pervious ratio (Ap) = 1.0000
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++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station        4.000 to Point/Station        5.000
**** INITIAL AREA EVALUATION ****
______________________________________________________________________
Soil classification AP and SCS  values input by user
USER INPUT of soil data for subarea
SCS curve number for soil(AMC 2)  = 61.50
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.659(In/Hr)
Initial subarea data:
Initial area flow distance =   500.000(Ft.)
Top (of initial area) elevation =  2954.500(Ft.)
Bottom (of initial area) elevation =  2945.800(Ft.)
Difference in elevation =     8.700(Ft.)
Slope =    0.01740  s(%)=       1.74
TC = k(0.877)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =   23.683 min.
Rainfall intensity =      2.070(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.614
Subarea runoff =      3.049(CFS)
Total initial stream area =        2.400(Ac.)
Pervious area fraction = 1.000
Initial area Fm value =    0.659(In/Hr)
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++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station        4.000 to Point/Station        5.000
**** CONFLUENCE OF MINOR STREAMS ****
______________________________________________________________________
Along Main Stream number: 1 in normal stream number 2
Stream flow area =      2.400(Ac.)
Runoff from this stream =      3.049(CFS)
Time of concentration =   23.68 min.
Rainfall intensity =     2.070(In/Hr)
Area averaged loss rate (Fm) =    0.6587(In/Hr)
Area averaged Pervious ratio (Ap) = 1.0000
Summary of stream data:

Stream Flow rate    Area    TC     Fm       Rainfall Intensity
 No.    (CFS)   (Ac.)       (min) (In/Hr)     (In/Hr)


1     19.64    11.690     20.54    0.420      2.287
2      3.05     2.400     23.68    0.659      2.070
Qmax(1) =
         1.000 *    1.000 *    19.643) +
         1.154 *    0.867 *     3.049) + =      22.694
Qmax(2) =
         0.884 *    1.000 *    19.643) +
         1.000 *    1.000 *     3.049) + =      20.410

Total of 2 streams to confluence:
Flow rates before confluence point:
      19.643       3.049
Maximum flow rates at confluence using above data:
       22.694       20.410
Area of streams before confluence:
       11.690        2.400
Effective area values after confluence:
       13.772       14.090
Results of confluence:
Total flow rate =     22.694(CFS)
Time of concentration =    20.540 min.
Effective stream area after confluence =     13.772(Ac.)
Study area average Pervious fraction(Ap) =  1.000
Study area average soil loss rate(Fm) =    0.461(In/Hr)
Study area total (this main stream) =      14.09(Ac.)
End of computations, Total Study Area =           14.09 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.
Note: These figures do not consider reduced effective area
effects caused by confluences in the rational equation.

Area averaged pervious area fraction(Ap) = 1.000
Area averaged SCS curve number =  74.4
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            San Bernardino County Rational Hydrology Program

                (Hydrology Manual Date - August 1986)

 CIVILCADD/CIVILDESIGN  Engineering Software, (c) 1989-2005 Version 7.1
      Rational Hydrology Study        Date: 10/28/21
------------------------------------------------------------------------
10-YEAR, 1-HOUR RATIONAL STUDY PRE-DEVELOPED
TR 20525,, CITY OF VICTORVILLE
AREA A1, A2 & A3 - Onsite Only
FILE: 17839A1A2PRE10.OUT
------------------------------------------------------------------------


Program License Serial Number 4070

------------------------------------------------------------------------
 *********   Hydrology Study Control Information **********

------------------------------------------------------------------------
Rational hydrology study storm event year is    10.0
Computed rainfall intensity:
Storm year =    10.00   1 hour rainfall =     0.626 (In.)
Slope used for rainfall intensity curve b =  0.7000
Soil antecedent moisture condition (AMC) = 2
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++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station        1.000 to Point/Station        2.000
**** INITIAL AREA EVALUATION ****
______________________________________________________________________
Soil classification AP and SCS  values input by user
USER INPUT of soil data for subarea
SCS curve number for soil(AMC 2)  = 77.00
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.420(In/Hr)
Initial subarea data:
Initial area flow distance =   620.000(Ft.)
Top (of initial area) elevation =  2965.000(Ft.)
Bottom (of initial area) elevation =  2953.000(Ft.)
Difference in elevation =    12.000(Ft.)
Slope =    0.01935  s(%)=       1.94
TC = k(0.628)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =   18.106 min.
Rainfall intensity =      1.448(In/Hr) for a    10.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.639
Subarea runoff =      3.266(CFS)
Total initial stream area =        3.530(Ac.)
Pervious area fraction = 1.000
Initial area Fm value =    0.420(In/Hr)
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++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       2.000 to Point/Station       3.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
______________________________________________________________________
Estimated mean flow rate at midpoint of channel =      0.000(CFS)
Depth of flow =   0.353(Ft.), Average velocity =   2.634(Ft/s)
      ******* Irregular Channel Data ***********
-----------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
      1             0.00             1.00
      2             5.00             0.00
      3            10.00             0.00
      4            15.00             1.00
Manning's 'N' friction factor =   0.030
-----------------------------------------------------------------
Sub-Channel flow  =      6.285(CFS)
  '     '   flow top width =      8.527(Ft.)
  '     '    velocity=    2.634(Ft/s)
  '     '   area =      2.386(Sq.Ft)
  '     '   Froude number =     0.878

Upstream point elevation =  2953.000(Ft.)
Downstream point elevation =  2945.500(Ft.)
Flow length =   480.000(Ft.)
Travel time  =    3.04 min.
Time of concentration =   21.14 min.
Depth of flow =   0.353(Ft.)
Average velocity =   2.634(Ft/s)
Total irregular channel flow =     6.285(CFS)
Irregular channel normal depth above invert elev. =   0.353(Ft.)
Average velocity of channel(s) =   2.634(Ft/s)
 Adding area flow to channel
Soil classification AP and SCS  values input by user
USER INPUT of soil data for subarea
SCS curve number for soil(AMC 2)  = 77.00
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.420(In/Hr)
Rainfall intensity =      1.299(In/Hr) for a    10.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.609
Subarea runoff =      5.982(CFS) for    8.160(Ac.)
Total runoff =      9.248(CFS)
Effective area this stream =       11.69(Ac.)
Total Study Area (Main Stream No. 1) =       11.69(Ac.)
Area averaged Fm value =    0.420(In/Hr)
Depth of flow =   0.435(Ft.), Average velocity =   2.962(Ft/s)
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++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station        2.000 to Point/Station       3.000
**** CONFLUENCE OF MINOR STREAMS ****
______________________________________________________________________
Along Main Stream number: 1 in normal stream number 1
Stream flow area =     11.690(Ac.)
Runoff from this stream =      9.248(CFS)
Time of concentration =   21.14 min.
Rainfall intensity =     1.299(In/Hr)
Area averaged loss rate (Fm) =    0.4202(In/Hr)
Area averaged Pervious ratio (Ap) = 1.0000
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++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station        4.000 to Point/Station       5.000
**** INITIAL AREA EVALUATION ****
______________________________________________________________________
Soil classification AP and SCS  values input by user
USER INPUT of soil data for subarea
SCS curve number for soil(AMC 2)  = 61.50
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.659(In/Hr)
Initial subarea data:
Initial area flow distance =   500.000(Ft.)
Top (of initial area) elevation =  2954.500(Ft.)
Bottom (of initial area) elevation =  2945.800(Ft.)
Difference in elevation =     8.700(Ft.)
Slope =    0.01740  s(%)=       1.74
TC = k(0.877)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =   23.683 min.
Rainfall intensity =      1.200(In/Hr) for a    10.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.406
Subarea runoff =      1.169(CFS)
Total initial stream area =        2.400(Ac.)
Pervious area fraction = 1.000
Initial area Fm value =    0.659(In/Hr)
```

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++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station        4.000 to Point/Station        5.000
**** CONFLUENCE OF MINOR STREAMS ****
______________________________________________________________________
Along Main Stream number: 1 in normal stream number 2
Stream flow area =      2.400(Ac.)
Runoff from this stream =      1.169(CFS)
Time of concentration =   23.68 min.
Rainfall intensity =     1.200(In/Hr)
Area averaged loss rate (Fm) =    0.6587(In/Hr)
Area averaged Pervious ratio (Ap) = 1.0000
Summary of stream data:

Stream Flow rate    Area    TC     Fm       Rainfall Intensity
 No.    (CFS)   (Ac.)       (min) (In/Hr)     (In/Hr)



1      9.25    11.690     21.14    0.420      1.299
2      1.17     2.400     23.68    0.659      1.200
Qmax(1) =
         1.000 *    1.000 *     9.248) +
         1.183 *    0.893 *     1.169) + =      10.483
Qmax(2) =
         0.887 *    1.000 *     9.248) +
         1.000 *    1.000 *     1.169) + =       9.374

Total of 2 streams to confluence:
Flow rates before confluence point:
       9.248       1.169
Maximum flow rates at confluence using above data:
       10.483        9.374
Area of streams before confluence:
       11.690        2.400
Effective area values after confluence:
       13.833       14.090
Results of confluence:
Total flow rate =     10.483(CFS)
Time of concentration =    21.143 min.
Effective stream area after confluence =     13.833(Ac.)
Study area average Pervious fraction(Ap) =  1.000
Study area average soil loss rate(Fm) =    0.461(In/Hr)
Study area total (this main stream) =      14.09(Ac.)
End of computations, Total Study Area =           14.09 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.
Note: These figures do not consider reduced effective area
effects caused by confluences in the rational equation.

Area averaged pervious area fraction(Ap) = 1.000
Area averaged SCS curve number =  74.4
```

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               San Bernardino County Rational Hydrology Program

                   (Hydrology Manual Date - August 1986)

 CIVILCADD/CIVILDESIGN  Engineering Software, (c) 1989-2005 Version 7.1
      Rational Hydrology Study        Date: 10/28/21
------------------------------------------------------------------------
2-YEAR, 1-HOUR RATIONAL STUDY PRE-DEVELOPED
TR 20525,, CITY OF VICTORVILLE
AREA A1, A2 & A3 - Onsite Only
FILE: 17839A1A2PRE2.OUT
------------------------------------------------------------------------


Program License Serial Number 4070

------------------------------------------------------------------------
 *********   Hydrology Study Control Information **********

------------------------------------------------------------------------
Rational hydrology study storm event year is     2.0
Computed rainfall intensity:
Storm year =     2.00   1 hour rainfall =     0.365 (In.)
Slope used for rainfall intensity curve b =  0.7000
Soil antecedent moisture condition (AMC) = 2
```

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       1.000 to Point/Station       2.000
**** INITIAL AREA EVALUATION ****
______________________________________________________________________
Soil classification AP and SCS  values input by user
USER INPUT of soil data for subarea
SCS curve number for soil(AMC 2)  = 77.00
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.420(In/Hr)
Initial subarea data:
Initial area flow distance =   620.000(Ft.)
Top (of initial area) elevation =  2965.000(Ft.)
Bottom (of initial area) elevation =  2953.000(Ft.)
Difference in elevation =    12.000(Ft.)
Slope =    0.01935  s(%)=       1.94
TC = k(0.628)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =   18.106 min.
Rainfall intensity =      0.844(In/Hr) for a     2.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.452
Subarea runoff =      1.348(CFS)
Total initial stream area =        3.530(Ac.)
Pervious area fraction = 1.000
Initial area Fm value =    0.420(In/Hr)
```

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station        2.000 to Point/Station        3.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
______________________________________________________________________
Estimated mean flow rate at midpoint of channel =      0.000(CFS)
Depth of flow =   0.203(Ft.), Average velocity =   1.922(Ft/s)
      ******* Irregular Channel Data ***********
-----------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
      1              0.00              1.00
      2              5.00              0.00
      3             10.00              0.00
      4             15.00              1.00
Manning's 'N' friction factor =   0.030
-----------------------------------------------------------------
Sub-Channel flow  =      2.352(CFS)
  '     '   flow top width =      7.034(Ft.)
  '     '    velocity=    1.922(Ft/s)
  '     '   area =      1.224(Sq.Ft)
  '     '   Froude number =     0.812

Upstream point elevation =  2953.000(Ft.)
Downstream point elevation =  2945.500(Ft.)
Flow length =   480.000(Ft.)
Travel time  =    4.16 min.
Time of concentration =   22.27 min.
Depth of flow =   0.203(Ft.)
Average velocity =   1.922(Ft/s)
Total irregular channel flow =     2.352(CFS)
Irregular channel normal depth above invert elev. =   0.203(Ft.)
Average velocity of channel(s) =   1.922(Ft/s)
 Adding area flow to channel
Soil classification AP and SCS  values input by user
USER INPUT of soil data for subarea
SCS curve number for soil(AMC 2)  = 77.00
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.420(In/Hr)
Rainfall intensity =      0.731(In/Hr) for a     2.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.382
Subarea runoff =      1.918(CFS) for    8.160(Ac.)
Total runoff =      3.265(CFS)
Effective area this stream =       11.69(Ac.)
Total Study Area (Main Stream No. 1) =       11.69(Ac.)
Area averaged Fm value =    0.420(In/Hr)
Depth of flow =   0.245(Ft.), Average velocity =   2.141(Ft/s)
```

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station        2.000 to Point/Station        3.000
**** CONFLUENCE OF MINOR STREAMS ****
______________________________________________________________________
Along Main Stream number: 1 in normal stream number 1
Stream flow area =     11.690(Ac.)
Runoff from this stream =      3.265(CFS)
Time of concentration =   22.27 min.
Rainfall intensity =     0.731(In/Hr)
Area averaged loss rate (Fm) =    0.4202(In/Hr)
Area averaged Pervious ratio (Ap) = 1.0000
```

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station        4.000 to Point/Station        5.000
**** INITIAL AREA EVALUATION ****
______________________________________________________________________
Soil classification AP and SCS  values input by user
USER INPUT of soil data for subarea
SCS curve number for soil(AMC 2)  = 61.50
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.659(In/Hr)
Initial subarea data:
Initial area flow distance =   500.000(Ft.)
Top (of initial area) elevation =  2954.500(Ft.)
Bottom (of initial area) elevation =  2945.800(Ft.)
Difference in elevation =     8.700(Ft.)
Slope =    0.01740  s(%)=       1.74
TC = k(0.877)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =   23.683 min.
Rainfall intensity =      0.700(In/Hr) for a     2.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.053
Subarea runoff =      0.089(CFS)
Total initial stream area =        2.400(Ac.)
Pervious area fraction = 1.000
Initial area Fm value =    0.659(In/Hr)
```

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       4.000 to Point/Station       5.000
**** CONFLUENCE OF MINOR STREAMS ****
______________________________________________________________________
Along Main Stream number: 1 in normal stream number 2
Stream flow area =      2.400(Ac.)
Runoff from this stream =      0.089(CFS)
Time of concentration =   23.68 min.
Rainfall intensity =     0.700(In/Hr)
Area averaged loss rate (Fm) =    0.6587(In/Hr)
Area averaged Pervious ratio (Ap) = 1.0000
Summary of stream data:

Stream Flow rate    Area    TC     Fm       Rainfall Intensity
 No.    (CFS)   (Ac.)       (min) (In/Hr)     (In/Hr)


1      3.27    11.690     22.27    0.420      0.731
2      0.09     2.400     23.68    0.659      0.700
Qmax(1) =
         1.000 *    1.000 *     3.265) +
         1.752 *    0.940 *     0.089) + =       3.411
Qmax(2) =
         0.901 *    1.000 *     3.265) +
         1.000 *    1.000 *     0.089) + =       3.029

Total of 2 streams to confluence:
Flow rates before confluence point:
       3.265       0.089
Maximum flow rates at confluence using above data:
        3.411        3.029
Area of streams before confluence:
       11.690        2.400
Effective area values after confluence:
       13.947       14.090
Results of confluence:
Total flow rate =      3.411(CFS)
Time of concentration =    22.268 min.
Effective stream area after confluence =     13.947(Ac.)
Study area average Pervious fraction(Ap) =  1.000
Study area average soil loss rate(Fm) =    0.461(In/Hr)
Study area total (this main stream) =      14.09(Ac.)
End of computations, Total Study Area =           14.09 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.
Note: These figures do not consider reduced effective area
effects caused by confluences in the rational equation.

Area averaged pervious area fraction(Ap) = 1.000
Area averaged SCS curve number =  74.4
```

```
           San Bernardino County Rational Hydrology Program

               (Hydrology Manual Date - August 1986)

 CIVILCADD/CIVILDESIGN  Engineering Software, (c) 1989-2005 Version 7.1
      Rational Hydrology Study        Date: 09/01/22
------------------------------------------------------------------------
100-YEAR, 1-HOUR RATIONAL STUDY PRE-DEVELOPED
TR 17839, CITY OF VICTORVILLE
AREA B1, B2 & B3 (WESTERLY AREA)- Onsite Only
FILE: 17839B1B2PRE100.OUT
------------------------------------------------------------------------


Program License Serial Number 4070

------------------------------------------------------------------------
 *********   Hydrology Study Control Information **********

------------------------------------------------------------------------
Rational hydrology study storm event year is   100.0
Computed rainfall intensity:
Storm year =   100.00   1 hour rainfall =     1.080 (In.)
Slope used for rainfall intensity curve b =  0.7000
Soil antecedent moisture condition (AMC) = 2
```

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       11.000 to Point/Station       12.000
**** INITIAL AREA EVALUATION ****
______________________________________________________________________
UNDEVELOPED (poor cover) subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 86.00
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.265(In/Hr)
Initial subarea data:
Initial area flow distance =   580.000(Ft.)
Top (of initial area) elevation =  2965.000(Ft.)
Bottom (of initial area) elevation =  2958.000(Ft.)
Difference in elevation =     7.000(Ft.)
Slope =    0.01207  s(%)=       1.21
TC = k(0.525)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =   16.188 min.
Rainfall intensity =      2.702(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.812
Subarea runoff =      0.877(CFS)
Total initial stream area =        0.400(Ac.)
Pervious area fraction = 1.000
Initial area Fm value =    0.265(In/Hr)
```

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       12.000 to Point/Station       13.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
______________________________________________________________________
Estimated mean flow rate at midpoint of channel =      0.000(CFS)
Depth of flow =   0.314(Ft.), Average velocity =   3.012(Ft/s)
      ******* Irregular Channel Data ***********
-----------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
      1              0.00              1.00
      2              5.00              0.00
      3             10.00              0.00
      4             15.00              1.00
Manning's 'N' friction factor =   0.030
-----------------------------------------------------------------
Sub-Channel flow  =      6.220(CFS)
  '     '   flow top width =      8.143(Ft.)
  '     '    velocity=    3.012(Ft/s)
  '     '   area =      2.065(Sq.Ft)
  '     '   Froude number =     1.054

Upstream point elevation =  2958.000(Ft.)
Downstream point elevation =  2926.600(Ft.)
Flow length =  1350.000(Ft.)
Travel time  =    7.47 min.
Time of concentration =   23.66 min.
Depth of flow =   0.314(Ft.)
Average velocity =   3.012(Ft/s)
Total irregular channel flow =     6.220(CFS)
Irregular channel normal depth above invert elev. =   0.314(Ft.)
Average velocity of channel(s) =   3.012(Ft/s)
 Adding area flow to channel
UNDEVELOPED (poor cover) subarea
Decimal fraction soil group A = 0.940
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.060
SCS curve number for soil(AMC 2)  = 68.32
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.558(In/Hr)
Rainfall intensity =      2.072(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.664
Subarea runoff =     10.601(CFS) for    7.950(Ac.)
Total runoff =     11.479(CFS)
Effective area this stream =        8.35(Ac.)
Total Study Area (Main Stream No. 1) =        8.35(Ac.)
Area averaged Fm value =    0.544(In/Hr)
Depth of flow =   0.439(Ft.), Average velocity =   3.632(Ft/s)
```

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       12.000 to Point/Station       13.000
**** CONFLUENCE OF MINOR STREAMS ****
______________________________________________________________________
Along Main Stream number: 1 in normal stream number 1
Stream flow area =      8.350(Ac.)
Runoff from this stream =     11.479(CFS)
Time of concentration =   23.66 min.
Rainfall intensity =     2.072(In/Hr)
Area averaged loss rate (Fm) =    0.5443(In/Hr)
Area averaged Pervious ratio (Ap) = 1.0000
```

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station        6.000 to Point/Station      14.000
**** INITIAL AREA EVALUATION ****
______________________________________________________________________
UNDEVELOPED (poor cover) subarea
Decimal fraction soil group A = 0.380
Decimal fraction soil group B = 0.620
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 73.82
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.472(In/Hr)
Initial subarea data:
Initial area flow distance =   723.000(Ft.)
Top (of initial area) elevation =  2950.000(Ft.)
Bottom (of initial area) elevation =  2926.000(Ft.)
Difference in elevation =    24.000(Ft.)
Slope =    0.03320  s(%)=       3.32
TC = k(0.525)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =   14.441 min.
Rainfall intensity =      2.927(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.755
Subarea runoff =     14.935(CFS)
Total initial stream area =        6.760(Ac.)
Pervious area fraction = 1.000
Initial area Fm value =    0.472(In/Hr)
```

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       6.000 to Point/Station      14.000
**** CONFLUENCE OF MINOR STREAMS ****
______________________________________________________________________
Along Main Stream number: 1 in normal stream number 2
Stream flow area =      6.760(Ac.)
Runoff from this stream =     14.935(CFS)
Time of concentration =   14.44 min.
Rainfall intensity =     2.927(In/Hr)
Area averaged loss rate (Fm) =    0.4721(In/Hr)
Area averaged Pervious ratio (Ap) = 1.0000
Summary of stream data:

Stream Flow rate    Area    TC     Fm       Rainfall Intensity
 No.    (CFS)   (Ac.)       (min) (In/Hr)     (In/Hr)


1     11.48     8.350     23.66    0.544      2.072
2     14.94     6.760     14.44    0.472      2.927
Qmax(1) =
         1.000 *    1.000 *    11.479) +
         0.652 *    1.000 *    14.935) + =      21.211
Qmax(2) =
         1.560 *    0.610 *    11.479) +
         1.000 *    1.000 *    14.935) + =      25.864

Total of 2 streams to confluence:
Flow rates before confluence point:
      11.479      14.935
Maximum flow rates at confluence using above data:
       21.211       25.864
Area of streams before confluence:
        8.350        6.760
Effective area values after confluence:
       15.110       11.857
Results of confluence:
Total flow rate =     25.864(CFS)
Time of concentration =    14.441 min.
Effective stream area after confluence =     11.857(Ac.)
Study area average Pervious fraction(Ap) =  1.000
Study area average soil loss rate(Fm) =    0.512(In/Hr)
Study area total (this main stream) =      15.11(Ac.)
End of computations, Total Study Area =          15.11 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.
Note: These figures do not consider reduced effective area
effects caused by confluences in the rational equation.

Area averaged pervious area fraction(Ap) = 1.000
Area averaged SCS curve number =  71.2
```

```
               San Bernardino County Rational Hydrology Program

                   (Hydrology Manual Date - August 1986)

 CIVILCADD/CIVILDESIGN  Engineering Software, (c) 1989-2005 Version 7.1
      Rational Hydrology Study        Date: 09/01/22
------------------------------------------------------------------------
10-YEAR, 1-HOUR RATIONAL STUDY PRE-DEVELOPED
TR 17839, CITY OF VICTORVILLE
AREA B1, B2 & B3 (WESTERLY AREA)- Onsite Only
FILE: 17839B1B2PRE10.OUT
------------------------------------------------------------------------


Program License Serial Number 4070

------------------------------------------------------------------------
 *********   Hydrology Study Control Information **********

------------------------------------------------------------------------
Rational hydrology study storm event year is    10.0
Computed rainfall intensity:
Storm year =    10.00   1 hour rainfall =     0.626 (In.)
Slope used for rainfall intensity curve b =  0.7000
Soil antecedent moisture condition (AMC) = 2
```

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      11.000 to Point/Station      12.000
**** INITIAL AREA EVALUATION ****
______________________________________________________________________
UNDEVELOPED (poor cover) subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 86.00
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.265(In/Hr)
Initial subarea data:
Initial area flow distance =   580.000(Ft.)
Top (of initial area) elevation =  2965.000(Ft.)
Bottom (of initial area) elevation =  2958.000(Ft.)
Difference in elevation =     7.000(Ft.)
Slope =    0.01207  s(%)=       1.21
TC = k(0.525)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =   16.188 min.
Rainfall intensity =      1.566(In/Hr) for a    10.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.748
Subarea runoff =      0.468(CFS)
Total initial stream area =        0.400(Ac.)
Pervious area fraction = 1.000
Initial area Fm value =    0.265(In/Hr)
```

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       12.000 to Point/Station       13.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
______________________________________________________________________
Estimated mean flow rate at midpoint of channel =      0.000(CFS)
Depth of flow =   0.184(Ft.), Average velocity =   2.214(Ft/s)
      ******* Irregular Channel Data ***********
-----------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
      1              0.00              1.00
      2              5.00              0.00
      3             10.00              0.00
      4             15.00              1.00
Manning's 'N' friction factor =   0.030
-----------------------------------------------------------------
Sub-Channel flow  =      2.418(CFS)
  '     '   flow top width =      6.844(Ft.)
  '     '    velocity=    2.214(Ft/s)
  '     '   area =      1.092(Sq.Ft)
  '     '   Froude number =     0.977

Upstream point elevation =  2958.000(Ft.)
Downstream point elevation =  2926.600(Ft.)
Flow length =  1350.000(Ft.)
Travel time  =   10.16 min.
Time of concentration =   26.35 min.
Depth of flow =   0.184(Ft.)
Average velocity =   2.214(Ft/s)
Total irregular channel flow =     2.418(CFS)
Irregular channel normal depth above invert elev. =   0.184(Ft.)
Average velocity of channel(s) =   2.214(Ft/s)
 Adding area flow to channel
UNDEVELOPED (poor cover) subarea
Decimal fraction soil group A = 0.940
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.060
SCS curve number for soil(AMC 2)  = 68.32
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.558(In/Hr)
Rainfall intensity =      1.114(In/Hr) for a    10.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.460
Subarea runoff =      3.810(CFS) for    7.950(Ac.)
Total runoff =      4.279(CFS)
Effective area this stream =        8.35(Ac.)
Total Study Area (Main Stream No. 1) =       8.35(Ac.)
Area averaged Fm value =    0.544(In/Hr)
Depth of flow =   0.255(Ft.), Average velocity =   2.674(Ft/s)
```

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       12.000 to Point/Station       13.000
**** CONFLUENCE OF MINOR STREAMS ****
______________________________________________________________________
Along Main Stream number: 1 in normal stream number 1
Stream flow area =      8.350(Ac.)
Runoff from this stream =      4.279(CFS)
Time of concentration =   26.35 min.
Rainfall intensity =     1.114(In/Hr)
Area averaged loss rate (Fm) =    0.5443(In/Hr)
Area averaged Pervious ratio (Ap) = 1.0000
```

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       6.000 to Point/Station      14.000
**** INITIAL AREA EVALUATION ****
______________________________________________________________________
UNDEVELOPED (poor cover) subarea
Decimal fraction soil group A = 0.380
Decimal fraction soil group B = 0.620
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 73.82
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.472(In/Hr)
Initial subarea data:
Initial area flow distance =   723.000(Ft.)
Top (of initial area) elevation =  2950.000(Ft.)
Bottom (of initial area) elevation =  2926.000(Ft.)
Difference in elevation =    24.000(Ft.)
Slope =    0.03320  s(%)=       3.32
TC = k(0.525)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =   14.441 min.
Rainfall intensity =      1.697(In/Hr) for a    10.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.650
Subarea runoff =      7.449(CFS)
Total initial stream area =        6.760(Ac.)
Pervious area fraction = 1.000
Initial area Fm value =    0.472(In/Hr)
```

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station        6.000 to Point/Station       14.000
**** CONFLUENCE OF MINOR STREAMS ****
______________________________________________________________________
Along Main Stream number: 1 in normal stream number 2
Stream flow area =      6.760(Ac.)
Runoff from this stream =      7.449(CFS)
Time of concentration =   14.44 min.
Rainfall intensity =     1.697(In/Hr)
Area averaged loss rate (Fm) =    0.4721(In/Hr)
Area averaged Pervious ratio (Ap) = 1.0000
Summary of stream data:

Stream Flow rate    Area    TC     Fm       Rainfall Intensity
 No.    (CFS)   (Ac.)       (min) (In/Hr)     (In/Hr)


1      4.28     8.350     26.35    0.544      1.114
2      7.45     6.760     14.44    0.472      1.697
Qmax(1) =
         1.000 *    1.000 *     4.279) +
         0.524 *    1.000 *     7.449) + =       8.182
Qmax(2) =
         2.024 *    0.548 *     4.279) +
         1.000 *    1.000 *     7.449) + =      12.195

Total of 2 streams to confluence:
Flow rates before confluence point:
       4.279       7.449
Maximum flow rates at confluence using above data:
        8.182       12.195
Area of streams before confluence:
        8.350        6.760
Effective area values after confluence:
       15.110       11.336
Results of confluence:
Total flow rate =     12.195(CFS)
Time of concentration =    14.441 min.
Effective stream area after confluence =     11.336(Ac.)
Study area average Pervious fraction(Ap) =  1.000
Study area average soil loss rate(Fm) =    0.512(In/Hr)
Study area total (this main stream) =      15.11(Ac.)
End of computations, Total Study Area =           15.11 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.
Note: These figures do not consider reduced effective area
effects caused by confluences in the rational equation.

Area averaged pervious area fraction(Ap) = 1.000
Area averaged SCS curve number =  71.2
```

```
           San Bernardino County Rational Hydrology Program

               (Hydrology Manual Date - August 1986)

 CIVILCADD/CIVILDESIGN  Engineering Software, (c) 1989-2005 Version 7.1
      Rational Hydrology Study        Date: 09/01/22
------------------------------------------------------------------------
2-YEAR, 1-HOUR RATIONAL STUDY PRE-DEVELOPED
TR 17839, CITY OF VICTORVILLE
AREA B1, B2 & B3 (WESTERLY AREA)- Onsite Only
FILE: 17839B1B2PRE2.OUT
------------------------------------------------------------------------


Program License Serial Number 4070

------------------------------------------------------------------------
 *********   Hydrology Study Control Information **********

------------------------------------------------------------------------
Rational hydrology study storm event year is     2.0
Computed rainfall intensity:
Storm year =     2.00   1 hour rainfall =     0.365 (In.)
Slope used for rainfall intensity curve b =  0.7000
Soil antecedent moisture condition (AMC) = 2
```

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       11.000 to Point/Station       12.000
**** INITIAL AREA EVALUATION ****
______________________________________________________________________
UNDEVELOPED (poor cover) subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 86.00
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.265(In/Hr)
Initial subarea data:
Initial area flow distance =   580.000(Ft.)
Top (of initial area) elevation =  2965.000(Ft.)
Bottom (of initial area) elevation =  2958.000(Ft.)
Difference in elevation =     7.000(Ft.)
Slope =    0.01207  s(%)=       1.21
TC = k(0.525)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =   16.188 min.
Rainfall intensity =      0.913(In/Hr) for a     2.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.639
Subarea runoff =      0.233(CFS)
Total initial stream area =        0.400(Ac.)
Pervious area fraction = 1.000
Initial area Fm value =    0.265(In/Hr)
```

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       12.000 to Point/Station      13.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
______________________________________________________________________
Estimated mean flow rate at midpoint of channel =      0.000(CFS)
Depth of flow =   0.053(Ft.), Average velocity =   1.024(Ft/s)
      ******* Irregular Channel Data ***********
-----------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
      1             0.00              1.00
      2             5.00              0.00
      3            10.00              0.00
      4            15.00              1.00
Manning's 'N' friction factor =   0.030
-----------------------------------------------------------------
Sub-Channel flow  =      0.283(CFS)
  '     '    flow top width =      5.525(Ft.)
  '     '     velocity=    1.024(Ft/s)
  '     '    area =      0.276(Sq.Ft)
  '     '    Froude number =     0.807

Upstream point elevation =  2958.000(Ft.)
Downstream point elevation =  2926.600(Ft.)
Flow length =  1350.000(Ft.)
Travel time  =   21.96 min.
Time of concentration =   38.15 min.
Depth of flow =   0.053(Ft.)
Average velocity =   1.024(Ft/s)
Total irregular channel flow =     0.283(CFS)
Irregular channel normal depth above invert elev. =   0.053(Ft.)
Average velocity of channel(s) =   1.024(Ft/s)
 Adding area flow to channel
UNDEVELOPED (poor cover) subarea
Decimal fraction soil group A = 0.940
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.060
SCS curve number for soil(AMC 2)  = 68.32
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.558(In/Hr)
The area added to the existing stream causes a
a lower flow rate of Q =      0.000(CFS)
therefore the upstream flow rate of Q =      0.233(CFS) is being used
Rainfall intensity =      0.501(In/Hr) for a     2.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.000
Subarea runoff =      0.000(CFS) for    7.950(Ac.)
Total runoff =      0.233(CFS)
Effective area this stream =        8.35(Ac.)
Total Study Area (Main Stream No. 1) =        8.35(Ac.)
Area averaged Fm value =    0.544(In/Hr)
Depth of flow =   0.047(Ft.), Average velocity =   0.952(Ft/s)
```

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       12.000 to Point/Station       13.000
**** CONFLUENCE OF MINOR STREAMS ****
______________________________________________________________________
Along Main Stream number: 1 in normal stream number 1
Stream flow area =      8.350(Ac.)
Runoff from this stream =      0.233(CFS)
Time of concentration =   38.15 min.
Rainfall intensity =     0.501(In/Hr)
Area averaged loss rate (Fm) =    0.5443(In/Hr)
Area averaged Pervious ratio (Ap) = 1.0000
```

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       6.000 to Point/Station      14.000
**** INITIAL AREA EVALUATION ****
______________________________________________________________________
UNDEVELOPED (poor cover) subarea
Decimal fraction soil group A = 0.380
Decimal fraction soil group B = 0.620
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 73.82
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.472(In/Hr)
Initial subarea data:
Initial area flow distance =   723.000(Ft.)
Top (of initial area) elevation =  2950.000(Ft.)
Bottom (of initial area) elevation =  2926.000(Ft.)
Difference in elevation =    24.000(Ft.)
Slope =    0.03320  s(%)=       3.32
TC = k(0.525)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =   14.441 min.
Rainfall intensity =      0.989(In/Hr) for a     2.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.470
Subarea runoff =      3.146(CFS)
Total initial stream area =        6.760(Ac.)
Pervious area fraction = 1.000
Initial area Fm value =    0.472(In/Hr)
```

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station        6.000 to Point/Station       14.000
**** CONFLUENCE OF MINOR STREAMS ****
______________________________________________________________________
Along Main Stream number: 1 in normal stream number 2
Stream flow area =      6.760(Ac.)
Runoff from this stream =      3.146(CFS)
Time of concentration =   14.44 min.
Rainfall intensity =     0.989(In/Hr)
Area averaged loss rate (Fm) =    0.4721(In/Hr)
Area averaged Pervious ratio (Ap) = 1.0000
Summary of stream data:

Stream Flow rate    Area    TC     Fm       Rainfall Intensity
 No.    (CFS)   (Ac.)       (min) (In/Hr)     (In/Hr)


1      0.23     8.350     38.15    0.544      0.501
2      3.15     6.760     14.44    0.472      0.989
Qmax(1) =
         1.000 *    1.000 *     0.233) +
         0.056 *    1.000 *     3.146) + =       0.410
Qmax(2) =
Fm Value exceeds Rainfall Intensity in one of the streams
Summing flow rates for conflunce solution
         1.000 *    0.379 *     0.233) +
         1.000 *    1.000 *     3.146) + =       3.234

Total of 2 streams to confluence:
Flow rates before confluence point:
       0.233       3.146
Maximum flow rates at confluence using above data:
        0.410        3.234
Area of streams before confluence:
        8.350        6.760
Effective area values after confluence:
       15.110        9.921
Results of confluence:
Total flow rate =      3.234(CFS)
Time of concentration =    14.441 min.
Effective stream area after confluence =      9.921(Ac.)
Study area average Pervious fraction(Ap) =  1.000
Study area average soil loss rate(Fm) =    0.512(In/Hr)
Study area total (this main stream) =      15.11(Ac.)
End of computations, Total Study Area =           15.11 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.
Note: These figures do not consider reduced effective area
effects caused by confluences in the rational equation.

Area averaged pervious area fraction(Ap) = 1.000
Area averaged SCS curve number =  71.2
```

```
            San Bernardino County Rational Hydrology Program

                (Hydrology Manual Date - August 1986)

 CIVILCADD/CIVILDESIGN  Engineering Software, (c) 1989-2005 Version 7.1
      Rational Hydrology Study        Date: 09/01/22
-----------------------------------------------------------------------
100-YEAR, 1-HOUR RATIONAL STUDY PRE-DEVELOPED – OFFSITE/ONSITE
TR 17839, CITY OF VICTORVILLE
AREA B1, B2, C1, C2 & C3 AMETHYST ROAD RUNOFF
FILE: 17839AMETHYSTPRE100.OUT
------------------------------------------------------------------------


Program License Serial Number 4070

------------------------------------------------------------------------
 *********   Hydrology Study Control Information **********

------------------------------------------------------------------------
Rational hydrology study storm event year is   100.0
Computed rainfall intensity:
Storm year =   100.00   1 hour rainfall =     1.080 (In.)
Slope used for rainfall intensity curve b =  0.7000
Soil antecedent moisture condition (AMC) = 2
```

```
+++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       15.000 to Point/Station       12.000
**** INITIAL AREA EVALUATION ****
_____________________________________________________________________
UNDEVELOPED (poor cover) subarea
Decimal fraction soil group A = 0.580
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.420
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 74.98
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.453(In/Hr)
Initial subarea data:
Initial area flow distance =   800.000(Ft.)
Top (of initial area) elevation =  2967.700(Ft.)
Bottom (of initial area) elevation =  2958.000(Ft.)
Difference in elevation =     9.700(Ft.)
Slope =    0.01212  s(%)=       1.21
TC = k(0.525)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =   18.393 min.
Rainfall intensity =      2.471(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.735
Subarea runoff =     11.985(CFS)
Total initial stream area =        6.600(Ac.)
Pervious area fraction = 1.000
Initial area Fm value =    0.453(In/Hr)
```

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       15.000 to Point/Station       12.000
**** CONFLUENCE OF MINOR STREAMS ****
______________________________________________________________________
Along Main Stream number: 1 in normal stream number 1
Stream flow area =      6.600(Ac.)
Runoff from this stream =     11.985(CFS)
Time of concentration =   18.39 min.
Rainfall intensity =     2.471(In/Hr)
Area averaged loss rate (Fm) =    0.4533(In/Hr)
Area averaged Pervious ratio (Ap) = 1.0000
```

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       11.000 to Point/Station       12.000
**** INITIAL AREA EVALUATION ****
______________________________________________________________________
Soil classification AP and SCS  values input by user
USER INPUT of soil data for subarea
SCS curve number for soil(AMC 2)  = 77.00
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.420(In/Hr)
Initial subarea data:
Initial area flow distance =   580.000(Ft.)
Top (of initial area) elevation =  2965.000(Ft.)
Bottom (of initial area) elevation =  2958.000(Ft.)
Difference in elevation =     7.000(Ft.)
Slope =    0.01207  s(%)=       1.21
TC = k(0.628)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =   19.376 min.
Rainfall intensity =      2.383(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.741
Subarea runoff =      0.706(CFS)
Total initial stream area =        0.400(Ac.)
Pervious area fraction = 1.000
Initial area Fm value =    0.420(In/Hr)
```

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       11.000 to Point/Station       12.000
**** CONFLUENCE OF MINOR STREAMS ****
______________________________________________________________________
Along Main Stream number: 1 in normal stream number 2
Stream flow area =      0.400(Ac.)
Runoff from this stream =      0.706(CFS)
Time of concentration =   19.38 min.
Rainfall intensity =     2.383(In/Hr)
Area averaged loss rate (Fm) =    0.4202(In/Hr)
Area averaged Pervious ratio (Ap) = 1.0000
Summary of stream data:

Stream Flow rate    Area    TC     Fm       Rainfall Intensity
 No.    (CFS)   (Ac.)       (min) (In/Hr)     (In/Hr)


1     11.98     6.600     18.39    0.453      2.471
2      0.71     0.400     19.38    0.420      2.383
Qmax(1) =
         1.000 *    1.000 *    11.985) +
         1.045 *    0.949 *     0.706) + =      12.686
Qmax(2) =
         0.956 *    1.000 *    11.985) +
         1.000 *    1.000 *     0.706) + =      12.166

Total of 2 streams to confluence:
Flow rates before confluence point:
      11.985       0.706
Maximum flow rates at confluence using above data:
       12.686       12.166
Area of streams before confluence:
        6.600        0.400
Effective area values after confluence:
        6.980        7.000
Results of confluence:
Total flow rate =     12.686(CFS)
Time of concentration =    18.393 min.
Effective stream area after confluence =      6.980(Ac.)
Study area average Pervious fraction(Ap) =  1.000
Study area average soil loss rate(Fm) =    0.451(In/Hr)
Study area total (this main stream) =      7.00(Ac.)
```

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       12.000 to Point/Station       13.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
______________________________________________________________________
Estimated mean flow rate at midpoint of channel =      0.000(CFS)
Depth of flow =   0.544(Ft.), Average velocity =   4.087(Ft/s)
      ******* Irregular Channel Data ***********
-----------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
      1              0.00              1.00
      2              5.00              0.00
      3             10.00              0.00
      4             15.00              1.00
Manning's 'N' friction factor =   0.030
-----------------------------------------------------------------
Sub-Channel flow  =     17.151(CFS)
  '     '   flow top width =     10.437(Ft.)
  '     '    velocity=    4.087(Ft/s)
  '     '   area =      4.196(Sq.Ft)
  '     '   Froude number =     1.136

Upstream point elevation =  2958.000(Ft.)
Downstream point elevation =  2926.600(Ft.)
Flow length =  1350.000(Ft.)
Travel time  =    5.51 min.
Time of concentration =   23.90 min.
Depth of flow =   0.544(Ft.)
Average velocity =   4.087(Ft/s)
Total irregular channel flow =    17.151(CFS)
Irregular channel normal depth above invert elev. =   0.544(Ft.)
Average velocity of channel(s) =   4.087(Ft/s)
 Adding area flow to channel
UNDEVELOPED (poor cover) subarea
Decimal fraction soil group A = 0.580
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.420
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 74.98
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.453(In/Hr)
Rainfall intensity =      2.057(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.702
Subarea runoff =      8.877(CFS) for    7.950(Ac.)
Total runoff =     21.563(CFS)
Effective area this stream =       14.93(Ac.)
Total Study Area (Main Stream No. 1) =       14.95(Ac.)
Area averaged Fm value =    0.452(In/Hr)
Depth of flow =   0.613(Ft.), Average velocity =   4.365(Ft/s)
```

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       12.000 to Point/Station       13.000
**** CONFLUENCE OF MINOR STREAMS ****
______________________________________________________________________
Along Main Stream number: 1 in normal stream number 1
Stream flow area =     14.930(Ac.)
Runoff from this stream =     21.563(CFS)
Time of concentration =   23.90 min.
Rainfall intensity =     2.057(In/Hr)
Area averaged loss rate (Fm) =    0.4524(In/Hr)
Area averaged Pervious ratio (Ap) = 1.0000
```

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       16.000 to Point/Station       17.000
**** INITIAL AREA EVALUATION ****
______________________________________________________________________
UNDEVELOPED (poor cover) subarea
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 67.00
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.578(In/Hr)
Initial subarea data:
Initial area flow distance =   964.000(Ft.)
Top (of initial area) elevation =  2972.000(Ft.)
Bottom (of initial area) elevation =  2950.000(Ft.)
Difference in elevation =    22.000(Ft.)
Slope =    0.02282  s(%)=       2.28
TC = k(0.525)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =   17.463 min.
Rainfall intensity =      2.562(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.697
Subarea runoff =     11.250(CFS)
Total initial stream area =        6.300(Ac.)
Pervious area fraction = 1.000
Initial area Fm value =    0.578(In/Hr)
```

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       17.000 to Point/Station       13.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
______________________________________________________________________
Estimated mean flow rate at midpoint of channel =      0.000(CFS)
Depth of flow =   0.462(Ft.), Average velocity =   2.564(Ft/s)
      ******* Irregular Channel Data ***********
-----------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
      1              0.00              1.27
      2             22.39              0.89
      3             27.05              0.00
      4             30.37              0.22
      5             45.34              0.48
      6             50.25              0.50
Manning's 'N' friction factor =   0.030
-----------------------------------------------------------------
Sub-Channel flow  =      6.124(CFS)
  '     '   flow top width =     19.662(Ft.)
  '     '    velocity=    1.796(Ft/s)
  '     '   area =      3.410(Sq.Ft)
  '     '   Froude number =     0.760

Information entered for subchannel number 2 :
Point number      'X' coordinate     'Y' coordinate
      1             50.25              0.50
      2             60.45              0.22
      3             62.91              0.00
      4             73.37              2.58
Manning's 'N' friction factor =   0.015
-----------------------------------------------------------------
Sub-Channel flow  =      8.679(CFS)
  '     '   flow top width =     13.142(Ft.)
  '     '    velocity=    3.673(Ft/s)
  '     '   area =      2.363(Sq.Ft)
  '     '   Froude number =     1.526

Upstream point elevation =  2950.000(Ft.)
Downstream point elevation =  2926.600(Ft.)
Flow length =  1226.000(Ft.)
Travel time  =    7.97 min.
Time of concentration =   25.43 min.
Depth of flow =   0.462(Ft.)
Average velocity =   2.564(Ft/s)
Total irregular channel flow =    14.802(CFS)
Irregular channel normal depth above invert elev. =   0.462(Ft.)
Average velocity of channel(s) =   2.564(Ft/s)
 Adding area flow to channel
UNDEVELOPED (poor cover) subarea
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
```

```
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 67.00
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.578(In/Hr)
Rainfall intensity =      1.970(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.636
Subarea runoff =      7.030(CFS) for    8.300(Ac.)
Total runoff =     18.280(CFS)
Effective area this stream =       14.60(Ac.)
Total Study Area (Main Stream No. 1) =       29.55(Ac.)
Area averaged Fm value =    0.578(In/Hr)
Depth of flow =   0.502(Ft.), Average velocity =   2.534(Ft/s)
```

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++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       17.000 to Point/Station       13.000
**** CONFLUENCE OF MINOR STREAMS ****
______________________________________________________________________
Along Main Stream number: 1 in normal stream number 2
Stream flow area =     14.600(Ac.)
Runoff from this stream =     18.280(CFS)
Time of concentration =   25.43 min.
Rainfall intensity =     1.970(In/Hr)
Area averaged loss rate (Fm) =    0.5783(In/Hr)
Area averaged Pervious ratio (Ap) = 1.0000
Summary of stream data:

Stream Flow rate    Area    TC     Fm       Rainfall Intensity
 No.    (CFS)   (Ac.)       (min) (In/Hr)     (In/Hr)


1     21.56    14.930     23.90    0.452      2.057
2     18.28    14.600     25.43    0.578      1.970
Qmax(1) =
         1.000 *    1.000 *    21.563) +
         1.063 *    0.940 *    18.280) + =      39.823
Qmax(2) =
         0.945 *    1.000 *    21.563) +
         1.000 *    1.000 *    18.280) + =      38.665

Total of 2 streams to confluence:
Flow rates before confluence point:
      21.563      18.280
Maximum flow rates at confluence using above data:
       39.823       38.665
Area of streams before confluence:
       14.930       14.600
Effective area values after confluence:
       28.649       29.530
Results of confluence:
Total flow rate =     39.823(CFS)
Time of concentration =    23.898 min.
Effective stream area after confluence =     28.649(Ac.)
Study area average Pervious fraction(Ap) =  1.000
Study area average soil loss rate(Fm) =    0.515(In/Hr)
Study area total (this main stream) =      29.53(Ac.)
End of computations, Total Study Area =           29.55 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.
Note: These figures do not consider reduced effective area
effects caused by confluences in the rational equation.

Area averaged pervious area fraction(Ap) = 1.000
Area averaged SCS curve number =  71.1
```

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            San Bernardino County Rational Hydrology Program

                (Hydrology Manual Date - August 1986)

 CIVILCADD/CIVILDESIGN  Engineering Software, (c) 1989-2005 Version 7.1
      Rational Hydrology Study        Date: 09/01/22
------------------------------------------------------------------------
10-YEAR, 1-HOUR RATIONAL STUDY PRE-DEVELOPED – OFFSITE/ONSITE
TR 17839, CITY OF VICTORVILLE
AREA B1, B2, C1, C2 & C3 AMETHYST ROAD RUNOFF
FILE: 17839AMETHYSTPRE10.OUT
------------------------------------------------------------------------


Program License Serial Number 4070

------------------------------------------------------------------------
 *********   Hydrology Study Control Information **********

------------------------------------------------------------------------
Rational hydrology study storm event year is    10.0
Computed rainfall intensity:
Storm year =    10.00   1 hour rainfall =     0.626 (In.)
Slope used for rainfall intensity curve b =  0.7000
Soil antecedent moisture condition (AMC) = 2
```

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      15.000 to Point/Station      12.000
**** INITIAL AREA EVALUATION ****
______________________________________________________________________
UNDEVELOPED (poor cover) subarea
Decimal fraction soil group A = 0.580
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.420
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 74.98
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.453(In/Hr)
Initial subarea data:
Initial area flow distance =   800.000(Ft.)
Top (of initial area) elevation =  2967.700(Ft.)
Bottom (of initial area) elevation =  2958.000(Ft.)
Difference in elevation =     9.700(Ft.)
Slope =    0.01212  s(%)=       1.21
TC = k(0.525)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =   18.393 min.
Rainfall intensity =      1.432(In/Hr) for a    10.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.615
Subarea runoff =      5.815(CFS)
Total initial stream area =        6.600(Ac.)
Pervious area fraction = 1.000
Initial area Fm value =    0.453(In/Hr)
```

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       15.000 to Point/Station       12.000
**** CONFLUENCE OF MINOR STREAMS ****
______________________________________________________________________
Along Main Stream number: 1 in normal stream number 1
Stream flow area =      6.600(Ac.)
Runoff from this stream =      5.815(CFS)
Time of concentration =   18.39 min.
Rainfall intensity =     1.432(In/Hr)
Area averaged loss rate (Fm) =    0.4533(In/Hr)
Area averaged Pervious ratio (Ap) = 1.0000
```

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       11.000 to Point/Station       12.000
**** INITIAL AREA EVALUATION ****
______________________________________________________________________
Soil classification AP and SCS  values input by user
USER INPUT of soil data for subarea
SCS curve number for soil(AMC 2)  = 77.00
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.420(In/Hr)
Initial subarea data:
Initial area flow distance =   580.000(Ft.)
Top (of initial area) elevation =  2965.000(Ft.)
Bottom (of initial area) elevation =  2958.000(Ft.)
Difference in elevation =     7.000(Ft.)
Slope =    0.01207  s(%)=       1.21
TC = k(0.628)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =   19.376 min.
Rainfall intensity =      1.381(In/Hr) for a    10.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.626
Subarea runoff =      0.346(CFS)
Total initial stream area =        0.400(Ac.)
Pervious area fraction = 1.000
Initial area Fm value =    0.420(In/Hr)
```

```
+++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       11.000 to Point/Station       12.000
**** CONFLUENCE OF MINOR STREAMS ****
_______________________________________________________________________
Along Main Stream number: 1 in normal stream number 2
Stream flow area =      0.400(Ac.)
Runoff from this stream =      0.346(CFS)
Time of concentration =   19.38 min.
Rainfall intensity =     1.381(In/Hr)
Area averaged loss rate (Fm) =    0.4202(In/Hr)
Area averaged Pervious ratio (Ap) = 1.0000
Summary of stream data:

Stream Flow rate    Area    TC     Fm       Rainfall Intensity
 No.    (CFS)   (Ac.)       (min) (In/Hr)     (In/Hr)


1      5.81     6.600     18.39    0.453      1.432
2      0.35     0.400     19.38    0.420      1.381
Qmax(1) =
         1.000 *    1.000 *     5.815) +
         1.053 *    0.949 *     0.346) + =       6.161
Qmax(2) =
         0.948 *    1.000 *     5.815) +
         1.000 *    1.000 *     0.346) + =       5.856

Total of 2 streams to confluence:
Flow rates before confluence point:
       5.815       0.346
Maximum flow rates at confluence using above data:
        6.161        5.856
Area of streams before confluence:
        6.600        0.400
Effective area values after confluence:
        6.980        7.000
Results of confluence:
Total flow rate =      6.161(CFS)
Time of concentration =    18.393 min.
Effective stream area after confluence =      6.980(Ac.)
Study area average Pervious fraction(Ap) =  1.000
Study area average soil loss rate(Fm) =    0.451(In/Hr)
Study area total (this main stream) =       7.00(Ac.)
```

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       12.000 to Point/Station      13.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
______________________________________________________________________
Estimated mean flow rate at midpoint of channel =      0.000(CFS)
Depth of flow =   0.355(Ft.), Average velocity =   3.226(Ft/s)
      ******* Irregular Channel Data ***********
-----------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
      1              0.00              1.00
      2              5.00              0.00
      3             10.00              0.00
      4             15.00              1.00
Manning's 'N' friction factor =   0.030
-----------------------------------------------------------------
Sub-Channel flow  =      7.764(CFS)
  '     '    flow top width =      8.552(Ft.)
  '     '     velocity=    3.226(Ft/s)
  '     '    area =      2.406(Sq.Ft)
  '     '    Froude number =     1.072

Upstream point elevation =  2958.000(Ft.)
Downstream point elevation =  2926.600(Ft.)
Flow length =  1350.000(Ft.)
Travel time  =    6.97 min.
Time of concentration =   25.37 min.
Depth of flow =   0.355(Ft.)
Average velocity =   3.226(Ft/s)
Total irregular channel flow =     7.764(CFS)
Irregular channel normal depth above invert elev. =   0.355(Ft.)
Average velocity of channel(s) =   3.226(Ft/s)
 Adding area flow to channel
UNDEVELOPED (poor cover) subarea
Decimal fraction soil group A = 0.580
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.420
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 74.98
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.453(In/Hr)
Rainfall intensity =      1.144(In/Hr) for a    10.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.544
Subarea runoff =      3.127(CFS) for    7.950(Ac.)
Total runoff =      9.288(CFS)
Effective area this stream =       14.93(Ac.)
Total Study Area (Main Stream No. 1) =       14.95(Ac.)
Area averaged Fm value =    0.452(In/Hr)
Depth of flow =   0.392(Ft.), Average velocity =   3.408(Ft/s)
```

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++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       12.000 to Point/Station       13.000
**** CONFLUENCE OF MINOR STREAMS ****
______________________________________________________________________
Along Main Stream number: 1 in normal stream number 1
Stream flow area =     14.930(Ac.)
Runoff from this stream =      9.288(CFS)
Time of concentration =   25.37 min.
Rainfall intensity =     1.144(In/Hr)
Area averaged loss rate (Fm) =    0.4524(In/Hr)
Area averaged Pervious ratio (Ap) = 1.0000
```

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       16.000 to Point/Station       17.000
**** INITIAL AREA EVALUATION ****
______________________________________________________________________
UNDEVELOPED (poor cover) subarea
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 67.00
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.578(In/Hr)
Initial subarea data:
Initial area flow distance =   964.000(Ft.)
Top (of initial area) elevation =  2972.000(Ft.)
Bottom (of initial area) elevation =  2950.000(Ft.)
Difference in elevation =    22.000(Ft.)
Slope =    0.02282  s(%)=       2.28
TC = k(0.525)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =   17.463 min.
Rainfall intensity =      1.485(In/Hr) for a    10.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.550
Subarea runoff =      5.142(CFS)
Total initial stream area =        6.300(Ac.)
Pervious area fraction = 1.000
Initial area Fm value =    0.578(In/Hr)
```

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++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       17.000 to Point/Station       13.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
______________________________________________________________________
Estimated mean flow rate at midpoint of channel =      0.000(CFS)
Depth of flow =   0.354(Ft.), Average velocity =   2.108(Ft/s)
      ******* Irregular Channel Data ***********
-----------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
      1              0.00             1.27
      2             22.39             0.89
      3             27.05             0.00
      4             30.37             0.22
      5             45.34             0.48
      6             50.25             0.50
Manning's 'N' friction factor =   0.030
-----------------------------------------------------------------
Sub-Channel flow  =      2.414(CFS)
  '     '   flow top width =     12.868(Ft.)
  '     '    velocity=    1.462(Ft/s)
  '     '   area =      1.651(Sq.Ft)
  '     '   Froude number =     0.720

Information entered for subchannel number 2 :
Point number      'X' coordinate     'Y' coordinate
      1             50.25             0.50
      2             60.45             0.22
      3             62.91             0.00
      4             73.37             2.58
Manning's 'N' friction factor =   0.015
-----------------------------------------------------------------
Sub-Channel flow  =      3.549(CFS)
  '     '   flow top width =      8.763(Ft.)
  '     '    velocity=    3.012(Ft/s)
  '     '   area =      1.178(Sq.Ft)
  '     '   Froude number =     1.448

Upstream point elevation =  2950.000(Ft.)
Downstream point elevation =  2926.600(Ft.)
Flow length =  1226.000(Ft.)
Travel time  =    9.69 min.
Time of concentration =   27.16 min.
Depth of flow =   0.354(Ft.)
Average velocity =   2.108(Ft/s)
Total irregular channel flow =     5.963(CFS)
Irregular channel normal depth above invert elev. =   0.354(Ft.)
Average velocity of channel(s) =   2.108(Ft/s)
 Adding area flow to channel
UNDEVELOPED (poor cover) subarea
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
```

