Appendix J

Water Quality Management Plan

Priority Project
Water Quality Management Plan

For:

Cordova Complex

APN: 0463-213-05, 06, 07, 08, 09, 16, 33, 34, 35, 36

Prepared for:

VVLIG HOLDINGS LLC

9040 Leslie Street, Suite 7
Richmond Hill, ON L4B3M4

Prepared by:

David Evans and Associates
18484 Outer Highway 18 North, Suite 225
Apple Valley, CA 92307
Tel: (760) 524-9100
Attn: Bret Thorpe

Submittal Date: November 01, 2022

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

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

Final Approval Date:_____________________

Project Owner's Certification

This Town of Apple Valley Water Quality Management Plan (WQMP) has been prepared for VVLIG Holdings LLC by David Evans and Associates. The WQMP is intended to comply with the requirements of the Town of Apple Valley and the Phase II Small MS4 General Permit for the Mojave River Watershed. The undersigned, while it owns the subject property, is responsible for the implementation of the provisions of this plan and will ensure that this plan is amended as appropriate to reflect up-to-date conditions on the site consistent with the Phase II Small MS4 Permit and the intent of the Town of Apple Valley's compliance efforts. Once the undersigned transfers its interest in the property, its successors in interest and the Town of Apple Valley shall be notified of the transfer. The new owner will be informed of its responsibility under this WQMP. A copy of the approved WQMP shall be available on the subject site in perpetuity.

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

Project Data			
Permit/Application Number(s):	TBD	Grading Permit Number(s):	TBD
Tract/Parcel Map Number(s):		Building Permit Number(s):	TBD
CUP, SUP, and/or APN (Specify Lot Numbers if Portions of Tract):			APN: 0463-213-05, 06, 07, 08, 09, 16, 33, 34, 35, 36

Owner's Signature			
Owner Name: Josh Malhi			
Title	Director		
Company	VVLIG, LLC		
Address	9040 Leslie Street, Suite 7 Richmond Hill, ON L4B3M4		
Email			
Telephone #			
Signature		Date	

Preparer's Certification

Project Data			
Permit/Application Number(s):	TBD	Grading Permit Number(s):	TBD
Tract/Parcel Map Number(s):		Building Permit Number(s):	
CUP, SUP, and/or APN (Specify Lot Numbers if Portions of Tract):			APN: 0463-213-05, 06, 07, 08, 09, 16, 33, 34, 35, 36

"The selection, sizing and design of stormwater treatment and other stormwater quality and quantity control measures in this plan were prepared under my oversight and meet the requirements of State of California Water Resources Control Board Order No. 2013-0001-DWQ.

Engineer: Bret Thorpe PE		PE Stamp Below
Title	Project Manager	
Company	David Evans and Associates, Inc	
Address	18484 Outer Highway 18 North Apple Valley, CA 92307	
Email	bthorpe@deainc.com	
Telephone #	(760) 524-9100	
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) only. This document should not be confused with the WQMP template for the Santa Ana Phase I area of San Bernardino County.

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

Section 1 Discretionary Permit(s)

Form 1-1 Project Information

Project Name	Cordova Complex				
Project Owner Contact Name:	Josh Malhi				
Mailing Address:	VVLIG, LLC 9040 Leslie Street, Suite 7 Richmond Hill, ON L4B3M4	E-mail Address:		Telephone:	
Permit/Application Number(s):	TBD	Tract/Parcel Map Number(s):	APN: 0463-213-05, 06, 07, 08, 09, 16, 33, 34, 35, 36		
Additional Information/ Comments:	This is a Preliminary WQMP				
Description of Project:	The Project site is located at south corner intersection of Cordova Road and Dachshund Avenue in Apple Valley. The site is approximately 86.14-acres. The site slopes up at an average slope of 1%, is primarily vacant. The proposed project consists of a large warehouse type building, loading docks, parking for trucks and separate parking for passenger cars and landscaping. One underground infiltration basin & two up-ground infiltration/detention basin is proposed, as well as some small LIDS areas where practical.				
Provide summary of Conceptual WQMP conditions (if previously submitted and approved). Attach complete copy.	This is a preliminary WQMP				

Section 2 Project Description

2.1 Project Information

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

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

2.1.1 Project Sizing Categorization

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

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

<table>
<tr><th colspan="6">Form 2.1-1 Description of Proposed Project</th></tr>
<tr><td colspan="6">1 Regulated Development Project Category (Select all that apply):</td></tr>
<tr><td colspan="2">☒ #1 New development involving the creation of 5,000 ft^2 or more of impervious surface collectively over entire site</td><td colspan="2">☐ #2 Significant re-development involving the addition or replacement of 5,000 ft^2 or more of impervious surface on an already developed site</td><td>☐ #3 Road Project – any road, sidewalk, or bicycle lane project that creates greater than 5,000 square feet of contiguous impervious surface</td><td>☐ #4 LUPs – linear underground/overhead projects that has a discrete location with 5,000 sq. ft. or more new constructed impervious surface</td></tr>
<tr><td colspan="6">☐ Site Design Only (Project Total Square Feet > 2,500 but < 5,000 sq.ft) Will require source control Site Design LID BMPs and other LIP requirements. See section 4. (Please go to Forms 4.1-3 and 4.3-2)</td></tr>
<tr><td>2 Project Area (ft2):</td><td>3,743,245</td><td>3 Number of Dwelling Units:</td><td></td><td>4 SIC Code:</td><td>4225</td></tr>
<tr><td colspan="6">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.</td></tr>
</table>

2.2 Property Ownership/Management

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

Form 2.2-1 Property Ownership/Management
Describe property ownership/management responsible for long-term maintenance of WQMP stormwater facilities:
The Property owner will be responsible for all the on-site BMPS such as infiltration basin, pre-treatment devices, landscaping and LID areas. Site maintenance BMPs is vested in: **VVLIG HOLDINGS LLC** 9040 Leslie Street, Suite 7 Richmond Hill, ON L4B3M4

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

Section 3 Site and Watershed Description

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

Form 3-1 Site Location and Hydrologic Features

Site coordinates *take GPS measurement at approximate center of site*	Latitude: 34°d 36'25.76"	Longitude: -117°11'59.18"	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 A1 to Outlet 1	On-site runoff will direct to catch basins passing through catch basin insert filters to storm drain system, then outlet to proposed Detention/Infiltration Basin for storm water treatment and mitigation, overflow from the basin will outlet the Johnson Road.
DA1 DMA	
DA2 DMA	

Form 3-2 Existing Hydrologic Characteristics for Drainage Area 1				
For Drainage Area 1's sub-watershed DMA, provide the following characteristics	DMA A			
1 DMA drainage area (ft^2)	3,752,258			
2 Existing site impervious area (ft^2)	0			
3 Antecedent moisture condition *For desert areas, use http://www.sbcounty.gov/dpw/floodcontrol/pdf/20100412_map.pdf*	2			
4 Hydrologic soil group *Refer to County Hydrology Manual Addendum for Arid Regions – http://www.sbcounty.gov/dpw/floodcontrol/pdf/20100412_addendum.pdf*	A			
5 Longest flowpath length (ft)	2,773			
6 Longest flowpath slope (ft/ft)	0.7%			
7 Current land cover type(s) *Select from Fig C-3 of Hydrology Manual*	Barren			
8 Pre-developed pervious area condition: *Based on the extent of wet season vegetated cover good >75%; Fair 50-75%; Poor <50% Attach photos of site to support rating*	Poor			

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

Section 4 Best Management Practices (BMP)

4.1 Source Control and Site Design BMPs

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

4.1.1 Source Control BMPs

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

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

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

Form 4.1-1 Non-Structural Source Control BMPs

Identifier	Name	Check One		Describe BMP Implementation OR, if not applicable, state reason
		Included	Not Applicable	
N1	Education of Property Owners, Tenants and Occupants on Stormwater BMPs	☒	☐	General information will be provided to the owner on housekeeping practices that contribute to the protection of storm water. The property owner and property manager will be familiar with the contents of this document and the BMPs used on the site. The owner will provide education materials to tenants (if applicable) on BMPs and housekeeping practices that contribute to the protection of storm water.
N2	Activity Restrictions	☒	☐	The property owner/manager shall control the discharge of the stormwater pollutants from this site through activity restrictions. Restrictions shall be provided to all new tenants/occupants through lease terms, or other mechanism upon first occupancy of the lease space and annually thereafter. Enforcement of activity restriction shall be on going during the operation of the project site.
N3	Landscape Management BMPs	☒	☐	The property owner, building operators, and landscape maintenance contractors will practice on going landscape maintenance BMPs consistent with applicable local ordinances and will regular inspect the irrigation system for signs of erosion or sediment debris buildup and clean/repair as needed.
N4	BMP Maintenance	☒	☐	The property owner/manager will maintain all post construction BMPs consistent with the O&M plan described in section 5 of this document (Form 5-1).
N5	Title 22 CCR Compliance (How development will comply)	☐	☒	Hazardous wastes are not anticipated to be stored or handled of-site.
N6	Local Water Quality Ordinances	☒	☐	he owner shall comply with the Town of Apple Valley Stormwater Ordinance through the implementation of BMP's.
N7	Spill Contingency Plan	☒	☐	Building operators shall prepare specific plans based on materials onsite for the cleanup of spills. Plans shall mandate stock piling of cleanup materials, notification of agencies, disposal, documentation, etc. Storage shall comply with Hazmat Regulations and any required contingency plans.

Form 4.1-1 Non-Structural Source Control BMPs

N8	Underground Storage Tank Compliance	☐	☒	No underground storage tanks proposed.
N9	Hazardous Materials Disclosure Compliance	☐	☒	The storing of hazardous materials is not proposed.

Form 4.1-1 Non-Structural Source Control BMPs

Identifier	Name	Check One		Describe BMP Implementation OR, if not applicable, state reason
		Included	Not Applicable	
N10	Uniform Fire Code Implementation	☒	☐	This project will be developed and operated in accordance with Article 80 of the Uniform Fire Code.
N11	Litter/Debris Control Program	☒	☐	The building operator shall prepare and implement an employee training program. This program shall include trash managementa and litter control procedures including on spill cleanup, litter control, and material storage procedures.
N12	Employee Training	☒	☐	The property owner/manager shall prepare and implement an employee-training program in accordance with California Storm Water Quality Association Standards and BMP. This program shall be reviewed on a bi-annual basis or with the every new edition of the Stormwater Best Management Practice Handbook for Industrial and Commercial. See appendix for all educational material.
N13	Housekeeping of Loading Docks	☒	☐	Loading docks shall be regulary maintained by keeping clean and orderly condition through a regular program of sweeping and litter control, cleaning up spills and broken containers immediately. Clean up should minimize use of water and do not discharge wash water into the storm drain.
N14	Catch Basin Inspection Program	☒	☐	Catch basins shall be inspected visually on a monthly basis; the entire storm drain system shall be inspected and cleaned prior to the start of the rainy season.

N15	Vacuum Sweeping of Private Streets and Parking Lots	☒	☐	Parking and dock areas will be swept regularly using a vacuum assisted sweeper. Frequency will depend on waste accumulations with a minimum of once per month and prior to the start of the rainy season.
N16	Other Non-structural Measures for Public Agency Projects	☐	☒	Not a Public Agency project.
N17	Comply with all other applicable NPDES permits	☒	☐	he developer will comply with the California statwide Construction General Permit during construction and all future occupants of the site shall comply with the requirements of the statewide General Stormwater Permit.

Form 4.1-2 Structural Source Control BMPs

Identifier	Name	Check One		Describe BMP Implementation OR, If not applicable, state reason
		Included	Not Applicable	
S1	Provide storm drain system stencilling and signage (CASQA New Development BMP Handbook SD-13)	☒	☐	All storm drain inlets shall have Stenciling illustrating an anti-dumping message.
S2	Design and construct outdoor material storage areas to reduce pollution introduction (CASQA New Development BMP Handbook SD-34)	☐	☒	This development does not include the storage of materials outdoors.
S3	Design and construct trash and waste storage areas to reduce pollution introduction (CASQA New Development BMP Handbook SD-32)	☒	☐	Trash storage areas shall be located away from storm drain inlets. All trash dumpsters/containers will be required to have a lid on at all times to prevent direct precipitation and prevent any rainfall from entering containers.
S4	Use efficient irrigation systems & landscape design, water conservation, smart controllers, and source control (Statewide Model Landscape Ordinance; CASQA New Development BMP Handbook SD-12)	☒	☐	Irrigation systems will be designed to each landscaped area's specific water need. Irrigation controls shall include rain-triggered shutoff devices to prevent irrigation after precipitation.
S5	Finish grade of landscaped areas at a minimum of 1-2 inches below top of curb, sidewalk, or pavement	☒	☐	Landscaped areas shall be below a minimum of 1" to 2" below the top of curb or walk.
S6	Protect slopes and channels and provide energy dissipation (CASQA New Development BMP Handbook SD-10)	☒	☐	Install permanent stabilization BMPs on slopes as quickly as possible. Install drought resistant landscaping. Install Rip-Rap at storm drain outlet to the basin.
S7	Covered dock areas (CASQA New Development BMP Handbook SD-31)	☐	☒	No covered dock areas within the new development.
S8	Covered maintenance bays with spill containment plans (CASQA New Development BMP Handbook SD-31)	☐	☒	No covered maintenance bays within the new development.
S9	Vehicle wash areas with spill containment plans (CASQA New Development BMP Handbook SD-33)	☐	☒	No vehicle wash areas proposed.
S10	Covered outdoor processing areas (CASQA New Development BMP Handbook SD-36)	☐	☒	No covered outdoor processing areas are proposed

Form 4.1-2 Structural Source Control BMPs				
Identifier	Name	Check One		Describe BMP Implementation OR, If not applicable, state reason
		Included	Not Applicable	
S11	Equipment wash areas with spill containment plans (CASQA New Development BMP Handbook SD-33)	☐	☒	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)	☐	☒	No natural existing hillsides on the project site.
S14	Wash water control for food preparation areas	☐	☒	No food preparation is proposed
S15	Community car wash racks (CASQA New Development BMP Handbook SD-33)	☐	☒	No Community car wash racks

4.1.2 Site Design BMPs

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

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

Describe site design and drainage plan including:

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

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

Form 4.1-3 Site Design Practices Checklist
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 areas are minimized to the Maximum Extent Possible without costing the facility inefficiencies in circulation, parking and loading and unloading.
Maximize natural infiltration capacity; Including improvement and maintenance of soil: Yes ☒ No ☐ Explanation: Infiltration basin bottom with natural soils, no compaction. Landscaped areas will amend the soil and be depressed to facilitate infiltration.
Preserve existing drainage patterns and time of concentration: Yes ☐ No ☒ Explanation: The site could not be developed due to the site topography as it is. The cost would be infeasible.
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: The site layout lends itself for some smaller parking areas to drain into impervious areas.
Use of Porous Pavement: Yes ☐ No ☒ Explanation: Not practical with truck loading.
Protect existing vegetation and sensitive areas: Yes ☐ No ☒ Explanation: There are no sensitive areas and site will have to be mass graded to develop it.
Re-vegetate disturbed areas. Including planting and preservation of drought tolerant vegetation: Yes ☒ No ☐ Explanation: There is 10% minimum landscaping proposed which will incorporate drought tolerant vegetation.

Minimize unnecessary compaction in stormwater retention/infiltration basin/trench areas: Yes ☒ No ☐ Explanation: Site to be mass graded. Basin is attempted to be placed in fill areas to minimize excavation and thus avoid compaction. However, it is unknown if the preliminary Geotechnical report could recommend to over excavation.
Utilize naturalized/rock-lined drainage swales in place of underground piping or imperviously lined swales: Yes ☐ No ☒ Explanation: Not practical in this development. The storm drain infrastructure is necessary to develop the site.
Stake off areas that will be used for landscaping to minimize compaction during construction: Yes ☐ No ☒ Explanation: Site will be mass graded.
Use of Rain Barrels and Cisterns, Including the use of on-site water collection systems: Yes ☐ No ☒ Explanation: No underground storage is proposed into the subject site.
Stream Setbacks. Includes a specified distance from an adjacent steam: Yes ☐ No ☒ Explanation: Not adjacent to a stream.

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

San Bernardino County Special Districts:

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

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

Mojave Water Agency:

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

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

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

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

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

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

4.2 Treatment BMPs

After implementation and design of both Source Control and Site Design BMPs, any remaining runoff from impervious DMAs must be directed to one or more on-site, treatment BMPs (LID or biotreatment) designed to infiltrate, 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 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): 3,743,245	2 Imperviousness after applying preventative site design practices (Imp%): 85%	3 Runoff Coefficient (Rc): _0.661 *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): 0.348 http://hdsc.nws.noaa.gov/hdsc/pfds/sa/sca_pfds.html		
5 Compute P_6, Mean 6-hr Precipitation (inches): 0.52 *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): 208,950 *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	1 130,680 *Form 4.2-3 Item 12*	2 30.25 *Form 4.2-4 Item 13*	3 35.20 *Form 4.2-5 Item 10*
Post-developed	4 554,945 *Form 4.2-3 Item 13*	5 21.78 *Form 4.2-4 Item 14*	6 89.13 *Form 4.2-5 Item 14*
Difference	7 *424,360* *Item 4 – Item 1*	8 *(-8.47)* *Item 2 – Item 5*	9 *(53.93)* *Item 6 – Item 3*
Difference (as % of pre-developed)	10 325% *Item 7 / Item 1*	11 *(-28%)* *Item 8 / Item 2*	12 *(153)%* *Item 9 / Item 3*

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

Weighted Curve Number Determination for: <u>Pre</u>-developed DA	DMA A	DMA B	DMA C	DMA D	DMA E	DMA F	DMA G	DMA H
1a Land Cover type								
2a Hydrologic Soil Group (HSG)								
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: <u>Post</u>-developed DA	DMA A	DMA B	DMA C	DMA D	DMA E	DMA F	DMA G	DMA H
1b Land Cover type								
2b Hydrologic Soil Group (HSG)								
3b DMA Area, 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): 2.14
Go to: http://hdsc.nws.noaa.gov/hdsc/pfds/sa/sca_pfds.html

12 Pre-developed Volume (ft^3): 130,680
*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): 554,945
*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): 396,518
*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): 0 *$T_{C-Hydro}$ = (Item 13 * 0.95) – Item 14*								

See HCOC Calculation & Summary in Attachment D

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)*		Pre DMA A	Pre DMA B	Pre DMA C	Post DMA A	Post DMA B	Post DMA C
	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): 0 $Q_{p-hydro}$ *= (Item 14 * 0.95) – Item 10*		

For Hydromodification Assessment calculation & Summary See Attachment D

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

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

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

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

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

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

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

4.3.1 Exceptions to Requirements for Bioretention Facilities

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

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

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

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

Form 4.3-1 Infiltration BMP Feasibility (DA 1)
Feasibility Criterion – Complete evaluation for each DA on the Project Site
[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 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 BMPs reduces the portion of the DCV that must be addressed in downstream BMPs. Therefore, all applicable Site Design shall be provided except where they are mutually exclusive with each other, or with other BMPs. Mutual exclusivity may result from overlapping BMP footprints such that either would be potentially feasible by itself, but both could not be implemented. Please note that while there are no numeric standards regarding the use of Site Design BMPs. If a project cannot feasibly meet BMP sizing requirements or cannot fully address hydromodification, feasibility of all applicable Site Design BMPs must be part of demonstrating that the BMP system has been designed to retain the maximum feasible portion of the DCV. Complete Form 4.3-2 to identify and calculate estimated retention volume from implementing site design BMP. Refer to Section 5.4 in the TGD for more detailed guidance.

Form 4.3-2 Site Design BMPs (DA 1)			
1 Implementation of Impervious Area Dispersion BMP (i.e. routing runoff from impervious to pervious areas), excluding impervious areas planned for routing to on-lot infiltration BMP: Yes ☐ No ☐ *If yes, complete Items 2-5; If no, proceed to Item 6*	DA 1 DMA A1 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 1A DMA A BMP Type HSC	DA 1 DMA A BMP Type HSC	DA 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)*			

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

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

4.3.3 Infiltration BMPs

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

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

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

4.3.3.1 Allowed Variations for Special Site Conditions

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

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

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

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

4) Facilities serving high-risk areas such as fueling stations, truck stops, auto repairs, and heavy industrial sites may be required to provide additional treatment to address pollutants of concern unless these high-risk areas are isolated from storm water runoff or bioretention areas with little chance of spill migration.

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

1 Remaining LID DCV not met by site design BMP (ft^3): 35,650 *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 A1 BMP Type Underground Infiltration Basin	DA 1 DMA A2 BMP Type Infiltration Basin	DA 1 DMA A3 BMP Type Infiltration Basin
2 Infiltration rate of underlying soils (in/hr) *See Section 5.4.2 and Appendix D of the TGD for WQMP for minimum requirements for assessment methods*	2.5	2.5	2.5
3 Infiltration safety factor *See TGD Section 5.4.2 and Appendix D*	2.19	2.19	2.19
4 Design percolation rate (in/hr) *P_{design} = Item 2 / Item 3*	1.14	1.14	1.14
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*	6	6	6
7 Ponding Depth (ft) *d_{BMP} = Minimum of (1/12*Item 4*Item 5) or Item 6*	4.56	4.56	4.56
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*	42,084	30,143	84,213
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*	1		
12 Gravel porosity	0.4		
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))]*	0	146,950	408,010
15 Underground Retention Volume (ft^3) *Volume determined using manufacturer's specifications and calculations*	278,111	0	0

16 Total Retention Volume from LID Infiltration BMPs: 833,071 *(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) n/a

1 Remaining LID DCV not met by site design , or infiltration, BMP for potential biotreatment (ft^3): *Form 4.2-1 Item 7 - Form 4.3-2 Item 19 – Form 4.3-3 Item 16*	List pollutants of concern *Copy from Form 2.3-1.*	
2 Biotreatment BMP Selected *(Select biotreatment BMP(s) necessary to ensure all pollutants of concern are addressed through Unit Operations and Processes, described in Table 5-5 of the TGD for WQMP)*	Volume-based biotreatment *Use Forms 4.3-5 and 4.3-6 to compute treated volume* ☐ 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 (ft^3): *Form 4.3-5 Item 15 + Form 4.3-6 Item 13*	4 Compute remaining LID DCV with implementation of volume based biotreatment BMP (ft^3): *Item 1 – Item 3*	5 Remaining fraction of LID DCV for sizing flow based biotreatment BMP: % *Item 4 / Item 1*
6 Flow-based biotreatment BMP capacity provided (cfs): *Use Figure 5-2 of the TGD for WQMP to determine flow capacity required to provide biotreatment of remaining percentage of unmet LID DCV (Item 5), for the project's precipitation zone (Form 3-1 Item 1)*		
7 Metrics for MEP determination: • Provided a WQMP with the portion of site area used for suite of LID BMP equal to minimum thresholds in Table 5-7 of the TGD for WQMP for the proposed category of development: ☐ *If maximized on-site retention BMPs is feasible for partial capture, then LID BMP implementation must be optimized to retain and infiltrate the maximum portion of the DCV possible within the prescribed minimum effective area. The remaining portion of the DCV shall then be mitigated using biotreatment BMP.*		

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

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 n/a

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

4.3.5 Conformance Summary

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

Form 4.3-8 Conformance Summary and Alternative Compliance Volume Estimate (DA 1)
1 Total LID DCV for the Project DA-1 (ft^3): 208,950 *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): 968,357 *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.

<table>
<tr><th colspan="2">Form 4.3-9 Hydromodification Control BMPs (DA 1)</th></tr>
<tr><td>1 Volume reduction needed for hydromodification performance criteria (ft^3):
(Form 4.2-2 Item 4 * 0.95) – Form 4.2-2 Item 1</td><td>2 On-site retention with site design and infiltration, BMP (ft^3): Sum of Form 4.3-8 Items 2, 3, and 4. Evaluate option to increase implementation of on-site retention in Forms 4.3-2, 4.3-3, and 4.3-4 in excess of LID DCV toward achieving hydromodification volume reduction</td></tr>
<tr><td>3 Remaining volume for hydromodification volume capture (ft^3): 0 Item 1 – Item 2</td><td>4 Volume capture provided by incorporating additional on-site BMPs (ft^3):</td></tr>
<tr><td colspan="2">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 ☐</td></tr>
<tr><td colspan="2">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 ☐</td></tr>
</table>

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 Covenant must be completed, signed, notarized and submitted to the Town's Engineering Department

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

BMP	Reponsible Party(s)	Inspection/ Maintenance Activities Required	Minimum Frequency of Activities
Site Design Infiltration Basin	VVLIG, LLC	Inspect Basin for trash, buildup of sediment and weeds. Clean out weeds and trash, remove sediment build up. Maintain landscaping around sides and adjacent area.	Twice yearly, April and October suggested.
Underground Infiltration Basin	VVLIG, LLC	Inspect the underground Arch via the access manhole, for accumulated sediment and debris levels and cleanout solids when > 6" build up occurs. Inspect for standing water with 48 hours of heavy rain events to ensure proper drawdown. Clean and flush underground systems to restore free drainage.	Inspections twice annually at a minimum, as well as after each storm event
Storm drain and Catch basin stenciling	VVLIG, LLC	Inspect catch basins, check for illicit dumping or spills, Inspect storm drain for trash and sediment. Clean if necessary. Refresh stenciling if needed.	Once yearly prior to rainy season
Parking lot sweeping	VVLIG, LLC	Inspect for spills, oil drips and trash. Clean any spills, oil immediately. Inspect for accumulation of dirt/dust. Sweep parking as needed.	Monthly
Catch basin inserts	VVLIG, LLC	Inspect for trash and debris and check the oil absorbing pillow.	Twice a year.

Irrigation and Landscaping	VVLIG, LLC	Maintain landscaping, replace dead material. Inspect irrigation, fix and repair leaks.	Weekly to monthly.
Trash Enclosures	VVLIG, LLC	Inspect and clean trash and debris. Do not wash area. Ensure lids are closed and enclosure properly maintained.	Weekly

Section 6 WQMP Attachments

6.1. Site Plan and Drainage Plan

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

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

6.2 Electronic Data Submittal

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

6.3 Post Construction

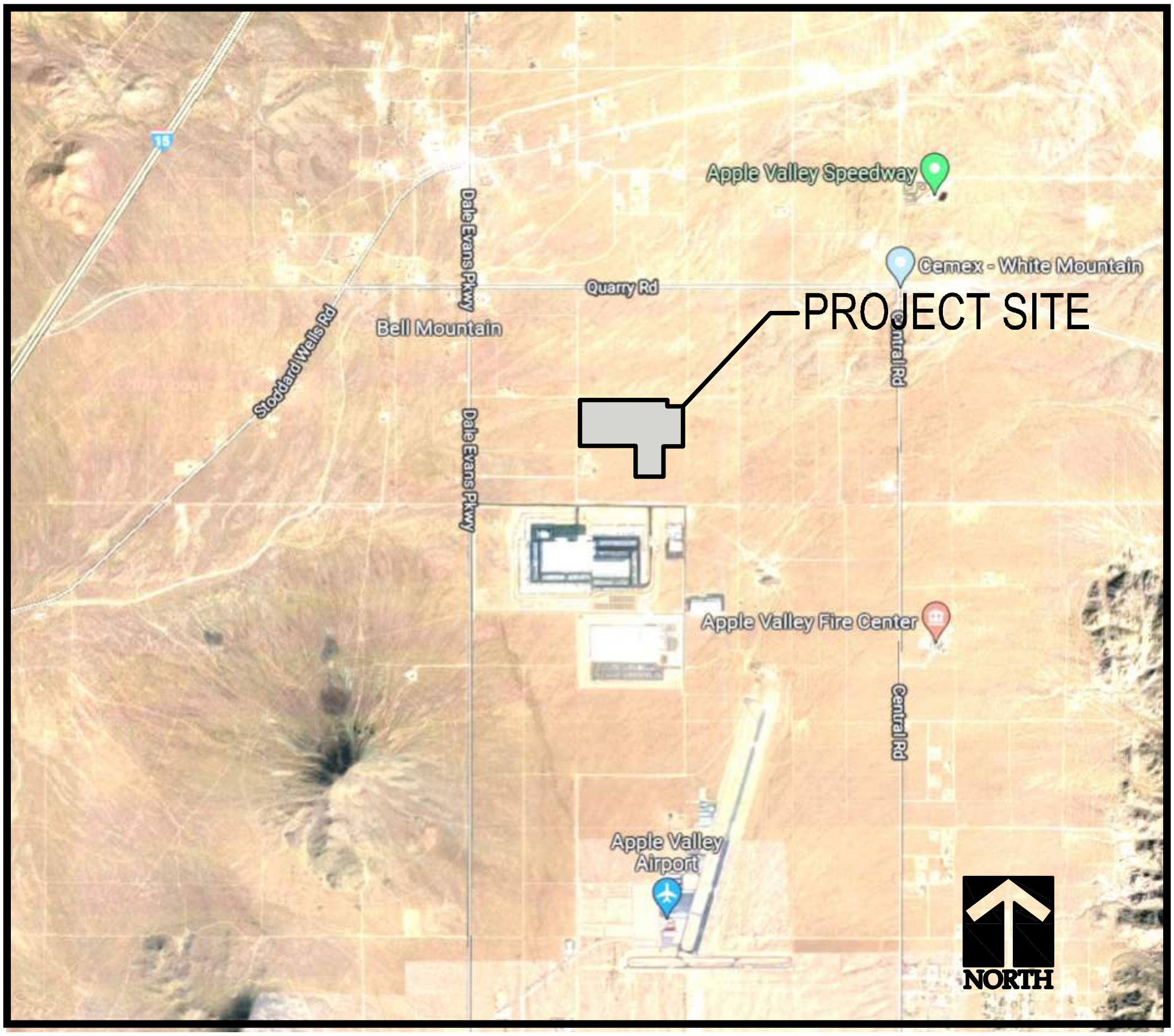
Attach all O&M Plans and Maintenance Covenant for BMP to the WQMP. See following page for Maintenance Covenant Template

6.4 Other Supporting Documentation

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

Appendix A

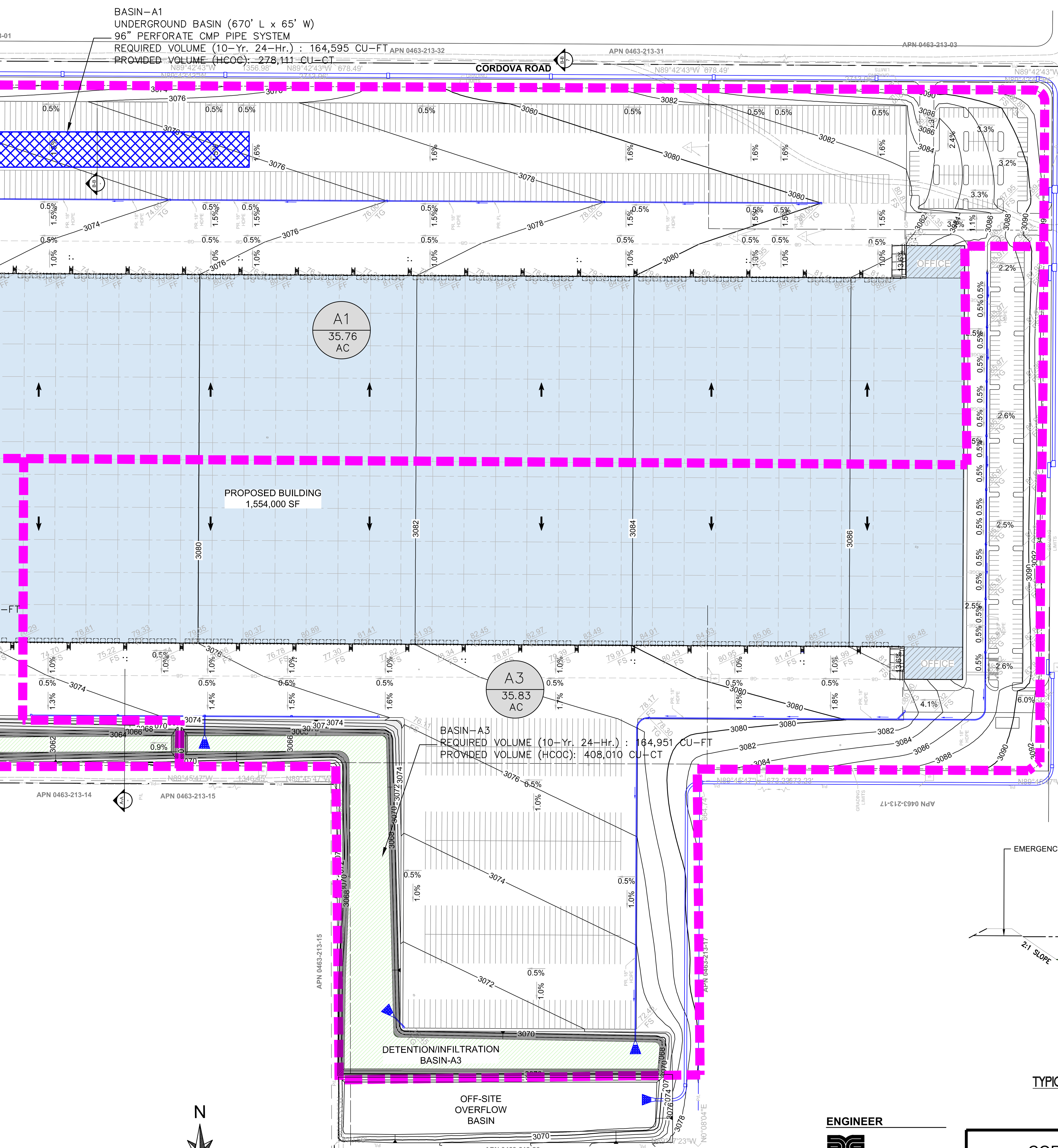
Vicinity Map

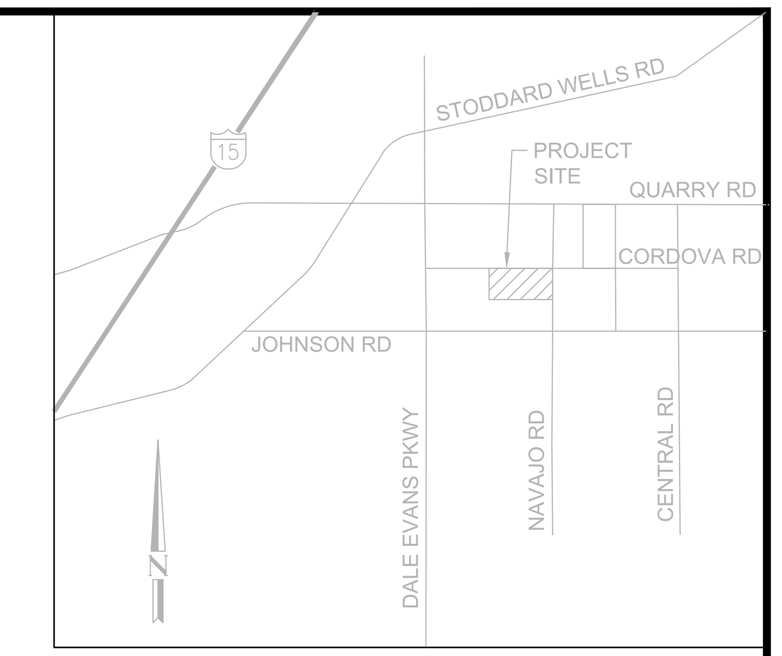


Vicinity Map
NTS

Appendix B

- WQMP Exhibit





VICINITY MAP

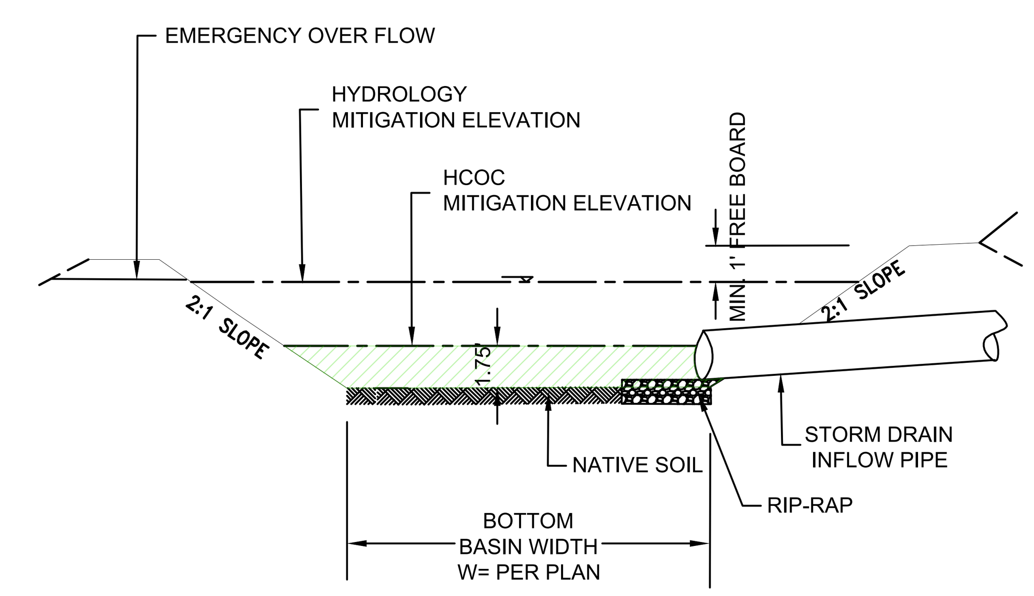
N.T.S.

MAP LEGEND:

- DRAINGE AREA BOUNDARY
- PROPOSED STORM DRAIN
- PROPOSED BUILDING
- INFILTRATION BASIN
- CMP UNDERGROUND BASIN
- ROOF DRAIN DIRECTION
- A1 / 5.0 AC — DRAINAGE MANAGEMENT AREA _DMA ID / AREA ACREAGE

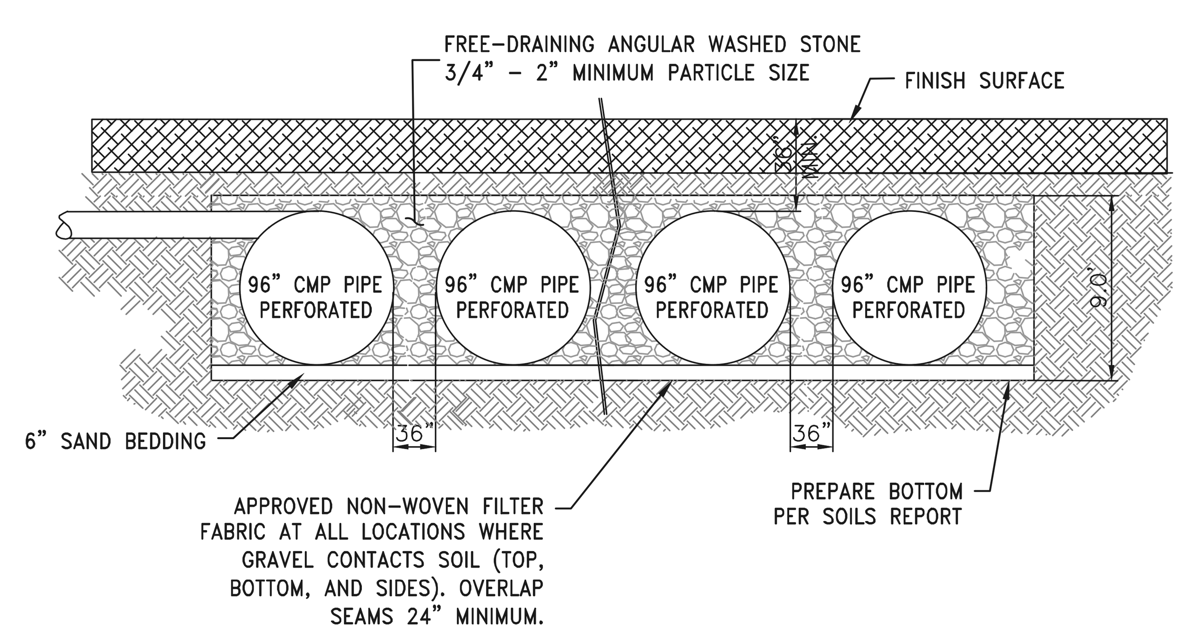
NOTE:

ALL CATCH BASIN SHOULD INSTALL FLOGARD CATCH BASIN INSERT FILTER OR EQUAL'S APPROVAL PRODUCTS



A-A
TYPICAL DETENTION/ INFILTRATION BASIN SECTION

N.T.S.



B-B
BASIN-1 UNDERGROUND DETENTION / INFILTRATION SYSTEM SECTION

N.T.S.

N

100 0 100 200
scale 1"= 100' feet

Plot Date: 1/6/2023 10:06 AM
Save Date: 11/4/2022 1:18 PM
By: Jose Aguilar
By: Jla
File: P:\V\VVL\00000001\0600INFO\0670Reports\WQMP Report\Cordova Site Files\CAD\WQMP Eexhibit-Cordova-VVL00000001.dwg

ENGINEER

DAVID EVANS AND ASSOCIATES INC.

18484 Outer Highway 18 N Suite 225
Apple Valley California 92307
Phone: 760.524.9100
SSchubert@deainc.com

CORDOVA ROAD INDUSTRIAL COMPLEX

WQMP EXHIBIT

FILE NO.

DRAWING NO.

SH. 1 OF 1

Appendix C

LID BMP sizing Calculations

Form 4.2-1 LID BMP Performance Criteria for Design Capture Volume Drainage Area 1 (DMA A)

1 Drainage area (ft^2):	3,752,258	2 Imperviousness after applying preventative site design practices (Imp%):	85.0%	3 Runoff Coefficient (Rc): R_c=0.858$(Imp)^3$-0.78$(Imp)^2$+0.774(Imp)+0.04	0.661

4 Determine 1-hour rainfall depth for a 2-year return period $P_{2yr-1hr}$ (in): **0.348** *http://hdsc.nws.noaa.gov/hdsc/pfds/sa/sca_pfds.html*

5 Compute P_6, Mean 6-hr Precipitation (inches): **0.52**

P_6=Item 4 * C_1 where C_1 is a function of site climatic region specified in Form 3-1 Item 1 (Valley=1.4807; Mountain=1.909; Desert = 1.2371)

6 Drawdown Rate:

Use 48 hours as the default condition. Selection and use of the 24 hour drawdown time condition is subject to the 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	X

7 Compute design capture volume, DCV (ft^3): **208,950**

DCV = 1/12 * [Item 1 * Item 3 * Item 5 * C2], Where C2 is a function of drawdown rate (24-hr = 1.582; 48-hr = 1.963)
Compute separate DCV for each outlet from the project site per schematic drawn in Form 3-1 Item 2

Cordova Site Basin-A1 Underground CMP Basin Stage Table:

Elevation (ft.)	Basin Area (sf)	Depth (ft.)	Basin Volume (cft)	Basin Volume (ac-ft)	Basin Infiltration Flow* (cfs)	12" Pipe Over Flow (cfs)	Total Outlet Flow (cfs)
0	42,084	-	-	-	1.11	0.00	1.11
4	42,084	4.00	120,715	2.77	1.11	0.00	1.11
5	42,084	5.00	157,395	3.61	1.11	0.00	1.11
6	42,084	6.00	193,457	4.44	1.11	0.00	1.11
7	42,084	7.00	227,522	5.22	1.11	0.00	1.11
8	42,084	8.00	257,533	5.91	1.11	4.20	5.31
9	42,084	9.00	278,111	6.38	1.11	16.88	17.99

Note:

* Infiltration flow based on the infiltration test the Infiltration rate =2.5in/hr with safty factor SF=2.19, design infiltration rate=2.5/2.19=1.14 in/hr.
  Basin infiltration flow=(1/12x1.14)/3600 xbasin Bottom Area = 1.11 cfs

Basin Provided Volume

CONTECH ENGINEERED SOLUTIONS

Date: 10/27/2022
Project Name: hz - 23059 (10-27-2022 18-50-55)

City / County:
State:

Designed By:
Company:
Telephone:

CMP: Underground Detention System Storage Volume Estimation

=Adjustable Input Cells

Contech Engineered Solutions, LLC is pleased to offer the following estimate of storage volume for the above named project. The results are submitted as an estimate only, without liability on the part of Contech Engineered Solutions, LLC for accuracy or suitability to any particular applicaton and are subject to verification of the Engineer of Record. **This tool is only applicable for rectangular shaped systems.**

Summary of Inputs

System Information		Backfill Information		Pipe & Analysis Information	
Out-to-out length (ft):	668.0	Backfill Porosity (%):	40%	System Diameter (in):	96
Out-to-out width (ft):	63.0	Depth Above Pipe (in):	6.0	Pipe Spacing (in):	36
Number of Manifolds (ea):	1.0	Depth Below Pipe (in):	6.0	Incremental Analysis (in):	2
Number of Barrels (ea):	6.0	Width At Ends (ft):	1.0	System Invert (Elevation):	0
		Width At Sides (ft):	1.0		

Storage Volume Estimation

System		Pipe		Stone		Total System		Miscellaneous	
Depth (ft)	Elevation (ft)	Incremental Storage (cf)	Cumulative Storage (cf)	Incremental Storage (cf)	Cumulative Storage (cf)	Incremental Storage (cf)	Cumulative Storage (cf)	Percent Open Storage (%)	Ave. Surface Area (sf)
0.00	0.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0%	17,420.0
0.17	0.16	0.0	0.0	2,903.3	2,903.3	2,903.3	2,903.3	0.0%	17,420.0
0.33	0.33	0.0	0.0	2,903.3	5,806.7	2,903.3	5,806.7	0.0%	17,420.0
0.50	0.50	0.0	0.0	2,903.3	8,710.0	2,903.3	8,710.0	0.0%	17,420.0
0.67	0.66	1,025.8	1,025.8	2,493.0	11,203.0	3,518.8	12,228.8	8.4%	22,936.1
0.83	0.83	1,857.2	2,883.0	2,160.5	13,363.5	4,017.6	16,246.5	17.7%	25,137.5
1.00	1.00	2,379.3	5,262.3	1,951.6	15,315.1	4,330.9	20,577.4	25.6%	26,768.6
1.17	1.16	2,786.5	8,048.8	1,788.7	17,103.8	4,575.2	25,152.6	32.0%	28,094.2
1.33	1.33	3,125.0	11,173.8	1,653.3	18,757.1	4,778.4	29,931.0	37.3%	29,217.8
1.50	1.50	3,415.6	14,589.4	1,537.1	20,294.2	4,952.7	34,883.6	41.8%	30,192.6
1.67	1.66	3,669.6	18,259.0	1,435.5	21,729.8	5,105.1	39,988.7	45.7%	31,050.8
1.83	1.83	3,894.2	22,153.2	1,345.6	23,075.4	5,239.9	45,228.6	49.0%	31,813.1
2.00	2.00	4,094.4	26,247.6	1,265.6	24,341.0	5,360.0	50,588.6	51.9%	32,494.2
2.17	2.16	4,273.6	30,521.2	1,193.9	25,534.9	5,467.5	56,056.1	54.4%	33,104.5
2.33	2.33	4,434.3	34,955.5	1,129.6	26,664.5	5,563.9	61,619.9	56.7%	33,652.2
2.50	2.50	4,578.4	39,533.9	1,072.0	27,736.5	5,650.4	67,270.3	58.8%	34,143.3
2.67	2.66	4,707.5	44,241.4	1,020.3	28,756.8	5,727.9	72,998.2	60.6%	34,582.7
2.83	2.83	4,822.9	49,064.3	974.2	29,731.0	5,797.1	78,795.2	62.3%	34,974.3
3.00	3.00	4,925.4	53,989.6	933.2	30,664.1	5,858.6	84,653.8	63.8%	35,321.2
3.17	3.16	5,015.8	59,005.5	897.0	31,561.1	5,912.8	90,566.6	65.2%	35,626.0
3.33	3.33	5,094.9	64,100.4	865.4	32,426.5	5,960.3	96,526.9	66.4%	35,890.8
3.50	3.50	5,163.1	69,263.5	838.1	33,264.6	6,001.2	102,528.1	67.6%	36,117.2
3.67	3.66	5,220.8	74,484.3	815.0	34,079.6	6,035.8	108,563.9	68.6%	36,306.7
3.83	3.83	5,268.5	79,752.8	796.0	34,875.6	6,064.4	114,628.3	69.6%	36,460.3
4.00	4.00	5,306.3	85,059.0	780.8	35,656.4	6,087.1	120,715.4	70.5%	36,578.9
4.17	4.16	5,334.4	90,393.4	769.6	36,426.0	6,104.0	126,819.4	71.3%	36,663.2
4.33	4.33	5,353.1	95,746.6	762.1	37,188.0	6,115.2	132,934.6	72.0%	36,713.6
4.50	4.50	5,362.4	101,109.0	758.4	37,946.4	6,120.8	139,055.4	72.7%	36,730.4
4.67	4.66	5,362.4	106,471.5	758.4	38,704.7	6,120.8	145,176.2	73.3%	36,713.6
4.83	4.83	5,353.1	111,824.6	762.1	39,466.8	6,115.2	151,291.4	73.9%	36,663.2
5.00	5.00	5,334.4	117,159.0	769.6	40,236.4	6,104.0	157,395.4	74.4%	36,578.9
5.17	5.16	5,306.3	122,465.3	780.8	41,017.2	6,087.1	163,482.5	74.9%	36,460.3
5.33	5.33	5,268.5	127,733.7	796.0	41,813.2	6,064.4	169,546.9	75.3%	36,306.7
5.50	5.50	5,220.8	132,954.6	815.0	42,628.2	6,035.8	175,582.7	75.7%	36,117.2
5.67	5.66	5,163.1	138,117.6	838.1	43,466.3	6,001.2	181,583.9	76.1%	35,890.8
5.83	5.83	5,094.9	143,212.6	865.4	44,331.6	5,960.3	187,544.2	76.4%	35,626.0
6.00	6.00	5,015.8	148,228.4	897.0	45,228.6	5,912.8	193,457.0	76.6%	35,321.2
6.17	6.16	4,925.4	153,153.8	933.2	46,161.8	5,858.6	199,315.6	76.8%	34,974.3

6.33	6.33	4,822.9	157,976.6	974.2	47,136.0	5,797.1	205,112.7	77.0%	34,582.7
6.50	6.50	4,707.5	162,684.2	1,020.3	48,156.3	5,727.9	210,840.5	77.2%	34,143.3
6.67	6.66	4,578.4	167,262.6	1,072.0	49,228.3	5,650.4	216,490.9	77.3%	33,652.2
6.83	6.83	4,434.3	171,696.8	1,129.6	50,357.9	5,563.9	222,054.8	77.3%	33,104.5
7.00	7.00	4,273.6	175,970.4	1,193.9	51,551.8	5,467.5	227,522.3	77.3%	32,494.2
7.17	7.16	4,094.4	180,064.8	1,265.6	52,817.4	5,360.0	232,882.2	77.3%	31,813.1
7.33	7.33	3,894.2	183,959.1	1,345.6	54,163.0	5,239.9	238,122.1	77.3%	31,050.8
7.50	7.50	3,669.6	187,628.7	1,435.5	55,598.5	5,105.1	243,227.2	77.1%	30,192.6
7.67	7.66	3,415.6	191,044.2	1,537.1	57,135.6	4,952.7	248,179.9	77.0%	29,217.8
7.83	7.83	3,125.0	194,169.3	1,653.3	58,789.0	4,778.4	252,958.2	76.8%	28,094.2
8.00	8.00	2,786.5	196,955.8	1,788.7	60,577.7	4,575.2	257,533.5	76.5%	26,768.6
8.17	8.16	2,379.3	199,335.0	1,951.6	62,529.3	4,330.9	261,864.3	76.1%	25,137.5
8.33	8.33	1,857.2	201,192.2	2,160.5	64,689.8	4,017.6	265,882.0	75.7%	22,936.1
8.50	8.50	1,025.8	202,218.0	2,493.0	67,182.8	3,518.8	269,400.8	75.1%	17,420.0
8.67	8.66	0.0	202,218.0	2,903.3	70,086.1	2,903.3	272,304.2	74.3%	17,420.0
8.83	8.83	0.0	202,218.0	2,903.3	72,989.5	2,903.3	275,207.5	73.5%	17,420.0
9.00	9.00	0.0	202,218.0	2,903.3	75,892.8	2,903.3	278,110.8	72.7%	17,420.0

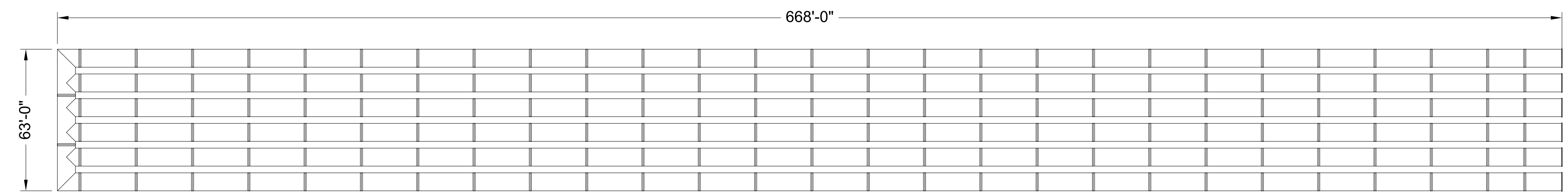
PROJECT SUMMARY

CALCULATION DETAILS
- LOADING = HS20/HS25
- APPROX. LINEAR FOOTAGE = 4,023 LF

STORAGE SUMMARY
- STORAGE VOLUME REQUIRED = 277,791 CF
- PIPE STORAGE VOLUME = 202,218 CF
- BACKFILL STORAGE VOLUME = 75,893 CF
- TOTAL STORAGE PROVIDED = 278,111 CF

PIPE DETAILS
- DIAMETER = 96"
- CORRUGATION = 5x1
- GAGE = 16
- COATING = ALT2
- WALL TYPE = PERFORATED
- BARREL SPACING = 36"

BACKFILL DETAILS
- WIDTH AT ENDS = 12"
- ABOVE PIPE = 6"
- WIDTH AT SIDES = 12"
- BELOW PIPE = 6"



NOTES

- ALL RISER AND STUB DIMENSIONS ARE TO CENTERLINE. ALL ELEVATIONS, DIMENSIONS, AND LOCATIONS OF RISERS AND INLETS, SHALL BE VERIFIED BY THE ENGINEER OF RECORD PRIOR TO RELEASING FOR FABRICATION.
- ALL FITTINGS AND REINFORCEMENT COMPLY WITH ASTM A998.
- ALL RISERS AND STUBS ARE $2\frac{2}{3}$" x $\frac{1}{2}$" CORRUGATION AND 16 GAGE UNLESS OTHERWISE NOTED.
- RISERS TO BE FIELD TRIMMED TO GRADE.
- QUANTITY OF PIPE SHOWN DOES NOT PROVIDE EXTRA PIPE FOR CONNECTING THE SYSTEM TO EXISTING PIPE OR DRAINAGE STRUCTURES. OUR SYSTEM AS DETAILED PROVIDES NOMINAL INLET AND/OR OUTLET PIPE STUB FOR CONNECTION TO EXISTING DRAINAGE FACILITIES. IF ADDITIONAL PIPE IS NEEDED IT IS THE RESPONSIBILITY OF THE CONTRACTOR.
- BAND TYPE TO BE DETERMINED UPON FINAL DESIGN.
- THE PROJECT SUMMARY IS REFLECTIVE OF THE DYODS DESIGN, QUANTITIES ARE APPROX. AND SHOULD BE VERIFIED UPON FINAL DESIGN AND APPROVAL. FOR EXAMPLE, TOTAL EXCAVATION DOES NOT CONSIDER ALL VARIABLES SUCH AS SHORING AND ONLY ACCOUNTS FOR MATERIAL WITHIN THE ESTIMATED EXCAVATION FOOTPRINT.
- THESE DRAWINGS ARE FOR CONCEPTUAL PURPOSES AND DO NOT REFLECT ANY LOCAL PREFERENCES OR REGULATIONS. PLEASE CONTACT YOUR LOCAL CONTECH REP FOR MODIFICATIONS.

ASSEMBLY
SCALE: 1" = 70'

DATE	REVISION DESCRIPTION	BY

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CONTECH CMP DETENTION SYSTEMS
CONTECH DYODS DRAWING

DYO23059 Cordova Complex
hz
Santa Ana, CA
DETENTION SYSTEM

PROJECT No.: 15164	SEQ. No.: 23059	DATE: 10/27/2022
DESIGNED: DYO	DRAWN: DYO	
CHECKED: DYO	APPROVED: DYO	
SHEET NO.: 1		

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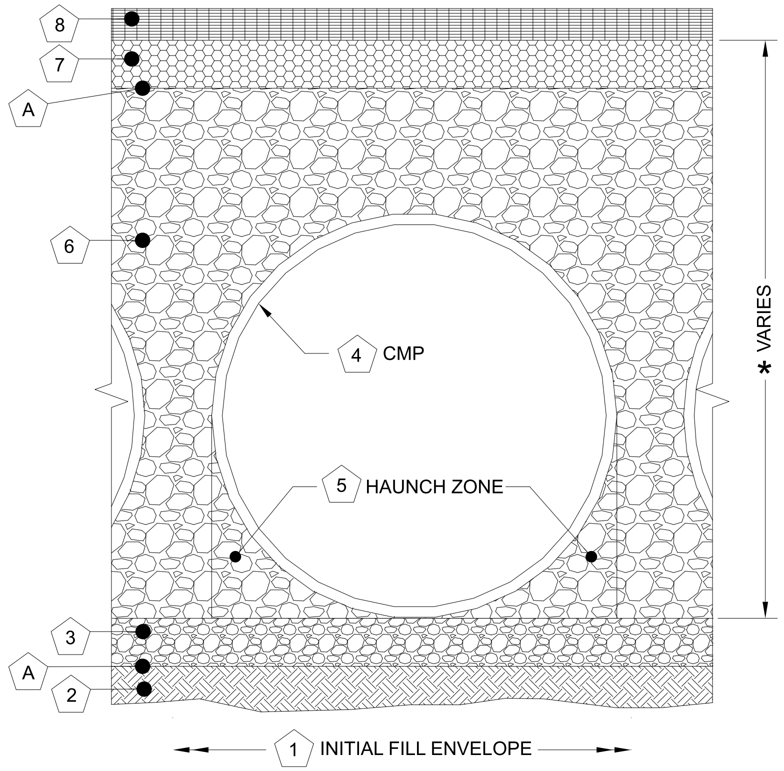


Infiltration Systems - CMP Infiltration & CMP Perforated Drainage Pipe				
	Material Location	Description	Material Designation	Designation
8	Rigid or Flexible Pavement (if applicable)			
7	Road Base (if applicable			
A	Geotextile Layer	Non-Woven Geotextile	CONTECH C-40 or C-45	Engineer Decision for consideration to prevent soil migration into varying soil types. Wrap the trench only.
6	Backfill	Infiltration pipe systems have a pipe perforation sized of 3/8" diameter. An open graded, free draining stone, with a particle size of ½" – 2 ½" diameter is recommended.	AASHTO M 145-A-1 or AASHTO M 43 - 3, 4	Material shall be worked into the pipe haunches by means of shovel-slicing, rodding, air-tamper, vibratory rod, or other effective methods. Compaction of all placed fill material is necessary and shall be considered adequate when no further yielding of the material is observed under the compactor, or under foot, and the Project Engineer or his representative is satisfied with the level of compaction"
3	Bedding Stone	Well graded granular bedding material w/maximum particle size of 3"	AASHTO M43 - 3,357,4,467, 5, 56, 57	For soil aggregates larger than 3/8" a dedicated bedding layer is not required for CMP. Pipe may be placed on the trench bottom comprised of native suitable well graded & granular material. For Arch pipes it is recommended to be shaped to a relatively flat bottom or fine-grade the foundation to a slight v-shape. Soil aggregates less than 3/8" and unsuitable material should be over-excavated and re-placed with a 4"-6" layer of well graded & granular stone per the material designation.
A	Geotextile Layer	None	None	Contech does not recommend geotextiles be placed under the invert of Infiltration systems due to the propensity for geotextiles to clog over time.
*	Note: The listed AASHTO designations are for gradation only. The stone must also be angular and clean.			

1 MINIMUM WIDTH DEPENDS ON SITE CONDITIONS AND ENGINEERING JUDGEMENT.

FOUNDATION/BEDDING PREPARATION

2 PRIOR TO PLACING THE BEDDING, THE FOUNDATION MUST BE CONSTRUCTED TO A UNIFORM AND STABLE GRADE. IN THE EVENT THAT UNSUITABLE FOUNDATION MATERIALS ARE ENCOUNTERED DURING EXCAVATION, THEY SHALL BE REMOVED AND BROUGHT BACK TO THE GRADE WITH A FILL MATERIAL AS APPROVED BY THE ENGINEER.

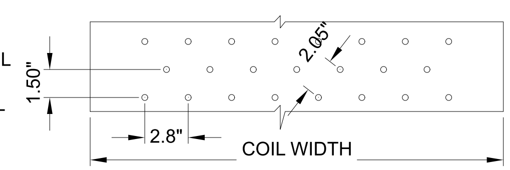
5 HAUNCH ZONE MATERIAL SHALL BE PLACED AND UNIFORMLY COMPACTED WITHOUT SOFT SPOTS.

BACKFILL
MATERIAL SHALL BE PLACED IN 8"-10" MAXIMUM LIFTS. INADEQUATE COMPACTION CAN LEAD TO EXCESSIVE DEFLECTIONS WITHIN THE SYSTEM AND SETTLEMENT OF THE SOILS OVER THE SYSTEM. BACKFILL SHALL BE PLACED SUCH THAT THERE IS NO MORE THAN A TWO-LIFT DIFFERENTIAL BETWEEN THE SIDES OF ANY PIPE IN THE SYSTEM AT ALL TIMES DURING THE BACKFILL PROCESS. BACKFILL SHALL BE ADVANCED ALONG THE LENGTH OF THE SYSTEM AT THE SAME RATE TO AVOID DIFFERENTIAL LOADING ON ANY PIPES IN THE SYSTEM.

EQUIPMENT USED TO PLACE AND COMPACT THE BACKFILL SHALL BE OF A SIZE AND TYPE SO AS NOT TO DISTORT, DAMAGE, OR DISPLACE THE PIPE. ATTENTION MUST BE GIVEN TO PROVIDING ADEQUATE MINIMUM COVER FOR SUCH EQUIPMENT. MAINTAIN BALANCED LOADING ON ALL PIPES IN THE SYSTEM DURING ALL SUCH OPERATIONS.

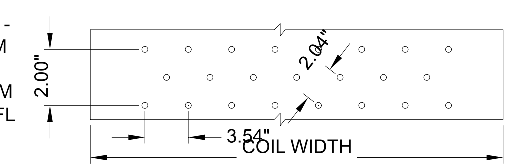
OTHER ALTERNATE BACKFILL MATERIAL MAY BE ALLOWED DEPENDING ON SITE SPECIFIC CONDITIONS. REFER TO TYPICAL BACKFILL DETAIL FOR MATERIAL REQUIRED.

2 2/3" x 1/2" CORRUGATION - STEEL AND ALUMINUM CMP EDGE SPACING EQUAL ON BOTH SIDES



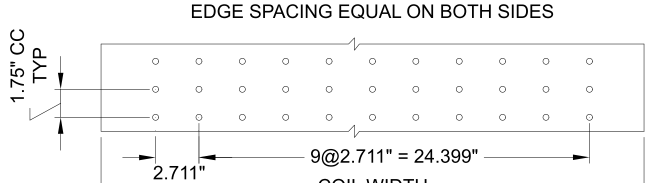
OPEN AREA = 3.76 SQ IN/SQ FT

3" x 1" CORRUGATION - STEEL AND ALUMINUM CMP (COIL PROVIDED FROM CONTECH LANTANA, FL PLANT)



OPEN AREA = 4.16 SQ IN/SQ FT

5" x 1" CORRUGATION - STEEL ONLY EDGE SPACING EQUAL ON BOTH SIDES



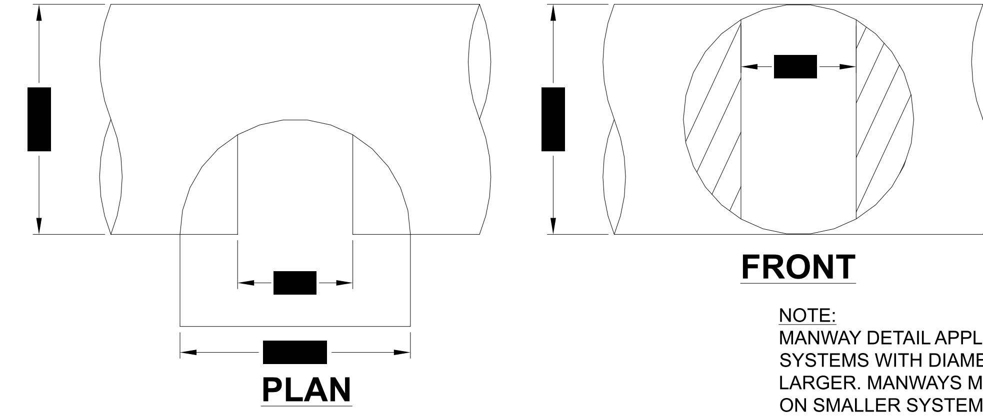
OPEN AREA = 3.33 SQ IN/SQ FT

NOTES:

1. PERFORATIONS MEET AASHTO AND ASTM SPECIFICATIONS.
2. PERFORATION OPEN AREA PER SQUARE FOOT OF PIPE IS BASED ON THE NOMINAL DIAMETER AND LENGTH OF PIPE.
3. ALL DIMENSIONS ARE SUBJECT TO MANUFACTURING TOLERANCES.
4. ALL HOLES ∅3/8".

TYPICAL PERFORATION DETAIL

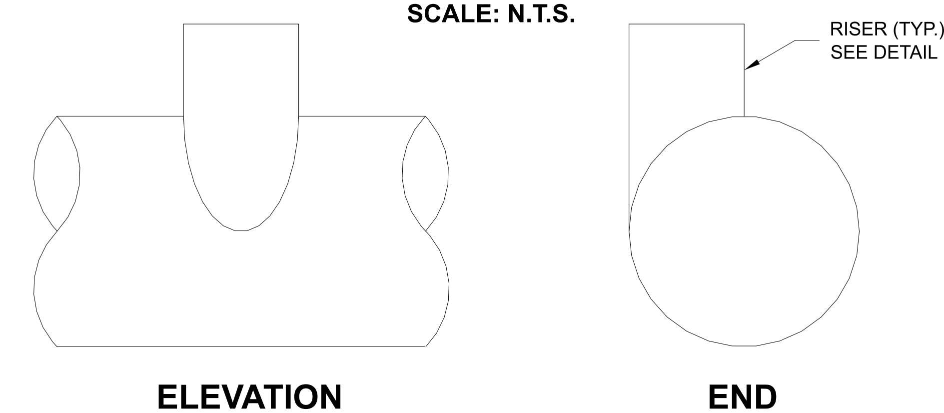
SCALE: N.T.S.



NOTE:
MANWAY DETAIL APPLICABLE FOR CMP SYSTEMS WITH DIAMETERS 48" AND LARGER. MANWAYS MAY BE REQUIRED ON SMALLER SYSTEMS DEPENDING ON ACTUAL SITE SPECIFIC CONDITIONS.

TYPICAL MANWAY DETAIL

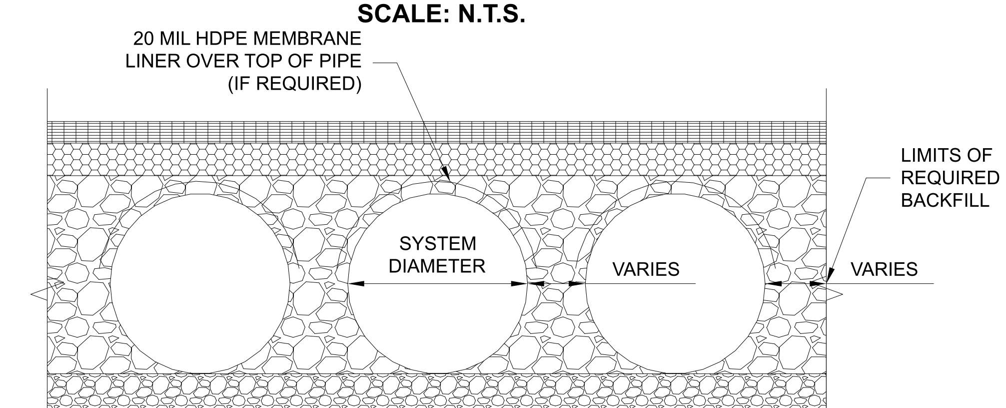
SCALE: N.T.S.



NOTE:
LADDERS ARE OPTIONAL AND ARE NOT REQUIRED FOR ALL SYSTEMS.

TYPICAL RISER DETAIL

SCALE: N.T.S.



TYPICAL SECTION VIEW

LINER OVER ROWS
SCALE: N.T.S.

NOTE: IF SALTING AGENTS FOR SNOW AND ICE REMOVAL ARE USED ON OR NEAR THE PROJECT, AN HDPE MEMBRANE LINER IS RECOMMENDED WITH THE SYSTEM. THE IMPERMEABLE LINER IS INTENDED TO HELP PROTECT THE SYSTEM FROM THE POTENTIAL ADVERSE EFFECTS THAT MAY RESULT FROM A CHANGE IN THE SURROUNDING ENVIRONMENT OVER A PERIOD OF TIME. PLEASE REFER TO THE CORRUGATED METAL PIPE DETENTION DESIGN GUIDE FOR ADDITIONAL INFORMATION.

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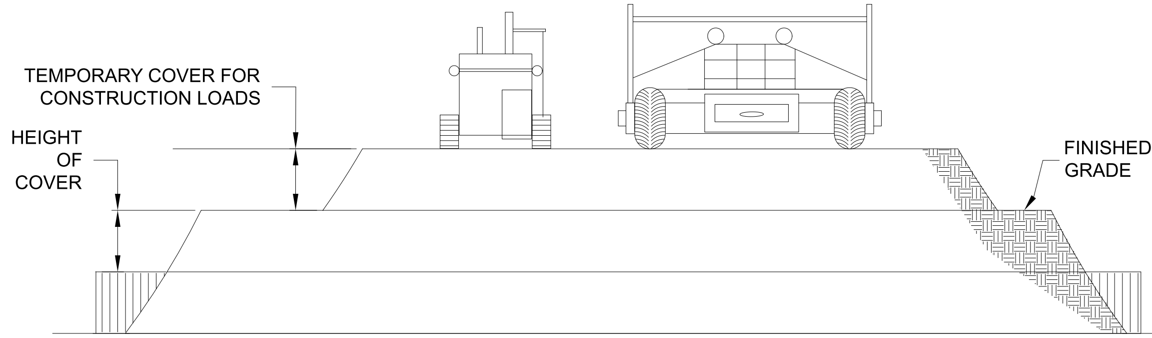
CONTECH CMP DETENTION SYSTEMS

CONTECH DYODS DRAWING

DYO23059 Cordova Complex
hz
Santa Ana, CA
DETENTION SYSTEM

PROJECT No.: 15164	SEQ. No.: 23059	DATE: 10/27/2022
DESIGNED: DYO		DRAWN: DYO
CHECKED: DYO		APPROVED: DYO
SHEET NO.: 1		



CONSTRUCTION LOADS

FOR TEMPORARY CONSTRUCTION VEHICLE LOADS, AN EXTRA AMOUNT OF COMPACTED COVER MAY BE REQUIRED OVER THE TOP OF THE PIPE. THE HEIGHT-OF-COVER SHALL MEET THE MINIMUM REQUIREMENTS SHOWN IN THE TABLE BELOW. THE USE OF HEAVY CONSTRUCTION EQUIPMENT NECESSITATES GREATER PROTECTION FOR THE PIPE THAN FINISHED GRADE COVER MINIMUMS FOR NORMAL HIGHWAY TRAFFIC.

PIPE SPAN, INCHES	AXLE LOADS (kips)			
	18-50	50-75	75-110	110-150
	MINIMUM COVER (FT)			
12-42	2.0	2.5	3.0	3.0
48-72	3.0	3.0	3.5	4.0
78-120	3.0	3.5	4.0	4.0
126-144	3.5	4.0	4.5	4.5

*MINIMUM COVER MAY VARY, DEPENDING ON LOCAL CONDITIONS. THE CONTRACTOR MUST PROVIDE THE ADDITIONAL COVER REQUIRED TO AVOID DAMAGE TO THE PIPE. MINIMUM COVER IS MEASURED FROM THE TOP OF THE PIPE TO THE TOP OF THE MAINTAINED CONSTRUCTION ROADWAY SURFACE.

CONSTRUCTION LOADING DIAGRAM

SCALE: N.T.S.

SPECIFICATION FOR DESIGNED DETENTION SYSTEM:

SCOPE
THIS SPECIFICATION COVERS THE MANUFACTURE AND INSTALLATION OF THE DESIGNED DETENTION SYSTEM DETAILED IN THE PROJECT PLANS.

MATERIAL
THE MATERIAL SHALL CONFORM TO THE APPLICABLE REQUIREMENTS LISTED BELOW:

ALUMINIZED TYPE 2 STEEL COILS SHALL CONFORM TO THE APPLICABLE REQUIREMENTS OF AASHTO M-274 OR ASTM A-92.

THE GALVANIZED STEEL COILS SHALL CONFORM TO THE APPLICABLE REQUIREMENTS OF AASHTO M-218 OR ASTM A-929.

THE POLYMER COATED STEEL COILS SHALL CONFORM TO THE APPLICABLE REQUIREMENTS OF AASHTO M-246 OR ASTM A-742.

THE ALUMINUM COILS SHALL CONFORM TO THE APPLICABLE REQUIREMENTS OF AASHTO M-197 OR ASTM B-744.

CONSTRUCTION LOADS
CONSTRUCTION LOADS MAY BE HIGHER THAN FINAL LOADS. FOLLOW THE MANUFACTURER'S OR NCSPA GUIDELINES.

PIPE
THE PIPE SHALL BE MANUFACTURED IN ACCORDANCE TO THE APPLICABLE REQUIREMENTS LISTED BELOW:

ALUMINIZED TYPE 2: AASHTO M-36 OR ASTM A-760

GALVANIZED: AASHTO M-36 OR ASTM A-760

POLYMER COATED: AASHTO M-245 OR ASTM A-762

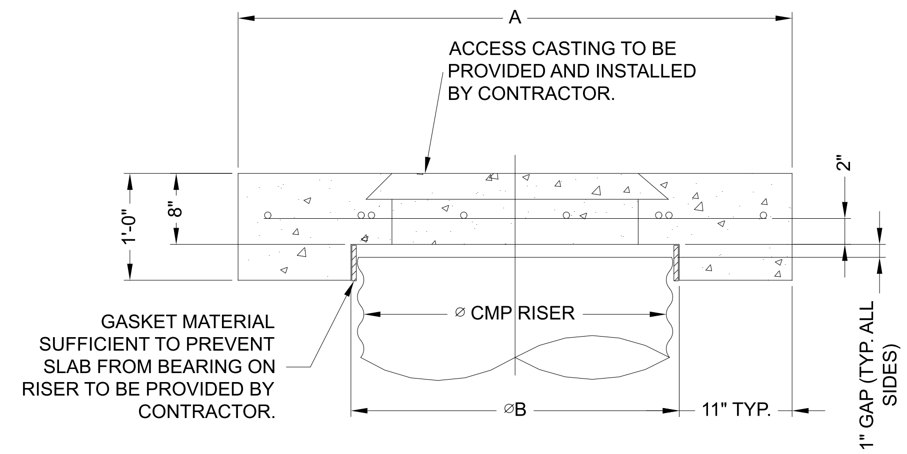
ALUMINUM: AASHTO M-196 OR ASTM B-745

HANDLING AND ASSEMBLY
SHALL BE IN ACCORDANCE WITH NCSP'S (NATIONAL CORRUGATED STEEL PIPE ASSOCIATION) FOR ALUMINIZED TYPE 2, GALVANIZED OR POLYMER COATED STEEL. SHALL BE IN ACCORDANCE WITH THE MANUFACTURER'S RECOMMENDATIONS FOR ALUMINUM PIPE.

INSTALLATION
SHALL BE IN ACCORDANCE WITH AASHTO STANDARD SPECIFICATIONS FOR HIGHWAY BRIDGES, SECTION 26, DIVISION II DIVISION II OR ASTM A-798 (FOR ALUMINIZED TYPE 2, GALVANIZED OR POLYMER COATED STEEL) OR ASTM B-788 (FOR ALUMINUM PIPE) AND IN CONFORMANCE WITH THE PROJECT PLANS AND SPECIFICATIONS. IF THERE ARE ANY INCONSISTENCIES OR CONFLICTS THE CONTRACTOR SHOULD DISCUSS AND RESOLVE WITH THE SITE ENGINEER.

IT IS ALWAYS THE RESPONSIBILITY OF THE CONTRACTOR TO FOLLOW OSHA GUIDELINES FOR SAFE PRACTICES.

NOTE:
THESE DRAWINGS ARE FOR CONCEPTUAL PURPOSES AND DO NOT REFLECT ANY LOCAL PREFERENCES OR REGULATIONS. PLEASE CONTACT YOUR LOCAL CONTECH REP FOR MODIFICATIONS.

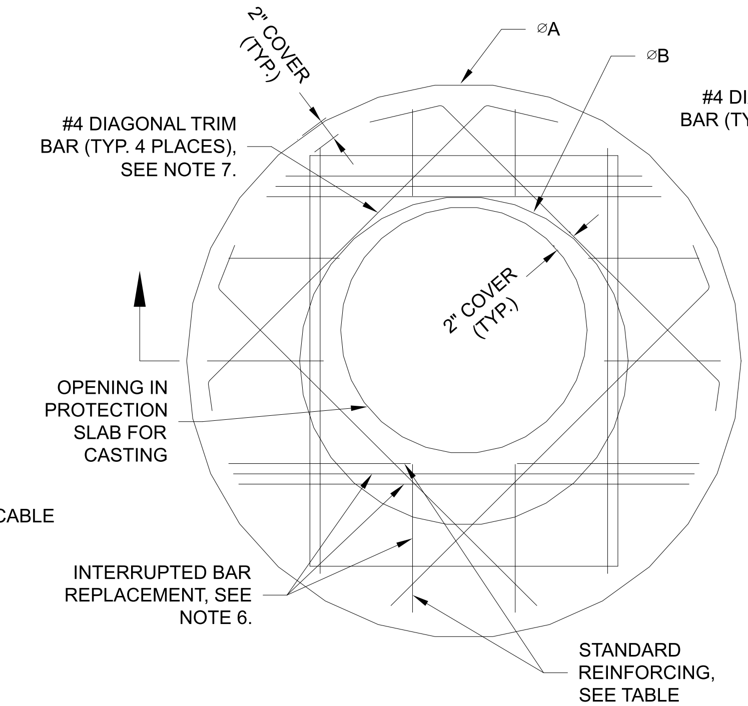


SECTION VIEW

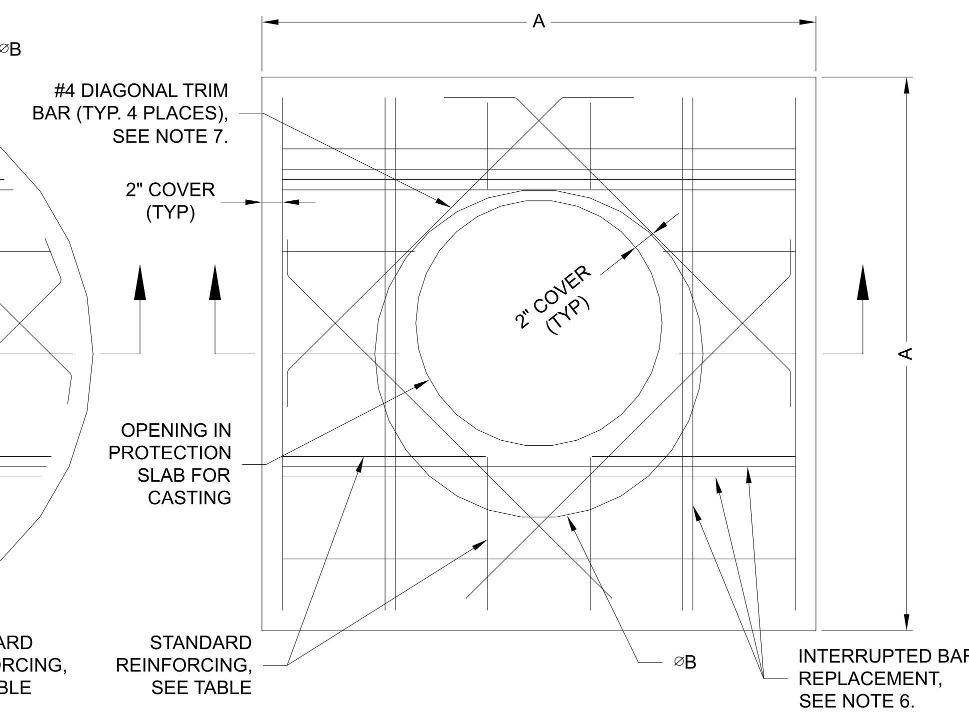
REINFORCING TABLE

⌀ CMP RISER	A	⌀ B	REINFORCING	**BEARING PRESSURE (PSF)
24"	⌀ 4' 4'X4'	26"	#5 @ 12" OCEW #5 @ 12" OCEW	2,410 1,780
30"	⌀ 4'-6" 4'-6" X 4'-6"	32"	#5 @ 12" OCEW #5 @ 12" OCEW	2,120 1,530
36"	⌀ 5' 5' X 5'	38"	#5 @ 10" OCEW #5 @ 10" OCEW	1,890 1,350
42"	⌀ 5'-6" 5'-6" X 5'-6"	44"	#5 @ 10" OCEW #5 @ 9" OCEW	1,720 1,210
48"	⌀ 6' 6' X 6'	50"	#5 @ 9" OCEW #5 @ 8" OCEW	1,600 1,100

** ASSUMED SOIL BEARING CAPACITY



ROUND OPTION PLAN VIEW



SQUARE OPTION PLAN VIEW

NOTES:

1. DESIGN IN ACCORDANCE WITH AASHTO, 17th EDITION.
2. DESIGN LOAD HS25.
3. EARTH COVER = 1' MAX.
4. CONCRETE STRENGTH = 3,500 psi
5. REINFORCING STEEL = ASTM A615, GRADE 60.
6. PROVIDE ADDITIONAL REINFORCING AROUND OPENINGS EQUAL TO THE BARS INTERRUPTED, HALF EACH SIDE. ADDITIONAL BARS TO BE IN THE SAME PLANE.
7. TRIM OPENING WITH DIAGONAL #4 BARS, EXTEND BARS A MINIMUM OF 12" BEYOND OPENING, BEND BARS AS REQUIRED TO MAINTAIN BAR COVER.
8. PROTECTION SLAB AND ALL MATERIALS TO BE PROVIDED AND INSTALLED BY CONTRACTOR.
9. DETAIL DESIGN BY DELTA ENGINEERING, BINGHAMTON, NY.

MANHOLE CAP DETAIL

SCALE: N.T.S.

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CONTECH CMP DETENTION SYSTEMS

CONTECH **DYODS** DRAWING

DYO23059 Cordova Complex
hz
Santa Ana, CA
DETENTION SYSTEM

PROJECT No.: 15164	SEQ. No.: 23059	DATE: 10/27/2022
DESIGNED: DYO		DRAWN: DYO
CHECKED: DYO		APPROVED: DYO
SHEET NO.: 1		

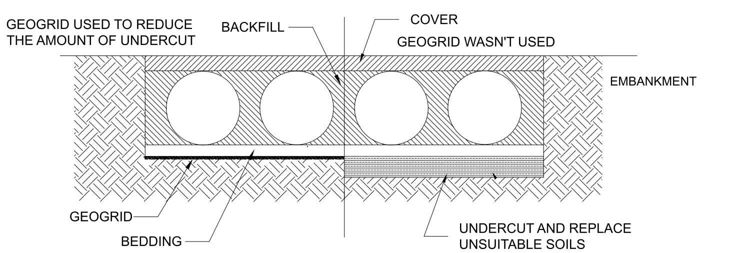
CMP DETENTION INSTALLATION GUIDE

PROPER INSTALLATION OF A FLEXIBLE UNDERGROUND DETENTION SYSTEM WILL ENSURE LONG-TERM PERFORMANCE. THE CONFIGURATION OF THESE SYSTEMS OFTEN REQUIRES SPECIAL CONSTRUCTION PRACTICES THAT DIFFER FROM CONVENTIONAL FLEXIBLE PIPE CONSTRUCTION. CONTECH ENGINEERED SOLUTIONS STRONGLY SUGGESTS SCHEDULING A PRE-CONSTRUCTION MEETING WITH YOUR LOCAL SALES ENGINEER TO DETERMINE IF ADDITIONAL MEASURES, NOT COVERED IN THIS GUIDE, ARE APPROPRIATE FOR YOUR SITE.

FOUNDATION

CONSTRUCT A FOUNDATION THAT CAN SUPPORT THE DESIGN LOADING APPLIED BY THE PIPE AND ADJACENT BACKFILL WEIGHT AS WELL AS MAINTAIN ITS INTEGRITY DURING CONSTRUCTION.

IF SOFT OR UNSUITABLE SOILS ARE ENCOUNTERED, REMOVE THE POOR SOILS DOWN TO A SUITABLE DEPTH AND THEN BUILD UP TO THE APPROPRIATE ELEVATION WITH A COMPETENT BACKFILL MATERIAL. THE STRUCTURAL FILL MATERIAL GRADATION SHOULD NOT ALLOW THE MIGRATION OF FINES, WHICH CAN CAUSE SETTLEMENT OF THE DETENTION SYSTEM OR PAVEMENT ABOVE. IF THE STRUCTURAL FILL MATERIAL IS NOT COMPATIBLE WITH THE UNDERLYING SOILS AN ENGINEERING FABRIC SHOULD BE USED AS A SEPARATOR. IN SOME CASES, USING A STIFF REINFORCING GEOGRID REDUCES OVER EXCAVATION AND REPLACEMENT FILL QUANTITIES.

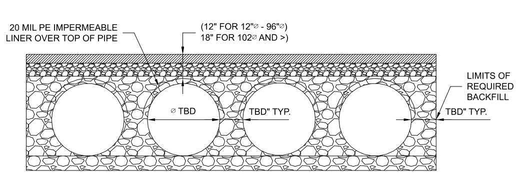


GRADE THE FOUNDATION SUBGRADE TO A UNIFORM OR SLIGHTLY SLOPING GRADE. IF THE SUBGRADE IS CLAY OR RELATIVELY NON-POROUS AND THE CONSTRUCTION SEQUENCE WILL LAST FOR AN EXTENDED PERIOD OF TIME, IT IS BEST TO SLOPE THE GRADE TO ONE END OF THE SYSTEM. THIS WILL ALLOW EXCESS WATER TO DRAIN QUICKLY, PREVENTING SATURATION OF THE SUBGRADE.

GEOMEMBRANE BARRIER

A SITE'S RESISTIVITY MAY CHANGE OVER TIME WHEN VARIOUS TYPES OF SALTING AGENTS ARE USED, SUCH AS ROAD SALTS FOR DEICING AGENTS. IF SALTING AGENTS ARE USED ON OR NEAR THE PROJECT SITE, A GEOMEMBRANE BARRIER IS RECOMMENDED WITH THE SYSTEM. THE GEOMEMBRANE LINER IS INTENDED TO HELP PROTECT THE SYSTEM FROM THE POTENTIAL ADVERSE EFFECTS THAT MAY RESULT FROM THE USE OF SUCH AGENTS INCLUDING PREMATURE CORROSION AND REDUCED ACTUAL SERVICE LIFE.

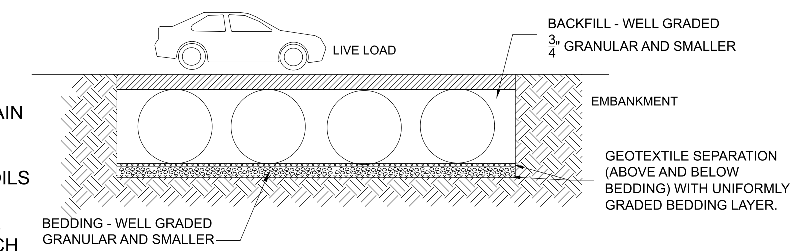
THE PROJECT'S ENGINEER OF RECORD IS TO EVALUATE WHETHER SALTING AGENTS WILL BE USED ON OR NEAR THE PROJECT SITE, AND USE HIS/HER BEST JUDGEMENT TO DETERMINE IF ANY ADDITIONAL PROTECTIVE MEASURES ARE REQUIRED. BELOW IS A TYPICAL DETAIL SHOWING THE PLACEMENT OF A GEOMEMBRANE BARRIER FOR PROJECTS WHERE SALTING AGENTS ARE USED ON OR NEAR THE PROJECT SITE.



IN-SITU TRENCH WALL

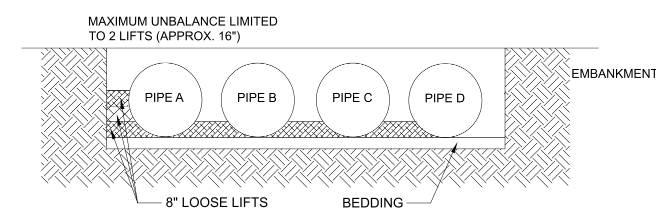
IF EXCAVATION IS REQUIRED, THE TRENCH WALL NEEDS TO BE CAPABLE OF SUPPORTING THE LOAD THAT THE PIPE SHEDS AS THE SYSTEM IS LOADED. IF SOILS ARE NOT CAPABLE OF SUPPORTING THESE LOADS, THE PIPE CAN DEFLECT. PERFORM A SIMPLE SOIL PRESSURE CHECK USING THE APPLIED LOADS TO DETERMINE THE LIMITS OF EXCAVATION BEYOND THE SPRING LINE OF THE OUTER MOST PIPES.

IN MOST CASES THE REQUIREMENTS FOR A SAFE WORK ENVIRONMENT AND PROPER BACKFILL PLACEMENT AND COMPACTION TAKE CARE OF THIS CONCERN.



BACKFILL PLACEMENT

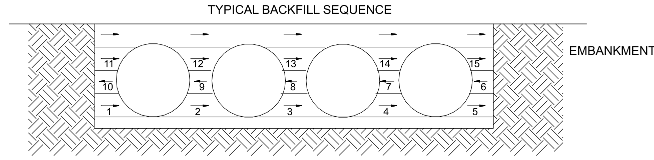
MATERIAL SHALL BE WORKED INTO THE PIPE HAUNCHES BY MEANS OF SHOVEL-SLICING, RODDING, AIR TAMPER, VIBRATORY ROD, OR OTHER EFFECTIVE METHODS.



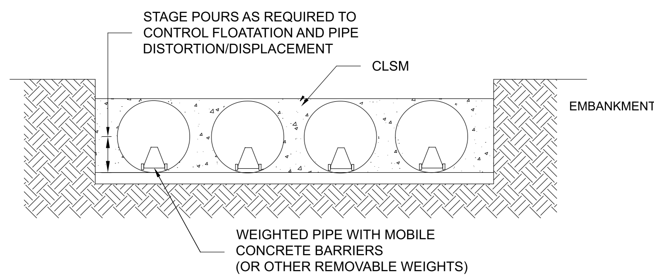
IF AASHTO T99 PROCEDURES ARE DETERMINED INFEASIBLE BY THE GEOTECHNICAL ENGINEER OF RECORD, COMPACTION IS CONSIDERED ADEQUATE WHEN NO FURTHER YIELDING OF THE MATERIAL IS OBSERVED UNDER THE COMPACTOR, OR UNDER FOOT, AND THE GEOTECHNICAL ENGINEER OF RECORD (OR REPRESENTATIVE THEREOF) IS SATISFIED WITH THE LEVEL OF COMPACTION.

FOR LARGE SYSTEMS, CONVEYOR SYSTEMS, BACKHOES WITH LONG REACHES OR DRAGLINES WITH STONE BUCKETS MAY BE USED TO PLACE BACKFILL. ONCE MINIMUM COVER FOR CONSTRUCTION LOADING ACROSS THE ENTIRE WIDTH OF THE SYSTEM IS REACHED, ADVANCE THE EQUIPMENT TO THE END OF THE RECENTLY PLACED FILL, AND BEGIN THE SEQUENCE AGAIN UNTIL THE SYSTEM IS COMPLETELY BACKFILLED. THIS TYPE OF CONSTRUCTION SEQUENCE PROVIDES ROOM FOR STOCKPILED BACKFILL DIRECTLY BEHIND THE BACKHOE, AS WELL AS THE MOVEMENT OF CONSTRUCTION TRAFFIC. MATERIAL STOCKPILES ON TOP OF THE BACKFILLED DETENTION SYSTEM SHOULD BE LIMITED TO 8- TO 10-FEET HIGH AND MUST PROVIDE BALANCED LOADING ACROSS ALL BARRELS. TO DETERMINE THE PROPER COVER OVER THE PIPES TO ALLOW THE MOVEMENT OF CONSTRUCTION EQUIPMENT SEE TABLE 1, OR CONTACT YOUR LOCAL CONTECH SALES ENGINEER.

TYPICAL BACKFILL SEQUENCE



WHEN FLOWABLE FILL IS USED, YOU MUST PREVENT PIPE FLOATATION. TYPICALLY, SMALL LIFTS ARE PLACED BETWEEN THE PIPES AND THEN ALLOWED TO SET-UP PRIOR TO THE PLACEMENT OF THE NEXT LIFT. THE ALLOWABLE THICKNESS OF THE CLSM LIFT IS A FUNCTION OF A PROPER BALANCE BETWEEN THE UPLIFT FORCE OF THE CLSM, THE OPPOSING WEIGHT OF THE PIPE, AND THE EFFECT OF OTHER RESTRAINING MEASURES. THE PIPE CAN CARRY LIMITED FLUID PRESSURE WITHOUT PIPE DISTORTION OR DISPLACEMENT, WHICH ALSO AFFECTS THE CLSM LIFT THICKNESS. YOUR LOCAL CONTECH SALES ENGINEER CAN HELP DETERMINE THE PROPER LIFT THICKNESS.

