EXHIBIT F
WATER QUALITY MANAGEMENT PLAN

SITE PLAN NO. PLAN 19-00029

November 2019

MOJAVE RIVER WATERSHED

Water Quality Management Plan

For:

Reinforced Earth Company Concrete Panel Yard

APN 0472-131-03, 04, 08, 10, 13, 16,17

& 0472-141-16

VICTORVILLE, CA 92394

Prepared for:

Don and Terry Cooley

17430 North D Street

Victorville, CA 92394

760-243-3116

Prepared by:

JE Miller & Associates

17995 Outer Highway 18, Suite 1

Apple Valley, CA, 92307

760-242-6777

Submittal Date: 5/27/2019

Revision No. and Date: 8/27/2019

Revision No. and Date: 10/29/2019

Revision No. and Date: _____

Revision No. and Date: _____

Revision No. and Date: _____

Final Approval Date:_____________________

Project Owner's Certification

This Mojave River Watershed Water Quality Management Plan (WQMP) has been prepared for Reinforced Earth Company Concrete Panel Yard by JE Miller and Associates. The WQMP is intended to comply with the requirements of the City of Victorville/Mojave River Watershed Group 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):		Grading Permit Number(s):	
Tract/Parcel Map Number(s):	APN 0472-131-03, 04, 08, 10, 13, 16,17 & 0472-141-16	Building Permit Number(s):	
CUP, SUP, and/or APN (Specify Lot Numbers if Portions of Tract):			APN 0472-131-03, 04, 08, 10, 13, 16,17 & 0472-141-16

Owner's Signature			
Owner Name: Don and Terry Cooley			
Title	Owner		
Company	Reinforced Earth		
Address	17430 North D Street		
Email			
Telephone #	760-242-6777		
Signature		Date	

Preparer's Certification

Project Data			
Permit/Application Number(s):		Grading Permit Number(s):	
Tract/Parcel Map Number(s):	APN 0472-131-03, 04, 08, 10, 13, 16,17 & 0472-141-16	Building Permit Number(s):	
CUP, SUP, and/or APN (Specify Lot Numbers if Portions of Tract):			APN 0472-131-03, 04, 08, 10, 13, 16,17 & 0472-141-16

"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:		PE Stamp Below
Title	Engineer	
Company	JE Miller and Associates	
Address	17995 Outer Highway 18, Suite 1	
Email	sjones@jemillersurvey.com	
Telephone #	760-242-6777	
Signature		
Date		

Table of Contents

Forms

Section I – Introduction

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

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

Section 1 Discretionary Permit(s)

<table>
<tr><th colspan="6">Form 1-1 Project Information</th></tr>
<tr><td colspan="2">Project Name</td><td colspan="4">Reinforced Earth Company
Concrete Panel Yard</td></tr>
<tr><td colspan="2">Project Owner Contact Name:</td><td colspan="4">760-243-3116</td></tr>
<tr><td>Mailing Address:</td><td>17430 North D Street, Victorville, CA 92394</td><td>E-mail Address:</td><td></td><td>Telephone:</td><td>760-243-3116</td></tr>
<tr><td colspan="2">Permit/Application Number(s):</td><td colspan="2"></td><td>Tract/Parcel Map Number(s):</td><td></td></tr>
<tr><td colspan="2">Additional Information/ Comments:</td><td colspan="4">Final WQMP</td></tr>
<tr><td colspan="2">Description of Project:</td><td colspan="4">The Reinforced Earth Company New Construction Project is a proposed industrial development on the southwest side of National Trails Highway , 1.5 Miles north of Interstate 15. The project proposes to develop 13.46 acres into an office building, parking lot, ac driveway and concrete casting beds with gravel road access (see site map). 3 stormwater basins, infiltration basin 1,2 &3 are proposed to retain and infiltrate stormwater runoff from proposed impervious improvements. Therefor there will be 3 drainage management areas (DMAs) considered in this report for Water Quality Calculations . The total watershed analyzed in the Hydrology Report spans 28.2 acres. Water Quality calculations will focus on the DMAs directly tributary to the 3 basins which total 21.67 acres. Hydromodifcation analysis will stay consistent with the Hydrolgy Report and provide calculations for the entire project area watershed of 28.2 acres. Drainage flows will be collected in proposed v swales and storm drain and conveyed to the proposed infiltration basins. Drainage will be managed as to ensure flows from proposed impervious surfaces will be drained to the basins for retention and infiltration. Onsite flows will be collected on the surface and conveyed to the onsite infiltration basins. Discharge from the infiltration basins will spill to National Trails Highway. This project is a priority development project, which requires the development of a WQMP to complete the plan check process.</td></tr>
</table>

Provide summary of Conceptual WQMP conditions (if previously submitted and approved). Attach complete copy.	Drainage patterns will be preserved for this project. Surface runoff currently drains from southeast to northwest within natural drainages where site flows are collected along National Trails Highway and directed southeast. In the proposed condition site flows will continue to flow northwest in natural drainages. Storm drains and v swales will be introduced to convey surface flow to to infiltration basins, but surface runoff will continue to mimic the predeveloped condition and discharge to National Trails Highway. The project lies within the Lohantan Regional Water Quality Control Board (Region 6). There are no known pre-existing water quality concerns within the project. In the existing condtion there are no impervious surfaces onsite. Proposed Improvments will create 2.63 acres of impervious surface, while preserving the remaining portion of the site in a pervious state. The project does not have any characteristics that would preclude it from use of infiltration BMPs. Given the requirement to reduce flow peaks and volumes, volume based infiltration BMPs are proposed. The site has no legagcy contamination, infiltration rates are estimated to be greater than 1in.hr and grdoundwater depth is estimated to exceed 100 feet. The treatment control BMPs proposed for stormwater mitigation include 3 infiltration basins. The basins were sized in the hydrology report for the 100 year storm event based. This volume was determined to be 23,143 ft3 for infiltraion basin 1, 3119 ft3 for infiltraion basin 2 and 7,416.5 ft3 for infiltraion basin 3. These volumes exceed the total storage for the e 85th percentile DCV and the 10 year storm hydromodification volume. Therefore the drainage report criteria is governing in this site condition. For 100 year storm calculatiosn see the drainage report.

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):	586,372	3 Number of Dwelling Units:	0	4 SIC Code:	3272
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:
Property is owned and managed by Don and Terry Cooley. The proposed WQMP stormwater facilities consisting of the 3 infiltration basins will likely be maintained by a sub contractor but will be the repsonsibility of Don and Terry Cooley . The contact information is as follows: Don and Terry Cooley 17430 North D Street Victoriville , CA. 760-243-3116

2.3 Potential Stormwater Pollutants

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

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

Form 2.3-1 Pollutants of Concern			
Pollutant	Please check: E=Expected, N=Not Expected		Additional Information and Comments
Pathogens (Bacterial / Virus)	E ☒	N ☐	
Nutrients - Phosphorous	E ☒	N ☐	
Nutrients - Nitrogen	E ☒	N ☐	
Noxious Aquatic Plants	E ☒	N ☐	
Sediment	E ☒	N ☐	
Metals	E ☒	N ☐	
Oil and Grease	E ☒	N ☐	
Trash/Debris	E ☒	N ☐	
Pesticides / Herbicides	E ☒	N ☐	
Organic Compounds	E ☒	N ☐	
Other:	E ☐	N ☐	Primary pollutants of concern given the activites associated with this industrial/commerical development are metals, hydrocarbons, sediment, trash and debris.
Other:	E ☐	N ☐	
Other:	E ☐	N ☐	

Section 3 Site and Watershed Description

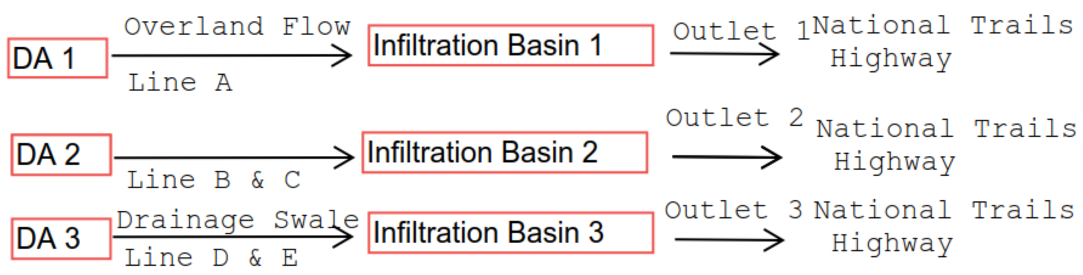
Describe the project site conditions that will facilitate the selection of BMPs through an analysis of the physical conditions and limitations of the site and its receiving waters. Identify distinct drainage areas (DA) that collect flow from a portion of the site and describe how runoff from each DA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

Form 3-1 Site Location and Hydrologic Features

Site coordinates take GPS measurement at approximate center of site	Latitude 34.563005	Longitude -117.315959	Thomas Bros Map page

1 San Bernardino County climatic region: ☒ Desert

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



Conveyance	Briefly describe on-site drainage features to convey runoff that is not retained within a DMA
DA1 DMA C flows to DA1 DMA A	Ex. Bioretention overflow to vegetated bioswale with 4' bottom width, 5:1 side slopes and bed slope of 0.01. Conveys runoff for 1000' through DMA 1 to existing catch basin on SE corner of property
DA1 DMA A to Outlet 1	DA1 drains to infiltration basin 1 via drainage swale and storm drain Line A. Infiltraion Basin 1 discharges to National Trails Highway (Outlet1). Mojave River is the ultimate receiving water
DA1 DMA B to Outlet 1	DA2 drains to infiltraion basin 2 via Line B and Line C storm drain systems. Infiltration Basin 2 discahrges to National trails highway (Outlet 2). Mojave River is the ultimate receiving water
DA2 to Outlet 2	DA3 drains to infiltration basin 3 via swale and Line D and E. Infiltration Basin 3 discharges to National Trails Highway (Outlet 3). Mojave

Form 3-2 Existing Hydrologic Characteristics for Drainage Area 1				
For Drainage Area 1's sub-watershed DMA, provide the following characteristics	DMA A	DMA B	DMA C	DMA D
1 DMA drainage area (ft^2)	292,000	69,532	582,394	
2 Existing site impervious area (ft^2)	0	0	0	
3 Antecedent moisture condition For desert areas, use http://www.sbcounty.gov/dpw/floodcontrol/pdf/20100412_map.pdf	1	1	1	
4 Hydrologic soil group Refer to County Hydrology Manual Addendum for Arid Regions – http://www.sbcounty.gov/dpw/floodcontrol/pdf/20100412_addendum.pdf	C	C	C	
5 Longest flowpath length (ft)	1022	778	1480	
6 Longest flowpath slope (ft/ft)	0.06	0.05	0.05	
7 Current land cover type(s) Select from Fig C-3 of Hydrology Manual	Desert Vegetation	Desert Vegetation	Desert Vegetation	
8 Pre-developed pervious area condition: Based on the extent of wet season vegetated cover good >75%; Fair 50-75%; Poor <50% Attach photos of site to support rating	Poor	Poor	Poor	

Form 3-2 Existing Hydrologic Characteristics for Drainage Area 1 (use only as needed for additional DMA w/in DA 1)

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

Form 3-3 Watershed Description for Drainage Area	
Receiving waters Refer to SWRCB site: http://www.waterboards.ca.gov/water_issues/programs/tmdl/integrated2010.shtml	Mojave River
Applicable TMDLs http://www.waterboards.ca.gov/water_issues/programs/tmdl/integrated2010.shtml	None
303(d) listed impairments http://www.waterboards.ca.gov/water_issues/programs/tmdl/integrated2010.shtml	Upper Narrows to Lower Narrows: Fluoride Sulfates TDS
Environmentally Sensitive Areas (ESA) Refer to Watershed Mapping Tool – http://sbcounty.permitrack.com/WAP	None
Hydromodification Assessment	☒ Yes Complete Hydromodification Assessment. Include Forms 4.2-2 through Form 4.2-5 and Hydromodification BMP Form 4.3-9 in submittal ☐ No

Section 4 Best Management Practices (BMP)

4.1 Source Control BMPs and Site Design BMP Measures

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

4.1.1 Source Control BMPs

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

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

The identified list of source control BMPs 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	☒	☐	Owner to be provided WQMP and Educ Materials
N2	Activity Restrictions	☐	☒	There will not be a list of restricted activities
N3	Landscape Management BMPs	☒	☐	Landscape Management to be provided per SD-10 provided in Attachments
N4	BMP Maintenance	☒	☐	BMP Maintenance to be provided per Form 5.1
N5	Title 22 CCR Compliance (How development will comply)	☐	☒	Not applicable
N6	Local Water Quality Ordinances	☒	☐	By completing and complying with this WQMP the site will comply with all water quality ordinances
N7	Spill Contingency Plan	☒	☐	Spill Contingency Plan will consist of a spill kit available onsite at all times and annual training for all staff
N8	Underground Storage Tank Compliance	☐	☒	No storage underground
N9	Hazardous Materials Disclosure Compliance	☐	☒	No hazardous material stored onsite

Form 4.1-1 Non-Structural Source Control BMPs

Identifier	Name	Check One		Describe BMP Implementation OR, if not applicable, state reason
		Included	Not Applicable	
N10	Uniform Fire Code Implementation	☒	☐	Site will comply with all fire code requirements
N11	Litter/Debris Control Program	☒	☐	Litter and debris will be deposited in appropriate covered receptacles. Any accumulated trash or debris onsite will be removed and disposed of by property owner.
N12	Employee Training	☒	☐	Owner will be provided a copy of the WQMP to train employees on post construction stormwater treatment management.
N13	Housekeeping of Loading Docks	☐	☒	No loading/unloading docks are proposed for this project.
N14	Catch Basin Inspection Program	☒	☐	Catch basins will be inspected and maintained per Form 5.1
N15	Vacuum Sweeping of Private Streets and Parking Lots	☒	☐	Parking lot will be swept bi monthly.
N16	Other Non-structural Measures for Public Agency Projects	☐	☒	Not a public agency project.
N17	Comply with all other applicable NPDES permits	☒	☐	SWPPP to be developed to comply with construction general permit

Form 4.1-2 Structural Source Control BMPs

Identifier	Name	Check One		Describe BMP Implementation OR, If not applicable, state reason
		Included	Not Applicable	
S1	Provide storm drain system stencilling and signage (CASQA New Development BMP Handbook SD-13)	☒	☐	Drains to River or Equivalent stenciling to be provided
S2	Design and construct outdoor material storage areas to reduce pollution introduction (CASQA New Development BMP Handbook SD-34)	☐	☒	No outdoor material storage areas
S3	Design and construct trash and waste storage areas to reduce pollution introduction (CASQA New Development BMP Handbook SD-32)	☒	☐	Trash/waste storage area to be covered
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)	☒	☐	Efficient irrigation to be provided per landscape plan
S5	Finish grade of landscaped areas at a minimum of 1-2 inches below top of curb, sidewalk, or pavement	☒	☐	Parkway landscape to be constructed as swale
S6	Protect slopes and channels and provide energy dissipation (CASQA New Development BMP Handbook SD-10)	☐	☒	No slopes or channels
S7	Covered dock areas (CASQA New Development BMP Handbook SD-31)	☒	☐	Dock areas to be managed per SD-31
S8	Covered maintenance bays with spill containment plans (CASQA New Development BMP Handbook SD-31)	☐	☒	No Maintenance Bays
S9	Vehicle wash areas with spill containment plans (CASQA New Development BMP Handbook SD-33)	☐	☒	No Vehicle wash areas
S10	Covered outdoor processing areas (CASQA New Development BMP Handbook SD-36)	☐	☒	No outdoor processing areas

Form 4.1-2 Structural Source Control BMPs

Identifier	Name	Check One: Included	Check One: Not Applicable	Describe BMP Implementation OR, If not applicable, state reason
S11	Equipment wash areas with spill containment plans (CASQA New Development BMP Handbook SD-33)	☐	☒	No equipment wash areas
S12	Fueling areas (CASQA New Development BMP Handbook SD-30)	☐	☒	No fueling areas
S13	Hillside landscaping (CASQA New Development BMP Handbook SD-10)	☒	☐	
S14	Wash water control for food preparation areas	☐	☒	No food preparation
S15	Community car wash racks (CASQA New Development BMP Handbook SD-33)	☐	☒	No community car wash

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: Impervious surfaces will be limited to the nortlerly 88% of the site and will preserve 12% in a pervious condition.
Maximize natural infiltration capacity; Including improvement and maintenance of soil: Yes ☒ No ☐ Explanation: Infiltration will be promoted through incorporation of infiltration basin/stromtech chamber
Preserve existing drainage patterns and time of concentration: Yes ☒ No ☐ Explanation: Site drains to the north east and will continue to drain to the northeast in the proposed condition. Due to infiltraiton basin storage times of concentration are expected to increase.
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: Impervious surfaces will be dissconnected by conveying runoff to an infiltration basin/stormtech chamber
Use of Porous Pavement.: Yes ☐ No ☒ Explanation: Porous pavement is infeasble due to heavy sediment blown by wind that clog porous pavement
Protect existing vegetation and sensitive areas: Yes ☐ No ☒ Explanation: All vegatation will be removed during grading. No sensitive areas.
Re-vegetate disturbed areas. Including planting and preservation of drought tolerant vegetation. : Yes ☒ No ☐ Explanation: All landscaping will be drought tolerant.
Minimize unnecessary compaction in stormwater retention/infiltration basin/trench areas: Yes ☒ No ☐ Explanation: Compaction will be minmimzed under infiltration basin/stormtech chamber

Utilize naturalized/rock-lined drainage swales in place of underground piping or imperviously lined swales: Yes ☐ No ☒ Explanation: v gutters and stormdrain to convey surface flows.
Stake off areas that will be used for landscaping to minimize compaction during construction : Yes ☒ No ☐ Explanation: SWPPP will identify areas where compaction should be limited during construction
Use of Rain Barrels and Cisterns, Including the use of on-site water collection systems.: Yes ☐ No ☒ Explanation: No rain barrels are proposed
Stream Setbacks. Includes a specified distance from an adjacent steam: : Yes ☐ No ☒ Explanation: No streams onsite .

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): 43,240	2 Imperviousness after applying preventative site design practices (Imp%): 0.24	3 Runoff Coefficient (Rc): _0.19 R_c = 0.858(Imp%)^3-0.78(Imp%)^2+0.774(Imp%)+0.04
4 Determine 1-hour rainfall depth for a 2-year return period $P_{2yr-1hr}$ (in): 0.36 http://hdsc.nws.noaa.gov/hdsc/pfds/sa/sca_pfds.html		
5 Compute P_6, Mean 6-hr Precipitation (inches): 0.45 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): 4108 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 72,200 Form 4.2-3 Item 12	2 12.31 Form 4.2-4 Item 13	3 31.86 Form 4.2-5 Item 10
Post-developed	4 48139 Form 4.2-3 Item 13	5 12.26 Form 4.2-4 Item 14	6 26.16 Form 4.2-5 Item 14
Difference	7 -24061 Item 4 – Item 1	8 0.05 Item 2 – Item 5	9 -5.7 Item 6 – Item 3
Difference (as % of pre-developed)	10 -0.33% Item 7 / Item 1	11 0.004% Item 8 / Item 2	12 -0.1789% Item 9 / Item 3

Form 4.2-1 LID BMP Performance Criteria for Design Capture Volume (DA 2)		
1 Project area DA 1 (ft^2): 69,532	2 Imperviousness after applying preventative site design practices (Imp%): 0.32	3 Runoff Coefficient (Rc): 0.24 R_c = 0.858(Imp%)^3-0.78(Imp%)^2+0.774(Imp%)+0.04
4 Determine 1-hour rainfall depth for a 2-year return period $P_{2yr\text{-}1hr}$ (in): 0.36 http://hdsc.nws.noaa.gov/hdsc/pfds/sa/sca_pfds.html		
5 Compute P_6, Mean 6-hr Precipitation (inches): 0.45 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): 1208 DCV = 1/12 * [Item 1* Item 3 *Item 5 * C_2], where C_2 is a function of drawdown rate (24-hr = 1.582; 48-hr = 1.963) Compute separate DCV for each outlet from the project site per schematic drawn in Form 3-1 Item 2		

Form 4.2-1 LID BMP Performance Criteria for Design Capture Volume (DA 3)		
1 Project area DA 1 (ft^2): 582,394	2 Imperviousness after applying preventative site design practices (Imp%): 0.04	3 Runoff Coefficient (Rc): 0.07 R_c = 0.858(Imp%)^3-0.78(Imp%)^2+0.774(Imp%)+0.04
4 Determine 1-hour rainfall depth for a 2-year return period $P_{2yr\text{-}1hr}$ (in): 0.36 http://hdsc.nws.noaa.gov/hdsc/pfds/sa/sca_pfds.html		
5 Compute P_6, Mean 6-hr Precipitation (inches): 0.45 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): 2956 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 4.2-3 Hydromodification Assessment for Runoff Volume (DA 1)

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

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

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

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

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

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

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

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

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

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

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

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

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

Compute peak runoff for pre- and post-developed conditions

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

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

4.3 BMP Selection and Sizing

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

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

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

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

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

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

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

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

4.3.1 Exceptions to Requirements for Bioretention Facilities

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

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

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

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

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

4.3.2 Site Design BMP

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

Form 4.3-2 Site Design BMPs (DA 1)			
1 Implementation of Impervious Area Dispersion BMP (i.e. routing runoff from impervious to pervious areas), excluding impervious areas planned for routing to on-lot infiltration BMP: Yes ☐ No ☒ If yes, complete Items 2-5; If no, proceed to Item 6	DA DMA BMP Type	DA DMA BMP Type	DA DMA BMP Type (Use additional forms for more BMPs)
2 Total impervious area draining to pervious area (ft^2)			
3 Ratio of pervious area receiving runoff to impervious area			
4 Retention volume achieved from impervious area dispersion (ft^3) V = Item2 * Item 3 * (0.5/12), assuming retention of 0.5 inches of runoff			
5 Sum of retention volume achieved from impervious area dispersion (ft^3): $V_{retention}$ =Sum of Item 4 for all BMPs			
6 Implementation of Localized On-lot Infiltration BMPs (e.g. on-lot rain gardens): Yes ☐ No ☒ If yes, complete Items 7-13 for aggregate of all on-lot infiltration BMP in each DA; If no, proceed to Item 14	DA DMA BMP Type	DA DMA BMP Type	DA DMA BMP Type (Use additional forms for more BMPs)
7 Ponding surface area (ft^2)			
8 Ponding depth (ft) (min. 0.5 ft.)			
9 Surface area of amended soil/gravel (ft^2)			
10 Average depth of amended soil/gravel (ft) (min. 1 ft.)			
11 Average porosity of amended soil/gravel			
12 Retention volume achieved from on-lot infiltration (ft^3) $V_{retention}$ = (Item 7 *Item 8) + (Item 9 * Item 10 * Item 11)			
13 Runoff volume retention from on-lot infiltration (ft^3): $V_{retention}$ =Sum of Item 12 for all BMPs			

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

14 Implementation of Street Trees: Yes ☐ No ☒ If yes, complete Items 14-18. If no, proceed to Item 19	DA DMA BMP Type	DA DMA BMP Type	DA DMA BMP Type (Use additional forms for more BMPs)
15 Number of Street Trees			
16 Average canopy cover over impervious area (ft^2)			
17 Runoff volume retention from street trees (ft^3) $V_{retention}$ = Item 15 * Item 16 * (0.05/12) assume runoff retention of 0.05 inches			
18 Runoff volume retention from street tree BMPs (ft^3): $V_{retention}$ = Sum of Item 17 for all BMPs			
19 Total Retention Volume from Site Design BMPs: 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): 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 2 DMA BMP Type	DA 3 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	4.54	4.54	4.54
3 Infiltration safety factor See TGD Section 5.4.2 and Appendix D	2	2	2
4 Design percolation rate (in/hr) P_{design} = Item 2 / Item 3	2.27	2.27	2.27
5 Ponded water drawdown time (hr) Copy Item 6 in Form 4.2-1	48	48	48
6 Maximum ponding depth (ft) BMP specific, see Table 5-4 of the TGD for WQMP for BMP design details	5	5	5
7 Ponding Depth (ft) d_{BMP} = Minimum of (1/12*Item 4*Item 5) or Item 6	5	5	5
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	10184	242	2885
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	0
10 Amended soil porosity	0	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	0
12 Gravel porosity	0	0	0
13 Duration of storm as basin is filling (hrs) Typical ~ 3hrs	3	3	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))]	23,143	3119	7416
15 Underground Retention Volume (ft^3) Volume determined using manufacturer's specifications and calculations	0	0	0

16 Total Retention Volume from LID Infiltration BMPs: DA 1,2,3 = 33,678 (Sum of Items 14 and 15 for all infiltration BMP included in plan)

17 Fraction of DCV achieved with infiltration BMP: 100% Retention% = Item 16 / Form 4.2-1 Item 7

18 Is full LID DCV retained onsite with combination of hydrologic source control and LID retention/infiltration BMPs? Yes ☒ No ☐
If yes, demonstrate conformance using Form 4.3-10; If no, then reduce Item 3, Factor of Safety to 2.0 and increase Item 8, Infiltrating Surface Area, such that the portion of the site area used for retention and infiltration BMPs equals or exceeds the minimum effective area thresholds (Table 5-7 of the TGD for WQMP) for the applicable category of development and repeat all above calculations.

4.3.4 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 (ft³): 0 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 ☐ Bioretention with underdrain ☐ Planter box with underdrain ☐ Constructed wetlands ☐ Wet extended detention ☐ Dry extended detention	Flow-based biotreatment Use Form 4.3-7 to compute treated flow ☐ Vegetated swale ☐ Vegetated filter strip ☐ Proprietary biotreatment
3 Volume biotreated in volume based biotreatment BMP (ft³): Form 4.3-5 Item 15 + Form 4.3-6 Item 13	4 Compute remaining LID DCV with implementation of volume based biotreatment BMP (ft³): Item 1 – Item 3	5 Remaining fraction of LID DCV for sizing flow based biotreatment BMP: % Item 4 / Item 1
6 Flow-based biotreatment BMP capacity provided (cfs): Use Figure 5-2 of the TGD for WQMP to determine flow capacity required to provide biotreatment of remaining percentage of unmet LID DCV (Item 5), for the project's precipitation zone (Form 3-1 Item 1)		
7 Metrics for MEP determination: • Provided a WQMP with the portion of site area used for suite of LID BMP equal to minimum thresholds in Table 5-7 of the TGD for WQMP for the proposed category of development: ☐ If maximized on-site retention BMPs is feasible for partial capture, then LID BMP implementation must be optimized to retain and infiltrate the maximum portion of the DCV possible within the prescribed minimum effective area. The remaining portion of the DCV shall then be mitigated using biotreatment BMP.		

Form 4.3-5 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 $2^{1.67}$ * Item $3^{0.5}$)			
6 Side Slope (ft/ft) BMP specific, see Table 5-6 of the TGD for WQMP for reference to BMP design details			
7 Cross sectional area (ft^2) A = (Item 5 * Item 2) + (Item 6 * Item 2^{2})			
8 Water quality flow velocity (ft/sec) V = Form 4.3-5 Item 6 / Item 7			
9 Hydraulic residence time (min) Pollutant specific, see Table 5-6 of the TGD for WQMP for reference to BMP design details			
10 Length of flow based BMP (ft) L = Item 8 * Item 9 * 60			
11 Water surface area at water quality flow depth (ft^2) SA_{top} = (Item 5 + (2 * Item 2 * Item 6)) * Item 10			

4.3.5 Conformance Summary

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

Form 4.3-8 Conformance Summary and Alternative Compliance Volume Estimate (DA 1)
1 Total LID DCV for the Project DA-1 (ft³): 4108 Copy Item 7 in Form 4.2-1
2 On-site retention with site design BMP (ft³): 0 Copy Item18 in Form 4.3-2
3 On-site retention with LID infiltration BMP (ft³): 23,143 Copy Item 16 in Form 4.3-3
4 On-site biotreatment with volume based biotreatment BMP (ft³): 0 Copy Item 3 in Form 4.3-4
5 Flow capacity provided by flow based biotreatment BMP (cfs): 0 Copy Item 6 in Form 4.3-4
6 LID BMP performance criteria are achieved if answer to any of the following is "Yes": • Full retention of LID DCV with site design or infiltration BMP: Yes ☒ No ☐ If yes, sum of Items 2, 3, and 4 is greater than Item 1 • Combination of on-site retention BMPs for a portion of the LID DCV and volume-based biotreatment BMP that address all pollutants of concern for the remaining LID DCV: Yes ☐ No ☐ If yes, a) sum of Items 2, 3, 4, and 5 is greater than Item 1, and Items 2, 3 and 4 are maximized; or b) Item 6 is greater than Form 4.3--5 Item 6 and Items 2, 3 and 4 are maximized ▪ On-site retention and infiltration is determined to be infeasible; therefore biotreatment BMP provides biotreatment for all pollutants of concern for full LID DCV: Yes ☐ No ☐ If yes, Form 4.3-1 Items 7 and 8 were both checked yes
7 If the LID DCV is not achieved by any of these means, then the project may be allowed to develop an alternative compliance plan. Check box that describes the scenario which caused the need for alternative compliance: • Combination of Site Design, retention and infiltration, , and biotreatment BMPs provide less than full LID DCV capture: ☐ Checked yes if Form 4.3-4 Item 7is checked yes, Form 4.3-4 Item 6 is zero, and sum of Items 2, 3, 4, and 5 is less than Item 1. If so, apply water quality credits and calculate volume for alternative compliance, V_{alt} = (Item 1 – Item 2 – Item 3 – Item 4 – Item 5) * (100 - Form 2.4-1 Item 2)% • Facilities, or a combination of facilities, of a different design than in Section E.12.e.(ii)(f) may be permitted if all of the following Phase II Small MS4 General Permit 2013-0001-DWQ 55 February 5, 2013 measures of equivalent effectiveness are demonstrated: 1) Equal or greater amount of runoff infiltrated or evapotranspired; ☐ 2) Equal or lower pollutant concentrations in runoff that is discharged after biotreatment; ☐ 3) Equal or greater protection against shock loadings and spills; ☐ 4) Equal or greater accessibility and ease of inspection and maintenance. ☐

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

1 Total LID DCV for the Project DA-2 (ft^3): 1208 Copy Item 7 in Form 4.2-1

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

3 On-site retention with LID infiltration BMP (ft^3): 3119 Copy Item 16 in Form 4.3-3

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

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

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

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

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

- Combination of Site Design, retention and infiltration, , and biotreatment BMPs provide less than full LID DCV capture: ☐
  Checked yes if Form 4.3-4 Item 7is checked yes, Form 4.3-4 Item 6 is zero, and sum of Items 2, 3, 4, and 5 is less than Item 1. If so, apply water quality credits and calculate volume for alternative compliance, V_{alt} = (Item 1 – Item 2 – Item 3 – Item 4 – Item 5) * (100 - Form 2.4-1 Item 2)%
- Facilities, or a combination of facilities, of a different design than in Section E.12.e.(ii)(f) may be permitted if all of the following Phase II Small MS4 General Permit 2013-0001-DWQ 55 February 5, 2013 measures of equivalent effectiveness are demonstrated:
  1) Equal or greater amount of runoff infiltrated or evapotranspired; ☐
  2) Equal or lower pollutant concentrations in runoff that is discharged after biotreatment; ☐
  3) Equal or greater protection against shock loadings and spills; ☐
  4) Equal or greater accessibility and ease of inspection and maintenance. ☐

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

1 Total LID DCV for the Project DA-3 (ft^3): 2956 Copy Item 7 in Form 4.2-1

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

3 On-site retention with LID infiltration BMP (ft^3): 7416.5 Copy Item 16 in Form 4.3-3

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

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

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

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

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

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

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

4.3.6 Hydromodification Control BMP

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

Form 4.3-9 Hydromodification Control BMPs (DA 1)	
1 Volume reduction needed for hydromodification performance criteria (ft³): -26468 (Form 4.2-2 Item 4 * 0.95) – Form 4.2-2 Item 1	2 On-site retention with site design and infiltration, BMP (ft³): 33,678.5 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 (ft³): 0 Item 1 – Item 2	4 Volume capture provided by incorporating additional on-site BMPs (ft³): 0
5 Is Form 4.2-2 Item 11 less than or equal to 5%: Yes ☒ No ☐ If yes, hydromodification performance criteria is achieved. If no, select one or more mitigation options below: • Demonstrate increase in time of concentration achieved by proposed LID site design, LID BMP, and additional on-site BMP ☐ • Increase time of concentration by preserving pre-developed flow path and/or increase travel time by reducing slope and increasing cross-sectional area and roughness for proposed on-site conveyance facilities ☐	
6 Form 4.2-2 Item 12 less than or equal to 5%: Yes ☒ No ☐ If yes, hydromodification performance criteria is achieved. If no, select one or more mitigation options below: • Demonstrate reduction in peak runoff achieved by proposed LID site design, LID BMPs, and additional on-site retention BMPs ☐	

4.4 Alternative Compliance Plan (if applicable)

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

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

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

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

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

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

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

Section 5 Inspection and Maintenance Responsibility for Post Construction BMP

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

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

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

BMP	Reponsible Party(s)	Inspection/ Maintenance Activities Required	Minimum Frequency of Activities
SD-10	Owner Management	Ongoing care and maintenance	Continual
SD-12	Owner Management	Ongoing Care and maintenance.	Continual
SD-13	Owner Management	Maintain inlet signs	Continual
SD-32	Owner Management	Inspect Trash Storage	Continual
Infiltratio n BMP	Owner Management	Maintain per CASQA BMP handbook	Biannually

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.