```
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 67.00
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.578(In/Hr)
Rainfall intensity =      1.090(In/Hr) for a    10.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.423
Subarea runoff =      1.586(CFS) for    8.300(Ac.)
Total runoff =      6.728(CFS)
Effective area this stream =       14.60(Ac.)
Total Study Area (Main Stream No. 1) =       29.55(Ac.)
Area averaged Fm value =    0.578(In/Hr)
Depth of flow =   0.367(Ft.), Average velocity =   2.160(Ft/s)
```

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       17.000 to Point/Station       13.000
**** CONFLUENCE OF MINOR STREAMS ****
______________________________________________________________________
Along Main Stream number: 1 in normal stream number 2
Stream flow area =     14.600(Ac.)
Runoff from this stream =      6.728(CFS)
Time of concentration =   27.16 min.
Rainfall intensity =     1.090(In/Hr)
Area averaged loss rate (Fm) =    0.5783(In/Hr)
Area averaged Pervious ratio (Ap) = 1.0000
Summary of stream data:

Stream Flow rate    Area    TC     Fm       Rainfall Intensity
 No.    (CFS)   (Ac.)       (min) (In/Hr)     (In/Hr)


1      9.29    14.930     25.37    0.452      1.144
2      6.73    14.600     27.16    0.578      1.090
Qmax(1) =
         1.000 *    1.000 *     9.288) +
         1.104 *    0.934 *     6.728) + =      16.226
Qmax(2) =
         0.923 *    1.000 *     9.288) +
         1.000 *    1.000 *     6.728) + =      15.299

Total of 2 streams to confluence:
Flow rates before confluence point:
       9.288       6.728
Maximum flow rates at confluence using above data:
       16.226       15.299
Area of streams before confluence:
       14.930       14.600
Effective area values after confluence:
       28.567       29.530
Results of confluence:
Total flow rate =     16.226(CFS)
Time of concentration =    25.367 min.
Effective stream area after confluence =     28.567(Ac.)
Study area average Pervious fraction(Ap) =  1.000
Study area average soil loss rate(Fm) =    0.515(In/Hr)
Study area total (this main stream) =      29.53(Ac.)
End of computations, Total Study Area =          29.55 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.
Note: These figures do not consider reduced effective area
effects caused by confluences in the rational equation.

Area averaged pervious area fraction(Ap) = 1.000
Area averaged SCS curve number =  71.1
```

```
          San Bernardino County Rational Hydrology Program

              (Hydrology Manual Date - August 1986)

 CIVILCADD/CIVILDESIGN  Engineering Software, (c) 1989-2005 Version 7.1
      Rational Hydrology Study        Date: 09/01/22
------------------------------------------------------------------------
-2-YEAR, 1-HOUR RATIONAL STUDY PRE-DEVELOPED – OFFSITE/ONSITE
TR 17839, CITY OF VICTORVILLE
AREA B1, B2, C1, C2 & C3 AMETHYST ROAD RUNOFF
FILE: 17839AMETHYSTPRE2.OUT
------------------------------------------------------------------------


Program License Serial Number 4070

------------------------------------------------------------------------
 *********   Hydrology Study Control Information **********

------------------------------------------------------------------------
Rational hydrology study storm event year is     2.0
Computed rainfall intensity:
Storm year =     2.00   1 hour rainfall =     0.365 (In.)
Slope used for rainfall intensity curve b =  0.7000
Soil antecedent moisture condition (AMC) = 2
```

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       15.000 to Point/Station       12.000
**** INITIAL AREA EVALUATION ****
______________________________________________________________________
UNDEVELOPED (poor cover) subarea
Decimal fraction soil group A = 0.580
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.420
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 74.98
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.453(In/Hr)
Initial subarea data:
Initial area flow distance =   800.000(Ft.)
Top (of initial area) elevation =  2967.700(Ft.)
Bottom (of initial area) elevation =  2958.000(Ft.)
Difference in elevation =     9.700(Ft.)
Slope =    0.01212  s(%)=       1.21
TC = k(0.525)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =   18.393 min.
Rainfall intensity =      0.835(In/Hr) for a     2.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.411
Subarea runoff =      2.268(CFS)
Total initial stream area =        6.600(Ac.)
Pervious area fraction = 1.000
Initial area Fm value =    0.453(In/Hr)
```

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       15.000 to Point/Station       12.000
**** CONFLUENCE OF MINOR STREAMS ****
______________________________________________________________________
Along Main Stream number: 1 in normal stream number 1
Stream flow area =      6.600(Ac.)
Runoff from this stream =      2.268(CFS)
Time of concentration =   18.39 min.
Rainfall intensity =     0.835(In/Hr)
Area averaged loss rate (Fm) =    0.4533(In/Hr)
Area averaged Pervious ratio (Ap) = 1.0000
```

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       11.000 to Point/Station       12.000
**** INITIAL AREA EVALUATION ****
______________________________________________________________________
Soil classification AP and SCS  values input by user
USER INPUT of soil data for subarea
SCS curve number for soil(AMC 2)  = 77.00
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.420(In/Hr)
Initial subarea data:
Initial area flow distance =   580.000(Ft.)
Top (of initial area) elevation =  2965.000(Ft.)
Bottom (of initial area) elevation =  2958.000(Ft.)
Difference in elevation =     7.000(Ft.)
Slope =    0.01207  s(%)=       1.21
TC = k(0.628)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =   19.376 min.
Rainfall intensity =      0.805(In/Hr) for a     2.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.430
Subarea runoff =      0.139(CFS)
Total initial stream area =        0.400(Ac.)
Pervious area fraction = 1.000
Initial area Fm value =    0.420(In/Hr)
```

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       11.000 to Point/Station       12.000
**** CONFLUENCE OF MINOR STREAMS ****
______________________________________________________________________
Along Main Stream number: 1 in normal stream number 2
Stream flow area =      0.400(Ac.)
Runoff from this stream =      0.139(CFS)
Time of concentration =   19.38 min.
Rainfall intensity =     0.805(In/Hr)
Area averaged loss rate (Fm) =    0.4202(In/Hr)
Area averaged Pervious ratio (Ap) = 1.0000
Summary of stream data:

Stream Flow rate    Area    TC     Fm       Rainfall Intensity
 No.    (CFS)   (Ac.)       (min) (In/Hr)     (In/Hr)


1      2.27     6.600     18.39    0.453      0.835
2      0.14     0.400     19.38    0.420      0.805
Qmax(1) =
         1.000 *    1.000 *     2.268) +
         1.078 *    0.949 *     0.139) + =       2.410
Qmax(2) =
         0.922 *    1.000 *     2.268) +
         1.000 *    1.000 *     0.139) + =       2.229

Total of 2 streams to confluence:
Flow rates before confluence point:
       2.268       0.139
Maximum flow rates at confluence using above data:
        2.410        2.229
Area of streams before confluence:
        6.600        0.400
Effective area values after confluence:
        6.980        7.000
Results of confluence:
Total flow rate =      2.410(CFS)
Time of concentration =    18.393 min.
Effective stream area after confluence =      6.980(Ac.)
Study area average Pervious fraction(Ap) =  1.000
Study area average soil loss rate(Fm) =    0.451(In/Hr)
Study area total (this main stream) =      7.00(Ac.)
```

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       12.000 to Point/Station       13.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
______________________________________________________________________
Estimated mean flow rate at midpoint of channel =      0.000(CFS)
Depth of flow =   0.186(Ft.), Average velocity =   2.225(Ft/s)
      ******* Irregular Channel Data ***********
-----------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
      1             0.00              1.00
      2             5.00              0.00
      3            10.00              0.00
      4            15.00              1.00
Manning's 'N' friction factor =   0.030
-----------------------------------------------------------------
Sub-Channel flow  =      2.453(CFS)
  '     '   flow top width =      6.859(Ft.)
  '     '    velocity=    2.225(Ft/s)
  '     '   area =      1.103(Sq.Ft)
  '     '   Froude number =     0.978

Upstream point elevation =  2958.000(Ft.)
Downstream point elevation =  2926.600(Ft.)
Flow length =  1350.000(Ft.)
Travel time  =   10.11 min.
Time of concentration =   28.50 min.
Depth of flow =   0.186(Ft.)
Average velocity =   2.225(Ft/s)
Total irregular channel flow =     2.453(CFS)
Irregular channel normal depth above invert elev. =   0.186(Ft.)
Average velocity of channel(s) =   2.225(Ft/s)
 Adding area flow to channel
UNDEVELOPED (poor cover) subarea
Decimal fraction soil group A = 0.580
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.420
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 74.98
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.453(In/Hr)
The area added to the existing stream causes a
a lower flow rate of Q =      2.178(CFS)
therefore the upstream flow rate of Q =      2.410(CFS) is being used
Rainfall intensity =      0.615(In/Hr) for a     2.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.237
Subarea runoff =      0.000(CFS) for    7.950(Ac.)
Total runoff =      2.410(CFS)
Effective area this stream =       14.93(Ac.)
Total Study Area (Main Stream No. 1) =       14.95(Ac.)
Area averaged Fm value =    0.452(In/Hr)
Depth of flow =   0.184(Ft.), Average velocity =   2.212(Ft/s)
```

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       12.000 to Point/Station      13.000
**** CONFLUENCE OF MINOR STREAMS ****
______________________________________________________________________
Along Main Stream number: 1 in normal stream number 1
Stream flow area =     14.930(Ac.)
Runoff from this stream =      2.410(CFS)
Time of concentration =   28.50 min.
Rainfall intensity =     0.615(In/Hr)
Area averaged loss rate (Fm) =    0.4524(In/Hr)
Area averaged Pervious ratio (Ap) = 1.0000
```

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       16.000 to Point/Station       17.000
**** INITIAL AREA EVALUATION ****
______________________________________________________________________
UNDEVELOPED (poor cover) subarea
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 67.00
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.578(In/Hr)
Initial subarea data:
Initial area flow distance =   964.000(Ft.)
Top (of initial area) elevation =  2972.000(Ft.)
Bottom (of initial area) elevation =  2950.000(Ft.)
Difference in elevation =    22.000(Ft.)
Slope =    0.02282  s(%)=       2.28
TC = k(0.525)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =   17.463 min.
Rainfall intensity =      0.866(In/Hr) for a     2.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.299
Subarea runoff =      1.631(CFS)
Total initial stream area =        6.300(Ac.)
Pervious area fraction = 1.000
Initial area Fm value =    0.578(In/Hr)
```

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       17.000 to Point/Station       13.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
______________________________________________________________________
Estimated mean flow rate at midpoint of channel =      0.000(CFS)
Depth of flow =   0.223(Ft.), Average velocity =   1.882(Ft/s)
      ******* Irregular Channel Data ***********
-----------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
      1              0.00              1.27
      2             22.39              0.89
      3             27.05              0.00
      4             30.37              0.22
      5             45.34              0.48
      6             50.25              0.50
Manning's 'N' friction factor =   0.030
-----------------------------------------------------------------
Sub-Channel flow  =      0.666(CFS)
  '     '    flow top width =      4.659(Ft.)
  '     '     velocity=    1.317(Ft/s)
  '     '    area =      0.505(Sq.Ft)
  '     '    Froude number =     0.705

Information entered for subchannel number 2 :
Point number      'X' coordinate     'Y' coordinate
      1             50.25              0.50
      2             60.45              0.22
      3             62.91              0.00
      4             73.37              2.58
Manning's 'N' friction factor =   0.015
-----------------------------------------------------------------
Sub-Channel flow  =      0.999(CFS)
  '     '    flow top width =      3.472(Ft.)
  '     '     velocity=    2.636(Ft/s)
  '     '    area =      0.379(Sq.Ft)
  '     '    Froude number =     1.406

Upstream point elevation =  2950.000(Ft.)
Downstream point elevation =  2926.600(Ft.)
Flow length =  1226.000(Ft.)
Travel time  =   10.86 min.
Time of concentration =   28.32 min.
Depth of flow =   0.223(Ft.)
Average velocity =   1.882(Ft/s)
Total irregular channel flow =     1.665(CFS)
Irregular channel normal depth above invert elev. =   0.223(Ft.)
Average velocity of channel(s) =   1.882(Ft/s)
 Adding area flow to channel
UNDEVELOPED (poor cover) subarea
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
```

```
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 67.00
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.578(In/Hr)
The area added to the existing stream causes a
a lower flow rate of Q =      0.513(CFS)
therefore the upstream flow rate of Q =      1.631(CFS) is being used
Rainfall intensity =      0.617(In/Hr) for a     2.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.057
Subarea runoff =      0.000(CFS) for    8.300(Ac.)
Total runoff =      1.631(CFS)
Effective area this stream =       14.60(Ac.)
Total Study Area (Main Stream No. 1) =       29.55(Ac.)
Area averaged Fm value =    0.578(In/Hr)
Depth of flow =   0.220(Ft.), Average velocity =   1.897(Ft/s)
```

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       17.000 to Point/Station      13.000
**** CONFLUENCE OF MINOR STREAMS ****
______________________________________________________________________
Along Main Stream number: 1 in normal stream number 2
Stream flow area =     14.600(Ac.)
Runoff from this stream =      1.631(CFS)
Time of concentration =   28.32 min.
Rainfall intensity =     0.617(In/Hr)
Area averaged loss rate (Fm) =    0.5783(In/Hr)
Area averaged Pervious ratio (Ap) = 1.0000
Summary of stream data:

Stream Flow rate    Area    TC     Fm       Rainfall Intensity
 No.    (CFS)   (Ac.)       (min) (In/Hr)     (In/Hr)


1      2.41    14.930     28.50    0.452      0.615
2      1.63    14.600     28.32    0.578      0.617
Qmax(1) =
         1.000 *    1.000 *     2.410) +
         0.928 *    1.000 *     1.631) + =       3.923
Qmax(2) =
         1.017 *    0.993 *     2.410) +
         1.000 *    1.000 *     1.631) + =       4.067

Total of 2 streams to confluence:
Flow rates before confluence point:
       2.410       1.631
Maximum flow rates at confluence using above data:
        3.923        4.067
Area of streams before confluence:
       14.930       14.600
Effective area values after confluence:
       29.530       29.432
Results of confluence:
Total flow rate =      4.067(CFS)
Time of concentration =    28.319 min.
Effective stream area after confluence =     29.432(Ac.)
Study area average Pervious fraction(Ap) =  1.000
Study area average soil loss rate(Fm) =    0.515(In/Hr)
Study area total (this main stream) =      29.53(Ac.)
End of computations, Total Study Area =           29.55 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.
Note: These figures do not consider reduced effective area
effects caused by confluences in the rational equation.

Area averaged pervious area fraction(Ap) = 1.000
Area averaged SCS curve number =  71.1
```

```
              San Bernardino County Rational Hydrology Program

                  (Hydrology Manual Date - August 1986)

 CIVILCADD/CIVILDESIGN  Engineering Software, (c) 1989-2005 Version 7.1
      Rational Hydrology Study        Date: 08/31/22
------------------------------------------------------------------------
100-YEAR, 1-HOUR RATIONAL STUDY PRE-DEVELOPED
TR 17839, CITY OF VICTORVILLE
AREA D1 MOJAVE DRIVE
FILE: 17839MOJAVEPRE100.OUT
------------------------------------------------------------------------


Program License Serial Number 4070

------------------------------------------------------------------------
 *********   Hydrology Study Control Information **********

------------------------------------------------------------------------
Rational hydrology study storm event year is   100.0
Computed rainfall intensity:
Storm year =   100.00   1 hour rainfall =     1.080 (In.)
Slope used for rainfall intensity curve b =  0.7000
Soil antecedent moisture condition (AMC) = 2
```

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       11.000 to Point/Station       18.000
**** INITIAL AREA EVALUATION ****
______________________________________________________________________
RESIDENTIAL(3 - 4 dwl/acre)
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 69.00
Pervious ratio(Ap) = 0.6000     Max loss rate(Fm)=     0.329(In/Hr)
Initial subarea data:
Initial area flow distance =   625.000(Ft.)
Top (of initial area) elevation =  2965.000(Ft.)
Bottom (of initial area) elevation =  2960.500(Ft.)
Difference in elevation =     4.500(Ft.)
Slope =    0.00720  s(%)=       0.72
TC = k(0.412)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =   14.514 min.
Rainfall intensity =      2.917(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.799
Subarea runoff =      2.259(CFS)
Total initial stream area =        0.970(Ac.)
Pervious area fraction = 0.600
Initial area Fm value =    0.329(In/Hr)
End of computations, Total Study Area =           0.97 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.
Note: These figures do not consider reduced effective area
effects caused by confluences in the rational equation.

Area averaged pervious area fraction(Ap) = 0.600
Area averaged SCS curve number =  69.0
```

```
              San Bernardino County Rational Hydrology Program

                  (Hydrology Manual Date - August 1986)

 CIVILCADD/CIVILDESIGN  Engineering Software, (c) 1989-2005 Version 7.1
      Rational Hydrology Study       Date: 08/31/22
------------------------------------------------------------------------
10-YEAR, 1-HOUR RATIONAL STUDY PRE-DEVELOPED
TR 17839, CITY OF VICTORVILLE
AREA D1 MOJAVE DRIVE
FILE: 17839MOJAVEPRE10.OUT
------------------------------------------------------------------------


Program License Serial Number 4070

------------------------------------------------------------------------
 *********   Hydrology Study Control Information **********

------------------------------------------------------------------------
Rational hydrology study storm event year is    10.0
Computed rainfall intensity:
Storm year =    10.00   1 hour rainfall =     0.626 (In.)
Slope used for rainfall intensity curve b =  0.7000
Soil antecedent moisture condition (AMC) = 2
```

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       11.000 to Point/Station       18.000
**** INITIAL AREA EVALUATION ****
______________________________________________________________________
RESIDENTIAL(3 - 4 dwl/acre)
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 69.00
Pervious ratio(Ap) = 0.6000     Max loss rate(Fm)=     0.329(In/Hr)
Initial subarea data:
Initial area flow distance =   625.000(Ft.)
Top (of initial area) elevation =  2965.000(Ft.)
Bottom (of initial area) elevation =  2960.500(Ft.)
Difference in elevation =     4.500(Ft.)
Slope =    0.00720  s(%)=       0.72
TC = k(0.412)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =   14.514 min.
Rainfall intensity =      1.691(In/Hr) for a    10.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.725
Subarea runoff =      1.189(CFS)
Total initial stream area =        0.970(Ac.)
Pervious area fraction = 0.600
Initial area Fm value =    0.329(In/Hr)
End of computations, Total Study Area =            0.97 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.
Note: These figures do not consider reduced effective area
effects caused by confluences in the rational equation.

Area averaged pervious area fraction(Ap) = 0.600
Area averaged SCS curve number =  69.0
```

```
            San Bernardino County Rational Hydrology Program

                (Hydrology Manual Date - August 1986)

 CIVILCADD/CIVILDESIGN  Engineering Software, (c) 1989-2005 Version 7.1
      Rational Hydrology Study        Date: 08/31/22
------------------------------------------------------------------------
2-YEAR, 1-HOUR RATIONAL STUDY PRE-DEVELOPED
TR 17839, CITY OF VICTORVILLE
AREA D1 MOJAVE DRIVE
FILE: 17839MOJAVEPRE2.OUT
------------------------------------------------------------------------


Program License Serial Number 4070

------------------------------------------------------------------------
 *********   Hydrology Study Control Information **********

------------------------------------------------------------------------
Rational hydrology study storm event year is     2.0
Computed rainfall intensity:
Storm year =     2.00   1 hour rainfall =     0.365 (In.)
Slope used for rainfall intensity curve b =  0.7000
Soil antecedent moisture condition (AMC) = 2
```

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       11.000 to Point/Station      18.000
**** INITIAL AREA EVALUATION ****
______________________________________________________________________
RESIDENTIAL(3 - 4 dwl/acre)
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 69.00
Pervious ratio(Ap) = 0.6000     Max loss rate(Fm)=     0.329(In/Hr)
Initial subarea data:
Initial area flow distance =   625.000(Ft.)
Top (of initial area) elevation =  2965.000(Ft.)
Bottom (of initial area) elevation =  2960.500(Ft.)
Difference in elevation =     4.500(Ft.)
Slope =    0.00720  s(%)=       0.72
TC = k(0.412)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =   14.514 min.
Rainfall intensity =      0.986(In/Hr) for a     2.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.600
Subarea runoff =      0.574(CFS)
Total initial stream area =        0.970(Ac.)
Pervious area fraction = 0.600
Initial area Fm value =    0.329(In/Hr)
End of computations, Total Study Area =            0.97 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.
Note: These figures do not consider reduced effective area
effects caused by confluences in the rational equation.

Area averaged pervious area fraction(Ap) = 0.600
Area averaged SCS curve number =  69.0
```

TR. 20525

100-year,10-year & 2-year 1-Hours Storm Events

Rational Method Post-Developed

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            San Bernardino County Rational Hydrology Program

                (Hydrology Manual Date - August 1986)

 CIVILCADD/CIVILDESIGN  Engineering Software, (c) 1989-2005 Version 7.1
      Rational Hydrology Study        Date: 08/26/22
------------------------------------------------------------------------
100-YEAR, 1-HOUR RATIONAL STUDY POST DEVELOPED
TR 20525, CITY OF VICTORVILLE
AREA AA1, AA2, AA3, BB1, BB2, BB3, BB4 & BB5
FILE: 20525RATIONALPOST100REV.OUT
------------------------------------------------------------------------


Program License Serial Number 4070

------------------------------------------------------------------------
 *********   Hydrology Study Control Information **********

------------------------------------------------------------------------
Rational hydrology study storm event year is   100.0
Computed rainfall intensity:
Storm year =   100.00   1 hour rainfall =     1.080 (In.)
Slope used for rainfall intensity curve b =  0.7000
Soil antecedent moisture condition (AMC) = 2
```

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      101.000 to Point/Station      102.000
**** INITIAL AREA EVALUATION ****
______________________________________________________________________
RESIDENTIAL(3 - 4 dwl/acre)
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 69.00
Pervious ratio(Ap) = 0.6000     Max loss rate(Fm)=     0.329(In/Hr)
Initial subarea data:
Initial area flow distance =   413.000(Ft.)
Top (of initial area) elevation =  2963.500(Ft.)
Bottom (of initial area) elevation =  2957.500(Ft.)
Difference in elevation =     6.000(Ft.)
Slope =    0.01453  s(%)=       1.45
TC = k(0.412)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =   10.687 min.
Rainfall intensity =      3.614(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.818
Subarea runoff =      5.854(CFS)
Total initial stream area =        1.980(Ac.)
Pervious area fraction = 0.600
Initial area Fm value =    0.329(In/Hr)
```

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      102.000 to Point/Station      103.000
**** STREET FLOW TRAVEL TIME + SUBAREA FLOW ADDITION ****
______________________________________________________________________
Top of street segment elevation =  2957.500(Ft.)
End of street segment elevation =  2946.700(Ft.)
Length of street segment  =   803.000(Ft.)
Height of curb above gutter flowline  =    6.0(In.)
Width of half street (curb to crown)  =  20.000(Ft.)
Distance from crown to crossfall grade break  =  18.500(Ft.)
Slope from gutter to grade break (v/hz) =   0.020
Slope from grade break to crown (v/hz)  =   0.020
Street flow is on [2] side(s) of the street
Distance from curb to property line  =  10.000(Ft.)
Slope from curb to property line (v/hz) =   0.020
Gutter width =   1.500(Ft.)
Gutter hike from flowline =  1.416(In.)
 Manning's N in gutter =  0.0150
 Manning's N from gutter to grade break =  0.0150
 Manning's N from grade break to crown =  0.0150
Estimated mean flow rate at midpoint of street =     11.493(CFS)
Depth of flow =   0.358(Ft.), Average velocity =   3.042(Ft/s)
Streetflow hydraulics at midpoint of street travel:
Halfstreet flow width =  13.503(Ft.)
Flow velocity =   3.04(Ft/s)
Travel time =    4.40 min.     TC =   15.09  min.
 Adding area flow to street
RESIDENTIAL(3 - 4 dwl/acre)
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 69.00
Pervious ratio(Ap) = 0.6000     Max loss rate(Fm)=     0.329(In/Hr)
Rainfall intensity =      2.839(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.796
Subarea runoff =     11.089(CFS) for    5.520(Ac.)
Total runoff =     16.942(CFS)
Effective area this stream =        7.50(Ac.)
Total Study Area (Main Stream No. 1) =        7.50(Ac.)
Area averaged Fm value =    0.329(In/Hr)
Street flow at end of street =     16.942(CFS)
Half street flow at end of street =      8.471(CFS)
Depth of flow =   0.402(Ft.), Average velocity =   3.346(Ft/s)
Flow width (from curb towards crown)=  15.704(Ft.)
```

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      103.000 to Point/Station      106.000
**** STREET FLOW TRAVEL TIME + SUBAREA FLOW ADDITION ****
______________________________________________________________________
Top of street segment elevation =  2946.700(Ft.)
End of street segment elevation =  2929.500(Ft.)
Length of street segment  =  1129.000(Ft.)
Height of curb above gutter flowline  =    6.0(In.)
Width of half street (curb to crown)  =  20.000(Ft.)
Distance from crown to crossfall grade break  =  18.500(Ft.)
Slope from gutter to grade break (v/hz) =   0.020
Slope from grade break to crown (v/hz)  =   0.020
Street flow is on [2] side(s) of the street
Distance from curb to property line  =  10.000(Ft.)
Slope from curb to property line (v/hz) =   0.020
Gutter width =   1.500(Ft.)
Gutter hike from flowline =  1.416(In.)
 Manning's N in gutter =  0.0150
 Manning's N from gutter to grade break =  0.0150
 Manning's N from grade break to crown =  0.0150
Estimated mean flow rate at midpoint of street =     21.606(CFS)
Depth of flow =   0.425(Ft.), Average velocity =   3.723(Ft/s)
Streetflow hydraulics at midpoint of street travel:
Halfstreet flow width =  16.840(Ft.)
Flow velocity =   3.72(Ft/s)
Travel time =    5.05 min.     TC =   20.14  min.
 Adding area flow to street
RESIDENTIAL(3 - 4 dwl/acre)
Decimal fraction soil group A = 0.510
Decimal fraction soil group B = 0.360
Decimal fraction soil group C = 0.130
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 45.45
Pervious ratio(Ap) = 0.6000     Max loss rate(Fm)=     0.517(In/Hr)
Rainfall intensity =      2.319(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.735
Subarea runoff =      9.173(CFS) for    7.820(Ac.)
Total runoff =     26.115(CFS)
Effective area this stream =       15.32(Ac.)
Total Study Area (Main Stream No. 1) =       15.32(Ac.)
Area averaged Fm value =    0.425(In/Hr)
Street flow at end of street =     26.115(CFS)
Half street flow at end of street =     13.058(CFS)
Depth of flow =   0.450(Ft.), Average velocity =   3.901(Ft/s)
Flow width (from curb towards crown)=  18.113(Ft.)
```

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      103.000 to Point/Station      106.000
**** CONFLUENCE OF MINOR STREAMS ****
```

```
Along Main Stream number: 1 in normal stream number 1
Stream flow area =     15.320(Ac.)
Runoff from this stream =     26.115(CFS)
Time of concentration =   20.14 min.
Rainfall intensity =     2.319(In/Hr)
Area averaged loss rate (Fm) =    0.4248(In/Hr)
Area averaged Pervious ratio (Ap) = 0.6000
```

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      104.000 to Point/Station      105.000
**** INITIAL AREA EVALUATION ****
______________________________________________________________________
RESIDENTIAL(3 - 4 dwl/acre)
Decimal fraction soil group A = 0.350
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.650
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 56.05
Pervious ratio(Ap) = 0.6000     Max loss rate(Fm)=     0.440(In/Hr)
Initial subarea data:
Initial area flow distance =  1000.000(Ft.)
Top (of initial area) elevation =  2963.500(Ft.)
Bottom (of initial area) elevation =  2944.400(Ft.)
Difference in elevation =    19.100(Ft.)
Slope =    0.01910  s(%)=       1.91
TC = k(0.412)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =   14.411 min.
Rainfall intensity =      2.931(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.765
Subarea runoff =     14.372(CFS)
Total initial stream area =        6.410(Ac.)
Pervious area fraction = 0.600
Initial area Fm value =    0.440(In/Hr)
```

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      105.000 to Point/Station      106.000
**** STREET FLOW TRAVEL TIME + SUBAREA FLOW ADDITION ****
______________________________________________________________________
Top of street segment elevation =  2944.400(Ft.)
End of street segment elevation =  2929.500(Ft.)
Length of street segment  =   769.000(Ft.)
Height of curb above gutter flowline  =    6.0(In.)
Width of half street (curb to crown)  =  20.000(Ft.)
Distance from crown to crossfall grade break  =  18.500(Ft.)
Slope from gutter to grade break (v/hz) =   0.020
Slope from grade break to crown (v/hz)  =   0.020
Street flow is on [2] side(s) of the street
Distance from curb to property line  =  10.000(Ft.)
Slope from curb to property line (v/hz) =   0.020
Gutter width =   1.500(Ft.)
Gutter hike from flowline =  1.416(In.)
 Manning's N in gutter =  0.0150
 Manning's N from gutter to grade break =  0.0150
 Manning's N from grade break to crown =  0.0150
Estimated mean flow rate at midpoint of street =     17.781(CFS)
Depth of flow =   0.386(Ft.), Average velocity =   3.885(Ft/s)
Streetflow hydraulics at midpoint of street travel:
Halfstreet flow width =  14.907(Ft.)
Flow velocity =   3.89(Ft/s)
Travel time =    3.30 min.     TC =   17.71  min.
 Adding area flow to street
RESIDENTIAL(3 - 4 dwl/acre)
Decimal fraction soil group A = 0.680
Decimal fraction soil group B = 0.320
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 39.68
Pervious ratio(Ap) = 0.6000     Max loss rate(Fm)=     0.552(In/Hr)
Rainfall intensity =      2.537(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.727
Subarea runoff =      6.663(CFS) for    5.000(Ac.)
Total runoff =     21.035(CFS)
Effective area this stream =       11.41(Ac.)
Total Study Area (Main Stream No. 1) =       26.73(Ac.)
Area averaged Fm value =    0.489(In/Hr)
Street flow at end of street =     21.035(CFS)
Half street flow at end of street =     10.518(CFS)
Depth of flow =   0.406(Ft.), Average velocity =   4.049(Ft/s)
Flow width (from curb towards crown)=  15.911(Ft.)
```

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      105.000 to Point/Station      106.000
**** CONFLUENCE OF MINOR STREAMS ****
______________________________________________________________________
Along Main Stream number: 1 in normal stream number 2
Stream flow area =     11.410(Ac.)
Runoff from this stream =     21.035(CFS)
Time of concentration =   17.71 min.
Rainfall intensity =     2.537(In/Hr)
Area averaged loss rate (Fm) =    0.4890(In/Hr)
Area averaged Pervious ratio (Ap) = 0.6000
```

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++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      107.000 to Point/Station      108.000
**** INITIAL AREA EVALUATION ****
______________________________________________________________________
RESIDENTIAL(3 - 4 dwl/acre)
Decimal fraction soil group A = 0.400
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.600
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 54.20
Pervious ratio(Ap) = 0.6000     Max loss rate(Fm)=     0.454(In/Hr)
Initial subarea data:
Initial area flow distance =  1000.000(Ft.)
Top (of initial area) elevation =  2965.500(Ft.)
Bottom (of initial area) elevation =  2941.800(Ft.)
Difference in elevation =    23.700(Ft.)
Slope =    0.02370  s(%)=       2.37
TC = k(0.412)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =   13.802 min.
Rainfall intensity =      3.021(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.765
Subarea runoff =      2.911(CFS)
Total initial stream area =        1.260(Ac.)
Pervious area fraction = 0.600
Initial area Fm value =    0.454(In/Hr)
```

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      108.000 to Point/Station      109.000
**** STREET FLOW TRAVEL TIME + SUBAREA FLOW ADDITION ****
______________________________________________________________________
Top of street segment elevation =  2941.800(Ft.)
End of street segment elevation =  2928.500(Ft.)
Length of street segment  =   724.000(Ft.)
Height of curb above gutter flowline  =    6.0(In.)
Width of half street (curb to crown)  =  40.000(Ft.)
Distance from crown to crossfall grade break  =  38.500(Ft.)
Slope from gutter to grade break (v/hz) =   0.020
Slope from grade break to crown (v/hz)  =   0.020
Street flow is on [2] side(s) of the street
Distance from curb to property line  =  10.000(Ft.)
Slope from curb to property line (v/hz) =   0.020
Gutter width =   1.500(Ft.)
Gutter hike from flowline =  1.416(In.)
 Manning's N in gutter =  0.0150
 Manning's N from gutter to grade break =  0.0150
 Manning's N from grade break to crown =  0.0150
Estimated mean flow rate at midpoint of street =      3.625(CFS)
Depth of flow =   0.247(Ft.), Average velocity =   2.597(Ft/s)
Streetflow hydraulics at midpoint of street travel:
Halfstreet flow width =   7.948(Ft.)
Flow velocity =   2.60(Ft/s)
Travel time =    4.65 min.     TC =   18.45  min.
 Adding area flow to street
RESIDENTIAL(3 - 4 dwl/acre)
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 69.00
Pervious ratio(Ap) = 0.6000     Max loss rate(Fm)=     0.329(In/Hr)
Rainfall intensity =      2.466(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.754
Subarea runoff =      1.294(CFS) for    1.000(Ac.)
Total runoff =      4.204(CFS)
Effective area this stream =        2.26(Ac.)
Total Study Area (Main Stream No. 1) =       28.99(Ac.)
Area averaged Fm value =    0.399(In/Hr)
Street flow at end of street =      4.204(CFS)
Half street flow at end of street =      2.102(CFS)
Depth of flow =   0.257(Ft.), Average velocity =   2.689(Ft/s)
Flow width (from curb towards crown)=   8.460(Ft.)
```

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++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      108.000 to Point/Station      109.000
**** CONFLUENCE OF MINOR STREAMS ****
______________________________________________________________________
Along Main Stream number: 1 in normal stream number 3
Stream flow area =      2.260(Ac.)
Runoff from this stream =      4.204(CFS)
Time of concentration =   18.45 min.
Rainfall intensity =     2.466(In/Hr)
Area averaged loss rate (Fm) =    0.3988(In/Hr)
Area averaged Pervious ratio (Ap) = 0.6000
Summary of stream data:

Stream Flow rate    Area    TC     Fm       Rainfall Intensity
 No.    (CFS)   (Ac.)       (min) (In/Hr)     (In/Hr)


1     26.12    15.320     20.14    0.425      2.319
2     21.04    11.410     17.71    0.489      2.537
3      4.20     2.260     18.45    0.399      2.466
Qmax(1) =
         1.000 *    1.000 *    26.115) +
         0.893 *    1.000 *    21.035) +
         0.929 *    1.000 *     4.204) + =      48.812
Qmax(2) =
         1.115 *    0.879 *    26.115) +
         1.000 *    1.000 *    21.035) +
         1.035 *    0.960 *     4.204) + =      50.823
Qmax(3) =
         1.078 *    0.916 *    26.115) +
         0.965 *    1.000 *    21.035) +
         1.000 *    1.000 *     4.204) + =      50.282

Total of 3 streams to confluence:
Flow rates before confluence point:
      26.115      21.035       4.204
Maximum flow rates at confluence using above data:
       48.812       50.823       50.282
Area of streams before confluence:
       15.320       11.410        2.260
Effective area values after confluence:
       28.990       27.050       27.702
Results of confluence:
Total flow rate =     50.823(CFS)
Time of concentration =    17.710 min.
Effective stream area after confluence =     27.050(Ac.)
Study area average Pervious fraction(Ap) =  0.600
Study area average soil loss rate(Fm) =    0.448(In/Hr)
Study area total (this main stream) =      28.99(Ac.)
End of computations, Total Study Area =           28.99 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.
```

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Note: These figures do not consider reduced effective area
effects caused by confluences in the rational equation.

Area averaged pervious area fraction(Ap) = 0.600
Area averaged SCS curve number =  54.1
```

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          San Bernardino County Rational Hydrology Program

              (Hydrology Manual Date - August 1986)

 CIVILCADD/CIVILDESIGN  Engineering Software, (c) 1989-2005 Version 7.1
      Rational Hydrology Study        Date: 08/26/22
------------------------------------------------------------------------
10-YEAR, 1-HOUR RATIONAL STUDY POST DEVELOPED
TR 20525, CITY OF VICTORVILLE
AREA AA1, AA2, AA3, BB1, BB2, BB3, BB4 & BB5
FILE: 20525RATIONALPOST10.OUT
------------------------------------------------------------------------


Program License Serial Number 4070

------------------------------------------------------------------------
 *********   Hydrology Study Control Information **********

------------------------------------------------------------------------
Rational hydrology study storm event year is    10.0
Computed rainfall intensity:
Storm year =    10.00   1 hour rainfall =     0.626 (In.)
Slope used for rainfall intensity curve b =  0.7000
Soil antecedent moisture condition (AMC) = 2
```

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      101.000 to Point/Station      102.000
**** INITIAL AREA EVALUATION ****
______________________________________________________________________
RESIDENTIAL(3 - 4 dwl/acre)
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 69.00
Pervious ratio(Ap) = 0.6000     Max loss rate(Fm)=     0.329(In/Hr)
Initial subarea data:
Initial area flow distance =   413.000(Ft.)
Top (of initial area) elevation =  2963.500(Ft.)
Bottom (of initial area) elevation =  2957.500(Ft.)
Difference in elevation =     6.000(Ft.)
Slope =    0.01453  s(%)=       1.45
TC = k(0.412)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =   10.687 min.
Rainfall intensity =      2.095(In/Hr) for a    10.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.759
Subarea runoff =      3.147(CFS)
Total initial stream area =        1.980(Ac.)
Pervious area fraction = 0.600
Initial area Fm value =    0.329(In/Hr)
```

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      102.000 to Point/Station      103.000
**** STREET FLOW TRAVEL TIME + SUBAREA FLOW ADDITION ****
______________________________________________________________________
Top of street segment elevation =  2957.500(Ft.)
End of street segment elevation =  2946.700(Ft.)
Length of street segment  =   803.000(Ft.)
Height of curb above gutter flowline  =    6.0(In.)
Width of half street (curb to crown)  =  20.000(Ft.)
Distance from crown to crossfall grade break  =  18.500(Ft.)
Slope from gutter to grade break (v/hz) =   0.020
Slope from grade break to crown (v/hz)  =   0.020
Street flow is on [2] side(s) of the street
Distance from curb to property line  =  10.000(Ft.)
Slope from curb to property line (v/hz) =   0.020
Gutter width =   1.500(Ft.)
Gutter hike from flowline =  1.416(In.)
 Manning's N in gutter =  0.0150
 Manning's N from gutter to grade break =  0.0150
 Manning's N from grade break to crown =  0.0150
Estimated mean flow rate at midpoint of street =      5.890(CFS)
Depth of flow =   0.295(Ft.), Average velocity =   2.587(Ft/s)
Streetflow hydraulics at midpoint of street travel:
Halfstreet flow width =  10.356(Ft.)
Flow velocity =   2.59(Ft/s)
Travel time =    5.17 min.     TC =   15.86  min.
 Adding area flow to street
RESIDENTIAL(3 - 4 dwl/acre)
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 69.00
Pervious ratio(Ap) = 0.6000     Max loss rate(Fm)=     0.329(In/Hr)
Rainfall intensity =      1.589(In/Hr) for a    10.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.714
Subarea runoff =      5.358(CFS) for    5.520(Ac.)
Total runoff =      8.505(CFS)
Effective area this stream =        7.50(Ac.)
Total Study Area (Main Stream No. 1) =        7.50(Ac.)
Area averaged Fm value =    0.329(In/Hr)
Street flow at end of street =      8.505(CFS)
Half street flow at end of street =      4.253(CFS)
Depth of flow =   0.328(Ft.), Average velocity =   2.827(Ft/s)
Flow width (from curb towards crown)=  11.994(Ft.)
```

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      103.000 to Point/Station      106.000
**** STREET FLOW TRAVEL TIME + SUBAREA FLOW ADDITION ****
______________________________________________________________________
Top of street segment elevation =  2946.700(Ft.)
End of street segment elevation =  2929.500(Ft.)
Length of street segment  =  1129.000(Ft.)
Height of curb above gutter flowline  =    6.0(In.)
Width of half street (curb to crown)  =  20.000(Ft.)
Distance from crown to crossfall grade break  =  18.500(Ft.)
Slope from gutter to grade break (v/hz) =   0.020
Slope from grade break to crown (v/hz)  =   0.020
Street flow is on [2] side(s) of the street
Distance from curb to property line  =  10.000(Ft.)
Slope from curb to property line (v/hz) =   0.020
Gutter width =   1.500(Ft.)
Gutter hike from flowline =  1.416(In.)
 Manning's N in gutter =  0.0150
 Manning's N from gutter to grade break =  0.0150
 Manning's N from grade break to crown =  0.0150
Estimated mean flow rate at midpoint of street =     10.103(CFS)
Depth of flow =   0.339(Ft.), Average velocity =   3.090(Ft/s)
Streetflow hydraulics at midpoint of street travel:
Halfstreet flow width =  12.525(Ft.)
Flow velocity =   3.09(Ft/s)
Travel time =    6.09 min.     TC =   21.95  min.
 Adding area flow to street
RESIDENTIAL(3 - 4 dwl/acre)
Decimal fraction soil group A = 0.510
Decimal fraction soil group B = 0.360
Decimal fraction soil group C = 0.130
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 45.45
Pervious ratio(Ap) = 0.6000     Max loss rate(Fm)=     0.517(In/Hr)
Rainfall intensity =      1.266(In/Hr) for a    10.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.598
Subarea runoff =      3.087(CFS) for    7.820(Ac.)
Total runoff =     11.592(CFS)
Effective area this stream =       15.32(Ac.)
Total Study Area (Main Stream No. 1) =       15.32(Ac.)
Area averaged Fm value =    0.425(In/Hr)
Street flow at end of street =     11.592(CFS)
Half street flow at end of street =      5.796(CFS)
Depth of flow =   0.352(Ft.), Average velocity =   3.195(Ft/s)
Flow width (from curb towards crown)=  13.221(Ft.)
```

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      103.000 to Point/Station      106.000
**** CONFLUENCE OF MINOR STREAMS ****
______________________________________________________________________
Along Main Stream number: 1 in normal stream number 1
Stream flow area =     15.320(Ac.)
Runoff from this stream =     11.592(CFS)
Time of concentration =   21.95 min.
Rainfall intensity =     1.266(In/Hr)
Area averaged loss rate (Fm) =    0.4248(In/Hr)
Area averaged Pervious ratio (Ap) = 0.6000
```

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      104.000 to Point/Station      105.000
**** INITIAL AREA EVALUATION ****
______________________________________________________________________
RESIDENTIAL(3 - 4 dwl/acre)
Decimal fraction soil group A = 0.350
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.650
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 56.05
Pervious ratio(Ap) = 0.6000     Max loss rate(Fm)=     0.440(In/Hr)
Initial subarea data:
Initial area flow distance =  1000.000(Ft.)
Top (of initial area) elevation =  2963.500(Ft.)
Bottom (of initial area) elevation =  2944.400(Ft.)
Difference in elevation =    19.100(Ft.)
Slope =    0.01910  s(%)=       1.91
TC = k(0.412)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =   14.411 min.
Rainfall intensity =      1.699(In/Hr) for a    10.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.667
Subarea runoff =      7.263(CFS)
Total initial stream area =        6.410(Ac.)
Pervious area fraction = 0.600
Initial area Fm value =    0.440(In/Hr)
```

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++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      105.000 to Point/Station      106.000
**** STREET FLOW TRAVEL TIME + SUBAREA FLOW ADDITION ****
______________________________________________________________________
Top of street segment elevation =  2944.400(Ft.)
End of street segment elevation =  2929.500(Ft.)
Length of street segment  =   769.000(Ft.)
Height of curb above gutter flowline  =    6.0(In.)
Width of half street (curb to crown)  =  20.000(Ft.)
Distance from crown to crossfall grade break  =  18.500(Ft.)
Slope from gutter to grade break (v/hz) =   0.020
Slope from grade break to crown (v/hz)  =   0.020
Street flow is on [2] side(s) of the street
Distance from curb to property line  =  10.000(Ft.)
Slope from curb to property line (v/hz) =   0.020
Gutter width =   1.500(Ft.)
Gutter hike from flowline =  1.416(In.)
 Manning's N in gutter =  0.0150
 Manning's N from gutter to grade break =  0.0150
 Manning's N from grade break to crown =  0.0150
Estimated mean flow rate at midpoint of street =      8.542(CFS)
Depth of flow =   0.311(Ft.), Average velocity =   3.249(Ft/s)
Streetflow hydraulics at midpoint of street travel:
Halfstreet flow width =  11.173(Ft.)
Flow velocity =   3.25(Ft/s)
Travel time =    3.94 min.     TC =   18.36  min.
 Adding area flow to street
RESIDENTIAL(3 - 4 dwl/acre)
Decimal fraction soil group A = 0.680
Decimal fraction soil group B = 0.320
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 39.68
Pervious ratio(Ap) = 0.6000     Max loss rate(Fm)=     0.552(In/Hr)
Rainfall intensity =      1.434(In/Hr) for a    10.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.593
Subarea runoff =      2.445(CFS) for    5.000(Ac.)
Total runoff =      9.708(CFS)
Effective area this stream =       11.41(Ac.)
Total Study Area (Main Stream No. 1) =       26.73(Ac.)
Area averaged Fm value =    0.489(In/Hr)
Street flow at end of street =      9.708(CFS)
Half street flow at end of street =      4.854(CFS)
Depth of flow =   0.323(Ft.), Average velocity =   3.352(Ft/s)
Flow width (from curb towards crown)=  11.757(Ft.)
```

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      105.000 to Point/Station      106.000
**** CONFLUENCE OF MINOR STREAMS ****
______________________________________________________________________
Along Main Stream number: 1 in normal stream number 2
Stream flow area =     11.410(Ac.)
Runoff from this stream =      9.708(CFS)
Time of concentration =   18.36 min.
Rainfall intensity =     1.434(In/Hr)
Area averaged loss rate (Fm) =    0.4890(In/Hr)
Area averaged Pervious ratio (Ap) = 0.6000
```

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      107.000 to Point/Station      108.000
**** INITIAL AREA EVALUATION ****
______________________________________________________________________
RESIDENTIAL(3 - 4 dwl/acre)
Decimal fraction soil group A = 0.400
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.600
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 54.20
Pervious ratio(Ap) = 0.6000     Max loss rate(Fm)=     0.454(In/Hr)
Initial subarea data:
Initial area flow distance =  1000.000(Ft.)
Top (of initial area) elevation =  2965.500(Ft.)
Bottom (of initial area) elevation =  2941.800(Ft.)
Difference in elevation =    23.700(Ft.)
Slope =    0.02370  s(%)=       2.37
TC = k(0.412)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =   13.802 min.
Rainfall intensity =      1.751(In/Hr) for a    10.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.666
Subarea runoff =      1.470(CFS)
Total initial stream area =       1.260(Ac.)
Pervious area fraction = 0.600
Initial area Fm value =    0.454(In/Hr)
```

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      108.000 to Point/Station      109.000
**** STREET FLOW TRAVEL TIME + SUBAREA FLOW ADDITION ****
______________________________________________________________________
Top of street segment elevation =  2941.800(Ft.)
End of street segment elevation =  2928.500(Ft.)
Length of street segment  =   724.000(Ft.)
Height of curb above gutter flowline  =    6.0(In.)
Width of half street (curb to crown)  =  40.000(Ft.)
Distance from crown to crossfall grade break  =  38.500(Ft.)
Slope from gutter to grade break (v/hz) =   0.020
Slope from grade break to crown (v/hz)  =   0.020
Street flow is on [2] side(s) of the street
Distance from curb to property line  =  10.000(Ft.)
Slope from curb to property line (v/hz) =   0.020
Gutter width =   1.500(Ft.)
Gutter hike from flowline =  1.416(In.)
 Manning's N in gutter =  0.0150
 Manning's N from gutter to grade break =  0.0150
 Manning's N from grade break to crown =  0.0150
Estimated mean flow rate at midpoint of street =      1.823(CFS)
Depth of flow =   0.205(Ft.), Average velocity =   2.225(Ft/s)
Streetflow hydraulics at midpoint of street travel:
Halfstreet flow width =   5.862(Ft.)
Flow velocity =   2.22(Ft/s)
Travel time =    5.42 min.     TC =   19.23  min.
 Adding area flow to street
RESIDENTIAL(3 - 4 dwl/acre)
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 69.00
Pervious ratio(Ap) = 0.6000     Max loss rate(Fm)=     0.329(In/Hr)
Rainfall intensity =      1.389(In/Hr) for a    10.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.642
Subarea runoff =      0.543(CFS) for    1.000(Ac.)
Total runoff =      2.013(CFS)
Effective area this stream =        2.26(Ac.)
Total Study Area (Main Stream No. 1) =       28.99(Ac.)
Area averaged Fm value =    0.399(In/Hr)
Street flow at end of street =      2.013(CFS)
Half street flow at end of street =      1.007(CFS)
Depth of flow =   0.211(Ft.), Average velocity =   2.274(Ft/s)
Flow width (from curb towards crown)=   6.138(Ft.)
```

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      108.000 to Point/Station      109.000
**** CONFLUENCE OF MINOR STREAMS ****
______________________________________________________________________
Along Main Stream number: 1 in normal stream number 3
Stream flow area =      2.260(Ac.)
Runoff from this stream =      2.013(CFS)
Time of concentration =   19.23 min.
Rainfall intensity =     1.389(In/Hr)
Area averaged loss rate (Fm) =    0.3988(In/Hr)
Area averaged Pervious ratio (Ap) = 0.6000
Summary of stream data:

Stream Flow rate    Area    TC     Fm       Rainfall Intensity
 No.    (CFS)   (Ac.)       (min) (In/Hr)     (In/Hr)


1     11.59    15.320     21.95    0.425      1.266
2      9.71    11.410     18.36    0.489      1.434
3      2.01     2.260     19.23    0.399      1.389
Qmax(1) =
         1.000 *    1.000 *    11.592) +
         0.821 *    1.000 *     9.708) +
         0.876 *    1.000 *     2.013) + =      21.329
Qmax(2) =
         1.201 *    0.836 *    11.592) +
         1.000 *    1.000 *     9.708) +
         1.046 *    0.955 *     2.013) + =      23.358
Qmax(3) =
         1.146 *    0.876 *    11.592) +
         0.952 *    1.000 *     9.708) +
         1.000 *    1.000 *     2.013) + =      22.890

Total of 3 streams to confluence:
Flow rates before confluence point:
      11.592       9.708       2.013
Maximum flow rates at confluence using above data:
       21.329       23.358       22.890
Area of streams before confluence:
       15.320       11.410        2.260
Effective area values after confluence:
       28.990       26.378       27.088
Results of confluence:
Total flow rate =     23.358(CFS)
Time of concentration =    18.355 min.
Effective stream area after confluence =     26.378(Ac.)
Study area average Pervious fraction(Ap) =  0.600
Study area average soil loss rate(Fm) =    0.448(In/Hr)
Study area total (this main stream) =      28.99(Ac.)
End of computations, Total Study Area =           28.99 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.
```

```
Note: These figures do not consider reduced effective area
effects caused by confluences in the rational equation.

Area averaged pervious area fraction(Ap) = 0.600
Area averaged SCS curve number =  54.1
```

```
          San Bernardino County Rational Hydrology Program

              (Hydrology Manual Date - August 1986)

 CIVILCADD/CIVILDESIGN  Engineering Software, (c) 1989-2005 Version 7.1
      Rational Hydrology Study        Date: 08/26/22
------------------------------------------------------------------------
2-YEAR, 1-HOUR RATIONAL STUDY POST DEVELOPED
TR 20525, CITY OF VICTORVILLE
AREA AA1, AA2, AA3, BB1, BB2, BB3, BB4 & BB5
FILE: 20525RATIONALPOST2REV.OUT
------------------------------------------------------------------------


Program License Serial Number 4070

------------------------------------------------------------------------
 *********   Hydrology Study Control Information **********

------------------------------------------------------------------------
Rational hydrology study storm event year is     2.0
Computed rainfall intensity:
Storm year =     2.00   1 hour rainfall =     0.365 (In.)
Slope used for rainfall intensity curve b =  0.7000
Soil antecedent moisture condition (AMC) = 2
```

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      101.000 to Point/Station      102.000
**** INITIAL AREA EVALUATION ****
______________________________________________________________________
RESIDENTIAL(3 - 4 dwl/acre)
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 69.00
Pervious ratio(Ap) = 0.6000     Max loss rate(Fm)=     0.329(In/Hr)
Initial subarea data:
Initial area flow distance =   413.000(Ft.)
Top (of initial area) elevation =  2963.500(Ft.)
Bottom (of initial area) elevation =  2957.500(Ft.)
Difference in elevation =     6.000(Ft.)
Slope =    0.01453  s(%)=       1.45
TC = k(0.412)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =   10.687 min.
Rainfall intensity =      1.221(In/Hr) for a     2.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.658
Subarea runoff =      1.590(CFS)
Total initial stream area =        1.980(Ac.)
Pervious area fraction = 0.600
Initial area Fm value =    0.329(In/Hr)
```

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++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      102.000 to Point/Station      103.000
**** STREET FLOW TRAVEL TIME + SUBAREA FLOW ADDITION ****
______________________________________________________________________
Top of street segment elevation =  2957.500(Ft.)
End of street segment elevation =  2946.700(Ft.)
Length of street segment  =   803.000(Ft.)
Height of curb above gutter flowline  =    6.0(In.)
Width of half street (curb to crown)  =  20.000(Ft.)
Distance from crown to crossfall grade break  =  18.500(Ft.)
Slope from gutter to grade break (v/hz) =   0.020
Slope from grade break to crown (v/hz)  =   0.020
Street flow is on [2] side(s) of the street
Distance from curb to property line  =  10.000(Ft.)
Slope from curb to property line (v/hz) =   0.020
Gutter width =   1.500(Ft.)
Gutter hike from flowline =  1.416(In.)
 Manning's N in gutter =  0.0150
 Manning's N from gutter to grade break =  0.0150
 Manning's N from grade break to crown =  0.0150
Estimated mean flow rate at midpoint of street =      2.764(CFS)
Depth of flow =   0.239(Ft.), Average velocity =   2.164(Ft/s)
Streetflow hydraulics at midpoint of street travel:
Halfstreet flow width =   7.567(Ft.)
Flow velocity =   2.16(Ft/s)
Travel time =    6.18 min.     TC =   16.87  min.
 Adding area flow to street
RESIDENTIAL(3 - 4 dwl/acre)
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 69.00
Pervious ratio(Ap) = 0.6000     Max loss rate(Fm)=     0.329(In/Hr)
Rainfall intensity =      0.887(In/Hr) for a     2.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.566
Subarea runoff =      2.179(CFS) for    5.520(Ac.)
Total runoff =      3.769(CFS)
Effective area this stream =        7.50(Ac.)
Total Study Area (Main Stream No. 1) =        7.50(Ac.)
Area averaged Fm value =    0.329(In/Hr)
Street flow at end of street =      3.769(CFS)
Half street flow at end of street =      1.885(CFS)
Depth of flow =   0.261(Ft.), Average velocity =   2.326(Ft/s)
Flow width (from curb towards crown)=   8.627(Ft.)
```

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      103.000 to Point/Station      106.000
**** STREET FLOW TRAVEL TIME + SUBAREA FLOW ADDITION ****
______________________________________________________________________
Top of street segment elevation =  2946.700(Ft.)
End of street segment elevation =  2929.500(Ft.)
Length of street segment  =  1129.000(Ft.)
Height of curb above gutter flowline  =    6.0(In.)
Width of half street (curb to crown)  =  20.000(Ft.)
Distance from crown to crossfall grade break  =  18.500(Ft.)
Slope from gutter to grade break (v/hz) =   0.020
Slope from grade break to crown (v/hz)  =   0.020
Street flow is on [2] side(s) of the street
Distance from curb to property line  =  10.000(Ft.)
Slope from curb to property line (v/hz) =   0.020
Gutter width =   1.500(Ft.)
Gutter hike from flowline =  1.416(In.)
 Manning's N in gutter =  0.0150
 Manning's N from gutter to grade break =  0.0150
 Manning's N from grade break to crown =  0.0150
Estimated mean flow rate at midpoint of street =      3.831(CFS)
Depth of flow =   0.257(Ft.), Average velocity =   2.449(Ft/s)
Streetflow hydraulics at midpoint of street travel:
Halfstreet flow width =   8.462(Ft.)
Flow velocity =   2.45(Ft/s)
Travel time =    7.68 min.     TC =   24.55  min.
 Adding area flow to street
RESIDENTIAL(3 - 4 dwl/acre)
Decimal fraction soil group A = 0.510
Decimal fraction soil group B = 0.360
Decimal fraction soil group C = 0.130
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 45.45
Pervious ratio(Ap) = 0.6000     Max loss rate(Fm)=     0.517(In/Hr)
The area added to the existing stream causes a
a lower flow rate of Q =      3.762(CFS)
therefore the upstream flow rate of Q =      3.769(CFS) is being used
Rainfall intensity =      0.682(In/Hr) for a     2.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.360
Subarea runoff =      0.000(CFS) for    7.820(Ac.)
Total runoff =      3.769(CFS)
Effective area this stream =       15.32(Ac.)
Total Study Area (Main Stream No. 1) =       15.32(Ac.)
Area averaged Fm value =    0.425(In/Hr)
Street flow at end of street =      3.769(CFS)
Half street flow at end of street =      1.885(CFS)
Depth of flow =   0.256(Ft.), Average velocity =   2.440(Ft/s)
Flow width (from curb towards crown)=   8.405(Ft.)
```

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      103.000 to Point/Station      106.000
**** CONFLUENCE OF MINOR STREAMS ****
______________________________________________________________________
Along Main Stream number: 1 in normal stream number 1
Stream flow area =     15.320(Ac.)
Runoff from this stream =      3.769(CFS)
Time of concentration =   24.55 min.
Rainfall intensity =     0.682(In/Hr)
Area averaged loss rate (Fm) =    0.4248(In/Hr)
Area averaged Pervious ratio (Ap) = 0.6000
```

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++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      104.000 to Point/Station      105.000
**** INITIAL AREA EVALUATION ****
______________________________________________________________________
RESIDENTIAL(3 - 4 dwl/acre)
Decimal fraction soil group A = 0.350
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.650
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 56.05
Pervious ratio(Ap) = 0.6000     Max loss rate(Fm)=     0.440(In/Hr)
Initial subarea data:
Initial area flow distance =  1000.000(Ft.)
Top (of initial area) elevation =  2963.500(Ft.)
Bottom (of initial area) elevation =  2944.400(Ft.)
Difference in elevation =    19.100(Ft.)
Slope =    0.01910  s(%)=       1.91
TC = k(0.412)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =   14.411 min.
Rainfall intensity =      0.991(In/Hr) for a     2.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.500
Subarea runoff =      3.177(CFS)
Total initial stream area =        6.410(Ac.)
Pervious area fraction = 0.600
Initial area Fm value =    0.440(In/Hr)
```

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      105.000 to Point/Station      106.000
**** STREET FLOW TRAVEL TIME + SUBAREA FLOW ADDITION ****
______________________________________________________________________
Top of street segment elevation =  2944.400(Ft.)
End of street segment elevation =  2929.500(Ft.)
Length of street segment  =   769.000(Ft.)
Height of curb above gutter flowline  =    6.0(In.)
Width of half street (curb to crown)  =  20.000(Ft.)
Distance from crown to crossfall grade break  =  18.500(Ft.)
Slope from gutter to grade break (v/hz) =   0.020
Slope from grade break to crown (v/hz)  =   0.020
Street flow is on [2] side(s) of the street
Distance from curb to property line  =  10.000(Ft.)
Slope from curb to property line (v/hz) =   0.020
Gutter width =   1.500(Ft.)
Gutter hike from flowline =  1.416(In.)
 Manning's N in gutter =  0.0150
 Manning's N from gutter to grade break =  0.0150
 Manning's N from grade break to crown =  0.0150
Estimated mean flow rate at midpoint of street =      3.302(CFS)
Depth of flow =   0.239(Ft.), Average velocity =   2.595(Ft/s)
Streetflow hydraulics at midpoint of street travel:
Halfstreet flow width =   7.552(Ft.)
Flow velocity =   2.59(Ft/s)
Travel time =    4.94 min.     TC =   19.35  min.
 Adding area flow to street
RESIDENTIAL(3 - 4 dwl/acre)
Decimal fraction soil group A = 0.680
Decimal fraction soil group B = 0.320
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 39.68
Pervious ratio(Ap) = 0.6000     Max loss rate(Fm)=     0.552(In/Hr)
Rainfall intensity =      0.806(In/Hr) for a     2.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.360
Subarea runoff =      0.134(CFS) for    5.000(Ac.)
Total runoff =      3.311(CFS)
Effective area this stream =       11.41(Ac.)
Total Study Area (Main Stream No. 1) =       26.73(Ac.)
Area averaged Fm value =    0.489(In/Hr)
Street flow at end of street =      3.311(CFS)
Half street flow at end of street =      1.655(CFS)
Depth of flow =   0.239(Ft.), Average velocity =   2.596(Ft/s)
Flow width (from curb towards crown)=   7.560(Ft.)
```

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      105.000 to Point/Station      106.000
**** CONFLUENCE OF MINOR STREAMS ****
______________________________________________________________________
Along Main Stream number: 1 in normal stream number 2
Stream flow area =     11.410(Ac.)
Runoff from this stream =      3.311(CFS)
Time of concentration =   19.35 min.
Rainfall intensity =     0.806(In/Hr)
Area averaged loss rate (Fm) =    0.4890(In/Hr)
Area averaged Pervious ratio (Ap) = 0.6000
```

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      107.000 to Point/Station      108.000
**** INITIAL AREA EVALUATION ****
______________________________________________________________________
RESIDENTIAL(3 - 4 dwl/acre)
Decimal fraction soil group A = 0.400
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.600
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 54.20
Pervious ratio(Ap) = 0.6000     Max loss rate(Fm)=     0.454(In/Hr)
Initial subarea data:
Initial area flow distance =  1000.000(Ft.)
Top (of initial area) elevation =  2965.500(Ft.)
Bottom (of initial area) elevation =  2941.800(Ft.)
Difference in elevation =    23.700(Ft.)
Slope =    0.02370  s(%)=       2.37
TC = k(0.412)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =   13.802 min.
Rainfall intensity =      1.021(In/Hr) for a     2.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.499
Subarea runoff =      0.643(CFS)
Total initial stream area =        1.260(Ac.)
Pervious area fraction = 0.600
Initial area Fm value =    0.454(In/Hr)
```

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      108.000 to Point/Station      109.000
**** STREET FLOW TRAVEL TIME + SUBAREA FLOW ADDITION ****
______________________________________________________________________
Top of street segment elevation =  2941.800(Ft.)
End of street segment elevation =  2928.500(Ft.)
Length of street segment  =   724.000(Ft.)
Height of curb above gutter flowline  =    6.0(In.)
Width of half street (curb to crown)  =  40.000(Ft.)
Distance from crown to crossfall grade break  =  38.500(Ft.)
Slope from gutter to grade break (v/hz) =   0.020
Slope from grade break to crown (v/hz)  =   0.020
Street flow is on [2] side(s) of the street
Distance from curb to property line  =  10.000(Ft.)
Slope from curb to property line (v/hz) =   0.020
Gutter width =   1.500(Ft.)
Gutter hike from flowline =  1.416(In.)
 Manning's N in gutter =  0.0150
 Manning's N from gutter to grade break =  0.0150
 Manning's N from grade break to crown =  0.0150
Estimated mean flow rate at midpoint of street =      0.806(CFS)
Depth of flow =   0.165(Ft.), Average velocity =   1.898(Ft/s)
Streetflow hydraulics at midpoint of street travel:
Halfstreet flow width =   3.826(Ft.)
Flow velocity =   1.90(Ft/s)
Travel time =    6.36 min.     TC =   20.16  min.
 Adding area flow to street
RESIDENTIAL(3 - 4 dwl/acre)
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 69.00
Pervious ratio(Ap) = 0.6000     Max loss rate(Fm)=     0.329(In/Hr)
Rainfall intensity =      0.783(In/Hr) for a     2.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.442
Subarea runoff =      0.139(CFS) for    1.000(Ac.)
Total runoff =      0.782(CFS)
Effective area this stream =        2.26(Ac.)
Total Study Area (Main Stream No. 1) =       28.99(Ac.)
Area averaged Fm value =    0.399(In/Hr)
Street flow at end of street =      0.782(CFS)
Half street flow at end of street =      0.391(CFS)
Depth of flow =   0.163(Ft.), Average velocity =   1.889(Ft/s)
Flow width (from curb towards crown)=   3.755(Ft.)
```

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      108.000 to Point/Station      109.000
**** CONFLUENCE OF MINOR STREAMS ****
______________________________________________________________________
Along Main Stream number: 1 in normal stream number 3
Stream flow area =      2.260(Ac.)
Runoff from this stream =      0.782(CFS)
Time of concentration =   20.16 min.
Rainfall intensity =     0.783(In/Hr)
Area averaged loss rate (Fm) =    0.3988(In/Hr)
Area averaged Pervious ratio (Ap) = 0.6000
Summary of stream data:

Stream Flow rate    Area    TC     Fm       Rainfall Intensity
 No.    (CFS)   (Ac.)       (min) (In/Hr)     (In/Hr)


1      3.77    15.320     24.55    0.425      0.682
2      3.31    11.410     19.35    0.489      0.806
3      0.78     2.260     20.16    0.399      0.783
Qmax(1) =
         1.000 *    1.000 *     3.769) +
         0.610 *    1.000 *     3.311) +
         0.737 *    1.000 *     0.782) + =       6.364
Qmax(2) =
         1.481 *    0.788 *     3.769) +
         1.000 *    1.000 *     3.311) +
         1.059 *    0.960 *     0.782) + =       8.504
Qmax(3) =
         1.392 *    0.821 *     3.769) +
         0.928 *    1.000 *     3.311) +
         1.000 *    1.000 *     0.782) + =       8.164

Total of 3 streams to confluence:
Flow rates before confluence point:
       3.769       3.311       0.782
Maximum flow rates at confluence using above data:
        6.364        8.504        8.164
Area of streams before confluence:
       15.320       11.410        2.260
Effective area values after confluence:
       28.990       25.653       26.247
Results of confluence:
Total flow rate =      8.504(CFS)
Time of concentration =    19.351 min.
Effective stream area after confluence =     25.653(Ac.)
Study area average Pervious fraction(Ap) =  0.600
Study area average soil loss rate(Fm) =    0.448(In/Hr)
Study area total (this main stream) =      28.99(Ac.)
End of computations, Total Study Area =           28.99 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.
```

```
Note: These figures do not consider reduced effective area
effects caused by confluences in the rational equation.