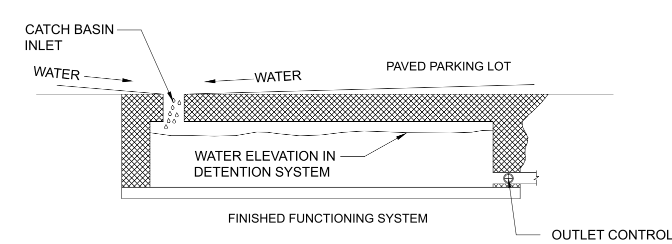


CONSTRUCTION LOADING

TYPICALLY, THE MINIMUM COVER SPECIFIED FOR A PROJECT ASSUMES H-20 LIVE LOAD. BECAUSE CONSTRUCTION LOADS OFTEN EXCEED DESIGN LIVE LOADS, INCREASED TEMPORARY MINIMUM COVER REQUIREMENTS ARE NECESSARY. SINCE CONSTRUCTION EQUIPMENT VARIES FROM JOB TO JOB, IT IS BEST TO ADDRESS EQUIPMENT SPECIFIC MINIMUM COVER REQUIREMENTS WITH YOUR LOCAL CONTECH SALES ENGINEER DURING YOUR PRE-CONSTRUCTION MEETING.

ADDITIONAL CONSIDERATIONS

BECAUSE MOST SYSTEMS ARE CONSTRUCTED BELOW-GRADE, RAINFALL CAN RAPIDLY FILL THE EXCAVATION; POTENTIALLY CAUSING FLOATATION AND MOVEMENT OF THE PREVIOUSLY PLACED PIPES. TO HELP MITIGATE POTENTIAL PROBLEMS, IT IS BEST TO START THE INSTALLATION AT THE DOWNSTREAM END WITH THE OUTLET ALREADY CONSTRUCTED TO ALLOW A ROUTE FOR THE WATER TO ESCAPE. TEMPORARY DIVERSION MEASURES MAY BE REQUIRED FOR HIGH FLOWS DUE TO THE RESTRICTED NATURE OF THE OUTLET PIPE.



CMP DETENTION SYSTEM INSPECTION AND MAINTENANCE

UNDERGROUND STORMWATER DETENTION AND INFILTRATION SYSTEMS MUST BE INSPECTED AND MAINTAINED AT REGULAR INTERVALS FOR PURPOSES OF PERFORMANCE AND LONGEVITY.

INSPECTION

INSPECTION IS THE KEY TO EFFECTIVE MAINTENANCE OF CMP DETENTION SYSTEMS AND IS EASILY PERFORMED. CONTECH RECOMMENDS ONGOING, ANNUAL INSPECTIONS. SITES WITH HIGH TRASH LOAD OR SMALL OUTLET CONTROL ORIFICES MAY NEED MORE FREQUENT INSPECTIONS. THE RATE AT WHICH THE SYSTEM COLLECTS POLLUTANTS WILL DEPEND MORE ON SITE SPECIFIC ACTIVITIES RATHER THAN THE SIZE OR CONFIGURATION OF THE SYSTEM.

INSPECTIONS SHOULD BE PERFORMED MORE OFTEN IN EQUIPMENT WASHDOWN AREAS, IN CLIMATES WHERE SANDING AND/OR SALTING OPERATIONS TAKE PLACE, AND IN OTHER VARIOUS INSTANCES IN WHICH ONE WOULD EXPECT HIGHER ACCUMULATIONS OF SEDIMENT OR ABRASIVE/ CORROSIVE CONDITIONS. A RECORD OF EACH INSPECTION IS TO BE MAINTAINED FOR THE LIFE OF THE SYSTEM

MAINTENANCE

CMP DETENTION SYSTEMS SHOULD BE CLEANED WHEN AN INSPECTION REVEALS ACCUMULATED SEDIMENT OR TRASH IS CLOGGING THE DISCHARGE ORIFICE.

ACCUMULATED SEDIMENT AND TRASH CAN TYPICALLY BE EVACUATED THROUGH THE MANHOLE OVER THE OUTLET ORIFICE. IF MAINTENANCE IS NOT PERFORMED AS RECOMMENDED, SEDIMENT AND TRASH MAY ACCUMULATE IN FRONT OF THE OUTLET ORIFICE. MANHOLE COVERS SHOULD BE SECURELY SEATED FOLLOWING CLEANING ACTIVITIES. CONTECH SUGGESTS THAT ALL SYSTEMS BE DESIGNED WITH AN ACCESS/INSPECTION MANHOLE SITUATED AT OR NEAR THE INLET AND THE OUTLET ORIFICE. SHOULD IT BE NECESSARY TO GET INSIDE THE SYSTEM TO PERFORM MAINTENANCE ACTIVITIES, ALL APPROPRIATE PRECAUTIONS REGARDING CONFINED SPACE ENTRY AND OSHA REGULATIONS SHOULD BE FOLLOWED.

ANNUAL INSPECTIONS ARE BEST PRACTICE FOR ALL UNDERGROUND SYSTEMS. DURING THIS INSPECTION, IF EVIDENCE OF SALTING/DE-ICING AGENTS IS OBSERVED WITHIN THE SYSTEM, IT IS BEST PRACTICE FOR THE SYSTEM TO BE RINSED, INCLUDING ABOVE THE SPRING LINE SOON AFTER THE SPRING THAW AS PART OF THE MAINTENANCE PROGRAM FOR THE SYSTEM.

MAINTAINING AN UNDERGROUND DETENTION OR INFILTRATION SYSTEM IS EASIEST WHEN THERE IS NO FLOW ENTERING THE SYSTEM. FOR THIS REASON, IT IS A GOOD IDEA TO SCHEDULE THE CLEANOUT DURING DRY WEATHER.

THE FOREGOING INSPECTION AND MAINTENANCE EFFORTS HELP ENSURE UNDERGROUND PIPE SYSTEMS USED FOR STORMWATER STORAGE CONTINUE TO FUNCTION AS INTENDED BY IDENTIFYING RECOMMENDED REGULAR INSPECTION AND MAINTENANCE PRACTICES. INSPECTION AND MAINTENANCE RELATED TO THE STRUCTURAL INTEGRITY OF THE PIPE OR THE SOUNDNESS OF PIPE JOINT CONNECTIONS IS BEYOND THE SCOPE OF THIS GUIDE.

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DATE	REVISION DESCRIPTION	BY

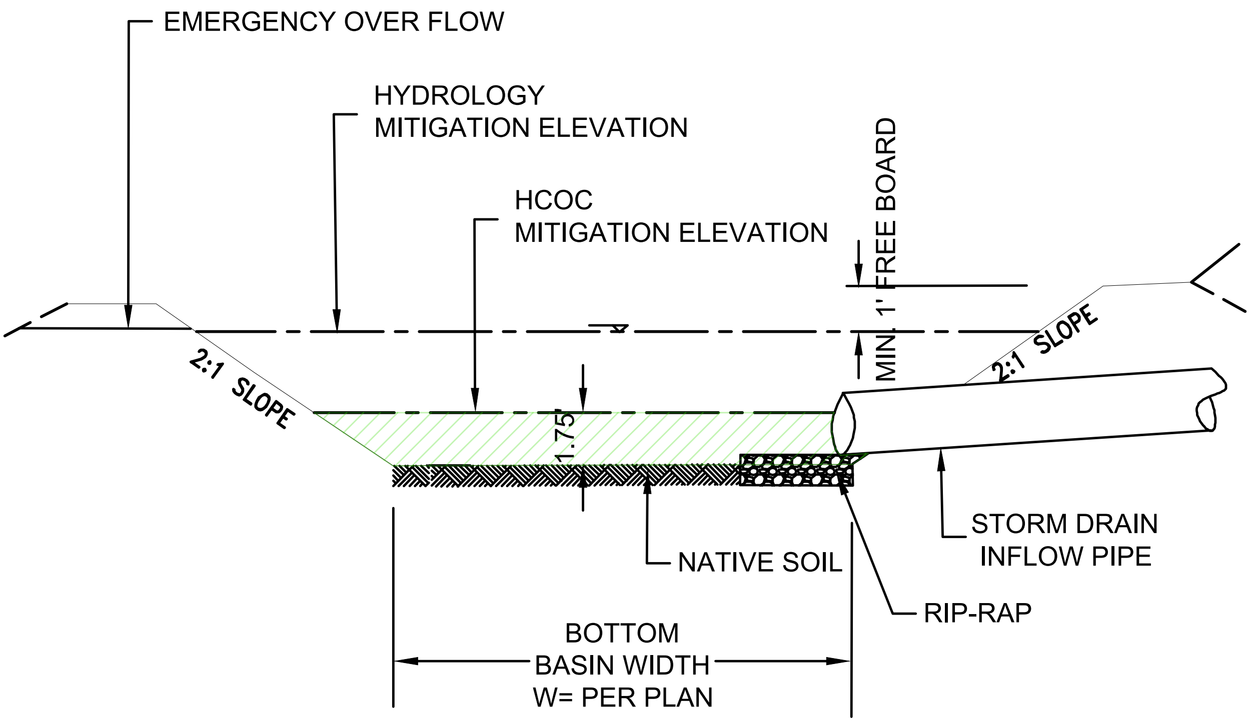
CONTECH®
ENGINEERED SOLUTIONS LLC
www.ContechES.com
9025 Centre Pointe Dr., Suite 400, West Chester, OH 45069
800-338-1122 513-645-7000 513-645-7993 FAX

CONTECH®
CMP DETENTION SYSTEMS

CONTECH
DYODS
DRAWING

DYO23059 Cordova Complex
hz
Santa Ana, CA
DETENTION SYSTEM

PROJECT No.: 15164	SEQ. No.: 23059	DATE: 10/27/2022
DESIGNED: DYO		DRAWN: DYO
CHECKED: DYO		APPROVED: DYO
SHEET NO.:		1



A-A
TYPICAL DETENTION/ INFILTRATION BASIN SECTION

N.T.S.

Cordova Site Basin-A2 Stage Table:

Elevation (ft.)	Basin Area (sf)	Depth (ft.)	Basin Volume (cft)	Basin Volume (ac-ft)	Basin Infiltration Flow* (cfs)	Weir Over Flow (cfs)	Total Outlet Flow (cfs)
0	30,775	-	-	-	0.81	0.00	0.81
1	34,815	1.00	32,795	0.75	0.81	0.00	0.81
2	38,882	2.00	73,697	1.69	0.81	0.00	0.81
3	42,979	3.00	114,628	2.63	0.81	0.00	0.81
4	47,103	4.00	159,669	3.67	0.81	0.00	0.81
5.5	51,256	5.50	233,438	5.36	0.81	0.00	0.81
6	55,437	6.00	260,111	5.97	0.81	18.00	18.81

Note:

* Infiltration flow based on the infiltration test the Infiltration rate =2.5in/hr with safty factor SF=2.19, design infiltration rate=2.5/2.19=1.14 in/hr.
Basin infiltration flow=(1/12x1.14)/3600 xBasin Bottom Area = 4.77 cfs

Basin Provided Volume

Cordova Site Basin-A3 Stage Table:

Elevation (ft.)	Basin Area (sf)	Depth (ft.)	Basin Volume (cft)	Basin Volume (ac-ft)	Basin Infiltration Flow* (cfs)	Weir Over Flow (cfs)	Total Outlet Flow (cfs)
0	84,266	-	-	-	2.22	0.00	2.22
1	90,151	1.00	87,209	2.00	2.22	0.00	2.22
2	96,068	2.00	186,219	4.28	2.22	0.00	2.22
3	102,017	3.00	285,262	6.55	2.22	0.00	2.22
4	107,988	4.00	390,264	8.96	2.22	0.00	2.22
5.5	114,010	5.50	556,763	12.78	2.22	0.00	2.22
6	120,033	6.00	615,273	14.12	2.22	18.00	20.22

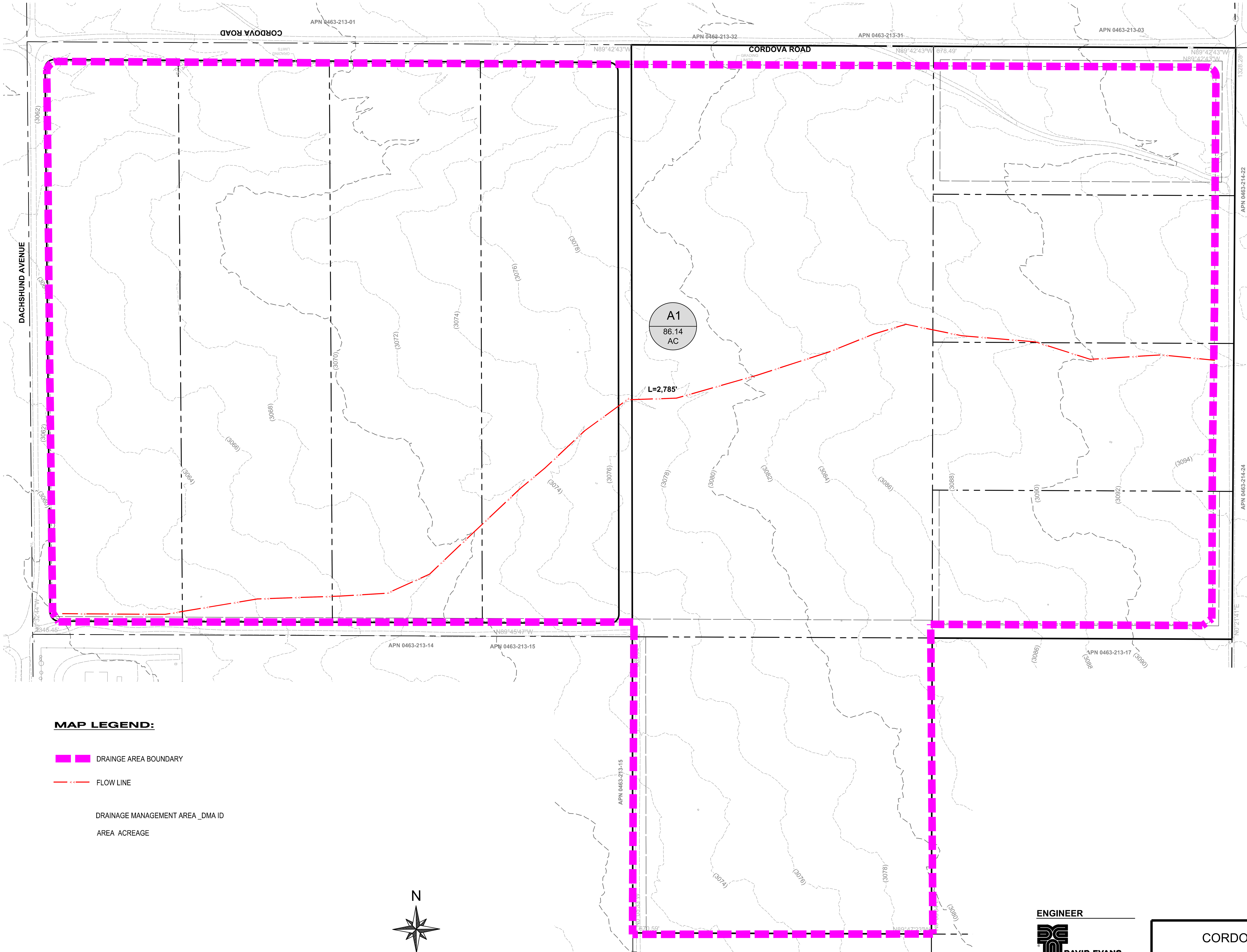
Note:

* Infiltration flow based on the infiltration test the Infiltration rate =2.5in/hr with safty factor SF=2.19, design infiltration rate=2.5/2.19=1.14 in/hr.
Basin infiltration flow=(1/12x1.14)/3600 xBasin Bottom Area = 4.77 cfs

Basin Provided Volume

Appendix D

HCOC Analysis



MAP LEGEND:

DRAINGE AREA BOUNDARY

FLOW LINE

DRAINAGE MANAGEMENT AREA _DMA ID

AREA ACREAGE

ENGINEER

DAVID EVANS AND ASSOCIATES INC.

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CORDOVA ROAD INDUSTRIAL COMPLEX

PRE-DEVELOPMENT UH METHOD EXHIBIT

FILE NO.

DRAWING NO.

SH. 1 OF 1

Plot Date: 10/19/2022 11:15 AM By: Hong Zhang
Save Date: 10/19/2022 11:14 AM By: Hxz
File: P:\VVVL00000001\0600INFO\0670Reports\WQMP Report\Cordova Site Files\CAD\PRE-UH Method Exhibit-Cordova-VVL00000001.dwg

BASIN–A1
UNDERGROUND BASIN (670' L x 65' W)
96" PERFORATE CMP PIPE SYSTEM
REQUIRED VOLUME (10–Yr. 24–Hr.) : 277,791 CU–FT
PROVIDED VOLUME (HCOC): 278,111 CU–CT
CORDOVA ROAD
DACHSHUND AVENUE
APN 0463-213-01
APN 0463-213-32
APN 0463-213-31
APN 0463-213-03
APN 0463-214-22
APN 0463-214-24
APN 0463-213-10
APN 0463-213-11
APN 0463-213-14
APN 0463-213-15
APN 0463-213-17
APN 0463-213-26
A1
35.76
AC
A2
14.55
AC
A3
35.83
AC
OFFICE
PROPOSED BUILDING
1,554,000 SF
BASIN–A2
REQUIRED VOLUME (10–Yr. 24–Hr.) : 165,696 CU–FT
PROVIDED VOLUME (HCOC): 260,111 CU–CT
DETENTION/INFILTRATION
BASIN–A2
BASIN–A3
REQUIRED VOLUME (10–Yr. 24–Hr.) : 255,666 CU–FT
PROVIDED VOLUME (HCOC): 615,273 CU–CT
DETENTION/INFILTRATION
BASIN–A3
OFF-SITE
OVERFLOW
BASIN
VICINITY MAP
N.T.S.
STODDARD WELLS RD
PROJECT
SITE
QUARRY RD
CORDOVA RD
JOHNSON RD
DALE EVANS PKWY
NAVAJO RD
CENTRAL RD
MAP LEGEND:
DRAINGE AREA BOUNDARY
PROPOSED STORM DRAIN
PROPOSED BUILDING
INFILTRATION BASIN
CMP UNDERGROUND BASIN
ROOF DRAIN DIRECTION
A1
5.0
AC
DRAINAGE MANAGEMENT AREA _DMA ID
AREA ACREAGE
NOTE:
ALL CATCH BASIN SHOULD INSTALL FLOGARD
CATCH BASIN INSERT FILTER OR EQUAL'S
APPROVAL PRODUCTS
EMERGENCY OVER FLOW
HYDROLOGY
MITIGATION ELEVATION
HCOC
MITIGATION ELEVATION
1' FREE BOARD
MIN
2:1 SLOPE
2:1 SLOPE
NATIVE SOIL
STORM DRAIN
INFLOW PIPE
RIP-RAP
BOTTOM
BASIN WIDTH
W= PER PLAN
A-A
TYPICAL DETENTION/ INFILTRATION BASIN
SECTION
N.T.S.
FREE-DRAINING ANGULAR WASHED STONE
3/4" – 2" MINIMUM PARTICLE SIZE
FINISH SURFACE
96" CMP PIPE
PERFORATED
6" SAND BEDDING
APPROVED NON-WOVEN FILTER
FABRIC AT ALL LOCATIONS WHERE
GRAVEL CONTACTS SOIL (TOP,
BOTTOM, AND SIDES). OVERLAP
SEAMS 24" MINIMUM.
PREPARE BOTTOM
PER SOILS REPORT
B-B
BASIN-1 UNDERGROUND
DETENTION / INFILTRATION SYSTEM SECTION
N.T.S.
N
scale
1"= 100'
feet
ENGINEER
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Apple Valley California 92307
Phone: 760.524.9100
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CORDOVA ROAD INDUSTRIAL COMPLEX
POST-DEVELOPMENT CONDITION
UH METHOD EXHIBIT
FILE NO.
DRAWING NO.
SH. 1 OF 1
Plot Date: 11/4/2022 10:36 AM
Save Date: 11/1/2022 4:52 PM
By: Jose Aguilar
By: hxz

Cordova Site HCOC Summary Table:

Hydromodification Analysis - 10 Year 24 Hour Storm Event					
Condition	**Area ID**	**Area (Ac)**	**Qpeak (cfs)**	**Volume (acft)**	**Volume (cuft)**
Existing Condition	A	86.14	35.20	3.00	130,680.00
Proposed Condition	A1	35.76	78.30	10.05	437,778.00
Mitigated Condition	A1	35.76	16.88	9.80	426,888.00
Proposed Condition	A2	14.55	32.96	4.08	177,724.80
Mitigated Condition	A2	14.55	0.00	4.08	177,724.80
Proposed Condition	A3	35.83	81.08	10.07	438,649.20
Mitigated Condition	A3	35.83	0.00	10.07	438,649.20
Mitigated Condition	Total;	86.14	16.88	23.95	1,043,262.00

Note: Basin mitigated volume: 99%

Basin mitigated peak Flow: 91%

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

        Copyright (c) CIVILCADD/CIVILDESIGN, 1989 - 2004, Version 7.0

                Study date  10/19/22

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

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


Program License Serial Number 4009

---------------------------------------------------------------------
Cordova Complex Site
Unit Hydrogragh Method
Existing Condition
10-year, 24-hours Storm
--------------------------------------------------------------------

        Storm Event Year = 10

        Antecedent Moisture Condition = 2

 English (in-lb) Input Units Used

 English Rainfall Data (Inches) Input Values Used

 English Units used in output format




Area averaged rainfall intensity isohyetal data:
        Sub-Area        Duration        Isohyetal
        (Ac.)            (hours)         (In)
Rainfall data for year 10
            86.14            1           0.61
--------------------------------------------------------------------
Rainfall data for year 10
            86.14            6           1.23
--------------------------------------------------------------------
Rainfall data for year 10
            86.14           24           2.14
--------------------------------------------------------------------
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++

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


SCS curve  SCS curve     Area     Area     Fp(Fig C6)    Ap      Fm
No.(AMCII) NO.(AMC 2)    (Ac.)    Fraction     (In/Hr)  (dec.)   (In/Hr)
 67.0      67.0         86.14      1.000     0.578    1.000    0.578

Area-averaged adjusted loss rate Fm (In/Hr) =  0.578

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

Area       Area          SCS CN    SCS CN      S     Pervious
 (Ac.)      Fract         (AMC2)    (AMC2)           Yield Fr
    86.14   1.000         67.0      67.0       4.93    0.103

Area-averaged catchment yield fraction, Y =  0.103
Area-averaged low loss fraction, Yb =  0.897
User entry of time of concentration  =   0.500 (hours)
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Watershed area =      86.14(Ac.)
Catchment Lag time =   0.400 hours
Unit interval =  10.000 minutes
```

```
Unit interval percentage of lag time = 41.6667
Hydrograph baseflow =     0.00(CFS)
Average maximum watershed loss rate(Fm) =  0.578(In/Hr)
Average low loss rate fraction (Yb) = 0.897 (decimal)
VALLEY UNDEVELOPED S-Graph Selected
Computed peak 5-minute rainfall =  0.289(In)
Computed peak 30-minute rainfall =  0.495(In)
Specified peak 1-hour rainfall =  0.609(In)
Computed peak 3-hour rainfall =  0.937(In)
Specified peak 6-hour rainfall =  1.230(In)
Specified peak 24-hour rainfall =  2.140(In)


Rainfall depth area reduction factors:
Using a total area of      86.14(Ac.) (Ref: fig. E-4)

5-minute factor = 0.996     Adjusted rainfall =  0.288(In)
30-minute factor = 0.996    Adjusted rainfall =  0.493(In)
1-hour factor = 0.996       Adjusted rainfall =  0.607(In)
3-hour factor = 0.999       Adjusted rainfall =  0.937(In)
6-hour factor = 1.000       Adjusted rainfall =  1.230(In)
24-hour factor = 1.000      Adjusted rainfall =  2.140(In)
---------------------------------------------------------------------

                        U n i t  H y d r o g r a p h
+++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Interval          'S' Graph         Unit Hydrograph
Number            Mean values           ((CFS))
---------------------------------------------------------------------
                (K =       520.88 (CFS))

  1               4.633                 24.134
  2              23.847                100.078
  3              51.410                143.571
  4              68.028                 86.558
  5              76.108                 42.090
  6              81.350                 27.303
  7              85.280                 20.470
  8              88.240                 15.418
  9              90.630                 12.449
 10              92.477                  9.619
 11              93.898                  7.405
 12              95.175                  6.650
 13              96.258                  5.643
 14              97.122                  4.497
 15              97.845                  3.768
 16              98.428                  3.038
 17              98.875                  2.327
 18              99.292                  2.170
 19              99.708                  2.170
 20             100.000                  1.519
---------------------------------------------------------------------
Peak Unit   Adjusted mass rainfall  Unit rainfall
Number              (In)                (In)
  1              0.3543              0.0665
  2              0.4362              0.0361
  3              0.4927              0.0262
  4              0.5371              0.0211
  5              0.5743              0.0179
  6              0.6065              0.0156
  7              0.6447              0.0186
  8              0.6796              0.0171
  9              0.7121              0.0159
 10              0.7424              0.0149
 11              0.7709              0.0141
 12              0.7979              0.0133
 13              0.8235              0.0127
 14              0.8480              0.0121
 15              0.8715              0.0116
 16              0.8940              0.0112
 17              0.9157              0.0107
 18              0.9367              0.0104
 19              0.9568              0.0100
```

20	0.9762	0.0097
21	0.9951	0.0094
22	1.0135	0.0091
23	1.0313	0.0089
24	1.0487	0.0086
25	1.0656	0.0084
26	1.0822	0.0082
27	1.0983	0.0080
28	1.1141	0.0079
29	1.1296	0.0077
30	1.1447	0.0075
31	1.1595	0.0074
32	1.1741	0.0072
33	1.1884	0.0071
34	1.2024	0.0070
35	1.2161	0.0069
36	1.2297	0.0067
37	1.2432	0.0067
38	1.2565	0.0066
39	1.2696	0.0065
40	1.2825	0.0064
41	1.2953	0.0063
42	1.3078	0.0062
43	1.3201	0.0062
44	1.3323	0.0061
45	1.3444	0.0060
46	1.3562	0.0059
47	1.3679	0.0058
48	1.3795	0.0058
49	1.3909	0.0057
50	1.4022	0.0056
51	1.4133	0.0056
52	1.4243	0.0055
53	1.4352	0.0054
54	1.4459	0.0054
55	1.4566	0.0053
56	1.4671	0.0052
57	1.4775	0.0052
58	1.4878	0.0051
59	1.4980	0.0051
60	1.5081	0.0050
61	1.5181	0.0050
62	1.5280	0.0049
63	1.5378	0.0049
64	1.5475	0.0048
65	1.5571	0.0048
66	1.5667	0.0048
67	1.5761	0.0047
68	1.5855	0.0047
69	1.5947	0.0046
70	1.6039	0.0046
71	1.6131	0.0045
72	1.6221	0.0045
73	1.6311	0.0045
74	1.6400	0.0044
75	1.6488	0.0044
76	1.6575	0.0044
77	1.6662	0.0043
78	1.6748	0.0043
79	1.6834	0.0043
80	1.6919	0.0042
81	1.7003	0.0042
82	1.7086	0.0042
83	1.7169	0.0041
84	1.7252	0.0041
85	1.7333	0.0041
86	1.7415	0.0041
87	1.7495	0.0040
88	1.7575	0.0040
89	1.7655	0.0040
90	1.7734	0.0039
91	1.7812	0.0039
92	1.7890	0.0039

93	1.7968	0.0039
94	1.8045	0.0038
95	1.8121	0.0038
96	1.8197	0.0038
97	1.8273	0.0038
98	1.8348	0.0037
99	1.8422	0.0037
100	1.8496	0.0037
101	1.8570	0.0037
102	1.8643	0.0037
103	1.8716	0.0036
104	1.8789	0.0036
105	1.8861	0.0036
106	1.8932	0.0036
107	1.9003	0.0036
108	1.9074	0.0035
109	1.9144	0.0035
110	1.9214	0.0035
111	1.9284	0.0035
112	1.9353	0.0035
113	1.9422	0.0034
114	1.9491	0.0034
115	1.9559	0.0034
116	1.9627	0.0034
117	1.9694	0.0034
118	1.9761	0.0034
119	1.9828	0.0033
120	1.9894	0.0033
121	1.9960	0.0033
122	2.0026	0.0033
123	2.0091	0.0033
124	2.0157	0.0033
125	2.0221	0.0032
126	2.0286	0.0032
127	2.0350	0.0032
128	2.0414	0.0032
129	2.0478	0.0032
130	2.0541	0.0032
131	2.0604	0.0031
132	2.0667	0.0031
133	2.0729	0.0031
134	2.0791	0.0031
135	2.0853	0.0031
136	2.0915	0.0031
137	2.0976	0.0031
138	2.1037	0.0030
139	2.1098	0.0030
140	2.1158	0.0030
141	2.1218	0.0030
142	2.1278	0.0030
143	2.1338	0.0030
144	2.1398	0.0030

Unit Period (number)	Unit Rainfall (In)	Unit Soil-Loss (In)	Effective Rainfall (In)
1	0.0060	0.0053	0.0006
2	0.0060	0.0054	0.0006
3	0.0060	0.0054	0.0006
4	0.0061	0.0054	0.0006
5	0.0061	0.0055	0.0006
6	0.0061	0.0055	0.0006
7	0.0062	0.0056	0.0006
8	0.0062	0.0056	0.0006
9	0.0063	0.0056	0.0006
10	0.0063	0.0057	0.0006
11	0.0064	0.0057	0.0007
12	0.0064	0.0057	0.0007
13	0.0064	0.0058	0.0007
14	0.0065	0.0058	0.0007
15	0.0065	0.0059	0.0007
16	0.0066	0.0059	0.0007

17	0.0066	0.0060	0.0007
18	0.0067	0.0060	0.0007
19	0.0067	0.0061	0.0007
20	0.0068	0.0061	0.0007
21	0.0068	0.0061	0.0007
22	0.0069	0.0062	0.0007
23	0.0070	0.0062	0.0007
24	0.0070	0.0063	0.0007
25	0.0071	0.0064	0.0007
26	0.0071	0.0064	0.0007
27	0.0072	0.0065	0.0007
28	0.0073	0.0065	0.0007
29	0.0073	0.0066	0.0008
30	0.0074	0.0066	0.0008
31	0.0075	0.0067	0.0008
32	0.0075	0.0068	0.0008
33	0.0076	0.0068	0.0008
34	0.0077	0.0069	0.0008
35	0.0077	0.0070	0.0008
36	0.0078	0.0070	0.0008
37	0.0079	0.0071	0.0008
38	0.0080	0.0072	0.0008
39	0.0081	0.0072	0.0008
40	0.0081	0.0073	0.0008
41	0.0082	0.0074	0.0008
42	0.0083	0.0075	0.0009
43	0.0084	0.0076	0.0009
44	0.0085	0.0076	0.0009
45	0.0086	0.0077	0.0009
46	0.0087	0.0078	0.0009
47	0.0088	0.0079	0.0009
48	0.0089	0.0080	0.0009
49	0.0090	0.0081	0.0009
50	0.0092	0.0082	0.0009
51	0.0093	0.0083	0.0010
52	0.0094	0.0084	0.0010
53	0.0095	0.0086	0.0010
54	0.0097	0.0087	0.0010
55	0.0098	0.0088	0.0010
56	0.0099	0.0089	0.0010
57	0.0101	0.0091	0.0010
58	0.0103	0.0092	0.0011
59	0.0104	0.0093	0.0011
60	0.0106	0.0095	0.0011
61	0.0108	0.0097	0.0011
62	0.0109	0.0098	0.0011
63	0.0111	0.0100	0.0011
64	0.0113	0.0102	0.0012
65	0.0116	0.0104	0.0012
66	0.0118	0.0106	0.0012
67	0.0120	0.0108	0.0012
68	0.0123	0.0110	0.0013
69	0.0125	0.0112	0.0013
70	0.0128	0.0115	0.0013
71	0.0131	0.0118	0.0013
72	0.0134	0.0121	0.0014
73	0.0135	0.0121	0.0014
74	0.0139	0.0125	0.0014
75	0.0143	0.0128	0.0015
76	0.0147	0.0132	0.0015
77	0.0151	0.0136	0.0016
78	0.0156	0.0140	0.0016
79	0.0162	0.0145	0.0017
80	0.0167	0.0150	0.0017
81	0.0174	0.0156	0.0018
82	0.0181	0.0162	0.0019
83	0.0189	0.0169	0.0019
84	0.0198	0.0177	0.0020
85	0.0209	0.0188	0.0021
86	0.0221	0.0198	0.0023
87	0.0235	0.0211	0.0024
88	0.0251	0.0225	0.0026
89	0.0270	0.0242	0.0028

90	0.0294	0.0264	0.0030
91	0.0324	0.0291	0.0033
92	0.0365	0.0327	0.0037
93	0.0323	0.0290	0.0033
94	0.0404	0.0363	0.0041
95	0.0564	0.0506	0.0058
96	0.1124	0.0964	0.0160
97	0.3239	0.0964	0.2275
98	0.0412	0.0370	0.0042
99	0.0366	0.0329	0.0038
100	0.0294	0.0264	0.0030
101	0.0251	0.0225	0.0026
102	0.0221	0.0199	0.0023
103	0.0198	0.0178	0.0020
104	0.0181	0.0162	0.0019
105	0.0167	0.0150	0.0017
106	0.0156	0.0140	0.0016
107	0.0147	0.0132	0.0015
108	0.0139	0.0125	0.0014
109	0.0134	0.0121	0.0014
110	0.0128	0.0115	0.0013
111	0.0123	0.0110	0.0013
112	0.0118	0.0106	0.0012
113	0.0113	0.0102	0.0012
114	0.0109	0.0098	0.0011
115	0.0106	0.0095	0.0011
116	0.0103	0.0092	0.0011
117	0.0099	0.0089	0.0010
118	0.0097	0.0087	0.0010
119	0.0094	0.0084	0.0010
120	0.0092	0.0082	0.0009
121	0.0089	0.0080	0.0009
122	0.0087	0.0078	0.0009
123	0.0085	0.0076	0.0009
124	0.0083	0.0075	0.0009
125	0.0081	0.0073	0.0008
126	0.0080	0.0072	0.0008
127	0.0078	0.0070	0.0008
128	0.0077	0.0069	0.0008
129	0.0075	0.0068	0.0008
130	0.0074	0.0066	0.0008
131	0.0073	0.0065	0.0007
132	0.0071	0.0064	0.0007
133	0.0070	0.0063	0.0007
134	0.0069	0.0062	0.0007
135	0.0068	0.0061	0.0007
136	0.0067	0.0060	0.0007
137	0.0066	0.0059	0.0007
138	0.0065	0.0058	0.0007
139	0.0064	0.0057	0.0007
140	0.0063	0.0057	0.0006
141	0.0062	0.0056	0.0006
142	0.0061	0.0055	0.0006
143	0.0061	0.0054	0.0006
144	0.0060	0.0054	0.0006

```
      ----------------------------------------------------------------------
      ----------------------------------------------------------------------
      Total soil rain loss =      1.72(In)
      Total effective rainfall =      0.42(In)
      Peak flow rate in flood hydrograph =     35.20(CFS)
      -----------------------------------------------------------------------
      +++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
                          24 - H O U R   S T O R M
                     R u n o f f     H y d r o g r a p h
      ----------------------------------------------------------------------
                  Hydrograph in  10   Minute intervals ((CFS))

      ----------------------------------------------------------------------
Time(h+m) Volume Ac.Ft   Q(CFS)  0       10.0      20.0      30.0      40.0
-----------------------------------------------------------------------
  0+10       0.0002      0.01  Q         |         |         |         |
  0+20       0.0012      0.08  Q         |         |         |         |
  0+30       0.0035      0.16  Q         |         |         |         |
```

0+40	0.0065	0.22	Q	
0+50	0.0099	0.24	Q	
1+ 0	0.0135	0.26	Q	
1+10	0.0173	0.28	Q	
1+20	0.0213	0.29	Q	
1+30	0.0254	0.30	Q	
1+40	0.0296	0.31	Q	
1+50	0.0339	0.31	Q	
2+ 0	0.0383	0.32	Q	
2+10	0.0428	0.32	Q	
2+20	0.0473	0.33	Q	
2+30	0.0519	0.33	Q	
2+40	0.0566	0.34	Q	
2+50	0.0613	0.34	Q	
3+ 0	0.0660	0.35	Q	
3+10	0.0709	0.35	Q	
3+20	0.0757	0.35	QV	
3+30	0.0806	0.36	QV	
3+40	0.0856	0.36	QV	
3+50	0.0905	0.36	QV	
4+ 0	0.0956	0.36	QV	
4+10	0.1006	0.37	QV	
4+20	0.1057	0.37	QV	
4+30	0.1109	0.37	QV	
4+40	0.1160	0.38	QV	
4+50	0.1213	0.38	QV	
5+ 0	0.1265	0.38	QV	
5+10	0.1319	0.39	QV	
5+20	0.1372	0.39	QV	
5+30	0.1426	0.39	QV	
5+40	0.1481	0.40	QV	
5+50	0.1536	0.40	Q V	
6+ 0	0.1592	0.40	Q V	
6+10	0.1648	0.41	Q V	
6+20	0.1705	0.41	Q V	
6+30	0.1762	0.42	Q V	
6+40	0.1820	0.42	Q V	
6+50	0.1878	0.42	Q V	
7+ 0	0.1937	0.43	Q V	
7+10	0.1997	0.43	Q V	
7+20	0.2057	0.44	Q V	
7+30	0.2118	0.44	Q V	
7+40	0.2180	0.45	Q V	
7+50	0.2242	0.45	Q V	
8+ 0	0.2305	0.46	Q V	
8+10	0.2369	0.46	Q V	
8+20	0.2433	0.47	Q V	
8+30	0.2498	0.47	Q V	
8+40	0.2565	0.48	Q V	
8+50	0.2632	0.49	Q V	
9+ 0	0.2699	0.49	Q V	
9+10	0.2768	0.50	Q V	
9+20	0.2838	0.51	Q V	
9+30	0.2908	0.51	Q V	
9+40	0.2980	0.52	Q V	
9+50	0.3053	0.53	Q V	
10+ 0	0.3127	0.54	Q V	
10+10	0.3202	0.54	Q V	
10+20	0.3278	0.55	Q V	
10+30	0.3355	0.56	Q V	
10+40	0.3434	0.57	Q V	
10+50	0.3514	0.58	Q V	
11+ 0	0.3595	0.59	Q V	
11+10	0.3678	0.60	Q V	
11+20	0.3762	0.61	Q V	
11+30	0.3848	0.62	Q V	
11+40	0.3936	0.64	Q V	
11+50	0.4026	0.65	Q V	
12+ 0	0.4117	0.66	Q V	
12+10	0.4211	0.68	Q V	
12+20	0.4306	0.69	Q V	
12+30	0.4403	0.71	Q V	
12+40	0.4502	0.72	Q V	

```
12+50       0.4604      0.74  Q     V   |         |         |         |
13+ 0       0.4709      0.76  Q     V   |         |         |         |
13+10       0.4816      0.78  Q     V   |         |         |         |
13+20       0.4927      0.80  Q     V   |         |         |         |
13+30       0.5041      0.83  Q     V   |         |         |         |
13+40       0.5159      0.86  Q     V   |         |         |         |
13+50       0.5281      0.89  Q      V  |         |         |         |
14+ 0       0.5408      0.92  Q      V  |         |         |         |
14+10       0.5541      0.96  Q      V  |         |         |         |
14+20       0.5679      1.01  |Q     V  |         |         |         |
14+30       0.5825      1.06  |Q     V  |         |         |         |
14+40       0.5978      1.11  |Q     V  |         |         |         |
14+50       0.6140      1.18  |Q      V |         |         |         |
15+ 0       0.6313      1.25  |Q      V |         |         |         |
15+10       0.6498      1.34  |Q      V |         |         |         |
15+20       0.6699      1.46  |Q      V |         |         |         |
15+30       0.6916      1.58  |Q       V|         |         |         |
15+40       0.7145      1.67  |Q       V|         |         |         |
15+50       0.7393      1.80  |Q       V|         |         |         |
16+ 0       0.7714      2.33  | Q       V         |         |         |
16+10       0.8922      8.77  |       Q |V        |         |         |
16+20       1.2532     26.20  |         |     V   |     Q   |         |
16+30       1.7380     35.20  |         |         |  V      |    Q    |
16+40       2.0395     21.89  |         |         |Q     V  |         |
16+50       2.1999     11.64  |         |Q        |        V|         |
17+ 0       2.3111      8.07  |       Q |         |         V         |
17+10       2.3980      6.31  |     Q   |         |         |V        |
17+20       2.4669      5.00  |    Q    |         |         | V       |
17+30       2.5245      4.18  |   Q     |         |         |  V      |
17+40       2.5716      3.42  |  Q      |         |         |   V     |
17+50       2.6106      2.83  | Q       |         |         |   V     |
18+ 0       2.6460      2.57  | Q       |         |         |    V    |
18+10       2.6771      2.26  | Q       |         |         |    V    |
18+20       2.7039      1.94  |Q        |         |         |     V   |
18+30       2.7276      1.72  |Q        |         |         |     V   |
18+40       2.7483      1.50  |Q        |         |         |     V   |
18+50       2.7663      1.30  |Q        |         |         |     V   |
19+ 0       2.7832      1.23  |Q        |         |         |      V  |
19+10       2.7995      1.18  |Q        |         |         |      V  |
19+20       2.8132      0.99  Q         |         |         |      V  |
19+30       2.8217      0.62  Q         |         |         |      V  |
19+40       2.8300      0.60  Q         |         |         |      V  |
19+50       2.8379      0.57  Q         |         |         |      V  |
20+ 0       2.8455      0.55  Q         |         |         |      V  |
20+10       2.8529      0.54  Q         |         |         |       V |
20+20       2.8600      0.52  Q         |         |         |       V |
20+30       2.8670      0.50  Q         |         |         |       V |
20+40       2.8738      0.49  Q         |         |         |       V |
20+50       2.8803      0.48  Q         |         |         |       V |
21+ 0       2.8868      0.47  Q         |         |         |       V |
21+10       2.8931      0.46  Q         |         |         |       V |
21+20       2.8992      0.45  Q         |         |         |       V |
21+30       2.9052      0.44  Q         |         |         |       V |
21+40       2.9111      0.43  Q         |         |         |       V |
21+50       2.9168      0.42  Q         |         |         |       V |
22+ 0       2.9225      0.41  Q         |         |         |       V |
22+10       2.9280      0.40  Q         |         |         |        V|
22+20       2.9334      0.39  Q         |         |         |        V|
22+30       2.9388      0.39  Q         |         |         |        V|
22+40       2.9440      0.38  Q         |         |         |        V|
22+50       2.9492      0.37  Q         |         |         |        V|
23+ 0       2.9542      0.37  Q         |         |         |        V|
23+10       2.9592      0.36  Q         |         |         |        V|
23+20       2.9641      0.36  Q         |         |         |        V|
23+30       2.9690      0.35  Q         |         |         |        V|
23+40       2.9737      0.35  Q         |         |         |        V|
23+50       2.9784      0.34  Q         |         |         |        V|
24+ 0       2.9831      0.34  Q         |         |         |        V|
24+10       2.9874      0.32  Q         |         |         |        V|
24+20       2.9909      0.25  Q         |         |         |        V|
24+30       2.9932      0.16  Q         |         |         |        V|
24+40       2.9946      0.11  Q         |         |         |        V|
24+50       2.9957      0.08  Q         |         |         |        V|
```

```
   25+ 0        2.9966      0.06  Q         |          |          |         V|
   25+10        2.9973      0.05  Q         |          |          |         V|
   25+20        2.9978      0.04  Q         |          |          |         V|
   25+30        2.9983      0.03  Q         |          |          |         V|
   25+40        2.9986      0.03  Q         |          |          |         V|
   25+50        2.9989      0.02  Q         |          |          |         V|
   26+ 0        2.9991      0.02  Q         |          |          |         V|
   26+10        2.9993      0.01  Q         |          |          |         V|
   26+20        2.9994      0.01  Q         |          |          |         V|
   26+30        2.9995      0.01  Q         |          |          |         V|
   26+40        2.9996      0.01  Q         |          |          |         V|
   26+50        2.9996      0.00  Q         |          |          |         V|
   27+ 0        2.9997      0.00  Q         |          |          |         V|
   27+10        2.9997      0.00  Q         |          |          |          V
-----------------------------------------------------------------------
```

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

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               Study date  10/31/22


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


Program License Serial Number 4009

---------------------------------------------------------------------
Cordova Complex Site, AREA A1
Unit Hydrogragh Method
Post-Development Condition
10-Year, 24-Hours Storm
--------------------------------------------------------------------

       Storm Event Year = 10

       Antecedent Moisture Condition = 2

 English (in-lb) Input Units Used

 English Rainfall Data (Inches) Input Values Used

 English Units used in output format




Area averaged rainfall intensity isohyetal data:
       Sub-Area        Duration        Isohyetal
       (Ac.)            (hours)         (In)
Rainfall data for year 10
           35.76           1           0.61
--------------------------------------------------------------------
Rainfall data for year 10
           35.76           6           1.23
--------------------------------------------------------------------
Rainfall data for year 10
           35.76          24           2.14
--------------------------------------------------------------------
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++

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


SCS curve  SCS curve     Area     Area     Fp(Fig C6)    Ap      Fm
No.(AMCII) NO.(AMC 2)    (Ac.)    Fraction     (In/Hr)  (dec.)   (In/Hr)
 32.0      32.0         35.76      1.000     0.978    0.150    0.147

Area-averaged adjusted loss rate Fm (In/Hr) =  0.147

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

Area       Area          SCS CN    SCS CN      S     Pervious
 (Ac.)      Fract         (AMC2)    (AMC2)           Yield Fr
     5.36   0.150         32.0      32.0      10.70     0.000
    30.40   0.850         98.0      98.0       0.20     0.894

Area-averaged catchment yield fraction, Y =  0.760
Area-averaged low loss fraction, Yb =  0.240
User entry of time of concentration  =   0.300 (hours)
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Watershed area =      35.76(Ac.)
Catchment Lag time =   0.240 hours
```

Unit interval = 5.000 minutes
Unit interval percentage of lag time = 34.7222
Hydrograph baseflow = 0.00(CFS)
Average maximum watershed loss rate(Fm) = 0.147(In/Hr)
Average low loss rate fraction (Yb) = 0.240 (decimal)
VALLEY UNDEVELOPED S-Graph Selected
Computed peak 5-minute rainfall = 0.289(In)
Computed peak 30-minute rainfall = 0.495(In)
Specified peak 1-hour rainfall = 0.609(In)
Computed peak 3-hour rainfall = 0.937(In)
Specified peak 6-hour rainfall = 1.230(In)
Specified peak 24-hour rainfall = 2.140(In)

Rainfall depth area reduction factors:
Using a total area of 35.76(Ac.) (Ref: fig. E-4)

5-minute factor = 0.998	Adjusted rainfall = 0.288(In)
30-minute factor = 0.998	Adjusted rainfall = 0.494(In)
1-hour factor = 0.998	Adjusted rainfall = 0.608(In)
3-hour factor = 1.000	Adjusted rainfall = 0.937(In)
6-hour factor = 1.000	Adjusted rainfall = 1.230(In)
24-hour factor = 1.000	Adjusted rainfall = 2.140(In)

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

+++

Interval Number	'S' Graph Mean values	Unit Hydrograph ((CFS))
	(K = 432.47 (CFS))	
1	5.965	25.796
2	32.290	113.850
3	78.859	201.396
4	127.451	210.149
5	155.381	120.790
6	169.833	62.499
7	178.171	36.060
8	182.894	20.427
9	186.236	14.451
10	189.020	12.043
11	191.140	9.167
12	192.621	6.407
13	193.789	5.049
14	194.862	4.643
15	195.854	4.289
16	196.638	3.392
17	197.312	2.915
18	197.901	2.547
19	198.388	2.102
20	198.771	1.657
21	199.118	1.502
22	199.465	1.502
23	199.812	1.502
24	200.000	0.811

Peak Unit Number	Adjusted mass rainfall (In)	Unit rainfall (In)
1	0.2885	0.2885
2	0.3552	0.0667
3	0.4011	0.0459
4	0.4373	0.0362
5	0.4675	0.0303
6	0.4938	0.0263
7	0.5172	0.0234
8	0.5383	0.0211
9	0.5577	0.0194
10	0.5756	0.0179
11	0.5923	0.0167
12	0.6080	0.0157
13	0.6274	0.0195
14	0.6460	0.0186

15	0.6638	0.0178
16	0.6809	0.0171
17	0.6973	0.0164
18	0.7132	0.0159
19	0.7285	0.0153
20	0.7434	0.0149
21	0.7578	0.0144
22	0.7718	0.0140
23	0.7854	0.0136
24	0.7987	0.0133
25	0.8117	0.0129
26	0.8243	0.0126
27	0.8366	0.0123
28	0.8487	0.0121
29	0.8605	0.0118
30	0.8720	0.0116
31	0.8834	0.0113
32	0.8945	0.0111
33	0.9054	0.0109
34	0.9161	0.0107
35	0.9266	0.0105
36	0.9369	0.0103
37	0.9471	0.0101
38	0.9570	0.0100
39	0.9668	0.0098
40	0.9765	0.0097
41	0.9860	0.0095
42	0.9954	0.0094
43	1.0046	0.0092
44	1.0137	0.0091
45	1.0227	0.0090
46	1.0316	0.0089
47	1.0403	0.0087
48	1.0489	0.0086
49	1.0575	0.0085
50	1.0659	0.0084
51	1.0742	0.0083
52	1.0824	0.0082
53	1.0905	0.0081
54	1.0986	0.0080
55	1.1065	0.0079
56	1.1143	0.0079
57	1.1221	0.0078
58	1.1298	0.0077
59	1.1374	0.0076
60	1.1449	0.0075
61	1.1524	0.0075
62	1.1598	0.0074
63	1.1671	0.0073
64	1.1743	0.0072
65	1.1815	0.0072
66	1.1886	0.0071
67	1.1956	0.0070
68	1.2026	0.0070
69	1.2095	0.0069
70	1.2163	0.0068
71	1.2231	0.0068
72	1.2299	0.0067
73	1.2367	0.0068
74	1.2434	0.0067
75	1.2501	0.0067
76	1.2567	0.0066
77	1.2633	0.0066
78	1.2698	0.0065
79	1.2763	0.0065
80	1.2827	0.0064
81	1.2891	0.0064
82	1.2955	0.0063
83	1.3017	0.0063
84	1.3080	0.0062
85	1.3142	0.0062
86	1.3203	0.0062
87	1.3265	0.0061

88	1.3325	0.0061
89	1.3386	0.0060
90	1.3445	0.0060
91	1.3505	0.0059
92	1.3564	0.0059
93	1.3623	0.0059
94	1.3681	0.0058
95	1.3739	0.0058
96	1.3797	0.0058
97	1.3854	0.0057
98	1.3911	0.0057
99	1.3967	0.0057
100	1.4023	0.0056
101	1.4079	0.0056
102	1.4135	0.0056
103	1.4190	0.0055
104	1.4245	0.0055
105	1.4300	0.0055
106	1.4354	0.0054
107	1.4408	0.0054
108	1.4461	0.0054
109	1.4515	0.0053
110	1.4568	0.0053
111	1.4621	0.0053
112	1.4673	0.0052
113	1.4725	0.0052
114	1.4777	0.0052
115	1.4829	0.0052
116	1.4880	0.0051
117	1.4931	0.0051
118	1.4982	0.0051
119	1.5033	0.0051
120	1.5083	0.0050
121	1.5133	0.0050
122	1.5183	0.0050
123	1.5233	0.0050
124	1.5282	0.0049
125	1.5331	0.0049
126	1.5380	0.0049
127	1.5429	0.0049
128	1.5477	0.0048
129	1.5525	0.0048
130	1.5573	0.0048
131	1.5621	0.0048
132	1.5669	0.0048
133	1.5716	0.0047
134	1.5763	0.0047
135	1.5810	0.0047
136	1.5857	0.0047
137	1.5903	0.0046
138	1.5949	0.0046
139	1.5995	0.0046
140	1.6041	0.0046
141	1.6087	0.0046
142	1.6132	0.0045
143	1.6178	0.0045
144	1.6223	0.0045
145	1.6268	0.0045
146	1.6312	0.0045
147	1.6357	0.0045
148	1.6401	0.0044
149	1.6446	0.0044
150	1.6490	0.0044
151	1.6533	0.0044
152	1.6577	0.0044
153	1.6621	0.0043
154	1.6664	0.0043
155	1.6707	0.0043
156	1.6750	0.0043
157	1.6793	0.0043
158	1.6835	0.0043
159	1.6878	0.0042
160	1.6920	0.0042

161	1.6962	0.0042
162	1.7004	0.0042
163	1.7046	0.0042
164	1.7088	0.0042
165	1.7130	0.0042
166	1.7171	0.0041
167	1.7212	0.0041
168	1.7253	0.0041
169	1.7294	0.0041
170	1.7335	0.0041
171	1.7376	0.0041
172	1.7416	0.0041
173	1.7457	0.0040
174	1.7497	0.0040
175	1.7537	0.0040
176	1.7577	0.0040
177	1.7617	0.0040
178	1.7657	0.0040
179	1.7696	0.0040
180	1.7735	0.0039
181	1.7775	0.0039
182	1.7814	0.0039
183	1.7853	0.0039
184	1.7892	0.0039
185	1.7931	0.0039
186	1.7969	0.0039
187	1.8008	0.0039
188	1.8046	0.0038
189	1.8085	0.0038
190	1.8123	0.0038
191	1.8161	0.0038
192	1.8199	0.0038
193	1.8237	0.0038
194	1.8274	0.0038
195	1.8312	0.0038
196	1.8349	0.0037
197	1.8387	0.0037
198	1.8424	0.0037
199	1.8461	0.0037
200	1.8498	0.0037
201	1.8535	0.0037
202	1.8572	0.0037
203	1.8608	0.0037
204	1.8645	0.0037
205	1.8681	0.0036
206	1.8718	0.0036
207	1.8754	0.0036
208	1.8790	0.0036
209	1.8826	0.0036
210	1.8862	0.0036
211	1.8898	0.0036
212	1.8934	0.0036
213	1.8969	0.0036
214	1.9005	0.0036
215	1.9040	0.0035
216	1.9076	0.0035
217	1.9111	0.0035
218	1.9146	0.0035
219	1.9181	0.0035
220	1.9216	0.0035
221	1.9251	0.0035
222	1.9286	0.0035
223	1.9320	0.0035
224	1.9355	0.0035
225	1.9389	0.0034
226	1.9424	0.0034
227	1.9458	0.0034
228	1.9492	0.0034
229	1.9526	0.0034
230	1.9560	0.0034
231	1.9594	0.0034
232	1.9628	0.0034
233	1.9662	0.0034

234	1.9695	0.0034
235	1.9729	0.0034
236	1.9763	0.0033
237	1.9796	0.0033
238	1.9829	0.0033
239	1.9863	0.0033
240	1.9896	0.0033
241	1.9929	0.0033
242	1.9962	0.0033
243	1.9995	0.0033
244	2.0028	0.0033
245	2.0060	0.0033
246	2.0093	0.0033
247	2.0126	0.0033
248	2.0158	0.0033
249	2.0191	0.0032
250	2.0223	0.0032
251	2.0255	0.0032
252	2.0287	0.0032
253	2.0319	0.0032
254	2.0352	0.0032
255	2.0383	0.0032
256	2.0415	0.0032
257	2.0447	0.0032
258	2.0479	0.0032
259	2.0511	0.0032
260	2.0542	0.0032
261	2.0574	0.0032
262	2.0605	0.0031
263	2.0637	0.0031
264	2.0668	0.0031
265	2.0699	0.0031
266	2.0730	0.0031
267	2.0761	0.0031
268	2.0792	0.0031
269	2.0823	0.0031
270	2.0854	0.0031
271	2.0885	0.0031
272	2.0916	0.0031
273	2.0947	0.0031
274	2.0977	0.0031
275	2.1008	0.0031
276	2.1038	0.0030
277	2.1069	0.0030
278	2.1099	0.0030
279	2.1129	0.0030
280	2.1160	0.0030
281	2.1190	0.0030
282	2.1220	0.0030
283	2.1250	0.0030
284	2.1280	0.0030
285	2.1310	0.0030
286	2.1340	0.0030
287	2.1369	0.0030
288	2.1399	0.0030

Unit Period (number)	Unit Rainfall (In)	Unit Soil-Loss (In)	Effective Rainfall (In)
1	0.0030	0.0007	0.0023
2	0.0030	0.0007	0.0023
3	0.0030	0.0007	0.0023
4	0.0030	0.0007	0.0023
5	0.0030	0.0007	0.0023
6	0.0030	0.0007	0.0023
7	0.0030	0.0007	0.0023
8	0.0030	0.0007	0.0023
9	0.0030	0.0007	0.0023
10	0.0031	0.0007	0.0023
11	0.0031	0.0007	0.0023
12	0.0031	0.0007	0.0023
13	0.0031	0.0007	0.0023

14	0.0031	0.0007	0.0024
15	0.0031	0.0007	0.0024
16	0.0031	0.0007	0.0024
17	0.0031	0.0008	0.0024
18	0.0031	0.0008	0.0024
19	0.0032	0.0008	0.0024
20	0.0032	0.0008	0.0024
21	0.0032	0.0008	0.0024
22	0.0032	0.0008	0.0024
23	0.0032	0.0008	0.0024
24	0.0032	0.0008	0.0024
25	0.0032	0.0008	0.0024
26	0.0032	0.0008	0.0025
27	0.0032	0.0008	0.0025
28	0.0033	0.0008	0.0025
29	0.0033	0.0008	0.0025
30	0.0033	0.0008	0.0025
31	0.0033	0.0008	0.0025
32	0.0033	0.0008	0.0025
33	0.0033	0.0008	0.0025
34	0.0033	0.0008	0.0025
35	0.0033	0.0008	0.0025
36	0.0033	0.0008	0.0025
37	0.0034	0.0008	0.0026
38	0.0034	0.0008	0.0026
39	0.0034	0.0008	0.0026
40	0.0034	0.0008	0.0026
41	0.0034	0.0008	0.0026
42	0.0034	0.0008	0.0026
43	0.0034	0.0008	0.0026
44	0.0035	0.0008	0.0026
45	0.0035	0.0008	0.0026
46	0.0035	0.0008	0.0026
47	0.0035	0.0008	0.0027
48	0.0035	0.0008	0.0027
49	0.0035	0.0008	0.0027
50	0.0035	0.0009	0.0027
51	0.0036	0.0009	0.0027
52	0.0036	0.0009	0.0027
53	0.0036	0.0009	0.0027
54	0.0036	0.0009	0.0027
55	0.0036	0.0009	0.0028
56	0.0036	0.0009	0.0028
57	0.0037	0.0009	0.0028
58	0.0037	0.0009	0.0028
59	0.0037	0.0009	0.0028
60	0.0037	0.0009	0.0028
61	0.0037	0.0009	0.0028
62	0.0037	0.0009	0.0028
63	0.0038	0.0009	0.0029
64	0.0038	0.0009	0.0029
65	0.0038	0.0009	0.0029
66	0.0038	0.0009	0.0029
67	0.0038	0.0009	0.0029
68	0.0038	0.0009	0.0029
69	0.0039	0.0009	0.0029
70	0.0039	0.0009	0.0029
71	0.0039	0.0009	0.0030
72	0.0039	0.0009	0.0030
73	0.0039	0.0009	0.0030
74	0.0040	0.0009	0.0030
75	0.0040	0.0010	0.0030
76	0.0040	0.0010	0.0030
77	0.0040	0.0010	0.0031
78	0.0040	0.0010	0.0031
79	0.0041	0.0010	0.0031
80	0.0041	0.0010	0.0031
81	0.0041	0.0010	0.0031
82	0.0041	0.0010	0.0031
83	0.0042	0.0010	0.0032
84	0.0042	0.0010	0.0032
85	0.0042	0.0010	0.0032
86	0.0042	0.0010	0.0032

87	0.0042	0.0010	0.0032
88	0.0043	0.0010	0.0032
89	0.0043	0.0010	0.0033
90	0.0043	0.0010	0.0033
91	0.0043	0.0010	0.0033
92	0.0044	0.0010	0.0033
93	0.0044	0.0011	0.0033
94	0.0044	0.0011	0.0034
95	0.0045	0.0011	0.0034
96	0.0045	0.0011	0.0034
97	0.0045	0.0011	0.0034
98	0.0045	0.0011	0.0034
99	0.0046	0.0011	0.0035
100	0.0046	0.0011	0.0035
101	0.0046	0.0011	0.0035
102	0.0046	0.0011	0.0035
103	0.0047	0.0011	0.0036
104	0.0047	0.0011	0.0036
105	0.0048	0.0011	0.0036
106	0.0048	0.0011	0.0036
107	0.0048	0.0012	0.0037
108	0.0048	0.0012	0.0037
109	0.0049	0.0012	0.0037
110	0.0049	0.0012	0.0037
111	0.0050	0.0012	0.0038
112	0.0050	0.0012	0.0038
113	0.0050	0.0012	0.0038
114	0.0051	0.0012	0.0038
115	0.0051	0.0012	0.0039
116	0.0051	0.0012	0.0039
117	0.0052	0.0012	0.0039
118	0.0052	0.0013	0.0040
119	0.0053	0.0013	0.0040
120	0.0053	0.0013	0.0040
121	0.0054	0.0013	0.0041
122	0.0054	0.0013	0.0041
123	0.0055	0.0013	0.0041
124	0.0055	0.0013	0.0042
125	0.0056	0.0013	0.0042
126	0.0056	0.0013	0.0042
127	0.0057	0.0014	0.0043
128	0.0057	0.0014	0.0043
129	0.0058	0.0014	0.0044
130	0.0058	0.0014	0.0044
131	0.0059	0.0014	0.0045
132	0.0059	0.0014	0.0045
133	0.0060	0.0014	0.0046
134	0.0060	0.0014	0.0046
135	0.0061	0.0015	0.0046
136	0.0062	0.0015	0.0047
137	0.0062	0.0015	0.0047
138	0.0063	0.0015	0.0048
139	0.0064	0.0015	0.0048
140	0.0064	0.0015	0.0049
141	0.0065	0.0016	0.0050
142	0.0066	0.0016	0.0050
143	0.0067	0.0016	0.0051
144	0.0067	0.0016	0.0051
145	0.0067	0.0016	0.0051
146	0.0068	0.0016	0.0052
147	0.0069	0.0017	0.0053
148	0.0070	0.0017	0.0053
149	0.0071	0.0017	0.0054
150	0.0072	0.0017	0.0054
151	0.0073	0.0018	0.0056
152	0.0074	0.0018	0.0056
153	0.0075	0.0018	0.0057
154	0.0076	0.0018	0.0058
155	0.0078	0.0019	0.0059
156	0.0079	0.0019	0.0060
157	0.0080	0.0019	0.0061
158	0.0081	0.0020	0.0062
159	0.0083	0.0020	0.0063

160	0.0084	0.0020	0.0064
161	0.0086	0.0021	0.0066
162	0.0087	0.0021	0.0066
163	0.0090	0.0022	0.0068
164	0.0091	0.0022	0.0069
165	0.0094	0.0022	0.0071
166	0.0095	0.0023	0.0072
167	0.0098	0.0024	0.0075
168	0.0100	0.0024	0.0076
169	0.0103	0.0025	0.0079
170	0.0105	0.0025	0.0080
171	0.0109	0.0026	0.0083
172	0.0111	0.0027	0.0084
173	0.0116	0.0028	0.0088
174	0.0118	0.0028	0.0090
175	0.0123	0.0030	0.0094
176	0.0126	0.0030	0.0096
177	0.0133	0.0032	0.0101
178	0.0136	0.0033	0.0104
179	0.0144	0.0035	0.0110
180	0.0149	0.0036	0.0113
181	0.0159	0.0038	0.0121
182	0.0164	0.0039	0.0125
183	0.0178	0.0043	0.0135
184	0.0186	0.0045	0.0141
185	0.0157	0.0038	0.0119
186	0.0167	0.0040	0.0127
187	0.0194	0.0046	0.0147
188	0.0211	0.0051	0.0161
189	0.0263	0.0063	0.0200
190	0.0303	0.0073	0.0230
191	0.0459	0.0110	0.0349
192	0.0667	0.0122	0.0545
193	0.2885	0.0122	0.2763
194	0.0362	0.0087	0.0275
195	0.0234	0.0056	0.0178
196	0.0179	0.0043	0.0136
197	0.0195	0.0047	0.0148
198	0.0171	0.0041	0.0130
199	0.0153	0.0037	0.0117
200	0.0140	0.0034	0.0106
201	0.0129	0.0031	0.0098
202	0.0121	0.0029	0.0092
203	0.0113	0.0027	0.0086
204	0.0107	0.0026	0.0081
205	0.0101	0.0024	0.0077
206	0.0097	0.0023	0.0073
207	0.0092	0.0022	0.0070
208	0.0089	0.0021	0.0067
209	0.0085	0.0020	0.0065
210	0.0082	0.0020	0.0062
211	0.0079	0.0019	0.0060
212	0.0077	0.0018	0.0058
213	0.0075	0.0018	0.0057
214	0.0072	0.0017	0.0055
215	0.0070	0.0017	0.0053
216	0.0068	0.0016	0.0052
217	0.0068	0.0016	0.0052
218	0.0066	0.0016	0.0050
219	0.0065	0.0016	0.0049
220	0.0063	0.0015	0.0048
221	0.0062	0.0015	0.0047
222	0.0061	0.0015	0.0046
223	0.0059	0.0014	0.0045
224	0.0058	0.0014	0.0044
225	0.0057	0.0014	0.0043
226	0.0056	0.0013	0.0043
227	0.0055	0.0013	0.0042
228	0.0054	0.0013	0.0041
229	0.0053	0.0013	0.0041
230	0.0052	0.0013	0.0040
231	0.0052	0.0012	0.0039
232	0.0051	0.0012	0.0039

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     233              0.0050          0.0012            0.0038
     234              0.0049          0.0012            0.0038
     235              0.0049          0.0012            0.0037
     236              0.0048          0.0012            0.0036
     237              0.0047          0.0011            0.0036
     238              0.0047          0.0011            0.0035
     239              0.0046          0.0011            0.0035
     240              0.0045          0.0011            0.0035
     241              0.0045          0.0011            0.0034
     242              0.0044          0.0011            0.0034
     243              0.0044          0.0011            0.0033
     244              0.0043          0.0010            0.0033
     245              0.0043          0.0010            0.0033
     246              0.0042          0.0010            0.0032
     247              0.0042          0.0010            0.0032
     248              0.0041          0.0010            0.0031
     249              0.0041          0.0010            0.0031
     250              0.0041          0.0010            0.0031
     251              0.0040          0.0010            0.0030
     252              0.0040          0.0010            0.0030
     253              0.0039          0.0009            0.0030
     254              0.0039          0.0009            0.0030
     255              0.0039          0.0009            0.0029
     256              0.0038          0.0009            0.0029
     257              0.0038          0.0009            0.0029
     258              0.0037          0.0009            0.0028
     259              0.0037          0.0009            0.0028
     260              0.0037          0.0009            0.0028
     261              0.0036          0.0009            0.0028
     262              0.0036          0.0009            0.0027
     263              0.0036          0.0009            0.0027
     264              0.0036          0.0009            0.0027
     265              0.0035          0.0008            0.0027
     266              0.0035          0.0008            0.0027
     267              0.0035          0.0008            0.0026
     268              0.0034          0.0008            0.0026
     269              0.0034          0.0008            0.0026
     270              0.0034          0.0008            0.0026
     271              0.0034          0.0008            0.0026
     272              0.0033          0.0008            0.0025
     273              0.0033          0.0008            0.0025
     274              0.0033          0.0008            0.0025
     275              0.0033          0.0008            0.0025
     276              0.0032          0.0008            0.0025
     277              0.0032          0.0008            0.0024
     278              0.0032          0.0008            0.0024
     279              0.0032          0.0008            0.0024
     280              0.0031          0.0008            0.0024
     281              0.0031          0.0008            0.0024
     282              0.0031          0.0007            0.0024
     283              0.0031          0.0007            0.0023
     284              0.0031          0.0007            0.0023
     285              0.0030          0.0007            0.0023
     286              0.0030          0.0007            0.0023
     287              0.0030          0.0007            0.0023
     288              0.0030          0.0007            0.0023
     --------------------------------------------------------------------
     --------------------------------------------------------------------
     Total soil rain loss =      0.45(In)
     Total effective rainfall =      1.69(In)
     Peak flow rate in flood hydrograph =     78.30(CFS)
     ---------------------------------------------------------------------
     ++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
                         24 - H O U R   S T O R M
                    R u n o f f     H y d r o g r a p h
     --------------------------------------------------------------------
                 Hydrograph in   5   Minute intervals ((CFS))

     --------------------------------------------------------------------
Time(h+m) Volume Ac.Ft   Q(CFS)  0       20.0      40.0      60.0      80.0
-----------------------------------------------------------------------
  0+ 5      0.0004      0.06  Q         |         |         |         |
  0+10      0.0026      0.32  Q         |         |         |         |
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 0+15        0.0079       0.77  Q         |         |         |         |
 0+20        0.0165       1.25  Q         |         |         |         |
 0+25        0.0270       1.52  Q         |         |         |         |
 0+30        0.0385       1.67  Q         |         |         |         |
 0+35        0.0506       1.76  Q         |         |         |         |
 0+40        0.0630       1.81  Q         |         |         |         |
 0+45        0.0758       1.85  Q         |         |         |         |
 0+50        0.0887       1.88  Q         |         |         |         |
 0+55        0.1018       1.91  Q         |         |         |         |
 1+ 0        0.1151       1.93  Q         |         |         |         |
 1+ 5        0.1285       1.95  Q         |         |         |         |
 1+10        0.1420       1.96  Q         |         |         |         |
 1+15        0.1556       1.98  Q         |         |         |         |
 1+20        0.1694       1.99  Q         |         |         |         |
 1+25        0.1832       2.01  VQ        |         |         |         |
 1+30        0.1971       2.02  VQ        |         |         |         |
 1+35        0.2111       2.03  VQ        |         |         |         |
 1+40        0.2251       2.04  VQ        |         |         |         |
 1+45        0.2392       2.05  VQ        |         |         |         |
 1+50        0.2534       2.06  |Q        |         |         |         |
 1+55        0.2677       2.07  |Q        |         |         |         |
 2+ 0        0.2820       2.08  |Q        |         |         |         |
 2+ 5        0.2964       2.09  |Q        |         |         |         |
 2+10        0.3109       2.10  |Q        |         |         |         |
 2+15        0.3253       2.10  |Q        |         |         |         |
 2+20        0.3399       2.11  |Q        |         |         |         |
 2+25        0.3545       2.12  |Q        |         |         |         |
 2+30        0.3691       2.13  |Q        |         |         |         |
 2+35        0.3838       2.13  |Q        |         |         |         |
 2+40        0.3985       2.14  |Q        |         |         |         |
 2+45        0.4133       2.15  |Q        |         |         |         |
 2+50        0.4282       2.16  |Q        |         |         |         |
 2+55        0.4431       2.16  |Q        |         |         |         |
 3+ 0        0.4581       2.17  |Q        |         |         |         |
 3+ 5        0.4731       2.18  |Q        |         |         |         |
 3+10        0.4882       2.19  |Q        |         |         |         |
 3+15        0.5033       2.20  |QV       |         |         |         |
 3+20        0.5185       2.21  |QV       |         |         |         |
 3+25        0.5338       2.21  |QV       |         |         |         |
 3+30        0.5491       2.22  |QV       |         |         |         |
 3+35        0.5644       2.23  |QV       |         |         |         |
 3+40        0.5799       2.24  |QV       |         |         |         |
 3+45        0.5954       2.25  |QV       |         |         |         |
 3+50        0.6109       2.26  |QV       |         |         |         |
 3+55        0.6265       2.27  |QV       |         |         |         |
 4+ 0        0.6422       2.28  |QV       |         |         |         |
 4+ 5        0.6580       2.29  |QV       |         |         |         |
 4+10        0.6738       2.30  |QV       |         |         |         |
 4+15        0.6896       2.30  |QV       |         |         |         |
 4+20        0.7056       2.31  |QV       |         |         |         |
 4+25        0.7216       2.32  |QV       |         |         |         |
 4+30        0.7377       2.33  |QV       |         |         |         |
 4+35        0.7538       2.34  |Q V      |         |         |         |
 4+40        0.7700       2.35  |Q V      |         |         |         |
 4+45        0.7863       2.36  |Q V      |         |         |         |
 4+50        0.8027       2.37  |Q V      |         |         |         |
 4+55        0.8191       2.38  |Q V      |         |         |         |
 5+ 0        0.8356       2.40  |Q V      |         |         |         |
 5+ 5        0.8521       2.41  |Q V      |         |         |         |
 5+10        0.8688       2.42  |Q V      |         |         |         |
 5+15        0.8855       2.43  |Q V      |         |         |         |
 5+20        0.9023       2.44  |Q V      |         |         |         |
 5+25        0.9192       2.45  |Q V      |         |         |         |
 5+30        0.9361       2.46  |Q V      |         |         |         |
 5+35        0.9531       2.47  |Q V      |         |         |         |
 5+40        0.9702       2.48  |Q V      |         |         |         |
 5+45        0.9874       2.50  |Q V      |         |         |         |
 5+50        1.0047       2.51  |Q V      |         |         |         |
 5+55        1.0220       2.52  |Q  V     |         |         |         |
 6+ 0        1.0395       2.53  |Q  V     |         |         |         |
 6+ 5        1.0570       2.54  |Q  V     |         |         |         |
 6+10        1.0746       2.56  |Q  V     |         |         |         |
 6+15        1.0923       2.57  |Q  V     |         |         |         |
```

```
 6+20        1.1101       2.58  |Q  V     |          |          |          |
 6+25        1.1279       2.59  |Q  V     |          |          |          |
 6+30        1.1459       2.61  |Q  V     |          |          |          |
 6+35        1.1639       2.62  |Q  V     |          |          |          |
 6+40        1.1821       2.63  |Q  V     |          |          |          |
 6+45        1.2003       2.65  |Q  V     |          |          |          |
 6+50        1.2187       2.66  |Q  V     |          |          |          |
 6+55        1.2371       2.68  |Q  V     |          |          |          |
 7+ 0        1.2556       2.69  |Q  V     |          |          |          |
 7+ 5        1.2742       2.70  |Q   V    |          |          |          |
 7+10        1.2930       2.72  |Q   V    |          |          |          |
 7+15        1.3118       2.73  |Q   V    |          |          |          |
 7+20        1.3307       2.75  |Q   V    |          |          |          |
 7+25        1.3498       2.76  |Q   V    |          |          |          |
 7+30        1.3689       2.78  |Q   V    |          |          |          |
 7+35        1.3882       2.80  |Q   V    |          |          |          |
 7+40        1.4076       2.81  |Q   V    |          |          |          |
 7+45        1.4270       2.83  |Q   V    |          |          |          |
 7+50        1.4466       2.85  |Q   V    |          |          |          |
 7+55        1.4663       2.86  |Q   V    |          |          |          |
 8+ 0        1.4862       2.88  |Q   V    |          |          |          |
 8+ 5        1.5061       2.90  |Q   V    |          |          |          |
 8+10        1.5262       2.91  |Q    V   |          |          |          |
 8+15        1.5464       2.93  |Q    V   |          |          |          |
 8+20        1.5667       2.95  |Q    V   |          |          |          |
 8+25        1.5871       2.97  |Q    V   |          |          |          |
 8+30        1.6077       2.99  |Q    V   |          |          |          |
 8+35        1.6284       3.01  |Q    V   |          |          |          |
 8+40        1.6493       3.03  |Q    V   |          |          |          |
 8+45        1.6702       3.05  |Q    V   |          |          |          |
 8+50        1.6914       3.07  |Q    V   |          |          |          |
 8+55        1.7126       3.09  |Q    V   |          |          |          |
 9+ 0        1.7340       3.11  |Q    V   |          |          |          |
 9+ 5        1.7556       3.13  |Q    V   |          |          |          |
 9+10        1.7773       3.15  |Q     V  |          |          |          |
 9+15        1.7991       3.17  |Q     V  |          |          |          |
 9+20        1.8211       3.20  |Q     V  |          |          |          |
 9+25        1.8433       3.22  |Q     V  |          |          |          |
 9+30        1.8656       3.24  |Q     V  |          |          |          |
 9+35        1.8881       3.27  |Q     V  |          |          |          |
 9+40        1.9108       3.29  |Q     V  |          |          |          |
 9+45        1.9336       3.31  |Q     V  |          |          |          |
 9+50        1.9566       3.34  |Q     V  |          |          |          |
 9+55        1.9798       3.37  |Q     V  |          |          |          |
10+ 0        2.0032       3.39  |Q     V  |          |          |          |
10+ 5        2.0267       3.42  |Q      V |          |          |          |
10+10        2.0504       3.45  |Q      V |          |          |          |
10+15        2.0744       3.48  |Q      V |          |          |          |
10+20        2.0985       3.50  |Q      V |          |          |          |
10+25        2.1228       3.53  |Q      V |          |          |          |
10+30        2.1474       3.56  |Q      V |          |          |          |
10+35        2.1721       3.59  |Q      V |          |          |          |
10+40        2.1971       3.63  |Q      V |          |          |          |
10+45        2.2223       3.66  |Q      V |          |          |          |
10+50        2.2477       3.69  |Q      V |          |          |          |
10+55        2.2734       3.72  |Q       V|          |          |          |
11+ 0        2.2993       3.76  |Q       V|          |          |          |
11+ 5        2.3254       3.79  |Q       V|          |          |          |
11+10        2.3518       3.83  |Q       V|          |          |          |
11+15        2.3784       3.87  |Q       V|          |          |          |
11+20        2.4053       3.91  |Q       V|          |          |          |
11+25        2.4325       3.95  |Q       V|          |          |          |
11+30        2.4600       3.99  |Q       V|          |          |          |
11+35        2.4877       4.03  | Q      V|          |          |          |
11+40        2.5158       4.07  | Q       V          |          |          |
11+45        2.5441       4.12  | Q       V          |          |          |
11+50        2.5728       4.16  | Q       V          |          |          |
11+55        2.6018       4.21  | Q       V          |          |          |
12+ 0        2.6311       4.26  | Q       V          |          |          |
12+ 5        2.6607       4.30  | Q       V          |          |          |
12+10        2.6906       4.34  | Q       V          |          |          |
12+15        2.7208       4.38  | Q       V          |          |          |
12+20        2.7512       4.41  | Q       V          |          |          |
```

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12+25       2.7819      4.46  | Q       |V        |         |         |
12+30       2.8130      4.51  | Q       |V        |         |         |
12+35       2.8444      4.57  | Q       |V        |         |         |
12+40       2.8763      4.63  | Q       |V        |         |         |
12+45       2.9086      4.69  | Q       |V        |         |         |
12+50       2.9414      4.76  | Q       |V        |         |         |
12+55       2.9746      4.83  | Q       |V        |         |         |
13+ 0       3.0084      4.90  | Q       |V        |         |         |
13+ 5       3.0426      4.97  | Q       | V       |         |         |
13+10       3.0774      5.05  | Q       | V       |         |         |
13+15       3.1128      5.13  | Q       | V       |         |         |
13+20       3.1487      5.22  | Q       | V       |         |         |
13+25       3.1853      5.31  | Q       | V       |         |         |
13+30       3.2225      5.40  | Q       | V       |         |         |
13+35       3.2604      5.50  | Q       | V       |         |         |
13+40       3.2990      5.60  | Q       |  V      |         |         |
13+45       3.3383      5.71  | Q       |  V      |         |         |
13+50       3.3785      5.83  | Q       |  V      |         |         |
13+55       3.4194      5.95  | Q       |  V      |         |         |
14+ 0       3.4613      6.08  |  Q      |  V      |         |         |
14+ 5       3.5041      6.21  |  Q      |  V      |         |         |
14+10       3.5478      6.36  |  Q      |   V     |         |         |
14+15       3.5927      6.51  |  Q      |   V     |         |         |
14+20       3.6387      6.68  |  Q      |   V     |         |         |
14+25       3.6860      6.86  |  Q      |   V     |         |         |
14+30       3.7345      7.05  |  Q      |   V     |         |         |
14+35       3.7845      7.25  |  Q      |    V    |         |         |
14+40       3.8359      7.47  |  Q      |    V    |         |         |
14+45       3.8890      7.71  |  Q      |    V    |         |         |
14+50       3.9439      7.97  |  Q      |    V    |         |         |
14+55       4.0007      8.25  |   Q     |    V    |         |         |
15+ 0       4.0596      8.56  |   Q     |     V   |         |         |
15+ 5       4.1209      8.90  |   Q     |     V   |         |         |
15+10       4.1849      9.29  |   Q     |     V   |         |         |
15+15       4.2519      9.72  |   Q     |     V   |         |         |
15+20       4.3222     10.22  |    Q    |      V  |         |         |
15+25       4.3959     10.69  |    Q    |      V  |         |         |
15+30       4.4712     10.94  |    Q    |      V  |         |         |
15+35       4.5467     10.97  |    Q    |       V |         |         |
15+40       4.6233     11.12  |    Q    |       V |         |         |
15+45       4.7046     11.80  |    Q    |       V |         |         |
15+50       4.7945     13.05  |     Q   |        V|         |         |
15+55       4.8980     15.04  |      Q  |        V|         |         |
16+ 0       5.0264     18.64  |        Q|         V         |         |
16+ 5       5.2349     30.27  |         |    Q    V         |         |
16+10       5.6224     56.26  |         |         | V     Q |         |
16+15       6.1616     78.30  |         |         |   V     |        Q|
16+20       6.6915     76.94  |         |         |     V   |       Q |
16+25       7.0418     50.86  |         |         |    Q  V |         |
16+30       7.2688     32.96  |         |     Q   |       V |         |
16+35       7.4343     24.02  |         | Q       |        V|         |
16+40       7.5629     18.68  |        Q|         |         V         |
16+45       7.6728     15.96  |      Q  |         |         V         |
16+50       7.7710     14.25  |      Q  |         |         V         |
16+55       7.8577     12.60  |     Q   |         |         |V        |
17+ 0       7.9343     11.12  |    Q    |         |         |V        |
17+ 5       8.0042     10.14  |    Q    |         |         |V        |
17+10       8.0694      9.48  |   Q     |         |         | V       |
17+15       8.1307      8.89  |   Q     |         |         | V       |
17+20       8.1874      8.24  |   Q     |         |         | V       |
17+25       8.2407      7.73  |  Q      |         |         | V       |
17+30       8.2910      7.30  |  Q      |         |         |  V      |
17+35       8.3383      6.88  |  Q      |         |         |  V      |
17+40       8.3831      6.50  |  Q      |         |         |  V      |
17+45       8.4259      6.21  |  Q      |         |         |  V      |
17+50       8.4671      5.98  | Q       |         |         |  V      |
17+55       8.5066      5.75  | Q       |         |         |  V      |
18+ 0       8.5435      5.36  | Q       |         |         |   V     |
18+ 5       8.5778      4.98  | Q       |         |         |   V     |
18+10       8.6110      4.82  | Q       |         |         |   V     |
18+15       8.6434      4.70  | Q       |         |         |   V     |
18+20       8.6750      4.59  | Q       |         |         |   V     |
18+25       8.7058      4.48  | Q       |         |         |   V     |
```

```
18+30       8.7359      4.37  | Q       |         |         |   V     |
18+35       8.7653      4.27  | Q       |         |         |   V     |
18+40       8.7940      4.17  | Q       |         |         |    V    |
18+45       8.8221      4.08  | Q       |         |         |    V    |
18+50       8.8496      3.99  |Q        |         |         |    V    |
18+55       8.8765      3.91  |Q        |         |         |    V    |
19+ 0       8.9030      3.83  |Q        |         |         |    V    |
19+ 5       8.9289      3.76  |Q        |         |         |    V    |
19+10       8.9543      3.69  |Q        |         |         |    V    |
19+15       8.9793      3.63  |Q        |         |         |    V    |
19+20       9.0038      3.56  |Q        |         |         |    V    |
19+25       9.0280      3.50  |Q        |         |         |    V    |
19+30       9.0517      3.45  |Q        |         |         |     V   |
19+35       9.0751      3.39  |Q        |         |         |     V   |
19+40       9.0981      3.34  |Q        |         |         |     V   |
19+45       9.1207      3.29  |Q        |         |         |     V   |
19+50       9.1430      3.24  |Q        |         |         |     V   |
19+55       9.1650      3.19  |Q        |         |         |     V   |
20+ 0       9.1867      3.15  |Q        |         |         |     V   |
20+ 5       9.2081      3.11  |Q        |         |         |     V   |
20+10       9.2292      3.06  |Q        |         |         |     V   |
20+15       9.2501      3.02  |Q        |         |         |     V   |
20+20       9.2706      2.99  |Q        |         |         |     V   |
20+25       9.2909      2.95  |Q        |         |         |     V   |
20+30       9.3110      2.91  |Q        |         |         |      V  |
20+35       9.3308      2.88  |Q        |         |         |      V  |
20+40       9.3504      2.84  |Q        |         |         |      V  |
20+45       9.3697      2.81  |Q        |         |         |      V  |
20+50       9.3889      2.78  |Q        |         |         |      V  |
20+55       9.4078      2.75  |Q        |         |         |      V  |
21+ 0       9.4265      2.72  |Q        |         |         |      V  |
21+ 5       9.4450      2.69  |Q        |         |         |      V  |
21+10       9.4633      2.66  |Q        |         |         |      V  |
21+15       9.4814      2.63  |Q        |         |         |      V  |
21+20       9.4994      2.61  |Q        |         |         |      V  |
21+25       9.5171      2.58  |Q        |         |         |      V  |
21+30       9.5347      2.55  |Q        |         |         |      V  |
21+35       9.5522      2.53  |Q        |         |         |       V |
21+40       9.5694      2.50  |Q        |         |         |       V |
21+45       9.5865      2.48  |Q        |         |         |       V |
21+50       9.6034      2.46  |Q        |         |         |       V |
21+55       9.6202      2.44  |Q        |         |         |       V |
22+ 0       9.6368      2.41  |Q        |         |         |       V |
22+ 5       9.6533      2.39  |Q        |         |         |       V |
22+10       9.6696      2.37  |Q        |         |         |       V |
22+15       9.6858      2.35  |Q        |         |         |       V |
22+20       9.7019      2.33  |Q        |         |         |       V |
22+25       9.7178      2.31  |Q        |         |         |       V |
22+30       9.7336      2.29  |Q        |         |         |       V |
22+35       9.7493      2.27  |Q        |         |         |       V |
22+40       9.7648      2.26  |Q        |         |         |       V |
22+45       9.7802      2.24  |Q        |         |         |       V |
22+50       9.7955      2.22  |Q        |         |         |       V |
22+55       9.8107      2.20  |Q        |         |         |        V|
23+ 0       9.8258      2.19  |Q        |         |         |        V|
23+ 5       9.8407      2.17  |Q        |         |         |        V|
23+10       9.8556      2.15  |Q        |         |         |        V|
23+15       9.8703      2.14  |Q        |         |         |        V|
23+20       9.8849      2.12  |Q        |         |         |        V|
23+25       9.8995      2.11  |Q        |         |         |        V|
23+30       9.9139      2.09  |Q        |         |         |        V|
23+35       9.9282      2.08  |Q        |         |         |        V|
23+40       9.9424      2.06  |Q        |         |         |        V|
23+45       9.9565      2.05  |Q        |         |         |        V|
23+50       9.9706      2.04  |Q        |         |         |        V|
23+55       9.9845      2.02  |Q        |         |         |        V|
24+ 0       9.9983      2.01  |Q        |         |         |        V|
24+ 5      10.0117      1.94  Q         |         |         |        V|
24+10      10.0232      1.67  Q         |         |         |        V|
24+15      10.0315      1.20  Q         |         |         |        V|
24+20      10.0365      0.72  Q         |         |         |        V|
24+25      10.0395      0.45  Q         |         |         |        V|
24+30      10.0416      0.30  Q         |         |         |        V|
```

```
   24+35      10.0431      0.22  Q          |          |          |         V|
   24+40      10.0443      0.17  Q          |          |          |         V|
   24+45      10.0453      0.14  Q          |          |          |         V|
   24+50      10.0461      0.11  Q          |          |          |         V|
   24+55      10.0467      0.09  Q          |          |          |         V|
   25+ 0      10.0472      0.07  Q          |          |          |         V|
   25+ 5      10.0476      0.06  Q          |          |          |         V|
   25+10      10.0480      0.05  Q          |          |          |         V|
   25+15      10.0482      0.04  Q          |          |          |         V|
   25+20      10.0485      0.03  Q          |          |          |         V|
   25+25      10.0487      0.03  Q          |          |          |         V|
   25+30      10.0488      0.02  Q          |          |          |         V|
   25+35      10.0489      0.02  Q          |          |          |         V|
   25+40      10.0490      0.01  Q          |          |          |         V|
   25+45      10.0491      0.01  Q          |          |          |         V|
   25+50      10.0491      0.01  Q          |          |          |         V|
   25+55      10.0491      0.00  Q          |          |          |         V|
----------------------------------------------------------------------
```

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

        Copyright (c) CIVILCADD/CIVILDESIGN, 1989 - 2004, Version 7.0

                Study date  10/31/22

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


Program License Serial Number 4009

---------------------------------------------------------------------
Cordova Complex Site, AREA A2
Unit Hydrogragh Method
Post-Development Condition
10-Year, 24-Hours Storm
--------------------------------------------------------------------

        Storm Event Year = 10

        Antecedent Moisture Condition = 2

 English (in-lb) Input Units Used

 English Rainfall Data (Inches) Input Values Used

 English Units used in output format




Area averaged rainfall intensity isohyetal data:
        Sub-Area        Duration        Isohyetal
        (Ac.)            (hours)         (In)
Rainfall data for year 10
            14.55            1           0.61
--------------------------------------------------------------------
Rainfall data for year 10
            14.55            6           1.23
--------------------------------------------------------------------
Rainfall data for year 10
            14.55           24           2.14
--------------------------------------------------------------------
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++

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


SCS curve  SCS curve     Area     Area     Fp(Fig C6)    Ap      Fm
No.(AMCII) NO.(AMC 2)    (Ac.)    Fraction     (In/Hr)  (dec.)   (In/Hr)
 32.0      32.0         14.55      1.000     0.978    0.150    0.147

Area-averaged adjusted loss rate Fm (In/Hr) =  0.147

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

Area       Area          SCS CN    SCS CN      S     Pervious
 (Ac.)      Fract         (AMC2)    (AMC2)           Yield Fr
     2.18   0.150         32.0      32.0      10.70     0.000
    12.37   0.850         98.0      98.0       0.20     0.894