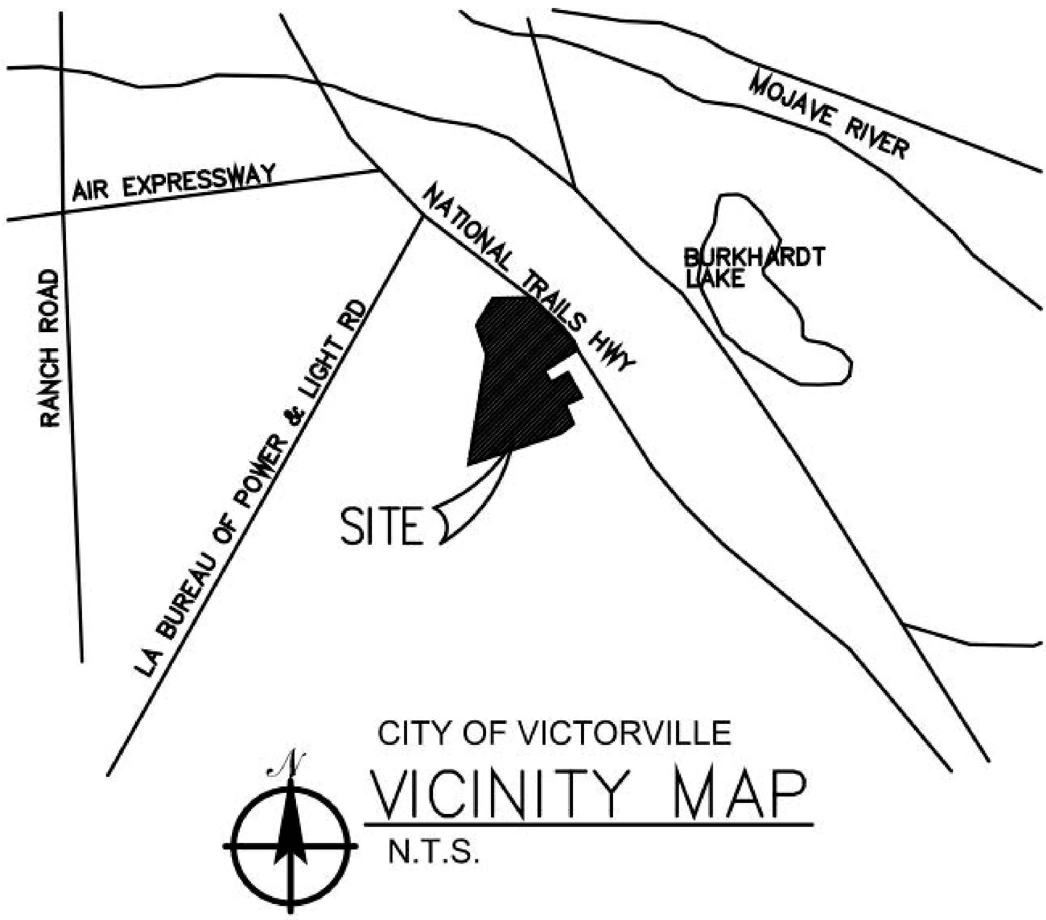
6.3 Post Construction

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

Reference Material



CITY OF VICTORVILLE

VICINITY MAP

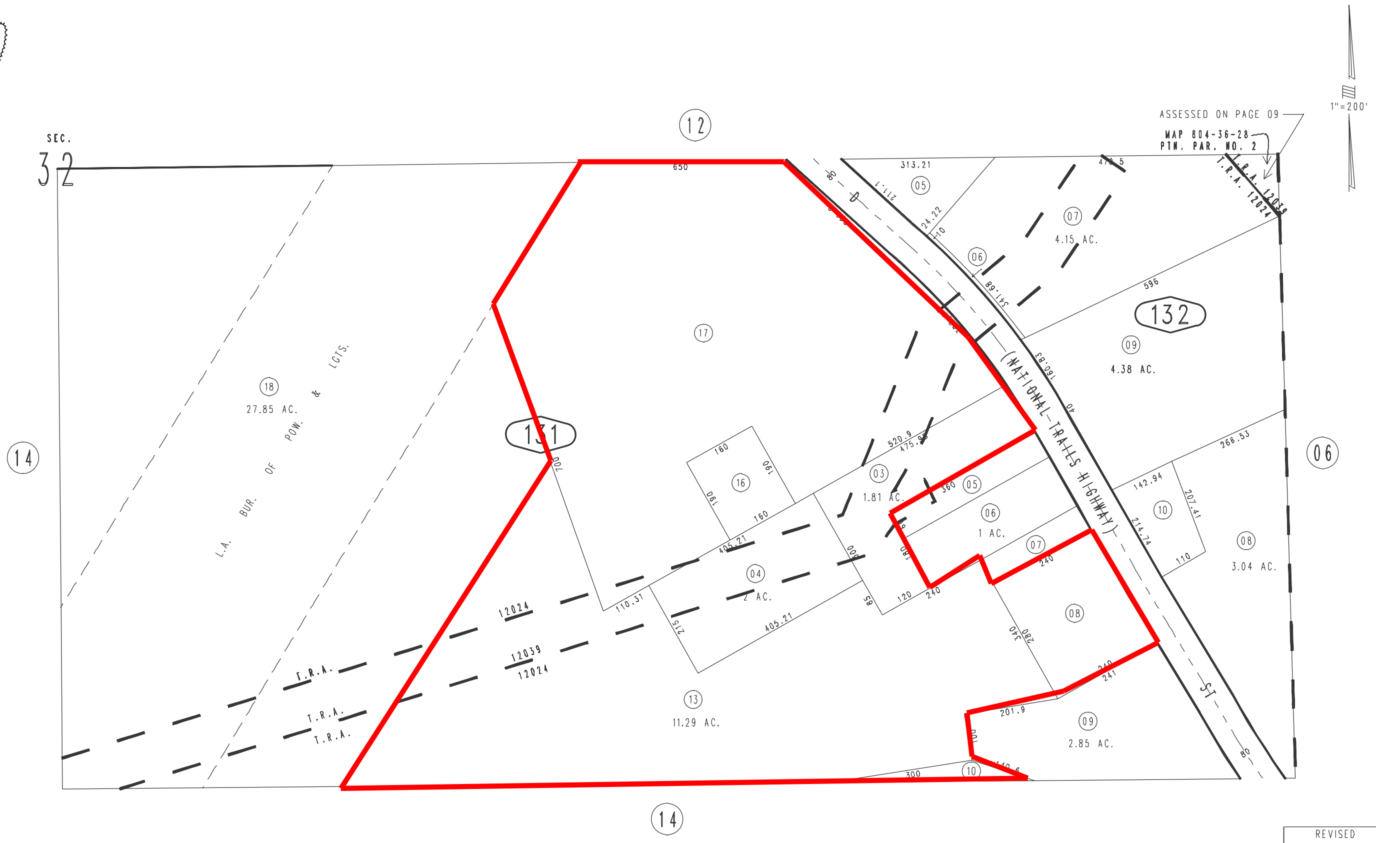
N.T.S.

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

N.1/2, S.E.1/4, Sec.32, T.6N., R.4W., S.B.B.&M.

City of Victorville
Tax Rate Area
12024 12039

0472-13



Assessor's Map
Book 0472 Page 13
San Bernardino County

REVISED
03/04/10 RM

June 2004

NOAA Atlas 14, Volume 6, Version 2
Location name: Victorville, California, USA*
Latitude: 34.5631°, Longitude: -117.3169°
Elevation: 2777.35 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	**0.101** (0.083-0.124)	**0.138** (0.113-0.169)	**0.189** (0.156-0.233)	**0.234** (0.191-0.290)	**0.300** (0.237-0.384)	**0.354** (0.273-0.463)	**0.413** (0.311-0.553)	**0.476** (0.349-0.656)	**0.569** (0.401-0.817)	**0.647** (0.440-0.960)
10-min	**0.145** (0.119-0.177)	**0.197** (0.163-0.242)	**0.271** (0.223-0.334)	**0.336** (0.274-0.416)	**0.430** (0.339-0.550)	**0.507** (0.392-0.664)	**0.591** (0.446-0.792)	**0.683** (0.501-0.940)	**0.816** (0.574-1.17)	**0.927** (0.631-1.38)
15-min	**0.175** (0.144-0.214)	**0.239** (0.197-0.292)	**0.328** (0.270-0.403)	**0.406** (0.331-0.503)	**0.520** (0.410-0.666)	**0.614** (0.474-0.802)	**0.715** (0.539-0.958)	**0.826** (0.606-1.14)	**0.987** (0.695-1.42)	**1.12** (0.763-1.66)
30-min	**0.233** (0.192-0.285)	**0.317** (0.261-0.389)	**0.436** (0.359-0.536)	**0.540** (0.440-0.669)	**0.691** (0.545-0.885)	**0.816** (0.630-1.07)	**0.951** (0.717-1.27)	**1.10** (0.805-1.51)	**1.31** (0.924-1.88)	**1.49** (1.01-2.21)
60-min	**0.265** (0.218-0.324)	**0.361** (0.297-0.443)	**0.497** (0.408-0.610)	**0.614** (0.501-0.762)	**0.787** (0.620-1.01)	**0.929** (0.717-1.21)	**1.08** (0.816-1.45)	**1.25** (0.917-1.72)	**1.49** (1.05-2.14)	**1.70** (1.15-2.52)
2-hr	**0.367** (0.303-0.450)	**0.491** (0.405-0.602)	**0.663** (0.545-0.815)	**0.811** (0.661-1.00)	**1.02** (0.807-1.31)	**1.20** (0.924-1.56)	**1.38** (1.04-1.85)	**1.58** (1.16-2.17)	**1.86** (1.31-2.67)	**2.10** (1.43-3.11)
3-hr	**0.431** (0.356-0.528)	**0.573** (0.472-0.703)	**0.769** (0.632-0.945)	**0.936** (0.763-1.16)	**1.17** (0.926-1.50)	**1.37** (1.06-1.79)	**1.57** (1.18-2.10)	**1.79** (1.31-2.46)	**2.09** (1.47-3.01)	**2.34** (1.59-3.48)
6-hr	**0.575** (0.474-0.704)	**0.763** (0.628-0.935)	**1.02** (0.836-1.25)	**1.23** (1.00-1.53)	**1.53** (1.21-1.96)	**1.77** (1.37-2.32)	**2.02** (1.52-2.71)	**2.29** (1.68-3.15)	**2.65** (1.87-3.81)	**2.95** (2.01-4.38)
12-hr	**0.726** (0.599-0.889)	**0.975** (0.803-1.20)	**1.31** (1.07-1.61)	**1.58** (1.29-1.96)	**1.96** (1.54-2.50)	**2.25** (1.74-2.94)	**2.55** (1.92-3.42)	**2.87** (2.10-3.95)	**3.30** (2.32-4.73)	**3.63** (2.47-5.39)
24-hr	**0.912** (0.809-1.05)	**1.25** (1.10-1.43)	**1.68** (1.49-1.94)	**2.04** (1.79-2.38)	**2.52** (2.14-3.04)	**2.90** (2.40-3.56)	**3.28** (2.65-4.13)	**3.67** (2.89-4.75)	**4.19** (3.17-5.66)	**4.60** (3.36-6.43)
2-day	**1.05** (0.926-1.20)	**1.45** (1.28-1.67)	**1.99** (1.75-2.29)	**2.42** (2.12-2.82)	**3.02** (2.56-3.64)	**3.48** (2.89-4.28)	**3.95** (3.20-4.98)	**4.44** (3.49-5.75)	**5.09** (3.85-6.88)	**5.61** (4.09-7.83)
3-day	**1.14** (1.01-1.31)	**1.60** (1.41-1.84)	**2.20** (1.94-2.54)	**2.70** (2.36-3.14)	**3.37** (2.86-4.06)	**3.90** (3.24-4.79)	**4.43** (3.59-5.58)	**4.99** (3.93-6.46)	**5.75** (4.34-7.76)	**6.34** (4.63-8.86)
4-day	**1.21** (1.08-1.40)	**1.70** (1.50-1.96)	**2.34** (2.07-2.71)	**2.87** (2.52-3.34)	**3.59** (3.04-4.32)	**4.14** (3.44-5.09)	**4.71** (3.82-5.93)	**5.30** (4.17-6.86)	**6.09** (4.60-8.22)	**6.71** (4.90-9.37)
7-day	**1.30** (1.15-1.49)	**1.80** (1.60-2.08)	**2.47** (2.18-2.85)	**3.01** (2.64-3.51)	**3.75** (3.17-4.51)	**4.31** (3.57-5.29)	**4.87** (3.94-6.13)	**5.45** (4.29-7.05)	**6.22** (4.70-8.40)	**6.81** (4.97-9.52)
10-day	**1.36** (1.21-1.57)	**1.89** (1.67-2.17)	**2.58** (2.28-2.98)	**3.14** (2.75-3.65)	**3.89** (3.30-4.68)	**4.46** (3.71-5.49)	**5.04** (4.08-6.35)	**5.62** (4.43-7.28)	**6.40** (4.84-8.65)	**7.00** (5.11-9.77)
20-day	**1.54** (1.37-1.78)	**2.16** (1.92-2.49)	**2.99** (2.64-3.45)	**3.67** (3.21-4.27)	**4.59** (3.89-5.53)	**5.30** (4.40-6.52)	**6.02** (4.88-7.58)	**6.75** (5.32-8.74)	**7.73** (5.84-10.4)	**8.47** (6.18-11.8)
30-day	**1.73** (1.53-1.99)	**2.45** (2.17-2.82)	**3.44** (3.04-3.97)	**4.26** (3.73-4.96)	**5.41** (4.59-6.51)	**6.31** (5.24-7.75)	**7.23** (5.85-9.10)	**8.18** (6.44-10.6)	**9.46** (7.15-12.8)	**10.5** (7.63-14.6)
45-day	**1.99** (1.77-2.29)	**2.86** (2.54-3.30)	**4.08** (3.61-4.72)	**5.13** (4.49-5.97)	**6.64** (5.62-7.99)	**7.85** (6.52-9.65)	**9.12** (7.39-11.5)	**10.5** (8.24-13.5)	**12.3** (9.32-16.6)	**13.8** (10.1-19.3)
60-day	**2.15** (1.91-2.47)	**3.11** (2.76-3.59)	**4.50** (3.98-5.20)	**5.73** (5.02-6.67)	**7.53** (6.38-9.06)	**9.01** (7.48-11.1)	**10.6** (8.59-13.4)	**12.3** (9.71-16.0)	**14.8** (11.2-19.9)	**16.8** (12.2-23.4)

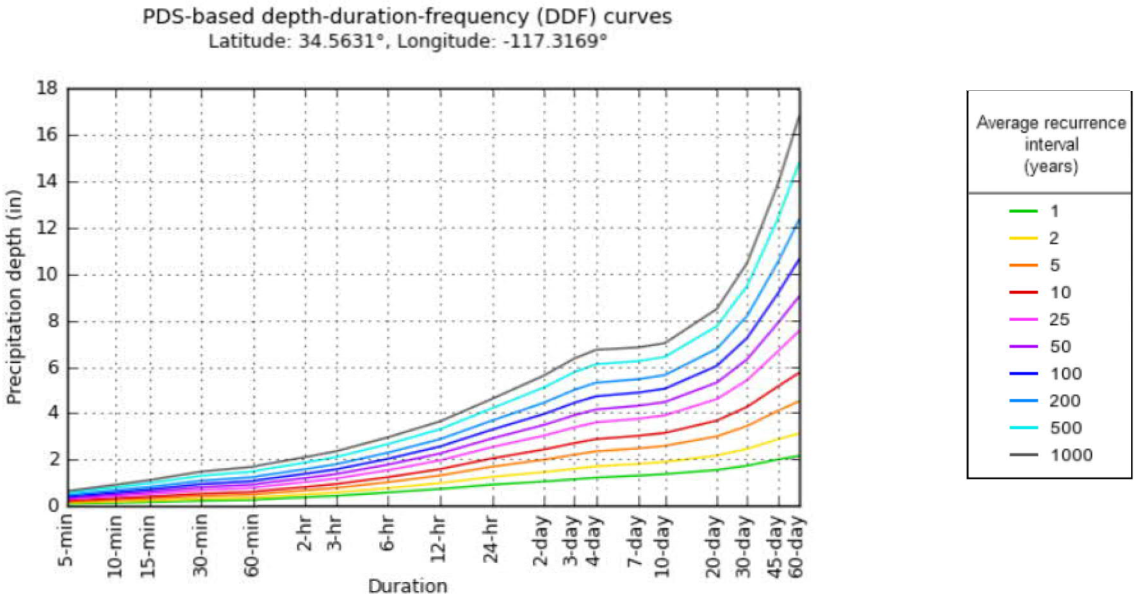
[1] Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

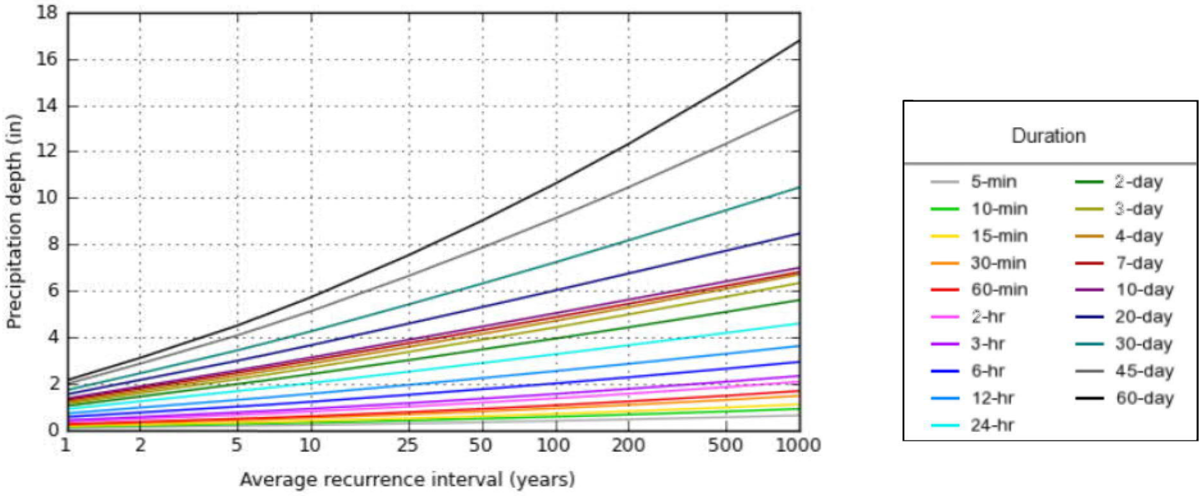
Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper 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.

Back to Top

PF graphical





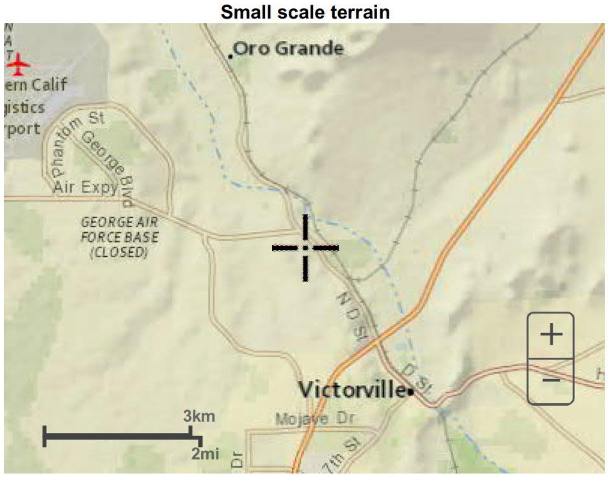
NOAA Atlas 14, Volume 6, Version 2

Created (GMT): Sat May 11 23:16:55 2019

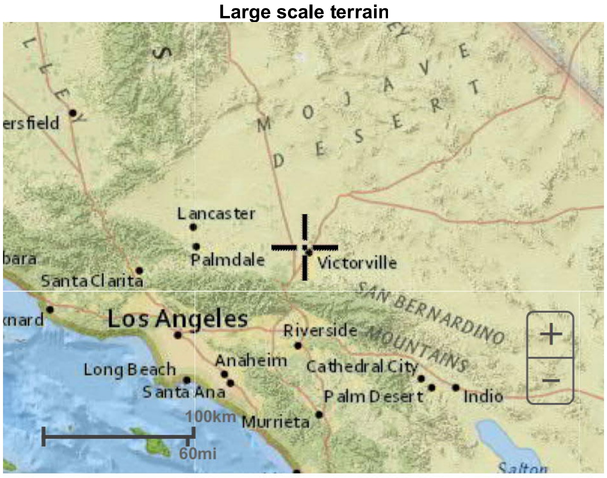
Back to Top

Maps & aerials

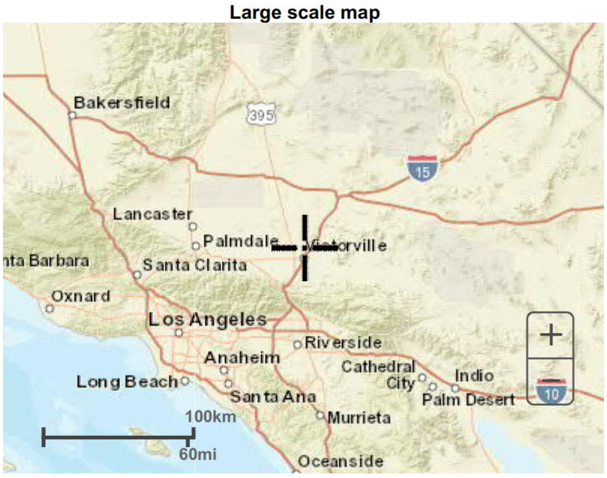
Small scale terrain



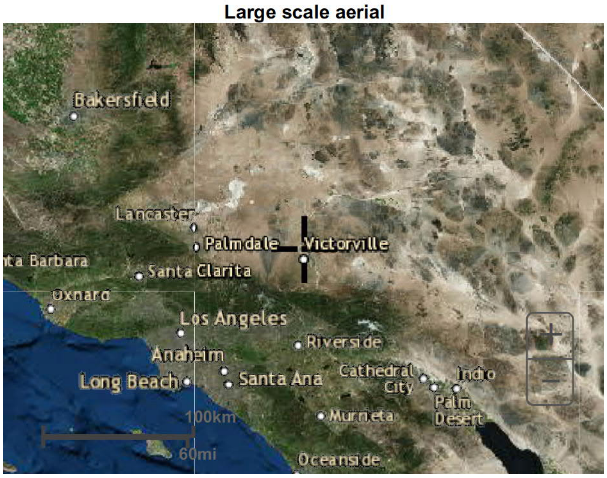
Large scale terrain



Large scale map



Large scale aerial



[Back to Top]

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

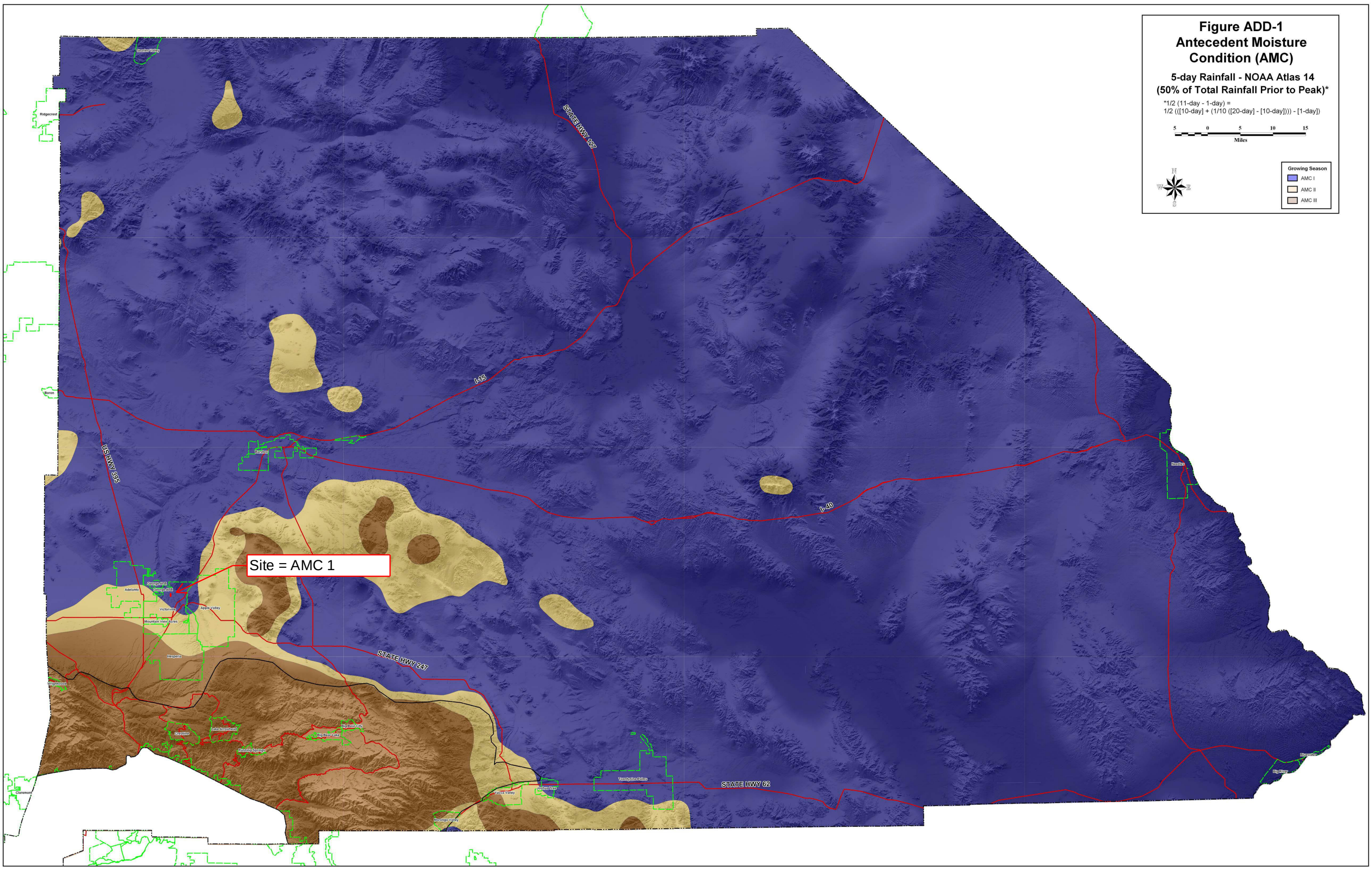
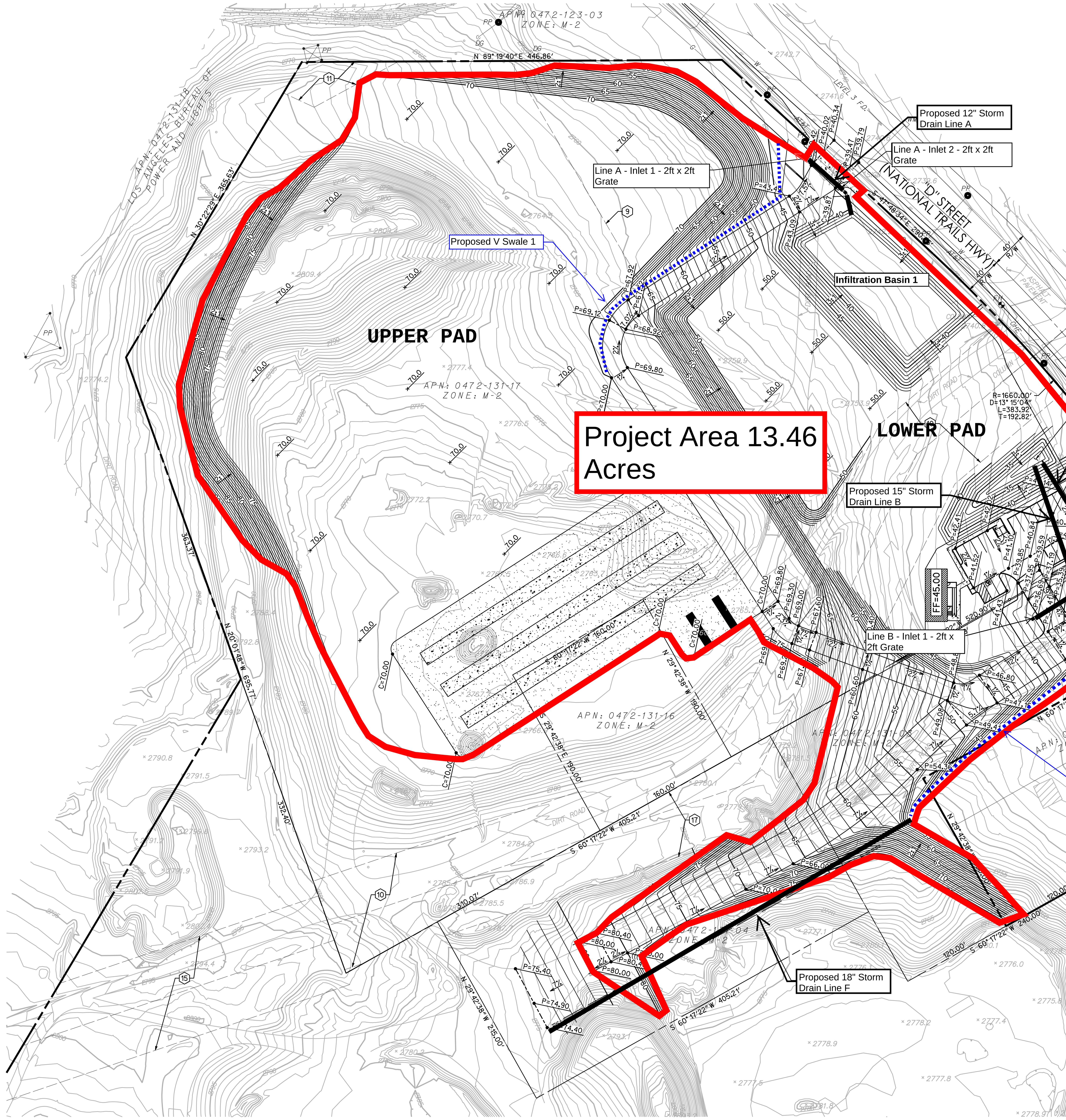
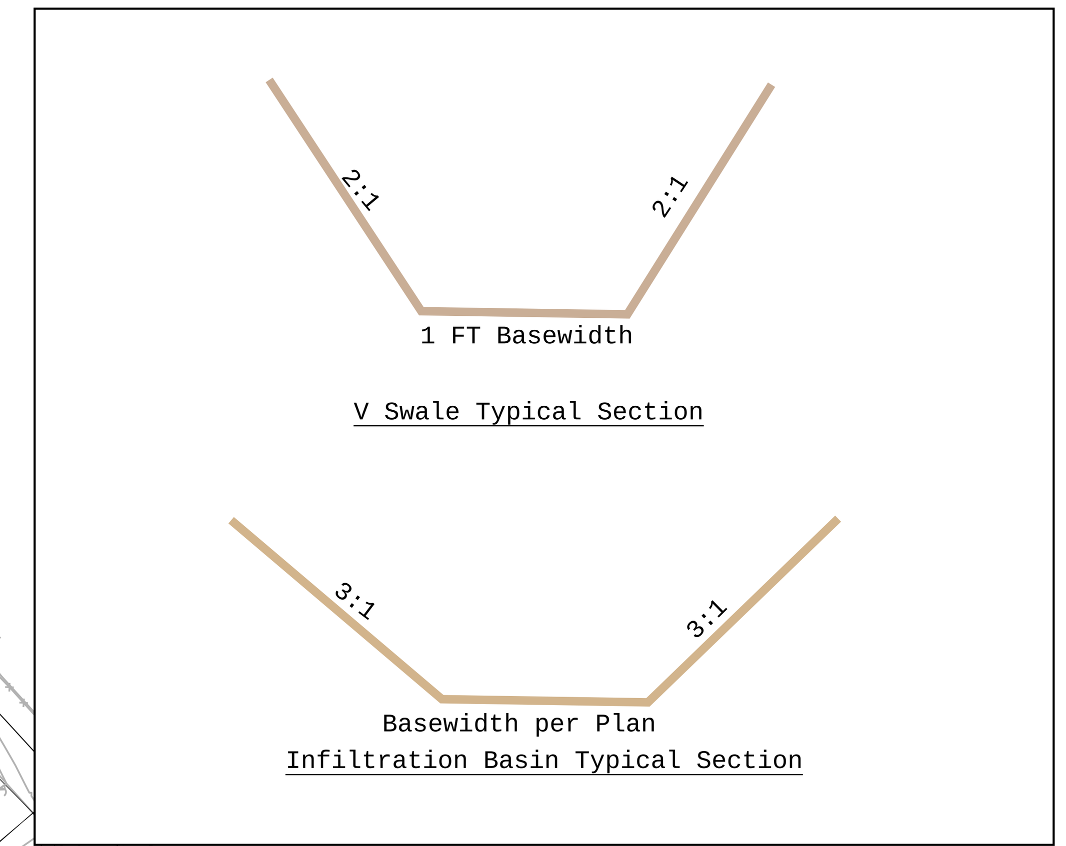