Area averaged pervious area fraction(Ap) = 0.600
Area averaged SCS curve number =  54.1
```

TR. 20525

10-year, 24-Hours Storm Events

Unit Hydrograph Pre–Developed

```
      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 - 2004, Version 7.0

           Study date  12/16/21

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

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


Program License Serial Number 4070

---------------------------------------------------------------------
10-YR, 24-HOUR UNIT HYDROGRAPH PRE-DEVELOPED
TR 17839, CITY OF VICTORVILLE
AREA A1, A2 & A3 (ONSITE EASTERLY AREAS TO APN 0394-031-08)
FILE: 17839HYDROA1A3PRE10YR.OUT
--------------------------------------------------------------------

      Storm Event Year = 10

      Antecedent Moisture Condition = 3

 English (in-lb) Input Units Used

 English Rainfall Data (Inches) Input Values Used

 English Units used in output format



Area averaged rainfall intensity isohyetal data:
      Sub-Area        Duration        Isohyetal
      (Ac.)            (hours)         (In)
Rainfall data for year 10
          14.09           1           0.63
--------------------------------------------------------------------
Rainfall data for year 10
          14.09           6           1.27
--------------------------------------------------------------------
Rainfall data for year 10
          14.09          24           2.27
--------------------------------------------------------------------
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++

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

```
SCS curve  SCS curve     Area     Area     Fp(Fig C6)    Ap      Fm
No.(AMCII) NO.(AMC 3)    (Ac.)    Fraction     (In/Hr)  (dec.)   (In/Hr)
 74.4      90.5         14.09      1.000     0.183    1.000    0.183

Area-averaged adjusted loss rate Fm (In/Hr) =  0.183

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

Area       Area          SCS CN    SCS CN      S     Pervious
 (Ac.)      Fract         (AMC2)    (AMC3)           Yield Fr
    14.09   1.000         74.4      90.5       1.05     0.602

Area-averaged catchment yield fraction, Y =  0.602
Area-averaged low loss fraction, Yb =  0.398
User entry of time of concentration  =   0.352 (hours)
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Watershed area =      14.09(Ac.)
Catchment Lag time =   0.282 hours
Unit interval =   5.000 minutes
Unit interval percentage of lag time = 29.5676
Hydrograph baseflow =     0.00(CFS)
Average maximum watershed loss rate(Fm) =  0.183(In/Hr)
Average low loss rate fraction (Yb) = 0.398 (decimal)
DESERT S-Graph Selected
Computed peak 5-minute rainfall =  0.297(In)
Computed peak 30-minute rainfall =  0.508(In)
Specified peak 1-hour rainfall =  0.626(In)
Computed peak 3-hour rainfall =  0.966(In)
Specified peak 6-hour rainfall =  1.270(In)
Specified peak 24-hour rainfall =  2.270(In)


Rainfall depth area reduction factors:
Using a total area of      14.09(Ac.) (Ref: fig. E-4)

5-minute factor = 0.999     Adjusted rainfall =  0.297(In)
30-minute factor = 0.999    Adjusted rainfall =  0.508(In)
1-hour factor = 0.999       Adjusted rainfall =  0.626(In)
3-hour factor = 1.000       Adjusted rainfall =  0.966(In)
6-hour factor = 1.000       Adjusted rainfall =  1.270(In)
24-hour factor = 1.000      Adjusted rainfall =  2.270(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 =       170.40 (CFS))

  1                1.723                   2.936
  2                9.125                  12.612
  3               29.728                  35.108
  4               51.477                  37.062
```

```
  5               63.671                  20.778
  6               71.375                  13.127
  7               76.944                   9.491
  8               81.118                   7.112
  9               84.390                   5.576
 10               87.150                   4.702
 11               89.321                   3.700
 12               91.038                   2.926
 13               92.535                   2.550
 14               93.830                   2.208
 15               94.877                   1.783
 16               95.810                   1.590
 17               96.584                   1.318
 18               97.214                   1.074
 19               97.727                   0.875
 20               98.066                   0.577
 21               98.376                   0.529
 22               98.728                   0.600
 23               99.083                   0.605
 24               99.429                   0.589
 25               99.653                   0.381
 26               99.837                   0.315
 27              100.000                   0.277
---------------------------------------------------------------------
Peak Unit   Adjusted mass rainfall  Unit rainfall
Number              (In)                (In)
  1              0.2968               0.2968
  2              0.3655               0.0686
  3              0.4127               0.0473
  4              0.4499               0.0372
  5              0.4811               0.0312
  6              0.5081               0.0270
  7              0.5322               0.0241
  8              0.5539               0.0218
  9              0.5739               0.0199
 10              0.5923               0.0184
 11              0.6095               0.0172
 12              0.6256               0.0161
 13              0.6457               0.0201
 14              0.6649               0.0192
 15              0.6833               0.0184
 16              0.7009               0.0177
 17              0.7179               0.0170
 18              0.7344               0.0164
 19              0.7502               0.0159
 20              0.7656               0.0154
 21              0.7805               0.0149
 22              0.7950               0.0145
 23              0.8091               0.0141
 24              0.8228               0.0137
 25              0.8362               0.0134
 26              0.8493               0.0131
 27              0.8620               0.0128
 28              0.8745               0.0125
```

29	0.8867	0.0122
30	0.8987	0.0120
31	0.9104	0.0117
32	0.9219	0.0115
33	0.9332	0.0113
34	0.9443	0.0111
35	0.9552	0.0109
36	0.9659	0.0107
37	0.9764	0.0105
38	0.9867	0.0103
39	0.9969	0.0102
40	1.0069	0.0100
41	1.0168	0.0099
42	1.0265	0.0097
43	1.0361	0.0096
44	1.0455	0.0094
45	1.0548	0.0093
46	1.0640	0.0092
47	1.0731	0.0091
48	1.0821	0.0090
49	1.0909	0.0088
50	1.0996	0.0087
51	1.1083	0.0086
52	1.1168	0.0085
53	1.1252	0.0084
54	1.1336	0.0083
55	1.1418	0.0082
56	1.1500	0.0082
57	1.1580	0.0081
58	1.1660	0.0080
59	1.1739	0.0079
60	1.1817	0.0078
61	1.1895	0.0077
62	1.1971	0.0077
63	1.2047	0.0076
64	1.2122	0.0075
65	1.2197	0.0074
66	1.2271	0.0074
67	1.2344	0.0073
68	1.2416	0.0072
69	1.2488	0.0072
70	1.2559	0.0071
71	1.2629	0.0071
72	1.2699	0.0070
73	1.2773	0.0074
74	1.2846	0.0073
75	1.2918	0.0072
76	1.2990	0.0072
77	1.3062	0.0071
78	1.3133	0.0071
79	1.3203	0.0070
80	1.3273	0.0070
81	1.3342	0.0069
82	1.3411	0.0069

83	1.3479	0.0068
84	1.3547	0.0068
85	1.3614	0.0067
86	1.3681	0.0067
87	1.3747	0.0066
88	1.3813	0.0066
89	1.3879	0.0066
90	1.3944	0.0065
91	1.4009	0.0065
92	1.4073	0.0064
93	1.4137	0.0064
94	1.4200	0.0063
95	1.4263	0.0063
96	1.4326	0.0063
97	1.4388	0.0062
98	1.4450	0.0062
99	1.4512	0.0062
100	1.4573	0.0061
101	1.4634	0.0061
102	1.4695	0.0061
103	1.4755	0.0060
104	1.4815	0.0060
105	1.4874	0.0060
106	1.4933	0.0059
107	1.4992	0.0059
108	1.5051	0.0059
109	1.5109	0.0058
110	1.5167	0.0058
111	1.5225	0.0058
112	1.5282	0.0057
113	1.5339	0.0057
114	1.5396	0.0057
115	1.5452	0.0056
116	1.5508	0.0056
117	1.5564	0.0056
118	1.5620	0.0056
119	1.5675	0.0055
120	1.5730	0.0055
121	1.5785	0.0055
122	1.5839	0.0055
123	1.5894	0.0054
124	1.5948	0.0054
125	1.6001	0.0054
126	1.6055	0.0054
127	1.6108	0.0053
128	1.6161	0.0053
129	1.6214	0.0053
130	1.6266	0.0053
131	1.6319	0.0052
132	1.6371	0.0052
133	1.6423	0.0052
134	1.6474	0.0052
135	1.6526	0.0051
136	1.6577	0.0051

137	1.6628	0.0051
138	1.6679	0.0051
139	1.6729	0.0051
140	1.6779	0.0050
141	1.6829	0.0050
142	1.6879	0.0050
143	1.6929	0.0050
144	1.6979	0.0049
145	1.7028	0.0049
146	1.7077	0.0049
147	1.7126	0.0049
148	1.7175	0.0049
149	1.7223	0.0049
150	1.7271	0.0048
151	1.7320	0.0048
152	1.7368	0.0048
153	1.7415	0.0048
154	1.7463	0.0048
155	1.7510	0.0047
156	1.7558	0.0047
157	1.7605	0.0047
158	1.7652	0.0047
159	1.7698	0.0047
160	1.7745	0.0047
161	1.7791	0.0046
162	1.7837	0.0046
163	1.7883	0.0046
164	1.7929	0.0046
165	1.7975	0.0046
166	1.8021	0.0046
167	1.8066	0.0045
168	1.8111	0.0045
169	1.8156	0.0045
170	1.8201	0.0045
171	1.8246	0.0045
172	1.8291	0.0045
173	1.8335	0.0044
174	1.8379	0.0044
175	1.8424	0.0044
176	1.8468	0.0044
177	1.8512	0.0044
178	1.8555	0.0044
179	1.8599	0.0044
180	1.8642	0.0043
181	1.8686	0.0043
182	1.8729	0.0043
183	1.8772	0.0043
184	1.8815	0.0043
185	1.8858	0.0043
186	1.8900	0.0043
187	1.8943	0.0043
188	1.8985	0.0042
189	1.9027	0.0042
190	1.9070	0.0042

191	1.9111	0.0042
192	1.9153	0.0042
193	1.9195	0.0042
194	1.9237	0.0042
195	1.9278	0.0041
196	1.9320	0.0041
197	1.9361	0.0041
198	1.9402	0.0041
199	1.9443	0.0041
200	1.9484	0.0041
201	1.9524	0.0041
202	1.9565	0.0041
203	1.9606	0.0041
204	1.9646	0.0040
205	1.9686	0.0040
206	1.9727	0.0040
207	1.9767	0.0040
208	1.9807	0.0040
209	1.9846	0.0040
210	1.9886	0.0040
211	1.9926	0.0040
212	1.9965	0.0040
213	2.0005	0.0039
214	2.0044	0.0039
215	2.0083	0.0039
216	2.0122	0.0039
217	2.0161	0.0039
218	2.0200	0.0039
219	2.0239	0.0039
220	2.0277	0.0039
221	2.0316	0.0039
222	2.0354	0.0038
223	2.0393	0.0038
224	2.0431	0.0038
225	2.0469	0.0038
226	2.0507	0.0038
227	2.0545	0.0038
228	2.0583	0.0038
229	2.0621	0.0038
230	2.0659	0.0038
231	2.0696	0.0038
232	2.0734	0.0037
233	2.0771	0.0037
234	2.0808	0.0037
235	2.0846	0.0037
236	2.0883	0.0037
237	2.0920	0.0037
238	2.0957	0.0037
239	2.0994	0.0037
240	2.1030	0.0037
241	2.1067	0.0037
242	2.1104	0.0037
243	2.1140	0.0036
244	2.1176	0.0036

```
245              2.1213               0.0036
246              2.1249               0.0036
247              2.1285               0.0036
248              2.1321               0.0036
249              2.1357               0.0036
250              2.1393               0.0036
251              2.1429               0.0036
252              2.1465               0.0036
253              2.1500               0.0036
254              2.1536               0.0036
255              2.1571               0.0035
256              2.1607               0.0035
257              2.1642               0.0035
258              2.1677               0.0035
259              2.1712               0.0035
260              2.1747               0.0035
261              2.1782               0.0035
262              2.1817               0.0035
263              2.1852               0.0035
264              2.1887               0.0035
265              2.1922               0.0035
266              2.1956               0.0035
267              2.1991               0.0035
268              2.2025               0.0034
269              2.2060               0.0034
270              2.2094               0.0034
271              2.2128               0.0034
272              2.2162               0.0034
273              2.2197               0.0034
274              2.2231               0.0034
275              2.2265               0.0034
276              2.2298               0.0034
277              2.2332               0.0034
278              2.2366               0.0034
279              2.2400               0.0034
280              2.2433               0.0034
281              2.2467               0.0034
282              2.2500               0.0033
283              2.2534               0.0033
284              2.2567               0.0033
285              2.2600               0.0033
286              2.2633               0.0033
287              2.2667               0.0033
288              2.2700               0.0033
---------------------------------------------------------------------
Unit              Unit            Unit              Effective
Period            Rainfall        Soil-Loss         Rainfall
(number)            (In)          (In)                 (In)
---------------------------------------------------------------------
  1              0.0033           0.0013              0.0020
  2              0.0033           0.0013              0.0020
  3              0.0033           0.0013              0.0020
  4              0.0033           0.0013              0.0020
  5              0.0033           0.0013              0.0020
```

6	0.0034	0.0013	0.0020
7	0.0034	0.0013	0.0020
8	0.0034	0.0013	0.0020
9	0.0034	0.0013	0.0020
10	0.0034	0.0014	0.0020
11	0.0034	0.0014	0.0021
12	0.0034	0.0014	0.0021
13	0.0034	0.0014	0.0021
14	0.0034	0.0014	0.0021
15	0.0035	0.0014	0.0021
16	0.0035	0.0014	0.0021
17	0.0035	0.0014	0.0021
18	0.0035	0.0014	0.0021
19	0.0035	0.0014	0.0021
20	0.0035	0.0014	0.0021
21	0.0035	0.0014	0.0021
22	0.0035	0.0014	0.0021
23	0.0035	0.0014	0.0021
24	0.0036	0.0014	0.0021
25	0.0036	0.0014	0.0022
26	0.0036	0.0014	0.0022
27	0.0036	0.0014	0.0022
28	0.0036	0.0014	0.0022
29	0.0036	0.0014	0.0022
30	0.0036	0.0014	0.0022
31	0.0036	0.0015	0.0022
32	0.0037	0.0015	0.0022
33	0.0037	0.0015	0.0022
34	0.0037	0.0015	0.0022
35	0.0037	0.0015	0.0022
36	0.0037	0.0015	0.0022
37	0.0037	0.0015	0.0022
38	0.0037	0.0015	0.0023
39	0.0038	0.0015	0.0023
40	0.0038	0.0015	0.0023
41	0.0038	0.0015	0.0023
42	0.0038	0.0015	0.0023
43	0.0038	0.0015	0.0023
44	0.0038	0.0015	0.0023
45	0.0038	0.0015	0.0023
46	0.0039	0.0015	0.0023
47	0.0039	0.0015	0.0023
48	0.0039	0.0015	0.0023
49	0.0039	0.0016	0.0024
50	0.0039	0.0016	0.0024
51	0.0039	0.0016	0.0024
52	0.0040	0.0016	0.0024
53	0.0040	0.0016	0.0024
54	0.0040	0.0016	0.0024
55	0.0040	0.0016	0.0024
56	0.0040	0.0016	0.0024
57	0.0040	0.0016	0.0024
58	0.0041	0.0016	0.0024
59	0.0041	0.0016	0.0025

60	0.0041	0.0016	0.0025
61	0.0041	0.0016	0.0025
62	0.0041	0.0016	0.0025
63	0.0041	0.0017	0.0025
64	0.0042	0.0017	0.0025
65	0.0042	0.0017	0.0025
66	0.0042	0.0017	0.0025
67	0.0042	0.0017	0.0025
68	0.0042	0.0017	0.0026
69	0.0043	0.0017	0.0026
70	0.0043	0.0017	0.0026
71	0.0043	0.0017	0.0026
72	0.0043	0.0017	0.0026
73	0.0043	0.0017	0.0026
74	0.0044	0.0017	0.0026
75	0.0044	0.0017	0.0026
76	0.0044	0.0018	0.0027
77	0.0044	0.0018	0.0027
78	0.0044	0.0018	0.0027
79	0.0045	0.0018	0.0027
80	0.0045	0.0018	0.0027
81	0.0045	0.0018	0.0027
82	0.0045	0.0018	0.0027
83	0.0046	0.0018	0.0028
84	0.0046	0.0018	0.0028
85	0.0046	0.0018	0.0028
86	0.0046	0.0018	0.0028
87	0.0047	0.0019	0.0028
88	0.0047	0.0019	0.0028
89	0.0047	0.0019	0.0028
90	0.0047	0.0019	0.0029
91	0.0048	0.0019	0.0029
92	0.0048	0.0019	0.0029
93	0.0048	0.0019	0.0029
94	0.0049	0.0019	0.0029
95	0.0049	0.0019	0.0029
96	0.0049	0.0020	0.0030
97	0.0049	0.0020	0.0030
98	0.0050	0.0020	0.0030
99	0.0050	0.0020	0.0030
100	0.0050	0.0020	0.0030
101	0.0051	0.0020	0.0031
102	0.0051	0.0020	0.0031
103	0.0051	0.0020	0.0031
104	0.0052	0.0021	0.0031
105	0.0052	0.0021	0.0031
106	0.0052	0.0021	0.0031
107	0.0053	0.0021	0.0032
108	0.0053	0.0021	0.0032
109	0.0054	0.0021	0.0032
110	0.0054	0.0021	0.0032
111	0.0054	0.0022	0.0033
112	0.0055	0.0022	0.0033
113	0.0055	0.0022	0.0033

114	0.0055	0.0022	0.0033
115	0.0056	0.0022	0.0034
116	0.0056	0.0022	0.0034
117	0.0057	0.0023	0.0034
118	0.0057	0.0023	0.0034
119	0.0058	0.0023	0.0035
120	0.0058	0.0023	0.0035
121	0.0059	0.0023	0.0035
122	0.0059	0.0023	0.0035
123	0.0060	0.0024	0.0036
124	0.0060	0.0024	0.0036
125	0.0061	0.0024	0.0036
126	0.0061	0.0024	0.0037
127	0.0062	0.0025	0.0037
128	0.0062	0.0025	0.0037
129	0.0063	0.0025	0.0038
130	0.0063	0.0025	0.0038
131	0.0064	0.0025	0.0038
132	0.0064	0.0026	0.0039
133	0.0065	0.0026	0.0039
134	0.0066	0.0026	0.0039
135	0.0066	0.0026	0.0040
136	0.0067	0.0027	0.0040
137	0.0068	0.0027	0.0041
138	0.0068	0.0027	0.0041
139	0.0069	0.0028	0.0042
140	0.0070	0.0028	0.0042
141	0.0071	0.0028	0.0043
142	0.0071	0.0028	0.0043
143	0.0072	0.0029	0.0044
144	0.0073	0.0029	0.0044
145	0.0070	0.0028	0.0042
146	0.0071	0.0028	0.0042
147	0.0072	0.0029	0.0043
148	0.0072	0.0029	0.0044
149	0.0074	0.0029	0.0044
150	0.0074	0.0030	0.0045
151	0.0076	0.0030	0.0046
152	0.0077	0.0031	0.0046
153	0.0078	0.0031	0.0047
154	0.0079	0.0031	0.0048
155	0.0081	0.0032	0.0049
156	0.0082	0.0032	0.0049
157	0.0083	0.0033	0.0050
158	0.0084	0.0034	0.0051
159	0.0086	0.0034	0.0052
160	0.0087	0.0035	0.0053
161	0.0090	0.0036	0.0054
162	0.0091	0.0036	0.0055
163	0.0093	0.0037	0.0056
164	0.0094	0.0038	0.0057
165	0.0097	0.0039	0.0059
166	0.0099	0.0039	0.0059
167	0.0102	0.0041	0.0061

168	0.0103	0.0041	0.0062
169	0.0107	0.0043	0.0064
170	0.0109	0.0043	0.0066
171	0.0113	0.0045	0.0068
172	0.0115	0.0046	0.0069
173	0.0120	0.0048	0.0072
174	0.0122	0.0049	0.0074
175	0.0128	0.0051	0.0077
176	0.0131	0.0052	0.0079
177	0.0137	0.0055	0.0083
178	0.0141	0.0056	0.0085
179	0.0149	0.0059	0.0090
180	0.0154	0.0061	0.0092
181	0.0164	0.0065	0.0099
182	0.0170	0.0068	0.0102
183	0.0184	0.0073	0.0111
184	0.0192	0.0076	0.0116
185	0.0161	0.0064	0.0097
186	0.0172	0.0068	0.0103
187	0.0199	0.0079	0.0120
188	0.0218	0.0087	0.0131
189	0.0270	0.0108	0.0163
190	0.0312	0.0124	0.0187
191	0.0473	0.0152	0.0320
192	0.0686	0.0152	0.0534
193	0.2968	0.0152	0.2816
194	0.0372	0.0148	0.0224
195	0.0241	0.0096	0.0145
196	0.0184	0.0073	0.0111
197	0.0201	0.0080	0.0121
198	0.0177	0.0070	0.0106
199	0.0159	0.0063	0.0095
200	0.0145	0.0058	0.0087
201	0.0134	0.0053	0.0081
202	0.0125	0.0050	0.0075
203	0.0117	0.0047	0.0071
204	0.0111	0.0044	0.0067
205	0.0105	0.0042	0.0063
206	0.0100	0.0040	0.0060
207	0.0096	0.0038	0.0058
208	0.0092	0.0037	0.0055
209	0.0088	0.0035	0.0053
210	0.0085	0.0034	0.0051
211	0.0082	0.0033	0.0050
212	0.0080	0.0032	0.0048
213	0.0077	0.0031	0.0047
214	0.0075	0.0030	0.0045
215	0.0073	0.0029	0.0044
216	0.0071	0.0028	0.0043
217	0.0074	0.0029	0.0044
218	0.0072	0.0029	0.0043
219	0.0070	0.0028	0.0042
220	0.0069	0.0027	0.0041
221	0.0067	0.0027	0.0041

222	0.0066	0.0026	0.0040
223	0.0065	0.0026	0.0039
224	0.0063	0.0025	0.0038
225	0.0062	0.0025	0.0038
226	0.0061	0.0024	0.0037
227	0.0060	0.0024	0.0036
228	0.0059	0.0024	0.0036
229	0.0058	0.0023	0.0035
230	0.0057	0.0023	0.0034
231	0.0056	0.0022	0.0034
232	0.0056	0.0022	0.0033
233	0.0055	0.0022	0.0033
234	0.0054	0.0022	0.0033
235	0.0053	0.0021	0.0032
236	0.0053	0.0021	0.0032
237	0.0052	0.0021	0.0031
238	0.0051	0.0020	0.0031
239	0.0051	0.0020	0.0030
240	0.0050	0.0020	0.0030
241	0.0049	0.0020	0.0030
242	0.0049	0.0019	0.0029
243	0.0048	0.0019	0.0029
244	0.0048	0.0019	0.0029
245	0.0047	0.0019	0.0028
246	0.0047	0.0019	0.0028
247	0.0046	0.0018	0.0028
248	0.0046	0.0018	0.0027
249	0.0045	0.0018	0.0027
250	0.0045	0.0018	0.0027
251	0.0044	0.0018	0.0027
252	0.0044	0.0017	0.0026
253	0.0043	0.0017	0.0026
254	0.0043	0.0017	0.0026
255	0.0043	0.0017	0.0026
256	0.0042	0.0017	0.0025
257	0.0042	0.0017	0.0025
258	0.0041	0.0016	0.0025
259	0.0041	0.0016	0.0025
260	0.0041	0.0016	0.0024
261	0.0040	0.0016	0.0024
262	0.0040	0.0016	0.0024
263	0.0040	0.0016	0.0024
264	0.0039	0.0016	0.0024
265	0.0039	0.0016	0.0023
266	0.0039	0.0015	0.0023
267	0.0038	0.0015	0.0023
268	0.0038	0.0015	0.0023
269	0.0038	0.0015	0.0023
270	0.0037	0.0015	0.0023
271	0.0037	0.0015	0.0022
272	0.0037	0.0015	0.0022
273	0.0037	0.0015	0.0022
274	0.0036	0.0014	0.0022
275	0.0036	0.0014	0.0022

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    276              0.0036          0.0014              0.0022
    277              0.0036          0.0014              0.0021
    278              0.0035          0.0014              0.0021
    279              0.0035          0.0014              0.0021
    280              0.0035          0.0014              0.0021
    281              0.0035          0.0014              0.0021
    282              0.0034          0.0014              0.0021
    283              0.0034          0.0014              0.0021
    284              0.0034          0.0014              0.0020
    285              0.0034          0.0013              0.0020
    286              0.0034          0.0013              0.0020
    287              0.0033          0.0013              0.0020
    288              0.0033          0.0013              0.0020
    --------------------------------------------------------------------
    --------------------------------------------------------------------
    Total soil rain loss =      0.79(In)
    Total effective rainfall =      1.48(In)
    Peak flow rate in flood hydrograph =     13.67(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        5.0      10.0      15.0      20.0
-----------------------------------------------------------------------
  0+ 5       0.0000      0.01  Q         |         |         |         |
  0+10       0.0003      0.03  Q         |         |         |         |
  0+15       0.0009      0.10  Q         |         |         |         |
  0+20       0.0022      0.17  Q         |         |         |         |
  0+25       0.0036      0.22  Q         |         |         |         |
  0+30       0.0053      0.24  Q         |         |         |         |
  0+35       0.0071      0.26  Q         |         |         |         |
  0+40       0.0090      0.28  Q         |         |         |         |
  0+45       0.0110      0.29  Q         |         |         |         |
  0+50       0.0131      0.30  Q         |         |         |         |
  0+55       0.0152      0.31  Q         |         |         |         |
  1+ 0       0.0174      0.32  Q         |         |         |         |
  1+ 5       0.0196      0.32  Q         |         |         |         |
  1+10       0.0219      0.33  Q         |         |         |         |
  1+15       0.0242      0.33  Q         |         |         |         |
  1+20       0.0265      0.34  Q         |         |         |         |
  1+25       0.0288      0.34  Q         |         |         |         |
  1+30       0.0312      0.34  Q         |         |         |         |
  1+35       0.0335      0.35  Q         |         |         |         |
  1+40       0.0359      0.35  Q         |         |         |         |
  1+45       0.0383      0.35  Q         |         |         |         |
  1+50       0.0408      0.35  Q         |         |         |         |
  1+55       0.0432      0.35  Q         |         |         |         |
  2+ 0       0.0457      0.36  QV        |         |         |         |
  2+ 5       0.0481      0.36  QV        |         |         |         |
  2+10       0.0506      0.36  QV        |         |         |         |
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2+15       0.0531      0.36  QV        |         |         |         |
2+20       0.0556      0.36  QV        |         |         |         |
2+25       0.0581      0.37  QV        |         |         |         |
2+30       0.0607      0.37  QV        |         |         |         |
2+35       0.0632      0.37  QV        |         |         |         |
2+40       0.0657      0.37  QV        |         |         |         |
2+45       0.0683      0.37  QV        |         |         |         |
2+50       0.0708      0.37  QV        |         |         |         |
2+55       0.0734      0.37  QV        |         |         |         |
3+ 0       0.0760      0.37  QV        |         |         |         |
3+ 5       0.0786      0.38  QV        |         |         |         |
3+10       0.0812      0.38  QV        |         |         |         |
3+15       0.0838      0.38  QV        |         |         |         |
3+20       0.0864      0.38  QV        |         |         |         |
3+25       0.0890      0.38  Q V       |         |         |         |
3+30       0.0916      0.38  Q V       |         |         |         |
3+35       0.0943      0.38  Q V       |         |         |         |
3+40       0.0969      0.39  Q V       |         |         |         |
3+45       0.0996      0.39  Q V       |         |         |         |
3+50       0.1023      0.39  Q V       |         |         |         |
3+55       0.1050      0.39  Q V       |         |         |         |
4+ 0       0.1077      0.39  Q V       |         |         |         |
4+ 5       0.1104      0.39  Q V       |         |         |         |
4+10       0.1131      0.39  Q V       |         |         |         |
4+15       0.1158      0.40  Q V       |         |         |         |
4+20       0.1185      0.40  Q V       |         |         |         |
4+25       0.1213      0.40  Q V       |         |         |         |
4+30       0.1241      0.40  Q V       |         |         |         |
4+35       0.1268      0.40  Q V       |         |         |         |
4+40       0.1296      0.40  Q V       |         |         |         |
4+45       0.1324      0.41  Q  V      |         |         |         |
4+50       0.1352      0.41  Q  V      |         |         |         |
4+55       0.1380      0.41  Q  V      |         |         |         |
5+ 0       0.1408      0.41  Q  V      |         |         |         |
5+ 5       0.1437      0.41  Q  V      |         |         |         |
5+10       0.1465      0.41  Q  V      |         |         |         |
5+15       0.1494      0.42  Q  V      |         |         |         |
5+20       0.1523      0.42  Q  V      |         |         |         |
5+25       0.1552      0.42  Q  V      |         |         |         |
5+30       0.1581      0.42  Q  V      |         |         |         |
5+35       0.1610      0.42  Q  V      |         |         |         |
5+40       0.1639      0.43  Q  V      |         |         |         |
5+45       0.1669      0.43  Q  V      |         |         |         |
5+50       0.1698      0.43  Q  V      |         |         |         |
5+55       0.1728      0.43  Q  V      |         |         |         |
6+ 0       0.1758      0.43  Q   V     |         |         |         |
6+ 5       0.1788      0.44  Q   V     |         |         |         |
6+10       0.1818      0.44  Q   V     |         |         |         |
6+15       0.1848      0.44  Q   V     |         |         |         |
6+20       0.1878      0.44  Q   V     |         |         |         |
6+25       0.1909      0.44  Q   V     |         |         |         |
6+30       0.1940      0.45  Q   V     |         |         |         |
6+35       0.1970      0.45  Q   V     |         |         |         |
6+40       0.2001      0.45  Q   V     |         |         |         |
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 6+45       0.2033      0.45  Q   V     |         |         |         |
 6+50       0.2064      0.45  Q   V     |         |         |         |
 6+55       0.2095      0.46  Q   V     |         |         |         |
 7+ 0       0.2127      0.46  Q   V     |         |         |         |
 7+ 5       0.2159      0.46  Q   V     |         |         |         |
 7+10       0.2191      0.46  Q    V    |         |         |         |
 7+15       0.2223      0.47  Q    V    |         |         |         |
 7+20       0.2255      0.47  Q    V    |         |         |         |
 7+25       0.2288      0.47  Q    V    |         |         |         |
 7+30       0.2320      0.47  Q    V    |         |         |         |
 7+35       0.2353      0.48  Q    V    |         |         |         |
 7+40       0.2386      0.48  Q    V    |         |         |         |
 7+45       0.2419      0.48  Q    V    |         |         |         |
 7+50       0.2453      0.48  Q    V    |         |         |         |
 7+55       0.2486      0.49  Q    V    |         |         |         |
 8+ 0       0.2520      0.49  Q    V    |         |         |         |
 8+ 5       0.2554      0.49  Q    V    |         |         |         |
 8+10       0.2588      0.50  Q    V    |         |         |         |
 8+15       0.2622      0.50  Q     V   |         |         |         |
 8+20       0.2657      0.50  |Q    V   |         |         |         |
 8+25       0.2692      0.50  |Q    V   |         |         |         |
 8+30       0.2726      0.51  |Q    V   |         |         |         |
 8+35       0.2762      0.51  |Q    V   |         |         |         |
 8+40       0.2797      0.51  |Q    V   |         |         |         |
 8+45       0.2833      0.52  |Q    V   |         |         |         |
 8+50       0.2868      0.52  |Q    V   |         |         |         |
 8+55       0.2905      0.52  |Q    V   |         |         |         |
 9+ 0       0.2941      0.53  |Q    V   |         |         |         |
 9+ 5       0.2977      0.53  |Q    V   |         |         |         |
 9+10       0.3014      0.53  |Q    V   |         |         |         |
 9+15       0.3051      0.54  |Q     V  |         |         |         |
 9+20       0.3088      0.54  |Q     V  |         |         |         |
 9+25       0.3126      0.54  |Q     V  |         |         |         |
 9+30       0.3164      0.55  |Q     V  |         |         |         |
 9+35       0.3202      0.55  |Q     V  |         |         |         |
 9+40       0.3240      0.56  |Q     V  |         |         |         |
 9+45       0.3279      0.56  |Q     V  |         |         |         |
 9+50       0.3318      0.56  |Q     V  |         |         |         |
 9+55       0.3357      0.57  |Q     V  |         |         |         |
10+ 0       0.3396      0.57  |Q     V  |         |         |         |
10+ 5       0.3436      0.58  |Q     V  |         |         |         |
10+10       0.3476      0.58  |Q     V  |         |         |         |
10+15       0.3516      0.59  |Q      V |         |         |         |
10+20       0.3557      0.59  |Q      V |         |         |         |
10+25       0.3598      0.60  |Q      V |         |         |         |
10+30       0.3639      0.60  |Q      V |         |         |         |
10+35       0.3681      0.61  |Q      V |         |         |         |
10+40       0.3723      0.61  |Q      V |         |         |         |
10+45       0.3766      0.62  |Q      V |         |         |         |
10+50       0.3808      0.62  |Q      V |         |         |         |
10+55       0.3852      0.63  |Q      V |         |         |         |
11+ 0       0.3895      0.63  |Q      V |         |         |         |
11+ 5       0.3939      0.64  |Q       V|         |         |         |
11+10       0.3983      0.64  |Q       V|         |         |         |
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11+15       0.4028      0.65  |Q       V|         |         |         |
11+20       0.4073      0.66  |Q       V|         |         |         |
11+25       0.4119      0.66  |Q       V|         |         |         |
11+30       0.4165      0.67  |Q       V|         |         |         |
11+35       0.4211      0.67  |Q       V|         |         |         |
11+40       0.4258      0.68  |Q       V|         |         |         |
11+45       0.4306      0.69  |Q       V|         |         |         |
11+50       0.4353      0.70  |Q       V|         |         |         |
11+55       0.4402      0.70  |Q        V         |         |         |
12+ 0       0.4451      0.71  |Q        V         |         |         |
12+ 5       0.4500      0.72  |Q        V         |         |         |
12+10       0.4550      0.72  |Q        V         |         |         |
12+15       0.4600      0.72  |Q        V         |         |         |
12+20       0.4649      0.72  |Q        V         |         |         |
12+25       0.4699      0.72  |Q        V         |         |         |
12+30       0.4750      0.73  |Q        V         |         |         |
12+35       0.4800      0.74  |Q        |V        |         |         |
12+40       0.4852      0.75  |Q        |V        |         |         |
12+45       0.4904      0.75  |Q        |V        |         |         |
12+50       0.4956      0.76  |Q        |V        |         |         |
12+55       0.5010      0.77  |Q        |V        |         |         |
13+ 0       0.5063      0.78  |Q        |V        |         |         |
13+ 5       0.5118      0.79  |Q        |V        |         |         |
13+10       0.5174      0.81  |Q        |V        |         |         |
13+15       0.5230      0.82  |Q        | V       |         |         |
13+20       0.5287      0.83  |Q        | V       |         |         |
13+25       0.5346      0.84  |Q        | V       |         |         |
13+30       0.5405      0.86  |Q        | V       |         |         |
13+35       0.5465      0.87  |Q        | V       |         |         |
13+40       0.5526      0.89  |Q        | V       |         |         |
13+45       0.5588      0.91  |Q        | V       |         |         |
13+50       0.5652      0.92  |Q        | V       |         |         |
13+55       0.5717      0.94  |Q        |  V      |         |         |
14+ 0       0.5783      0.96  |Q        |  V      |         |         |
14+ 5       0.5851      0.98  |Q        |  V      |         |         |
14+10       0.5920      1.00  | Q       |  V      |         |         |
14+15       0.5990      1.03  | Q       |  V      |         |         |
14+20       0.6063      1.05  | Q       |  V      |         |         |
14+25       0.6137      1.08  | Q       |   V     |         |         |
14+30       0.6213      1.11  | Q       |   V     |         |         |
14+35       0.6292      1.14  | Q       |   V     |         |         |
14+40       0.6372      1.17  | Q       |   V     |         |         |
14+45       0.6455      1.20  | Q       |   V     |         |         |
14+50       0.6541      1.24  | Q       |    V    |         |         |
14+55       0.6629      1.28  | Q       |    V    |         |         |
15+ 0       0.6721      1.33  | Q       |    V    |         |         |
15+ 5       0.6816      1.38  | Q       |    V    |         |         |
15+10       0.6915      1.44  | Q       |    V    |         |         |
15+15       0.7018      1.50  |  Q      |     V   |         |         |
15+20       0.7127      1.57  |  Q      |     V   |         |         |
15+25       0.7240      1.65  |  Q      |     V   |         |         |
15+30       0.7357      1.70  |  Q      |     V   |         |         |
15+35       0.7474      1.71  |  Q      |      V  |         |         |
15+40       0.7593      1.72  |  Q      |      V  |         |         |
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15+45       0.7718      1.82  |  Q      |      V  |         |         |
15+50       0.7854      1.97  |  Q      |       V |         |         |
15+55       0.8008      2.24  |   Q     |       V |         |         |
16+ 0       0.8196      2.72  |    Q    |       V |         |         |
16+ 5       0.8493      4.32  |       Q |        V|         |         |
16+10       0.9031      7.80  |         |    Q    V         |         |
16+15       0.9973     13.67  |         |         | V    Q  |         |
16+20       1.0910     13.60  |         |         |    V Q  |         |
16+25       1.1521      8.88  |         |      Q  |     V   |         |
16+30       1.1963      6.42  |         | Q       |      V  |         |
16+35       1.2319      5.17  |         Q         |       V |         |
16+40       1.2617      4.33  |       Q |         |       V |         |
16+45       1.2874      3.73  |      Q  |         |        V|         |
16+50       1.3102      3.31  |     Q   |         |         V         |
16+55       1.3301      2.88  |    Q    |         |         V         |
17+ 0       1.3476      2.55  |    Q    |         |         V         |
17+ 5       1.3636      2.32  |   Q     |         |         |V        |
17+10       1.3782      2.13  |   Q     |         |         |V        |
17+15       1.3914      1.92  |  Q      |         |         |V        |
17+20       1.4037      1.78  |  Q      |         |         | V       |
17+25       1.4149      1.63  |  Q      |         |         | V       |
17+30       1.4252      1.49  | Q       |         |         | V       |
17+35       1.4346      1.37  | Q       |         |         | V       |
17+40       1.4432      1.24  | Q       |         |         |  V      |
17+45       1.4513      1.19  | Q       |         |         |  V      |
17+50       1.4594      1.16  | Q       |         |         |  V      |
17+55       1.4671      1.12  | Q       |         |         |  V      |
18+ 0       1.4745      1.08  | Q       |         |         |  V      |
18+ 5       1.4813      0.98  |Q        |         |         |   V     |
18+10       1.4877      0.93  |Q        |         |         |   V     |
18+15       1.4939      0.89  |Q        |         |         |   V     |
18+20       1.4994      0.80  |Q        |         |         |   V     |
18+25       1.5048      0.78  |Q        |         |         |   V     |
18+30       1.5101      0.76  |Q        |         |         |   V     |
18+35       1.5152      0.75  |Q        |         |         |   V     |
18+40       1.5202      0.73  |Q        |         |         |   V     |
18+45       1.5251      0.71  |Q        |         |         |    V    |
18+50       1.5299      0.70  |Q        |         |         |    V    |
18+55       1.5346      0.68  |Q        |         |         |    V    |
19+ 0       1.5392      0.67  |Q        |         |         |    V    |
19+ 5       1.5437      0.66  |Q        |         |         |    V    |
19+10       1.5482      0.64  |Q        |         |         |    V    |
19+15       1.5525      0.63  |Q        |         |         |    V    |
19+20       1.5568      0.62  |Q        |         |         |    V    |
19+25       1.5610      0.61  |Q        |         |         |    V    |
19+30       1.5652      0.60  |Q        |         |         |    V    |
19+35       1.5693      0.59  |Q        |         |         |     V   |
19+40       1.5733      0.58  |Q        |         |         |     V   |
19+45       1.5772      0.57  |Q        |         |         |     V   |
19+50       1.5811      0.57  |Q        |         |         |     V   |
19+55       1.5850      0.56  |Q        |         |         |     V   |
20+ 0       1.5887      0.55  |Q        |         |         |     V   |
20+ 5       1.5925      0.54  |Q        |         |         |     V   |
20+10       1.5962      0.53  |Q        |         |         |     V   |
```

```
   20+15       1.5998      0.53  |Q        |         |         |     V   |
   20+20       1.6034      0.52  |Q        |         |         |     V   |
   20+25       1.6069      0.51  |Q        |         |         |     V   |
   20+30       1.6104      0.51  |Q        |         |         |     V   |
   20+35       1.6139      0.50  |Q        |         |         |      V  |
   20+40       1.6173      0.50  Q         |         |         |      V  |
   20+45       1.6207      0.49  Q         |         |         |      V  |
   20+50       1.6240      0.48  Q         |         |         |      V  |
   20+55       1.6273      0.48  Q         |         |         |      V  |
   21+ 0       1.6306      0.47  Q         |         |         |      V  |
   21+ 5       1.6338      0.47  Q         |         |         |      V  |
   21+10       1.6370      0.46  Q         |         |         |      V  |
   21+15       1.6402      0.46  Q         |         |         |      V  |
   21+20       1.6433      0.45  Q         |         |         |      V  |
   21+25       1.6464      0.45  Q         |         |         |      V  |
   21+30       1.6495      0.45  Q         |         |         |      V  |
   21+35       1.6525      0.44  Q         |         |         |      V  |
   21+40       1.6555      0.44  Q         |         |         |       V |
   21+45       1.6585      0.43  Q         |         |         |       V |
   21+50       1.6614      0.43  Q         |         |         |       V |
   21+55       1.6644      0.43  Q         |         |         |       V |
   22+ 0       1.6673      0.42  Q         |         |         |       V |
   22+ 5       1.6702      0.42  Q         |         |         |       V |
   22+10       1.6730      0.41  Q         |         |         |       V |
   22+15       1.6758      0.41  Q         |         |         |       V |
   22+20       1.6786      0.41  Q         |         |         |       V |
   22+25       1.6814      0.40  Q         |         |         |       V |
   22+30       1.6842      0.40  Q         |         |         |       V |
   22+35       1.6869      0.40  Q         |         |         |       V |
   22+40       1.6896      0.39  Q         |         |         |       V |
   22+45       1.6923      0.39  Q         |         |         |       V |
   22+50       1.6950      0.39  Q         |         |         |       V |
   22+55       1.6976      0.39  Q         |         |         |       V |
   23+ 0       1.7003      0.38  Q         |         |         |        V|
   23+ 5       1.7029      0.38  Q         |         |         |        V|
   23+10       1.7055      0.38  Q         |         |         |        V|
   23+15       1.7081      0.37  Q         |         |         |        V|
   23+20       1.7106      0.37  Q         |         |         |        V|
   23+25       1.7132      0.37  Q         |         |         |        V|
   23+30       1.7157      0.37  Q         |         |         |        V|
   23+35       1.7182      0.36  Q         |         |         |        V|
   23+40       1.7207      0.36  Q         |         |         |        V|
   23+45       1.7231      0.36  Q         |         |         |        V|
   23+50       1.7256      0.36  Q         |         |         |        V|
   23+55       1.7280      0.35  Q         |         |         |        V|
   24+ 0       1.7305      0.35  Q         |         |         |        V|
-----------------------------------------------------------------------
```

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

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            Study date  10/25/22

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

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


Program License Serial Number 4070

---------------------------------------------------------------------
10-YR, 24-HOUR UNIT HYDROGRAPH PRE-DEVELOPED
TR 20525, CITY OF VICTORVILLE
AREA B1, B2 & B3 (ONSITE WESTERLY AREAS FLOW TOWARDS AMETHYS RD.)
FILE: 20525HYDROB1B3PRE10YR.OUT
--------------------------------------------------------------------

      Storm Event Year = 10

      Antecedent Moisture Condition = 3

 English (in-lb) Input Units Used

 English Rainfall Data (Inches) Input Values Used

 English Units used in output format



Area averaged rainfall intensity isohyetal data:
      Sub-Area        Duration        Isohyetal
      (Ac.)            (hours)         (In)
Rainfall data for year 10
          15.11            1          0.63
--------------------------------------------------------------------
Rainfall data for year 10
          15.11            6          1.27
--------------------------------------------------------------------
Rainfall data for year 10
          15.11           24          2.27
--------------------------------------------------------------------
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++

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

```
SCS curve  SCS curve     Area     Area     Fp(Fig C6)    Ap      Fm
No.(AMCII) NO.(AMC 3)    (Ac.)    Fraction     (In/Hr)  (dec.)   (In/Hr)
 71.2      88.0         15.11      1.000     0.230    1.000    0.230

Area-averaged adjusted loss rate Fm (In/Hr) =  0.230

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

Area       Area          SCS CN    SCS CN      S     Pervious
 (Ac.)      Fract         (AMC2)    (AMC3)           Yield Fr
    15.11   1.000         71.2      88.0       1.37     0.522

Area-averaged catchment yield fraction, Y =  0.522
Area-averaged low loss fraction, Yb =  0.478
User entry of time of concentration  =   0.240 (hours)
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Watershed area =      15.11(Ac.)
Catchment Lag time =   0.192 hours
Unit interval =   5.000 minutes
Unit interval percentage of lag time = 43.4028
Hydrograph baseflow =     0.00(CFS)
Average maximum watershed loss rate(Fm) =  0.230(In/Hr)
Average low loss rate fraction (Yb) = 0.478 (decimal)
DESERT S-Graph Selected
Computed peak 5-minute rainfall =  0.297(In)
Computed peak 30-minute rainfall =  0.508(In)
Specified peak 1-hour rainfall =  0.626(In)
Computed peak 3-hour rainfall =  0.966(In)
Specified peak 6-hour rainfall =  1.270(In)
Specified peak 24-hour rainfall =  2.270(In)


Rainfall depth area reduction factors:
Using a total area of      15.11(Ac.) (Ref: fig. E-4)

5-minute factor = 0.999     Adjusted rainfall =  0.297(In)
30-minute factor = 0.999    Adjusted rainfall =  0.508(In)
1-hour factor = 0.999       Adjusted rainfall =  0.626(In)
3-hour factor = 1.000       Adjusted rainfall =  0.966(In)
6-hour factor = 1.000       Adjusted rainfall =  1.270(In)
24-hour factor = 1.000      Adjusted rainfall =  2.270(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 =       182.74 (CFS))

  1                3.137                  5.733
  2               22.663                 35.680
  3               53.668                 56.658
  4               68.764                 27.586
```

```
  5               77.374                  15.734
  6               83.049                  10.369
  7               87.227                   7.635
  8               90.208                   5.448
  9               92.496                   4.181
 10               94.309                   3.312
 11               95.725                   2.588
 12               96.837                   2.032
 13               97.647                   1.479
 14               98.161                   0.939
 15               98.652                   0.898
 16               99.173                   0.952
 17               99.599                   0.778
 18              100.000                   0.733
---------------------------------------------------------------------
Peak Unit   Adjusted mass rainfall  Unit rainfall
Number               (In)                (In)
  1              0.2968               0.2968
  2              0.3654               0.0686
  3              0.4127               0.0473
  4              0.4499               0.0372
  5              0.4811               0.0311
  6              0.5081               0.0270
  7              0.5322               0.0240
  8              0.5539               0.0218
  9              0.5738               0.0199
 10              0.5923               0.0184
 11              0.6094               0.0172
 12              0.6256               0.0161
 13              0.6457               0.0201
 14              0.6649               0.0192
 15              0.6833               0.0184
 16              0.7009               0.0177
 17              0.7179               0.0170
 18              0.7343               0.0164
 19              0.7502               0.0159
 20              0.7656               0.0154
 21              0.7805               0.0149
 22              0.7950               0.0145
 23              0.8091               0.0141
 24              0.8228               0.0137
 25              0.8362               0.0134
 26              0.8492               0.0131
 27              0.8620               0.0128
 28              0.8745               0.0125
 29              0.8867               0.0122
 30              0.8987               0.0120
 31              0.9104               0.0117
 32              0.9219               0.0115
 33              0.9332               0.0113
 34              0.9443               0.0111
 35              0.9552               0.0109
 36              0.9659               0.0107
 37              0.9764               0.0105
```

38	0.9867	0.0103
39	0.9969	0.0102
40	1.0069	0.0100
41	1.0168	0.0099
42	1.0265	0.0097
43	1.0361	0.0096
44	1.0455	0.0094
45	1.0548	0.0093
46	1.0640	0.0092
47	1.0731	0.0091
48	1.0821	0.0090
49	1.0909	0.0088
50	1.0996	0.0087
51	1.1083	0.0086
52	1.1168	0.0085
53	1.1252	0.0084
54	1.1336	0.0083
55	1.1418	0.0082
56	1.1500	0.0082
57	1.1580	0.0081
58	1.1660	0.0080
59	1.1739	0.0079
60	1.1817	0.0078
61	1.1895	0.0077
62	1.1971	0.0077
63	1.2047	0.0076
64	1.2122	0.0075
65	1.2197	0.0074
66	1.2270	0.0074
67	1.2344	0.0073
68	1.2416	0.0072
69	1.2488	0.0072
70	1.2559	0.0071
71	1.2629	0.0071
72	1.2699	0.0070
73	1.2773	0.0074
74	1.2846	0.0073
75	1.2918	0.0072
76	1.2990	0.0072
77	1.3062	0.0071
78	1.3132	0.0071
79	1.3203	0.0070
80	1.3273	0.0070
81	1.3342	0.0069
82	1.3411	0.0069
83	1.3479	0.0068
84	1.3547	0.0068
85	1.3614	0.0067
86	1.3681	0.0067
87	1.3747	0.0066
88	1.3813	0.0066
89	1.3879	0.0066
90	1.3944	0.0065
91	1.4009	0.0065

92	1.4073	0.0064
93	1.4137	0.0064
94	1.4200	0.0063
95	1.4263	0.0063
96	1.4326	0.0063
97	1.4388	0.0062
98	1.4450	0.0062
99	1.4512	0.0062
100	1.4573	0.0061
101	1.4634	0.0061
102	1.4695	0.0061
103	1.4755	0.0060
104	1.4815	0.0060
105	1.4874	0.0060
106	1.4933	0.0059
107	1.4992	0.0059
108	1.5051	0.0059
109	1.5109	0.0058
110	1.5167	0.0058
111	1.5224	0.0058
112	1.5282	0.0057
113	1.5339	0.0057
114	1.5396	0.0057
115	1.5452	0.0056
116	1.5508	0.0056
117	1.5564	0.0056
118	1.5620	0.0056
119	1.5675	0.0055
120	1.5730	0.0055
121	1.5785	0.0055
122	1.5839	0.0055
123	1.5894	0.0054
124	1.5948	0.0054
125	1.6001	0.0054
126	1.6055	0.0054
127	1.6108	0.0053
128	1.6161	0.0053
129	1.6214	0.0053
130	1.6266	0.0053
131	1.6319	0.0052
132	1.6371	0.0052
133	1.6423	0.0052
134	1.6474	0.0052
135	1.6526	0.0051
136	1.6577	0.0051
137	1.6628	0.0051
138	1.6678	0.0051
139	1.6729	0.0051
140	1.6779	0.0050
141	1.6829	0.0050
142	1.6879	0.0050
143	1.6929	0.0050
144	1.6979	0.0049
145	1.7028	0.0049

146	1.7077	0.0049
147	1.7126	0.0049
148	1.7175	0.0049
149	1.7223	0.0049
150	1.7271	0.0048
151	1.7320	0.0048
152	1.7368	0.0048
153	1.7415	0.0048
154	1.7463	0.0048
155	1.7510	0.0047
156	1.7558	0.0047
157	1.7605	0.0047
158	1.7652	0.0047
159	1.7698	0.0047
160	1.7745	0.0047
161	1.7791	0.0046
162	1.7837	0.0046
163	1.7883	0.0046
164	1.7929	0.0046
165	1.7975	0.0046
166	1.8021	0.0046
167	1.8066	0.0045
168	1.8111	0.0045
169	1.8156	0.0045
170	1.8201	0.0045
171	1.8246	0.0045
172	1.8291	0.0045
173	1.8335	0.0044
174	1.8379	0.0044
175	1.8424	0.0044
176	1.8468	0.0044
177	1.8512	0.0044
178	1.8555	0.0044
179	1.8599	0.0044
180	1.8642	0.0043
181	1.8686	0.0043
182	1.8729	0.0043
183	1.8772	0.0043
184	1.8815	0.0043
185	1.8858	0.0043
186	1.8900	0.0043
187	1.8943	0.0043
188	1.8985	0.0042
189	1.9027	0.0042
190	1.9069	0.0042
191	1.9111	0.0042
192	1.9153	0.0042
193	1.9195	0.0042
194	1.9237	0.0042
195	1.9278	0.0041
196	1.9319	0.0041
197	1.9361	0.0041
198	1.9402	0.0041
199	1.9443	0.0041

200	1.9484	0.0041
201	1.9524	0.0041
202	1.9565	0.0041
203	1.9606	0.0041
204	1.9646	0.0040
205	1.9686	0.0040
206	1.9726	0.0040
207	1.9767	0.0040
208	1.9806	0.0040
209	1.9846	0.0040
210	1.9886	0.0040
211	1.9926	0.0040
212	1.9965	0.0040
213	2.0005	0.0039
214	2.0044	0.0039
215	2.0083	0.0039
216	2.0122	0.0039
217	2.0161	0.0039
218	2.0200	0.0039
219	2.0239	0.0039
220	2.0277	0.0039
221	2.0316	0.0039
222	2.0354	0.0038
223	2.0393	0.0038
224	2.0431	0.0038
225	2.0469	0.0038
226	2.0507	0.0038
227	2.0545	0.0038
228	2.0583	0.0038
229	2.0621	0.0038
230	2.0659	0.0038
231	2.0696	0.0038
232	2.0734	0.0037
233	2.0771	0.0037
234	2.0808	0.0037
235	2.0846	0.0037
236	2.0883	0.0037
237	2.0920	0.0037
238	2.0957	0.0037
239	2.0993	0.0037
240	2.1030	0.0037
241	2.1067	0.0037
242	2.1103	0.0037
243	2.1140	0.0036
244	2.1176	0.0036
245	2.1213	0.0036
246	2.1249	0.0036
247	2.1285	0.0036
248	2.1321	0.0036
249	2.1357	0.0036
250	2.1393	0.0036
251	2.1429	0.0036
252	2.1465	0.0036
253	2.1500	0.0036