Area-averaged catchment yield fraction, Y =  0.760
Area-averaged low loss fraction, Yb =  0.240
User entry of time of concentration  =   0.290 (hours)
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Watershed area =      14.55(Ac.)
Catchment Lag time =   0.232 hours
```

Unit interval = 5.000 minutes
Unit interval percentage of lag time = 35.9195
Hydrograph baseflow = 0.00(CFS)
Average maximum watershed loss rate(Fm) = 0.147(In/Hr)
Average low loss rate fraction (Yb) = 0.240 (decimal)
VALLEY UNDEVELOPED S-Graph Selected
Computed peak 5-minute rainfall = 0.289(In)
Computed peak 30-minute rainfall = 0.495(In)
Specified peak 1-hour rainfall = 0.609(In)
Computed peak 3-hour rainfall = 0.937(In)
Specified peak 6-hour rainfall = 1.230(In)
Specified peak 24-hour rainfall = 2.140(In)

Rainfall depth area reduction factors:
Using a total area of 14.55(Ac.) (Ref: fig. E-4)

5-minute factor = 0.999	Adjusted rainfall = 0.289(In)
30-minute factor = 0.999	Adjusted rainfall = 0.494(In)
1-hour factor = 0.999	Adjusted rainfall = 0.609(In)
3-hour factor = 1.000	Adjusted rainfall = 0.937(In)
6-hour factor = 1.000	Adjusted rainfall = 1.230(In)
24-hour factor = 1.000	Adjusted rainfall = 2.140(In)

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

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Interval Number	'S' Graph Mean values	Unit Hydrograph ((CFS))
	(K = 175.96 (CFS))	
1	6.271	11.035
2	34.370	49.444
3	83.329	86.151
4	131.857	85.391
5	158.300	46.529
6	171.770	23.704
7	179.463	13.537
8	183.822	7.670
9	187.088	5.747
10	189.955	5.046
11	191.695	3.061
12	193.114	2.498
13	194.260	2.016
14	195.346	1.912
15	196.258	1.605
16	197.015	1.331
17	197.662	1.139
18	198.200	0.948
19	198.644	0.782
20	199.004	0.633
21	199.364	0.632
22	199.723	0.632
23	200.000	0.488

Peak Unit Number	Adjusted mass rainfall (In)	Unit rainfall (In)
1	0.2888	0.2888
2	0.3555	0.0667
3	0.4015	0.0460
4	0.4377	0.0362
5	0.4680	0.0303
6	0.4943	0.0263
7	0.5177	0.0234
8	0.5389	0.0212
9	0.5583	0.0194
10	0.5762	0.0179
11	0.5929	0.0167
12	0.6086	0.0157
13	0.6280	0.0194
14	0.6466	0.0186
15	0.6643	0.0178

16	0.6814	0.0171
17	0.6978	0.0164
18	0.7137	0.0158
19	0.7290	0.0153
20	0.7438	0.0148
21	0.7582	0.0144
22	0.7722	0.0140
23	0.7858	0.0136
24	0.7991	0.0132
25	0.8120	0.0129
26	0.8246	0.0126
27	0.8369	0.0123
28	0.8490	0.0120
29	0.8607	0.0118
30	0.8723	0.0115
31	0.8836	0.0113
32	0.8947	0.0111
33	0.9056	0.0109
34	0.9162	0.0107
35	0.9267	0.0105
36	0.9371	0.0103
37	0.9472	0.0101
38	0.9571	0.0100
39	0.9670	0.0098
40	0.9766	0.0097
41	0.9861	0.0095
42	0.9955	0.0094
43	1.0047	0.0092
44	1.0138	0.0091
45	1.0228	0.0090
46	1.0317	0.0089
47	1.0404	0.0087
48	1.0490	0.0086
49	1.0576	0.0085
50	1.0660	0.0084
51	1.0743	0.0083
52	1.0825	0.0082
53	1.0906	0.0081
54	1.0987	0.0080
55	1.1066	0.0079
56	1.1144	0.0079
57	1.1222	0.0078
58	1.1299	0.0077
59	1.1375	0.0076
60	1.1450	0.0075
61	1.1525	0.0075
62	1.1599	0.0074
63	1.1672	0.0073
64	1.1744	0.0072
65	1.1816	0.0072
66	1.1887	0.0071
67	1.1957	0.0070
68	1.2027	0.0070
69	1.2096	0.0069
70	1.2164	0.0068
71	1.2232	0.0068
72	1.2299	0.0067
73	1.2367	0.0068
74	1.2435	0.0067
75	1.2502	0.0067
76	1.2568	0.0066
77	1.2634	0.0066
78	1.2699	0.0065
79	1.2764	0.0065
80	1.2828	0.0064
81	1.2892	0.0064
82	1.2955	0.0063
83	1.3018	0.0063
84	1.3081	0.0062
85	1.3143	0.0062
86	1.3204	0.0062
87	1.3265	0.0061
88	1.3326	0.0061

89	1.3386	0.0060
90	1.3446	0.0060
91	1.3506	0.0059
92	1.3565	0.0059
93	1.3624	0.0059
94	1.3682	0.0058
95	1.3740	0.0058
96	1.3797	0.0058
97	1.3855	0.0057
98	1.3912	0.0057
99	1.3968	0.0057
100	1.4024	0.0056
101	1.4080	0.0056
102	1.4136	0.0056
103	1.4191	0.0055
104	1.4246	0.0055
105	1.4300	0.0055
106	1.4355	0.0054
107	1.4409	0.0054
108	1.4462	0.0054
109	1.4516	0.0053
110	1.4569	0.0053
111	1.4621	0.0053
112	1.4674	0.0052
113	1.4726	0.0052
114	1.4778	0.0052
115	1.4830	0.0052
116	1.4881	0.0051
117	1.4932	0.0051
118	1.4983	0.0051
119	1.5034	0.0051
120	1.5084	0.0050
121	1.5134	0.0050
122	1.5184	0.0050
123	1.5233	0.0050
124	1.5283	0.0049
125	1.5332	0.0049
126	1.5381	0.0049
127	1.5429	0.0049
128	1.5478	0.0048
129	1.5526	0.0048
130	1.5574	0.0048
131	1.5622	0.0048
132	1.5669	0.0048
133	1.5717	0.0047
134	1.5764	0.0047
135	1.5811	0.0047
136	1.5857	0.0047
137	1.5904	0.0046
138	1.5950	0.0046
139	1.5996	0.0046
140	1.6042	0.0046
141	1.6088	0.0046
142	1.6133	0.0045
143	1.6178	0.0045
144	1.6224	0.0045
145	1.6268	0.0045
146	1.6313	0.0045
147	1.6358	0.0045
148	1.6402	0.0044
149	1.6446	0.0044
150	1.6490	0.0044
151	1.6534	0.0044
152	1.6578	0.0044
153	1.6621	0.0043
154	1.6665	0.0043
155	1.6708	0.0043
156	1.6751	0.0043
157	1.6794	0.0043
158	1.6836	0.0043
159	1.6879	0.0042
160	1.6921	0.0042
161	1.6963	0.0042

162	1.7005	0.0042
163	1.7047	0.0042
164	1.7089	0.0042
165	1.7130	0.0042
166	1.7172	0.0041
167	1.7213	0.0041
168	1.7254	0.0041
169	1.7295	0.0041
170	1.7336	0.0041
171	1.7376	0.0041
172	1.7417	0.0041
173	1.7457	0.0040
174	1.7498	0.0040
175	1.7538	0.0040
176	1.7578	0.0040
177	1.7618	0.0040
178	1.7657	0.0040
179	1.7697	0.0040
180	1.7736	0.0039
181	1.7776	0.0039
182	1.7815	0.0039
183	1.7854	0.0039
184	1.7893	0.0039
185	1.7931	0.0039
186	1.7970	0.0039
187	1.8009	0.0039
188	1.8047	0.0038
189	1.8085	0.0038
190	1.8123	0.0038
191	1.8162	0.0038
192	1.8199	0.0038
193	1.8237	0.0038
194	1.8275	0.0038
195	1.8313	0.0038
196	1.8350	0.0037
197	1.8387	0.0037
198	1.8425	0.0037
199	1.8462	0.0037
200	1.8499	0.0037
201	1.8536	0.0037
202	1.8572	0.0037
203	1.8609	0.0037
204	1.8646	0.0037
205	1.8682	0.0036
206	1.8718	0.0036
207	1.8755	0.0036
208	1.8791	0.0036
209	1.8827	0.0036
210	1.8863	0.0036
211	1.8899	0.0036
212	1.8934	0.0036
213	1.8970	0.0036
214	1.9006	0.0036
215	1.9041	0.0035
216	1.9076	0.0035
217	1.9111	0.0035
218	1.9147	0.0035
219	1.9182	0.0035
220	1.9217	0.0035
221	1.9251	0.0035
222	1.9286	0.0035
223	1.9321	0.0035
224	1.9355	0.0035
225	1.9390	0.0034
226	1.9424	0.0034
227	1.9459	0.0034
228	1.9493	0.0034
229	1.9527	0.0034
230	1.9561	0.0034
231	1.9595	0.0034
232	1.9629	0.0034
233	1.9662	0.0034
234	1.9696	0.0034

235	1.9730	0.0034
236	1.9763	0.0033
237	1.9797	0.0033
238	1.9830	0.0033
239	1.9863	0.0033
240	1.9896	0.0033
241	1.9929	0.0033
242	1.9962	0.0033
243	1.9995	0.0033
244	2.0028	0.0033
245	2.0061	0.0033
246	2.0094	0.0033
247	2.0126	0.0033
248	2.0159	0.0033
249	2.0191	0.0032
250	2.0223	0.0032
251	2.0256	0.0032
252	2.0288	0.0032
253	2.0320	0.0032
254	2.0352	0.0032
255	2.0384	0.0032
256	2.0416	0.0032
257	2.0448	0.0032
258	2.0480	0.0032
259	2.0511	0.0032
260	2.0543	0.0032
261	2.0574	0.0032
262	2.0606	0.0031
263	2.0637	0.0031
264	2.0669	0.0031
265	2.0700	0.0031
266	2.0731	0.0031
267	2.0762	0.0031
268	2.0793	0.0031
269	2.0824	0.0031
270	2.0855	0.0031
271	2.0886	0.0031
272	2.0916	0.0031
273	2.0947	0.0031
274	2.0978	0.0031
275	2.1008	0.0031
276	2.1039	0.0030
277	2.1069	0.0030
278	2.1100	0.0030
279	2.1130	0.0030
280	2.1160	0.0030
281	2.1190	0.0030
282	2.1220	0.0030
283	2.1250	0.0030
284	2.1280	0.0030
285	2.1310	0.0030
286	2.1340	0.0030
287	2.1370	0.0030
288	2.1400	0.0030

Unit Period (number)	Unit Rainfall (In)	Unit Soil-Loss (In)	Effective Rainfall (In)
1	0.0030	0.0007	0.0023
2	0.0030	0.0007	0.0023
3	0.0030	0.0007	0.0023
4	0.0030	0.0007	0.0023
5	0.0030	0.0007	0.0023
6	0.0030	0.0007	0.0023
7	0.0030	0.0007	0.0023
8	0.0030	0.0007	0.0023
9	0.0030	0.0007	0.0023
10	0.0031	0.0007	0.0023
11	0.0031	0.0007	0.0023
12	0.0031	0.0007	0.0023
13	0.0031	0.0007	0.0023
14	0.0031	0.0007	0.0024

15	0.0031	0.0007	0.0024
16	0.0031	0.0007	0.0024
17	0.0031	0.0008	0.0024
18	0.0031	0.0008	0.0024
19	0.0032	0.0008	0.0024
20	0.0032	0.0008	0.0024
21	0.0032	0.0008	0.0024
22	0.0032	0.0008	0.0024
23	0.0032	0.0008	0.0024
24	0.0032	0.0008	0.0024
25	0.0032	0.0008	0.0024
26	0.0032	0.0008	0.0025
27	0.0032	0.0008	0.0025
28	0.0033	0.0008	0.0025
29	0.0033	0.0008	0.0025
30	0.0033	0.0008	0.0025
31	0.0033	0.0008	0.0025
32	0.0033	0.0008	0.0025
33	0.0033	0.0008	0.0025
34	0.0033	0.0008	0.0025
35	0.0033	0.0008	0.0025
36	0.0033	0.0008	0.0025
37	0.0034	0.0008	0.0026
38	0.0034	0.0008	0.0026
39	0.0034	0.0008	0.0026
40	0.0034	0.0008	0.0026
41	0.0034	0.0008	0.0026
42	0.0034	0.0008	0.0026
43	0.0034	0.0008	0.0026
44	0.0035	0.0008	0.0026
45	0.0035	0.0008	0.0026
46	0.0035	0.0008	0.0026
47	0.0035	0.0008	0.0027
48	0.0035	0.0008	0.0027
49	0.0035	0.0008	0.0027
50	0.0035	0.0009	0.0027
51	0.0036	0.0009	0.0027
52	0.0036	0.0009	0.0027
53	0.0036	0.0009	0.0027
54	0.0036	0.0009	0.0027
55	0.0036	0.0009	0.0028
56	0.0036	0.0009	0.0028
57	0.0037	0.0009	0.0028
58	0.0037	0.0009	0.0028
59	0.0037	0.0009	0.0028
60	0.0037	0.0009	0.0028
61	0.0037	0.0009	0.0028
62	0.0037	0.0009	0.0028
63	0.0038	0.0009	0.0029
64	0.0038	0.0009	0.0029
65	0.0038	0.0009	0.0029
66	0.0038	0.0009	0.0029
67	0.0038	0.0009	0.0029
68	0.0038	0.0009	0.0029
69	0.0039	0.0009	0.0029
70	0.0039	0.0009	0.0029
71	0.0039	0.0009	0.0030
72	0.0039	0.0009	0.0030
73	0.0039	0.0009	0.0030
74	0.0040	0.0009	0.0030
75	0.0040	0.0010	0.0030
76	0.0040	0.0010	0.0030
77	0.0040	0.0010	0.0031
78	0.0040	0.0010	0.0031
79	0.0041	0.0010	0.0031
80	0.0041	0.0010	0.0031
81	0.0041	0.0010	0.0031
82	0.0041	0.0010	0.0031
83	0.0042	0.0010	0.0032
84	0.0042	0.0010	0.0032
85	0.0042	0.0010	0.0032
86	0.0042	0.0010	0.0032
87	0.0042	0.0010	0.0032

88	0.0043	0.0010	0.0032
89	0.0043	0.0010	0.0033
90	0.0043	0.0010	0.0033
91	0.0043	0.0010	0.0033
92	0.0044	0.0010	0.0033
93	0.0044	0.0011	0.0033
94	0.0044	0.0011	0.0034
95	0.0045	0.0011	0.0034
96	0.0045	0.0011	0.0034
97	0.0045	0.0011	0.0034
98	0.0045	0.0011	0.0034
99	0.0046	0.0011	0.0035
100	0.0046	0.0011	0.0035
101	0.0046	0.0011	0.0035
102	0.0046	0.0011	0.0035
103	0.0047	0.0011	0.0036
104	0.0047	0.0011	0.0036
105	0.0048	0.0011	0.0036
106	0.0048	0.0011	0.0036
107	0.0048	0.0012	0.0037
108	0.0048	0.0012	0.0037
109	0.0049	0.0012	0.0037
110	0.0049	0.0012	0.0037
111	0.0050	0.0012	0.0038
112	0.0050	0.0012	0.0038
113	0.0050	0.0012	0.0038
114	0.0051	0.0012	0.0038
115	0.0051	0.0012	0.0039
116	0.0051	0.0012	0.0039
117	0.0052	0.0012	0.0039
118	0.0052	0.0013	0.0040
119	0.0053	0.0013	0.0040
120	0.0053	0.0013	0.0040
121	0.0054	0.0013	0.0041
122	0.0054	0.0013	0.0041
123	0.0055	0.0013	0.0041
124	0.0055	0.0013	0.0042
125	0.0056	0.0013	0.0042
126	0.0056	0.0013	0.0042
127	0.0057	0.0014	0.0043
128	0.0057	0.0014	0.0043
129	0.0058	0.0014	0.0044
130	0.0058	0.0014	0.0044
131	0.0059	0.0014	0.0045
132	0.0059	0.0014	0.0045
133	0.0060	0.0014	0.0046
134	0.0060	0.0014	0.0046
135	0.0061	0.0015	0.0046
136	0.0062	0.0015	0.0047
137	0.0062	0.0015	0.0047
138	0.0063	0.0015	0.0048
139	0.0064	0.0015	0.0048
140	0.0064	0.0015	0.0049
141	0.0065	0.0016	0.0050
142	0.0066	0.0016	0.0050
143	0.0067	0.0016	0.0051
144	0.0067	0.0016	0.0051
145	0.0067	0.0016	0.0051
146	0.0068	0.0016	0.0052
147	0.0069	0.0017	0.0053
148	0.0070	0.0017	0.0053
149	0.0071	0.0017	0.0054
150	0.0072	0.0017	0.0054
151	0.0073	0.0018	0.0056
152	0.0074	0.0018	0.0056
153	0.0075	0.0018	0.0057
154	0.0076	0.0018	0.0058
155	0.0078	0.0019	0.0059
156	0.0079	0.0019	0.0060
157	0.0080	0.0019	0.0061
158	0.0081	0.0019	0.0062
159	0.0083	0.0020	0.0063
160	0.0084	0.0020	0.0064

161	0.0086	0.0021	0.0066
162	0.0087	0.0021	0.0066
163	0.0090	0.0022	0.0068
164	0.0091	0.0022	0.0069
165	0.0094	0.0022	0.0071
166	0.0095	0.0023	0.0072
167	0.0098	0.0024	0.0075
168	0.0100	0.0024	0.0076
169	0.0103	0.0025	0.0078
170	0.0105	0.0025	0.0080
171	0.0109	0.0026	0.0083
172	0.0111	0.0027	0.0084
173	0.0115	0.0028	0.0088
174	0.0118	0.0028	0.0090
175	0.0123	0.0030	0.0094
176	0.0126	0.0030	0.0096
177	0.0132	0.0032	0.0101
178	0.0136	0.0033	0.0103
179	0.0144	0.0035	0.0109
180	0.0148	0.0036	0.0113
181	0.0158	0.0038	0.0120
182	0.0164	0.0039	0.0125
183	0.0178	0.0043	0.0135
184	0.0186	0.0045	0.0141
185	0.0157	0.0038	0.0119
186	0.0167	0.0040	0.0127
187	0.0194	0.0047	0.0147
188	0.0212	0.0051	0.0161
189	0.0263	0.0063	0.0200
190	0.0303	0.0073	0.0230
191	0.0460	0.0110	0.0349
192	0.0667	0.0122	0.0545
193	0.2888	0.0122	0.2766
194	0.0362	0.0087	0.0275
195	0.0234	0.0056	0.0178
196	0.0179	0.0043	0.0136
197	0.0194	0.0047	0.0148
198	0.0171	0.0041	0.0130
199	0.0153	0.0037	0.0116
200	0.0140	0.0034	0.0106
201	0.0129	0.0031	0.0098
202	0.0120	0.0029	0.0092
203	0.0113	0.0027	0.0086
204	0.0107	0.0026	0.0081
205	0.0101	0.0024	0.0077
206	0.0097	0.0023	0.0073
207	0.0092	0.0022	0.0070
208	0.0089	0.0021	0.0067
209	0.0085	0.0020	0.0065
210	0.0082	0.0020	0.0062
211	0.0079	0.0019	0.0060
212	0.0077	0.0018	0.0058
213	0.0075	0.0018	0.0057
214	0.0072	0.0017	0.0055
215	0.0070	0.0017	0.0053
216	0.0068	0.0016	0.0052
217	0.0068	0.0016	0.0052
218	0.0066	0.0016	0.0050
219	0.0065	0.0016	0.0049
220	0.0063	0.0015	0.0048
221	0.0062	0.0015	0.0047
222	0.0061	0.0015	0.0046
223	0.0059	0.0014	0.0045
224	0.0058	0.0014	0.0044
225	0.0057	0.0014	0.0043
226	0.0056	0.0013	0.0043
227	0.0055	0.0013	0.0042
228	0.0054	0.0013	0.0041
229	0.0053	0.0013	0.0041
230	0.0052	0.0013	0.0040
231	0.0052	0.0012	0.0039
232	0.0051	0.0012	0.0039
233	0.0050	0.0012	0.0038

234	0.0049	0.0012	0.0038
235	0.0049	0.0012	0.0037
236	0.0048	0.0012	0.0036
237	0.0047	0.0011	0.0036
238	0.0047	0.0011	0.0035
239	0.0046	0.0011	0.0035
240	0.0045	0.0011	0.0035
241	0.0045	0.0011	0.0034
242	0.0044	0.0011	0.0034
243	0.0044	0.0011	0.0033
244	0.0043	0.0010	0.0033
245	0.0043	0.0010	0.0033
246	0.0042	0.0010	0.0032
247	0.0042	0.0010	0.0032
248	0.0041	0.0010	0.0031
249	0.0041	0.0010	0.0031
250	0.0041	0.0010	0.0031
251	0.0040	0.0010	0.0030
252	0.0040	0.0010	0.0030
253	0.0039	0.0009	0.0030
254	0.0039	0.0009	0.0030
255	0.0039	0.0009	0.0029
256	0.0038	0.0009	0.0029
257	0.0038	0.0009	0.0029
258	0.0037	0.0009	0.0028
259	0.0037	0.0009	0.0028
260	0.0037	0.0009	0.0028
261	0.0036	0.0009	0.0028
262	0.0036	0.0009	0.0027
263	0.0036	0.0009	0.0027
264	0.0036	0.0009	0.0027
265	0.0035	0.0008	0.0027
266	0.0035	0.0008	0.0027
267	0.0035	0.0008	0.0026
268	0.0034	0.0008	0.0026
269	0.0034	0.0008	0.0026
270	0.0034	0.0008	0.0026
271	0.0034	0.0008	0.0026
272	0.0033	0.0008	0.0025
273	0.0033	0.0008	0.0025
274	0.0033	0.0008	0.0025
275	0.0033	0.0008	0.0025
276	0.0032	0.0008	0.0025
277	0.0032	0.0008	0.0024
278	0.0032	0.0008	0.0024
279	0.0032	0.0008	0.0024
280	0.0031	0.0008	0.0024
281	0.0031	0.0008	0.0024
282	0.0031	0.0007	0.0024
283	0.0031	0.0007	0.0023
284	0.0031	0.0007	0.0023
285	0.0030	0.0007	0.0023
286	0.0030	0.0007	0.0023
287	0.0030	0.0007	0.0023
288	0.0030	0.0007	0.0023

```
----------------------------------------------------------------------
----------------------------------------------------------------------
Total soil rain loss =      0.45(In)
Total effective rainfall =      1.69(In)
Peak flow rate in flood hydrograph =     32.96(CFS)
-----------------------------------------------------------------------
+++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
                    24 - H O U R   S T O R M
               R u n o f f     H y d r o g r a p h
----------------------------------------------------------------------
            Hydrograph in   5   Minute intervals ((CFS))

----------------------------------------------------------------------
Time(h+m) Volume Ac.Ft   Q(CFS)  0       10.0      20.0      30.0      40.0
-----------------------------------------------------------------------
  0+ 5       0.0002      0.02  Q          |         |         |         |
  0+10       0.0011      0.14  Q          |         |         |         |
  0+15       0.0034      0.33  Q          |         |         |         |
```

```
0+20       0.0070     0.53  Q         |         |         |         |
0+25       0.0114     0.63  Q         |         |         |         |
0+30       0.0161     0.69  Q         |         |         |         |
0+35       0.0211     0.72  Q         |         |         |         |
0+40       0.0262     0.74  Q         |         |         |         |
0+45       0.0314     0.76  Q         |         |         |         |
0+50       0.0366     0.77  Q         |         |         |         |
0+55       0.0420     0.78  Q         |         |         |         |
1+ 0       0.0474     0.79  Q         |         |         |         |
1+ 5       0.0529     0.79  Q         |         |         |         |
1+10       0.0584     0.80  Q         |         |         |         |
1+15       0.0640     0.81  Q         |         |         |         |
1+20       0.0696     0.81  Q         |         |         |         |
1+25       0.0752     0.82  Q         |         |         |         |
1+30       0.0809     0.82  Q         |         |         |         |
1+35       0.0866     0.83  Q         |         |         |         |
1+40       0.0923     0.83  Q         |         |         |         |
1+45       0.0980     0.84  Q         |         |         |         |
1+50       0.1038     0.84  QV        |         |         |         |
1+55       0.1096     0.84  QV        |         |         |         |
2+ 0       0.1155     0.85  QV        |         |         |         |
2+ 5       0.1213     0.85  QV        |         |         |         |
2+10       0.1272     0.85  QV        |         |         |         |
2+15       0.1331     0.86  QV        |         |         |         |
2+20       0.1390     0.86  QV        |         |         |         |
2+25       0.1449     0.86  QV        |         |         |         |
2+30       0.1509     0.87  QV        |         |         |         |
2+35       0.1569     0.87  QV        |         |         |         |
2+40       0.1629     0.87  QV        |         |         |         |
2+45       0.1689     0.87  QV        |         |         |         |
2+50       0.1750     0.88  QV        |         |         |         |
2+55       0.1810     0.88  QV        |         |         |         |
3+ 0       0.1871     0.88  QV        |         |         |         |
3+ 5       0.1932     0.89  QV        |         |         |         |
3+10       0.1994     0.89  QV        |         |         |         |
3+15       0.2055     0.89  Q V       |         |         |         |
3+20       0.2117     0.90  Q V       |         |         |         |
3+25       0.2179     0.90  Q V       |         |         |         |
3+30       0.2242     0.91  Q V       |         |         |         |
3+35       0.2304     0.91  Q V       |         |         |         |
3+40       0.2367     0.91  Q V       |         |         |         |
3+45       0.2430     0.92  Q V       |         |         |         |
3+50       0.2493     0.92  Q V       |         |         |         |
3+55       0.2557     0.92  Q V       |         |         |         |
4+ 0       0.2621     0.93  Q V       |         |         |         |
4+ 5       0.2685     0.93  Q V       |         |         |         |
4+10       0.2749     0.93  Q V       |         |         |         |
4+15       0.2814     0.94  Q V       |         |         |         |
4+20       0.2879     0.94  Q V       |         |         |         |
4+25       0.2944     0.95  Q V       |         |         |         |
4+30       0.3009     0.95  Q V       |         |         |         |
4+35       0.3075     0.95  Q  V      |         |         |         |
4+40       0.3141     0.96  Q  V      |         |         |         |
4+45       0.3207     0.96  Q  V      |         |         |         |
4+50       0.3274     0.97  Q  V      |         |         |         |
4+55       0.3341     0.97  Q  V      |         |         |         |
5+ 0       0.3408     0.98  Q  V      |         |         |         |
5+ 5       0.3475     0.98  Q  V      |         |         |         |
5+10       0.3543     0.98  Q  V      |         |         |         |
5+15       0.3611     0.99  Q  V      |         |         |         |
5+20       0.3679     0.99  Q  V      |         |         |         |
5+25       0.3748     1.00  Q  V      |         |         |         |
5+30       0.3817     1.00  |Q V      |         |         |         |
5+35       0.3886     1.01  |Q V      |         |         |         |
5+40       0.3956     1.01  |Q V      |         |         |         |
5+45       0.4026     1.02  |Q V      |         |         |         |
5+50       0.4096     1.02  |Q  V     |         |         |         |
5+55       0.4167     1.03  |Q  V     |         |         |         |
6+ 0       0.4238     1.03  |Q  V     |         |         |         |
6+ 5       0.4309     1.04  |Q  V     |         |         |         |
6+10       0.4381     1.04  |Q  V     |         |         |         |
6+15       0.4453     1.05  |Q  V     |         |         |         |
6+20       0.4525     1.05  |Q  V     |         |         |         |
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 6+25      0.4598      1.06  |Q  V     |         |         |         |
 6+30      0.4671      1.06  |Q  V     |         |         |         |
 6+35      0.4745      1.07  |Q  V     |         |         |         |
 6+40      0.4819      1.07  |Q  V     |         |         |         |
 6+45      0.4893      1.08  |Q  V     |         |         |         |
 6+50      0.4967      1.08  |Q  V     |         |         |         |
 6+55      0.5042      1.09  |Q  V     |         |         |         |
 7+ 0      0.5118      1.10  |Q   V    |         |         |         |
 7+ 5      0.5194      1.10  |Q   V    |         |         |         |
 7+10      0.5270      1.11  |Q   V    |         |         |         |
 7+15      0.5347      1.11  |Q   V    |         |         |         |
 7+20      0.5424      1.12  |Q   V    |         |         |         |
 7+25      0.5501      1.13  |Q   V    |         |         |         |
 7+30      0.5579      1.13  |Q   V    |         |         |         |
 7+35      0.5658      1.14  |Q   V    |         |         |         |
 7+40      0.5736      1.15  |Q   V    |         |         |         |
 7+45      0.5816      1.15  |Q   V    |         |         |         |
 7+50      0.5896      1.16  |Q   V    |         |         |         |
 7+55      0.5976      1.17  |Q   V    |         |         |         |
 8+ 0      0.6057      1.17  |Q   V    |         |         |         |
 8+ 5      0.6138      1.18  |Q    V   |         |         |         |
 8+10      0.6219      1.19  |Q    V   |         |         |         |
 8+15      0.6302      1.19  |Q    V   |         |         |         |
 8+20      0.6384      1.20  |Q    V   |         |         |         |
 8+25      0.6468      1.21  |Q    V   |         |         |         |
 8+30      0.6551      1.22  |Q    V   |         |         |         |
 8+35      0.6636      1.22  |Q    V   |         |         |         |
 8+40      0.6721      1.23  |Q    V   |         |         |         |
 8+45      0.6806      1.24  |Q    V   |         |         |         |
 8+50      0.6892      1.25  |Q    V   |         |         |         |
 8+55      0.6979      1.26  |Q    V   |         |         |         |
 9+ 0      0.7066      1.27  |Q    V   |         |         |         |
 9+ 5      0.7154      1.27  |Q    V   |         |         |         |
 9+10      0.7242      1.28  |Q     V  |         |         |         |
 9+15      0.7331      1.29  |Q     V  |         |         |         |
 9+20      0.7420      1.30  |Q     V  |         |         |         |
 9+25      0.7511      1.31  |Q     V  |         |         |         |
 9+30      0.7602      1.32  |Q     V  |         |         |         |
 9+35      0.7693      1.33  |Q     V  |         |         |         |
 9+40      0.7786      1.34  |Q     V  |         |         |         |
 9+45      0.7878      1.35  |Q     V  |         |         |         |
 9+50      0.7972      1.36  |Q     V  |         |         |         |
 9+55      0.8067      1.37  |Q     V  |         |         |         |
10+ 0      0.8162      1.38  |Q     V  |         |         |         |
10+ 5      0.8258      1.39  |Q      V |         |         |         |
10+10      0.8354      1.40  |Q      V |         |         |         |
10+15      0.8452      1.42  |Q      V |         |         |         |
10+20      0.8550      1.43  |Q      V |         |         |         |
10+25      0.8649      1.44  |Q      V |         |         |         |
10+30      0.8749      1.45  |Q      V |         |         |         |
10+35      0.8850      1.46  |Q      V |         |         |         |
10+40      0.8952      1.48  |Q      V |         |         |         |
10+45      0.9054      1.49  |Q      V |         |         |         |
10+50      0.9158      1.50  |Q      V |         |         |         |
10+55      0.9262      1.52  |Q       V|         |         |         |
11+ 0      0.9368      1.53  |Q       V|         |         |         |
11+ 5      0.9474      1.55  |Q       V|         |         |         |
11+10      0.9582      1.56  |Q       V|         |         |         |
11+15      0.9690      1.58  |Q       V|         |         |         |
11+20      0.9800      1.59  |Q       V|         |         |         |
11+25      0.9911      1.61  |Q       V|         |         |         |
11+30      1.0022      1.62  |Q       V|         |         |         |
11+35      1.0135      1.64  |Q       V|         |         |         |
11+40      1.0250      1.66  |Q        V         |         |         |
11+45      1.0365      1.68  |Q        V         |         |         |
11+50      1.0482      1.70  |Q        V         |         |         |
11+55      1.0600      1.71  |Q        V         |         |         |
12+ 0      1.0719      1.73  |Q        V         |         |         |
12+ 5      1.0840      1.75  |Q        V         |         |         |
12+10      1.0962      1.77  |Q        V         |         |         |
12+15      1.1085      1.78  |Q        V         |         |         |
12+20      1.1209      1.80  |Q        V         |         |         |
12+25      1.1334      1.82  |Q        |V        |         |         |
```

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12+30       1.1460      1.84  |Q        |V        |         |         |
12+35       1.1588      1.86  |Q        |V        |         |         |
12+40       1.1718      1.89  |Q        |V        |         |         |
12+45       1.1850      1.91  |Q        |V        |         |         |
12+50       1.1984      1.94  |Q        |V        |         |         |
12+55       1.2119      1.97  |Q        |V        |         |         |
13+ 0       1.2257      2.00  |Q        |V        |         |         |
13+ 5       1.2396      2.03  | Q       | V       |         |         |
13+10       1.2538      2.06  | Q       | V       |         |         |
13+15       1.2682      2.09  | Q       | V       |         |         |
13+20       1.2829      2.13  | Q       | V       |         |         |
13+25       1.2978      2.16  | Q       | V       |         |         |
13+30       1.3129      2.20  | Q       | V       |         |         |
13+35       1.3284      2.24  | Q       | V       |         |         |
13+40       1.3441      2.28  | Q       |  V      |         |         |
13+45       1.3602      2.33  | Q       |  V      |         |         |
13+50       1.3765      2.38  | Q       |  V      |         |         |
13+55       1.3932      2.43  | Q       |  V      |         |         |
14+ 0       1.4103      2.48  | Q       |  V      |         |         |
14+ 5       1.4277      2.53  | Q       |  V      |         |         |
14+10       1.4456      2.59  | Q       |   V     |         |         |
14+15       1.4639      2.66  | Q       |   V     |         |         |
14+20       1.4826      2.72  | Q       |   V     |         |         |
14+25       1.5019      2.80  | Q       |   V     |         |         |
14+30       1.5217      2.87  | Q       |   V     |         |         |
14+35       1.5420      2.95  | Q       |    V    |         |         |
14+40       1.5630      3.04  |  Q      |    V    |         |         |
14+45       1.5846      3.14  |  Q      |    V    |         |         |
14+50       1.6070      3.25  |  Q      |    V    |         |         |
14+55       1.6301      3.36  |  Q      |    V    |         |         |
15+ 0       1.6542      3.49  |  Q      |     V   |         |         |
15+ 5       1.6792      3.63  |  Q      |     V   |         |         |
15+10       1.7053      3.79  |  Q      |     V   |         |         |
15+15       1.7326      3.97  |  Q      |     V   |         |         |
15+20       1.7614      4.17  |   Q     |      V  |         |         |
15+25       1.7915      4.37  |   Q     |      V  |         |         |
15+30       1.8222      4.46  |   Q     |      V  |         |         |
15+35       1.8529      4.47  |   Q     |       V |         |         |
15+40       1.8842      4.54  |   Q     |       V |         |         |
15+45       1.9174      4.83  |   Q     |       V |         |         |
15+50       1.9544      5.36  |    Q    |        V|         |         |
15+55       1.9970      6.20  |     Q   |        V|         |         |
16+ 0       2.0502      7.72  |      Q  |         V         |         |
16+ 5       2.1375     12.67  |         | Q       V         |         |
16+10       2.3019     23.88  |         |         | VQ      |         |
16+15       2.5289     32.96  |         |         |   V     | Q       |
16+20       2.7440     31.22  |         |         |     V   |Q        |
16+25       2.8813     19.95  |         |        Q|       V |         |
16+30       2.9700     12.87  |         | Q       |        V|         |
16+35       3.0349      9.42  |        Q|         |        V|         |
16+40       3.0858      7.39  |      Q  |         |         V         |
16+45       3.1299      6.41  |     Q   |         |         V         |
16+50       3.1697      5.77  |    Q    |         |         |V        |
16+55       3.2035      4.92  |   Q     |         |         |V        |
17+ 0       3.2342      4.46  |   Q     |         |         |V        |
17+ 5       3.2623      4.08  |   Q     |         |         |V        |
17+10       3.2887      3.83  |  Q      |         |         | V       |
17+15       3.3132      3.55  |  Q      |         |         | V       |
17+20       3.3360      3.31  |  Q      |         |         | V       |
17+25       3.3574      3.11  |  Q      |         |         | V       |
17+30       3.3776      2.92  | Q       |         |         |  V      |
17+35       3.3966      2.76  | Q       |         |         |  V      |
17+40       3.4146      2.61  | Q       |         |         |  V      |
17+45       3.4319      2.51  | Q       |         |         |  V      |
17+50       3.4485      2.41  | Q       |         |         |  V      |
17+55       3.4642      2.28  | Q       |         |         |  V      |
18+ 0       3.4786      2.08  | Q       |         |         |   V     |
18+ 5       3.4924      2.01  | Q       |         |         |   V     |
18+10       3.5058      1.95  |Q        |         |         |   V     |
18+15       3.5189      1.90  |Q        |         |         |   V     |
18+20       3.5317      1.86  |Q        |         |         |   V     |
18+25       3.5442      1.81  |Q        |         |         |   V     |
18+30       3.5564      1.77  |Q        |         |         |   V     |
```

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18+35       3.5683      1.73  |Q        |         |         |   V     |
18+40       3.5800      1.69  |Q        |         |         |    V    |
18+45       3.5914      1.65  |Q        |         |         |    V    |
18+50       3.6025      1.62  |Q        |         |         |    V    |
18+55       3.6134      1.59  |Q        |         |         |    V    |
19+ 0       3.6241      1.56  |Q        |         |         |    V    |
19+ 5       3.6347      1.53  |Q        |         |         |    V    |
19+10       3.6450      1.50  |Q        |         |         |    V    |
19+15       3.6551      1.47  |Q        |         |         |    V    |
19+20       3.6651      1.45  |Q        |         |         |    V    |
19+25       3.6749      1.42  |Q        |         |         |    V    |
19+30       3.6845      1.40  |Q        |         |         |     V   |
19+35       3.6940      1.38  |Q        |         |         |     V   |
19+40       3.7033      1.36  |Q        |         |         |     V   |
19+45       3.7125      1.34  |Q        |         |         |     V   |
19+50       3.7216      1.32  |Q        |         |         |     V   |
19+55       3.7305      1.30  |Q        |         |         |     V   |
20+ 0       3.7393      1.28  |Q        |         |         |     V   |
20+ 5       3.7480      1.26  |Q        |         |         |     V   |
20+10       3.7566      1.24  |Q        |         |         |     V   |
20+15       3.7651      1.23  |Q        |         |         |     V   |
20+20       3.7734      1.21  |Q        |         |         |     V   |
20+25       3.7817      1.20  |Q        |         |         |     V   |
20+30       3.7898      1.18  |Q        |         |         |      V  |
20+35       3.7979      1.17  |Q        |         |         |      V  |
20+40       3.8058      1.15  |Q        |         |         |      V  |
20+45       3.8137      1.14  |Q        |         |         |      V  |
20+50       3.8214      1.13  |Q        |         |         |      V  |
20+55       3.8291      1.12  |Q        |         |         |      V  |
21+ 0       3.8367      1.10  |Q        |         |         |      V  |
21+ 5       3.8442      1.09  |Q        |         |         |      V  |
21+10       3.8517      1.08  |Q        |         |         |      V  |
21+15       3.8591      1.07  |Q        |         |         |      V  |
21+20       3.8663      1.06  |Q        |         |         |      V  |
21+25       3.8736      1.05  |Q        |         |         |      V  |
21+30       3.8807      1.04  |Q        |         |         |      V  |
21+35       3.8878      1.03  |Q        |         |         |       V |
21+40       3.8948      1.02  |Q        |         |         |       V |
21+45       3.9017      1.01  |Q        |         |         |       V |
21+50       3.9086      1.00  Q         |         |         |       V |
21+55       3.9154      0.99  Q         |         |         |       V |
22+ 0       3.9222      0.98  Q         |         |         |       V |
22+ 5       3.9289      0.97  Q         |         |         |       V |
22+10       3.9355      0.96  Q         |         |         |       V |
22+15       3.9421      0.96  Q         |         |         |       V |
22+20       3.9486      0.95  Q         |         |         |       V |
22+25       3.9551      0.94  Q         |         |         |       V |
22+30       3.9615      0.93  Q         |         |         |       V |
22+35       3.9679      0.92  Q         |         |         |       V |
22+40       3.9742      0.92  Q         |         |         |       V |
22+45       3.9805      0.91  Q         |         |         |       V |
22+50       3.9867      0.90  Q         |         |         |       V |
22+55       3.9929      0.90  Q         |         |         |        V|
23+ 0       3.9990      0.89  Q         |         |         |        V|
23+ 5       4.0051      0.88  Q         |         |         |        V|
23+10       4.0111      0.88  Q         |         |         |        V|
23+15       4.0171      0.87  Q         |         |         |        V|
23+20       4.0230      0.86  Q         |         |         |        V|
23+25       4.0289      0.86  Q         |         |         |        V|
23+30       4.0348      0.85  Q         |         |         |        V|
23+35       4.0406      0.85  Q         |         |         |        V|
23+40       4.0464      0.84  Q         |         |         |        V|
23+45       4.0521      0.83  Q         |         |         |        V|
23+50       4.0578      0.83  Q         |         |         |        V|
23+55       4.0635      0.82  Q         |         |         |        V|
24+ 0       4.0691      0.82  Q         |         |         |        V|
24+ 5       4.0746      0.79  Q         |         |         |        V|
24+10       4.0792      0.67  Q         |         |         |        V|
24+15       4.0824      0.47  Q         |         |         |        V|
24+20       4.0843      0.28  Q         |         |         |        V|
24+25       4.0855      0.17  Q         |         |         |        V|
24+30       4.0863      0.12  Q         |         |         |        V|
24+35       4.0869      0.08  Q         |         |         |        V|
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   24+40       4.0873      0.07  Q         |         |         |        V|
   24+45       4.0877      0.05  Q         |         |         |        V|
   24+50       4.0880      0.04  Q         |         |         |        V|
   24+55       4.0882      0.03  Q         |         |         |        V|
   25+ 0       4.0884      0.03  Q         |         |         |        V|
   25+ 5       4.0886      0.02  Q         |         |         |        V|
   25+10       4.0887      0.02  Q         |         |         |        V|
   25+15       4.0888      0.02  Q         |         |         |        V|
   25+20       4.0889      0.01  Q         |         |         |        V|
   25+25       4.0889      0.01  Q         |         |         |        V|
   25+30       4.0890      0.01  Q         |         |         |        V|
   25+35       4.0890      0.01  Q         |         |         |        V|
   25+40       4.0891      0.00  Q         |         |         |        V|
   25+45       4.0891      0.00  Q         |         |         |        V|
   25+50       4.0891      0.00  Q         |         |         |         V
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BASIN ROUTING

Cordova Site Basin-A1 Underground CMP Basin Stage Table:

Elevation (ft.)	Basin Area (sf)	Depth (ft.)	Basin Volume (cft)	Basin Volume (ac-ft)	Basin Infiltration Flow* (cfs)	12" Pipe Over Flow (cfs)	Total Outlet Flow (cfs)
0	42,084	-	-	-	1.11	0.00	1.11
4	42,084	4.00	120,715	2.77	1.11	0.00	1.11
5	42,084	5.00	157,395	3.61	1.11	0.00	1.11
6	42,084	6.00	193,457	4.44	1.11	0.00	1.11
7	42,084	7.00	227,522	5.22	1.11	0.00	1.11
8	42,084	8.00	257,533	5.91	1.11	4.20	5.31
9	42,084	9.00	278,111	6.38	1.11	16.88	17.99

Note:

* Infiltration flow based on the infiltration test the Infiltration rate =2.5in/hr with safty factor SF=2.19, design infiltration rate=2.5/2.19=1.14 in/hr.
  Basin infiltration flow=(1/12x1.14)/3600 xbasin Bottom Area = 1.11 cfs

Cordova Site Basin-A2 Stage Table:

Elevation (ft.)	Basin Area (sf)	Depth (ft.)	Basin Volume (cft)	Basin Volume (ac-ft)	Basin Infiltration Flow* (cfs)	Weir Over Flow (cfs)	Total Outlet Flow (cfs)
0	30,775	-	-	-	0.81	0.00	0.81
1	34,815	1.00	32,795	0.75	0.81	0.00	0.81
2	38,882	2.00	73,697	1.69	0.81	0.00	0.81
3	42,979	3.00	114,628	2.63	0.81	0.00	0.81
4	47,103	4.00	159,669	3.67	0.81	0.00	0.81
5.5	51,256	5.50	233,438	5.36	0.81	0.00	0.81
6	55,437	6.00	260,111	5.97	0.81	18.00	18.81

Note:

* Infiltration flow based on the infiltration test the Infiltration rate =2.5in/hr with safty factor SF=2.19, design infiltration rate=2.5/2.19=1.14 in/hr.

Basin infiltration flow=(1/12x1.14)/3600 xBasin Bottom Area = 4.77 cfs

Cordova Site Basin-A3 Stage Table:

Elevation (ft.)	Basin Area (sf)	Depth (ft.)	Basin Volume (cft)	Basin Volume (ac-ft)	Basin Infiltration Flow* (cfs)	Weir Over Flow (cfs)	Total Outlet Flow (cfs)
0	84,266	-	-	-	2.22	0.00	2.22
1	90,151	1.00	87,209	2.00	2.22	0.00	2.22
2	96,068	2.00	186,219	4.28	2.22	0.00	2.22
3	102,017	3.00	285,262	6.55	2.22	0.00	2.22
4	107,988	4.00	390,264	8.96	2.22	0.00	2.22
5.5	114,010	5.50	556,763	12.78	2.22	0.00	2.22
6	120,033	6.00	615,273	14.12	2.22	18.00	20.22

Note:

* Infiltration flow based on the infiltration test the Infiltration rate =2.5in/hr with safty factor SF=2.19, design infiltration rate=2.5/2.19=1.14 in/hr.
Basin infiltration flow=(1/12x1.14)/3600 xBasin Bottom Area = 4.77 cfs

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                    FLOOD HYDROGRAPH ROUTING PROGRAM
             Copyright (c) CIVILCADD/CIVILDESIGN, 1989 - 2004
                          Study date: 11/01/22

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


     Cordova Site
     Basin A1 Routing
     10-year, 24-hours storm

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


     Program License Serial Number 4009

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

                     From study/file name: CordovaUHprA110.rte
     ****************************HYDROGRAPH DATA****************************
                     Number of intervals =   311
                     Time interval =    5.0 (Min.)
                     Maximum/Peak flow rate =       78.298 (CFS)
                     Total volume =      10.049 (Ac.Ft)
             Status of hydrographs being held in storage
                        Stream 1  Stream 2  Stream 3  Stream 4  Stream 5
             Peak (CFS)      0.000     0.000     0.000     0.000     0.000
             Vol (Ac.Ft)      0.000     0.000     0.000     0.000     0.000
     **********************************************************************



     ++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
     Process from Point/Station        1.000 to Point/Station       2.000
     **** RETARDING BASIN ROUTING ****
     ______________________________________________________________________

     User entry of depth-outflow-storage data
     --------------------------------------------------------------------
     Total number of inflow hydrograph intervals = 311
     Hydrograph time unit =  5.000 (Min.)
     Initial depth in storage basin =   0.00(Ft.)
     --------------------------------------------------------------------
     --------------------------------------------------------------------
     Initial basin depth =   0.00 (Ft.)
     Initial basin storage =      0.00 (Ac.Ft)
     Initial basin outflow =   0.00 (CFS)
     ---------------------------------------------------------------------
     --------------------------------------------------------------------
     Depth vs. Storage and Depth vs. Discharge data:
      Basin Depth  Storage    Outflow   (S-O*dt/2)   (S+O*dt/2)
          (Ft.)    (Ac.Ft)    (CFS)     (Ac.Ft)    (Ac.Ft)
     ---------------------------------------------------------------------
       0.000      0.000      0.000      0.000        0.000
       4.000      2.770      1.110      2.766        2.774
       5.000      3.610      1.111      3.606        3.614
       6.000      4.440      1.112      4.436        4.444
       7.000      5.220      1.113      5.216        5.224
       8.000      5.910      5.310      5.892        5.928
       9.000      6.380     17.990      6.318        6.442
     --------------------------------------------------------------------
                     Hydrograph Detention Basin Routing
     ---------------------------------------------------------------------

     Graph values: 'I'= unit inflow; 'O'=outflow at time shown
     ---------------------------------------------------------------------
 Time   Inflow  Outflow    Storage                                    Depth
(Hours)  (CFS)   (CFS)      (Ac.Ft) .0      19.6   39.15   58.72   78.30 (Ft.)
 0.083    0.06    0.00      0.000  O       |       |       |       |      0.00
 0.167    0.32    0.00      0.001  O       |       |       |       |      0.00
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0.250	0.77	0.00	0.005	O	0.01
0.333	1.25	0.00	0.012	O	0.02
0.417	1.52	0.01	0.022	O	0.03
0.500	1.67	0.01	0.033	O	0.05
0.583	1.76	0.02	0.044	O	0.06
0.667	1.81	0.02	0.056	O	0.08
0.750	1.85	0.03	0.069	O	0.10
0.833	1.88	0.03	0.081	O	0.12
0.917	1.91	0.04	0.094	O	0.14
1.000	1.93	0.04	0.107	O	0.15
1.083	1.95	0.05	0.120	O	0.17
1.167	1.96	0.05	0.133	O	0.19
1.250	1.98	0.06	0.146	O	0.21
1.333	1.99	0.06	0.160	O	0.23
1.417	2.01	0.07	0.173	O	0.25
1.500	2.02	0.07	0.186	O	0.27
1.583	2.03	0.08	0.200	O	0.29
1.667	2.04	0.09	0.213	O	0.31
1.750	2.05	0.09	0.227	O	0.33
1.833	2.06	0.10	0.240	O	0.35
1.917	2.07	0.10	0.254	O	0.37
2.000	2.08	0.11	0.267	O	0.39
2.083	2.09	0.11	0.281	O	0.41
2.167	2.10	0.12	0.295	O	0.43
2.250	2.10	0.12	0.308	O	0.45
2.333	2.11	0.13	0.322	O	0.46
2.417	2.12	0.13	0.336	O	0.48
2.500	2.13	0.14	0.349	O	0.50
2.583	2.13	0.15	0.363	O	0.52
2.667	2.14	0.15	0.377	O	0.54
2.750	2.15	0.16	0.390	O	0.56
2.833	2.16	0.16	0.404	O	0.58
2.917	2.16	0.17	0.418	O	0.60
3.000	2.17	0.17	0.432	O	0.62
3.083	2.18	0.18	0.445	O	0.64
3.167	2.19	0.18	0.459	O	0.66
3.250	2.20	0.19	0.473	O	0.68
3.333	2.21	0.20	0.487	O	0.70
3.417	2.21	0.20	0.501	O	0.72
3.500	2.22	0.21	0.515	O	0.74
3.583	2.23	0.21	0.528	O	0.76
3.667	2.24	0.22	0.542	O	0.78
3.750	2.25	0.22	0.556	O	0.80
3.833	2.26	0.23	0.570	O	0.82
3.917	2.27	0.23	0.584	O	0.84
4.000	2.28	0.24	0.598	O	0.86
4.083	2.29	0.25	0.612	O	0.88
4.167	2.30	0.25	0.626	O	0.90
4.250	2.30	0.26	0.640	O	0.92
4.333	2.31	0.26	0.655	O	0.95
4.417	2.32	0.27	0.669	O	0.97
4.500	2.33	0.27	0.683	O	0.99
4.583	2.34	0.28	0.697	O	1.01
4.667	2.35	0.29	0.711	O	1.03
4.750	2.36	0.29	0.726	O	1.05
4.833	2.37	0.30	0.740	O	1.07
4.917	2.38	0.30	0.754	O	1.09
5.000	2.40	0.31	0.769	O	1.11
5.083	2.41	0.31	0.783	O	1.13
5.167	2.42	0.32	0.797	O	1.15
5.250	2.43	0.33	0.812	O	1.17
5.333	2.44	0.33	0.826	O	1.19
5.417	2.45	0.34	0.841	OI	1.21
5.500	2.46	0.34	0.855	OI	1.24
5.583	2.47	0.35	0.870	OI	1.26
5.667	2.48	0.35	0.885	OI	1.28
5.750	2.50	0.36	0.899	OI	1.30
5.833	2.51	0.37	0.914	OI	1.32
5.917	2.52	0.37	0.929	OI	1.34
6.000	2.53	0.38	0.944	OI	1.36
6.083	2.54	0.38	0.959	OI	1.38
6.167	2.56	0.39	0.973	OI	1.41
6.250	2.57	0.40	0.988	OI	1.43

6.333	2.58	0.40	1.003	OI				1.45
6.417	2.59	0.41	1.018	OI				1.47
6.500	2.61	0.41	1.033	OI				1.49
6.583	2.62	0.42	1.049	OI				1.51
6.667	2.63	0.43	1.064	OI				1.54
6.750	2.65	0.43	1.079	OI				1.56
6.833	2.66	0.44	1.094	OI				1.58
6.917	2.68	0.44	1.110	OI				1.60
7.000	2.69	0.45	1.125	OI				1.62
7.083	2.70	0.46	1.141	OI				1.65
7.167	2.72	0.46	1.156	OI				1.67
7.250	2.73	0.47	1.172	OI				1.69
7.333	2.75	0.48	1.187	OI				1.71
7.417	2.76	0.48	1.203	OI				1.74
7.500	2.78	0.49	1.219	OI				1.76
7.583	2.80	0.49	1.234	OI				1.78
7.667	2.81	0.50	1.250	OI				1.81
7.750	2.83	0.51	1.266	OI				1.83
7.833	2.85	0.51	1.282	OI				1.85
7.917	2.86	0.52	1.298	OI				1.87
8.000	2.88	0.53	1.315	OI				1.90
8.083	2.90	0.53	1.331	OI				1.92
8.167	2.91	0.54	1.347	OI				1.95
8.250	2.93	0.55	1.364	OI				1.97
8.333	2.95	0.55	1.380	OI				1.99
8.417	2.97	0.56	1.397	OI				2.02
8.500	2.99	0.57	1.413	OI				2.04
8.583	3.01	0.57	1.430	OI				2.06
8.667	3.03	0.58	1.447	OI				2.09
8.750	3.05	0.59	1.464	OI				2.11
8.833	3.07	0.59	1.481	OI				2.14
8.917	3.09	0.60	1.498	OI				2.16
9.000	3.11	0.61	1.515	OI				2.19
9.083	3.13	0.61	1.532	OI				2.21
9.167	3.15	0.62	1.549	OI				2.24
9.250	3.17	0.63	1.567	OI				2.26
9.333	3.20	0.63	1.585	OI				2.29
9.417	3.22	0.64	1.602	OI				2.31
9.500	3.24	0.65	1.620	OI				2.34
9.583	3.27	0.66	1.638	OI				2.37
9.667	3.29	0.66	1.656	OI				2.39
9.750	3.31	0.67	1.674	OI				2.42
9.833	3.34	0.68	1.692	OI				2.44
9.917	3.37	0.69	1.711	OI				2.47
10.000	3.39	0.69	1.729	OI				2.50
10.083	3.42	0.70	1.748	OI				2.52
10.167	3.45	0.71	1.767	OI				2.55
10.250	3.48	0.72	1.786	OI				2.58
10.333	3.50	0.72	1.805	OI				2.61
10.417	3.53	0.73	1.824	OI				2.63
10.500	3.56	0.74	1.843	OI				2.66
10.583	3.59	0.75	1.863	OI				2.69
10.667	3.63	0.75	1.883	OI				2.72
10.750	3.66	0.76	1.902	OI				2.75
10.833	3.69	0.77	1.922	OI				2.78
10.917	3.72	0.78	1.943	OI				2.81
11.000	3.76	0.79	1.963	OI				2.83
11.083	3.79	0.79	1.984	OI				2.86
11.167	3.83	0.80	2.004	OI				2.89
11.250	3.87	0.81	2.025	OI				2.92
11.333	3.91	0.82	2.047	OI				2.96
11.417	3.95	0.83	2.068	OI				2.99
11.500	3.99	0.84	2.089	OI				3.02
11.583	4.03	0.85	2.111	OI				3.05
11.667	4.07	0.85	2.133	OI				3.08
11.750	4.12	0.86	2.156	OI				3.11
11.833	4.16	0.87	2.178	OI				3.15
11.917	4.21	0.88	2.201	OI				3.18
12.000	4.26	0.89	2.224	OI				3.21
12.083	4.30	0.90	2.247	OI				3.25
12.167	4.34	0.91	2.271	OI				3.28
12.250	4.38	0.92	2.295	OI				3.31
12.333	4.41	0.93	2.318	OI				3.35

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12.417    4.46    0.94      2.343  OI      |       |       |       |     3.38
12.500    4.51    0.95      2.367  OI      |       |       |       |     3.42
12.583    4.57    0.96      2.392  OI      |       |       |       |     3.45
12.667    4.63    0.97      2.417  OI      |       |       |       |     3.49
12.750    4.69    0.98      2.442  OI      |       |       |       |     3.53
12.833    4.76    0.99      2.468  OI      |       |       |       |     3.56
12.917    4.83    1.00      2.494  OI      |       |       |       |     3.60
13.000    4.90    1.01      2.521  O I     |       |       |       |     3.64
13.083    4.97    1.02      2.548  O I     |       |       |       |     3.68
13.167    5.05    1.03      2.575  O I     |       |       |       |     3.72
13.250    5.13    1.04      2.603  O I     |       |       |       |     3.76
13.333    5.22    1.05      2.631  O I     |       |       |       |     3.80
13.417    5.31    1.07      2.660  O I     |       |       |       |     3.84
13.500    5.40    1.08      2.690  O I     |       |       |       |     3.88
13.583    5.50    1.09      2.720  O I     |       |       |       |     3.93
13.667    5.60    1.10      2.751  O I     |       |       |       |     3.97
13.750    5.71    1.11      2.782  O I     |       |       |       |     4.01
13.833    5.83    1.11      2.814  O I     |       |       |       |     4.05
13.917    5.95    1.11      2.847  O I     |       |       |       |     4.09
14.000    6.08    1.11      2.881  O I     |       |       |       |     4.13
14.083    6.21    1.11      2.915  O I     |       |       |       |     4.17
14.167    6.36    1.11      2.951  O I     |       |       |       |     4.22
14.250    6.51    1.11      2.988  O I     |       |       |       |     4.26
14.333    6.68    1.11      3.026  O I     |       |       |       |     4.30
14.417    6.86    1.11      3.065  O I     |       |       |       |     4.35
14.500    7.05    1.11      3.105  O I     |       |       |       |     4.40
14.583    7.25    1.11      3.146  O I     |       |       |       |     4.45
14.667    7.47    1.11      3.189  O  I    |       |       |       |     4.50
14.750    7.71    1.11      3.234  O  I    |       |       |       |     4.55
14.833    7.97    1.11      3.280  O  I    |       |       |       |     4.61
14.917    8.25    1.11      3.329  O  I    |       |       |       |     4.66
15.000    8.56    1.11      3.379  O  I    |       |       |       |     4.72
15.083    8.90    1.11      3.431  O  I    |       |       |       |     4.79
15.167    9.29    1.11      3.486  O  I    |       |       |       |     4.85
15.250    9.72    1.11      3.544  O  I    |       |       |       |     4.92
15.333   10.22    1.11      3.605  O   I   |       |       |       |     4.99
15.417   10.69    1.11      3.669  O   I   |       |       |       |     5.07
15.500   10.94    1.11      3.736  O   I   |       |       |       |     5.15
15.583   10.97    1.11      3.804  O   I   |       |       |       |     5.23
15.667   11.12    1.11      3.872  O   I   |       |       |       |     5.32
15.750   11.80    1.11      3.944  O   I   |       |       |       |     5.40
15.833   13.05    1.11      4.022  O    I  |       |       |       |     5.50
15.917   15.04    1.11      4.111  O     I |       |       |       |     5.60
16.000   18.64    1.11      4.219  O      I|       |       |       |     5.73
16.083   30.27    1.11      4.380  O       |   I   |       |       |     5.93
16.167   56.26    1.11      4.670  O       |       |     I |       |     6.30
16.250   78.30    1.11      5.126  O       |       |       |       I     6.88
16.333   76.94    3.69      5.644  |O      |       |       |      I|     7.61
16.417   50.86    8.84      6.041  |  O    |       |   I   |       |     8.28
16.500   32.96   14.46      6.249  |    O  |    I  |       |       |     8.72
16.583   24.02   16.85      6.338  |     O |I      |       |       |     8.91
16.667   18.68   17.61      6.366  |      O|       |       |       |     8.97
16.750   15.96   17.56      6.364  |     IO|       |       |       |     8.97
16.833   14.25   17.14      6.349  |    I O|       |       |       |     8.93
16.917   12.60   16.51      6.325  |    IO |       |       |       |     8.88
17.000   11.12   15.72      6.296  |   I O |       |       |       |     8.82
17.083   10.14   14.86      6.264  |   I O |       |       |       |     8.75
17.167    9.48   14.00      6.232  |  I O  |       |       |       |     8.69
17.250    8.89   13.18      6.202  |  I O  |       |       |       |     8.62
17.333    8.24   12.40      6.173  |  I O  |       |       |       |     8.56
17.417    7.73   11.65      6.145  |  IO   |       |       |       |     8.50
17.500    7.30   10.94      6.119  | I O   |       |       |       |     8.44
17.583    6.88   10.29      6.095  | I O   |       |       |       |     8.39
17.667    6.50    9.68      6.072  | IO    |       |       |       |     8.34
17.750    6.21    9.11      6.051  | IO    |       |       |       |     8.30
17.833    5.98    8.60      6.032  | IO    |       |       |       |     8.26
17.917    5.75    8.13      6.015  | IO    |       |       |       |     8.22
18.000    5.36    7.70      5.998  | IO    |       |       |       |     8.19
18.083    4.98    7.27      5.982  | O     |       |       |       |     8.15
18.167    4.82    6.86      5.968  |IO     |       |       |       |     8.12
18.250    4.70    6.51      5.954  |IO     |       |       |       |     8.09
18.333    4.59    6.19      5.943  |IO     |       |       |       |     8.07
18.417    4.48    5.91      5.932  |IO     |       |       |       |     8.05
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18.500    4.37    5.66      5.923  |IO       |        |        |        |       8.03
18.583    4.27    5.43      5.914  |IO       |        |        |        |       8.01
18.667    4.17    5.29      5.907  |IO       |        |        |        |       7.99
18.750    4.08    5.24      5.899  |IO       |        |        |        |       7.98
18.833    3.99    5.19      5.891  |IO       |        |        |        |       7.97
18.917    3.91    5.14      5.882  |IO       |        |        |        |       7.96
19.000    3.83    5.09      5.874  |IO       |        |        |        |       7.95
19.083    3.76    5.04      5.865  |IO       |        |        |        |       7.93
19.167    3.69    4.98      5.856  |IO       |        |        |        |       7.92
19.250    3.63    4.93      5.847  |IO       |        |        |        |       7.91
19.333    3.56    4.87      5.838  |O        |        |        |        |       7.90
19.417    3.50    4.82      5.829  |O        |        |        |        |       7.88
19.500    3.45    4.76      5.820  |O        |        |        |        |       7.87
19.583    3.39    4.71      5.811  |O        |        |        |        |       7.86
19.667    3.34    4.65      5.802  |O        |        |        |        |       7.84
19.750    3.29    4.60      5.793  |O        |        |        |        |       7.83
19.833    3.24    4.54      5.784  |O        |        |        |        |       7.82
19.917    3.19    4.49      5.775  |O        |        |        |        |       7.80
20.000    3.15    4.43      5.766  |O        |        |        |        |       7.79
20.083    3.11    4.38      5.757  |O        |        |        |        |       7.78
20.167    3.06    4.33      5.749  |O        |        |        |        |       7.77
20.250    3.02    4.28      5.740  |O        |        |        |        |       7.75
20.333    2.99    4.22      5.731  |O        |        |        |        |       7.74
20.417    2.95    4.17      5.723  |O        |        |        |        |       7.73
20.500    2.91    4.12      5.714  |O        |        |        |        |       7.72
20.583    2.88    4.07      5.706  |O        |        |        |        |       7.70
20.667    2.84    4.02      5.698  |O        |        |        |        |       7.69
20.750    2.81    3.97      5.690  |O        |        |        |        |       7.68
20.833    2.78    3.92      5.682  |O        |        |        |        |       7.67
20.917    2.75    3.88      5.674  |O        |        |        |        |       7.66
21.000    2.72    3.83      5.667  |O        |        |        |        |       7.65
21.083    2.69    3.78      5.659  |O        |        |        |        |       7.64
21.167    2.66    3.74      5.651  |O        |        |        |        |       7.63
21.250    2.63    3.69      5.644  |O        |        |        |        |       7.61
21.333    2.61    3.65      5.637  |O        |        |        |        |       7.60
21.417    2.58    3.61      5.630  |O        |        |        |        |       7.59
21.500    2.55    3.56      5.623  |O        |        |        |        |       7.58
21.583    2.53    3.52      5.616  |O        |        |        |        |       7.57
21.667    2.50    3.48      5.609  |O        |        |        |        |       7.56
21.750    2.48    3.44      5.602  |O        |        |        |        |       7.55
21.833    2.46    3.40      5.596  |O        |        |        |        |       7.54
21.917    2.44    3.36      5.589  IO        |        |        |        |       7.54
22.000    2.41    3.32      5.583  IO        |        |        |        |       7.53
22.083    2.39    3.28      5.577  IO        |        |        |        |       7.52
22.167    2.37    3.25      5.571  IO        |        |        |        |       7.51
22.250    2.35    3.21      5.565  IO        |        |        |        |       7.50
22.333    2.33    3.18      5.559  IO        |        |        |        |       7.49
22.417    2.31    3.14      5.553  IO        |        |        |        |       7.48
22.500    2.29    3.11      5.548  IO        |        |        |        |       7.47
22.583    2.27    3.07      5.542  IO        |        |        |        |       7.47
22.667    2.26    3.04      5.537  IO        |        |        |        |       7.46
22.750    2.24    3.01      5.531  IO        |        |        |        |       7.45
22.833    2.22    2.97      5.526  IO        |        |        |        |       7.44
22.917    2.20    2.94      5.521  IO        |        |        |        |       7.44
23.000    2.19    2.91      5.516  IO        |        |        |        |       7.43
23.083    2.17    2.88      5.511  IO        |        |        |        |       7.42
23.167    2.15    2.85      5.506  IO        |        |        |        |       7.41
23.250    2.14    2.82      5.501  IO        |        |        |        |       7.41
23.333    2.12    2.80      5.497  IO        |        |        |        |       7.40
23.417    2.11    2.77      5.492  IO        |        |        |        |       7.39
23.500    2.09    2.74      5.488  IO        |        |        |        |       7.39
23.583    2.08    2.71      5.483  IO        |        |        |        |       7.38
23.667    2.06    2.69      5.479  IO        |        |        |        |       7.38
23.750    2.05    2.66      5.475  IO        |        |        |        |       7.37
23.833    2.04    2.64      5.470  IO        |        |        |        |       7.36
23.917    2.02    2.61      5.466  IO        |        |        |        |       7.36
24.000    2.01    2.59      5.462  IO        |        |        |        |       7.35
24.083    1.94    2.56      5.458  IO        |        |        |        |       7.35
24.167    1.67    2.53      5.453  IO        |        |        |        |       7.34
24.250    1.20    2.49      5.446  IO        |        |        |        |       7.33
24.333    0.72    2.42      5.435  O         |        |        |        |       7.31
24.417    0.45    2.35      5.423  O         |        |        |        |       7.29
24.500    0.30    2.27      5.410  O         |        |        |        |       7.27
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24.583	0.22	2.18	5.396	O	7.26
24.667	0.17	2.10	5.383	O	7.24
24.750	0.14	2.02	5.370	O	7.22
24.833	0.11	1.95	5.357	O	7.20
24.917	0.09	1.87	5.344	O	7.18
25.000	0.07	1.80	5.332	O	7.16
25.083	0.06	1.73	5.321	O	7.15
25.167	0.05	1.66	5.309	O	7.13
25.250	0.04	1.59	5.299	O	7.11
25.333	0.03	1.53	5.288	O	7.10
25.417	0.03	1.47	5.278	O	7.08
25.500	0.02	1.41	5.268	O	7.07
25.583	0.02	1.35	5.259	O	7.06
25.667	0.01	1.29	5.250	O	7.04
25.750	0.01	1.24	5.241	O	7.03
25.833	0.01	1.19	5.233	O	7.02
25.917	0.00	1.14	5.225	O	7.01
26.000	0.00	1.11	5.217	O	7.00
26.083	0.00	1.11	5.209	O	6.99
26.167	0.00	1.11	5.202	O	6.98
26.250	0.00	1.11	5.194	O	6.97
26.333	0.00	1.11	5.186	O	6.96
26.417	0.00	1.11	5.179	O	6.95
26.500	0.00	1.11	5.171	O	6.94
26.583	0.00	1.11	5.163	O	6.93
26.667	0.00	1.11	5.156	O	6.92
26.750	0.00	1.11	5.148	O	6.91
26.833	0.00	1.11	5.140	O	6.90
26.917	0.00	1.11	5.133	O	6.89
27.000	0.00	1.11	5.125	O	6.88
27.083	0.00	1.11	5.117	O	6.87
27.167	0.00	1.11	5.110	O	6.86
27.250	0.00	1.11	5.102	O	6.85
27.333	0.00	1.11	5.094	O	6.84
27.417	0.00	1.11	5.087	O	6.83
27.500	0.00	1.11	5.079	O	6.82
27.583	0.00	1.11	5.071	O	6.81
27.667	0.00	1.11	5.064	O	6.80
27.750	0.00	1.11	5.056	O	6.79
27.833	0.00	1.11	5.048	O	6.78
27.917	0.00	1.11	5.041	O	6.77
28.000	0.00	1.11	5.033	O	6.76
28.083	0.00	1.11	5.025	O	6.75
28.167	0.00	1.11	5.018	O	6.74
28.250	0.00	1.11	5.010	O	6.73
28.333	0.00	1.11	5.002	O	6.72
28.417	0.00	1.11	4.995	O	6.71
28.500	0.00	1.11	4.987	O	6.70
28.583	0.00	1.11	4.980	O	6.69
28.667	0.00	1.11	4.972	O	6.68
28.750	0.00	1.11	4.964	O	6.67
28.833	0.00	1.11	4.957	O	6.66
28.917	0.00	1.11	4.949	O	6.65
29.000	0.00	1.11	4.941	O	6.64
29.083	0.00	1.11	4.934	O	6.63
29.167	0.00	1.11	4.926	O	6.62
29.250	0.00	1.11	4.918	O	6.61
29.333	0.00	1.11	4.911	O	6.60
29.417	0.00	1.11	4.903	O	6.59
29.500	0.00	1.11	4.895	O	6.58
29.583	0.00	1.11	4.888	O	6.57
29.667	0.00	1.11	4.880	O	6.56
29.750	0.00	1.11	4.872	O	6.55
29.833	0.00	1.11	4.865	O	6.54
29.917	0.00	1.11	4.857	O	6.53
30.000	0.00	1.11	4.849	O	6.52
30.083	0.00	1.11	4.842	O	6.51
30.167	0.00	1.11	4.834	O	6.51
30.250	0.00	1.11	4.826	O	6.50
30.333	0.00	1.11	4.819	O	6.49
30.417	0.00	1.11	4.811	O	6.48
30.500	0.00	1.11	4.803	O	6.47
30.583	0.00	1.11	4.796	O	6.46

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30.667   0.00   1.11    4.788  O       |       |       |       |     6.45
30.750   0.00   1.11    4.780  O       |       |       |       |     6.44
30.833   0.00   1.11    4.773  O       |       |       |       |     6.43
30.917   0.00   1.11    4.765  O       |       |       |       |     6.42
31.000   0.00   1.11    4.757  O       |       |       |       |     6.41
31.083   0.00   1.11    4.750  O       |       |       |       |     6.40
31.167   0.00   1.11    4.742  O       |       |       |       |     6.39
31.250   0.00   1.11    4.734  O       |       |       |       |     6.38
31.333   0.00   1.11    4.727  O       |       |       |       |     6.37
31.417   0.00   1.11    4.719  O       |       |       |       |     6.36
31.500   0.00   1.11    4.711  O       |       |       |       |     6.35
31.583   0.00   1.11    4.704  O       |       |       |       |     6.34
31.667   0.00   1.11    4.696  O       |       |       |       |     6.33
31.750   0.00   1.11    4.688  O       |       |       |       |     6.32
31.833   0.00   1.11    4.681  O       |       |       |       |     6.31
31.917   0.00   1.11    4.673  O       |       |       |       |     6.30
32.000   0.00   1.11    4.665  O       |       |       |       |     6.29
32.083   0.00   1.11    4.658  O       |       |       |       |     6.28
32.167   0.00   1.11    4.650  O       |       |       |       |     6.27
32.250   0.00   1.11    4.642  O       |       |       |       |     6.26
32.333   0.00   1.11    4.635  O       |       |       |       |     6.25
32.417   0.00   1.11    4.627  O       |       |       |       |     6.24
32.500   0.00   1.11    4.619  O       |       |       |       |     6.23
32.583   0.00   1.11    4.612  O       |       |       |       |     6.22
32.667   0.00   1.11    4.604  O       |       |       |       |     6.21
32.750   0.00   1.11    4.596  O       |       |       |       |     6.20
32.833   0.00   1.11    4.589  O       |       |       |       |     6.19
32.917   0.00   1.11    4.581  O       |       |       |       |     6.18
33.000   0.00   1.11    4.573  O       |       |       |       |     6.17
33.083   0.00   1.11    4.566  O       |       |       |       |     6.16
33.167   0.00   1.11    4.558  O       |       |       |       |     6.15
33.250   0.00   1.11    4.550  O       |       |       |       |     6.14
33.333   0.00   1.11    4.543  O       |       |       |       |     6.13
33.417   0.00   1.11    4.535  O       |       |       |       |     6.12
33.500   0.00   1.11    4.527  O       |       |       |       |     6.11
33.583   0.00   1.11    4.520  O       |       |       |       |     6.10
33.667   0.00   1.11    4.512  O       |       |       |       |     6.09
33.750   0.00   1.11    4.505  O       |       |       |       |     6.08
33.833   0.00   1.11    4.497  O       |       |       |       |     6.07
33.917   0.00   1.11    4.489  O       |       |       |       |     6.06
34.000   0.00   1.11    4.482  O       |       |       |       |     6.05
34.083   0.00   1.11    4.474  O       |       |       |       |     6.04
34.167   0.00   1.11    4.466  O       |       |       |       |     6.03
34.250   0.00   1.11    4.459  O       |       |       |       |     6.02
34.333   0.00   1.11    4.451  O       |       |       |       |     6.01
34.417   0.00   1.11    4.443  O       |       |       |       |     6.00
34.500   0.00   1.11    4.436  O       |       |       |       |     5.99
34.583   0.00   1.11    4.428  O       |       |       |       |     5.99
34.667   0.00   1.11    4.420  O       |       |       |       |     5.98
34.750   0.00   1.11    4.413  O       |       |       |       |     5.97
34.833   0.00   1.11    4.405  O       |       |       |       |     5.96
34.917   0.00   1.11    4.397  O       |       |       |       |     5.95
35.000   0.00   1.11    4.390  O       |       |       |       |     5.94
35.083   0.00   1.11    4.382  O       |       |       |       |     5.93
35.167   0.00   1.11    4.374  O       |       |       |       |     5.92
35.250   0.00   1.11    4.367  O       |       |       |       |     5.91
35.333   0.00   1.11    4.359  O       |       |       |       |     5.90
35.417   0.00   1.11    4.351  O       |       |       |       |     5.89
35.500   0.00   1.11    4.344  O       |       |       |       |     5.88
35.583   0.00   1.11    4.336  O       |       |       |       |     5.87
35.667   0.00   1.11    4.328  O       |       |       |       |     5.87
35.750   0.00   1.11    4.321  O       |       |       |       |     5.86
35.833   0.00   1.11    4.313  O       |       |       |       |     5.85
35.917   0.00   1.11    4.305  O       |       |       |       |     5.84
36.000   0.00   1.11    4.298  O       |       |       |       |     5.83
36.083   0.00   1.11    4.290  O       |       |       |       |     5.82
36.167   0.00   1.11    4.282  O       |       |       |       |     5.81
36.250   0.00   1.11    4.275  O       |       |       |       |     5.80
36.333   0.00   1.11    4.267  O       |       |       |       |     5.79
36.417   0.00   1.11    4.259  O       |       |       |       |     5.78
36.500   0.00   1.11    4.252  O       |       |       |       |     5.77
36.583   0.00   1.11    4.244  O       |       |       |       |     5.76
36.667   0.00   1.11    4.236  O       |       |       |       |     5.75
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36.750	0.00	1.11	4.229	O	5.75
36.833	0.00	1.11	4.221	O	5.74
36.917	0.00	1.11	4.214	O	5.73
37.000	0.00	1.11	4.206	O	5.72
37.083	0.00	1.11	4.198	O	5.71
37.167	0.00	1.11	4.191	O	5.70
37.250	0.00	1.11	4.183	O	5.69
37.333	0.00	1.11	4.175	O	5.68
37.417	0.00	1.11	4.168	O	5.67
37.500	0.00	1.11	4.160	O	5.66
37.583	0.00	1.11	4.152	O	5.65
37.667	0.00	1.11	4.145	O	5.64
37.750	0.00	1.11	4.137	O	5.63
37.833	0.00	1.11	4.129	O	5.63
37.917	0.00	1.11	4.122	O	5.62
38.000	0.00	1.11	4.114	O	5.61
38.083	0.00	1.11	4.106	O	5.60
38.167	0.00	1.11	4.099	O	5.59
38.250	0.00	1.11	4.091	O	5.58
38.333	0.00	1.11	4.083	O	5.57
38.417	0.00	1.11	4.076	O	5.56
38.500	0.00	1.11	4.068	O	5.55
38.583	0.00	1.11	4.060	O	5.54
38.667	0.00	1.11	4.053	O	5.53
38.750	0.00	1.11	4.045	O	5.52
38.833	0.00	1.11	4.037	O	5.51
38.917	0.00	1.11	4.030	O	5.51
39.000	0.00	1.11	4.022	O	5.50
39.083	0.00	1.11	4.014	O	5.49
39.167	0.00	1.11	4.007	O	5.48
39.250	0.00	1.11	3.999	O	5.47
39.333	0.00	1.11	3.992	O	5.46
39.417	0.00	1.11	3.984	O	5.45
39.500	0.00	1.11	3.976	O	5.44
39.583	0.00	1.11	3.969	O	5.43
39.667	0.00	1.11	3.961	O	5.42
39.750	0.00	1.11	3.953	O	5.41
39.833	0.00	1.11	3.946	O	5.40
39.917	0.00	1.11	3.938	O	5.40
40.000	0.00	1.11	3.930	O	5.39
40.083	0.00	1.11	3.923	O	5.38
40.167	0.00	1.11	3.915	O	5.37
40.250	0.00	1.11	3.907	O	5.36
40.333	0.00	1.11	3.900	O	5.35
40.417	0.00	1.11	3.892	O	5.34
40.500	0.00	1.11	3.884	O	5.33
40.583	0.00	1.11	3.877	O	5.32
40.667	0.00	1.11	3.869	O	5.31
40.750	0.00	1.11	3.861	O	5.30
40.833	0.00	1.11	3.854	O	5.29
40.917	0.00	1.11	3.846	O	5.28
41.000	0.00	1.11	3.838	O	5.28
41.083	0.00	1.11	3.831	O	5.27
41.167	0.00	1.11	3.823	O	5.26
41.250	0.00	1.11	3.815	O	5.25
41.333	0.00	1.11	3.808	O	5.24
41.417	0.00	1.11	3.800	O	5.23
41.500	0.00	1.11	3.793	O	5.22
41.583	0.00	1.11	3.785	O	5.21
41.667	0.00	1.11	3.777	O	5.20
41.750	0.00	1.11	3.770	O	5.19
41.833	0.00	1.11	3.762	O	5.18
41.917	0.00	1.11	3.754	O	5.17
42.000	0.00	1.11	3.747	O	5.16
42.083	0.00	1.11	3.739	O	5.16
42.167	0.00	1.11	3.731	O	5.15
42.250	0.00	1.11	3.724	O	5.14
42.333	0.00	1.11	3.716	O	5.13
42.417	0.00	1.11	3.708	O	5.12
42.500	0.00	1.11	3.701	O	5.11
42.583	0.00	1.11	3.693	O	5.10
42.667	0.00	1.11	3.685	O	5.09
42.750	0.00	1.11	3.678	O	5.08

42.833	0.00	1.11	3.670	O					5.07
42.917	0.00	1.11	3.662	O					5.06
43.000	0.00	1.11	3.655	O					5.05
43.083	0.00	1.11	3.647	O					5.04
43.167	0.00	1.11	3.639	O					5.04
43.250	0.00	1.11	3.632	O					5.03
43.333	0.00	1.11	3.624	O					5.02
43.417	0.00	1.11	3.617	O					5.01
43.500	0.00	1.11	3.609	O					5.00
43.583	0.00	1.11	3.601	O					4.99
43.667	0.00	1.11	3.594	O					4.98
43.750	0.00	1.11	3.586	O					4.97
43.833	0.00	1.11	3.578	O					4.96
43.917	0.00	1.11	3.571	O					4.95
44.000	0.00	1.11	3.563	O					4.94
44.083	0.00	1.11	3.555	O					4.93
44.167	0.00	1.11	3.548	O					4.93
44.250	0.00	1.11	3.540	O					4.92
44.333	0.00	1.11	3.532	O					4.91
44.417	0.00	1.11	3.525	O					4.90
44.500	0.00	1.11	3.517	O					4.89
44.583	0.00	1.11	3.509	O					4.88
44.667	0.00	1.11	3.502	O					4.87
44.750	0.00	1.11	3.494	O					4.86
44.833	0.00	1.11	3.486	O					4.85
44.917	0.00	1.11	3.479	O					4.84
45.000	0.00	1.11	3.471	O					4.83
45.083	0.00	1.11	3.463	O					4.83
45.167	0.00	1.11	3.456	O					4.82
45.250	0.00	1.11	3.448	O					4.81
45.333	0.00	1.11	3.441	O					4.80
45.417	0.00	1.11	3.433	O					4.79
45.500	0.00	1.11	3.425	O					4.78
45.583	0.00	1.11	3.418	O					4.77
45.667	0.00	1.11	3.410	O					4.76
45.750	0.00	1.11	3.402	O					4.75
45.833	0.00	1.11	3.395	O					4.74
45.917	0.00	1.11	3.387	O					4.73
46.000	0.00	1.11	3.379	O					4.73
46.083	0.00	1.11	3.372	O					4.72
46.167	0.00	1.11	3.364	O					4.71
46.250	0.00	1.11	3.356	O					4.70
46.333	0.00	1.11	3.349	O					4.69
46.417	0.00	1.11	3.341	O					4.68
46.500	0.00	1.11	3.333	O					4.67
46.583	0.00	1.11	3.326	O					4.66
46.667	0.00	1.11	3.318	O					4.65
46.750	0.00	1.11	3.310	O					4.64
46.833	0.00	1.11	3.303	O					4.63
46.917	0.00	1.11	3.295	O					4.63
47.000	0.00	1.11	3.288	O					4.62
47.083	0.00	1.11	3.280	O					4.61
47.167	0.00	1.11	3.272	O					4.60
47.250	0.00	1.11	3.265	O					4.59
47.333	0.00	1.11	3.257	O					4.58
47.417	0.00	1.11	3.249	O					4.57
47.500	0.00	1.11	3.242	O					4.56
47.583	0.00	1.11	3.234	O					4.55
47.667	0.00	1.11	3.226	O					4.54
47.750	0.00	1.11	3.219	O					4.53
47.833	0.00	1.11	3.211	O					4.53
47.917	0.00	1.11	3.203	O					4.52
48.000	0.00	1.11	3.196	O					4.51
48.083	0.00	1.11	3.188	O					4.50
48.167	0.00	1.11	3.180	O					4.49
48.250	0.00	1.11	3.173	O					4.48
48.333	0.00	1.11	3.165	O					4.47
48.417	0.00	1.11	3.158	O					4.46
48.500	0.00	1.11	3.150	O					4.45
48.583	0.00	1.11	3.142	O					4.44
48.667	0.00	1.11	3.135	O					4.43
48.750	0.00	1.11	3.127	O					4.42
48.833	0.00	1.11	3.119	O					4.42

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48.917    0.00    1.11      3.112  O        |       |       |       |      4.41
49.000    0.00    1.11      3.104  O        |       |       |       |      4.40
49.083    0.00    1.11      3.096  O        |       |       |       |      4.39
49.167    0.00    1.11      3.089  O        |       |       |       |      4.38
49.250    0.00    1.11      3.081  O        |       |       |       |      4.37
49.333    0.00    1.11      3.073  O        |       |       |       |      4.36
49.417    0.00    1.11      3.066  O        |       |       |       |      4.35
49.500    0.00    1.11      3.058  O        |       |       |       |      4.34
49.583    0.00    1.11      3.050  O        |       |       |       |      4.33
49.667    0.00    1.11      3.043  O        |       |       |       |      4.32
49.750    0.00    1.11      3.035  O        |       |       |       |      4.32
49.833    0.00    1.11      3.028  O        |       |       |       |      4.31
49.917    0.00    1.11      3.020  O        |       |       |       |      4.30
50.000    0.00    1.11      3.012  O        |       |       |       |      4.29
50.083    0.00    1.11      3.005  O        |       |       |       |      4.28
50.167    0.00    1.11      2.997  O        |       |       |       |      4.27
50.250    0.00    1.11      2.989  O        |       |       |       |      4.26
50.333    0.00    1.11      2.982  O        |       |       |       |      4.25
50.417    0.00    1.11      2.974  O        |       |       |       |      4.24
50.500    0.00    1.11      2.966  O        |       |       |       |      4.23
50.583    0.00    1.11      2.959  O        |       |       |       |      4.22
50.667    0.00    1.11      2.951  O        |       |       |       |      4.22
50.750    0.00    1.11      2.943  O        |       |       |       |      4.21
50.833    0.00    1.11      2.936  O        |       |       |       |      4.20
50.917    0.00    1.11      2.928  O        |       |       |       |      4.19
51.000    0.00    1.11      2.920  O        |       |       |       |      4.18
51.083    0.00    1.11      2.913  O        |       |       |       |      4.17
51.167    0.00    1.11      2.905  O        |       |       |       |      4.16
51.250    0.00    1.11      2.898  O        |       |       |       |      4.15
51.333    0.00    1.11      2.890  O        |       |       |       |      4.14
51.417    0.00    1.11      2.882  O        |       |       |       |      4.13
51.500    0.00    1.11      2.875  O        |       |       |       |      4.12
51.583    0.00    1.11      2.867  O        |       |       |       |      4.12
51.667    0.00    1.11      2.859  O        |       |       |       |      4.11
51.750    0.00    1.11      2.852  O        |       |       |       |      4.10
51.833    0.00    1.11      2.844  O        |       |       |       |      4.09
51.917    0.00    1.11      2.836  O        |       |       |       |      4.08
52.000    0.00    1.11      2.829  O        |       |       |       |      4.07
52.083    0.00    1.11      2.821  O        |       |       |       |      4.06
52.167    0.00    1.11      2.813  O        |       |       |       |      4.05
52.250    0.00    1.11      2.806  O        |       |       |       |      4.04
52.333    0.00    1.11      2.798  O        |       |       |       |      4.03
52.417    0.00    1.11      2.791  O        |       |       |       |      4.02
52.500    0.00    1.11      2.783  O        |       |       |       |      4.02
52.583    0.00    1.11      2.775  O        |       |       |       |      4.01
52.667    0.00    1.11      2.768  O        |       |       |       |      4.00
52.750    0.00    1.11      2.760  O        |       |       |       |      3.99
52.833    0.00    1.10      2.752  O        |       |       |       |      3.97
52.917    0.00    1.10      2.745  O        |       |       |       |      3.96
53.000    0.00    1.10      2.737  O        |       |       |       |      3.95
53.083    0.00    1.09      2.730  O        |       |       |       |      3.94
53.167    0.00    1.09      2.722  O        |       |       |       |      3.93
53.250    0.00    1.09      2.715  O        |       |       |       |      3.92
53.333    0.00    1.08      2.707  O        |       |       |       |      3.91
53.417    0.00    1.08      2.700  O        |       |       |       |      3.90
53.500    0.00    1.08      2.692  O        |       |       |       |      3.89
53.583    0.00    1.08      2.685  O        |       |       |       |      3.88
53.667    0.00    1.07      2.677  O        |       |       |       |      3.87
53.750    0.00    1.07      2.670  O        |       |       |       |      3.86
53.833    0.00    1.07      2.663  O        |       |       |       |      3.85
53.917    0.00    1.06      2.655  O        |       |       |       |      3.83
54.000    0.00    1.06      2.648  O        |       |       |       |      3.82
54.083    0.00    1.06      2.641  O        |       |       |       |      3.81
54.167    0.00    1.06      2.633  O        |       |       |       |      3.80
54.250    0.00    1.05      2.626  O        |       |       |       |      3.79
54.333    0.00    1.05      2.619  O        |       |       |       |      3.78
54.417    0.00    1.05      2.612  O        |       |       |       |      3.77
54.500    0.00    1.04      2.605  O        |       |       |       |      3.76
54.583    0.00    1.04      2.597  O        |       |       |       |      3.75
54.667    0.00    1.04      2.590  O        |       |       |       |      3.74
54.750    0.00    1.04      2.583  O        |       |       |       |      3.73
54.833    0.00    1.03      2.576  O        |       |       |       |      3.72
54.917    0.00    1.03      2.569  O        |       |       |       |      3.71
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55.000	0.00	1.03	2.562	O	3.70
55.083	0.00	1.02	2.555	O	3.69
55.167	0.00	1.02	2.548	O	3.68
55.250	0.00	1.02	2.541	O	3.67
55.333	0.00	1.02	2.534	O	3.66
55.417	0.00	1.01	2.527	O	3.65
55.500	0.00	1.01	2.520	O	3.64
55.583	0.00	1.01	2.513	O	3.63
55.667	0.00	1.00	2.506	O	3.62
55.750	0.00	1.00	2.499	O	3.61
55.833	0.00	1.00	2.492	O	3.60
55.917	0.00	1.00	2.485	O	3.59
56.000	0.00	0.99	2.478	O	3.58
56.083	0.00	0.99	2.471	O	3.57
56.167	0.00	0.99	2.465	O	3.56
56.250	0.00	0.98	2.458	O	3.55
56.333	0.00	0.98	2.451	O	3.54
56.417	0.00	0.98	2.444	O	3.53
56.500	0.00	0.98	2.438	O	3.52
56.583	0.00	0.97	2.431	O	3.51
56.667	0.00	0.97	2.424	O	3.50
56.750	0.00	0.97	2.418	O	3.49
56.833	0.00	0.97	2.411	O	3.48
56.917	0.00	0.96	2.404	O	3.47
57.000	0.00	0.96	2.398	O	3.46
57.083	0.00	0.96	2.391	O	3.45
57.167	0.00	0.96	2.384	O	3.44
57.250	0.00	0.95	2.378	O	3.43
57.333	0.00	0.95	2.371	O	3.42
57.417	0.00	0.95	2.365	O	3.41
57.500	0.00	0.94	2.358	O	3.41
57.583	0.00	0.94	2.352	O	3.40
57.667	0.00	0.94	2.345	O	3.39
57.750	0.00	0.94	2.339	O	3.38
57.833	0.00	0.93	2.332	O	3.37
57.917	0.00	0.93	2.326	O	3.36
58.000	0.00	0.93	2.319	O	3.35
58.083	0.00	0.93	2.313	O	3.34
58.167	0.00	0.92	2.307	O	3.33
58.250	0.00	0.92	2.300	O	3.32
58.333	0.00	0.92	2.294	O	3.31
58.417	0.00	0.92	2.288	O	3.30
58.500	0.00	0.91	2.281	O	3.29
58.583	0.00	0.91	2.275	O	3.29
58.667	0.00	0.91	2.269	O	3.28
58.750	0.00	0.91	2.263	O	3.27
58.833	0.00	0.90	2.256	O	3.26
58.917	0.00	0.90	2.250	O	3.25
59.000	0.00	0.90	2.244	O	3.24
59.083	0.00	0.90	2.238	O	3.23
59.167	0.00	0.89	2.232	O	3.22
59.250	0.00	0.89	2.225	O	3.21
59.333	0.00	0.89	2.219	O	3.20
59.417	0.00	0.89	2.213	O	3.20
59.500	0.00	0.88	2.207	O	3.19
59.583	0.00	0.88	2.201	O	3.18
59.667	0.00	0.88	2.195	O	3.17
59.750	0.00	0.88	2.189	O	3.16
59.833	0.00	0.87	2.183	O	3.15
59.917	0.00	0.87	2.177	O	3.14
60.000	0.00	0.87	2.171	O	3.13
60.083	0.00	0.87	2.165	O	3.13
60.167	0.00	0.87	2.159	O	3.12
60.250	0.00	0.86	2.153	O	3.11
60.333	0.00	0.86	2.147	O	3.10
60.417	0.00	0.86	2.141	O	3.09
60.500	0.00	0.86	2.135	O	3.08
60.583	0.00	0.85	2.129	O	3.07
60.667	0.00	0.85	2.123	O	3.07
60.750	0.00	0.85	2.118	O	3.06
60.833	0.00	0.85	2.112	O	3.05
60.917	0.00	0.84	2.106	O	3.04
61.000	0.00	0.84	2.100	O	3.03

61.083	0.00	0.84	2.094	O	3.02
61.167	0.00	0.84	2.089	O	3.02
61.250	0.00	0.83	2.083	O	3.01
61.333	0.00	0.83	2.077	O	3.00
61.417	0.00	0.83	2.071	O	2.99
61.500	0.00	0.83	2.066	O	2.98
61.583	0.00	0.83	2.060	O	2.97
61.667	0.00	0.82	2.054	O	2.97
61.750	0.00	0.82	2.049	O	2.96
61.833	0.00	0.82	2.043	O	2.95
61.917	0.00	0.82	2.037	O	2.94
62.000	0.00	0.81	2.032	O	2.93
62.083	0.00	0.81	2.026	O	2.93
62.167	0.00	0.81	2.021	O	2.92
62.250	0.00	0.81	2.015	O	2.91
62.333	0.00	0.81	2.009	O	2.90
62.417	0.00	0.80	2.004	O	2.89
62.500	0.00	0.80	1.998	O	2.89
62.583	0.00	0.80	1.993	O	2.88
62.667	0.00	0.80	1.987	O	2.87
62.750	0.00	0.79	1.982	O	2.86
62.833	0.00	0.79	1.976	O	2.85
62.917	0.00	0.79	1.971	O	2.85
63.000	0.00	0.79	1.966	O	2.84
63.083	0.00	0.79	1.960	O	2.83
63.167	0.00	0.78	1.955	O	2.82
63.250	0.00	0.78	1.949	O	2.81
63.333	0.00	0.78	1.944	O	2.81
63.417	0.00	0.78	1.939	O	2.80
63.500	0.00	0.77	1.933	O	2.79
63.583	0.00	0.77	1.928	O	2.78
63.667	0.00	0.77	1.923	O	2.78
63.750	0.00	0.77	1.917	O	2.77
63.833	0.00	0.77	1.912	O	2.76
63.917	0.00	0.76	1.907	O	2.75
64.000	0.00	0.76	1.901	O	2.75
64.083	0.00	0.76	1.896	O	2.74
64.167	0.00	0.76	1.891	O	2.73
64.250	0.00	0.76	1.886	O	2.72
64.333	0.00	0.75	1.881	O	2.72
64.417	0.00	0.75	1.875	O	2.71
64.500	0.00	0.75	1.870	O	2.70
64.583	0.00	0.75	1.865	O	2.69
64.667	0.00	0.75	1.860	O	2.69
64.750	0.00	0.74	1.855	O	2.68
64.833	0.00	0.74	1.850	O	2.67
64.917	0.00	0.74	1.845	O	2.66
65.000	0.00	0.74	1.840	O	2.66
65.083	0.00	0.74	1.834	O	2.65
65.167	0.00	0.73	1.829	O	2.64
65.250	0.00	0.73	1.824	O	2.63
65.333	0.00	0.73	1.819	O	2.63
65.417	0.00	0.73	1.814	O	2.62
65.500	0.00	0.73	1.809	O	2.61
65.583	0.00	0.72	1.804	O	2.61
65.667	0.00	0.72	1.799	O	2.60
65.750	0.00	0.72	1.794	O	2.59
65.833	0.00	0.72	1.789	O	2.58
65.917	0.00	0.72	1.785	O	2.58
66.000	0.00	0.71	1.780	O	2.57
66.083	0.00	0.71	1.775	O	2.56
66.167	0.00	0.71	1.770	O	2.56
66.250	0.00	0.71	1.765	O	2.55
66.333	0.00	0.71	1.760	O	2.54
66.417	0.00	0.70	1.755	O	2.53
66.500	0.00	0.70	1.750	O	2.53
66.583	0.00	0.70	1.746	O	2.52
66.667	0.00	0.70	1.741	O	2.51
66.750	0.00	0.70	1.736	O	2.51
66.833	0.00	0.69	1.731	O	2.50
66.917	0.00	0.69	1.726	O	2.49
67.000	0.00	0.69	1.722	O	2.49
67.083	0.00	0.69	1.717	O	2.48