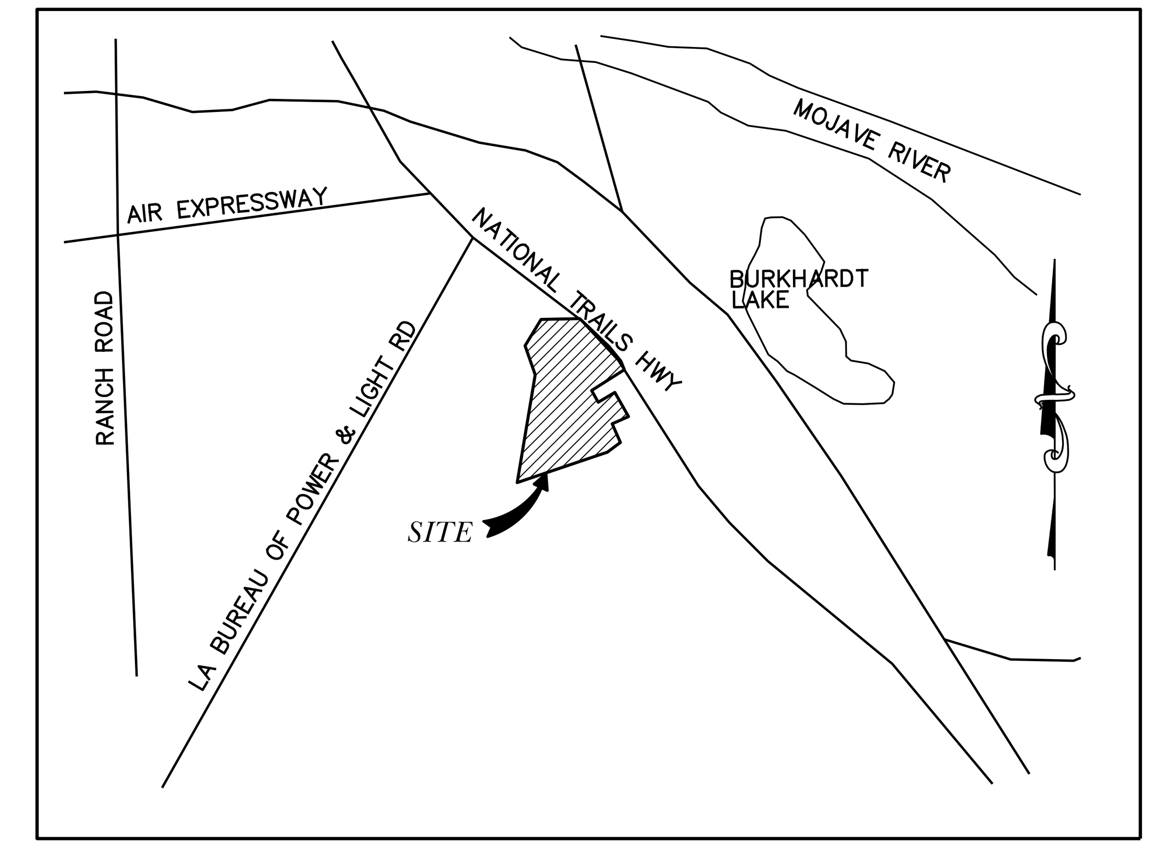
Figure ADD-1
Antecedent Moisture Condition (AMC)
5-day Rainfall - NOAA Atlas 14
(50% of Total Rainfall Prior to Peak)*
*1/2 (11-day - 1-day) =
1/2 (([10-day] + (1/10 ([20-day] - [10-day]))) - [1-day])
5 0 5 10 15
Miles
N
W
E
S
Growing Season
AMC I
AMC II
AMC III
Site = AMC 1
STATE HWY 127
I-15
US HWY 395
I-40
STATE HWY 247
STATE HWY 62

SBCHM Soils Exhibit

WQMP EXHIBITS







VICINITY MAP

Infiltration Basin 1

Depth (ft)	Area (ft2)	Storage (ft3)	Total Storage (ft3)	Total Storage (ac/ft)
0	10184	0	0	0.00
1	11556	10870	10870	0.25
2	12990	12273	23143	0.53

Infiltration Basin 2

Depth (ft)	Area (ft2)	Storage (ft3)	Total Storage (ft3)	Total Storage (ac/ft)
0	242	0	0	0.00
1	695	468.5	468.5	0.01
2	1307	1001	1469.5	0.03
3	1992	1649.5	3119	0.07

Infiltration Basin 3

Depth (ft)	Area (ft2)	Storage (ft3)	Total Storage (ft3)	Total Storage (ac/ft)
0	2885	0	0	0.00
1	3690	3287.5	3287.5	0.08
2	4568	4129	7416.5	0.17

LEGEND

- PROPERTY / BOUNDARY LINE
- EXISTING CONTOUR ELEVATION
- PROPOSED CONTOUR ELEVATION
- PROPOSED PAVEMENT ELEVATION
- PROPOSED DIRECTION OF FLOW & SLOPE
- PROPOSED GROUND ELEVATION
- PROPOSED FINISH FLOOR ELEVATION
- PROPOSED CATCH BASIN
- PROPOSED STORM DRAIN PIPE
- EXISTING WATER LINE & SIZE
- EXISTING SEWER LINE & SIZE
- EXISTING FIRE HYDRANT
- EXISTING WATER METER
- EXISTING OVERHEAD LINE
- EXISTING POWER POLE
- EXISTING GAS LINE & SIZE
- PROJECT BOUNDARY
- PROPOSED V SWALE

SCALE: 1"= 60'

0' 30' 60' 120'

DIG ALERT

CALL BEFORE YOU DIG!

1-800-227-2600

UNDERGROUND SERVICE ALERT

Call at least 2 working days prior to excavating.

BENCHMARK:

NO. V-12R
NW CORNER OF BEAR VALLEY ROAD AND AMARGOSA ROAD @ BCR

ELEVATION: 3178.86'

3 ENGINEERING, LLC PROJECT NO.
1754

3engineering

planning civil engineering surveying

6370 E. THOMAS ROAD, SUITE # 200, SCOTTSDALE, ARIZONA 85251 - PHONE: (602) 334-4387 - FAX: (602) 490-3230 - WWW.3ENGINEERING.COM

PREPARED UNDER THE DIRECTION OF:

DATE: 8/15/19

DANIEL G. MANN R.C.E. 69695
REGISTRATION EXPIRES 6/30/19

REGISTERED PROFESSIONAL ENGINEER
DANIEL G. MANN
No. 69695
Exp.6-30-16
CIVIL
STATE OF CALIFORNIA

REVISIONS

No.	Description	Date	Approved

CITY CASE NO.

CITY OF VICTORVILLE
ENGINEERING DEPARTMENT

14343 Civic Drive, Victorville, CA 92392 (760) 955-5000

Approved By:

Brian W. Gengler, RCE C44730
City Engineer

DATE

PRELIMINARY GRADING PLAN
THE REINFORCED EARTH COMPANY
CONCRETE PANEL YARD

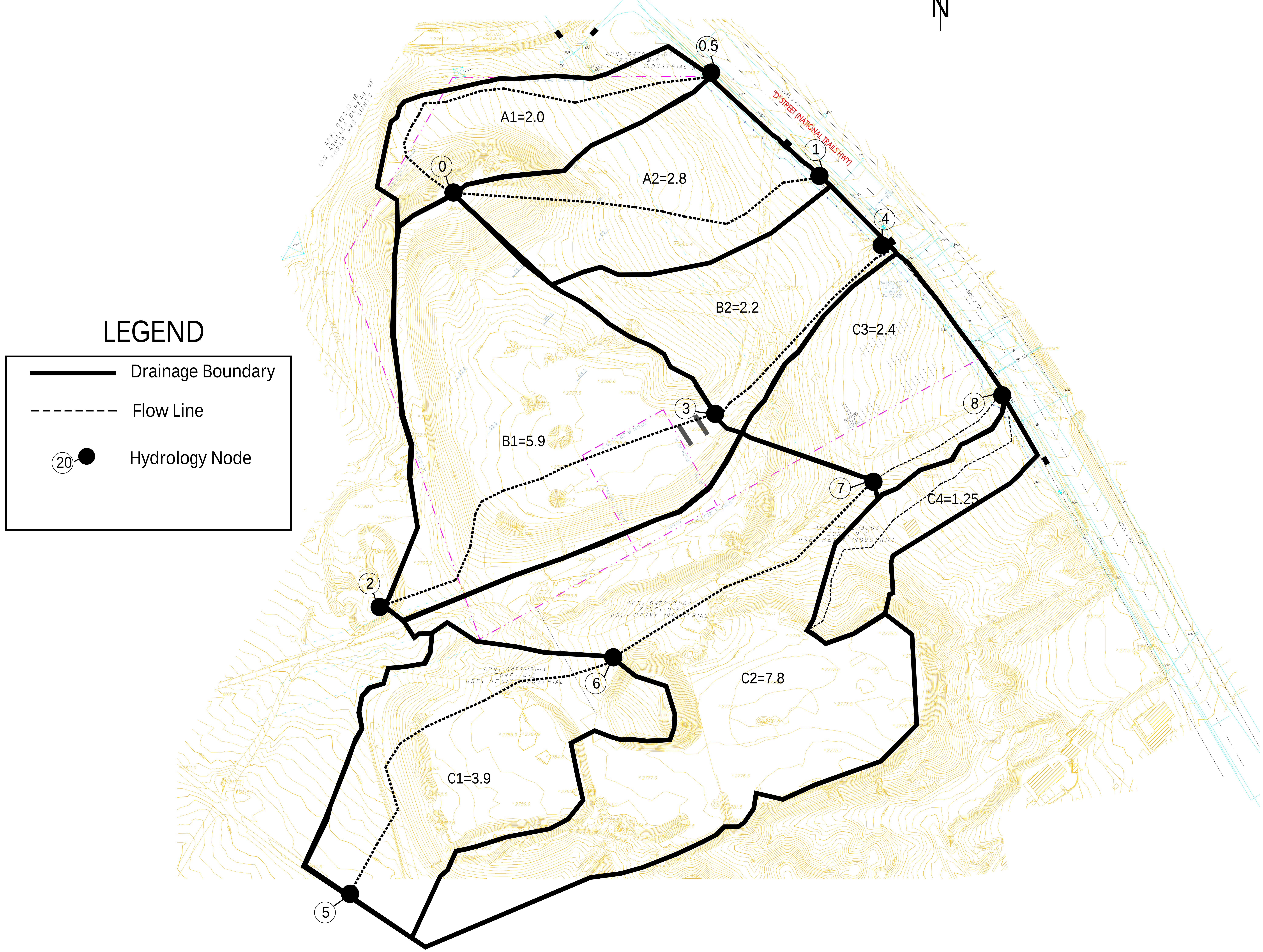
D STREET (NATIONAL TRAILS HWY)
APN'S 072-131-03, 04, 08, 10, 13, 16, 17, & 0472-141-16

PGRD01

SHEET NO.
1 of 1

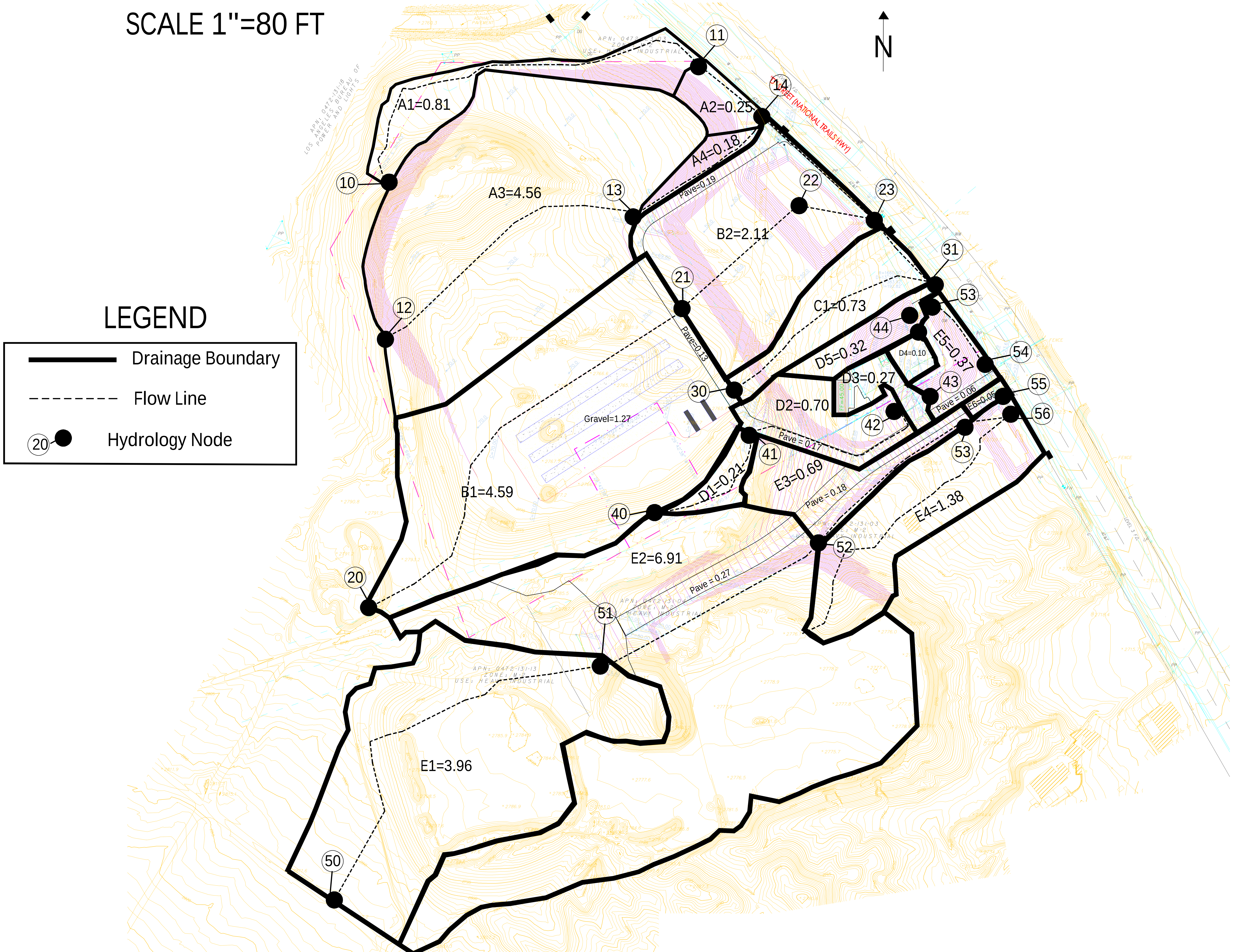
EXISTING CONDITION HYDROLOGY

SCALE 1"=80 FT



PROPOSED CONDITION HYDROLOGY

SCALE 1"=80 FT



HYDROMODIFICATION ANALYSIS

Drainage report demonstrates mitigation for 100 year storm event requires larger volume than DCV of hydromodification.

Hydromodification Summary Table			
	Volume (ft3)	**TC (mins)**	**Peak Flow (cfs)**
Predeveloped	72200	12.31	31.86
Post Developed	48139	12.26	26.16
Difference	-24061	0.05	-5.7
Difference %	-0.333254848	0.004	-0.178907721
Proposed Volume	**Hydrograph (ft3**	**Inf Basin Storage Volume (ft3)**	**Net (ft3)**
A	14915		14915
B	20185.7	23143	0
C	1877		1877
D	5784	3119	2665
E	36098	7416	28682
			48139
Proposed Peak	**Peak (cfs)**		
A	7.15		
B	3.44		
C	1.23		
D	1.52		
E	12.82		
total	26.16		

```
____________________________________________________________________________
****************************************************************************
             RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE
          (Reference: 1986 SAN BERNARDINO CO. HYDROLOGY CRITERION)
         (c) Copyright 1983-2011 Advanced Engineering Software (aes)
             Ver. 18.0  Release Date: 07/01/2011  License ID 1501

                          Analysis prepared by:




 ************************** DESCRIPTION OF STUDY **************************
* APN 0472-131-03, 04, 08, 10, 13, 16, 17 & 0472-141-16                    *
* Existing Condition                                                       *
* 10 Year Storm Event                                                      *
 **************************************************************************

  FILE NAME: 0472E.DAT
  TIME/DATE OF STUDY: 22:02 08/26/2019
============================================================================
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
============================================================================
                    --*TIME-OF-CONCENTRATION MODEL*--

  USER SPECIFIED STORM EVENT(YEAR) =   10.00
  SPECIFIED MINIMUM PIPE SIZE(INCH) =  12.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.90
  *USER-DEFINED LOGARITHMIC INTERPOLATION USED FOR RAINFALL*

  SLOPE OF INTENSITY DURATION CURVE(LOG(I;IN/HR) vs. LOG(Tc;MIN)) = 0.7000
  USER SPECIFIED 1-HOUR INTENSITY(INCH/HOUR) = 0.6140

  *ANTECEDENT MOISTURE CONDITION (AMC) I ASSUMED FOR RATIONAL METHOD*

  *USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW MODEL*
     HALF-  CROWN TO   STREET-CROSSFALL:   CURB  GUTTER-GEOMETRIES:  MANNING
     WIDTH  CROSSFALL  IN-  / OUT-/PARK-  HEIGHT  WIDTH  LIP   HIKE  FACTOR
NO.   (FT)     (FT)    SIDE / SIDE/ WAY    (FT)    (FT)  (FT)  (FT)    (n)
===  =====  =========  =================  ======  ===== ====== ===== =======
  1   30.0     20.0    0.018/0.018/0.020   0.67    2.00 0.0313 0.167 0.0150

  GLOBAL STREET FLOW-DEPTH CONSTRAINTS:
    1. Relative Flow-Depth =  0.00 FEET
       as (Maximum Allowable Street Flow Depth) - (Top-of-Curb)
    2. (Depth)*(Velocity) Constraint =  6.0 (FT*FT/S)
  *SIZE PIPE WITH A FLOW CAPACITY GREATER THAN
   OR EQUAL TO THE UPSTREAM TRIBUTARY PIPE.*
  *USER-SPECIFIED MINIMUM TOPOGRAPHIC SLOPE ADJUSTMENT NOT SELECTED

****************************************************************************
```

```
  FLOW PROCESS FROM NODE      0.00 TO NODE      0.50 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   700.00
  ELEVATION DATA: UPSTREAM(FEET) =   2809.40  DOWNSTREAM(FEET) =   2743.00

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =   11.555
  *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  1.945
  SUBAREA Tc AND LOSS RATE DATA(AMC  I ):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS   Tc
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  NATURAL DESERT COVER
  "DESERT BRUSH"   (15.0%)   C        2.00      0.43     1.000    76   11.56
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.43
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.000
  SUBAREA RUNOFF(CFS) =      2.73
  TOTAL AREA(ACRES) =      2.00   PEAK FLOW RATE(CFS) =      2.73

****************************************************************************
  FLOW PROCESS FROM NODE      0.50 TO NODE      1.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   2745.00  DOWNSTREAM(FEET) =   2743.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =   254.00   CHANNEL SLOPE =  0.0079
  CHANNEL BASE(FEET) =    0.00   "Z" FACTOR =   2.000
  MANNING'S FACTOR = 0.025   MAXIMUM DEPTH(FEET) =   5.00
  CHANNEL FLOW THRU SUBAREA(CFS) =       2.73
  FLOW VELOCITY(FEET/SEC.) =   2.52   FLOW DEPTH(FEET) =   0.74
  TRAVEL TIME(MIN.) =   1.68   Tc(MIN.) =   13.24
  LONGEST FLOWPATH FROM NODE      0.00 TO NODE      1.00 =     954.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE      1.00 TO NODE      1.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =   13.24
  RAINFALL INTENSITY(INCH/HR) =   1.77
  AREA-AVERAGED Fm(INCH/HR) =  0.43
  AREA-AVERAGED Fp(INCH/HR) =  0.43
  AREA-AVERAGED Ap =  1.00
  EFFECTIVE STREAM AREA(ACRES) =       2.00
  TOTAL STREAM AREA(ACRES) =       2.00
  PEAK FLOW RATE(CFS) AT CONFLUENCE =       2.73

****************************************************************************
```

```
  FLOW PROCESS FROM NODE      0.00 TO NODE      1.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   651.00
  ELEVATION DATA: UPSTREAM(FEET) =   2809.40  DOWNSTREAM(FEET) =   2743.00

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =   11.063
  *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  2.005
  SUBAREA Tc AND LOSS RATE DATA(AMC  I ):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS   Tc
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  NATURAL DESERT COVER
  "DESERT BRUSH"   (15.0%)   C        2.80      0.43     1.000    76   11.06
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.43
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.000
  SUBAREA RUNOFF(CFS) =      3.98
  TOTAL AREA(ACRES) =      2.80   PEAK FLOW RATE(CFS) =      3.98

****************************************************************************
  FLOW PROCESS FROM NODE      1.00 TO NODE      1.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =   11.06
  RAINFALL INTENSITY(INCH/HR) =   2.01
  AREA-AVERAGED Fm(INCH/HR) =  0.43
  AREA-AVERAGED Fp(INCH/HR) =  0.43
  AREA-AVERAGED Ap =  1.00
  EFFECTIVE STREAM AREA(ACRES) =       2.80
  TOTAL STREAM AREA(ACRES) =       2.80
  PEAK FLOW RATE(CFS) AT CONFLUENCE =       3.98

  ** CONFLUENCE DATA **
   STREAM       Q      Tc   Intensity   Fp(Fm)     Ap     Ae     HEADWATER
   NUMBER     (CFS)  (MIN.) (INCH/HR) (INCH/HR)         (ACRES)    NODE
      1        2.73   13.24    1.768  0.43( 0.43) 1.00       2.0       0.00
      2        3.98   11.06    2.005  0.43( 0.43) 1.00       2.8       0.00

  RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
  CONFLUENCE FORMULA USED FOR  2 STREAMS.

  ** PEAK FLOW RATE TABLE **
   STREAM       Q      Tc   Intensity   Fp(Fm)     Ap     Ae     HEADWATER
   NUMBER     (CFS)  (MIN.) (INCH/HR) (INCH/HR)         (ACRES)    NODE
      1        6.67   11.06    2.005  0.43( 0.43) 1.00       4.5       0.00
      2        6.12   13.24    1.768  0.43( 0.43) 1.00       4.8       0.00
```

```
  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =       6.67    Tc(MIN.) =    11.06
  EFFECTIVE AREA(ACRES) =       4.47   AREA-AVERAGED Fm(INCH/HR) =  0.43
  AREA-AVERAGED Fp(INCH/HR) =  0.43  AREA-AVERAGED Ap =  1.00
  TOTAL AREA(ACRES) =        4.8
  LONGEST FLOWPATH FROM NODE      0.00 TO NODE      1.00 =     954.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE      1.00 TO NODE      4.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   2743.00  DOWNSTREAM(FEET) =   2740.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =   160.00   CHANNEL SLOPE =  0.0188
  CHANNEL BASE(FEET) =    0.00   "Z" FACTOR =   2.000
  MANNING'S FACTOR = 0.025   MAXIMUM DEPTH(FEET) =   5.00
  CHANNEL FLOW THRU SUBAREA(CFS) =       6.67
  FLOW VELOCITY(FEET/SEC.) =   4.36   FLOW DEPTH(FEET) =   0.87
  TRAVEL TIME(MIN.) =   0.61   Tc(MIN.) =   11.67
  LONGEST FLOWPATH FROM NODE      0.00 TO NODE      4.00 =    1114.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE      4.00 TO NODE      4.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =   11.67
  RAINFALL INTENSITY(INCH/HR) =   1.93
  AREA-AVERAGED Fm(INCH/HR) =  0.43
  AREA-AVERAGED Fp(INCH/HR) =  0.43
  AREA-AVERAGED Ap =  1.00
  EFFECTIVE STREAM AREA(ACRES) =       4.47
  TOTAL STREAM AREA(ACRES) =       4.80
  PEAK FLOW RATE(CFS) AT CONFLUENCE =       6.67

****************************************************************************
  FLOW PROCESS FROM NODE      2.00 TO NODE      3.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   700.00
  ELEVATION DATA: UPSTREAM(FEET) =   2802.00  DOWNSTREAM(FEET) =   2765.70

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =   13.039
  *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  1.787
  SUBAREA Tc AND LOSS RATE DATA(AMC  I ):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS   Tc
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
```

```
  NATURAL DESERT COVER
  "DESERT BRUSH"   (15.0%)   C        5.90      0.43     1.000    76   13.04
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.43
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.000
  SUBAREA RUNOFF(CFS) =      7.23
  TOTAL AREA(ACRES) =      5.90   PEAK FLOW RATE(CFS) =      7.23

****************************************************************************
  FLOW PROCESS FROM NODE      3.00 TO NODE      4.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   2765.70  DOWNSTREAM(FEET) =   2740.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =   400.00   CHANNEL SLOPE =  0.0642
  CHANNEL BASE(FEET) =   25.00   "Z" FACTOR =   2.000
  MANNING'S FACTOR = 0.025   MAXIMUM DEPTH(FEET) =   2.00
  *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  1.614
  SUBAREA LOSS RATE DATA(AMC  I ):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  NATURAL DESERT COVER
  "DESERT BRUSH"   (15.0%)   C        2.20      0.43     1.000    76
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.43
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.000
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      8.41
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   3.27
  AVERAGE FLOW DEPTH(FEET) =   0.10   TRAVEL TIME(MIN.) =   2.04
  Tc(MIN.) =   15.08
  SUBAREA AREA(ACRES) =     2.20       SUBAREA RUNOFF(CFS) =    2.35
  EFFECTIVE AREA(ACRES) =      8.10     AREA-AVERAGED Fm(INCH/HR) =   0.43
  AREA-AVERAGED Fp(INCH/HR) =   0.43  AREA-AVERAGED Ap =   1.00
  TOTAL AREA(ACRES) =        8.1         PEAK FLOW RATE(CFS) =       8.66

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.10   FLOW VELOCITY(FEET/SEC.) =   3.31
  LONGEST FLOWPATH FROM NODE      2.00 TO NODE      4.00 =    1100.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE      4.00 TO NODE      4.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =   15.08
  RAINFALL INTENSITY(INCH/HR) =   1.61
  AREA-AVERAGED Fm(INCH/HR) =  0.43
  AREA-AVERAGED Fp(INCH/HR) =  0.43
  AREA-AVERAGED Ap =  1.00
  EFFECTIVE STREAM AREA(ACRES) =       8.10
  TOTAL STREAM AREA(ACRES) =       8.10
```

```
PEAK FLOW RATE(CFS) AT CONFLUENCE =       8.66

** CONFLUENCE DATA **
```

STREAM NUMBER	Q (CFS)	Tc (MIN.)	Intensity (INCH/HR)	Fp(Fm) (INCH/HR)	Ap	Ae (ACRES)	HEADWATER NODE
1	6.67	11.67	1.931	0.43(0.43)	1.00	4.5	0.00
1	6.12	13.87	1.712	0.43(0.43)	1.00	4.8	0.00
2	8.66	15.08	1.614	0.43(0.43)	1.00	8.1	2.00

```
RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
CONFLUENCE FORMULA USED FOR  2 STREAMS.

** PEAK FLOW RATE TABLE **
```

STREAM NUMBER	Q (CFS)	Tc (MIN.)	Intensity (INCH/HR)	Fp(Fm) (INCH/HR)	Ap	Ae (ACRES)	HEADWATER NODE
1	15.16	11.67	1.931	0.43(0.43)	1.00	10.7	0.00
2	14.74	13.87	1.712	0.43(0.43)	1.00	12.2	0.00
3	14.32	15.08	1.614	0.43(0.43)	1.00	12.9	2.00

```
  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =      15.16    Tc(MIN.) =    11.67
  EFFECTIVE AREA(ACRES) =      10.74   AREA-AVERAGED Fm(INCH/HR) =  0.43
  AREA-AVERAGED Fp(INCH/HR) =  0.43  AREA-AVERAGED Ap =  1.00
  TOTAL AREA(ACRES) =      12.9
  LONGEST FLOWPATH FROM NODE      0.00 TO NODE      4.00 =    1114.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE      4.00 TO NODE      8.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   2740.00  DOWNSTREAM(FEET) =   2723.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =   305.00   CHANNEL SLOPE =  0.0557
  CHANNEL BASE(FEET) =    0.00   "Z" FACTOR =   2.000
  MANNING'S FACTOR = 0.025   MAXIMUM DEPTH(FEET) =   5.00
  CHANNEL FLOW THRU SUBAREA(CFS) =      15.16
  FLOW VELOCITY(FEET/SEC.) =   8.03   FLOW DEPTH(FEET) =   0.97
  TRAVEL TIME(MIN.) =   0.63   Tc(MIN.) =   12.31
  LONGEST FLOWPATH FROM NODE      0.00 TO NODE      8.00 =    1419.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE      8.00 TO NODE      8.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =   12.31
  RAINFALL INTENSITY(INCH/HR) =   1.86
  AREA-AVERAGED Fm(INCH/HR) =  0.43
  AREA-AVERAGED Fp(INCH/HR) =  0.43
  AREA-AVERAGED Ap =  1.00
```

```
  EFFECTIVE STREAM AREA(ACRES) =      10.74
  TOTAL STREAM AREA(ACRES) =      12.90
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      15.16

****************************************************************************
  FLOW PROCESS FROM NODE      5.00 TO NODE      6.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   700.00
  ELEVATION DATA: UPSTREAM(FEET) =   2812.00  DOWNSTREAM(FEET) =   2772.00

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =   12.788
  *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  1.812
  SUBAREA Tc AND LOSS RATE DATA(AMC  I ):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS   Tc
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  NATURAL DESERT COVER
  "DESERT BRUSH"   (15.0%)   C        3.90      0.43     1.000    76   12.79
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.43
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.000
  SUBAREA RUNOFF(CFS) =      4.86
  TOTAL AREA(ACRES) =      3.90   PEAK FLOW RATE(CFS) =      4.86

****************************************************************************
  FLOW PROCESS FROM NODE      6.00 TO NODE      7.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   2772.00  DOWNSTREAM(FEET) =   2741.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =   540.00   CHANNEL SLOPE =  0.0574
  CHANNEL BASE(FEET) =    1.00   "Z" FACTOR =   2.000
  MANNING'S FACTOR = 0.025   MAXIMUM DEPTH(FEET) =   3.00
  *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  1.696
  SUBAREA LOSS RATE DATA(AMC  I ):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  NATURAL DESERT COVER
  "DESERT BRUSH"   (15.0%)   C        7.80      0.43     1.000    76
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.43
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.000
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      9.33
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   7.10
  AVERAGE FLOW DEPTH(FEET) =   0.60   TRAVEL TIME(MIN.) =   1.27
  Tc(MIN.) =   14.05
  SUBAREA AREA(ACRES) =     7.80       SUBAREA RUNOFF(CFS) =    8.91
  EFFECTIVE AREA(ACRES) =     11.70     AREA-AVERAGED Fm(INCH/HR) =   0.43
  AREA-AVERAGED Fp(INCH/HR) =   0.43  AREA-AVERAGED Ap =   1.00
  TOTAL AREA(ACRES) =      11.7         PEAK FLOW RATE(CFS) =      13.37
```

```
  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.71   FLOW VELOCITY(FEET/SEC.) =   7.84
  LONGEST FLOWPATH FROM NODE      5.00 TO NODE      7.00 =    1240.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE      7.00 TO NODE      8.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   2741.00  DOWNSTREAM(FEET) =   2723.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =   280.00   CHANNEL SLOPE =  0.0643
  CHANNEL BASE(FEET) =    1.00   "Z" FACTOR =   2.000
  MANNING'S FACTOR = 0.025   MAXIMUM DEPTH(FEET) =   3.00
  *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  1.650
  SUBAREA LOSS RATE DATA(AMC  I ):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  NATURAL DESERT COVER
  "DESERT BRUSH"   (15.0%)   C        2.40      0.43     1.000    76
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.43
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.000
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      14.69
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   8.36
  AVERAGE FLOW DEPTH(FEET) =   0.72   TRAVEL TIME(MIN.) =   0.56
  Tc(MIN.) =   14.61
  SUBAREA AREA(ACRES) =     2.40       SUBAREA RUNOFF(CFS) =    2.64
  EFFECTIVE AREA(ACRES) =     14.10     AREA-AVERAGED Fm(INCH/HR) =   0.43
  AREA-AVERAGED Fp(INCH/HR) =   0.43  AREA-AVERAGED Ap =   1.00
  TOTAL AREA(ACRES) =       14.1         PEAK FLOW RATE(CFS) =      15.54

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.74   FLOW VELOCITY(FEET/SEC.) =   8.52
  LONGEST FLOWPATH FROM NODE      5.00 TO NODE      8.00 =    1520.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE      8.00 TO NODE      8.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN.) =   14.61
  *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  1.650
  SUBAREA LOSS RATE DATA(AMC  I ):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  NATURAL DESERT COVER
  "DESERT BRUSH"   (15.0%)   C        1.25      0.43     1.000    76
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.43
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.000
  SUBAREA AREA(ACRES) =    1.25      SUBAREA RUNOFF(CFS) =    1.38
  EFFECTIVE AREA(ACRES) =     15.35   AREA-AVERAGED Fm(INCH/HR) =  0.43
  AREA-AVERAGED Fp(INCH/HR) =  0.43  AREA-AVERAGED Ap =  1.00
  TOTAL AREA(ACRES) =       15.4       PEAK FLOW RATE(CFS) =      16.91
```

```
****************************************************************************
  FLOW PROCESS FROM NODE      8.00 TO NODE      8.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =   14.61
  RAINFALL INTENSITY(INCH/HR) =   1.65
  AREA-AVERAGED Fm(INCH/HR) =  0.43
  AREA-AVERAGED Fp(INCH/HR) =  0.43
  AREA-AVERAGED Ap =  1.00
  EFFECTIVE STREAM AREA(ACRES) =      15.35
  TOTAL STREAM AREA(ACRES) =      15.35
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      16.91

  ** CONFLUENCE DATA **
   STREAM       Q      Tc   Intensity   Fp(Fm)     Ap     Ae     HEADWATER
   NUMBER     (CFS)  (MIN.) (INCH/HR) (INCH/HR)         (ACRES)    NODE
      1       15.16   12.31    1.861  0.43( 0.43) 1.00      10.7       0.00
      1       14.74   14.50    1.659  0.43( 0.43) 1.00      12.2       0.00
      1       14.32   15.72    1.568  0.43( 0.43) 1.00      12.9       2.00
      2       16.91   14.61    1.650  0.43( 0.43) 1.00      15.4       5.00

  RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
  CONFLUENCE FORMULA USED FOR  2 STREAMS.

  ** PEAK FLOW RATE TABLE **
   STREAM       Q      Tc   Intensity   Fp(Fm)     Ap     Ae     HEADWATER
   NUMBER     (CFS)  (MIN.) (INCH/HR) (INCH/HR)         (ACRES)    NODE
      1       31.86   12.31    1.861  0.43( 0.43) 1.00      23.7       0.00
      2       31.64   14.50    1.659  0.43( 0.43) 1.00      27.5       0.00
      3       31.61   14.61    1.650  0.43( 0.43) 1.00      27.7       5.00
      4       30.09   15.72    1.568  0.43( 0.43) 1.00      28.2       2.00

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =      31.86    Tc(MIN.) =    12.31
  EFFECTIVE AREA(ACRES) =      23.67   AREA-AVERAGED Fm(INCH/HR) =  0.43
  AREA-AVERAGED Fp(INCH/HR) =  0.43  AREA-AVERAGED Ap =  1.00
  TOTAL AREA(ACRES) =       28.2
  LONGEST FLOWPATH FROM NODE      5.00 TO NODE      8.00 =    1520.00 FEET.
============================================================================
  END OF STUDY SUMMARY:
  TOTAL AREA(ACRES)     =       28.2  TC(MIN.) =     12.31
  EFFECTIVE AREA(ACRES) =     23.67  AREA-AVERAGED Fm(INCH/HR)=  0.43
  AREA-AVERAGED Fp(INCH/HR) =  0.43  AREA-AVERAGED Ap = 1.000
  PEAK FLOW RATE(CFS)   =      31.86

  ** PEAK FLOW RATE TABLE **
   STREAM       Q      Tc   Intensity   Fp(Fm)     Ap     Ae     HEADWATER
   NUMBER     (CFS)  (MIN.) (INCH/HR) (INCH/HR)         (ACRES)    NODE
```