```
254              2.1536               0.0036
255              2.1571               0.0035
256              2.1607               0.0035
257              2.1642               0.0035
258              2.1677               0.0035
259              2.1712               0.0035
260              2.1747               0.0035
261              2.1782               0.0035
262              2.1817               0.0035
263              2.1852               0.0035
264              2.1887               0.0035
265              2.1922               0.0035
266              2.1956               0.0035
267              2.1991               0.0035
268              2.2025               0.0034
269              2.2060               0.0034
270              2.2094               0.0034
271              2.2128               0.0034
272              2.2162               0.0034
273              2.2197               0.0034
274              2.2231               0.0034
275              2.2265               0.0034
276              2.2298               0.0034
277              2.2332               0.0034
278              2.2366               0.0034
279              2.2400               0.0034
280              2.2433               0.0034
281              2.2467               0.0034
282              2.2500               0.0033
283              2.2534               0.0033
284              2.2567               0.0033
285              2.2600               0.0033
286              2.2633               0.0033
287              2.2667               0.0033
288              2.2700               0.0033
---------------------------------------------------------------------
Unit              Unit            Unit              Effective
Period            Rainfall        Soil-Loss         Rainfall
(number)            (In)          (In)                 (In)
---------------------------------------------------------------------
  1              0.0033           0.0016              0.0017
  2              0.0033           0.0016              0.0017
  3              0.0033           0.0016              0.0017
  4              0.0033           0.0016              0.0017
  5              0.0033           0.0016              0.0017
  6              0.0034           0.0016              0.0017
  7              0.0034           0.0016              0.0018
  8              0.0034           0.0016              0.0018
  9              0.0034           0.0016              0.0018
 10              0.0034           0.0016              0.0018
 11              0.0034           0.0016              0.0018
 12              0.0034           0.0016              0.0018
 13              0.0034           0.0016              0.0018
 14              0.0034           0.0016              0.0018
```

15	0.0035	0.0017	0.0018
16	0.0035	0.0017	0.0018
17	0.0035	0.0017	0.0018
18	0.0035	0.0017	0.0018
19	0.0035	0.0017	0.0018
20	0.0035	0.0017	0.0018
21	0.0035	0.0017	0.0018
22	0.0035	0.0017	0.0018
23	0.0035	0.0017	0.0019
24	0.0036	0.0017	0.0019
25	0.0036	0.0017	0.0019
26	0.0036	0.0017	0.0019
27	0.0036	0.0017	0.0019
28	0.0036	0.0017	0.0019
29	0.0036	0.0017	0.0019
30	0.0036	0.0017	0.0019
31	0.0036	0.0017	0.0019
32	0.0037	0.0017	0.0019
33	0.0037	0.0018	0.0019
34	0.0037	0.0018	0.0019
35	0.0037	0.0018	0.0019
36	0.0037	0.0018	0.0019
37	0.0037	0.0018	0.0019
38	0.0037	0.0018	0.0020
39	0.0038	0.0018	0.0020
40	0.0038	0.0018	0.0020
41	0.0038	0.0018	0.0020
42	0.0038	0.0018	0.0020
43	0.0038	0.0018	0.0020
44	0.0038	0.0018	0.0020
45	0.0038	0.0018	0.0020
46	0.0039	0.0018	0.0020
47	0.0039	0.0019	0.0020
48	0.0039	0.0019	0.0020
49	0.0039	0.0019	0.0020
50	0.0039	0.0019	0.0020
51	0.0039	0.0019	0.0021
52	0.0040	0.0019	0.0021
53	0.0040	0.0019	0.0021
54	0.0040	0.0019	0.0021
55	0.0040	0.0019	0.0021
56	0.0040	0.0019	0.0021
57	0.0040	0.0019	0.0021
58	0.0041	0.0019	0.0021
59	0.0041	0.0019	0.0021
60	0.0041	0.0020	0.0021
61	0.0041	0.0020	0.0021
62	0.0041	0.0020	0.0022
63	0.0041	0.0020	0.0022
64	0.0042	0.0020	0.0022
65	0.0042	0.0020	0.0022
66	0.0042	0.0020	0.0022
67	0.0042	0.0020	0.0022
68	0.0042	0.0020	0.0022

69	0.0043	0.0020	0.0022
70	0.0043	0.0020	0.0022
71	0.0043	0.0021	0.0022
72	0.0043	0.0021	0.0023
73	0.0043	0.0021	0.0023
74	0.0044	0.0021	0.0023
75	0.0044	0.0021	0.0023
76	0.0044	0.0021	0.0023
77	0.0044	0.0021	0.0023
78	0.0044	0.0021	0.0023
79	0.0045	0.0021	0.0023
80	0.0045	0.0021	0.0023
81	0.0045	0.0022	0.0024
82	0.0045	0.0022	0.0024
83	0.0046	0.0022	0.0024
84	0.0046	0.0022	0.0024
85	0.0046	0.0022	0.0024
86	0.0046	0.0022	0.0024
87	0.0047	0.0022	0.0024
88	0.0047	0.0022	0.0024
89	0.0047	0.0023	0.0025
90	0.0047	0.0023	0.0025
91	0.0048	0.0023	0.0025
92	0.0048	0.0023	0.0025
93	0.0048	0.0023	0.0025
94	0.0049	0.0023	0.0025
95	0.0049	0.0023	0.0026
96	0.0049	0.0023	0.0026
97	0.0049	0.0024	0.0026
98	0.0050	0.0024	0.0026
99	0.0050	0.0024	0.0026
100	0.0050	0.0024	0.0026
101	0.0051	0.0024	0.0026
102	0.0051	0.0024	0.0027
103	0.0051	0.0025	0.0027
104	0.0052	0.0025	0.0027
105	0.0052	0.0025	0.0027
106	0.0052	0.0025	0.0027
107	0.0053	0.0025	0.0028
108	0.0053	0.0025	0.0028
109	0.0054	0.0026	0.0028
110	0.0054	0.0026	0.0028
111	0.0054	0.0026	0.0028
112	0.0055	0.0026	0.0028
113	0.0055	0.0026	0.0029
114	0.0055	0.0026	0.0029
115	0.0056	0.0027	0.0029
116	0.0056	0.0027	0.0029
117	0.0057	0.0027	0.0030
118	0.0057	0.0027	0.0030
119	0.0058	0.0028	0.0030
120	0.0058	0.0028	0.0030
121	0.0059	0.0028	0.0031
122	0.0059	0.0028	0.0031

123	0.0060	0.0028	0.0031
124	0.0060	0.0029	0.0031
125	0.0061	0.0029	0.0032
126	0.0061	0.0029	0.0032
127	0.0062	0.0029	0.0032
128	0.0062	0.0030	0.0032
129	0.0063	0.0030	0.0033
130	0.0063	0.0030	0.0033
131	0.0064	0.0031	0.0033
132	0.0064	0.0031	0.0034
133	0.0065	0.0031	0.0034
134	0.0066	0.0031	0.0034
135	0.0066	0.0032	0.0035
136	0.0067	0.0032	0.0035
137	0.0068	0.0032	0.0035
138	0.0068	0.0033	0.0036
139	0.0069	0.0033	0.0036
140	0.0070	0.0033	0.0036
141	0.0071	0.0034	0.0037
142	0.0071	0.0034	0.0037
143	0.0072	0.0035	0.0038
144	0.0073	0.0035	0.0038
145	0.0070	0.0033	0.0036
146	0.0071	0.0034	0.0037
147	0.0072	0.0034	0.0037
148	0.0072	0.0035	0.0038
149	0.0074	0.0035	0.0038
150	0.0074	0.0036	0.0039
151	0.0076	0.0036	0.0040
152	0.0077	0.0037	0.0040
153	0.0078	0.0037	0.0041
154	0.0079	0.0038	0.0041
155	0.0081	0.0039	0.0042
156	0.0082	0.0039	0.0043
157	0.0083	0.0040	0.0043
158	0.0084	0.0040	0.0044
159	0.0086	0.0041	0.0045
160	0.0087	0.0042	0.0046
161	0.0090	0.0043	0.0047
162	0.0091	0.0043	0.0047
163	0.0093	0.0045	0.0049
164	0.0094	0.0045	0.0049
165	0.0097	0.0046	0.0051
166	0.0099	0.0047	0.0051
167	0.0102	0.0049	0.0053
168	0.0103	0.0049	0.0054
169	0.0107	0.0051	0.0056
170	0.0109	0.0052	0.0057
171	0.0113	0.0054	0.0059
172	0.0115	0.0055	0.0060
173	0.0120	0.0057	0.0062
174	0.0122	0.0058	0.0064
175	0.0128	0.0061	0.0067
176	0.0131	0.0063	0.0068

177	0.0137	0.0066	0.0072
178	0.0141	0.0067	0.0074
179	0.0149	0.0071	0.0078
180	0.0154	0.0074	0.0080
181	0.0164	0.0078	0.0086
182	0.0170	0.0081	0.0089
183	0.0184	0.0088	0.0096
184	0.0192	0.0092	0.0100
185	0.0161	0.0077	0.0084
186	0.0172	0.0082	0.0090
187	0.0199	0.0095	0.0104
188	0.0218	0.0104	0.0113
189	0.0270	0.0129	0.0141
190	0.0311	0.0149	0.0163
191	0.0473	0.0191	0.0281
192	0.0686	0.0191	0.0495
193	0.2968	0.0191	0.2777
194	0.0372	0.0178	0.0194
195	0.0240	0.0115	0.0125
196	0.0184	0.0088	0.0096
197	0.0201	0.0096	0.0105
198	0.0177	0.0084	0.0092
199	0.0159	0.0076	0.0083
200	0.0145	0.0069	0.0076
201	0.0134	0.0064	0.0070
202	0.0125	0.0060	0.0065
203	0.0117	0.0056	0.0061
204	0.0111	0.0053	0.0058
205	0.0105	0.0050	0.0055
206	0.0100	0.0048	0.0052
207	0.0096	0.0046	0.0050
208	0.0092	0.0044	0.0048
209	0.0088	0.0042	0.0046
210	0.0085	0.0041	0.0045
211	0.0082	0.0039	0.0043
212	0.0080	0.0038	0.0042
213	0.0077	0.0037	0.0040
214	0.0075	0.0036	0.0039
215	0.0073	0.0035	0.0038
216	0.0071	0.0034	0.0037
217	0.0074	0.0035	0.0038
218	0.0072	0.0034	0.0038
219	0.0070	0.0034	0.0037
220	0.0069	0.0033	0.0036
221	0.0067	0.0032	0.0035
222	0.0066	0.0032	0.0034
223	0.0065	0.0031	0.0034
224	0.0063	0.0030	0.0033
225	0.0062	0.0030	0.0033
226	0.0061	0.0029	0.0032
227	0.0060	0.0029	0.0031
228	0.0059	0.0028	0.0031
229	0.0058	0.0028	0.0030
230	0.0057	0.0027	0.0030

231	0.0056	0.0027	0.0029
232	0.0056	0.0027	0.0029
233	0.0055	0.0026	0.0029
234	0.0054	0.0026	0.0028
235	0.0053	0.0025	0.0028
236	0.0053	0.0025	0.0027
237	0.0052	0.0025	0.0027
238	0.0051	0.0024	0.0027
239	0.0051	0.0024	0.0026
240	0.0050	0.0024	0.0026
241	0.0049	0.0024	0.0026
242	0.0049	0.0023	0.0025
243	0.0048	0.0023	0.0025
244	0.0048	0.0023	0.0025
245	0.0047	0.0023	0.0025
246	0.0047	0.0022	0.0024
247	0.0046	0.0022	0.0024
248	0.0046	0.0022	0.0024
249	0.0045	0.0022	0.0024
250	0.0045	0.0021	0.0023
251	0.0044	0.0021	0.0023
252	0.0044	0.0021	0.0023
253	0.0043	0.0021	0.0023
254	0.0043	0.0021	0.0022
255	0.0043	0.0020	0.0022
256	0.0042	0.0020	0.0022
257	0.0042	0.0020	0.0022
258	0.0041	0.0020	0.0022
259	0.0041	0.0020	0.0021
260	0.0041	0.0019	0.0021
261	0.0040	0.0019	0.0021
262	0.0040	0.0019	0.0021
263	0.0040	0.0019	0.0021
264	0.0039	0.0019	0.0020
265	0.0039	0.0019	0.0020
266	0.0039	0.0018	0.0020
267	0.0038	0.0018	0.0020
268	0.0038	0.0018	0.0020
269	0.0038	0.0018	0.0020
270	0.0037	0.0018	0.0020
271	0.0037	0.0018	0.0019
272	0.0037	0.0018	0.0019
273	0.0037	0.0018	0.0019
274	0.0036	0.0017	0.0019
275	0.0036	0.0017	0.0019
276	0.0036	0.0017	0.0019
277	0.0036	0.0017	0.0019
278	0.0035	0.0017	0.0018
279	0.0035	0.0017	0.0018
280	0.0035	0.0017	0.0018
281	0.0035	0.0017	0.0018
282	0.0034	0.0016	0.0018
283	0.0034	0.0016	0.0018
284	0.0034	0.0016	0.0018

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    285             0.0034           0.0016             0.0018
    286             0.0034           0.0016             0.0018
    287             0.0033           0.0016             0.0017
    288             0.0033           0.0016             0.0017
    --------------------------------------------------------------------
    --------------------------------------------------------------------
    Total soil rain loss =      0.95(In)
    Total effective rainfall =      1.32(In)
    Peak flow rate in flood hydrograph =     18.81(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       0.0001      0.01  Q         |         |         |         |
  0+10       0.0006      0.07  Q         |         |         |         |
  0+15       0.0017      0.17  Q         |         |         |         |
  0+20       0.0032      0.22  Q         |         |         |         |
  0+25       0.0049      0.25  Q         |         |         |         |
  0+30       0.0067      0.26  Q         |         |         |         |
  0+35       0.0086      0.28  Q         |         |         |         |
  0+40       0.0106      0.29  Q         |         |         |         |
  0+45       0.0127      0.30  Q         |         |         |         |
  0+50       0.0147      0.30  Q         |         |         |         |
  0+55       0.0169      0.31  Q         |         |         |         |
  1+ 0       0.0190      0.31  Q         |         |         |         |
  1+ 5       0.0212      0.32  Q         |         |         |         |
  1+10       0.0234      0.32  Q         |         |         |         |
  1+15       0.0256      0.32  Q         |         |         |         |
  1+20       0.0278      0.32  Q         |         |         |         |
  1+25       0.0301      0.33  Q         |         |         |         |
  1+30       0.0324      0.33  Q         |         |         |         |
  1+35       0.0346      0.33  Q         |         |         |         |
  1+40       0.0369      0.33  Q         |         |         |         |
  1+45       0.0392      0.33  Q         |         |         |         |
  1+50       0.0415      0.33  Q         |         |         |         |
  1+55       0.0438      0.33  QV        |         |         |         |
  2+ 0       0.0461      0.34  QV        |         |         |         |
  2+ 5       0.0484      0.34  QV        |         |         |         |
  2+10       0.0507      0.34  QV        |         |         |         |
  2+15       0.0531      0.34  QV        |         |         |         |
  2+20       0.0554      0.34  QV        |         |         |         |
  2+25       0.0578      0.34  QV        |         |         |         |
  2+30       0.0601      0.34  QV        |         |         |         |
  2+35       0.0625      0.34  QV        |         |         |         |
  2+40       0.0649      0.34  QV        |         |         |         |
  2+45       0.0672      0.35  QV        |         |         |         |
  2+50       0.0696      0.35  QV        |         |         |         |
  2+55       0.0720      0.35  QV        |         |         |         |
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3+ 0       0.0744      0.35  QV        |         |         |         |
3+ 5       0.0769      0.35  QV        |         |         |         |
3+10       0.0793      0.35  QV        |         |         |         |
3+15       0.0817      0.35  QV        |         |         |         |
3+20       0.0842      0.35  Q V       |         |         |         |
3+25       0.0866      0.36  Q V       |         |         |         |
3+30       0.0891      0.36  Q V       |         |         |         |
3+35       0.0915      0.36  Q V       |         |         |         |
3+40       0.0940      0.36  Q V       |         |         |         |
3+45       0.0965      0.36  Q V       |         |         |         |
3+50       0.0990      0.36  Q V       |         |         |         |
3+55       0.1015      0.36  Q V       |         |         |         |
4+ 0       0.1041      0.37  Q V       |         |         |         |
4+ 5       0.1066      0.37  Q V       |         |         |         |
4+10       0.1091      0.37  Q V       |         |         |         |
4+15       0.1117      0.37  Q V       |         |         |         |
4+20       0.1142      0.37  Q V       |         |         |         |
4+25       0.1168      0.37  Q V       |         |         |         |
4+30       0.1194      0.37  Q V       |         |         |         |
4+35       0.1220      0.38  Q V       |         |         |         |
4+40       0.1246      0.38  Q V       |         |         |         |
4+45       0.1272      0.38  Q  V      |         |         |         |
4+50       0.1298      0.38  Q  V      |         |         |         |
4+55       0.1325      0.38  Q  V      |         |         |         |
5+ 0       0.1351      0.38  Q  V      |         |         |         |
5+ 5       0.1378      0.39  Q  V      |         |         |         |
5+10       0.1404      0.39  Q  V      |         |         |         |
5+15       0.1431      0.39  Q  V      |         |         |         |
5+20       0.1458      0.39  Q  V      |         |         |         |
5+25       0.1485      0.39  Q  V      |         |         |         |
5+30       0.1512      0.39  Q  V      |         |         |         |
5+35       0.1540      0.40  Q  V      |         |         |         |
5+40       0.1567      0.40  Q  V      |         |         |         |
5+45       0.1594      0.40  Q  V      |         |         |         |
5+50       0.1622      0.40  Q  V      |         |         |         |
5+55       0.1650      0.40  Q  V      |         |         |         |
6+ 0       0.1678      0.41  Q   V     |         |         |         |
6+ 5       0.1706      0.41  Q   V     |         |         |         |
6+10       0.1734      0.41  Q   V     |         |         |         |
6+15       0.1762      0.41  Q   V     |         |         |         |
6+20       0.1791      0.41  Q   V     |         |         |         |
6+25       0.1820      0.42  Q   V     |         |         |         |
6+30       0.1848      0.42  Q   V     |         |         |         |
6+35       0.1877      0.42  Q   V     |         |         |         |
6+40       0.1906      0.42  Q   V     |         |         |         |
6+45       0.1935      0.42  Q   V     |         |         |         |
6+50       0.1965      0.43  Q   V     |         |         |         |
6+55       0.1994      0.43  Q   V     |         |         |         |
7+ 0       0.2024      0.43  Q   V     |         |         |         |
7+ 5       0.2054      0.43  Q   V     |         |         |         |
7+10       0.2083      0.43  Q    V    |         |         |         |
7+15       0.2114      0.44  Q    V    |         |         |         |
7+20       0.2144      0.44  Q    V    |         |         |         |
7+25       0.2174      0.44  Q    V    |         |         |         |
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 7+30       0.2205      0.44  Q    V    |         |         |         |
 7+35       0.2236      0.45  Q    V    |         |         |         |
 7+40       0.2267      0.45  Q    V    |         |         |         |
 7+45       0.2298      0.45  Q    V    |         |         |         |
 7+50       0.2329      0.45  Q    V    |         |         |         |
 7+55       0.2360      0.46  Q    V    |         |         |         |
 8+ 0       0.2392      0.46  Q    V    |         |         |         |
 8+ 5       0.2424      0.46  Q    V    |         |         |         |
 8+10       0.2456      0.46  Q    V    |         |         |         |
 8+15       0.2488      0.47  Q    V    |         |         |         |
 8+20       0.2520      0.47  Q     V   |         |         |         |
 8+25       0.2553      0.47  Q     V   |         |         |         |
 8+30       0.2586      0.48  Q     V   |         |         |         |
 8+35       0.2619      0.48  Q     V   |         |         |         |
 8+40       0.2652      0.48  Q     V   |         |         |         |
 8+45       0.2685      0.49  Q     V   |         |         |         |
 8+50       0.2719      0.49  Q     V   |         |         |         |
 8+55       0.2753      0.49  Q     V   |         |         |         |
 9+ 0       0.2787      0.49  Q     V   |         |         |         |
 9+ 5       0.2821      0.50  Q     V   |         |         |         |
 9+10       0.2856      0.50  |Q    V   |         |         |         |
 9+15       0.2891      0.50  |Q    V   |         |         |         |
 9+20       0.2926      0.51  |Q     V  |         |         |         |
 9+25       0.2961      0.51  |Q     V  |         |         |         |
 9+30       0.2996      0.52  |Q     V  |         |         |         |
 9+35       0.3032      0.52  |Q     V  |         |         |         |
 9+40       0.3068      0.52  |Q     V  |         |         |         |
 9+45       0.3104      0.53  |Q     V  |         |         |         |
 9+50       0.3141      0.53  |Q     V  |         |         |         |
 9+55       0.3178      0.53  |Q     V  |         |         |         |
10+ 0       0.3215      0.54  |Q     V  |         |         |         |
10+ 5       0.3252      0.54  |Q     V  |         |         |         |
10+10       0.3290      0.55  |Q     V  |         |         |         |
10+15       0.3328      0.55  |Q     V  |         |         |         |
10+20       0.3366      0.56  |Q      V |         |         |         |
10+25       0.3405      0.56  |Q      V |         |         |         |
10+30       0.3444      0.57  |Q      V |         |         |         |
10+35       0.3483      0.57  |Q      V |         |         |         |
10+40       0.3523      0.57  |Q      V |         |         |         |
10+45       0.3562      0.58  |Q      V |         |         |         |
10+50       0.3603      0.58  |Q      V |         |         |         |
10+55       0.3643      0.59  |Q      V |         |         |         |
11+ 0       0.3684      0.60  |Q      V |         |         |         |
11+ 5       0.3726      0.60  |Q      V |         |         |         |
11+10       0.3767      0.61  |Q       V|         |         |         |
11+15       0.3810      0.61  |Q       V|         |         |         |
11+20       0.3852      0.62  |Q       V|         |         |         |
11+25       0.3895      0.62  |Q       V|         |         |         |
11+30       0.3939      0.63  |Q       V|         |         |         |
11+35       0.3982      0.64  |Q       V|         |         |         |
11+40       0.4027      0.64  |Q       V|         |         |         |
11+45       0.4071      0.65  |Q       V|         |         |         |
11+50       0.4117      0.66  |Q       V|         |         |         |
11+55       0.4162      0.66  |Q       V|         |         |         |
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12+ 0       0.4209      0.67  |Q        V         |         |         |
12+ 5       0.4255      0.68  |Q        V         |         |         |
12+10       0.4302      0.68  |Q        V         |         |         |
12+15       0.4348      0.67  |Q        V         |         |         |
12+20       0.4395      0.68  |Q        V         |         |         |
12+25       0.4442      0.68  |Q        V         |         |         |
12+30       0.4489      0.69  |Q        V         |         |         |
12+35       0.4537      0.69  |Q        V         |         |         |
12+40       0.4585      0.70  |Q        |V        |         |         |
12+45       0.4634      0.71  |Q        |V        |         |         |
12+50       0.4684      0.72  |Q        |V        |         |         |
12+55       0.4734      0.73  |Q        |V        |         |         |
13+ 0       0.4786      0.74  |Q        |V        |         |         |
13+ 5       0.4837      0.75  |Q        |V        |         |         |
13+10       0.4890      0.76  |Q        |V        |         |         |
13+15       0.4944      0.78  |Q        |V        |         |         |
13+20       0.4998      0.79  |Q        |V        |         |         |
13+25       0.5053      0.80  |Q        | V       |         |         |
13+30       0.5110      0.82  |Q        | V       |         |         |
13+35       0.5167      0.83  |Q        | V       |         |         |
13+40       0.5225      0.85  |Q        | V       |         |         |
13+45       0.5285      0.86  |Q        | V       |         |         |
13+50       0.5345      0.88  |Q        | V       |         |         |
13+55       0.5407      0.90  |Q        | V       |         |         |
14+ 0       0.5471      0.92  |Q        |  V      |         |         |
14+ 5       0.5536      0.94  |Q        |  V      |         |         |
14+10       0.5602      0.96  |Q        |  V      |         |         |
14+15       0.5670      0.99  |Q        |  V      |         |         |
14+20       0.5739      1.01  | Q       |  V      |         |         |
14+25       0.5811      1.04  | Q       |  V      |         |         |
14+30       0.5884      1.07  | Q       |   V     |         |         |
14+35       0.5960      1.10  | Q       |   V     |         |         |
14+40       0.6038      1.13  | Q       |   V     |         |         |
14+45       0.6118      1.17  | Q       |   V     |         |         |
14+50       0.6201      1.21  | Q       |   V     |         |         |
14+55       0.6287      1.25  | Q       |    V    |         |         |
15+ 0       0.6377      1.30  | Q       |    V    |         |         |
15+ 5       0.6470      1.35  | Q       |    V    |         |         |
15+10       0.6567      1.41  | Q       |    V    |         |         |
15+15       0.6668      1.48  | Q       |     V   |         |         |
15+20       0.6775      1.55  |  Q      |     V   |         |         |
15+25       0.6888      1.63  |  Q      |     V   |         |         |
15+30       0.7000      1.64  |  Q      |     V   |         |         |
15+35       0.7111      1.61  |  Q      |      V  |         |         |
15+40       0.7227      1.68  |  Q      |      V  |         |         |
15+45       0.7352      1.82  |  Q      |      V  |         |         |
15+50       0.7491      2.02  |   Q     |      V  |         |         |
15+55       0.7655      2.38  |   Q     |       V |         |         |
16+ 0       0.7872      3.15  |     Q   |       V |         |         |
16+ 5       0.8287      6.02  |         | Q      V|         |         |
16+10       0.9272     14.30  |         |         | V     Q |         |
16+15       1.0567     18.81  |         |         |    V    |      Q  |
16+20       1.1304     10.71  |         |         |Q     V  |         |
16+25       1.1788      7.03  |         |   Q     |       V |         |
```

```
16+30       1.2150      5.25  |         Q         |        V|         |
16+35       1.2447      4.31  |       Q |         |        V|         |
16+40       1.2689      3.52  |      Q  |         |         V         |
16+45       1.2895      2.99  |    Q    |         |         V         |
16+50       1.3074      2.60  |    Q    |         |         |V        |
16+55       1.3230      2.26  |   Q     |         |         |V        |
17+ 0       1.3367      1.99  |  Q      |         |         | V       |
17+ 5       1.3486      1.73  |  Q      |         |         | V       |
17+10       1.3590      1.51  |  Q      |         |         | V       |
17+15       1.3688      1.42  | Q       |         |         | V       |
17+20       1.3782      1.37  | Q       |         |         |  V      |
17+25       1.3868      1.25  | Q       |         |         |  V      |
17+30       1.3948      1.17  | Q       |         |         |  V      |
17+35       1.4012      0.93  |Q        |         |         |  V      |
17+40       1.4073      0.88  |Q        |         |         |  V      |
17+45       1.4131      0.85  |Q        |         |         |  V      |
17+50       1.4188      0.82  |Q        |         |         |   V     |
17+55       1.4242      0.79  |Q        |         |         |   V     |
18+ 0       1.4294      0.76  |Q        |         |         |   V     |
18+ 5       1.4345      0.74  |Q        |         |         |   V     |
18+10       1.4395      0.72  |Q        |         |         |   V     |
18+15       1.4444      0.72  |Q        |         |         |   V     |
18+20       1.4492      0.70  |Q        |         |         |   V     |
18+25       1.4540      0.69  |Q        |         |         |   V     |
18+30       1.4586      0.67  |Q        |         |         |    V    |
18+35       1.4632      0.66  |Q        |         |         |    V    |
18+40       1.4676      0.65  |Q        |         |         |    V    |
18+45       1.4720      0.64  |Q        |         |         |    V    |
18+50       1.4763      0.62  |Q        |         |         |    V    |
18+55       1.4805      0.61  |Q        |         |         |    V    |
19+ 0       1.4846      0.60  |Q        |         |         |    V    |
19+ 5       1.4887      0.59  |Q        |         |         |    V    |
19+10       1.4927      0.58  |Q        |         |         |    V    |
19+15       1.4966      0.57  |Q        |         |         |    V    |
19+20       1.5005      0.56  |Q        |         |         |     V   |
19+25       1.5043      0.55  |Q        |         |         |     V   |
19+30       1.5080      0.54  |Q        |         |         |     V   |
19+35       1.5117      0.53  |Q        |         |         |     V   |
19+40       1.5153      0.53  |Q        |         |         |     V   |
19+45       1.5189      0.52  |Q        |         |         |     V   |
19+50       1.5224      0.51  |Q        |         |         |     V   |
19+55       1.5259      0.50  |Q        |         |         |     V   |
20+ 0       1.5294      0.50  Q         |         |         |     V   |
20+ 5       1.5327      0.49  Q         |         |         |     V   |
20+10       1.5361      0.49  Q         |         |         |     V   |
20+15       1.5394      0.48  Q         |         |         |     V   |
20+20       1.5426      0.47  Q         |         |         |      V  |
20+25       1.5459      0.47  Q         |         |         |      V  |
20+30       1.5490      0.46  Q         |         |         |      V  |
20+35       1.5522      0.46  Q         |         |         |      V  |
20+40       1.5553      0.45  Q         |         |         |      V  |
20+45       1.5584      0.45  Q         |         |         |      V  |
20+50       1.5614      0.44  Q         |         |         |      V  |
20+55       1.5644      0.44  Q         |         |         |      V  |
```

```
   21+ 0       1.5674      0.43  Q         |         |         |      V  |
   21+ 5       1.5704      0.43  Q         |         |         |      V  |
   21+10       1.5733      0.42  Q         |         |         |      V  |
   21+15       1.5762      0.42  Q         |         |         |      V  |
   21+20       1.5790      0.42  Q         |         |         |      V  |
   21+25       1.5818      0.41  Q         |         |         |      V  |
   21+30       1.5847      0.41  Q         |         |         |       V |
   21+35       1.5874      0.40  Q         |         |         |       V |
   21+40       1.5902      0.40  Q         |         |         |       V |
   21+45       1.5929      0.40  Q         |         |         |       V |
   21+50       1.5956      0.39  Q         |         |         |       V |
   21+55       1.5983      0.39  Q         |         |         |       V |
   22+ 0       1.6010      0.39  Q         |         |         |       V |
   22+ 5       1.6036      0.38  Q         |         |         |       V |
   22+10       1.6062      0.38  Q         |         |         |       V |
   22+15       1.6088      0.38  Q         |         |         |       V |
   22+20       1.6114      0.37  Q         |         |         |       V |
   22+25       1.6139      0.37  Q         |         |         |       V |
   22+30       1.6164      0.37  Q         |         |         |       V |
   22+35       1.6189      0.36  Q         |         |         |       V |
   22+40       1.6214      0.36  Q         |         |         |       V |
   22+45       1.6239      0.36  Q         |         |         |       V |
   22+50       1.6264      0.36  Q         |         |         |        V|
   22+55       1.6288      0.35  Q         |         |         |        V|
   23+ 0       1.6312      0.35  Q         |         |         |        V|
   23+ 5       1.6336      0.35  Q         |         |         |        V|
   23+10       1.6360      0.35  Q         |         |         |        V|
   23+15       1.6384      0.34  Q         |         |         |        V|
   23+20       1.6407      0.34  Q         |         |         |        V|
   23+25       1.6430      0.34  Q         |         |         |        V|
   23+30       1.6454      0.34  Q         |         |         |        V|
   23+35       1.6477      0.33  Q         |         |         |        V|
   23+40       1.6499      0.33  Q         |         |         |        V|
   23+45       1.6522      0.33  Q         |         |         |        V|
   23+50       1.6545      0.33  Q         |         |         |        V|
   23+55       1.6567      0.33  Q         |         |         |        V|
   24+ 0       1.6589      0.32  Q         |         |         |        V|
-----------------------------------------------------------------------
```

TR. 20525

10-year, 24-Hours Storm Events

Unit Hydrograph Post–Developed

```
      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 - 2004, Version 7.0

            Study date  08/26/22

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

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


Program License Serial Number 4070

---------------------------------------------------------------------
10-YR, 24-HOUR UNIT HYDROGRAPH POST DEVELOPED
TR 20525, CITY OF VICTORVILLE
AREA AA & BB (ONSITE AREAS TOWARDS NORTHWEST CORNER to BASIN No.1)
FILE: 20525HYDROAA110YR.OUT
--------------------------------------------------------------------

      Storm Event Year = 10

      Antecedent Moisture Condition = 3

 English (in-lb) Input Units Used

 English Rainfall Data (Inches) Input Values Used

 English Units used in output format



Area averaged rainfall intensity isohyetal data:
      Sub-Area        Duration        Isohyetal
      (Ac.)            (hours)         (In)
Rainfall data for year 10
          28.99           1           0.63
--------------------------------------------------------------------
Rainfall data for year 10
          28.99           6           1.27
--------------------------------------------------------------------
Rainfall data for year 10
          28.99          24           2.27
--------------------------------------------------------------------
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++

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

```
SCS curve  SCS curve     Area     Area     Fp(Fig C6)    Ap      Fm
No.(AMCII) NO.(AMC 3)    (Ac.)    Fraction    (In/Hr)  (dec.)   (In/Hr)
 54.1      74.1         28.99      1.000     0.468    0.600    0.281

Area-averaged adjusted loss rate Fm (In/Hr) =  0.281

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

Area       Area          SCS CN    SCS CN      S     Pervious
 (Ac.)      Fract         (AMC2)    (AMC3)           Yield Fr
    17.39   0.600         54.1      74.1       3.50     0.215
    11.60   0.400         98.0      98.0       0.20     0.900

Area-averaged catchment yield fraction, Y =  0.489
Area-averaged low loss fraction, Yb =  0.511
User entry of time of concentration  =   0.306 (hours)
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Watershed area =      28.99(Ac.)
Catchment Lag time =   0.245 hours
Unit interval =   5.000 minutes
Unit interval percentage of lag time = 34.0637
Hydrograph baseflow =     0.00(CFS)
Average maximum watershed loss rate(Fm) =  0.281(In/Hr)
Average low loss rate fraction (Yb) = 0.511 (decimal)
DESERT S-Graph Selected
Computed peak 5-minute rainfall =  0.297(In)
Computed peak 30-minute rainfall =  0.508(In)
Specified peak 1-hour rainfall =  0.626(In)
Computed peak 3-hour rainfall =  0.966(In)
Specified peak 6-hour rainfall =  1.270(In)
Specified peak 24-hour rainfall =  2.270(In)


Rainfall depth area reduction factors:
Using a total area of      28.99(Ac.) (Ref: fig. E-4)

5-minute factor = 0.999     Adjusted rainfall =  0.297(In)
30-minute factor = 0.999    Adjusted rainfall =  0.508(In)
1-hour factor = 0.999       Adjusted rainfall =  0.625(In)
3-hour factor = 1.000       Adjusted rainfall =  0.966(In)
6-hour factor = 1.000       Adjusted rainfall =  1.270(In)
24-hour factor = 1.000      Adjusted rainfall =  2.270(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 =       350.60 (CFS))

  1                2.141                   7.507
  2               12.528                  36.416
  3               39.187                  93.466
```

```
  4               58.736                  68.537
  5               69.185                  36.636
  6               76.122                  24.321
  7               81.063                  17.322
  8               84.802                  13.110
  9               87.849                  10.682
 10               90.102                   7.898
 11               91.958                   6.507
 12               93.525                   5.494
 13               94.777                   4.390
 14               95.850                   3.763
 15               96.728                   3.077
 16               97.404                   2.370
 17               97.918                   1.801
 18               98.266                   1.222
 19               98.662                   1.388
 20               99.071                   1.433
 21               99.460                   1.364
 22               99.702                   0.850
 23              100.000                   0.425
----------------------------------------------------------------------
Peak Unit   Adjusted mass rainfall  Unit rainfall
Number              (In)                (In)
  1              0.2966               0.2966
  2              0.3652               0.0686
  3              0.4124               0.0472
  4              0.4496               0.0372
  5              0.4808               0.0311
  6              0.5078               0.0270
  7              0.5318               0.0240
  8              0.5535               0.0217
  9              0.5735               0.0199
 10              0.5919               0.0184
 11              0.6090               0.0172
 12              0.6251               0.0161
 13              0.6453               0.0201
 14              0.6645               0.0192
 15              0.6829               0.0184
 16              0.7006               0.0177
 17              0.7176               0.0170
 18              0.7340               0.0164
 19              0.7499               0.0159
 20              0.7653               0.0154
 21              0.7802               0.0149
 22              0.7947               0.0145
 23              0.8088               0.0141
 24              0.8225               0.0137
 25              0.8360               0.0134
 26              0.8490               0.0131
 27              0.8618               0.0128
 28              0.8743               0.0125
 29              0.8865               0.0122
 30              0.8985               0.0120
 31              0.9103               0.0117
```

32	0.9218	0.0115
33	0.9331	0.0113
34	0.9442	0.0111
35	0.9551	0.0109
36	0.9658	0.0107
37	0.9763	0.0105
38	0.9866	0.0103
39	0.9968	0.0102
40	1.0068	0.0100
41	1.0167	0.0099
42	1.0264	0.0097
43	1.0360	0.0096
44	1.0454	0.0094
45	1.0548	0.0093
46	1.0639	0.0092
47	1.0730	0.0091
48	1.0820	0.0090
49	1.0908	0.0088
50	1.0996	0.0087
51	1.1082	0.0086
52	1.1167	0.0085
53	1.1252	0.0084
54	1.1335	0.0083
55	1.1417	0.0082
56	1.1499	0.0082
57	1.1580	0.0081
58	1.1659	0.0080
59	1.1738	0.0079
60	1.1817	0.0078
61	1.1894	0.0077
62	1.1971	0.0077
63	1.2047	0.0076
64	1.2122	0.0075
65	1.2196	0.0074
66	1.2270	0.0074
67	1.2343	0.0073
68	1.2415	0.0072
69	1.2487	0.0072
70	1.2558	0.0071
71	1.2629	0.0071
72	1.2699	0.0070
73	1.2772	0.0074
74	1.2845	0.0073
75	1.2918	0.0072
76	1.2990	0.0072
77	1.3061	0.0071
78	1.3132	0.0071
79	1.3202	0.0070
80	1.3272	0.0070
81	1.3341	0.0069
82	1.3410	0.0069
83	1.3478	0.0068
84	1.3546	0.0068
85	1.3613	0.0067

86	1.3680	0.0067
87	1.3747	0.0066
88	1.3813	0.0066
89	1.3878	0.0066
90	1.3943	0.0065
91	1.4008	0.0065
92	1.4072	0.0064
93	1.4136	0.0064
94	1.4200	0.0063
95	1.4263	0.0063
96	1.4326	0.0063
97	1.4388	0.0062
98	1.4450	0.0062
99	1.4511	0.0062
100	1.4573	0.0061
101	1.4634	0.0061
102	1.4694	0.0061
103	1.4754	0.0060
104	1.4814	0.0060
105	1.4874	0.0060
106	1.4933	0.0059
107	1.4992	0.0059
108	1.5050	0.0059
109	1.5108	0.0058
110	1.5166	0.0058
111	1.5224	0.0058
112	1.5281	0.0057
113	1.5338	0.0057
114	1.5395	0.0057
115	1.5451	0.0056
116	1.5508	0.0056
117	1.5563	0.0056
118	1.5619	0.0056
119	1.5674	0.0055
120	1.5729	0.0055
121	1.5784	0.0055
122	1.5839	0.0055
123	1.5893	0.0054
124	1.5947	0.0054
125	1.6001	0.0054
126	1.6054	0.0054
127	1.6108	0.0053
128	1.6161	0.0053
129	1.6213	0.0053
130	1.6266	0.0053
131	1.6318	0.0052
132	1.6370	0.0052
133	1.6422	0.0052
134	1.6474	0.0052
135	1.6525	0.0051
136	1.6576	0.0051
137	1.6627	0.0051
138	1.6678	0.0051
139	1.6729	0.0051

140	1.6779	0.0050
141	1.6829	0.0050
142	1.6879	0.0050
143	1.6929	0.0050
144	1.6978	0.0049
145	1.7027	0.0049
146	1.7076	0.0049
147	1.7125	0.0049
148	1.7174	0.0049
149	1.7223	0.0049
150	1.7271	0.0048
151	1.7319	0.0048
152	1.7367	0.0048
153	1.7415	0.0048
154	1.7462	0.0048
155	1.7510	0.0047
156	1.7557	0.0047
157	1.7604	0.0047
158	1.7651	0.0047
159	1.7698	0.0047
160	1.7744	0.0047
161	1.7791	0.0046
162	1.7837	0.0046
163	1.7883	0.0046
164	1.7929	0.0046
165	1.7975	0.0046
166	1.8020	0.0046
167	1.8065	0.0045
168	1.8111	0.0045
169	1.8156	0.0045
170	1.8201	0.0045
171	1.8246	0.0045
172	1.8290	0.0045
173	1.8335	0.0044
174	1.8379	0.0044
175	1.8423	0.0044
176	1.8467	0.0044
177	1.8511	0.0044
178	1.8555	0.0044
179	1.8598	0.0044
180	1.8642	0.0043
181	1.8685	0.0043
182	1.8728	0.0043
183	1.8771	0.0043
184	1.8814	0.0043
185	1.8857	0.0043
186	1.8900	0.0043
187	1.8942	0.0043
188	1.8985	0.0042
189	1.9027	0.0042
190	1.9069	0.0042
191	1.9111	0.0042
192	1.9153	0.0042
193	1.9195	0.0042

194	1.9236	0.0042
195	1.9278	0.0041
196	1.9319	0.0041
197	1.9360	0.0041
198	1.9401	0.0041
199	1.9442	0.0041
200	1.9483	0.0041
201	1.9524	0.0041
202	1.9565	0.0041
203	1.9605	0.0041
204	1.9646	0.0040
205	1.9686	0.0040
206	1.9726	0.0040
207	1.9766	0.0040
208	1.9806	0.0040
209	1.9846	0.0040
210	1.9886	0.0040
211	1.9925	0.0040
212	1.9965	0.0040
213	2.0004	0.0039
214	2.0043	0.0039
215	2.0083	0.0039
216	2.0122	0.0039
217	2.0161	0.0039
218	2.0200	0.0039
219	2.0238	0.0039
220	2.0277	0.0039
221	2.0316	0.0039
222	2.0354	0.0038
223	2.0392	0.0038
224	2.0431	0.0038
225	2.0469	0.0038
226	2.0507	0.0038
227	2.0545	0.0038
228	2.0583	0.0038
229	2.0620	0.0038
230	2.0658	0.0038
231	2.0696	0.0038
232	2.0733	0.0037
233	2.0771	0.0037
234	2.0808	0.0037
235	2.0845	0.0037
236	2.0882	0.0037
237	2.0919	0.0037
238	2.0956	0.0037
239	2.0993	0.0037
240	2.1030	0.0037
241	2.1066	0.0037
242	2.1103	0.0037
243	2.1140	0.0036
244	2.1176	0.0036
245	2.1212	0.0036
246	2.1249	0.0036
247	2.1285	0.0036

```
248              2.1321               0.0036
249              2.1357               0.0036
250              2.1393               0.0036
251              2.1428               0.0036
252              2.1464               0.0036
253              2.1500               0.0036
254              2.1535               0.0036
255              2.1571               0.0035
256              2.1606               0.0035
257              2.1642               0.0035
258              2.1677               0.0035
259              2.1712               0.0035
260              2.1747               0.0035
261              2.1782               0.0035
262              2.1817               0.0035
263              2.1852               0.0035
264              2.1887               0.0035
265              2.1921               0.0035
266              2.1956               0.0035
267              2.1990               0.0035
268              2.2025               0.0034
269              2.2059               0.0034
270              2.2094               0.0034
271              2.2128               0.0034
272              2.2162               0.0034
273              2.2196               0.0034
274              2.2230               0.0034
275              2.2264               0.0034
276              2.2298               0.0034
277              2.2332               0.0034
278              2.2366               0.0034
279              2.2399               0.0034
280              2.2433               0.0034
281              2.2466               0.0034
282              2.2500               0.0033
283              2.2533               0.0033
284              2.2567               0.0033
285              2.2600               0.0033
286              2.2633               0.0033
287              2.2666               0.0033
288              2.2699               0.0033
---------------------------------------------------------------------
Unit              Unit            Unit              Effective
Period            Rainfall        Soil-Loss         Rainfall
(number)            (In)          (In)                 (In)
---------------------------------------------------------------------
  1              0.0033           0.0017              0.0016
  2              0.0033           0.0017              0.0016
  3              0.0033           0.0017              0.0016
  4              0.0033           0.0017              0.0016
  5              0.0033           0.0017              0.0016
  6              0.0034           0.0017              0.0016
  7              0.0034           0.0017              0.0016
  8              0.0034           0.0017              0.0016
```

9	0.0034	0.0017	0.0017
10	0.0034	0.0017	0.0017
11	0.0034	0.0017	0.0017
12	0.0034	0.0017	0.0017
13	0.0034	0.0018	0.0017
14	0.0034	0.0018	0.0017
15	0.0035	0.0018	0.0017
16	0.0035	0.0018	0.0017
17	0.0035	0.0018	0.0017
18	0.0035	0.0018	0.0017
19	0.0035	0.0018	0.0017
20	0.0035	0.0018	0.0017
21	0.0035	0.0018	0.0017
22	0.0035	0.0018	0.0017
23	0.0035	0.0018	0.0017
24	0.0036	0.0018	0.0017
25	0.0036	0.0018	0.0017
26	0.0036	0.0018	0.0017
27	0.0036	0.0018	0.0018
28	0.0036	0.0018	0.0018
29	0.0036	0.0019	0.0018
30	0.0036	0.0019	0.0018
31	0.0036	0.0019	0.0018
32	0.0037	0.0019	0.0018
33	0.0037	0.0019	0.0018
34	0.0037	0.0019	0.0018
35	0.0037	0.0019	0.0018
36	0.0037	0.0019	0.0018
37	0.0037	0.0019	0.0018
38	0.0037	0.0019	0.0018
39	0.0038	0.0019	0.0018
40	0.0038	0.0019	0.0018
41	0.0038	0.0019	0.0019
42	0.0038	0.0019	0.0019
43	0.0038	0.0020	0.0019
44	0.0038	0.0020	0.0019
45	0.0038	0.0020	0.0019
46	0.0039	0.0020	0.0019
47	0.0039	0.0020	0.0019
48	0.0039	0.0020	0.0019
49	0.0039	0.0020	0.0019
50	0.0039	0.0020	0.0019
51	0.0039	0.0020	0.0019
52	0.0040	0.0020	0.0019
53	0.0040	0.0020	0.0019
54	0.0040	0.0020	0.0019
55	0.0040	0.0020	0.0020
56	0.0040	0.0021	0.0020
57	0.0040	0.0021	0.0020
58	0.0041	0.0021	0.0020
59	0.0041	0.0021	0.0020
60	0.0041	0.0021	0.0020
61	0.0041	0.0021	0.0020
62	0.0041	0.0021	0.0020

63	0.0041	0.0021	0.0020
64	0.0042	0.0021	0.0020
65	0.0042	0.0021	0.0020
66	0.0042	0.0021	0.0021
67	0.0042	0.0022	0.0021
68	0.0042	0.0022	0.0021
69	0.0043	0.0022	0.0021
70	0.0043	0.0022	0.0021
71	0.0043	0.0022	0.0021
72	0.0043	0.0022	0.0021
73	0.0043	0.0022	0.0021
74	0.0044	0.0022	0.0021
75	0.0044	0.0022	0.0021
76	0.0044	0.0023	0.0022
77	0.0044	0.0023	0.0022
78	0.0044	0.0023	0.0022
79	0.0045	0.0023	0.0022
80	0.0045	0.0023	0.0022
81	0.0045	0.0023	0.0022
82	0.0045	0.0023	0.0022
83	0.0046	0.0023	0.0022
84	0.0046	0.0023	0.0022
85	0.0046	0.0024	0.0023
86	0.0046	0.0024	0.0023
87	0.0047	0.0024	0.0023
88	0.0047	0.0024	0.0023
89	0.0047	0.0024	0.0023
90	0.0047	0.0024	0.0023
91	0.0048	0.0024	0.0023
92	0.0048	0.0025	0.0023
93	0.0048	0.0025	0.0024
94	0.0049	0.0025	0.0024
95	0.0049	0.0025	0.0024
96	0.0049	0.0025	0.0024
97	0.0049	0.0025	0.0024
98	0.0050	0.0025	0.0024
99	0.0050	0.0026	0.0024
100	0.0050	0.0026	0.0025
101	0.0051	0.0026	0.0025
102	0.0051	0.0026	0.0025
103	0.0051	0.0026	0.0025
104	0.0052	0.0026	0.0025
105	0.0052	0.0027	0.0025
106	0.0052	0.0027	0.0026
107	0.0053	0.0027	0.0026
108	0.0053	0.0027	0.0026
109	0.0054	0.0027	0.0026
110	0.0054	0.0027	0.0026
111	0.0054	0.0028	0.0027
112	0.0055	0.0028	0.0027
113	0.0055	0.0028	0.0027
114	0.0055	0.0028	0.0027
115	0.0056	0.0029	0.0027
116	0.0056	0.0029	0.0027

117	0.0057	0.0029	0.0028
118	0.0057	0.0029	0.0028
119	0.0058	0.0029	0.0028
120	0.0058	0.0030	0.0028
121	0.0059	0.0030	0.0029
122	0.0059	0.0030	0.0029
123	0.0060	0.0030	0.0029
124	0.0060	0.0031	0.0029
125	0.0061	0.0031	0.0030
126	0.0061	0.0031	0.0030
127	0.0062	0.0031	0.0030
128	0.0062	0.0032	0.0030
129	0.0063	0.0032	0.0031
130	0.0063	0.0032	0.0031
131	0.0064	0.0033	0.0031
132	0.0064	0.0033	0.0031
133	0.0065	0.0033	0.0032
134	0.0066	0.0034	0.0032
135	0.0066	0.0034	0.0032
136	0.0067	0.0034	0.0033
137	0.0068	0.0035	0.0033
138	0.0068	0.0035	0.0033
139	0.0069	0.0035	0.0034
140	0.0070	0.0036	0.0034
141	0.0071	0.0036	0.0035
142	0.0071	0.0036	0.0035
143	0.0072	0.0037	0.0035
144	0.0073	0.0037	0.0036
145	0.0070	0.0036	0.0034
146	0.0071	0.0036	0.0034
147	0.0072	0.0037	0.0035
148	0.0072	0.0037	0.0035
149	0.0074	0.0038	0.0036
150	0.0074	0.0038	0.0036
151	0.0076	0.0039	0.0037
152	0.0077	0.0039	0.0037
153	0.0078	0.0040	0.0038
154	0.0079	0.0040	0.0039
155	0.0081	0.0041	0.0039
156	0.0082	0.0042	0.0040
157	0.0083	0.0043	0.0041
158	0.0084	0.0043	0.0041
159	0.0086	0.0044	0.0042
160	0.0087	0.0045	0.0043
161	0.0090	0.0046	0.0044
162	0.0091	0.0046	0.0044
163	0.0093	0.0048	0.0046
164	0.0094	0.0048	0.0046
165	0.0097	0.0050	0.0048
166	0.0099	0.0050	0.0048
167	0.0102	0.0052	0.0050
168	0.0103	0.0053	0.0051
169	0.0107	0.0055	0.0052
170	0.0109	0.0056	0.0053

171	0.0113	0.0058	0.0055
172	0.0115	0.0059	0.0056
173	0.0120	0.0061	0.0059
174	0.0122	0.0063	0.0060
175	0.0128	0.0065	0.0062
176	0.0131	0.0067	0.0064
177	0.0137	0.0070	0.0067
178	0.0141	0.0072	0.0069
179	0.0149	0.0076	0.0073
180	0.0154	0.0079	0.0075
181	0.0164	0.0084	0.0080
182	0.0170	0.0087	0.0083
183	0.0184	0.0094	0.0090
184	0.0192	0.0098	0.0094
185	0.0161	0.0082	0.0079
186	0.0172	0.0088	0.0084
187	0.0199	0.0102	0.0097
188	0.0217	0.0111	0.0106
189	0.0270	0.0138	0.0132
190	0.0311	0.0159	0.0152
191	0.0472	0.0234	0.0239
192	0.0686	0.0234	0.0452
193	0.2966	0.0234	0.2733
194	0.0372	0.0190	0.0182
195	0.0240	0.0123	0.0117
196	0.0184	0.0094	0.0090
197	0.0201	0.0103	0.0098
198	0.0177	0.0090	0.0086
199	0.0159	0.0081	0.0078
200	0.0145	0.0074	0.0071
201	0.0134	0.0069	0.0065
202	0.0125	0.0064	0.0061
203	0.0117	0.0060	0.0057
204	0.0111	0.0057	0.0054
205	0.0105	0.0054	0.0051
206	0.0100	0.0051	0.0049
207	0.0096	0.0049	0.0047
208	0.0092	0.0047	0.0045
209	0.0088	0.0045	0.0043
210	0.0085	0.0044	0.0042
211	0.0082	0.0042	0.0040
212	0.0080	0.0041	0.0039
213	0.0077	0.0040	0.0038
214	0.0075	0.0038	0.0037
215	0.0073	0.0037	0.0036
216	0.0071	0.0036	0.0035
217	0.0074	0.0038	0.0036
218	0.0072	0.0037	0.0035
219	0.0070	0.0036	0.0034
220	0.0069	0.0035	0.0034
221	0.0067	0.0034	0.0033
222	0.0066	0.0034	0.0032
223	0.0065	0.0033	0.0032
224	0.0063	0.0032	0.0031

225	0.0062	0.0032	0.0030
226	0.0061	0.0031	0.0030
227	0.0060	0.0031	0.0029
228	0.0059	0.0030	0.0029
229	0.0058	0.0030	0.0028
230	0.0057	0.0029	0.0028
231	0.0056	0.0029	0.0028
232	0.0056	0.0028	0.0027
233	0.0055	0.0028	0.0027
234	0.0054	0.0028	0.0026
235	0.0053	0.0027	0.0026
236	0.0053	0.0027	0.0026
237	0.0052	0.0027	0.0025
238	0.0051	0.0026	0.0025
239	0.0051	0.0026	0.0025
240	0.0050	0.0026	0.0024
241	0.0049	0.0025	0.0024
242	0.0049	0.0025	0.0024
243	0.0048	0.0025	0.0024
244	0.0048	0.0024	0.0023
245	0.0047	0.0024	0.0023
246	0.0047	0.0024	0.0023
247	0.0046	0.0024	0.0022
248	0.0046	0.0023	0.0022
249	0.0045	0.0023	0.0022
250	0.0045	0.0023	0.0022
251	0.0044	0.0023	0.0022
252	0.0044	0.0022	0.0021
253	0.0043	0.0022	0.0021
254	0.0043	0.0022	0.0021
255	0.0043	0.0022	0.0021
256	0.0042	0.0022	0.0021
257	0.0042	0.0021	0.0020
258	0.0041	0.0021	0.0020
259	0.0041	0.0021	0.0020
260	0.0041	0.0021	0.0020
261	0.0040	0.0021	0.0020
262	0.0040	0.0020	0.0020
263	0.0040	0.0020	0.0019
264	0.0039	0.0020	0.0019
265	0.0039	0.0020	0.0019
266	0.0039	0.0020	0.0019
267	0.0038	0.0020	0.0019
268	0.0038	0.0019	0.0019
269	0.0038	0.0019	0.0018
270	0.0037	0.0019	0.0018
271	0.0037	0.0019	0.0018
272	0.0037	0.0019	0.0018
273	0.0037	0.0019	0.0018
274	0.0036	0.0019	0.0018
275	0.0036	0.0018	0.0018
276	0.0036	0.0018	0.0018
277	0.0036	0.0018	0.0017
278	0.0035	0.0018	0.0017

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    279              0.0035           0.0018              0.0017
    280              0.0035           0.0018              0.0017
    281              0.0035           0.0018              0.0017
    282              0.0034           0.0018              0.0017
    283              0.0034           0.0018              0.0017
    284              0.0034           0.0017              0.0017
    285              0.0034           0.0017              0.0017
    286              0.0034           0.0017              0.0016
    287              0.0033           0.0017              0.0016
    288              0.0033           0.0017              0.0016
    --------------------------------------------------------------------
    --------------------------------------------------------------------
    Total soil rain loss =      1.02(In)
    Total effective rainfall =      1.25(In)
    Peak flow rate in flood hydrograph =     31.44(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       10.0      20.0      30.0      40.0
-----------------------------------------------------------------------
  0+ 5       0.0001      0.01  Q         |         |         |         |
  0+10       0.0006      0.07  Q         |         |         |         |
  0+15       0.0021      0.22  Q         |         |         |         |
  0+20       0.0044      0.33  Q         |         |         |         |
  0+25       0.0071      0.39  Q         |         |         |         |
  0+30       0.0101      0.43  Q         |         |         |         |
  0+35       0.0133      0.46  Q         |         |         |         |
  0+40       0.0166      0.49  Q         |         |         |         |
  0+45       0.0201      0.50  Q         |         |         |         |
  0+50       0.0237      0.52  Q         |         |         |         |
  0+55       0.0273      0.53  Q         |         |         |         |
  1+ 0       0.0311      0.54  Q         |         |         |         |
  1+ 5       0.0349      0.55  Q         |         |         |         |
  1+10       0.0387      0.56  Q         |         |         |         |
  1+15       0.0426      0.57  Q         |         |         |         |
  1+20       0.0465      0.57  Q         |         |         |         |
  1+25       0.0505      0.58  Q         |         |         |         |
  1+30       0.0545      0.58  Q         |         |         |         |
  1+35       0.0585      0.58  Q         |         |         |         |
  1+40       0.0625      0.59  Q         |         |         |         |
  1+45       0.0666      0.59  Q         |         |         |         |
  1+50       0.0707      0.60  Q         |         |         |         |
  1+55       0.0748      0.60  Q         |         |         |         |
  2+ 0       0.0790      0.60  QV        |         |         |         |
  2+ 5       0.0831      0.60  QV        |         |         |         |
  2+10       0.0873      0.60  QV        |         |         |         |
  2+15       0.0914      0.61  QV        |         |         |         |
  2+20       0.0956      0.61  QV        |         |         |         |
  2+25       0.0998      0.61  QV        |         |         |         |
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2+30       0.1040      0.61  QV        |         |         |         |
2+35       0.1083      0.61  QV        |         |         |         |
2+40       0.1125      0.62  QV        |         |         |         |
2+45       0.1168      0.62  QV        |         |         |         |
2+50       0.1211      0.62  QV        |         |         |         |
2+55       0.1254      0.62  QV        |         |         |         |
3+ 0       0.1297      0.63  QV        |         |         |         |
3+ 5       0.1340      0.63  QV        |         |         |         |
3+10       0.1383      0.63  QV        |         |         |         |
3+15       0.1427      0.63  QV        |         |         |         |
3+20       0.1470      0.63  QV        |         |         |         |
3+25       0.1514      0.64  Q V       |         |         |         |
3+30       0.1558      0.64  Q V       |         |         |         |
3+35       0.1603      0.64  Q V       |         |         |         |
3+40       0.1647      0.64  Q V       |         |         |         |
3+45       0.1691      0.65  Q V       |         |         |         |
3+50       0.1736      0.65  Q V       |         |         |         |
3+55       0.1781      0.65  Q V       |         |         |         |
4+ 0       0.1826      0.65  Q V       |         |         |         |
4+ 5       0.1871      0.66  Q V       |         |         |         |
4+10       0.1917      0.66  Q V       |         |         |         |
4+15       0.1962      0.66  Q V       |         |         |         |
4+20       0.2008      0.66  Q V       |         |         |         |
4+25       0.2054      0.67  Q V       |         |         |         |
4+30       0.2100      0.67  Q V       |         |         |         |
4+35       0.2146      0.67  Q V       |         |         |         |
4+40       0.2193      0.68  Q V       |         |         |         |
4+45       0.2240      0.68  Q V       |         |         |         |
4+50       0.2287      0.68  Q  V      |         |         |         |
4+55       0.2334      0.68  Q  V      |         |         |         |
5+ 0       0.2381      0.69  Q  V      |         |         |         |
5+ 5       0.2428      0.69  Q  V      |         |         |         |
5+10       0.2476      0.69  Q  V      |         |         |         |
5+15       0.2524      0.70  Q  V      |         |         |         |
5+20       0.2572      0.70  Q  V      |         |         |         |
5+25       0.2621      0.70  Q  V      |         |         |         |
5+30       0.2669      0.70  Q  V      |         |         |         |
5+35       0.2718      0.71  Q  V      |         |         |         |
5+40       0.2767      0.71  Q  V      |         |         |         |
5+45       0.2816      0.71  Q  V      |         |         |         |
5+50       0.2865      0.72  Q  V      |         |         |         |
5+55       0.2915      0.72  Q  V      |         |         |         |
6+ 0       0.2965      0.72  Q  V      |         |         |         |
6+ 5       0.3015      0.73  Q   V     |         |         |         |
6+10       0.3066      0.73  Q   V     |         |         |         |
6+15       0.3116      0.73  Q   V     |         |         |         |
6+20       0.3167      0.74  Q   V     |         |         |         |
6+25       0.3218      0.74  Q   V     |         |         |         |
6+30       0.3269      0.75  Q   V     |         |         |         |
6+35       0.3321      0.75  Q   V     |         |         |         |
6+40       0.3373      0.75  Q   V     |         |         |         |
6+45       0.3425      0.76  Q   V     |         |         |         |
6+50       0.3477      0.76  Q   V     |         |         |         |
6+55       0.3530      0.76  Q   V     |         |         |         |
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 7+ 0       0.3583      0.77  Q   V     |         |         |         |
 7+ 5       0.3636      0.77  Q   V     |         |         |         |
 7+10       0.3689      0.78  Q   V     |         |         |         |
 7+15       0.3743      0.78  Q   V     |         |         |         |
 7+20       0.3797      0.78  Q    V    |         |         |         |
 7+25       0.3852      0.79  Q    V    |         |         |         |
 7+30       0.3906      0.79  Q    V    |         |         |         |
 7+35       0.3961      0.80  Q    V    |         |         |         |
 7+40       0.4016      0.80  Q    V    |         |         |         |
 7+45       0.4072      0.81  Q    V    |         |         |         |
 7+50       0.4128      0.81  Q    V    |         |         |         |
 7+55       0.4184      0.82  Q    V    |         |         |         |
 8+ 0       0.4240      0.82  Q    V    |         |         |         |
 8+ 5       0.4297      0.82  Q    V    |         |         |         |
 8+10       0.4354      0.83  Q    V    |         |         |         |
 8+15       0.4412      0.83  Q    V    |         |         |         |
 8+20       0.4469      0.84  Q    V    |         |         |         |
 8+25       0.4528      0.84  Q     V   |         |         |         |
 8+30       0.4586      0.85  Q     V   |         |         |         |
 8+35       0.4645      0.85  Q     V   |         |         |         |
 8+40       0.4704      0.86  Q     V   |         |         |         |
 8+45       0.4764      0.87  Q     V   |         |         |         |
 8+50       0.4824      0.87  Q     V   |         |         |         |
 8+55       0.4884      0.88  Q     V   |         |         |         |
 9+ 0       0.4945      0.88  Q     V   |         |         |         |
 9+ 5       0.5006      0.89  Q     V   |         |         |         |
 9+10       0.5068      0.89  Q     V   |         |         |         |
 9+15       0.5130      0.90  Q     V   |         |         |         |
 9+20       0.5192      0.91  Q     V   |         |         |         |
 9+25       0.5255      0.91  Q     V   |         |         |         |
 9+30       0.5318      0.92  Q      V  |         |         |         |
 9+35       0.5382      0.93  Q      V  |         |         |         |
 9+40       0.5446      0.93  Q      V  |         |         |         |
 9+45       0.5511      0.94  Q      V  |         |         |         |
 9+50       0.5576      0.95  Q      V  |         |         |         |
 9+55       0.5642      0.95  Q      V  |         |         |         |
10+ 0       0.5708      0.96  Q      V  |         |         |         |
10+ 5       0.5775      0.97  Q      V  |         |         |         |
10+10       0.5842      0.97  Q      V  |         |         |         |
10+15       0.5909      0.98  Q      V  |         |         |         |
10+20       0.5978      0.99  Q      V  |         |         |         |
10+25       0.6046      1.00  Q       V |         |         |         |
10+30       0.6116      1.01  |Q      V |         |         |         |
10+35       0.6186      1.01  |Q      V |         |         |         |
10+40       0.6256      1.02  |Q      V |         |         |         |
10+45       0.6327      1.03  |Q      V |         |         |         |
10+50       0.6399      1.04  |Q      V |         |         |         |
10+55       0.6471      1.05  |Q      V |         |         |         |
11+ 0       0.6544      1.06  |Q      V |         |         |         |
11+ 5       0.6618      1.07  |Q      V |         |         |         |
11+10       0.6692      1.08  |Q      V |         |         |         |
11+15       0.6767      1.09  |Q      V |         |         |         |
11+20       0.6843      1.10  |Q       V|         |         |         |
11+25       0.6919      1.11  |Q       V|         |         |         |
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11+30        0.6996       1.12  |Q       V|         |         |         |
11+35        0.7074       1.13  |Q       V|         |         |         |
11+40        0.7153       1.14  |Q       V|         |         |         |
11+45        0.7233       1.16  |Q       V|         |         |         |
11+50        0.7313       1.17  |Q       V|         |         |         |
11+55        0.7395       1.18  |Q       V|         |         |         |
12+ 0        0.7477       1.19  |Q       V|         |         |         |
12+ 5        0.7560       1.21  |Q        V         |         |         |
12+10        0.7643       1.21  |Q        V         |         |         |
12+15        0.7726       1.21  |Q        V         |         |         |
12+20        0.7809       1.21  |Q        V         |         |         |
12+25        0.7893       1.21  |Q        V         |         |         |
12+30        0.7977       1.22  |Q        V         |         |         |
12+35        0.8062       1.24  |Q        V         |         |         |
12+40        0.8149       1.25  |Q        V         |         |         |
12+45        0.8236       1.27  |Q        V         |         |         |
12+50        0.8324       1.28  |Q        |V        |         |         |
12+55        0.8413       1.30  |Q        |V        |         |         |
13+ 0        0.8504       1.32  |Q        |V        |         |         |
13+ 5        0.8596       1.34  |Q        |V        |         |         |
13+10        0.8689       1.36  |Q        |V        |         |         |
13+15        0.8784       1.38  |Q        |V        |         |         |
13+20        0.8881       1.40  |Q        |V        |         |         |
13+25        0.8978       1.42  |Q        |V        |         |         |
13+30        0.9078       1.45  |Q        | V       |         |         |
13+35        0.9179       1.47  |Q        | V       |         |         |
13+40        0.9283       1.50  |Q        | V       |         |         |
13+45        0.9388       1.53  |Q        | V       |         |         |
13+50        0.9495       1.56  |Q        | V       |         |         |
13+55        0.9604       1.59  |Q        | V       |         |         |
14+ 0        0.9716       1.62  |Q        | V       |         |         |
14+ 5        0.9830       1.66  |Q        |  V      |         |         |
14+10        0.9947       1.69  |Q        |  V      |         |         |
14+15        1.0067       1.74  |Q        |  V      |         |         |
14+20        1.0189       1.78  |Q        |  V      |         |         |
14+25        1.0315       1.83  |Q        |  V      |         |         |
14+30        1.0444       1.87  |Q        |  V      |         |         |
14+35        1.0577       1.93  |Q        |   V     |         |         |
14+40        1.0713       1.98  |Q        |   V     |         |         |
14+45        1.0854       2.05  | Q       |   V     |         |         |
14+50        1.1000       2.11  | Q       |   V     |         |         |
14+55        1.1150       2.19  | Q       |   V     |         |         |
15+ 0        1.1306       2.26  | Q       |    V    |         |         |
15+ 5        1.1468       2.36  | Q       |    V    |         |         |
15+10        1.1637       2.45  | Q       |    V    |         |         |
15+15        1.1814       2.57  | Q       |    V    |         |         |
15+20        1.1999       2.69  | Q       |    V    |         |         |
15+25        1.2193       2.82  | Q       |     V   |         |         |
15+30        1.2392       2.89  | Q       |     V   |         |         |
15+35        1.2590       2.86  | Q       |     V   |         |         |
15+40        1.2790       2.92  | Q       |     V   |         |         |
15+45        1.3005       3.12  |  Q      |      V  |         |         |
15+50        1.3240       3.41  |  Q      |      V  |         |         |
15+55        1.3510       3.91  |  Q      |      V  |         |         |
```