67.167	0.00	0.69	1.712	O	2.47
67.250	0.00	0.68	1.707	O	2.47
67.333	0.00	0.68	1.703	O	2.46
67.417	0.00	0.68	1.698	O	2.45
67.500	0.00	0.68	1.693	O	2.45
67.583	0.00	0.68	1.689	O	2.44
67.667	0.00	0.67	1.684	O	2.43
67.750	0.00	0.67	1.679	O	2.43
67.833	0.00	0.67	1.675	O	2.42
67.917	0.00	0.67	1.670	O	2.41
68.000	0.00	0.67	1.666	O	2.41
68.083	0.00	0.67	1.661	O	2.40
68.167	0.00	0.66	1.656	O	2.39
68.250	0.00	0.66	1.652	O	2.39
68.333	0.00	0.66	1.647	O	2.38
68.417	0.00	0.66	1.643	O	2.37
68.500	0.00	0.66	1.638	O	2.37
68.583	0.00	0.65	1.634	O	2.36
68.667	0.00	0.65	1.629	O	2.35
68.750	0.00	0.65	1.625	O	2.35
68.833	0.00	0.65	1.620	O	2.34
68.917	0.00	0.65	1.616	O	2.33
69.000	0.00	0.65	1.611	O	2.33
69.083	0.00	0.64	1.607	O	2.32
69.167	0.00	0.64	1.602	O	2.31
69.250	0.00	0.64	1.598	O	2.31
69.333	0.00	0.64	1.594	O	2.30
69.417	0.00	0.64	1.589	O	2.29
69.500	0.00	0.64	1.585	O	2.29
69.583	0.00	0.63	1.580	O	2.28
69.667	0.00	0.63	1.576	O	2.28
69.750	0.00	0.63	1.572	O	2.27
69.833	0.00	0.63	1.567	O	2.26
69.917	0.00	0.63	1.563	O	2.26
70.000	0.00	0.62	1.559	O	2.25
70.083	0.00	0.62	1.555	O	2.24
70.167	0.00	0.62	1.550	O	2.24
70.250	0.00	0.62	1.546	O	2.23
70.333	0.00	0.62	1.542	O	2.23
70.417	0.00	0.62	1.537	O	2.22
70.500	0.00	0.61	1.533	O	2.21
70.583	0.00	0.61	1.529	O	2.21
70.667	0.00	0.61	1.525	O	2.20
70.750	0.00	0.61	1.521	O	2.20
70.833	0.00	0.61	1.516	O	2.19
70.917	0.00	0.61	1.512	O	2.18
71.000	0.00	0.60	1.508	O	2.18
71.083	0.00	0.60	1.504	O	2.17
71.167	0.00	0.60	1.500	O	2.17
71.250	0.00	0.60	1.496	O	2.16
71.333	0.00	0.60	1.491	O	2.15
71.417	0.00	0.60	1.487	O	2.15
71.500	0.00	0.59	1.483	O	2.14
71.583	0.00	0.59	1.479	O	2.14
71.667	0.00	0.59	1.475	O	2.13
71.750	0.00	0.59	1.471	O	2.12
71.833	0.00	0.59	1.467	O	2.12
71.917	0.00	0.59	1.463	O	2.11
72.000	0.00	0.58	1.459	O	2.11
72.083	0.00	0.58	1.455	O	2.10
72.167	0.00	0.58	1.451	O	2.10
72.250	0.00	0.58	1.447	O	2.09
72.333	0.00	0.58	1.443	O	2.08
72.417	0.00	0.58	1.439	O	2.08
72.500	0.00	0.58	1.435	O	2.07
72.583	0.00	0.57	1.431	O	2.07
72.667	0.00	0.57	1.427	O	2.06
72.750	0.00	0.57	1.423	O	2.06
72.833	0.00	0.57	1.419	O	2.05
72.917	0.00	0.57	1.415	O	2.04
73.000	0.00	0.57	1.411	O	2.04
73.083	0.00	0.56	1.408	O	2.03
73.167	0.00	0.56	1.404	O	2.03

73.250	0.00	0.56	1.400	O	2.02
73.333	0.00	0.56	1.396	O	2.02
73.417	0.00	0.56	1.392	O	2.01
73.500	0.00	0.56	1.388	O	2.00
73.583	0.00	0.55	1.384	O	2.00
73.667	0.00	0.55	1.381	O	1.99
73.750	0.00	0.55	1.377	O	1.99
73.833	0.00	0.55	1.373	O	1.98
73.917	0.00	0.55	1.369	O	1.98
74.000	0.00	0.55	1.365	O	1.97
74.083	0.00	0.55	1.362	O	1.97
74.167	0.00	0.54	1.358	O	1.96
74.250	0.00	0.54	1.354	O	1.96
74.333	0.00	0.54	1.350	O	1.95
74.417	0.00	0.54	1.347	O	1.94
74.500	0.00	0.54	1.343	O	1.94
74.583	0.00	0.54	1.339	O	1.93
74.667	0.00	0.54	1.336	O	1.93
74.750	0.00	0.53	1.332	O	1.92
74.833	0.00	0.53	1.328	O	1.92
74.917	0.00	0.53	1.325	O	1.91
75.000	0.00	0.53	1.321	O	1.91
75.083	0.00	0.53	1.317	O	1.90
75.167	0.00	0.53	1.314	O	1.90
75.250	0.00	0.52	1.310	O	1.89
75.333	0.00	0.52	1.306	O	1.89
75.417	0.00	0.52	1.303	O	1.88
75.500	0.00	0.52	1.299	O	1.88
75.583	0.00	0.52	1.296	O	1.87
75.667	0.00	0.52	1.292	O	1.87
75.750	0.00	0.52	1.289	O	1.86
75.833	0.00	0.51	1.285	O	1.86
75.917	0.00	0.51	1.281	O	1.85
76.000	0.00	0.51	1.278	O	1.85
76.083	0.00	0.51	1.274	O	1.84
76.167	0.00	0.51	1.271	O	1.84
76.250	0.00	0.51	1.267	O	1.83
76.333	0.00	0.51	1.264	O	1.83
76.417	0.00	0.51	1.260	O	1.82
76.500	0.00	0.50	1.257	O	1.82
76.583	0.00	0.50	1.253	O	1.81
76.667	0.00	0.50	1.250	O	1.81
76.750	0.00	0.50	1.247	O	1.80
76.833	0.00	0.50	1.243	O	1.80
76.917	0.00	0.50	1.240	O	1.79
77.000	0.00	0.50	1.236	O	1.79
77.083	0.00	0.49	1.233	O	1.78
77.167	0.00	0.49	1.229	O	1.78
77.250	0.00	0.49	1.226	O	1.77
77.333	0.00	0.49	1.223	O	1.77
77.417	0.00	0.49	1.219	O	1.76
77.500	0.00	0.49	1.216	O	1.76
77.583	0.00	0.49	1.213	O	1.75
77.667	0.00	0.48	1.209	O	1.75
77.750	0.00	0.48	1.206	O	1.74
77.833	0.00	0.48	1.203	O	1.74
77.917	0.00	0.48	1.199	O	1.73
78.000	0.00	0.48	1.196	O	1.73
78.083	0.00	0.48	1.193	O	1.72
78.167	0.00	0.48	1.189	O	1.72
78.250	0.00	0.48	1.186	O	1.71
78.333	0.00	0.47	1.183	O	1.71
78.417	0.00	0.47	1.180	O	1.70
78.500	0.00	0.47	1.176	O	1.70
78.583	0.00	0.47	1.173	O	1.69
78.667	0.00	0.47	1.170	O	1.69
78.750	0.00	0.47	1.167	O	1.68
78.833	0.00	0.47	1.163	O	1.68
78.917	0.00	0.46	1.160	O	1.68
79.000	0.00	0.46	1.157	O	1.67
79.083	0.00	0.46	1.154	O	1.67
79.167	0.00	0.46	1.151	O	1.66
79.250	0.00	0.46	1.148	O	1.66

79.333	0.00	0.46	1.144	O	1.65
79.417	0.00	0.46	1.141	O	1.65
79.500	0.00	0.46	1.138	O	1.64
79.583	0.00	0.45	1.135	O	1.64
79.667	0.00	0.45	1.132	O	1.63
79.750	0.00	0.45	1.129	O	1.63
79.833	0.00	0.45	1.126	O	1.63
79.917	0.00	0.45	1.122	O	1.62
80.000	0.00	0.45	1.119	O	1.62
80.083	0.00	0.45	1.116	O	1.61
80.167	0.00	0.45	1.113	O	1.61
80.250	0.00	0.44	1.110	O	1.60
80.333	0.00	0.44	1.107	O	1.60
80.417	0.00	0.44	1.104	O	1.59
80.500	0.00	0.44	1.101	O	1.59
80.583	0.00	0.44	1.098	O	1.59
80.667	0.00	0.44	1.095	O	1.58
80.750	0.00	0.44	1.092	O	1.58
80.833	0.00	0.44	1.089	O	1.57
80.917	0.00	0.44	1.086	O	1.57
81.000	0.00	0.43	1.083	O	1.56
81.083	0.00	0.43	1.080	O	1.56
81.167	0.00	0.43	1.077	O	1.56
81.250	0.00	0.43	1.074	O	1.55
81.333	0.00	0.43	1.071	O	1.55
81.417	0.00	0.43	1.068	O	1.54
81.500	0.00	0.43	1.065	O	1.54
81.583	0.00	0.43	1.062	O	1.53
81.667	0.00	0.42	1.059	O	1.53
81.750	0.00	0.42	1.056	O	1.53
81.833	0.00	0.42	1.053	O	1.52
81.917	0.00	0.42	1.051	O	1.52
82.000	0.00	0.42	1.048	O	1.51
82.083	0.00	0.42	1.045	O	1.51
82.167	0.00	0.42	1.042	O	1.50
82.250	0.00	0.42	1.039	O	1.50
82.333	0.00	0.42	1.036	O	1.50
82.417	0.00	0.41	1.033	O	1.49
82.500	0.00	0.41	1.030	O	1.49
82.583	0.00	0.41	1.028	O	1.48
82.667	0.00	0.41	1.025	O	1.48
82.750	0.00	0.41	1.022	O	1.48
82.833	0.00	0.41	1.019	O	1.47
82.917	0.00	0.41	1.016	O	1.47
83.000	0.00	0.41	1.013	O	1.46
83.083	0.00	0.41	1.011	O	1.46
83.167	0.00	0.40	1.008	O	1.46
83.250	0.00	0.40	1.005	O	1.45
83.333	0.00	0.40	1.002	O	1.45
83.417	0.00	0.40	1.000	O	1.44
83.500	0.00	0.40	0.997	O	1.44
83.583	0.00	0.40	0.994	O	1.44
83.667	0.00	0.40	0.991	O	1.43
83.750	0.00	0.40	0.989	O	1.43
83.833	0.00	0.40	0.986	O	1.42
83.917	0.00	0.39	0.983	O	1.42
84.000	0.00	0.39	0.980	O	1.42
84.083	0.00	0.39	0.978	O	1.41
84.167	0.00	0.39	0.975	O	1.41
84.250	0.00	0.39	0.972	O	1.40
84.333	0.00	0.39	0.970	O	1.40
84.417	0.00	0.39	0.967	O	1.40
84.500	0.00	0.39	0.964	O	1.39
84.583	0.00	0.39	0.962	O	1.39
84.667	0.00	0.38	0.959	O	1.38
84.750	0.00	0.38	0.956	O	1.38
84.833	0.00	0.38	0.954	O	1.38
84.917	0.00	0.38	0.951	O	1.37
85.000	0.00	0.38	0.949	O	1.37
85.083	0.00	0.38	0.946	O	1.37
85.167	0.00	0.38	0.943	O	1.36
85.250	0.00	0.38	0.941	O	1.36
85.333	0.00	0.38	0.938	O	1.35

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85.417    0.00    0.37     0.936  O        |        |        |        |      1.35
85.500    0.00    0.37     0.933  O        |        |        |        |      1.35
85.583    0.00    0.37     0.930  O        |        |        |        |      1.34
85.667    0.00    0.37     0.928  O        |        |        |        |      1.34
85.750    0.00    0.37     0.925  O        |        |        |        |      1.34
85.833    0.00    0.37     0.923  O        |        |        |        |      1.33
85.917    0.00    0.37     0.920  O        |        |        |        |      1.33
86.000    0.00    0.37     0.918  O        |        |        |        |      1.33
86.083    0.00    0.37     0.915  O        |        |        |        |      1.32
86.167    0.00    0.37     0.913  O        |        |        |        |      1.32
86.250    0.00    0.36     0.910  O        |        |        |        |      1.31
86.333    0.00    0.36     0.908  O        |        |        |        |      1.31
86.417    0.00    0.36     0.905  O        |        |        |        |      1.31
86.500    0.00    0.36     0.903  O        |        |        |        |      1.30
86.583    0.00    0.36     0.900  O        |        |        |        |      1.30
86.667    0.00    0.36     0.898  O        |        |        |        |      1.30
86.750    0.00    0.36     0.895  O        |        |        |        |      1.29
86.833    0.00    0.36     0.893  O        |        |        |        |      1.29
86.917    0.00    0.36     0.890  O        |        |        |        |      1.29
87.000    0.00    0.36     0.888  O        |        |        |        |      1.28
87.083    0.00    0.35     0.885  O        |        |        |        |      1.28
87.167    0.00    0.35     0.883  O        |        |        |        |      1.27
87.250    0.00    0.35     0.880  O        |        |        |        |      1.27
87.333    0.00    0.35     0.878  O        |        |        |        |      1.27
87.417    0.00    0.35     0.876  O        |        |        |        |      1.26
87.500    0.00    0.35     0.873  O        |        |        |        |      1.26
87.583    0.00    0.35     0.871  O        |        |        |        |      1.26
87.667    0.00    0.35     0.868  O        |        |        |        |      1.25
87.750    0.00    0.35     0.866  O        |        |        |        |      1.25
87.833    0.00    0.35     0.864  O        |        |        |        |      1.25
87.917    0.00    0.35     0.861  O        |        |        |        |      1.24
88.000    0.00    0.34     0.859  O        |        |        |        |      1.24
88.083    0.00    0.34     0.856  O        |        |        |        |      1.24
88.167    0.00    0.34     0.854  O        |        |        |        |      1.23
88.250    0.00    0.34     0.852  O        |        |        |        |      1.23
88.333    0.00    0.34     0.849  O        |        |        |        |      1.23
88.417    0.00    0.34     0.847  O        |        |        |        |      1.22
88.500    0.00    0.34     0.845  O        |        |        |        |      1.22
88.583    0.00    0.34     0.842  O        |        |        |        |      1.22
88.667    0.00    0.34     0.840  O        |        |        |        |      1.21
88.750    0.00    0.34     0.838  O        |        |        |        |      1.21
88.833    0.00    0.33     0.835  O        |        |        |        |      1.21
88.917    0.00    0.33     0.833  O        |        |        |        |      1.20
89.000    0.00    0.33     0.831  O        |        |        |        |      1.20
89.083    0.00    0.33     0.829  O        |        |        |        |      1.20
89.167    0.00    0.33     0.826  O        |        |        |        |      1.19
89.250    0.00    0.33     0.824  O        |        |        |        |      1.19
89.333    0.00    0.33     0.822  O        |        |        |        |      1.19
89.417    0.00    0.33     0.819  O        |        |        |        |      1.18
89.500    0.00    0.33     0.817  O        |        |        |        |      1.18
89.583    0.00    0.33     0.815  O        |        |        |        |      1.18
89.667    0.00    0.33     0.813  O        |        |        |        |      1.17
89.750    0.00    0.32     0.810  O        |        |        |        |      1.17
89.833    0.00    0.32     0.808  O        |        |        |        |      1.17
89.917    0.00    0.32     0.806  O        |        |        |        |      1.16
90.000    0.00    0.32     0.804  O        |        |        |        |      1.16
90.083    0.00    0.32     0.802  O        |        |        |        |      1.16
90.167    0.00    0.32     0.799  O        |        |        |        |      1.15
90.250    0.00    0.32     0.797  O        |        |        |        |      1.15
90.333    0.00    0.32     0.795  O        |        |        |        |      1.15
90.417    0.00    0.32     0.793  O        |        |        |        |      1.14
90.500    0.00    0.32     0.791  O        |        |        |        |      1.14
90.583    0.00    0.32     0.788  O        |        |        |        |      1.14
90.667    0.00    0.32     0.786  O        |        |        |        |      1.14
90.750    0.00    0.31     0.784  O        |        |        |        |      1.13
90.833    0.00    0.31     0.782  O        |        |        |        |      1.13
90.917    0.00    0.31     0.780  O        |        |        |        |      1.13
91.000    0.00    0.31     0.778  O        |        |        |        |      1.12
91.083    0.00    0.31     0.775  O        |        |        |        |      1.12
91.167    0.00    0.31     0.773  O        |        |        |        |      1.12
91.250    0.00    0.31     0.771  O        |        |        |        |      1.11
91.333    0.00    0.31     0.769  O        |        |        |        |      1.11
91.417    0.00    0.31     0.767  O        |        |        |        |      1.11
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91.500	0.00	0.31	0.765	O					1.10
91.583	0.00	0.31	0.763	O					1.10
91.667	0.00	0.30	0.761	O					1.10
91.750	0.00	0.30	0.759	O					1.10
91.833	0.00	0.30	0.756	O					1.09
91.917	0.00	0.30	0.754	O					1.09
92.000	0.00	0.30	0.752	O					1.09
92.083	0.00	0.30	0.750	O					1.08
92.167	0.00	0.30	0.748	O					1.08
92.250	0.00	0.30	0.746	O					1.08
92.333	0.00	0.30	0.744	O					1.07
92.417	0.00	0.30	0.742	O					1.07
92.500	0.00	0.30	0.740	O					1.07
92.583	0.00	0.30	0.738	O					1.07
92.667	0.00	0.29	0.736	O					1.06
92.750	0.00	0.29	0.734	O					1.06
92.833	0.00	0.29	0.732	O					1.06
92.917	0.00	0.29	0.730	O					1.05
93.000	0.00	0.29	0.728	O					1.05
93.083	0.00	0.29	0.726	O					1.05
93.167	0.00	0.29	0.724	O					1.05
93.250	0.00	0.29	0.722	O					1.04
93.333	0.00	0.29	0.720	O					1.04
93.417	0.00	0.29	0.718	O					1.04
93.500	0.00	0.29	0.716	O					1.03
93.583	0.00	0.29	0.714	O					1.03
93.667	0.00	0.29	0.712	O					1.03
93.750	0.00	0.28	0.710	O					1.03
93.833	0.00	0.28	0.708	O					1.02
93.917	0.00	0.28	0.706	O					1.02
94.000	0.00	0.28	0.704	O					1.02
94.083	0.00	0.28	0.702	O					1.01
94.167	0.00	0.28	0.700	O					1.01
94.250	0.00	0.28	0.698	O					1.01
94.333	0.00	0.28	0.696	O					1.01
94.417	0.00	0.28	0.694	O					1.00
94.500	0.00	0.28	0.693	O					1.00
94.583	0.00	0.28	0.691	O					1.00
94.667	0.00	0.28	0.689	O					0.99
94.750	0.00	0.28	0.687	O					0.99
94.833	0.00	0.27	0.685	O					0.99
94.917	0.00	0.27	0.683	O					0.99
95.000	0.00	0.27	0.681	O					0.98
95.083	0.00	0.27	0.679	O					0.98
95.167	0.00	0.27	0.677	O					0.98
95.250	0.00	0.27	0.676	O					0.98
95.333	0.00	0.27	0.674	O					0.97
95.417	0.00	0.27	0.672	O					0.97
95.500	0.00	0.27	0.670	O					0.97
95.583	0.00	0.27	0.668	O					0.96
95.667	0.00	0.27	0.666	O					0.96
95.750	0.00	0.27	0.664	O					0.96
95.833	0.00	0.27	0.663	O					0.96
95.917	0.00	0.26	0.661	O					0.95
96.000	0.00	0.26	0.659	O					0.95
96.083	0.00	0.26	0.657	O					0.95
96.167	0.00	0.26	0.655	O					0.95
96.250	0.00	0.26	0.654	O					0.94
96.333	0.00	0.26	0.652	O					0.94
96.417	0.00	0.26	0.650	O					0.94
96.500	0.00	0.26	0.648	O					0.94
96.583	0.00	0.26	0.646	O					0.93
96.667	0.00	0.26	0.645	O					0.93
96.750	0.00	0.26	0.643	O					0.93
96.833	0.00	0.26	0.641	O					0.93
96.917	0.00	0.26	0.639	O					0.92
97.000	0.00	0.26	0.637	O					0.92
97.083	0.00	0.25	0.636	O					0.92
97.167	0.00	0.25	0.634	O					0.92
97.250	0.00	0.25	0.632	O					0.91
97.333	0.00	0.25	0.630	O					0.91
97.417	0.00	0.25	0.629	O					0.91
97.500	0.00	0.25	0.627	O					0.91

97.583	0.00	0.25	0.625	O	0.90
97.667	0.00	0.25	0.624	O	0.90
97.750	0.00	0.25	0.622	O	0.90
97.833	0.00	0.25	0.620	O	0.90
97.917	0.00	0.25	0.618	O	0.89
98.000	0.00	0.25	0.617	O	0.89
98.083	0.00	0.25	0.615	O	0.89
98.167	0.00	0.25	0.613	O	0.89
98.250	0.00	0.25	0.612	O	0.88
98.333	0.00	0.24	0.610	O	0.88
98.417	0.00	0.24	0.608	O	0.88
98.500	0.00	0.24	0.607	O	0.88
98.583	0.00	0.24	0.605	O	0.87
98.667	0.00	0.24	0.603	O	0.87
98.750	0.00	0.24	0.602	O	0.87
98.833	0.00	0.24	0.600	O	0.87
98.917	0.00	0.24	0.598	O	0.86
99.000	0.00	0.24	0.597	O	0.86
99.083	0.00	0.24	0.595	O	0.86
99.167	0.00	0.24	0.593	O	0.86
99.250	0.00	0.24	0.592	O	0.85
99.333	0.00	0.24	0.590	O	0.85
99.417	0.00	0.24	0.588	O	0.85
99.500	0.00	0.24	0.587	O	0.85
99.583	0.00	0.23	0.585	O	0.85
99.667	0.00	0.23	0.584	O	0.84
99.750	0.00	0.23	0.582	O	0.84
99.833	0.00	0.23	0.580	O	0.84
99.917	0.00	0.23	0.579	O	0.84
100.000	0.00	0.23	0.577	O	0.83
100.083	0.00	0.23	0.576	O	0.83
100.167	0.00	0.23	0.574	O	0.83
100.250	0.00	0.23	0.572	O	0.83
100.333	0.00	0.23	0.571	O	0.82
100.417	0.00	0.23	0.569	O	0.82
100.500	0.00	0.23	0.568	O	0.82
100.583	0.00	0.23	0.566	O	0.82
100.667	0.00	0.23	0.565	O	0.82
100.750	0.00	0.23	0.563	O	0.81
100.833	0.00	0.22	0.561	O	0.81
100.917	0.00	0.22	0.560	O	0.81
101.000	0.00	0.22	0.558	O	0.81
101.083	0.00	0.22	0.557	O	0.80
101.167	0.00	0.22	0.555	O	0.80
101.250	0.00	0.22	0.554	O	0.80
101.333	0.00	0.22	0.552	O	0.80
101.417	0.00	0.22	0.551	O	0.80
101.500	0.00	0.22	0.549	O	0.79
101.583	0.00	0.22	0.548	O	0.79
101.667	0.00	0.22	0.546	O	0.79
101.750	0.00	0.22	0.545	O	0.79
101.833	0.00	0.22	0.543	O	0.78
101.917	0.00	0.22	0.542	O	0.78
102.000	0.00	0.22	0.540	O	0.78
102.083	0.00	0.22	0.539	O	0.78
102.167	0.00	0.22	0.537	O	0.78
102.250	0.00	0.21	0.536	O	0.77
102.333	0.00	0.21	0.534	O	0.77
102.417	0.00	0.21	0.533	O	0.77
102.500	0.00	0.21	0.531	O	0.77
102.583	0.00	0.21	0.530	O	0.77
102.667	0.00	0.21	0.528	O	0.76
102.750	0.00	0.21	0.527	O	0.76
102.833	0.00	0.21	0.525	O	0.76
102.917	0.00	0.21	0.524	O	0.76
103.000	0.00	0.21	0.523	O	0.75
103.083	0.00	0.21	0.521	O	0.75
103.167	0.00	0.21	0.520	O	0.75
103.250	0.00	0.21	0.518	O	0.75
103.333	0.00	0.21	0.517	O	0.75
103.417	0.00	0.21	0.515	O	0.74
103.500	0.00	0.21	0.514	O	0.74
103.583	0.00	0.21	0.513	O	0.74

103.667	0.00	0.20	0.511	O	0.74
103.750	0.00	0.20	0.510	O	0.74
103.833	0.00	0.20	0.508	O	0.73
103.917	0.00	0.20	0.507	O	0.73
104.000	0.00	0.20	0.506	O	0.73
104.083	0.00	0.20	0.504	O	0.73
104.167	0.00	0.20	0.503	O	0.73
104.250	0.00	0.20	0.501	O	0.72
104.333	0.00	0.20	0.500	O	0.72
104.417	0.00	0.20	0.499	O	0.72
104.500	0.00	0.20	0.497	O	0.72
104.583	0.00	0.20	0.496	O	0.72
104.667	0.00	0.20	0.495	O	0.71
104.750	0.00	0.20	0.493	O	0.71
104.833	0.00	0.20	0.492	O	0.71
104.917	0.00	0.20	0.490	O	0.71
105.000	0.00	0.20	0.489	O	0.71
105.083	0.00	0.20	0.488	O	0.70
105.167	0.00	0.19	0.486	O	0.70
105.250	0.00	0.19	0.485	O	0.70
105.333	0.00	0.19	0.484	O	0.70
105.417	0.00	0.19	0.482	O	0.70
105.500	0.00	0.19	0.481	O	0.69
105.583	0.00	0.19	0.480	O	0.69
105.667	0.00	0.19	0.478	O	0.69
105.750	0.00	0.19	0.477	O	0.69
105.833	0.00	0.19	0.476	O	0.69
105.917	0.00	0.19	0.474	O	0.69
106.000	0.00	0.19	0.473	O	0.68
106.083	0.00	0.19	0.472	O	0.68
106.167	0.00	0.19	0.471	O	0.68
106.250	0.00	0.19	0.469	O	0.68
106.333	0.00	0.19	0.468	O	0.68
106.417	0.00	0.19	0.467	O	0.67
106.500	0.00	0.19	0.465	O	0.67
106.583	0.00	0.19	0.464	O	0.67
106.667	0.00	0.19	0.463	O	0.67
106.750	0.00	0.18	0.462	O	0.67
106.833	0.00	0.18	0.460	O	0.66
106.917	0.00	0.18	0.459	O	0.66
107.000	0.00	0.18	0.458	O	0.66
107.083	0.00	0.18	0.456	O	0.66
107.167	0.00	0.18	0.455	O	0.66
107.250	0.00	0.18	0.454	O	0.66
107.333	0.00	0.18	0.453	O	0.65
107.417	0.00	0.18	0.451	O	0.65
107.500	0.00	0.18	0.450	O	0.65
107.583	0.00	0.18	0.449	O	0.65
107.667	0.00	0.18	0.448	O	0.65
107.750	0.00	0.18	0.447	O	0.64
107.833	0.00	0.18	0.445	O	0.64
107.917	0.00	0.18	0.444	O	0.64
108.000	0.00	0.18	0.443	O	0.64
108.083	0.00	0.18	0.442	O	0.64
108.167	0.00	0.18	0.440	O	0.64
108.250	0.00	0.18	0.439	O	0.63
108.333	0.00	0.18	0.438	O	0.63
108.417	0.00	0.18	0.437	O	0.63
108.500	0.00	0.17	0.436	O	0.63
108.583	0.00	0.17	0.434	O	0.63
108.667	0.00	0.17	0.433	O	0.63
108.750	0.00	0.17	0.432	O	0.62
108.833	0.00	0.17	0.431	O	0.62
108.917	0.00	0.17	0.430	O	0.62
109.000	0.00	0.17	0.428	O	0.62
109.083	0.00	0.17	0.427	O	0.62
109.167	0.00	0.17	0.426	O	0.62
109.250	0.00	0.17	0.425	O	0.61
109.333	0.00	0.17	0.424	O	0.61
109.417	0.00	0.17	0.423	O	0.61
109.500	0.00	0.17	0.421	O	0.61
109.583	0.00	0.17	0.420	O	0.61
109.667	0.00	0.17	0.419	O	0.61

109.750	0.00	0.17	0.418	O	|	|	|	|	0.60
109.833	0.00	0.17	0.417	O	|	|	|	|	0.60
109.917	0.00	0.17	0.416	O	|	|	|	|	0.60
110.000	0.00	0.17	0.414	O	|	|	|	|	0.60
110.083	0.00	0.17	0.413	O	|	|	|	|	0.60
110.167	0.00	0.17	0.412	O	|	|	|	|	0.60
110.250	0.00	0.16	0.411	O	|	|	|	|	0.59
110.333	0.00	0.16	0.410	O	|	|	|	|	0.59
110.417	0.00	0.16	0.409	O	|	|	|	|	0.59
110.500	0.00	0.16	0.408	O	|	|	|	|	0.59
110.583	0.00	0.16	0.407	O	|	|	|	|	0.59
110.667	0.00	0.16	0.405	O	|	|	|	|	0.59
110.750	0.00	0.16	0.404	O	|	|	|	|	0.58
110.833	0.00	0.16	0.403	O	|	|	|	|	0.58
110.917	0.00	0.16	0.402	O	|	|	|	|	0.58
111.000	0.00	0.16	0.401	O	|	|	|	|	0.58
111.083	0.00	0.16	0.400	O	|	|	|	|	0.58
111.167	0.00	0.16	0.399	O	|	|	|	|	0.58
111.250	0.00	0.16	0.398	O	|	|	|	|	0.57
111.333	0.00	0.16	0.397	O	|	|	|	|	0.57
111.417	0.00	0.16	0.395	O	|	|	|	|	0.57
111.500	0.00	0.16	0.394	O	|	|	|	|	0.57
111.583	0.00	0.16	0.393	O	|	|	|	|	0.57
111.667	0.00	0.16	0.392	O	|	|	|	|	0.57
111.750	0.00	0.16	0.391	O	|	|	|	|	0.56
111.833	0.00	0.16	0.390	O	|	|	|	|	0.56
111.917	0.00	0.16	0.389	O	|	|	|	|	0.56
112.000	0.00	0.16	0.388	O	|	|	|	|	0.56
112.083	0.00	0.16	0.387	O	|	|	|	|	0.56
112.167	0.00	0.15	0.386	O	|	|	|	|	0.56
112.250	0.00	0.15	0.385	O	|	|	|	|	0.56
112.333	0.00	0.15	0.384	O	|	|	|	|	0.55
112.417	0.00	0.15	0.383	O	|	|	|	|	0.55
112.500	0.00	0.15	0.382	O	|	|	|	|	0.55
112.583	0.00	0.15	0.380	O	|	|	|	|	0.55
112.667	0.00	0.15	0.379	O	|	|	|	|	0.55
112.750	0.00	0.15	0.378	O	|	|	|	|	0.55
112.833	0.00	0.15	0.377	O	|	|	|	|	0.54
112.917	0.00	0.15	0.376	O	|	|	|	|	0.54
113.000	0.00	0.15	0.375	O	|	|	|	|	0.54
113.083	0.00	0.15	0.374	O	|	|	|	|	0.54
113.167	0.00	0.15	0.373	O	|	|	|	|	0.54
113.250	0.00	0.15	0.372	O	|	|	|	|	0.54
113.333	0.00	0.15	0.371	O	|	|	|	|	0.54
113.417	0.00	0.15	0.370	O	|	|	|	|	0.53
113.500	0.00	0.15	0.369	O	|	|	|	|	0.53
113.583	0.00	0.15	0.368	O	|	|	|	|	0.53
113.667	0.00	0.15	0.367	O	|	|	|	|	0.53
113.750	0.00	0.15	0.366	O	|	|	|	|	0.53
113.833	0.00	0.15	0.365	O	|	|	|	|	0.53
113.917	0.00	0.15	0.364	O	|	|	|	|	0.53
114.000	0.00	0.15	0.363	O	|	|	|	|	0.52
114.083	0.00	0.15	0.362	O	|	|	|	|	0.52
114.167	0.00	0.14	0.361	O	|	|	|	|	0.52
114.250	0.00	0.14	0.360	O	|	|	|	|	0.52
114.333	0.00	0.14	0.359	O	|	|	|	|	0.52
114.417	0.00	0.14	0.358	O	|	|	|	|	0.52
114.500	0.00	0.14	0.357	O	|	|	|	|	0.52
114.583	0.00	0.14	0.356	O	|	|	|	|	0.51
114.667	0.00	0.14	0.355	O	|	|	|	|	0.51
114.750	0.00	0.14	0.354	O	|	|	|	|	0.51
114.833	0.00	0.14	0.353	O	|	|	|	|	0.51
114.917	0.00	0.14	0.352	O	|	|	|	|	0.51
115.000	0.00	0.14	0.351	O	|	|	|	|	0.51
115.083	0.00	0.14	0.350	O	|	|	|	|	0.51
115.167	0.00	0.14	0.349	O	|	|	|	|	0.50
115.250	0.00	0.14	0.348	O	|	|	|	|	0.50
115.333	0.00	0.14	0.347	O	|	|	|	|	0.50
115.417	0.00	0.14	0.346	O	|	|	|	|	0.50
115.500	0.00	0.14	0.345	O	|	|	|	|	0.50
115.583	0.00	0.14	0.344	O	|	|	|	|	0.50
115.667	0.00	0.14	0.344	O	|	|	|	|	0.50
115.750	0.00	0.14	0.343	O	|	|	|	|	0.49

115.833	0.00	0.14	0.342	O	|	|	|	|	0.49
115.917	0.00	0.14	0.341	O	|	|	|	|	0.49
116.000	0.00	0.14	0.340	O	|	|	|	|	0.49
116.083	0.00	0.14	0.339	O	|	|	|	|	0.49
116.167	0.00	0.14	0.338	O	|	|	|	|	0.49
116.250	0.00	0.14	0.337	O	|	|	|	|	0.49
116.333	0.00	0.13	0.336	O	|	|	|	|	0.49
116.417	0.00	0.13	0.335	O	|	|	|	|	0.48
116.500	0.00	0.13	0.334	O	|	|	|	|	0.48
116.583	0.00	0.13	0.333	O	|	|	|	|	0.48
116.667	0.00	0.13	0.332	O	|	|	|	|	0.48
116.750	0.00	0.13	0.331	O	|	|	|	|	0.48
116.833	0.00	0.13	0.331	O	|	|	|	|	0.48
116.917	0.00	0.13	0.330	O	|	|	|	|	0.48
117.000	0.00	0.13	0.329	O	|	|	|	|	0.47
117.083	0.00	0.13	0.328	O	|	|	|	|	0.47
117.167	0.00	0.13	0.327	O	|	|	|	|	0.47
117.250	0.00	0.13	0.326	O	|	|	|	|	0.47
117.333	0.00	0.13	0.325	O	|	|	|	|	0.47
117.417	0.00	0.13	0.324	O	|	|	|	|	0.47
117.500	0.00	0.13	0.323	O	|	|	|	|	0.47
117.583	0.00	0.13	0.322	O	|	|	|	|	0.47
117.667	0.00	0.13	0.322	O	|	|	|	|	0.46
117.750	0.00	0.13	0.321	O	|	|	|	|	0.46
117.833	0.00	0.13	0.320	O	|	|	|	|	0.46
117.917	0.00	0.13	0.319	O	|	|	|	|	0.46
118.000	0.00	0.13	0.318	O	|	|	|	|	0.46
118.083	0.00	0.13	0.317	O	|	|	|	|	0.46
118.167	0.00	0.13	0.316	O	|	|	|	|	0.46
118.250	0.00	0.13	0.315	O	|	|	|	|	0.46
118.333	0.00	0.13	0.315	O	|	|	|	|	0.45
118.417	0.00	0.13	0.314	O	|	|	|	|	0.45
118.500	0.00	0.13	0.313	O	|	|	|	|	0.45
118.583	0.00	0.12	0.312	O	|	|	|	|	0.45
118.667	0.00	0.12	0.311	O	|	|	|	|	0.45
118.750	0.00	0.12	0.310	O	|	|	|	|	0.45
118.833	0.00	0.12	0.309	O	|	|	|	|	0.45
118.917	0.00	0.12	0.308	O	|	|	|	|	0.45
119.000	0.00	0.12	0.308	O	|	|	|	|	0.44
119.083	0.00	0.12	0.307	O	|	|	|	|	0.44
119.167	0.00	0.12	0.306	O	|	|	|	|	0.44
119.250	0.00	0.12	0.305	O	|	|	|	|	0.44
119.333	0.00	0.12	0.304	O	|	|	|	|	0.44
119.417	0.00	0.12	0.303	O	|	|	|	|	0.44
119.500	0.00	0.12	0.303	O	|	|	|	|	0.44
119.583	0.00	0.12	0.302	O	|	|	|	|	0.44
119.667	0.00	0.12	0.301	O	|	|	|	|	0.43
119.750	0.00	0.12	0.300	O	|	|	|	|	0.43
119.833	0.00	0.12	0.299	O	|	|	|	|	0.43
119.917	0.00	0.12	0.298	O	|	|	|	|	0.43
120.000	0.00	0.12	0.298	O	|	|	|	|	0.43
120.083	0.00	0.12	0.297	O	|	|	|	|	0.43
120.167	0.00	0.12	0.296	O	|	|	|	|	0.43
120.250	0.00	0.12	0.295	O	|	|	|	|	0.43
120.333	0.00	0.12	0.294	O	|	|	|	|	0.43
120.417	0.00	0.12	0.294	O	|	|	|	|	0.42
120.500	0.00	0.12	0.293	O	|	|	|	|	0.42
120.583	0.00	0.12	0.292	O	|	|	|	|	0.42
120.667	0.00	0.12	0.291	O	|	|	|	|	0.42
120.750	0.00	0.12	0.290	O	|	|	|	|	0.42
120.833	0.00	0.12	0.290	O	|	|	|	|	0.42
120.917	0.00	0.12	0.289	O	|	|	|	|	0.42
121.000	0.00	0.12	0.288	O	|	|	|	|	0.42
121.083	0.00	0.12	0.287	O	|	|	|	|	0.41
121.167	0.00	0.11	0.286	O	|	|	|	|	0.41
121.250	0.00	0.11	0.286	O	|	|	|	|	0.41
121.333	0.00	0.11	0.285	O	|	|	|	|	0.41
121.417	0.00	0.11	0.284	O	|	|	|	|	0.41
121.500	0.00	0.11	0.283	O	|	|	|	|	0.41
121.583	0.00	0.11	0.282	O	|	|	|	|	0.41
121.667	0.00	0.11	0.282	O	|	|	|	|	0.41
121.750	0.00	0.11	0.281	O	|	|	|	|	0.41
121.833	0.00	0.11	0.280	O	|	|	|	|	0.40

```
121.917   0.00   0.11     0.279  O       |       |       |       |     0.40
122.000   0.00   0.11     0.279  O       |       |       |       |     0.40
122.083   0.00   0.11     0.278  O       |       |       |       |     0.40
122.167   0.00   0.11     0.277  O       |       |       |       |     0.40
122.250   0.00   0.11     0.276  O       |       |       |       |     0.40
122.333   0.00   0.11     0.275  O       |       |       |       |     0.40
122.417   0.00   0.11     0.275  O       |       |       |       |     0.40
122.500   0.00   0.11     0.274  O       |       |       |       |     0.40
122.583   0.00   0.11     0.273  O       |       |       |       |     0.39
122.667   0.00   0.11     0.272  O       |       |       |       |     0.39
122.750   0.00   0.11     0.272  O       |       |       |       |     0.39
122.833   0.00   0.11     0.271  O       |       |       |       |     0.39
122.917   0.00   0.11     0.270  O       |       |       |       |     0.39
123.000   0.00   0.11     0.269  O       |       |       |       |     0.39
123.083   0.00   0.11     0.269  O       |       |       |       |     0.39
123.167   0.00   0.11     0.268  O       |       |       |       |     0.39
123.250   0.00   0.11     0.267  O       |       |       |       |     0.39
123.333   0.00   0.11     0.267  O       |       |       |       |     0.38
123.417   0.00   0.11     0.266  O       |       |       |       |     0.38
123.500   0.00   0.11     0.265  O       |       |       |       |     0.38
123.583   0.00   0.11     0.264  O       |       |       |       |     0.38
123.667   0.00   0.11     0.264  O       |       |       |       |     0.38
123.750   0.00   0.11     0.263  O       |       |       |       |     0.38
123.833   0.00   0.11     0.262  O       |       |       |       |     0.38
123.917   0.00   0.10     0.261  O       |       |       |       |     0.38
124.000   0.00   0.10     0.261  O       |       |       |       |     0.38
124.083   0.00   0.10     0.260  O       |       |       |       |     0.38
124.167   0.00   0.10     0.259  O       |       |       |       |     0.37
124.250   0.00   0.10     0.259  O       |       |       |       |     0.37
124.333   0.00   0.10     0.258  O       |       |       |       |     0.37
124.417   0.00   0.10     0.257  O       |       |       |       |     0.37
124.500   0.00   0.10     0.256  O       |       |       |       |     0.37
124.583   0.00   0.10     0.256  O       |       |       |       |     0.37
124.667   0.00   0.10     0.255  O       |       |       |       |     0.37
124.750   0.00   0.10     0.254  O       |       |       |       |     0.37
124.833   0.00   0.10     0.254  O       |       |       |       |     0.37
124.917   0.00   0.10     0.253  O       |       |       |       |     0.37
125.000   0.00   0.10     0.252  O       |       |       |       |     0.36
125.083   0.00   0.10     0.252  O       |       |       |       |     0.36
125.167   0.00   0.10     0.251  O       |       |       |       |     0.36
125.250   0.00   0.10     0.250  O       |       |       |       |     0.36
125.333   0.00   0.10     0.249  O       |       |       |       |     0.36

        Remaining water in basin =    0.25 (Ac.Ft)


        ****************************HYDROGRAPH DATA****************************
                        Number of intervals =  1504
                        Time interval =    5.0 (Min.)
                        Maximum/Peak flow rate =       17.613 (CFS)
                        Total volume =       9.800 (Ac.Ft)
                Status of hydrographs being held in storage
                           Stream 1  Stream 2  Stream 3  Stream 4  Stream 5
                Peak (CFS)      0.000     0.000     0.000     0.000     0.000
                Vol (Ac.Ft)      0.000     0.000     0.000     0.000     0.000
        ***********************************************************************

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                    FLOOD HYDROGRAPH ROUTING PROGRAM
             Copyright (c) CIVILCADD/CIVILDESIGN, 1989 - 2004
                         Study date: 11/01/22


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 Cordova Site
 Basin A2 Routing
 10-year, 24-hours storm

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 Program License Serial Number 4009

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

                 From study/file name: CordovaUHprA210.rte
 ***************************HYDROGRAPH DATA***************************
                 Number of intervals =   310
                 Time interval =    5.0 (Min.)
                 Maximum/Peak flow rate =       32.962 (CFS)
                 Total volume =       4.089 (Ac.Ft)
         Status of hydrographs being held in storage
                    Stream 1  Stream 2  Stream 3  Stream 4  Stream 5
         Peak (CFS)      0.000     0.000     0.000     0.000     0.000
         Vol (Ac.Ft)      0.000     0.000     0.000     0.000     0.000
 ***********************************************************************



 ++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
 Process from Point/Station       1.000 to Point/Station       2.000
 **** RETARDING BASIN ROUTING ****
 ______________________________________________________________________

 User entry of depth-outflow-storage data
 -------------------------------------------------------------------
 Total number of inflow hydrograph intervals = 310
 Hydrograph time unit =  5.000 (Min.)
 Initial depth in storage basin =   0.00(Ft.)
 -------------------------------------------------------------------
 -------------------------------------------------------------------
 Initial basin depth =   0.00 (Ft.)
 Initial basin storage =      0.00 (Ac.Ft)
 Initial basin outflow =   0.00 (CFS)
 --------------------------------------------------------------------
 -------------------------------------------------------------------
 Depth vs. Storage and Depth vs. Discharge data:
  Basin Depth  Storage    Outflow   (S-O*dt/2)   (S+O*dt/2)
      (Ft.)    (Ac.Ft)    (CFS)     (Ac.Ft)    (Ac.Ft)
 --------------------------------------------------------------------
   0.000      0.000      0.000      0.000        0.000
   1.000      0.750      0.810      0.747        0.753
   2.000      1.690      0.811      1.687        1.693
   3.000      2.630      0.812      2.627        2.633
   4.000      3.670      0.814      3.667        3.673
   5.500      5.360      0.815      5.357        5.363
   6.000      5.970     18.810      5.905        6.035
 -------------------------------------------------------------------
                 Hydrograph Detention Basin Routing
 --------------------------------------------------------------------

 Graph values: 'I'= unit inflow; 'O'=outflow at time shown
 --------------------------------------------------------------------
 Time   Inflow  Outflow    Storage                                    Depth
(Hours)  (CFS)   (CFS)      (Ac.Ft) .0       8.2   16.48   24.72   32.96 (Ft.)
 0.083    0.02    0.00       0.000  O       |       |       |       |     0.00
 0.167    0.14    0.00       0.001  O       |       |       |       |     0.00
```

0.250	0.33	0.00	0.002	O					0.00
0.333	0.53	0.01	0.005	O					0.01
0.417	0.63	0.01	0.009	O					0.01
0.500	0.69	0.01	0.014	O					0.02
0.583	0.72	0.02	0.018	O					0.02
0.667	0.74	0.03	0.023	O					0.03
0.750	0.76	0.03	0.028	O					0.04
0.833	0.77	0.04	0.033	O					0.04
0.917	0.78	0.04	0.038	O					0.05
1.000	0.79	0.05	0.043	O					0.06
1.083	0.79	0.05	0.048	O					0.06
1.167	0.80	0.06	0.053	O					0.07
1.250	0.81	0.06	0.059	O					0.08
1.333	0.81	0.07	0.064	O					0.08
1.417	0.82	0.07	0.069	O					0.09
1.500	0.82	0.08	0.074	O					0.10
1.583	0.83	0.09	0.079	O					0.11
1.667	0.83	0.09	0.084	O					0.11
1.750	0.84	0.10	0.089	O					0.12
1.833	0.84	0.10	0.094	O					0.13
1.917	0.84	0.11	0.099	O					0.13
2.000	0.85	0.11	0.105	O					0.14
2.083	0.85	0.12	0.110	O					0.15
2.167	0.85	0.12	0.115	O					0.15
2.250	0.86	0.13	0.120	O					0.16
2.333	0.86	0.13	0.125	O					0.17
2.417	0.86	0.14	0.130	O					0.17
2.500	0.87	0.15	0.135	O					0.18
2.583	0.87	0.15	0.139	O					0.19
2.667	0.87	0.16	0.144	O					0.19
2.750	0.87	0.16	0.149	O					0.20
2.833	0.88	0.17	0.154	O					0.21
2.917	0.88	0.17	0.159	O					0.21
3.000	0.88	0.18	0.164	O					0.22
3.083	0.89	0.18	0.169	O					0.23
3.167	0.89	0.19	0.174	O					0.23
3.250	0.89	0.19	0.179	O					0.24
3.333	0.90	0.20	0.183	O					0.24
3.417	0.90	0.20	0.188	O					0.25
3.500	0.91	0.21	0.193	O					0.26
3.583	0.91	0.21	0.198	O					0.26
3.667	0.91	0.22	0.203	O					0.27
3.750	0.92	0.22	0.207	O					0.28
3.833	0.92	0.23	0.212	O					0.28
3.917	0.92	0.23	0.217	O					0.29
4.000	0.93	0.24	0.222	O					0.30
4.083	0.93	0.24	0.226	O					0.30
4.167	0.93	0.25	0.231	O					0.31
4.250	0.94	0.25	0.236	O					0.31
4.333	0.94	0.26	0.240	O					0.32
4.417	0.95	0.26	0.245	O					0.33
4.500	0.95	0.27	0.250	O					0.33
4.583	0.95	0.27	0.255	O					0.34
4.667	0.96	0.28	0.259	O					0.35
4.750	0.96	0.29	0.264	O					0.35
4.833	0.97	0.29	0.269	O					0.36
4.917	0.97	0.30	0.273	O					0.36
5.000	0.98	0.30	0.278	O					0.37
5.083	0.98	0.31	0.283	O					0.38
5.167	0.98	0.31	0.287	O					0.38
5.250	0.99	0.32	0.292	O					0.39
5.333	0.99	0.32	0.296	O					0.40
5.417	1.00	0.33	0.301	O					0.40
5.500	1.00	0.33	0.306	O					0.41
5.583	1.01	0.34	0.310	O					0.41
5.667	1.01	0.34	0.315	O					0.42
5.750	1.02	0.35	0.320	O					0.43
5.833	1.02	0.35	0.324	O					0.43
5.917	1.03	0.36	0.329	O					0.44
6.000	1.03	0.36	0.333	OI					0.44
6.083	1.04	0.37	0.338	OI					0.45
6.167	1.04	0.37	0.343	OI					0.46
6.250	1.05	0.38	0.347	OI					0.46

6.333	1.05	0.38	0.352	OI	0.47
6.417	1.06	0.39	0.356	OI	0.48
6.500	1.06	0.39	0.361	OI	0.48
6.583	1.07	0.40	0.366	OI	0.49
6.667	1.07	0.40	0.370	OI	0.49
6.750	1.08	0.41	0.375	OI	0.50
6.833	1.08	0.41	0.380	OI	0.51
6.917	1.09	0.42	0.384	OI	0.51
7.000	1.10	0.42	0.389	OI	0.52
7.083	1.10	0.43	0.394	OI	0.52
7.167	1.11	0.43	0.398	OI	0.53
7.250	1.11	0.44	0.403	OI	0.54
7.333	1.12	0.44	0.408	OI	0.54
7.417	1.13	0.45	0.412	OI	0.55
7.500	1.13	0.45	0.417	OI	0.56
7.583	1.14	0.46	0.422	OI	0.56
7.667	1.15	0.46	0.426	OI	0.57
7.750	1.15	0.47	0.431	OI	0.57
7.833	1.16	0.47	0.436	OI	0.58
7.917	1.17	0.48	0.441	OI	0.59
8.000	1.17	0.48	0.445	OI	0.59
8.083	1.18	0.49	0.450	OI	0.60
8.167	1.19	0.49	0.455	OI	0.61
8.250	1.19	0.50	0.460	OI	0.61
8.333	1.20	0.50	0.464	OI	0.62
8.417	1.21	0.51	0.469	OI	0.63
8.500	1.22	0.51	0.474	OI	0.63
8.583	1.22	0.52	0.479	OI	0.64
8.667	1.23	0.52	0.484	OI	0.65
8.750	1.24	0.53	0.489	OI	0.65
8.833	1.25	0.53	0.494	OI	0.66
8.917	1.26	0.54	0.499	OI	0.66
9.000	1.27	0.54	0.504	OI	0.67
9.083	1.27	0.55	0.509	OI	0.68
9.167	1.28	0.55	0.514	OI	0.68
9.250	1.29	0.56	0.519	OI	0.69
9.333	1.30	0.57	0.524	OI	0.70
9.417	1.31	0.57	0.529	OI	0.70
9.500	1.32	0.58	0.534	OI	0.71
9.583	1.33	0.58	0.539	OI	0.72
9.667	1.34	0.59	0.544	OI	0.73
9.750	1.35	0.59	0.549	OI	0.73
9.833	1.36	0.60	0.555	OI	0.74
9.917	1.37	0.60	0.560	OI	0.75
10.000	1.38	0.61	0.565	OI	0.75
10.083	1.39	0.62	0.570	OI	0.76
10.167	1.40	0.62	0.576	OI	0.77
10.250	1.42	0.63	0.581	OI	0.77
10.333	1.43	0.63	0.587	OI	0.78
10.417	1.44	0.64	0.592	OI	0.79
10.500	1.45	0.65	0.598	OI	0.80
10.583	1.46	0.65	0.603	OI	0.80
10.667	1.48	0.66	0.609	OI	0.81
10.750	1.49	0.66	0.615	OI	0.82
10.833	1.50	0.67	0.620	OI	0.83
10.917	1.52	0.68	0.626	OI	0.83
11.000	1.53	0.68	0.632	OI	0.84
11.083	1.55	0.69	0.638	OI	0.85
11.167	1.56	0.70	0.644	OI	0.86
11.250	1.58	0.70	0.650	OI	0.87
11.333	1.59	0.71	0.656	OI	0.87
11.417	1.61	0.71	0.662	OI	0.88
11.500	1.62	0.72	0.668	OI	0.89
11.583	1.64	0.73	0.674	OI	0.90
11.667	1.66	0.74	0.681	OI	0.91
11.750	1.68	0.74	0.687	OI	0.92
11.833	1.70	0.75	0.693	OI	0.92
11.917	1.71	0.76	0.700	OI	0.93
12.000	1.73	0.76	0.707	OI	0.94
12.083	1.75	0.77	0.713	OI	0.95
12.167	1.77	0.78	0.720	OI	0.96
12.250	1.78	0.79	0.727	OI	0.97
12.333	1.80	0.79	0.734	OI	0.98

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12.417    1.82    0.80      0.741  OI      |       |       |       |    0.99
12.500    1.84    0.81      0.748  OI      |       |       |       |    1.00
12.583    1.86    0.81      0.755  OI      |       |       |       |    1.01
12.667    1.89    0.81      0.762  OI      |       |       |       |    1.01
12.750    1.91    0.81      0.770  OI      |       |       |       |    1.02
12.833    1.94    0.81      0.778  OI      |       |       |       |    1.03
12.917    1.97    0.81      0.785  OI      |       |       |       |    1.04
13.000    2.00    0.81      0.794  OI      |       |       |       |    1.05
13.083    2.03    0.81      0.802  OI      |       |       |       |    1.06
13.167    2.06    0.81      0.810  OI      |       |       |       |    1.06
13.250    2.09    0.81      0.819  O I     |       |       |       |    1.07
13.333    2.13    0.81      0.828  O I     |       |       |       |    1.08
13.417    2.16    0.81      0.837  O I     |       |       |       |    1.09
13.500    2.20    0.81      0.847  O I     |       |       |       |    1.10
13.583    2.24    0.81      0.856  O I     |       |       |       |    1.11
13.667    2.28    0.81      0.866  O I     |       |       |       |    1.12
13.750    2.33    0.81      0.877  O I     |       |       |       |    1.13
13.833    2.38    0.81      0.887  O I     |       |       |       |    1.15
13.917    2.43    0.81      0.898  O I     |       |       |       |    1.16
14.000    2.48    0.81      0.910  O I     |       |       |       |    1.17
14.083    2.53    0.81      0.921  O I     |       |       |       |    1.18
14.167    2.59    0.81      0.933  O I     |       |       |       |    1.20
14.250    2.66    0.81      0.946  O I     |       |       |       |    1.21
14.333    2.72    0.81      0.959  O I     |       |       |       |    1.22
14.417    2.80    0.81      0.972  O I     |       |       |       |    1.24
14.500    2.87    0.81      0.986  O I     |       |       |       |    1.25
14.583    2.95    0.81      1.001  O I     |       |       |       |    1.27
14.667    3.04    0.81      1.016  O I     |       |       |       |    1.28
14.750    3.14    0.81      1.031  O  I    |       |       |       |    1.30
14.833    3.25    0.81      1.048  O  I    |       |       |       |    1.32
14.917    3.36    0.81      1.065  O  I    |       |       |       |    1.34
15.000    3.49    0.81      1.083  O  I    |       |       |       |    1.35
15.083    3.63    0.81      1.102  O  I    |       |       |       |    1.37
15.167    3.79    0.81      1.122  O  I    |       |       |       |    1.40
15.250    3.97    0.81      1.143  O  I    |       |       |       |    1.42
15.333    4.17    0.81      1.166  O   I   |       |       |       |    1.44
15.417    4.37    0.81      1.189  O   I   |       |       |       |    1.47
15.500    4.46    0.81      1.214  O   I   |       |       |       |    1.49
15.583    4.47    0.81      1.239  O   I   |       |       |       |    1.52
15.667    4.54    0.81      1.265  O   I   |       |       |       |    1.55
15.750    4.83    0.81      1.291  O   I   |       |       |       |    1.58
15.833    5.36    0.81      1.321  O    I  |       |       |       |    1.61
15.917    6.20    0.81      1.355  O     I |       |       |       |    1.64
16.000    7.72    0.81      1.397  O      I|       |       |       |    1.69
16.083   12.67    0.81      1.462  O       |   I   |       |       |    1.76
16.167   23.88    0.81      1.582  O       |       |      I|       |    1.89
16.250   32.96    0.81      1.773  O       |       |       |       I    2.09
16.333   31.22    0.81      1.988  O       |       |       |     I |    2.32
16.417   19.95    0.81      2.159  O       |       |  I    |       |    2.50
16.500   12.87    0.81      2.266  O       |   I   |       |       |    2.61
16.583    9.42    0.81      2.337  O       |I      |       |       |    2.69
16.667    7.39    0.81      2.389  O      I|       |       |       |    2.74
16.750    6.41    0.81      2.431  O     I |       |       |       |    2.79
16.833    5.77    0.81      2.468  O    I  |       |       |       |    2.83
16.917    4.92    0.81      2.499  O   I   |       |       |       |    2.86
17.000    4.46    0.81      2.526  O   I   |       |       |       |    2.89
17.083    4.08    0.81      2.550  O  I    |       |       |       |    2.91
17.167    3.83    0.81      2.571  O  I    |       |       |       |    2.94
17.250    3.55    0.81      2.591  O  I    |       |       |       |    2.96
17.333    3.31    0.81      2.609  O  I    |       |       |       |    2.98
17.417    3.11    0.81      2.626  O  I    |       |       |       |    3.00
17.500    2.92    0.81      2.641  O I     |       |       |       |    3.01
17.583    2.76    0.81      2.655  O I     |       |       |       |    3.02
17.667    2.61    0.81      2.668  O I     |       |       |       |    3.04
17.750    2.51    0.81      2.680  O I     |       |       |       |    3.05
17.833    2.41    0.81      2.691  O I     |       |       |       |    3.06
17.917    2.28    0.81      2.702  O I     |       |       |       |    3.07
18.000    2.08    0.81      2.711  O I     |       |       |       |    3.08
18.083    2.01    0.81      2.720  OI      |       |       |       |    3.09
18.167    1.95    0.81      2.728  OI      |       |       |       |    3.09
18.250    1.90    0.81      2.735  OI      |       |       |       |    3.10
18.333    1.86    0.81      2.743  OI      |       |       |       |    3.11
18.417    1.81    0.81      2.750  OI      |       |       |       |    3.12
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18.500	1.77	0.81	2.756	OI	3.12
18.583	1.73	0.81	2.763	OI	3.13
18.667	1.69	0.81	2.769	OI	3.13
18.750	1.65	0.81	2.775	OI	3.14
18.833	1.62	0.81	2.781	OI	3.14
18.917	1.59	0.81	2.786	OI	3.15
19.000	1.56	0.81	2.791	OI	3.16
19.083	1.53	0.81	2.796	OI	3.16
19.167	1.50	0.81	2.801	OI	3.16
19.250	1.47	0.81	2.806	OI	3.17
19.333	1.45	0.81	2.810	OI	3.17
19.417	1.42	0.81	2.815	OI	3.18
19.500	1.40	0.81	2.819	OI	3.18
19.583	1.38	0.81	2.823	OI	3.19
19.667	1.36	0.81	2.826	OI	3.19
19.750	1.34	0.81	2.830	OI	3.19
19.833	1.32	0.81	2.834	OI	3.20
19.917	1.30	0.81	2.837	OI	3.20
20.000	1.28	0.81	2.840	OI	3.20
20.083	1.26	0.81	2.844	OI	3.21
20.167	1.24	0.81	2.847	OI	3.21
20.250	1.23	0.81	2.849	OI	3.21
20.333	1.21	0.81	2.852	OI	3.21
20.417	1.20	0.81	2.855	OI	3.22
20.500	1.18	0.81	2.858	OI	3.22
20.583	1.17	0.81	2.860	OI	3.22
20.667	1.15	0.81	2.862	OI	3.22
20.750	1.14	0.81	2.865	OI	3.23
20.833	1.13	0.81	2.867	OI	3.23
20.917	1.12	0.81	2.869	OI	3.23
21.000	1.10	0.81	2.871	OI	3.23
21.083	1.09	0.81	2.873	OI	3.23
21.167	1.08	0.81	2.875	OI	3.24
21.250	1.07	0.81	2.877	OI	3.24
21.333	1.06	0.81	2.879	OI	3.24
21.417	1.05	0.81	2.880	OI	3.24
21.500	1.04	0.81	2.882	OI	3.24
21.583	1.03	0.81	2.883	O	3.24
21.667	1.02	0.81	2.885	O	3.25
21.750	1.01	0.81	2.886	O	3.25
21.833	1.00	0.81	2.888	O	3.25
21.917	0.99	0.81	2.889	O	3.25
22.000	0.98	0.81	2.890	O	3.25
22.083	0.97	0.81	2.891	O	3.25
22.167	0.96	0.81	2.892	O	3.25
22.250	0.96	0.81	2.893	O	3.25
22.333	0.95	0.81	2.894	O	3.25
22.417	0.94	0.81	2.895	O	3.25
22.500	0.93	0.81	2.896	O	3.26
22.583	0.92	0.81	2.897	O	3.26
22.667	0.92	0.81	2.897	O	3.26
22.750	0.91	0.81	2.898	O	3.26
22.833	0.90	0.81	2.899	O	3.26
22.917	0.90	0.81	2.899	O	3.26
23.000	0.89	0.81	2.900	O	3.26
23.083	0.88	0.81	2.900	O	3.26
23.167	0.88	0.81	2.901	O	3.26
23.250	0.87	0.81	2.901	O	3.26
23.333	0.86	0.81	2.902	O	3.26
23.417	0.86	0.81	2.902	O	3.26
23.500	0.85	0.81	2.902	O	3.26
23.583	0.85	0.81	2.903	O	3.26
23.667	0.84	0.81	2.903	O	3.26
23.750	0.83	0.81	2.903	O	3.26
23.833	0.83	0.81	2.903	O	3.26
23.917	0.82	0.81	2.903	O	3.26
24.000	0.82	0.81	2.903	O	3.26
24.083	0.79	0.81	2.903	O	3.26
24.167	0.67	0.81	2.903	O	3.26
24.250	0.47	0.81	2.901	O	3.26
24.333	0.28	0.81	2.898	O	3.26
24.417	0.17	0.81	2.894	O	3.25
24.500	0.12	0.81	2.889	O	3.25

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24.583    0.08    0.81     2.884  O        |        |        |        |     3.24
24.667    0.07    0.81     2.879  O        |        |        |        |     3.24
24.750    0.05    0.81     2.874  O        |        |        |        |     3.23
24.833    0.04    0.81     2.869  O        |        |        |        |     3.23
24.917    0.03    0.81     2.863  O        |        |        |        |     3.22
25.000    0.03    0.81     2.858  O        |        |        |        |     3.22
25.083    0.02    0.81     2.853  O        |        |        |        |     3.21
25.167    0.02    0.81     2.847  O        |        |        |        |     3.21
25.250    0.02    0.81     2.842  O        |        |        |        |     3.20
25.333    0.01    0.81     2.836  O        |        |        |        |     3.20
25.417    0.01    0.81     2.831  O        |        |        |        |     3.19
25.500    0.01    0.81     2.825  O        |        |        |        |     3.19
25.583    0.01    0.81     2.820  O        |        |        |        |     3.18
25.667    0.00    0.81     2.814  O        |        |        |        |     3.18
25.750    0.00    0.81     2.808  O        |        |        |        |     3.17
25.833    0.00    0.81     2.803  O        |        |        |        |     3.17
25.917    0.00    0.81     2.797  O        |        |        |        |     3.16
26.000    0.00    0.81     2.792  O        |        |        |        |     3.16
26.083    0.00    0.81     2.786  O        |        |        |        |     3.15
26.167    0.00    0.81     2.780  O        |        |        |        |     3.14
26.250    0.00    0.81     2.775  O        |        |        |        |     3.14
26.333    0.00    0.81     2.769  O        |        |        |        |     3.13
26.417    0.00    0.81     2.764  O        |        |        |        |     3.13
26.500    0.00    0.81     2.758  O        |        |        |        |     3.12
26.583    0.00    0.81     2.752  O        |        |        |        |     3.12
26.667    0.00    0.81     2.747  O        |        |        |        |     3.11
26.750    0.00    0.81     2.741  O        |        |        |        |     3.11
26.833    0.00    0.81     2.736  O        |        |        |        |     3.10
26.917    0.00    0.81     2.730  O        |        |        |        |     3.10
27.000    0.00    0.81     2.725  O        |        |        |        |     3.09
27.083    0.00    0.81     2.719  O        |        |        |        |     3.09
27.167    0.00    0.81     2.713  O        |        |        |        |     3.08
27.250    0.00    0.81     2.708  O        |        |        |        |     3.07
27.333    0.00    0.81     2.702  O        |        |        |        |     3.07
27.417    0.00    0.81     2.697  O        |        |        |        |     3.06
27.500    0.00    0.81     2.691  O        |        |        |        |     3.06
27.583    0.00    0.81     2.685  O        |        |        |        |     3.05
27.667    0.00    0.81     2.680  O        |        |        |        |     3.05
27.750    0.00    0.81     2.674  O        |        |        |        |     3.04
27.833    0.00    0.81     2.669  O        |        |        |        |     3.04
27.917    0.00    0.81     2.663  O        |        |        |        |     3.03
28.000    0.00    0.81     2.657  O        |        |        |        |     3.03
28.083    0.00    0.81     2.652  O        |        |        |        |     3.02
28.167    0.00    0.81     2.646  O        |        |        |        |     3.02
28.250    0.00    0.81     2.641  O        |        |        |        |     3.01
28.333    0.00    0.81     2.635  O        |        |        |        |     3.00
28.417    0.00    0.81     2.629  O        |        |        |        |     3.00
28.500    0.00    0.81     2.624  O        |        |        |        |     2.99
28.583    0.00    0.81     2.618  O        |        |        |        |     2.99
28.667    0.00    0.81     2.613  O        |        |        |        |     2.98
28.750    0.00    0.81     2.607  O        |        |        |        |     2.98
28.833    0.00    0.81     2.601  O        |        |        |        |     2.97
28.917    0.00    0.81     2.596  O        |        |        |        |     2.96
29.000    0.00    0.81     2.590  O        |        |        |        |     2.96
29.083    0.00    0.81     2.585  O        |        |        |        |     2.95
29.167    0.00    0.81     2.579  O        |        |        |        |     2.95
29.250    0.00    0.81     2.574  O        |        |        |        |     2.94
29.333    0.00    0.81     2.568  O        |        |        |        |     2.93
29.417    0.00    0.81     2.562  O        |        |        |        |     2.93
29.500    0.00    0.81     2.557  O        |        |        |        |     2.92
29.583    0.00    0.81     2.551  O        |        |        |        |     2.92
29.667    0.00    0.81     2.546  O        |        |        |        |     2.91
29.750    0.00    0.81     2.540  O        |        |        |        |     2.90
29.833    0.00    0.81     2.534  O        |        |        |        |     2.90
29.917    0.00    0.81     2.529  O        |        |        |        |     2.89
30.000    0.00    0.81     2.523  O        |        |        |        |     2.89
30.083    0.00    0.81     2.518  O        |        |        |        |     2.88
30.167    0.00    0.81     2.512  O        |        |        |        |     2.87
30.250    0.00    0.81     2.506  O        |        |        |        |     2.87
30.333    0.00    0.81     2.501  O        |        |        |        |     2.86
30.417    0.00    0.81     2.495  O        |        |        |        |     2.86
30.500    0.00    0.81     2.490  O        |        |        |        |     2.85
30.583    0.00    0.81     2.484  O        |        |        |        |     2.84
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30.667	0.00	0.81	2.478	O	2.84
30.750	0.00	0.81	2.473	O	2.83
30.833	0.00	0.81	2.467	O	2.83
30.917	0.00	0.81	2.462	O	2.82
31.000	0.00	0.81	2.456	O	2.81
31.083	0.00	0.81	2.450	O	2.81
31.167	0.00	0.81	2.445	O	2.80
31.250	0.00	0.81	2.439	O	2.80
31.333	0.00	0.81	2.434	O	2.79
31.417	0.00	0.81	2.428	O	2.79
31.500	0.00	0.81	2.423	O	2.78
31.583	0.00	0.81	2.417	O	2.77
31.667	0.00	0.81	2.411	O	2.77
31.750	0.00	0.81	2.406	O	2.76
31.833	0.00	0.81	2.400	O	2.76
31.917	0.00	0.81	2.395	O	2.75
32.000	0.00	0.81	2.389	O	2.74
32.083	0.00	0.81	2.383	O	2.74
32.167	0.00	0.81	2.378	O	2.73
32.250	0.00	0.81	2.372	O	2.73
32.333	0.00	0.81	2.367	O	2.72
32.417	0.00	0.81	2.361	O	2.71
32.500	0.00	0.81	2.355	O	2.71
32.583	0.00	0.81	2.350	O	2.70
32.667	0.00	0.81	2.344	O	2.70
32.750	0.00	0.81	2.339	O	2.69
32.833	0.00	0.81	2.333	O	2.68
32.917	0.00	0.81	2.328	O	2.68
33.000	0.00	0.81	2.322	O	2.67
33.083	0.00	0.81	2.316	O	2.67
33.167	0.00	0.81	2.311	O	2.66
33.250	0.00	0.81	2.305	O	2.65
33.333	0.00	0.81	2.300	O	2.65
33.417	0.00	0.81	2.294	O	2.64
33.500	0.00	0.81	2.288	O	2.64
33.583	0.00	0.81	2.283	O	2.63
33.667	0.00	0.81	2.277	O	2.62
33.750	0.00	0.81	2.272	O	2.62
33.833	0.00	0.81	2.266	O	2.61
33.917	0.00	0.81	2.260	O	2.61
34.000	0.00	0.81	2.255	O	2.60
34.083	0.00	0.81	2.249	O	2.59
34.167	0.00	0.81	2.244	O	2.59
34.250	0.00	0.81	2.238	O	2.58
34.333	0.00	0.81	2.232	O	2.58
34.417	0.00	0.81	2.227	O	2.57
34.500	0.00	0.81	2.221	O	2.57
34.583	0.00	0.81	2.216	O	2.56
34.667	0.00	0.81	2.210	O	2.55
34.750	0.00	0.81	2.205	O	2.55
34.833	0.00	0.81	2.199	O	2.54
34.917	0.00	0.81	2.193	O	2.54
35.000	0.00	0.81	2.188	O	2.53
35.083	0.00	0.81	2.182	O	2.52
35.167	0.00	0.81	2.177	O	2.52
35.250	0.00	0.81	2.171	O	2.51
35.333	0.00	0.81	2.165	O	2.51
35.417	0.00	0.81	2.160	O	2.50
35.500	0.00	0.81	2.154	O	2.49
35.583	0.00	0.81	2.149	O	2.49
35.667	0.00	0.81	2.143	O	2.48
35.750	0.00	0.81	2.137	O	2.48
35.833	0.00	0.81	2.132	O	2.47
35.917	0.00	0.81	2.126	O	2.46
36.000	0.00	0.81	2.121	O	2.46
36.083	0.00	0.81	2.115	O	2.45
36.167	0.00	0.81	2.110	O	2.45
36.250	0.00	0.81	2.104	O	2.44
36.333	0.00	0.81	2.098	O	2.43
36.417	0.00	0.81	2.093	O	2.43
36.500	0.00	0.81	2.087	O	2.42
36.583	0.00	0.81	2.082	O	2.42
36.667	0.00	0.81	2.076	O	2.41

36.750	0.00	0.81	2.070	O	2.40
36.833	0.00	0.81	2.065	O	2.40
36.917	0.00	0.81	2.059	O	2.39
37.000	0.00	0.81	2.054	O	2.39
37.083	0.00	0.81	2.048	O	2.38
37.167	0.00	0.81	2.042	O	2.37
37.250	0.00	0.81	2.037	O	2.37
37.333	0.00	0.81	2.031	O	2.36
37.417	0.00	0.81	2.026	O	2.36
37.500	0.00	0.81	2.020	O	2.35
37.583	0.00	0.81	2.015	O	2.35
37.667	0.00	0.81	2.009	O	2.34
37.750	0.00	0.81	2.003	O	2.33
37.833	0.00	0.81	1.998	O	2.33
37.917	0.00	0.81	1.992	O	2.32
38.000	0.00	0.81	1.987	O	2.32
38.083	0.00	0.81	1.981	O	2.31
38.167	0.00	0.81	1.975	O	2.30
38.250	0.00	0.81	1.970	O	2.30
38.333	0.00	0.81	1.964	O	2.29
38.417	0.00	0.81	1.959	O	2.29
38.500	0.00	0.81	1.953	O	2.28
38.583	0.00	0.81	1.947	O	2.27
38.667	0.00	0.81	1.942	O	2.27
38.750	0.00	0.81	1.936	O	2.26
38.833	0.00	0.81	1.931	O	2.26
38.917	0.00	0.81	1.925	O	2.25
39.000	0.00	0.81	1.920	O	2.24
39.083	0.00	0.81	1.914	O	2.24
39.167	0.00	0.81	1.908	O	2.23
39.250	0.00	0.81	1.903	O	2.23
39.333	0.00	0.81	1.897	O	2.22
39.417	0.00	0.81	1.892	O	2.21
39.500	0.00	0.81	1.886	O	2.21
39.583	0.00	0.81	1.880	O	2.20
39.667	0.00	0.81	1.875	O	2.20
39.750	0.00	0.81	1.869	O	2.19
39.833	0.00	0.81	1.864	O	2.18
39.917	0.00	0.81	1.858	O	2.18
40.000	0.00	0.81	1.852	O	2.17
40.083	0.00	0.81	1.847	O	2.17
40.167	0.00	0.81	1.841	O	2.16
40.250	0.00	0.81	1.836	O	2.16
40.333	0.00	0.81	1.830	O	2.15
40.417	0.00	0.81	1.825	O	2.14
40.500	0.00	0.81	1.819	O	2.14
40.583	0.00	0.81	1.813	O	2.13
40.667	0.00	0.81	1.808	O	2.13
40.750	0.00	0.81	1.802	O	2.12
40.833	0.00	0.81	1.797	O	2.11
40.917	0.00	0.81	1.791	O	2.11
41.000	0.00	0.81	1.785	O	2.10
41.083	0.00	0.81	1.780	O	2.10
41.167	0.00	0.81	1.774	O	2.09
41.250	0.00	0.81	1.769	O	2.08
41.333	0.00	0.81	1.763	O	2.08
41.417	0.00	0.81	1.758	O	2.07
41.500	0.00	0.81	1.752	O	2.07
41.583	0.00	0.81	1.746	O	2.06
41.667	0.00	0.81	1.741	O	2.05
41.750	0.00	0.81	1.735	O	2.05
41.833	0.00	0.81	1.730	O	2.04
41.917	0.00	0.81	1.724	O	2.04
42.000	0.00	0.81	1.718	O	2.03
42.083	0.00	0.81	1.713	O	2.02
42.167	0.00	0.81	1.707	O	2.02
42.250	0.00	0.81	1.702	O	2.01
42.333	0.00	0.81	1.696	O	2.01
42.417	0.00	0.81	1.691	O	2.00
42.500	0.00	0.81	1.685	O	1.99
42.583	0.00	0.81	1.679	O	1.99
42.667	0.00	0.81	1.674	O	1.98
42.750	0.00	0.81	1.668	O	1.98

42.833	0.00	0.81	1.663	O	1.97
42.917	0.00	0.81	1.657	O	1.96
43.000	0.00	0.81	1.651	O	1.96
43.083	0.00	0.81	1.646	O	1.95
43.167	0.00	0.81	1.640	O	1.95
43.250	0.00	0.81	1.635	O	1.94
43.333	0.00	0.81	1.629	O	1.94
43.417	0.00	0.81	1.623	O	1.93
43.500	0.00	0.81	1.618	O	1.92
43.583	0.00	0.81	1.612	O	1.92
43.667	0.00	0.81	1.607	O	1.91
43.750	0.00	0.81	1.601	O	1.91
43.833	0.00	0.81	1.596	O	1.90
43.917	0.00	0.81	1.590	O	1.89
44.000	0.00	0.81	1.584	O	1.89
44.083	0.00	0.81	1.579	O	1.88
44.167	0.00	0.81	1.573	O	1.88
44.250	0.00	0.81	1.568	O	1.87
44.333	0.00	0.81	1.562	O	1.86
44.417	0.00	0.81	1.556	O	1.86
44.500	0.00	0.81	1.551	O	1.85
44.583	0.00	0.81	1.545	O	1.85
44.667	0.00	0.81	1.540	O	1.84
44.750	0.00	0.81	1.534	O	1.83
44.833	0.00	0.81	1.529	O	1.83
44.917	0.00	0.81	1.523	O	1.82
45.000	0.00	0.81	1.517	O	1.82
45.083	0.00	0.81	1.512	O	1.81
45.167	0.00	0.81	1.506	O	1.80
45.250	0.00	0.81	1.501	O	1.80
45.333	0.00	0.81	1.495	O	1.79
45.417	0.00	0.81	1.489	O	1.79
45.500	0.00	0.81	1.484	O	1.78
45.583	0.00	0.81	1.478	O	1.77
45.667	0.00	0.81	1.473	O	1.77
45.750	0.00	0.81	1.467	O	1.76
45.833	0.00	0.81	1.462	O	1.76
45.917	0.00	0.81	1.456	O	1.75
46.000	0.00	0.81	1.450	O	1.75
46.083	0.00	0.81	1.445	O	1.74
46.167	0.00	0.81	1.439	O	1.73
46.250	0.00	0.81	1.434	O	1.73
46.333	0.00	0.81	1.428	O	1.72
46.417	0.00	0.81	1.422	O	1.72
46.500	0.00	0.81	1.417	O	1.71
46.583	0.00	0.81	1.411	O	1.70
46.667	0.00	0.81	1.406	O	1.70
46.750	0.00	0.81	1.400	O	1.69
46.833	0.00	0.81	1.395	O	1.69
46.917	0.00	0.81	1.389	O	1.68
47.000	0.00	0.81	1.383	O	1.67
47.083	0.00	0.81	1.378	O	1.67
47.167	0.00	0.81	1.372	O	1.66
47.250	0.00	0.81	1.367	O	1.66
47.333	0.00	0.81	1.361	O	1.65
47.417	0.00	0.81	1.355	O	1.64
47.500	0.00	0.81	1.350	O	1.64
47.583	0.00	0.81	1.344	O	1.63
47.667	0.00	0.81	1.339	O	1.63
47.750	0.00	0.81	1.333	O	1.62
47.833	0.00	0.81	1.328	O	1.61
47.917	0.00	0.81	1.322	O	1.61
48.000	0.00	0.81	1.316	O	1.60
48.083	0.00	0.81	1.311	O	1.60
48.167	0.00	0.81	1.305	O	1.59
48.250	0.00	0.81	1.300	O	1.58
48.333	0.00	0.81	1.294	O	1.58
48.417	0.00	0.81	1.288	O	1.57
48.500	0.00	0.81	1.283	O	1.57
48.583	0.00	0.81	1.277	O	1.56
48.667	0.00	0.81	1.272	O	1.56
48.750	0.00	0.81	1.266	O	1.55
48.833	0.00	0.81	1.261	O	1.54

48.917	0.00	0.81	1.255	O					1.54
49.000	0.00	0.81	1.249	O					1.53
49.083	0.00	0.81	1.244	O					1.53
49.167	0.00	0.81	1.238	O					1.52
49.250	0.00	0.81	1.233	O					1.51
49.333	0.00	0.81	1.227	O					1.51
49.417	0.00	0.81	1.221	O					1.50
49.500	0.00	0.81	1.216	O					1.50
49.583	0.00	0.81	1.210	O					1.49
49.667	0.00	0.81	1.205	O					1.48
49.750	0.00	0.81	1.199	O					1.48
49.833	0.00	0.81	1.194	O					1.47
49.917	0.00	0.81	1.188	O					1.47
50.000	0.00	0.81	1.182	O					1.46
50.083	0.00	0.81	1.177	O					1.45
50.167	0.00	0.81	1.171	O					1.45
50.250	0.00	0.81	1.166	O					1.44
50.333	0.00	0.81	1.160	O					1.44
50.417	0.00	0.81	1.154	O					1.43
50.500	0.00	0.81	1.149	O					1.42
50.583	0.00	0.81	1.143	O					1.42
50.667	0.00	0.81	1.138	O					1.41
50.750	0.00	0.81	1.132	O					1.41
50.833	0.00	0.81	1.127	O					1.40
50.917	0.00	0.81	1.121	O					1.39
51.000	0.00	0.81	1.115	O					1.39
51.083	0.00	0.81	1.110	O					1.38
51.167	0.00	0.81	1.104	O					1.38
51.250	0.00	0.81	1.099	O					1.37
51.333	0.00	0.81	1.093	O					1.36
51.417	0.00	0.81	1.088	O					1.36
51.500	0.00	0.81	1.082	O					1.35
51.583	0.00	0.81	1.076	O					1.35
51.667	0.00	0.81	1.071	O					1.34
51.750	0.00	0.81	1.065	O					1.34
51.833	0.00	0.81	1.060	O					1.33
51.917	0.00	0.81	1.054	O					1.32
52.000	0.00	0.81	1.048	O					1.32
52.083	0.00	0.81	1.043	O					1.31
52.167	0.00	0.81	1.037	O					1.31
52.250	0.00	0.81	1.032	O					1.30
52.333	0.00	0.81	1.026	O					1.29
52.417	0.00	0.81	1.021	O					1.29
52.500	0.00	0.81	1.015	O					1.28
52.583	0.00	0.81	1.009	O					1.28
52.667	0.00	0.81	1.004	O					1.27
52.750	0.00	0.81	0.998	O					1.26
52.833	0.00	0.81	0.993	O					1.26
52.917	0.00	0.81	0.987	O					1.25
53.000	0.00	0.81	0.981	O					1.25
53.083	0.00	0.81	0.976	O					1.24
53.167	0.00	0.81	0.970	O					1.23
53.250	0.00	0.81	0.965	O					1.23
53.333	0.00	0.81	0.959	O					1.22
53.417	0.00	0.81	0.954	O					1.22
53.500	0.00	0.81	0.948	O					1.21
53.583	0.00	0.81	0.942	O					1.20
53.667	0.00	0.81	0.937	O					1.20
53.750	0.00	0.81	0.931	O					1.19
53.833	0.00	0.81	0.926	O					1.19
53.917	0.00	0.81	0.920	O					1.18
54.000	0.00	0.81	0.915	O					1.18
54.083	0.00	0.81	0.909	O					1.17
54.167	0.00	0.81	0.903	O					1.16
54.250	0.00	0.81	0.898	O					1.16
54.333	0.00	0.81	0.892	O					1.15
54.417	0.00	0.81	0.887	O					1.15
54.500	0.00	0.81	0.881	O					1.14
54.583	0.00	0.81	0.875	O					1.13
54.667	0.00	0.81	0.870	O					1.13
54.750	0.00	0.81	0.864	O					1.12
54.833	0.00	0.81	0.859	O					1.12
54.917	0.00	0.81	0.853	O					1.11

55.000	0.00	0.81	0.848	O					1.10
55.083	0.00	0.81	0.842	O					1.10
55.167	0.00	0.81	0.836	O					1.09
55.250	0.00	0.81	0.831	O					1.09
55.333	0.00	0.81	0.825	O					1.08
55.417	0.00	0.81	0.820	O					1.07
55.500	0.00	0.81	0.814	O					1.07
55.583	0.00	0.81	0.809	O					1.06
55.667	0.00	0.81	0.803	O					1.06
55.750	0.00	0.81	0.797	O					1.05
55.833	0.00	0.81	0.792	O					1.04
55.917	0.00	0.81	0.786	O					1.04
56.000	0.00	0.81	0.781	O					1.03
56.083	0.00	0.81	0.775	O					1.03
56.167	0.00	0.81	0.769	O					1.02
56.250	0.00	0.81	0.764	O					1.01
56.333	0.00	0.81	0.758	O					1.01
56.417	0.00	0.81	0.753	O					1.00
56.500	0.00	0.81	0.747	O					1.00
56.583	0.00	0.80	0.742	O					0.99
56.667	0.00	0.80	0.736	O					0.98
56.750	0.00	0.79	0.731	O					0.97
56.833	0.00	0.78	0.725	O					0.97
56.917	0.00	0.78	0.720	O					0.96
57.000	0.00	0.77	0.715	O					0.95
57.083	0.00	0.77	0.709	O					0.95
57.167	0.00	0.76	0.704	O					0.94
57.250	0.00	0.75	0.699	O					0.93
57.333	0.00	0.75	0.694	O					0.92
57.417	0.00	0.74	0.688	O					0.92
57.500	0.00	0.74	0.683	O					0.91
57.583	0.00	0.73	0.678	O					0.90
57.667	0.00	0.73	0.673	O					0.90
57.750	0.00	0.72	0.668	O					0.89
57.833	0.00	0.72	0.663	O					0.88
57.917	0.00	0.71	0.658	O					0.88
58.000	0.00	0.71	0.654	O					0.87
58.083	0.00	0.70	0.649	O					0.86
58.167	0.00	0.70	0.644	O					0.86
58.250	0.00	0.69	0.639	O					0.85
58.333	0.00	0.69	0.634	O					0.85
58.417	0.00	0.68	0.630	O					0.84
58.500	0.00	0.68	0.625	O					0.83
58.583	0.00	0.67	0.620	O					0.83
58.667	0.00	0.67	0.616	O					0.82
58.750	0.00	0.66	0.611	O					0.81
58.833	0.00	0.66	0.607	O					0.81
58.917	0.00	0.65	0.602	O					0.80
59.000	0.00	0.65	0.598	O					0.80
59.083	0.00	0.64	0.593	O					0.79
59.167	0.00	0.64	0.589	O					0.79
59.250	0.00	0.63	0.585	O					0.78
59.333	0.00	0.63	0.580	O					0.77
59.417	0.00	0.62	0.576	O					0.77
59.500	0.00	0.62	0.572	O					0.76
59.583	0.00	0.61	0.567	O					0.76
59.667	0.00	0.61	0.563	O					0.75
59.750	0.00	0.60	0.559	O					0.75
59.833	0.00	0.60	0.555	O					0.74
59.917	0.00	0.59	0.551	O					0.73
60.000	0.00	0.59	0.547	O					0.73
60.083	0.00	0.59	0.543	O					0.72
60.167	0.00	0.58	0.539	O					0.72
60.250	0.00	0.58	0.535	O					0.71
60.333	0.00	0.57	0.531	O					0.71
60.417	0.00	0.57	0.527	O					0.70
60.500	0.00	0.56	0.523	O					0.70
60.583	0.00	0.56	0.519	O					0.69
60.667	0.00	0.56	0.515	O					0.69
60.750	0.00	0.55	0.511	O					0.68
60.833	0.00	0.55	0.508	O					0.68
60.917	0.00	0.54	0.504	O					0.67
61.000	0.00	0.54	0.500	O					0.67

61.083	0.00	0.54	0.496	O	0.66
61.167	0.00	0.53	0.493	O	0.66
61.250	0.00	0.53	0.489	O	0.65
61.333	0.00	0.52	0.485	O	0.65
61.417	0.00	0.52	0.482	O	0.64
61.500	0.00	0.52	0.478	O	0.64
61.583	0.00	0.51	0.475	O	0.63
61.667	0.00	0.51	0.471	O	0.63
61.750	0.00	0.51	0.468	O	0.62
61.833	0.00	0.50	0.464	O	0.62
61.917	0.00	0.50	0.461	O	0.61
62.000	0.00	0.49	0.457	O	0.61
62.083	0.00	0.49	0.454	O	0.61
62.167	0.00	0.49	0.451	O	0.60
62.250	0.00	0.48	0.447	O	0.60
62.333	0.00	0.48	0.444	O	0.59
62.417	0.00	0.48	0.441	O	0.59
62.500	0.00	0.47	0.437	O	0.58
62.583	0.00	0.47	0.434	O	0.58
62.667	0.00	0.47	0.431	O	0.57
62.750	0.00	0.46	0.428	O	0.57
62.833	0.00	0.46	0.425	O	0.57
62.917	0.00	0.46	0.421	O	0.56
63.000	0.00	0.45	0.418	O	0.56
63.083	0.00	0.45	0.415	O	0.55
63.167	0.00	0.45	0.412	O	0.55
63.250	0.00	0.44	0.409	O	0.55
63.333	0.00	0.44	0.406	O	0.54
63.417	0.00	0.44	0.403	O	0.54
63.500	0.00	0.43	0.400	O	0.53
63.583	0.00	0.43	0.397	O	0.53
63.667	0.00	0.43	0.394	O	0.53
63.750	0.00	0.42	0.391	O	0.52
63.833	0.00	0.42	0.388	O	0.52
63.917	0.00	0.42	0.385	O	0.51
64.000	0.00	0.41	0.383	O	0.51
64.083	0.00	0.41	0.380	O	0.51
64.167	0.00	0.41	0.377	O	0.50
64.250	0.00	0.40	0.374	O	0.50
64.333	0.00	0.40	0.371	O	0.50
64.417	0.00	0.40	0.369	O	0.49
64.500	0.00	0.40	0.366	O	0.49
64.583	0.00	0.39	0.363	O	0.48
64.667	0.00	0.39	0.360	O	0.48
64.750	0.00	0.39	0.358	O	0.48
64.833	0.00	0.38	0.355	O	0.47
64.917	0.00	0.38	0.352	O	0.47
65.000	0.00	0.38	0.350	O	0.47
65.083	0.00	0.38	0.347	O	0.46
65.167	0.00	0.37	0.345	O	0.46
65.250	0.00	0.37	0.342	O	0.46
65.333	0.00	0.37	0.340	O	0.45
65.417	0.00	0.36	0.337	O	0.45
65.500	0.00	0.36	0.335	O	0.45
65.583	0.00	0.36	0.332	O	0.44
65.667	0.00	0.36	0.330	O	0.44
65.750	0.00	0.35	0.327	O	0.44
65.833	0.00	0.35	0.325	O	0.43
65.917	0.00	0.35	0.322	O	0.43
66.000	0.00	0.35	0.320	O	0.43
66.083	0.00	0.34	0.318	O	0.42
66.167	0.00	0.34	0.315	O	0.42
66.250	0.00	0.34	0.313	O	0.42
66.333	0.00	0.34	0.311	O	0.41
66.417	0.00	0.33	0.308	O	0.41
66.500	0.00	0.33	0.306	O	0.41
66.583	0.00	0.33	0.304	O	0.41
66.667	0.00	0.33	0.302	O	0.40
66.750	0.00	0.32	0.299	O	0.40
66.833	0.00	0.32	0.297	O	0.40
66.917	0.00	0.32	0.295	O	0.39
67.000	0.00	0.32	0.293	O	0.39
67.083	0.00	0.31	0.291	O	0.39

67.167	0.00	0.31	0.288	O	0.38
67.250	0.00	0.31	0.286	O	0.38
67.333	0.00	0.31	0.284	O	0.38
67.417	0.00	0.30	0.282	O	0.38
67.500	0.00	0.30	0.280	O	0.37
67.583	0.00	0.30	0.278	O	0.37
67.667	0.00	0.30	0.276	O	0.37
67.750	0.00	0.30	0.274	O	0.36
67.833	0.00	0.29	0.272	O	0.36
67.917	0.00	0.29	0.270	O	0.36
68.000	0.00	0.29	0.268	O	0.36
68.083	0.00	0.29	0.266	O	0.35
68.167	0.00	0.28	0.264	O	0.35
68.250	0.00	0.28	0.262	O	0.35
68.333	0.00	0.28	0.260	O	0.35
68.417	0.00	0.28	0.258	O	0.34
68.500	0.00	0.28	0.256	O	0.34
68.583	0.00	0.27	0.254	O	0.34
68.667	0.00	0.27	0.252	O	0.34
68.750	0.00	0.27	0.250	O	0.33
68.833	0.00	0.27	0.249	O	0.33
68.917	0.00	0.27	0.247	O	0.33
69.000	0.00	0.26	0.245	O	0.33
69.083	0.00	0.26	0.243	O	0.32
69.167	0.00	0.26	0.241	O	0.32
69.250	0.00	0.26	0.239	O	0.32
69.333	0.00	0.26	0.238	O	0.32
69.417	0.00	0.25	0.236	O	0.31
69.500	0.00	0.25	0.234	O	0.31
69.583	0.00	0.25	0.232	O	0.31
69.667	0.00	0.25	0.231	O	0.31
69.750	0.00	0.25	0.229	O	0.31
69.833	0.00	0.25	0.227	O	0.30
69.917	0.00	0.24	0.226	O	0.30
70.000	0.00	0.24	0.224	O	0.30
70.083	0.00	0.24	0.222	O	0.30
70.167	0.00	0.24	0.221	O	0.29
70.250	0.00	0.24	0.219	O	0.29
70.333	0.00	0.23	0.217	O	0.29
70.417	0.00	0.23	0.216	O	0.29
70.500	0.00	0.23	0.214	O	0.29
70.583	0.00	0.23	0.213	O	0.28
70.667	0.00	0.23	0.211	O	0.28
70.750	0.00	0.23	0.209	O	0.28
70.833	0.00	0.22	0.208	O	0.28
70.917	0.00	0.22	0.206	O	0.28
71.000	0.00	0.22	0.205	O	0.27
71.083	0.00	0.22	0.203	O	0.27
71.167	0.00	0.22	0.202	O	0.27
71.250	0.00	0.22	0.200	O	0.27
71.333	0.00	0.21	0.199	O	0.27
71.417	0.00	0.21	0.197	O	0.26
71.500	0.00	0.21	0.196	O	0.26
71.583	0.00	0.21	0.194	O	0.26
71.667	0.00	0.21	0.193	O	0.26
71.750	0.00	0.21	0.192	O	0.26
71.833	0.00	0.21	0.190	O	0.25
71.917	0.00	0.20	0.189	O	0.25
72.000	0.00	0.20	0.187	O	0.25
72.083	0.00	0.20	0.186	O	0.25
72.167	0.00	0.20	0.185	O	0.25
72.250	0.00	0.20	0.183	O	0.24
72.333	0.00	0.20	0.182	O	0.24
72.417	0.00	0.19	0.180	O	0.24
72.500	0.00	0.19	0.179	O	0.24
72.583	0.00	0.19	0.178	O	0.24
72.667	0.00	0.19	0.176	O	0.24
72.750	0.00	0.19	0.175	O	0.23
72.833	0.00	0.19	0.174	O	0.23
72.917	0.00	0.19	0.173	O	0.23
73.000	0.00	0.19	0.171	O	0.23
73.083	0.00	0.18	0.170	O	0.23
73.167	0.00	0.18	0.169	O	0.23