1	31.86	12.31	1.861	0.43(0.43) 1.00	23.7	0.00
2	31.64	14.50	1.659	0.43(0.43) 1.00	27.5	0.00
3	31.61	14.61	1.650	0.43(0.43) 1.00	27.7	5.00
4	30.09	15.72	1.568	0.43(0.43) 1.00	28.2	2.00

==
==

END OF RATIONAL METHOD ANALYSIS

```
****************************************************************************
          RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE
        (Reference: 1986 SAN BERNARDINO CO. HYDROLOGY CRITERION)
       (c) Copyright 1983-2011 Advanced Engineering Software (aes)
          Ver. 18.0  Release Date: 07/01/2011  License ID 1501

                       Analysis prepared by:




 ************************* DESCRIPTION OF STUDY *************************
* APN 0472-131-03, 04, 08, 10, 13, 16, 17 & 0472-141-16                    *
* Developed Condition                                                      *
* 10 Year Storm Event                                                      *
 **************************************************************************

  FILE NAME: RE.DAT
  TIME/DATE OF STUDY: 21:59 08/26/2019
============================================================================
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
============================================================================
                   --*TIME-OF-CONCENTRATION MODEL*--

  USER SPECIFIED STORM EVENT(YEAR) =   10.00
  SPECIFIED MINIMUM PIPE SIZE(INCH) =   6.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.90
  *USER-DEFINED LOGARITHMIC INTERPOLATION USED FOR RAINFALL*

  SLOPE OF INTENSITY DURATION CURVE(LOG(I;IN/HR) vs. LOG(Tc;MIN)) = 0.7000
  USER SPECIFIED 1-HOUR INTENSITY(INCH/HOUR) = 0.6140

  *ANTECEDENT MOISTURE CONDITION (AMC) I ASSUMED FOR RATIONAL METHOD*

  *USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW MODEL*
     HALF-  CROWN TO   STREET-CROSSFALL:   CURB  GUTTER-GEOMETRIES:  MANNING
     WIDTH  CROSSFALL  IN-  / OUT-/PARK-  HEIGHT  WIDTH  LIP   HIKE  FACTOR
NO.   (FT)     (FT)    SIDE / SIDE/ WAY    (FT)    (FT)  (FT)  (FT)    (n)
===  =====  =========  =================  ======  ===== ====== ===== =======
  1   30.0     20.0    0.018/0.018/0.020   0.67    2.00 0.0312 0.167 0.0150

  GLOBAL STREET FLOW-DEPTH CONSTRAINTS:
    1. Relative Flow-Depth =  0.00 FEET
       as (Maximum Allowable Street Flow Depth) - (Top-of-Curb)
    2. (Depth)*(Velocity) Constraint =  6.0 (FT*FT/S)
  *SIZE PIPE WITH A FLOW CAPACITY GREATER THAN
   OR EQUAL TO THE UPSTREAM TRIBUTARY PIPE.*
  *USER-SPECIFIED MINIMUM TOPOGRAPHIC SLOPE ADJUSTMENT NOT SELECTED

****************************************************************************
```

```
  FLOW PROCESS FROM NODE     10.00 TO NODE     11.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   704.00
  ELEVATION DATA: UPSTREAM(FEET) =   2788.60  DOWNSTREAM(FEET) =   2746.00

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =   12.671
  *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  1.823
  SUBAREA Tc AND LOSS RATE DATA(AMC  I ):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS   Tc
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  NATURAL DESERT COVER
  "DESERT BRUSH"   (15.0%)   C        0.81      0.43     1.000    76   12.67
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.43
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.000
  SUBAREA RUNOFF(CFS) =      1.02
  TOTAL AREA(ACRES) =      0.81   PEAK FLOW RATE(CFS) =      1.02

****************************************************************************
  FLOW PROCESS FROM NODE     11.00 TO NODE     14.00 IS CODE =  52
----------------------------------------------------------------------------
  >>>>>COMPUTE NATURAL VALLEY CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   2746.00  DOWNSTREAM(FEET) =   2744.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =   140.00   CHANNEL SLOPE =  0.0143
  CHANNEL FLOW THRU SUBAREA(CFS) =       1.02
  FLOW VELOCITY(FEET/SEC) =   1.80 (PER LACFCD/RCFC&WCD HYDROLOGY MANUAL)
  TRAVEL TIME(MIN.) =   1.30   Tc(MIN.) =   13.97
  LONGEST FLOWPATH FROM NODE     10.00 TO NODE     14.00 =     844.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE     14.00 TO NODE     14.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN.) =   13.97
  *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  1.703
  SUBAREA LOSS RATE DATA(AMC  I ):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  NATURAL DESERT COVER
  "DESERT BRUSH"   (15.0%)   C        0.25      0.43     1.000    76
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.43
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.000
  SUBAREA AREA(ACRES) =    0.25      SUBAREA RUNOFF(CFS) =    0.29
  EFFECTIVE AREA(ACRES) =      1.06   AREA-AVERAGED Fm(INCH/HR) =  0.43
  AREA-AVERAGED Fp(INCH/HR) =  0.43  AREA-AVERAGED Ap =  1.00
  TOTAL AREA(ACRES) =        1.1       PEAK FLOW RATE(CFS) =       1.22
```

```
****************************************************************************
  FLOW PROCESS FROM NODE     14.00 TO NODE     14.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =   13.97
  RAINFALL INTENSITY(INCH/HR) =   1.70
  AREA-AVERAGED Fm(INCH/HR) =  0.43
  AREA-AVERAGED Fp(INCH/HR) =  0.43
  AREA-AVERAGED Ap =  1.00
  EFFECTIVE STREAM AREA(ACRES) =       1.06
  TOTAL STREAM AREA(ACRES) =       1.06
  PEAK FLOW RATE(CFS) AT CONFLUENCE =       1.22

****************************************************************************
  FLOW PROCESS FROM NODE     12.00 TO NODE     13.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   504.00
  ELEVATION DATA: UPSTREAM(FEET) =   2788.00  DOWNSTREAM(FEET) =   2769.12

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =   12.202
  *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  1.872
  SUBAREA Tc AND LOSS RATE DATA(AMC  I ):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS   Tc
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  NATURAL DESERT COVER
  "DESERT BRUSH"   (15.0%)   C        4.56      0.43     1.000    76   12.20
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.43
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.000
  SUBAREA RUNOFF(CFS) =      5.94
  TOTAL AREA(ACRES) =      4.56   PEAK FLOW RATE(CFS) =      5.94

****************************************************************************
  FLOW PROCESS FROM NODE     13.00 TO NODE     14.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   2769.12  DOWNSTREAM(FEET) =   2744.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =   275.00   CHANNEL SLOPE =  0.0913
  CHANNEL BASE(FEET) =    1.00   "Z" FACTOR =   2.000
  MANNING'S FACTOR = 0.025   MAXIMUM DEPTH(FEET) =   4.00
  *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  1.810
  SUBAREA LOSS RATE DATA(AMC  I ):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  NATURAL DESERT COVER
```

```
  "DESERT BRUSH"   (15.0%)   C        0.18      0.43     1.000    76
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.43
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.000
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       6.05
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   7.56
  AVERAGE FLOW DEPTH(FEET) =   0.43   TRAVEL TIME(MIN.) =   0.61
  Tc(MIN.) =   12.81
  SUBAREA AREA(ACRES) =     0.18       SUBAREA RUNOFF(CFS) =    0.22
  EFFECTIVE AREA(ACRES) =      4.74     AREA-AVERAGED Fm(INCH/HR) =   0.43
  AREA-AVERAGED Fp(INCH/HR) =   0.43  AREA-AVERAGED Ap =   1.00
  TOTAL AREA(ACRES) =        4.7         PEAK FLOW RATE(CFS) =       5.94
  NOTE: PEAK FLOW RATE DEFAULTED TO UPSTREAM VALUE

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.42   FLOW VELOCITY(FEET/SEC.) =   7.57
  LONGEST FLOWPATH FROM NODE     12.00 TO NODE     14.00 =     779.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE     14.00 TO NODE     14.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =   12.81
  RAINFALL INTENSITY(INCH/HR) =   1.81
  AREA-AVERAGED Fm(INCH/HR) =  0.43
  AREA-AVERAGED Fp(INCH/HR) =  0.43
  AREA-AVERAGED Ap =  1.00
  EFFECTIVE STREAM AREA(ACRES) =      4.74
  TOTAL STREAM AREA(ACRES) =      4.74
  PEAK FLOW RATE(CFS) AT CONFLUENCE =       5.94

  ** CONFLUENCE DATA **
   STREAM       Q      Tc   Intensity   Fp(Fm)     Ap     Ae     HEADWATER
   NUMBER     (CFS)  (MIN.) (INCH/HR) (INCH/HR)         (ACRES)    NODE
      1        1.22   13.97    1.703  0.43( 0.43) 1.00       1.1      10.00
      2        5.94   12.81    1.810  0.43( 0.43) 1.00       4.7      12.00

  RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
  CONFLUENCE FORMULA USED FOR  2 STREAMS.

  ** PEAK FLOW RATE TABLE **
   STREAM       Q      Tc   Intensity   Fp(Fm)     Ap     Ae     HEADWATER
   NUMBER     (CFS)  (MIN.) (INCH/HR) (INCH/HR)         (ACRES)    NODE
      1        7.15   12.81    1.810  0.43( 0.43) 1.00       5.7      12.00
      2        6.70   13.97    1.703  0.43( 0.43) 1.00       5.8      10.00

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =       7.15    Tc(MIN.) =    12.81
  EFFECTIVE AREA(ACRES) =       5.71   AREA-AVERAGED Fm(INCH/HR) =  0.43
  AREA-AVERAGED Fp(INCH/HR) =  0.43  AREA-AVERAGED Ap =  1.00
```

```
  TOTAL AREA(ACRES) =        5.8
  LONGEST FLOWPATH FROM NODE     10.00 TO NODE     14.00 =     844.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE     14.00 TO NODE     23.00 IS CODE =  52
----------------------------------------------------------------------------
  >>>>>COMPUTE NATURAL VALLEY CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   2744.00  DOWNSTREAM(FEET) =   2740.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =   259.00   CHANNEL SLOPE =  0.0154
  CHANNEL FLOW THRU SUBAREA(CFS) =       7.15
  FLOW VELOCITY(FEET/SEC) =   2.86 (PER LACFCD/RCFC&WCD HYDROLOGY MANUAL)
  TRAVEL TIME(MIN.) =   1.51   Tc(MIN.) =   14.32
  LONGEST FLOWPATH FROM NODE     10.00 TO NODE     23.00 =    1103.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE     23.00 TO NODE     23.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =   14.32
  RAINFALL INTENSITY(INCH/HR) =   1.67
  AREA-AVERAGED Fm(INCH/HR) =  0.43
  AREA-AVERAGED Fp(INCH/HR) =  0.43
  AREA-AVERAGED Ap =  1.00
  EFFECTIVE STREAM AREA(ACRES) =       5.71
  TOTAL STREAM AREA(ACRES) =       5.80
  PEAK FLOW RATE(CFS) AT CONFLUENCE =       7.15

****************************************************************************
  FLOW PROCESS FROM NODE     20.00 TO NODE     21.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   762.00
  ELEVATION DATA: UPSTREAM(FEET) =   2802.00  DOWNSTREAM(FEET) =   2769.80

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    8.137
  *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  2.486
  SUBAREA Tc AND LOSS RATE DATA(AMC  I ):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS   Tc
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  COMMERCIAL                 C       1.40      0.81     0.100    50    8.14
  NATURAL DESERT COVER
  "DESERT BRUSH"   (15.0%)   C       3.19      0.43     1.000    76   14.05
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.44
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.725
  SUBAREA RUNOFF(CFS) =      8.95
```

```
  TOTAL AREA(ACRES) =      4.59   PEAK FLOW RATE(CFS) =      8.95

****************************************************************************
  FLOW PROCESS FROM NODE     21.00 TO NODE     22.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   2769.80  DOWNSTREAM(FEET) =   2737.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =   260.00   CHANNEL SLOPE =  0.1262
  CHANNEL BASE(FEET) =    1.00   "Z" FACTOR =   2.000
  MANNING'S FACTOR = 0.025   MAXIMUM DEPTH(FEET) =   5.00
  *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  2.397
  SUBAREA LOSS RATE DATA(AMC  I ):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  NATURAL DESERT COVER
  "DESERT BRUSH"   (15.0%)   C        1.92      0.43     1.000    76
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.43
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.000
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      10.65
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   9.93
  AVERAGE FLOW DEPTH(FEET) =   0.52   TRAVEL TIME(MIN.) =   0.44
  Tc(MIN.) =    8.57
  SUBAREA AREA(ACRES) =     1.92       SUBAREA RUNOFF(CFS) =    3.41
  EFFECTIVE AREA(ACRES) =      6.51     AREA-AVERAGED Fm(INCH/HR) =   0.35
  AREA-AVERAGED Fp(INCH/HR) =   0.44  AREA-AVERAGED Ap =   0.81
  TOTAL AREA(ACRES) =        6.5         PEAK FLOW RATE(CFS) =      11.98

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.55   FLOW VELOCITY(FEET/SEC.) =  10.26
  LONGEST FLOWPATH FROM NODE     20.00 TO NODE     22.00 =    1022.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE     22.00 TO NODE     22.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN.) =    8.57
  *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  2.397
  SUBAREA LOSS RATE DATA(AMC  I ):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                 C        0.19      0.81     0.100    50
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.81
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
  SUBAREA AREA(ACRES) =    0.19      SUBAREA RUNOFF(CFS) =    0.40
  EFFECTIVE AREA(ACRES) =      6.70   AREA-AVERAGED Fm(INCH/HR) =  0.34
  AREA-AVERAGED Fp(INCH/HR) =  0.44  AREA-AVERAGED Ap =  0.79
  TOTAL AREA(ACRES) =        6.7       PEAK FLOW RATE(CFS) =      12.38

****************************************************************************
  FLOW PROCESS FROM NODE     22.00 TO NODE     23.00 IS CODE =  52
```

\>>>>>COMPUTE NATURAL VALLEY CHANNEL FLOW<<<<<
\>>>>>TRAVELTIME THRU SUBAREA<<<<<

==

ELEVATION DATA: UPSTREAM(FEET) = 2740.01 DOWNSTREAM(FEET) = 2740.00
CHANNEL LENGTH THRU SUBAREA(FEET) = 130.00 CHANNEL SLOPE = 0.0001
NOTE: CHANNEL SLOPE OF .001 WAS ASSUMED IN VELOCITY ESTIMATION
CHANNEL FLOW THRU SUBAREA(CFS) = 12.38
FLOW VELOCITY(FEET/SEC) = 0.83 (PER LACFCD/RCFC&WCD HYDROLOGY MANUAL)
TRAVEL TIME(MIN.) = 2.60 Tc(MIN.) = 11.17
LONGEST FLOWPATH FROM NODE 20.00 TO NODE 23.00 = 1152.00 FEET.

****

FLOW PROCESS FROM NODE 23.00 TO NODE 23.00 IS CODE = 1

\>>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
\>>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<

==

TOTAL NUMBER OF STREAMS = 2
CONFLUENCE VALUES USED FOR INDEPENDENT STREAM 2 ARE:
TIME OF CONCENTRATION(MIN.) = 11.17
RAINFALL INTENSITY(INCH/HR) = 1.99
AREA-AVERAGED Fm(INCH/HR) = 0.34
AREA-AVERAGED Fp(INCH/HR) = 0.44
AREA-AVERAGED Ap = 0.79
EFFECTIVE STREAM AREA(ACRES) = 6.70
TOTAL STREAM AREA(ACRES) = 6.70
PEAK FLOW RATE(CFS) AT CONFLUENCE = 12.38

** CONFLUENCE DATA **

STREAM NUMBER	Q (CFS)	Tc (MIN.)	Intensity (INCH/HR)	Fp(Fm) (INCH/HR)	Ap	Ae (ACRES)	HEADWATER NODE
1	7.15	14.32	1.674	0.43(0.43)	1.00	5.7	12.00
1	6.70	15.50	1.583	0.43(0.43)	1.00	5.8	10.00
2	12.38	11.17	1.992	0.44(0.34)	0.79	6.7	20.00

RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
CONFLUENCE FORMULA USED FOR 2 STREAMS.

** PEAK FLOW RATE TABLE **

STREAM NUMBER	Q (CFS)	Tc (MIN.)	Intensity (INCH/HR)	Fp(Fm) (INCH/HR)	Ap	Ae (ACRES)	HEADWATER NODE
1	19.37	11.17	1.992	0.43(0.38)	0.87	11.2	20.00
2	17.14	14.32	1.674	0.43(0.38)	0.88	12.4	12.00
3	16.01	15.50	1.583	0.43(0.38)	0.89	12.5	10.00

COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
PEAK FLOW RATE(CFS) = 19.37 Tc(MIN.) = 11.17
EFFECTIVE AREA(ACRES) = 11.16 AREA-AVERAGED Fm(INCH/HR) = 0.38
AREA-AVERAGED Fp(INCH/HR) = 0.43 AREA-AVERAGED Ap = 0.87
TOTAL AREA(ACRES) = 12.5
LONGEST FLOWPATH FROM NODE 20.00 TO NODE 23.00 = 1152.00 FEET.

```
****************************************************************************
  FLOW PROCESS FROM NODE     23.00 TO NODE     31.00 IS CODE =  52
----------------------------------------------------------------------------
  >>>>>COMPUTE NATURAL VALLEY CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   2740.00  DOWNSTREAM(FEET) =   2733.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =   142.00   CHANNEL SLOPE =  0.0493
  CHANNEL FLOW THRU SUBAREA(CFS) =      19.37
  FLOW VELOCITY(FEET/SEC) =   6.60 (PER LACFCD/RCFC&WCD HYDROLOGY MANUAL)
  TRAVEL TIME(MIN.) =   0.36   Tc(MIN.) =   11.53
  LONGEST FLOWPATH FROM NODE     20.00 TO NODE     31.00 =    1294.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE     31.00 TO NODE     31.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  3
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =   11.53
  RAINFALL INTENSITY(INCH/HR) =   1.95
  AREA-AVERAGED Fm(INCH/HR) =  0.38
  AREA-AVERAGED Fp(INCH/HR) =  0.43
  AREA-AVERAGED Ap =  0.87
  EFFECTIVE STREAM AREA(ACRES) =      11.16
  TOTAL STREAM AREA(ACRES) =      12.50
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      19.37

****************************************************************************
  FLOW PROCESS FROM NODE     30.00 TO NODE     31.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   400.00
  ELEVATION DATA: UPSTREAM(FEET) =   2769.80  DOWNSTREAM(FEET) =   2733.00

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    9.294
  *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  2.265
  SUBAREA Tc AND LOSS RATE DATA(AMC  I ):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS   Tc
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  NATURAL DESERT COVER
  "DESERT BRUSH"   ( 1.0%)   C        0.73      0.40     1.000    78    9.29
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.40
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.000
  SUBAREA RUNOFF(CFS) =      1.23
  TOTAL AREA(ACRES) =      0.73   PEAK FLOW RATE(CFS) =      1.23

****************************************************************************
  FLOW PROCESS FROM NODE     31.00 TO NODE     31.00 IS CODE =   1
```

```
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  3
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =    9.29
  RAINFALL INTENSITY(INCH/HR) =   2.27
  AREA-AVERAGED Fm(INCH/HR) =  0.40
  AREA-AVERAGED Fp(INCH/HR) =  0.40
  AREA-AVERAGED Ap =  1.00
  EFFECTIVE STREAM AREA(ACRES) =       0.73
  TOTAL STREAM AREA(ACRES) =       0.73
  PEAK FLOW RATE(CFS) AT CONFLUENCE =       1.23

****************************************************************************
  FLOW PROCESS FROM NODE     40.00 TO NODE     41.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   238.00
  ELEVATION DATA: UPSTREAM(FEET) =   2781.00  DOWNSTREAM(FEET) =   2773.00

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    9.236
  *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  2.275
  SUBAREA Tc AND LOSS RATE DATA(AMC  I ):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS   Tc
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  NATURAL DESERT COVER
  "DESERT BRUSH"   (15.0%)   C        0.21      0.43     1.000    76    9.24
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.43
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.000
  SUBAREA RUNOFF(CFS) =      0.35
  TOTAL AREA(ACRES) =      0.21   PEAK FLOW RATE(CFS) =      0.35

****************************************************************************
  FLOW PROCESS FROM NODE     41.00 TO NODE     42.00 IS CODE =  61
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STANDARD CURB SECTION USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) = 2773.00  DOWNSTREAM ELEVATION(FEET) = 2736.69
  STREET LENGTH(FEET) =   310.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 10.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =   1.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0150
```

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    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       0.91
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.16
    HALFSTREET FLOOD WIDTH(FEET) =    1.87
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    5.97
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.98
  STREET FLOW TRAVEL TIME(MIN.) =   0.86   Tc(MIN.) =   10.10
  *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  2.137
  SUBAREA LOSS RATE DATA(AMC  I ):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                 C        0.17      0.81     0.100    50
  NATURAL DESERT COVER
  "DESERT BRUSH"   (15.0%)   C        0.53      0.43     1.000    76
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.44
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.781
  SUBAREA AREA(ACRES) =    0.70      SUBAREA RUNOFF(CFS) =    1.13
  EFFECTIVE AREA(ACRES) =      0.91    AREA-AVERAGED Fm(INCH/HR) =  0.36
  AREA-AVERAGED Fp(INCH/HR) =  0.43  AREA-AVERAGED Ap =  0.83
  TOTAL AREA(ACRES) =        0.9        PEAK FLOW RATE(CFS) =       1.45

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.20   HALFSTREET FLOOD WIDTH(FEET) =   3.86
  FLOW VELOCITY(FEET/SEC.) =  5.45   DEPTH*VELOCITY(FT*FT/SEC.) =   1.11
  LONGEST FLOWPATH FROM NODE     40.00 TO NODE     42.00 =     548.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE     42.00 TO NODE     43.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =  2736.69  DOWNSTREAM(FEET) =  2732.69
  FLOW LENGTH(FEET) =    53.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN   6.0 INCH PIPE IS   4.9 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   8.51
  ESTIMATED PIPE DIAMETER(INCH) =   6.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       1.45
  PIPE TRAVEL TIME(MIN.) =   0.10    Tc(MIN.) =   10.20
  LONGEST FLOWPATH FROM NODE     40.00 TO NODE     43.00 =     601.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE     43.00 TO NODE     43.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN.) =   10.20
  *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  2.122
  SUBAREA LOSS RATE DATA(AMC  I ):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                 C        0.27      0.81     0.100    50
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.81
```

```
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
  SUBAREA AREA(ACRES) =    0.27      SUBAREA RUNOFF(CFS) =    0.50
  EFFECTIVE AREA(ACRES) =      1.18   AREA-AVERAGED Fm(INCH/HR) =  0.30
  AREA-AVERAGED Fp(INCH/HR) =  0.45  AREA-AVERAGED Ap =  0.66
  TOTAL AREA(ACRES) =        1.2       PEAK FLOW RATE(CFS) =       1.94

****************************************************************************
  FLOW PROCESS FROM NODE     43.00 TO NODE     44.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =  2732.69  DOWNSTREAM(FEET) =  2732.00
  FLOW LENGTH(FEET) =   140.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  12.0 INCH PIPE IS   8.2 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   3.37
  ESTIMATED PIPE DIAMETER(INCH) =  12.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       1.94
  PIPE TRAVEL TIME(MIN.) =   0.69    Tc(MIN.) =   10.90
  LONGEST FLOWPATH FROM NODE     40.00 TO NODE     44.00 =     741.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE     44.00 TO NODE     44.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN.) =   10.90
  *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  2.026
  SUBAREA LOSS RATE DATA(AMC  I ):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                 C       0.10      0.81     0.100    50
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.81
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
  SUBAREA AREA(ACRES) =    0.10      SUBAREA RUNOFF(CFS) =    0.18
  EFFECTIVE AREA(ACRES) =      1.28   AREA-AVERAGED Fm(INCH/HR) =  0.28
  AREA-AVERAGED Fp(INCH/HR) =  0.45  AREA-AVERAGED Ap =  0.62
  TOTAL AREA(ACRES) =        1.3       PEAK FLOW RATE(CFS) =       2.01

****************************************************************************
  FLOW PROCESS FROM NODE     44.00 TO NODE     44.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN.) =   10.90
  *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  2.026
  SUBAREA LOSS RATE DATA(AMC  I ):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  NATURAL DESERT COVER
  "DESERT BRUSH"   (15.0%)   C       0.32      0.43     1.000    76
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.43
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.000
```

SUBAREA AREA(ACRES) = 0.32 SUBAREA RUNOFF(CFS) = 0.46
EFFECTIVE AREA(ACRES) = 1.60 AREA-AVERAGED Fm(INCH/HR) = 0.31
AREA-AVERAGED Fp(INCH/HR) = 0.44 AREA-AVERAGED Ap = 0.70
TOTAL AREA(ACRES) = 1.6 PEAK FLOW RATE(CFS) = 2.47

****
FLOW PROCESS FROM NODE 44.00 TO NODE 31.00 IS CODE = 52

>>>>>COMPUTE NATURAL VALLEY CHANNEL FLOW<<<<<
>>>>>TRAVELTIME THRU SUBAREA<<<<<
==
ELEVATION DATA: UPSTREAM(FEET) = 2736.00 DOWNSTREAM(FEET) = 2733.00
CHANNEL LENGTH THRU SUBAREA(FEET) = 48.00 CHANNEL SLOPE = 0.0625
CHANNEL FLOW THRU SUBAREA(CFS) = 2.47
FLOW VELOCITY(FEET/SEC) = 4.50 (PER LACFCD/RCFC&WCD HYDROLOGY MANUAL)
TRAVEL TIME(MIN.) = 0.18 Tc(MIN.) = 11.08
LONGEST FLOWPATH FROM NODE 40.00 TO NODE 31.00 = 789.00 FEET.

****
FLOW PROCESS FROM NODE 31.00 TO NODE 31.00 IS CODE = 1

>>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
>>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
==
TOTAL NUMBER OF STREAMS = 3
CONFLUENCE VALUES USED FOR INDEPENDENT STREAM 3 ARE:
TIME OF CONCENTRATION(MIN.) = 11.08
RAINFALL INTENSITY(INCH/HR) = 2.00
AREA-AVERAGED Fm(INCH/HR) = 0.31
AREA-AVERAGED Fp(INCH/HR) = 0.44
AREA-AVERAGED Ap = 0.70
EFFECTIVE STREAM AREA(ACRES) = 1.60
TOTAL STREAM AREA(ACRES) = 1.60
PEAK FLOW RATE(CFS) AT CONFLUENCE = 2.47

** CONFLUENCE DATA **

STREAM NUMBER	Q (CFS)	Tc (MIN.)	Intensity (INCH/HR)	Fp(Fm) (INCH/HR)	Ap	Ae (ACRES)	HEADWATER NODE
1	19.37	11.53	1.948	0.43(0.38)	0.87	11.2	20.00
1	17.14	14.69	1.644	0.43(0.38)	0.88	12.4	12.00
1	16.01	15.88	1.557	0.43(0.38)	0.89	12.5	10.00
2	1.23	9.29	2.265	0.40(0.40)	1.00	0.7	30.00
3	2.47	11.08	2.004	0.44(0.31)	0.70	1.6	40.00

RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
CONFLUENCE FORMULA USED FOR 3 STREAMS.

** PEAK FLOW RATE TABLE **

STREAM NUMBER	Q (CFS)	Tc (MIN.)	Intensity (INCH/HR)	Fp(Fm) (INCH/HR)	Ap	Ae (ACRES)	HEADWATER NODE
1	22.39	9.29	2.265	0.43(0.37)	0.86	11.1	30.00
2	22.78	11.08	2.004	0.43(0.37)	0.86	13.0	40.00
3	22.78	11.53	1.948	0.43(0.37)	0.86	13.5	20.00

```
     4       19.90   14.69    1.644  0.43( 0.37) 0.87      14.7      12.00
     5       18.59   15.88    1.557  0.43( 0.38) 0.87      14.8      10.00

 COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
 PEAK FLOW RATE(CFS) =      22.78    Tc(MIN.) =    11.08
 EFFECTIVE AREA(ACRES) =      13.05   AREA-AVERAGED Fm(INCH/HR) =  0.37
 AREA-AVERAGED Fp(INCH/HR) =  0.43  AREA-AVERAGED Ap =  0.86
 TOTAL AREA(ACRES) =      14.8
 LONGEST FLOWPATH FROM NODE     20.00 TO NODE     31.00 =    1294.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE     31.00 TO NODE     56.00 IS CODE =  52
----------------------------------------------------------------------------
 >>>>>COMPUTE NATURAL VALLEY CHANNEL FLOW<<<<<
 >>>>>TRAVELTIME THRU SUBAREA<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =   2733.00  DOWNSTREAM(FEET) =   2722.00
 CHANNEL LENGTH THRU SUBAREA(FEET) =   273.00   CHANNEL SLOPE =  0.0403
 CHANNEL FLOW THRU SUBAREA(CFS) =      22.78
 FLOW VELOCITY(FEET/SEC) =   6.23 (PER LACFCD/RCFC&WCD HYDROLOGY MANUAL)
 TRAVEL TIME(MIN.) =   0.73   Tc(MIN.) =   11.81
 LONGEST FLOWPATH FROM NODE     20.00 TO NODE     56.00 =    1567.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE     56.00 TO NODE     56.00 IS CODE =   1
----------------------------------------------------------------------------
 >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
 TOTAL NUMBER OF STREAMS =  3
 CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
 TIME OF CONCENTRATION(MIN.) =   11.81
 RAINFALL INTENSITY(INCH/HR) =   1.92
 AREA-AVERAGED Fm(INCH/HR) =  0.37
 AREA-AVERAGED Fp(INCH/HR) =  0.43
 AREA-AVERAGED Ap =  0.86
 EFFECTIVE STREAM AREA(ACRES) =      13.05
 TOTAL STREAM AREA(ACRES) =      14.83
 PEAK FLOW RATE(CFS) AT CONFLUENCE =      22.78

****************************************************************************
 FLOW PROCESS FROM NODE     50.00 TO NODE     51.00 IS CODE =  21
----------------------------------------------------------------------------
 >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
 >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
 INITIAL SUBAREA FLOW-LENGTH(FEET) =   700.00
 ELEVATION DATA: UPSTREAM(FEET) =   2812.00  DOWNSTREAM(FEET) =   2774.40

 Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
 SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =   12.947
 *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  1.796
 SUBAREA Tc AND LOSS RATE DATA(AMC  I ):
  DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS   Tc
```

```
     LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
 NATURAL DESERT COVER
 "DESERT BRUSH"   (15.0%)   C        3.96      0.43     1.000    76   12.95
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.43
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.000
 SUBAREA RUNOFF(CFS) =      4.88
 TOTAL AREA(ACRES) =      3.96   PEAK FLOW RATE(CFS) =      4.88