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16+ 0       1.3842      4.83  |   Q     |       V |         |         |
16+ 5       1.4421      8.41  |       Q |        V|         |         |
16+10       1.5630     17.56  |         |      Q  V         |         |
16+15       1.7796     31.44  |         |         |  V      |Q        |
16+20       1.9453     24.06  |         |         |   QV    |         |
16+25       2.0484     14.98  |         |   Q     |      V  |         |
16+30       2.1245     11.05  |         |Q        |       V |         |
16+35       2.1852      8.81  |       Q |         |        V|         |
16+40       2.2360      7.37  |      Q  |         |        V|         |
16+45       2.2799      6.38  |     Q   |         |         V         |
16+50       2.3168      5.37  |    Q    |         |         V         |
16+55       2.3495      4.74  |   Q     |         |         |V        |
17+ 0       2.3788      4.25  |   Q     |         |         |V        |
17+ 5       2.4047      3.77  |  Q      |         |         |V        |
17+10       2.4283      3.42  |  Q      |         |         | V       |
17+15       2.4495      3.08  |  Q      |         |         | V       |
17+20       2.4685      2.75  | Q       |         |         | V       |
17+25       2.4856      2.48  | Q       |         |         |  V      |
17+30       2.5010      2.24  | Q       |         |         |  V      |
17+35       2.5161      2.19  | Q       |         |         |  V      |
17+40       2.5307      2.12  | Q       |         |         |  V      |
17+45       2.5445      2.01  | Q       |         |         |  V      |
17+50       2.5568      1.79  |Q        |         |         |  V      |
17+55       2.5678      1.60  |Q        |         |         |   V     |
18+ 0       2.5777      1.43  |Q        |         |         |   V     |
18+ 5       2.5872      1.38  |Q        |         |         |   V     |
18+10       2.5964      1.34  |Q        |         |         |   V     |
18+15       2.6055      1.32  |Q        |         |         |   V     |
18+20       2.6144      1.30  |Q        |         |         |   V     |
18+25       2.6232      1.27  |Q        |         |         |   V     |
18+30       2.6317      1.24  |Q        |         |         |   V     |
18+35       2.6401      1.21  |Q        |         |         |    V    |
18+40       2.6482      1.19  |Q        |         |         |    V    |
18+45       2.6563      1.16  |Q        |         |         |    V    |
18+50       2.6641      1.14  |Q        |         |         |    V    |
18+55       2.6718      1.12  |Q        |         |         |    V    |
19+ 0       2.6794      1.10  |Q        |         |         |    V    |
19+ 5       2.6868      1.08  |Q        |         |         |    V    |
19+10       2.6941      1.06  |Q        |         |         |    V    |
19+15       2.7012      1.04  |Q        |         |         |    V    |
19+20       2.7083      1.02  |Q        |         |         |    V    |
19+25       2.7152      1.01  |Q        |         |         |     V   |
19+30       2.7220      0.99  Q         |         |         |     V   |
19+35       2.7287      0.97  Q         |         |         |     V   |
19+40       2.7354      0.96  Q         |         |         |     V   |
19+45       2.7419      0.95  Q         |         |         |     V   |
19+50       2.7483      0.93  Q         |         |         |     V   |
19+55       2.7546      0.92  Q         |         |         |     V   |
20+ 0       2.7609      0.91  Q         |         |         |     V   |
20+ 5       2.7670      0.89  Q         |         |         |     V   |
20+10       2.7731      0.88  Q         |         |         |     V   |
20+15       2.7791      0.87  Q         |         |         |     V   |
20+20       2.7850      0.86  Q         |         |         |     V   |
20+25       2.7909      0.85  Q         |         |         |      V  |
```

```
   20+30       2.7966      0.84  Q         |         |         |      V  |
   20+35       2.8023      0.83  Q         |         |         |      V  |
   20+40       2.8080      0.82  Q         |         |         |      V  |
   20+45       2.8136      0.81  Q         |         |         |      V  |
   20+50       2.8191      0.80  Q         |         |         |      V  |
   20+55       2.8245      0.79  Q         |         |         |      V  |
   21+ 0       2.8299      0.78  Q         |         |         |      V  |
   21+ 5       2.8353      0.78  Q         |         |         |      V  |
   21+10       2.8406      0.77  Q         |         |         |      V  |
   21+15       2.8458      0.76  Q         |         |         |      V  |
   21+20       2.8510      0.75  Q         |         |         |      V  |
   21+25       2.8561      0.74  Q         |         |         |      V  |
   21+30       2.8612      0.74  Q         |         |         |      V  |
   21+35       2.8662      0.73  Q         |         |         |       V |
   21+40       2.8712      0.72  Q         |         |         |       V |
   21+45       2.8761      0.72  Q         |         |         |       V |
   21+50       2.8810      0.71  Q         |         |         |       V |
   21+55       2.8859      0.70  Q         |         |         |       V |
   22+ 0       2.8907      0.70  Q         |         |         |       V |
   22+ 5       2.8954      0.69  Q         |         |         |       V |
   22+10       2.9002      0.69  Q         |         |         |       V |
   22+15       2.9049      0.68  Q         |         |         |       V |
   22+20       2.9095      0.67  Q         |         |         |       V |
   22+25       2.9141      0.67  Q         |         |         |       V |
   22+30       2.9187      0.66  Q         |         |         |       V |
   22+35       2.9232      0.66  Q         |         |         |       V |
   22+40       2.9277      0.65  Q         |         |         |       V |
   22+45       2.9322      0.65  Q         |         |         |       V |
   22+50       2.9366      0.64  Q         |         |         |       V |
   22+55       2.9410      0.64  Q         |         |         |        V|
   23+ 0       2.9454      0.63  Q         |         |         |        V|
   23+ 5       2.9497      0.63  Q         |         |         |        V|
   23+10       2.9540      0.62  Q         |         |         |        V|
   23+15       2.9583      0.62  Q         |         |         |        V|
   23+20       2.9625      0.62  Q         |         |         |        V|
   23+25       2.9667      0.61  Q         |         |         |        V|
   23+30       2.9709      0.61  Q         |         |         |        V|
   23+35       2.9751      0.60  Q         |         |         |        V|
   23+40       2.9792      0.60  Q         |         |         |        V|
   23+45       2.9833      0.60  Q         |         |         |        V|
   23+50       2.9874      0.59  Q         |         |         |        V|
   23+55       2.9914      0.59  Q         |         |         |        V|
   24+ 0       2.9954      0.58  Q         |         |         |        V|
-----------------------------------------------------------------------
```

TR. 20525

2-year, 24-Hours Storm Events

Unit Hydrograph Pre–Developed

```
     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 - 2004, Version 7.0

          Study date  10/25/22

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

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


Program License Serial Number 4070

---------------------------------------------------------------------
2-YR, 24-HOUR UNIT HYDROGRAPH PRE-DEVELOPED
TR 20525, CITY OF VICTORVILLE
AREA B1, B2 TO B3 (ONSITE WESTERLY AREAS FLOW TOWARDS AMETHYS RD.)
FILE: 20525HYDROB1B3PRE2YR.OUT
--------------------------------------------------------------------

     Storm Event Year = 2

     Antecedent Moisture Condition = 3

 English (in-lb) Input Units Used

 English Rainfall Data (Inches) Input Values Used

 English Units used in output format



Area averaged rainfall intensity isohyetal data:
     Sub-Area       Duration       Isohyetal
     (Ac.)           (hours)        (In)
Rainfall data for year 2
         15.11           1          0.36
--------------------------------------------------------------------
Rainfall data for year 2
         15.11           6          0.78
--------------------------------------------------------------------
Rainfall data for year 2
         15.11          24          1.34
--------------------------------------------------------------------
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++

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

```
SCS curve  SCS curve     Area     Area     Fp(Fig C6)    Ap      Fm
No.(AMCII) NO.(AMC 3)    (Ac.)    Fraction     (In/Hr)  (dec.)   (In/Hr)
 71.2      88.0         15.11      1.000     0.230    1.000    0.230

Area-averaged adjusted loss rate Fm (In/Hr) =  0.230

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

Area       Area          SCS CN    SCS CN      S     Pervious
 (Ac.)      Fract         (AMC2)    (AMC3)           Yield Fr
    15.11   1.000         71.2      88.0       1.37     0.348

Area-averaged catchment yield fraction, Y =  0.348
Area-averaged low loss fraction, Yb =  0.652
User entry of time of concentration  =   0.241 (hours)
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Watershed area =      15.11(Ac.)
Catchment Lag time =   0.193 hours
Unit interval =   5.000 minutes
Unit interval percentage of lag time = 43.2766
Hydrograph baseflow =     0.00(CFS)
Average maximum watershed loss rate(Fm) =  0.230(In/Hr)
Average low loss rate fraction (Yb) = 0.652 (decimal)
DESERT S-Graph Selected
Computed peak 5-minute rainfall =  0.173(In)
Computed peak 30-minute rainfall =  0.296(In)
Specified peak 1-hour rainfall =  0.365(In)
Computed peak 3-hour rainfall =  0.583(In)
Specified peak 6-hour rainfall =  0.783(In)
Specified peak 24-hour rainfall =  1.340(In)


Rainfall depth area reduction factors:
Using a total area of      15.11(Ac.) (Ref: fig. E-4)

5-minute factor = 0.999     Adjusted rainfall =  0.173(In)
30-minute factor = 0.999    Adjusted rainfall =  0.296(In)
1-hour factor = 0.999       Adjusted rainfall =  0.365(In)
3-hour factor = 1.000       Adjusted rainfall =  0.583(In)
6-hour factor = 1.000       Adjusted rainfall =  0.783(In)
24-hour factor = 1.000      Adjusted rainfall =  1.340(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 =       182.74 (CFS))

  1                3.122                   5.706
  2               22.512                  35.432
  3               53.515                  56.654
  4               68.655                  27.666
```

```
  5               77.285                  15.771
  6               82.973                  10.393
  7               87.158                   7.649
  8               90.154                   5.474
  9               92.446                   4.189
 10               94.266                   3.325
 11               95.687                   2.598
 12               96.805                   2.043
 13               97.623                   1.494
 14               98.143                   0.951
 15               98.630                   0.890
 16               99.149                   0.949
 17               99.584                   0.794
 18               99.858                   0.501
 19              100.000                   0.259
---------------------------------------------------------------------
Peak Unit   Adjusted mass rainfall  Unit rainfall
Number              (In)                (In)
  1              0.1731               0.1731
  2              0.2131               0.0400
  3              0.2406               0.0276
  4              0.2623               0.0217
  5              0.2805               0.0182
  6              0.2963               0.0158
  7              0.3103               0.0140
  8              0.3230               0.0127
  9              0.3346               0.0116
 10              0.3453               0.0107
 11              0.3553               0.0100
 12              0.3647               0.0094
 13              0.3774               0.0127
 14              0.3895               0.0121
 15              0.4012               0.0116
 16              0.4124               0.0112
 17              0.4232               0.0108
 18              0.4336               0.0104
 19              0.4437               0.0101
 20              0.4535               0.0098
 21              0.4631               0.0095
 22              0.4724               0.0093
 23              0.4814               0.0090
 24              0.4902               0.0088
 25              0.4988               0.0086
 26              0.5072               0.0084
 27              0.5155               0.0082
 28              0.5235               0.0081
 29              0.5314               0.0079
 30              0.5392               0.0077
 31              0.5468               0.0076
 32              0.5542               0.0075
 33              0.5615               0.0073
 34              0.5687               0.0072
 35              0.5758               0.0071
 36              0.5828               0.0070
```

37	0.5896	0.0068
38	0.5963	0.0067
39	0.6030	0.0066
40	0.6095	0.0065
41	0.6160	0.0064
42	0.6223	0.0064
43	0.6286	0.0063
44	0.6348	0.0062
45	0.6409	0.0061
46	0.6469	0.0060
47	0.6529	0.0060
48	0.6588	0.0059
49	0.6646	0.0058
50	0.6703	0.0057
51	0.6760	0.0057
52	0.6816	0.0056
53	0.6872	0.0056
54	0.6926	0.0055
55	0.6981	0.0054
56	0.7035	0.0054
57	0.7088	0.0053
58	0.7141	0.0053
59	0.7193	0.0052
60	0.7244	0.0052
61	0.7296	0.0051
62	0.7346	0.0051
63	0.7397	0.0050
64	0.7446	0.0050
65	0.7496	0.0049
66	0.7545	0.0049
67	0.7593	0.0048
68	0.7641	0.0048
69	0.7689	0.0048
70	0.7736	0.0047
71	0.7783	0.0047
72	0.7830	0.0047
73	0.7872	0.0042
74	0.7913	0.0042
75	0.7954	0.0041
76	0.7995	0.0041
77	0.8036	0.0041
78	0.8076	0.0040
79	0.8116	0.0040
80	0.8156	0.0040
81	0.8195	0.0039
82	0.8234	0.0039
83	0.8273	0.0039
84	0.8312	0.0038
85	0.8350	0.0038
86	0.8388	0.0038
87	0.8426	0.0038
88	0.8463	0.0037
89	0.8500	0.0037
90	0.8537	0.0037

91	0.8574	0.0037
92	0.8610	0.0036
93	0.8646	0.0036
94	0.8682	0.0036
95	0.8718	0.0036
96	0.8753	0.0035
97	0.8788	0.0035
98	0.8823	0.0035
99	0.8858	0.0035
100	0.8893	0.0035
101	0.8927	0.0034
102	0.8961	0.0034
103	0.8995	0.0034
104	0.9029	0.0034
105	0.9063	0.0034
106	0.9096	0.0033
107	0.9129	0.0033
108	0.9162	0.0033
109	0.9195	0.0033
110	0.9227	0.0033
111	0.9260	0.0032
112	0.9292	0.0032
113	0.9324	0.0032
114	0.9356	0.0032
115	0.9388	0.0032
116	0.9419	0.0032
117	0.9451	0.0031
118	0.9482	0.0031
119	0.9513	0.0031
120	0.9544	0.0031
121	0.9575	0.0031
122	0.9605	0.0031
123	0.9636	0.0030
124	0.9666	0.0030
125	0.9696	0.0030
126	0.9726	0.0030
127	0.9756	0.0030
128	0.9786	0.0030
129	0.9815	0.0030
130	0.9845	0.0029
131	0.9874	0.0029
132	0.9903	0.0029
133	0.9932	0.0029
134	0.9961	0.0029
135	0.9990	0.0029
136	1.0018	0.0029
137	1.0047	0.0028
138	1.0075	0.0028
139	1.0103	0.0028
140	1.0132	0.0028
141	1.0160	0.0028
142	1.0187	0.0028
143	1.0215	0.0028
144	1.0243	0.0028

145	1.0270	0.0028
146	1.0298	0.0027
147	1.0325	0.0027
148	1.0352	0.0027
149	1.0379	0.0027
150	1.0406	0.0027
151	1.0433	0.0027
152	1.0460	0.0027
153	1.0486	0.0027
154	1.0513	0.0027
155	1.0539	0.0026
156	1.0566	0.0026
157	1.0592	0.0026
158	1.0618	0.0026
159	1.0644	0.0026
160	1.0670	0.0026
161	1.0696	0.0026
162	1.0721	0.0026
163	1.0747	0.0026
164	1.0772	0.0026
165	1.0798	0.0025
166	1.0823	0.0025
167	1.0848	0.0025
168	1.0873	0.0025
169	1.0898	0.0025
170	1.0923	0.0025
171	1.0948	0.0025
172	1.0973	0.0025
173	1.0998	0.0025
174	1.1022	0.0025
175	1.1047	0.0025
176	1.1071	0.0024
177	1.1096	0.0024
178	1.1120	0.0024
179	1.1144	0.0024
180	1.1168	0.0024
181	1.1192	0.0024
182	1.1216	0.0024
183	1.1240	0.0024
184	1.1264	0.0024
185	1.1287	0.0024
186	1.1311	0.0024
187	1.1335	0.0024
188	1.1358	0.0023
189	1.1381	0.0023
190	1.1405	0.0023
191	1.1428	0.0023
192	1.1451	0.0023
193	1.1474	0.0023
194	1.1497	0.0023
195	1.1520	0.0023
196	1.1543	0.0023
197	1.1566	0.0023
198	1.1588	0.0023

199	1.1611	0.0023
200	1.1634	0.0023
201	1.1656	0.0023
202	1.1679	0.0022
203	1.1701	0.0022
204	1.1723	0.0022
205	1.1746	0.0022
206	1.1768	0.0022
207	1.1790	0.0022
208	1.1812	0.0022
209	1.1834	0.0022
210	1.1856	0.0022
211	1.1878	0.0022
212	1.1899	0.0022
213	1.1921	0.0022
214	1.1943	0.0022
215	1.1964	0.0022
216	1.1986	0.0022
217	1.2007	0.0021
218	1.2029	0.0021
219	1.2050	0.0021
220	1.2071	0.0021
221	1.2093	0.0021
222	1.2114	0.0021
223	1.2135	0.0021
224	1.2156	0.0021
225	1.2177	0.0021
226	1.2198	0.0021
227	1.2219	0.0021
228	1.2240	0.0021
229	1.2261	0.0021
230	1.2281	0.0021
231	1.2302	0.0021
232	1.2323	0.0021
233	1.2343	0.0021
234	1.2364	0.0021
235	1.2384	0.0020
236	1.2404	0.0020
237	1.2425	0.0020
238	1.2445	0.0020
239	1.2465	0.0020
240	1.2486	0.0020
241	1.2506	0.0020
242	1.2526	0.0020
243	1.2546	0.0020
244	1.2566	0.0020
245	1.2586	0.0020
246	1.2606	0.0020
247	1.2625	0.0020
248	1.2645	0.0020
249	1.2665	0.0020
250	1.2685	0.0020
251	1.2704	0.0020
252	1.2724	0.0020

```
253              1.2743               0.0020
254              1.2763               0.0019
255              1.2782               0.0019
256              1.2802               0.0019
257              1.2821               0.0019
258              1.2840               0.0019
259              1.2860               0.0019
260              1.2879               0.0019
261              1.2898               0.0019
262              1.2917               0.0019
263              1.2936               0.0019
264              1.2955               0.0019
265              1.2974               0.0019
266              1.2993               0.0019
267              1.3012               0.0019
268              1.3031               0.0019
269              1.3050               0.0019
270              1.3069               0.0019
271              1.3087               0.0019
272              1.3106               0.0019
273              1.3125               0.0019
274              1.3143               0.0019
275              1.3162               0.0019
276              1.3181               0.0019
277              1.3199               0.0018
278              1.3217               0.0018
279              1.3236               0.0018
280              1.3254               0.0018
281              1.3273               0.0018
282              1.3291               0.0018
283              1.3309               0.0018
284              1.3327               0.0018
285              1.3345               0.0018
286              1.3364               0.0018
287              1.3382               0.0018
288              1.3400               0.0018
---------------------------------------------------------------------
Unit              Unit            Unit              Effective
Period            Rainfall        Soil-Loss         Rainfall
(number)            (In)          (In)                 (In)
---------------------------------------------------------------------
  1              0.0018           0.0012              0.0006
  2              0.0018           0.0012              0.0006
  3              0.0018           0.0012              0.0006
  4              0.0018           0.0012              0.0006
  5              0.0018           0.0012              0.0006
  6              0.0018           0.0012              0.0006
  7              0.0018           0.0012              0.0006
  8              0.0018           0.0012              0.0006
  9              0.0019           0.0012              0.0006
 10              0.0019           0.0012              0.0006
 11              0.0019           0.0012              0.0006
 12              0.0019           0.0012              0.0007
 13              0.0019           0.0012              0.0007
```

14	0.0019	0.0012	0.0007
15	0.0019	0.0012	0.0007
16	0.0019	0.0012	0.0007
17	0.0019	0.0012	0.0007
18	0.0019	0.0012	0.0007
19	0.0019	0.0012	0.0007
20	0.0019	0.0013	0.0007
21	0.0019	0.0013	0.0007
22	0.0019	0.0013	0.0007
23	0.0019	0.0013	0.0007
24	0.0019	0.0013	0.0007
25	0.0020	0.0013	0.0007
26	0.0020	0.0013	0.0007
27	0.0020	0.0013	0.0007
28	0.0020	0.0013	0.0007
29	0.0020	0.0013	0.0007
30	0.0020	0.0013	0.0007
31	0.0020	0.0013	0.0007
32	0.0020	0.0013	0.0007
33	0.0020	0.0013	0.0007
34	0.0020	0.0013	0.0007
35	0.0020	0.0013	0.0007
36	0.0020	0.0013	0.0007
37	0.0021	0.0013	0.0007
38	0.0021	0.0013	0.0007
39	0.0021	0.0013	0.0007
40	0.0021	0.0014	0.0007
41	0.0021	0.0014	0.0007
42	0.0021	0.0014	0.0007
43	0.0021	0.0014	0.0007
44	0.0021	0.0014	0.0007
45	0.0021	0.0014	0.0007
46	0.0021	0.0014	0.0007
47	0.0021	0.0014	0.0007
48	0.0021	0.0014	0.0007
49	0.0022	0.0014	0.0008
50	0.0022	0.0014	0.0008
51	0.0022	0.0014	0.0008
52	0.0022	0.0014	0.0008
53	0.0022	0.0014	0.0008
54	0.0022	0.0014	0.0008
55	0.0022	0.0014	0.0008
56	0.0022	0.0014	0.0008
57	0.0022	0.0015	0.0008
58	0.0022	0.0015	0.0008
59	0.0023	0.0015	0.0008
60	0.0023	0.0015	0.0008
61	0.0023	0.0015	0.0008
62	0.0023	0.0015	0.0008
63	0.0023	0.0015	0.0008
64	0.0023	0.0015	0.0008
65	0.0023	0.0015	0.0008
66	0.0023	0.0015	0.0008
67	0.0023	0.0015	0.0008

68	0.0023	0.0015	0.0008
69	0.0024	0.0015	0.0008
70	0.0024	0.0015	0.0008
71	0.0024	0.0016	0.0008
72	0.0024	0.0016	0.0008
73	0.0024	0.0016	0.0008
74	0.0024	0.0016	0.0008
75	0.0024	0.0016	0.0008
76	0.0024	0.0016	0.0009
77	0.0025	0.0016	0.0009
78	0.0025	0.0016	0.0009
79	0.0025	0.0016	0.0009
80	0.0025	0.0016	0.0009
81	0.0025	0.0016	0.0009
82	0.0025	0.0016	0.0009
83	0.0025	0.0017	0.0009
84	0.0026	0.0017	0.0009
85	0.0026	0.0017	0.0009
86	0.0026	0.0017	0.0009
87	0.0026	0.0017	0.0009
88	0.0026	0.0017	0.0009
89	0.0026	0.0017	0.0009
90	0.0026	0.0017	0.0009
91	0.0027	0.0017	0.0009
92	0.0027	0.0017	0.0009
93	0.0027	0.0018	0.0009
94	0.0027	0.0018	0.0009
95	0.0027	0.0018	0.0010
96	0.0027	0.0018	0.0010
97	0.0028	0.0018	0.0010
98	0.0028	0.0018	0.0010
99	0.0028	0.0018	0.0010
100	0.0028	0.0018	0.0010
101	0.0028	0.0018	0.0010
102	0.0028	0.0019	0.0010
103	0.0029	0.0019	0.0010
104	0.0029	0.0019	0.0010
105	0.0029	0.0019	0.0010
106	0.0029	0.0019	0.0010
107	0.0030	0.0019	0.0010
108	0.0030	0.0019	0.0010
109	0.0030	0.0020	0.0010
110	0.0030	0.0020	0.0011
111	0.0030	0.0020	0.0011
112	0.0031	0.0020	0.0011
113	0.0031	0.0020	0.0011
114	0.0031	0.0020	0.0011
115	0.0031	0.0020	0.0011
116	0.0032	0.0021	0.0011
117	0.0032	0.0021	0.0011
118	0.0032	0.0021	0.0011
119	0.0032	0.0021	0.0011
120	0.0033	0.0021	0.0011
121	0.0033	0.0021	0.0011

122	0.0033	0.0022	0.0012
123	0.0034	0.0022	0.0012
124	0.0034	0.0022	0.0012
125	0.0034	0.0022	0.0012
126	0.0034	0.0022	0.0012
127	0.0035	0.0023	0.0012
128	0.0035	0.0023	0.0012
129	0.0035	0.0023	0.0012
130	0.0036	0.0023	0.0012
131	0.0036	0.0024	0.0013
132	0.0036	0.0024	0.0013
133	0.0037	0.0024	0.0013
134	0.0037	0.0024	0.0013
135	0.0038	0.0025	0.0013
136	0.0038	0.0025	0.0013
137	0.0038	0.0025	0.0013
138	0.0039	0.0025	0.0014
139	0.0039	0.0026	0.0014
140	0.0040	0.0026	0.0014
141	0.0040	0.0026	0.0014
142	0.0041	0.0026	0.0014
143	0.0041	0.0027	0.0014
144	0.0042	0.0027	0.0015
145	0.0047	0.0030	0.0016
146	0.0047	0.0031	0.0016
147	0.0048	0.0031	0.0017
148	0.0048	0.0031	0.0017
149	0.0049	0.0032	0.0017
150	0.0049	0.0032	0.0017
151	0.0050	0.0033	0.0018
152	0.0051	0.0033	0.0018
153	0.0052	0.0034	0.0018
154	0.0052	0.0034	0.0018
155	0.0053	0.0035	0.0019
156	0.0054	0.0035	0.0019
157	0.0055	0.0036	0.0019
158	0.0056	0.0036	0.0019
159	0.0057	0.0037	0.0020
160	0.0057	0.0037	0.0020
161	0.0059	0.0038	0.0020
162	0.0060	0.0039	0.0021
163	0.0061	0.0040	0.0021
164	0.0062	0.0040	0.0022
165	0.0064	0.0041	0.0022
166	0.0064	0.0042	0.0022
167	0.0066	0.0043	0.0023
168	0.0067	0.0044	0.0023
169	0.0070	0.0045	0.0024
170	0.0071	0.0046	0.0025
171	0.0073	0.0048	0.0026
172	0.0075	0.0049	0.0026
173	0.0077	0.0050	0.0027
174	0.0079	0.0051	0.0028
175	0.0082	0.0054	0.0029

176	0.0084	0.0055	0.0029
177	0.0088	0.0057	0.0031
178	0.0090	0.0059	0.0032
179	0.0095	0.0062	0.0033
180	0.0098	0.0064	0.0034
181	0.0104	0.0068	0.0036
182	0.0108	0.0070	0.0038
183	0.0116	0.0076	0.0041
184	0.0121	0.0079	0.0042
185	0.0094	0.0061	0.0033
186	0.0100	0.0065	0.0035
187	0.0116	0.0076	0.0040
188	0.0127	0.0083	0.0044
189	0.0158	0.0103	0.0055
190	0.0182	0.0118	0.0063
191	0.0276	0.0180	0.0096
192	0.0400	0.0191	0.0209
193	0.1731	0.0191	0.1539
194	0.0217	0.0141	0.0076
195	0.0140	0.0091	0.0049
196	0.0107	0.0070	0.0037
197	0.0127	0.0083	0.0044
198	0.0112	0.0073	0.0039
199	0.0101	0.0066	0.0035
200	0.0093	0.0060	0.0032
201	0.0086	0.0056	0.0030
202	0.0081	0.0053	0.0028
203	0.0076	0.0049	0.0026
204	0.0072	0.0047	0.0025
205	0.0068	0.0045	0.0024
206	0.0065	0.0043	0.0023
207	0.0063	0.0041	0.0022
208	0.0060	0.0039	0.0021
209	0.0058	0.0038	0.0020
210	0.0056	0.0037	0.0020
211	0.0054	0.0035	0.0019
212	0.0053	0.0034	0.0018
213	0.0051	0.0033	0.0018
214	0.0050	0.0032	0.0017
215	0.0048	0.0032	0.0017
216	0.0047	0.0031	0.0016
217	0.0042	0.0027	0.0015
218	0.0041	0.0027	0.0014
219	0.0040	0.0026	0.0014
220	0.0039	0.0025	0.0014
221	0.0038	0.0025	0.0013
222	0.0037	0.0024	0.0013
223	0.0037	0.0024	0.0013
224	0.0036	0.0023	0.0013
225	0.0035	0.0023	0.0012
226	0.0035	0.0023	0.0012
227	0.0034	0.0022	0.0012
228	0.0033	0.0022	0.0012
229	0.0033	0.0021	0.0011

230	0.0032	0.0021	0.0011
231	0.0032	0.0021	0.0011
232	0.0031	0.0020	0.0011
233	0.0031	0.0020	0.0011
234	0.0030	0.0020	0.0011
235	0.0030	0.0019	0.0010
236	0.0029	0.0019	0.0010
237	0.0029	0.0019	0.0010
238	0.0029	0.0019	0.0010
239	0.0028	0.0018	0.0010
240	0.0028	0.0018	0.0010
241	0.0028	0.0018	0.0010
242	0.0027	0.0018	0.0009
243	0.0027	0.0017	0.0009
244	0.0027	0.0017	0.0009
245	0.0026	0.0017	0.0009
246	0.0026	0.0017	0.0009
247	0.0026	0.0017	0.0009
248	0.0025	0.0016	0.0009
249	0.0025	0.0016	0.0009
250	0.0025	0.0016	0.0009
251	0.0025	0.0016	0.0009
252	0.0024	0.0016	0.0008
253	0.0024	0.0016	0.0008
254	0.0024	0.0015	0.0008
255	0.0024	0.0015	0.0008
256	0.0023	0.0015	0.0008
257	0.0023	0.0015	0.0008
258	0.0023	0.0015	0.0008
259	0.0023	0.0015	0.0008
260	0.0022	0.0015	0.0008
261	0.0022	0.0014	0.0008
262	0.0022	0.0014	0.0008
263	0.0022	0.0014	0.0008
264	0.0022	0.0014	0.0008
265	0.0021	0.0014	0.0007
266	0.0021	0.0014	0.0007
267	0.0021	0.0014	0.0007
268	0.0021	0.0014	0.0007
269	0.0021	0.0014	0.0007
270	0.0021	0.0013	0.0007
271	0.0020	0.0013	0.0007
272	0.0020	0.0013	0.0007
273	0.0020	0.0013	0.0007
274	0.0020	0.0013	0.0007
275	0.0020	0.0013	0.0007
276	0.0020	0.0013	0.0007
277	0.0020	0.0013	0.0007
278	0.0019	0.0013	0.0007
279	0.0019	0.0013	0.0007
280	0.0019	0.0012	0.0007
281	0.0019	0.0012	0.0007
282	0.0019	0.0012	0.0007
283	0.0019	0.0012	0.0007

```
    284             0.0019           0.0012               0.0006
    285             0.0018           0.0012               0.0006
    286             0.0018           0.0012               0.0006
    287             0.0018           0.0012               0.0006
    288             0.0018           0.0012               0.0006
    --------------------------------------------------------------------
    --------------------------------------------------------------------
    Total soil rain loss =      0.77(In)
    Total effective rainfall =      0.57(In)
    Peak flow rate in flood hydrograph =      9.94(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      0.03  Q          |         |         |         |
  0+15       0.0006      0.06  Q          |         |         |         |
  0+20       0.0012      0.08  Q          |         |         |         |
  0+25       0.0018      0.09  Q          |         |         |         |
  0+30       0.0024      0.10  Q          |         |         |         |
  0+35       0.0031      0.10  Q          |         |         |         |
  0+40       0.0039      0.11  Q          |         |         |         |
  0+45       0.0046      0.11  Q          |         |         |         |
  0+50       0.0054      0.11  Q          |         |         |         |
  0+55       0.0062      0.11  Q          |         |         |         |
  1+ 0       0.0069      0.11  Q          |         |         |         |
  1+ 5       0.0077      0.12  Q          |         |         |         |
  1+10       0.0085      0.12  Q          |         |         |         |
  1+15       0.0093      0.12  Q          |         |         |         |
  1+20       0.0102      0.12  Q          |         |         |         |
  1+25       0.0110      0.12  Q          |         |         |         |
  1+30       0.0118      0.12  Q          |         |         |         |
  1+35       0.0126      0.12  Q          |         |         |         |
  1+40       0.0135      0.12  Q          |         |         |         |
  1+45       0.0143      0.12  Q          |         |         |         |
  1+50       0.0151      0.12  Q          |         |         |         |
  1+55       0.0160      0.12  Q          |         |         |         |
  2+ 0       0.0168      0.12  Q          |         |         |         |
  2+ 5       0.0177      0.12  Q          |         |         |         |
  2+10       0.0185      0.12  QV         |         |         |         |
  2+15       0.0194      0.12  QV         |         |         |         |
  2+20       0.0202      0.12  QV         |         |         |         |
  2+25       0.0211      0.12  QV         |         |         |         |
  2+30       0.0220      0.13  QV         |         |         |         |
  2+35       0.0228      0.13  QV         |         |         |         |
  2+40       0.0237      0.13  QV         |         |         |         |
  2+45       0.0246      0.13  QV         |         |         |         |
  2+50       0.0255      0.13  QV         |         |         |         |
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2+55       0.0263      0.13  QV        |         |         |         |
3+ 0       0.0272      0.13  QV        |         |         |         |
3+ 5       0.0281      0.13  QV        |         |         |         |
3+10       0.0290      0.13  QV        |         |         |         |
3+15       0.0299      0.13  QV        |         |         |         |
3+20       0.0308      0.13  QV        |         |         |         |
3+25       0.0317      0.13  QV        |         |         |         |
3+30       0.0326      0.13  QV        |         |         |         |
3+35       0.0335      0.13  QV        |         |         |         |
3+40       0.0344      0.13  QV        |         |         |         |
3+45       0.0353      0.13  QV        |         |         |         |
3+50       0.0362      0.13  Q V       |         |         |         |
3+55       0.0372      0.13  Q V       |         |         |         |
4+ 0       0.0381      0.13  Q V       |         |         |         |
4+ 5       0.0390      0.14  Q V       |         |         |         |
4+10       0.0400      0.14  Q V       |         |         |         |
4+15       0.0409      0.14  Q V       |         |         |         |
4+20       0.0418      0.14  Q V       |         |         |         |
4+25       0.0428      0.14  Q V       |         |         |         |
4+30       0.0437      0.14  Q V       |         |         |         |
4+35       0.0447      0.14  Q V       |         |         |         |
4+40       0.0456      0.14  Q V       |         |         |         |
4+45       0.0466      0.14  Q V       |         |         |         |
4+50       0.0476      0.14  Q V       |         |         |         |
4+55       0.0486      0.14  Q V       |         |         |         |
5+ 0       0.0495      0.14  Q V       |         |         |         |
5+ 5       0.0505      0.14  Q V       |         |         |         |
5+10       0.0515      0.14  Q V       |         |         |         |
5+15       0.0525      0.14  Q V       |         |         |         |
5+20       0.0535      0.14  Q V       |         |         |         |
5+25       0.0545      0.14  Q  V      |         |         |         |
5+30       0.0555      0.15  Q  V      |         |         |         |
5+35       0.0565      0.15  Q  V      |         |         |         |
5+40       0.0575      0.15  Q  V      |         |         |         |
5+45       0.0585      0.15  Q  V      |         |         |         |
5+50       0.0595      0.15  Q  V      |         |         |         |
5+55       0.0606      0.15  Q  V      |         |         |         |
6+ 0       0.0616      0.15  Q  V      |         |         |         |
6+ 5       0.0626      0.15  Q  V      |         |         |         |
6+10       0.0637      0.15  Q  V      |         |         |         |
6+15       0.0647      0.15  Q  V      |         |         |         |
6+20       0.0658      0.15  Q  V      |         |         |         |
6+25       0.0668      0.15  Q  V      |         |         |         |
6+30       0.0679      0.15  Q  V      |         |         |         |
6+35       0.0690      0.16  Q  V      |         |         |         |
6+40       0.0700      0.16  Q  V      |         |         |         |
6+45       0.0711      0.16  Q  V      |         |         |         |
6+50       0.0722      0.16  Q   V     |         |         |         |
6+55       0.0733      0.16  Q   V     |         |         |         |
7+ 0       0.0744      0.16  Q   V     |         |         |         |
7+ 5       0.0755      0.16  Q   V     |         |         |         |
7+10       0.0766      0.16  Q   V     |         |         |         |
7+15       0.0777      0.16  Q   V     |         |         |         |
7+20       0.0789      0.16  Q   V     |         |         |         |
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 7+25       0.0800      0.16  Q   V     |         |         |         |
 7+30       0.0811      0.17  Q   V     |         |         |         |
 7+35       0.0823      0.17  Q   V     |         |         |         |
 7+40       0.0834      0.17  Q   V     |         |         |         |
 7+45       0.0846      0.17  Q   V     |         |         |         |
 7+50       0.0857      0.17  Q   V     |         |         |         |
 7+55       0.0869      0.17  Q   V     |         |         |         |
 8+ 0       0.0881      0.17  Q   V     |         |         |         |
 8+ 5       0.0893      0.17  Q    V    |         |         |         |
 8+10       0.0905      0.17  Q    V    |         |         |         |
 8+15       0.0917      0.17  Q    V    |         |         |         |
 8+20       0.0929      0.18  Q    V    |         |         |         |
 8+25       0.0941      0.18  Q    V    |         |         |         |
 8+30       0.0953      0.18  Q    V    |         |         |         |
 8+35       0.0965      0.18  Q    V    |         |         |         |
 8+40       0.0978      0.18  Q    V    |         |         |         |
 8+45       0.0990      0.18  Q    V    |         |         |         |
 8+50       0.1003      0.18  Q    V    |         |         |         |
 8+55       0.1016      0.18  Q    V    |         |         |         |
 9+ 0       0.1028      0.18  Q    V    |         |         |         |
 9+ 5       0.1041      0.19  Q    V    |         |         |         |
 9+10       0.1054      0.19  Q    V    |         |         |         |
 9+15       0.1067      0.19  Q    V    |         |         |         |
 9+20       0.1080      0.19  Q     V   |         |         |         |
 9+25       0.1093      0.19  Q     V   |         |         |         |
 9+30       0.1107      0.19  Q     V   |         |         |         |
 9+35       0.1120      0.19  Q     V   |         |         |         |
 9+40       0.1134      0.20  Q     V   |         |         |         |
 9+45       0.1147      0.20  Q     V   |         |         |         |
 9+50       0.1161      0.20  Q     V   |         |         |         |
 9+55       0.1175      0.20  Q     V   |         |         |         |
10+ 0       0.1189      0.20  Q     V   |         |         |         |
10+ 5       0.1203      0.20  Q     V   |         |         |         |
10+10       0.1217      0.21  Q     V   |         |         |         |
10+15       0.1231      0.21  Q     V   |         |         |         |
10+20       0.1245      0.21  Q     V   |         |         |         |
10+25       0.1260      0.21  Q      V  |         |         |         |
10+30       0.1275      0.21  Q      V  |         |         |         |
10+35       0.1289      0.21  Q      V  |         |         |         |
10+40       0.1304      0.22  Q      V  |         |         |         |
10+45       0.1319      0.22  Q      V  |         |         |         |
10+50       0.1335      0.22  Q      V  |         |         |         |
10+55       0.1350      0.22  Q      V  |         |         |         |
11+ 0       0.1365      0.22  Q      V  |         |         |         |
11+ 5       0.1381      0.23  Q      V  |         |         |         |
11+10       0.1397      0.23  Q      V  |         |         |         |
11+15       0.1413      0.23  Q      V  |         |         |         |
11+20       0.1429      0.23  Q       V |         |         |         |
11+25       0.1445      0.24  Q       V |         |         |         |
11+30       0.1461      0.24  Q       V |         |         |         |
11+35       0.1478      0.24  Q       V |         |         |         |
11+40       0.1495      0.24  Q       V |         |         |         |
11+45       0.1512      0.25  Q       V |         |         |         |
11+50       0.1529      0.25  Q       V |         |         |         |
```

```
11+55       0.1546      0.25  |Q      V |         |         |         |
12+ 0       0.1564      0.26  |Q      V |         |         |         |
12+ 5       0.1582      0.26  |Q      V |         |         |         |
12+10       0.1600      0.27  |Q      V |         |         |         |
12+15       0.1619      0.28  |Q       V|         |         |         |
12+20       0.1639      0.29  |Q       V|         |         |         |
12+25       0.1659      0.29  |Q       V|         |         |         |
12+30       0.1680      0.30  |Q       V|         |         |         |
12+35       0.1701      0.30  |Q       V|         |         |         |
12+40       0.1722      0.31  |Q       V|         |         |         |
12+45       0.1743      0.31  |Q       V|         |         |         |
12+50       0.1765      0.32  |Q       V|         |         |         |
12+55       0.1787      0.32  |Q        V         |         |         |
13+ 0       0.1810      0.33  |Q        V         |         |         |
13+ 5       0.1832      0.33  |Q        V         |         |         |
13+10       0.1856      0.34  |Q        V         |         |         |
13+15       0.1879      0.34  |Q        V         |         |         |
13+20       0.1903      0.35  |Q        V         |         |         |
13+25       0.1927      0.35  |Q        V         |         |         |
13+30       0.1952      0.36  |Q        V         |         |         |
13+35       0.1977      0.37  |Q        |V        |         |         |
13+40       0.2003      0.37  |Q        |V        |         |         |
13+45       0.2029      0.38  |Q        |V        |         |         |
13+50       0.2055      0.39  |Q        |V        |         |         |
13+55       0.2083      0.39  |Q        |V        |         |         |
14+ 0       0.2110      0.40  |Q        |V        |         |         |
14+ 5       0.2138      0.41  |Q        |V        |         |         |
14+10       0.2167      0.42  |Q        | V       |         |         |
14+15       0.2197      0.43  |Q        | V       |         |         |
14+20       0.2227      0.44  |Q        | V       |         |         |
14+25       0.2258      0.45  |Q        | V       |         |         |
14+30       0.2290      0.46  |Q        | V       |         |         |
14+35       0.2323      0.47  |Q        |  V      |         |         |
14+40       0.2356      0.49  |Q        |  V      |         |         |
14+45       0.2391      0.50  | Q       |  V      |         |         |
14+50       0.2427      0.52  | Q       |  V      |         |         |
14+55       0.2464      0.54  | Q       |  V      |         |         |
15+ 0       0.2502      0.56  | Q       |   V     |         |         |
15+ 5       0.2542      0.58  | Q       |   V     |         |         |
15+10       0.2583      0.60  | Q       |   V     |         |         |
15+15       0.2627      0.63  | Q       |   V     |         |         |
15+20       0.2672      0.66  | Q       |   V     |         |         |
15+25       0.2720      0.69  | Q       |    V    |         |         |
15+30       0.2766      0.68  | Q       |    V    |         |         |
15+35       0.2811      0.65  | Q       |    V    |         |         |
15+40       0.2858      0.67  | Q       |     V   |         |         |
15+45       0.2907      0.72  | Q       |     V   |         |         |
15+50       0.2962      0.80  |  Q      |     V   |         |         |
15+55       0.3026      0.92  |  Q      |     V   |         |         |
16+ 0       0.3108      1.19  |   Q     |      V  |         |         |
16+ 5       0.3286      2.58  |         Q       V |         |         |
16+10       0.3783      7.22  |         |         |V      Q |         |
16+15       0.4468      9.94  |         |         |    V    |        Q|
16+20       0.4844      5.46  |         |         |Q     V  |         |
```

```
16+25       0.5083      3.47  |         |  Q      |       V |         |
16+30       0.5258      2.54  |         Q         |        V|         |
16+35       0.5401      2.07  |       Q |         |         V         |
16+40       0.5515      1.67  |     Q   |         |         V         |
16+45       0.5612      1.40  |    Q    |         |         |V        |
16+50       0.5695      1.21  |   Q     |         |         |V        |
16+55       0.5768      1.05  |   Q     |         |         | V       |
17+ 0       0.5831      0.92  |  Q      |         |         | V       |
17+ 5       0.5885      0.79  |  Q      |         |         | V       |
17+10       0.5932      0.68  | Q       |         |         |  V      |
17+15       0.5976      0.64  | Q       |         |         |  V      |
17+20       0.6018      0.62  | Q       |         |         |  V      |
17+25       0.6058      0.57  | Q       |         |         |  V      |
17+30       0.6092      0.50  | Q       |         |         |   V     |
17+35       0.6123      0.44  |Q        |         |         |   V     |
17+40       0.6149      0.39  |Q        |         |         |   V     |
17+45       0.6175      0.37  |Q        |         |         |   V     |
17+50       0.6199      0.36  |Q        |         |         |   V     |
17+55       0.6223      0.35  |Q        |         |         |   V     |
18+ 0       0.6246      0.34  |Q        |         |         |   V     |
18+ 5       0.6269      0.32  |Q        |         |         |    V    |
18+10       0.6290      0.31  |Q        |         |         |    V    |
18+15       0.6310      0.29  |Q        |         |         |    V    |
18+20       0.6330      0.28  |Q        |         |         |    V    |
18+25       0.6349      0.27  |Q        |         |         |    V    |
18+30       0.6367      0.26  |Q        |         |         |    V    |
18+35       0.6384      0.26  |Q        |         |         |    V    |
18+40       0.6402      0.25  |Q        |         |         |    V    |
18+45       0.6418      0.24  Q         |         |         |    V    |
18+50       0.6435      0.24  Q         |         |         |     V   |
18+55       0.6451      0.23  Q         |         |         |     V   |
19+ 0       0.6467      0.23  Q         |         |         |     V   |
19+ 5       0.6482      0.22  Q         |         |         |     V   |
19+10       0.6497      0.22  Q         |         |         |     V   |
19+15       0.6512      0.22  Q         |         |         |     V   |
19+20       0.6527      0.21  Q         |         |         |     V   |
19+25       0.6541      0.21  Q         |         |         |     V   |
19+30       0.6555      0.20  Q         |         |         |     V   |
19+35       0.6569      0.20  Q         |         |         |     V   |
19+40       0.6582      0.20  Q         |         |         |     V   |
19+45       0.6596      0.19  Q         |         |         |     V   |
19+50       0.6609      0.19  Q         |         |         |      V  |
19+55       0.6622      0.19  Q         |         |         |      V  |
20+ 0       0.6635      0.19  Q         |         |         |      V  |
20+ 5       0.6647      0.18  Q         |         |         |      V  |
20+10       0.6660      0.18  Q         |         |         |      V  |
20+15       0.6672      0.18  Q         |         |         |      V  |
20+20       0.6684      0.18  Q         |         |         |      V  |
20+25       0.6696      0.17  Q         |         |         |      V  |
20+30       0.6708      0.17  Q         |         |         |      V  |
20+35       0.6720      0.17  Q         |         |         |      V  |
20+40       0.6732      0.17  Q         |         |         |      V  |
20+45       0.6743      0.17  Q         |         |         |      V  |
20+50       0.6754      0.16  Q         |         |         |      V  |
```

```
   20+55       0.6765       0.16  Q         |         |         |      V  |
   21+ 0       0.6776       0.16  Q         |         |         |      V  |
   21+ 5       0.6787       0.16  Q         |         |         |       V |
   21+10       0.6798       0.16  Q         |         |         |       V |
   21+15       0.6809       0.16  Q         |         |         |       V |
   21+20       0.6820       0.15  Q         |         |         |       V |
   21+25       0.6830       0.15  Q         |         |         |       V |
   21+30       0.6840       0.15  Q         |         |         |       V |
   21+35       0.6851       0.15  Q         |         |         |       V |
   21+40       0.6861       0.15  Q         |         |         |       V |
   21+45       0.6871       0.15  Q         |         |         |       V |
   21+50       0.6881       0.14  Q         |         |         |       V |
   21+55       0.6891       0.14  Q         |         |         |       V |
   22+ 0       0.6901       0.14  Q         |         |         |       V |
   22+ 5       0.6910       0.14  Q         |         |         |       V |
   22+10       0.6920       0.14  Q         |         |         |       V |
   22+15       0.6929       0.14  Q         |         |         |       V |
   22+20       0.6939       0.14  Q         |         |         |       V |
   22+25       0.6948       0.14  Q         |         |         |       V |
   22+30       0.6958       0.14  Q         |         |         |       V |
   22+35       0.6967       0.13  Q         |         |         |        V|
   22+40       0.6976       0.13  Q         |         |         |        V|
   22+45       0.6985       0.13  Q         |         |         |        V|
   22+50       0.6994       0.13  Q         |         |         |        V|
   22+55       0.7003       0.13  Q         |         |         |        V|
   23+ 0       0.7012       0.13  Q         |         |         |        V|
   23+ 5       0.7021       0.13  Q         |         |         |        V|
   23+10       0.7029       0.13  Q         |         |         |        V|
   23+15       0.7038       0.13  Q         |         |         |        V|
   23+20       0.7047       0.12  Q         |         |         |        V|
   23+25       0.7055       0.12  Q         |         |         |        V|
   23+30       0.7064       0.12  Q         |         |         |        V|
   23+35       0.7072       0.12  Q         |         |         |        V|
   23+40       0.7080       0.12  Q         |         |         |        V|
   23+45       0.7089       0.12  Q         |         |         |        V|
   23+50       0.7097       0.12  Q         |         |         |        V|
   23+55       0.7105       0.12  Q         |         |         |        V|
   24+ 0       0.7113       0.12  Q         |         |         |        V|
-----------------------------------------------------------------------
```