73.250	0.00	0.18	0.168	O	0.22
73.333	0.00	0.18	0.166	O	0.22
73.417	0.00	0.18	0.165	O	0.22
73.500	0.00	0.18	0.164	O	0.22
73.583	0.00	0.18	0.163	O	0.22
73.667	0.00	0.17	0.161	O	0.22
73.750	0.00	0.17	0.160	O	0.21
73.833	0.00	0.17	0.159	O	0.21
73.917	0.00	0.17	0.158	O	0.21
74.000	0.00	0.17	0.157	O	0.21
74.083	0.00	0.17	0.156	O	0.21
74.167	0.00	0.17	0.154	O	0.21
74.250	0.00	0.17	0.153	O	0.20
74.333	0.00	0.16	0.152	O	0.20
74.417	0.00	0.16	0.151	O	0.20
74.500	0.00	0.16	0.150	O	0.20
74.583	0.00	0.16	0.149	O	0.20
74.667	0.00	0.16	0.148	O	0.20
74.750	0.00	0.16	0.147	O	0.20
74.833	0.00	0.16	0.145	O	0.19
74.917	0.00	0.16	0.144	O	0.19
75.000	0.00	0.15	0.143	O	0.19
75.083	0.00	0.15	0.142	O	0.19
75.167	0.00	0.15	0.141	O	0.19
75.250	0.00	0.15	0.140	O	0.19
75.333	0.00	0.15	0.139	O	0.19
75.417	0.00	0.15	0.138	O	0.18
75.500	0.00	0.15	0.137	O	0.18
75.583	0.00	0.15	0.136	O	0.18
75.667	0.00	0.15	0.135	O	0.18
75.750	0.00	0.14	0.134	O	0.18
75.833	0.00	0.14	0.133	O	0.18
75.917	0.00	0.14	0.132	O	0.18
76.000	0.00	0.14	0.131	O	0.17
76.083	0.00	0.14	0.130	O	0.17
76.167	0.00	0.14	0.129	O	0.17
76.250	0.00	0.14	0.128	O	0.17
76.333	0.00	0.14	0.127	O	0.17
76.417	0.00	0.14	0.126	O	0.17
76.500	0.00	0.14	0.125	O	0.17
76.583	0.00	0.13	0.124	O	0.17
76.667	0.00	0.13	0.124	O	0.16
76.750	0.00	0.13	0.123	O	0.16
76.833	0.00	0.13	0.122	O	0.16
76.917	0.00	0.13	0.121	O	0.16
77.000	0.00	0.13	0.120	O	0.16
77.083	0.00	0.13	0.119	O	0.16
77.167	0.00	0.13	0.118	O	0.16
77.250	0.00	0.13	0.117	O	0.16
77.333	0.00	0.13	0.116	O	0.16
77.417	0.00	0.12	0.116	O	0.15
77.500	0.00	0.12	0.115	O	0.15
77.583	0.00	0.12	0.114	O	0.15
77.667	0.00	0.12	0.113	O	0.15
77.750	0.00	0.12	0.112	O	0.15
77.833	0.00	0.12	0.111	O	0.15
77.917	0.00	0.12	0.110	O	0.15
78.000	0.00	0.12	0.110	O	0.15
78.083	0.00	0.12	0.109	O	0.15
78.167	0.00	0.12	0.108	O	0.14
78.250	0.00	0.12	0.107	O	0.14
78.333	0.00	0.11	0.106	O	0.14
78.417	0.00	0.11	0.106	O	0.14
78.500	0.00	0.11	0.105	O	0.14
78.583	0.00	0.11	0.104	O	0.14
78.667	0.00	0.11	0.103	O	0.14
78.750	0.00	0.11	0.103	O	0.14
78.833	0.00	0.11	0.102	O	0.14
78.917	0.00	0.11	0.101	O	0.13
79.000	0.00	0.11	0.100	O	0.13
79.083	0.00	0.11	0.100	O	0.13
79.167	0.00	0.11	0.099	O	0.13
79.250	0.00	0.11	0.098	O	0.13

```
79.333    0.00    0.11      0.097  O       |       |       |       |     0.13
79.417    0.00    0.10      0.097  O       |       |       |       |     0.13
79.500    0.00    0.10      0.096  O       |       |       |       |     0.13
79.583    0.00    0.10      0.095  O       |       |       |       |     0.13
79.667    0.00    0.10      0.094  O       |       |       |       |     0.13
79.750    0.00    0.10      0.094  O       |       |       |       |     0.13
79.833    0.00    0.10      0.093  O       |       |       |       |     0.12
79.917    0.00    0.10      0.092  O       |       |       |       |     0.12

       Remaining water in basin =    0.09 (Ac.Ft)

       ****************************HYDROGRAPH DATA****************************
                       Number of intervals =   959
                       Time interval =    5.0 (Min.)
                       Maximum/Peak flow rate =        0.813 (CFS)
                       Total volume =       3.997 (Ac.Ft)
               Status of hydrographs being held in storage
                          Stream 1  Stream 2  Stream 3  Stream 4  Stream 5
               Peak (CFS)      0.000     0.000     0.000     0.000     0.000
               Vol (Ac.Ft)      0.000     0.000     0.000     0.000     0.000
       ***********************************************************************

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                  FLOOD HYDROGRAPH ROUTING PROGRAM
         Copyright (c) CIVILCADD/CIVILDESIGN, 1989 - 2004
                     Study date: 11/01/22


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 Cordova Site
 Basin A3 Routing
 10-year, 24-hours storm

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 Program License Serial Number 4009

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

                From study/file name: CordovaUHprA310.rte
 ****************************HYDROGRAPH DATA***************************
                Number of intervals =   310
                Time interval =    5.0 (Min.)
                Maximum/Peak flow rate =       81.084 (CFS)
                Total volume =      10.069 (Ac.Ft)
        Status of hydrographs being held in storage
                   Stream 1  Stream 2  Stream 3  Stream 4  Stream 5
        Peak (CFS)      0.000     0.000     0.000     0.000     0.000
        Vol (Ac.Ft)      0.000     0.000     0.000     0.000     0.000
 **********************************************************************



 ++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
 Process from Point/Station        1.000 to Point/Station       2.000
 **** RETARDING BASIN ROUTING ****
 ______________________________________________________________________

 User entry of depth-outflow-storage data
 -------------------------------------------------------------------
 Total number of inflow hydrograph intervals = 310
 Hydrograph time unit =  5.000 (Min.)
 Initial depth in storage basin =   0.00(Ft.)
 -------------------------------------------------------------------
 -------------------------------------------------------------------
 Initial basin depth =   0.00 (Ft.)
 Initial basin storage =      0.00 (Ac.Ft)
 Initial basin outflow =   0.00 (CFS)
 --------------------------------------------------------------------
 -------------------------------------------------------------------
 Depth vs. Storage and Depth vs. Discharge data:
  Basin Depth  Storage    Outflow   (S-O*dt/2)   (S+O*dt/2)
      (Ft.)    (Ac.Ft)    (CFS)     (Ac.Ft)    (Ac.Ft)
 --------------------------------------------------------------------
   0.000      0.000      0.000      0.000        0.000
   1.000      2.000      2.220      1.992        2.008
   2.000      4.280      2.221      4.272        4.288
   3.000      6.550      2.222      6.542        6.558
   4.000      8.960      2.223      8.952        8.968
   5.500     12.780      2.224     12.772       12.788
   6.000     14.120     20.220     14.050       14.190
 -------------------------------------------------------------------
                Hydrograph Detention Basin Routing
 --------------------------------------------------------------------

 Graph values: 'I'= unit inflow; 'O'=outflow at time shown
 --------------------------------------------------------------------
 Time   Inflow  Outflow    Storage                                 Depth
(Hours)  (CFS)   (CFS)      (Ac.Ft) .0      20.3   40.54   60.81   81.08 (Ft.)
 0.083    0.06    0.00      0.000  O       |       |       |       |     0.00
 0.167    0.34    0.00      0.002  O       |       |       |       |     0.00
```

0.250	0.82	0.01	0.006	O	0.00
0.333	1.29	0.01	0.013	O	0.01
0.417	1.56	0.02	0.022	O	0.01
0.500	1.69	0.04	0.033	O	0.02
0.583	1.77	0.05	0.045	O	0.02
0.667	1.82	0.06	0.057	O	0.03
0.750	1.86	0.08	0.069	O	0.03
0.833	1.89	0.09	0.082	O	0.04
0.917	1.92	0.10	0.094	O	0.05
1.000	1.94	0.12	0.106	O	0.05
1.083	1.95	0.13	0.119	O	0.06
1.167	1.97	0.15	0.132	O	0.07
1.250	1.99	0.16	0.144	O	0.07
1.333	2.00	0.17	0.157	O	0.08
1.417	2.01	0.19	0.169	O	0.08
1.500	2.03	0.20	0.182	O	0.09
1.583	2.04	0.22	0.194	O	0.10
1.667	2.05	0.23	0.207	O	0.10
1.750	2.06	0.24	0.219	O	0.11
1.833	2.07	0.26	0.232	O	0.12
1.917	2.08	0.27	0.244	O	0.12
2.000	2.09	0.29	0.257	O	0.13
2.083	2.09	0.30	0.269	O	0.13
2.167	2.10	0.31	0.282	O	0.14
2.250	2.11	0.33	0.294	O	0.15
2.333	2.12	0.34	0.306	O	0.15
2.417	2.12	0.35	0.318	O	0.16
2.500	2.13	0.37	0.330	O	0.17
2.583	2.14	0.38	0.343	O	0.17
2.667	2.15	0.39	0.355	O	0.18
2.750	2.15	0.41	0.367	O	0.18
2.833	2.16	0.42	0.379	O	0.19
2.917	2.17	0.43	0.391	O	0.20
3.000	2.18	0.45	0.403	O	0.20
3.083	2.19	0.46	0.415	O	0.21
3.167	2.19	0.47	0.426	O	0.21
3.250	2.20	0.49	0.438	O	0.22
3.333	2.21	0.50	0.450	O	0.23
3.417	2.22	0.51	0.462	O	0.23
3.500	2.23	0.53	0.474	O	0.24
3.583	2.24	0.54	0.485	O	0.24
3.667	2.25	0.55	0.497	O	0.25
3.750	2.26	0.56	0.509	O	0.25
3.833	2.26	0.58	0.520	O	0.26
3.917	2.27	0.59	0.532	O	0.27
4.000	2.28	0.60	0.543	O	0.27
4.083	2.29	0.62	0.555	O	0.28
4.167	2.30	0.63	0.567	O	0.28
4.250	2.31	0.64	0.578	O	0.29
4.333	2.32	0.65	0.590	O	0.29
4.417	2.33	0.67	0.601	O	0.30
4.500	2.34	0.68	0.612	O	0.31
4.583	2.35	0.69	0.624	O	0.31
4.667	2.36	0.71	0.635	O	0.32
4.750	2.37	0.72	0.647	O	0.32
4.833	2.38	0.73	0.658	O	0.33
4.917	2.39	0.74	0.669	O	0.33
5.000	2.40	0.76	0.681	O	0.34
5.083	2.41	0.77	0.692	O	0.35
5.167	2.42	0.78	0.703	O	0.35
5.250	2.43	0.79	0.715	O	0.36
5.333	2.44	0.81	0.726	O	0.36
5.417	2.46	0.82	0.737	O	0.37
5.500	2.47	0.83	0.749	O	0.37
5.583	2.48	0.84	0.760	O	0.38
5.667	2.49	0.86	0.771	O	0.39
5.750	2.50	0.87	0.782	O	0.39
5.833	2.51	0.88	0.794	O	0.40
5.917	2.53	0.89	0.805	O	0.40
6.000	2.54	0.91	0.816	OI	0.41
6.083	2.55	0.92	0.827	OI	0.41
6.167	2.56	0.93	0.839	OI	0.42
6.250	2.58	0.94	0.850	OI	0.42

6.333	2.59	0.96	0.861	OI	0.43
6.417	2.60	0.97	0.872	OI	0.44
6.500	2.61	0.98	0.883	OI	0.44
6.583	2.63	0.99	0.895	OI	0.45
6.667	2.64	1.01	0.906	OI	0.45
6.750	2.65	1.02	0.917	OI	0.46
6.833	2.67	1.03	0.929	OI	0.46
6.917	2.68	1.04	0.940	OI	0.47
7.000	2.70	1.06	0.951	OI	0.48
7.083	2.71	1.07	0.962	OI	0.48
7.167	2.73	1.08	0.974	OI	0.49
7.250	2.74	1.09	0.985	OI	0.49
7.333	2.76	1.11	0.996	OI	0.50
7.417	2.77	1.12	1.008	OI	0.50
7.500	2.79	1.13	1.019	OI	0.51
7.583	2.80	1.14	1.031	OI	0.52
7.667	2.82	1.16	1.042	OI	0.52
7.750	2.84	1.17	1.054	OI	0.53
7.833	2.85	1.18	1.065	OI	0.53
7.917	2.87	1.19	1.077	OI	0.54
8.000	2.89	1.21	1.088	OI	0.54
8.083	2.90	1.22	1.100	OI	0.55
8.167	2.92	1.23	1.111	OI	0.56
8.250	2.94	1.25	1.123	OI	0.56
8.333	2.96	1.26	1.135	OI	0.57
8.417	2.98	1.27	1.146	OI	0.57
8.500	3.00	1.29	1.158	OI	0.58
8.583	3.01	1.30	1.170	OI	0.58
8.667	3.03	1.31	1.182	OI	0.59
8.750	3.05	1.32	1.194	OI	0.60
8.833	3.07	1.34	1.206	OI	0.60
8.917	3.10	1.35	1.218	OI	0.61
9.000	3.12	1.36	1.230	OI	0.61
9.083	3.14	1.38	1.242	OI	0.62
9.167	3.16	1.39	1.254	OI	0.63
9.250	3.18	1.41	1.266	OI	0.63
9.333	3.20	1.42	1.278	OI	0.64
9.417	3.23	1.43	1.291	OI	0.65
9.500	3.25	1.45	1.303	OI	0.65
9.583	3.27	1.46	1.315	OI	0.66
9.667	3.30	1.47	1.328	OI	0.66
9.750	3.32	1.49	1.341	OI	0.67
9.833	3.35	1.50	1.353	OI	0.68
9.917	3.38	1.52	1.366	OI	0.68
10.000	3.40	1.53	1.379	OI	0.69
10.083	3.43	1.54	1.392	OI	0.70
10.167	3.46	1.56	1.405	OI	0.70
10.250	3.49	1.57	1.418	OI	0.71
10.333	3.51	1.59	1.431	OI	0.72
10.417	3.54	1.60	1.445	OI	0.72
10.500	3.57	1.62	1.458	OI	0.73
10.583	3.60	1.63	1.471	OI	0.74
10.667	3.64	1.65	1.485	OI	0.74
10.750	3.67	1.66	1.499	OI	0.75
10.833	3.70	1.68	1.513	OI	0.76
10.917	3.74	1.69	1.527	OI	0.76
11.000	3.77	1.71	1.541	OI	0.77
11.083	3.81	1.73	1.555	OI	0.78
11.167	3.84	1.74	1.570	OI	0.78
11.250	3.88	1.76	1.584	OI	0.79
11.333	3.92	1.77	1.599	OI	0.80
11.417	3.96	1.79	1.614	OI	0.81
11.500	4.00	1.81	1.629	OI	0.81
11.583	4.04	1.82	1.644	OI	0.82
11.667	4.08	1.84	1.659	OI	0.83
11.750	4.13	1.86	1.675	OI	0.84
11.833	4.17	1.88	1.690	OI	0.85
11.917	4.22	1.89	1.706	OI	0.85
12.000	4.27	1.91	1.722	OI	0.86
12.083	4.32	1.93	1.739	OI	0.87
12.167	4.36	1.95	1.755	OI	0.88
12.250	4.39	1.97	1.772	OI	0.89
12.333	4.43	1.99	1.789	OI	0.89

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12.417    4.47    2.00      1.806  OI      |       |       |       |    0.90
12.500    4.53    2.02      1.823  OI      |       |       |       |    0.91
12.583    4.58    2.04      1.840  OI      |       |       |       |    0.92
12.667    4.65    2.06      1.858  OI      |       |       |       |    0.93
12.750    4.71    2.08      1.876  OI      |       |       |       |    0.94
12.833    4.78    2.10      1.894  OI      |       |       |       |    0.95
12.917    4.84    2.12      1.913  OI      |       |       |       |    0.96
13.000    4.92    2.14      1.931  OI      |       |       |       |    0.97
13.083    4.99    2.17      1.951  OI      |       |       |       |    0.98
13.167    5.07    2.19      1.970  O I     |       |       |       |    0.99
13.250    5.15    2.21      1.991  O I     |       |       |       |    1.00
13.333    5.24    2.22      2.011  O I     |       |       |       |    1.00
13.417    5.33    2.22      2.032  O I     |       |       |       |    1.01
13.500    5.42    2.22      2.054  O I     |       |       |       |    1.02
13.583    5.52    2.22      2.076  O I     |       |       |       |    1.03
13.667    5.63    2.22      2.099  O I     |       |       |       |    1.04
13.750    5.74    2.22      2.123  O I     |       |       |       |    1.05
13.833    5.85    2.22      2.148  O I     |       |       |       |    1.06
13.917    5.97    2.22      2.173  O I     |       |       |       |    1.08
14.000    6.10    2.22      2.200  O I     |       |       |       |    1.09
14.083    6.24    2.22      2.227  O I     |       |       |       |    1.10
14.167    6.39    2.22      2.255  O I     |       |       |       |    1.11
14.250    6.55    2.22      2.284  O I     |       |       |       |    1.12
14.333    6.72    2.22      2.315  O I     |       |       |       |    1.14
14.417    6.89    2.22      2.346  O I     |       |       |       |    1.15
14.500    7.09    2.22      2.379  O I     |       |       |       |    1.17
14.583    7.29    2.22      2.413  O I     |       |       |       |    1.18
14.667    7.51    2.22      2.449  O I     |       |       |       |    1.20
14.750    7.75    2.22      2.486  O  I    |       |       |       |    1.21
14.833    8.01    2.22      2.525  O  I    |       |       |       |    1.23
14.917    8.29    2.22      2.566  O  I    |       |       |       |    1.25
15.000    8.61    2.22      2.609  O  I    |       |       |       |    1.27
15.083    8.96    2.22      2.654  O  I    |       |       |       |    1.29
15.167    9.35    2.22      2.702  O  I    |       |       |       |    1.31
15.250    9.79    2.22      2.752  O  I    |       |       |       |    1.33
15.333   10.29    2.22      2.806  O   I   |       |       |       |    1.35
15.417   10.76    2.22      2.863  O   I   |       |       |       |    1.38
15.500   11.00    2.22      2.923  O   I   |       |       |       |    1.40
15.583   11.00    2.22      2.984  O   I   |       |       |       |    1.43
15.667   11.17    2.22      3.045  O   I   |       |       |       |    1.46
15.750   11.89    2.22      3.109  O   I   |       |       |       |    1.49
15.833   13.19    2.22      3.180  O    I  |       |       |       |    1.52
15.917   15.25    2.22      3.262  O     I |       |       |       |    1.55
16.000   18.99    2.22      3.365  O      I|       |       |       |    1.60
16.083   31.17    2.22      3.522  O       |   I   |       |       |    1.67
16.167   58.73    2.22      3.817  O       |       |      I|       |    1.80
16.250   81.08    2.22      4.283  O       |       |       |       I    2.00
16.333   76.81    2.22      4.811  O       |       |       |     I |    2.23
16.417   49.07    2.22      5.230  O       |       |  I    |       |    2.42
16.500   31.67    2.22      5.492  O       |   I   |       |       |    2.53
16.583   23.18    2.22      5.666  O       |I      |       |       |    2.61
16.667   18.20    2.22      5.793  O      I|       |       |       |    2.67
16.750   15.79    2.22      5.895  O     I |       |       |       |    2.71
16.833   14.23    2.22      5.983  O    I  |       |       |       |    2.75
16.917   12.11    2.22      6.058  O   I   |       |       |       |    2.78
17.000   10.98    2.22      6.123  O   I   |       |       |       |    2.81
17.083   10.06    2.22      6.180  O  I    |       |       |       |    2.84
17.167    9.44    2.22      6.232  O  I    |       |       |       |    2.86
17.250    8.76    2.22      6.279  O  I    |       |       |       |    2.88
17.333    8.16    2.22      6.322  O  I    |       |       |       |    2.90
17.417    7.66    2.22      6.361  O  I    |       |       |       |    2.92
17.500    7.20    2.22      6.397  O I     |       |       |       |    2.93
17.583    6.80    2.22      6.430  O I     |       |       |       |    2.95
17.667    6.44    2.22      6.460  O I     |       |       |       |    2.96
17.750    6.19    2.22      6.488  O I     |       |       |       |    2.97
17.833    5.95    2.22      6.515  O I     |       |       |       |    2.98
17.917    5.62    2.22      6.539  O I     |       |       |       |    3.00
18.000    5.12    2.22      6.561  O I     |       |       |       |    3.00
18.083    4.95    2.22      6.580  OI      |       |       |       |    3.01
18.167    4.81    2.22      6.599  OI      |       |       |       |    3.02
18.250    4.69    2.22      6.616  OI      |       |       |       |    3.03
18.333    4.58    2.22      6.633  OI      |       |       |       |    3.03
18.417    4.47    2.22      6.648  OI      |       |       |       |    3.04
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18.500	4.36	2.22	6.664	OI	3.05
18.583	4.26	2.22	6.678	OI	3.05
18.667	4.16	2.22	6.692	OI	3.06
18.750	4.07	2.22	6.705	OI	3.06
18.833	3.99	2.22	6.717	OI	3.07
18.917	3.91	2.22	6.729	OI	3.07
19.000	3.83	2.22	6.740	OI	3.08
19.083	3.76	2.22	6.751	OI	3.08
19.167	3.69	2.22	6.762	OI	3.09
19.250	3.62	2.22	6.771	OI	3.09
19.333	3.56	2.22	6.781	OI	3.10
19.417	3.50	2.22	6.790	OI	3.10
19.500	3.45	2.22	6.798	OI	3.10
19.583	3.39	2.22	6.807	OI	3.11
19.667	3.34	2.22	6.815	OI	3.11
19.750	3.29	2.22	6.822	OI	3.11
19.833	3.24	2.22	6.829	OI	3.12
19.917	3.19	2.22	6.836	OI	3.12
20.000	3.15	2.22	6.843	OI	3.12
20.083	3.11	2.22	6.849	OI	3.12
20.167	3.07	2.22	6.855	OI	3.13
20.250	3.02	2.22	6.861	OI	3.13
20.333	2.99	2.22	6.866	OI	3.13
20.417	2.95	2.22	6.871	OI	3.13
20.500	2.91	2.22	6.876	OI	3.14
20.583	2.88	2.22	6.881	OI	3.14
20.667	2.84	2.22	6.885	OI	3.14
20.750	2.81	2.22	6.889	OI	3.14
20.833	2.78	2.22	6.893	OI	3.14
20.917	2.75	2.22	6.897	OI	3.14
21.000	2.72	2.22	6.900	OI	3.15
21.083	2.69	2.22	6.904	OI	3.15
21.167	2.66	2.22	6.907	OI	3.15
21.250	2.63	2.22	6.910	OI	3.15
21.333	2.61	2.22	6.912	OI	3.15
21.417	2.58	2.22	6.915	OI	3.15
21.500	2.56	2.22	6.917	OI	3.15
21.583	2.53	2.22	6.920	O	3.15
21.667	2.51	2.22	6.922	O	3.15
21.750	2.48	2.22	6.924	O	3.15
21.833	2.46	2.22	6.925	O	3.16
21.917	2.44	2.22	6.927	O	3.16
22.000	2.42	2.22	6.928	O	3.16
22.083	2.39	2.22	6.929	O	3.16
22.167	2.37	2.22	6.931	O	3.16
22.250	2.35	2.22	6.932	O	3.16
22.333	2.33	2.22	6.932	O	3.16
22.417	2.31	2.22	6.933	O	3.16
22.500	2.30	2.22	6.934	O	3.16
22.583	2.28	2.22	6.934	O	3.16
22.667	2.26	2.22	6.934	O	3.16
22.750	2.24	2.22	6.935	O	3.16
22.833	2.22	2.22	6.935	O	3.16
22.917	2.21	2.22	6.935	O	3.16
23.000	2.19	2.22	6.934	O	3.16
23.083	2.17	2.22	6.934	O	3.16
23.167	2.16	2.22	6.934	O	3.16
23.250	2.14	2.22	6.933	O	3.16
23.333	2.13	2.22	6.933	O	3.16
23.417	2.11	2.22	6.932	O	3.16
23.500	2.10	2.22	6.931	O	3.16
23.583	2.08	2.22	6.930	O	3.16
23.667	2.07	2.22	6.929	O	3.16
23.750	2.05	2.22	6.928	O	3.16
23.833	2.04	2.22	6.927	O	3.16
23.917	2.03	2.22	6.926	O	3.16
24.000	2.01	2.22	6.924	O	3.16
24.083	1.94	2.22	6.922	O	3.15
24.167	1.65	2.22	6.920	O	3.15
24.250	1.16	2.22	6.914	O	3.15
24.333	0.68	2.22	6.905	O	3.15
24.417	0.42	2.22	6.893	O	3.14
24.500	0.28	2.22	6.881	O	3.14

24.583	0.21	2.22	6.867	O	|	|	|	|	3.13
24.667	0.16	2.22	6.853	O	|	|	|	|	3.13
24.750	0.13	2.22	6.839	O	|	|	|	|	3.12
24.833	0.10	2.22	6.824	O	|	|	|	|	3.11
24.917	0.08	2.22	6.809	O	|	|	|	|	3.11
25.000	0.07	2.22	6.795	O	|	|	|	|	3.10
25.083	0.06	2.22	6.780	O	|	|	|	|	3.10
25.167	0.05	2.22	6.765	O	|	|	|	|	3.09
25.250	0.04	2.22	6.750	O	|	|	|	|	3.08
25.333	0.03	2.22	6.735	O	|	|	|	|	3.08
25.417	0.02	2.22	6.720	O	|	|	|	|	3.07
25.500	0.02	2.22	6.704	O	|	|	|	|	3.06
25.583	0.01	2.22	6.689	O	|	|	|	|	3.06
25.667	0.01	2.22	6.674	O	|	|	|	|	3.05
25.750	0.01	2.22	6.659	O	|	|	|	|	3.05
25.833	0.00	2.22	6.644	O	|	|	|	|	3.04
25.917	0.00	2.22	6.628	O	|	|	|	|	3.03
26.000	0.00	2.22	6.613	O	|	|	|	|	3.03
26.083	0.00	2.22	6.598	O	|	|	|	|	3.02
26.167	0.00	2.22	6.582	O	|	|	|	|	3.01
26.250	0.00	2.22	6.567	O	|	|	|	|	3.01
26.333	0.00	2.22	6.552	O	|	|	|	|	3.00
26.417	0.00	2.22	6.536	O	|	|	|	|	2.99
26.500	0.00	2.22	6.521	O	|	|	|	|	2.99
26.583	0.00	2.22	6.506	O	|	|	|	|	2.98
26.667	0.00	2.22	6.491	O	|	|	|	|	2.97
26.750	0.00	2.22	6.475	O	|	|	|	|	2.97
26.833	0.00	2.22	6.460	O	|	|	|	|	2.96
26.917	0.00	2.22	6.445	O	|	|	|	|	2.95
27.000	0.00	2.22	6.429	O	|	|	|	|	2.95
27.083	0.00	2.22	6.414	O	|	|	|	|	2.94
27.167	0.00	2.22	6.399	O	|	|	|	|	2.93
27.250	0.00	2.22	6.383	O	|	|	|	|	2.93
27.333	0.00	2.22	6.368	O	|	|	|	|	2.92
27.417	0.00	2.22	6.353	O	|	|	|	|	2.91
27.500	0.00	2.22	6.337	O	|	|	|	|	2.91
27.583	0.00	2.22	6.322	O	|	|	|	|	2.90
27.667	0.00	2.22	6.307	O	|	|	|	|	2.89
27.750	0.00	2.22	6.292	O	|	|	|	|	2.89
27.833	0.00	2.22	6.276	O	|	|	|	|	2.88
27.917	0.00	2.22	6.261	O	|	|	|	|	2.87
28.000	0.00	2.22	6.246	O	|	|	|	|	2.87
28.083	0.00	2.22	6.230	O	|	|	|	|	2.86
28.167	0.00	2.22	6.215	O	|	|	|	|	2.85
28.250	0.00	2.22	6.200	O	|	|	|	|	2.85
28.333	0.00	2.22	6.184	O	|	|	|	|	2.84
28.417	0.00	2.22	6.169	O	|	|	|	|	2.83
28.500	0.00	2.22	6.154	O	|	|	|	|	2.83
28.583	0.00	2.22	6.139	O	|	|	|	|	2.82
28.667	0.00	2.22	6.123	O	|	|	|	|	2.81
28.750	0.00	2.22	6.108	O	|	|	|	|	2.81
28.833	0.00	2.22	6.093	O	|	|	|	|	2.80
28.917	0.00	2.22	6.077	O	|	|	|	|	2.79
29.000	0.00	2.22	6.062	O	|	|	|	|	2.79
29.083	0.00	2.22	6.047	O	|	|	|	|	2.78
29.167	0.00	2.22	6.031	O	|	|	|	|	2.77
29.250	0.00	2.22	6.016	O	|	|	|	|	2.76
29.333	0.00	2.22	6.001	O	|	|	|	|	2.76
29.417	0.00	2.22	5.986	O	|	|	|	|	2.75
29.500	0.00	2.22	5.970	O	|	|	|	|	2.74
29.583	0.00	2.22	5.955	O	|	|	|	|	2.74
29.667	0.00	2.22	5.940	O	|	|	|	|	2.73
29.750	0.00	2.22	5.924	O	|	|	|	|	2.72
29.833	0.00	2.22	5.909	O	|	|	|	|	2.72
29.917	0.00	2.22	5.894	O	|	|	|	|	2.71
30.000	0.00	2.22	5.878	O	|	|	|	|	2.70
30.083	0.00	2.22	5.863	O	|	|	|	|	2.70
30.167	0.00	2.22	5.848	O	|	|	|	|	2.69
30.250	0.00	2.22	5.833	O	|	|	|	|	2.68
30.333	0.00	2.22	5.817	O	|	|	|	|	2.68
30.417	0.00	2.22	5.802	O	|	|	|	|	2.67
30.500	0.00	2.22	5.787	O	|	|	|	|	2.66
30.583	0.00	2.22	5.771	O	|	|	|	|	2.66

30.667	0.00	2.22	5.756	O	2.65
30.750	0.00	2.22	5.741	O	2.64
30.833	0.00	2.22	5.725	O	2.64
30.917	0.00	2.22	5.710	O	2.63
31.000	0.00	2.22	5.695	O	2.62
31.083	0.00	2.22	5.680	O	2.62
31.167	0.00	2.22	5.664	O	2.61
31.250	0.00	2.22	5.649	O	2.60
31.333	0.00	2.22	5.634	O	2.60
31.417	0.00	2.22	5.618	O	2.59
31.500	0.00	2.22	5.603	O	2.58
31.583	0.00	2.22	5.588	O	2.58
31.667	0.00	2.22	5.572	O	2.57
31.750	0.00	2.22	5.557	O	2.56
31.833	0.00	2.22	5.542	O	2.56
31.917	0.00	2.22	5.527	O	2.55
32.000	0.00	2.22	5.511	O	2.54
32.083	0.00	2.22	5.496	O	2.54
32.167	0.00	2.22	5.481	O	2.53
32.250	0.00	2.22	5.465	O	2.52
32.333	0.00	2.22	5.450	O	2.52
32.417	0.00	2.22	5.435	O	2.51
32.500	0.00	2.22	5.419	O	2.50
32.583	0.00	2.22	5.404	O	2.50
32.667	0.00	2.22	5.389	O	2.49
32.750	0.00	2.22	5.374	O	2.48
32.833	0.00	2.22	5.358	O	2.47
32.917	0.00	2.22	5.343	O	2.47
33.000	0.00	2.22	5.328	O	2.46
33.083	0.00	2.22	5.312	O	2.45
33.167	0.00	2.22	5.297	O	2.45
33.250	0.00	2.22	5.282	O	2.44
33.333	0.00	2.22	5.266	O	2.43
33.417	0.00	2.22	5.251	O	2.43
33.500	0.00	2.22	5.236	O	2.42
33.583	0.00	2.22	5.221	O	2.41
33.667	0.00	2.22	5.205	O	2.41
33.750	0.00	2.22	5.190	O	2.40
33.833	0.00	2.22	5.175	O	2.39
33.917	0.00	2.22	5.159	O	2.39
34.000	0.00	2.22	5.144	O	2.38
34.083	0.00	2.22	5.129	O	2.37
34.167	0.00	2.22	5.113	O	2.37
34.250	0.00	2.22	5.098	O	2.36
34.333	0.00	2.22	5.083	O	2.35
34.417	0.00	2.22	5.068	O	2.35
34.500	0.00	2.22	5.052	O	2.34
34.583	0.00	2.22	5.037	O	2.33
34.667	0.00	2.22	5.022	O	2.33
34.750	0.00	2.22	5.006	O	2.32
34.833	0.00	2.22	4.991	O	2.31
34.917	0.00	2.22	4.976	O	2.31
35.000	0.00	2.22	4.960	O	2.30
35.083	0.00	2.22	4.945	O	2.29
35.167	0.00	2.22	4.930	O	2.29
35.250	0.00	2.22	4.915	O	2.28
35.333	0.00	2.22	4.899	O	2.27
35.417	0.00	2.22	4.884	O	2.27
35.500	0.00	2.22	4.869	O	2.26
35.583	0.00	2.22	4.853	O	2.25
35.667	0.00	2.22	4.838	O	2.25
35.750	0.00	2.22	4.823	O	2.24
35.833	0.00	2.22	4.807	O	2.23
35.917	0.00	2.22	4.792	O	2.23
36.000	0.00	2.22	4.777	O	2.22
36.083	0.00	2.22	4.762	O	2.21
36.167	0.00	2.22	4.746	O	2.21
36.250	0.00	2.22	4.731	O	2.20
36.333	0.00	2.22	4.716	O	2.19
36.417	0.00	2.22	4.700	O	2.19
36.500	0.00	2.22	4.685	O	2.18
36.583	0.00	2.22	4.670	O	2.17
36.667	0.00	2.22	4.655	O	2.16

36.750	0.00	2.22	4.639	O	|	|	|	|	2.16
36.833	0.00	2.22	4.624	O	|	|	|	|	2.15
36.917	0.00	2.22	4.609	O	|	|	|	|	2.14
37.000	0.00	2.22	4.593	O	|	|	|	|	2.14
37.083	0.00	2.22	4.578	O	|	|	|	|	2.13
37.167	0.00	2.22	4.563	O	|	|	|	|	2.12
37.250	0.00	2.22	4.547	O	|	|	|	|	2.12
37.333	0.00	2.22	4.532	O	|	|	|	|	2.11
37.417	0.00	2.22	4.517	O	|	|	|	|	2.10
37.500	0.00	2.22	4.502	O	|	|	|	|	2.10
37.583	0.00	2.22	4.486	O	|	|	|	|	2.09
37.667	0.00	2.22	4.471	O	|	|	|	|	2.08
37.750	0.00	2.22	4.456	O	|	|	|	|	2.08
37.833	0.00	2.22	4.440	O	|	|	|	|	2.07
37.917	0.00	2.22	4.425	O	|	|	|	|	2.06
38.000	0.00	2.22	4.410	O	|	|	|	|	2.06
38.083	0.00	2.22	4.394	O	|	|	|	|	2.05
38.167	0.00	2.22	4.379	O	|	|	|	|	2.04
38.250	0.00	2.22	4.364	O	|	|	|	|	2.04
38.333	0.00	2.22	4.349	O	|	|	|	|	2.03
38.417	0.00	2.22	4.333	O	|	|	|	|	2.02
38.500	0.00	2.22	4.318	O	|	|	|	|	2.02
38.583	0.00	2.22	4.303	O	|	|	|	|	2.01
38.667	0.00	2.22	4.287	O	|	|	|	|	2.00
38.750	0.00	2.22	4.272	O	|	|	|	|	2.00
38.833	0.00	2.22	4.257	O	|	|	|	|	1.99
38.917	0.00	2.22	4.241	O	|	|	|	|	1.98
39.000	0.00	2.22	4.226	O	|	|	|	|	1.98
39.083	0.00	2.22	4.211	O	|	|	|	|	1.97
39.167	0.00	2.22	4.196	O	|	|	|	|	1.96
39.250	0.00	2.22	4.180	O	|	|	|	|	1.96
39.333	0.00	2.22	4.165	O	|	|	|	|	1.95
39.417	0.00	2.22	4.150	O	|	|	|	|	1.94
39.500	0.00	2.22	4.134	O	|	|	|	|	1.94
39.583	0.00	2.22	4.119	O	|	|	|	|	1.93
39.667	0.00	2.22	4.104	O	|	|	|	|	1.92
39.750	0.00	2.22	4.089	O	|	|	|	|	1.92
39.833	0.00	2.22	4.073	O	|	|	|	|	1.91
39.917	0.00	2.22	4.058	O	|	|	|	|	1.90
40.000	0.00	2.22	4.043	O	|	|	|	|	1.90
40.083	0.00	2.22	4.027	O	|	|	|	|	1.89
40.167	0.00	2.22	4.012	O	|	|	|	|	1.88
40.250	0.00	2.22	3.997	O	|	|	|	|	1.88
40.333	0.00	2.22	3.981	O	|	|	|	|	1.87
40.417	0.00	2.22	3.966	O	|	|	|	|	1.86
40.500	0.00	2.22	3.951	O	|	|	|	|	1.86
40.583	0.00	2.22	3.936	O	|	|	|	|	1.85
40.667	0.00	2.22	3.920	O	|	|	|	|	1.84
40.750	0.00	2.22	3.905	O	|	|	|	|	1.84
40.833	0.00	2.22	3.890	O	|	|	|	|	1.83
40.917	0.00	2.22	3.874	O	|	|	|	|	1.82
41.000	0.00	2.22	3.859	O	|	|	|	|	1.82
41.083	0.00	2.22	3.844	O	|	|	|	|	1.81
41.167	0.00	2.22	3.829	O	|	|	|	|	1.80
41.250	0.00	2.22	3.813	O	|	|	|	|	1.80
41.333	0.00	2.22	3.798	O	|	|	|	|	1.79
41.417	0.00	2.22	3.783	O	|	|	|	|	1.78
41.500	0.00	2.22	3.767	O	|	|	|	|	1.78
41.583	0.00	2.22	3.752	O	|	|	|	|	1.77
41.667	0.00	2.22	3.737	O	|	|	|	|	1.76
41.750	0.00	2.22	3.721	O	|	|	|	|	1.76
41.833	0.00	2.22	3.706	O	|	|	|	|	1.75
41.917	0.00	2.22	3.691	O	|	|	|	|	1.74
42.000	0.00	2.22	3.676	O	|	|	|	|	1.73
42.083	0.00	2.22	3.660	O	|	|	|	|	1.73
42.167	0.00	2.22	3.645	O	|	|	|	|	1.72
42.250	0.00	2.22	3.630	O	|	|	|	|	1.71
42.333	0.00	2.22	3.614	O	|	|	|	|	1.71
42.417	0.00	2.22	3.599	O	|	|	|	|	1.70
42.500	0.00	2.22	3.584	O	|	|	|	|	1.69
42.583	0.00	2.22	3.569	O	|	|	|	|	1.69
42.667	0.00	2.22	3.553	O	|	|	|	|	1.68
42.750	0.00	2.22	3.538	O	|	|	|	|	1.67

42.833	0.00	2.22	3.523	O					1.67
42.917	0.00	2.22	3.507	O					1.66
43.000	0.00	2.22	3.492	O					1.65
43.083	0.00	2.22	3.477	O					1.65
43.167	0.00	2.22	3.461	O					1.64
43.250	0.00	2.22	3.446	O					1.63
43.333	0.00	2.22	3.431	O					1.63
43.417	0.00	2.22	3.416	O					1.62
43.500	0.00	2.22	3.400	O					1.61
43.583	0.00	2.22	3.385	O					1.61
43.667	0.00	2.22	3.370	O					1.60
43.750	0.00	2.22	3.354	O					1.59
43.833	0.00	2.22	3.339	O					1.59
43.917	0.00	2.22	3.324	O					1.58
44.000	0.00	2.22	3.309	O					1.57
44.083	0.00	2.22	3.293	O					1.57
44.167	0.00	2.22	3.278	O					1.56
44.250	0.00	2.22	3.263	O					1.55
44.333	0.00	2.22	3.247	O					1.55
44.417	0.00	2.22	3.232	O					1.54
44.500	0.00	2.22	3.217	O					1.53
44.583	0.00	2.22	3.201	O					1.53
44.667	0.00	2.22	3.186	O					1.52
44.750	0.00	2.22	3.171	O					1.51
44.833	0.00	2.22	3.156	O					1.51
44.917	0.00	2.22	3.140	O					1.50
45.000	0.00	2.22	3.125	O					1.49
45.083	0.00	2.22	3.110	O					1.49
45.167	0.00	2.22	3.094	O					1.48
45.250	0.00	2.22	3.079	O					1.47
45.333	0.00	2.22	3.064	O					1.47
45.417	0.00	2.22	3.049	O					1.46
45.500	0.00	2.22	3.033	O					1.45
45.583	0.00	2.22	3.018	O					1.45
45.667	0.00	2.22	3.003	O					1.44
45.750	0.00	2.22	2.987	O					1.43
45.833	0.00	2.22	2.972	O					1.43
45.917	0.00	2.22	2.957	O					1.42
46.000	0.00	2.22	2.942	O					1.41
46.083	0.00	2.22	2.926	O					1.41
46.167	0.00	2.22	2.911	O					1.40
46.250	0.00	2.22	2.896	O					1.39
46.333	0.00	2.22	2.880	O					1.39
46.417	0.00	2.22	2.865	O					1.38
46.500	0.00	2.22	2.850	O					1.37
46.583	0.00	2.22	2.834	O					1.37
46.667	0.00	2.22	2.819	O					1.36
46.750	0.00	2.22	2.804	O					1.35
46.833	0.00	2.22	2.789	O					1.35
46.917	0.00	2.22	2.773	O					1.34
47.000	0.00	2.22	2.758	O					1.33
47.083	0.00	2.22	2.743	O					1.33
47.167	0.00	2.22	2.727	O					1.32
47.250	0.00	2.22	2.712	O					1.31
47.333	0.00	2.22	2.697	O					1.31
47.417	0.00	2.22	2.682	O					1.30
47.500	0.00	2.22	2.666	O					1.29
47.583	0.00	2.22	2.651	O					1.29
47.667	0.00	2.22	2.636	O					1.28
47.750	0.00	2.22	2.620	O					1.27
47.833	0.00	2.22	2.605	O					1.27
47.917	0.00	2.22	2.590	O					1.26
48.000	0.00	2.22	2.575	O					1.25
48.083	0.00	2.22	2.559	O					1.25
48.167	0.00	2.22	2.544	O					1.24
48.250	0.00	2.22	2.529	O					1.23
48.333	0.00	2.22	2.513	O					1.23
48.417	0.00	2.22	2.498	O					1.22
48.500	0.00	2.22	2.483	O					1.21
48.583	0.00	2.22	2.467	O					1.21
48.667	0.00	2.22	2.452	O					1.20
48.750	0.00	2.22	2.437	O					1.19
48.833	0.00	2.22	2.422	O					1.18

48.917	0.00	2.22	2.406	O	1.18
49.000	0.00	2.22	2.391	O	1.17
49.083	0.00	2.22	2.376	O	1.16
49.167	0.00	2.22	2.360	O	1.16
49.250	0.00	2.22	2.345	O	1.15
49.333	0.00	2.22	2.330	O	1.14
49.417	0.00	2.22	2.315	O	1.14
49.500	0.00	2.22	2.299	O	1.13
49.583	0.00	2.22	2.284	O	1.12
49.667	0.00	2.22	2.269	O	1.12
49.750	0.00	2.22	2.253	O	1.11
49.833	0.00	2.22	2.238	O	1.10
49.917	0.00	2.22	2.223	O	1.10
50.000	0.00	2.22	2.208	O	1.09
50.083	0.00	2.22	2.192	O	1.08
50.167	0.00	2.22	2.177	O	1.08
50.250	0.00	2.22	2.162	O	1.07
50.333	0.00	2.22	2.146	O	1.06
50.417	0.00	2.22	2.131	O	1.06
50.500	0.00	2.22	2.116	O	1.05
50.583	0.00	2.22	2.101	O	1.04
50.667	0.00	2.22	2.085	O	1.04
50.750	0.00	2.22	2.070	O	1.03
50.833	0.00	2.22	2.055	O	1.02
50.917	0.00	2.22	2.039	O	1.02
51.000	0.00	2.22	2.024	O	1.01
51.083	0.00	2.22	2.009	O	1.00
51.167	0.00	2.21	1.994	O	1.00
51.250	0.00	2.20	1.978	O	0.99
51.333	0.00	2.18	1.963	O	0.98
51.417	0.00	2.16	1.948	O	0.97
51.500	0.00	2.15	1.933	O	0.97
51.583	0.00	2.13	1.919	O	0.96
51.667	0.00	2.11	1.904	O	0.95
51.750	0.00	2.10	1.890	O	0.94
51.833	0.00	2.08	1.875	O	0.94
51.917	0.00	2.07	1.861	O	0.93
52.000	0.00	2.05	1.847	O	0.92
52.083	0.00	2.03	1.833	O	0.92
52.167	0.00	2.02	1.819	O	0.91
52.250	0.00	2.00	1.805	O	0.90
52.333	0.00	1.99	1.791	O	0.90
52.417	0.00	1.97	1.778	O	0.89
52.500	0.00	1.96	1.764	O	0.88
52.583	0.00	1.94	1.751	O	0.88
52.667	0.00	1.93	1.737	O	0.87
52.750	0.00	1.91	1.724	O	0.86
52.833	0.00	1.90	1.711	O	0.86
52.917	0.00	1.88	1.698	O	0.85
53.000	0.00	1.87	1.685	O	0.84
53.083	0.00	1.86	1.672	O	0.84
53.167	0.00	1.84	1.659	O	0.83
53.250	0.00	1.83	1.647	O	0.82
53.333	0.00	1.81	1.634	O	0.82
53.417	0.00	1.80	1.622	O	0.81
53.500	0.00	1.79	1.609	O	0.80
53.583	0.00	1.77	1.597	O	0.80
53.667	0.00	1.76	1.585	O	0.79
53.750	0.00	1.75	1.573	O	0.79
53.833	0.00	1.73	1.561	O	0.78
53.917	0.00	1.72	1.549	O	0.77
54.000	0.00	1.71	1.537	O	0.77
54.083	0.00	1.69	1.526	O	0.76
54.167	0.00	1.68	1.514	O	0.76
54.250	0.00	1.67	1.502	O	0.75
54.333	0.00	1.65	1.491	O	0.75
54.417	0.00	1.64	1.480	O	0.74
54.500	0.00	1.63	1.468	O	0.73
54.583	0.00	1.62	1.457	O	0.73
54.667	0.00	1.61	1.446	O	0.72
54.750	0.00	1.59	1.435	O	0.72
54.833	0.00	1.58	1.424	O	0.71
54.917	0.00	1.57	1.413	O	0.71

55.000	0.00	1.56	1.402	O	0.70
55.083	0.00	1.54	1.392	O	0.70
55.167	0.00	1.53	1.381	O	0.69
55.250	0.00	1.52	1.371	O	0.69
55.333	0.00	1.51	1.360	O	0.68
55.417	0.00	1.50	1.350	O	0.67
55.500	0.00	1.49	1.340	O	0.67
55.583	0.00	1.48	1.329	O	0.66
55.667	0.00	1.46	1.319	O	0.66
55.750	0.00	1.45	1.309	O	0.65
55.833	0.00	1.44	1.299	O	0.65
55.917	0.00	1.43	1.289	O	0.64
56.000	0.00	1.42	1.280	O	0.64
56.083	0.00	1.41	1.270	O	0.63
56.167	0.00	1.40	1.260	O	0.63
56.250	0.00	1.39	1.251	O	0.63
56.333	0.00	1.38	1.241	O	0.62
56.417	0.00	1.37	1.232	O	0.62
56.500	0.00	1.36	1.222	O	0.61
56.583	0.00	1.35	1.213	O	0.61
56.667	0.00	1.34	1.204	O	0.60
56.750	0.00	1.33	1.194	O	0.60
56.833	0.00	1.32	1.185	O	0.59
56.917	0.00	1.31	1.176	O	0.59
57.000	0.00	1.30	1.167	O	0.58
57.083	0.00	1.29	1.158	O	0.58
57.167	0.00	1.28	1.150	O	0.57
57.250	0.00	1.27	1.141	O	0.57
57.333	0.00	1.26	1.132	O	0.57
57.417	0.00	1.25	1.124	O	0.56
57.500	0.00	1.24	1.115	O	0.56
57.583	0.00	1.23	1.107	O	0.55
57.667	0.00	1.22	1.098	O	0.55
57.750	0.00	1.21	1.090	O	0.54
57.833	0.00	1.20	1.081	O	0.54
57.917	0.00	1.19	1.073	O	0.54
58.000	0.00	1.18	1.065	O	0.53
58.083	0.00	1.17	1.057	O	0.53
58.167	0.00	1.16	1.049	O	0.52
58.250	0.00	1.16	1.041	O	0.52
58.333	0.00	1.15	1.033	O	0.52
58.417	0.00	1.14	1.025	O	0.51
58.500	0.00	1.13	1.017	O	0.51
58.583	0.00	1.12	1.010	O	0.50
58.667	0.00	1.11	1.002	O	0.50
58.750	0.00	1.10	0.994	O	0.50
58.833	0.00	1.10	0.987	O	0.49
58.917	0.00	1.09	0.979	O	0.49
59.000	0.00	1.08	0.972	O	0.49
59.083	0.00	1.07	0.964	O	0.48
59.167	0.00	1.06	0.957	O	0.48
59.250	0.00	1.05	0.950	O	0.47
59.333	0.00	1.05	0.942	O	0.47
59.417	0.00	1.04	0.935	O	0.47
59.500	0.00	1.03	0.928	O	0.46
59.583	0.00	1.02	0.921	O	0.46
59.667	0.00	1.01	0.914	O	0.46
59.750	0.00	1.01	0.907	O	0.45
59.833	0.00	1.00	0.900	O	0.45
59.917	0.00	0.99	0.893	O	0.45
60.000	0.00	0.98	0.887	O	0.44
60.083	0.00	0.98	0.880	O	0.44
60.167	0.00	0.97	0.873	O	0.44
60.250	0.00	0.96	0.866	O	0.43
60.333	0.00	0.95	0.860	O	0.43
60.417	0.00	0.95	0.853	O	0.43
60.500	0.00	0.94	0.847	O	0.42
60.583	0.00	0.93	0.840	O	0.42
60.667	0.00	0.93	0.834	O	0.42
60.750	0.00	0.92	0.828	O	0.41
60.833	0.00	0.91	0.821	O	0.41
60.917	0.00	0.90	0.815	O	0.41
61.000	0.00	0.90	0.809	O	0.40

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61.083    0.00    0.89      0.803  O        |        |        |        |      0.40
61.167    0.00    0.88      0.797  O        |        |        |        |      0.40
61.250    0.00    0.88      0.790  O        |        |        |        |      0.40
61.333    0.00    0.87      0.784  O        |        |        |        |      0.39
61.417    0.00    0.86      0.778  O        |        |        |        |      0.39
61.500    0.00    0.86      0.773  O        |        |        |        |      0.39
61.583    0.00    0.85      0.767  O        |        |        |        |      0.38
61.667    0.00    0.84      0.761  O        |        |        |        |      0.38
61.750    0.00    0.84      0.755  O        |        |        |        |      0.38
61.833    0.00    0.83      0.749  O        |        |        |        |      0.37
61.917    0.00    0.83      0.744  O        |        |        |        |      0.37
62.000    0.00    0.82      0.738  O        |        |        |        |      0.37
62.083    0.00    0.81      0.732  O        |        |        |        |      0.37
62.167    0.00    0.81      0.727  O        |        |        |        |      0.36
62.250    0.00    0.80      0.721  O        |        |        |        |      0.36
62.333    0.00    0.79      0.716  O        |        |        |        |      0.36
62.417    0.00    0.79      0.710  O        |        |        |        |      0.36
62.500    0.00    0.78      0.705  O        |        |        |        |      0.35
62.583    0.00    0.78      0.699  O        |        |        |        |      0.35
62.667    0.00    0.77      0.694  O        |        |        |        |      0.35
62.750    0.00    0.76      0.689  O        |        |        |        |      0.34
62.833    0.00    0.76      0.684  O        |        |        |        |      0.34
62.917    0.00    0.75      0.678  O        |        |        |        |      0.34
63.000    0.00    0.75      0.673  O        |        |        |        |      0.34
63.083    0.00    0.74      0.668  O        |        |        |        |      0.33
63.167    0.00    0.74      0.663  O        |        |        |        |      0.33
63.250    0.00    0.73      0.658  O        |        |        |        |      0.33
63.333    0.00    0.72      0.653  O        |        |        |        |      0.33
63.417    0.00    0.72      0.648  O        |        |        |        |      0.32
63.500    0.00    0.71      0.643  O        |        |        |        |      0.32
63.583    0.00    0.71      0.638  O        |        |        |        |      0.32
63.667    0.00    0.70      0.633  O        |        |        |        |      0.32
63.750    0.00    0.70      0.628  O        |        |        |        |      0.31
63.833    0.00    0.69      0.624  O        |        |        |        |      0.31
63.917    0.00    0.69      0.619  O        |        |        |        |      0.31
64.000    0.00    0.68      0.614  O        |        |        |        |      0.31
64.083    0.00    0.68      0.610  O        |        |        |        |      0.30
64.167    0.00    0.67      0.605  O        |        |        |        |      0.30
64.250    0.00    0.67      0.600  O        |        |        |        |      0.30
64.333    0.00    0.66      0.596  O        |        |        |        |      0.30
64.417    0.00    0.66      0.591  O        |        |        |        |      0.30
64.500    0.00    0.65      0.587  O        |        |        |        |      0.29
64.583    0.00    0.65      0.582  O        |        |        |        |      0.29
64.667    0.00    0.64      0.578  O        |        |        |        |      0.29
64.750    0.00    0.64      0.573  O        |        |        |        |      0.29
64.833    0.00    0.63      0.569  O        |        |        |        |      0.28
64.917    0.00    0.63      0.565  O        |        |        |        |      0.28
65.000    0.00    0.62      0.560  O        |        |        |        |      0.28
65.083    0.00    0.62      0.556  O        |        |        |        |      0.28
65.167    0.00    0.61      0.552  O        |        |        |        |      0.28
65.250    0.00    0.61      0.548  O        |        |        |        |      0.27
65.333    0.00    0.60      0.544  O        |        |        |        |      0.27
65.417    0.00    0.60      0.539  O        |        |        |        |      0.27
65.500    0.00    0.59      0.535  O        |        |        |        |      0.27
65.583    0.00    0.59      0.531  O        |        |        |        |      0.27
65.667    0.00    0.59      0.527  O        |        |        |        |      0.26
65.750    0.00    0.58      0.523  O        |        |        |        |      0.26
65.833    0.00    0.58      0.519  O        |        |        |        |      0.26
65.917    0.00    0.57      0.515  O        |        |        |        |      0.26
66.000    0.00    0.57      0.511  O        |        |        |        |      0.26
66.083    0.00    0.56      0.507  O        |        |        |        |      0.25
66.167    0.00    0.56      0.504  O        |        |        |        |      0.25
66.250    0.00    0.55      0.500  O        |        |        |        |      0.25
66.333    0.00    0.55      0.496  O        |        |        |        |      0.25
66.417    0.00    0.55      0.492  O        |        |        |        |      0.25
66.500    0.00    0.54      0.488  O        |        |        |        |      0.24
66.583    0.00    0.54      0.485  O        |        |        |        |      0.24
66.667    0.00    0.53      0.481  O        |        |        |        |      0.24
66.750    0.00    0.53      0.477  O        |        |        |        |      0.24
66.833    0.00    0.53      0.474  O        |        |        |        |      0.24
66.917    0.00    0.52      0.470  O        |        |        |        |      0.24
67.000    0.00    0.52      0.466  O        |        |        |        |      0.23
67.083    0.00    0.51      0.463  O        |        |        |        |      0.23
```

67.167	0.00	0.51	0.459	O					0.23
67.250	0.00	0.51	0.456	O					0.23
67.333	0.00	0.50	0.452	O					0.23
67.417	0.00	0.50	0.449	O					0.22
67.500	0.00	0.49	0.446	O					0.22
67.583	0.00	0.49	0.442	O					0.22
67.667	0.00	0.49	0.439	O					0.22
67.750	0.00	0.48	0.435	O					0.22
67.833	0.00	0.48	0.432	O					0.22
67.917	0.00	0.48	0.429	O					0.21
68.000	0.00	0.47	0.426	O					0.21
68.083	0.00	0.47	0.422	O					0.21
68.167	0.00	0.47	0.419	O					0.21
68.250	0.00	0.46	0.416	O					0.21
68.333	0.00	0.46	0.413	O					0.21
68.417	0.00	0.45	0.410	O					0.20
68.500	0.00	0.45	0.406	O					0.20
68.583	0.00	0.45	0.403	O					0.20
68.667	0.00	0.44	0.400	O					0.20
68.750	0.00	0.44	0.397	O					0.20
68.833	0.00	0.44	0.394	O					0.20
68.917	0.00	0.43	0.391	O					0.20
69.000	0.00	0.43	0.388	O					0.19
69.083	0.00	0.43	0.385	O					0.19
69.167	0.00	0.42	0.382	O					0.19
69.250	0.00	0.42	0.379	O					0.19
69.333	0.00	0.42	0.377	O					0.19
69.417	0.00	0.41	0.374	O					0.19
69.500	0.00	0.41	0.371	O					0.19
69.583	0.00	0.41	0.368	O					0.18
69.667	0.00	0.41	0.365	O					0.18
69.750	0.00	0.40	0.362	O					0.18
69.833	0.00	0.40	0.360	O					0.18
69.917	0.00	0.40	0.357	O					0.18
70.000	0.00	0.39	0.354	O					0.18
70.083	0.00	0.39	0.352	O					0.18
70.167	0.00	0.39	0.349	O					0.17
70.250	0.00	0.38	0.346	O					0.17
70.333	0.00	0.38	0.344	O					0.17
70.417	0.00	0.38	0.341	O					0.17
70.500	0.00	0.38	0.338	O					0.17
70.583	0.00	0.37	0.336	O					0.17
70.667	0.00	0.37	0.333	O					0.17
70.750	0.00	0.37	0.331	O					0.17
70.833	0.00	0.36	0.328	O					0.16
70.917	0.00	0.36	0.326	O					0.16
71.000	0.00	0.36	0.323	O					0.16
71.083	0.00	0.36	0.321	O					0.16
71.167	0.00	0.35	0.318	O					0.16
71.250	0.00	0.35	0.316	O					0.16
71.333	0.00	0.35	0.313	O					0.16
71.417	0.00	0.35	0.311	O					0.16
71.500	0.00	0.34	0.309	O					0.15
71.583	0.00	0.34	0.306	O					0.15
71.667	0.00	0.34	0.304	O					0.15
71.750	0.00	0.33	0.302	O					0.15
71.833	0.00	0.33	0.299	O					0.15
71.917	0.00	0.33	0.297	O					0.15
72.000	0.00	0.33	0.295	O					0.15
72.083	0.00	0.32	0.293	O					0.15
72.167	0.00	0.32	0.290	O					0.15
72.250	0.00	0.32	0.288	O					0.14
72.333	0.00	0.32	0.286	O					0.14
72.417	0.00	0.32	0.284	O					0.14
72.500	0.00	0.31	0.282	O					0.14
72.583	0.00	0.31	0.279	O					0.14
72.667	0.00	0.31	0.277	O					0.14
72.750	0.00	0.31	0.275	O					0.14
72.833	0.00	0.30	0.273	O					0.14
72.917	0.00	0.30	0.271	O					0.14
73.000	0.00	0.30	0.269	O					0.13
73.083	0.00	0.30	0.267	O					0.13
73.167	0.00	0.29	0.265	O					0.13

73.250	0.00	0.29	0.263	O	0.13
73.333	0.00	0.29	0.261	O	0.13
73.417	0.00	0.29	0.259	O	0.13
73.500	0.00	0.29	0.257	O	0.13
73.583	0.00	0.28	0.255	O	0.13
73.667	0.00	0.28	0.253	O	0.13
73.750	0.00	0.28	0.251	O	0.13
73.833	0.00	0.28	0.249	O	0.12
73.917	0.00	0.27	0.247	O	0.12
74.000	0.00	0.27	0.245	O	0.12
74.083	0.00	0.27	0.244	O	0.12
74.167	0.00	0.27	0.242	O	0.12
74.250	0.00	0.27	0.240	O	0.12
74.333	0.00	0.26	0.238	O	0.12
74.417	0.00	0.26	0.236	O	0.12
74.500	0.00	0.26	0.234	O	0.12
74.583	0.00	0.26	0.233	O	0.12
74.667	0.00	0.26	0.231	O	0.12
74.750	0.00	0.25	0.229	O	0.11
74.833	0.00	0.25	0.227	O	0.11
74.917	0.00	0.25	0.226	O	0.11
75.000	0.00	0.25	0.224	O	0.11
75.083	0.00	0.25	0.222	O	0.11
75.167	0.00	0.24	0.221	O	0.11
75.250	0.00	0.24	0.219	O	0.11
75.333	0.00	0.24	0.217	O	0.11
75.417	0.00	0.24	0.216	O	0.11
75.500	0.00	0.24	0.214	O	0.11
75.583	0.00	0.24	0.212	O	0.11
75.667	0.00	0.23	0.211	O	0.11
75.750	0.00	0.23	0.209	O	0.10
75.833	0.00	0.23	0.207	O	0.10
75.917	0.00	0.23	0.206	O	0.10
76.000	0.00	0.23	0.204	O	0.10
76.083	0.00	0.23	0.203	O	0.10
76.167	0.00	0.22	0.201	O	0.10
76.250	0.00	0.22	0.200	O	0.10
76.333	0.00	0.22	0.198	O	0.10
76.417	0.00	0.22	0.197	O	0.10
76.500	0.00	0.22	0.195	O	0.10
76.583	0.00	0.21	0.194	O	0.10
76.667	0.00	0.21	0.192	O	0.10
76.750	0.00	0.21	0.191	O	0.10
76.833	0.00	0.21	0.189	O	0.09
76.917	0.00	0.21	0.188	O	0.09
77.000	0.00	0.21	0.186	O	0.09
77.083	0.00	0.21	0.185	O	0.09
77.167	0.00	0.20	0.184	O	0.09
77.250	0.00	0.20	0.182	O	0.09
77.333	0.00	0.20	0.181	O	0.09
77.417	0.00	0.20	0.179	O	0.09
77.500	0.00	0.20	0.178	O	0.09
77.583	0.00	0.20	0.177	O	0.09
77.667	0.00	0.19	0.175	O	0.09
77.750	0.00	0.19	0.174	O	0.09
77.833	0.00	0.19	0.173	O	0.09
77.917	0.00	0.19	0.171	O	0.09
78.000	0.00	0.19	0.170	O	0.09
78.083	0.00	0.19	0.169	O	0.08
78.167	0.00	0.19	0.167	O	0.08
78.250	0.00	0.18	0.166	O	0.08
78.333	0.00	0.18	0.165	O	0.08
78.417	0.00	0.18	0.164	O	0.08
78.500	0.00	0.18	0.162	O	0.08
78.583	0.00	0.18	0.161	O	0.08
78.667	0.00	0.18	0.160	O	0.08
78.750	0.00	0.18	0.159	O	0.08
78.833	0.00	0.17	0.158	O	0.08
78.917	0.00	0.17	0.156	O	0.08
79.000	0.00	0.17	0.155	O	0.08
79.083	0.00	0.17	0.154	O	0.08
79.167	0.00	0.17	0.153	O	0.08
79.250	0.00	0.17	0.152	O	0.08

79.333	0.00	0.17	0.150	O	|	|	|	|	0.08
79.417	0.00	0.17	0.149	O	|	|	|	|	0.07
79.500	0.00	0.16	0.148	O	|	|	|	|	0.07
79.583	0.00	0.16	0.147	O	|	|	|	|	0.07
79.667	0.00	0.16	0.146	O	|	|	|	|	0.07
79.750	0.00	0.16	0.145	O	|	|	|	|	0.07
79.833	0.00	0.16	0.144	O	|	|	|	|	0.07
79.917	0.00	0.16	0.143	O	|	|	|	|	0.07
80.000	0.00	0.16	0.142	O	|	|	|	|	0.07
80.083	0.00	0.16	0.140	O	|	|	|	|	0.07
80.167	0.00	0.15	0.139	O	|	|	|	|	0.07
80.250	0.00	0.15	0.138	O	|	|	|	|	0.07
80.333	0.00	0.15	0.137	O	|	|	|	|	0.07
80.417	0.00	0.15	0.136	O	|	|	|	|	0.07
80.500	0.00	0.15	0.135	O	|	|	|	|	0.07
80.583	0.00	0.15	0.134	O	|	|	|	|	0.07
80.667	0.00	0.15	0.133	O	|	|	|	|	0.07
80.750	0.00	0.15	0.132	O	|	|	|	|	0.07
80.833	0.00	0.15	0.131	O	|	|	|	|	0.07
80.917	0.00	0.14	0.130	O	|	|	|	|	0.07
81.000	0.00	0.14	0.129	O	|	|	|	|	0.06
81.083	0.00	0.14	0.128	O	|	|	|	|	0.06
81.167	0.00	0.14	0.127	O	|	|	|	|	0.06
81.250	0.00	0.14	0.126	O	|	|	|	|	0.06
81.333	0.00	0.14	0.125	O	|	|	|	|	0.06
81.417	0.00	0.14	0.124	O	|	|	|	|	0.06
81.500	0.00	0.14	0.123	O	|	|	|	|	0.06
81.583	0.00	0.14	0.122	O	|	|	|	|	0.06
81.667	0.00	0.13	0.121	O	|	|	|	|	0.06
81.750	0.00	0.13	0.121	O	|	|	|	|	0.06
81.833	0.00	0.13	0.120	O	|	|	|	|	0.06
81.917	0.00	0.13	0.119	O	|	|	|	|	0.06
82.000	0.00	0.13	0.118	O	|	|	|	|	0.06
82.083	0.00	0.13	0.117	O	|	|	|	|	0.06
82.167	0.00	0.13	0.116	O	|	|	|	|	0.06
82.250	0.00	0.13	0.115	O	|	|	|	|	0.06
82.333	0.00	0.13	0.114	O	|	|	|	|	0.06
82.417	0.00	0.13	0.113	O	|	|	|	|	0.06
82.500	0.00	0.12	0.113	O	|	|	|	|	0.06
82.583	0.00	0.12	0.112	O	|	|	|	|	0.06
82.667	0.00	0.12	0.111	O	|	|	|	|	0.06
82.750	0.00	0.12	0.110	O	|	|	|	|	0.05
82.833	0.00	0.12	0.109	O	|	|	|	|	0.05
82.917	0.00	0.12	0.108	O	|	|	|	|	0.05
83.000	0.00	0.12	0.107	O	|	|	|	|	0.05
83.083	0.00	0.12	0.107	O	|	|	|	|	0.05
83.167	0.00	0.12	0.106	O	|	|	|	|	0.05
83.250	0.00	0.12	0.105	O	|	|	|	|	0.05
83.333	0.00	0.12	0.104	O	|	|	|	|	0.05
83.417	0.00	0.11	0.103	O	|	|	|	|	0.05
83.500	0.00	0.11	0.103	O	|	|	|	|	0.05
83.583	0.00	0.11	0.102	O	|	|	|	|	0.05
83.667	0.00	0.11	0.101	O	|	|	|	|	0.05
83.750	0.00	0.11	0.100	O	|	|	|	|	0.05
83.833	0.00	0.11	0.100	O	|	|	|	|	0.05
83.917	0.00	0.11	0.099	O	|	|	|	|	0.05
84.000	0.00	0.11	0.098	O	|	|	|	|	0.05
84.083	0.00	0.11	0.097	O	|	|	|	|	0.05
84.167	0.00	0.11	0.097	O	|	|	|	|	0.05
84.250	0.00	0.11	0.096	O	|	|	|	|	0.05
84.333	0.00	0.11	0.095	O	|	|	|	|	0.05
84.417	0.00	0.10	0.094	O	|	|	|	|	0.05
84.500	0.00	0.10	0.094	O	|	|	|	|	0.05
84.583	0.00	0.10	0.093	O	|	|	|	|	0.05
84.667	0.00	0.10	0.092	O	|	|	|	|	0.05
84.750	0.00	0.10	0.092	O	|	|	|	|	0.05
84.833	0.00	0.10	0.091	O	|	|	|	|	0.05
84.917	0.00	0.10	0.090	O	|	|	|	|	0.05
85.000	0.00	0.10	0.089	O	|	|	|	|	0.04

Remaining water in basin = 0.09 (Ac.Ft)

```
***************************HYDROGRAPH DATA****************************
                Number of intervals =  1020
                Time interval =    5.0 (Min.)
                Maximum/Peak flow rate =        2.222 (CFS)
                Total volume =       9.980 (Ac.Ft)
        Status of hydrographs being held in storage
                   Stream 1  Stream 2  Stream 3  Stream 4  Stream 5
        Peak (CFS)      0.000     0.000     0.000     0.000     0.000
        Vol (Ac.Ft)      0.000     0.000     0.000     0.000     0.000
**********************************************************************

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

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               Study date  10/31/22

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


Program License Serial Number 4009

--------------------------------------------------------------------
Cordova Complex Site, AREA A3
Unit Hydrogragh Method
Post-Development Condition
10-Year, 24-Hours Storm
-------------------------------------------------------------------

       Storm Event Year = 10

       Antecedent Moisture Condition = 2

 English (in-lb) Input Units Used

 English Rainfall Data (Inches) Input Values Used

 English Units used in output format




Area averaged rainfall intensity isohyetal data:
       Sub-Area       Duration       Isohyetal
       (Ac.)           (hours)        (In)
Rainfall data for year 10
           35.83           1           0.61
-------------------------------------------------------------------
Rainfall data for year 10
           35.83           6           1.23
-------------------------------------------------------------------
Rainfall data for year 10
           35.83          24           2.14
-------------------------------------------------------------------
+++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++

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


SCS curve  SCS curve     Area     Area     Fp(Fig C6)    Ap      Fm
No.(AMCII) NO.(AMC 2)    (Ac.)    Fraction     (In/Hr)  (dec.)   (In/Hr)
 32.0      32.0         35.83      1.000     0.978    0.150    0.147

Area-averaged adjusted loss rate Fm (In/Hr) =  0.147

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

Area       Area          SCS CN    SCS CN      S     Pervious
 (Ac.)      Fract         (AMC2)    (AMC2)           Yield Fr
     5.37   0.150         32.0      32.0      10.70     0.000
    30.46   0.850         98.0      98.0       0.20     0.894

Area-averaged catchment yield fraction, Y =  0.760
Area-averaged low loss fraction, Yb =  0.240
User entry of time of concentration  =   0.290 (hours)
+++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Watershed area =      35.83(Ac.)
Catchment Lag time =   0.232 hours
```

```
Unit interval =   5.000 minutes
Unit interval percentage of lag time = 35.9195
Hydrograph baseflow =     0.00(CFS)
Average maximum watershed loss rate(Fm) =  0.147(In/Hr)
Average low loss rate fraction (Yb) = 0.240 (decimal)
VALLEY UNDEVELOPED S-Graph Selected
Computed peak 5-minute rainfall =  0.289(In)
Computed peak 30-minute rainfall =  0.495(In)
Specified peak 1-hour rainfall =  0.609(In)
Computed peak 3-hour rainfall =  0.937(In)
Specified peak 6-hour rainfall =  1.230(In)
Specified peak 24-hour rainfall =  2.140(In)


Rainfall depth area reduction factors:
Using a total area of      35.83(Ac.) (Ref: fig. E-4)

5-minute factor = 0.998     Adjusted rainfall =  0.288(In)
30-minute factor = 0.998    Adjusted rainfall =  0.494(In)
1-hour factor = 0.998       Adjusted rainfall =  0.608(In)
3-hour factor = 1.000       Adjusted rainfall =  0.937(In)
6-hour factor = 1.000       Adjusted rainfall =  1.230(In)
24-hour factor = 1.000      Adjusted rainfall =  2.140(In)
---------------------------------------------------------------------

                        U n i t  H y d r o g r a p h
+++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Interval          'S' Graph          Unit Hydrograph
Number            Mean values            ((CFS))
---------------------------------------------------------------------
                (K =       433.32 (CFS))