****************************************************************************
 FLOW PROCESS FROM NODE     51.00 TO NODE     52.00 IS CODE =  31
----------------------------------------------------------------------------
 >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =  2774.40  DOWNSTREAM(FEET) =  2754.00
 FLOW LENGTH(FEET) =   439.00   MANNING'S N =  0.013
 DEPTH OF FLOW IN  12.0 INCH PIPE IS   7.2 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) =   9.94
 ESTIMATED PIPE DIAMETER(INCH) =  12.00    NUMBER OF PIPES =   1
 PIPE-FLOW(CFS) =       4.88
 PIPE TRAVEL TIME(MIN.) =   0.74    Tc(MIN.) =   13.68
 LONGEST FLOWPATH FROM NODE     50.00 TO NODE     52.00 =    1139.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE     52.00 TO NODE     52.00 IS CODE =  81
----------------------------------------------------------------------------
 >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
 MAINLINE Tc(MIN.) =   13.68
 *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  1.728
 SUBAREA LOSS RATE DATA(AMC  I ):
  DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
     LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
 COMMERCIAL                 C        0.27      0.81     0.100    50
 NATURAL DESERT COVER
 "DESERT BRUSH"   (15.0%)   C        6.64      0.43     1.000    76
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.43
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.965
 SUBAREA AREA(ACRES) =    6.91      SUBAREA RUNOFF(CFS) =    8.18
 EFFECTIVE AREA(ACRES) =     10.87   AREA-AVERAGED Fm(INCH/HR) =  0.42
 AREA-AVERAGED Fp(INCH/HR) =  0.43  AREA-AVERAGED Ap =  0.98
 TOTAL AREA(ACRES) =       10.9       PEAK FLOW RATE(CFS) =      12.82

****************************************************************************
 FLOW PROCESS FROM NODE     52.00 TO NODE     53.00 IS CODE =  51
----------------------------------------------------------------------------
 >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
 >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =   2754.00  DOWNSTREAM(FEET) =   2727.00
 CHANNEL LENGTH THRU SUBAREA(FEET) =   324.00   CHANNEL SLOPE =  0.0833
 CHANNEL BASE(FEET) =    1.00   "Z" FACTOR =   2.000
 MANNING'S FACTOR = 0.025   MAXIMUM DEPTH(FEET) =   5.00
```

```
  *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  1.677
  SUBAREA LOSS RATE DATA(AMC  I ):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                 C        0.18      0.81     0.100    50
  NATURAL DESERT COVER
  "DESERT BRUSH"   (15.0%)   C        0.51      0.43     1.000    76
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.44
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.765
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      13.24
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   8.99
  AVERAGE FLOW DEPTH(FEET) =   0.64   TRAVEL TIME(MIN.) =   0.60
  Tc(MIN.) =   14.28
  SUBAREA AREA(ACRES) =     0.69       SUBAREA RUNOFF(CFS) =    0.83
  EFFECTIVE AREA(ACRES) =     11.56     AREA-AVERAGED Fm(INCH/HR) =   0.41
  AREA-AVERAGED Fp(INCH/HR) =   0.43  AREA-AVERAGED Ap =   0.96
  TOTAL AREA(ACRES) =       11.6         PEAK FLOW RATE(CFS) =      13.15

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.64   FLOW VELOCITY(FEET/SEC.) =   8.93
  LONGEST FLOWPATH FROM NODE     50.00 TO NODE     53.00 =    1463.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE     53.00 TO NODE     56.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   2728.00  DOWNSTREAM(FEET) =   2721.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =    68.00   CHANNEL SLOPE =  0.1029
  CHANNEL BASE(FEET) =    1.00   "Z" FACTOR =   2.000
  MANNING'S FACTOR = 0.025   MAXIMUM DEPTH(FEET) =   5.00
  *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  1.667
  SUBAREA LOSS RATE DATA(AMC  I ):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  NATURAL DESERT COVER
  "DESERT BRUSH"   (15.0%)   C        1.38      0.43     1.000    76
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.43
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.000
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      13.92
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   9.82
  AVERAGE FLOW DEPTH(FEET) =   0.63   TRAVEL TIME(MIN.) =   0.12
  Tc(MIN.) =   14.40
  SUBAREA AREA(ACRES) =     1.38       SUBAREA RUNOFF(CFS) =    1.54
  EFFECTIVE AREA(ACRES) =     12.94     AREA-AVERAGED Fm(INCH/HR) =   0.41
  AREA-AVERAGED Fp(INCH/HR) =   0.43  AREA-AVERAGED Ap =   0.97
  TOTAL AREA(ACRES) =       12.9         PEAK FLOW RATE(CFS) =      14.60

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.64   FLOW VELOCITY(FEET/SEC.) =   9.91
  LONGEST FLOWPATH FROM NODE     50.00 TO NODE     56.00 =    1531.00 FEET.
```

```
****************************************************************************
  FLOW PROCESS FROM NODE     56.00 TO NODE     56.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  3
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =   14.40
  RAINFALL INTENSITY(INCH/HR) =   1.67
  AREA-AVERAGED Fm(INCH/HR) =  0.41
  AREA-AVERAGED Fp(INCH/HR) =  0.43
  AREA-AVERAGED Ap =  0.97
  EFFECTIVE STREAM AREA(ACRES) =      12.94
  TOTAL STREAM AREA(ACRES) =      12.94
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      14.60

****************************************************************************
  FLOW PROCESS FROM NODE     53.00 TO NODE     54.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   172.00
  ELEVATION DATA: UPSTREAM(FEET) =   2739.00  DOWNSTREAM(FEET) =   2723.00

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    5.000
  *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  3.496
  SUBAREA Tc AND LOSS RATE DATA(AMC  I ):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS   Tc
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  COMMERCIAL                 C        0.06      0.81     0.100    50    5.00
  NATURAL DESERT COVER
  "DESERT BRUSH"   (15.0%)   C        0.31      0.43     1.000    76    6.62
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.43
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.854
  SUBAREA RUNOFF(CFS) =      1.04
  TOTAL AREA(ACRES) =      0.37   PEAK FLOW RATE(CFS) =      1.04

****************************************************************************
  FLOW PROCESS FROM NODE     54.00 TO NODE     55.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =  2723.00  DOWNSTREAM(FEET) =  2722.50
  FLOW LENGTH(FEET) =    53.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN   9.0 INCH PIPE IS   5.5 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   3.71
  ESTIMATED PIPE DIAMETER(INCH) =   9.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       1.04
  PIPE TRAVEL TIME(MIN.) =   0.24    Tc(MIN.) =    5.24
  LONGEST FLOWPATH FROM NODE     53.00 TO NODE     55.00 =     225.00 FEET.
```

```
****************************************************************************
  FLOW PROCESS FROM NODE     55.00 TO NODE     55.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN.) =    5.24
  *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  3.384
  SUBAREA LOSS RATE DATA(AMC  I ):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                 C        0.03      0.81     0.100    50
  NATURAL DESERT COVER
  "DESERT BRUSH"   (15.0%)   C        0.02      0.43     1.000    76
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.48
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.460
  SUBAREA AREA(ACRES) =    0.05      SUBAREA RUNOFF(CFS) =    0.14
  EFFECTIVE AREA(ACRES) =      0.42   AREA-AVERAGED Fm(INCH/HR) =  0.35
  AREA-AVERAGED Fp(INCH/HR) =  0.44  AREA-AVERAGED Ap =  0.81
  TOTAL AREA(ACRES) =        0.4       PEAK FLOW RATE(CFS) =       1.15

****************************************************************************
  FLOW PROCESS FROM NODE     55.00 TO NODE     56.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =  2722.50  DOWNSTREAM(FEET) =  2722.00
  FLOW LENGTH(FEET) =    16.80   MANNING'S N =  0.013
  DEPTH OF FLOW IN   9.0 INCH PIPE IS   4.1 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   5.89
  ESTIMATED PIPE DIAMETER(INCH) =   9.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       1.15
  PIPE TRAVEL TIME(MIN.) =   0.05    Tc(MIN.) =    5.29
  LONGEST FLOWPATH FROM NODE     53.00 TO NODE     56.00 =     241.80 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE     56.00 TO NODE     56.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  3
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  3 ARE:
  TIME OF CONCENTRATION(MIN.) =    5.29
  RAINFALL INTENSITY(INCH/HR) =   3.36
  AREA-AVERAGED Fm(INCH/HR) =  0.35
  AREA-AVERAGED Fp(INCH/HR) =  0.44
  AREA-AVERAGED Ap =  0.81
  EFFECTIVE STREAM AREA(ACRES) =       0.42
  TOTAL STREAM AREA(ACRES) =       0.42
  PEAK FLOW RATE(CFS) AT CONFLUENCE =       1.15
```

** CONFLUENCE DATA **

STREAM NUMBER	Q (CFS)	Tc (MIN.)	Intensity (INCH/HR)	Fp(Fm) (INCH/HR)	Ap	Ae (ACRES)	HEADWATER NODE
1	22.39	10.03	2.148	0.43(0.37)	0.86	11.1	30.00
1	22.78	11.81	1.916	0.43(0.37)	0.86	13.0	40.00
1	22.78	12.26	1.866	0.43(0.37)	0.86	13.5	20.00
1	19.90	15.45	1.587	0.43(0.37)	0.87	14.7	12.00
1	18.59	16.65	1.506	0.43(0.38)	0.87	14.8	10.00
2	14.60	14.40	1.667	0.43(0.41)	0.97	12.9	50.00
3	1.15	5.29	3.363	0.44(0.35)	0.81	0.4	53.00

RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
CONFLUENCE FORMULA USED FOR 3 STREAMS.

** PEAK FLOW RATE TABLE **

STREAM NUMBER	Q (CFS)	Tc (MIN.)	Intensity (INCH/HR)	Fp(Fm) (INCH/HR)	Ap	Ae (ACRES)	HEADWATER NODE
1	33.64	5.29	3.363	0.43(0.39)	0.90	11.0	53.00
2	37.14	10.03	2.148	0.43(0.39)	0.91	20.5	30.00
3	37.72	11.81	1.916	0.43(0.39)	0.91	24.1	40.00
4	37.76	12.26	1.866	0.43(0.39)	0.91	24.9	20.00
5	35.95	14.40	1.667	0.43(0.39)	0.91	27.7	50.00
6	34.04	15.45	1.587	0.43(0.39)	0.91	28.1	12.00
7	31.74	16.65	1.506	0.43(0.39)	0.91	28.2	10.00

COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
PEAK FLOW RATE(CFS) = 37.76 Tc(MIN.) = 12.26
EFFECTIVE AREA(ACRES) = 24.92 AREA-AVERAGED Fm(INCH/HR) = 0.39
AREA-AVERAGED Fp(INCH/HR) = 0.43 AREA-AVERAGED Ap = 0.91
TOTAL AREA(ACRES) = 28.2
LONGEST FLOWPATH FROM NODE 20.00 TO NODE 56.00 = 1567.00 FEET.

==

END OF STUDY SUMMARY:
TOTAL AREA(ACRES) = 28.2 TC(MIN.) = 12.26
EFFECTIVE AREA(ACRES) = 24.92 AREA-AVERAGED Fm(INCH/HR)= 0.39
AREA-AVERAGED Fp(INCH/HR) = 0.43 AREA-AVERAGED Ap = 0.906
PEAK FLOW RATE(CFS) = 37.76

** PEAK FLOW RATE TABLE **

STREAM NUMBER	Q (CFS)	Tc (MIN.)	Intensity (INCH/HR)	Fp(Fm) (INCH/HR)	Ap	Ae (ACRES)	HEADWATER NODE
1	33.64	5.29	3.363	0.43(0.39)	0.90	11.0	53.00
2	37.14	10.03	2.148	0.43(0.39)	0.91	20.5	30.00
3	37.72	11.81	1.916	0.43(0.39)	0.91	24.1	40.00
4	37.76	12.26	1.866	0.43(0.39)	0.91	24.9	20.00
5	35.95	14.40	1.667	0.43(0.39)	0.91	27.7	50.00
6	34.04	15.45	1.587	0.43(0.39)	0.91	28.1	12.00
7	31.74	16.65	1.506	0.43(0.39)	0.91	28.2	10.00

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END OF RATIONAL METHOD ANALYSIS

Hydrograph - Existing Condition 28.2 Acres - 10 Year Storm Event

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*** NON-HOMOGENEOUS WATERSHED AREA-AVERAGED LOSS RATE (Fm)
AND LOW LOSS FRACTION ESTIMATIONS FOR AMC I:

TOTAL 24-HOUR DURATION RAINFALL DEPTH = 2.04 (inches)

SOIL-COVER TYPE	AREA (Acres)	PERCENT OF PERVIOUS AREA	SCS CURVE NUMBER	LOSS RATE Fp(in./hr.)	YIELD
1	28.20	100.00	90.(AMC II)	0.400	0.249

TOTAL AREA (Acres) = 28.20

AREA-AVERAGED LOSS RATE, Fm (in./hr.) = 0.400

AREA-AVERAGED LOW LOSS FRACTION, Y = 0.751

==

RATIONAL METHOD CALIBRATION COEFFICIENT = 1.00
TOTAL CATCHMENT AREA(ACRES) = 28.20
SOIL-LOSS RATE, Fm,(INCH/HR) = 0.400
LOW LOSS FRACTION = 0.751
TIME OF CONCENTRATION(MIN.) = 12.31
SMALL AREA PEAK Q COMPUTED USING PEAK FLOW RATE FORMULA
USER SPECIFIED RAINFALL VALUES ARE USED
RETURN FREQUENCY(YEARS) = 10
5-MINUTE POINT RAINFALL VALUE(INCHES) = 0.23
30-MINUTE POINT RAINFALL VALUE(INCHES) = 0.54
1-HOUR POINT RAINFALL VALUE(INCHES) = 0.61
3-HOUR POINT RAINFALL VALUE(INCHES) = 0.94
6-HOUR POINT RAINFALL VALUE(INCHES) = 1.23
24-HOUR POINT RAINFALL VALUE(INCHES) = 2.04

TOTAL CATCHMENT RUNOFF VOLUME(ACRE-FEET) = 1.66
TOTAL CATCHMENT SOIL-LOSS VOLUME(ACRE-FEET) = 3.14

****

TIME (HOURS)	VOLUME (AF)	Q (CFS)	0.	10.0	20.0	30.0	40.0
0.04	0.0000	0.00	Q	.	.	.	.
0.29	0.0023	0.22	Q	.	.	.	.
0.55	0.0070	0.22	Q	.	.	.	.
0.81	0.0117	0.22	Q	.	.	.	.
1.07	0.0165	0.23	Q	.	.	.	.
1.32	0.0213	0.23	Q	.	.	.	.
1.58	0.0262	0.23	Q	.	.	.	.
1.84	0.0311	0.23	Q	.	.	.	.
2.10	0.0361	0.24	Q	.	.	.	.
2.35	0.0412	0.24	Q	.	.	.	.
2.61	0.0463	0.24	Q	.	.	.	.
2.87	0.0515	0.24	Q	.	.	.	.
3.13	0.0567	0.25	Q	.	.	.	.

3.38	0.0620	0.25	Q . . . .
3.64	0.0674	0.25	Q . . . .
3.90	0.0728	0.26	Q . . . .
4.16	0.0783	0.26	Q . . . .
4.41	0.0839	0.26	Q . . . .
4.67	0.0896	0.27	Q . . . .
4.93	0.0953	0.27	Q . . . .
5.18	0.1011	0.28	Q . . . .
5.44	0.1070	0.28	Q . . . .
5.70	0.1130	0.28	Q . . . .
5.96	0.1191	0.29	Q . . . .
6.21	0.1253	0.29	Q . . . .
6.47	0.1316	0.30	Q . . . .
6.73	0.1380	0.30	Q . . . .
6.99	0.1446	0.31	Q . . . .
7.25	0.1512	0.31	Q . . . .
7.50	0.1580	0.32	Q . . . .
7.76	0.1648	0.33	Q . . . .
8.02	0.1719	0.33	Q . . . .
8.27	0.1790	0.34	Q . . . .
8.53	0.1863	0.35	Q . . . .
8.79	0.1938	0.35	Q . . . .
9.05	0.2014	0.36	Q . . . .
9.30	0.2092	0.37	Q . . . .
9.56	0.2172	0.38	Q . . . .
9.82	0.2254	0.39	Q . . . .
10.08	0.2339	0.40	Q . . . .
10.34	0.2425	0.41	Q . . . .
10.59	0.2514	0.43	Q . . . .
10.85	0.2605	0.43	Q . . . .
11.11	0.2699	0.45	Q . . . .
11.37	0.2797	0.46	Q . . . .
11.62	0.2897	0.48	Q . . . .
11.88	0.3002	0.50	Q . . . .
12.14	0.3111	0.53	Q . . . .
12.40	0.3229	0.57	Q . . . .
12.65	0.3354	0.60	Q . . . .
12.91	0.3484	0.62	Q . . . .
13.17	0.3621	0.67	Q . . . .
13.43	0.3765	0.69	Q . . . .
13.68	0.3918	0.75	Q . . . .
13.94	0.4081	0.78	Q . . . .
14.20	0.4256	0.87	Q . . . .
14.45	0.4447	0.92	Q . . . .
14.71	0.4657	1.05	.Q . . . .
14.97	0.4889	1.13	.Q . . . .
15.23	0.5155	1.37	.Q . . . .
15.48	0.5464	1.54	.Q . . . .
15.74	0.5745	1.09	.Q . . . .
16.00	0.6399	5.06	. Q . . . .
16.26	1.0324	31.86	. . . .Q .
16.52	1.3811	0.93	Q . . . .
16.77	1.4041	1.23	.Q . . . .
17.03	1.4277	0.98	Q . . . .
17.29	1.4468	0.82	Q . . . .
17.55	1.4632	0.72	Q . . . .
17.80	1.4776	0.64	Q . . . .
18.06	1.4907	0.59	Q . . . .

18.32	1.5024	0.51	Q	.	.	.	.		
18.58	1.5128	0.47	Q	.	.	.	.		
18.83	1.5226	0.44	Q	.	.	.	.		
19.09	1.5317	0.42	Q	.	.	.	.		
19.35	1.5404	0.40	Q	.	.	.	.		
19.61	1.5486	0.38	Q	.	.	.	.		
19.86	1.5564	0.36	Q	.	.	.	.		
20.12	1.5638	0.34	Q	.	.	.	.		
20.38	1.5710	0.33	Q	.	.	.	.		
20.64	1.5779	0.32	Q	.	.	.	.		
20.89	1.5845	0.31	Q	.	.	.	.		
21.15	1.5909	0.30	Q	.	.	.	.		
21.41	1.5971	0.29	Q	.	.	.	.		
21.67	1.6031	0.28	Q	.	.	.	.		
21.92	1.6090	0.27	Q	.	.	.	.		
22.18	1.6146	0.26	Q	.	.	.	.		
22.44	1.6201	0.26	Q	.	.	.	.		
22.69	1.6255	0.25	Q	.	.	.	.		
22.95	1.6308	0.24	Q	.	.	.	.		
23.21	1.6359	0.24	Q	.	.	.	.		
23.47	1.6408	0.23	Q	.	.	.	.		
23.73	1.6457	0.23	Q	.	.	.	.		
23.98	1.6505	0.22	Q	.	.	.	.		
24.24	1.6552	0.22	Q	.	.	.	.		
24.50	1.6575	0.00	Q	.	.	.	.		72200.7

TIME DURATION(minutes) OF PERCENTILES OF ESTIMATED PEAK FLOW RATE:
(Note: 100% of Peak Flow Rate estimate assumed to have
an instantaneous time duration)

Percentile of Estimated Peak Flow Rate	Duration (minutes)
0%	1452.3
10%	30.9
20%	15.4
30%	15.4
40%	15.4
50%	15.4
60%	15.4
70%	15.4
80%	15.4
90%	15.4

Hydrograph - Basin A - 10 Year Storm Event - Proposed Condition

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==============================================================================
*** NON-HOMOGENEOUS WATERSHED AREA-AVERAGED LOSS RATE (Fm)
    AND LOW LOSS FRACTION ESTIMATIONS FOR AMC I:

    TOTAL 24-HOUR DURATION RAINFALL DEPTH =     2.04 (inches)

    SOIL-COVER     AREA      PERCENT OF    SCS CURVE    LOSS RATE
      TYPE      (Acres)   PERVIOUS AREA     NUMBER    Fp(in./hr.)    YIELD
        1         5.80       100.00       90.(AMC II)     0.400       0.249

    TOTAL AREA (Acres) =      5.80
                           _
    AREA-AVERAGED LOSS RATE, Fm (in./hr.) =  0.400
                                 _
    AREA-AVERAGED LOW LOSS FRACTION, Y = 0.751
==============================================================================

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    RATIONAL METHOD CALIBRATION COEFFICIENT = 1.00
    TOTAL CATCHMENT AREA(ACRES) =    5.80
    SOIL-LOSS RATE, Fm,(INCH/HR) =  0.400
    LOW LOSS FRACTION = 0.751
    TIME OF CONCENTRATION(MIN.) = 12.81
    SMALL AREA PEAK Q COMPUTED USING PEAK FLOW RATE FORMULA
    USER SPECIFIED RAINFALL VALUES ARE USED
    RETURN FREQUENCY(YEARS) =  10
       5-MINUTE POINT RAINFALL VALUE(INCHES) =  0.23
      30-MINUTE POINT RAINFALL VALUE(INCHES) =  0.54
       1-HOUR   POINT RAINFALL VALUE(INCHES) =  0.61
       3-HOUR   POINT RAINFALL VALUE(INCHES) =  0.94
       6-HOUR   POINT RAINFALL VALUE(INCHES) =  1.23
      24-HOUR   POINT RAINFALL VALUE(INCHES) =  2.04

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    TOTAL CATCHMENT   RUNOFF  VOLUME(ACRE-FEET) =     0.34
    TOTAL CATCHMENT SOIL-LOSS VOLUME(ACRE-FEET) =     0.64

****************************************************************************
  TIME     VOLUME       Q    0.       2.5       5.0       7.5      10.0
 (HOURS)    (AF)      (CFS)
----------------------------------------------------------------------------
  0.20     0.0004     0.04  Q       .        .        .        .
  0.41     0.0012     0.05  Q       .        .        .        .
  0.63     0.0020     0.05  Q       .        .        .        .
  0.84     0.0028     0.05  Q       .        .        .        .
  1.05     0.0036     0.05  Q       .        .        .        .
  1.27     0.0044     0.05  Q       .        .        .        .
  1.48     0.0053     0.05  Q       .        .        .        .
  1.70     0.0061     0.05  Q       .        .        .        .
  1.91     0.0070     0.05  Q       .        .        .        .
```

2.12	0.0078	0.05	Q	.	.	.	.
2.34	0.0087	0.05	Q	.	.	.	.
2.55	0.0095	0.05	Q	.	.	.	.
2.76	0.0104	0.05	Q	.	.	.	.
2.98	0.0113	0.05	Q	.	.	.	.
3.19	0.0122	0.05	Q	.	.	.	.
3.40	0.0131	0.05	Q	.	.	.	.
3.62	0.0140	0.05	Q	.	.	.	.
3.83	0.0150	0.05	Q	.	.	.	.
4.04	0.0159	0.05	Q	.	.	.	.
4.26	0.0168	0.05	Q	.	.	.	.
4.47	0.0178	0.05	Q	.	.	.	.
4.68	0.0188	0.06	Q	.	.	.	.
4.90	0.0198	0.06	Q	.	.	.	.
5.11	0.0207	0.06	Q	.	.	.	.
5.32	0.0218	0.06	Q	.	.	.	.
5.54	0.0228	0.06	Q	.	.	.	.
5.75	0.0238	0.06	Q	.	.	.	.
5.97	0.0248	0.06	Q	.	.	.	.
6.18	0.0259	0.06	Q	.	.	.	.
6.39	0.0270	0.06	Q	.	.	.	.
6.61	0.0281	0.06	Q	.	.	.	.
6.82	0.0292	0.06	Q	.	.	.	.
7.03	0.0303	0.06	Q	.	.	.	.
7.25	0.0314	0.07	Q	.	.	.	.
7.46	0.0326	0.07	Q	.	.	.	.
7.67	0.0337	0.07	Q	.	.	.	.
7.89	0.0349	0.07	Q	.	.	.	.
8.10	0.0361	0.07	Q	.	.	.	.
8.31	0.0374	0.07	Q	.	.	.	.
8.53	0.0386	0.07	Q	.	.	.	.
8.74	0.0399	0.07	Q	.	.	.	.
8.95	0.0412	0.07	Q	.	.	.	.
9.17	0.0425	0.08	Q	.	.	.	.
9.38	0.0439	0.08	Q	.	.	.	.
9.60	0.0453	0.08	Q	.	.	.	.
9.81	0.0467	0.08	Q	.	.	.	.
10.02	0.0481	0.08	Q	.	.	.	.
10.24	0.0496	0.08	Q	.	.	.	.
10.45	0.0511	0.09	Q	.	.	.	.
10.66	0.0526	0.09	Q	.	.	.	.
10.88	0.0542	0.09	Q	.	.	.	.
11.09	0.0558	0.09	Q	.	.	.	.
11.30	0.0574	0.09	Q	.	.	.	.
11.52	0.0591	0.10	Q	.	.	.	.
11.73	0.0609	0.10	Q	.	.	.	.
11.94	0.0627	0.10	Q	.	.	.	.
12.16	0.0646	0.11	Q	.	.	.	.
12.37	0.0666	0.12	Q	.	.	.	.
12.58	0.0687	0.12	Q	.	.	.	.
12.80	0.0709	0.13	Q	.	.	.	.
13.01	0.0732	0.13	Q	.	.	.	.
13.22	0.0756	0.14	Q	.	.	.	.
13.44	0.0781	0.14	Q	.	.	.	.
13.65	0.0807	0.15	Q	.	.	.	.

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 13.87     0.0835     0.16  Q       .       .       .       .
 14.08     0.0864     0.17  Q       .       .       .       .
 14.29     0.0895     0.18  Q       .       .       .       .
 14.51     0.0929     0.20  Q       .       .       .       .
 14.72     0.0966     0.21  Q       .       .       .       .
 14.93     0.1006     0.24  Q       .       .       .       .
 15.15     0.1050     0.26  .Q      .       .       .       .
 15.36     0.1101     0.31  .Q      .       .       .       .
 15.57     0.1148     0.22  Q       .       .       .       .
 15.79     0.1205     0.43  .Q      .       .       .       .
 16.00     0.1376     1.51  .    Q  .       .       .       .
 16.21     0.2167     7.15  .      .       .      Q.       .
 16.43     0.2843     0.20  Q       .       .       .       .
 16.64     0.2885     0.28  .Q      .       .       .       .
 16.85     0.2930     0.23  Q       .       .       .       .
 17.07     0.2967     0.19  Q       .       .       .       .
 17.28     0.2999     0.17  Q       .       .       .       .
 17.49     0.3026     0.15  Q       .       .       .       .
 17.71     0.3051     0.14  Q       .       .       .       .
 17.92     0.3074     0.12  Q       .       .       .       .
 18.14     0.3096     0.12  Q       .       .       .       .
 18.35     0.3115     0.10  Q       .       .       .       .
 18.56     0.3132     0.10  Q       .       .       .       .
 18.78     0.3149     0.09  Q       .       .       .       .
 18.99     0.3165     0.09  Q       .       .       .       .
 19.20     0.3180     0.08  Q       .       .       .       .
 19.42     0.3194     0.08  Q       .       .       .       .
 19.63     0.3208     0.08  Q       .       .       .       .
 19.84     0.3221     0.07  Q       .       .       .       .
 20.06     0.3234     0.07  Q       .       .       .       .
 20.27     0.3246     0.07  Q       .       .       .       .
 20.48     0.3258     0.07  Q       .       .       .       .
 20.70     0.3270     0.06  Q       .       .       .       .
 20.91     0.3281     0.06  Q       .       .       .       .
 21.12     0.3292     0.06  Q       .       .       .       .
 21.34     0.3302     0.06  Q       .       .       .       .
 21.55     0.3313     0.06  Q       .       .       .       .
 21.76     0.3323     0.06  Q       .       .       .       .
 21.98     0.3332     0.05  Q       .       .       .       .
 22.19     0.3342     0.05  Q       .       .       .       .
 22.41     0.3351     0.05  Q       .       .       .       .
 22.62     0.3361     0.05  Q       .       .       .       .
 22.83     0.3370     0.05  Q       .       .       .       .
 23.05     0.3378     0.05  Q       .       .       .       .
 23.26     0.3387     0.05  Q       .       .       .       .
 23.47     0.3395     0.05  Q       .       .       .       .
 23.69     0.3404     0.05  Q       .       .       .       .
 23.90     0.3412     0.05  Q       .       .       .       .
 24.11     0.3420     0.05  Q       .       .       .       .
 24.33     0.3424     0.00  Q       .       .       .       .                         14914.94
-----------------------------------------------------------------------
----------------------------------------------------------------------------
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TIME DURATION(minutes) OF PERCENTILES OF ESTIMATED PEAK FLOW RATE:
(Note: 100% of Peak Flow Rate estimate assumed to have
an instantaneous time duration)

Percentile of Estimated Peak Flow Rate	Duration (minutes)
0%	1447.5
10%	25.6
20%	25.6
30%	12.8
40%	12.8
50%	12.8
60%	12.8
70%	12.8
80%	12.8
90%	12.8

Hydrograph - Basin B Tributary to Infiltration Basin 1 - 10 Year Storm Event

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*** NON-HOMOGENEOUS WATERSHED AREA-AVERAGED LOSS RATE (Fm)
AND LOW LOSS FRACTION ESTIMATIONS FOR AMC I:

TOTAL 24-HOUR DURATION RAINFALL DEPTH = 2.04 (inches)

SOIL-COVER TYPE	AREA (Acres)	PERCENT OF PERVIOUS AREA	SCS CURVE NUMBER	LOSS RATE Fp(in./hr.)	YIELD
1	5.11	100.00	90.(AMC II)	0.400	0.249
2	0.32	0.00	98.(AMC II)	0.000	0.889
3	1.27	100.00	91.(AMC II)	0.370	0.288

TOTAL AREA (Acres) = 6.70

AREA-AVERAGED LOSS RATE, $\bar{F}m$ (in./hr.) = 0.375

AREA-AVERAGED LOW LOSS FRACTION, $\bar{Y}$ = 0.713

==

RATIONAL METHOD CALIBRATION COEFFICIENT = 1.07
TOTAL CATCHMENT AREA(ACRES) = 6.70
SOIL-LOSS RATE, Fm,(INCH/HR) = 0.375
LOW LOSS FRACTION = 0.713
TIME OF CONCENTRATION(MIN.) = 8.57
SMALL AREA PEAK Q COMPUTED USING PEAK FLOW RATE FORMULA
USER SPECIFIED RAINFALL VALUES ARE USED
RETURN FREQUENCY(YEARS) = 10
5-MINUTE POINT RAINFALL VALUE(INCHES) = 0.23
30-MINUTE POINT RAINFALL VALUE(INCHES) = 0.54
1-HOUR POINT RAINFALL VALUE(INCHES) = 0.61
3-HOUR POINT RAINFALL VALUE(INCHES) = 0.94
6-HOUR POINT RAINFALL VALUE(INCHES) = 1.23
24-HOUR POINT RAINFALL VALUE(INCHES) = 2.04

TOTAL CATCHMENT RUNOFF VOLUME(ACRE-FEET) = 0.46
TOTAL CATCHMENT SOIL-LOSS VOLUME(ACRE-FEET) = 0.68

****

TIME (HOURS)	VOLUME (AF)	Q (CFS)	0.	5.0	10.0	15.0	20.0
0.00	0.0000	0.00	Q	.	.	.	.
0.15	0.0004	0.06	Q	.	.	.	.
0.29	0.0011	0.06	Q	.	.	.	.
0.43	0.0019	0.06	Q	.	.	.	.
0.57	0.0027	0.06	Q	.	.	.	.
0.72	0.0034	0.07	Q	.	.	.	.
0.86	0.0042	0.07	Q	.	.	.	.
1.00	0.0050	0.07	Q	.	.	.	.