TR. 20525

2-year, 24-Hours Storm Events

Unit Hydrograph Post–Developed

```
      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 - 2004, Version 7.0

            Study date  08/26/22

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

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


Program License Serial Number 4070

----------------------------------------------------------------------
2-YR, 24-HOUR UNIT HYDROGRAPH POST DEVELOPED
TR 20525, CITY OF VICTORVILLE
AREA AA & BB (ONSITE AREAS TOWARDS NORTHWEST CORNER to BASIN No.1)
FILE: 20525HYDROAA12YR.OUT
---------------------------------------------------------------------

      Storm Event Year = 2

      Antecedent Moisture Condition = 3

 English (in-lb) Input Units Used

 English Rainfall Data (Inches) Input Values Used

 English Units used in output format



Area averaged rainfall intensity isohyetal data:
      Sub-Area        Duration        Isohyetal
      (Ac.)            (hours)         (In)
Rainfall data for year 2
          28.99            1           0.36
---------------------------------------------------------------------
Rainfall data for year 2
          28.99            6           0.78
---------------------------------------------------------------------
Rainfall data for year 2
          28.99           24           1.34
---------------------------------------------------------------------
+++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++

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

```
SCS curve  SCS curve     Area     Area     Fp(Fig C6)    Ap      Fm
No.(AMCII) NO.(AMC 3)    (Ac.)    Fraction     (In/Hr)  (dec.)   (In/Hr)
 54.1      74.1         28.99      1.000     0.468    0.600    0.281

Area-averaged adjusted loss rate Fm (In/Hr) =  0.281

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

Area       Area          SCS CN    SCS CN      S     Pervious
 (Ac.)      Fract         (AMC2)    (AMC3)           Yield Fr
    17.39   0.600         54.1      74.1       3.50     0.074
    11.60   0.400         98.0      98.0       0.20     0.838

Area-averaged catchment yield fraction, Y =  0.380
Area-averaged low loss fraction, Yb =  0.620
User entry of time of concentration  =   0.323 (hours)
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Watershed area =      28.99(Ac.)
Catchment Lag time =   0.258 hours
Unit interval =   5.000 minutes
Unit interval percentage of lag time = 32.2997
Hydrograph baseflow =     0.00(CFS)
Average maximum watershed loss rate(Fm) =  0.281(In/Hr)
Average low loss rate fraction (Yb) = 0.620 (decimal)
DESERT S-Graph Selected
Computed peak 5-minute rainfall =  0.173(In)
Computed peak 30-minute rainfall =  0.296(In)
Specified peak 1-hour rainfall =  0.365(In)
Computed peak 3-hour rainfall =  0.583(In)
Specified peak 6-hour rainfall =  0.783(In)
Specified peak 24-hour rainfall =  1.340(In)


Rainfall depth area reduction factors:
Using a total area of      28.99(Ac.) (Ref: fig. E-4)

5-minute factor = 0.999     Adjusted rainfall =  0.173(In)
30-minute factor = 0.999    Adjusted rainfall =  0.296(In)
1-hour factor = 0.999       Adjusted rainfall =  0.365(In)
3-hour factor = 1.000       Adjusted rainfall =  0.583(In)
6-hour factor = 1.000       Adjusted rainfall =  0.783(In)
24-hour factor = 1.000      Adjusted rainfall =  1.340(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 =       350.60 (CFS))

  1                1.973                   6.916
  2               11.045                  31.808
  3               35.645                  86.246
```

```
  4               56.161                  71.929
  5               67.172                  38.604
  6               74.393                  25.317
  7               79.591                  18.225
  8               83.450                  13.527
  9               86.596                  11.029
 10               89.084                   8.725
 11               90.989                   6.677
 12               92.620                   5.719
 13               94.004                   4.852
 14               95.125                   3.932
 15               96.077                   3.338
 16               96.882                   2.822
 17               97.493                   2.143
 18               97.952                   1.610
 19               98.281                   1.153
 20               98.658                   1.321
 21               99.046                   1.359
 22               99.423                   1.324
 23               99.667                   0.855
 24               99.869                   0.708
 25              100.000                   0.459
---------------------------------------------------------------------
Peak Unit   Adjusted mass rainfall  Unit rainfall
Number              (In)                (In)
  1              0.1730               0.1730
  2              0.2129               0.0400
  3              0.2405               0.0275
  4              0.2622               0.0217
  5              0.2803               0.0182
  6              0.2961               0.0158
  7              0.3101               0.0140
  8              0.3228               0.0127
  9              0.3344               0.0116
 10              0.3451               0.0107
 11              0.3551               0.0100
 12              0.3645               0.0094
 13              0.3772               0.0127
 14              0.3893               0.0121
 15              0.4009               0.0116
 16              0.4122               0.0112
 17              0.4230               0.0108
 18              0.4334               0.0105
 19              0.4435               0.0101
 20              0.4534               0.0098
 21              0.4629               0.0095
 22              0.4722               0.0093
 23              0.4812               0.0090
 24              0.4901               0.0088
 25              0.4987               0.0086
 26              0.5071               0.0084
 27              0.5153               0.0082
 28              0.5234               0.0081
 29              0.5313               0.0079
```

30	0.5391	0.0077
31	0.5467	0.0076
32	0.5541	0.0075
33	0.5615	0.0073
34	0.5687	0.0072
35	0.5757	0.0071
36	0.5827	0.0070
37	0.5896	0.0068
38	0.5963	0.0067
39	0.6029	0.0066
40	0.6095	0.0065
41	0.6159	0.0064
42	0.6223	0.0064
43	0.6285	0.0063
44	0.6347	0.0062
45	0.6408	0.0061
46	0.6469	0.0060
47	0.6528	0.0060
48	0.6587	0.0059
49	0.6645	0.0058
50	0.6703	0.0057
51	0.6759	0.0057
52	0.6816	0.0056
53	0.6871	0.0056
54	0.6926	0.0055
55	0.6980	0.0054
56	0.7034	0.0054
57	0.7087	0.0053
58	0.7140	0.0053
59	0.7192	0.0052
60	0.7244	0.0052
61	0.7295	0.0051
62	0.7346	0.0051
63	0.7396	0.0050
64	0.7446	0.0050
65	0.7495	0.0049
66	0.7544	0.0049
67	0.7593	0.0048
68	0.7641	0.0048
69	0.7689	0.0048
70	0.7736	0.0047
71	0.7783	0.0047
72	0.7829	0.0047
73	0.7871	0.0042
74	0.7913	0.0042
75	0.7954	0.0041
76	0.7995	0.0041
77	0.8036	0.0041
78	0.8076	0.0040
79	0.8116	0.0040
80	0.8156	0.0040
81	0.8195	0.0039
82	0.8234	0.0039
83	0.8273	0.0039

84	0.8311	0.0038
85	0.8350	0.0038
86	0.8388	0.0038
87	0.8425	0.0038
88	0.8463	0.0037
89	0.8500	0.0037
90	0.8537	0.0037
91	0.8573	0.0037
92	0.8610	0.0036
93	0.8646	0.0036
94	0.8682	0.0036
95	0.8717	0.0036
96	0.8753	0.0035
97	0.8788	0.0035
98	0.8823	0.0035
99	0.8858	0.0035
100	0.8892	0.0035
101	0.8927	0.0034
102	0.8961	0.0034
103	0.8995	0.0034
104	0.9029	0.0034
105	0.9062	0.0034
106	0.9096	0.0033
107	0.9129	0.0033
108	0.9162	0.0033
109	0.9195	0.0033
110	0.9227	0.0033
111	0.9260	0.0032
112	0.9292	0.0032
113	0.9324	0.0032
114	0.9356	0.0032
115	0.9387	0.0032
116	0.9419	0.0032
117	0.9450	0.0031
118	0.9482	0.0031
119	0.9513	0.0031
120	0.9544	0.0031
121	0.9574	0.0031
122	0.9605	0.0031
123	0.9635	0.0030
124	0.9666	0.0030
125	0.9696	0.0030
126	0.9726	0.0030
127	0.9756	0.0030
128	0.9785	0.0030
129	0.9815	0.0030
130	0.9844	0.0029
131	0.9874	0.0029
132	0.9903	0.0029
133	0.9932	0.0029
134	0.9961	0.0029
135	0.9989	0.0029
136	1.0018	0.0029
137	1.0047	0.0028

138	1.0075	0.0028
139	1.0103	0.0028
140	1.0131	0.0028
141	1.0159	0.0028
142	1.0187	0.0028
143	1.0215	0.0028
144	1.0242	0.0028
145	1.0270	0.0028
146	1.0297	0.0027
147	1.0325	0.0027
148	1.0352	0.0027
149	1.0379	0.0027
150	1.0406	0.0027
151	1.0433	0.0027
152	1.0459	0.0027
153	1.0486	0.0027
154	1.0513	0.0027
155	1.0539	0.0026
156	1.0565	0.0026
157	1.0591	0.0026
158	1.0618	0.0026
159	1.0644	0.0026
160	1.0669	0.0026
161	1.0695	0.0026
162	1.0721	0.0026
163	1.0747	0.0026
164	1.0772	0.0026
165	1.0797	0.0025
166	1.0823	0.0025
167	1.0848	0.0025
168	1.0873	0.0025
169	1.0898	0.0025
170	1.0923	0.0025
171	1.0948	0.0025
172	1.0973	0.0025
173	1.0997	0.0025
174	1.1022	0.0025
175	1.1047	0.0025
176	1.1071	0.0024
177	1.1095	0.0024
178	1.1120	0.0024
179	1.1144	0.0024
180	1.1168	0.0024
181	1.1192	0.0024
182	1.1216	0.0024
183	1.1240	0.0024
184	1.1263	0.0024
185	1.1287	0.0024
186	1.1311	0.0024
187	1.1334	0.0024
188	1.1358	0.0023
189	1.1381	0.0023
190	1.1404	0.0023
191	1.1428	0.0023

192	1.1451	0.0023
193	1.1474	0.0023
194	1.1497	0.0023
195	1.1520	0.0023
196	1.1543	0.0023
197	1.1565	0.0023
198	1.1588	0.0023
199	1.1611	0.0023
200	1.1633	0.0023
201	1.1656	0.0023
202	1.1678	0.0022
203	1.1701	0.0022
204	1.1723	0.0022
205	1.1745	0.0022
206	1.1767	0.0022
207	1.1790	0.0022
208	1.1812	0.0022
209	1.1834	0.0022
210	1.1855	0.0022
211	1.1877	0.0022
212	1.1899	0.0022
213	1.1921	0.0022
214	1.1942	0.0022
215	1.1964	0.0022
216	1.1986	0.0022
217	1.2007	0.0021
218	1.2029	0.0021
219	1.2050	0.0021
220	1.2071	0.0021
221	1.2092	0.0021
222	1.2114	0.0021
223	1.2135	0.0021
224	1.2156	0.0021
225	1.2177	0.0021
226	1.2198	0.0021
227	1.2219	0.0021
228	1.2239	0.0021
229	1.2260	0.0021
230	1.2281	0.0021
231	1.2302	0.0021
232	1.2322	0.0021
233	1.2343	0.0021
234	1.2363	0.0021
235	1.2384	0.0020
236	1.2404	0.0020
237	1.2425	0.0020
238	1.2445	0.0020
239	1.2465	0.0020
240	1.2485	0.0020
241	1.2505	0.0020
242	1.2525	0.0020
243	1.2546	0.0020
244	1.2566	0.0020
245	1.2585	0.0020

```
246                1.2605               0.0020
247                1.2625               0.0020
248                1.2645               0.0020
249                1.2665               0.0020
250                1.2684               0.0020
251                1.2704               0.0020
252                1.2724               0.0020
253                1.2743               0.0020
254                1.2763               0.0019
255                1.2782               0.0019
256                1.2802               0.0019
257                1.2821               0.0019
258                1.2840               0.0019
259                1.2859               0.0019
260                1.2879               0.0019
261                1.2898               0.0019
262                1.2917               0.0019
263                1.2936               0.0019
264                1.2955               0.0019
265                1.2974               0.0019
266                1.2993               0.0019
267                1.3012               0.0019
268                1.3031               0.0019
269                1.3050               0.0019
270                1.3068               0.0019
271                1.3087               0.0019
272                1.3106               0.0019
273                1.3125               0.0019
274                1.3143               0.0019
275                1.3162               0.0019
276                1.3180               0.0019
277                1.3199               0.0018
278                1.3217               0.0018
279                1.3236               0.0018
280                1.3254               0.0018
281                1.3272               0.0018
282                1.3291               0.0018
283                1.3309               0.0018
284                1.3327               0.0018
285                1.3345               0.0018
286                1.3363               0.0018
287                1.3381               0.0018
288                1.3400               0.0018
----------------------------------------------------------------------
Unit                Unit            Unit                 Effective
Period              Rainfall        Soil-Loss            Rainfall
(number)              (In)          (In)                    (In)
----------------------------------------------------------------------
  1                0.0018          0.0011                  0.0007
  2                0.0018          0.0011                  0.0007
  3                0.0018          0.0011                  0.0007
  4                0.0018          0.0011                  0.0007
  5                0.0018          0.0011                  0.0007
  6                0.0018          0.0011                  0.0007
```

7	0.0018	0.0011	0.0007
8	0.0018	0.0011	0.0007
9	0.0019	0.0011	0.0007
10	0.0019	0.0012	0.0007
11	0.0019	0.0012	0.0007
12	0.0019	0.0012	0.0007
13	0.0019	0.0012	0.0007
14	0.0019	0.0012	0.0007
15	0.0019	0.0012	0.0007
16	0.0019	0.0012	0.0007
17	0.0019	0.0012	0.0007
18	0.0019	0.0012	0.0007
19	0.0019	0.0012	0.0007
20	0.0019	0.0012	0.0007
21	0.0019	0.0012	0.0007
22	0.0019	0.0012	0.0007
23	0.0019	0.0012	0.0007
24	0.0019	0.0012	0.0007
25	0.0020	0.0012	0.0007
26	0.0020	0.0012	0.0007
27	0.0020	0.0012	0.0007
28	0.0020	0.0012	0.0008
29	0.0020	0.0012	0.0008
30	0.0020	0.0012	0.0008
31	0.0020	0.0012	0.0008
32	0.0020	0.0012	0.0008
33	0.0020	0.0013	0.0008
34	0.0020	0.0013	0.0008
35	0.0020	0.0013	0.0008
36	0.0020	0.0013	0.0008
37	0.0021	0.0013	0.0008
38	0.0021	0.0013	0.0008
39	0.0021	0.0013	0.0008
40	0.0021	0.0013	0.0008
41	0.0021	0.0013	0.0008
42	0.0021	0.0013	0.0008
43	0.0021	0.0013	0.0008
44	0.0021	0.0013	0.0008
45	0.0021	0.0013	0.0008
46	0.0021	0.0013	0.0008
47	0.0021	0.0013	0.0008
48	0.0021	0.0013	0.0008
49	0.0022	0.0013	0.0008
50	0.0022	0.0013	0.0008
51	0.0022	0.0013	0.0008
52	0.0022	0.0014	0.0008
53	0.0022	0.0014	0.0008
54	0.0022	0.0014	0.0008
55	0.0022	0.0014	0.0008
56	0.0022	0.0014	0.0008
57	0.0022	0.0014	0.0008
58	0.0022	0.0014	0.0008
59	0.0023	0.0014	0.0009
60	0.0023	0.0014	0.0009

61	0.0023	0.0014	0.0009
62	0.0023	0.0014	0.0009
63	0.0023	0.0014	0.0009
64	0.0023	0.0014	0.0009
65	0.0023	0.0014	0.0009
66	0.0023	0.0014	0.0009
67	0.0023	0.0015	0.0009
68	0.0023	0.0015	0.0009
69	0.0024	0.0015	0.0009
70	0.0024	0.0015	0.0009
71	0.0024	0.0015	0.0009
72	0.0024	0.0015	0.0009
73	0.0024	0.0015	0.0009
74	0.0024	0.0015	0.0009
75	0.0024	0.0015	0.0009
76	0.0024	0.0015	0.0009
77	0.0025	0.0015	0.0009
78	0.0025	0.0015	0.0009
79	0.0025	0.0015	0.0009
80	0.0025	0.0015	0.0009
81	0.0025	0.0016	0.0010
82	0.0025	0.0016	0.0010
83	0.0025	0.0016	0.0010
84	0.0026	0.0016	0.0010
85	0.0026	0.0016	0.0010
86	0.0026	0.0016	0.0010
87	0.0026	0.0016	0.0010
88	0.0026	0.0016	0.0010
89	0.0026	0.0016	0.0010
90	0.0026	0.0016	0.0010
91	0.0027	0.0017	0.0010
92	0.0027	0.0017	0.0010
93	0.0027	0.0017	0.0010
94	0.0027	0.0017	0.0010
95	0.0027	0.0017	0.0010
96	0.0027	0.0017	0.0010
97	0.0028	0.0017	0.0010
98	0.0028	0.0017	0.0011
99	0.0028	0.0017	0.0011
100	0.0028	0.0017	0.0011
101	0.0028	0.0018	0.0011
102	0.0028	0.0018	0.0011
103	0.0029	0.0018	0.0011
104	0.0029	0.0018	0.0011
105	0.0029	0.0018	0.0011
106	0.0029	0.0018	0.0011
107	0.0030	0.0018	0.0011
108	0.0030	0.0018	0.0011
109	0.0030	0.0019	0.0011
110	0.0030	0.0019	0.0011
111	0.0030	0.0019	0.0012
112	0.0031	0.0019	0.0012
113	0.0031	0.0019	0.0012
114	0.0031	0.0019	0.0012

115	0.0031	0.0019	0.0012
116	0.0032	0.0020	0.0012
117	0.0032	0.0020	0.0012
118	0.0032	0.0020	0.0012
119	0.0032	0.0020	0.0012
120	0.0033	0.0020	0.0012
121	0.0033	0.0020	0.0013
122	0.0033	0.0021	0.0013
123	0.0034	0.0021	0.0013
124	0.0034	0.0021	0.0013
125	0.0034	0.0021	0.0013
126	0.0034	0.0021	0.0013
127	0.0035	0.0022	0.0013
128	0.0035	0.0022	0.0013
129	0.0035	0.0022	0.0013
130	0.0036	0.0022	0.0014
131	0.0036	0.0022	0.0014
132	0.0036	0.0023	0.0014
133	0.0037	0.0023	0.0014
134	0.0037	0.0023	0.0014
135	0.0038	0.0023	0.0014
136	0.0038	0.0024	0.0014
137	0.0038	0.0024	0.0015
138	0.0039	0.0024	0.0015
139	0.0039	0.0024	0.0015
140	0.0040	0.0025	0.0015
141	0.0040	0.0025	0.0015
142	0.0041	0.0025	0.0015
143	0.0041	0.0026	0.0016
144	0.0042	0.0026	0.0016
145	0.0047	0.0029	0.0018
146	0.0047	0.0029	0.0018
147	0.0048	0.0030	0.0018
148	0.0048	0.0030	0.0018
149	0.0049	0.0030	0.0019
150	0.0049	0.0031	0.0019
151	0.0050	0.0031	0.0019
152	0.0051	0.0031	0.0019
153	0.0052	0.0032	0.0020
154	0.0052	0.0032	0.0020
155	0.0053	0.0033	0.0020
156	0.0054	0.0033	0.0020
157	0.0055	0.0034	0.0021
158	0.0056	0.0034	0.0021
159	0.0057	0.0035	0.0022
160	0.0057	0.0036	0.0022
161	0.0059	0.0036	0.0022
162	0.0060	0.0037	0.0023
163	0.0061	0.0038	0.0023
164	0.0062	0.0038	0.0023
165	0.0064	0.0039	0.0024
166	0.0064	0.0040	0.0024
167	0.0066	0.0041	0.0025
168	0.0067	0.0042	0.0026

169	0.0070	0.0043	0.0026
170	0.0071	0.0044	0.0027
171	0.0073	0.0045	0.0028
172	0.0075	0.0046	0.0028
173	0.0077	0.0048	0.0029
174	0.0079	0.0049	0.0030
175	0.0082	0.0051	0.0031
176	0.0084	0.0052	0.0032
177	0.0088	0.0055	0.0034
178	0.0090	0.0056	0.0034
179	0.0095	0.0059	0.0036
180	0.0098	0.0061	0.0037
181	0.0105	0.0065	0.0040
182	0.0108	0.0067	0.0041
183	0.0116	0.0072	0.0044
184	0.0121	0.0075	0.0046
185	0.0094	0.0058	0.0036
186	0.0100	0.0062	0.0038
187	0.0116	0.0072	0.0044
188	0.0127	0.0079	0.0048
189	0.0158	0.0098	0.0060
190	0.0182	0.0113	0.0069
191	0.0275	0.0171	0.0105
192	0.0400	0.0234	0.0166
193	0.1730	0.0234	0.1496
194	0.0217	0.0134	0.0082
195	0.0140	0.0087	0.0053
196	0.0107	0.0067	0.0041
197	0.0127	0.0079	0.0048
198	0.0112	0.0070	0.0043
199	0.0101	0.0063	0.0038
200	0.0093	0.0058	0.0035
201	0.0086	0.0053	0.0033
202	0.0081	0.0050	0.0031
203	0.0076	0.0047	0.0029
204	0.0072	0.0045	0.0027
205	0.0068	0.0042	0.0026
206	0.0065	0.0041	0.0025
207	0.0063	0.0039	0.0024
208	0.0060	0.0037	0.0023
209	0.0058	0.0036	0.0022
210	0.0056	0.0035	0.0021
211	0.0054	0.0034	0.0021
212	0.0053	0.0033	0.0020
213	0.0051	0.0032	0.0019
214	0.0050	0.0031	0.0019
215	0.0048	0.0030	0.0018
216	0.0047	0.0029	0.0018
217	0.0042	0.0026	0.0016
218	0.0041	0.0025	0.0016
219	0.0040	0.0025	0.0015
220	0.0039	0.0024	0.0015
221	0.0038	0.0024	0.0015
222	0.0037	0.0023	0.0014

223	0.0037	0.0023	0.0014
224	0.0036	0.0022	0.0014
225	0.0035	0.0022	0.0013
226	0.0035	0.0021	0.0013
227	0.0034	0.0021	0.0013
228	0.0033	0.0021	0.0013
229	0.0033	0.0020	0.0012
230	0.0032	0.0020	0.0012
231	0.0032	0.0020	0.0012
232	0.0031	0.0019	0.0012
233	0.0031	0.0019	0.0012
234	0.0030	0.0019	0.0011
235	0.0030	0.0019	0.0011
236	0.0029	0.0018	0.0011
237	0.0029	0.0018	0.0011
238	0.0029	0.0018	0.0011
239	0.0028	0.0018	0.0011
240	0.0028	0.0017	0.0011
241	0.0028	0.0017	0.0010
242	0.0027	0.0017	0.0010
243	0.0027	0.0017	0.0010
244	0.0027	0.0016	0.0010
245	0.0026	0.0016	0.0010
246	0.0026	0.0016	0.0010
247	0.0026	0.0016	0.0010
248	0.0025	0.0016	0.0010
249	0.0025	0.0016	0.0010
250	0.0025	0.0015	0.0009
251	0.0025	0.0015	0.0009
252	0.0024	0.0015	0.0009
253	0.0024	0.0015	0.0009
254	0.0024	0.0015	0.0009
255	0.0024	0.0015	0.0009
256	0.0023	0.0014	0.0009
257	0.0023	0.0014	0.0009
258	0.0023	0.0014	0.0009
259	0.0023	0.0014	0.0009
260	0.0022	0.0014	0.0009
261	0.0022	0.0014	0.0008
262	0.0022	0.0014	0.0008
263	0.0022	0.0014	0.0008
264	0.0022	0.0013	0.0008
265	0.0021	0.0013	0.0008
266	0.0021	0.0013	0.0008
267	0.0021	0.0013	0.0008
268	0.0021	0.0013	0.0008
269	0.0021	0.0013	0.0008
270	0.0021	0.0013	0.0008
271	0.0020	0.0013	0.0008
272	0.0020	0.0013	0.0008
273	0.0020	0.0012	0.0008
274	0.0020	0.0012	0.0008
275	0.0020	0.0012	0.0008
276	0.0020	0.0012	0.0007

```
    277              0.0020           0.0012              0.0007
    278              0.0019           0.0012              0.0007
    279              0.0019           0.0012              0.0007
    280              0.0019           0.0012              0.0007
    281              0.0019           0.0012              0.0007
    282              0.0019           0.0012              0.0007
    283              0.0019           0.0012              0.0007
    284              0.0019           0.0012              0.0007
    285              0.0018           0.0011              0.0007
    286              0.0018           0.0011              0.0007
    287              0.0018           0.0011              0.0007
    288              0.0018           0.0011              0.0007
    --------------------------------------------------------------------
    --------------------------------------------------------------------
    Total soil rain loss =      0.75(In)
    Total effective rainfall =      0.59(In)
    Peak flow rate in flood hydrograph =     15.37(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      0.00  Q          |         |         |         |
  0+10       0.0002      0.03  Q          |         |         |         |
  0+15       0.0008      0.09  Q          |         |         |         |
  0+20       0.0017      0.14  Q          |         |         |         |
  0+25       0.0029      0.16  Q          |         |         |         |
  0+30       0.0041      0.18  Q          |         |         |         |
  0+35       0.0054      0.19  Q          |         |         |         |
  0+40       0.0068      0.20  Q          |         |         |         |
  0+45       0.0083      0.21  Q          |         |         |         |
  0+50       0.0098      0.22  Q          |         |         |         |
  0+55       0.0113      0.22  Q          |         |         |         |
  1+ 0       0.0129      0.23  Q          |         |         |         |
  1+ 5       0.0145      0.23  Q          |         |         |         |
  1+10       0.0161      0.24  Q          |         |         |         |
  1+15       0.0177      0.24  Q          |         |         |         |
  1+20       0.0194      0.24  Q          |         |         |         |
  1+25       0.0211      0.24  Q          |         |         |         |
  1+30       0.0228      0.25  Q          |         |         |         |
  1+35       0.0245      0.25  Q          |         |         |         |
  1+40       0.0262      0.25  Q          |         |         |         |
  1+45       0.0279      0.25  Q          |         |         |         |
  1+50       0.0296      0.25  Q          |         |         |         |
  1+55       0.0314      0.25  Q          |         |         |         |
  2+ 0       0.0332      0.26  Q          |         |         |         |
  2+ 5       0.0349      0.26  Q          |         |         |         |
  2+10       0.0367      0.26  QV         |         |         |         |
  2+15       0.0385      0.26  QV         |         |         |         |
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2+20       0.0403      0.26  QV        |         |         |         |
2+25       0.0420      0.26  QV        |         |         |         |
2+30       0.0438      0.26  QV        |         |         |         |
2+35       0.0457      0.26  QV        |         |         |         |
2+40       0.0475      0.26  QV        |         |         |         |
2+45       0.0493      0.26  QV        |         |         |         |
2+50       0.0511      0.27  QV        |         |         |         |
2+55       0.0529      0.27  QV        |         |         |         |
3+ 0       0.0548      0.27  QV        |         |         |         |
3+ 5       0.0566      0.27  QV        |         |         |         |
3+10       0.0585      0.27  QV        |         |         |         |
3+15       0.0603      0.27  QV        |         |         |         |
3+20       0.0622      0.27  QV        |         |         |         |
3+25       0.0641      0.27  QV        |         |         |         |
3+30       0.0660      0.27  QV        |         |         |         |
3+35       0.0679      0.27  QV        |         |         |         |
3+40       0.0697      0.28  QV        |         |         |         |
3+45       0.0717      0.28  QV        |         |         |         |
3+50       0.0736      0.28  Q V       |         |         |         |
3+55       0.0755      0.28  Q V       |         |         |         |
4+ 0       0.0774      0.28  Q V       |         |         |         |
4+ 5       0.0794      0.28  Q V       |         |         |         |
4+10       0.0813      0.28  Q V       |         |         |         |
4+15       0.0832      0.28  Q V       |         |         |         |
4+20       0.0852      0.28  Q V       |         |         |         |
4+25       0.0872      0.29  Q V       |         |         |         |
4+30       0.0892      0.29  Q V       |         |         |         |
4+35       0.0911      0.29  Q V       |         |         |         |
4+40       0.0931      0.29  Q V       |         |         |         |
4+45       0.0951      0.29  Q V       |         |         |         |
4+50       0.0971      0.29  Q V       |         |         |         |
4+55       0.0992      0.29  Q V       |         |         |         |
5+ 0       0.1012      0.29  Q V       |         |         |         |
5+ 5       0.1032      0.30  Q V       |         |         |         |
5+10       0.1053      0.30  Q V       |         |         |         |
5+15       0.1073      0.30  Q V       |         |         |         |
5+20       0.1094      0.30  Q  V      |         |         |         |
5+25       0.1115      0.30  Q  V      |         |         |         |
5+30       0.1136      0.30  Q  V      |         |         |         |
5+35       0.1157      0.30  Q  V      |         |         |         |
5+40       0.1178      0.31  Q  V      |         |         |         |
5+45       0.1199      0.31  Q  V      |         |         |         |
5+50       0.1220      0.31  Q  V      |         |         |         |
5+55       0.1242      0.31  Q  V      |         |         |         |
6+ 0       0.1263      0.31  Q  V      |         |         |         |
6+ 5       0.1285      0.31  Q  V      |         |         |         |
6+10       0.1306      0.31  Q  V      |         |         |         |
6+15       0.1328      0.32  Q  V      |         |         |         |
6+20       0.1350      0.32  Q  V      |         |         |         |
6+25       0.1372      0.32  Q  V      |         |         |         |
6+30       0.1394      0.32  Q  V      |         |         |         |
6+35       0.1416      0.32  Q  V      |         |         |         |
6+40       0.1439      0.32  Q   V     |         |         |         |
6+45       0.1461      0.33  Q   V     |         |         |         |
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 6+50       0.1484      0.33  Q   V     |         |         |         |
 6+55       0.1506      0.33  Q   V     |         |         |         |
 7+ 0       0.1529      0.33  Q   V     |         |         |         |
 7+ 5       0.1552      0.33  Q   V     |         |         |         |
 7+10       0.1575      0.34  Q   V     |         |         |         |
 7+15       0.1598      0.34  Q   V     |         |         |         |
 7+20       0.1622      0.34  Q   V     |         |         |         |
 7+25       0.1645      0.34  Q   V     |         |         |         |
 7+30       0.1669      0.34  Q   V     |         |         |         |
 7+35       0.1693      0.34  Q   V     |         |         |         |
 7+40       0.1717      0.35  Q   V     |         |         |         |
 7+45       0.1741      0.35  Q   V     |         |         |         |
 7+50       0.1765      0.35  Q   V     |         |         |         |
 7+55       0.1789      0.35  Q   V     |         |         |         |
 8+ 0       0.1813      0.36  Q    V    |         |         |         |
 8+ 5       0.1838      0.36  Q    V    |         |         |         |
 8+10       0.1863      0.36  Q    V    |         |         |         |
 8+15       0.1888      0.36  Q    V    |         |         |         |
 8+20       0.1913      0.36  Q    V    |         |         |         |
 8+25       0.1938      0.37  Q    V    |         |         |         |
 8+30       0.1963      0.37  Q    V    |         |         |         |
 8+35       0.1989      0.37  Q    V    |         |         |         |
 8+40       0.2015      0.37  Q    V    |         |         |         |
 8+45       0.2041      0.38  Q    V    |         |         |         |
 8+50       0.2067      0.38  Q    V    |         |         |         |
 8+55       0.2093      0.38  Q    V    |         |         |         |
 9+ 0       0.2119      0.38  Q    V    |         |         |         |
 9+ 5       0.2146      0.39  Q    V    |         |         |         |
 9+10       0.2173      0.39  Q     V   |         |         |         |
 9+15       0.2200      0.39  Q     V   |         |         |         |
 9+20       0.2227      0.39  Q     V   |         |         |         |
 9+25       0.2254      0.40  Q     V   |         |         |         |
 9+30       0.2282      0.40  Q     V   |         |         |         |
 9+35       0.2310      0.40  Q     V   |         |         |         |
 9+40       0.2338      0.41  Q     V   |         |         |         |
 9+45       0.2366      0.41  Q     V   |         |         |         |
 9+50       0.2394      0.41  Q     V   |         |         |         |
 9+55       0.2423      0.42  Q     V   |         |         |         |
10+ 0       0.2452      0.42  Q     V   |         |         |         |
10+ 5       0.2481      0.42  Q     V   |         |         |         |
10+10       0.2510      0.43  Q      V  |         |         |         |
10+15       0.2540      0.43  Q      V  |         |         |         |
10+20       0.2570      0.43  Q      V  |         |         |         |
10+25       0.2600      0.44  Q      V  |         |         |         |
10+30       0.2630      0.44  Q      V  |         |         |         |
10+35       0.2661      0.44  Q      V  |         |         |         |
10+40       0.2691      0.45  Q      V  |         |         |         |
10+45       0.2723      0.45  Q      V  |         |         |         |
10+50       0.2754      0.46  Q      V  |         |         |         |
10+55       0.2786      0.46  Q      V  |         |         |         |
11+ 0       0.2818      0.46  Q      V  |         |         |         |
11+ 5       0.2850      0.47  Q      V  |         |         |         |
11+10       0.2883      0.47  Q       V |         |         |         |
11+15       0.2916      0.48  Q       V |         |         |         |
```

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11+20       0.2949      0.48  Q       V |         |         |         |
11+25       0.2983      0.49  Q       V |         |         |         |
11+30       0.3017      0.49  Q       V |         |         |         |
11+35       0.3051      0.50  Q       V |         |         |         |
11+40       0.3086      0.50  |Q      V |         |         |         |
11+45       0.3121      0.51  |Q      V |         |         |         |
11+50       0.3156      0.51  |Q      V |         |         |         |
11+55       0.3192      0.52  |Q      V |         |         |         |
12+ 0       0.3228      0.53  |Q       V|         |         |         |
12+ 5       0.3265      0.53  |Q       V|         |         |         |
12+10       0.3303      0.55  |Q       V|         |         |         |
12+15       0.3342      0.57  |Q       V|         |         |         |
12+20       0.3382      0.58  |Q       V|         |         |         |
12+25       0.3423      0.60  |Q       V|         |         |         |
12+30       0.3465      0.61  |Q       V|         |         |         |
12+35       0.3507      0.62  |Q       V|         |         |         |
12+40       0.3551      0.63  |Q       V|         |         |         |
12+45       0.3595      0.64  |Q        V         |         |         |
12+50       0.3640      0.65  |Q        V         |         |         |
12+55       0.3685      0.66  |Q        V         |         |         |
13+ 0       0.3731      0.67  |Q        V         |         |         |
13+ 5       0.3778      0.68  |Q        V         |         |         |
13+10       0.3826      0.69  |Q        V         |         |         |
13+15       0.3874      0.70  |Q        V         |         |         |
13+20       0.3923      0.71  |Q        V         |         |         |
13+25       0.3973      0.72  |Q        |V        |         |         |
13+30       0.4024      0.74  |Q        |V        |         |         |
13+35       0.4075      0.75  |Q        |V        |         |         |
13+40       0.4128      0.76  |Q        |V        |         |         |
13+45       0.4181      0.78  |Q        |V        |         |         |
13+50       0.4236      0.79  |Q        |V        |         |         |
13+55       0.4291      0.81  |Q        |V        |         |         |
14+ 0       0.4348      0.82  |Q        | V       |         |         |
14+ 5       0.4406      0.84  |Q        | V       |         |         |
14+10       0.4465      0.86  |Q        | V       |         |         |
14+15       0.4525      0.88  |Q        | V       |         |         |
14+20       0.4587      0.90  |Q        | V       |         |         |
14+25       0.4650      0.92  |Q        | V       |         |         |
14+30       0.4715      0.94  |Q        |  V      |         |         |
14+35       0.4782      0.97  |Q        |  V      |         |         |
14+40       0.4850      0.99  |Q        |  V      |         |         |
14+45       0.4921      1.02  | Q       |  V      |         |         |
14+50       0.4993      1.05  | Q       |  V      |         |         |
14+55       0.5068      1.09  | Q       |   V     |         |         |
15+ 0       0.5146      1.13  | Q       |   V     |         |         |
15+ 5       0.5226      1.17  | Q       |   V     |         |         |
15+10       0.5310      1.21  | Q       |   V     |         |         |
15+15       0.5397      1.27  | Q       |    V    |         |         |
15+20       0.5488      1.32  | Q       |    V    |         |         |
15+25       0.5583      1.38  | Q       |    V    |         |         |
15+30       0.5680      1.41  | Q       |    V    |         |         |
15+35       0.5774      1.37  | Q       |     V   |         |         |
15+40       0.5869      1.37  | Q       |     V   |         |         |
15+45       0.5967      1.44  | Q       |     V   |         |         |
```

```
15+50       0.6075      1.56  |  Q      |     V   |         |         |
15+55       0.6196      1.76  |  Q      |      V  |         |         |
16+ 0       0.6341      2.11  |   Q     |      V  |         |         |
16+ 5       0.6594      3.67  |      Q  |       V |         |         |
16+10       0.7130      7.78  |         |    Q   V|         |         |
16+15       0.8189     15.37  |         |         | V       Q         |
16+20       0.9085     13.02  |         |         |    VQ   |         |
16+25       0.9633      7.95  |         |    Q    |     V   |         |
16+30       1.0029      5.75  |         |Q        |      V  |         |
16+35       1.0344      4.58  |        Q|         |       V |         |
16+40       1.0605      3.79  |      Q  |         |        V|         |
16+45       1.0832      3.29  |     Q   |         |         V         |
16+50       1.1027      2.83  |    Q    |         |         V         |
16+55       1.1194      2.43  |   Q     |         |         |V        |
17+ 0       1.1346      2.20  |   Q     |         |         |V        |
17+ 5       1.1482      1.98  |  Q      |         |         | V       |
17+10       1.1604      1.77  |  Q      |         |         | V       |
17+15       1.1716      1.62  |  Q      |         |         | V       |
17+20       1.1818      1.48  | Q       |         |         | V       |
17+25       1.1909      1.32  | Q       |         |         |  V      |
17+30       1.1991      1.20  | Q       |         |         |  V      |
17+35       1.2067      1.09  | Q       |         |         |  V      |
17+40       1.2141      1.08  | Q       |         |         |  V      |
17+45       1.2213      1.05  | Q       |         |         |   V     |
17+50       1.2282      1.01  | Q       |         |         |   V     |
17+55       1.2345      0.91  |Q        |         |         |   V     |
18+ 0       1.2403      0.85  |Q        |         |         |   V     |
18+ 5       1.2457      0.78  |Q        |         |         |   V     |
18+10       1.2505      0.69  |Q        |         |         |   V     |
18+15       1.2550      0.65  |Q        |         |         |   V     |
18+20       1.2593      0.62  |Q        |         |         |    V    |
18+25       1.2634      0.60  |Q        |         |         |    V    |
18+30       1.2674      0.58  |Q        |         |         |    V    |
18+35       1.2713      0.56  |Q        |         |         |    V    |
18+40       1.2751      0.55  |Q        |         |         |    V    |
18+45       1.2787      0.53  |Q        |         |         |    V    |
18+50       1.2823      0.52  |Q        |         |         |    V    |
18+55       1.2858      0.51  |Q        |         |         |    V    |
19+ 0       1.2892      0.49  Q         |         |         |    V    |
19+ 5       1.2925      0.48  Q         |         |         |     V   |
19+10       1.2958      0.47  Q         |         |         |     V   |
19+15       1.2989      0.46  Q         |         |         |     V   |
19+20       1.3021      0.45  Q         |         |         |     V   |
19+25       1.3051      0.45  Q         |         |         |     V   |
19+30       1.3082      0.44  Q         |         |         |     V   |
19+35       1.3111      0.43  Q         |         |         |     V   |
19+40       1.3140      0.42  Q         |         |         |     V   |
19+45       1.3169      0.42  Q         |         |         |     V   |
19+50       1.3197      0.41  Q         |         |         |     V   |
19+55       1.3225      0.40  Q         |         |         |     V   |
20+ 0       1.3252      0.40  Q         |         |         |     V   |
20+ 5       1.3279      0.39  Q         |         |         |      V  |
20+10       1.3306      0.39  Q         |         |         |      V  |
20+15       1.3332      0.38  Q         |         |         |      V  |
```

```
   20+20       1.3358      0.38  Q         |         |         |      V  |
   20+25       1.3384      0.37  Q         |         |         |      V  |
   20+30       1.3409      0.37  Q         |         |         |      V  |
   20+35       1.3434      0.36  Q         |         |         |      V  |
   20+40       1.3458      0.36  Q         |         |         |      V  |
   20+45       1.3482      0.35  Q         |         |         |      V  |
   20+50       1.3506      0.35  Q         |         |         |      V  |
   20+55       1.3530      0.34  Q         |         |         |      V  |
   21+ 0       1.3554      0.34  Q         |         |         |      V  |
   21+ 5       1.3577      0.34  Q         |         |         |      V  |
   21+10       1.3600      0.33  Q         |         |         |      V  |
   21+15       1.3622      0.33  Q         |         |         |      V  |
   21+20       1.3645      0.33  Q         |         |         |       V |
   21+25       1.3667      0.32  Q         |         |         |       V |
   21+30       1.3689      0.32  Q         |         |         |       V |
   21+35       1.3711      0.32  Q         |         |         |       V |
   21+40       1.3732      0.31  Q         |         |         |       V |
   21+45       1.3754      0.31  Q         |         |         |       V |
   21+50       1.3775      0.31  Q         |         |         |       V |
   21+55       1.3796      0.30  Q         |         |         |       V |
   22+ 0       1.3816      0.30  Q         |         |         |       V |
   22+ 5       1.3837      0.30  Q         |         |         |       V |
   22+10       1.3857      0.30  Q         |         |         |       V |
   22+15       1.3877      0.29  Q         |         |         |       V |
   22+20       1.3897      0.29  Q         |         |         |       V |
   22+25       1.3917      0.29  Q         |         |         |       V |
   22+30       1.3937      0.29  Q         |         |         |       V |
   22+35       1.3956      0.28  Q         |         |         |       V |
   22+40       1.3976      0.28  Q         |         |         |       V |
   22+45       1.3995      0.28  Q         |         |         |        V|
   22+50       1.4014      0.28  Q         |         |         |        V|
   22+55       1.4033      0.27  Q         |         |         |        V|
   23+ 0       1.4051      0.27  Q         |         |         |        V|
   23+ 5       1.4070      0.27  Q         |         |         |        V|
   23+10       1.4088      0.27  Q         |         |         |        V|
   23+15       1.4107      0.27  Q         |         |         |        V|
   23+20       1.4125      0.26  Q         |         |         |        V|
   23+25       1.4143      0.26  Q         |         |         |        V|
   23+30       1.4161      0.26  Q         |         |         |        V|
   23+35       1.4179      0.26  Q         |         |         |        V|
   23+40       1.4196      0.26  Q         |         |         |        V|
   23+45       1.4214      0.25  Q         |         |         |        V|
   23+50       1.4231      0.25  Q         |         |         |        V|
   23+55       1.4248      0.25  Q         |         |         |        V|
   24+ 0       1.4265      0.25  Q         |         |         |        V|
----------------------------------------------------------------------
```

2-YEAR, 24-HOURS STORM
VOLUME= 1.43 AC.FT.
VOLUME= 62,291 CU.FT.

TR. 20525

100-year, 24-Hours Storm Events

Routing

```
                     FLOOD HYDROGRAPH ROUTING PROGRAM
            Copyright (c) CIVILCADD/CIVILDESIGN, 1989 - 2004
                        Study date: 08/26/22

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


100-YR ROUTING TO BASIN 1
TR 20525, CITY OF VICTORVILLE
AREA NORTHWEST Basin # 1
FILE; 20525ROUTINGBASIN.OUT
--------------------------------------------------------------------


Program License Serial Number 4070

--------------------------------------------------------------------
********************* HYDROGRAPH INFORMATION **********************

           From study/file name: 20525HYDROAA1100YR.rte
****************************HYDROGRAPH DATA****************************
           Number of intervals =   310
           Time interval =    5.0 (Min.)
           Maximum/Peak flow rate =      60.213 (CFS)
           Total volume =      6.107 (Ac.Ft)
      Status of hydrographs being held in storage
                 Stream 1  Stream 2  Stream 3  Stream 4  Stream 5
      Peak (CFS)      0.000     0.000     0.000     0.000     0.000
      Vol (Ac.Ft)      0.000     0.000     0.000     0.000     0.000
***********************************************************************



++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       1.000 to Point/Station       2.000
**** RETARDING BASIN ROUTING ****
______________________________________________________________________

Program computation of outflow v. depth




CALCULATED OUTFLOW DATA AT DEPTH =    1.00(Ft.))
Total outflow at this depth =      0.00(CFS)


CALCULATED OUTFLOW DATA AT DEPTH =    2.00(Ft.))
Total outflow at this depth =      0.00(CFS)
```

```
CALCULATED OUTFLOW DATA AT DEPTH =    3.00(Ft.))
Channel length =    44.00(Ft.)     Elevation difference =   0.88(Ft.)
Covered channel
Channel base width  =   10.000(Ft.)
Slope or 'Z' of left channel bank =   0.000
Slope or 'Z' of right channel bank =   0.000
Manning's 'N'    = 0.015
Maximum depth of channel  =    0.333(Ft.)
Channel flow top width =   10.000(Ft.)
Depth of flow in channel =   0.06(Ft.)
Total number of channels (same dimensions) = 1
Flow Velocity =    2.04(Ft/s)
Travel time  =    0.09 min.
Individual channel flow =    1.140(CFS)
Total capacity of improved channels =      1.140(CFS)
Critical Depth in Channel =    0.07(Ft.)

Total outflow at this depth =      1.14(CFS)


CALCULATED OUTFLOW DATA AT DEPTH =    4.00(Ft.))
Channel length =    44.00(Ft.)     Elevation difference =   0.88(Ft.)
Covered channel
Channel base width  =   10.000(Ft.)
Slope or 'Z' of left channel bank =   0.000
Slope or 'Z' of right channel bank =   0.000
Manning's 'N'    = 0.015
Maximum depth of channel  =    0.333(Ft.)
 NOTE: Assuming free outlet flow.
Pressure flow condition in covered channel:
Wetted perimeter =   20.67(Ft.)  Flow area =    3.33(Sq.Ft)
Total head loss through channel =      1.961(Ft.)
Friction loss =      1.348(Ft.), Minor loss =      0.614(Ft.)
Total number of channels (same dimensions) = 1
Flow Velocity =    5.13(Ft/s)
Travel time  =    0.14 min.
Individual channel flow =   17.095(CFS)
Total capacity of improved channels =     17.095(CFS)

Total outflow at this depth =     17.10(CFS)


CALCULATED OUTFLOW DATA AT DEPTH =    5.00(Ft.))
Channel length =    44.00(Ft.)     Elevation difference =   0.88(Ft.)
Covered channel
Channel base width  =   10.000(Ft.)
Slope or 'Z' of left channel bank =   0.000
Slope or 'Z' of right channel bank =   0.000
Manning's 'N'    = 0.015
Maximum depth of channel  =    0.333(Ft.)
 NOTE: Assuming free outlet flow.
Pressure flow condition in covered channel:
Wetted perimeter =   20.67(Ft.)  Flow area =    3.33(Sq.Ft)
Total head loss through channel =      2.962(Ft.)
```

```
Friction loss =      2.035(Ft.), Minor loss =      0.927(Ft.)
Total number of channels (same dimensions) = 1
Flow Velocity =    6.31(Ft/s)
Travel time  =    0.12 min.
Individual channel flow =   21.008(CFS)
Total capacity of improved channels =     21.008(CFS)

Total outflow at this depth =     21.01(CFS)


CALCULATED OUTFLOW DATA AT DEPTH =    6.00(Ft.))
Channel length =    44.00(Ft.)     Elevation difference =   0.88(Ft.)
Covered channel
Channel base width  =   10.000(Ft.)
Slope or 'Z' of left channel bank =   0.000
Slope or 'Z' of right channel bank =   0.000
Manning's 'N'    = 0.015
Maximum depth of channel  =    0.333(Ft.)
 NOTE: Assuming free outlet flow.
Pressure flow condition in covered channel:
Wetted perimeter =   20.67(Ft.)  Flow area =    3.33(Sq.Ft)
Total head loss through channel =      3.963(Ft.)
Friction loss =      2.722(Ft.), Minor loss =      1.240(Ft.)
Total number of channels (same dimensions) = 1
Flow Velocity =    7.30(Ft/s)
Travel time  =    0.10 min.
Individual channel flow =   24.299(CFS)
Total capacity of improved channels =     24.299(CFS)

Total outflow at this depth =     24.30(CFS)

--------------------------------------------------------------------
Total number of inflow hydrograph intervals = 310
Hydrograph time unit =  5.000 (Min.)
Initial depth in storage basin =   0.00(Ft.)
--------------------------------------------------------------------
--------------------------------------------------------------------
Initial basin depth =   0.00 (Ft.)
Initial basin storage =      0.00 (Ac.Ft)
Initial basin outflow =   0.00 (CFS)
---------------------------------------------------------------------
--------------------------------------------------------------------
Depth vs. Storage and Depth vs. Discharge data:
 Basin Depth  Storage    Outflow   (S-O*dt/2)   (S+O*dt/2)
     (Ft.)    (Ac.Ft)    (CFS)     (Ac.Ft)    (Ac.Ft)
---------------------------------------------------------------------
    0.000      0.000      0.000      0.000        0.000
    1.000      0.205      0.000      0.205        0.205
    2.000      0.446      0.000      0.446        0.446
    3.000      0.724      1.140      0.720        0.728
    4.000      1.042     17.095      0.983        1.101
    5.000      1.401     21.008      1.329        1.473
    6.000      1.803     24.299      1.719        1.887
--------------------------------------------------------------------
```

```
                Hydrograph Detention Basin Routing
     ---------------------------------------------------------------------

     Graph values: 'I'= unit inflow; 'O'=outflow at time shown
     ---------------------------------------------------------------------
 Time   Inflow  Outflow    Storage                                     Depth
(Hours)  (CFS)   (CFS)     (Ac.Ft) .0      15.1   30.11   45.16   60.21 (Ft.)
 0.083    0.03    0.00      0.000  O       |       |       |       |     0.00
 0.167    0.16    0.00      0.001  O       |       |       |       |     0.00
 0.250    0.49    0.00      0.003  O       |       |       |       |     0.01
 0.333    0.72    0.00      0.007  O       |       |       |       |     0.04
 0.417    0.84    0.00      0.013  O       |       |       |       |     0.06
 0.500    0.93    0.00      0.019  O       |       |       |       |     0.09
 0.583    0.99    0.00      0.025  O       |       |       |       |     0.12
 0.667    1.03    0.00      0.032  O       |       |       |       |     0.16
 0.750    1.07    0.00      0.039  O       |       |       |       |     0.19
 0.833    1.10    0.00      0.047  O       |       |       |       |     0.23
 0.917    1.12    0.00      0.055  O       |       |       |       |     0.27
 1.000    1.15    0.00      0.062  O       |       |       |       |     0.30
 1.083    1.16    0.00      0.070  O       |       |       |       |     0.34
 1.167    1.18    0.00      0.078  O       |       |       |       |     0.38
 1.250    1.19    0.00      0.087  O       |       |       |       |     0.42
 1.333    1.20    0.00      0.095  O       |       |       |       |     0.46
 1.417    1.21    0.00      0.103  O       |       |       |       |     0.50
 1.500    1.22    0.00      0.111  O       |       |       |       |     0.54
 1.583    1.23    0.00      0.120  O       |       |       |       |     0.58
 1.667    1.24    0.00      0.128  O       |       |       |       |     0.63
 1.750    1.25    0.00      0.137  O       |       |       |       |     0.67
 1.833    1.25    0.00      0.146  O       |       |       |       |     0.71
 1.917    1.26    0.00      0.154  O       |       |       |       |     0.75
 2.000    1.26    0.00      0.163  O       |       |       |       |     0.79
 2.083    1.27    0.00      0.172  O       |       |       |       |     0.84
 2.167    1.27    0.00      0.180  O       |       |       |       |     0.88
 2.250    1.28    0.00      0.189  O       |       |       |       |     0.92
 2.333    1.28    0.00      0.198  O       |       |       |       |     0.97
 2.417    1.28    0.00      0.207  O       |       |       |       |     1.01
 2.500    1.29    0.00      0.216  O       |       |       |       |     1.04
 2.583    1.29    0.00      0.225  O       |       |       |       |     1.08
 2.667    1.30    0.00      0.233  O       |       |       |       |     1.12
 2.750    1.30    0.00      0.242  O       |       |       |       |     1.16
 2.833    1.31    0.00      0.251  O       |       |       |       |     1.19
 2.917    1.31    0.00      0.260  O       |       |       |       |     1.23
 3.000    1.32    0.00      0.269  O       |       |       |       |     1.27
 3.083    1.32    0.00      0.279  O       |       |       |       |     1.31
 3.167    1.33    0.00      0.288  O       |       |       |       |     1.34
 3.250    1.33    0.00      0.297  O       |       |       |       |     1.38
 3.333    1.34    0.00      0.306  O       |       |       |       |     1.42
 3.417    1.34    0.00      0.315  O       |       |       |       |     1.46
 3.500    1.35    0.00      0.324  O       |       |       |       |     1.50
 3.583    1.35    0.00      0.334  O       |       |       |       |     1.53
 3.667    1.36    0.00      0.343  O       |       |       |       |     1.57
 3.750    1.36    0.00      0.352  O       |       |       |       |     1.61
 3.833    1.37    0.00      0.362  O       |       |       |       |     1.65
 3.917    1.37    0.00      0.371  O       |       |       |       |     1.69
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4.000    1.38    0.00      0.381  O       |       |       |       |     1.73
4.083    1.38    0.00      0.390  O       |       |       |       |     1.77
4.167    1.39    0.00      0.400  O       |       |       |       |     1.81
4.250    1.39    0.00      0.409  O       |       |       |       |     1.85
4.333    1.40    0.00      0.419  O       |       |       |       |     1.89
4.417    1.40    0.00      0.429  O       |       |       |       |     1.93
4.500    1.41    0.00      0.438  O       |       |       |       |     1.97
4.583    1.42    0.01      0.448  O       |       |       |       |     2.01
4.667    1.42    0.05      0.458  O       |       |       |       |     2.04
4.750    1.43    0.09      0.467  O       |       |       |       |     2.08
4.833    1.43    0.12      0.476  O       |       |       |       |     2.11
4.917    1.44    0.16      0.485  O       |       |       |       |     2.14
5.000    1.45    0.20      0.494  O       |       |       |       |     2.17
5.083    1.45    0.23      0.502  O       |       |       |       |     2.20
5.167    1.46    0.26      0.510  O       |       |       |       |     2.23
5.250    1.46    0.30      0.519  O       |       |       |       |     2.26
5.333    1.47    0.33      0.527  O       |       |       |       |     2.29
5.417    1.48    0.36      0.534  O       |       |       |       |     2.32
5.500    1.48    0.39      0.542  O       |       |       |       |     2.35
5.583    1.49    0.42      0.549  O       |       |       |       |     2.37
5.667    1.50    0.45      0.557  O       |       |       |       |     2.40
5.750    1.50    0.48      0.564  O       |       |       |       |     2.42
5.833    1.51    0.51      0.571  O       |       |       |       |     2.45
5.917    1.52    0.54      0.577  O       |       |       |       |     2.47
6.000    1.52    0.57      0.584  O       |       |       |       |     2.50
6.083    1.53    0.59      0.591  O       |       |       |       |     2.52
6.167    1.54    0.62      0.597  O       |       |       |       |     2.54
6.250    1.55    0.65      0.603  O       |       |       |       |     2.57
6.333    1.55    0.67      0.609  O       |       |       |       |     2.59
6.417    1.56    0.70      0.615  O       |       |       |       |     2.61
6.500    1.57    0.72      0.621  O       |       |       |       |     2.63
6.583    1.58    0.74      0.627  O       |       |       |       |     2.65
6.667    1.58    0.77      0.633  O       |       |       |       |     2.67
6.750    1.59    0.79      0.638  O       |       |       |       |     2.69
6.833    1.60    0.81      0.644  O       |       |       |       |     2.71
6.917    1.61    0.83      0.649  O       |       |       |       |     2.73
7.000    1.62    0.86      0.655  O       |       |       |       |     2.75
7.083    1.62    0.88      0.660  O       |       |       |       |     2.77
7.167    1.63    0.90      0.665  O       |       |       |       |     2.79
7.250    1.64    0.92      0.670  O       |       |       |       |     2.81
7.333    1.65    0.94      0.675  O       |       |       |       |     2.82
7.417    1.66    0.96      0.680  O       |       |       |       |     2.84
7.500    1.67    0.98      0.685  O       |       |       |       |     2.86
7.583    1.68    1.00      0.689  O       |       |       |       |     2.87
7.667    1.69    1.02      0.694  O       |       |       |       |     2.89
7.750    1.70    1.04      0.698  O       |       |       |       |     2.91
7.833    1.71    1.05      0.703  O       |       |       |       |     2.92
7.917    1.71    1.07      0.707  O       |       |       |       |     2.94
8.000    1.72    1.09      0.712  O       |       |       |       |     2.96
8.083    1.73    1.11      0.716  O       |       |       |       |     2.97
8.167    1.74    1.13      0.720  O       |       |       |       |     2.99
8.250    1.76    1.17      0.725  O       |       |       |       |     3.00
8.333    1.77    1.34      0.728  O       |       |       |       |     3.01
8.417    1.78    1.47      0.731  O       |       |       |       |     3.02
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 8.500    1.79    1.56      0.732  O       |       |       |       |     3.03
 8.583    1.80    1.63      0.734  O       |       |       |       |     3.03
 8.667    1.81    1.68      0.735  O       |       |       |       |     3.03
 8.750    1.82    1.72      0.736  O       |       |       |       |     3.04
 8.833    1.83    1.75      0.736  O       |       |       |       |     3.04
 8.917    1.84    1.78      0.737  O       |       |       |       |     3.04
 9.000    1.86    1.80      0.737  O       |       |       |       |     3.04
 9.083    1.87    1.82      0.737  O       |       |       |       |     3.04
 9.167    1.88    1.83      0.738  O       |       |       |       |     3.04
 9.250    1.89    1.85      0.738  OI      |       |       |       |     3.04
 9.333    1.91    1.86      0.738  OI      |       |       |       |     3.05
 9.417    1.92    1.88      0.739  OI      |       |       |       |     3.05
 9.500    1.93    1.89      0.739  |O      |       |       |       |     3.05
 9.583    1.95    1.91      0.739  |O      |       |       |       |     3.05
 9.667    1.96    1.92      0.740  |O      |       |       |       |     3.05
 9.750    1.97    1.93      0.740  |O      |       |       |       |     3.05
 9.833    1.99    1.95      0.740  |O      |       |       |       |     3.05
 9.917    2.00    1.96      0.740  |O      |       |       |       |     3.05
10.000    2.02    1.98      0.741  |O      |       |       |       |     3.05
10.083    2.03    1.99      0.741  |O      |       |       |       |     3.05
10.167    2.05    2.01      0.741  |O      |       |       |       |     3.05
10.250    2.07    2.02      0.742  |O      |       |       |       |     3.06
10.333    2.08    2.04      0.742  |O      |       |       |       |     3.06
10.417    2.10    2.05      0.742  |O      |       |       |       |     3.06
10.500    2.12    2.07      0.743  |O      |       |       |       |     3.06
10.583    2.13    2.09      0.743  |O      |       |       |       |     3.06
10.667    2.15    2.10      0.743  |O      |       |       |       |     3.06
10.750    2.17    2.12      0.744  |O      |       |       |       |     3.06
10.833    2.19    2.14      0.744  |O      |       |       |       |     3.06
10.917    2.21    2.15      0.744  |O      |       |       |       |     3.06
11.000    2.23    2.17      0.745  |O      |       |       |       |     3.06
11.083    2.25    2.19      0.745  |O      |       |       |       |     3.07
11.167    2.27    2.21      0.745  |O      |       |       |       |     3.07
11.250    2.29    2.23      0.746  |O      |       |       |       |     3.07
11.333    2.31    2.25      0.746  |O      |       |       |       |     3.07
11.417    2.33    2.27      0.747  |O      |       |       |       |     3.07
11.500    2.36    2.29      0.747  |O      |       |       |       |     3.07
11.583    2.38    2.32      0.747  |O      |       |       |       |     3.07
11.667    2.40    2.34      0.748  |O      |       |       |       |     3.08
11.750    2.43    2.36      0.748  |O      |       |       |       |     3.08
11.833    2.45    2.38      0.749  |O      |       |       |       |     3.08
11.917    2.48    2.41      0.749  |O      |       |       |       |     3.08
12.000    2.51    2.43      0.750  |O      |       |       |       |     3.08
12.083    2.53    2.46      0.750  |O      |       |       |       |     3.08
12.167    2.53    2.48      0.751  |O      |       |       |       |     3.08
12.250    2.48    2.49      0.751  |O      |       |       |       |     3.08
12.333    2.46    2.48      0.751  |O      |       |       |       |     3.08
12.417    2.47    2.48      0.751  |O      |       |       |       |     3.08
12.500    2.48    2.48      0.751  |O      |       |       |       |     3.08
12.583    2.50    2.48      0.751  |O      |       |       |       |     3.08
12.667    2.53    2.49      0.751  |O      |       |       |       |     3.08
12.750    2.55    2.51      0.751  |O      |       |       |       |     3.09
12.833    2.59    2.52      0.752  |O      |       |       |       |     3.09
12.917    2.62    2.55      0.752  |O      |       |       |       |     3.09
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13.000    2.65    2.57      0.753  |O      |       |       |       |     3.09
13.083    2.69    2.60      0.753  |O      |       |       |       |     3.09
13.167    2.73    2.64      0.754  |O      |       |       |       |     3.09
13.250    2.78    2.67      0.755  |O      |       |       |       |     3.10
13.333    2.82    2.71      0.755  |O      |       |       |       |     3.10
13.417    2.87    2.75      0.756  |O      |       |       |       |     3.10
13.500    2.92    2.79      0.757  |O      |       |       |       |     3.10
13.583    2.97    2.84      0.758  |O      |       |       |       |     3.11
13.667    3.03    2.88      0.759  |O      |       |       |       |     3.11
13.750    3.09    2.93      0.760  |O      |       |       |       |     3.11
13.833    3.15    2.99      0.761  |O      |       |       |       |     3.12
13.917    3.21    3.04      0.762  |O      |       |       |       |     3.12
14.000    3.28    3.10      0.763  |O      |       |       |       |     3.12
14.083    3.36    3.17      0.764  |O      |       |       |       |     3.13
14.167    3.43    3.23      0.766  |O      |       |       |       |     3.13
14.250    3.52    3.31      0.767  |O      |       |       |       |     3.14
14.333    3.61    3.38      0.769  |O      |       |       |       |     3.14
14.417    3.71    3.46      0.770  |O      |       |       |       |     3.15
14.500    3.81    3.55      0.772  |OI     |       |       |       |     3.15
14.583    3.92    3.64      0.774  |OI     |       |       |       |     3.16
14.667    4.04    3.74      0.776  |OI     |       |       |       |     3.16
14.750    4.17    3.85      0.778  | O     |       |       |       |     3.17
14.833    4.31    3.96      0.780  | O     |       |       |       |     3.18
14.917    4.47    4.09      0.783  | O     |       |       |       |     3.18
15.000    4.63    4.22      0.785  | O     |       |       |       |     3.19
15.083    4.82    4.37      0.788  | O     |       |       |       |     3.20
15.167    5.03    4.54      0.792  | O     |       |       |       |     3.21
15.250    5.27    4.72      0.795  | O     |       |       |       |     3.22
15.333    5.53    4.92      0.799  | O     |       |       |       |     3.24
15.417    5.81    5.14      0.804  | OI    |       |       |       |     3.25
15.500    5.98    5.36      0.808  | OI    |       |       |       |     3.26
15.583    5.99    5.55      0.812  | OI    |       |       |       |     3.28
15.667    6.17    5.70      0.815  |  O    |       |       |       |     3.29
15.750    6.64    5.91      0.819  |  O    |       |       |       |     3.30
15.833    7.32    6.23      0.825  |  O    |       |       |       |     3.32
15.917    8.50    6.72      0.835  |  OI   |       |       |       |     3.35
16.000   10.76    7.58      0.852  |   OI  |       |       |       |     3.40
16.083   18.44    9.65      0.894  |    O  |I      |       |       |     3.53
16.167   36.27   14.86      0.998  |      O|       |  I    |       |     3.86
16.250   60.21   18.96      1.213  |       | O     |       |      I|     4.48
16.333   44.06   21.28      1.434  |       |  O    |      I|       |     5.08
16.417   28.06   22.09      1.533  |       |  O  I |       |       |     5.33
16.500   20.99   22.22      1.549  |       |  O    |       |       |     5.37
16.583   16.87   22.04      1.527  |       I  O    |       |       |     5.31
16.667   14.24   21.69      1.484  |      I|  O    |       |       |     5.21
16.750   12.21   21.22      1.427  |     I |  O    |       |       |     5.06
16.833   10.36   20.57      1.361  |    I  | O     |       |       |     4.89
16.917    9.21   19.79      1.289  |   I   | O     |       |       |     4.69
17.000    8.22   18.99      1.216  |   I   | O     |       |       |     4.48
17.083    7.32   18.18      1.141  |  I    |O      |       |       |     4.28
17.167    6.59   17.36      1.067  |  I    |O      |       |       |     4.07
17.250    5.95   14.93      0.999  |  I   O|       |       |       |     3.86
17.333    5.32   12.19      0.944  | I   O |       |       |       |     3.69
17.417    4.75   10.08      0.902  | I  O  |       |       |       |     3.56
```