  1                6.271                 27.175
  2               34.370                121.757
  3               83.329                212.150
  4              131.857                210.280
  5              158.300                114.581
  6              171.770                 58.371
  7              179.463                 33.335
  8              183.822                 18.887
  9              187.088                 14.152
 10              189.955                 12.425
 11              191.695                  7.538
 12              193.114                  6.151
 13              194.260                  4.963
 14              195.346                  4.709
 15              196.258                  3.951
 16              197.015                  3.277
 17              197.662                  2.805
 18              198.200                  2.333
 19              198.644                  1.925
 20              199.004                  1.559
 21              199.364                  1.556
 22              199.723                  1.556
 23              200.000                  1.202
---------------------------------------------------------------------
Peak Unit   Adjusted mass rainfall  Unit rainfall
Number              (In)                (In)
  1              0.2885              0.2885
  2              0.3552              0.0667
  3              0.4011              0.0459
  4              0.4373              0.0362
  5              0.4675              0.0303
  6              0.4938              0.0263
  7              0.5172              0.0234
  8              0.5383              0.0211
  9              0.5577              0.0194
 10              0.5756              0.0179
 11              0.5923              0.0167
 12              0.6080              0.0157
 13              0.6274              0.0195
 14              0.6460              0.0186
 15              0.6638              0.0178
```

16	0.6809	0.0171
17	0.6973	0.0164
18	0.7132	0.0159
19	0.7285	0.0153
20	0.7434	0.0149
21	0.7578	0.0144
22	0.7718	0.0140
23	0.7854	0.0136
24	0.7987	0.0133
25	0.8117	0.0129
26	0.8243	0.0126
27	0.8366	0.0123
28	0.8487	0.0121
29	0.8605	0.0118
30	0.8720	0.0116
31	0.8834	0.0113
32	0.8945	0.0111
33	0.9054	0.0109
34	0.9161	0.0107
35	0.9266	0.0105
36	0.9369	0.0103
37	0.9471	0.0101
38	0.9570	0.0100
39	0.9668	0.0098
40	0.9765	0.0097
41	0.9860	0.0095
42	0.9954	0.0094
43	1.0046	0.0092
44	1.0137	0.0091
45	1.0227	0.0090
46	1.0316	0.0089
47	1.0403	0.0087
48	1.0489	0.0086
49	1.0575	0.0085
50	1.0659	0.0084
51	1.0742	0.0083
52	1.0824	0.0082
53	1.0905	0.0081
54	1.0986	0.0080
55	1.1065	0.0079
56	1.1143	0.0079
57	1.1221	0.0078
58	1.1298	0.0077
59	1.1374	0.0076
60	1.1449	0.0075
61	1.1524	0.0075
62	1.1598	0.0074
63	1.1671	0.0073
64	1.1743	0.0072
65	1.1815	0.0072
66	1.1886	0.0071
67	1.1956	0.0070
68	1.2026	0.0070
69	1.2095	0.0069
70	1.2163	0.0068
71	1.2231	0.0068
72	1.2299	0.0067
73	1.2367	0.0068
74	1.2434	0.0067
75	1.2501	0.0067
76	1.2567	0.0066
77	1.2633	0.0066
78	1.2698	0.0065
79	1.2763	0.0065
80	1.2827	0.0064
81	1.2891	0.0064
82	1.2955	0.0063
83	1.3017	0.0063
84	1.3080	0.0062
85	1.3142	0.0062
86	1.3203	0.0062
87	1.3265	0.0061
88	1.3325	0.0061

89	1.3386	0.0060
90	1.3445	0.0060
91	1.3505	0.0059
92	1.3564	0.0059
93	1.3623	0.0059
94	1.3681	0.0058
95	1.3739	0.0058
96	1.3797	0.0058
97	1.3854	0.0057
98	1.3911	0.0057
99	1.3967	0.0057
100	1.4023	0.0056
101	1.4079	0.0056
102	1.4135	0.0056
103	1.4190	0.0055
104	1.4245	0.0055
105	1.4300	0.0055
106	1.4354	0.0054
107	1.4408	0.0054
108	1.4461	0.0054
109	1.4515	0.0053
110	1.4568	0.0053
111	1.4621	0.0053
112	1.4673	0.0052
113	1.4725	0.0052
114	1.4777	0.0052
115	1.4829	0.0052
116	1.4880	0.0051
117	1.4931	0.0051
118	1.4982	0.0051
119	1.5033	0.0051
120	1.5083	0.0050
121	1.5133	0.0050
122	1.5183	0.0050
123	1.5233	0.0050
124	1.5282	0.0049
125	1.5331	0.0049
126	1.5380	0.0049
127	1.5429	0.0049
128	1.5477	0.0048
129	1.5525	0.0048
130	1.5573	0.0048
131	1.5621	0.0048
132	1.5669	0.0048
133	1.5716	0.0047
134	1.5763	0.0047
135	1.5810	0.0047
136	1.5857	0.0047
137	1.5903	0.0046
138	1.5949	0.0046
139	1.5995	0.0046
140	1.6041	0.0046
141	1.6087	0.0046
142	1.6132	0.0045
143	1.6178	0.0045
144	1.6223	0.0045
145	1.6268	0.0045
146	1.6312	0.0045
147	1.6357	0.0045
148	1.6401	0.0044
149	1.6446	0.0044
150	1.6490	0.0044
151	1.6533	0.0044
152	1.6577	0.0044
153	1.6621	0.0043
154	1.6664	0.0043
155	1.6707	0.0043
156	1.6750	0.0043
157	1.6793	0.0043
158	1.6835	0.0043
159	1.6878	0.0042
160	1.6920	0.0042
161	1.6962	0.0042

162	1.7004	0.0042
163	1.7046	0.0042
164	1.7088	0.0042
165	1.7130	0.0042
166	1.7171	0.0041
167	1.7212	0.0041
168	1.7253	0.0041
169	1.7294	0.0041
170	1.7335	0.0041
171	1.7376	0.0041
172	1.7416	0.0041
173	1.7457	0.0040
174	1.7497	0.0040
175	1.7537	0.0040
176	1.7577	0.0040
177	1.7617	0.0040
178	1.7657	0.0040
179	1.7696	0.0040
180	1.7735	0.0039
181	1.7775	0.0039
182	1.7814	0.0039
183	1.7853	0.0039
184	1.7892	0.0039
185	1.7931	0.0039
186	1.7969	0.0039
187	1.8008	0.0039
188	1.8046	0.0038
189	1.8085	0.0038
190	1.8123	0.0038
191	1.8161	0.0038
192	1.8199	0.0038
193	1.8237	0.0038
194	1.8274	0.0038
195	1.8312	0.0038
196	1.8349	0.0037
197	1.8387	0.0037
198	1.8424	0.0037
199	1.8461	0.0037
200	1.8498	0.0037
201	1.8535	0.0037
202	1.8572	0.0037
203	1.8608	0.0037
204	1.8645	0.0037
205	1.8681	0.0036
206	1.8718	0.0036
207	1.8754	0.0036
208	1.8790	0.0036
209	1.8826	0.0036
210	1.8862	0.0036
211	1.8898	0.0036
212	1.8934	0.0036
213	1.8969	0.0036
214	1.9005	0.0036
215	1.9040	0.0035
216	1.9076	0.0035
217	1.9111	0.0035
218	1.9146	0.0035
219	1.9181	0.0035
220	1.9216	0.0035
221	1.9251	0.0035
222	1.9286	0.0035
223	1.9320	0.0035
224	1.9355	0.0035
225	1.9389	0.0034
226	1.9424	0.0034
227	1.9458	0.0034
228	1.9492	0.0034
229	1.9526	0.0034
230	1.9560	0.0034
231	1.9594	0.0034
232	1.9628	0.0034
233	1.9662	0.0034
234	1.9695	0.0034

235	1.9729	0.0034
236	1.9763	0.0033
237	1.9796	0.0033
238	1.9829	0.0033
239	1.9863	0.0033
240	1.9896	0.0033
241	1.9929	0.0033
242	1.9962	0.0033
243	1.9995	0.0033
244	2.0028	0.0033
245	2.0060	0.0033
246	2.0093	0.0033
247	2.0126	0.0033
248	2.0158	0.0033
249	2.0191	0.0032
250	2.0223	0.0032
251	2.0255	0.0032
252	2.0287	0.0032
253	2.0319	0.0032
254	2.0352	0.0032
255	2.0383	0.0032
256	2.0415	0.0032
257	2.0447	0.0032
258	2.0479	0.0032
259	2.0511	0.0032
260	2.0542	0.0032
261	2.0574	0.0032
262	2.0605	0.0031
263	2.0637	0.0031
264	2.0668	0.0031
265	2.0699	0.0031
266	2.0730	0.0031
267	2.0761	0.0031
268	2.0792	0.0031
269	2.0823	0.0031
270	2.0854	0.0031
271	2.0885	0.0031
272	2.0916	0.0031
273	2.0947	0.0031
274	2.0977	0.0031
275	2.1008	0.0031
276	2.1038	0.0030
277	2.1069	0.0030
278	2.1099	0.0030
279	2.1129	0.0030
280	2.1160	0.0030
281	2.1190	0.0030
282	2.1220	0.0030
283	2.1250	0.0030
284	2.1280	0.0030
285	2.1310	0.0030
286	2.1340	0.0030
287	2.1369	0.0030
288	2.1399	0.0030

Unit Period (number)	Unit Rainfall (In)	Unit Soil-Loss (In)	Effective Rainfall (In)
1	0.0030	0.0007	0.0023
2	0.0030	0.0007	0.0023
3	0.0030	0.0007	0.0023
4	0.0030	0.0007	0.0023
5	0.0030	0.0007	0.0023
6	0.0030	0.0007	0.0023
7	0.0030	0.0007	0.0023
8	0.0030	0.0007	0.0023
9	0.0030	0.0007	0.0023
10	0.0031	0.0007	0.0023
11	0.0031	0.0007	0.0023
12	0.0031	0.0007	0.0023
13	0.0031	0.0007	0.0023
14	0.0031	0.0007	0.0024

15	0.0031	0.0007	0.0024
16	0.0031	0.0007	0.0024
17	0.0031	0.0008	0.0024
18	0.0031	0.0008	0.0024
19	0.0032	0.0008	0.0024
20	0.0032	0.0008	0.0024
21	0.0032	0.0008	0.0024
22	0.0032	0.0008	0.0024
23	0.0032	0.0008	0.0024
24	0.0032	0.0008	0.0024
25	0.0032	0.0008	0.0024
26	0.0032	0.0008	0.0025
27	0.0032	0.0008	0.0025
28	0.0033	0.0008	0.0025
29	0.0033	0.0008	0.0025
30	0.0033	0.0008	0.0025
31	0.0033	0.0008	0.0025
32	0.0033	0.0008	0.0025
33	0.0033	0.0008	0.0025
34	0.0033	0.0008	0.0025
35	0.0033	0.0008	0.0025
36	0.0033	0.0008	0.0025
37	0.0034	0.0008	0.0026
38	0.0034	0.0008	0.0026
39	0.0034	0.0008	0.0026
40	0.0034	0.0008	0.0026
41	0.0034	0.0008	0.0026
42	0.0034	0.0008	0.0026
43	0.0034	0.0008	0.0026
44	0.0035	0.0008	0.0026
45	0.0035	0.0008	0.0026
46	0.0035	0.0008	0.0026
47	0.0035	0.0008	0.0027
48	0.0035	0.0008	0.0027
49	0.0035	0.0008	0.0027
50	0.0035	0.0009	0.0027
51	0.0036	0.0009	0.0027
52	0.0036	0.0009	0.0027
53	0.0036	0.0009	0.0027
54	0.0036	0.0009	0.0027
55	0.0036	0.0009	0.0028
56	0.0036	0.0009	0.0028
57	0.0037	0.0009	0.0028
58	0.0037	0.0009	0.0028
59	0.0037	0.0009	0.0028
60	0.0037	0.0009	0.0028
61	0.0037	0.0009	0.0028
62	0.0037	0.0009	0.0028
63	0.0038	0.0009	0.0029
64	0.0038	0.0009	0.0029
65	0.0038	0.0009	0.0029
66	0.0038	0.0009	0.0029
67	0.0038	0.0009	0.0029
68	0.0038	0.0009	0.0029
69	0.0039	0.0009	0.0029
70	0.0039	0.0009	0.0029
71	0.0039	0.0009	0.0030
72	0.0039	0.0009	0.0030
73	0.0039	0.0009	0.0030
74	0.0040	0.0009	0.0030
75	0.0040	0.0010	0.0030
76	0.0040	0.0010	0.0030
77	0.0040	0.0010	0.0031
78	0.0040	0.0010	0.0031
79	0.0041	0.0010	0.0031
80	0.0041	0.0010	0.0031
81	0.0041	0.0010	0.0031
82	0.0041	0.0010	0.0031
83	0.0042	0.0010	0.0032
84	0.0042	0.0010	0.0032
85	0.0042	0.0010	0.0032
86	0.0042	0.0010	0.0032
87	0.0042	0.0010	0.0032

88	0.0043	0.0010	0.0032
89	0.0043	0.0010	0.0033
90	0.0043	0.0010	0.0033
91	0.0043	0.0010	0.0033
92	0.0044	0.0010	0.0033
93	0.0044	0.0011	0.0033
94	0.0044	0.0011	0.0034
95	0.0045	0.0011	0.0034
96	0.0045	0.0011	0.0034
97	0.0045	0.0011	0.0034
98	0.0045	0.0011	0.0034
99	0.0046	0.0011	0.0035
100	0.0046	0.0011	0.0035
101	0.0046	0.0011	0.0035
102	0.0046	0.0011	0.0035
103	0.0047	0.0011	0.0036
104	0.0047	0.0011	0.0036
105	0.0048	0.0011	0.0036
106	0.0048	0.0011	0.0036
107	0.0048	0.0012	0.0037
108	0.0048	0.0012	0.0037
109	0.0049	0.0012	0.0037
110	0.0049	0.0012	0.0037
111	0.0050	0.0012	0.0038
112	0.0050	0.0012	0.0038
113	0.0050	0.0012	0.0038
114	0.0051	0.0012	0.0038
115	0.0051	0.0012	0.0039
116	0.0051	0.0012	0.0039
117	0.0052	0.0012	0.0039
118	0.0052	0.0013	0.0040
119	0.0053	0.0013	0.0040
120	0.0053	0.0013	0.0040
121	0.0054	0.0013	0.0041
122	0.0054	0.0013	0.0041
123	0.0055	0.0013	0.0041
124	0.0055	0.0013	0.0042
125	0.0056	0.0013	0.0042
126	0.0056	0.0013	0.0042
127	0.0057	0.0014	0.0043
128	0.0057	0.0014	0.0043
129	0.0058	0.0014	0.0044
130	0.0058	0.0014	0.0044
131	0.0059	0.0014	0.0045
132	0.0059	0.0014	0.0045
133	0.0060	0.0014	0.0046
134	0.0060	0.0014	0.0046
135	0.0061	0.0015	0.0046
136	0.0062	0.0015	0.0047
137	0.0062	0.0015	0.0047
138	0.0063	0.0015	0.0048
139	0.0064	0.0015	0.0048
140	0.0064	0.0015	0.0049
141	0.0065	0.0016	0.0050
142	0.0066	0.0016	0.0050
143	0.0067	0.0016	0.0051
144	0.0067	0.0016	0.0051
145	0.0067	0.0016	0.0051
146	0.0068	0.0016	0.0052
147	0.0069	0.0017	0.0053
148	0.0070	0.0017	0.0053
149	0.0071	0.0017	0.0054
150	0.0072	0.0017	0.0054
151	0.0073	0.0018	0.0056
152	0.0074	0.0018	0.0056
153	0.0075	0.0018	0.0057
154	0.0076	0.0018	0.0058
155	0.0078	0.0019	0.0059
156	0.0079	0.0019	0.0060
157	0.0080	0.0019	0.0061
158	0.0081	0.0020	0.0062
159	0.0083	0.0020	0.0063
160	0.0084	0.0020	0.0064

161	0.0086	0.0021	0.0066
162	0.0087	0.0021	0.0066
163	0.0090	0.0022	0.0068
164	0.0091	0.0022	0.0069
165	0.0094	0.0022	0.0071
166	0.0095	0.0023	0.0072
167	0.0098	0.0024	0.0075
168	0.0100	0.0024	0.0076
169	0.0103	0.0025	0.0079
170	0.0105	0.0025	0.0080
171	0.0109	0.0026	0.0083
172	0.0111	0.0027	0.0084
173	0.0116	0.0028	0.0088
174	0.0118	0.0028	0.0090
175	0.0123	0.0030	0.0094
176	0.0126	0.0030	0.0096
177	0.0133	0.0032	0.0101
178	0.0136	0.0033	0.0104
179	0.0144	0.0035	0.0110
180	0.0149	0.0036	0.0113
181	0.0159	0.0038	0.0121
182	0.0164	0.0039	0.0125
183	0.0178	0.0043	0.0135
184	0.0186	0.0045	0.0141
185	0.0157	0.0038	0.0119
186	0.0167	0.0040	0.0127
187	0.0194	0.0046	0.0147
188	0.0211	0.0051	0.0161
189	0.0263	0.0063	0.0200
190	0.0303	0.0073	0.0230
191	0.0459	0.0110	0.0349
192	0.0667	0.0122	0.0545
193	0.2885	0.0122	0.2763
194	0.0362	0.0087	0.0275
195	0.0234	0.0056	0.0178
196	0.0179	0.0043	0.0136
197	0.0195	0.0047	0.0148
198	0.0171	0.0041	0.0130
199	0.0153	0.0037	0.0117
200	0.0140	0.0034	0.0106
201	0.0129	0.0031	0.0098
202	0.0121	0.0029	0.0092
203	0.0113	0.0027	0.0086
204	0.0107	0.0026	0.0081
205	0.0101	0.0024	0.0077
206	0.0097	0.0023	0.0073
207	0.0092	0.0022	0.0070
208	0.0089	0.0021	0.0067
209	0.0085	0.0020	0.0065
210	0.0082	0.0020	0.0062
211	0.0079	0.0019	0.0060
212	0.0077	0.0018	0.0058
213	0.0075	0.0018	0.0057
214	0.0072	0.0017	0.0055
215	0.0070	0.0017	0.0053
216	0.0068	0.0016	0.0052
217	0.0068	0.0016	0.0052
218	0.0066	0.0016	0.0050
219	0.0065	0.0016	0.0049
220	0.0063	0.0015	0.0048
221	0.0062	0.0015	0.0047
222	0.0061	0.0015	0.0046
223	0.0059	0.0014	0.0045
224	0.0058	0.0014	0.0044
225	0.0057	0.0014	0.0043
226	0.0056	0.0013	0.0043
227	0.0055	0.0013	0.0042
228	0.0054	0.0013	0.0041
229	0.0053	0.0013	0.0041
230	0.0052	0.0013	0.0040
231	0.0052	0.0012	0.0039
232	0.0051	0.0012	0.0039
233	0.0050	0.0012	0.0038

234	0.0049	0.0012	0.0038
235	0.0049	0.0012	0.0037
236	0.0048	0.0012	0.0036
237	0.0047	0.0011	0.0036
238	0.0047	0.0011	0.0035
239	0.0046	0.0011	0.0035
240	0.0045	0.0011	0.0035
241	0.0045	0.0011	0.0034
242	0.0044	0.0011	0.0034
243	0.0044	0.0011	0.0033
244	0.0043	0.0010	0.0033
245	0.0043	0.0010	0.0033
246	0.0042	0.0010	0.0032
247	0.0042	0.0010	0.0032
248	0.0041	0.0010	0.0031
249	0.0041	0.0010	0.0031
250	0.0041	0.0010	0.0031
251	0.0040	0.0010	0.0030
252	0.0040	0.0010	0.0030
253	0.0039	0.0009	0.0030
254	0.0039	0.0009	0.0030
255	0.0039	0.0009	0.0029
256	0.0038	0.0009	0.0029
257	0.0038	0.0009	0.0029
258	0.0037	0.0009	0.0028
259	0.0037	0.0009	0.0028
260	0.0037	0.0009	0.0028
261	0.0036	0.0009	0.0028
262	0.0036	0.0009	0.0027
263	0.0036	0.0009	0.0027
264	0.0036	0.0009	0.0027
265	0.0035	0.0008	0.0027
266	0.0035	0.0008	0.0027
267	0.0035	0.0008	0.0026
268	0.0034	0.0008	0.0026
269	0.0034	0.0008	0.0026
270	0.0034	0.0008	0.0026
271	0.0034	0.0008	0.0026
272	0.0033	0.0008	0.0025
273	0.0033	0.0008	0.0025
274	0.0033	0.0008	0.0025
275	0.0033	0.0008	0.0025
276	0.0032	0.0008	0.0025
277	0.0032	0.0008	0.0024
278	0.0032	0.0008	0.0024
279	0.0032	0.0008	0.0024
280	0.0031	0.0008	0.0024
281	0.0031	0.0008	0.0024
282	0.0031	0.0007	0.0024
283	0.0031	0.0007	0.0023
284	0.0031	0.0007	0.0023
285	0.0030	0.0007	0.0023
286	0.0030	0.0007	0.0023
287	0.0030	0.0007	0.0023
288	0.0030	0.0007	0.0023

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--------------------------------------------------------------------
--------------------------------------------------------------------
Total soil rain loss =      0.45(In)
Total effective rainfall =      1.69(In)
Peak flow rate in flood hydrograph =     81.08(CFS)
---------------------------------------------------------------------
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
                    24 - H O U R    S T O R M
               R u n o f f     H y d r o g r a p h
--------------------------------------------------------------------
            Hydrograph in   5   Minute intervals ((CFS))

--------------------------------------------------------------------
Time(h+m) Volume Ac.Ft   Q(CFS)  0       22.5      45.0      67.5      90.0
-----------------------------------------------------------------------
  0+ 5       0.0004      0.06  Q         |         |         |         |
  0+10       0.0027      0.34  Q         |         |         |         |
  0+15       0.0084      0.82  Q         |         |         |         |
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0+20       0.0173      1.29  Q         |         |         |         |
0+25       0.0280      1.56  Q         |         |         |         |
0+30       0.0396      1.69  Q         |         |         |         |
0+35       0.0519      1.77  Q         |         |         |         |
0+40       0.0644      1.82  Q         |         |         |         |
0+45       0.0772      1.86  Q         |         |         |         |
0+50       0.0903      1.89  Q         |         |         |         |
0+55       0.1035      1.92  Q         |         |         |         |
1+ 0       0.1168      1.94  Q         |         |         |         |
1+ 5       0.1303      1.95  Q         |         |         |         |
1+10       0.1438      1.97  Q         |         |         |         |
1+15       0.1575      1.99  Q         |         |         |         |
1+20       0.1713      2.00  Q         |         |         |         |
1+25       0.1852      2.01  Q         |         |         |         |
1+30       0.1991      2.03  Q         |         |         |         |
1+35       0.2131      2.04  Q         |         |         |         |
1+40       0.2273      2.05  Q         |         |         |         |
1+45       0.2414      2.06  Q         |         |         |         |
1+50       0.2557      2.07  QV        |         |         |         |
1+55       0.2700      2.08  QV        |         |         |         |
2+ 0       0.2844      2.09  QV        |         |         |         |
2+ 5       0.2988      2.09  QV        |         |         |         |
2+10       0.3132      2.10  QV        |         |         |         |
2+15       0.3278      2.11  QV        |         |         |         |
2+20       0.3423      2.12  QV        |         |         |         |
2+25       0.3569      2.12  QV        |         |         |         |
2+30       0.3716      2.13  QV        |         |         |         |
2+35       0.3863      2.14  QV        |         |         |         |
2+40       0.4011      2.15  QV        |         |         |         |
2+45       0.4160      2.15  QV        |         |         |         |
2+50       0.4309      2.16  QV        |         |         |         |
2+55       0.4458      2.17  QV        |         |         |         |
3+ 0       0.4608      2.18  QV        |         |         |         |
3+ 5       0.4759      2.19  QV        |         |         |         |
3+10       0.4910      2.19  QV        |         |         |         |
3+15       0.5062      2.20  Q V       |         |         |         |
3+20       0.5214      2.21  Q V       |         |         |         |
3+25       0.5367      2.22  Q V       |         |         |         |
3+30       0.5520      2.23  Q V       |         |         |         |
3+35       0.5674      2.24  Q V       |         |         |         |
3+40       0.5829      2.25  Q V       |         |         |         |
3+45       0.5984      2.26  |QV       |         |         |         |
3+50       0.6140      2.26  |QV       |         |         |         |
3+55       0.6297      2.27  |QV       |         |         |         |
4+ 0       0.6454      2.28  |QV       |         |         |         |
4+ 5       0.6612      2.29  |QV       |         |         |         |
4+10       0.6770      2.30  |QV       |         |         |         |
4+15       0.6929      2.31  |QV       |         |         |         |
4+20       0.7089      2.32  |QV       |         |         |         |
4+25       0.7250      2.33  |QV       |         |         |         |
4+30       0.7411      2.34  |QV       |         |         |         |
4+35       0.7573      2.35  |Q V      |         |         |         |
4+40       0.7735      2.36  |Q V      |         |         |         |
4+45       0.7898      2.37  |Q V      |         |         |         |
4+50       0.8062      2.38  |Q V      |         |         |         |
4+55       0.8227      2.39  |Q V      |         |         |         |
5+ 0       0.8392      2.40  |Q V      |         |         |         |
5+ 5       0.8558      2.41  |Q V      |         |         |         |
5+10       0.8725      2.42  |Q V      |         |         |         |
5+15       0.8893      2.43  |Q V      |         |         |         |
5+20       0.9061      2.44  |Q V      |         |         |         |
5+25       0.9230      2.46  |Q V      |         |         |         |
5+30       0.9400      2.47  |Q V      |         |         |         |
5+35       0.9571      2.48  |Q V      |         |         |         |
5+40       0.9742      2.49  |Q V      |         |         |         |
5+45       0.9915      2.50  |Q V      |         |         |         |
5+50       1.0088      2.51  |Q  V     |         |         |         |
5+55       1.0262      2.53  |Q  V     |         |         |         |
6+ 0       1.0437      2.54  |Q  V     |         |         |         |
6+ 5       1.0612      2.55  |Q  V     |         |         |         |
6+10       1.0789      2.56  |Q  V     |         |         |         |
6+15       1.0966      2.58  |Q  V     |         |         |         |
6+20       1.1144      2.59  |Q  V     |         |         |         |
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     6+25        1.1323      2.60  |Q  V     |         |         |         |
     6+30        1.1503      2.61  |Q  V     |         |         |         |
     6+35        1.1684      2.63  |Q  V     |         |         |         |
     6+40        1.1866      2.64  |Q  V     |         |         |         |
     6+45        1.2049      2.65  |Q  V     |         |         |         |
     6+50        1.2233      2.67  |Q  V     |         |         |         |
     6+55        1.2418      2.68  |Q  V     |         |         |         |
     7+ 0        1.2603      2.70  |Q   V    |         |         |         |
     7+ 5        1.2790      2.71  |Q   V    |         |         |         |
     7+10        1.2978      2.73  |Q   V    |         |         |         |
     7+15        1.3167      2.74  |Q   V    |         |         |         |
     7+20        1.3357      2.76  |Q   V    |         |         |         |
     7+25        1.3548      2.77  |Q   V    |         |         |         |
     7+30        1.3740      2.79  |Q   V    |         |         |         |
     7+35        1.3933      2.80  |Q   V    |         |         |         |
     7+40        1.4127      2.82  |Q   V    |         |         |         |
     7+45        1.4322      2.84  |Q   V    |         |         |         |
     7+50        1.4519      2.85  |Q   V    |         |         |         |
     7+55        1.4716      2.87  |Q   V    |         |         |         |
     8+ 0        1.4915      2.89  |Q   V    |         |         |         |
     8+ 5        1.5115      2.90  |Q    V   |         |         |         |
     8+10        1.5316      2.92  |Q    V   |         |         |         |
     8+15        1.5519      2.94  |Q    V   |         |         |         |
     8+20        1.5722      2.96  |Q    V   |         |         |         |
     8+25        1.5927      2.98  |Q    V   |         |         |         |
     8+30        1.6134      3.00  |Q    V   |         |         |         |
     8+35        1.6341      3.01  |Q    V   |         |         |         |
     8+40        1.6550      3.03  |Q    V   |         |         |         |
     8+45        1.6761      3.05  |Q    V   |         |         |         |
     8+50        1.6973      3.07  |Q    V   |         |         |         |
     8+55        1.7186      3.10  |Q    V   |         |         |         |
     9+ 0        1.7400      3.12  |Q    V   |         |         |         |
     9+ 5        1.7616      3.14  |Q    V   |         |         |         |
     9+10        1.7834      3.16  |Q     V  |         |         |         |
     9+15        1.8053      3.18  |Q     V  |         |         |         |
     9+20        1.8274      3.20  |Q     V  |         |         |         |
     9+25        1.8496      3.23  |Q     V  |         |         |         |
     9+30        1.8720      3.25  |Q     V  |         |         |         |
     9+35        1.8946      3.27  |Q     V  |         |         |         |
     9+40        1.9173      3.30  |Q     V  |         |         |         |
     9+45        1.9402      3.32  |Q     V  |         |         |         |
     9+50        1.9632      3.35  |Q     V  |         |         |         |
     9+55        1.9865      3.38  |Q     V  |         |         |         |
    10+ 0        2.0099      3.40  |Q     V  |         |         |         |
    10+ 5        2.0335      3.43  |Q      V |         |         |         |
    10+10        2.0574      3.46  |Q      V |         |         |         |
    10+15        2.0814      3.49  |Q      V |         |         |         |
    10+20        2.1056      3.51  |Q      V |         |         |         |
    10+25        2.1300      3.54  |Q      V |         |         |         |
    10+30        2.1546      3.57  |Q      V |         |         |         |
    10+35        2.1794      3.60  |Q      V |         |         |         |
    10+40        2.2045      3.64  |Q      V |         |         |         |
    10+45        2.2297      3.67  |Q      V |         |         |         |
    10+50        2.2552      3.70  |Q      V |         |         |         |
    10+55        2.2809      3.74  |Q       V|         |         |         |
    11+ 0        2.3069      3.77  |Q       V|         |         |         |
    11+ 5        2.3331      3.81  |Q       V|         |         |         |
    11+10        2.3596      3.84  |Q       V|         |         |         |
    11+15        2.3863      3.88  |Q       V|         |         |         |
    11+20        2.4133      3.92  |Q       V|         |         |         |
    11+25        2.4406      3.96  |Q       V|         |         |         |
    11+30        2.4681      4.00  |Q       V|         |         |         |
    11+35        2.4960      4.04  |Q       V|         |         |         |
    11+40        2.5241      4.08  |Q        V         |         |         |
    11+45        2.5525      4.13  |Q        V         |         |         |
    11+50        2.5813      4.17  |Q        V         |         |         |
    11+55        2.6104      4.22  |Q        V         |         |         |
    12+ 0        2.6398      4.27  |Q        V         |         |         |
    12+ 5        2.6695      4.32  |Q        V         |         |         |
    12+10        2.6995      4.36  |Q        V         |         |         |
    12+15        2.7298      4.39  |Q        V         |         |         |
    12+20        2.7603      4.43  |Q        V         |         |         |
    12+25        2.7911      4.47  |Q        |V        |         |         |
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12+30       2.8222      4.53  | Q       |V        |         |         |
12+35       2.8538      4.58  | Q       |V        |         |         |
12+40       2.8858      4.65  | Q       |V        |         |         |
12+45       2.9182      4.71  | Q       |V        |         |         |
12+50       2.9511      4.78  | Q       |V        |         |         |
12+55       2.9845      4.84  | Q       |V        |         |         |
13+ 0       3.0183      4.92  | Q       |V        |         |         |
13+ 5       3.0527      4.99  | Q       | V       |         |         |
13+10       3.0877      5.07  | Q       | V       |         |         |
13+15       3.1231      5.15  | Q       | V       |         |         |
13+20       3.1592      5.24  | Q       | V       |         |         |
13+25       3.1959      5.33  | Q       | V       |         |         |
13+30       3.2333      5.42  | Q       | V       |         |         |
13+35       3.2713      5.52  | Q       | V       |         |         |
13+40       3.3101      5.63  | Q       |  V      |         |         |
13+45       3.3496      5.74  | Q       |  V      |         |         |
13+50       3.3899      5.85  | Q       |  V      |         |         |
13+55       3.4310      5.97  | Q       |  V      |         |         |
14+ 0       3.4731      6.10  | Q       |  V      |         |         |
14+ 5       3.5160      6.24  | Q       |  V      |         |         |
14+10       3.5600      6.39  | Q       |   V     |         |         |
14+15       3.6051      6.55  | Q       |   V     |         |         |
14+20       3.6513      6.72  | Q       |   V     |         |         |
14+25       3.6988      6.89  |  Q      |   V     |         |         |
14+30       3.7476      7.09  |  Q      |   V     |         |         |
14+35       3.7978      7.29  |  Q      |    V    |         |         |
14+40       3.8495      7.51  |  Q      |    V    |         |         |
14+45       3.9029      7.75  |  Q      |    V    |         |         |
14+50       3.9580      8.01  |  Q      |    V    |         |         |
14+55       4.0152      8.29  |  Q      |    V    |         |         |
15+ 0       4.0745      8.61  |  Q      |     V   |         |         |
15+ 5       4.1362      8.96  |  Q      |     V   |         |         |
15+10       4.2005      9.35  |   Q     |     V   |         |         |
15+15       4.2680      9.79  |   Q     |     V   |         |         |
15+20       4.3388     10.29  |   Q     |      V  |         |         |
15+25       4.4130     10.76  |   Q     |      V  |         |         |
15+30       4.4887     11.00  |   Q     |      V  |         |         |
15+35       4.5644     11.00  |   Q     |       V |         |         |
15+40       4.6414     11.17  |   Q     |       V |         |         |
15+45       4.7232     11.89  |    Q    |       V |         |         |
15+50       4.8141     13.19  |    Q    |        V|         |         |
15+55       4.9191     15.25  |     Q   |        V|         |         |
16+ 0       5.0499     18.99  |       Q |         V         |         |
16+ 5       5.2646     31.17  |         |  Q      V         |         |
16+10       5.6691     58.73  |         |         | V   Q   |         |
16+15       6.2275     81.08  |         |         |   V     |     Q   |
16+20       6.7565     76.81  |         |         |     V   |   Q     |
16+25       7.0944     49.07  |         |         |Q      V |         |
16+30       7.3126     31.67  |         |   Q     |        V|         |
16+35       7.4722     23.18  |         Q         |        V|         |
16+40       7.5976     18.20  |       Q |         |         V         |
16+45       7.7064     15.79  |      Q  |         |         V         |
16+50       7.8043     14.23  |     Q   |         |         |V        |
16+55       7.8877     12.11  |    Q    |         |         |V        |
17+ 0       7.9634     10.98  |   Q     |         |         |V        |
17+ 5       8.0327     10.06  |   Q     |         |         |V        |
17+10       8.0977      9.44  |   Q     |         |         | V       |
17+15       8.1580      8.76  |  Q      |         |         | V       |
17+20       8.2142      8.16  |  Q      |         |         | V       |
17+25       8.2669      7.66  |  Q      |         |         | V       |
17+30       8.3165      7.20  |  Q      |         |         |  V      |
17+35       8.3634      6.80  |  Q      |         |         |  V      |
17+40       8.4077      6.44  | Q       |         |         |  V      |
17+45       8.4504      6.19  | Q       |         |         |  V      |
17+50       8.4913      5.95  | Q       |         |         |  V      |
17+55       8.5300      5.62  | Q       |         |         |  V      |
18+ 0       8.5653      5.12  | Q       |         |         |   V     |
18+ 5       8.5993      4.95  | Q       |         |         |   V     |
18+10       8.6324      4.81  | Q       |         |         |   V     |
18+15       8.6647      4.69  | Q       |         |         |   V     |
18+20       8.6962      4.58  | Q       |         |         |   V     |
18+25       8.7270      4.47  |Q        |         |         |   V     |
18+30       8.7570      4.36  |Q        |         |         |   V     |
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18+35       8.7863      4.26  |Q        |         |         |   V     |
18+40       8.8150      4.16  |Q        |         |         |    V    |
18+45       8.8431      4.07  |Q        |         |         |    V    |
18+50       8.8705      3.99  |Q        |         |         |    V    |
18+55       8.8974      3.91  |Q        |         |         |    V    |
19+ 0       8.9238      3.83  |Q        |         |         |    V    |
19+ 5       8.9497      3.76  |Q        |         |         |    V    |
19+10       8.9751      3.69  |Q        |         |         |    V    |
19+15       9.0001      3.62  |Q        |         |         |    V    |
19+20       9.0246      3.56  |Q        |         |         |    V    |
19+25       9.0487      3.50  |Q        |         |         |    V    |
19+30       9.0725      3.45  |Q        |         |         |     V   |
19+35       9.0958      3.39  |Q        |         |         |     V   |
19+40       9.1188      3.34  |Q        |         |         |     V   |
19+45       9.1415      3.29  |Q        |         |         |     V   |
19+50       9.1638      3.24  |Q        |         |         |     V   |
19+55       9.1858      3.19  |Q        |         |         |     V   |
20+ 0       9.2075      3.15  |Q        |         |         |     V   |
20+ 5       9.2289      3.11  |Q        |         |         |     V   |
20+10       9.2500      3.07  |Q        |         |         |     V   |
20+15       9.2708      3.02  |Q        |         |         |     V   |
20+20       9.2914      2.99  |Q        |         |         |     V   |
20+25       9.3117      2.95  |Q        |         |         |     V   |
20+30       9.3318      2.91  |Q        |         |         |      V  |
20+35       9.3516      2.88  |Q        |         |         |      V  |
20+40       9.3712      2.84  |Q        |         |         |      V  |
20+45       9.3905      2.81  |Q        |         |         |      V  |
20+50       9.4097      2.78  |Q        |         |         |      V  |
20+55       9.4286      2.75  |Q        |         |         |      V  |
21+ 0       9.4473      2.72  |Q        |         |         |      V  |
21+ 5       9.4658      2.69  |Q        |         |         |      V  |
21+10       9.4842      2.66  |Q        |         |         |      V  |
21+15       9.5023      2.63  |Q        |         |         |      V  |
21+20       9.5203      2.61  |Q        |         |         |      V  |
21+25       9.5380      2.58  |Q        |         |         |      V  |
21+30       9.5556      2.56  |Q        |         |         |      V  |
21+35       9.5731      2.53  |Q        |         |         |       V |
21+40       9.5903      2.51  |Q        |         |         |       V |
21+45       9.6074      2.48  |Q        |         |         |       V |
21+50       9.6244      2.46  |Q        |         |         |       V |
21+55       9.6412      2.44  |Q        |         |         |       V |
22+ 0       9.6578      2.42  |Q        |         |         |       V |
22+ 5       9.6743      2.39  |Q        |         |         |       V |
22+10       9.6906      2.37  |Q        |         |         |       V |
22+15       9.7068      2.35  |Q        |         |         |       V |
22+20       9.7229      2.33  |Q        |         |         |       V |
22+25       9.7389      2.31  |Q        |         |         |       V |
22+30       9.7547      2.30  |Q        |         |         |       V |
22+35       9.7703      2.28  |Q        |         |         |       V |
22+40       9.7859      2.26  |Q        |         |         |       V |
22+45       9.8013      2.24  Q         |         |         |       V |
22+50       9.8166      2.22  Q         |         |         |       V |
22+55       9.8318      2.21  Q         |         |         |        V|
23+ 0       9.8469      2.19  Q         |         |         |        V|
23+ 5       9.8619      2.17  Q         |         |         |        V|
23+10       9.8767      2.16  Q         |         |         |        V|
23+15       9.8915      2.14  Q         |         |         |        V|
23+20       9.9061      2.13  Q         |         |         |        V|
23+25       9.9207      2.11  Q         |         |         |        V|
23+30       9.9351      2.10  Q         |         |         |        V|
23+35       9.9494      2.08  Q         |         |         |        V|
23+40       9.9637      2.07  Q         |         |         |        V|
23+45       9.9778      2.05  Q         |         |         |        V|
23+50       9.9918      2.04  Q         |         |         |        V|
23+55      10.0058      2.03  Q         |         |         |        V|
24+ 0      10.0196      2.01  Q         |         |         |        V|
24+ 5      10.0330      1.94  Q         |         |         |        V|
24+10      10.0444      1.65  Q         |         |         |        V|
24+15      10.0524      1.16  Q         |         |         |        V|
24+20      10.0571      0.68  Q         |         |         |        V|
24+25      10.0599      0.42  Q         |         |         |        V|
24+30      10.0619      0.28  Q         |         |         |        V|
24+35      10.0633      0.21  Q         |         |         |        V|
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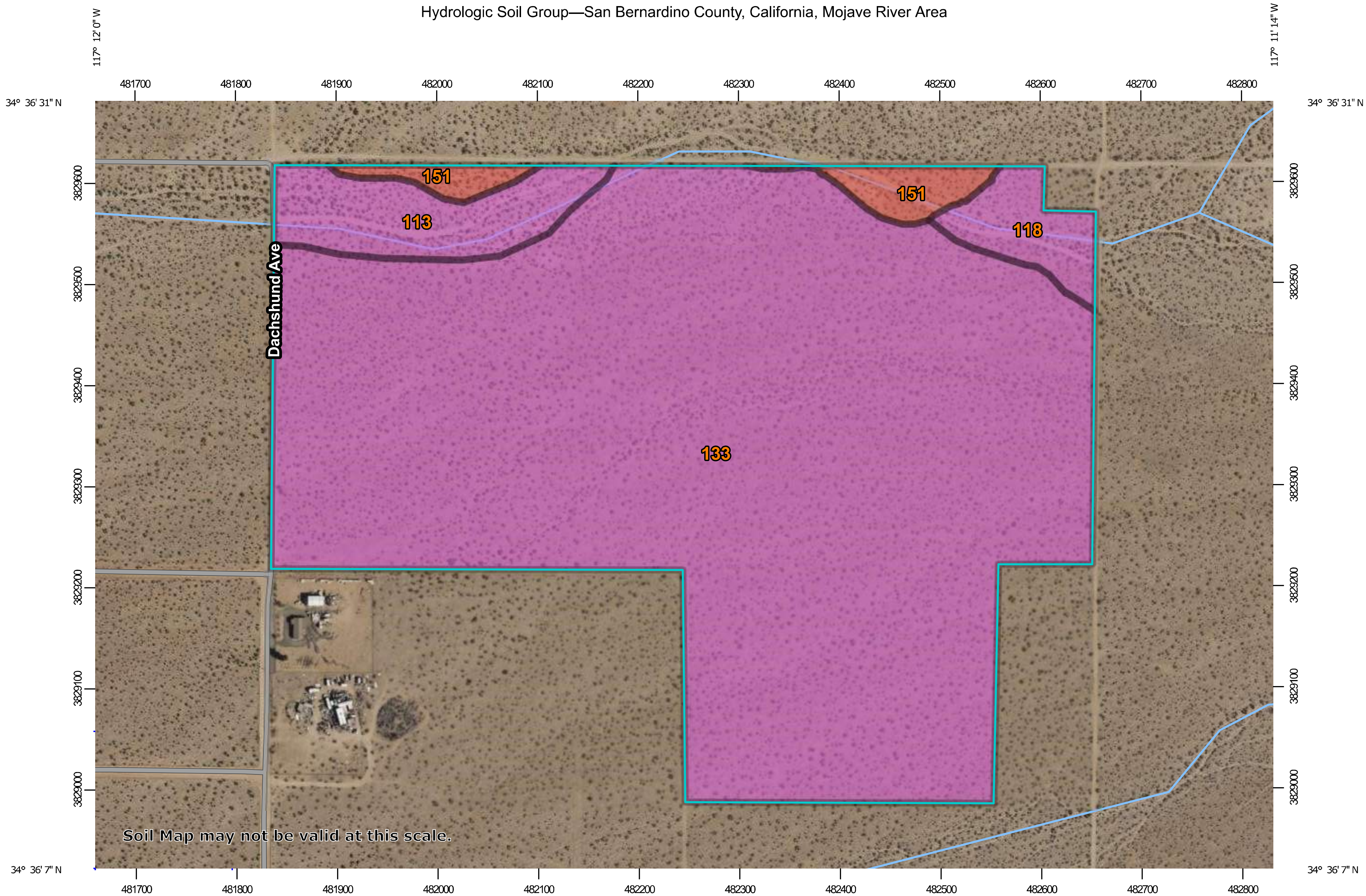
24+40	10.0644	0.16	Q				V
24+45	10.0653	0.13	Q				V
24+50	10.0660	0.10	Q				V
24+55	10.0666	0.08	Q				V
25+ 0	10.0671	0.07	Q				V
25+ 5	10.0675	0.06	Q				V
25+10	10.0678	0.05	Q				V
25+15	10.0681	0.04	Q				V
25+20	10.0683	0.03	Q				V
25+25	10.0684	0.02	Q				V
25+30	10.0686	0.02	Q				V
25+35	10.0686	0.01	Q				V
25+40	10.0687	0.01	Q				V
25+45	10.0688	0.01	Q				V
25+50	10.0688	0.00	Q				V

Appendix E

Soil Information

- USGS Soil Survey
- Geotechnical Report



Map Scale: 1:5,360 if printed on A landscape (11" x 8.5") sheet.

N

0 50 100 200 300 Meters

0 250 500 1000 1500 Feet

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

MAP LEGEND

Area of Interest (AOI)

Area of Interest (AOI)

Soils

Soil Rating Polygons

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

Soil Rating Lines

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

Soil Rating Points

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

Water Features

- Streams and Canals

Transportation

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

Background

- Aerial Photography

MAP INFORMATION

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

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

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

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

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

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

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

Soil Survey Area: San Bernardino County, California, Mojave River Area
Survey Area Data: Version 14, Sep 1, 2022

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

Date(s) aerial images were photographed: Mar 17, 2022—Jun 12, 2022

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

Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
113	CAJON SAND, 2 TO 9 PERCENT SLOPES	A	5.5	5.6%
118	CAJON-ARIZO COMPLEX, 2 TO 15 PERCENT SLOPES*	A	2.9	2.9%
133	HELENDALE-BRYMAN LOAMY SANDS, 2 TO 5 PERCENT SLOPES*	A	87.0	88.8%
151	NEBONA-CUDDEBACK COMPLEX, 2 TO 9 PERCENT SLOPES*	D	2.7	2.7%
Totals for Area of Interest			**98.0**	**100.0%**

Description

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

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

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

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

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

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

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

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

INFILTRATION TEST SUMMARY TABLE

PRELIMINARY RESULTS

Boring	Test Zone (ft)	Soil Classification (% fines)	Raw Infiltration Rates (in./hr)
13673.001 Parcel A Apple Valley			
LI-1	10 to 15	Silty Sand (23% fines)	2.0
LI-2	10 to 15	Silty Sand (24% fines)	1.5
LI-3	9 to 14	Silty Sand (21% fines)	2.8
LI-4	10 to 15	Silty Sand (13-20% fines)	10.0
13673.002 Parcel B Victorville			
LI-1	10 to 15	Silty Sand (28% fines)	0.2
LI-2	7 to 12	Silty Sand (26% fines)	1.8
13673.003 Cordova Road			
LI-1	10 to 15	Silty Sand (17% fines)	0.4
LI-2	10 to 15	Sand with Silt (9% fines)	2.5
13673.004 Quarry Road			
LI-1	10 to 15	Silty Sand (16% fines)	2.3
LI-2	0 to 5	Silty Sand (24% fines)	1.5

Results of Well Permeameter, from USBR 7300-89 Method

Leighton 60th Anniversary

Project: 13673.001
Exploration #/Location: *LI-1*
Depth Boring drilled, bgs (ft): 15
Tested by: AA
USCS Soil Type in test zone: SP-SM
Weather (start to finish): Sunny
Water Source/pH: H2O
Measured boring diameter: 8 in. 4 in. Well Radius
Depth to GW or aquitard, bgs: 100 ft
Well Prep: Drill to 15', bottom 10' screen pipe, sand backfilll in test zone

Initial estimated Depth to Water Surface (in.): 126
Average depth of water in well, "h" (in.): 53
approx. h/r: 13.4
Tu (Fig. 8) (ft): 89.5
Tu>3h?: yes, OK

Cross-sectional area for flow calcs based on Δh
Well pack sand porosity 0.4
Casing outer diameter, in. 2.3
Casing inner diameter, in. 2.1
Cross-sectional area, in.^2 21.9

Use of Barrels: No
Use of Flow Meter: Yes
Test Type: Constant Head

	ft	in.	Total (in.)
Depth to bottom of well measured from top of auger (or ground surfa	15.1 ft	0. in.	181
Casing stickup measured above top of auger (or ground surface) (+ i	0. ft	2. in.	2
Depth to top of sand from top of casing			

Depth of well bottom below top of casing (in): 183

Flow Meter ID: 2497 Meter Units: Gallons 0.05 gallons/pulse
Data logger ID:

Field Data / **Calculations**

Date	Time	Data from Flow Meter: Reading (gallons)	Data from Flow Meter: Interval Pulse Count	Depth to WL in Boring (measured from top of casing) ft	in.	Water Temp (deg F)	Refilled? (or Comments)	Δt (min)	Total Elapsed Time (min)	Depth to WL in well (in.)	h, Height of Water in Well (in.)	Δh (in.)	Avg. h	Vol Change (in.^3) from supply	from Δh	Total	Flow (in^3/ min)	q, Flow (in^3/ hr)	Average Infiltration Surface Area, (in^2)	V (Fig 9)	K20, Coef. Of Perme-ability at 20 deg C (in./hr)	Infiltration Rate [flow/surf area] (in./hr) (FS=1)
Start Date 9/27/2022	Start time: 11:37	Gallons																				
9/27/22	11:37	1590.14		11.23					0	132.8	48.4											
9/27/22	11:40	1591.45		11.08				3	3	131.0	50.2	1.8	49	303	-39	263	88	5264	1290	0.9	0.70	3.76
9/27/22	11:45	1593.6		10.90				5	8	128.8	52.4	2.16	51	497	-47	449	90	5392	1340	0.9	0.67	3.71
9/27/22	11:53	1597.04		10.61				8	16	125.3	55.9	3.48	54	795	-76	718	90	5388	1411	0.9	0.60	3.52
9/27/22	12:03	1601.35		10.32				10	26	121.8	59.4	3.48	58	996	-76	919	92	5516	1498	0.9	0.56	3.39
9/27/22							adjust flow															
9/27/22	12:05	1601.95		10.54					28	124.5	56.7											
9/27/22	12:15	1604.3		10.97				10	38	129.6	51.6	-5.16	54	543	113	656	66	3935	1411	0.9	0.51	2.57
9/27/22	12:25	1606.67		11.00				10	48	130.0	51.2	-0.36	51	547	8	555	56	3332	1342	0.9	0.43	2.29
9/27/22	12:35	1609.04		10.95				10	58	129.4	51.8	0.6	52	547	-13	534	53	3206	1345	0.9	0.41	2.20
9/27/22	12:45	1611.38		10.90				10	68	128.8	52.4	0.6	52	541	-13	527	53	3164	1360	0.9	0.39	2.15
9/27/22	12:55	1613.73		10.83				10	78	128.0	53.2	0.84	53	543	-18	524	52	3147	1378	0.9	0.38	2.11
9/27/22	13:05	1616.08		10.80				10	88	127.6	53.6	0.36	53	543	-8	535	53	3210	1393	0.9	0.39	2.12
9/27/22	13:15	1618.44		10.78				10	98	127.4	53.8	0.24	54	545	-5	540	54	3239	1400	0.9	0.39	2.13
9/27/22	13:25	1620.78		10.71				10	108	126.5	54.7	0.84	54	541	-18	522	52	3133	1414	0.9	0.36	2.04
9/27/22	13:35	1623.12		10.70				10	118	126.4	54.8	0.12	55	541	-3	538	54	3227	1426	0.9	0.38	2.09
9/27/22	13:46	1625.69		10.69				11	129	126.3	54.9	0.12	55	594	-3	591	54	3224	1429	0.9	0.37	2.08
9/27/22	13:56	1628.03		10.68				10	139	126.2	55.0	0.12	55	541	-3	538	54	3227	1432	0.9	0.37	2.08
9/27/22	14:00	1628.95		10.68				4	143	126.2	55.0	0	55	213	0	213	53	3188	1434	0.9	0.37	2.05

Minimum Rate: 2.0
Raw Rate for design, prior to application of adjustment factors: **2.0**

Results of Well Permeameter, from USBR 7300-89 Method

Leighton 60th Anniversary

Project: 13673.001
Exploration #/Location: LI-2
Depth Boring drilled, bgs (ft): 15
Tested by: AA
USCS Soil Type in test zone: SP-SM
Weather (start to finish): Sunny
Water Source/pH: H2O
Measured boring diameter: 8 in. — 4 in. Well Radius
Depth to GW or aquitard, bgs: 100 ft
Well Prep: Drill to 15', bottom 5' screen pipe, sand backfilll in test zone

Initial estimated Depth to Water Surface (in.): 150
Average depth of water in well, "h" (in.): 42
approx. h/r: 10.6
Tu (Fig. 8) (ft): 87.5
Tu>3h?: yes, OK

Cross-sectional area for flow calcs based on Δh
Well pack sand porosity: 0.4
Casing outer diameter, in.: 2.3
Casing inner diameter, in.: 2.1
Cross-sectional area, in.^2: 21.9

Use of Barrels: No
Use of Flow Meter: Yes
Test Type: Constant Head

	ft	in.	Total (in.)
Depth to bottom of well measured from top of auger (or ground surfa	15.5 ft	0. in.	186
Casing stickup measured above top of auger (or ground surface) (+ i	0. ft	-6. in.	-6
Depth to top of sand from top of casing			

Depth of well bottom below top of casing (in): 180

Flow Meter ID: 2497 Meter Units: Gallons 0.05 gallons/pulse
Data logger ID:

Field Data — **Calculations**

Date	Time	Data from Flow Meter: Reading (gallons)	Data from Flow Meter: Interval Pulse Count	Depth to WL in Boring (measured from top of casing) ft	Depth to WL in Boring in.	Water Temp (deg F)	Refilled? (or Comments)	Δt (min)	Total Elapsed Time (min)	Depth to WL in well (in.)	h, Height of Water in Well (in.)	Δh (in.)	Avg. h	Vol Change (in.^3) from supply	Vol Change from Δh	Vol Change Total	Flow (in^3/ min)	q, Flow (in^3/ hr)	Average Infiltration Surface Area, (in^2)	V (Fig 9)	K20, Coef. Of Perme-ability at 20 deg C (in./hr)	Infiltration Rate [flow/surf area] (in./hr) (FS=1)
Start Date 9/26/2022	Start time: 14:28	Gallons																				
9/26/22	14:28	1540.69		11.56					0	144.7	41.3											
9/26/22	14:30	1541.31		11.5				2	2	144.0	42.0	0.72	42	143	-16	127	64	3823	1097	0.9	0.68	3.21
9/26/22							Flow Change															
9/26/22	14:35	1542.75		11.55					7	144.6	41.4											
9/26/22	14:40	1544.72		11.07				5	12	138.8	47.2	5.76	44	455	-126	329	66	3947	1163	0.9	0.57	3.13
9/26/22	14:42	1545.48		10.5				2	14	132.0	54.0	6.84	51	176	-150	26	13	771	1321	0.9	0.09	0.54
9/26/22	14:45	1546.01		11.28			Adjust flow	3	17	141.4	44.6	-9.36	49	122	205	327	109	6550	1290	0.9	1.10	4.68
9/26/22	14:50	1546.26		11.48				5	22	143.8	42.2	-2.4	43	58	53	110	22	1324	1142	0.9	0.24	1.07
9/26/22	15:00	1547.56		11.6				10	32	145.2	40.8	-1.44	42	300	32	332	33	1991	1094	0.9	0.37	1.68
9/26/22	15:10	1548.83		11.7				10	42	146.4	39.6	-1.2	40	293	26	320	32	1918	1061	0.9	0.38	1.67
9/26/22	15:20	1550.15		11.73				10	52	146.8	39.2	-0.36	39	305	8	313	31	1877	1041	0.9	0.37	1.66
9/26/22	15:30	1551.43		11.73				10	62	146.8	39.2	0	39	296	0	296	30	1774	1036	0.9	0.35	1.58
9/26/22	15:40	1552.7		11.72				10	72	146.6	39.4	0.12	39	293	-3	291	29	1744	1038	0.9	0.34	1.55
9/26/22	15:50	1553.98		11.7				10	82	146.4	39.6	0.24	39	296	-5	290	29	1743	1043	0.9	0.34	1.54
9/26/22	16:00	1555.26		11.7				10	92	146.4	39.6	0	40	296	0	296	30	1774	1046	0.9	0.35	1.56

Minimum Rate: 1.1
Raw Rate for design, prior to application of adjustment factors: **1.5**

Results of Well Permeameter, from USBR 7300-89 Method

Leighton 60 Anniversary

Project: 13673.001

Exploration #/Location:	LI-3	Initial estimated Depth to Water Surface (in.):	122
Depth Boring drilled, bgs (ft):	14	Average depth of water in well, "h" (in.):	38
Tested by:	AA	approx. h/r:	9.5
USCS Soil Type in test zone:	SM / SP-SM	Tu (Fig. 8) (ft):	89.8
Weather (start to finish):	Sunny	Tu>3h?:	yes, OK
Water Source/pH:	H2O		
Measured boring diameter:	8 in.	4 in. Well Radius	
Depth to GW or aquitard, bgs:	100 ft		
Well Prep:	Drill to 14', bottom 5' screen pipe, sand backfilll in test zone		

Cross-sectional area for flow calcs based on Δh

Well pack sand porosity	0.4
Casing outer diameter, in.	2.3
Casing inner diameter, in.	2.1
Cross-sectional area, in.^2	21.9

	ft	in.	Total (in.)
Depth to bottom of well measured from top of auger (or ground surfa	14. ft	4. in.	172
Casing stickup measured above top of auger (or ground surface) (+ i	0. ft	12. in.	12
Depth to top of sand from top of casing			

Depth of well bottom below top of casing (in): 184

Use of Barrels:	No
Use of Flow Meter:	Yes
Test Type:	Constant Head

Flow Meter ID: 2497 Meter Units: Gallons 0.05 gallons/pulse

Data logger ID:

Field Data **Calculations**

Date	Time	Data from Flow Meter: Reading (gallons)	Data from Flow Meter: Interval Pulse Count	Depth to WL in Boring (measured from top of casing) ft	in.	Water Temp (deg F)	Refilled? (or Comments)	Δt (min)	Total Elapsed Time (min)	Depth to WL in well (in.)	h, Height of Water in Well (in.)	Δh (in.)	Avg. h	Vol Change (in.^3) from supply	Vol Change (in.^3) from Δh	Vol Change (in.^3) Total	Flow (in^3/ min)	q, Flow (in^3/ hr)	Average Infiltration Surface Area, (in^2)	V (Fig 9)	K20, Coef. Of Perme-ability at 20 deg C (in./hr)	Infiltration Rate [flow/surf area] (in./hr) (FS=1)
Start Date	Start time:																					
9/28/2022	8:42	Gallons		ft	in.																	
9/28/22	8:42	1639.65		12.16					0	133.9	38.1											
9/28/22	8:45	1640.34		12.2				3	3	134.4	37.6	-0.48	38	159	11	170	57	3398	1001	0.9	0.72	3.13
9/28/22	8:50	1641.48		12.28				5	8	135.4	36.6	-0.96	37	263	21	284	57	3412	983	0.9	0.76	3.20
9/28/22	9:00	1643.76		12.45				10	18	137.4	34.6	-2.04	36	527	45	571	57	3428	945	0.9	0.84	3.34
9/28/22							Adjust Flow															
9/28/22	9:05	1645.32		12.21					23	134.5	37.5											
9/28/22	9:15	1648.59		12.05				10	33	132.6	39.4	1.92	38	755	-42	713	71	4280	1016	0.9	0.83	3.88
9/28/22	9:25	1651.86		11.9				10	43	130.8	41.2	1.8	40	755	-39	716	72	4296	1063	0.9	0.78	3.72
9/28/22	9:35	1655.07		11.78				10	53	129.4	42.6	1.44	42	742	-32	710	71	4260	1104	0.9	0.73	3.56
9/28/22	9:45	1657.75		11.83			Adjust Flow	10	63	130.0	42.0	-0.6	42	619	13	632	63	3793	1114	0.9	0.68	3.14
9/28/22	9:55	1659.89		12.27				10	73	135.2	36.8	-5.28	39	494	116	610	61	3660	1040	0.9	0.83	3.24
9/28/22	10:05	1662.01		12.3				10	83	135.6	36.4	-0.36	37	490	8	498	50	2986	970	0.9	0.67	2.84
9/28/22	10:15	1664.14		12.3				10	93	135.6	36.4	0	36	492	0	492	49	2952	965	0.9	0.66	2.82
9/28/22	10:25	1666.25		12.3				10	103	135.6	36.4	0	36	487	0	487	49	2924	965	0.9	0.65	2.79
9/28/22	10:35	1668.38		12.3				10	113	135.6	36.4	0	36	492	0	492	49	2952	965	0.9	0.66	2.82
9/28/22	10:45	1670.48		12.3				10	123	135.6	36.4	0	36	485	0	485	49	2911	965	0.9	0.65	2.78
																			Minimum Rate:			2.8
														Raw Rate for design, prior to application of adjustment factors:								**2.8**

Results of Well Permeameter, from USBR 7300-89 Method

Leighton 60th Anniversary

Project:	13673.001	Initial estimated Depth to Water Surface (in.):	142
Exploration #/Location:	*LI-4*	Average depth of water in well, "h" (in.):	39
Depth Boring drilled, bgs (ft):	15	approx. h/r:	9.7
Tested by:	AA	Tu (Fig. 8) (ft):	88.1
USCS Soil Type in test zone:	SP	Tu>3h?:	yes, OK
Weather (start to finish):	Sunny		
Water Source/pH:	H2O		
Measured boring diameter:	8 in.	4 in. Well Radius	
Depth to GW or aquitard, bgs:	100 ft		
Well Prep:	Drill to 15', bottom 5' screen pipe, sand backfilll in test zone		

Cross-sectional area for flow calcs based on Δh

Well pack sand porosity	0.4
Casing outer diameter, in.	2.3
Casing inner diameter, in.	2.1
Cross-sectional area, in.^2	21.9

	ft	in.	Total (in.)
Depth to bottom of well measured from top of auger (or ground surfa	15.1 ft	0. in.	181
Casing stickup measured above top of auger (or ground surface) (+ i	0. ft	0. in.	0
Depth to top of sand from top of casing			

Depth of well bottom below top of casing (in): 181

Use of Barrels:	No
Use of Flow Meter:	Yes
Test Type:	Constant Head

Flow Meter ID: 2497 Meter Units: Gallons 0.05 gallons/pulse

Data logger ID:

Field Data **Calculations**

Date	Time	Data from Flow Meter: Reading (gallons)	Data from Flow Meter: Interval Pulse Count	Depth to WL in Boring (measured from top of casing) ft	in.	Water Temp (deg F)	Refilled? (or Comments)	Δt (min)	Total Elapsed Time (min)	Depth to WL in well (in.)	h, Height of Water in Well (in.)	Δh (in.)	Avg. h	Vol Change (in.^3) from supply	from Δh	Total	Flow (in^3/ min)	q, Flow (in^3/ hr)	Average Infiltration Surface Area, (in^2)	V (Fig 9)	K20, Coef. Of Perme-ability at 20 deg C (in./hr)	Infiltration Rate [flow/surf area] (in./hr) (FS=1)
Start Date	Start time:																					
9/26/2022	11:55	Gallons		ft	in.																	
9/26/22	11:55	1433.44		12.11					0	145.3	35.9											
9/26/22	12:00	1437.29		12.07				5	5	144.8	36.4	0.48	36	889	-11	879	176	10546	958	0.9	2.34	10.15
9/26/22	12:05	1441.44		12.04				5	10	144.5	36.7	0.36	37	959	-8	951	190	11409	969	0.9	2.50	10.86
9/26/22	12:15	1450.07		11.95				10	20	143.4	37.8	1.08	37	1994	-24	1970	197	11819	987	0.9	2.46	11.04
9/26/22	12:25	1458.15		11.91				10	30	142.9	38.3	0.48	38	1866	-11	1856	186	11136	1006	0.9	2.28	10.20
9/26/22	12:35	1466.53		11.88				10	40	142.6	38.6	0.36	38	1936	-8	1928	193	11567	1017	0.9	2.34	10.49
9/26/22	12:45	1474.92		11.86				10	50	142.3	38.9	0.24	39	1938	-5	1933	193	11597	1024	0.9	2.32	10.44
9/26/22	12:55	1483.35		11.82				10	60	141.8	39.4	0.48	39	1947	-11	1937	194	11621	1033	0.9	2.28	10.37
9/26/22	13:05	1491.16		11.78				10	70	141.4	39.8	0.48	40	1804	-11	1794	179	10762	1046	0.9	2.07	9.49
9/26/22	13:15	1500.17		11.72				10	80	140.6	40.6	0.72	40	2081	-16	2066	207	12393	1061	0.9	2.32	10.77
9/26/22	13:25	1508.65		11.73				10	90	140.8	40.4	-0.12	41	1959	3	1962	196	11769	1068	0.9	2.22	10.16
9/26/22	13:35	1517.01		11.75				10	100	141.0	40.2	-0.24	40	1931	5	1936	194	11619	1064	0.9	2.22	10.07
9/26/22	13:45	1525.53		11.7				10	110	140.4	40.8	0.6	41	1968	-13	1955	195	11730	1068	0.9	2.18	10.12
9/26/22	13:55	1533.89		11.72				10	120	140.6	40.6	-0.24	41	1931	5	1936	194	11619	1073	0.9	2.18	9.99
9/26/22																						
9/26/22																						
																				Minimum Rate:		9.5
													Raw Rate for design, prior to application of adjustment factors:									**10.0**

Results of Falling Head Infiltration Test

Project: 13673.002

Exploration #/Location:	*LI-1*		
Depth Boring drilled, bgs (ft):	15		
Tested by:	AA		
USCS Soil Type in test zone:	SM		
Weather (start to finish):	Sunny		
Water Source/pH:	H2O		
Measured boring diameter:	8	in.	4 in. Well Radius
Depth to GW or aquitard, bgs:	100	ft	
Well Prep:	Drill to 15', bottom 5' screen pipe, sand backfilll in test zone		

Initial estimated Depth to Water Surface (in.):	138
Average depth of water in well, "h" (in.):	37
approx. h/r:	9.2
Tu (Fig. 8) (ft):	88.5
Tu>3h?:	yes, OK

Cross-sectional area for flow calcs based on Δh

Well pack sand porosity	0.4
Casing outer diameter, in.	2.3
Casing inner diameter, in.	2.1
Cross-sectional area, in.^2	21.9

Use of Barrels:	No
Use of Flow Meter:	No
Test Type:	Falling Head

	ft	in.	Total (in.)
Depth to bottom of well measured from top of auger (or ground surfa	15. ft	0. in.	180
Casing stickup measured above top of auger (or ground surface) (+ i	0. ft	5.5 in.	5.5
Depth to top of sand from top of casing			

Depth of well bottom below top of casing (in): 186

Flow Meter ID: Meter Units: Gallons 0.05 gallons/pulse Data logger ID:

Field Data **Calculations**

Date	Time	Data from Flow Meter: Reading (gallons)	Interval Pulse Count	Depth to WL in Boring (measured from top of casing) ft	in.	Water Temp (deg F)	Refilled? (or Comments)	Δt (min)	Total Elapsed Time (min)	Depth to WL in well (in.)	h, Height of Water in Well (in.)	Δh (in.)	Avg. h	Vol Change (in.^3) from supply	from Δh	Total	Flow (in^3/ min)	q, Flow (in^3/ hr)	Average Infiltration Surface Area, (in^2)	V (Fig 9)	K20, Coef. Of Perme-ability at 20 deg C (in./hr)	Infiltration Rate [flow/surf area] (in./hr) (FS=1)
Start Date	Start time:	Gallons																				
9/26/2022	9:05																					
9/26/22	9:05			11.15					0	128.3	51.7											
9/26/22	9:10			11.38				5	5	131.1	48.9	-2.76	50	0	60	60	12	726	1315	0.9	0.10	0.51
9/26/22	9:15			11.5				5	10	132.5	47.5	-1.44	48	0	32	32	6	379	1262	0.9	0.06	0.28
9/26/22	9:25			11.83				10	20	136.5	43.5	-3.96	46	0	87	87	9	521	1194	0.9	0.09	0.40
9/26/22	9:35			12.02				10	30	138.7	41.3	-2.28	42	0	50	50	5	300	1116	0.9	0.06	0.25
9/26/22	9:45			12.25				10	40	141.5	38.5	-2.76	40	0	60	60	6	363	1053	0.9	0.08	0.32
9/26/22	9:55			12.43				10	50	143.7	36.3	-2.16	37	0	47	47	5	284	991	0.9	0.06	0.26
9/26/22	10:05			12.56				10	60	145.2	34.8	-1.56	36	0	34	34	3	205	944	0.9	0.05	0.20
9/26/22	10:14			12.73				9	69	147.3	32.7	-2.04	34	0	45	45	5	298	899	0.9	0.08	0.31
9/26/22	10:25			12.83				11	80	148.5	31.5	-1.2	32	0	26	26	2	143	858	0.9	0.04	0.15
9/26/22	10:34			12.95				9	89	149.9	30.1	-1.44	31	0	32	32	4	210	825	0.9	0.06	0.24
9/26/22	10:45			13.05				11	100	151.1	28.9	-1.2	30	0	26	26	2	143	792	0.9	0.05	0.17
9/26/22	10:55			13.15				10	110	152.3	27.7	-1.2	28	0	26	26	3	158	762	0.9	0.05	0.19
9/26/22	11:05			13.25				10	120	153.5	26.5	-1.2	27	0	26	26	3	158	731	0.9	0.06	0.20
																				Minimum Rate:		0.2
														Raw Rate for design, prior to application of adjustment factors:								**0.2**

Results of Well Permeameter, from USBR 7300-89 Method

Leighton 60 Anniversary

Project: 13673.002
Exploration #/Location: *LI-2*
Depth Boring drilled, bgs (ft): 12
Tested by: AA
USCS Soil Type in test zone: SP-SM
Weather (start to finish): Sunny
Water Source/pH: H2O
Measured boring diameter: 8 in. — 4 in. Well Radius
Depth to GW or aquitard, bgs: 100 ft
Well Prep: Drill to 12', bottom 5' screen pipe, sand backfilll in test zone

Initial estimated Depth to Water Surface (in.): 108
Average depth of water in well, "h" (in.): 34
approx. h/r: 8.5
Tu (Fig. 8) (ft): 91.0
Tu>3h?: yes, OK

Cross-sectional area for flow calcs based on Δh
Well pack sand porosity: 0.4
Casing outer diameter, in.: 2.3
Casing inner diameter, in.: 2.1
Cross-sectional area, in.^2: 21.9

Use of Barrels: No
Use of Flow Meter: Yes
Test Type: Constant Head

	ft	in.	Total (in.)
Depth to bottom of well measured from top of auger (or ground surfa	11. ft	10. in.	142
Casing stickup measured above top of auger (or ground surface) (+ i	0. ft	0. in.	0
Depth to top of sand from top of casing			

Depth of well bottom below top of casing (in): 142

Flow Meter ID: 2497 Meter Units: Gallons 0.05 gallons/pulse
Data logger ID:

Field Data — **Calculations**

Date	Time	Data from Flow Meter: Reading (gallons)	Data from Flow Meter: Interval Pulse Count	Depth to WL in Boring (measured from top of casing) ft	in.	Water Temp (deg F)	Refilled? (or Comments)	Δt (min)	Total Elapsed Time (min)	Depth to WL in well (in.)	h, Height of Water in Well (in.)	Δh (in.)	Avg. h	Vol Change (in.^3) from supply	Vol Change from Δh	Vol Change Total	Flow (in^3/ min)	q, Flow (in^3/ hr)	Average Infiltration Surface Area, (in^2)	V (Fig 9)	K20, Coef. Of Perme-ability at 20 deg C (in./hr)	Infiltration Rate [flow/surf area] (in./hr) (FS=1)
Start Date 9/27/2022	Start time: 8:47	Gallons		ft	in.																	
9/27/22	8:47	1563.15		8.62					0	103.4	38.6											
9/27/22	8:50	1563.23		8.92				3	3	107.0	35.0	-3.6	37	18	79	97	32	1947	974	0.9	0.47	1.84
9/27/22	8:55	1563.89		9				5	8	108.0	34.0	-0.96	34	152	21	173	35	2082	917	0.9	0.52	2.09
9/27/22	9:00	1564.54		9.05				5	13	108.6	33.4	-0.6	34	150	13	163	33	1960	897	0.9	0.50	2.01
9/27/22	9:10	1565.86		9.05				10	23	108.6	33.4	0	33	305	0	305	30	1830	890	0.9	0.46	1.90
9/27/22	9:20	1567.16		9.05				10	33	108.6	33.4	0	33	300	0	300	30	1802	890	0.9	0.46	1.87
9/27/22	9:30	1568.47		9.03				10	43	108.4	33.6	0.24	34	303	-5	297	30	1784	893	0.9	0.45	1.84
9/27/22	9:40	1569.78		9.02				10	53	108.2	33.8	0.12	34	303	-3	300	30	1800	897	0.9	0.45	1.85
9/27/22	9:50	1571.08		9.01				10	63	108.1	33.9	0.12	34	300	-3	298	30	1786	900	0.9	0.44	1.83
9/27/22	10:00	1572.38		9				10	73	108.0	34.0	0.12	34	300	-3	298	30	1786	903	0.9	0.44	1.82
9/27/22	10:10	1573.69		9				10	83	108.0	34.0	0	34	303	0	303	30	1816	905	0.9	0.45	1.85
9/27/22	10:20	1574.98		9				10	93	108.0	34.0	0	34	298	0	298	30	1788	905	0.9	0.44	1.82
9/27/22	10:30	1576.28		8.98				10	103	107.8	34.2	0.24	34	300	-5	295	30	1770	908	0.9	0.43	1.80
9/27/22	10:40	1577.58		8.98				10	113	107.8	34.2	0	34	300	0	300	30	1802	911	0.9	0.44	1.82
9/27/22	10:50	1578.79		9.04				10	123	108.5	33.5	-0.72	34	280	16	295	30	1772	902	0.9	0.45	1.81

Minimum Rate: 1.8
Raw Rate for design, prior to application of adjustment factors: **1.8**

Results of Well Permeameter, from USBR 7300-89 Method

Leighton 60th Anniversary

Project: 13673.003

Exploration #/Location: *LI-1*

Depth Boring drilled, bgs (ft): 15

Tested by: AA

USCS Soil Type in test zone: SM / SP-SM

Weather (start to finish): Sunny

Water Source/pH: H2O

Measured boring diameter: 8 in. — 4 in. Well Radius

Depth to GW or aquitard, bgs: 100 ft

Well Prep: Drill to 15', bottom 10' screen pipe, sand backfilll in test zone

Initial estimated Depth to Water Surface (in.): 133

Average depth of water in well, "h" (in.): 51

approx. h/r: 12.7

Tu (Fig. 8) (ft): 88.9

Tu>3h?: yes, OK

Cross-sectional area for flow calcs based on Δh

Well pack sand porosity: 0.4

Casing outer diameter, in.: 2.3

Casing inner diameter, in.: 2.1

Cross-sectional area, in.^2: 21.9

Use of Barrels: No

Use of Flow Meter: Yes

Test Type: Constant Head

	ft	in.	Total (in.)
Depth to bottom of well measured from top of auger (or ground surfa	15. ft	3.5 in.	184
Casing stickup measured above top of auger (or ground surface) (+ i	0. ft	0. in.	0
Depth to top of sand from top of casing			

Depth of well bottom below top of casing (in): 184

Flow Meter ID: 2497 Meter Units: Gallons 0.05 gallons/pulse

Data logger ID:

Field Data / **Calculations**

Date	Time	Data from Flow Meter: Reading (gallons)	Data from Flow Meter: Interval Pulse Count	Depth to WL in Boring (measured from top of casing): ft	in.	Water Temp (deg F)	Refilled? (or Comments)	Δt (min)	Total Elapsed Time (min)	Depth to WL in well (in.)	h, Height of Water in Well (in.)	Δh (in.)	Avg. h	Vol Change (in.^3): from supply	from Δh	Total	Flow (in^3/ min)	q, Flow (in^3/ hr)	Average Infiltration Surface Area, (in^2)	V (Fig 9)	K20, Coef. Of Perme-ability at 20 deg C (in./hr)	Infiltration Rate [flow/surf area] (in./hr) (FS=1)
Start Date	Start time:	Gallons		ft	in.																	
9/28/2022	11:35																					
9/28/22	11:35	1677.77		11.9					0	142.8	40.7											
9/28/22	11:37	1677.95		11.85				2	2	142.2	41.3	0.6	41	42	-13	28	14	853	1081	0.9	0.16	0.73
9/28/22	11:40	1678.23		11.78				3	5	141.4	42.1	0.84	42	65	-18	46	15	926	1099	0.9	0.16	0.78
9/28/22							Adjust Flow															
9/28/22	11:42	1678.3		11.82					7	141.8	41.7											
9/28/22	11:52	1678.92		11.67				10	17	140.0	43.5	1.8	43	143	-39	104	10	623	1120	0.9	0.10	0.51
9/28/22	12:02	1679.57		11.5				10	27	138.0	45.5	2.04	44	150	-45	105	11	633	1168	0.9	0.10	0.50
9/28/22	12:12	1680.21		11.26				10	37	135.1	48.4	2.88	47	148	-63	85	8	508	1230	0.9	0.07	0.38
9/28/22	12:21	1680.8		11.08				9	46	133.0	50.5	2.16	49	136	-47	89	10	593	1293	0.9	0.08	0.42
9/28/22	12:31	1681.44		10.87				10	56	130.4	53.1	2.52	52	148	-55	93	9	556	1352	0.9	0.07	0.38
9/28/22	12:42	1682.16		10.6				11	67	127.2	56.3	3.24	55	166	-71	95	9	520	1425	0.9	0.06	0.34
9/28/22	12:51	1682.76		10.45				9	76	125.4	58.1	1.8	57	139	-39	99	11	661	1488	0.9	0.07	0.41
9/28/22							Adjust Flow															
9/28/22	12:57	1682.82		10.62			(slow for readings)		82	127.4	56.1											
9/28/22	13:00	1682.86		10.54			(slow for readings)	3	85	126.5	57.0	0.96	57	9	-21	-12	-4	-236	1471	0.9	-0.03	-0.15
9/28/22	13:09	1682.87		10.54			(slow for readings)	9	94	126.5	57.0	0	57	2	0	2	0	15	1483	0.9	0.00	0.01
9/28/22	13:20	1683.03		10.52			(slow for readings)	11	105	126.2	57.3	0.24	57	37	-5	32	3	173	1486	0.9	0.02	0.11
9/28/22							Switch to Falling Head															
9/28/22	13:36			9.5					121	114.0	69.5											
9/28/22	13:38			9.54				2	123	114.5	69.0	-0.48	69	0	11	11	5	315	1791	0.9	0.03	0.16
9/28/22	13:40			9.58				2	125	115.0	68.5	-0.48	69	0	11	11	5	315	1779	0.9	0.03	0.16
9/28/22	13:44			9.75				4	129	117.0	66.5	-2.04	68	0	45	45	11	670	1747	0.9	0.06	0.35
9/28/22	13:54			10.73				10	139	128.8	54.7	-11.76	61	0	258	258	26	1546	1574	0.9	0.19	0.91
9/28/22	13:59			11.07				5	144	132.8	50.7	-4.08	53	0	89	89	18	1073	1375	0.9	0.14	0.72
9/28/22	14:05			11.58				6	150	139.0	44.5	-6.12	48	0	134	134	22	1341	1247	0.9	0.22	0.99
9/28/22	14:10			11.98				5	155	143.8	39.7	-4.8	42	0	105	105	21	1262	1109	0.9	0.25	1.05
9/28/22	14:15			12.3				5	160	147.6	35.9	-3.84	38	0	84	84	17	1010	1001	0.9	0.23	0.93
9/28/22	14:21			12.56				6	166	150.7	32.8	-3.12	34	0	68	68	11	684	913	0.9	0.18	0.69
9/28/22	14:30			12.65				9	175	151.8	31.7	-1.08	32	0	24	24	3	158	861	0.9	0.04	0.17
9/28/22																						
9/28/22																						

Minimum Rate: 0.3

Raw Rate for design, prior to application of adjustment factors: **0.4**

Results of Well Permeameter, from USBR 7300-89 Method

Project: 13673.003

Exploration #/Location: LI-2
Depth Boring drilled, bgs (ft): 15
Tested by: AA
USCS Soil Type in test zone: SM / SP-SM
Weather (start to finish): Sunny
Water Source/pH: H2O
Measured boring diameter: 8 in. 4 in. Well Radius
Depth to GW or aquitard, bgs: 100 ft
Well Prep: Drill to 15', bottom 10' screen pipe, sand backfilll in test zone

Initial estimated Depth to Water Surface (in.): 155
Average depth of water in well, "h" (in.): 25
approx. h/r: 6.3
Tu (Fig. 8) (ft): 87.1
Tu>3h?: yes, OK

Cross-sectional area for flow calcs based on Δh
Well pack sand porosity 0.4
Casing outer diameter, in. 2.3
Casing inner diameter, in. 2.1
Cross-sectional area, in.^2 21.9

Use of Barrels: No
Use of Flow Meter: Yes
Test Type: Constant Head

	ft	in.	Total (in.)
Depth to bottom of well measured from top of auger (or ground surfa	15. ft	1.5 in.	182
Casing stickup measured above top of auger (or ground surface) (+ i	0. ft	1.5 in.	1.5
Depth to top of sand from top of casing			

Depth of well bottom below top of casing (in): 183

Flow Meter ID: 2497 Meter Units: Gallons 0.05 gallons/pulse
Data logger ID:

Field Data / Calculations

Date	Time	Data from Flow Meter: Reading (gallons)	Interval Pulse Count	Depth to WL in Boring (measured from top of casing) ft	in.	Water Temp (deg F)	Refilled? (or Comments)	Δt (min)	Total Elapsed Time (min)	Depth to WL in well (in.)	h, Height of Water in Well (in.)	Δh (in.)	Avg. h	Vol Change (in.^3) from supply	from Δh	Total	Flow (in^3/ min)	q, Flow (in^3/ hr)	Average Infiltration Surface Area, (in^2)	V (Fig 9)	K20, Coef. Of Perme-ability at 20 deg C (in./hr)	Infiltration Rate [flow/surf area] (in./hr) (FS=1)
Start Date 9/29/2022	Start time: 9:12	Gallons																				
9/29/22	9:12	1694.11		13.5					0	160.5	21.0											
9/29/22	9:14	1694.46		13.47				2	2	160.1	21.4	0.36	21	81	-8	73	36	2189	583	0.9	1.08	3.46
9/29/22	9:19	1695.34		13.32				5	7	158.3	23.2	1.8	22	203	-39	164	33	1966	610	0.9	0.85	2.97
9/29/22	9:24	1696.28		13.27			Adjust Flow	5	12	157.7	23.8	0.6	23	217	-13	204	41	2448	640	0.9	1.03	3.53
9/29/22	9:34	1697.98		13.18				10	22	156.7	24.8	1.08	24	393	-24	369	37	2214	661	0.9	0.87	3.09
9/29/22	9:45	1699.91		13.1				11	33	155.7	25.8	0.96	25	446	-21	425	39	2317	687	0.9	0.86	3.11
9/29/22	9:55	1701.65		13.04				10	43	155.0	26.5	0.72	26	402	-16	386	39	2317	708	0.9	0.83	3.02
9/29/22	10:05	1703.4		13				10	53	154.5	27.0	0.48	27	404	-11	394	39	2362	723	0.9	0.83	3.01
9/29/22																						
9/29/22	10:10			11.3					58	134.1	47.4											
9/29/22	10:11			11.69				1	59	138.8	42.7	-4.68	45	0	103	103	103	6152	1183	0.9	1.09	4.79
9/29/22	10:12			12.15				1	60	144.3	37.2	-5.52	40	0	121	121	121	7256	1055	0.9	1.61	6.34
9/29/22	10:13			12.39				1	61	147.2	34.3	-2.88	36	0	63	63	63	3786	949	0.9	0.94	3.68
9/29/22	10:14			12.64				1	62	150.2	31.3	-3	33	0	66	66	66	3943	875	0.9	1.13	4.15
9/29/22	10:16			12.93				2	64	153.7	27.8	-3.48	30	0	76	76	38	2287	794	0.9	0.79	2.66
9/29/22	10:18			13.23				2	66	157.3	24.2	-3.6	26	0	79	79	39	2366	705	0.9	1.01	3.10
9/29/22	10:20			13.5				2	68	160.5	21.0	-3.24	23	0	71	71	35	2129	619	0.9	1.13	3.17
9/29/22	10:22			13.8				2	70	164.1	17.4	-3.6	19	0	79	79	39	2366	533	0.9	1.67	4.09
9/29/22	10:27			14.14				5	75	168.2	13.3	-4.08	15	0	89	89	18	1073	436	0.9	1.14	2.27
9/29/22	10:32			14.43				5	80	171.7	9.8	-3.48	12	0	76	76	15	915	341	0.9	1.49	2.47
9/29/22	10:37			14.71				5	85	175.0	6.5	-3.36	8	0	74	74	15	883	255	0.9	2.59	3.19
9/29/22																						
9/29/22	10:50			11.1					98	131.7	49.8											
9/29/22	10:52			11.23				2	100	133.3	48.2	-1.56	49	0	34	34	17	1025	1282	0.9	0.15	0.74
9/29/22	10:57			12.98				5	105	154.3	27.2	-21	38	0	460	460	92	5521	999	0.9	2.23	5.10
9/29/22	11:00			13.33				3	108	158.5	23.0	-4.2	25	0	92	92	31	1840	682	0.9	0.86	2.49
9/29/22	11:05			14.05				5	113	167.1	14.4	-8.64	19	0	189	189	38	2271	521	0.9	2.31	4.02
9/29/22	11:10			14.37				5	118	170.9	10.6	-3.84	12	0	84	84	17	1010	364	0.9	1.50	2.56
9/29/22	11:12			14.5				2	120	172.5	9.0	-1.56	10	0	34	34	17	1025	296	0.9	1.77	3.19
9/29/22																						
9/29/22																						
																			Minimum Rate:			2.3
														Raw Rate for design, prior to application of adjustment factors:								2.5

Results of Well Permeameter, from USBR 7300-89 Method

Project:	13673.004	Initial estimated Depth to Water Surface (in.):	95
Exploration #/Location:	*LI-1*	Average depth of water in well, "h" (in.):	31
Depth Boring drilled, bgs (ft):	10.5	approx. h/r:	7.6
Tested by:	AA	Tu (Fig. 8) (ft):	92.0
USCS Soil Type in test zone:	SM / SP-SM	Tu>3h?:	yes, OK
Weather (start to finish):	Sunny		
Water Source/pH:	H2O		
Measured boring diameter:	8 in.	4 in. Well Radius	
Depth to GW or aquitard, bgs:	100 ft		
Well Prep:	Drill to 5', hit refusal, set 5' screen, sand backfilll in test zone		

Cross-sectional area for flow calcs based on Δh

Well pack sand porosity	0.4
Casing outer diameter, in.	2.3
Casing inner diameter, in.	2.1
Cross-sectional area, in.^2	21.9

Use of Barrels:	No
Use of Flow Meter:	Yes
Test Type:	Constant Head

	ft	in.	Total (in.)
Depth to bottom of well measured from top of auger (or ground surfa	10. ft	0. in.	120
Casing stickup measured above top of auger (or ground surface) (+ i	0. ft	-6. in.	-6
Depth to top of sand from top of casing			

Depth of well bottom below top of casing (in): 114

Flow Meter ID: 2497 Meter Units: Gallons 0.05 gallons/pulse Data logger ID:

Field Data **Calculations**

Date	Time	Data from Flow Meter: Reading (gallons)	Data from Flow Meter: Interval Pulse Count	**Depth to WL in Boring (measured from top of casing)** ft	in.	Water Temp (deg F)	Refilled? (or Comments)	Δt (min)	Total Elapsed Time (min)	Depth to WL in well (in.)	h, Height of Water in Well (in.)	Δh (in.)	Avg. h	Vol Change (in.^3) from supply	Vol Change from Δh	Vol Change Total	Flow (in^3/ min)	q, Flow (in^3/ hr)	Average Infiltration Surface Area, (in^2)	V (Fig 9)	K20, Coef. Of Perme-ability at 20 deg C (in./hr)	**Infiltration Rate [flow/surf area] (in./hr) (FS=1)**
Start Date 9/29/2022	Start time: 14:29	Gallons																				
9/29/22	14:29	1736.91		7.03					0	90.4	29.6											
9/29/22	14:31	1737.22		7.07				2	2	90.8	29.2	-0.48	29	72	11	82	41	2464	789	0.9	0.77	2.88
9/29/22	14:35	1737.84		7.11				4	6	91.3	28.7	-0.48	29	143	11	154	38	2306	777	0.9	0.74	2.74
9/29/22	14:45	1739.35		7.07				10	16	90.8	29.2	0.48	29	349	-11	338	34	2030	777	0.9	0.63	2.41
9/29/22	14:55	1740.87		7				10	26	90.0	30.0	0.84	30	351	-18	333	33	1996	794	0.9	0.59	2.32
9/29/22	15:05	1742.39		6.95				10	36	89.4	30.6	0.6	30	351	-13	338	34	2028	812	0.9	0.59	2.30
9/29/22	15:15	1743.9		6.92				10	46	89.0	31.0	0.36	31	349	-8	341	34	2046	824	0.9	0.58	2.29
9/29/22	15:25	1745.4		6.9				10	56	88.8	31.2	0.24	31	347	-5	341	34	2047	831	0.9	0.58	2.27
9/29/22	15:35	1746.92		6.87				10	66	88.4	31.6	0.36	31	351	-8	343	34	2059	839	0.9	0.57	2.26
9/29/22	15:45	1748.43		6.86				10	76	88.3	31.7	0.12	32	349	-3	346	35	2077	845	0.9	0.57	2.27
9/29/22	15:55	1749.94		6.85				10	86	88.2	31.8	0.12	32	349	-3	346	35	2077	848	0.9	0.57	2.26
9/29/22	16:05	1751.48		6.83				10	96	88.0	32.0	0.24	32	356	-5	350	35	2103	853	0.9	0.57	2.27
																			Minimum Rate:			2.3
														Raw Rate for design, prior to application of adjustment factors:								**2.3**

Results of Well Permeameter, from USBR 7300-89 Method

Leighton 60 Anniversary

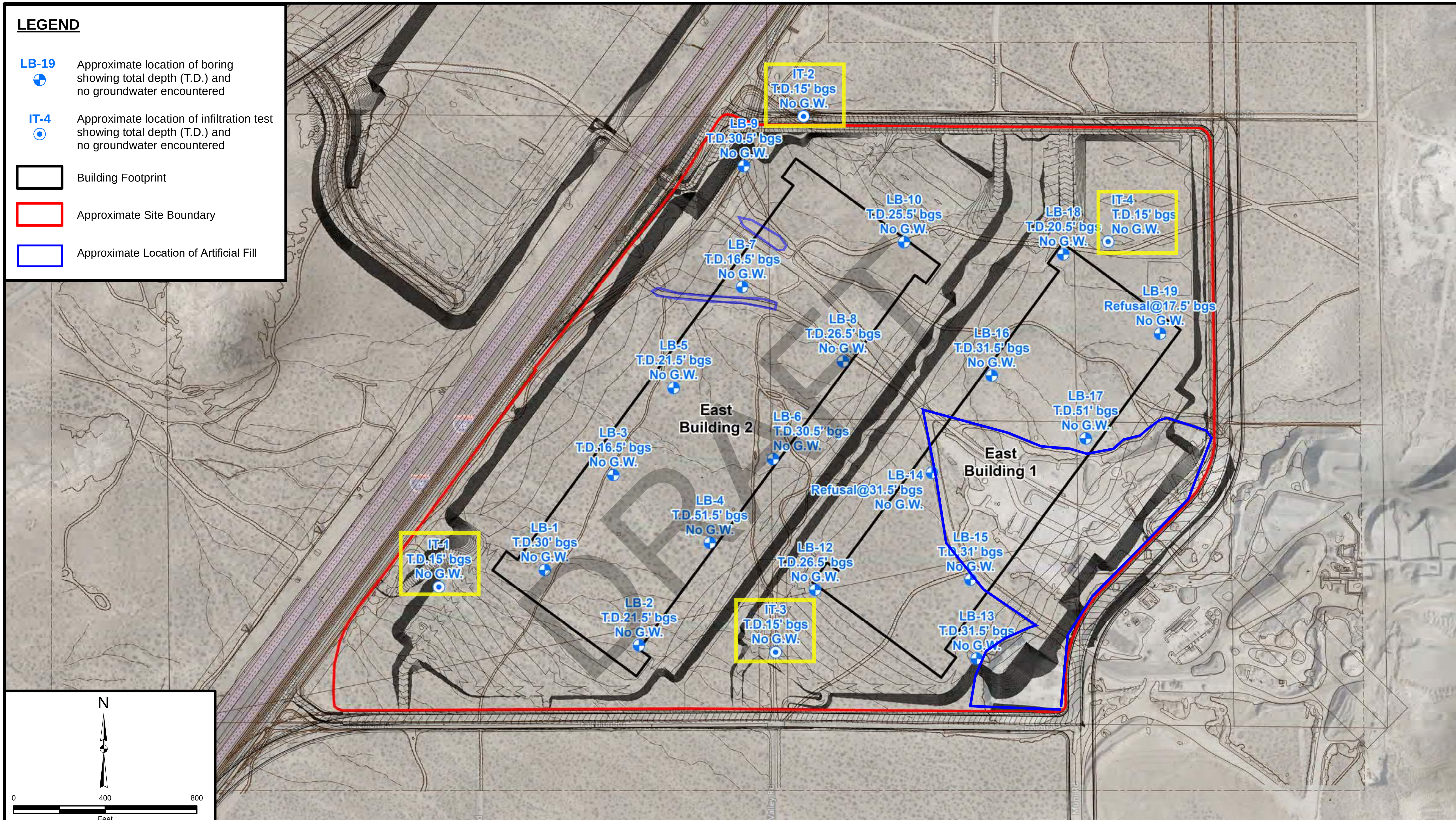
Project:	13673.004	Initial estimated Depth to Water Surface (in.):	21		
Exploration #/Location:	LI-2	Average depth of water in well, "h" (in.):	39	Cross-sectional area for flow calcs based on Δh	
Depth Boring drilled, bgs (ft):	5	approx. h/r:	9.7	Well pack sand porosity	0.4
Tested by:	AA	Tu (Fig. 8) (ft):	98.2	Casing outer diameter, in.	2.3
USCS Soil Type in test zone:	SM / SP-SM	Tu>3h?:	yes, OK	Casing inner diameter, in.	2.1
Weather (start to finish):	Sunny			Cross-sectional area, in.^2	21.9
Water Source/pH:	H2O				
Measured boring diameter:	8 in.	4 in. Well Radius			
Depth to GW or aquitard, bgs:	100 ft				
Well Prep:	Drill to 5', hit refusal, set 5' screen, sand backfilll in test zone			Use of Barrels:	No

	ft	in.	Total (in.)		
Depth to bottom of well measured from top of auger (or ground surfa	5. ft	0. in.	60	Depth of well bottom below top of casing (in): 60	Use of Flow Meter: Yes
Casing stickup measured above top of auger (or ground surface) (+ i	0. ft	0. in.	0		Test Type: Constant Head
Depth to top of sand from top of casing					

Flow Meter ID: 2497 Meter Units: Gallons 0.05 gallons/pulse Data logger ID:

Field Data **Calculations**

Date	Time	Data from Flow Meter: Reading (gallons)	Interval Pulse Count	Depth to WL in Boring (measured from top of casing) ft	in.	Water Temp (deg F)	Refilled? (or Comments)	Δt (min)	Total Elapsed Time (min)	Depth to WL in well (in.)	h, Height of Water in Well (in.)	Δh (in.)	Avg. h	Vol Change (in.^3) from supply	from Δh	Total	Flow (in^3/ min)	q, Flow (in^3/ hr)	Average Infiltration Surface Area, (in^2)	V (Fig 9)	K20, Coef. Of Perme-ability at 20 deg C (in./hr)	Infiltration Rate [flow/surf area] (in./hr) (FS=1)
Start Date 9/29/2022	Start time: 11:53	Gallons		ft	in.																	
9/29/22	11:53	1712.22		2.72					0	32.6	27.4											
9/29/22	11:55	1712.73		2.44				2	2	29.3	30.7	3.36	29	118	-74	44	22	1326	780	0.9	0.37	1.57
9/29/22	12:00	1713.52		2.25				5	7	27.0	33.0	2.28	32	182	-50	133	27	1590	851	0.9	0.40	1.72
9/29/22	12:05	1714.22		2.11				5	12	25.3	34.7	1.68	34	162	-37	125	25	1499	901	0.9	0.36	1.53
9/29/22	12:15	1715.62		1.89				10	22	22.7	37.3	2.64	36	323	-58	266	27	1593	955	0.9	0.34	1.54
9/29/22	12:25	1717.05		1.74				10	32	20.9	39.1	1.8	38	330	-39	291	29	1745	1011	0.9	0.34	1.59
9/29/22	12:35	1718.42		1.66				10	42	19.9	40.1	0.96	40	316	-21	295	30	1773	1046	0.9	0.34	1.56
9/29/22	12:45	1719.81		1.6				10	52	19.2	40.8	0.72	40	321	-16	305	31	1832	1067	0.9	0.34	1.58
9/29/22	12:55	1721.22		1.54				10	62	18.5	41.5	0.72	41	326	-16	310	31	1860	1085	0.9	0.34	1.58
9/29/22	13:05	1722.62		1.52				10	72	18.2	41.8	0.24	42	323	-5	318	32	1909	1097	0.9	0.34	1.60
9/29/22	13:18	1724.43		1.47				13	85	17.6	42.4	0.6	42	418	-13	405	31	1869	1107	0.9	0.33	1.56
9/29/22	13:29	1725.91		1.45				11	96	17.4	42.6	0.24	42	342	-5	337	31	1836	1118	0.9	0.32	1.51
9/29/22	13:40	1727.5		1.45				11	107	17.4	42.6	0	43	367	0	367	33	2003	1121	0.9	0.35	1.65
9/29/22	13:50	1728.9		1.44				10	117	17.3	42.7	0.12	43	323	-3	321	32	1925	1122	0.9	0.33	1.58
9/29/22	14:00	1730.28		1.42				10	127	17.0	43.0	0.24	43	319	-5	314	31	1881	1127	0.9	0.32	1.54
																			Minimum Rate:			1.5
														Raw Rate for design, prior to application of adjustment factors:								**1.5**



Project: 13673.001	Eng/Geol: JDH/SGO
Scale:1 " = 400 '	Date: September 2022

Reference: Conceptual Site Plan, Sheet A1-0
Date: March 5, 2022 by Rexford Industrial Realty

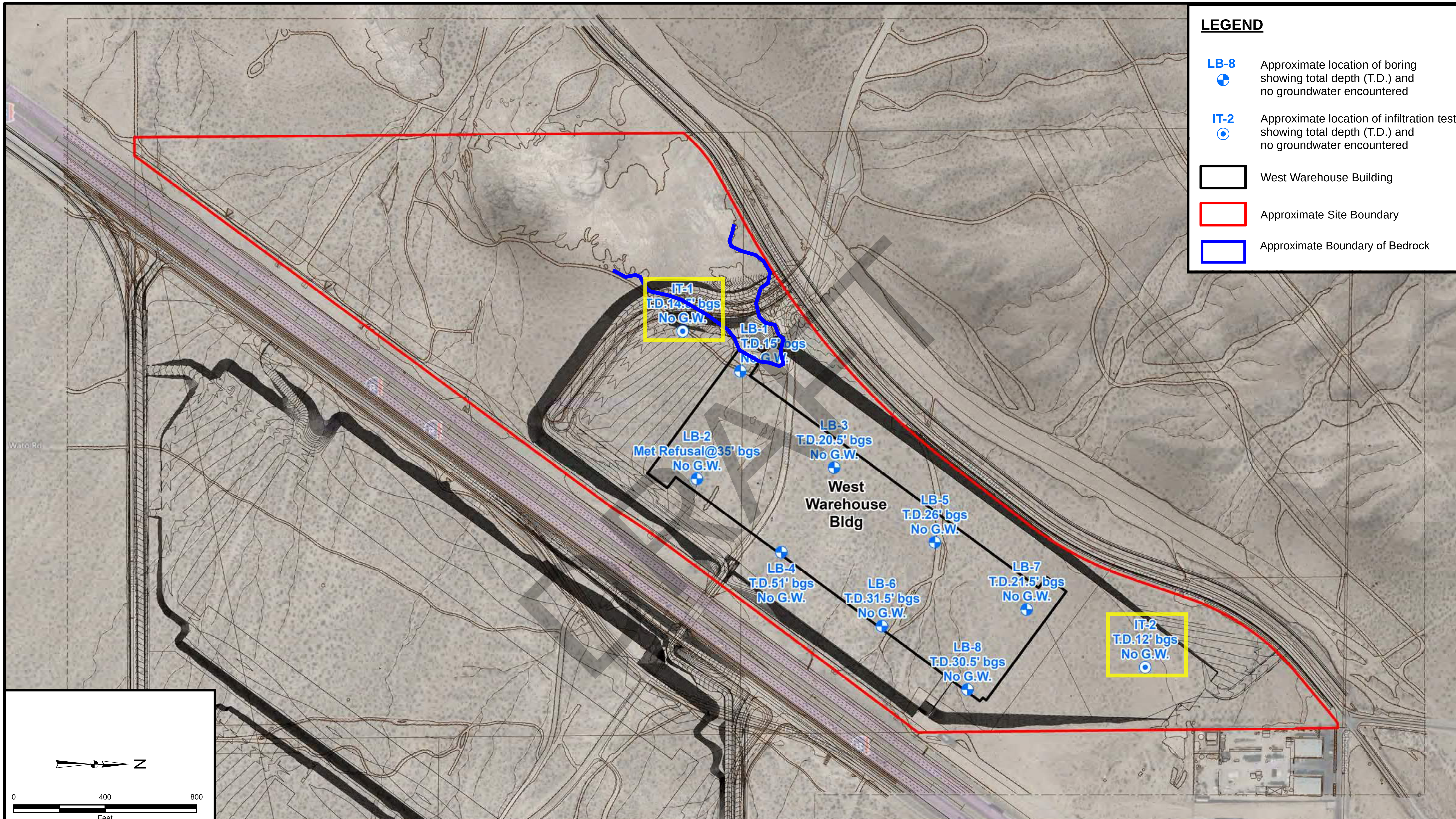
EXPLORATION LOCATION MAP

Proposed Warehouse Building Development
Parcel A APN 0472-031-08,
Apple Valley, California

FIGURE 2

Leighton

Map Saved as J:\Drafting\13673\001\Maps\13673-001_F02_ELM_2022-09-28.mxd on 9/28/2022 9:57:22 AM Author: KVM (btran)



Project: 13673.002 | Eng/Geol: JDH/SGO

Scale:1 " = 400 ' | Date: September 2022

Reference: Conceptual Site Plan, Sheet A1-0
Date: March 5, 2022 by Rexford Industrial Realty

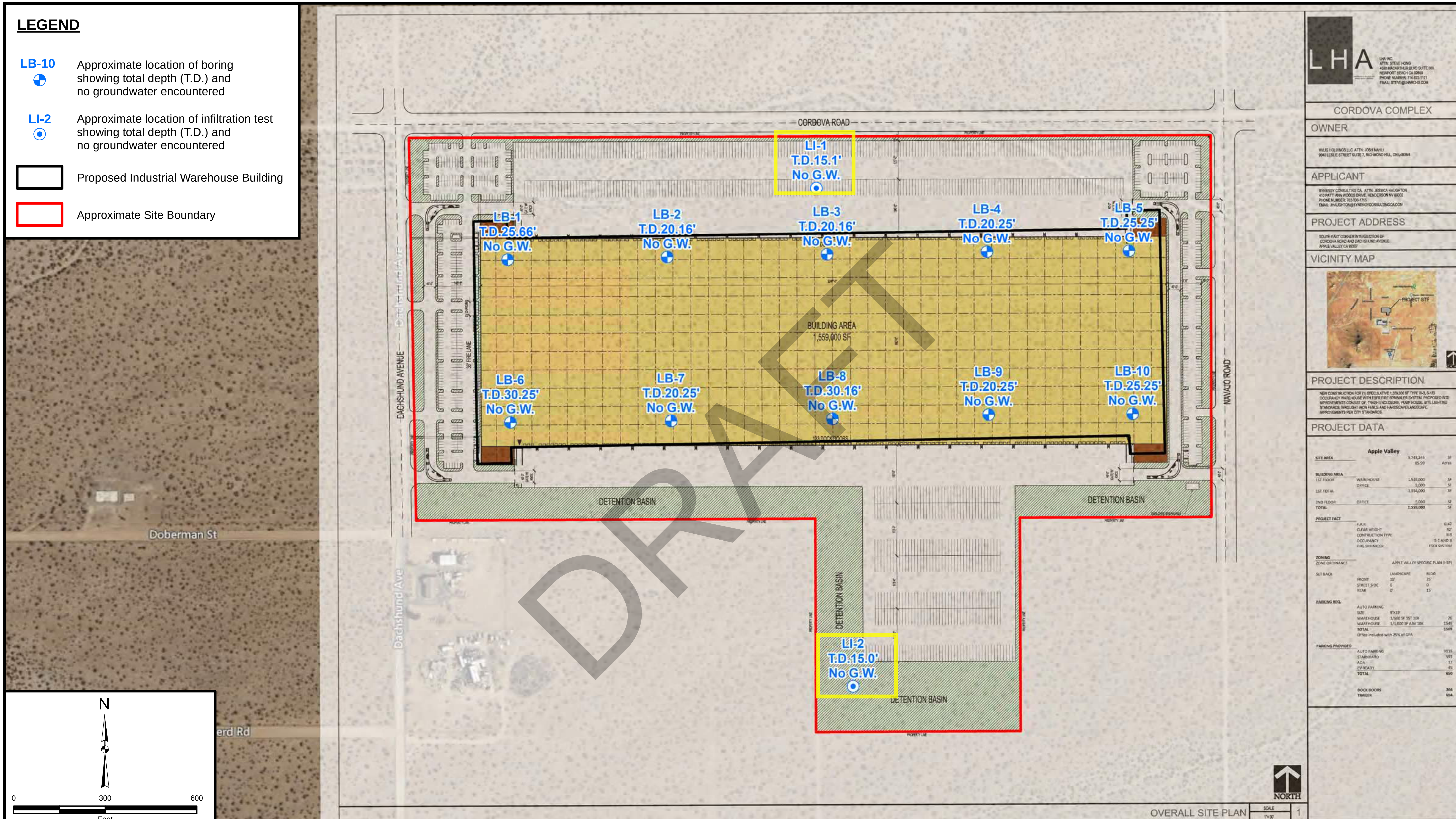
EXPLORATION LOCATION MAP

Proposed Warehouse Building Development
Parcel B APNs 0472-031-60, 61, 62, 63, and 64
Victorville, California

FIGURE 2

Leighton

Map Saved as J:\Drafting\13673\002\Maps\13673-002_F02_ELM_2022-09-28.mxd on 9/28/2022 9:47:44 AM Author: KVM (btran)



Project: 13673.003	Eng/Geol: JDH/SGO
Scale: 1 " = 300 '	Date: October 2022

Reference: Conceptual Site Plan, Sheet 1 by LHA

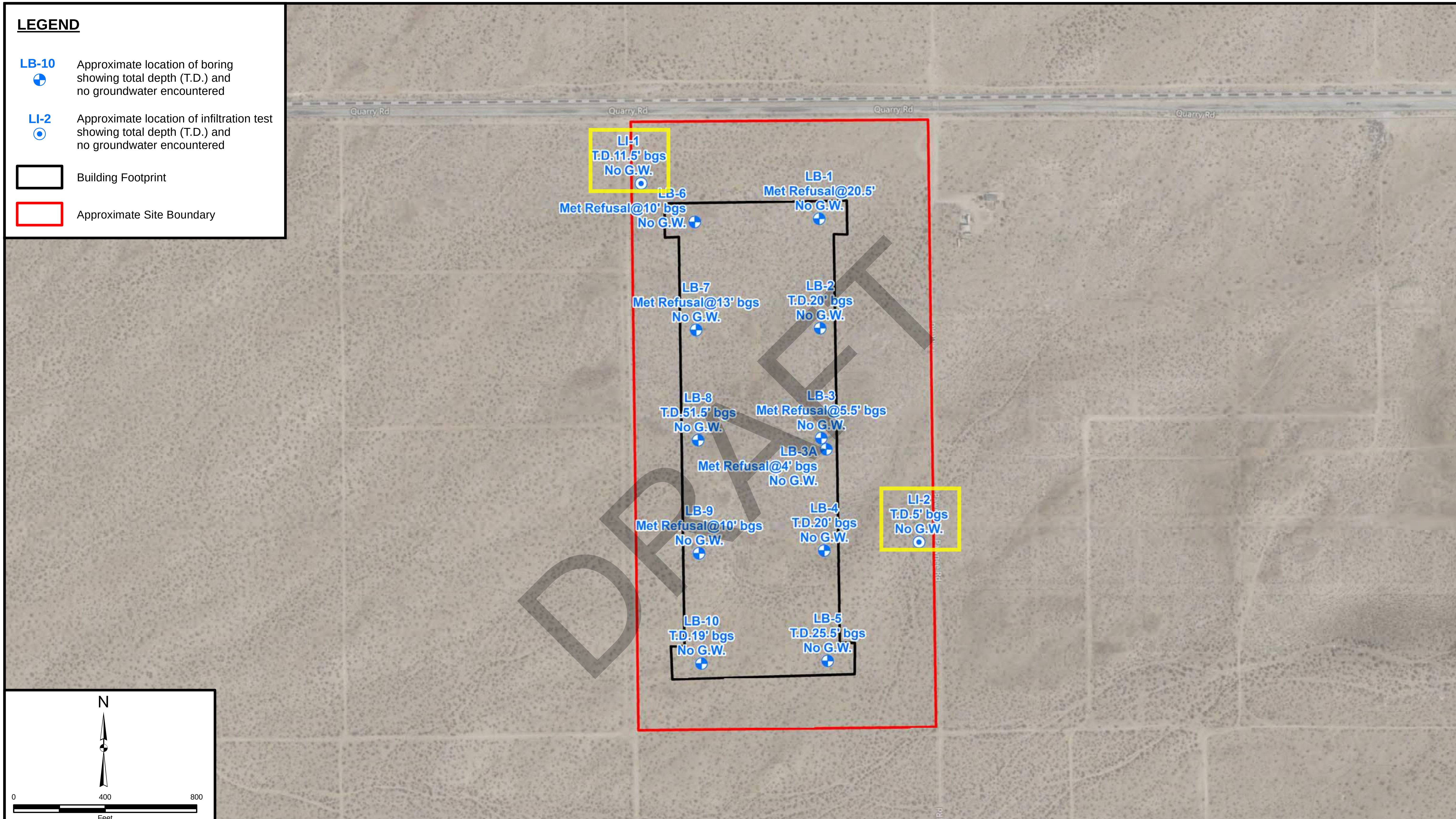
GEOTECHNICAL MAP

Proposed Industrial Warehouse Building Development
Southeast of Cordova Road and Dachshund Avenue
Apple Valley, California

FIGURE 2

Leighton

Map Saved as J:\Drafting\13673\003\Maps\13673-003_F02_ELM_2022-10-04.mxd on 10/4/2022 10:26:05 AM Author: KVM (btran)



Project: 13673.004	Eng/Geol: JDH/SGO
Scale:1 " = 400 '	Date: September 2022

Reference: Conceptual Site Plan, Sheet A1-0
Date: March 5, 2022 by Rexford Industrial Realty

EXPLORATION LOCATION MAP

Proposed Warehouse Building Development
Parcel B APNs 0463-213-05, 07, 08, 09, 16, 33, 34, 35, and 36
Apple Valley, California

FIGURE 2

Leighton

Map Saved as J:\Drafting\13673\004\Maps\13673-004_F02_ELM_2022-09-27.mxd on 9/26/2022 2:22:01 PM Author: KVM (btran)

Appendix F

- BMP Fact Sheets

Section 3
Source Control BMPs

3.1 Introduction

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

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

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

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

3.2 Fact Sheet Format

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

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

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

SC-xx Example Fact Sheet

Description of the BMP

Approach

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

Requirements

- Costs
- Maintenance

Supplemental Information

- Further Details on the BMP
- Examples

References and Resources

Figure 3-1
Example Fact Sheet

3.3 BMP Fact Sheets

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

Site Design & Landscape Planning SD-10

Design Objectives

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

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

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

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

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

CASQA
CALIFORNIA STORMWATER QUALITY ASSOCIATION

Designing New Installations

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

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

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

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

Conserve Natural Areas during Landscape Planning

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