1.15	0.0057	0.07	Q	.	.	.	.
1.29	0.0065	0.07	Q	.	.	.	.
1.43	0.0073	0.07	Q	.	.	.	.
1.57	0.0081	0.07	Q	.	.	.	.
1.72	0.0089	0.07	Q	.	.	.	.
1.86	0.0097	0.07	Q	.	.	.	.
2.00	0.0105	0.07	Q	.	.	.	.
2.15	0.0114	0.07	Q	.	.	.	.
2.29	0.0122	0.07	Q	.	.	.	.
2.43	0.0130	0.07	Q	.	.	.	.
2.57	0.0138	0.07	Q	.	.	.	.
2.72	0.0147	0.07	Q	.	.	.	.
2.86	0.0155	0.07	Q	.	.	.	.
3.00	0.0164	0.07	Q	.	.	.	.
3.15	0.0172	0.07	Q	.	.	.	.
3.29	0.0181	0.07	Q	.	.	.	.
3.43	0.0190	0.07	Q	.	.	.	.
3.57	0.0198	0.07	Q	.	.	.	.
3.72	0.0207	0.07	Q	.	.	.	.
3.86	0.0216	0.08	Q	.	.	.	.
4.00	0.0225	0.08	Q	.	.	.	.
4.14	0.0234	0.08	Q	.	.	.	.
4.29	0.0243	0.08	Q	.	.	.	.
4.43	0.0252	0.08	Q	.	.	.	.
4.57	0.0261	0.08	Q	.	.	.	.
4.72	0.0271	0.08	Q	.	.	.	.
4.86	0.0280	0.08	Q	.	.	.	.
5.00	0.0289	0.08	Q	.	.	.	.
5.14	0.0299	0.08	Q	.	.	.	.
5.29	0.0308	0.08	Q	.	.	.	.
5.43	0.0318	0.08	Q	.	.	.	.
5.57	0.0328	0.08	Q	.	.	.	.
5.72	0.0338	0.08	Q	.	.	.	.
5.86	0.0348	0.08	Q	.	.	.	.
6.00	0.0358	0.09	Q	.	.	.	.
6.14	0.0368	0.09	Q	.	.	.	.
6.29	0.0378	0.09	Q	.	.	.	.
6.43	0.0388	0.09	Q	.	.	.	.
6.57	0.0399	0.09	Q	.	.	.	.
6.72	0.0409	0.09	Q	.	.	.	.
6.86	0.0420	0.09	Q	.	.	.	.
7.00	0.0430	0.09	Q	.	.	.	.
7.14	0.0441	0.09	Q	.	.	.	.
7.29	0.0452	0.09	Q	.	.	.	.
7.43	0.0463	0.09	Q	.	.	.	.
7.57	0.0474	0.09	Q	.	.	.	.
7.72	0.0485	0.10	Q	.	.	.	.
7.86	0.0497	0.10	Q	.	.	.	.
8.00	0.0508	0.10	Q	.	.	.	.
8.14	0.0520	0.10	Q	.	.	.	.
8.29	0.0532	0.10	Q	.	.	.	.
8.43	0.0544	0.10	Q	.	.	.	.
8.57	0.0556	0.10	Q	.	.	.	.
8.72	0.0568	0.10	Q	.	.	.	.
8.86	0.0580	0.10	Q	.	.	.	.

9.00	0.0593	0.11	Q . . . .
9.14	0.0605	0.11	Q . . . .
9.29	0.0618	0.11	Q . . . .
9.43	0.0631	0.11	Q . . . .
9.57	0.0644	0.11	Q . . . .
9.72	0.0658	0.11	Q . . . .
9.86	0.0671	0.12	Q . . . .
10.00	0.0685	0.12	Q . . . .
10.14	0.0699	0.12	Q . . . .
10.29	0.0713	0.12	Q . . . .
10.43	0.0727	0.12	Q . . . .
10.57	0.0742	0.12	Q . . . .
10.72	0.0757	0.13	Q . . . .
10.86	0.0772	0.13	Q . . . .
11.00	0.0787	0.13	Q . . . .
11.14	0.0803	0.13	Q . . . .
11.29	0.0819	0.14	Q . . . .
11.43	0.0835	0.14	Q . . . .
11.57	0.0851	0.14	Q . . . .
11.72	0.0868	0.14	Q . . . .
11.86	0.0886	0.15	Q . . . .
12.00	0.0903	0.15	Q . . . .
12.14	0.0922	0.17	Q . . . .
12.29	0.0942	0.17	Q . . . .
12.43	0.0962	0.17	Q . . . .
12.57	0.0983	0.18	Q . . . .
12.71	0.1004	0.18	Q . . . .
12.86	0.1026	0.19	Q . . . .
13.00	0.1048	0.19	Q . . . .
13.14	0.1072	0.20	Q . . . .
13.29	0.1095	0.21	Q . . . .
13.43	0.1120	0.21	Q . . . .
13.57	0.1145	0.22	Q . . . .
13.71	0.1171	0.22	Q . . . .
13.86	0.1198	0.24	Q . . . .
14.00	0.1227	0.24	Q . . . .
14.14	0.1256	0.25	Q . . . .
14.29	0.1286	0.26	Q . . . .
14.43	0.1317	0.27	Q . . . .
14.57	0.1350	0.29	Q . . . .
14.71	0.1385	0.31	Q . . . .
14.86	0.1422	0.32	Q . . . .
15.00	0.1462	0.36	Q . . . .
15.14	0.1506	0.38	Q . . . .
15.29	0.1553	0.43	Q . . . .
15.43	0.1606	0.46	Q . . . .
15.57	0.1650	0.28	Q . . . .
15.71	0.1687	0.34	Q . . . .
15.86	0.1804	1.66	. Q . . . .
16.00	0.2083	3.07	. Q . . . .
16.14	0.2995	12.38	. . . Q . .
16.29	0.3769	0.73	.Q . . . .
16.43	0.3827	0.25	Q . . . .
16.57	0.3865	0.40	Q . . . .
16.71	0.3909	0.34	Q . . . .

16.86	0.3946	0.30	Q	.	.	.	.	
17.00	0.3980	0.27	Q	.	.	.	.	
17.14	0.4010	0.25	Q	.	.	.	.	
17.29	0.4038	0.23	Q	.	.	.	.	
17.43	0.4064	0.21	Q	.	.	.	.	
17.57	0.4089	0.20	Q	.	.	.	.	
17.71	0.4112	0.19	Q	.	.	.	.	
17.86	0.4134	0.18	Q	.	.	.	.	
18.00	0.4155	0.17	Q	.	.	.	.	
18.14	0.4174	0.15	Q	.	.	.	.	
18.29	0.4191	0.15	Q	.	.	.	.	
18.43	0.4208	0.14	Q	.	.	.	.	
18.57	0.4225	0.13	Q	.	.	.	.	
18.71	0.4240	0.13	Q	.	.	.	.	
18.86	0.4255	0.13	Q	.	.	.	.	
19.00	0.4270	0.12	Q	.	.	.	.	
19.14	0.4284	0.12	Q	.	.	.	.	
19.29	0.4298	0.11	Q	.	.	.	.	
19.43	0.4311	0.11	Q	.	.	.	.	
19.57	0.4324	0.11	Q	.	.	.	.	
19.71	0.4337	0.11	Q	.	.	.	.	
19.86	0.4349	0.10	Q	.	.	.	.	
20.00	0.4361	0.10	Q	.	.	.	.	
20.14	0.4373	0.10	Q	.	.	.	.	
20.28	0.4384	0.10	Q	.	.	.	.	
20.43	0.4396	0.09	Q	.	.	.	.	
20.57	0.4407	0.09	Q	.	.	.	.	
20.71	0.4418	0.09	Q	.	.	.	.	
20.86	0.4428	0.09	Q	.	.	.	.	
21.00	0.4438	0.09	Q	.	.	.	.	
21.14	0.4449	0.09	Q	.	.	.	.	
21.28	0.4459	0.08	Q	.	.	.	.	
21.43	0.4469	0.08	Q	.	.	.	.	
21.57	0.4478	0.08	Q	.	.	.	.	
21.71	0.4488	0.08	Q	.	.	.	.	
21.86	0.4497	0.08	Q	.	.	.	.	
22.00	0.4506	0.08	Q	.	.	.	.	
22.14	0.4515	0.08	Q	.	.	.	.	
22.28	0.4524	0.08	Q	.	.	.	.	
22.43	0.4533	0.07	Q	.	.	.	.	
22.57	0.4542	0.07	Q	.	.	.	.	
22.71	0.4550	0.07	Q	.	.	.	.	
22.86	0.4559	0.07	Q	.	.	.	.	
23.00	0.4567	0.07	Q	.	.	.	.	
23.14	0.4575	0.07	Q	.	.	.	.	
23.28	0.4583	0.07	Q	.	.	.	.	
23.43	0.4591	0.07	Q	.	.	.	.	
23.57	0.4599	0.07	Q	.	.	.	.	
23.71	0.4607	0.07	Q	.	.	.	.	
23.86	0.4615	0.07	Q	.	.	.	.	
24.00	0.4622	0.06	Q	.	.	.	.	
24.14	0.4630	0.06	Q	.	.	.	.	
24.28	0.4634	0.00	Q	.	.	.	.	20185.7

Routed Hydrograph - Basin B routed thru Basin 1 - 10 Year Storm Event

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FLOW-THROUGH DETENTION BASIN MODEL

SPECIFIED BASIN CONDITIONS ARE AS FOLLOWS:
CONSTANT HYDROGRAPH TIME UNIT(MINUTES) = 8.570
DEAD STORAGE(AF) = 0.00
SPECIFIED DEAD STORAGE(AF) FILLED = 0.00
ASSUMED INITIAL DEPTH(FEET) IN STORAGE BASIN = 0.00

```
          INFLOW
            |
            |
            |
            V          __effective depth
       -------------      |  (and volume)
       |           |   |   |
       | detention |   |....V............
       |   basin   |<-->|        outflow
       |           |   |.........__________
       -------------   |        |  \
            |          | storage |    basin outlet
            V           -----------
         OUTFLOW
```

DEPTH-VS.-STORAGE AND DEPTH-VS.-DISCHARGE INFORMATION:
TOTAL NUMBER OF BASIN DEPTH INFORMATION ENTRIES = 3

```
*BASIN-DEPTH  STORAGE   OUTFLOW  **BASIN-DEPTH  STORAGE   OUTFLOW  *
*  (FEET)  (ACRE-FEET)   (CFS)   **   (FEET)  (ACRE-FEET)   (CFS)  *
*     0.000     0.000     0.000**     1.000     0.250     0.000*
*     2.000     0.530    23.490**
```

BASIN STORAGE, OUTFLOW AND DEPTH ROUTING VALUES:

INTERVAL NUMBER	DEPTH (FEET)	{S-O*DT/2} (ACRE-FEET)	{S+O*DT/2} (ACRE-FEET)
1	0.00	0.00000	0.00000
2	1.00	0.25000	0.25000
3	2.00	0.39136	0.66864

WHERE S=STORAGE(AF);O=OUTFLOW(AF/MIN.);DT=UNIT INTERVAL(MIN.)

DETENTION BASIN ROUTING RESULTS:
NOTE: COMPUTED BASIN DEPTH, OUTFLOW, AND STORAGE QUANTITIES
OCCUR AT THE GIVEN TIME. BASIN INFLOW VALUES REPRESENT THE
AVERAGE INFLOW DURING THE RECENT HYDROGRAPH UNIT INTERVAL.

TIME (HRS)	DEAD-STORAGE FILLED(AF)	INFLOW (CFS)	EFFECTIVE DEPTH(FT)	OUTFLOW (CFS)	EFFECTIVE VOLUME(AF)
0.003	0.000	0.00	0.00	0.00	0.000
0.146	0.000	0.06	0.00	0.00	0.001
0.288	0.000	0.06	0.01	0.00	0.002
0.431	0.000	0.06	0.01	0.00	0.002
0.574	0.000	0.06	0.01	0.00	0.003

0.717	0.000	0.07	0.02	0.00	0.004
0.860	0.000	0.07	0.02	0.00	0.005
1.003	0.000	0.07	0.02	0.00	0.005
1.145	0.000	0.07	0.02	0.00	0.006
1.288	0.000	0.07	0.03	0.00	0.007
1.431	0.000	0.07	0.03	0.00	0.008
1.574	0.000	0.07	0.03	0.00	0.009
1.717	0.000	0.07	0.04	0.00	0.009
1.860	0.000	0.07	0.04	0.00	0.010
2.002	0.000	0.07	0.04	0.00	0.011
2.145	0.000	0.07	0.05	0.00	0.012
2.288	0.000	0.07	0.05	0.00	0.013
2.431	0.000	0.07	0.05	0.00	0.013
2.574	0.000	0.07	0.06	0.00	0.014
2.717	0.000	0.07	0.06	0.00	0.015
2.859	0.000	0.07	0.06	0.00	0.016
3.002	0.000	0.07	0.07	0.00	0.017
3.145	0.000	0.07	0.07	0.00	0.018
3.288	0.000	0.07	0.07	0.00	0.019
3.431	0.000	0.07	0.08	0.00	0.019
3.574	0.000	0.07	0.08	0.00	0.020
3.716	0.000	0.07	0.08	0.00	0.021
3.859	0.000	0.08	0.09	0.00	0.022
4.002	0.000	0.08	0.09	0.00	0.023
4.145	0.000	0.08	0.10	0.00	0.024
4.288	0.000	0.08	0.10	0.00	0.025
4.431	0.000	0.08	0.10	0.00	0.026
4.573	0.000	0.08	0.11	0.00	0.027
4.716	0.000	0.08	0.11	0.00	0.028
4.859	0.000	0.08	0.11	0.00	0.028
5.002	0.000	0.08	0.12	0.00	0.029
5.145	0.000	0.08	0.12	0.00	0.030
5.288	0.000	0.08	0.13	0.00	0.031
5.430	0.000	0.08	0.13	0.00	0.032
5.573	0.000	0.08	0.13	0.00	0.033
5.716	0.000	0.08	0.14	0.00	0.034
5.859	0.000	0.08	0.14	0.00	0.035
6.002	0.000	0.09	0.15	0.00	0.036
6.145	0.000	0.09	0.15	0.00	0.037
6.287	0.000	0.09	0.15	0.00	0.038
6.430	0.000	0.09	0.16	0.00	0.039
6.573	0.000	0.09	0.16	0.00	0.040
6.716	0.000	0.09	0.17	0.00	0.041
6.859	0.000	0.09	0.17	0.00	0.042
7.002	0.000	0.09	0.17	0.00	0.044
7.144	0.000	0.09	0.18	0.00	0.045
7.287	0.000	0.09	0.18	0.00	0.046
7.430	0.000	0.09	0.19	0.00	0.047
7.573	0.000	0.09	0.19	0.00	0.048
7.716	0.000	0.10	0.20	0.00	0.049
7.859	0.000	0.10	0.20	0.00	0.050
8.001	0.000	0.10	0.21	0.00	0.051
8.144	0.000	0.10	0.21	0.00	0.053
8.287	0.000	0.10	0.22	0.00	0.054
8.430	0.000	0.10	0.22	0.00	0.055

8.573	0.000	0.10	0.22	0.00	0.056
8.715	0.000	0.10	0.23	0.00	0.057
8.858	0.000	0.10	0.23	0.00	0.059
9.001	0.000	0.11	0.24	0.00	0.060
9.144	0.000	0.11	0.24	0.00	0.061
9.287	0.000	0.11	0.25	0.00	0.062
9.430	0.000	0.11	0.26	0.00	0.064
9.573	0.000	0.11	0.26	0.00	0.065
9.715	0.000	0.11	0.27	0.00	0.066
9.858	0.000	0.12	0.27	0.00	0.068
10.001	0.000	0.12	0.28	0.00	0.069
10.144	0.000	0.12	0.28	0.00	0.071
10.287	0.000	0.12	0.29	0.00	0.072
10.430	0.000	0.12	0.29	0.00	0.073
10.572	0.000	0.12	0.30	0.00	0.075
10.715	0.000	0.13	0.31	0.00	0.076
10.858	0.000	0.13	0.31	0.00	0.078
11.001	0.000	0.13	0.32	0.00	0.079
11.144	0.000	0.13	0.32	0.00	0.081
11.286	0.000	0.14	0.33	0.00	0.083
11.429	0.000	0.14	0.34	0.00	0.084
11.572	0.000	0.14	0.34	0.00	0.086
11.715	0.000	0.14	0.35	0.00	0.088
11.858	0.000	0.15	0.36	0.00	0.089
12.001	0.000	0.15	0.36	0.00	0.091
12.143	0.000	0.17	0.37	0.00	0.093
12.286	0.000	0.17	0.38	0.00	0.095
12.429	0.000	0.17	0.39	0.00	0.097
12.572	0.000	0.18	0.40	0.00	0.099
12.715	0.000	0.18	0.41	0.00	0.102
12.858	0.000	0.19	0.41	0.00	0.104
13.001	0.000	0.19	0.42	0.00	0.106
13.143	0.000	0.20	0.43	0.00	0.108
13.286	0.000	0.21	0.44	0.00	0.111
13.429	0.000	0.21	0.45	0.00	0.113
13.572	0.000	0.22	0.46	0.00	0.116
13.715	0.000	0.22	0.47	0.00	0.118
13.858	0.000	0.24	0.48	0.00	0.121
14.000	0.000	0.24	0.50	0.00	0.124
14.143	0.000	0.25	0.51	0.00	0.127
14.286	0.000	0.26	0.52	0.00	0.130
14.429	0.000	0.27	0.53	0.00	0.133
14.572	0.000	0.29	0.55	0.00	0.137
14.714	0.000	0.31	0.56	0.00	0.140
14.857	0.000	0.32	0.58	0.00	0.144
15.000	0.000	0.36	0.59	0.00	0.148
15.143	0.000	0.38	0.61	0.00	0.153
15.286	0.000	0.43	0.63	0.00	0.158
15.429	0.000	0.46	0.65	0.00	0.163
15.571	0.000	0.28	0.67	0.00	0.167
15.714	0.000	0.34	0.68	0.00	0.171
15.857	0.000	1.66	0.76	0.00	0.190
16.000	0.000	3.07	0.91	0.00	0.226
16.143	0.000	12.38	1.29	3.44	0.332
16.286	0.000	0.73	1.12	4.84	0.283

16.429	0.000	0.25	1.05	1.96	0.263
16.571	0.000	0.40	1.03	0.88	0.258
16.714	0.000	0.34	1.02	0.54	0.255
16.857	0.000	0.30	1.01	0.39	0.254
17.000	0.000	0.27	1.01	0.32	0.253
17.143	0.000	0.25	1.01	0.28	0.253
17.285	0.000	0.23	1.01	0.25	0.253
17.428	0.000	0.21	1.01	0.23	0.253
17.571	0.000	0.20	1.01	0.22	0.252
17.714	0.000	0.19	1.01	0.20	0.252
17.857	0.000	0.18	1.01	0.19	0.252
18.000	0.000	0.17	1.01	0.18	0.252
18.142	0.000	0.15	1.01	0.17	0.252
18.285	0.000	0.15	1.01	0.16	0.252
18.428	0.000	0.14	1.01	0.15	0.252
18.571	0.000	0.13	1.01	0.14	0.252
18.714	0.000	0.13	1.01	0.14	0.252
18.857	0.000	0.13	1.01	0.13	0.252
19.000	0.000	0.12	1.01	0.13	0.251
19.142	0.000	0.12	1.01	0.12	0.251
19.285	0.000	0.11	1.00	0.12	0.251
19.428	0.000	0.11	1.00	0.11	0.251
19.571	0.000	0.11	1.00	0.11	0.251
19.714	0.000	0.11	1.00	0.11	0.251
19.857	0.000	0.10	1.00	0.11	0.251
19.999	0.000	0.10	1.00	0.10	0.251
20.142	0.000	0.10	1.00	0.10	0.251
20.285	0.000	0.10	1.00	0.10	0.251
20.428	0.000	0.09	1.00	0.10	0.251
20.571	0.000	0.09	1.00	0.09	0.251
20.713	0.000	0.09	1.00	0.09	0.251
20.856	0.000	0.09	1.00	0.09	0.251
20.999	0.000	0.09	1.00	0.09	0.251
21.142	0.000	0.09	1.00	0.09	0.251
21.285	0.000	0.08	1.00	0.09	0.251
21.428	0.000	0.08	1.00	0.08	0.251
21.570	0.000	0.08	1.00	0.08	0.251
21.713	0.000	0.08	1.00	0.08	0.251
21.856	0.000	0.08	1.00	0.08	0.251
21.999	0.000	0.08	1.00	0.08	0.251
22.142	0.000	0.08	1.00	0.08	0.251
22.285	0.000	0.08	1.00	0.08	0.251
22.427	0.000	0.07	1.00	0.08	0.251
22.570	0.000	0.07	1.00	0.07	0.251
22.713	0.000	0.07	1.00	0.07	0.251
22.856	0.000	0.07	1.00	0.07	0.251
22.999	0.000	0.07	1.00	0.07	0.251
23.142	0.000	0.07	1.00	0.07	0.251
23.284	0.000	0.07	1.00	0.07	0.251
23.427	0.000	0.07	1.00	0.07	0.251
23.570	0.000	0.07	1.00	0.07	0.251
23.713	0.000	0.07	1.00	0.07	0.251
23.856	0.000	0.07	1.00	0.07	0.251
23.999	0.000	0.06	1.00	0.07	0.251
24.142	0.000	0.06	1.00	0.06	0.251

24.284	0.000	0.00	1.00	0.04	0.250

Hydrograph - Basin C - 10 Year Storm Event - Proposed Condition

```
==========================================================================
*** NON-HOMOGENEOUS WATERSHED AREA-AVERAGED LOSS RATE (Fm)
   AND LOW LOSS FRACTION ESTIMATIONS FOR AMC I:

   TOTAL 24-HOUR DURATION RAINFALL DEPTH =     2.04 (inches)

   SOIL-COVER     AREA     PERCENT OF    SCS CURVE    LOSS RATE
     TYPE      (Acres)  PERVIOUS AREA     NUMBER    Fp(in./hr.)    YIELD
       1         0.73      100.00       90.(AMC II)     0.400       0.249

   TOTAL AREA (Acres) =      0.73
                  _
   AREA-AVERAGED LOSS RATE, Fm (in./hr.) =  0.400
                       _
   AREA-AVERAGED LOW LOSS FRACTION, Y = 0.751
==========================================================================
----------------------------------------------------------------------------


   RATIONAL METHOD CALIBRATION COEFFICIENT = 1.00
   TOTAL CATCHMENT AREA(ACRES) =    0.73
   SOIL-LOSS RATE, Fm,(INCH/HR) =  0.400
   LOW LOSS FRACTION = 0.751
   TIME OF CONCENTRATION(MIN.) =  9.29
   SMALL AREA PEAK Q COMPUTED USING PEAK FLOW RATE FORMULA
   USER SPECIFIED RAINFALL VALUES ARE USED
   RETURN FREQUENCY(YEARS) =  10
     5-MINUTE POINT RAINFALL VALUE(INCHES) =  0.23
    30-MINUTE POINT RAINFALL VALUE(INCHES) =  0.54
     1-HOUR   POINT RAINFALL VALUE(INCHES) =  0.61
     3-HOUR   POINT RAINFALL VALUE(INCHES) =  0.94
     6-HOUR   POINT RAINFALL VALUE(INCHES) =  1.23
    24-HOUR   POINT RAINFALL VALUE(INCHES) =  2.04

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

   TOTAL CATCHMENT   RUNOFF  VOLUME(ACRE-FEET) =     0.04
   TOTAL CATCHMENT SOIL-LOSS VOLUME(ACRE-FEET) =     0.08

********************************************************************************
  TIME     VOLUME       Q    0.        2.5       5.0       7.5      10.0
 (HOURS)    (AF)     (CFS)
----------------------------------------------------------------------------
  0.05    0.0000    0.01  Q        .        .        .        .
  0.21    0.0001    0.01  Q        .        .        .        .
  0.36    0.0002    0.01  Q        .        .        .        .
  0.52    0.0002    0.01  Q        .        .        .        .
  0.67    0.0003    0.01  Q        .        .        .        .
  0.83    0.0004    0.01  Q        .        .        .        .
  0.98    0.0005    0.01  Q        .        .        .        .
  1.14    0.0005    0.01  Q        .        .        .        .
  1.29    0.0006    0.01  Q        .        .        .        .
  1.45    0.0007    0.01  Q        .        .        .        .
```

1.60	0.0008	0.01	Q	.	.	.	.
1.76	0.0008	0.01	Q	.	.	.	.
1.91	0.0009	0.01	Q	.	.	.	.
2.07	0.0010	0.01	Q	.	.	.	.
2.22	0.0011	0.01	Q	.	.	.	.
2.37	0.0011	0.01	Q	.	.	.	.
2.53	0.0012	0.01	Q	.	.	.	.
2.68	0.0013	0.01	Q	.	.	.	.
2.84	0.0014	0.01	Q	.	.	.	.
2.99	0.0015	0.01	Q	.	.	.	.
3.15	0.0015	0.01	Q	.	.	.	.
3.30	0.0016	0.01	Q	.	.	.	.
3.46	0.0017	0.01	Q	.	.	.	.
3.61	0.0018	0.01	Q	.	.	.	.
3.77	0.0019	0.01	Q	.	.	.	.
3.92	0.0020	0.01	Q	.	.	.	.
4.08	0.0021	0.01	Q	.	.	.	.
4.23	0.0021	0.01	Q	.	.	.	.
4.39	0.0022	0.01	Q	.	.	.	.
4.54	0.0023	0.01	Q	.	.	.	.
4.70	0.0024	0.01	Q	.	.	.	.
4.85	0.0025	0.01	Q	.	.	.	.
5.01	0.0026	0.01	Q	.	.	.	.
5.16	0.0027	0.01	Q	.	.	.	.
5.32	0.0028	0.01	Q	.	.	.	.
5.47	0.0029	0.01	Q	.	.	.	.
5.63	0.0030	0.01	Q	.	.	.	.
5.78	0.0031	0.01	Q	.	.	.	.
5.94	0.0031	0.01	Q	.	.	.	.
6.09	0.0032	0.01	Q	.	.	.	.
6.25	0.0033	0.01	Q	.	.	.	.
6.40	0.0034	0.01	Q	.	.	.	.
6.56	0.0035	0.01	Q	.	.	.	.
6.71	0.0036	0.01	Q	.	.	.	.
6.86	0.0037	0.01	Q	.	.	.	.
7.02	0.0038	0.01	Q	.	.	.	.
7.17	0.0039	0.01	Q	.	.	.	.
7.33	0.0041	0.01	Q	.	.	.	.
7.48	0.0042	0.01	Q	.	.	.	.
7.64	0.0043	0.01	Q	.	.	.	.
7.79	0.0044	0.01	Q	.	.	.	.
7.95	0.0045	0.01	Q	.	.	.	.
8.10	0.0046	0.01	Q	.	.	.	.
8.26	0.0047	0.01	Q	.	.	.	.
8.41	0.0048	0.01	Q	.	.	.	.
8.57	0.0049	0.01	Q	.	.	.	.
8.72	0.0051	0.01	Q	.	.	.	.
8.88	0.0052	0.01	Q	.	.	.	.
9.03	0.0053	0.01	Q	.	.	.	.
9.19	0.0054	0.01	Q	.	.	.	.
9.34	0.0055	0.01	Q	.	.	.	.
9.50	0.0057	0.01	Q	.	.	.	.
9.65	0.0058	0.01	Q	.	.	.	.
9.81	0.0059	0.01	Q	.	.	.	.
9.96	0.0061	0.01	Q	.	.	.	.

10.12	0.0062	0.01	Q	.	.	.	.
10.27	0.0063	0.01	Q	.	.	.	.
10.43	0.0065	0.01	Q	.	.	.	.
10.58	0.0066	0.01	Q	.	.	.	.
10.74	0.0067	0.01	Q	.	.	.	.
10.89	0.0069	0.01	Q	.	.	.	.
11.05	0.0070	0.01	Q	.	.	.	.
11.20	0.0072	0.01	Q	.	.	.	.
11.35	0.0073	0.01	Q	.	.	.	.
11.51	0.0075	0.01	Q	.	.	.	.
11.66	0.0077	0.01	Q	.	.	.	.
11.82	0.0078	0.01	Q	.	.	.	.
11.97	0.0080	0.01	Q	.	.	.	.
12.13	0.0082	0.01	Q	.	.	.	.
12.28	0.0084	0.01	Q	.	.	.	.
12.44	0.0085	0.02	Q	.	.	.	.
12.59	0.0087	0.02	Q	.	.	.	.
12.75	0.0089	0.02	Q	.	.	.	.
12.90	0.0091	0.02	Q	.	.	.	.
13.06	0.0094	0.02	Q	.	.	.	.
13.21	0.0096	0.02	Q	.	.	.	.
13.37	0.0098	0.02	Q	.	.	.	.
13.52	0.0100	0.02	Q	.	.	.	.
13.68	0.0103	0.02	Q	.	.	.	.
13.83	0.0105	0.02	Q	.	.	.	.
13.99	0.0108	0.02	Q	.	.	.	.
14.14	0.0111	0.02	Q	.	.	.	.
14.30	0.0114	0.02	Q	.	.	.	.
14.45	0.0117	0.02	Q	.	.	.	.
14.61	0.0120	0.03	Q	.	.	.	.
14.76	0.0124	0.03	Q	.	.	.	.
14.92	0.0128	0.03	Q	.	.	.	.
15.07	0.0132	0.03	Q	.	.	.	.
15.23	0.0136	0.04	Q	.	.	.	.
15.38	0.0141	0.04	Q	.	.	.	.
15.54	0.0145	0.02	Q	.	.	.	.
15.69	0.0148	0.03	Q	.	.	.	.
15.85	0.0159	0.14	Q	.	.	.	.
16.00	0.0185	0.28	.Q	.	.	.	.
16.15	0.0278	1.23	. Q	.	.	.	.
16.31	0.0355	0.05	Q	.	.	.	.
16.46	0.0360	0.03	Q	.	.	.	.
16.62	0.0364	0.03	Q	.	.	.	.
16.77	0.0369	0.03	Q	.	.	.	.
16.93	0.0372	0.03	Q	.	.	.	.
17.08	0.0375	0.02	Q	.	.	.	.
17.24	0.0378	0.02	Q	.	.	.	.
17.39	0.0380	0.02	Q	.	.	.	.
17.55	0.0383	0.02	Q	.	.	.	.
17.70	0.0385	0.02	Q	.	.	.	.
17.86	0.0387	0.02	Q	.	.	.	.
18.01	0.0389	0.01	Q	.	.	.	.
18.17	0.0391	0.01	Q	.	.	.	.
18.32	0.0393	0.01	Q	.	.	.	.
18.48	0.0394	0.01	Q	.	.	.	.

```
 18.63     0.0396     0.01  Q       .        .        .        .
 18.79     0.0397     0.01  Q       .        .        .        .
 18.94     0.0399     0.01  Q       .        .        .        .
 19.10     0.0400     0.01  Q       .        .        .        .
 19.25     0.0401     0.01  Q       .        .        .        .
 19.41     0.0403     0.01  Q       .        .        .        .
 19.56     0.0404     0.01  Q       .        .        .        .
 19.72     0.0405     0.01  Q       .        .        .        .
 19.87     0.0406     0.01  Q       .        .        .        .
 20.03     0.0407     0.01  Q       .        .        .        .
 20.18     0.0409     0.01  Q       .        .        .        .
 20.34     0.0410     0.01  Q       .        .        .        .
 20.49     0.0411     0.01  Q       .        .        .        .
 20.64     0.0412     0.01  Q       .        .        .        .
 20.80     0.0413     0.01  Q       .        .        .        .
 20.95     0.0414     0.01  Q       .        .        .        .
 21.11     0.0415     0.01  Q       .        .        .        .
 21.26     0.0416     0.01  Q       .        .        .        .
 21.42     0.0417     0.01  Q       .        .        .        .
 21.57     0.0418     0.01  Q       .        .        .        .
 21.73     0.0419     0.01  Q       .        .        .        .
 21.88     0.0419     0.01  Q       .        .        .        .
 22.04     0.0420     0.01  Q       .        .        .        .
 22.19     0.0421     0.01  Q       .        .        .        .
 22.35     0.0422     0.01  Q       .        .        .        .
 22.50     0.0423     0.01  Q       .        .        .        .
 22.66     0.0424     0.01  Q       .        .        .        .
 22.81     0.0425     0.01  Q       .        .        .        .
 22.97     0.0425     0.01  Q       .        .        .        .
 23.12     0.0426     0.01  Q       .        .        .        .
 23.28     0.0427     0.01  Q       .        .        .        .
 23.43     0.0428     0.01  Q       .        .        .        .
 23.59     0.0428     0.01  Q       .        .        .        .
 23.74     0.0429     0.01  Q       .        .        .        .
 23.90     0.0430     0.01  Q       .        .        .        .
 24.05     0.0431     0.01  Q       .        .        .        .
 24.21     0.0431     0.00  Q       .        .        .        .                1877.436
 ---------------------------------------------------------------------------
------------------------------------------------------------------------------
   TIME DURATION(minutes) OF PERCENTILES OF ESTIMATED PEAK FLOW RATE:
   (Note: 100% of Peak Flow Rate estimate assumed to have
   an instantaneous time duration)

   Percentile of Estimated              Duration
      Peak Flow Rate                   (minutes)
   ========================           =========
           0%                    1449.2
          10%                      27.9
          20%                      18.6
          30%                       9.3
          40%                       9.3
          50%                       9.3
          60%                       9.3
          70%                       9.3
          80%                       9.3
```

90%	9.3

Hydrograph - Basin D Tributary to Infiltration Basin 2 - 10 Year Storm Event

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==============================================================================
*** NON-HOMOGENEOUS WATERSHED AREA-AVERAGED LOSS RATE (Fm)
    AND LOW LOSS FRACTION ESTIMATIONS FOR AMC I:

    TOTAL 24-HOUR DURATION RAINFALL DEPTH =     2.04 (inches)

    SOIL-COVER    AREA     PERCENT OF    SCS CURVE    LOSS RATE
      TYPE     (Acres)   PERVIOUS AREA    NUMBER    Fp(in./hr.)    YIELD
        1        1.08      100.00       90.(AMC II)    0.400       0.249
        2        0.52       98.00       98.(AMC II)    0.000       0.748

    TOTAL AREA (Acres) =      1.60
                   _
    AREA-AVERAGED LOSS RATE, Fm (in./hr.) =  0.270
                        _
    AREA-AVERAGED LOW LOSS FRACTION, Y = 0.589
==============================================================================
----------------------------------------------------------------------------