INFLOW
100-YEAR, 24-HOURS STORM
Q100= 60.21 CFS

OUTFLOW
100-YEAR
Q100= 22.22 CFS

MAX. DEPTH OF
WATER= 5.37 FT

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17.500    4.52    8.48      0.870  | I O   |       |       |       |     3.46
17.583    4.39    7.29      0.847  | IO    |       |       |       |     3.39
17.667    4.18    6.41      0.829  | IO    |       |       |       |     3.33
17.750    3.80    5.69      0.815  | IO    |       |       |       |     3.29
17.833    3.50    5.09      0.803  |IO     |       |       |       |     3.25
17.917    3.20    4.58      0.793  |IO     |       |       |       |     3.22
18.000    2.87    4.12      0.783  |IO     |       |       |       |     3.19
18.083    2.77    3.74      0.776  |O      |       |       |       |     3.16
18.167    2.70    3.44      0.770  |O      |       |       |       |     3.14
18.250    2.69    3.22      0.766  |O      |       |       |       |     3.13
18.333    2.66    3.06      0.762  |O      |       |       |       |     3.12
18.417    2.62    2.94      0.760  |O      |       |       |       |     3.11
18.500    2.57    2.84      0.758  |O      |       |       |       |     3.11
18.583    2.52    2.75      0.756  |O      |       |       |       |     3.10
18.667    2.47    2.67      0.755  |O      |       |       |       |     3.10
18.750    2.42    2.61      0.753  |O      |       |       |       |     3.09
18.833    2.38    2.55      0.752  |O      |       |       |       |     3.09
18.917    2.33    2.49      0.751  |O      |       |       |       |     3.08
19.000    2.29    2.44      0.750  |O      |       |       |       |     3.08
19.083    2.25    2.39      0.749  |O      |       |       |       |     3.08
19.167    2.21    2.34      0.748  |O      |       |       |       |     3.08
19.250    2.18    2.30      0.747  |O      |       |       |       |     3.07
19.333    2.14    2.26      0.746  |O      |       |       |       |     3.07
19.417    2.11    2.22      0.745  |O      |       |       |       |     3.07
19.500    2.07    2.18      0.745  |O      |       |       |       |     3.07
19.583    2.04    2.14      0.744  |O      |       |       |       |     3.06
19.667    2.01    2.11      0.743  |O      |       |       |       |     3.06
19.750    1.98    2.08      0.743  |O      |       |       |       |     3.06
19.833    1.95    2.04      0.742  |O      |       |       |       |     3.06
19.917    1.93    2.01      0.741  |O      |       |       |       |     3.05
20.000    1.90    1.98      0.741  |O      |       |       |       |     3.05
20.083    1.88    1.96      0.740  IO      |       |       |       |     3.05
20.167    1.85    1.93      0.740  IO      |       |       |       |     3.05
20.250    1.83    1.90      0.739  IO      |       |       |       |     3.05
20.333    1.80    1.88      0.739  O       |       |       |       |     3.05
20.417    1.78    1.85      0.738  O       |       |       |       |     3.04
20.500    1.76    1.83      0.738  O       |       |       |       |     3.04
20.583    1.74    1.81      0.737  O       |       |       |       |     3.04
20.667    1.72    1.78      0.737  O       |       |       |       |     3.04
20.750    1.70    1.76      0.736  O       |       |       |       |     3.04
20.833    1.68    1.74      0.736  O       |       |       |       |     3.04
20.917    1.66    1.72      0.736  O       |       |       |       |     3.04
21.000    1.65    1.70      0.735  O       |       |       |       |     3.04
21.083    1.63    1.68      0.735  O       |       |       |       |     3.03
21.167    1.61    1.66      0.734  O       |       |       |       |     3.03
21.250    1.60    1.65      0.734  O       |       |       |       |     3.03
21.333    1.58    1.63      0.734  O       |       |       |       |     3.03
21.417    1.56    1.61      0.733  O       |       |       |       |     3.03
21.500    1.55    1.60      0.733  O       |       |       |       |     3.03
21.583    1.53    1.58      0.733  O       |       |       |       |     3.03
21.667    1.52    1.56      0.732  O       |       |       |       |     3.03
21.750    1.51    1.55      0.732  O       |       |       |       |     3.03
21.833    1.49    1.53      0.732  O       |       |       |       |     3.02
21.917    1.48    1.52      0.732  O       |       |       |       |     3.02
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22.000    1.47    1.51      0.731  O        |         |         |         |        3.02
22.083    1.45    1.49      0.731  O        |         |         |         |        3.02
22.167    1.44    1.48      0.731  O        |         |         |         |        3.02
22.250    1.43    1.47      0.731  O        |         |         |         |        3.02
22.333    1.42    1.45      0.730  O        |         |         |         |        3.02
22.417    1.41    1.44      0.730  O        |         |         |         |        3.02
22.500    1.40    1.43      0.730  O        |         |         |         |        3.02
22.583    1.38    1.42      0.730  O        |         |         |         |        3.02
22.667    1.37    1.41      0.729  O        |         |         |         |        3.02
22.750    1.36    1.40      0.729  O        |         |         |         |        3.02
22.833    1.35    1.38      0.729  O        |         |         |         |        3.02
22.917    1.34    1.37      0.729  O        |         |         |         |        3.01
23.000    1.33    1.36      0.728  O        |         |         |         |        3.01
23.083    1.32    1.35      0.728  O        |         |         |         |        3.01
23.167    1.31    1.34      0.728  O        |         |         |         |        3.01
23.250    1.30    1.33      0.728  O        |         |         |         |        3.01
23.333    1.29    1.32      0.728  O        |         |         |         |        3.01
23.417    1.29    1.31      0.727  O        |         |         |         |        3.01
23.500    1.28    1.30      0.727  O        |         |         |         |        3.01
23.583    1.27    1.29      0.727  O        |         |         |         |        3.01
23.667    1.26    1.29      0.727  O        |         |         |         |        3.01
23.750    1.25    1.28      0.727  O        |         |         |         |        3.01
23.833    1.24    1.27      0.727  O        |         |         |         |        3.01
23.917    1.24    1.26      0.726  O        |         |         |         |        3.01
24.000    1.23    1.25      0.726  O        |         |         |         |        3.01
24.083    1.19    1.24      0.726  O        |         |         |         |        3.01
24.167    1.05    1.20      0.725  O        |         |         |         |        3.00
24.250    0.71    1.14      0.723  O        |         |         |         |        3.00
24.333    0.48    1.12      0.720  O        |         |         |         |        2.98
24.417    0.36    1.10      0.715  O        |         |         |         |        2.97
24.500    0.28    1.08      0.710  O        |         |         |         |        2.95
24.583    0.22    1.06      0.704  O        |         |         |         |        2.93
24.667    0.18    1.03      0.698  O        |         |         |         |        2.91
24.750    0.14    1.01      0.692  O        |         |         |         |        2.89
24.833    0.11    0.98      0.686  O        |         |         |         |        2.86
24.917    0.09    0.96      0.680  O        |         |         |         |        2.84
25.000    0.07    0.94      0.674  O        |         |         |         |        2.82
25.083    0.06    0.91      0.668  O        |         |         |         |        2.80
25.167    0.05    0.89      0.662  O        |         |         |         |        2.78
25.250    0.04    0.86      0.657  O        |         |         |         |        2.76
25.333    0.03    0.84      0.651  O        |         |         |         |        2.74
25.417    0.02    0.82      0.645  O        |         |         |         |        2.72
25.500    0.02    0.80      0.640  O        |         |         |         |        2.70
25.583    0.01    0.77      0.635  O        |         |         |         |        2.68
25.667    0.01    0.75      0.630  O        |         |         |         |        2.66
25.750    0.00    0.73      0.625  O        |         |         |         |        2.64
25.833    0.00    0.71      0.620  O        |         |         |         |        2.62
25.917    0.00    0.69      0.615  O        |         |         |         |        2.61
26.000    0.00    0.67      0.610  O        |         |         |         |        2.59
26.083    0.00    0.65      0.605  O        |         |         |         |        2.57
26.167    0.00    0.64      0.601  O        |         |         |         |        2.56
26.250    0.00    0.62      0.597  O        |         |         |         |        2.54
26.333    0.00    0.60      0.593  O        |         |         |         |        2.53
26.417    0.00    0.58      0.588  O        |         |         |         |        2.51
```

DCV= 0.702 AC.FT
DCV= 30,580 CU.FT.

DEPTH OF WATER
@ DCV= 2.92 FT

```
 26.500     0.00     0.57       0.584  O         |         |         |         |        2.50
 26.583     0.00     0.55       0.581  O         |         |         |         |        2.48
 26.667     0.00     0.54       0.577  O         |         |         |         |        2.47
 26.750     0.00     0.52       0.573  O         |         |         |         |        2.46
 26.833     0.00     0.51       0.570  O         |         |         |         |        2.44
 26.917     0.00     0.49       0.566  O         |         |         |         |        2.43
 27.000     0.00     0.48       0.563  O         |         |         |         |        2.42
 27.083     0.00     0.47       0.560  O         |         |         |         |        2.41
 27.167     0.00     0.45       0.556  O         |         |         |         |        2.40
 27.250     0.00     0.44       0.553  O         |         |         |         |        2.39
 27.333     0.00     0.43       0.550  O         |         |         |         |        2.38
 27.417     0.00     0.42       0.547  O         |         |         |         |        2.37
 27.500     0.00     0.40       0.545  O         |         |         |         |        2.35
 27.583     0.00     0.39       0.542  O         |         |         |         |        2.35
 27.667     0.00     0.38       0.539  O         |         |         |         |        2.34
 27.750     0.00     0.37       0.537  O         |         |         |         |        2.33
 27.833     0.00     0.36       0.534  O         |         |         |         |        2.32
 27.917     0.00     0.35       0.532  O         |         |         |         |        2.31
 28.000     0.00     0.34       0.529  O         |         |         |         |        2.30
 28.083     0.00     0.33       0.527  O         |         |         |         |        2.29
 28.167     0.00     0.32       0.525  O         |         |         |         |        2.28
 28.250     0.00     0.31       0.523  O         |         |         |         |        2.28
 28.333     0.00     0.31       0.520  O         |         |         |         |        2.27
 28.417     0.00     0.30       0.518  O         |         |         |         |        2.26
 28.500     0.00     0.29       0.516  O         |         |         |         |        2.25
 28.583     0.00     0.28       0.514  O         |         |         |         |        2.25
 28.667     0.00     0.27       0.512  O         |         |         |         |        2.24
 28.750     0.00     0.26       0.511  O         |         |         |         |        2.23
 28.833     0.00     0.26       0.509  O         |         |         |         |        2.23
 28.917     0.00     0.25       0.507  O         |         |         |         |        2.22
 29.000     0.00     0.24       0.505  O         |         |         |         |        2.21
 29.083     0.00     0.24       0.504  O         |         |         |         |        2.21
 29.167     0.00     0.23       0.502  O         |         |         |         |        2.20
 29.250     0.00     0.22       0.501  O         |         |         |         |        2.20
 29.333     0.00     0.22       0.499  O         |         |         |         |        2.19
 29.417     0.00     0.21       0.498  O         |         |         |         |        2.19
 29.500     0.00     0.21       0.496  O         |         |         |         |        2.18
 29.583     0.00     0.20       0.495  O         |         |         |         |        2.18
 29.667     0.00     0.19       0.493  O         |         |         |         |        2.17
 29.750     0.00     0.19       0.492  O         |         |         |         |        2.17
 29.833     0.00     0.18       0.491  O         |         |         |         |        2.16
 29.917     0.00     0.18       0.489  O         |         |         |         |        2.16
 30.000     0.00     0.17       0.488  O         |         |         |         |        2.15
 30.083     0.00     0.17       0.487  O         |         |         |         |        2.15
 30.167     0.00     0.16       0.486  O         |         |         |         |        2.14
 30.250     0.00     0.16       0.485  O         |         |         |         |        2.14
 30.333     0.00     0.15       0.484  O         |         |         |         |        2.14
 30.417     0.00     0.15       0.483  O         |         |         |         |        2.13
 30.500     0.00     0.15       0.482  O         |         |         |         |        2.13
 30.583     0.00     0.14       0.481  O         |         |         |         |        2.12
 30.667     0.00     0.14       0.480  O         |         |         |         |        2.12
 30.750     0.00     0.13       0.479  O         |         |         |         |        2.12
 30.833     0.00     0.13       0.478  O         |         |         |         |        2.11
 30.917     0.00     0.13       0.477  O         |         |         |         |        2.11
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31.000    0.00    0.12      0.476  O       |       |       |       |     2.11
31.083    0.00    0.12      0.475  O       |       |       |       |     2.11
31.167    0.00    0.12      0.474  O       |       |       |       |     2.10
31.250    0.00    0.11      0.474  O       |       |       |       |     2.10
31.333    0.00    0.11      0.473  O       |       |       |       |     2.10
31.417    0.00    0.11      0.472  O       |       |       |       |     2.09
31.500    0.00    0.10      0.471  O       |       |       |       |     2.09
31.583    0.00    0.10      0.471  O       |       |       |       |     2.09
31.667    0.00    0.10      0.470  O       |       |       |       |     2.09


     Remaining water in basin =    0.47 (Ac.Ft)


     ****************************HYDROGRAPH DATA****************************
                Number of intervals =   380
                Time interval =    5.0 (Min.)
                Maximum/Peak flow rate =       22.222 (CFS)
                Total volume =       5.637 (Ac.Ft)
          Status of hydrographs being held in storage
                     Stream 1  Stream 2  Stream 3  Stream 4  Stream 5
          Peak (CFS)      0.000     0.000     0.000     0.000     0.000
          Vol (Ac.Ft)      0.000     0.000     0.000     0.000     0.000
     ***********************************************************************