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

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

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

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

- Preserve riparian areas and wetlands.

Maximize Natural Water Storage and Infiltration Opportunities Within the Landscape Unit

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

- Maintain natural storage reservoirs and drainage corridors, including depressions, areas of permeable soils, swales, and intermittent streams. Develop and implement policies and

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

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

Protection of Slopes and Channels during Landscape Design

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

Redeveloping Existing Installations

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

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

Other Resources

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

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

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

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

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

Spill Prevention, Control & Cleanup SC-11

Objectives

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

Targeted Constituents

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

Description

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

Approach

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

Pollution Prevention

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

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

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

Suggested Protocols

Spill/Leak Prevention Measures

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

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

Training

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

Spill Response and Prevention

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

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

Spill Cleanup Procedures

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

Reporting

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

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

Other Considerations

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

Requirements

Costs

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

Maintenance

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

Supplemental Information

Further Detail of the BMP

Reporting

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

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

These records should contain the following information:

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

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

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

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

Examples

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

References and Resources

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

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

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

Efficient Irrigation SD-12

Design Objectives

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

Description

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

Approach

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

Suitable Applications

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

Design Considerations

Designing New Installations

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

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

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

Redeveloping Existing Installations

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

Other Resources

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

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

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

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

Storm Drain Signage SD-13

Design Objectives

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

Description

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

Approach

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

Suitable Applications

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

Design Considerations

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

Designing New Installations

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

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

– DRAINS TO OCEAN" and/or other graphical icons to discourage illegal dumping.

- Post signs with prohibitive language and/or graphical icons, which prohibit illegal dumping at public access points along channels and creeks within the project area.

Note - Some local agencies have approved specific signage and/or storm drain message placards for use. Consult local agency stormwater staff to determine specific requirements for placard types and methods of application.

Redeveloping Existing Installations

Various jurisdictional stormwater management and mitigation plans (SUSMP, WQMP, etc.) define "redevelopment" in terms of amounts of additional impervious area, increases in gross floor area and/or exterior construction, and land disturbing activities with structural or impervious surfaces. If the project meets the definition of "redevelopment", then the requirements stated under " designing new installations" above should be included in all project design plans.

Additional Information

Maintenance Considerations

- Legibility of markers and signs should be maintained. If required by the agency with jurisdiction over the project, the owner/operator or homeowner's association should enter into a maintenance agreement with the agency or record a deed restriction upon the property title to maintain the legibility of placards or signs.

Placement

- Signage on top of curbs tends to weather and fade.

- Signage on face of curbs tends to be worn by contact with vehicle tires and sweeper brooms.

Supplemental Information

Examples

- Most MS4 programs have storm drain signage programs. Some MS4 programs will provide stencils, or arrange for volunteers to stencil storm drains as part of their outreach program.

Other Resources

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

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

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

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

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

Redeveloping Existing Installations

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

Additional Information

Maintenance Considerations

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

Other Resources

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

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

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

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

Objectives

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

Targeted Constituents

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

Description

Stormwater runoff from building and grounds maintenance activities can be contaminated with toxic hydrocarbons in solvents, fertilizers and pesticides, suspended solids, heavy metals, abnormal pH, and oils and greases. Utilizing the protocols in this fact sheet will prevent or reduce the discharge of pollutants to stormwater from building and grounds maintenance activities by washing and cleaning up with as little water as possible, following good landscape management practices, preventing and cleaning up spills immediately, keeping debris from entering the storm drains, and maintaining the stormwater collection system.

Approach

Reduce potential for pollutant discharge through source control pollution prevention and BMP implementation. Successful implementation depends on effective training of employees on applicable BMPs and general pollution prevention strategies and objectives.

Pollution Prevention

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

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- Encourage use of Integrated Pest Management techniques for pest control.
- Encourage proper onsite recycling of yard trimmings.
- Recycle residual paints, solvents, lumber, and other material as much as possible.

Suggested Protocols

Pressure Washing of Buildings, Rooftops, and Other Large Objects

- In situations where soaps or detergents are used and the surrounding area is paved, pressure washers must use a water collection device that enables collection of wash water and associated solids. A sump pump, wet vacuum or similarly effective device must be used to collect the runoff and loose materials. The collected runoff and solids must be disposed of properly.
- If soaps or detergents are not used, and the surrounding area is paved, wash runoff does not have to be collected but must be screened. Pressure washers must use filter fabric or some other type of screen on the ground and/or in the catch basin to trap the particles in wash water runoff.
- If you are pressure washing on a grassed area (with or without soap), runoff must be dispersed as sheet flow as much as possible, rather than as a concentrated stream. The wash runoff must remain on the grass and not drain to pavement.

Landscaping Activities

- Dispose of grass clippings, leaves, sticks, or other collected vegetation as garbage, or by composting. Do not dispose of collected vegetation into waterways or storm drainage systems.
- Use mulch or other erosion control measures on exposed soils.

Building Repair, Remodeling, and Construction

- Do not dump any toxic substance or liquid waste on the pavement, the ground, or toward a storm drain.
- Use ground or drop cloths underneath outdoor painting, scraping, and sandblasting work, and properly dispose of collected material daily.
- Use a ground cloth or oversized tub for activities such as paint mixing and tool cleaning.
- Clean paintbrushes and tools covered with water-based paints in sinks connected to sanitary sewers or in portable containers that can be dumped into a sanitary sewer drain. Brushes and tools covered with non-water-based paints, finishes, or other materials must be cleaned in a manner that enables collection of used solvents (e.g., paint thinner, turpentine, etc.) for recycling or proper disposal.
- Use a storm drain cover, filter fabric, or similarly effective runoff control mechanism if dust, grit, wash water, or other pollutants may escape the work area and enter a catch basin. This is particularly necessary on rainy days. The containment device(s) must be in place at the beginning of the work day, and accumulated dirty runoff and solids must be collected and disposed of before removing the containment device(s) at the end of the work day.

- If you need to de-water an excavation site, you may need to filter the water before discharging to a catch basin or off-site. If directed off-site, you should direct the water through hay bales and filter fabric or use other sediment filters or traps.

- Store toxic material under cover during precipitation events and when not in use. A cover would include tarps or other temporary cover material.

Mowing, Trimming, and Planting

- Dispose of leaves, sticks, or other collected vegetation as garbage, by composting or at a permitted landfill. Do not dispose of collected vegetation into waterways or storm drainage systems.

- Use mulch or other erosion control measures when soils are exposed.

- Place temporarily stockpiled material away from watercourses and drain inlets, and berm or cover stockpiles to prevent material releases to the storm drain system.

- Consider an alternative approach when bailing out muddy water: do not put it in the storm drain; pour over landscaped areas.

- Use hand weeding where practical.

Fertilizer and Pesticide Management

- Follow all federal, state, and local laws and regulations governing the use, storage, and disposal of fertilizers and pesticides and training of applicators and pest control advisors.

- Use less toxic pesticides that will do the job when applicable. Avoid use of copper-based pesticides if possible.

- Do not use pesticides if rain is expected.

- Do not mix or prepare pesticides for application near storm drains.

- Use the minimum amount needed for the job.

- Calibrate fertilizer distributors to avoid excessive application.

- Employ techniques to minimize off-target application (e.g., spray drift) of pesticides, including consideration of alternative application techniques.

- Apply pesticides only when wind speeds are low.

- Fertilizers should be worked into the soil rather than dumped or broadcast onto the surface.

- Irrigate slowly to prevent runoff and then only as much as is needed.

- Clean pavement and sidewalk if fertilizer is spilled on these surfaces before applying irrigation water.

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

- Use up the pesticides. Rinse containers, and use rinse water as product. Dispose of unused pesticide as hazardous waste.
- Implement storage requirements for pesticide products with guidance from the local fire department and County Agricultural Commissioner. Provide secondary containment for pesticides.

Inspection

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

Training

- Educate and train employees on pesticide use and in pesticide application techniques to prevent pollution.
- Train employees and contractors in proper techniques for spill containment and cleanup.
- Be sure the frequency of training takes into account the complexity of the operations and the nature of the staff.

Spill Response and Prevention

- Keep your Spill Prevention Control and Countermeasure (SPCC) Plan up-to-date.
- Place a stockpile of spill cleanup materials, such as brooms, dustpans, and vacuum sweepers (if desired) near the storage area where it will be readily accessible.
- Have employees trained in spill containment and cleanup present during the loading/unloading of dangerous wastes, liquid chemicals, or other materials.
- Familiarize employees with the Spill Prevention Control and Countermeasure Plan.
- Clean up spills immediately.

Other Considerations

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

Requirements

Costs

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

Maintenance

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

Supplemental Information

Further Detail of the BMP

Fire Sprinkler Line Flushing

Building fire sprinkler line flushing may be a source of non-stormwater runoff pollution. The water entering the system is usually potable water, though in some areas it may be non-potable reclaimed wastewater. There are subsequent factors that may drastically reduce the quality of the water in such systems. Black iron pipe is usually used since it is cheaper than potable piping, but it is subject to rusting and results in lower quality water. Initially, the black iron pipe has an oil coating to protect it from rusting between manufacture and installation; this will contaminate the water from the first flush but not from subsequent flushes. Nitrates, poly-phosphates and other corrosion inhibitors, as well as fire suppressants and antifreeze may be added to the sprinkler water system. Water generally remains in the sprinkler system a long time (typically a year) and between flushes may accumulate iron, manganese, lead, copper, nickel, and zinc. The water generally becomes anoxic and contains living and dead bacteria and breakdown products from chlorination. This may result in a significant BOD problem and the water often smells. Consequently dispose fire sprinkler line flush water into the sanitary sewer. Do not allow discharge to storm drain or infiltration due to potential high levels of pollutants in fire sprinkler line water.

References and Resources

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

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

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

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

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

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

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

Parking/Storage Area Maintenance SC-43

Objectives

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

Targeted Constituents

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

Description

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

Approach

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

Pollution Prevention

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

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Suggested Protocols

General

- Keep the parking and storage areas clean and orderly. Remove debris in a timely fashion.
- Allow sheet runoff to flow into biofilters (vegetated strip and swale) and/or infiltration devices.
- Utilize sand filters or oleophilic collectors for oily waste in low quantities.
- Arrange rooftop drains to prevent drainage directly onto paved surfaces.
- Design lot to include semi-permeable hardscape.
- Discharge soapy water remaining in mop or wash buckets to the sanitary sewer through a sink, toilet, clean-out, or wash area with drain.

Controlling Litter

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

Surface Cleaning

- Use dry cleaning methods (e.g., sweeping, vacuuming) to prevent the discharge of pollutants into the stormwater conveyance system if possible.
- Establish frequency of public parking lot sweeping based on usage and field observations of waste accumulation.
- Sweep all parking lots at least once before the onset of the wet season.
- Follow the procedures below if water is used to clean surfaces:
  - Block the storm drain or contain runoff.
  - Collect and pump wash water to the sanitary sewer or discharge to a pervious surface. Do not allow wash water to enter storm drains.
  - Dispose of parking lot sweeping debris and dirt at a landfill.
- Follow the procedures below when cleaning heavy oily deposits:
  - Clean oily spots with absorbent materials.
  - Use a screen or filter fabric over inlet, then wash surfaces.

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

Surface Repair

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

Inspection

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

Training

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

Spill Response and Prevention

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

Other Considerations

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

SC-43 Parking/Storage Area Maintenance

Requirements

Costs

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

Maintenance

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

Supplemental Information

Further Detail of the BMP

Surface Repair

Apply concrete, asphalt, and seal coat during dry weather to prevent contamination from contacting stormwater runoff. Where applicable, cover and seal nearby storm drain inlets (with waterproof material or mesh) and manholes before applying seal coat, slurry seal, etc. Leave covers in place until job is complete and all water from emulsified oil sealants has drained or evaporated. Clean any debris from these covered manholes and drains for proper disposal. Only use only as much water as is necessary for dust control to avoid runoff.

References and Resources

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

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

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

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

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

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

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

Housekeeping Practices SC-60

Description

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

Approach

Pollution Prevention

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

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

Suggested Protocols

General

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

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

- Recycle or dispose of fluids properly.

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

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

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

Objectives

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

Targeted Constituents

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

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

Training

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

Spill Response and Prevention

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

Other Considerations

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

Requirements

Costs

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

Maintenance

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

Supplemental Information

Further Detail of the BMP

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

Examples

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

References and Resources

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

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

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

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

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

Trash Storage Areas SD-32

Design Objectives

Maximize Infiltration

Provide Retention

Slow Runoff

Minimize Impervious Land Coverage

Prohibit Dumping of Improper Materials

☑ Contain Pollutants

Collect and Convey

Description

Trash storage areas are areas where a trash receptacle (s) are located for use as a repository for solid wastes. Stormwater runoff from areas where trash is stored or disposed of can be polluted. In addition, loose trash and debris can be easily transported by water or wind into nearby storm drain inlets, channels, and/or creeks. Waste handling operations that may be sources of stormwater pollution include dumpsters, litter control, and waste piles.

Approach

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

Suitable Applications

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

Design Considerations

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

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

Designing New Installations

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

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

- Make sure trash container areas are screened or walled to prevent off-site transport of trash.

CASQA
CALIFORNIA STORMWATER QUALITY ASSOCIATION

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

Redeveloping Existing Installations

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

Additional Information

Maintenance Considerations

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

Other Resources

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

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

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

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

Appendix G

- Educational Materials

The Updated Model Water Efficient Landscape Ordinance

CALIFORNIA DEPARTMENT OF WATER RESOURCES

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

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

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

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

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

Important points to consider...

Water purveyors have an important role.

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

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

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

Existing landscapes are also subject to the Model Ordinance.

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

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

All new landscapes will be assigned a water budget.

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

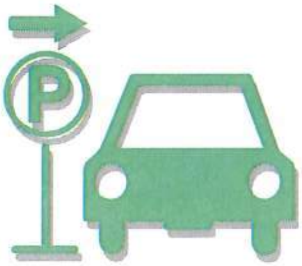
The MAWA, is the water budget used for compliance and is an annual water allowance based on landscape area, local evapotranspiration and ETAF of 0.7. The ETWU is an annual water use estimation for design purposes and is based on the water needs of the plants actually chosen for a given landscape. The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

Water efficient landscapes offer multiple benefits.

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

The Department of Water Resources will offer technical assistance.

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



R-3 AUTOMOBILE PARKING

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

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

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

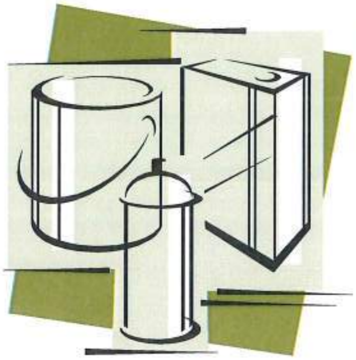
Required Activities

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

Recommended Activities

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

For additional information contact:
County of Orange, **OC Watershed**
Main: (714) 955-0600/ 24hr Water Pollution Discharge Hotline 1-877-89-SPILL
or visit our website at: www.ocwatersheds.com



R-7
HOUSEHOLD HAZARDOUS WASTE

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

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

List of most common HHW products:

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

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

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

RECYCLE USED OIL

Required Activities

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

Recommended Activities

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

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

For additional information contact:
County of Orange, **OC Watershed**
Main: (714) 955-0600/ 24hr Water Pollution Discharge Hotline 1-877-89-SPILL
or visit our website at: www.ocwatersheds.com

R-8
WATER CONSERVATION

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

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

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

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

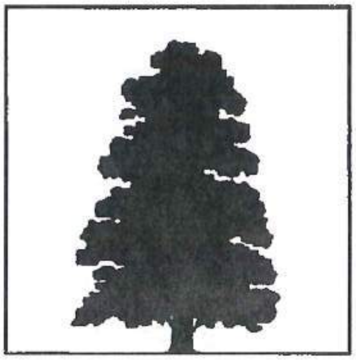
Required Activities

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

Recommended Activities

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

For additional information contact:
County of Orange, **OC Watershed**
Main: (714) 955-0600/ 24hr Water Pollution Discharge Hotline 1-877-89-SPILL
or visit our website at: www.ocwatersheds.com



FP-2

LANDSCAPE MAINTENANCE

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

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

POLLUTION PREVENTION:

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

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

MODEL PROCEDURES:

1. Mowing, Trimming/Weeding, and Planting

Mowing, Trimming/Weeding

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

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

Planting

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

OPTIONAL:

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

2. Irrigation

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

3. Fertilizer and Pesticide Management

Usage

✓ Utilize a comprehensive management system that incorporates integrated pest management techniques.

✓ Follow all federal, state, and local laws and regulations governing the use, storage, and disposal of fertilizers and pesticides and training of applicators and pest control advisors.

✓ Educate and train employees on use of pesticides and in pesticide application techniques to prevent pollution.

✓ Pesticide application must be under the supervision of a California qualified pesticide applicator.

✓ When applicable use the least toxic pesticides that will do the job. Avoid use of copper-based pesticides if possible.

✓ Do not mix or prepare pesticides or fertilizers for application near storm drains.

✓ Prepare the minimum amount of pesticide needed for the job and use the lowest rate that will effectively control the pest.

✓ Employ techniques to minimize off-target application (e.g. spray drift) of pesticides, including consideration of alternative application techniques.

✓ Calibrate fertilizer and pesticide application equipment to avoid excessive application.

✓ Periodically test soils for determining proper fertilizer use.

✓ Sweep pavement and sidewalk if fertilizer is spilled on these surfaces before applying irrigation water.

✓ Inspect pesticide/fertilizer equipment and transportation vehicles daily.

✓ Refer to Appendix D for further guidance on Fertilizer and Pesticide management

OPTIONAL:

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

Scheduling

✓ Do not use pesticides if rain is expected within 24 hours.

✓ Apply pesticides only when wind speeds are low (less than 5 mph).

Disposal

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

4. Managing Landscape Waste

Also see Waste Handling and Disposal procedure sheet

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

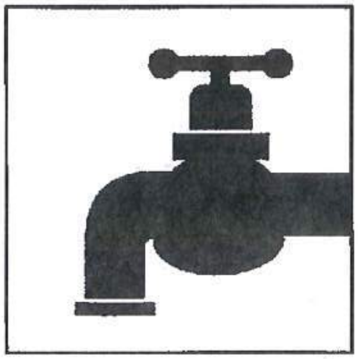
5. Erosion Control

Also see Waste Handling and Disposal procedure sheet

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

LIMITATIONS:

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



FP-6

WATER AND SEWER UTILITY OPERATION AND MAINTENANCE

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

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

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

POLLUTION PREVENTION:

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

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

MODEL PROCEDURES:

1. Water Line Maintenance

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

Planned Discharges

✓ For planned discharges use one of the following options:

- Reuse water for dust suppression, irrigation, or construction compaction
- Discharge to the sanitary sewer system with approval
- Discharge to the storm drain system or to a creek using applicable pollution control measures listed below (this option is ONLY applicable to uncontaminated pumped ground water, water line flushing, fire hydrant testing and flushing, discharges from potable water sources other than water main breaks) and may require a permit from the Regional Water Quality Control Board.

✓ If water is discharged to a storm drain inlet (catch basin), control measures must be put in place to control potential pollutants (i.e. sediment, chlorine, etc.). Examples of some storm drain inlet protection options include:

- Silt fence – appropriate where the inlet drains a relatively flat area.
- Gravel and wire mesh sediment filter – Appropriate where concentrated flows are expected.
- Wooden weir and fabric – use at curb inlets where a compact installation is desired.

✓ Prior to discharge, inspect discharge flow path and clear/cleanup any debris or pollutants found (i.e. remove trash, leaves, sediment, and wipe up liquids, including oil spills).

✓ Select appropriate pollution control measure(s) considering the receiving system (i.e. curb inlet, drop inlet, culvert, creek, etc.) and ensure that the control device(s) fit properly.

✓ General design considerations for inlet protection devices include the following:

- The device should be constructed such that cleaning and disposal of trapped sediment is made easy, while minimizing interference with discharge activities.
- Devices should be constructed so that any standing water resulting from the discharge will not cause excessive inconvenience or flooding/damage to adjacent land or structures.

✓ The effectiveness of control devices must be monitored during the discharge period and any necessary repairs or modifications made as needed.

OPTIONAL:

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

Unplanned Discharges

✓ Stop the discharge as quickly as possible by turning off water source.

✓ Inspect flow path of the discharged water:

- Control erosion along the flow path.
- Identify areas that may produce significant sediment or gullies, use sandbags to redirect the flow.
- Identify erodible areas which may need to be repaired or protected during subsequent repairs or corrective actions

✓ If repairs or corrective action will cause additional discharges of water, select the appropriate procedures for erosion control, chlorine residual, turbidity, and chemical additives. Prevent potential pollutants from entering the flow path and ensure that no additional discharged water enters storm drain inlets.

2. Sanitary Sewer Maintenance

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

Sewer System Cleaning

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

Preventative and Corrective Maintenance

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

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

Control

Also see Drainage System procedures sheet

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

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

Response and Containment

✓ Establish lead department/agency responsible for spill response and containment. Provide coordination within departments.

✓ When a spill, leak, and/or overflow occurs, keep sewage from entering the storm drain system to the maximum extent practicable by covering or blocking storm drain inlets or by containing and diverting the sewage away from open channels and other storm drain facilities (using sandbags, inflatable dams, etc.).

✓ If a spill reaches the storm drain notify County of Orange Health Care Agency through Control One at (714) 628-7208.

✓ Remove the sewage using vacuum equipment or use other measures to divert it back to the sanitary sewer system.

✓ Record required information at the spill site.

✓ Perform field tests as necessary to determine the source of the spill.

✓ Develop additional notification procedures regarding spill reporting as needed.

LIMITATIONS:

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

REFERENCES:

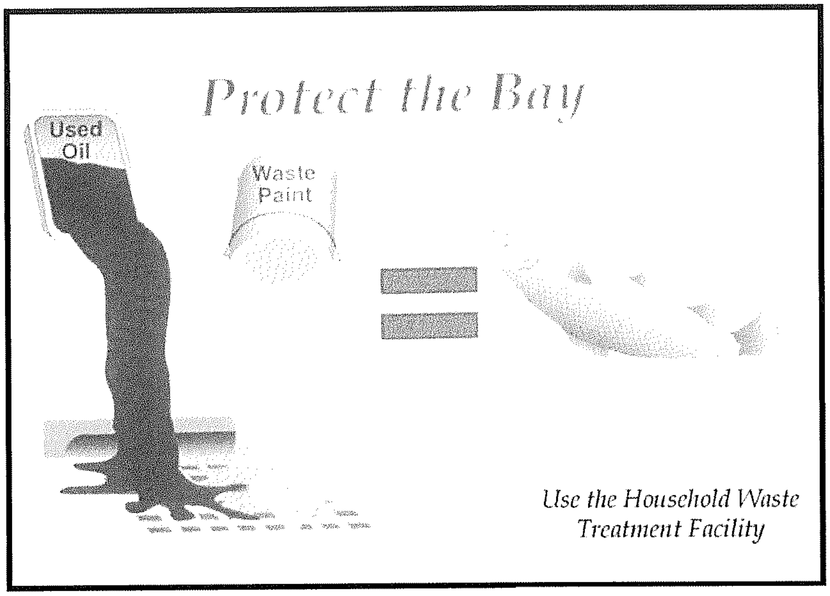
California Storm Water Best Management Practice Handbooks. Municipal Best Management Practice Handbook. Prepared by Camp Dresser & McKee, Larry Walker Associates, Uribe and Associates, Resources Planning Associates for Stormwater Quality Task Force. March 1993.

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

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

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

Non-Stormwater Discharges SC-10



Graphic by: Margie Winter

Objectives

- Contain
- Educate
- Reduce/Minimize

Targeted Constituents

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

Description

Non-stormwater discharges are those flows that do not consist entirely of stormwater. For municipalities non-stormwater discharges present themselves in two situations. One is from fixed facilities owned and/or operated by the municipality. The other situation is non-stormwater discharges that are discovered during the normal operation of a field program. Some non-stormwater discharges do not include pollutants and may be discharged to the storm drain. These include uncontaminated groundwater and natural springs. There are also some non-stormwater discharges that typically do not contain pollutants and may be discharged to the storm drain with conditions. These include car washing, and surface cleaning. However, there are certain non-stormwater discharges that pose environmental concern. These discharges may originate from illegal dumping or from internal floor drains, appliances, industrial processes, sinks, and toilets that are connected to the nearby storm drainage system. These discharges (which may include: process waste waters, cooling waters, wash waters, and sanitary wastewater) can carry substances (such as paint, oil, fuel and other automotive fluids, chemicals and other pollutants) into storm drains. The ultimate goal is to effectively eliminate non-stormwater discharges to the stormwater drainage system through implementation of measures to detect, correct, and enforce against illicit connections and illegal discharges.

Approach

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

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

Suggested Protocols

Fixed Facility

General

- Post "No Dumping" signs with a phone number for reporting dumping and disposal. Signs should also indicate fines and penalties for illegal dumping.
- Stencil storm drains, where applicable, to prevent illegal disposal of pollutants. Storm drain inlets should have messages such as "Dump No Waste Drains to Stream" stenciled next to them to warn against ignorant or intentional dumping of pollutants into the storm drainage system.
- Landscaping and beautification efforts of hot spots might also discourage future dumping, as well as provide open space and increase property values.
- Lighting or barriers may also be needed to discourage future dumping.

Illicit Connections

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

Visual Inspection and Inventory

- Inventory and inspect each discharge point during dry weather.
- Keep in mind that drainage from a storm event can continue for several days following the end of a storm and groundwater may infiltrate the underground stormwater collection system. Also, non-stormwater discharges are often intermittent and may require periodic inspections.

Review Infield Piping

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

Smoke Testing

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

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

  Dye Testing

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

TV Inspection of Storm Sewer

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

Illegal Dumping

- Regularly inspect and clean up hot spots and other storm drainage areas where illegal dumping and disposal occurs.
- Clean up spills on paved surfaces with as little water as possible. Use a rag for small spills, a damp mop for general cleanup, and absorbent material for larger spills. If the spilled material is hazardous, then the used cleanup materials are also hazardous and must be sent to a certified laundry (rags) or disposed of as hazardous waste.
- Never hose down or bury dry material spills. Sweep up the material and dispose of properly.
- Use adsorbent materials on small spills rather than hosing down the spill. Remove the adsorbent materials promptly and dispose of properly.
- For larger spills, a private spill cleanup company or Hazmat team may be necessary.
- See fact sheet SC-11 Spill Prevention, Control, and Clean Up.

Field Program

General

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

Field Inspection

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

Recommended Complaint Investigation Equipment

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

- Educational materials

Reporting

- A database is useful for defining and tracking the magnitude and location of the problem.
- Report prohibited non-stormwater discharges observed during the course of normal daily activities so they can be investigated, contained and cleaned up or eliminated.
- Document that non-stormwater discharges have been eliminated by recording tests performed, methods used, dates of testing, and any onsite drainage points observed.
- Maintain documentation of illicit connection and illegal dumping incidents, including significant conditionally exempt discharges that are not properly managed.

Enforcement

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

Training

- Train technical staff to identify and document illegal dumping incidents.
- Well-trained employees can reduce human errors that lead to accidental releases or spills. The employee should have the tools and knowledge to immediately begin cleaning up a spill if one should occur. Employees should be familiar with the Spill Prevention Control and Countermeasure Plan.
- Train employees to identify non-stormwater discharges and report them to the appropriate departments.
- Train staff who have the authority to conduct surveillance and inspections, and write citations for those caught illegally dumping.

- Train municipal staff responsible for surveillance and inspection in the following:
  - OSHA-required Health and Safety Training (29 CFR 1910.120) plus annual refresher training (as needed).
  - OSHA Confined Space Entry training (Cal-OSHA Confined Space, Title 8 and federal OSHA 29 CFR 1910.146).
  - Procedural training (field screening, sampling, smoke/dye testing, TV inspection).
- Educate the identified responsible party on the impacts of his or her actions.

Spill Response and Prevention

- See SC-11 Spill Prevention Control and Clean Up

Other Considerations

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

Requirements

Costs

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

Maintenance

Not applicable

Supplemental Information

Further Detail of the BMP

What constitutes a "non-stormwater" discharge?

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

Permit Requirements

- Current municipal NPDES permits require municipalities to effectively prohibit non-stormwater discharges unless authorized by a separate NPDES permit or allowed in accordance with the current NPDES permit conditions. Typically the current permits allow certain non-stormwater discharges in the storm drain system as long as the discharges are not significant sources of pollutants. In this context the following non-stormwater discharges are typically allowed:

  - Diverted stream flows;
  - Rising found waters;
  - Uncontaminated ground water infiltration (as defined at 40 CFR 35.2005(20));
  - Uncontaminated pumped ground water;
  - Foundation drains;
  - Springs;
  - Water from crawl space pumps;
  - Footing drains;
  - Air conditioning condensation;
  - Flows from riparian habitats and wetlands;
  - Water line and hydrant flushing ;
  - Landscape irrigation;
  - Planned and unplanned discharges from potable water sources;
  - Irrigation water;
  - Individual residential car washing; and
  - Lawn watering.

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

Illegal Dumping

- Establish a system for tracking incidents. The system should be designed to identify the following:
  - Illegal dumping hot spots
  - Types and quantities (in some cases) of wastes
  - Patterns in time of occurrence (time of day/night, month, or year)
  - Mode of dumping (abandoned containers, "midnight dumping" from moving vehicles, direct dumping of materials, accidents/spills)
  - Responsible parties

Outreach

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

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

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  - Landscape irrigation;
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Storm Drain Stenciling

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

Oil Recycling

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

Household Hazardous Waste

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

Training

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

Spill Response and Prevention

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

Other Considerations

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

Examples

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

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

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

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

References and Resources

http://www.stormwatercenter.net/

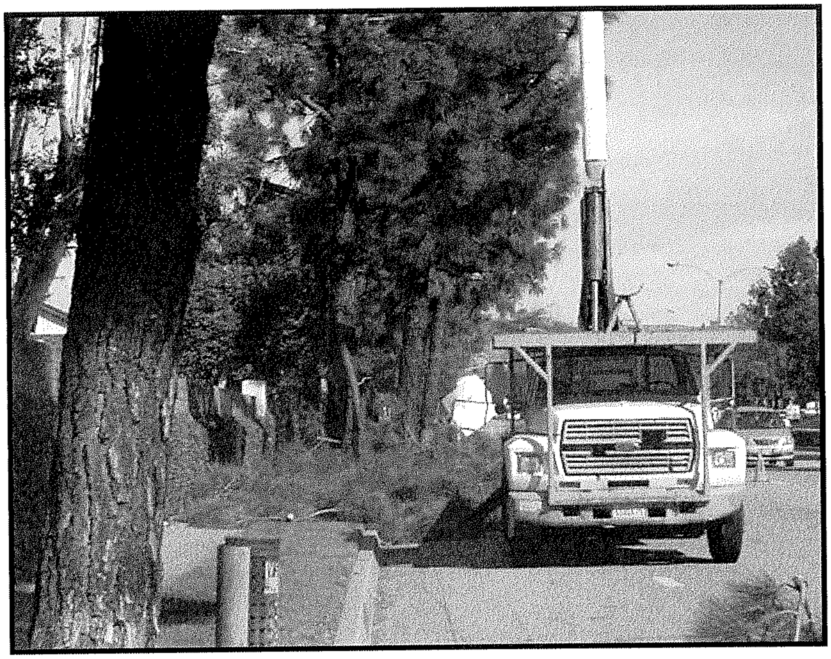
California's Nonpoint Source Program Plan http://www.co.clark.wa.us/pubworks/bmpman.pdf

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

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

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

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



Objectives

- Contain
- Educate
- Reduce/Minimize
- Product Substitution

Targeted Constituents

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

Description

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

Approach

Pollution Prevention

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

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

Suggested Protocols

Mowing, Trimming, and Weeding

- Whenever possible use mechanical methods of vegetation removal (e.g mowing with tractor-type or push mowers, hand cutting with gas or electric powered weed trimmers) rather than applying herbicides. Use hand weeding where practical.

- Avoid loosening the soil when conducting mechanical or manual weed control, this could lead to erosion. Use mulch or other erosion control measures when soils are exposed.

- Performing mowing at optimal times. Mowing should not be performed if significant rain events are predicted.

- Mulching mowers may be recommended for certain flat areas. Other techniques may be employed to minimize mowing such as selective vegetative planting using low maintenance grasses and shrubs.

- Collect lawn and garden clippings, pruning waste, tree trimmings, and weeds. Chip if necessary, and compost or dispose of at a landfill (see waste management section of this fact sheet).

- Place temporarily stockpiled material away from watercourses, and berm or cover stockpiles to prevent material releases to storm drains.

Planting

- Determine existing native vegetation features (location, species, size, function, importance) and consider the feasibility of protecting them. Consider elements such as their effect on drainage and erosion, hardiness, maintenance requirements, and possible conflicts between preserving vegetation and the resulting maintenance needs.

- Retain and/or plant selected native vegetation whose features are determined to be beneficial, where feasible. Native vegetation usually requires less maintenance (e.g., irrigation, fertilizer) than planting new vegetation.

- Consider using low water use groundcovers when planting or replanting.

Waste Management

- Compost leaves, sticks, or other collected vegetation or dispose of at a permitted landfill. Do not dispose of collected vegetation into waterways or storm drainage systems.

- Place temporarily stockpiled material away from watercourses and storm drain inlets, and berm or cover stockpiles to prevent material releases to the storm drain system.

- Reduce the use of high nitrogen fertilizers that produce excess growth requiring more frequent mowing or trimming.

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

Irrigation

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

Fertilizer and Pesticide Management

- Utilize a comprehensive management system that incorporates integrated pest management (IPM) techniques. There are many methods and types of IPM, including the following:
  - Mulching can be used to prevent weeds where turf is absent, fencing installed to keep rodents out, and netting used to keep birds and insects away from leaves and fruit.
  - Visible insects can be removed by hand (with gloves or tweezers) and placed in soapy water or vegetable oil. Alternatively, insects can be sprayed off the plant with water or in some cases vacuumed off of larger plants.
  - Store-bought traps, such as species-specific, pheromone-based traps or colored sticky cards, can be used.
  - Slugs can be trapped in small cups filled with beer that are set in the ground so the slugs can get in easily.
  - In cases where microscopic parasites, such as bacteria and fungi, are causing damage to plants, the affected plant material can be removed and disposed of (pruning equipment should be disinfected with bleach to prevent spreading the disease organism).
  - Small mammals and birds can be excluded using fences, netting, tree trunk guards.
  - Beneficial organisms, such as bats, birds, green lacewings, ladybugs, praying mantis, ground beetles, parasitic nematodes, trichogramma wasps, seed head weevils, and spiders that prey on detrimental pest species can be promoted.
- Follow all federal, state, and local laws and regulations governing the use, storage, and disposal of fertilizers and pesticides and training of applicators and pest control advisors.

- Use pesticides only if there is an actual pest problem (not on a regular preventative schedule).
- Do not use pesticides if rain is expected. Apply pesticides only when wind speeds are low (less than 5 mph).
- Do not mix or prepare pesticides for application near storm drains.
- Prepare the minimum amount of pesticide needed for the job and use the lowest rate that will effectively control the pest.
- Employ techniques to minimize off-target application (e.g. spray drift) of pesticides, including consideration of alternative application techniques.
- Fertilizers should be worked into the soil rather than dumped or broadcast onto the surface.
- Calibrate fertilizer and pesticide application equipment to avoid excessive application.
- Periodically test soils for determining proper fertilizer use.
- Sweep pavement and sidewalk if fertilizer is spilled on these surfaces before applying irrigation water.
- Purchase only the amount of pesticide that you can reasonably use in a given time period (month or year depending on the product).
- Triple rinse containers, and use rinse water as product. Dispose of unused pesticide as hazardous waste.
- Dispose of empty pesticide containers according to the instructions on the container label.

Inspection

- Inspect irrigation system periodically to ensure that the right amount of water is being applied and that excessive runoff is not occurring. Minimize excess watering, and repair leaks in the irrigation system as soon as they are observed.
- Inspect pesticide/fertilizer equipment and transportation vehicles daily.

Training

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

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

- Use a training log or similar method to document training.

Spill Response and Prevention

- Refer to SC-11, Spill Prevention, Control & Cleanup

- Have spill cleanup materials readily available and in a know in location

- Cleanup spills immediately and use dry methods if possible.

- Properly dispose of spill cleanup material.

Other Considerations

- The Federal Pesticide, Fungicide, and Rodenticide Act and California Title 3, Division 6, Pesticides and Pest Control Operations place strict controls over pesticide application and handling and specify training, annual refresher, and testing requirements. The regulations generally cover: a list of approved pesticides and selected uses, updated regularly; general application information; equipment use and maintenance procedures; and record keeping. The California Department of Pesticide Regulations and the County Agricultural Commission coordinate and maintain the licensing and certification programs. All public agency employees who apply pesticides and herbicides in "agricultural use" areas such as parks, golf courses, rights-of-way and recreation areas should be properly certified in accordance with state regulations. Contracts for landscape maintenance should include similar requirements.

- All employees who handle pesticides should be familiar with the most recent material safety data sheet (MSDS) files.

- Municipalities do not have the authority to regulate the use of pesticides by school districts, however the California Healthy Schools Act of 2000 (AB 2260) has imposed requirements on California school districts regarding pesticide use in schools. Posting of notification prior to the application of pesticides is now required, and IPM is stated as the preferred approach to pest management in schools.

Requirements

Costs

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

Maintenance

Not applicable

Supplemental Information

Further Detail of the BMP

Waste Management

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

Contractors and Other Pesticide Users

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

References and Resources

King County Stormwater Pollution Control Manual. Best Management Practices for Businesses. 1995. King County Surface Water Management. July. On-line: http://dnr.metrokc.gov/wlr/dss/spcm.htm

Los Angeles County Stormwater Quality Model Programs. Public Agency Activities http://ladpw.org/wmd/npdes/model_links.cfm

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

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

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

United States Environmental Protection Agency (USEPA). 2002. Pollution Prevention/Good Housekeeping for Municipal Operations Landscaping and Lawn Care. Office of Water. Office of Wastewater Management. On-line: http://www.epa.gov/npdes/menuofbmps/poll_8.htm

Drainage System Maintenance SC-74

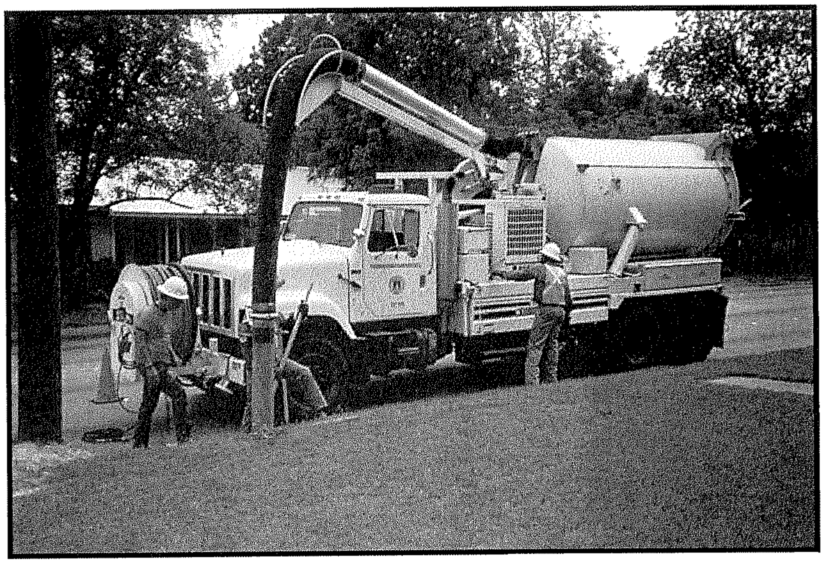

Photo Credit: Geoff Brosseau

Objectives

- Contain
- Educate
- Reduce/Minimize

Targeted Constituents

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

Description

As a consequence of its function, the stormwater conveyance system collects and transports urban runoff that may contain certain pollutants. Maintaining catch basins, stormwater inlets, and other stormwater conveyance structures on a regular basis will remove pollutants, prevent clogging of the downstream conveyance system, restore catch basins' sediment trapping capacity, and ensure the system functions properly hydraulically to avoid flooding.

Approach

Suggested Protocols

Catch Basins/Inlet Structures

- Municipal staff should regularly inspect facilities to ensure the following:
  - Immediate repair of any deterioration threatening structural integrity.
  - Cleaning before the sump is 40% full. Catch basins should be cleaned as frequently as needed to meet this standard.
  - Stenciling of catch basins and inlets (see SC-75 Waste Handling and Disposal).
- Clean catch basins, storm drain inlets, and other conveyance structures in high pollutant load areas just before the wet season to remove sediments and debris accumulated during the summer.

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- Conduct inspections more frequently during the wet season for problem areas where sediment or trash accumulates more often. Clean and repair as needed.
- Keep accurate logs of the number of catch basins cleaned.
- Record the amount of waste collected.
- Store wastes collected from cleaning activities of the drainage system in appropriate containers or temporary storage sites in a manner that prevents discharge to the storm drain.
- Dewater the wastes with outflow into the sanitary sewer if permitted. Water should be treated with an appropriate filtering device prior to discharge to the sanitary sewer. If discharge to the sanitary sewer is not allowed, water should be pumped or vacuumed to a tank and properly disposed of. Do not dewater near a storm drain or stream.
- Except for small communities with relatively few catch basins that may be cleaned manually, most municipalities will require mechanical cleaners such as eductors, vacuums, or bucket loaders.

Storm Drain Conveyance System

- Locate reaches of storm drain with deposit problems and develop a flushing schedule that keeps the pipe clear of excessive buildup.
- Collect flushed effluent and pump to the sanitary sewer for treatment.

Pump Stations

- Clean all storm drain pump stations prior to the wet season to remove silt and trash.
- Do not allow discharge from cleaning a storm drain pump station or other facility to reach the storm drain system.
- Conduct quarterly routine maintenance at each pump station.
- Inspect, clean, and repair as necessary all outlet structures prior to the wet season.
- Sample collected sediments to determine if landfill disposal is possible, or illegal discharges in the watershed are occurring.

Open Channel

- Consider modification of storm channel characteristics to improve channel hydraulics, to increase pollutant removals, and to enhance channel/creek aesthetic and habitat value.
- Conduct channel modification/improvement in accordance with existing laws. Any person, government agency, or public utility proposing an activity that will change the natural (emphasis added) state of any river, stream, or lake in California, must enter into a steam or Lake Alteration Agreement with the Department of Fish and Game. The developer-applicant should also contact local governments (city, county, special districts), other state agencies

(SWRCB, RWQCB, Department of Forestry, Department of Water Resources), and Federal Corps of Engineers and USFWS

Illicit Connections and Discharges

- During routine maintenance of conveyance system and drainage structures field staff should look for evidence of illegal discharges or illicit connections:
  - Is there evidence of spills such as paints, discoloring, etc.
  - Are there any odors associated with the drainage system
  - Record locations of apparent illegal discharges/illicit connections
  - Track flows back to potential dischargers and conduct aboveground inspections. This can be done through visual inspection of up gradient manholes or alternate techniques including zinc chloride smoke testing, fluorometric dye testing, physical inspection testing, or television camera inspection.
  - Once the origin of flow is established, require illicit discharger to eliminate the discharge.
- Stencil storm drains, where applicable, to prevent illegal disposal of pollutants. Storm drain inlets should have messages such as "Dump No Waste Drains to Stream" stenciled next to them to warn against ignorant or intentional dumping of pollutants into the storm drainage system.
- Refer to fact sheet SC-10 Non-Stormwater Discharges.

Illegal Dumping

- Regularly inspect and clean up hot spots and other storm drainage areas where illegal dumping and disposal occurs.
- Establish a system for tracking incidents. The system should be designed to identify the following:
  - Illegal dumping hot spots
  - Types and quantities (in some cases) of wastes
  - Patterns in time of occurrence (time of day/night, month, or year)
  - Mode of dumping (abandoned containers, "midnight dumping" from moving vehicles, direct dumping of materials, accidents/spills)
  - Responsible parties
- Post "No Dumping" signs in problem areas with a phone number for reporting dumping and disposal. Signs should also indicate fines and penalties for illegal dumping.
- Refer to fact sheet SC-10 Non-Stormwater Discharges.

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

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

Training

- Train crews in proper maintenance activities, including record keeping and disposal.

- Only properly trained individuals are allowed to handle hazardous materials/wastes.

- Train municipal employees from all departments (public works, utilities, street cleaning, parks and recreation, industrial waste inspection, hazardous waste inspection, sewer maintenance) to recognize and report illegal dumping.

- Train municipal employees and educate businesses, contractors, and the general public in proper and consistent methods for disposal.

- Train municipal staff regarding non-stormwater discharges (See SC-10 Non-Stormwater Discharges).

Spill Response and Prevention

- Refer to SC-11, Prevention, Control & Cleanup

- Have spill cleanup materials readily available and in a known location.

- Cleanup spills immediately and use dry methods if possible.

- Properly dispose of spill cleanup material.

Other Considerations

- Cleanup activities may create a slight disturbance for local aquatic species. Access to items and material on private property may be limited. Trade-offs may exist between channel hydraulics and water quality/riparian habitat. If storm channels or basins are recognized as wetlands, many activities, including maintenance, may be subject to regulation and permitting.

- Storm drain flushing is most effective in small diameter pipes (36-inch diameter pipe or less, depending on water supply and sediment collection capacity). Other considerations associated with storm drain flushing may include the availability of a water source, finding a downstream area to collect sediments, liquid/sediment disposal, and disposal of flushed effluent to sanitary sewer may be prohibited in some areas.

- Regulations may include adoption of substantial penalties for illegal dumping and disposal.

- Municipal codes should include sections prohibiting the discharge of soil, debris, refuse, hazardous wastes, and other pollutants into the storm drain system.

- Private property access rights may be needed to track illegal discharges up gradient.

- Requirements of municipal ordinance authority for suspected source verification testing for illicit connections necessary for guaranteed rights of entry.

Requirements

Costs

- An aggressive catch basin cleaning program could require a significant capital and O&M budget. A careful study of cleaning effectiveness should be undertaken before increased cleaning is implemented. Catch basin cleaning costs are less expensive if vacuum street sweepers are available; cleaning catch basins manually can cost approximately twice as much as cleaning the basins with a vacuum attached to a sweeper.

- Methods used for illicit connection detection (smoke testing, dye testing, visual inspection, and flow monitoring) can be costly and time-consuming. Site-specific factors, such as the level of impervious area, the density and ages of buildings, and type of land use will determine the level of investigation necessary. Encouraging reporting of illicit discharges by employees can offset costs by saving expense on inspectors and directing resources more efficiently. Some programs have used funds available from "environmental fees" or special assessment districts to fund their illicit connection elimination programs.

Maintenance

- Two-person teams may be required to clean catch basins with vactor trucks.

- Identifying illicit discharges requires teams of at least two people (volunteers can be used), plus administrative personnel, depending on the complexity of the storm sewer system.

- Arrangements must be made for proper disposal of collected wastes.

- Requires technical staff to detect and investigate illegal dumping violations, and to coordinate public education.

Supplemental Information

Further Detail of the BMP

Storm Drain flushing

Sanitary sewer flushing is a common maintenance activity used to improve pipe hydraulics and to remove pollutants in sanitary sewer systems. The same principles that make sanitary sewer flushing effective can be used to flush storm drains. Flushing may be designed to hydraulically convey accumulated material to strategic locations, such as to an open channel, to another point where flushing will be initiated, or over to the sanitary sewer and on to the treatment facilities, thus preventing re-suspension and overflow of a portion of the solids during storm events. Flushing prevents "plug flow" discharges of concentrated pollutant loadings and sediments. The deposits can hinder the designed conveyance capacity of the storm drain system and potentially cause backwater conditions in severe cases of clogging.

Storm drain flushing usually takes place along segments of pipe with grades that are too flat to maintain adequate velocity to keep particles in suspension. An upstream manhole is selected to place an inflatable device that temporarily plugs the pipe. Further upstream, water is pumped into the line to create a flushing wave. When the upstream reach of pipe is sufficiently full to cause a flushing wave, the inflated device is rapidly deflated with the assistance of a vacuum pump, releasing the backed up water and resulting in the cleaning of the storm drain segment.

To further reduce the impacts of stormwater pollution, a second inflatable device, placed well downstream, may be used to re-collect the water after the force of the flushing wave has dissipated. A pump may then be used to transfer the water and accumulated material to the sanitary sewer for treatment. In some cases, an interceptor structure may be more practical or required to re-collect the flushed waters.

It has been found that cleansing efficiency of periodic flush waves is dependent upon flush volume, flush discharge rate, sewer slope, sewer length, sewer flow rate, sewer diameter, and population density. As a rule of thumb, the length of line to be flushed should not exceed 700 feet. At this maximum recommended length, the percent removal efficiency ranges between 65-75 percent for organics and 55-65 percent for dry weather grit/inorganic material. The percent removal efficiency drops rapidly beyond that. Water is commonly supplied by a water truck, but fire hydrants can also supply water. To make the best use of water, it is recommended that reclaimed water be used or that fire hydrant line flushing coincide with storm drain flushing.

Flow Management

Flow management has been one of the principal motivations for designing urban stream corridors in the past. Such needs may or may not be compatible with the stormwater quality goals in the stream corridor.

Downstream flood peaks can be suppressed by reducing through flow velocity. This can be accomplished by reducing gradient with grade control structures or increasing roughness with boulders, dense vegetation, or complex banks forms. Reducing velocity correspondingly increases flood height, so all such measures have a natural association with floodplain open space. Flood elevations laterally adjacent to the stream can be lowered by increasing through flow velocity.

However, increasing velocity increases flooding downstream and inherently conflicts with channel stability and human safety. Where topography permits, another way to lower flood elevation is to lower the level of the floodway with drop structures into a large but subtly excavated bowl where flood flows we allowed to spread out.

Stream Corridor Planning

Urban streams receive and convey stormwater flows from developed or developing watersheds. Planning of stream corridors thus interacts with urban stormwater management programs. If local programs are intended to control or protect downstream environments by managing flows delivered to the channels, then it is logical that such programs should be supplemented by management of the materials, forms, and uses of the downstream riparian corridor. Any proposal for steam alteration or management should be investigated for its potential flow and stability effects on upstream, downstream, and laterally adjacent areas. The timing and rate of flow from various tributaries can combine in complex ways to alter flood hazards. Each section of channel is unique, influenced by its own distribution of roughness elements, management activities, and stream responses.

Flexibility to adapt to stream features and behaviors as they evolve must be included in stream reclamation planning. The amenity and ecology of streams may be enhanced through the landscape design options of 1) corridor reservation, 2) bank treatment, 3) geomorphic restoration, and 4) grade control.

Corridor reservation - Reserving stream corridors and valleys to accommodate natural stream meandering, aggradation, degradation, and over bank flows allows streams to find their own form and generate less ongoing erosion. In California, open stream corridors in recent urban developments have produced recreational open space, irrigation of streamside plantings, and the aesthetic amenity of flowing water.

Bank treatment - The use of armoring, vegetative cover, and flow deflection may be used to influence a channel's form, stability, and biotic habitat. To prevent bank erosion, armoring can be done with rigid construction materials, such as concrete, masonry, wood planks and logs, riprap, and gabions. Concrete linings have been criticized because of their lack of provision of biotic habitat. In contrast, riprap and gabions make relatively porous and flexible linings. Boulders, placed in the bed reduce velocity and erosive power.

Riparian vegetation can stabilize the banks of streams that are at or near a condition of equilibrium. Binding networks of roots increase bank shear strength. During flood flows, resilient vegetation is forced into erosion-inhibiting mats. The roughness of vegetation leads to lower velocity, further reducing erosive effects. Structural flow deflection can protect banks from erosion or alter fish habitat. By concentrating flow, a deflector causes a pool to be scoured in the bed.

Geomorphic restoration – Restoration refers to alteration of disturbed streams so their form and behavior emulate those of undisturbed streams. Natural meanders are retained, with grading to gentle slopes on the inside of curves to allow point bars and riffle-pool sequences to develop. Trees are retained to provide scenic quality, biotic productivity, and roots for bank stabilization, supplemented by plantings where necessary.

A restorative approach can be successful where the stream is already approaching equilibrium. However, if upstream urbanization continues new flow regimes will be generated that could disrupt the equilibrium of the treated system.

Grade Control - A grade control structure is a level shelf of a permanent material, such as stone, masonry, or concrete, over which stream water flows. A grade control structure is called a sill, weir, or drop structure, depending on the relation of its invert elevation to upstream and downstream channels.

A sill is installed at the preexisting channel bed elevation to prevent upstream migration of nick points. It establishes a firm base level below which the upstream channel can not erode.

A weir or check dam is installed with invert above the preexisting bed elevation. A weir raises the local base level of the stream and causes aggradation upstream. The gradient, velocity, and erosive potential of the stream channel are reduced. A drop structure lowers the downstream invert below its preexisting elevation, reducing downstream gradient and velocity. Weirs and drop structure control erosion by dissipating energy and reducing slope velocity.

When carefully applied, grade control structures can be highly versatile in establishing human and environmental benefits in stabilized channels. To be successful, application of grade control structures should be guided by analysis of the stream system both upstream and downstream from the area to he reclaimed.

Examples

The California Department of Water Resources began the Urban Stream Restoration Program in 1985. The program provides grant funds to municipalities and community groups to implement stream restoration projects. The projects reduce damages from streambank aid watershed instability arid floods while restoring streams' aesthetic, recreational, and fish and wildlife values.

In Buena Vista Park, upper floodway slopes are gentle and grassed to achieve continuity of usable park land across the channel of small boulders at the base of the slopes.

The San Diego River is a large, vegetative lined channel, which was planted in a variety of species to support riparian wildlife while stabilizing the steep banks of the floodway.

References and Resources

Ferguson, B.K. 1991. Urban Stream Reclamation, p. 324-322, Journal of Soil and Water Conservation.

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

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

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

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

San Diego Stormwater Co-permittees Jurisdictional Urban Runoff Management Program (URMP) Municipal Activities Model Program Guidance. 2001. Project Clean Water. November.

United States Environmental Protection Agency (USEPA). 1999. Stormwater Management Fact Sheet Non-stormwater Discharges to Storm Sewers. EPA 832-F-99-022. Office of Water, Washington, D.C. September.

United States Environmental Protection Agency (USEPA). 1999. Stormwater O&M Fact Sheet Catch Basin Cleaning. EPA 832-F-99-011. Office of Water, Washington, D.C. September.

United States Environmental Protection Agency (USEPA). 2002. Pollution Prevention/Good Housekeeping for Municipal Operations Illegal Dumping Control. On line: http://www.epa.gov/npdes/menuofbmps/poll_7.htm

United States Environmental Protection Agency (USEPA). 2002. Pollution Prevention/Good Housekeeping for Municipal Operations Storm Drain System Cleaning. On line: http://www.epa.gov/npdes/menuofbmps/poll_16.htm

6. BMP Fact Sheets

Section 3
Source Control BMPs

3.1 Introduction

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

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

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

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

3.2 Fact Sheet Format

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

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

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

SC-xx Example Fact Sheet

Description of the BMP

Approach

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

Requirements

- Costs
- Maintenance

Supplemental Information

- Further Details on the BMP
- Examples

References and Resources

Figure 3-1
Example Fact Sheet

3.3 BMP Fact Sheets

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

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SC-33	Outdoor Storage of Raw Materials
SC-34	Waste Handling and Disposal
Building and Grounds Management	
SC-41	Building and Grounds Maintenance
SC-43	Parking/Storage Area Maintenance
Over Water Activities	
SC-50	Over Water Activities
General Stormwater Management	
SC-60	Housekeeping Practices
SC-61	Safer Alternative Products

Table 3-2 Municipal Field Program BMPs

SC-70	Road and Street Maintenance
SC-71	Plaza and Sidewalk Cleaning
SC-72	Fountains & Pools Maintenance
SC-73	Landscape Maintenance
SC-74	Drainage System Maintenance
SC-75	Waste Handling and Disposal
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Site Design & Landscape Planning SD-10

Design Objectives

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

Description

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

Approach

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

Suitable Applications

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

Design Considerations

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

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Designing New Installations

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

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

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

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

Conserve Natural Areas during Landscape Planning

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

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

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

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

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

- Preserve riparian areas and wetlands.

Maximize Natural Water Storage and Infiltration Opportunities Within the Landscape Unit

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

- Maintain natural storage reservoirs and drainage corridors, including depressions, areas of permeable soils, swales, and intermittent streams. Develop and implement policies and

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

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

Protection of Slopes and Channels during Landscape Design

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

Redeveloping Existing Installations

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

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

Other Resources

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

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

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

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

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

Spill Prevention, Control & Cleanup SC-11

Objectives

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

Targeted Constituents

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

Description

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

Approach

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

Pollution Prevention

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

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

■ Product substitution – use less toxic materials (i.e. use water based paints instead of oil based paints)

■ Recycle, reclaim, or reuse materials whenever possible. This will reduce the amount of materials that are brought into the facility or into the field.

Suggested Protocols

Spill/Leak Prevention Measures

■ If possible, move material handling indoors, under cover, or away from storm drains or sensitive water bodies.

■ Properly label all containers so that the contents are easily identifiable.

■ Berm storage areas so that if a spill or leak occurs, the material is contained.

■ Cover outside storage areas either with a permanent structure or with a seasonal one such as a tarp so that rain can not come into contact with the materials.

■ Check containers (and any containment sumps) often for leaks and spills. Replace containers that are leaking, corroded, or otherwise deteriorating with containers in good condition. Collect all spilled liquids and properly dispose of them.

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

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

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

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