    RATIONAL METHOD CALIBRATION COEFFICIENT = 0.99
    TOTAL CATCHMENT AREA(ACRES) =    1.60
    SOIL-LOSS RATE, Fm,(INCH/HR) =  0.270
    LOW LOSS FRACTION = 0.589
    TIME OF CONCENTRATION(MIN.) = 10.90
    SMALL AREA PEAK Q COMPUTED USING PEAK FLOW RATE FORMULA
    USER SPECIFIED RAINFALL VALUES ARE USED
    RETURN FREQUENCY(YEARS) =  10
       5-MINUTE POINT RAINFALL VALUE(INCHES) =  0.23
      30-MINUTE POINT RAINFALL VALUE(INCHES) =  0.54
       1-HOUR   POINT RAINFALL VALUE(INCHES) =  0.61
       3-HOUR   POINT RAINFALL VALUE(INCHES) =  0.94
       6-HOUR   POINT RAINFALL VALUE(INCHES) =  1.23
      24-HOUR   POINT RAINFALL VALUE(INCHES) =  2.04

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

    TOTAL CATCHMENT   RUNOFF  VOLUME(ACRE-FEET) =     0.13
    TOTAL CATCHMENT SOIL-LOSS VOLUME(ACRE-FEET) =     0.14

 ****************************************************************************
   TIME     VOLUME      Q    0.       2.5      5.0      7.5      10.0
  (HOURS)    (AF)     (CFS)
 ----------------------------------------------------------------------------
   0.01    0.0000     0.00  Q       .        .        .        .
   0.20    0.0002     0.02  Q       .        .        .        .
   0.38    0.0005     0.02  Q       .        .        .        .
   0.56    0.0008     0.02  Q       .        .        .        .
   0.74    0.0011     0.02  Q       .        .        .        .
   0.92    0.0014     0.02  Q       .        .        .        .
   1.10    0.0017     0.02  Q       .        .        .        .
   1.29    0.0020     0.02  Q       .        .        .        .
   1.47    0.0023     0.02  Q       .        .        .        .
   1.65    0.0027     0.02  Q       .        .        .        .
```

1.83	0.0030	0.02	Q	.	.	.	.
2.01	0.0033	0.02	Q	.	.	.	.
2.19	0.0036	0.02	Q	.	.	.	.
2.38	0.0040	0.02	Q	.	.	.	.
2.56	0.0043	0.02	Q	.	.	.	.
2.74	0.0046	0.02	Q	.	.	.	.
2.92	0.0050	0.02	Q	.	.	.	.
3.10	0.0053	0.02	Q	.	.	.	.
3.28	0.0057	0.02	Q	.	.	.	.
3.47	0.0060	0.02	Q	.	.	.	.
3.65	0.0064	0.02	Q	.	.	.	.
3.83	0.0067	0.02	Q	.	.	.	.
4.01	0.0071	0.02	Q	.	.	.	.
4.19	0.0074	0.02	Q	.	.	.	.
4.37	0.0078	0.02	Q	.	.	.	.
4.56	0.0082	0.02	Q	.	.	.	.
4.74	0.0085	0.02	Q	.	.	.	.
4.92	0.0089	0.03	Q	.	.	.	.
5.10	0.0093	0.03	Q	.	.	.	.
5.28	0.0097	0.03	Q	.	.	.	.
5.46	0.0101	0.03	Q	.	.	.	.
5.64	0.0105	0.03	Q	.	.	.	.
5.83	0.0109	0.03	Q	.	.	.	.
6.01	0.0113	0.03	Q	.	.	.	.
6.19	0.0117	0.03	Q	.	.	.	.
6.37	0.0121	0.03	Q	.	.	.	.
6.55	0.0125	0.03	Q	.	.	.	.
6.74	0.0129	0.03	Q	.	.	.	.
6.92	0.0134	0.03	Q	.	.	.	.
7.10	0.0138	0.03	Q	.	.	.	.
7.28	0.0142	0.03	Q	.	.	.	.
7.46	0.0147	0.03	Q	.	.	.	.
7.64	0.0151	0.03	Q	.	.	.	.
7.83	0.0156	0.03	Q	.	.	.	.
8.01	0.0160	0.03	Q	.	.	.	.
8.19	0.0165	0.03	Q	.	.	.	.
8.37	0.0170	0.03	Q	.	.	.	.
8.55	0.0175	0.03	Q	.	.	.	.
8.73	0.0179	0.03	Q	.	.	.	.
8.91	0.0184	0.03	Q	.	.	.	.
9.10	0.0189	0.03	Q	.	.	.	.
9.28	0.0195	0.03	Q	.	.	.	.
9.46	0.0200	0.03	Q	.	.	.	.
9.64	0.0205	0.04	Q	.	.	.	.
9.82	0.0211	0.04	Q	.	.	.	.
10.01	0.0216	0.04	Q	.	.	.	.
10.19	0.0222	0.04	Q	.	.	.	.
10.37	0.0227	0.04	Q	.	.	.	.
10.55	0.0233	0.04	Q	.	.	.	.
10.73	0.0239	0.04	Q	.	.	.	.
10.91	0.0245	0.04	Q	.	.	.	.
11.10	0.0251	0.04	Q	.	.	.	.
11.28	0.0258	0.04	Q	.	.	.	.
11.46	0.0264	0.04	Q	.	.	.	.
11.64	0.0271	0.04	Q	.	.	.	.

11.82	0.0278	0.05	Q . . . .
12.00	0.0285	0.05	Q . . . .
12.19	0.0292	0.05	Q . . . .
12.37	0.0300	0.05	Q . . . .
12.55	0.0308	0.06	Q . . . .
12.73	0.0317	0.06	Q . . . .
12.91	0.0325	0.06	Q . . . .
13.09	0.0334	0.06	Q . . . .
13.27	0.0344	0.06	Q . . . .
13.46	0.0353	0.07	Q . . . .
13.64	0.0364	0.07	Q . . . .
13.82	0.0374	0.07	Q . . . .
14.00	0.0385	0.08	Q . . . .
14.18	0.0397	0.08	Q . . . .
14.37	0.0409	0.09	Q . . . .
14.55	0.0423	0.09	Q . . . .
14.73	0.0437	0.10	Q . . . .
14.91	0.0452	0.11	Q . . . .
15.09	0.0469	0.12	Q . . . .
15.27	0.0488	0.13	Q . . . .
15.45	0.0506	0.11	Q . . . .
15.64	0.0521	0.08	Q . . . .
15.82	0.0550	0.31	.Q . . . .
16.00	0.0626	0.71	. Q . . . .
16.18	0.0865	2.47	. Q. . . .
16.36	0.1059	0.10	Q . . . .
16.55	0.1077	0.14	Q . . . .
16.73	0.1096	0.11	Q . . . .
16.91	0.1111	0.09	Q . . . .
17.09	0.1125	0.08	Q . . . .
17.27	0.1137	0.07	Q . . . .
17.45	0.1147	0.07	Q . . . .
17.64	0.1157	0.06	Q . . . .
17.82	0.1166	0.06	Q . . . .
18.00	0.1174	0.05	Q . . . .
18.18	0.1182	0.05	Q . . . .
18.36	0.1189	0.05	Q . . . .
18.54	0.1196	0.04	Q . . . .
18.73	0.1202	0.04	Q . . . .
18.91	0.1208	0.04	Q . . . .
19.09	0.1214	0.04	Q . . . .
19.27	0.1220	0.04	Q . . . .
19.45	0.1225	0.04	Q . . . .
19.63	0.1230	0.03	Q . . . .
19.82	0.1235	0.03	Q . . . .
20.00	0.1240	0.03	Q . . . .
20.18	0.1245	0.03	Q . . . .
20.36	0.1249	0.03	Q . . . .
20.54	0.1254	0.03	Q . . . .
20.72	0.1258	0.03	Q . . . .
20.91	0.1263	0.03	Q . . . .
21.09	0.1267	0.03	Q . . . .
21.27	0.1271	0.03	Q . . . .
21.45	0.1275	0.03	Q . . . .
21.63	0.1279	0.03	Q . . . .

21.81	0.1283	0.03	Q	.	.	.	.		
21.99	0.1286	0.02	Q	.	.	.	.		
22.18	0.1290	0.02	Q	.	.	.	.		
22.36	0.1293	0.02	Q	.	.	.	.		
22.54	0.1297	0.02	Q	.	.	.	.		
22.72	0.1300	0.02	Q	.	.	.	.		
22.90	0.1304	0.02	Q	.	.	.	.		
23.08	0.1307	0.02	Q	.	.	.	.		
23.27	0.1311	0.02	Q	.	.	.	.		
23.45	0.1314	0.02	Q	.	.	.	.		
23.63	0.1317	0.02	Q	.	.	.	.		
23.81	0.1320	0.02	Q	.	.	.	.		
23.99	0.1323	0.02	Q	.	.	.	.		
24.17	0.1326	0.02	Q	.	.	.	.		
24.36	0.1328	0.00	Q	.	.	.	.		5784.768

Routed Hydrograph - Basin D routed thru Basin 2 - 10 Year Storm Event

===

FLOW-THROUGH DETENTION BASIN MODEL

SPECIFIED BASIN CONDITIONS ARE AS FOLLOWS:
CONSTANT HYDROGRAPH TIME UNIT(MINUTES) = 10.900
DEAD STORAGE(AF) = 0.00
SPECIFIED DEAD STORAGE(AF) FILLED = 0.00
ASSUMED INITIAL DEPTH(FEET) IN STORAGE BASIN = 0.00

```
              INFLOW
                |
                |
                |
                V               __effective depth
          -------------         |  (and volume)
          |           |    |    |
          | detention |    |....V............
          |   basin   |<-->|         outflow
          |           |    |.........__________
          -------------    |         |  \
                |          | storage |    basin outlet
                V          -----------
             OUTFLOW
```

DEPTH-VS.-STORAGE AND DEPTH-VS.-DISCHARGE INFORMATION:
TOTAL NUMBER OF BASIN DEPTH INFORMATION ENTRIES = 4

*BASIN-DEPTH * (FEET)	STORAGE (ACRE-FEET)	OUTFLOW (CFS)	**BASIN-DEPTH ** (FEET)	STORAGE (ACRE-FEET)	OUTFLOW (CFS) *
* 0.000	0.000	0.000**	1.000	0.010	0.000*
* 2.000	0.030	0.000**	3.000	0.070	4.700*

BASIN STORAGE, OUTFLOW AND DEPTH ROUTING VALUES:

INTERVAL NUMBER	DEPTH (FEET)	{S-O*DT/2} (ACRE-FEET)	{S+O*DT/2} (ACRE-FEET)
1	0.00	0.00000	0.00000
2	1.00	0.01000	0.01000
3	2.00	0.03000	0.03000
4	3.00	0.03472	0.10528

WHERE S=STORAGE(AF);O=OUTFLOW(AF/MIN.);DT=UNIT INTERVAL(MIN.)

DETENTION BASIN ROUTING RESULTS:
NOTE: COMPUTED BASIN DEPTH, OUTFLOW, AND STORAGE QUANTITIES OCCUR AT THE GIVEN TIME. BASIN INFLOW VALUES REPRESENT THE AVERAGE INFLOW DURING THE RECENT HYDROGRAPH UNIT INTERVAL.

TIME (HRS)	DEAD-STORAGE FILLED(AF)	INFLOW (CFS)	EFFECTIVE DEPTH(FT)	OUTFLOW (CFS)	EFFECTIVE VOLUME(AF)
0.013	0.000	0.00	0.00	0.00	0.000
0.195	0.000	0.02	0.03	0.00	0.000

0.377	0.000	0.02	0.06	0.00	0.001
0.558	0.000	0.02	0.09	0.00	0.001
0.740	0.000	0.02	0.12	0.00	0.001
0.922	0.000	0.02	0.15	0.00	0.002
1.103	0.000	0.02	0.19	0.00	0.002
1.285	0.000	0.02	0.22	0.00	0.002
1.467	0.000	0.02	0.25	0.00	0.002
1.648	0.000	0.02	0.28	0.00	0.003
1.830	0.000	0.02	0.31	0.00	0.003
2.012	0.000	0.02	0.35	0.00	0.003
2.193	0.000	0.02	0.38	0.00	0.004
2.375	0.000	0.02	0.41	0.00	0.004
2.557	0.000	0.02	0.45	0.00	0.004
2.738	0.000	0.02	0.48	0.00	0.005
2.920	0.000	0.02	0.51	0.00	0.005
3.102	0.000	0.02	0.55	0.00	0.005
3.283	0.000	0.02	0.58	0.00	0.006
3.465	0.000	0.02	0.62	0.00	0.006
3.647	0.000	0.02	0.65	0.00	0.007
3.828	0.000	0.02	0.69	0.00	0.007
4.010	0.000	0.02	0.73	0.00	0.007
4.192	0.000	0.02	0.76	0.00	0.008
4.373	0.000	0.02	0.80	0.00	0.008
4.555	0.000	0.02	0.84	0.00	0.008
4.737	0.000	0.02	0.87	0.00	0.009
4.918	0.000	0.03	0.91	0.00	0.009
5.100	0.000	0.03	0.95	0.00	0.009
5.282	0.000	0.03	0.99	0.00	0.010
5.463	0.000	0.03	1.01	0.00	0.010
5.645	0.000	0.03	1.03	0.00	0.011
5.827	0.000	0.03	1.05	0.00	0.011
6.008	0.000	0.03	1.07	0.00	0.011
6.190	0.000	0.03	1.09	0.00	0.012
6.372	0.000	0.03	1.11	0.00	0.012
6.553	0.000	0.03	1.14	0.00	0.013
6.735	0.000	0.03	1.16	0.00	0.013
6.917	0.000	0.03	1.18	0.00	0.014
7.098	0.000	0.03	1.20	0.00	0.014
7.280	0.000	0.03	1.22	0.00	0.014
7.462	0.000	0.03	1.24	0.00	0.015
7.643	0.000	0.03	1.27	0.00	0.015
7.825	0.000	0.03	1.29	0.00	0.016
8.007	0.000	0.03	1.31	0.00	0.016
8.188	0.000	0.03	1.34	0.00	0.017
8.370	0.000	0.03	1.36	0.00	0.017
8.552	0.000	0.03	1.38	0.00	0.018
8.733	0.000	0.03	1.41	0.00	0.018
8.915	0.000	0.03	1.43	0.00	0.019
9.097	0.000	0.03	1.46	0.00	0.019
9.278	0.000	0.03	1.49	0.00	0.020
9.460	0.000	0.03	1.51	0.00	0.020
9.642	0.000	0.04	1.54	0.00	0.021
9.823	0.000	0.04	1.57	0.00	0.021
10.005	0.000	0.04	1.59	0.00	0.022
10.187	0.000	0.04	1.62	0.00	0.022

10.368	0.000	0.04	1.65	0.00	0.023
10.550	0.000	0.04	1.68	0.00	0.024
10.732	0.000	0.04	1.71	0.00	0.024
10.913	0.000	0.04	1.74	0.00	0.025
11.095	0.000	0.04	1.77	0.00	0.025
11.277	0.000	0.04	1.81	0.00	0.026
11.458	0.000	0.04	1.84	0.00	0.027
11.640	0.000	0.04	1.87	0.00	0.027
11.822	0.000	0.05	1.91	0.00	0.028
12.003	0.000	0.05	1.94	0.00	0.029
12.185	0.000	0.05	1.98	0.00	0.030
12.367	0.000	0.05	2.01	0.01	0.030
12.548	0.000	0.06	2.01	0.04	0.030
12.730	0.000	0.06	2.01	0.05	0.030
12.912	0.000	0.06	2.01	0.06	0.031
13.093	0.000	0.06	2.01	0.06	0.031
13.275	0.000	0.06	2.01	0.06	0.031
13.457	0.000	0.07	2.01	0.06	0.031
13.638	0.000	0.07	2.01	0.07	0.031
13.820	0.000	0.07	2.02	0.07	0.031
14.002	0.000	0.08	2.02	0.07	0.031
14.183	0.000	0.08	2.02	0.08	0.031
14.365	0.000	0.09	2.02	0.08	0.031
14.547	0.000	0.09	2.02	0.09	0.031
14.728	0.000	0.10	2.02	0.09	0.031
14.910	0.000	0.11	2.02	0.10	0.031
15.092	0.000	0.12	2.03	0.11	0.031
15.273	0.000	0.13	2.03	0.12	0.031
15.455	0.000	0.11	2.02	0.12	0.031
15.637	0.000	0.08	2.02	0.10	0.031
15.818	0.000	0.31	2.06	0.19	0.033
16.000	0.000	0.71	2.15	0.49	0.036
16.182	0.000	2.47	2.50	1.52	0.050
16.363	0.000	0.10	2.05	1.30	0.032
16.545	0.000	0.14	2.03	0.20	0.031
16.727	0.000	0.11	2.02	0.13	0.031
16.908	0.000	0.09	2.02	0.11	0.031
17.090	0.000	0.08	2.02	0.09	0.031
17.272	0.000	0.07	2.02	0.08	0.031
17.453	0.000	0.07	2.01	0.07	0.031
17.635	0.000	0.06	2.01	0.07	0.031
17.817	0.000	0.06	2.01	0.06	0.030
17.998	0.000	0.05	2.01	0.06	0.030
18.180	0.000	0.05	2.01	0.05	0.030
18.362	0.000	0.05	2.01	0.05	0.030
18.543	0.000	0.04	2.01	0.04	0.030
18.725	0.000	0.04	2.01	0.04	0.030
18.907	0.000	0.04	2.01	0.04	0.030
19.088	0.000	0.04	2.01	0.04	0.030
19.270	0.000	0.04	2.01	0.04	0.030
19.452	0.000	0.04	2.01	0.04	0.030
19.633	0.000	0.03	2.01	0.03	0.030
19.815	0.000	0.03	2.01	0.03	0.030
19.997	0.000	0.03	2.01	0.03	0.030
20.178	0.000	0.03	2.01	0.03	0.030

20.360	0.000	0.03	2.01	0.03	0.030
20.542	0.000	0.03	2.01	0.03	0.030
20.723	0.000	0.03	2.01	0.03	0.030
20.905	0.000	0.03	2.01	0.03	0.030
21.087	0.000	0.03	2.01	0.03	0.030
21.268	0.000	0.03	2.01	0.03	0.030
21.450	0.000	0.03	2.01	0.03	0.030
21.632	0.000	0.03	2.01	0.03	0.030
21.813	0.000	0.03	2.01	0.03	0.030
21.995	0.000	0.02	2.01	0.02	0.030
22.177	0.000	0.02	2.01	0.02	0.030
22.358	0.000	0.02	2.01	0.02	0.030
22.540	0.000	0.02	2.00	0.02	0.030
22.722	0.000	0.02	2.00	0.02	0.030
22.903	0.000	0.02	2.00	0.02	0.030
23.085	0.000	0.02	2.00	0.02	0.030
23.267	0.000	0.02	2.00	0.02	0.030
23.448	0.000	0.02	2.00	0.02	0.030
23.630	0.000	0.02	2.00	0.02	0.030
23.812	0.000	0.02	2.00	0.02	0.030
23.993	0.000	0.02	2.00	0.02	0.030
24.175	0.000	0.02	2.00	0.02	0.030
24.357	0.000	0.00	2.00	0.01	0.030

Hydrograph - Basin E Tributary to Infiltration Basin 3 - 10 Year Storm Event

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===============================================================================
 *** NON-HOMOGENEOUS WATERSHED AREA-AVERAGED LOSS RATE (Fm)
     AND LOW LOSS FRACTION ESTIMATIONS FOR AMC I:

     TOTAL 24-HOUR DURATION RAINFALL DEPTH =     2.04 (inches)

     SOIL-COVER     AREA     PERCENT OF    SCS CURVE    LOSS RATE
       TYPE       (Acres)   PERVIOUS AREA    NUMBER    Fp(in./hr.)    YIELD
         1          0.53        0.00       98.(AMC II)    0.000       0.889
         2         12.84      100.00       90.(AMC II)    0.400       0.249

     TOTAL AREA (Acres) =     13.37
                       _
     AREA-AVERAGED LOSS RATE, Fm (in./hr.) =  0.384
                            _
     AREA-AVERAGED LOW LOSS FRACTION, Y = 0.726
===============================================================================

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


     RATIONAL METHOD CALIBRATION COEFFICIENT = 1.00
     TOTAL CATCHMENT AREA(ACRES) =   13.37
     SOIL-LOSS RATE, Fm,(INCH/HR) =  0.384
     LOW LOSS FRACTION = 0.726
     TIME OF CONCENTRATION(MIN.) = 16.50
     SMALL AREA PEAK Q COMPUTED USING PEAK FLOW RATE FORMULA
     USER SPECIFIED RAINFALL VALUES ARE USED
     RETURN FREQUENCY(YEARS) =  10
       5-MINUTE POINT RAINFALL VALUE(INCHES) =  0.23
      30-MINUTE POINT RAINFALL VALUE(INCHES) =  0.54
       1-HOUR   POINT RAINFALL VALUE(INCHES) =  0.61
       3-HOUR   POINT RAINFALL VALUE(INCHES) =  0.94
       6-HOUR   POINT RAINFALL VALUE(INCHES) =  1.23
      24-HOUR   POINT RAINFALL VALUE(INCHES) =  2.04

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

     TOTAL CATCHMENT   RUNOFF  VOLUME(ACRE-FEET) =     0.83
     TOTAL CATCHMENT SOIL-LOSS VOLUME(ACRE-FEET) =     1.44

 ****************************************************************************
   TIME     VOLUME       Q    0.       5.0      10.0      15.0      20.0
  (HOURS)    (AF)      (CFS)
 ----------------------------------------------------------------------------
   0.05     0.0000     0.00  Q        .        .         .         .
   0.32     0.0013     0.11  Q        .        .         .         .
   0.60     0.0039     0.12  Q        .        .         .         .
   0.88     0.0065     0.12  Q        .        .         .         .
   1.15     0.0092     0.12  Q        .        .         .         .
   1.42     0.0119     0.12  Q        .        .         .         .
   1.70     0.0146     0.12  Q        .        .         .         .
   1.98     0.0174     0.12  Q        .        .         .         .
   2.25     0.0202     0.12  Q        .        .         .         .
```

2.53	0.0230	0.13	Q	.	.	.	.
2.80	0.0259	0.13	Q	.	.	.	.
3.08	0.0288	0.13	Q	.	.	.	.
3.35	0.0317	0.13	Q	.	.	.	.
3.62	0.0347	0.13	Q	.	.	.	.
3.90	0.0378	0.13	Q	.	.	.	.
4.18	0.0408	0.14	Q	.	.	.	.
4.45	0.0439	0.14	Q	.	.	.	.
4.72	0.0471	0.14	Q	.	.	.	.
5.00	0.0503	0.14	Q	.	.	.	.
5.28	0.0536	0.14	Q	.	.	.	.
5.55	0.0569	0.15	Q	.	.	.	.
5.82	0.0603	0.15	Q	.	.	.	.
6.10	0.0637	0.15	Q	.	.	.	.
6.38	0.0672	0.16	Q	.	.	.	.
6.65	0.0707	0.16	Q	.	.	.	.
6.93	0.0743	0.16	Q	.	.	.	.
7.20	0.0780	0.16	Q	.	.	.	.
7.47	0.0817	0.17	Q	.	.	.	.
7.75	0.0856	0.17	Q	.	.	.	.
8.02	0.0895	0.17	Q	.	.	.	.
8.30	0.0935	0.18	Q	.	.	.	.
8.57	0.0975	0.18	Q	.	.	.	.
8.85	0.1017	0.19	Q	.	.	.	.
9.12	0.1060	0.19	Q	.	.	.	.
9.40	0.1104	0.19	Q	.	.	.	.
9.68	0.1149	0.20	Q	.	.	.	.
9.95	0.1195	0.20	Q	.	.	.	.
10.23	0.1242	0.21	Q	.	.	.	.
10.50	0.1291	0.22	Q	.	.	.	.
10.77	0.1342	0.23	Q	.	.	.	.
11.05	0.1394	0.23	Q	.	.	.	.
11.32	0.1447	0.24	Q	.	.	.	.
11.60	0.1503	0.25	Q	.	.	.	.
11.88	0.1561	0.26	Q	.	.	.	.
12.15	0.1621	0.27	Q	.	.	.	.
12.43	0.1686	0.30	Q	.	.	.	.
12.70	0.1756	0.31	Q	.	.	.	.
12.98	0.1829	0.33	Q	.	.	.	.
13.25	0.1907	0.35	Q	.	.	.	.
13.52	0.1988	0.37	Q	.	.	.	.
13.80	0.2075	0.39	Q	.	.	.	.
14.07	0.2169	0.43	Q	.	.	.	.
14.35	0.2270	0.46	Q	.	.	.	.
14.62	0.2383	0.53	.Q	.	.	.	.
14.90	0.2507	0.57	.Q	.	.	.	.
15.18	0.2649	0.69	.Q	.	.	.	.
15.45	0.2815	0.77	.Q	.	.	.	.
15.73	0.2965	0.54	.Q	.	.	.	.
16.00	0.3242	1.90	. Q	.	.	.	.
16.27	0.5119	14.61	.	.	.	Q.	.
16.55	0.6846	0.58	.Q	.	.	.	.
16.83	0.6982	0.62	.Q	.	.	.	.
17.10	0.7109	0.49	Q	.	.	.	.
17.38	0.7211	0.41	Q	.	.	.	.

17.65	0.7298	0.36	Q	.	.	.	.		
17.92	0.7376	0.32	Q	.	.	.	.		
18.20	0.7446	0.29	Q	.	.	.	.		
18.48	0.7508	0.25	Q	.	.	.	.		
18.75	0.7563	0.24	Q	.	.	.	.		
19.02	0.7615	0.22	Q	.	.	.	.		
19.30	0.7664	0.21	Q	.	.	.	.		
19.58	0.7711	0.20	Q	.	.	.	.		
19.85	0.7754	0.19	Q	.	.	.	.		
20.12	0.7796	0.18	Q	.	.	.	.		
20.40	0.7836	0.17	Q	.	.	.	.		
20.67	0.7874	0.17	Q	.	.	.	.		
20.95	0.7911	0.16	Q	.	.	.	.		
21.23	0.7947	0.15	Q	.	.	.	.		
21.50	0.7981	0.15	Q	.	.	.	.		
21.77	0.8014	0.14	Q	.	.	.	.		
22.05	0.8046	0.14	Q	.	.	.	.		
22.33	0.8077	0.14	Q	.	.	.	.		
22.60	0.8107	0.13	Q	.	.	.	.		
22.88	0.8137	0.13	Q	.	.	.	.		
23.15	0.8166	0.12	Q	.	.	.	.		
23.42	0.8194	0.12	Q	.	.	.	.		
23.70	0.8221	0.12	Q	.	.	.	.		
23.98	0.8248	0.12	Q	.	.	.	.		
24.25	0.8274	0.11	Q	.	.	.	.		
24.52	0.8287	0.00	Q	.	.	.	.		36098.17

Routed Hydrograph - Basin E routed thru Basin 3 - 10 Year Storm Event

==

FLOW-THROUGH DETENTION BASIN MODEL

SPECIFIED BASIN CONDITIONS ARE AS FOLLOWS:
CONSTANT HYDROGRAPH TIME UNIT(MINUTES) = 16.500
DEAD STORAGE(AF) = 0.00
SPECIFIED DEAD STORAGE(AF) FILLED = 0.00
ASSUMED INITIAL DEPTH(FEET) IN STORAGE BASIN = 0.00

```
           INFLOW
             |
             |
             |
             V              __effective depth
        -------------        |  (and volume)
        |           |   |    |
        | detention |   |....V............
        |   basin   |<-->|        outflow
        |           |   |.........__________
        -------------    |        |  \
             |          | storage |     basin outlet
             V           -----------
          OUTFLOW
```

DEPTH-VS.-STORAGE AND DEPTH-VS.-DISCHARGE INFORMATION:
TOTAL NUMBER OF BASIN DEPTH INFORMATION ENTRIES = 3

```
*BASIN-DEPTH  STORAGE    OUTFLOW  **BASIN-DEPTH  STORAGE    OUTFLOW
*  (FEET)  (ACRE-FEET)   (CFS)   **  (FEET)  (ACRE-FEET)   (CFS)  *
*    0.000     0.000     0.000**     1.000     0.080     0.000*
*    2.000     0.170    43.500**
```

BASIN STORAGE, OUTFLOW AND DEPTH ROUTING VALUES:

INTERVAL NUMBER	DEPTH (FEET)	{S-O*DT/2} (ACRE-FEET)	{S+O*DT/2} (ACRE-FEET)
1	0.00	0.00000	0.00000
2	1.00	0.08000	0.08000
3	2.00	-0.32432	0.66432

WHERE S=STORAGE(AF);O=OUTFLOW(AF/MIN.);DT=UNIT INTERVAL(MIN.)

DETENTION BASIN ROUTING RESULTS:
NOTE: COMPUTED BASIN DEPTH, OUTFLOW, AND STORAGE QUANTITIES
OCCUR AT THE GIVEN TIME. BASIN INFLOW VALUES REPRESENT THE
AVERAGE INFLOW DURING THE RECENT HYDROGRAPH UNIT INTERVAL.

TIME (HRS)	DEAD-STORAGE FILLED(AF)	INFLOW (CFS)	EFFECTIVE DEPTH(FT)	OUTFLOW (CFS)	EFFECTIVE VOLUME(AF)
0.050	0.000	0.00	0.00	0.00	0.000
0.325	0.000	0.11	0.03	0.00	0.003
0.600	0.000	0.12	0.07	0.00	0.005
0.875	0.000	0.12	0.10	0.00	0.008
1.150	0.000	0.12	0.13	0.00	0.011

1.425	0.000	0.12	0.17	0.00	0.013
1.700	0.000	0.12	0.20	0.00	0.016
1.975	0.000	0.12	0.23	0.00	0.019
2.250	0.000	0.12	0.27	0.00	0.022
2.525	0.000	0.13	0.31	0.00	0.024
2.800	0.000	0.13	0.34	0.00	0.027
3.075	0.000	0.13	0.38	0.00	0.030
3.350	0.000	0.13	0.42	0.00	0.033
3.625	0.000	0.13	0.45	0.00	0.036
3.900	0.000	0.13	0.49	0.00	0.039
4.175	0.000	0.14	0.53	0.00	0.042
4.450	0.000	0.14	0.57	0.00	0.046
4.725	0.000	0.14	0.61	0.00	0.049
5.000	0.000	0.14	0.65	0.00	0.052
5.275	0.000	0.14	0.69	0.00	0.055
5.550	0.000	0.15	0.73	0.00	0.059
5.825	0.000	0.15	0.77	0.00	0.062
6.100	0.000	0.15	0.82	0.00	0.065
6.375	0.000	0.16	0.86	0.00	0.069
6.650	0.000	0.16	0.91	0.00	0.072
6.925	0.000	0.16	0.95	0.00	0.076
7.200	0.000	0.16	1.00	0.00	0.080
7.475	0.000	0.17	1.01	0.14	0.081
7.750	0.000	0.17	1.00	0.19	0.080
8.025	0.000	0.17	1.01	0.16	0.080
8.300	0.000	0.18	1.00	0.18	0.080
8.575	0.000	0.18	1.00	0.18	0.080
8.850	0.000	0.19	1.00	0.19	0.080
9.125	0.000	0.19	1.00	0.19	0.080
9.400	0.000	0.19	1.00	0.20	0.080
9.675	0.000	0.20	1.00	0.20	0.080
9.950	0.000	0.20	1.00	0.21	0.080
10.225	0.000	0.21	1.01	0.21	0.080
10.500	0.000	0.22	1.00	0.22	0.080
10.775	0.000	0.23	1.01	0.22	0.080
11.050	0.000	0.23	1.01	0.23	0.080
11.325	0.000	0.24	1.01	0.24	0.081
11.600	0.000	0.25	1.01	0.25	0.081
11.875	0.000	0.26	1.01	0.26	0.081
12.150	0.000	0.27	1.01	0.27	0.081
12.425	0.000	0.30	1.01	0.30	0.081
12.700	0.000	0.31	1.01	0.31	0.081
12.975	0.000	0.33	1.01	0.33	0.081
13.250	0.000	0.35	1.01	0.35	0.081
13.525	0.000	0.37	1.01	0.37	0.081
13.800	0.000	0.39	1.01	0.39	0.081
14.075	0.000	0.43	1.01	0.42	0.081
14.350	0.000	0.46	1.01	0.46	0.081
14.625	0.000	0.53	1.01	0.52	0.081
14.900	0.000	0.57	1.01	0.57	0.081
15.175	0.000	0.69	1.02	0.67	0.082
15.450	0.000	0.77	1.02	0.77	0.082
15.725	0.000	0.54	1.01	0.58	0.081
16.000	0.000	1.90	1.07	1.67	0.086
16.275	0.000	14.61	1.52	12.82	0.127

16.550	0.000	0.58	0.17	11.34	0.013
16.825	0.000	0.62	0.34	0.00	0.027
17.100	0.000	0.49	0.48	0.00	0.038
17.375	0.000	0.41	0.60	0.00	0.048
17.650	0.000	0.36	0.70	0.00	0.056
17.925	0.000	0.32	0.79	0.00	0.063
18.200	0.000	0.29	0.87	0.00	0.070
18.475	0.000	0.25	0.95	0.00	0.076
18.750	0.000	0.24	1.00	0.04	0.080
19.025	0.000	0.22	1.01	0.20	0.081
19.300	0.000	0.21	1.00	0.23	0.080
19.575	0.000	0.20	1.01	0.19	0.081
19.850	0.000	0.19	1.00	0.20	0.080
20.125	0.000	0.18	1.00	0.17	0.080
20.400	0.000	0.17	1.00	0.18	0.080
20.675	0.000	0.17	1.00	0.16	0.080
20.950	0.000	0.16	1.00	0.16	0.080
21.225	0.000	0.15	1.00	0.15	0.080
21.500	0.000	0.15	1.00	0.15	0.080
21.775	0.000	0.14	1.00	0.14	0.080
22.050	0.000	0.14	1.00	0.14	0.080
22.325	0.000	0.14	1.00	0.14	0.080
22.600	0.000	0.13	1.00	0.13	0.080
22.875	0.000	0.13	1.00	0.13	0.080
23.150	0.000	0.12	1.00	0.12	0.080
23.425	0.000	0.12	1.00	0.12	0.080
23.700	0.000	0.12	1.00	0.12	0.080
23.975	0.000	0.12	1.00	0.12	0.080
24.250	0.000	0.11	1.00	0.11	0.080
24.525	0.000	0.00	0.99	0.06	0.079

Water Quality Calculations

SAN BERNARDINO COUNTY STORMWATER PROGRAM
MODEL WATER QUALITY MANAGEMENT PLAN GUIDANCE

Estimating Volume- and Flow-based BMP Design Runoff Quantities

BMP Drainage Area designation	Area, A	Impervious area ratio, i	Region	NOAA Atlas 14 Precipitation Depth (2-yr 1-Hr Rainfall)	Factor of Safety[1]	Volume-based BMP drawdown time[2]	Composite runoff coefficient, C_{BMP}	Intensity regression coefficient, I	Design rainfall intensity, I_{BMP}	Flow-based BMP treatment flowrate, Q	6-hour rainfall regression coefficient	6-hour mean storm rainfall, P_6	Drawdown time regression constant, a	Maximized detention volume, P_0	Target capture volume, V_0	Target capture volume, V_0
	acres		(Valley, Mountain, or Desert)	inches/hour		(24 or 48) hours			inches/hour	cfs		inches		inches	acre-feet	ft^3
DA-1	6.70	0.24	Desert	0.36	2	48	0.19	0.3250	0.23	0.3029	1.2371	0.45	1.963	0.17	0.094	4108
DA-2	1.60	0.32	Desert	0.36	2	48	0.24	0.3250	0.23	0.0891	1.2371	0.45	1.963	0.21	0.028	1208
DA-3	13.37	0.04	Desert	0.36	2	48	0.07	0.3250	0.23	0.22	1.2371	0.45	1.963	0.06	0.068	2956

Regression Coefficients for Intensity (I) and 6-hour mean storm rainfall (P_6)			
Quantity	Valley	Mountain	Desert
	85% upper confidence limits		
I	0.2787	0.3614	0.3250
P_6	1.4807	1.9090	1.2371

Drawdown Time Regression Constant, a	
Time	a
hours	
24	1.582
48	1.963

Notes:

[1] The SBC MWQMPG recommends a factor of safety of 2.