     --------------------------------------------------------------------
```
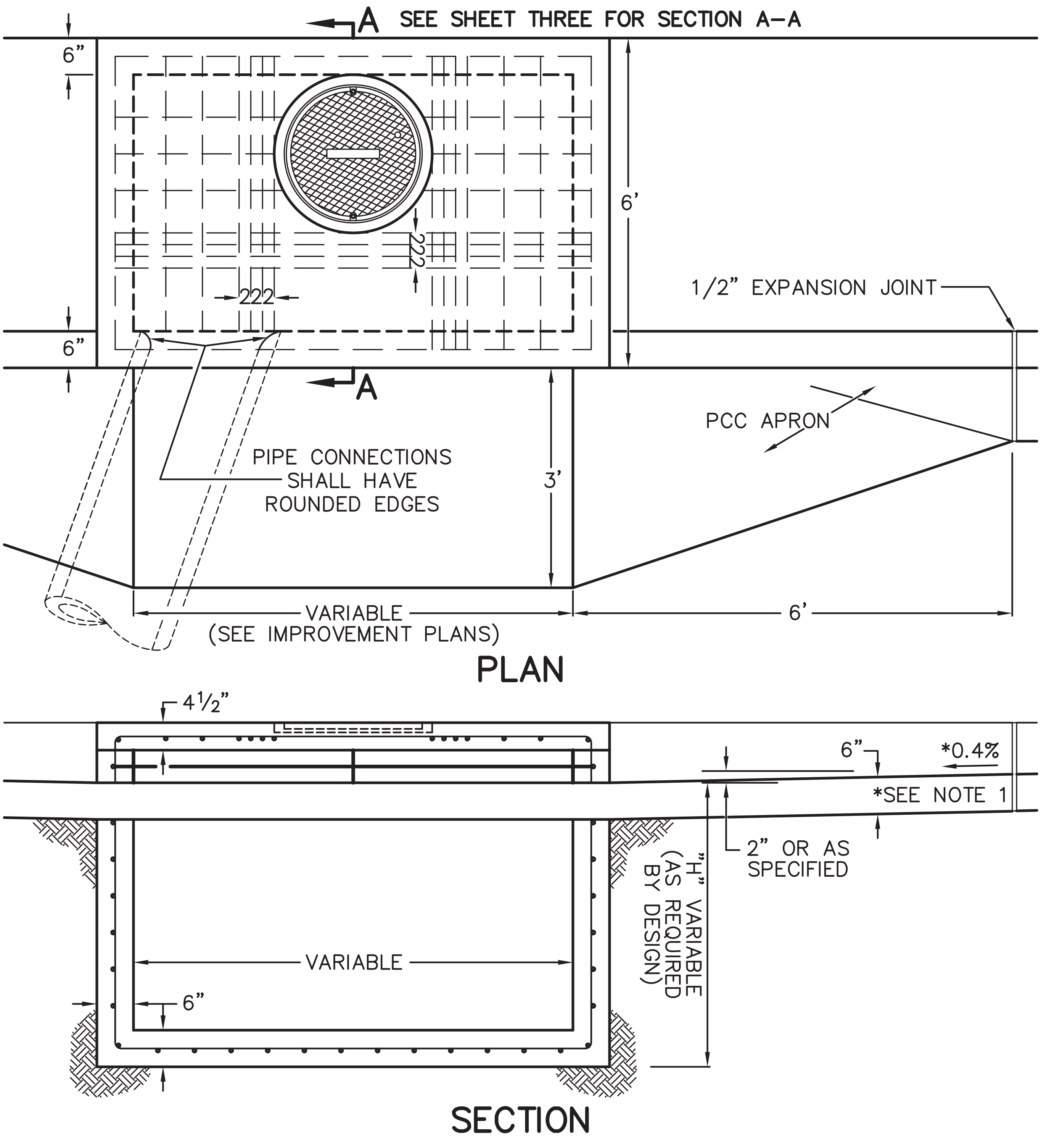



NOTES:

1. THE GUTTER CROSS SLOPE SHALL NOT EXCEED 8.33%. THE GUTTER FLOW LINE SHALL NOT BE LESS THAN 0.3% WITHIN 30 FEET OF THE EDGE OF THE DROP INLET OPENING. THE APRON TRANSITION MAY BE EXTENDED UP TO 15 FEET IN LENGTH.

REV.	DATE	BY
	1/26/65	J.H.F.
NOTES	5/1/77	M.A.T.
BOX WIDTH	3/21/78	X.S.S.
NOTES	7/1/94	D.G.H.
	6/1/07	STAFF

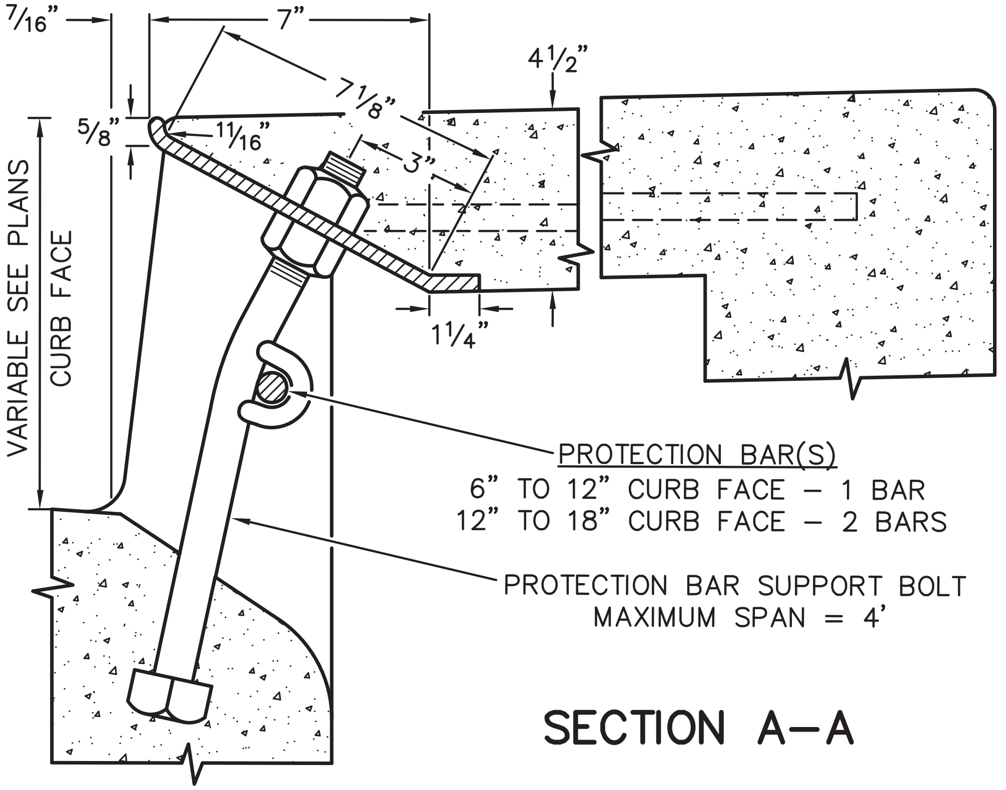
CITY OF VICTORVILLE - ENGINEERING DEPARTMENT

STANDARD DROP INLET

D-02

JOHN A. McGLADE, CITY ENGINEER

SHEET 1 OF 3



SECTION A–A

NOTES:

1. CONCRETE SHALL BE CLASS 1, PER SECTION 90–1.01 OF STANDARD SPECIFICATIONS.
2. ALL CONCRETE SHALL HAVE 4% AIR ENTRAINMENT.
3. SEE DRAWING S–01 FOR EXPANSION JOINT DETAIL.
4. FLOOR SLOPE SHALL BE 1" PER FOOT TOWARD OUTLET OR AS SPECIFIED ON THE PLANS.
5. REINFORCING SHALL CONSIST OF NO. 4 DEFORMED BARS AT 6" CENTERS EACH WAY UNLESS OTHERWISE NOTED.
6. ALL STEEL REINFORCING SPLICES SHALL BE LAPPED 40 DIAMETERS.
7. ALL STEEL REINFORCING JOINTS SHALL BE BENT TO 1" RADIUS AND EITHER CONTINUED OR LAPPED 40 DIAMETERS.
8. COVER SHALL BE BOLTED DOWN WITH 2 SOCKET SET SCREW BOLTS PER DETAILS ON STANDARD DRAWING D–04.
9. FRAME AND COVER SHALL BE ALHAMBRA FOUNDRY NO. A1530B, GALVANIZED, 22" DIAMETER OPENING OR EQUAL.
10. CURB PROTECTION PLATE SHALL BE ALHAMBRA FOUNDRY NO. A3911 OR EQUAL. PROTECTION BAR SHALL BE ALHAMBRA FOUNDRY A1564 OR EQUAL. PROTECTION BAR SUPPORT BOLTS SHALL BE ALHAMBRA FOUNDRY A1572 OR EQUAL.
11. STEPS – NONE REQUIRED WHERE "H" IS 3'6" OR LESS. INSTALL ONE STEP 16"± ABOVE FLOOR WHEN "H" IS 3'6" TO 5'0". WHERE "H" IS MORE THAN 5'0", STEPS SHALL BE EVENLY SPACED AT 12"± INTERVALS FROM 16"± ABOVE FLOOR TO WITHIN 12"± OF THE TOP OF THE BOX. PLACE STEPS IN WALL WITHOUT PIPE OPENINGS.
12. ALL EXPOSED METAL PARTS SHALL BE GALVANIZED.

REV.	DATE	BY
	1/26/65	J.H.F.
NOTES	5/1/77	M.A.T.
NOTES	7/1/94	D.G.H.
	6/1/07	STAFF

CITY OF VICTORVILLE - ENGINEERING DEPARTMENT

STANDARD DROP INLET

D-02

JOHN A. McGLADE, CITY ENGINEER

SHEET 3 OF 3

LUDWIG ENGINEERING
109 E. Third Street
San Bernardino, California 92410
(909)884-8217
Fax (909) 889-0153

JOB **MI-0508**

CATCH BASIN #1 AND #2 @ BASIN NO. 2 (NORTHWEST) RIO BRAVO PLACE

CAPACITY OF CURB OPENING INLET ON A SUMP CONDITION:

HEIGHT OF CURB = 6” CF.

Q 100 = 25.4 CFS ; CATCH BASIN # 1
Q 100 = 25.4 CFS ; CATCH BASIN # 2

LOCAL DEPRESSION = 4”

PONDING DEPTH = 6” + 4” = H = 10” (1’) TO TC.

h (eff.) = 0.58’

with h = 0.58’ and $\frac{H}{h} = \frac{0.833'}{0.58'} = 1.44$

PER NOMOGRAPH:

$\frac{Q}{L} =$ 1.6 CFS/FT

FOR CATCH BASIN #1 AND #2;

$$\mathbf{L = \frac{25.4}{1.6}}$$

L = 15.9’ SAY **W=16' CATCH BASIN #1 AND #2**

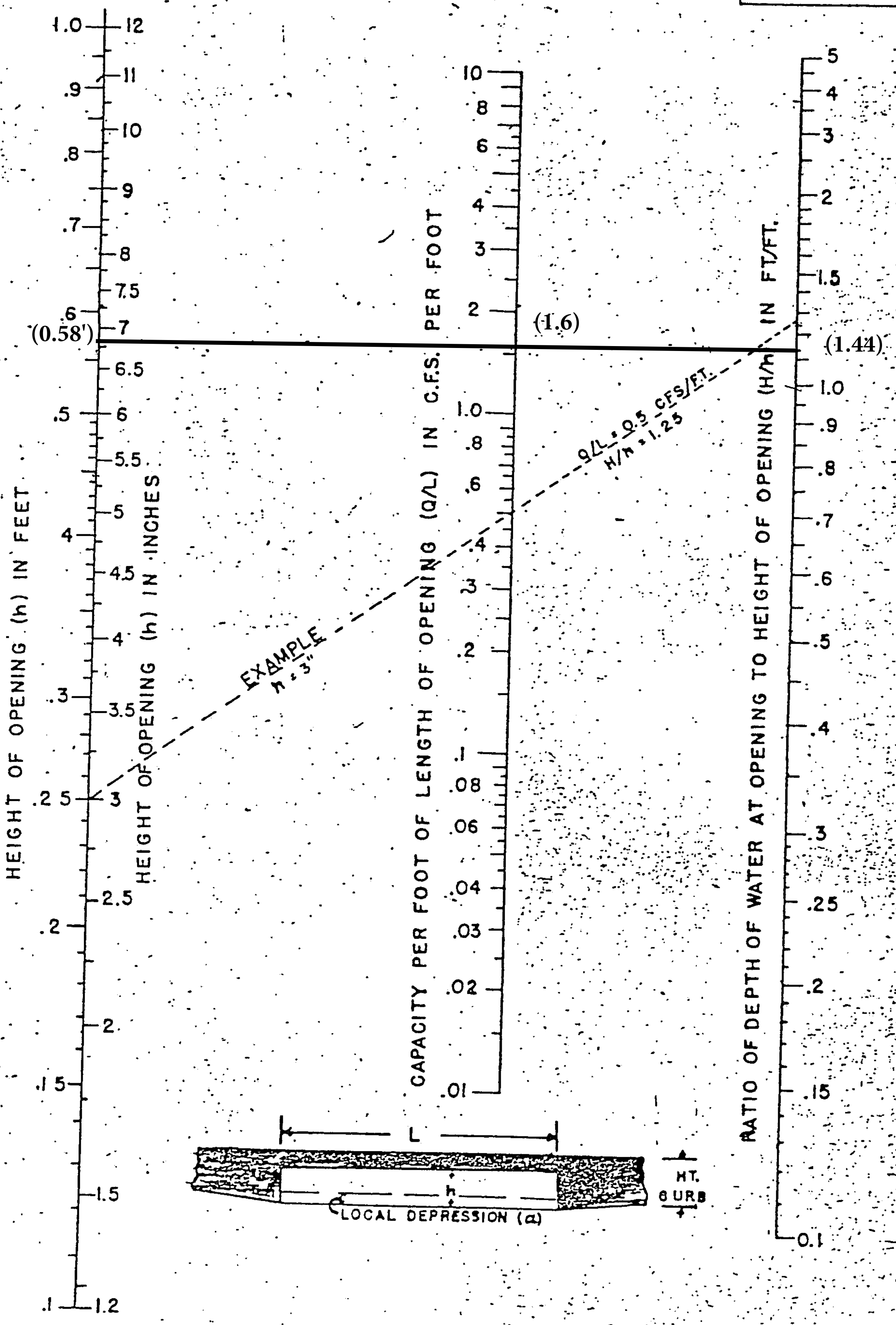
MAXIMUM PONDING DEPTH = 6” + 4” + 0.2’ = 1.033’ TO R/W

H = 1.033’ h = 0.58’ $\frac{H}{h} = \frac{1.033'}{0.58'} = 1.78$

PER NOMOGRAPH 1073.3

$\frac{Q}{L}$ = 2.6 CFS/FT

$$\mathbf{L = \frac{Q}{2.6} = \frac{25.4}{2.6} = 9.8'}$$ **USE W = 10’**

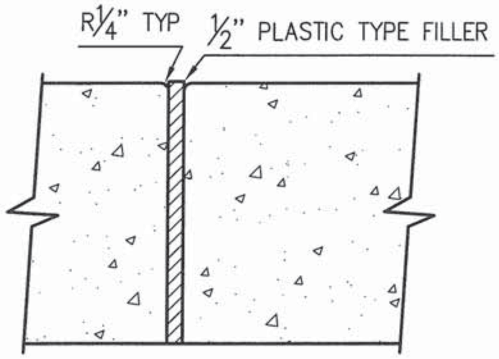


JAN., 1951

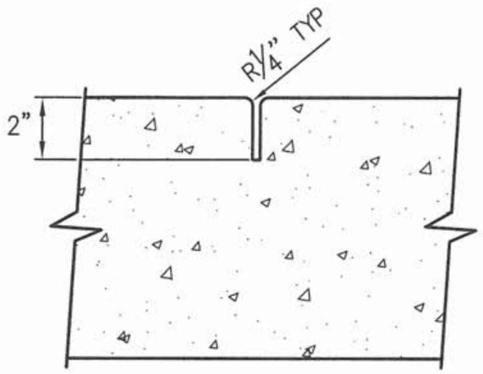
BUREAU OF PUBLIC ROADS
DIVISION TWO WASH., D. C.

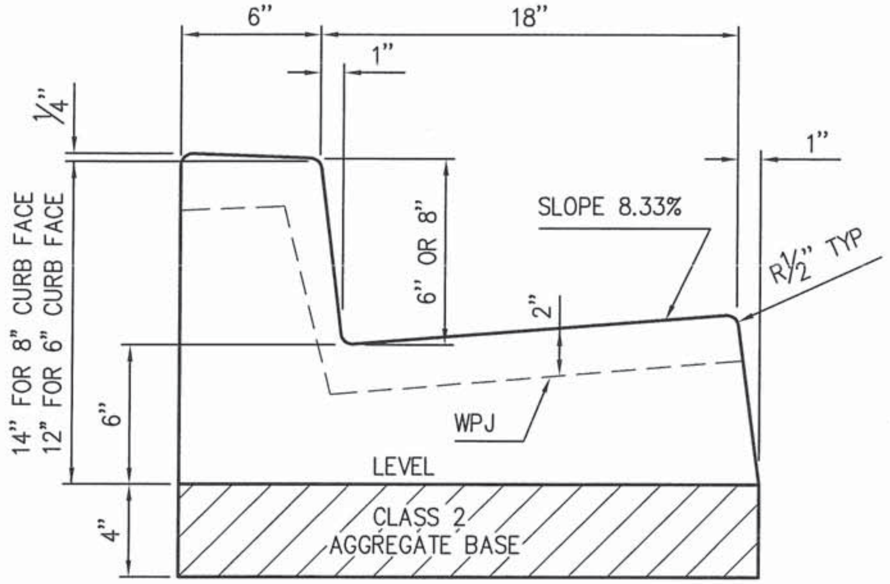
NOMOGRAPH FOR CAPACITY OF CURB OPENING INLETS AT LOW POINTS

EXPANSION JOINT



WEAKENED PLANE JOINT





STANDARD CURB & GUTTER

NOT TO SCALE

NOTES:

1. CURB AND GUTTER SHALL BE CONSTRUCTED FROM PORTLAND CEMENT CONCRETE CONTAINING NOT LESS THAN 550 POUNDS OF TYPE II PORTLAND CEMENT PER CUBIC YARD WITH 4% AIR ENTRAINMENT AND 1" MAXIMUM AGGREGATE GRADING.
2. CONCRETE SHALL BE CURED WITH WHITE PIGMENTED CURING COMPOUND.
3. CURB AND GUTTER SHALL BE CONSTRUCTED ON MINIMUM 4" CLASS 2 AGGREGATE BASE COMPACTED TO 95% RELATIVE COMPACTION.
4. WEAKENED PLANE JOINTS SHALL BE CONSTRUCTED AT 10' INTERVALS.
5. WEAKENED PLANE JOINTS SHALL BE AT LEAST 2" DEEP.
6. EXPANSION JOINTS SHALL BE CONSTRUCTED AT ALL CURB RETURNS, DRIVEWAY APPROACHES AND AT 60' INTERVALS.
7. EXPANSION JOINTS SHALL BE 1/2" WIDE AND FILLED WITH PLASTIC TYPE FILLERS.

(NOTES CONTINUE ON SHEET 2)

APPROVED BY CITY ENGINEER		**CITY OF VICTORVILLE - ENGINEERING DEPARTMENT**	
DATE	SIGNATURE	**STANDARD CURB & GUTTER**	**S-01**
02/03/09	J.	JOHN A. McGLADE, CITY ENGINEER	SHEET 1 OF 2

SECTION **6.3**

RECORDING REQUESTED BY:

County of San Bernardino
Department of Public Works

AND WHEN RECORDED MAIL TO:

County of San Bernardino
Department of Public Works
825 E. Third Street, Room 201
San Bernardino, CA 92415-0835

SPACE ABOVE THIS LINE FOR RECORDER'S USE

AGREEMENT

THIS PAGE ADDED TO PROVIDE ADEQUATE SPACE FOR RECORDING INFORMATION

Water Quality Management Plan and Stormwater Best Management Practices Transfer, Access and Maintenance Agreement

OWNER NAME : DAVID MICHELSON

PROPERTY ADDRESS: 17802 LAKESIDE HAVEN DRIVE
CYPRESS, TEXAS 77233

APN: 0394-031-02, 03 & 04

THIS AGREEMENT is made and entered into in

_______________________________________ ,California, this _________ day of

_______________________________________ , by and between

____ , hereinafter

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

WHEREAS, the Owner owns real property ("Property") in the County of San Bernardino, 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

TR 20525 within the Property described herein, the County 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 County, 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 County;

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 County of San Bernardino'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 County 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 County 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 County Stormwater Ordinance, County Code 3587. 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 County, the Owner shall provide the County 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 County , the County 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 County Code from the date of the notice of expense until paid in full.

5. The County may require the owner to post security in form and for a time period satisfactory to the County to guarantee the performance of the obligations stated herein. Should the Owner fail to perform the obligations under the Agreement, the County 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 County 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 County, 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 County harmless and pay all costs incurred by the County 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 County 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 County, 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.

[REMAINDER OF THIS PAGE INTENTIONALLY LEFT BLANK]

IF TO CITY:
City of Victorville – Engineering Department

14343 Civic Drive,

Victorville, CA 92392

IF TO OWNER:
MOJAVE AMETHYST 40, L.P.(OWNER)
THREE ARCH INVESTMENT CORP.(GENERAL PARTNER)
DAVID MICHELSON, PRESIDENT

17802 LAKESIDE HAVEN DRIVE

CYPRESS, TEXAS 77433

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

OWNER:

Signature: ______________________

Name: DAVID MICHELSON

Title: PRESIDENT, THREE ARCH INVESTMENT CORP.(GENERAL PARTNER)

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

State of: Texas

County of: Harris

The foregoing instrument was acknowledged before me 07th day of January, 2023

Eric Frame

Your Name Here, Notary Public

My Commission Expires 07/07/2025

for David Michelson

ERIC FRAME
Notary Public, State of Texas
Comm. Expires 07-07-2025
Notary ID 133197011

EXHIBIT A

(Legal Description)

Real property in the City of Victorville, County of San Bernardino, State of California, described as follows:

PARCEL 1:

THE NORTH ½ OF THE SOUTH ½ OF THE WEST ½ OF THE NORTH ½ OF THE WEST ½ OF THE SOUTHWEST ¼ OF SECTION 12, TOWNSHIP 5 NORTH, RANGE 5 WEST, SAN BERNARDINO MERIDIAN, IN THE COUNTY OF SAN BERNARDINO, STATE OF CALIFORNIA, ACCORDING TO THE OFFICIAL PLAT THEREOF.

EXCEPT AN UNDIVIDED ½ INTEREST IN AND TO ALL THE OIL, GAS, MINERALS AND OTHER HYDROCARBON SUBSTANCES LYING AND BEING MORE THAN 500 FEET BELOW THE RESPECTIVE ELEVATIONS OF THE SURFACE OF SAID LAND, BUT WITHOUT RIGHT OF SURFACE ENTRY, OR SUB-SURFACE ENTRY TO A DEPTH OF 500 FEET BELOW THE RESPECTIVE SURFACE ELEVATIONS OF SAID LAND FOR THE DEVELOPMENT OF OIL, GAS, MINERALS, AND OTHER HYDROCARBON SUBSTANCES, AS RESERVED BY FRED MILKE AND ALMA MILKE, HUSBAND AND WIFE, AS TO AN UNDIVIDED ½ INTEREST, AND E. H. BOOKASTA AND REGINA BOOKASTA, HUSBAND AND WIFE, AS TO AN UNDIVIDED ½ INTEREST, IN DEED RECORDED AUGUST 28, 1959 IN BOOK 4915 PAGE 384 OFFICIAL RECORDS.

PARCEL 2:

THE SOUTH ½ OF THE SOUTH ½ OF THE WEST ½ OF THE NORTH ½ OF THE WEST ½ OF THE SOUTHWEST ¼ OF SECTION 12, TOWNSHIP 5 NORTH, RANGE 5 WEST, SAN BERNARDINO BASE AND MERIDIAN. 5 ACRES ACCORDING TO GOVERNMENT SURVEY.

EXCEPT AN UNDIVIDED ½ INTEREST IN AND TO ALL THE OIL, GAS, MINERALS AND OTHER HYDROCARBON SUBSTANCES LYING AND BEING MORE THAN 500 FEET BELOW THE RESPECTIVE ELEVATIONS OF THE SURFACE OF SAID LAND, BUT WITHOUT RIGHT OF SURFACE ENTRY, OR SUB-SURFACE ENTRY TO A DEPTH OF 500 FEET BELOW THE RESPECTIVE SURFACE ELEVATIONS OF SAID LAND FOR THE DEVELOPMENT OF OIL, GAS, MINERALS AND OTHER HYDROCARBON SUBSTANCES, AS RESERVED BY FRED MILKE AND ALMA MILKE, HUSBAND AND WIFE, AS TO AN UNDIVIDED ½ INTEREST AND R. H. BOOKASTA AND REGINA BOOKASTA, HUSBAND AND WIFE, AS TO AN UNDIVIDED ½ INTEREST, IN DEED RECORDED AUGUST 28, 1959 IN BOOK 4915 PAGE 384 OFFICIAL RECORDS.

PARCEL 3:

THE SOUTH ½ OF THE WEST ½ OF THE WEST ½ OF THE SOUTHWEST ¼ OF SECTION 12, TOWNSHIP 5 NORTH, RANGE 5 WEST, SAN BERNARDINO BASE AND MERIDIAN, IN THE COUNTY OF SAN BERNARDINO, STATE OF CALIFORNIA, ACCORDING TO THE OFFICIAL PLAT THEREOF.

EXCEPT AN UNDIVIDED ½ INTEREST IN AND TO ALL THE OIL, GAS, MINERALS AND OTHER HYDROCARBON SUBSTANCES LYING AND BEING MORE THAN 500 FEET BELOW THE RESPECTIVE ELEVATIONS OF THE SURFACE OF SAID LAND, BUT WITHOUT RIGHT OF SURFACE ENTRY, OR SUB-SURFACE ENTRY TO A DEPTH OF 500 FEET BELOW THE RESPECTIVE SURFACE ELEVATIONS OF SAID LAND FOR THE DEVELOPMENT OF OIL, GAS, MINERALS AND OTHER HYDROCARBON SUBSTANCES, AS RESERVED BY FRED MILKE AND ALMA MILKE, HUSBAND AND WIFE, AS TO AN UNDIVIDED ½ INTEREST AND E.H. BOOKASTA AND REGINA BOOKASTA, HUSBAND AND WIFE, AS TO AN UNDIVIDED ½ INTEREST, IN DEED RECORDED AUGUST 28, 1959, IN BOOK 4915, PAGE 384, OFFICIAL RECORDS.

APN: 0394-031-02-0-000 (Affects Parcel 1);
0394-031-03-0-000 (Affects Parcel 2);
0394-031-04-0-000 (Affects Parcel 3)

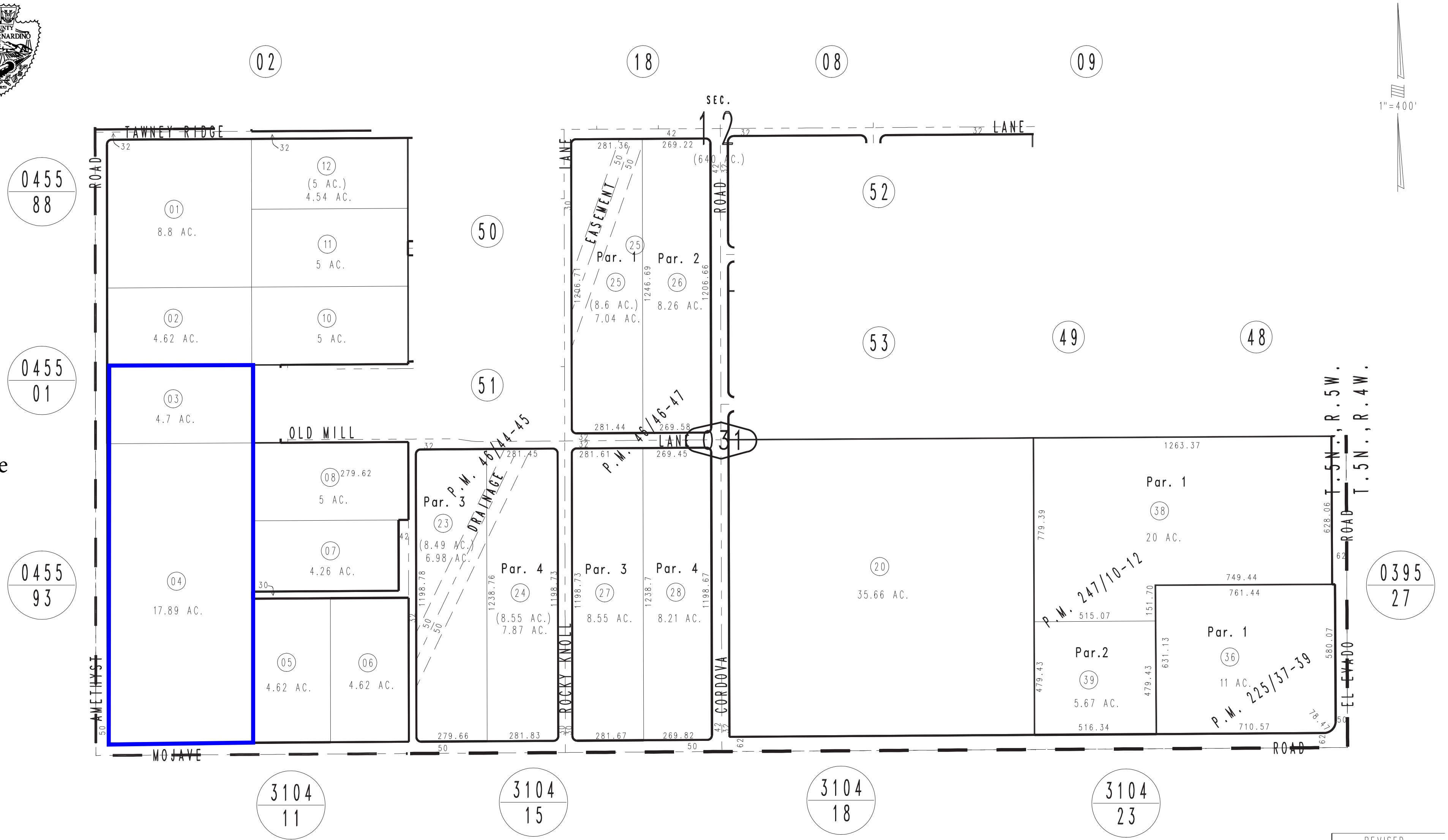
EXHIBIT B
(Map/illustration)

THIS MAP IS FOR THE PURPOSE
OF AD VALOREM TAXATION ONLY.

Ptn. S.1/2 Sec.12, T.5N.,R.5W., S.B.B.&M.

City of Victorville
Tax Rate Area
12209

0394- 03



Project Site

Parcel Map No. 19746, P.M. 247/10-12
Ptn. Parcel Map No. 18813, P.M. 225/37-39
Ptn. Parcel Map No. 3755, P.M. 46/44-45
Parcel Map No. 3754, P.M. 46/46-47

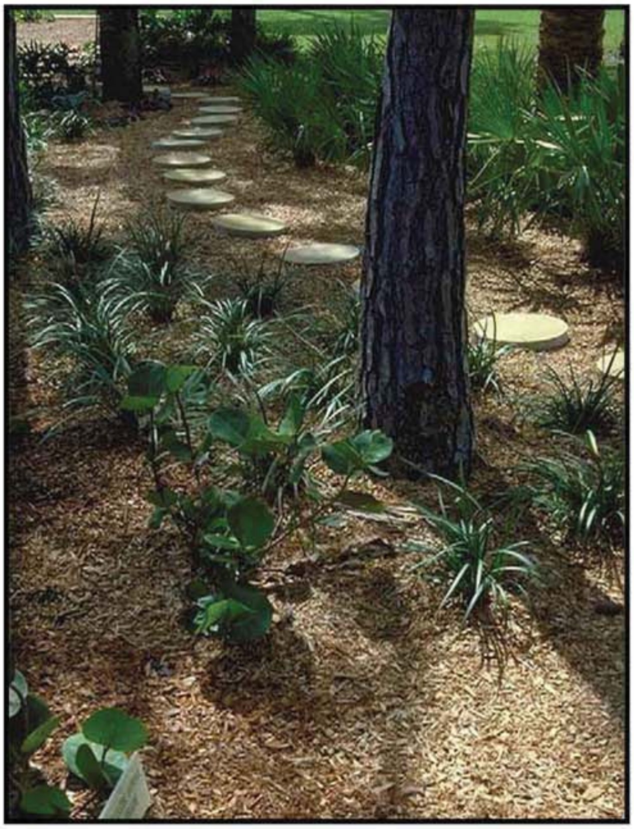
March 2004

Assessor's Map
Book 0394 Page 03
San Bernardino County

REVISED
12/07/20 RU
02/02/21 GW

SECTION 6.4

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.

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.

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.

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

- Group plants with similar water requirements in order to reduce excess irrigation runoff and promote surface filtration. Choose plants with low irrigation requirements (for example, native or drought tolerant species). Consider design features such as:

  - Using mulches (such as wood chips or bar) in planter areas without ground cover to minimize sediment in runoff

  - Installing appropriate plant materials for the location, in accordance with amount of sunlight and climate, and use native plant materials where possible and/or as recommended by the landscape architect

  - Leaving a vegetative barrier along the property boundary and interior watercourses, to act as a pollutant filter, where appropriate and feasible

  - Choosing plants that minimize or eliminate the use of fertilizer or pesticides to sustain growth

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

Redeveloping Existing Installations

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

Other Resources

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

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

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

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

Storm Drain Signage SD-13

Design Objectives

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

Description

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

Approach

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

Suitable Applications

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

Design Considerations

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

Designing New Installations

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

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

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QUALITY ASSOCIATION

– 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.

Trash Storage Areas SD-32

Description

Trash storage areas are areas where a trash receptacle (s) are located for use as a repository for solid wastes. Stormwater runoff from areas where trash is stored or disposed of can be polluted. In addition, loose trash and debris can be easily transported by water or wind into nearby storm drain inlets, channels, and/or creeks. Waste handling operations that may be sources of stormwater pollution include dumpsters, litter control, and waste piles.

Approach

This fact sheet contains details on the specific measures required to prevent or reduce pollutants in stormwater runoff associated with trash storage and handling. Preventative measures including enclosures, containment structures, and impervious pavements to mitigate spills, should be used to reduce the likelihood of contamination.

Design Objectives

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

Suitable Applications

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

Design Considerations

Design requirements for waste handling areas are governed by Building and Fire Codes, and by current local agency ordinances and zoning requirements. The design criteria described in this fact sheet are meant to enhance and be consistent with these code and ordinance requirements. Hazardous waste should be handled in accordance with legal requirements established in Title 22, California Code of Regulation.

Wastes from commercial and industrial sites are typically hauled by either public or commercial carriers that may have design or access requirements for waste storage areas. The design criteria in this fact sheet are recommendations and are not intended to be in conflict with requirements established by the waste hauler. The waste hauler should be contacted prior to the design of your site trash collection areas. Conflicts or issues should be discussed with the local agency.

Designing New Installations

Trash storage areas should be designed to consider the following structural or treatment control BMPs:

- Design trash container areas so that drainage from adjoining roofs and pavement is diverted around the area(s) to avoid run-on. This might include berming or grading the waste handling area to prevent run-on of stormwater.

- Make sure trash container areas are screened or walled to prevent off-site transport of trash.

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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.

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Trash Storage Areas SD-32

Design Objectives

Maximize Infiltration

Provide Retention

Slow Runoff

Minimize Impervious Land Coverage

Prohibit Dumping of Improper Materials

☑ Contain Pollutants

Collect and Convey

Description

Trash storage areas are areas where a trash receptacle (s) are located for use as a repository for solid wastes. Stormwater runoff from areas where trash is stored or disposed of can be polluted. In addition, loose trash and debris can be easily transported by water or wind into nearby storm drain inlets, channels, and/or creeks. Waste handling operations that may be sources of stormwater pollution include dumpsters, litter control, and waste piles.

Approach

This fact sheet contains details on the specific measures required to prevent or reduce pollutants in stormwater runoff associated with trash storage and handling. Preventative measures including enclosures, containment structures, and impervious pavements to mitigate spills, should be used to reduce the likelihood of contamination.

Suitable Applications

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

Design Considerations

Design requirements for waste handling areas are governed by Building and Fire Codes, and by current local agency ordinances and zoning requirements. The design criteria described in this fact sheet are meant to enhance and be consistent with these code and ordinance requirements. Hazardous waste should be handled in accordance with legal requirements established in Title 22, California Code of Regulation.

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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.

Building & Grounds Maintenance SC-41

Description

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

Approach

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

Pollution Prevention

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

Objectives

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

Targeted Constituents

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

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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.

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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.

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/

Landscape Maintenance SC-73

Objectives

- Contain
- Educate
- Reduce/Minimize
- Product Substitution

Targeted Constituents

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

Description

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

Approach

Pollution Prevention

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

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

Suggested Protocols

Mowing, Trimming, and Weeding

- Whenever possible use mechanical methods of vegetation removal (e.g mowing with tractor-type or push mowers, hand cutting with gas or electric powered weed trimmers) rather than applying herbicides. Use hand weeding where practical.

- Avoid loosening the soil when conducting mechanical or manual weed control, this could lead to erosion. Use mulch or other erosion control measures when soils are exposed.

- Performing mowing at optimal times. Mowing should not be performed if significant rain events are predicted.

- Mulching mowers may be recommended for certain flat areas. Other techniques may be employed to minimize mowing such as selective vegetative planting using low maintenance grasses and shrubs.

- Collect lawn and garden clippings, pruning waste, tree trimmings, and weeds. Chip if necessary, and compost or dispose of at a landfill (see waste management section of this fact sheet).

- Place temporarily stockpiled material away from watercourses, and berm or cover stockpiles to prevent material releases to storm drains.

Planting

- Determine existing native vegetation features (location, species, size, function, importance) and consider the feasibility of protecting them. Consider elements such as their effect on drainage and erosion, hardiness, maintenance requirements, and possible conflicts between preserving vegetation and the resulting maintenance needs.

- Retain and/or plant selected native vegetation whose features are determined to be beneficial, where feasible. Native vegetation usually requires less maintenance (e.g., irrigation, fertilizer) than planting new vegetation.

- Consider using low water use groundcovers when planting or replanting.

Waste Management

- Compost leaves, sticks, or other collected vegetation or dispose of at a permitted landfill. Do not dispose of collected vegetation into waterways or storm drainage systems.

- Place temporarily stockpiled material away from watercourses and storm drain inlets, and berm or cover stockpiles to prevent material releases to the storm drain system.

- Reduce the use of high nitrogen fertilizers that produce excess growth requiring more frequent mowing or trimming.

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

Irrigation

- Where practical, use automatic timers to minimize runoff.

- Use popup sprinkler heads in areas with a lot of activity or where there is a chance the pipes may be broken. Consider the use of mechanisms that reduce water flow to sprinkler heads if broken.

- Ensure that there is no runoff from the landscaped area(s) if re-claimed water is used for irrigation.

- If bailing of muddy water is required (e.g. when repairing a water line leak), do not put it in the storm drain; pour over landscaped areas.

- Irrigate slowly or pulse irrigate to prevent runoff and then only irrigate as much as is needed.

- Apply water at rates that do not exceed the infiltration rate of the soil.

Fertilizer and Pesticide Management

- Utilize a comprehensive management system that incorporates integrated pest management (IPM) techniques. There are many methods and types of IPM, including the following:

  - Mulching can be used to prevent weeds where turf is absent, fencing installed to keep rodents out, and netting used to keep birds and insects away from leaves and fruit.

  - Visible insects can be removed by hand (with gloves or tweezers) and placed in soapy water or vegetable oil. Alternatively, insects can be sprayed off the plant with water or in some cases vacuumed off of larger plants.

  - Store-bought traps, such as species-specific, pheromone-based traps or colored sticky cards, can be used.

  - Slugs can be trapped in small cups filled with beer that are set in the ground so the slugs can get in easily.

  - In cases where microscopic parasites, such as bacteria and fungi, are causing damage to plants, the affected plant material can be removed and disposed of (pruning equipment should be disinfected with bleach to prevent spreading the disease organism).

  - Small mammals and birds can be excluded using fences, netting, tree trunk guards.

  - Beneficial organisms, such as bats, birds, green lacewings, ladybugs, praying mantis, ground beetles, parasitic nematodes, trichogramma wasps, seed head weevils, and spiders that prey on detrimental pest species can be promoted.

- Follow all federal, state, and local laws and regulations governing the use, storage, and disposal of fertilizers and pesticides and training of applicators and pest control advisors.

- Use pesticides only if there is an actual pest problem (not on a regular preventative schedule).

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

- Do not mix or prepare pesticides for application near storm drains.

- Prepare the minimum amount of pesticide needed for the job and use the lowest rate that will effectively control the pest.

- Employ techniques to minimize off-target application (e.g. spray drift) of pesticides, including consideration of alternative application techniques.

- Fertilizers should be worked into the soil rather than dumped or broadcast onto the surface.

- Calibrate fertilizer and pesticide application equipment to avoid excessive application.

- Periodically test soils for determining proper fertilizer use.

- Sweep pavement and sidewalk if fertilizer is spilled on these surfaces before applying irrigation water.

- Purchase only the amount of pesticide that you can reasonably use in a given time period (month or year depending on the product).

- Triple rinse containers, and use rinse water as product. Dispose of unused pesticide as hazardous waste.

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

Inspection

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

- Inspect pesticide/fertilizer equipment and transportation vehicles daily.

Training

- Educate and train employees on use of pesticides and in pesticide application techniques to prevent pollution. Pesticide application must be under the supervision of a California qualified pesticide applicator.

- Train/encourage municipal maintenance crews to use IPM techniques for managing public green areas.

- Annually train employees within departments responsible for pesticide application on the appropriate portions of the agency's IPM Policy, SOPs, and BMPs, and the latest IPM techniques.

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

Spill Response and Prevention

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

Other Considerations

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

Requirements

Costs

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

Maintenance

Not applicable

Supplemental Information

Further Detail of the BMP

Waste Management

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

Contractors and Other Pesticide Users

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

References and Resources

King County Stormwater Pollution Control Manual. Best Management Practices for Businesses. 1995. King County Surface Water Management. July. On-line: http://dnr.metrokc.gov/wlr/dss/spcm.htm

Los Angeles County Stormwater Quality Model Programs. Public Agency Activities http://ladpw.org/wmd/npdes/model_links.cfm

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

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

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

United States Environmental Protection Agency (USEPA). 2002. Pollution Prevention/Good Housekeeping for Municipal Operations Landscaping and Lawn Care. Office of Water. Office of Wastewater Management. On-line: http://www.epa.gov/npdes/menuofbmps/poll_8.htm

Drainage System Maintenance SC-74

Photo Credit: Geoff Brosseau

Objectives

- Contain
- Educate
- Reduce/Minimize

Targeted Constituents

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

Description

As a consequence of its function, the stormwater conveyance system collects and transports urban runoff that may contain certain pollutants. Maintaining catch basins, stormwater inlets, and other stormwater conveyance structures on a regular basis will remove pollutants, prevent clogging of the downstream conveyance system, restore catch basins' sediment trapping capacity, and ensure the system functions properly hydraulically to avoid flooding.

Approach

Suggested Protocols

Catch Basins/Inlet Structures

- Municipal staff should regularly inspect facilities to ensure the following:
  - Immediate repair of any deterioration threatening structural integrity.
  - Cleaning before the sump is 40% full. Catch basins should be cleaned as frequently as needed to meet this standard.
  - Stenciling of catch basins and inlets (see SC-75 Waste Handling and Disposal).
- Clean catch basins, storm drain inlets, and other conveyance structures in high pollutant load areas just before the wet season to remove sediments and debris accumulated during the summer.

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- Conduct inspections more frequently during the wet season for problem areas where sediment or trash accumulates more often. Clean and repair as needed.

- Keep accurate logs of the number of catch basins cleaned.

- Record the amount of waste collected.

- Store wastes collected from cleaning activities of the drainage system in appropriate containers or temporary storage sites in a manner that prevents discharge to the storm drain.

- Dewater the wastes with outflow into the sanitary sewer if permitted. Water should be treated with an appropriate filtering device prior to discharge to the sanitary sewer. If discharge to the sanitary sewer is not allowed, water should be pumped or vacuumed to a tank and properly disposed of. Do not dewater near a storm drain or stream.

- Except for small communities with relatively few catch basins that may be cleaned manually, most municipalities will require mechanical cleaners such as eductors, vacuums, or bucket loaders.

Storm Drain Conveyance System

- Locate reaches of storm drain with deposit problems and develop a flushing schedule that keeps the pipe clear of excessive buildup.

- Collect flushed effluent and pump to the sanitary sewer for treatment.

Pump Stations

- Clean all storm drain pump stations prior to the wet season to remove silt and trash.

- Do not allow discharge from cleaning a storm drain pump station or other facility to reach the storm drain system.

- Conduct quarterly routine maintenance at each pump station.

- Inspect, clean, and repair as necessary all outlet structures prior to the wet season.

- Sample collected sediments to determine if landfill disposal is possible, or illegal discharges in the watershed are occurring.

Open Channel

- Consider modification of storm channel characteristics to improve channel hydraulics, to increase pollutant removals, and to enhance channel/creek aesthetic and habitat value.

- Conduct channel modification/improvement in accordance with existing laws. Any person, government agency, or public utility proposing an activity that will change the natural (emphasis added) state of any river, stream, or lake in California, must enter into a steam or Lake Alteration Agreement with the Department of Fish and Game. The developer-applicant should also contact local governments (city, county, special districts), other state agencies

(SWRCB, RWQCB, Department of Forestry, Department of Water Resources), and Federal Corps of Engineers and USFWS

Illicit Connections and Discharges

- During routine maintenance of conveyance system and drainage structures field staff should look for evidence of illegal discharges or illicit connections:
  - Is there evidence of spills such as paints, discoloring, etc.
  - Are there any odors associated with the drainage system
  - Record locations of apparent illegal discharges/illicit connections
  - Track flows back to potential dischargers and conduct aboveground inspections. This can be done through visual inspection of up gradient manholes or alternate techniques including zinc chloride smoke testing, fluorometric dye testing, physical inspection testing, or television camera inspection.
  - Once the origin of flow is established, require illicit discharger to eliminate the discharge.
- Stencil storm drains, where applicable, to prevent illegal disposal of pollutants. Storm drain inlets should have messages such as “Dump No Waste Drains to Stream” stenciled next to them to warn against ignorant or intentional dumping of pollutants into the storm drainage system.
- Refer to fact sheet SC-10 Non-Stormwater Discharges.

Illegal Dumping

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

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

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

Training

- Train crews in proper maintenance activities, including record keeping and disposal.

- Only properly trained individuals are allowed to handle hazardous materials/wastes.

- Train municipal employees from all departments (public works, utilities, street cleaning, parks and recreation, industrial waste inspection, hazardous waste inspection, sewer maintenance) to recognize and report illegal dumping.

- Train municipal employees and educate businesses, contractors, and the general public in proper and consistent methods for disposal.

- Train municipal staff regarding non-stormwater discharges (See SC-10 Non-Stormwater Discharges).

Spill Response and Prevention

- Refer to SC-11, Prevention, Control & Cleanup

- Have spill cleanup materials readily available and in a known location.

- Cleanup spills immediately and use dry methods if possible.

- Properly dispose of spill cleanup material.

Other Considerations

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

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

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

- Municipal codes should include sections prohibiting the discharge of soil, debris, refuse, hazardous wastes, and other pollutants into the storm drain system.

- Private property access rights may be needed to track illegal discharges up gradient.

- Requirements of municipal ordinance authority for suspected source verification testing for illicit connections necessary for guaranteed rights of entry.

Requirements

Costs

- An aggressive catch basin cleaning program could require a significant capital and O&M budget. A careful study of cleaning effectiveness should be undertaken before increased cleaning is implemented. Catch basin cleaning costs are less expensive if vacuum street sweepers are available; cleaning catch basins manually can cost approximately twice as much as cleaning the basins with a vacuum attached to a sweeper.

- Methods used for illicit connection detection (smoke testing, dye testing, visual inspection, and flow monitoring) can be costly and time-consuming. Site-specific factors, such as the level of impervious area, the density and ages of buildings, and type of land use will determine the level of investigation necessary. Encouraging reporting of illicit discharges by employees can offset costs by saving expense on inspectors and directing resources more efficiently. Some programs have used funds available from "environmental fees" or special assessment districts to fund their illicit connection elimination programs.

Maintenance

- Two-person teams may be required to clean catch basins with vactor trucks.

- Identifying illicit discharges requires teams of at least two people (volunteers can be used), plus administrative personnel, depending on the complexity of the storm sewer system.

- Arrangements must be made for proper disposal of collected wastes.

- Requires technical staff to detect and investigate illegal dumping violations, and to coordinate public education.

Supplemental Information

Further Detail of the BMP

Storm Drain flushing

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

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

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

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

Flow Management

Flow management has been one of the principal motivations for designing urban stream corridors in the past. Such needs may or may not be compatible with the stormwater quality goals in the stream corridor.

Downstream flood peaks can be suppressed by reducing through flow velocity. This can be accomplished by reducing gradient with grade control structures or increasing roughness with boulders, dense vegetation, or complex banks forms. Reducing velocity correspondingly increases flood height, so all such measures have a natural association with floodplain open space. Flood elevations laterally adjacent to the stream can be lowered by increasing through flow velocity.

However, increasing velocity increases flooding downstream and inherently conflicts with channel stability and human safety. Where topography permits, another way to lower flood elevation is to lower the level of the floodway with drop structures into a large but subtly excavated bowl where flood flows we allowed to spread out.

Stream Corridor Planning

Urban streams receive and convey stormwater flows from developed or developing watersheds. Planning of stream corridors thus interacts with urban stormwater management programs. If local programs are intended to control or protect downstream environments by managing flows delivered to the channels, then it is logical that such programs should be supplemented by management of the materials, forms, and uses of the downstream riparian corridor. Any proposal for steam alteration or management should be investigated for its potential flow and stability effects on upstream, downstream, and laterally adjacent areas. The timing and rate of flow from various tributaries can combine in complex ways to alter flood hazards. Each section of channel is unique, influenced by its own distribution of roughness elements, management activities, and stream responses.

Flexibility to adapt to stream features and behaviors as they evolve must be included in stream reclamation planning. The amenity and ecology of streams may be enhanced through the landscape design options of 1) corridor reservation, 2) bank treatment, 3) geomorphic restoration, and 4) grade control.

Corridor reservation - Reserving stream corridors and valleys to accommodate natural stream meandering, aggradation, degradation, and over bank flows allows streams to find their own form and generate less ongoing erosion. In California, open stream corridors in recent urban developments have produced recreational open space, irrigation of streamside plantings, and the aesthetic amenity of flowing water.

Bank treatment - The use of armoring, vegetative cover, and flow deflection may be used to influence a channel's form, stability, and biotic habitat. To prevent bank erosion, armoring can be done with rigid construction materials, such as concrete, masonry, wood planks and logs, riprap, and gabions. Concrete linings have been criticized because of their lack of provision of biotic habitat. In contrast, riprap and gabions make relatively porous and flexible linings. Boulders, placed in the bed reduce velocity and erosive power.

Riparian vegetation can stabilize the banks of streams that are at or near a condition of equilibrium. Binding networks of roots increase bank shear strength. During flood flows, resilient vegetation is forced into erosion-inhibiting mats. The roughness of vegetation leads to lower velocity, further reducing erosive effects. Structural flow deflection can protect banks from erosion or alter fish habitat. By concentrating flow, a deflector causes a pool to be scoured in the bed.

Geomorphic restoration – Restoration refers to alteration of disturbed streams so their form and behavior emulate those of undisturbed streams. Natural meanders are retained, with grading to gentle slopes on the inside of curves to allow point bars and riffle-pool sequences to develop. Trees are retained to provide scenic quality, biotic productivity, and roots for bank stabilization, supplemented by plantings where necessary.

A restorative approach can be successful where the stream is already approaching equilibrium. However, if upstream urbanization continues new flow regimes will be generated that could disrupt the equilibrium of the treated system.

Grade Control - A grade control structure is a level shelf of a permanent material, such as stone, masonry, or concrete, over which stream water flows. A grade control structure is called a sill, weir, or drop structure, depending on the relation of its invert elevation to upstream and downstream channels.

A sill is installed at the preexisting channel bed elevation to prevent upstream migration of nick points. It establishes a firm base level below which the upstream channel can not erode.

A weir or check dam is installed with invert above the preexisting bed elevation. A weir raises the local base level of the stream and causes aggradation upstream. The gradient, velocity, and erosive potential of the stream channel are reduced. A drop structure lowers the downstream invert below its preexisting elevation, reducing downstream gradient and velocity. Weirs and drop structure control erosion by dissipating energy and reducing slope velocity.

When carefully applied, grade control structures can be highly versatile in establishing human and environmental benefits in stabilized channels. To be successful, application of grade control structures should be guided by analysis of the stream system both upstream and downstream from the area to he reclaimed.

Examples

The California Department of Water Resources began the Urban Stream Restoration Program in 1985. The program provides grant funds to municipalities and community groups to implement stream restoration projects. The projects reduce damages from streambank aid watershed instability arid floods while restoring streams' aesthetic, recreational, and fish and wildlife values.

In Buena Vista Park, upper floodway slopes are gentle and grassed to achieve continuity of usable park land across the channel of small boulders at the base of the slopes.

The San Diego River is a large, vegetative lined channel, which was planted in a variety of species to support riparian wildlife while stabilizing the steep banks of the floodway.

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Infiltration Basin TC-11

Description

An infiltration basin is a shallow impoundment that is designed to infiltrate stormwater. Infiltration basins use the natural filtering ability of the soil to remove pollutants in stormwater runoff. Infiltration facilities store runoff until it gradually exfiltrates through the soil and eventually into the water table. This practice has high pollutant removal efficiency and can also help recharge groundwater, thus helping to maintain low flows in stream systems. Infiltration basins can be challenging to apply on many sites, however, because of soils requirements. In addition, some studies have shown relatively high failure rates compared with other management practices.

California Experience

Infiltration basins have a long history of use in California, especially in the Central Valley. Basins located in Fresno were among those initially evaluated in the National Urban Runoff Program and were found to be effective at reducing the volume of runoff, while posing little long-term threat to groundwater quality (EPA, 1983; Schroeder, 1995). Proper siting of these devices is crucial as underscored by the experience of Caltrans in siting two basins in Southern California. The basin with marginal separation from groundwater and soil permeability failed immediately and could never be rehabilitated.

Advantages

- Provides 100% reduction in the load discharged to surface waters.

- The principal benefit of infiltration basins is the approximation of pre-development hydrology during which a

Design Considerations

- Soil for Infiltration
- Slope
- Aesthetics

Targeted Constituents

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

Legend ***(Removal Effectiveness)***

● Low ■ High

▲ Medium

CASQA
CALIFORNIA STORMWATER QUALITY ASSOCIATION

significant portion of the average annual rainfall runoff is infiltrated and evaporated rather than flushed directly to creeks.

- If the water quality volume is adequately sized, infiltration basins can be useful for providing control of channel forming (erosion) and high frequency (generally less than the 2-year) flood events.

Limitations

- May not be appropriate for industrial sites or locations where spills may occur.
- Infiltration basins require a minimum soil infiltration rate of 0.5 inches/hour, not appropriate at sites with Hydrologic Soil Types C and D.
- If infiltration rates exceed 2.4 inches/hour, then the runoff should be fully treated prior to infiltration to protect groundwater quality.
- Not suitable on fill sites or steep slopes.
- Risk of groundwater contamination in very coarse soils.
- Upstream drainage area must be completely stabilized before construction.
- Difficult to restore functioning of infiltration basins once clogged.

Design and Sizing Guidelines

- Water quality volume determined by local requirements or sized so that 85% of the annual runoff volume is captured.
- Basin sized so that the entire water quality volume is infiltrated within 48 hours.
- Vegetation establishment on the basin floor may help reduce the clogging rate.

Construction/Inspection Considerations

- Before construction begins, stabilize the entire area draining to the facility. If impossible, place a diversion berm around the perimeter of the infiltration site to prevent sediment entrance during construction or remove the top 2 inches of soil after the site is stabililized. Stabilize the entire contributing drainage area, including the side slopes, before allowing any runoff to enter once construction is complete.
- Place excavated material such that it can not be washed back into the basin if a storm occurs during construction of the facility.
- Build the basin without driving heavy equipment over the infiltration surface. Any equipment driven on the surface should have extra-wide ("low pressure") tires. Prior to any construction, rope off the infiltration area to stop entrance by unwanted equipment.
- After final grading, till the infiltration surface deeply.
- Use appropriate erosion control seed mix for the specific project and location.

Performance

As water migrates through porous soil and rock, pollutant attenuation mechanisms include precipitation, sorption, physical filtration, and bacterial degradation. If functioning properly, this approach is presumed to have high removal efficiencies for particulate pollutants and moderate removal of soluble pollutants. Actual pollutant removal in the subsurface would be expected to vary depending upon site-specific soil types. This technology eliminates discharge to surface waters except for the very largest storms; consequently, complete removal of all stormwater constituents can be assumed.

There remain some concerns about the potential for groundwater contamination despite the findings of the NURP and Nightingale (1975; 1987a,b,c; 1989). For instance, a report by Pitt et al. (1994) highlighted the potential for groundwater contamination from intentional and unintentional stormwater infiltration. That report recommends that infiltration facilities not be sited in areas where high concentrations are present or where there is a potential for spills of toxic material. Conversely, Schroeder (1995) reported that there was no evidence of groundwater impacts from an infiltration basin serving a large industrial catchment in Fresno, CA.

Siting Criteria

The key element in siting infiltration basins is identifying sites with appropriate soil and hydrogeologic properties, which is critical for long term performance. In one study conducted in Prince George's County, Maryland (Galli, 1992), all of the infiltration basins investigated clogged within 2 years. It is believed that these failures were for the most part due to allowing infiltration at sites with rates of less than 0.5 in/hr, basing siting on soil type rather than field infiltration tests, and poor construction practices that resulted in soil compaction of the basin invert.

A study of 23 infiltration basins in the Pacific Northwest showed better long-term performance in an area with highly permeable soils (Hilding, 1996). In this study, few of the infiltration basins had failed after 10 years. Consequently, the following guidelines for identifying appropriate soil and subsurface conditions should be rigorously adhered to.

- Determine soil type (consider RCS soil type 'A, B or C' only) from mapping and consult USDA soil survey tables to review other parameters such as the amount of silt and clay, presence of a restrictive layer or seasonal high water table, and estimated permeability. The soil should not have more than 30% clay or more than 40% of clay and silt combined. Eliminate sites that are clearly unsuitable for infiltration.

- Groundwater separation should be at least 3 m from the basin invert to the measured ground water elevation. There is concern at the state and regional levels of the impact on groundwater quality from infiltrated runoff, especially when the separation between groundwater and the surface is small.

- Location away from buildings, slopes and highway pavement (greater than 6 m) and wells and bridge structures (greater than 30 m). Sites constructed of fill, having a base flow or with a slope greater than 15% should not be considered.

- Ensure that adequate head is available to operate flow splitter structures (to allow the basin to be offline) without ponding in the splitter structure or creating backwater upstream of the splitter.

- Base flow should not be present in the tributary watershed.

Secondary Screening Based on Site Geotechnical Investigation

- At least three in-hole conductivity tests shall be performed using USBR 7300-89 or Bouwer-Rice procedures (the latter if groundwater is encountered within the boring), two tests at different locations within the proposed basin and the third down gradient by no more than approximately 10 m. The tests shall measure permeability in the side slopes and the bed within a depth of 3 m of the invert.

- The minimum acceptable hydraulic conductivity as measured in any of the three required test holes is 13 mm/hr. If any test hole shows less than the minimum value, the site should be disqualified from further consideration.

- Exclude from consideration sites constructed in fill or partially in fill unless no silts or clays are present in the soil boring. Fill tends to be compacted, with clays in a dispersed rather than flocculated state, greatly reducing permeability.

- The geotechnical investigation should be such that a good understanding is gained as to how the stormwater runoff will move in the soil (horizontally or vertically) and if there are any geological conditions that could inhibit the movement of water.

Additional Design Guidelines

(1) Basin Sizing - The required water quality volume is determined by local regulations or sufficient to capture 85% of the annual runoff.

(2) Provide pretreatment if sediment loading is a maintenance concern for the basin.

(3) Include energy dissipation in the inlet design for the basins. Avoid designs that include a permanent pool to reduce opportunity for standing water and associated vector problems.

(4) Basin invert area should be determined by the equation:

$$A = \frac{WQV}{kt}$$

where A = Basin invert area (m^2)

WQV = water quality volume (m^3)

k = 0.5 times the lowest field-measured hydraulic conductivity (m/hr)

t = drawdown time (48 hr)

(5) The use of vertical piping, either for distribution or infiltration enhancement shall not be allowed to avoid device classification as a Class V injection well per 40 CFR146.5(e)(4).

Maintenance

Regular maintenance is critical to the successful operation of infiltration basins. Recommended operation and maintenance guidelines include:

- Inspections and maintenance to ensure that water infiltrates into the subsurface completely (recommended infiltration rate of 72 hours or less) and that vegetation is carefully managed to prevent creating mosquito and other vector habitats.
- Observe drain time for the design storm after completion or modification of the facility to confirm that the desired drain time has been obtained.
- Schedule semiannual inspections for beginning and end of the wet season to identify potential problems such as erosion of the basin side slopes and invert, standing water, trash and debris, and sediment accumulation.
- Remove accumulated trash and debris in the basin at the start and end of the wet season.
- Inspect for standing water at the end of the wet season.
- Trim vegetation at the beginning and end of the wet season to prevent establishment of woody vegetation and for aesthetic and vector reasons.
- Remove accumulated sediment and regrade when the accumulated sediment volume exceeds 10% of the basin.
- If erosion is occurring within the basin, revegetate immediately and stabilize with an erosion control mulch or mat until vegetation cover is established.
- To avoid reversing soil development, scarification or other disturbance should only be performed when there are actual signs of clogging, rather than on a routine basis. Always remove deposited sediments before scarification, and use a hand-guided rotary tiller, if possible, or a disc harrow pulled by a very light tractor.

Cost

Infiltration basins are relatively cost-effective practices because little infrastructure is needed when constructing them. One study estimated the total construction cost at about $2 per ft (adjusted for inflation) of storage for a 0.25-acre basin (SWRPC, 1991). As with other BMPs, these published cost estimates may deviate greatly from what might be incurred at a specific site. For instance, Caltrans spent about $18/ft^3 for the two infiltration basins constructed in southern California, each of which had a water quality volume of about 0.34 ac.-ft. Much of the higher cost can be attributed to changes in the storm drain system necessary to route the runoff to the basin locations.

Infiltration basins typically consume about 2 to 3% of the site draining to them, which is relatively small. Additional space may be required for buffer, landscaping, access road, and fencing. Maintenance costs are estimated at 5 to 10% of construction costs.

One cost concern associated with infiltration practices is the maintenance burden and longevity. If improperly maintained, infiltration basins have a high failure rate. Thus, it may be necessary to replace the basin with a different technology after a relatively short period of time.

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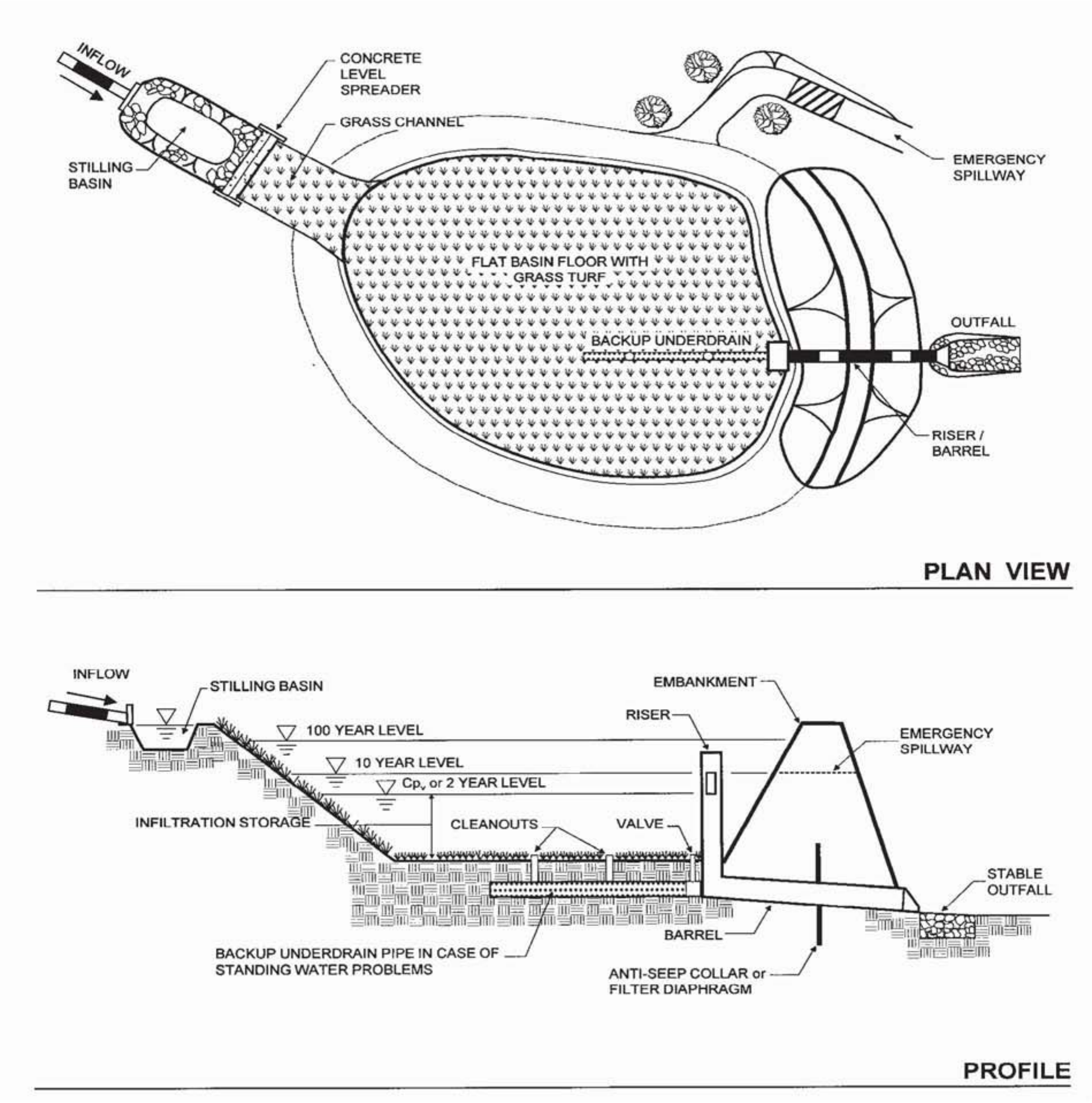
INFLOW
CONCRETE LEVEL SPREADER
GRASS CHANNEL
STILLING BASIN
EMERGENCY SPILLWAY
FLAT BASIN FLOOR WITH GRASS TURF
OUTFALL
BACKUP UNDERDRAIN
RISER / BARREL
PLAN VIEW
INFLOW
STILLING BASIN
EMBANKMENT
RISER
100 YEAR LEVEL
EMERGENCY SPILLWAY
10 YEAR LEVEL
Cp$_v$ or 2 YEAR LEVEL
INFILTRATION STORAGE
CLEANOUTS
VALVE
STABLE OUTFALL
BARREL
BACKUP UNDERDRAIN PIPE IN CASE OF STANDING WATER PROBLEMS
ANTI-SEEP COLLAR or FILTER DIAPHRAGM
PROFILE

Stormwater Pollution Prevention

Best Management Practices for Homeowner's Associations, Property Managers and Property Owners

San
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County
STORMWATER PROGRAM

Your Guide To Maintaining Water Friendly Standards In Your Community

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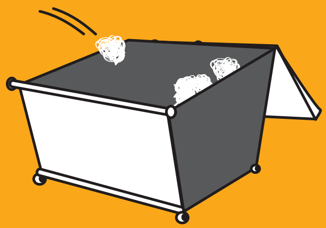
COMMERCIAL TRASH ENCLOSURES

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

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

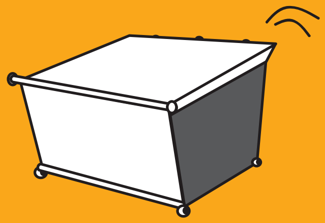
PROTECT WATER QUALITY BY FOLLOWING THESE SIMPLE STEPS

PUT TRASH INSIDE



Place trash inside the bin (preferably in sealed bags)

CLOSE THE LID



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

KEEP TOXICS OUT

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

SOME ADDITIONAL GUIDELINES, INCLUDE

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

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

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

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

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

San Bernardino County
STORMWATER PROGRAM

In the event of a spill or discharge to a storm drain or waterway, contact San Bernadino County Stormwater immediately: (877) WASTE18 | sbcountystormwater.org/report

sbcountystormwater.org

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CESQG PROGRAM

Conditionally Exempt Small Quantity Generator

WHAT IS A CESQG?

Businesses that generate 27 gallons or 220 lbs. of hazardous waste, or 2.2 lbs. of extremely hazardous waste per month are called "Conditionally Exempt Small Quantity Generators," or CESQGs. San Bernardino County Household Hazardous Program provides waste management services to CESQG businesses. The most common CESQGs in San Bernardino County are painters, print shops, auto shops, builders, agricultural operators and property managers, but there are many others. When you call, be ready to describe the types and amounts of waste your business generates in a typical month. If you generate hazardous waste on a regular basis, you must:

- Register with San Bernardino County Fire Department (909) 386-8401 as a hazardous waste generator.
- To obtain an EPA ID# and application form from the State visit www.dtsc.ca.gov.
- Manage hazardous waste in accordance with all applicable local, state and federal laws and regulations.

HOW DO I GET SERVICE?

To arrange an appointment for the CESQG Program, call 1-800-OILY CAT or 909-382-5401. Be ready to describe the type and amount of hazardous waste your business is ready to dispose of, and the types and size(s) of containers that the waste is in.

Waste Type and Cost

There is a small handling fee involved in the collection of hazardous waste from your business. Disposal costs depend on the type of waste.

Aerosols	$1.29/lb.
Automobile motor oil	$.73/gal.
Anti-freeze	$1.57/gal.
Contaminated oil	$4.48/gal.
Car batteries	$.62/ea.
Corrosive liquids, solids	$2.80/lb.
Flammable solids, liquids	$1.57/lb.
Latex Paint	$.73/lb.
Mercury	$10.08/lb.
NiCad/Alkaline Batteries	$2.13/lb.
Oil Base Paints	$1.00/lb.
Oil Filters	$.56/ea.
Oxidizers	$9.63/lb.
PCB Ballasts	$5.94/lb.
Pesticides (most)	$2.91/lb.
Photofixer, developer	$4.31/gal.
Television & Monitors	$11.20/ea.
Additional Handling	$138.00/hr.

Rates subject to change without notice

WE CANNOT ACCEPT

- Radioactives
- Water reactives
- Explosives
- Compressed gas cylinders
- Medical or biohazardous waste
- Asbestos
- Remediation wastes

HAZARDOUS WASTE

WHY IS THE FIRE DEPARTMENT COLLECTING HAZARDOUS WASTE?

Small Quantity Generators often have difficulty disposing of small quantities of hazardous waste. Hazardous waste companies usually have a minimum amount of waste that they will pick up, or charge a minimum fee for service. Typically, the minimum fee exceeds the cost of disposal for the hazardous waste. This leaves the small quantity generator in a difficult situation. Some respond by storing hazardous waste until it becomes economical for the hazardous waste transporter to pick it up, putting the business out of compliance by exceeding regulatory accumulation time limits. Other businesses simply store their hazardous wastes indefinitely, creating an unsafe work environment and exceeding accumulation time limits. Yet other businesses attempt to illegally dispose of their waste at household hazardous waste collection facilities. These facilities are not legally permitted to accept commercial wastes, nor are prepared to provide legal documentation for commercial hazardous waste disposal. In answer to the problems identified above, the San Bernardino County Fire Department Household Hazardous Program instituted the Conditionally Exempt Small Quantity Generator Program.

PAYMENT FOR SERVICES

The CESQG Program will prepare an invoice for your business at the time of service. You can pay at the time of service with cash or a check, or you can mail your payment to the Fire Department within 30 days. Please note that we do not accept credit card payments. The preferred method of payment is to handle payment at time of service. Additional charges may apply for accounts not paid within 30 days.

ARE THERE ANY OTHER WAYS THAT I CAN SAVE MONEY ON HAZARDOUS WASTE DISPOSAL?

Yes! First, start by reducing the amount of waste that you produce by changing processes or process chemicals, at your business. Next, examine if there is a way that you can recycle your waste back into your processes. Network with similar businesses or trade associations for waste minimization and pollution prevention solutions.

WHAT IF YOUR BUSINESS DOES NOT QUALIFY?

Call the San Bernardino County Fire Department Field Services Division for assistance with hazardous waste management at 909-386-8401. If you reduce the amount of waste you generate each month to 27 gallons or less, you may qualify in the future.

WHAT HAPPENS TO YOUR HAZARDOUS WASTE?

Hazardous waste collected by the CESQG Program is transported to a state permitted processing facility in San Bernardino. The waste is further processed at this point and packaged for off-site recycling (oil filters, oil, latex paint, antifreeze, and batteries) or destructive incineration (pesticides, corrosives, flammables, oil based paint).

San Bernardino County Fire Department
CESQG Program
2824 East "W" Street
San Bernardino, CA 92415-0799
Phone: 909-382-5401
Fax: 909-382-5413
www.sbcfire.org/hazmat/hhw.asp
Email: jschwab@sbcfire.org

WORKING OUTDOORS & HANDLING SPILLS

WHEN WORKING OUTDOORS USE THE 3Cs

CUANDO TRABAJE AL AIRE LIBRE UTILICE LAS 3Cs

CONTROL | CONTROL

Locate the nearest storm drain and ensure nothing can enter or be discharged into it.

Ubique el desagüe de aguas pluviales más cercano y asegúrese de que nada pueda ingresar a éste ni descargarse en él.

CONTAIN | CONTENER

Isolate your area to prevent material from potentially flowing or being blown away.

Aísle su área para evitar que el material pueda discurrirse o ser llevado por el viento.

CAPTURE | CAPTURAR

Sweep up debris and place it in the trash. Clean up spills with an absorbent material (e.g. kitty litter) or vacuum with a Wet-Vac and dispose of properly.

Recoja los restos y colóquelos en la basura. Limpie los derrames con un material absorbente (como la arena para gatos) o aspírelos con una Wet-Vac (aspiradora de humedad) y deséchelos correctamente.

In the event of a spill or discharge to a storm drain or waterway, contact San Bernadino County Stormwater immediately: (877) WASTE18 | sbcountystormwater.org/report

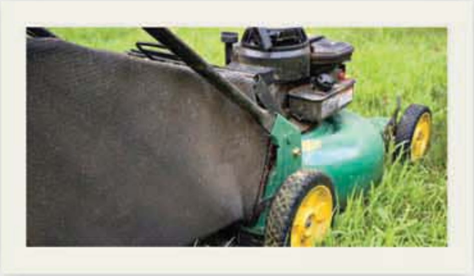
sbcountystormwater.org

COMMERCIAL LANDSCAPE

DISCHARGE TO THE STORM DRAIN, **ACCIDENTAL OR NOT**, COULD LEAD TO ENFORCEMENT ACTIONS, WHICH COULD INCLUDE FINES.

Follow the best practices below to **prevent water pollution from landscaping activities.**

RECYCLE YARD WASTE



- ✓ Recycle leaves, grass clippings and other yard waste.
- ✓ Do not blow, sweep, rake or hose yard waste into the street or catch basin.
- ✓ **Try grasscycling:** the natural recycling of grass by leaving clippings on the lawn when mowing.

For more information, please visit: **www.calrecycle.ca.gov/organics /grasscycling**

USE FERTILIZERS, HERBICIDES AND PESTICIDES SAFELY

- ✓ Fertilizers, herbicides and pesticides are often carried into the storm drain system by sprinkler runoff. Use natural and non-toxic alternatives as often as possible.
- ✓ If you must use chemical fertilizers, herbicides or pesticides:
  - Spot apply, rather than blanketing entire areas.
  - Avoid applying near curbs and driveways, and **never** before a rain.
  - Apply fertilizers as needed: when plants could best use it and when the potential runoff would be low.
  - Follow the manufacturer's instructions carefully—this will not only give the best results, but will save money.

USE WATER WISELY

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

HOMEOWNERS

KEEP THESE TIPS IN MIND WHEN HIRING PROFESSIONAL LANDSCAPERS AND REMIND AS NECESSARY.

Leftover pesticides, fertilizers, and herbicides contaminate landfills and should be disposed of through a Hazardous Waste Facility.

For more information on proper disposal call,

(909) 382-5401 or 1-800-OILY CAT.

*FREE for San Bernardino County residents only. Businesses can call for cost inquiries and to schedule an appointment.

San Bernardino County STORMWATER PROGRAM

In the event of a spill or discharge to a storm drain or waterway, contact San Bernardino County Stormwater immediately: (877) WASTE18 | sbcountystormwater.org/report

sbcountystormwater.org

Big Bear • Chino • Chino Hills • Colton • Fontana • Grand Terrace • Highland • Loma Linda • Montclair • Ontario • Rancho Cucamonga
Redlands • Rialto • San Bernadino • San Bernadino County • San Bernadino County Flood Control District • Upland • Yucaipa

SIDEWALK, PLAZA, ENTRY MONUMENT & FOUNTAIN MAINTENANCE

Pollutants on sidewalks and other pedestrian traffic areas and plazas are typically due to littering and vehicle use. Fountain water containing chlorine and copperbased algaecides is toxic to aquatic life. Proper inspection, cleaning, and repair of pedestrian areas and HOA owned surfaces and structures can reduce pollutant runoff from these areas. Maintaining these areas may involve one or more of the following activities:

1. **Surface Cleaning**
2. **Graffiti Cleaning**
3. **Sidewalk Repair**
4. **Controlling Litter**
5. **Fountain Maintenance**

POLLUTION PREVENTION:

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

- Use dry cleaning methods whenever practical for surface cleaning activities.
- Use the least toxic materials available (e.g. water based paints, gels or sprays for graffiti removal).
- Once per year, educate HOA staff and tenants on pollution prevention measures.

MODEL PROCEDURES:

1. Surface Cleaning

Discharges of wash water to the storm water drainage system from cleaning or hosing of impervious surfaces is prohibited.
Sidewalks, Plazas

✓ Use dry methods (e.g. sweeping, backpack blowers, vacuuming) whenever practical to clean sidewalks and plazas rather than hosing, pressure washing, or steam cleaning. DO NOT sweep or blow material into curb; use devices that contain the materials.

✓ If water must be used, block storm drain inlets and contain runoff. Discharge wash water to landscaping or contain and dispose of properly.

SIDEWALK, PLAZA, ENTRY MONUMENT & FOUNTAIN MAINTENANCE

Parking Areas, Driveways, Drive-thru

✓ Parking facilities should be swept/vacuumed on a regular basis. Establish frequency of public parking lot sweeping based on usage and field observations of waste accumulation.

✓ If water must be used, block storm drain inlets and contain runoff. Discharge wash water to landscaping or contain and dispose of properly.

✓ Sweep all parking lots at least once before the onset of the wet season.

✓ Use absorbents to pick up oil; then dry sweep.

✓ Appropriately dispose of spilled materials and absorbents.

OPTIONAL:

- Consider increasing sweeping frequency based on factors such as traffic volume, land use, field observations of sediment and trash accumulation, proximity to water courses, etc.

Building Surfaces, Decks, etc., without loose paint

✓ Use high-pressure water, no soap.

✓ If water must be used, block storm drain inlets and contain runoff. Discharge wash water to landscaping or contain and dispose of properly.

Unpainted Building Surfaces, Wood Decks, etc.

✓ If water must be used, block storm drain inlets and contain runoff. Discharge wash water to landscaping or contain and dispose of properly.

✓ Use biodegradable cleaning agents to remove deposits.

✓ Make sure pH is between 6.5 and 8.5 THEN discharge to landscaping (if cold water without a cleaning agent) otherwise dispose of properly.

2. Graffiti Cleaning

Graffiti Removal

✓ Avoid graffiti abatement activities during rain events.

✓ When graffiti is removed by painting over, implement the procedures under Painting and Paint Removal in the Roads, Streets, and Highway Operation and Maintenance procedure sheet.

✓ Protect nearby storm drain inlets prior to removing graffiti from walls, signs, sidewalks, or other structures needing graffiti abatement. Clean up afterwards by sweeping or vacuuming thoroughly, and/or by using absorbent and properly disposing of the absorbent.

✓ Note that care should be taken when disposing of waste since it may need to be disposed of as hazardous waste.

OPTIONAL:

- Consider using a waterless and non-toxic chemical cleaning method for graffiti removal (e.g. gels or spray compounds).

3. Sidewalk Repair

Surface Removal and Repair

✓ Schedule surface removal activities for dry weather if possible.

✓ Avoid creating excess dust when breaking asphalt or concrete.

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

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

✓ Remove and recycle as much of the broken pavement as possible.

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

✓ Always dry sweep first to clean up tracked dirt. Use a street sweeper or vacuum truck. Do not dump vacuumed liquid in storm drains. Once dry sweeping is complete, the area may be hosed down if needed. Discharge wash water to landscaping, pump to the sanitary sewer if permitted to do so or contain and dispose of properly.

Concrete Installation and Repair

✓ Avoid mixing excess amounts of fresh concrete or cement mortar on-site. Only mix what is needed for the job.

✓ Wash concrete trucks off-site or in designated areas on-site, such that there is no discharge of concrete wash water into storm drain inlets, open ditches, streets, or other storm water conveyance structures. (See Concrete Waste Management BMP WM – 8)

SIDEWALK, PLAZA, ENTRY MONUMENT & FOUNTAIN MAINTENANCE

✓ Store dry and wet concrete materials under cover, protected from rainfall and runoff and away from drainage areas. After job is complete remove temporary stockpiles (asphalt materials, sand, etc.) and other materials as soon as possible.

✓ Return leftover materials to the transit mixer. Dispose of small amounts of excess concrete, grout, and mortar in the trash.

✓ When washing concrete to remove fine particles and expose the aggregate, contain the wash water for proper disposal.

✓ Do not wash sweepings from exposed aggregate concrete into the street or storm drain. Collect and return sweepings to aggregate base stock pile, or dispose in the trash.

✓ Protect applications of fresh concrete from rainfall and runoff until the material has hardened.

4. Litter Control

✓ Enforce anti-litter laws.

✓ Provide litter receptacles in busy, high pedestrian traffic areas of the community, at recreational facilities, and at community events.

✓ Cover litter receptacles and clean out frequently to prevent leaking/spillage or overflow.

OPTIONAL:

- Post "No Littering" signs.

5. Fountain Maintenance

✓ Do not use copper-based algaecides. Control algae with chlorine or other alternatives, such as sodium bromide.

✓ Allow chlorine to dissipate for a few days and then recycle/reuse water by draining it gradually onto a landscaped area. Water must be tested prior to discharge to ensure that chlorine is not present (concentration must be less than 0.1 ppm).

✓ Contact local agency for approval to drain into sewer or storm drain.

✓ Avoid mixing excess amounts of fresh concrete or cement mortar on-site. Only mix what is needed for the job.

EQUIPMENT MAINTENANCE & REPAIR

Vehicle or equipment maintenance has the potential to be a significant source of stormwater pollution. Engine repair and service (parts cleaning, spilled fuel, oil, etc.), replacement of fluids, and outdoor equipment storage and parking (dripping engines) can all contaminate stormwater. Conducting the following activities in a controlled manner will reduce the potential for stormwater contamination:

1. **General Maintenance and Repair**
2. **Vehicle and Machine Repair**
3. **Waste Handling/Disposal**

Related vehicle maintenance activities are covered under the following program headings in this manual: "Vehicle and Equipment Cleaning", "Vehicle and Equipment Storage", and "Vehicle Fueling".

POLLUTION PREVENTION:

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

- Review maintenance activities to verify that they minimize the amount of pollutants discharged to receiving waters. Keep accurate maintenance logs to evaluate materials removed and improvements made.
- Switch to non-toxic chemicals for maintenance when possible.
- Choose cleaning agents that can be recycled.
- Minimize use of solvents. Clean parts without using solvents whenever possible. Recycle used motor oil, diesel oil, and other vehicle fluids and parts whenever possible.
- Once per year, educate HOA staff and tenants on pollution prevention measures.

EQUIPMENT MAINTENANCE & REPAIR

MODEL PROCEDURES:

1. General Maintenance and Repair

General Guidelines

➔Note: Permission must be obtained for any discharge of wash water to the sanitary sewer from the local sewering agency.

✓ Review maintenance activities to verify that they minimize the amount of pollutants discharged to receiving waters. Keep accurate maintenance logs to evaluate materials removed and improvements made.

✓ Regularly inspect vehicles and equipment for leaks.

✓ Move activity indoors or cover repair area with a permanent roof if feasible.

✓ Minimize contact of stormwater with outside operations through berming the local sewering and drainage routing.

✓ Place curbs around the immediate boundaries of the process equipment.

✓ Clean yard storm drain inlets regularly and stencil them.

Good Housekeeping

✓ Avoid hosing down work areas. If work areas are washed and if discharge to the sanitary sewer is allowed, treat water with an appropriate treatment device (e.g. clarifier) before discharging. If discharge to the sanitary sewer is not permitted, pump water to a tank and dispose of properly.

✓ Collect leaking or dripping fluids in drip pans or container. Fluids are easier to recycle or dispose of properly if kept separate.

✓ Keep a drip pan under the vehicle while you unclip hoses, unscrew filters, any discharge of or remove other parts. Place a drip pan under any vehicle that might leak while you work on it to keep splatters or drips off the shop floor.

✓ Educate employees on proper handling and disposal of engine fluids.

✓ Promptly transfer used fluids to the proper waste or recycling drums. Don't leave full drip pans or other open containers lying around.

✓ Do not pour liquid waste to floor drains, sinks, outdoor storm drain inlets, or other storm drains or sewer connections.

✓ Post signs at sinks and stencil outdoor storm drain inlets.

2. Vehicle Repair

General Guidelines

✓ Perform vehicle fluid removal or changing inside of a building or in a contained covered area, where feasible, to prevent the run-on of stormwater and the runoff of spills.

✓ Regularly inspect vehicles and equipment for leaks, and repair as needed.

- ✓ Use secondary containment, such as a drain pan or drop cloth, to catch spills or leaks when removing or changing fluids.
- ✓ Immediately drain all fluids from wrecked vehicles. Ensure that the drain pan or drip pan is large enough to contain drained fluids (e.g. larger pans are needed to contain antifreeze, which may gush from some vehicles).
- ✓ Promptly transfer used fluids to the proper waste or recycling drums. Don't leave full drip pans or other open containers lying around.
- ✓ Recycle used motor oil, diesel oil, and other vehicle fluids and parts whenever possible.
- ✓ Oil filters disposed of in trash cans or dumpsters can leak oil. Place the oil filter in a funnel over a waste oil recycling drum to drain excess oil before disposal. Oil filters can also be recycled. Ask your oil supplier or recycler about recycling oil filters.
- ✓ Store cracked batteries in a non-leaking secondary container and dispose of properly at recycling facilities or at County hazardous waste disposal site.

Vehicle Leak and Spill Control

- ✓ Use absorbent materials on small spills. Remove the absorbent materials promptly and dispose of properly.
- ✓ Place a stockpile of spill cleanup materials where it will be readily accessible.
- ✓ Sweep floor using dry absorbent material.

3. Machine Repair

- ✓ Keep equipment clean; don't allow excessive build-up of oil or grease.
- ✓ Minimize use of solvents.
- ✓ Use secondary containment, such as a drain pan or drop cloth, to catch spills or leaks when removing or changing fluids.
- ✓ Perform major equipment repairs at the corporation yard, when practical.
- ✓ Following good housekeeping measures in Vehicle Repair section.

4. Waste Handling/Disposal

Waste Reduction

- ✓ Prevent spills and drips of solvents and cleansers to the shop floor.
- ✓ Do liquid cleaning at a centralized station so the solvents and residues stay in one area. Recycle liquid cleaners when feasible.

✓ Locate drip pans, drain boards, and drying racks to direct drips back into a solvent sink or fluid holding tank for reuse.

OPTIONAL:

- If possible, eliminate or reduce the amount of hazardous materials and waste by substituting non-hazardous or less hazardous material:

  -Use non-caustic detergents instead of caustic cleaning for parts cleaning.

  -Use a water-based cleaning service and have tank cleaned. Use detergent-based or water-based cleaning systems in place of organic solvent degreasers.

  -Replace chlorinated organic solvents with non-chlorinated solvents. Non-chlorinated solvents like kerosene or mineral spirits are less toxic and less expensive to dispose of properly. Check list of active ingredients to see whether it contains chlorinated solvents.

  -Choose cleaning agents that can be recycled.

Recycling

OPTIONAL:

- Separate wastes for easier recycling. Keep hazardous and non-hazardous wastes separate, do not mix used oil and solvents, and keep chlorinated solvents separate from non-chlorinated solvents.

- Label and track the recycling of waste material (e.g. used oil, spent solvents, batteries).

- Purchase recycled products to support the market for recycled materials.

LIMITATIONS:

Space and time limitations may preclude all work being conducted indoors. It may not be possible to contain and clean up spills from vehicles/equipment brought on-site after working hours. Dry floor cleaning methods may not be sufficient for some spills – see spill prevention and control procedures sheet. Identification of engine leaks may require some use of solvents.

POOL MAINTENANCE

Pool chemicals and filter solids, when discharged to the City streets, gutters or storm drans, DO NOT GET TREATED before reaching the Santa Ana River. Chlorine, acid cleaning chemicals and metal-based algaecides used in pools can kill beneficial organisms in the food chain and pollute our drinking water.

When emptying your swimming pool, spa or fountain, please use one of the following best management practices to prevent water pollution:

- Reuse the water as landscape irrigation
- Empty the water into the sewer between midnight and 6:00 am
- Remove solids and floating debris and dispose of in the trash, de-chlorinate the water to a chlorine residual = 0, wait 24 hours, then discharge the water to the street or storm drain
- Try not to use metal-based algaecides (i.e. copper sulfate) in your pool or spa. If you have, empty your pool or spa into the sewer. *Prior to discharging pool water into the sanitary sewer system, contact your local agency.*
- If the pool contains algae and mosquito larvae, discharge the water to the sewer

When acid cleaning or other chemical cleaning:

- Neutralize the pool water to pH of 6.5 to 8.5, then discharge to the sewer

For swimming pool and spa filter backwash:

- Dispose of solids into trash bag, then wash filter into a landscape area
- Settle, dispose of solids in trash and discharge water to the sewer, never to the storm drain

» For Residents

The following is a preview of the information we have available to residents. For more fact sheets, visit ***sbcountystormwater.org***

Household Hazardous Waste Center Locations

TOO TOXIC TO TRASH

Dispose of your **HOUSEHOLD HAZARDOUS WASTE** (HHW) at a **FREE** HHW Center near you. Examples of items collected: pesticides, fertilizers, paints, cleaners, antifreeze, batteries, motor oil, oil filters, and electronic waste.

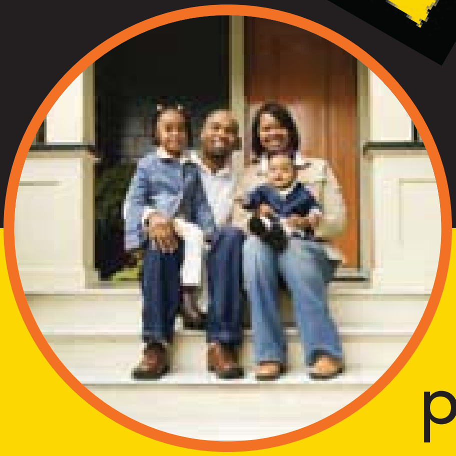
SERVICE AREA	LOCATION	DAYS OPEN	HOURS
Big Bear Lake (does not accept E-waste)	42040 Garstin Dr. (cross: Big Bear Blvd.)	Saturdays	9 a.m. - 2 p.m.
Chino	5050 Schaefer Ave. (cross: 4th St.)	2nd & 4th Sat.	8 a.m. - 1 p.m.
Fontana (Fontana residents only)	16454 Orange Way (cross: Cypress Ave.) Note: Provide a trash bill and a driver's license as proof of residency.	Saturdays	8 a.m. - 12 p.m.
Ontario	1430 S. Cucamonga Ave. (cross: Belmont St.)	Fri. & Sat.	9 a.m. - 2 p.m.
Rancho Cucamonga	8794 Lion Street. (Off 9th St, between Vineyard and Hellman)	Saturdays	8 a.m. - 12 p.m.
Redlands	500 Kansas St. (cross: Park Ave.)	Saturdays	9:30 a.m. - 12:30 p.m.
Rialto (does not accept E-waste)	246 Willow Ave. (cross: Rialto Ave.)	2nd & 4th Fri. & Sat.	8 a.m. - 12 p.m.
San Bernardino	2824 East 'W' St., 302 (cross: Victoria Ave.)	Mon. – Fri.	9 a.m. - 4 p.m.
Upland	1370 N. Benson Ave. (cross: 14th St.)	Saturdays	9 a.m. - 2 p.m.

San Bernardino County STORMWATER PROGRAM

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

Artwork Courtesy of the City of Los Angeles Stormwater Program. Printed on recycled paper.

TAKE ONE



WE DID IT OURSELVES AND WE DID IT RIGHT

When painting your home, protect your family and community.

- **PAINTS** that are water-based are less toxic and should be used whenever possible.
- **BRUSHES** with water-based paint should be washed in the sink. Those with oil-based paint should be cleaned with paint thinner.
- **SAFELY** dispose of unwanted paint and paint thinner. The County of San Bernardino offers 9 HHW Centers that accept paint and other household hazardous waste from residents FREE of charge. For a list of acceptable materials, location information, and hours of operation call 1-800-OILY CAT.

VEHICLE MAINTENANCE

Oil, grease, anti-freeze and other toxic automotive fluids often make their way into the San Bernardino County storm drain system, and do not get treated before reaching the Santa Ana River. This pollutes our drinking water and contaminates waterways, making them unsafe for people and wildlife. Follow these best management practices to prevent pollution and protect public health.

Cleaning Auto Parts

Scrape parts with a wire brush or use a bake oven rather than liquid cleaners. Arrange drip pans, drying racks and drain boards so that fluids are directed back into the parts washer or the fluid holding tank. Do not wash parts or equipment in a sink, parking lot, driveway or street.

Storing Hazardous Waste

Keep your liquid waste segregated. Many fluids can be recycled via hazardous waste disposal companies if they are not mixed. Store all materials under cover with spill containment or inside to prevent contamination of rainwater runoff.

Preventing Leaks and Spills

Conduct all vehicle maintenance inside of a garage. Place drip pans underneath vehicle to capture fluids. Use absorbent materials instead of water to clean work areas.

Cleaning Spills

Use dry methods for spill cleanup (sweeping, absorbent materials). To report accidental spills into the street or storm drain call (877) WASTE18 or 911.

Proper Disposal of Hazardous Waste

Dispose of household hazardous waste by taking it to your nearest household hazardous waste center. For more information, call 1-800-OILY CAT or check out sbcountystormwater.org/Disposal.html

PET WASTE DISPOSAL

FREE

DOGGIE WASTE BAGS

Remember to pick up after your pet every time to keep San Bernardino County clean and healthy!

To RECEIVE your

FREE CONTAINER

visit us online at

sbcountystormwater.org/dog

San Bernardino County STORMWATER PROGRAM

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sbcountystormwater.org

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» Report Pollution Violations
sbcountystormwater.org/report

» Email
info@sbcountystormwater.org