[2] The SBC MWQMPG recommends a drawdown time of 48 hours. (A shorter time is not feasible for all soil types. A longer time can negatively affect vector control efforts.)

BMP HANDBOOK

Infiltration Basin TC-11

Design Considerations

- Soil for Infiltration
- Slope
- Aesthetics

Targeted Constituents

	Constituent	Removal Effectiveness
☑	Sediment	■
☑	Nutrients	■
☑	Trash	■
☑	Metals	■
☑	Bacteria	■
☑	Oil and Grease	■
☑	Organics	■

Legend ***(Removal Effectiveness)***

● Low ■ High

▲ Medium

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

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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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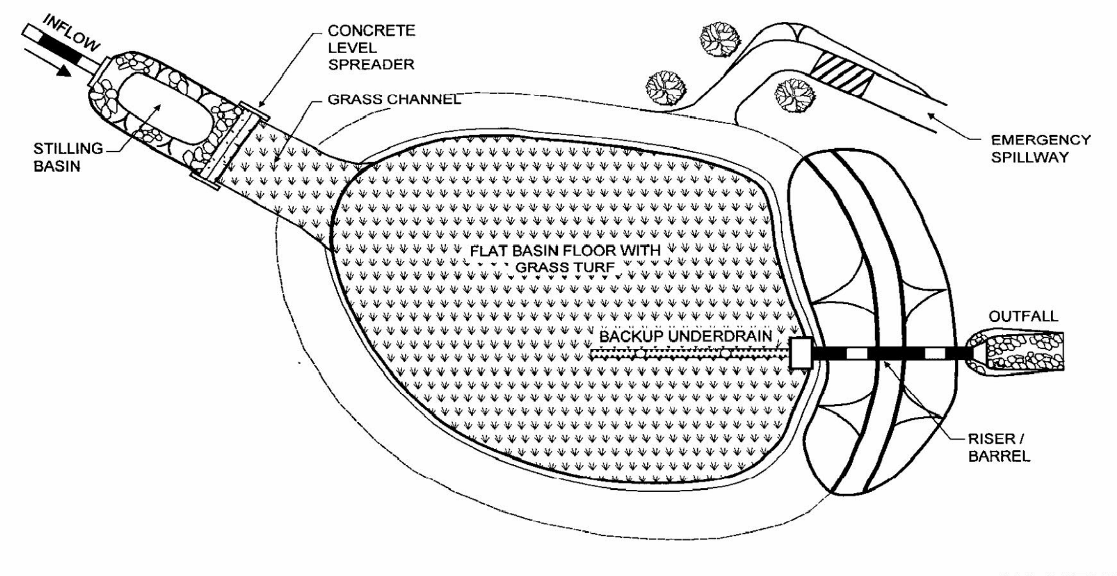
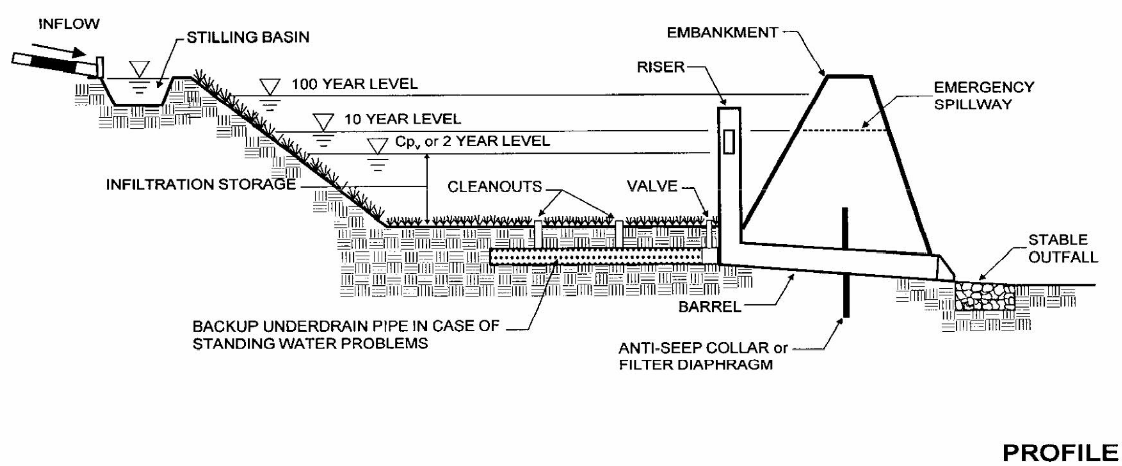


PLAN VIEW



PROFILE

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.

Rain Garden

Design Objectives

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

Description

Various roof runoff controls are available to address stormwater that drains off rooftops. The objective is to reduce the total volume and rate of runoff from individual lots, and retain the pollutants on site that may be picked up from roofing materials and atmospheric deposition. Roof runoff controls consist of directing the roof runoff away from paved areas and mitigating flow to the storm drain system through one of several general approaches: cisterns or rain barrels; dry wells or infiltration trenches; pop-up emitters, and foundation planting. The first three approaches require the roof runoff to be contained in a gutter and downspout system. Foundation planting provides a vegetated strip under the drip line of the roof.

Approach

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

Suitable Applications

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

Design Considerations

Designing New Installations

Cisterns or Rain Barrels

One method of addressing roof runoff is to direct roof downspouts to cisterns or rain barrels. A cistern is an above ground storage vessel with either a manually operated valve or a permanently open outlet. Roof runoff is temporarily stored and then released for irrigation or infiltration between storms. The number of rain barrels needed is a function of the rooftop area. Some low impact developers recommend that every house have at least 2 rain barrels, with a minimum storage capacity of 1000 liters. Roof barrels serve several purposes including mitigating the first flush from the roof which has a high volume, amount of contaminants, and thermal load. Several types of rain barrels are commercially available. Consideration must be given to selecting rain barrels that are vector proof and childproof. In addition, some barrels are designed with a bypass valve that filters out grit and other contaminants and routes overflow to a soak-away pit or rain garden.

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

A cistern system with a permanently open outlet can also provide for metering stormwater runoff. If the cistern outlet is significantly smaller than the size of the downspout inlet (say ¼ to ½ inch diameter), runoff will build up inside the cistern during storms, and will empty out slowly after peak intensities subside. This is a feasible way to mitigate the peak flow increases caused by rooftop impervious land coverage, especially for the frequent, small storms.

Dry wells and Infiltration Trenches

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

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

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

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

Pop-up Drainage Emitter

Roof downspouts can be directed to an underground pipe that daylights some distance from the building foundation, releasing the roof runoff through a pop-up emitter. Similar to a pop-up irrigation head, the emitter only opens when there is flow from the roof. The emitter remains flush to the ground during dry periods, for ease of lawn or landscape maintenance.

Foundation Planting

Landscape planting can be provided around the base to allow increased opportunities for stormwater infiltration and protect the soil from erosion caused by concentrated sheet flow coming off the roof. Foundation plantings can reduce the physical impact of water on the soil and provide a subsurface matrix of roots that encourage infiltration. These plantings must be sturdy enough to tolerate the heavy runoff sheet flows, and periodic soil saturation.

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.

Supplemental Information

Examples

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

Other Resources

Hager, Marty Catherine, Stormwater, "Low-Impact Development", January/February 2003. www.stormh2o.com

Low Impact Urban Design Tools, Low Impact Development Design Center, Beltsville, MD. www.lid-stormwater.net

Start at the Source, Bay Area Stormwater Management Agencies Association, 1999 Edition

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.

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.

Design Objectives

Maximize Infiltration

Provide Retention

Slow Runoff

Minimize Impervious Land Coverage

Prohibit Dumping of Improper Materials

☑ Contain Pollutants

Collect and Convey

Approach

This fact sheet contains details on the specific measures required to prevent or reduce pollutants in stormwater runoff associated with trash storage and handling. Preventative measures including enclosures, containment structures, and impervious pavements to mitigate spills, should be used to reduce the likelihood of contamination.

Suitable Applications

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

Design Considerations

Design requirements for waste handling areas are governed by Building and Fire Codes, and by current local agency ordinances and zoning requirements. The design criteria described in this fact sheet are meant to enhance and be consistent with these code and ordinance requirements. Hazardous waste should be handled in accordance with legal requirements established in Title 22, California Code of Regulation.

Wastes from commercial and industrial sites are typically hauled by either public or commercial carriers that may have design or access requirements for waste storage areas. The design criteria in this fact sheet are recommendations and are not intended to be in conflict with requirements established by the waste hauler. The waste hauler should be contacted prior to the design of your site trash collection areas. Conflicts or issues should be discussed with the local agency.

Designing New Installations

Trash storage areas should be designed to consider the following structural or treatment control BMPs:

- Design trash container areas so that drainage from adjoining roofs and pavement is diverted around the area(s) to avoid run-on. This might include berming or grading the waste handling area to prevent run-on of stormwater.
- Make sure trash container areas are screened or walled to prevent off-site transport of trash.

- 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.

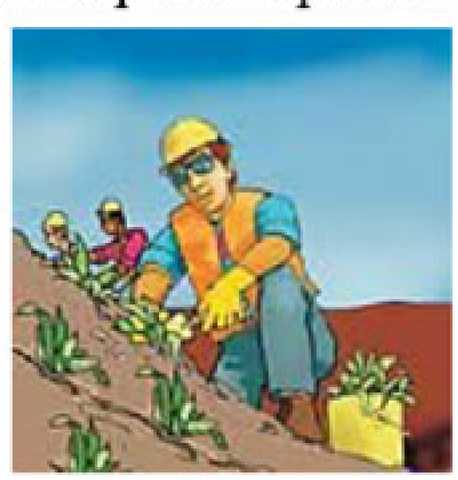
Ventura Countywide Technical Guidance Manual for Stormwater Quality Control Measures, July 2002.

Education Materials

Commercial landscape maintenance:

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

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



General industrial & manufacturing businesses:

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

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

Infiltration Test

ALTEC ENGINEERING CORP.

17995 Hwy 18, Suite 4
Apple Valley, CA 92307
760-242-9900

October 7, 2019

SURFACE RETENTION INFILTRATION TEST

PROPOSED MANUFACTURING FACILITY
A PORTION OF APN 0472-131-17
National Trails Highway
Victorville

PREPARED AT THE REQUEST OF:

MARTINEZ OKAMOTO ARCHITECTS
15487 Seneca Road, # 203
Victorville, CA. 92392

REGISTERED PROFESSIONAL ENGINEER
RANDOLPH J COLEMAN
36293
Exp 6-30-20
SIGN 10/03/19
CIVIL
STATE OF CALIFORNIA

W.O. NO. 19-174

DESCRIPTION OF SITE AND PROPOSAL

This report has been prepared for the site of a proposed concrete manufacturing facility development. The site is located on the west side of National Trails Highway (D Street) approximately 1,500 feet southeast of Air Expressway in Victorville. The legal description of the site is APN 0472-131-03,04,08,10,13,16,& 17.

The on-site retention for the site will be utilizing a surface retention basin located near the west right-of-way of National Trails Highway on Parcel 0472-131-17. Per the site plan provided to this office, this system is to be placed in an undeveloped area of the site.

There has been grading on the site. There are various commercial/industrial/manufacturing facilities to the east and vacant land to the south, west, and north. The natural grade of the existing site slopes generally east at approximately 5% to 8%. Only minor grading will be required to prepare the site for construction.

METHODOLOGY AND PROCEDURES

The infiltration tests for retention system were performed at the proposed location of the system. The testing was performed based upon the procedures for Percolation Test Procedure as outlined by the San Bernardino County Stormwater Program Technical Guidance Document for Water Quality Management Plans (WQMP) dated July 28, 2011.

An exploratory trench was excavated to a depth of approximately 12 feet. The soil profile consists of fine silty sand over coarse to fine grained sand (Drawing No. 6). The test holes were located approximately at the location of the proposed retention facility (Drawing No. 5). The test holes were excavated to a depth of approximately 24 inches below the existing natural grade to the approximate proposed depth of the retention basin.

The test holes were not presoaked with clear water prior to testing as they both as both holes seeped more than 6 inches of water in two consecutive 25 minute intervals. During the initial test measurements, it was determined the soils met the "Sandy Soil Requirements" as described in the guidance document. Measurements continued for an additional 60 minutes until the fall rate was uniform. The fall was then timed to determine a rate in minutes per inch (Drawing No. 7 and 8). This rate was then used to determine the infiltration rate in inches per hour. (Drawing No. 7 and 8).

RESULTS

The sandy soils encountered at the test site did infiltrate at an acceptable rate.

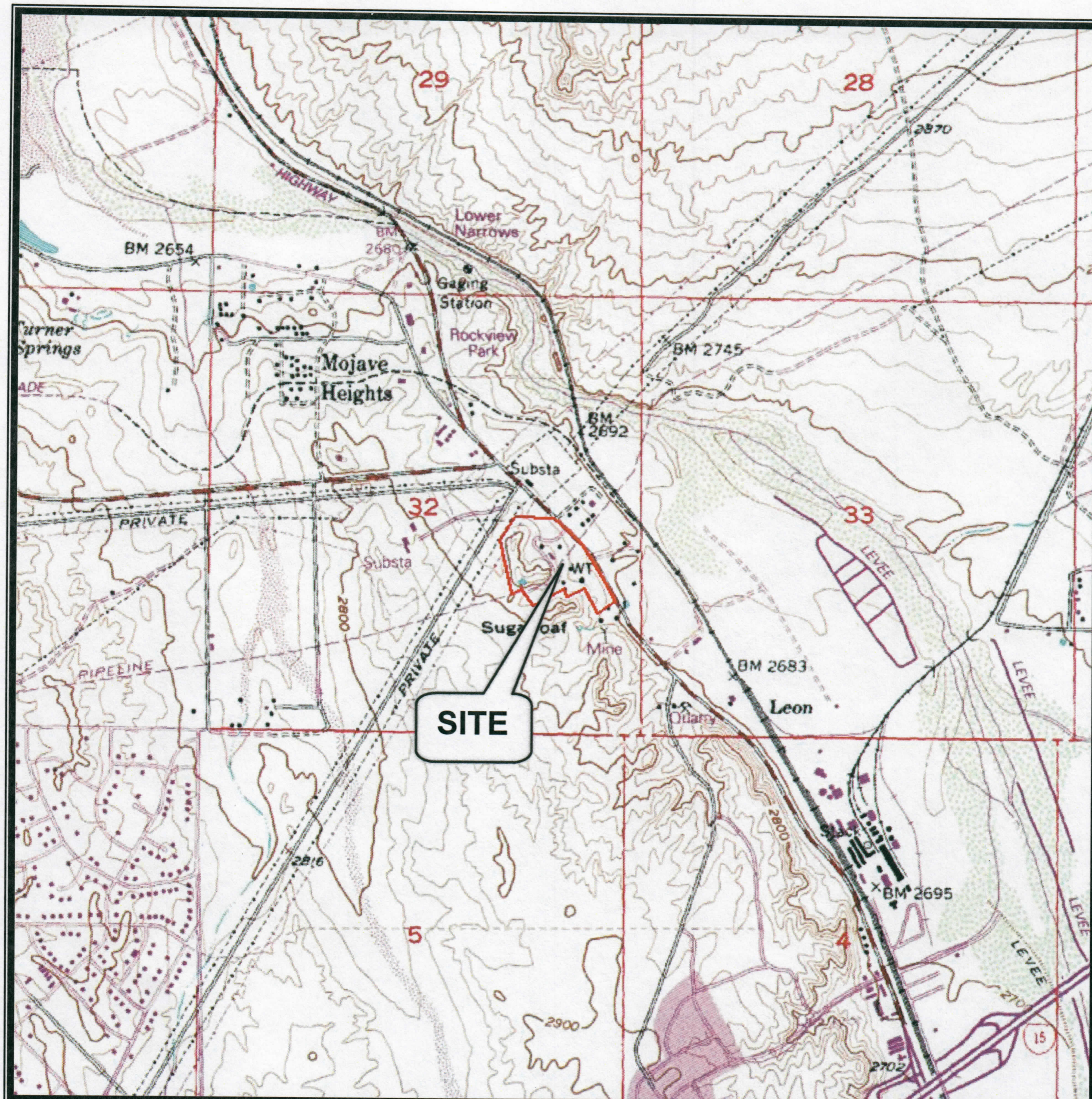
DESIGN

The percolation rate of 1.43 minutes per inch (mpi) will be used for this site. This rate equates to an infiltration rate of 4.54 inches per hour. The design rate to be used for this site is 2.27 inches per hour. Assuming a depth of the retention basin to be 24 inches. If the basin is completely full, it will drain completely in approximately 12 hours, which is within the 72-hour requirement.

RANDOLPH J. COLEMAN, RCE 36293
EXP 6-30-2020

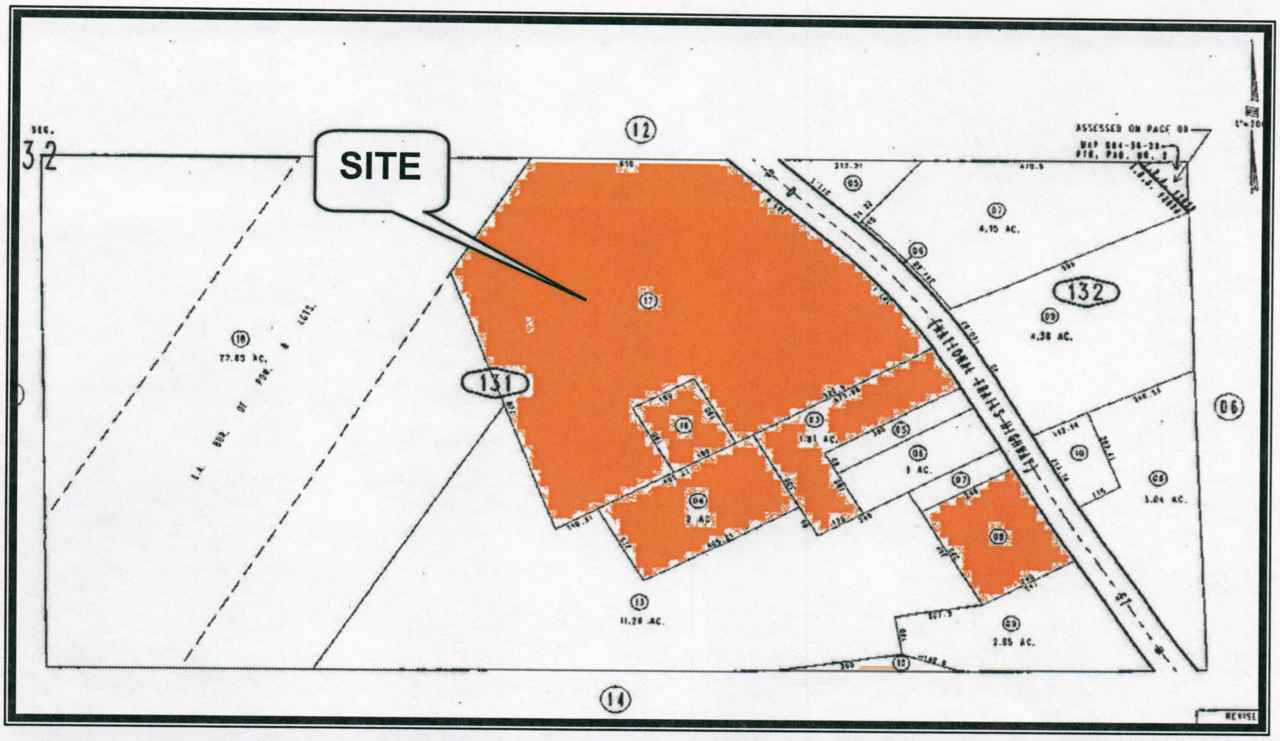
LOCATION MAP - SOUTHWEST SIDE OF NATIONAL TRAILS HIGHWAY SOUTHEAST OF AIR EXPRESSWAY VICTORVILLE

DRAWING 1



USGS QUAD SHEET - VICTORVILLE

DRAWING 2

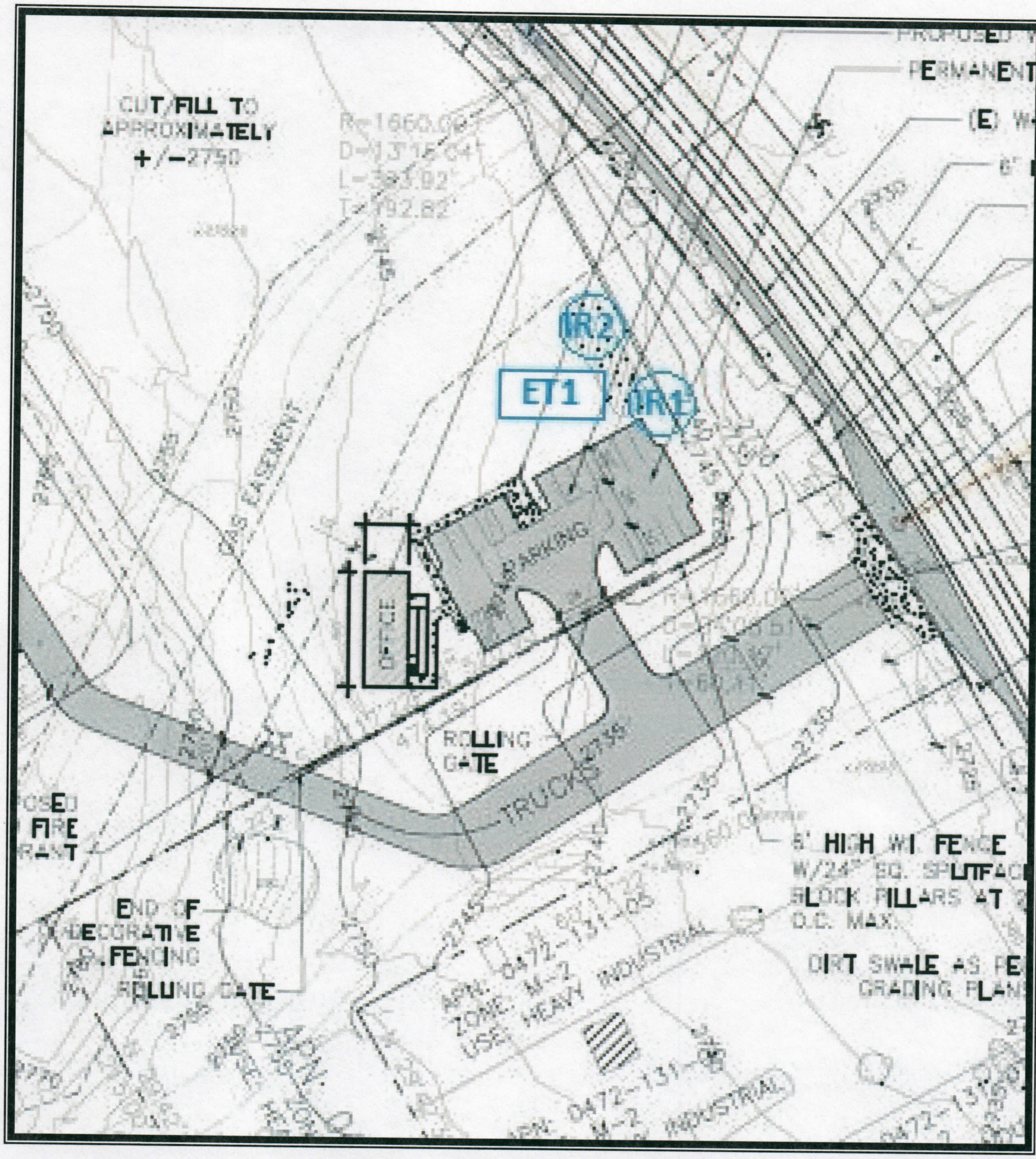


ASSESSOR'S MAP - APN 0472-131-03,04,08,10,13,16, & 17

DRAWING 3

AERIAL PHOTO OF SITE
AUGUST, 2018

DRAWING 4



EXPLORATORY TRENCH AND TEST LOCATIONS

DRAWING 5

TRENCH LOG

TRENCH NO. 1

DEPTH FT	IN PLACE DENSITY (PCF)	MOISTURE (%)	PERCENT COMPACTION	CLASSIF.	
1					Fine Silty Sand, Gray, Dry
2					Coarse to Fine Sand, Gray, Dry,
3					Loose to Medium Dense
4					
5					
6					
7					
8					
9					
10					
11					
12					
13					BOTTOM OF TRENCH NO GROUNDWATER NO VOIDS
14					
15					

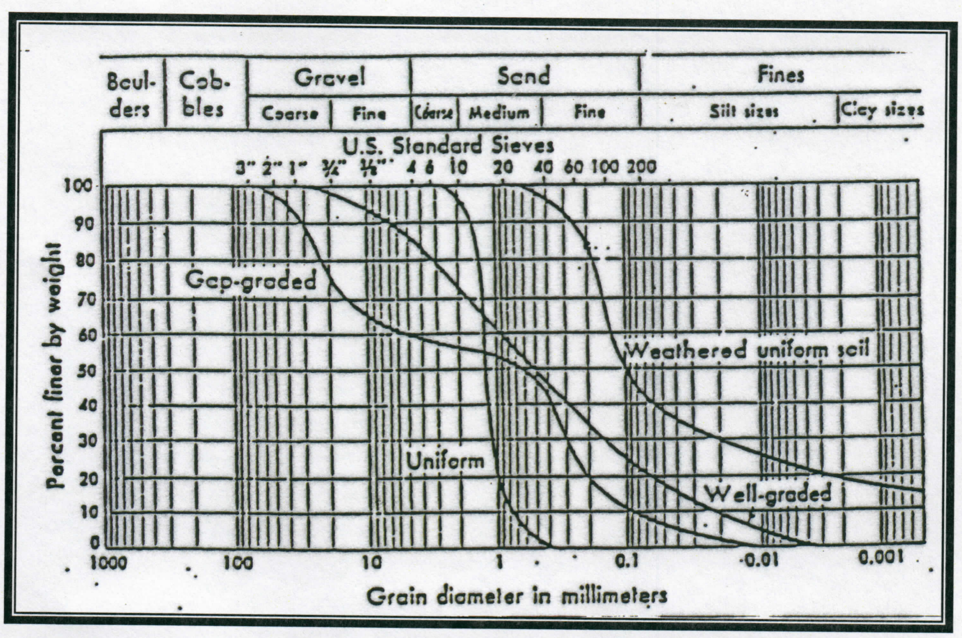
DRAWING 6

SIEVE ANALYSIS RESULTS

SAMPLE # 1 SAMPLE DEPTH 3.0′ BORING/TRENCH # 1

SIEVE #	WEIGHT RETAINED	% RETAINED	% PASSING
4	0.04	3.0	97.0
10	0.22	14.0	86.0
20	0.60	39.0	61.0
40	0.88	58.0	42.0
80	1.23	80.0	20.0
100	1.29	84.0	16.0
200	1.42	93.0	7.0
PAN	1.53	100.0	0.0

TOTAL SAMPLE WEIGHT 1.53 LBS.
PERCENT FINES 7.0%



DRAWING 7

Percolation/Infiltration Test Data Sheet

Project:	Martinez Okamoto		Project #:	19-174	Date:		10/1/2019
Test Hole No:		1	Tested By:	R.H.			
Depth of Test Hole		24	USCS Soils Classification		Coarse to Fine Sand		
Test Hole Dimensions (inches)					Length	Width	
Diameter in. (if round)		8	Sides in.(if rectangular) =				

Sandy Soil Criteria Test*

Trial No.	Start Time	Stop Time	Time Interval (min)	Initial Depth to Water (in.)	Final Depth to Water (in.)	Change in Water Level (in.)	Greater than or Equal to 6"? (y/n)
1	10:13	10:28	25	4	19	15	Y
2	10:40	11:05	25	4	16.5	12.5	Y

* If two consecutive measurements show that six inches of water seeps away in less than 25 minutes, the test shall runfor an additional hour with measurements taken every 10 minutes. Other wise, pre-soak (fill) overnight. Obtain at least twelve measurements per hole over at least six hours (approximate 30 minute intervals) with a precision of at least 0.25".

Trial No.	Start Time	Stop Time	Δt Time Interval (min)	D_o Initial Depth to Water (in.)	D_f Final Depth to Water (in.)	ΔD Change in Water Level (in.)	Percolation Rate (min./in.)
1	11:10	11:20	10	4	10.75	6.75	1.48
2	11:21	11:31	10	4	10.5	6.5	1.54
3	11:32	11:42	10	4	10.25	6.25	1.60
4	11:43	11:53	10	4	10.25	6.25	1.60
5	11:54	12:04	10	4	10.25	6.25	1.60
6	12:05	12:15	10	4	10.25	6.25	1.60
7						0	#DIV/0!
8						0	#DIV/0!
9						0	#DIV/0!
10						0	#DIV/0!
11						0	#DIV/0!
12						0	#DIV/0!
13						0	#DIV/0!
14						0	#DIV/0!
15						0	#DIV/0!

Infiltration Rate (inches per hour)

H_o =	20	**3.97**
H_f =	13.75	**Design Infiltration Rate (F.S. = 2)**
H_{avg} =	16.875	**1.99**

Percolation/Infiltration Test Data Sheet

Project:	Martinez Okamoto		Project #:	19-174		Date:	10/1/2019
Test Hole No:		2	Tested By:	R.H.			
Depth of Test Hole		24	USCS Soils Classification			Coarse to Fine Sand Some Silt	
	Test Hole Dimensions (inches)					Length	Width
Diameter in. (if round)		8	Sides in.(if rectangular) =				

Sandy Soil Criteria Test*

Trial No.	Start Time	Stop Time	Time Interval (min)	Initial Depth to Water (in.)	Final Depth to Water (in.)	Change in Water Level (in.)	Greater than or Equal to 6"? (y/n)
1	10:14	10:39	25	4	22	18	Y
2	10:42	11:07	25	4	19	15	Y

* If two consecutive measurements show that six inches of water seeps away in less than 25 minutes, the test shall runfor an additional hour with measurements taken every 10 minutes. Other wise, pre-soak (fill) overnight. Obtain at least twelve measurements per hole over at least six hours (approximate 30 minute intervals) with a precision of at least 0.25".

Trial No.	Start Time	Stop Time	Δt Time Interval (min)	D_o Initial Depth to Water (in.)	D_f Final Depth to Water (in.)	ΔD Change in Water Level (in.)	Percolation Rate (min./in.)
1	11:12	11:22	10	4	11.5	7.5	1.33
2	11:23	11:33	10	4	11.5	7.5	1.33
3	11:34	11:44	10	4	11.25	7.25	1.38
4	11:45	11:55	10	4	11	7	1.43
5	11:56	12:06	10	4	11	7	1.43
6	12:07	12:17	10	4	11	7	1.43
7						0	#DIV/0!
8						0	#DIV/0!
9						0	#DIV/0!
10						0	#DIV/0!
11						0	#DIV/0!
12						0	#DIV/0!
13						0	#DIV/0!
14						0	#DIV/0!
15						0	#DIV/0!

Infiltration Rate (inches per hour)

H_o =	20	**4.54**
H_f =	13	**Design Infiltration Rate (F.S. = 2)**
H_{avg} =	16.5	**2.27**

DRAWING #9