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

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

Training

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

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

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

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

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

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

Spill Response and Prevention

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

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

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

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

Spill Cleanup Procedures

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

Reporting

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

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

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

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

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

Other Considerations

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

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

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

Requirements

Costs

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

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

Maintenance

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

Supplemental Information

Further Detail of the BMP

Reporting

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

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

These records should contain the following information:

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

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

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

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

Examples

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

References and Resources

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

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

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

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.

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

Redeveloping Existing Installations

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

Other Resources

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

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

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

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

Storm Drain Signage SD-13

Design Objectives

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

Description

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

Approach

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

Suitable Applications

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

Design Considerations

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

Designing New Installations

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

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

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– DRAINS TO OCEAN" and/or other graphical icons to discourage illegal dumping.

- Post signs with prohibitive language and/or graphical icons, which prohibit illegal dumping at public access points along channels and creeks within the project area.

Note - Some local agencies have approved specific signage and/or storm drain message placards for use. Consult local agency stormwater staff to determine specific requirements for placard types and methods of application.

Redeveloping Existing Installations

Various jurisdictional stormwater management and mitigation plans (SUSMP, WQMP, etc.) define "redevelopment" in terms of amounts of additional impervious area, increases in gross floor area and/or exterior construction, and land disturbing activities with structural or impervious surfaces. If the project meets the definition of "redevelopment", then the requirements stated under " designing new installations" above should be included in all project design plans.

Additional Information

Maintenance Considerations

- Legibility of markers and signs should be maintained. If required by the agency with jurisdiction over the project, the owner/operator or homeowner's association should enter into a maintenance agreement with the agency or record a deed restriction upon the property title to maintain the legibility of placards or signs.

Placement

- Signage on top of curbs tends to weather and fade.

- Signage on face of curbs tends to be worn by contact with vehicle tires and sweeper brooms.

Supplemental Information

Examples

- Most MS4 programs have storm drain signage programs. Some MS4 programs will provide stencils, or arrange for volunteers to stencil storm drains as part of their outreach program.

Other Resources

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

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

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

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

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

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

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

Other Resources

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

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

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

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

Objectives

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

Targeted Constituents

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

Description

Stormwater runoff from building and grounds maintenance activities can be contaminated with toxic hydrocarbons in solvents, fertilizers and pesticides, suspended solids, heavy metals, abnormal pH, and oils and greases. Utilizing the protocols in this fact sheet will prevent or reduce the discharge of pollutants to stormwater from building and grounds maintenance activities by washing and cleaning up with as little water as possible, following good landscape management practices, preventing and cleaning up spills immediately, keeping debris from entering the storm drains, and maintaining the stormwater collection system.

Approach

Reduce potential for pollutant discharge through source control pollution prevention and BMP implementation. Successful implementation depends on effective training of employees on applicable BMPs and general pollution prevention strategies and objectives.

Pollution Prevention

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

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- Encourage use of Integrated Pest Management techniques for pest control.
- Encourage proper onsite recycling of yard trimmings.
- Recycle residual paints, solvents, lumber, and other material as much as possible.

Suggested Protocols

Pressure Washing of Buildings, Rooftops, and Other Large Objects

- In situations where soaps or detergents are used and the surrounding area is paved, pressure washers must use a water collection device that enables collection of wash water and associated solids. A sump pump, wet vacuum or similarly effective device must be used to collect the runoff and loose materials. The collected runoff and solids must be disposed of properly.
- If soaps or detergents are not used, and the surrounding area is paved, wash runoff does not have to be collected but must be screened. Pressure washers must use filter fabric or some other type of screen on the ground and/or in the catch basin to trap the particles in wash water runoff.
- If you are pressure washing on a grassed area (with or without soap), runoff must be dispersed as sheet flow as much as possible, rather than as a concentrated stream. The wash runoff must remain on the grass and not drain to pavement.

Landscaping Activities

- Dispose of grass clippings, leaves, sticks, or other collected vegetation as garbage, or by composting. Do not dispose of collected vegetation into waterways or storm drainage systems.
- Use mulch or other erosion control measures on exposed soils.

Building Repair, Remodeling, and Construction

- Do not dump any toxic substance or liquid waste on the pavement, the ground, or toward a storm drain.
- Use ground or drop cloths underneath outdoor painting, scraping, and sandblasting work, and properly dispose of collected material daily.
- Use a ground cloth or oversized tub for activities such as paint mixing and tool cleaning.
- Clean paintbrushes and tools covered with water-based paints in sinks connected to sanitary sewers or in portable containers that can be dumped into a sanitary sewer drain. Brushes and tools covered with non-water-based paints, finishes, or other materials must be cleaned in a manner that enables collection of used solvents (e.g., paint thinner, turpentine, etc.) for recycling or proper disposal.
- Use a storm drain cover, filter fabric, or similarly effective runoff control mechanism if dust, grit, wash water, or other pollutants may escape the work area and enter a catch basin. This is particularly necessary on rainy days. The containment device(s) must be in place at the beginning of the work day, and accumulated dirty runoff and solids must be collected and disposed of before removing the containment device(s) at the end of the work day.

- If you need to de-water an excavation site, you may need to filter the water before discharging to a catch basin or off-site. If directed off-site, you should direct the water through hay bales and filter fabric or use other sediment filters or traps.

- Store toxic material under cover during precipitation events and when not in use. A cover would include tarps or other temporary cover material.

Mowing, Trimming, and Planting

- Dispose of leaves, sticks, or other collected vegetation as garbage, by composting or at a permitted landfill. Do not dispose of collected vegetation into waterways or storm drainage systems.

- Use mulch or other erosion control measures when soils are exposed.

- Place temporarily stockpiled material away from watercourses and drain inlets, and berm or cover stockpiles to prevent material releases to the storm drain system.

- Consider an alternative approach when bailing out muddy water: do not put it in the storm drain; pour over landscaped areas.

- Use hand weeding where practical.

Fertilizer and Pesticide Management

- Follow all federal, state, and local laws and regulations governing the use, storage, and disposal of fertilizers and pesticides and training of applicators and pest control advisors.

- Use less toxic pesticides that will do the job when applicable. Avoid use of copper-based pesticides if possible.

- Do not use pesticides if rain is expected.

- Do not mix or prepare pesticides for application near storm drains.

- Use the minimum amount needed for the job.

- Calibrate fertilizer distributors to avoid excessive application.

- Employ techniques to minimize off-target application (e.g., spray drift) of pesticides, including consideration of alternative application techniques.

- Apply pesticides only when wind speeds are low.

- Fertilizers should be worked into the soil rather than dumped or broadcast onto the surface.

- Irrigate slowly to prevent runoff and then only as much as is needed.

- Clean pavement and sidewalk if fertilizer is spilled on these surfaces before applying irrigation water.

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

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

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

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

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

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

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

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

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

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

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

- Clean up spills immediately.

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

Requirements

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

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

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

Supplemental Information

Further Detail of the BMP

Fire Sprinkler Line Flushing

Building fire sprinkler line flushing may be a source of non-stormwater runoff pollution. The water entering the system is usually potable water, though in some areas it may be non-potable reclaimed wastewater. There are subsequent factors that may drastically reduce the quality of the water in such systems. Black iron pipe is usually used since it is cheaper than potable piping, but it is subject to rusting and results in lower quality water. Initially, the black iron pipe has an oil coating to protect it from rusting between manufacture and installation; this will contaminate the water from the first flush but not from subsequent flushes. Nitrates, poly-phosphates and other corrosion inhibitors, as well as fire suppressants and antifreeze may be added to the sprinkler water system. Water generally remains in the sprinkler system a long time (typically a year) and between flushes may accumulate iron, manganese, lead, copper, nickel, and zinc. The water generally becomes anoxic and contains living and dead bacteria and breakdown products from chlorination. This may result in a significant BOD problem and the water often smells. Consequently dispose fire sprinkler line flush water into the sanitary sewer. Do not allow discharge to storm drain or infiltration due to potential high levels of pollutants in fire sprinkler line water.

References and Resources

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

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

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

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

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

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

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

Parking/Storage Area Maintenance SC-43

Objectives

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

Targeted Constituents

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

Description

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

Approach

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

Pollution Prevention

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

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Suggested Protocols

General

- Keep the parking and storage areas clean and orderly. Remove debris in a timely fashion.
- Allow sheet runoff to flow into biofilters (vegetated strip and swale) and/or infiltration devices.
- Utilize sand filters or oleophilic collectors for oily waste in low quantities.
- Arrange rooftop drains to prevent drainage directly onto paved surfaces.
- Design lot to include semi-permeable hardscape.
- Discharge soapy water remaining in mop or wash buckets to the sanitary sewer through a sink, toilet, clean-out, or wash area with drain.

Controlling Litter

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

Surface Cleaning

- Use dry cleaning methods (e.g., sweeping, vacuuming) to prevent the discharge of pollutants into the stormwater conveyance system if possible.
- Establish frequency of public parking lot sweeping based on usage and field observations of waste accumulation.
- Sweep all parking lots at least once before the onset of the wet season.
- Follow the procedures below if water is used to clean surfaces:
  - Block the storm drain or contain runoff.
  - Collect and pump wash water to the sanitary sewer or discharge to a pervious surface. Do not allow wash water to enter storm drains.
  - Dispose of parking lot sweeping debris and dirt at a landfill.
- Follow the procedures below when cleaning heavy oily deposits:
  - Clean oily spots with absorbent materials.
  - Use a screen or filter fabric over inlet, then wash surfaces.

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

Surface Repair

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

Inspection

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

Training

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

Spill Response and Prevention

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

Other Considerations

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

SC-43 Parking/Storage Area Maintenance

Requirements

Costs

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

Maintenance

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

Supplemental Information

Further Detail of the BMP

Surface Repair

Apply concrete, asphalt, and seal coat during dry weather to prevent contamination from contacting stormwater runoff. Where applicable, cover and seal nearby storm drain inlets (with waterproof material or mesh) and manholes before applying seal coat, slurry seal, etc. Leave covers in place until job is complete and all water from emulsified oil sealants has drained or evaporated. Clean any debris from these covered manholes and drains for proper disposal. Only use only as much water as is necessary for dust control to avoid runoff.

References and Resources

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

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

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

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

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

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

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

Housekeeping Practices SC-60

Objectives

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

Targeted Constituents

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

Description

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

Approach

Pollution Prevention

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

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

Suggested Protocols

General

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

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

- Recycle or dispose of fluids properly.

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

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

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

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- Require a signed checklist from every user of any hazardous material detailing amount taken, amount used, amount returned and disposal of spent material.

- Do a before audit of your site to establish baseline conditions and regular subsequent audits to note any changes and whether conditions are improving or deteriorating.

- Keep records of water, air and solid waste quantities and quality tests and their disposition.

- Maintain a mass balance of incoming, outgoing and on hand materials so you know when there are unknown losses that need to be tracked down and accounted for.

- Use and reward employee suggestions related to BMPs, hazards, pollution reduction, work place safety, cost reduction, alternative materials and procedures, recycling and disposal.

- Have, and review regularly, a contingency plan for spills, leaks, weather extremes etc. Make sure all employees know about it and what their role is so that it comes into force automatically.

Training

- Train all employees, management, office, yard, manufacturing, field and clerical in BMPs and pollution prevention and make them accountable.

- Train municipal employees who handle potentially harmful materials in good housekeeping practices.

- Train personnel who use pesticides in the proper use of the pesticides. The California Department of Pesticide Regulation license pesticide dealers, certify pesticide applicators and conduct onsite inspections.

- Train employees and contractors in proper techniques for spill containment and cleanup. The employee should have the tools and knowledge to immediately begin cleaning up a spill if one should occur.

Spill Response and Prevention

- Refer to SC-11, Spill Prevention, Control & Cleanup.

- Keep your Spill Prevention Control and Countermeasure (SPCC) plant up-to-date, and implement accordingly.

- Have spill cleanup materials readily available and in a known location.

- Cleanup spills immediately and use dry methods if possible.

- Properly dispose of spill cleanup material.

Other Considerations

- There are no major limitations to this best management practice.

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

Requirements

Costs

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

Maintenance

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

Supplemental Information

Further Detail of the BMP

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

Examples

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

References and Resources

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

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

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

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

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

Trash Storage Areas SD-32

Design Objectives

Maximize Infiltration

Provide Retention

Slow Runoff

Minimize Impervious Land Coverage

Prohibit Dumping of Improper Materials

☑ Contain Pollutants

Collect and Convey

Description

Trash storage areas are areas where a trash receptacle (s) are located for use as a repository for solid wastes. Stormwater runoff from areas where trash is stored or disposed of can be polluted. In addition, loose trash and debris can be easily transported by water or wind into nearby storm drain inlets, channels, and/or creeks. Waste handling operations that may be sources of stormwater pollution include dumpsters, litter control, and waste piles.

Approach

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

Suitable Applications

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

Design Considerations

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

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

Designing New Installations

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

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

- Make sure trash container areas are screened or walled to prevent off-site transport of trash.

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

Redeveloping Existing Installations

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

Additional Information

Maintenance Considerations

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

Other Resources

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

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

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

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

Appendix H

- Maintenance Manual & Covenant Agreement

Will be provided in final engineering stage

Appendix I

Supporting Information

- NOAA Atlas 14 Rainfall
- Basin Factor Safety Calculation
- Catch Basin Filter Insert Details

NOAA Atlas 14, Volume 6, Version 2
Location name: Apple Valley, California, USA*
Latitude: 34.6082°, Longitude: -117.198°
Elevation: 3063.9 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	**0.083** (0.068-0.102)	**0.117** (0.096-0.143)	**0.163** (0.134-0.201)	**0.204** (0.166-0.253)	**0.262** (0.207-0.336)	**0.310** (0.239-0.406)	**0.361** (0.272-0.484)	**0.417** (0.306-0.575)	**0.498** (0.350-0.714)	**0.564** (0.384-0.838)
10-min	**0.119** (0.098-0.146)	**0.167** (0.137-0.205)	**0.234** (0.192-0.288)	**0.292** (0.238-0.362)	**0.376** (0.296-0.482)	**0.444** (0.343-0.582)	**0.518** (0.390-0.694)	**0.598** (0.438-0.824)	**0.713** (0.502-1.02)	**0.809** (0.550-1.20)
15-min	**0.144** (0.119-0.176)	**0.202** (0.166-0.248)	**0.283** (0.232-0.349)	**0.353** (0.287-0.438)	**0.454** (0.358-0.583)	**0.537** (0.415-0.703)	**0.626** (0.472-0.840)	**0.723** (0.530-0.996)	**0.863** (0.607-1.24)	**0.978** (0.665-1.45)
30-min	**0.197** (0.162-0.242)	**0.277** (0.228-0.340)	**0.388** (0.318-0.477)	**0.484** (0.394-0.600)	**0.622** (0.490-0.798)	**0.736** (0.568-0.963)	**0.858** (0.646-1.15)	**0.990** (0.726-1.36)	**1.18** (0.831-1.70)	**1.34** (0.911-1.99)
60-min	**0.248** (0.204-0.304)	**0.348** (0.286-0.427)	**0.488** (0.400-0.601)	**0.609** (0.495-0.755)	**0.783** (0.617-1.00)	**0.926** (0.715-1.21)	**1.08** (0.813-1.45)	**1.25** (0.913-1.72)	**1.49** (1.05-2.13)	**1.69** (1.15-2.50)
2-hr	**0.351** (0.289-0.431)	**0.475** (0.391-0.583)	**0.646** (0.530-0.796)	**0.793** (0.645-0.984)	**1.00** (0.790-1.29)	**1.17** (0.905-1.54)	**1.35** (1.02-1.81)	**1.55** (1.14-2.13)	**1.83** (1.29-2.62)	**2.05** (1.40-3.05)
3-hr	**0.426** (0.351-0.523)	**0.569** (0.468-0.699)	**0.765** (0.628-0.942)	**0.933** (0.759-1.16)	**1.17** (0.922-1.50)	**1.36** (1.05-1.78)	**1.57** (1.18-2.10)	**1.78** (1.31-2.46)	**2.09** (1.47-3.00)	**2.34** (1.59-3.48)
6-hr	**0.580** (0.477-0.711)	**0.766** (0.630-0.940)	**1.02** (0.836-1.25)	**1.23** (1.00-1.53)	**1.54** (1.21-1.97)	**1.78** (1.37-2.32)	**2.03** (1.53-2.72)	**2.30** (1.68-3.16)	**2.67** (1.88-3.83)	**2.97** (2.02-4.42)
12-hr	**0.744** (0.613-0.913)	**0.989** (0.813-1.21)	**1.32** (1.08-1.62)	**1.59** (1.30-1.98)	**1.97** (1.56-2.53)	**2.28** (1.76-2.98)	**2.59** (1.95-3.47)	**2.92** (2.14-4.02)	**3.38** (2.38-4.85)	**3.74** (2.55-5.55)
24-hr	**0.977** (0.867-1.12)	**1.32** (1.17-1.52)	**1.77** (1.56-2.04)	**2.14** (1.87-2.49)	**2.65** (2.25-3.19)	**3.05** (2.53-3.75)	**3.46** (2.81-4.36)	**3.90** (3.07-5.05)	**4.49** (3.39-6.06)	**4.96** (3.62-6.93)
2-day	**1.15** (1.02-1.33)	**1.58** (1.40-1.82)	**2.14** (1.89-2.47)	**2.61** (2.28-3.03)	**3.24** (2.75-3.90)	**3.73** (3.10-4.59)	**4.24** (3.44-5.34)	**4.77** (3.76-6.17)	**5.49** (4.15-7.41)	**6.06** (4.42-8.46)
3-day	**1.25** (1.11-1.44)	**1.73** (1.54-2.00)	**2.37** (2.09-2.73)	**2.89** (2.53-3.36)	**3.60** (3.05-4.33)	**4.15** (3.44-5.10)	**4.71** (3.82-5.93)	**5.30** (4.18-6.86)	**6.10** (4.61-8.24)	**6.74** (4.92-9.41)
4-day	**1.33** (1.18-1.53)	**1.84** (1.63-2.12)	**2.52** (2.23-2.91)	**3.08** (2.70-3.58)	**3.84** (3.25-4.62)	**4.43** (3.67-5.44)	**5.03** (4.07-6.33)	**5.65** (4.45-7.32)	**6.51** (4.92-8.79)	**7.18** (5.25-10.0)
7-day	**1.45** (1.29-1.67)	**1.99** (1.77-2.30)	**2.72** (2.40-3.14)	**3.31** (2.90-3.85)	**4.13** (3.50-4.97)	**4.76** (3.95-5.85)	**5.41** (4.38-6.81)	**6.09** (4.79-7.88)	**7.01** (5.30-9.47)	**7.74** (5.65-10.8)
10-day	**1.53** (1.36-1.76)	**2.10** (1.86-2.42)	**2.85** (2.52-3.30)	**3.48** (3.05-4.05)	**4.34** (3.68-5.22)	**5.01** (4.16-6.15)	**5.69** (4.61-7.17)	**6.41** (5.05-8.31)	**7.40** (5.60-9.99)	**8.18** (5.98-11.4)
20-day	**1.76** (1.56-2.02)	**2.42** (2.14-2.78)	**3.30** (2.92-3.81)	**4.04** (3.54-4.70)	**5.06** (4.29-6.10)	**5.87** (4.87-7.22)	**6.70** (5.43-8.44)	**7.58** (5.97-9.82)	**8.79** (6.64-11.9)	**9.75** (7.12-13.6)
30-day	**1.99** (1.76-2.29)	**2.74** (2.43-3.16)	**3.76** (3.33-4.35)	**4.62** (4.05-5.38)	**5.83** (4.94-7.01)	**6.78** (5.63-8.34)	**7.77** (6.30-9.79)	**8.82** (6.95-11.4)	**10.3** (7.76-13.9)	**11.4** (8.35-16.0)
45-day	**2.34** (2.07-2.69)	**3.23** (2.86-3.72)	**4.46** (3.94-5.15)	**5.50** (4.82-6.41)	**6.98** (5.92-8.41)	**8.17** (6.78-10.0)	**9.41** (7.63-11.9)	**10.7** (8.46-13.9)	**12.6** (9.51-17.0)	**14.1** (10.3-19.6)
60-day	**2.56** (2.27-2.95)	**3.53** (3.13-4.07)	**4.88** (4.32-5.64)	**6.04** (5.29-7.03)	**7.70** (6.52-9.26)	**9.04** (7.50-11.1)	**10.5** (8.47-13.2)	**12.0** (9.43-15.5)	**14.1** (10.7-19.1)	**15.9** (11.6-22.2)

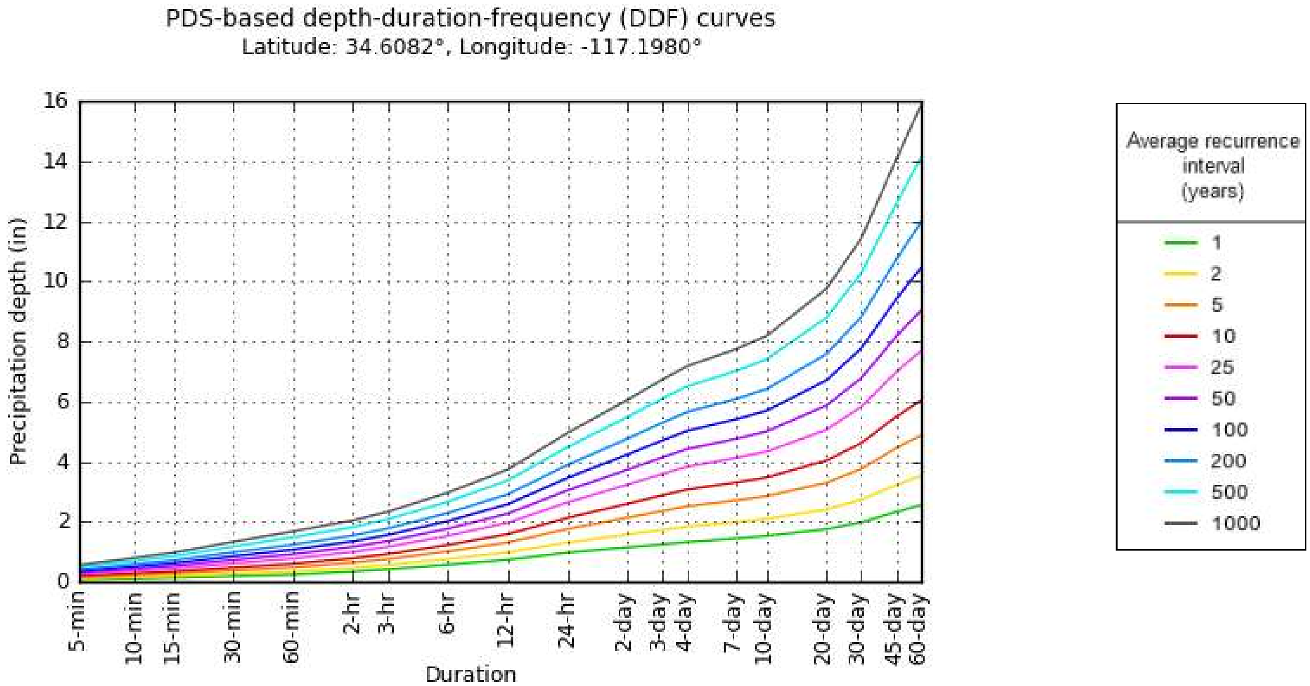
[1] Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

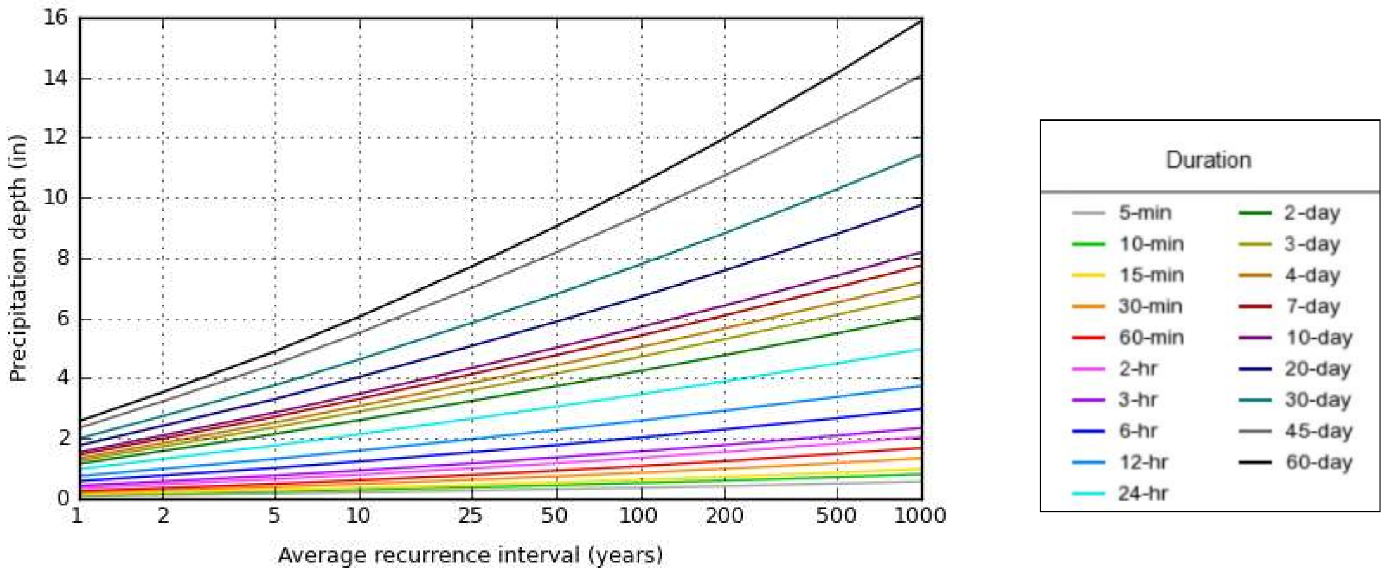
Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper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

Please refer to NOAA Atlas 14 document for more information.

Back to Top

PF graphical



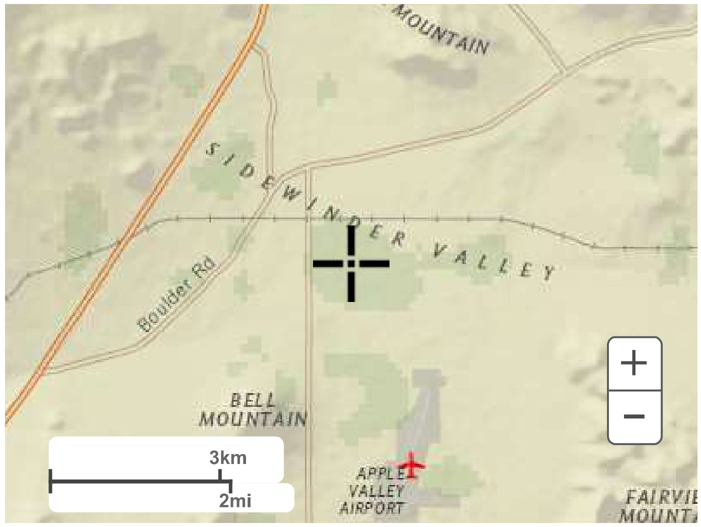


NOAA Atlas 14, Volume 6, Version 2 Created (GMT): Thu Oct 13 23:21:12 2022

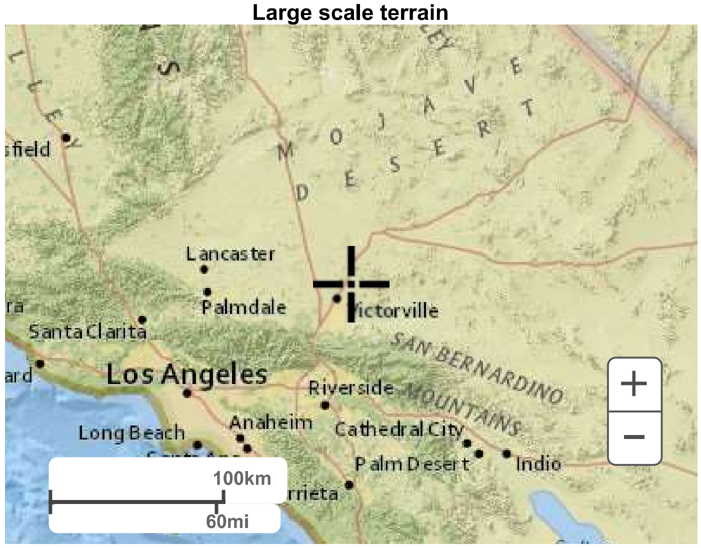
Back to Top

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

Disclaimer

Infiltration Rate Factor of Safety Calculation Summary

Drainage Area DA1-A1

Factor Category		Factor Description	Assigned Weight (w)	Factor Value $(v)^2$	Product (p) p=w*v
A	Suitability Assesment	Soil Assesment Methods	0.25	2	0.50
		Predominant Soil Texture	0.25	1	0.25
		Site Soil Variability	0.25	1	0.25
		Depth to Groundwater / Impervious Layer	0.25	1	0.25
		Suitability Assessment Safety Factor = Σp			1.25
B	Design	Tributary Area Size	0.25	1	0.50
		Level of Pretreatment / Expected Sediment Loads	0.25	3	0.50
		Redundancy*	0.25	2	0.50
		Compaction During Construction	0.25	1	0.25
		Design Safety Factor SB = Σp			1.75
Calculated Safety Factor					2.19
Minimum Allowable Safety Factor					2.00
Safety Factor Applied					2.19

Oldcastle Infrastructure™
A CRH COMPANY

FLOGARD®

Catch Basin Insert Filter

Catch basin insert designed to capture sediment, gross solids, trash and petroleum hydrocarbons from low (“first flush”) flows, even during the most extreme weather conditions

Example Types, Sizes and Capacities: Additional sizes, including regional and custom options are available.

FloGard Combination Inlet

SPECIFIER CHART

MODEL NO. STANDARD DEPTH	STANDARD & SHALLOW DEPTH (Data in these columns is the same for both STANDARD & SHALLOW versions)			STANDARD DEPTH -20 Inches-		MODEL NO. SHALLOW DEPTH	SHALLOW DEPTH -12 Inches-	
	INLET ID Inside Dimension (inch x inch)	GRADE OD Outside Dimension (inch x inch)	TOTAL BYPASS CAPACITY (cu. ft. / sec.)	SOLIDS STORAGE CAPACITY (cu. ft.)	FILTERED FLOW (cu. ft. / sec.)		SOLIDS STORAGE CAPACITY (cu. ft.)	FILTERED FLOW (cu. ft. / sec.)
FGP-1633FGO	16 X 33	18 X 36	7.0	2.5	1.7	FGP-1633FGO8	1.4	1.1
FGP-1836FGO	18 X 36	18 X 40	6.9	2.3	1.6	FGP-1836FGO8	1.3	.9
FGP-2234FGO	22 X 34	24 X 36	8.1	3.6	2.1	FGP-2234FGO8	2.1	1.4
FGP-2436FGO	24 X 36	24 X 40	8.0	3.4	2.0	FGP-2436FGO8	1.95	1.15

FloGard Flat Grated Inlet

SPECIFIER CHART

MODEL NO. STANDARD DEPTH	STANDARD & SHALLOW DEPTH (Data in these columns is the same for both STANDARD & SHALLOW versions)			STANDARD DEPTH -20 Inches-		MODEL NO. SHALLOW DEPTH	SHALLOW DEPTH -12 Inches-	
	INLET ID Inside Dimension (inch x inch)	GRADE OD Outside Dimension (inch x inch)	TOTAL BYPASS CAPACITY (cu. ft. / sec.)	SOLIDS STORAGE CAPACITY (cu. ft.)	FILTERED FLOW (cu. ft. / sec.)		SOLIDS STORAGE CAPACITY (cu. ft.)	FILTERED FLOW (cu. ft. / sec.)
FGP-12F	12 X 12	12 X 14	2.8	0.3	0.4	FGP-12F8	.15	.25
FGP-16F	16 X 16	16 X 19	4.7	0.8	0.7	FGP-16F8	.45	.4
FGP-18F	18 X 18	18 X 20	4.7	0.8	0.7	FGP-18F8	.45	.4
FGP-1836F	18 X 36	18 X 40	6.9	2.3	1.6	FGP-1836F8	1.3	.9
FGP-21F	22 X 22	22 X 24	6.1	2.2	1.5	FGP-21F8	1.25	.85
FGP-24F	24 X 24	24 X 27	6.1	2.2	1.5	FGP-24F8	1.25	.85
FGP-2436F	24 X 36	24 X 40	8.0	3.4	2.0	FGP-2436F8	1.95	1.15
FGP-2448F	24 X 48	24 X 48	9.3	4.4	2.4	FGP-2448F8	2.5	1.35
FGP-32F-TN	28 X 28	32 X 32	6.3	2.2	1.5	FGP-32F8-TN	1.25	.85
FGP-30F	30 X 30	30 X 34	8.1	3.6	2.0	FGP-30F8	2.05	1.15
FGP-36F	36 X 36	36 X 40	9.1	4.6	2.4	FGP-36F8	2.65	1.35
FGP-3648F	36 X 48	40 X 48	11.5	6.8	3.2	FGP-3648F8	3.9	1.85
FGP-48F	48 X 48	48 X 54	13.2	9.5	3.9	FGP-48F8	5.45	2.25
FGP-1633F	16 X 34	18 X 36	6.9	2.3	1.6	FGP-1633F8	1.3	.9
FGP-2234F	22 X 34	24 X 36	8.0	3.4	2.0	FGP-2234F8	1.95	1.15

FloGard Circular Grated Inlet

SPECIFIER CHART

MODEL NUMBER	INLET ID (inches)	GRADE OD (inches)	SOLIDS STORAGE CAPACITY (CU FT)	FILTERED FLOW (CSF)	TOTAL BYPASS CAPACITY (CFS)
FGP-RF15F	15	18	0.3	0.4	2.8
FGP-RF18F	18	20	0.8	0.7	4.7
FGP-RF20F	20	23	0.8	0.7	4.7
FGP-RF21F	21	23.5	0.8	0.7	4.7
FGP-RF22F	22	24	0.8	0.7	4.7
FGP-RF24F	24	26	0.8	0.7	4.7
FGP-RF30F	30	32	2.2	1.5	6.1
FGP-RF36F	36	39	3.6	2.0	8.1

Combination Inlet

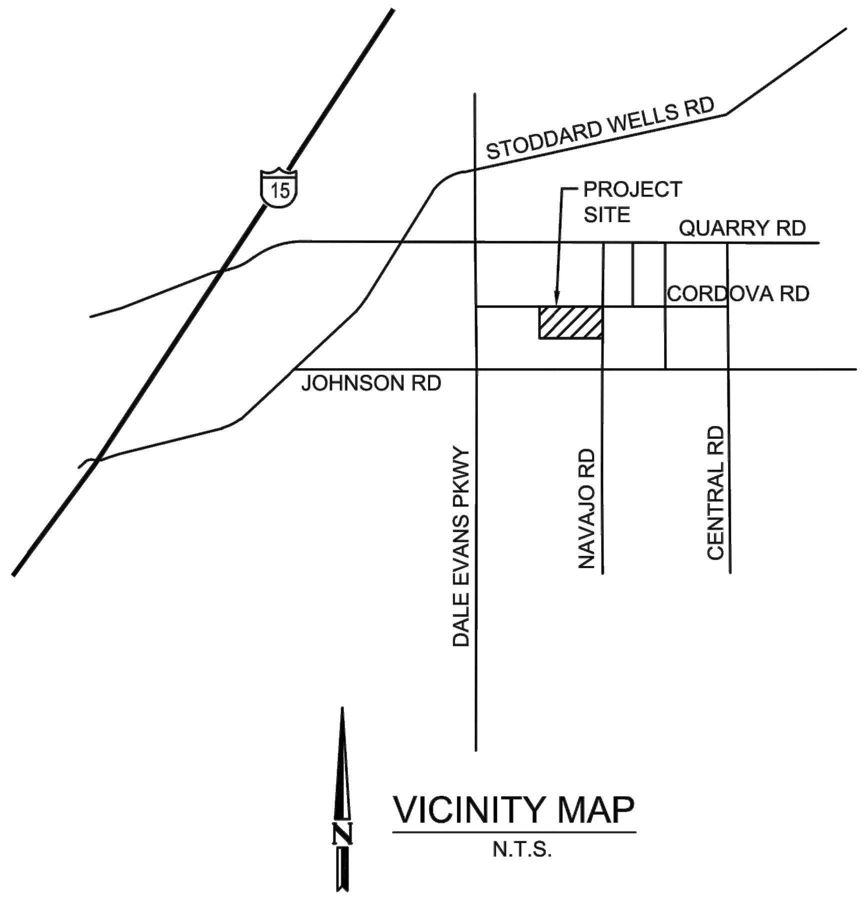
Flat-Grated Inlet

Circular Frame Inlet

Appendix J

Grading Plan

CORDOVA ROAD INDUSTRIAL COMPLEX TOWN OF APPLE VALLEY



VICINITY MAP
N.T.S.

OWNER/DEVELOPER:

VVLIG INDUSTRIAL
RAMSEY SHEEHAN
JOSH MALHI
9040 LESLIE STREET
RICHMOND, ON
L4B3M4

OWNER'S REPRESENTATIVE :

JESSICA HAUGHTON
PRESIDENT
SYNERGY CONSULTING CA.
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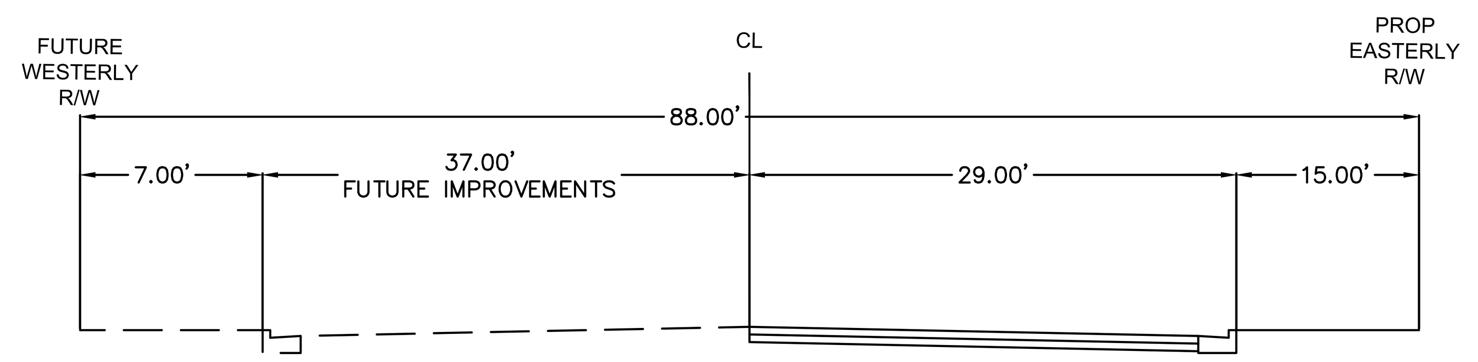
APPLE VALLEY, CA 92307
(760) 524-9123



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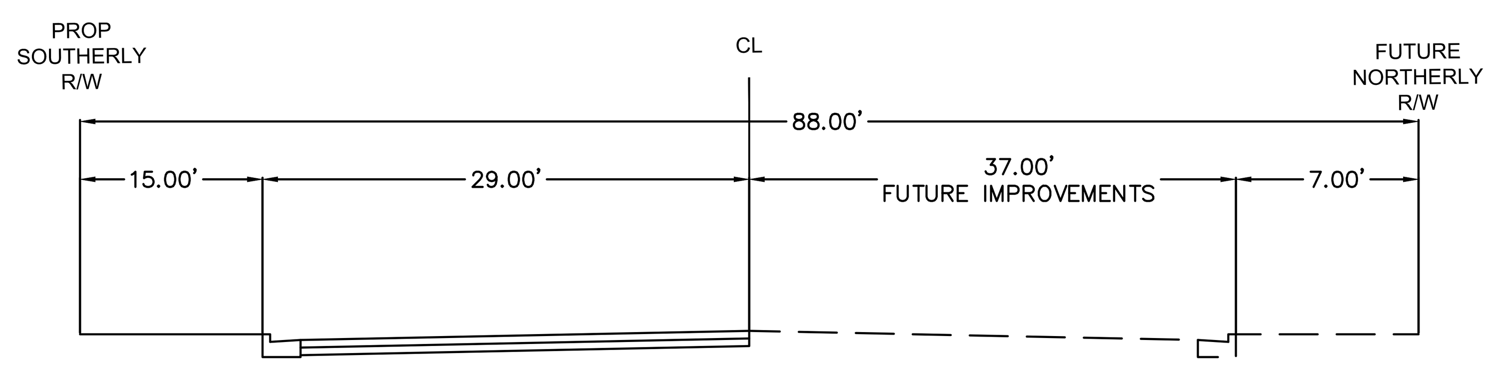
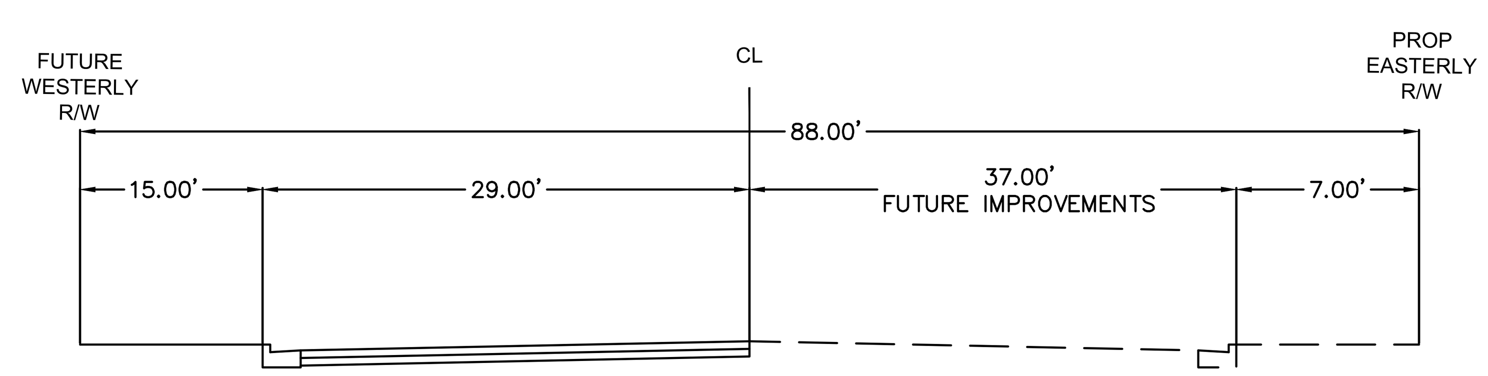


CORDOVA ROAD



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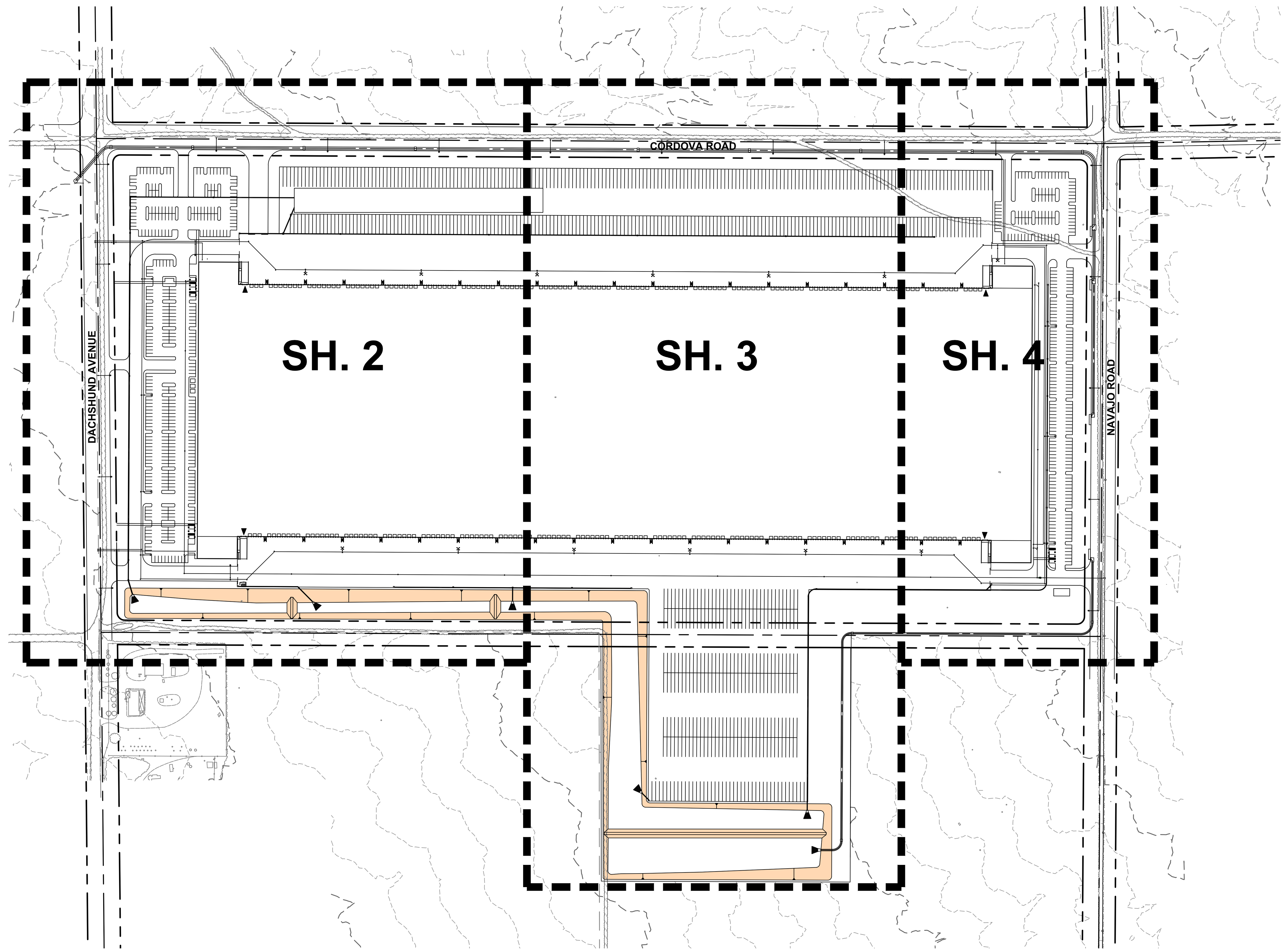

SHEET INDEX

1. KEY MAP AND GENERAL INFO
2. CONCEPTUAL GRADING
3. CONCEPTUAL GRADING
4. CONCEPTUAL GRADING
5. SITE SECTIONS
6. SITE SECTIONS
7. SITE SECTIONS
8. COMPOSITE ONSITE WET UTILITY PLAN
9. COMPOSITE ONSITE WET UTILITY PLAN
10. COMPOSITE ONSITE WET UTILITY PLAN

LAND USE CALCULATION:

GROSS AREA:	85.9 AC
LANDSCAPE AREA	12.9 AC

EARTHWORK NUMBERS:

RAW CUT	311,000 C.Y.
RAW FILL	336,000 C.Y.
NET FILL	25,000 C.Y.

LEGEND:

2800.00 FS	-	PROPOSED FINISHED SURFACE
2800.00 FG	-	PROPOSED FINISHED GRADE
2800.00 TG	-	PROPOSED TOP OF GRATE
(2800.00) FG	-	EXISTING FINISHED GRADE
2800	-	PROPOSED SLOPE
(2800)	-	EXISTING SLOPE
INV	-	INVERT
EX.	-	EXISTING
PROP.	-	PROPOSED
R/W	-	RIGHT OF WAY
P/L	-	PROPERTY LINE
—2800—	-	PROPOSED CONTOUR
—(2800)—	-	EXISTING CONTOUR
	-	PROPOSED RIGHT OF WAY
	-	FUTURE RIGHT OF WAY
	-	DAYLIGHT LINE / LIMITS OF GRADING
	-	CUT/FILL LINE

TOP TOE PROPOSED SLOPE 2:1 MAX.

PROPOSED AC PAVEMENT

PROPOSED PCC PAVEMENT

PROPOSED STORM DRAIN PIPE

PROPOSED STORM DRAIN PIPE FLOW DIRECTION

NOTE:

ALL ELEVATIONS SHOWN ON THIS PLAN HAVE BEEN LOWERED 3000'.

NOT FOR CONSTRUCTION

ENGINEER

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Phone: 760.524.9100
SSchubert@deainc.com

DATE: 10/27/2022

CORDOVA ROAD INDUSTRIAL COMPLEX
APN: 0436-213-05 - 09, 16, 33 - 36

SITE PLAN REVIEW
KEY MAP AND GENERAL INFO

FILE NO.

DRAWING NO.

SH. 1 OF 10

Plot Date: 11/2/2022 2:13 PM By: Jose Aguilar File: P:\V\VVLI00000001\0400CAD\SHEETS\EC\Conceptual Grading\001-Cardova-Title Sheet-VVLI00000001.dwg
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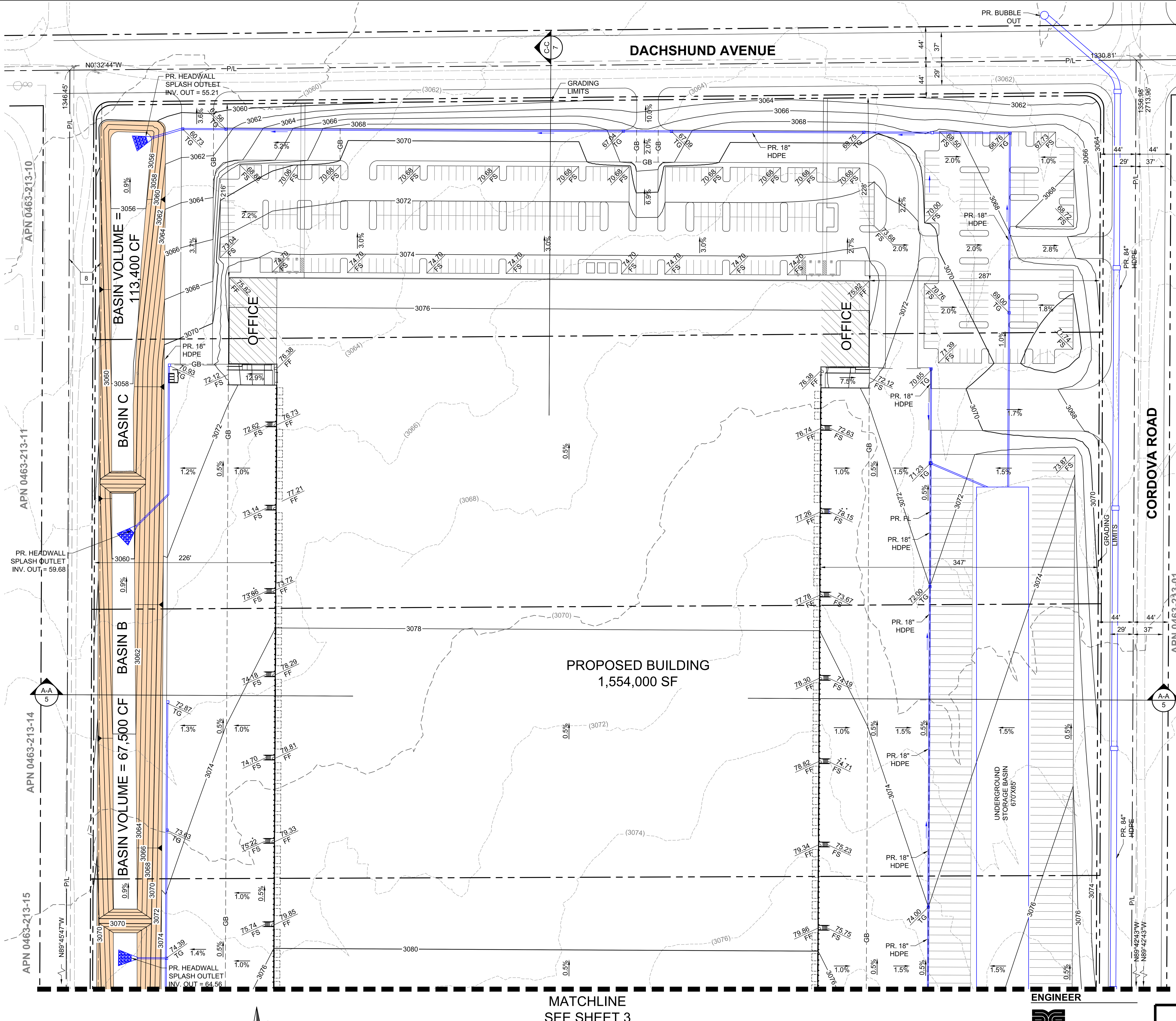

N

60 0 60 120
scale 1"= 60' feet
CONTOUR INTERVALS = 2'

ABBREVIATIONS

BFP	BACK FLOW PREVENTER
C/L	CENTERLINE
C&G	CURB AND GUTTER
CB	CATCH BASIN
EG	EXISTING GROUND
EL.	ELEVATION
ELEC.	ELECTRIC
EX.	EXISTING
FF	FINISH FLOOR
FG	FINISH GRADE
FL	FLOW LINE
FH	FIRE HYDRANT
FS	FINISH SURFACE
FUT.	FUTURE
GB	GRADE BREAK
GUY	GUY ANCHOR
HP	HIGH POINT
INV	INVERT
LF	LINEAR FEET
LP	LOW POINT
P/L	PROPERTY LINE
PE	PAD ELEVATION
PP	POWER POLE
PS	PIPE SLOPE
PR.	PROPOSED
R/W	RIGHT OF WAY
ST.	STREET
SWR	SEWER
TG	TOP OF GRATE
TYP	TYPICAL
WTR	WATER

EASEMENTS

8 A 40' WIDE OFFER OF DEDICATION FOR PIPELINE, UTILITIES, ACCESS AND INCIDENTAL PURPOSES, RECORDED MAY 06, 1987 AS INSTRUMENT NO. 87-150726 OF OFFICIAL RECORDS.

LEGEND

TOP / TOE PROPOSED SLOPE 2:1 MAX.
PROPOSED AC PAVEMENT
PROPOSED PCC PAVEMENT
PROPOSED STORM DRAIN PIPE
PROPOSED STORM DRAIN PIPE FLOW DIRECTION

NOT FOR CONSTRUCTION

DATE: 10/27/2022

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CORDOVA ROAD INDUSTRIAL COMPLEX
APN: 0436-213-05 - 09, 16, 33 - 36

SITE PLAN REVIEW
CONCEPTUAL GRADING
AND DRAINAGE

FILE NO.

DRAWING NO.

SH. 2 OF 10

Plot Date: 11/2/2022 2:13 PM By: Jose Aguilar
Save Date: 11/2/2022 1:58 PM By: Jfa
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MATCHLINE SEE SHEET 2

MATCHLINE SEE SHEET 4

NOT FOR CONSTRUCTION

EASEMENTS

5 — A VARIABLE WIDTH EASEMENT FOR INGRESS, EGRESS AND INCIDENTAL PURPOSES IN THE DOCUMENT RECORDED JUNE 5, 1984 AS INSTRUMENT NO. 84-131161 OF OFFICIAL RECORDS.

7 — A 30' WIDE OFFER OF DEDICATION FOR PIPELINE, UTILITIES, ACCESS AND INCIDENTAL PURPOSES, RECORDED MAY 06, 1987 AS INSTRUMENT NO. 87-150725 OF OFFICIAL RECORDS.

8 — A 40' WIDE OFFER OF DEDICATION FOR PIPELINE, UTILITIES, ACCESS AND INCIDENTAL PURPOSES, RECORDED MAY 06, 1987 AS INSTRUMENT NO. 87-150726 OF OFFICIAL RECORDS.

7 — A VARIABLE WIDTH EASEMENT FOR INGRESS, EGRESS AND INCIDENTAL PURPOSES, RECORDED FEBRUARY 24, 1972 AS BOOK 7866, PAGE 704 OF OFFICIAL RECORDS AND RECORDED FEBRUARY 24, 1972 AS BOOK 7866, PAGE 708 OF OFFICIAL RECORDS.

ABBREVIATIONS

BFP	BACK FLOW PREVENTER	GUY	GUY ANCHOR
C/L	CENTERLINE	HP	HIGH POINT
C&G	CURB AND GUTTER	INV	INVERT
CB	CATCH BASIN	LF	LINEAR FEET
EG	EXISTING GROUND	LP	LOW POINT
EL.	ELEVATION	P/L	PROPERTY LINE
ELEC.	ELECTRIC	PE	PAD ELEVATION
EX.	EXISTING	PP	POWER POLE
FF	FINISH FLOOR	PS	PIPE SLOPE
FG	FINISH GRADE	PR.	PROPOSED
FL	FLOW LINE	R/W	RIGHT OF WAY
FH	FIRE HYDRANT	ST.	STREET
FS	FINISH SURFACE	SWR	SEWER
FUT.	FUTURE	TG	TOP OF GRATE
GB	GRADE BREAK	TYP	TYPICAL
		WTR	WATER

LEGEND

- TOP / TOE — PROPOSED SLOPE 2:1 MAX.
- PROPOSED AC PAVEMENT
- PROPOSED PCC PAVEMENT
- PROPOSED STORM DRAIN PIPE
- PROPOSED STORM DRAIN PIPE FLOW DIRECTION

N

60 0 60 120
scale feet
1"= 60'
CONTOUR INTERVALS = 2'

ENGINEER

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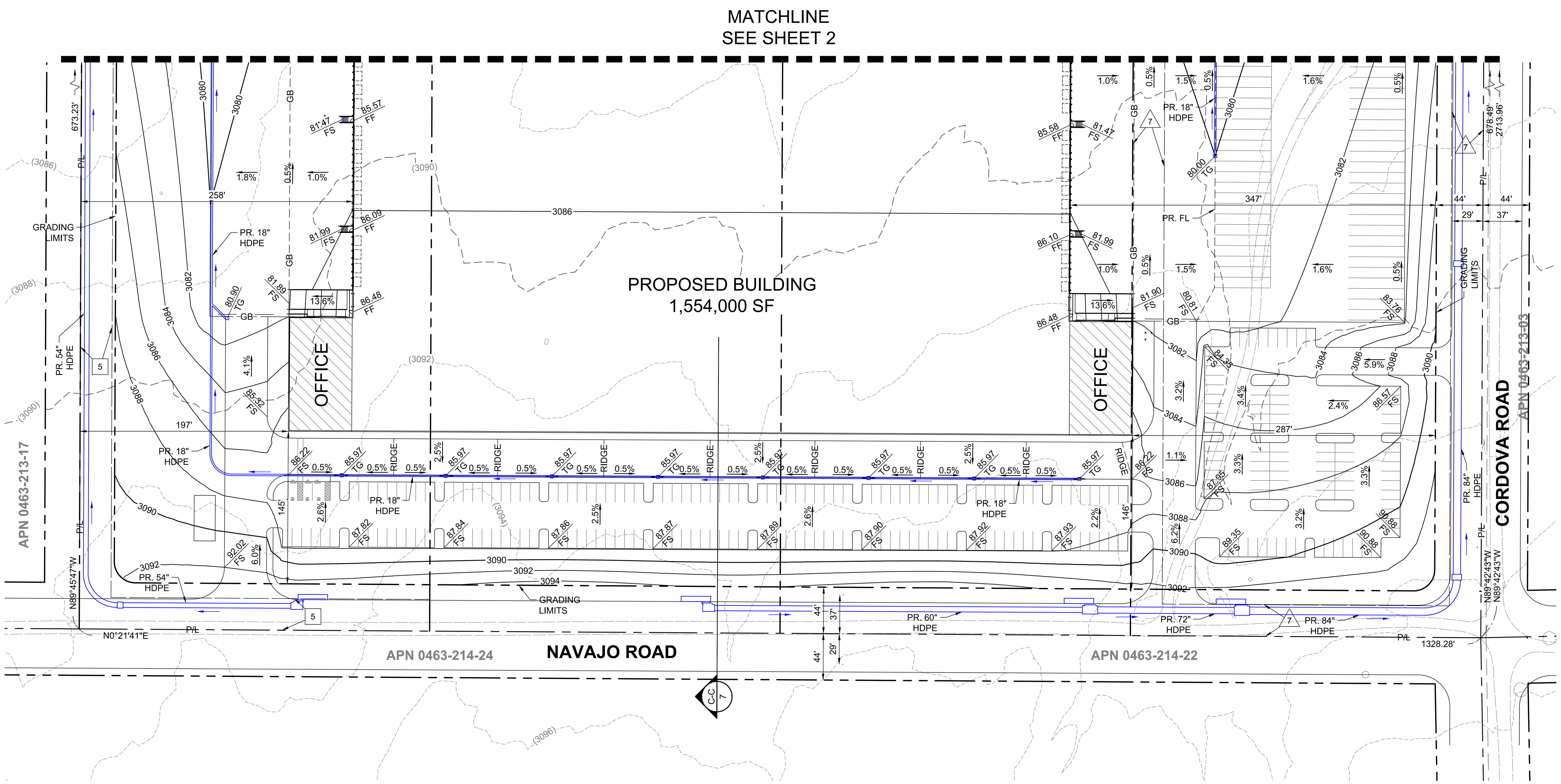
CORDOVA ROAD INDUSTRIAL COMPLEX
APN: 0436-213-05 - 09, 16, 33 - 36

SITE PLAN REVIEW
CONCEPTUAL GRADING AND DRAINAGE

FILE NO.

DRAWING NO.

SH. 3 OF 10



ABBREVIATIONS

BFP	BACK FLOW PREVENTER
C/L	CENTERLINE
C&G	CURB AND GUTTER
CB	CATCH BASIN
EG	EXISTING GROUND
EL.	ELEVATION
ELEC.	ELECTRIC
EX.	EXISTING
FF	FINISH FLOOR
FG	FINISH GRADE
FL	FLOW LINE
FH	FIRE HYDRANT
FS	FINISH SURFACE
FUT.	FUTURE
GB	GRADE BREAK
GUY	GUY ANCHOR
HP	HIGH POINT
INV	INVERT
LF	LINEAR FEET
LP	LOW POINT
P/L	PROPERTY LINE
PE	PAD ELEVATION
PP	POWER POLE
PS	PIPE SLOPE
PR.	PROPOSED
R/W	RIGHT OF WAY
ST.	STREET
SWR	SEWER
TG	TOP OF GRATE
TYP	TYPICAL
WTR	WATER

EASEMENTS

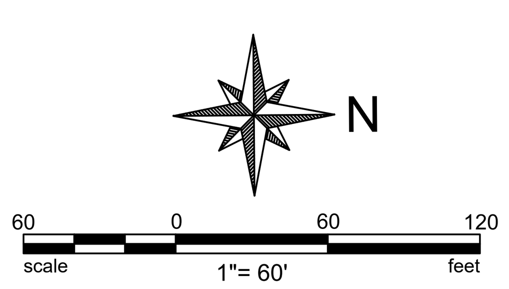
5 A VARIABLE WIDTH EASEMENT FOR INGRESS, EGRESS AND INCIDENTAL PURPOSES IN THE DOCUMENT RECORDED JUNE 5, 1984 AS INSTRUMENT NO. 84-131161 OF OFFICIAL RECORDS.

7 A VARIABLE WIDTH EASEMENT FOR INGRESS, EGRESS AND INCIDENTAL PURPOSES, RECORDED FEBRUARY 24, 1972 AS BOOK 7866, PAGE 704 OF OFFICIAL RECORDS AND RECORDED FEBRUARY 24, 1972 AS BOOK 7866, PAGE 708 OF OFFICIAL RECORDS.

LEGEND

- TOP / TOE — PROPOSED SLOPE 2:1 MAX.
- PROPOSED AC PAVEMENT
- PROPOSED PCC PAVEMENT
- PROPOSED STORM DRAIN PIPE
- PROPOSED STORM DRAIN PIPE FLOW DIRECTION

NOT FOR CONSTRUCTION



CONTOUR INTERVALS = 2'

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DATE: 10/27/2022

CORDOVA ROAD INDUSTRIAL COMPLEX
APN: 0436-213-05 - 09, 16, 33 - 36

SITE PLAN REVIEW

CONCEPTUAL GRADING AND DRAINAGE

FILE NO.

DRAWING NO.

SH. 4 OF 10

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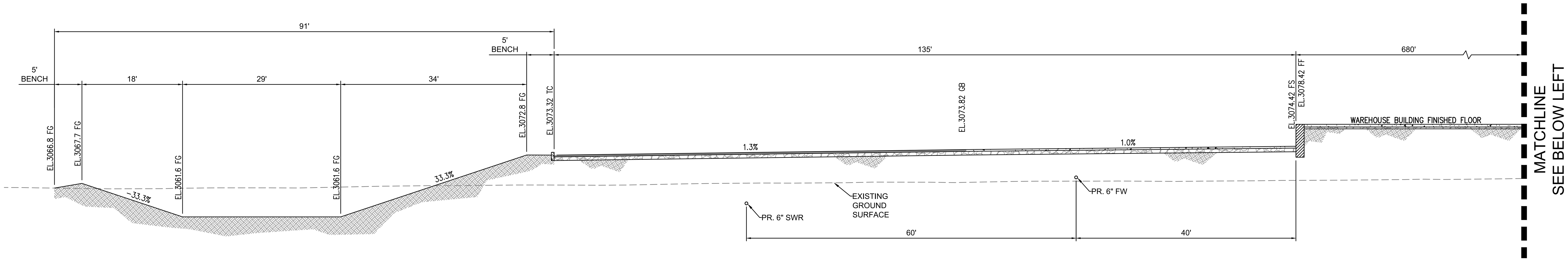
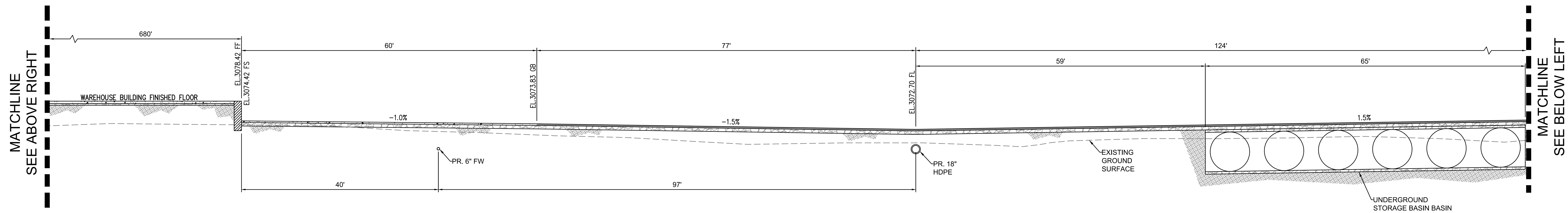


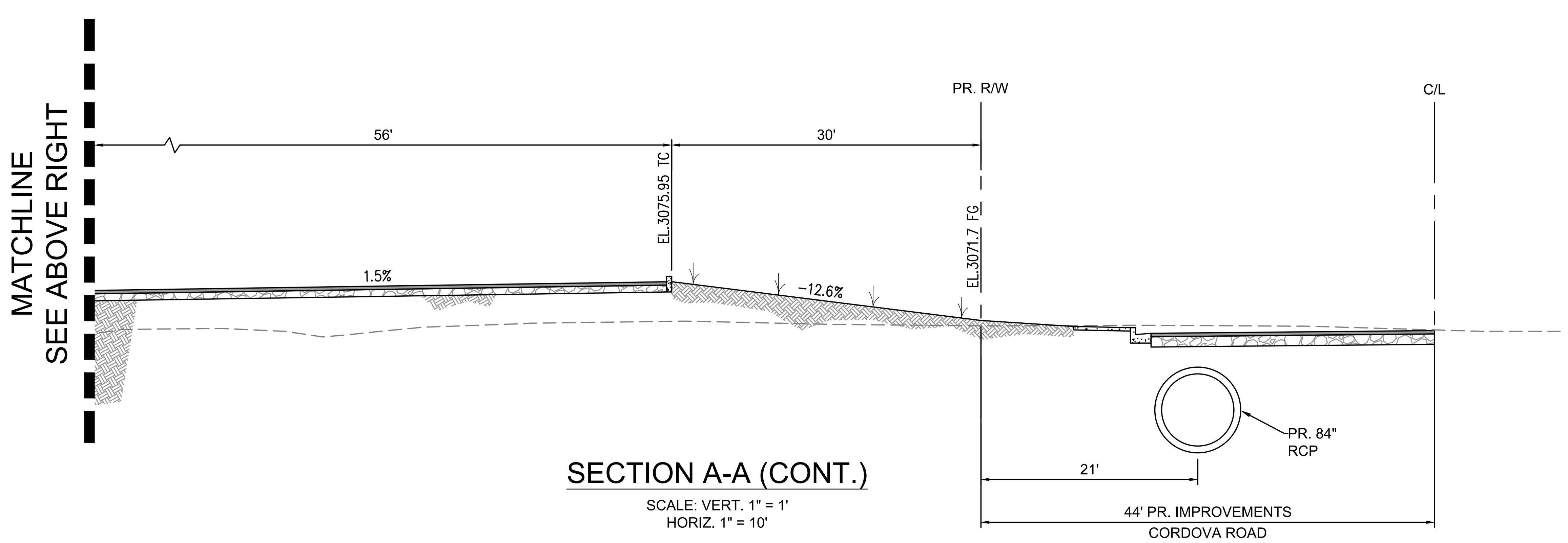
SECTION A-A

SCALE: VERT. 1" = 1'
HORIZ. 1" = 10'



SECTION A-A (CONT.)

SCALE: VERT. 1" = 1'
HORIZ. 1" = 10'



SECTION A-A (CONT.)

SCALE: VERT. 1" = 1'
HORIZ. 1" = 10'

NOT FOR CONSTRUCTION

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CORDOVA ROAD INDUSTRIAL COMPLEX APN: 0436-213-05 - 09, 16, 33 - 36	
SITE PLAN REVIEW CONCEPTUAL GRADING SECTIONS	FILE NO. DRAWING NO. SH. 5 OF 10

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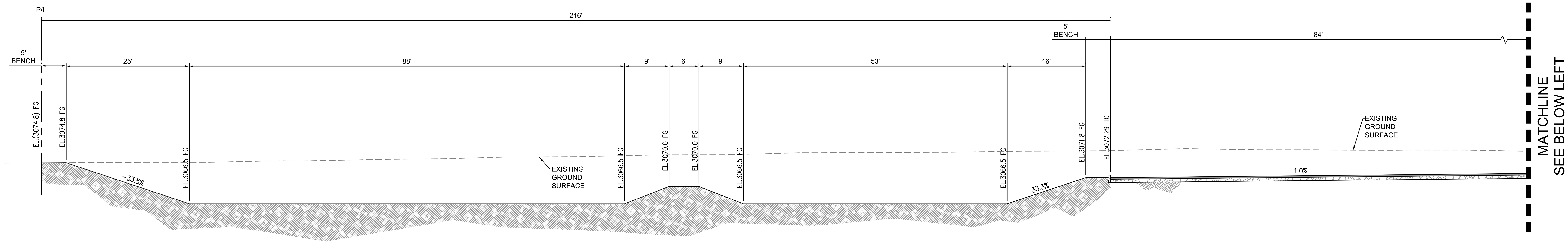
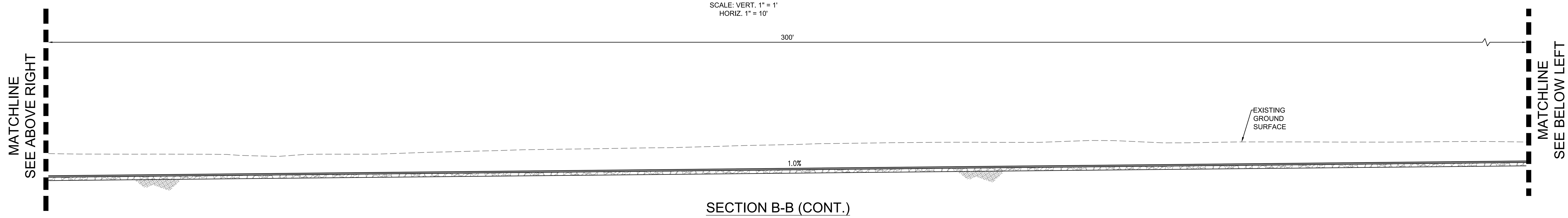


SECTION B-B

SCALE: VERT. 1" = 1'
HORIZ. 1" = 10'



SECTION B-B (CONT.)

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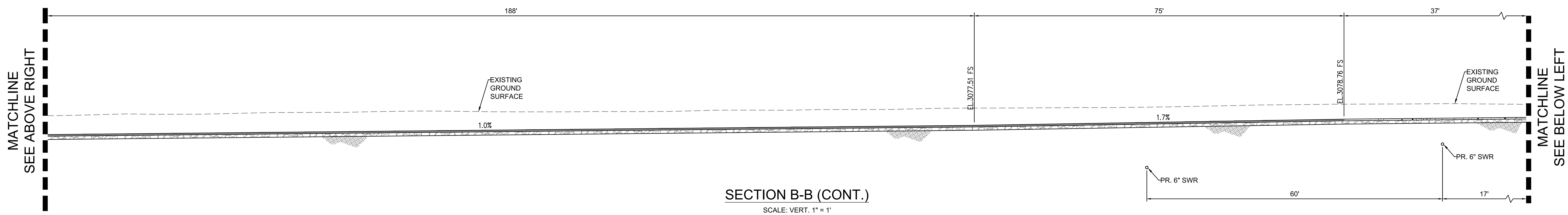
HORIZ. 1" = 10'



SECTION B-B (CONT.)

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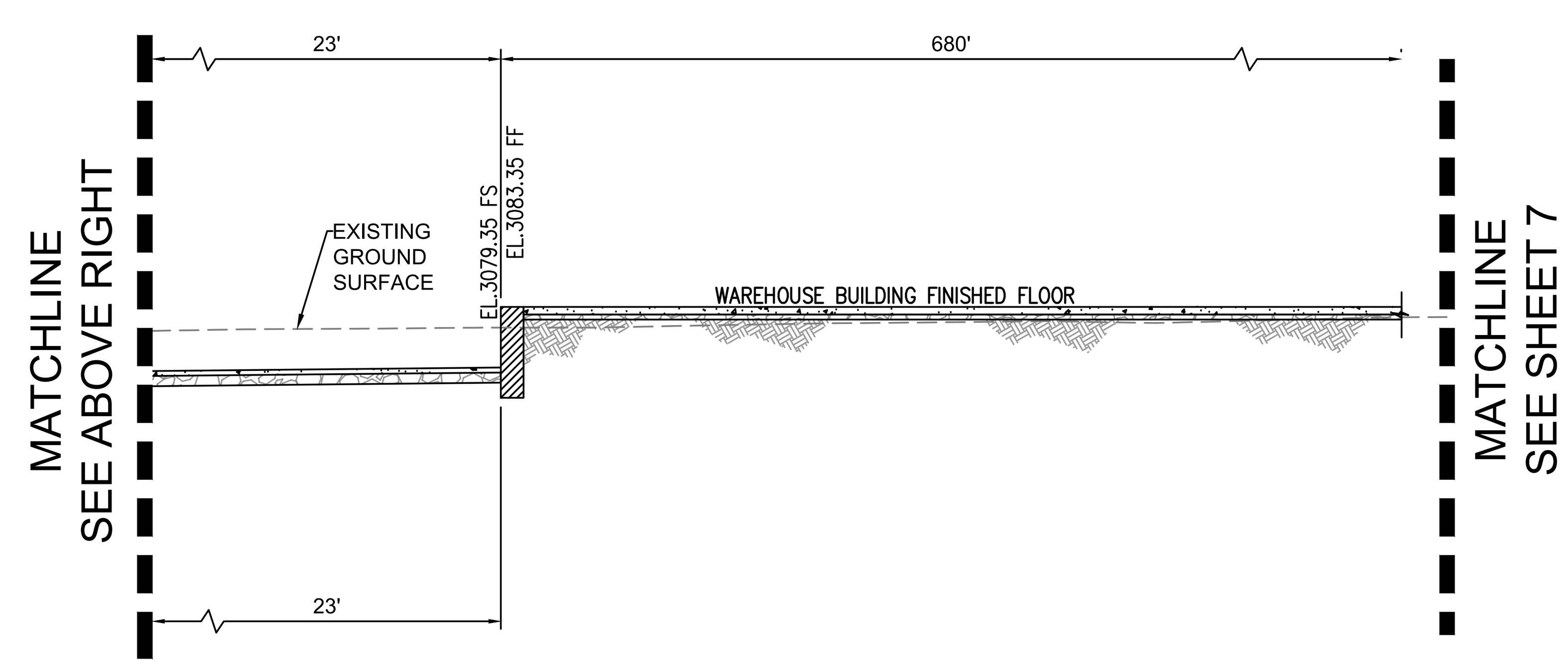
HORIZ. 1" = 10'



NOT FOR CONSTRUCTION

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ENGINEER

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DATE: 10/27/2022

CORDOVA ROAD INDUSTRIAL COMPLEX
APN: 0436-213-05 - 09, 16, 33 - 36

SITE PLAN REVIEW
CONCEPTUAL GRADING
SECTIONS

FILE NO.

DRAWING NO.

SH. 6 OF 10

NOT FOR CONSTRUCTION

DATE: 10/27/2022

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CORDOVA ROAD INDUSTRIAL COMPLEX
APN: 0436-213-05 - 09, 16, 33 - 36

SITE PLAN REVIEW
CONCEPTUAL GRADING
SECTIONS

FILE NO.

DRAWING NO.

SH. 7 OF 10

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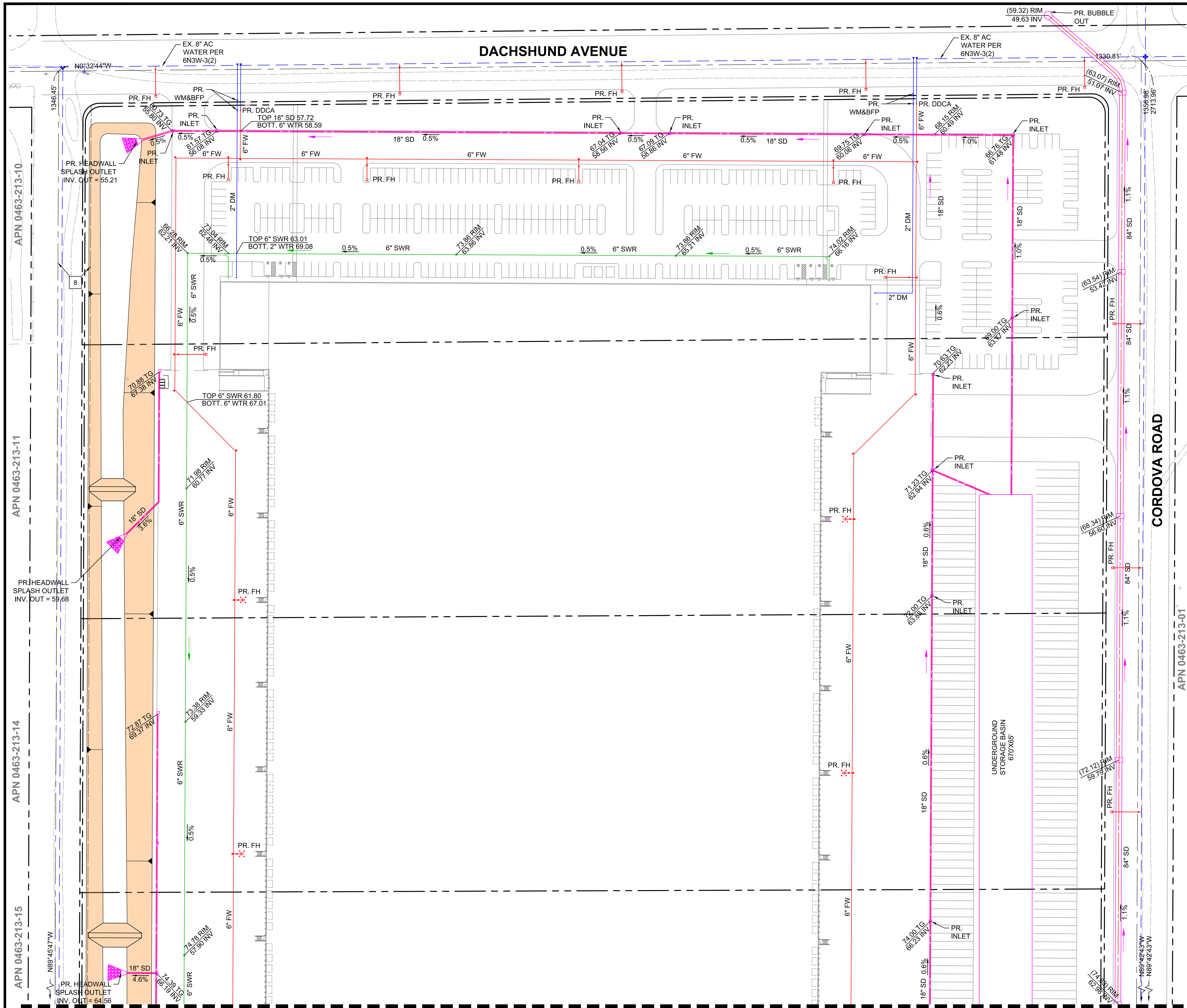

N

60 0 60 120

scale 1"= 60' feet

CONTOUR INTERVALS = 2'

ABBREVIATIONS

BFP	BACK FLOW PREVENTER
C/L	CENTERLINE
C&G	CURB AND GUTTER
CB	CATCH BASIN
EG	EXISTING GROUND
EL.	ELEVATION
ELEC.	ELECTRIC
EX.	EXISTING
FF	FINISH FLOOR
FG	FINISH GRADE
FL	FLOW LINE
FH	FIRE HYDRANT
FS	FINISH SURFACE
FUT.	FUTURE
GB	GRADE BREAK
GUY	GUY ANCHOR
HP	HIGH POINT
INV	INVERT
LF	LINEAR FEET
LP	LOW POINT
P/L	PROPERTY LINE
PE	PAD ELEVATION
PP	POWER POLE
PS	PIPE SLOPE
PR.	PROPOSED
R/W	RIGHT OF WAY
ST.	STREET
SWR	SEWER
TG	TOP OF GRATE
TYP	TYPICAL
WTR	WATER

EASEMENTS

8 A 40' WIDE OFFER OF DEDICATION FOR PIPELINE, UTILITIES, ACCESS AND INCIDENTAL PURPOSES, RECORDED MAY 06, 1987 AS INSTRUMENT NO. 87-150726 OF OFFICIAL RECORDS.

UTILITY LEGEND

- PROPOSED FIRE WATER SERVICE/MAIN
- PROPOSED DOMESTIC WATER SERVICE/MAIN
- PROPOSED SEWER SERVICE/MAIN
- PROPOSED STORM DRAIN
- PROPOSED SEWER PIPE FLOW DIRECTION
- PROPOSED STORM DRAIN PIPE FLOW DIRECTION

LEGEND

- TOP TOE PROPOSED SLOPE 2:1 MAX.
- PROPOSED AC PAVEMENT
- PROPOSED PCC PAVEMENT
- PROPOSED STORM DRAIN PIPE
- PROPOSED STORM DRAIN PIPE FLOW DIRECTION

NOT FOR CONSTRUCTION

DATE: 10/27/2022

ENGINEER

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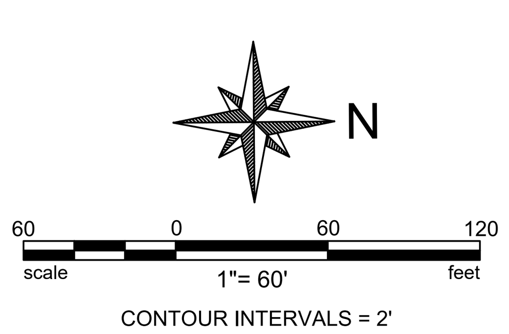
CORDOVA ROAD INDUSTRIAL COMPLEX
APN: 0436-213-05 - 09, 16, 33 - 36

SITE PLAN REVIEW
CONCEPTUAL WET UTILITY PLAN

FILE NO.

DRAWING NO.

Plot Date: 11/2/2022 2:14 PM By: Jose Aguilar
Save Date: 11/2/2022 2:07 PM By: Jfa
File: P:\V\VVLI00000001\0400CAD\SHEETS\EC\Conceptual Utility\001-Cordova-Conceptual Utility-VVLI00000001.dwg



EASEMENTS

5	A VARIABLE WIDTH EASEMENT FOR INGRESS, EGRESS AND INCIDENTAL PURPOSES IN THE DOCUMENT RECORDED JUNE 5, 1984 AS INSTRUMENT NO. 84-131161 OF OFFICIAL RECORDS.
7	A 30' WIDE OFFER OF DEDICATION FOR PIPELINE, UTILITIES, ACCESS AND INCIDENTAL PURPOSES, RECORDED MAY 06, 1987 AS INSTRUMENT NO. 87-150725 OF OFFICIAL RECORDS.
8	A 40' WIDE OFFER OF DEDICATION FOR PIPELINE, UTILITIES, ACCESS AND INCIDENTAL PURPOSES, RECORDED MAY 06, 1987 AS INSTRUMENT NO. 87-150726 OF OFFICIAL RECORDS.
7 (triangle)	A VARIABLE WIDTH EASEMENT FOR INGRESS, EGRESS AND INCIDENTAL PURPOSES, RECORDED FEBRUARY 24, 1972 AS BOOK 7866, PAGE 704 OF OFFICIAL RECORDS AND RECORDED FEBRUARY 24, 1972 AS BOOK 7866, PAGE 708 OF OFFICIAL RECORDS.

ABBREVIATIONS

BFP	BACK FLOW PREVENTER	GUY	GUY ANCHOR
C/L	CENTERLINE	HP	HIGH POINT
C&G	CURB AND GUTTER	INV	INVERT
CB	CATCH BASIN	LF	LINEAR FEET
EG	EXISTING GROUND	LP	LOW POINT
EL.	ELEVATION	P/L	PROPERTY LINE
ELEC.	ELECTRIC	PE	PAD ELEVATION
EX.	EXISTING	PP	POWER POLE
FF	FINISH FLOOR	PS	PIPE SLOPE
FG	FINISH GRADE	PR.	PROPOSED
FL	FLOW LINE	R/W	RIGHT OF WAY
FH	FIRE HYDRANT	ST.	STREET
FS	FINISH SURFACE	SWR	SEWER
FUT.	FUTURE	TG	TOP OF GRATE
GB	GRADE BREAK	TYP	TYPICAL
		WTR	WATER

UTILITY LEGEND

- PROPOSED FIRE WATER SERVICE/MAIN
- PROPOSED DOMESTIC WATER SERVICE/MAIN
- PROPOSED SEWER SERVICE/MAIN
- PROPOSED STORM DRAIN
- PROPOSED SEWER PIPE FLOW DIRECTION
- PROPOSED STORM DRAIN PIPE FLOW DIRECTION

LEGEND

- TOP / TOE PROPOSED SLOPE 2:1 MAX.
- PROPOSED AC PAVEMENT
- PROPOSED PCC PAVEMENT
- PROPOSED STORM DRAIN PIPE
- PROPOSED STORM DRAIN PIPE FLOW DIRECTION

NOT FOR CONSTRUCTION

DATE: 10/27/2022

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CORDOVA ROAD INDUSTRIAL COMPLEX
APN: 0436-213-05 - 09, 16, 33 - 36

SITE PLAN REVIEW
CONCEPTUAL WET UTILITY PLAN

FILE NO.

DRAWING NO.

Plot Date: 11/2/2022 2:14 PM By: Jose Aguilar
Save Date: 11/2/2022 2:08 PM By: Jfa
File: P:\V\VVLI00000001\0400CAD\SHEETS\EC\Conceptual Utility\002-Cordova-Conceptual Utility-VVLI00000001.dwg

ABBREVIATIONS

BFP	BACK FLOW PREVENTER	GUY	GUY ANCHOR
C/L	CENTERLINE	HP	HIGH POINT
C&G	CURB AND GUTTER	INV	INVERT
CB	CATCH BASIN	LF	LINEAR FEET
EG	EXISTING GROUND	LP	LOW POINT
EL.	ELEVATION	P/L	PROPERTY LINE
ELEC.	ELECTRIC	PE	PAD ELEVATION
EX.	EXISTING	PP	POWER POLE
FF	FINISH FLOOR	PS	PIPE SLOPE
FG	FINISH GRADE	PR.	PROPOSED
FL	FLOW LINE	R/W	RIGHT OF WAY
FH	FIRE HYDRANT	ST.	STREET
FS	FINISH SURFACE	SWR	SEWER
FUT.	FUTURE	TG	TOP OF GRATE
GB	GRADE BREAK	TYP	TYPICAL
		WTR	WATER

EASEMENTS

5 A VARIABLE WIDTH EASEMENT FOR INGRESS, EGRESS AND INCIDENTAL PURPOSES IN THE DOCUMENT RECORDED JUNE 5, 1984 AS INSTRUMENT NO. 84-131161 OF OFFICIAL RECORDS.

7 A VARIABLE WIDTH EASEMENT FOR INGRESS, EGRESS AND INCIDENTAL PURPOSES, RECORDED FEBRUARY 24, 1972 AS BOOK 7866, PAGE 704 OF OFFICIAL RECORDS AND RECORDED FEBRUARY 24, 1972 AS BOOK 7866, PAGE 708 OF OFFICIAL RECORDS.

UTILITY LEGEND

- PROPOSED FIRE WATER SERVICE/MAIN
- PROPOSED DOMESTIC WATER SERVICE/MAIN
- PROPOSED SEWER SERVICE/MAIN
- PROPOSED STORM DRAIN
- PROPOSED SEWER PIPE FLOW DIRECTION
- PROPOSED STORM DRAIN PIPE FLOW DIRECTION

LEGEND

- TOP / TOE PROPOSED SLOPE 2:1 MAX.
- PROPOSED AC PAVEMENT
- PROPOSED PCC PAVEMENT
- PROPOSED STORM DRAIN PIPE
- PROPOSED STORM DRAIN PIPE FLOW DIRECTION

ENGINEER

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Apple Valley California 92307
Phone: 760.524.9100
SSchubert@deainc.com

DATE: 10/27/2022

CORDOVA ROAD INDUSTRIAL COMPLEX
APN: 0436-213-05 - 09, 16, 33 - 36

SITE PLAN REVIEW
CONCEPTUAL WET UTILITY PLAN

FILE NO.

DRAWING NO.

SH. 10OF 10

Plot Date: 11/2/2022 2:14 PM By: Jose Aguilar File: P:\V\VVLI00000001\0400CAD\SHEETS\EC\Conceptual Utility\003-Cordova-Conceptual Utility-VVLI00000001.dwg
Save Date: 11/2/2022 2:10 PM By: Jfa

Priority Project

Water Quality Management Plan

For:

Quarry Complex

APN: 0463-214-06,07,08,09

Prepared for:

VVLIG HOLDINGS LLC

9040 Leslie Street, Suite 7
Richmond Hill, ON L4B3M4

Prepared by:

David Evans and Associates
18484 Outer Highway 18 North, Suite 225
Apple Valley, CA 92307
Tel: (760) 524-9100
Attn: Bret Thorpe

Submittal Date: **November 01, 2022**

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

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

Final Approval Date:______________________

Project Owner's Certification

This Town of Apple Valley Water Quality Management Plan (WQMP) has been prepared for VVLIG Holdings LLC by David Evans and Associates. The WQMP is intended to comply with the requirements of the Town of Apple Valley and the Phase II Small MS4 General Permit for the Mojave River Watershed. The undersigned, while it owns the subject property, is responsible for the implementation of the provisions of this plan and will ensure that this plan is amended as appropriate to reflect up-to-date conditions on the site consistent with the Phase II Small MS4 Permit and the intent of the Town of Apple Valley's compliance efforts. Once the undersigned transfers its interest in the property, its successors in interest and the Town of Apple Valley shall be notified of the transfer. The new owner will be informed of its responsibility under this WQMP. A copy of the approved WQMP shall be available on the subject site in perpetuity.

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

Project Data			
Permit/Application Number(s):	TBD	Grading Permit Number(s):	TBD
Tract/Parcel Map Number(s):		Building Permit Number(s):	TBD
CUP, SUP, and/or APN (Specify Lot Numbers if Portions of Tract):			APN: 0463-214-06,07,08,09

Owner's Signature			
Owner Name: Josh Malhi			
Title	Director		
Company	VVLIG, LLC		
Address	9040 Leslie Street, Suite 7 Richmond Hill, ON L4B3M4		
Email			
Telephone #			
Signature		Date	

Preparer's Certification

Project Data			
Permit/Application Number(s):	TBD	Grading Permit Number(s):	TBD
Tract/Parcel Map Number(s):		Building Permit Number(s):	
CUP, SUP, and/or APN (Specify Lot Numbers if Portions of Tract):			APN: 0463-214-06,07,08,09

"The selection, sizing and design of stormwater treatment and other stormwater quality and quantity control measures in this plan were prepared under my oversight and meet the requirements of State of California Water Resources Control Board Order No. 2013-0001-DWQ.

Engineer: Bret Thorpe PE		PE Stamp Below
Title	Project Manager	
Company	David Evans and Associates, Inc	
Address	18484 Outer Highway 18 North Apple Valley, CA 92307	
Email	bthorpe@deainc.com	
Telephone #	(760) 524-9100	
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) only. This document should not be confused with the WQMP template for the Santa Ana Phase I area of San Bernardino County.

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

Section 1 Discretionary Permit(s)

<table>
<tr><th colspan="6">Form 1-1 Project Information</th></tr>
<tr><td colspan="2">Project Name</td><td colspan="4">Quarry Complex</td></tr>
<tr><td colspan="2">Project Owner Contact Name:</td><td colspan="4">Josh Malhi</td></tr>
<tr><td>Mailing Address:</td><td>VVLIG, LLC
9040 Leslie Street, Suite 7
Richmond Hill, ON L4B3M4</td><td>E-mail Address:</td><td></td><td>Telephone:</td><td></td></tr>
<tr><td colspan="2">Permit/Application Number(s):</td><td>TBD</td><td>Tract/Parcel Map Number(s):</td><td colspan="2">APN: 0463-214-06,07,08,09</td></tr>
<tr><td colspan="2">Additional Information/
Comments:</td><td colspan="4">This is a Preliminary WQMP</td></tr>
<tr><td colspan="2">Description of Project:</td><td colspan="4">The Project site is located at northeast corner intersection of Flint Road and Quarry Road in Apple Valley. The site is approximately 76.34-acres. The site slopes up at an average slope of 1%, is primarily vacant. The proposed project consists of a large warehouse type building, loading docks, parking for trucks and separate parking for passenger cars and landscaping. One infiltration/detention basin is proposed, as well as some small LIDS areas where practical.</td></tr>
<tr><td colspan="2">Provide summary of Conceptual WQMP conditions (if previously submitted and approved). Attach complete copy.</td><td colspan="4">This is a preliminary WQMP</td></tr>
</table>

Section 2 Project Description

2.1 Project Information

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

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

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.

<table>
<tr><th colspan="6">Form 2.1-1 Description of Proposed Project</th></tr>
<tr><td colspan="6">1 Regulated Development Project Category (Select all that apply):</td></tr>
<tr><td colspan="2">☒ #1 New development involving the creation of 5,000 ft^2 or more of impervious surface collectively over entire site</td><td colspan="2">☐ #2 Significant re-development involving the addition or replacement of 5,000 ft^2 or more of impervious surface on an already developed site</td><td>☐ #3 Road Project – any road, sidewalk, or bicycle lane project that creates greater than 5,000 square feet of contiguous impervious surface</td><td>☐ #4 LUPs – linear underground/overhead projects that has a discrete location with 5,000 sq. ft. or more new constructed impervious surface</td></tr>
<tr><td colspan="6">☐ Site Design Only (Project Total Square Feet > 2,500 but < 5,000 sq.ft) Will require source control Site Design LID BMPs and other LIP requirements. See section 4. (Please go to Forms 4.1-3 and 4.3-2)</td></tr>
<tr><td>2 Project Area (ft2):</td><td>3,325,370</td><td>3 Number of Dwelling Units:</td><td></td><td>4 SIC Code:</td><td>4225</td></tr>
<tr><td colspan="6">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.</td></tr>
</table>

2.2 Property Ownership/Management

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

Form 2.2-1 Property Ownership/Management
Describe property ownership/management responsible for long-term maintenance of WQMP stormwater facilities:
The Property owner will be responsible for all the on-site BMPS such as infiltration basin, pre-treatment devices, landscaping and LID areas. Site maintenance BMPs is vested in: **VVLIG HOLDINGS LLC** 9040 Leslie Street, Suite 7 Richmond Hill, ON L4B3M4

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

Section 3 Site and Watershed Description

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

Form 3-1 Site Location and Hydrologic Features

Site coordinates *take GPS measurement at approximate center of site*	Latitude: 34°d 36’47.63”	Longitude: -117°11’53.98”	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 A1 to Outlet 1	On-site runoff will direct to catch basins passing through catch basin insert filters to storm drain system, then outlet to proposed Detention/Infiltration Basin for storm water treatment and mitigation, overflow from the basin will outlet the Cordova Road.
DA1 DMA	
DA2 DMA	

Form 3-2 Existing Hydrologic Characteristics for Drainage Area 1

For Drainage Area 1's sub-watershed DMA, provide the following characteristics	DMA A			
1 DMA drainage area (ft^2)	3,526,581			
2 Existing site impervious area (ft^2)	0			
3 Antecedent moisture condition *For desert areas, use http://www.sbcounty.gov/dpw/floodcontrol/pdf/20100412_map.pdf*	2			
4 Hydrologic soil group *Refer to County Hydrology Manual Addendum for Arid Regions – http://www.sbcounty.gov/dpw/floodcontrol/pdf/20100412_addendum.pdf*	A			
5 Longest flowpath length (ft)	2,527			
6 Longest flowpath slope (ft/ft)	1%			
7 Current land cover type(s) Select *from Fig C-3 of Hydrology Manual*	Barren			
8 Pre-developed pervious area condition: *Based on the extent of wet season vegetated cover good >75%; Fair 50-75%; Poor <50% Attach photos of site to support rating*	Poor			

Form 3-3 Watershed Description for Drainage Area

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

Section 4 Best Management Practices (BMP)

4.1 Source Control and Site Design BMPs

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

4.1.1 Source Control BMPs

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

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

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

Form 4.1-1 Non-Structural Source Control BMPs

Identifier	Name	Check One		Describe BMP Implementation OR, if not applicable, state reason
		Included	Not Applicable	
N1	Education of Property Owners, Tenants and Occupants on Stormwater BMPs	☒	☐	General information will be provided to the owner on housekeeping practices that contribute to the protection of storm water. The property owner and property manager will be familiar with the contents of this document and the BMPs used on the site. The owner will provide education materials to tenants (if applicable) on BMPs and housekeeping practices that contribute to the protection of storm water.
N2	Activity Restrictions	☒	☐	The property owner/manager shall control the discharge of the stormwater pollutants from this site through activity restrictions. Restrictions shall be provided to all new tenants/occupants through lease terms, or other mechanism upon first occupancy of the lease space and annually thereafter. Enforcement of activity restriction shall be on going during the operation of the project site.
N3	Landscape Management BMPs	☒	☐	The property owner, building operators, and landscape maintenance contractors will practice on going landscape maintenance BMPs consistent with applicable local ordinances and will regular inspect the irrigation system for signs of erosion or sediment debris buildup and clean/repair as needed.
N4	BMP Maintenance	☒	☐	The property owner/manager will maintain all post construction BMPs consistent with the O&M plan described in section 5 of this document (Form 5-1).
N5	Title 22 CCR Compliance (How development will comply)	☐	☒	Hazardous wastes are not anticipated to be stored or handled of-site.
N6	Local Water Quality Ordinances	☒	☐	he owner shall comply with the Town of Apple Valley Stormwater Ordinance through the implementation of BMP's.
N7	Spill Contingency Plan	☒	☐	Building operators shall prepare specific plans based on materials onsite for the cleanup of spills. Plans shall mandate stock piling of cleanup materials, notification of agencies, disposal, documentation, etc. Storage shall comply with Hazmat Regulations and any required contingency plans.

Form 4.1-1 Non-Structural Source Control BMPs

N8	Underground Storage Tank Compliance	☐	☒	No underground storage tanks proposed.
N9	Hazardous Materials Disclosure Compliance	☐	☒	The storing of hazardous materials is not proposed.

Form 4.1-1 Non-Structural Source Control BMPs

Identifier	Name	Check One		Describe BMP Implementation OR, if not applicable, state reason
		Included	Not Applicable	
N10	Uniform Fire Code Implementation	☒	☐	This project will be developed and operated in accordance with Article 80 of the Uniform Fire Code.
N11	Litter/Debris Control Program	☒	☐	The building operator shall prepare and implement an employee training program. This program shall include trash managementa and litter control procedures including on spill cleanup, litter control, and material storage procedures.
N12	Employee Training	☒	☐	The property owner/manager shall prepare and implement an employee-training program in accordance with California Storm Water Quality Association Standards and BMP. This program shall be reviewed on a bi-annual basis or with the every new edition of the Stormwater Best Management Practice Handbook for Industrial and Commercial. See appendix for all educational material.
N13	Housekeeping of Loading Docks	☒	☐	Loading docks shall be regulary maintained by keeping clean and orderly condition through a regular program of sweeping and litter control, cleaning up spills and broken containers immediately. Clean up should minimize use of water and do not discharge wash water into the storm drain.
N14	Catch Basin Inspection Program	☒	☐	Catch basins shall be inspected visually on a monthly basis; the entire storm drain system shall be inspected and cleaned prior to the start of the rainy season.

N15	Vacuum Sweeping of Private Streets and Parking Lots	☒	☐	Parking and dock areas will be swept regularly using a vacuum assisted sweeper. Frequency will depend on waste accumulations with a minimum of once per month and prior to the start of the rainy season.
N16	Other Non-structural Measures for Public Agency Projects	☐	☒	Not a Public Agency project.
N17	Comply with all other applicable NPDES permits	☒	☐	he developer will comply with the California statwide Construction General Permit during construction and all future occupants of the site shall comply with the requirements of the statewide General Stormwater Permit.

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
S1	Provide storm drain system stencilling and signage (CASQA New Development BMP Handbook SD-13)	☒	☐	All storm drain inlets shall have Stenciling illustrating an anti-dumping message.
S2	Design and construct outdoor material storage areas to reduce pollution introduction (CASQA New Development BMP Handbook SD-34)	☐	☒	This development does not include the storage of materials outdoors.
S3	Design and construct trash and waste storage areas to reduce pollution introduction (CASQA New Development BMP Handbook SD-32)	☒	☐	Trash storage areas shall be located away from storm drain inlets. All trash dumpsters/containers will be required to have a lid on at all times to prevent direct precipitation and prevent any rainfall from entering containers.
S4	Use efficient irrigation systems & landscape design, water conservation, smart controllers, and source control (Statewide Model Landscape Ordinance; CASQA New Development BMP Handbook SD-12)	☒	☐	Irrigation systems will be designed to each landscaped area's specific water need. Irrigation controls shall include rain-triggered shutoff devices to prevent irrigation after precipitation.
S5	Finish grade of landscaped areas at a minimum of 1-2 inches below top of curb, sidewalk, or pavement	☒	☐	Landscaped areas shall be below a minimum of 1" to 2" below the top of curb or walk.
S6	Protect slopes and channels and provide energy dissipation (CASQA New Development BMP Handbook SD-10)	☒	☐	Install permanent stabilization BMPs on slopes as quickly as possible. Install drought resistant landscaping. Install Rip-Rap at storm drain outlet to the basin.
S7	Covered dock areas (CASQA New Development BMP Handbook SD-31)	☐	☒	No covered dock areas within the new development.
S8	Covered maintenance bays with spill containment plans (CASQA New Development BMP Handbook SD-31)	☐	☒	No covered maintenance bays within the new development.
S9	Vehicle wash areas with spill containment plans (CASQA New Development BMP Handbook SD-33)	☐	☒	No vehicle wash areas proposed.
S10	Covered outdoor processing areas (CASQA New Development BMP Handbook SD-36)	☐	☒	No covered outdoor processing areas are proposed

Form 4.1-2 Structural Source Control BMPs

Identifier	Name	Check One		Describe BMP Implementation OR, If not applicable, state reason
		Included	Not Applicable	
S11	Equipment wash areas with spill containment plans (CASQA New Development BMP Handbook SD-33)	☐	☒	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)	☐	☒	No natural existing hillsides on the project site.
S14	Wash water control for food preparation areas	☐	☒	No food preparation is proposed
S15	Community car wash racks (CASQA New Development BMP Handbook SD-33)	☐	☒	No Community car wash racks

4.1.2 Site Design BMPs

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

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

Describe site design and drainage plan including:

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

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

Form 4.1-3 Site Design Practices Checklist
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 areas are minimized to the Maximum Extent Possible without costing the facility inefficiencies in circulation, parking and loading and unloading.
Maximize natural infiltration capacity; Including improvement and maintenance of soil: Yes ☒ No ☐ Explanation: Infiltration basin bottom with natural soils, no compaction. Landscaped areas will amend the soil and be depressed to facilitate infiltration.
Preserve existing drainage patterns and time of concentration: Yes ☐ No ☒ Explanation: The site could not be developed due to the site topography as it is. The cost would be infeasible.
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: The site layout lends itself for some smaller parking areas to drain into impervious areas.
Use of Porous Pavement: Yes ☐ No ☒ Explanation: Not practical with truck loading.
Protect existing vegetation and sensitive areas: Yes ☐ No ☒ Explanation: There are no sensitive areas and site will have to be mass graded to develop it.
Re-vegetate disturbed areas. Including planting and preservation of drought tolerant vegetation: Yes ☒ No ☐ Explanation: There is 10% minimum landscaping proposed which will incorporate drought tolerant vegetation.

Minimize unnecessary compaction in stormwater retention/infiltration basin/trench areas: Yes ☒ No ☐ Explanation: Site to be mass graded. Basin is attempted to be placed in fill areas to minimize excavation and thus avoid compaction. However, it is unknown if the preliminary Geotechnical report could recommend to over excavation.
Utilize naturalized/rock-lined drainage swales in place of underground piping or imperviously lined swales: Yes ☐ No ☒ Explanation: Not practical in this development. The storm drain infrastructure is necessary to develop the site.
Stake off areas that will be used for landscaping to minimize compaction during construction: Yes ☐ No ☒ Explanation: Site will be mass graded.
Use of Rain Barrels and Cisterns, Including the use of on-site water collection systems: Yes ☐ No ☒ Explanation: No underground storage is proposed into the subject site.
Stream Setbacks. Includes a specified distance from an adjacent steam: Yes ☐ No ☒ Explanation: Not adjacent to a stream.

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

San Bernardino County Special Districts:

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

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

Mojave Water Agency:

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

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

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

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

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

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

4.2 Treatment BMPs

After implementation and design of both Source Control and Site Design BMPs, any remaining runoff from impervious DMAs must be directed to one or more on-site, treatment BMPs (LID or biotreatment) designed to infiltrate, 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 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-A1)		
1 Project area DA1-A1 (ft^2): 3,526,581	2 Imperviousness after applying preventative site design practices (Imp%): 85%	3 Runoff Coefficient (Rc): _0.661 *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): 0.348 http://hdsc.nws.noaa.gov/hdsc/pfds/sa/sca_pfds.html		
5 Compute P_6, Mean 6-hr Precipitation (inches): 0.52 *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): 198,389 *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	1 230,023 *Form 4.2-3 Item 12*	2 25.81 *Form 4.2-4 Item 13*	3 66.5 *Form 4.2-5 Item 10*
Post-developed	4 519,645 *Form 4.2-3 Item 13*	5 20.33 *Form 4.2-4 Item 14*	6 87.6 *Form 4.2-5 Item 14*
Difference	7 *289,622* *Item 4 – Item 1*	8 *(-5.48)* *Item 2 – Item 5*	9 21.1 *Item 6 – Item 3*
Difference (as % of pre-developed)	10 125% *Item 7 / Item 1*	11 (*-21.2%)* *Item 8 / Item 2*	12 *31.7%* *Item 9 / Item 3*

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

Weighted Curve Number Determination for: <u>Pre</u>-developed DA	DMA A	DMA B	DMA C	DMA D	DMA E	DMA F	DMA G	DMA H
1a Land Cover type								
2a Hydrologic Soil Group (HSG)								
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: <u>Post</u>-developed DA	DMA A	DMA B	DMA C	DMA D	DMA E	DMA F	DMA G	DMA H
1b Land Cover type								
2b Hydrologic Soil Group (HSG)								
3b DMA Area, 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): 2.14
Go to: http://hdsc.nws.noaa.gov/hdsc/pfds/sa/sca_pfds.html

12 Pre-developed Volume (ft^3): 230,023
*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): 519,645
*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): 289,622
*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): *25*.81

14 Post-developed time of concentration (min): *20.33*

15 Additional time of concentration needed to meet hydromodification requirement (min): 0 *$T_{C\text{-}Hydro}$ = (Item 13 * 0.95) – Item 14 4.19*

The time concentration is based on the Rational Method Hydrology Calculations of the development site.

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): 0 *$Q_{p-hydro}$ = (Item 14 * 0.95) – Item 10*

For Hydromodification Assessment Calculation & Summary See Attachment D

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

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

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

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

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

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

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

4.3.1 Exceptions to Requirements for Bioretention Facilities

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

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

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

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

Form 4.3-1 Infiltration BMP Feasibility (DA 1)
Feasibility Criterion – Complete evaluation for each DA on the Project Site
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 BMPs reduces the portion of the DCV that must be addressed in downstream BMPs. Therefore, all applicable Site Design shall be provided except where they are mutually exclusive with each other, or with other BMPs. Mutual exclusivity may result from overlapping BMP footprints such that either would be potentially feasible by itself, but both could not be implemented. Please note that while there are no numeric standards regarding the use of Site Design BMPs. If a project cannot feasibly meet BMP sizing requirements or cannot fully address hydromodification, feasibility of all applicable Site Design BMPs must be part of demonstrating that the BMP system has been designed to retain the maximum feasible portion of the DCV. Complete Form 4.3-2 to identify and calculate estimated retention volume from implementing site design BMP. Refer to Section 5.4 in the TGD for more detailed guidance.

Form 4.3-2 Site Design BMPs (DA 1)			
1 Implementation of Impervious Area Dispersion BMP (i.e. routing runoff from impervious to pervious areas), excluding impervious areas planned for routing to on-lot infiltration BMP: Yes ☐ No ☐ *If yes, complete Items 2-5; If no, proceed to Item 6*	DA 1 DMA A1 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 1A DMA A BMP Type HSC	DA 1 DMA A BMP Type HSC	DA 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)*			

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

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

4.3.3 Infiltration BMPs

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

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

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

4.3.3.1 Allowed Variations for Special Site Conditions

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

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

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

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

4) Facilities serving high-risk areas such as fueling stations, truck stops, auto repairs, and heavy industrial sites may be required to provide additional treatment to address pollutants of concern unless these high-risk areas are isolated from storm water runoff or bioretention areas with little chance of spill migration.

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

1 Remaining LID DCV not met by site design BMP (ft^3): 35,650 *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 A1 BMP Type Infiltration Basin	DA DMA BMP Type	DA DMA BMP Type *(Use additional forms for more BMPs)*
2 Infiltration rate of underlying soils (in/hr) *See Section 5.4.2 and Appendix D of the TGD for WQMP for minimum requirements for assessment methods*	1.5		
3 Infiltration safety factor *See TGD Section 5.4.2 and Appendix D*	2.19		
4 Design percolation rate (in/hr) *P_{design} = Item 2 / Item 3*	0.68		
5 Ponded water drawdown time (hr) *Copy Item 6 in Form 4.2-1*	48		
6 Maximum ponding depth (ft) *BMP specific, see Table 5-4 of the TGD for WQMP for BMP design details*	6		
7 Ponding Depth (ft) *d_{BMP} = Minimum of (1/12*Item 4*Item 5) or Item 6*	2.72		
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*	100,350		
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		
10 Amended soil porosity	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		
12 Gravel porosity	0		
13 Duration of storm as basin is filling (hrs) *Typical ~ 3hrs*	3		
14 Above Ground Retention Volume (ft^3) *$V_{retention}$ = Item 8 * [Item7 + (Item 9 * Item 10) + (Item 11 * Item 12) + (Item 13 * (Item 4 / 12))]*	290,011		
15 Underground Retention Volume (ft^3) *Volume determined using manufacturer's specifications and calculations*			

16 Total Retention Volume from LID Infiltration BMPs: 290,011 *(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) n/a		
1 Remaining LID DCV not met by site design , or infiltration, BMP for potential biotreatment (ft³): *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	Volume-based biotreatment *Use Forms 4.3-5 and 4.3-6 to compute treated volume*	Flow-based biotreatment *Use Form 4.3-7 to compute treated flow*
(Select biotreatment BMP(s) necessary to ensure all pollutants of concern are addressed through Unit Operations and Processes, described in Table 5-5 of the TGD for WQMP)	☐ Bioretention with underdrain ☐ Planter box with underdrain ☐ Constructed wetlands ☐ Wet extended detention ☐ Dry extended detention	☐ Vegetated swale ☐ Vegetated filter strip ☐ Proprietary biotreatment
3 Volume biotreated in volume based biotreatment BMP (ft³): *Form 4.3-5 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 n/a			
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 n/a

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

4.3.5 Conformance Summary

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

Form 4.3-8 Conformance Summary and Alternative Compliance Volume Estimate (DA 1)
1 Total LID DCV for the Project DA-1 (ft^3): 185,180 *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): 185,180 *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 (ft^3): *(Form 4.2-2 Item 4 * 0.95) – Form 4.2-2 Item 1*	**2** On-site retention with site design and infiltration, BMP (ft^3): *Sum of Form 4.3-8 Items 2, 3, and 4. Evaluate option to increase implementation of on-site retention in Forms 4.3-2, 4.3-3, and 4.3-4 in excess of LID DCV toward achieving hydromodification volume reduction*
3 Remaining volume for hydromodification volume capture (ft^3): 0 *Item 1 – Item 2*	**4** Volume capture provided by incorporating additional on-site BMPs (ft^3):
5 Is Form 4.2-2 Item 11 less than or equal to 5%: Yes ☒ No ☐ *If yes, hydromodification performance criteria is achieved. If no, select one or more mitigation options below:* • Demonstrate increase in time of concentration achieved by proposed LID site design, LID BMP, and additional on-site BMP ☐ • Increase time of concentration by preserving pre-developed flow path and/or increase travel time by reducing slope and increasing cross-sectional area and roughness for proposed on-site conveyance facilities ☐	
6 Form 4.2-2 Item 12 less than or equal to 5%: Yes ☒ No ☐ *If yes, hydromodification performance criteria is achieved. If no, select one or more mitigation options below:* • Demonstrate reduction in peak runoff achieved by proposed LID site design, LID BMPs, and additional on-site retention BMPs ☐	

4.4 Alternative Compliance Plan (if applicable)

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

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

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

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

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

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

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

Section 5 Inspection and Maintenance Responsibility for Post Construction BMP

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

Note that at time of Project construction completion, the Maintenance Covenant must be completed, signed, notarized and submitted to the Town's Engineering Department

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

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

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

Section 6 WQMP Attachments

6.1. Site Plan and Drainage Plan

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

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

6.2 Electronic Data Submittal

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

6.3 Post Construction

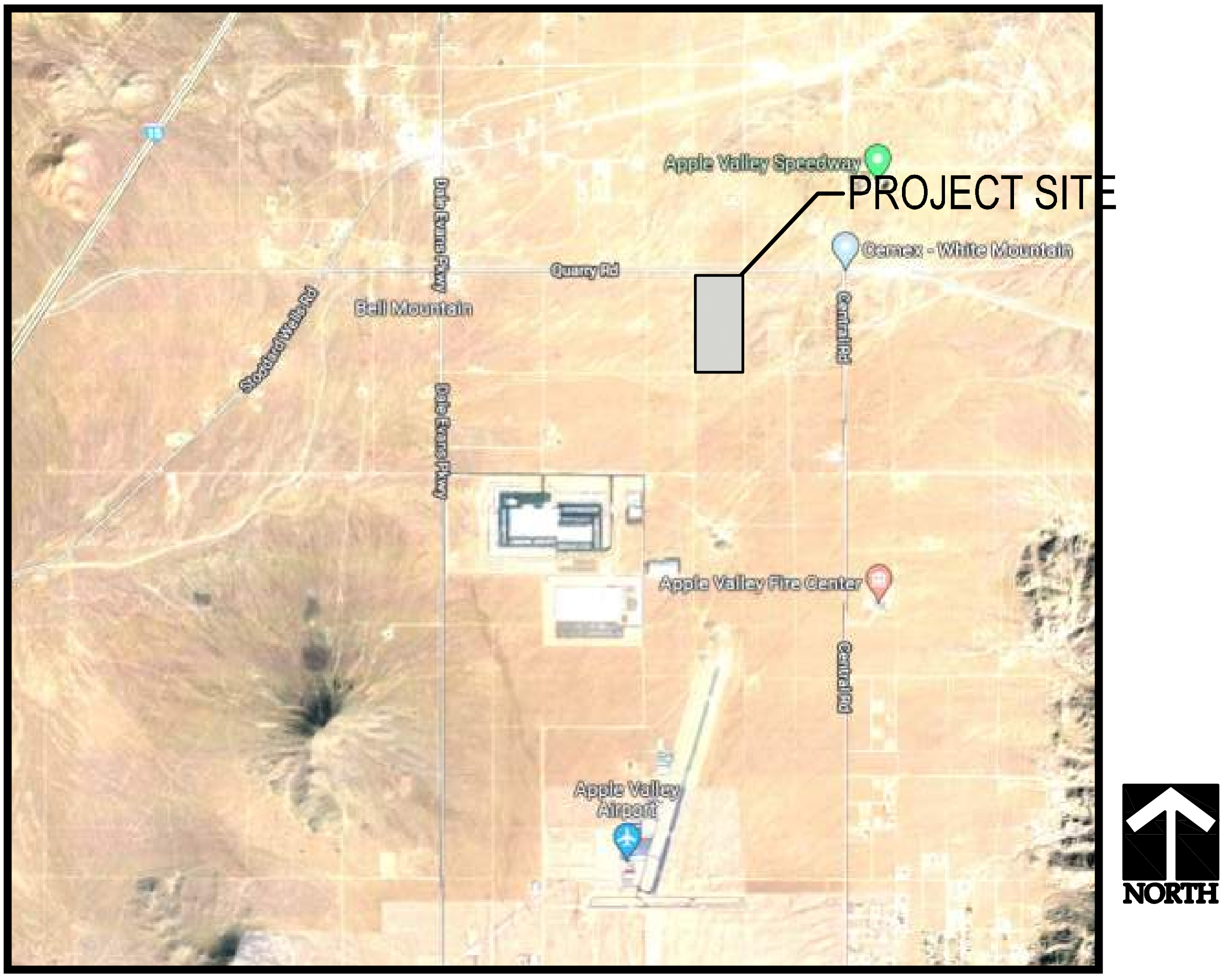
Attach all O&M Plans and Maintenance Covenant for BMP to the WQMP. See following page for Maintenance Covenant Template

6.4 Other Supporting Documentation

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

Appendix A

Vicinity Map

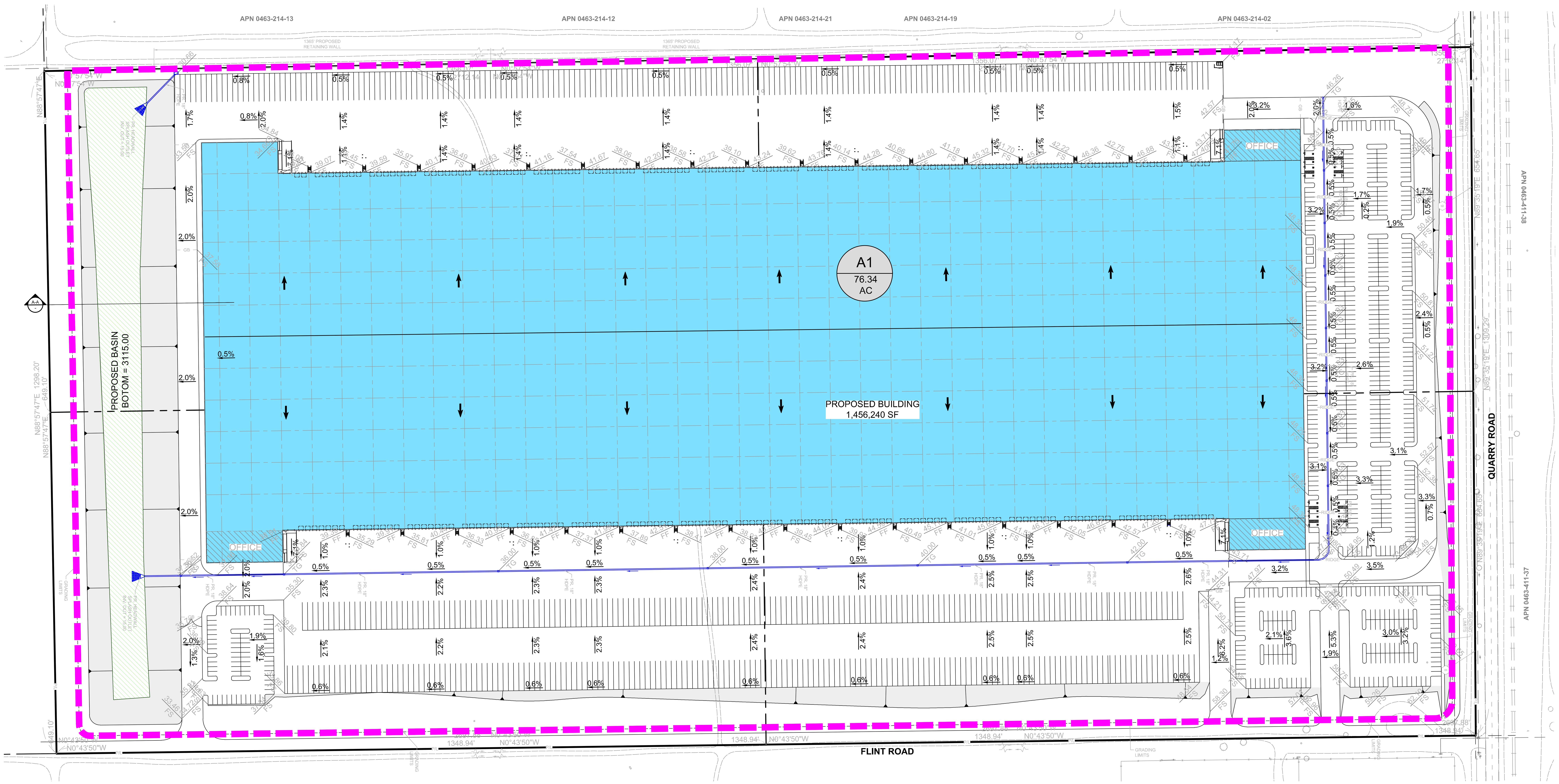


Vicinity Map

NTS

Appendix B

- WQMP Exhibit



MAP LEGEND:

DRAINGE AREA BOUNDARY

PROPOSED STORM DRAIN

PROPOSED BUILDING

INFILTRATION BASIN

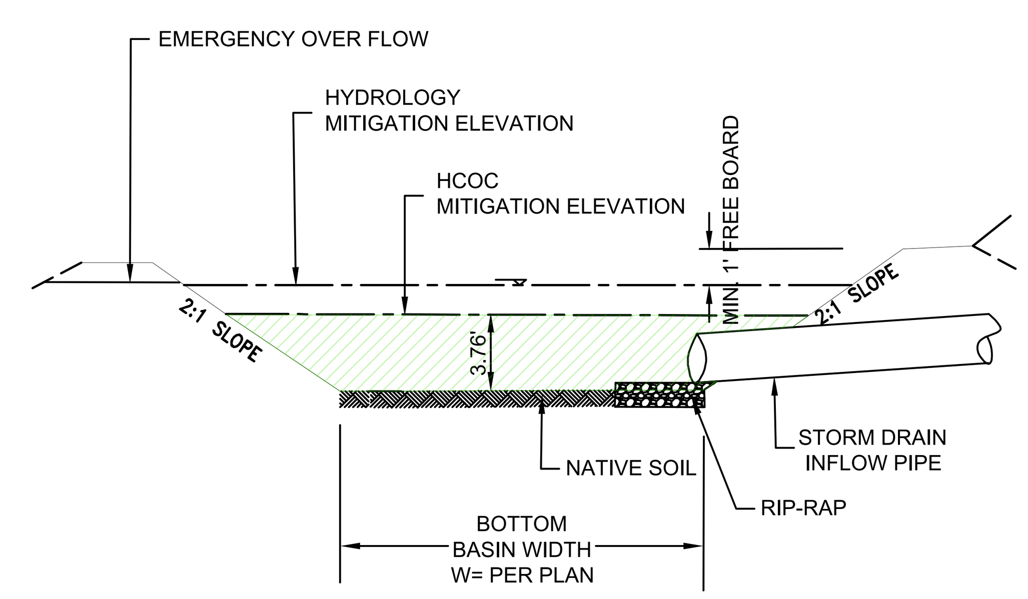
ROOF DRAIN DIRECTION

A1 5.0 AC DRAINAGE MANAGEMENT AREA _DMA ID

AREA ACREAGE

NOTE:

ALL CATCH BASIN SHOULD INSTALL FLOGARD CATCH BASIN INSERT FILTER OR EQUAL'S APPROVAL PRODUCTS



A-A
TYPICAL DETENTION/
INFILTRATION BASIN SECTION
N.T.S.

N

scale 1"= 100' feet

ENGINEER

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QUARRY ROAD INDUSTRIAL COMPLEX

WQMP EXHIBIT

FILE NO.

DRAWING NO.

SH. 1 OF 1

Plot Date: 10/26/2022 11:18 AM By: Hong Zhang
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Appendix C

BMP sizing Calculations

<table>
<tr><th colspan="3">Form 4.2-1 LID BMP Performance Criteria for Design Capture Volume
(DA 1-A1)</th></tr>
<tr><td>1 Project area DA1-A1 (ft^2):
3,325,370</td><td>2 Imperviousness after applying preventative site design practices (Imp%):
85%</td><td>3 Runoff Coefficient (Rc): _0.661
R_c = 0.858(Imp%)^3-0.78(Imp%)^2+0.774(Imp%)+0.04</td></tr>
<tr><td colspan="3">4 Determine 1-hour rainfall depth for a 2-year return period $P_{2yr-1hr}$ (in): 0.348 http://hdsc.nws.noaa.gov/hdsc/pfds/sa/sca_pfds.html</td></tr>
<tr><td colspan="3">5 Compute P_6, Mean 6-hr Precipitation (inches): 0.52
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)</td></tr>
<tr><td colspan="2">6 Drawdown Rate
Use 48 hours as the default condition. Selection and use of the 24 hour drawdown time condition is subject to approval by the local jurisdiction. The necessary BMP footprint is a function of drawdown time. While shorter drawdown times reduce the performance criteria for LID BMP design capture volume, the depth of water that can be stored is also reduced.</td><td>24-hrs ☐
48-hrs ☒</td></tr>
<tr><td colspan="3">7 Compute design capture volume, DCV (ft^3): 185,180
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</td></tr>
</table>

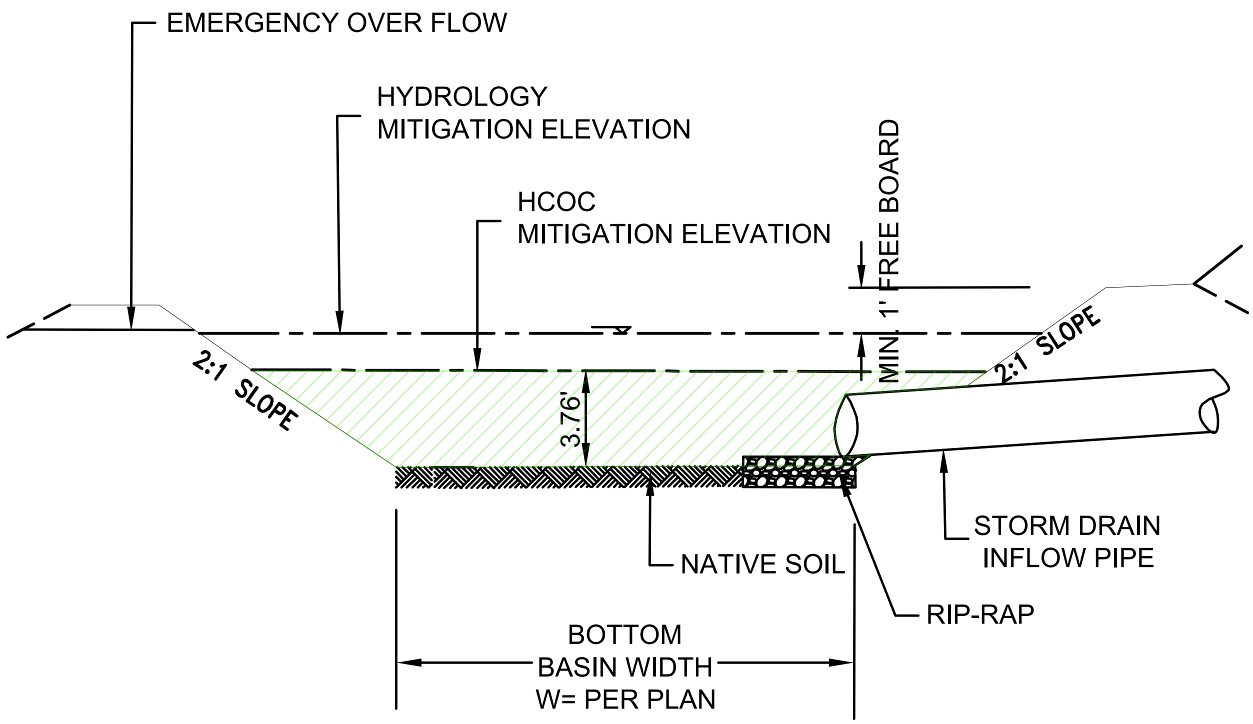
Quarry Site Basin Table:

Elevation (ft.)	Basin Area (sf)	Depth (ft.)	Basin Volume (cft)	Basin Volume (ac-ft)	Basin Infiltration Flow* (cfs)	Weir Over Flow (cfs)	Total Outlet Flow (cfs)
0	94,667	-	-	-	1.49	0.00	1.49
1	99,161	1.00	96,914	2.22	1.49	0.00	1.49
2	104,225	2.00	203,386	4.67	1.49	0.00	1.49
3	109,320	3.00	310,159	7.12	1.49	0.00	1.49
4	114,446	4.00	422,042	9.69	1.49	0.00	1.49
5.5	122,191	5.50	599,519	13.76	1.49	0.00	1.49
6	124,778	6.00	661,262	15.18	1.49	107.00	108.49

Note:

* Infiltration flow based on the infiltration test the Infiltration rate =1.5in/hr with safty factor SF=2.19, design infiltration rate=1.5/2.19=0.68 in/hr.
  Basin infiltration flow=(1/12x0.68)/3600 xbasin Bottom Area = 1.49 cfs

BASIN PROVIDED VOLUME



A-A
TYPICAL DETENTION/ INFILTRATION BASIN SECTION

N.T.S.

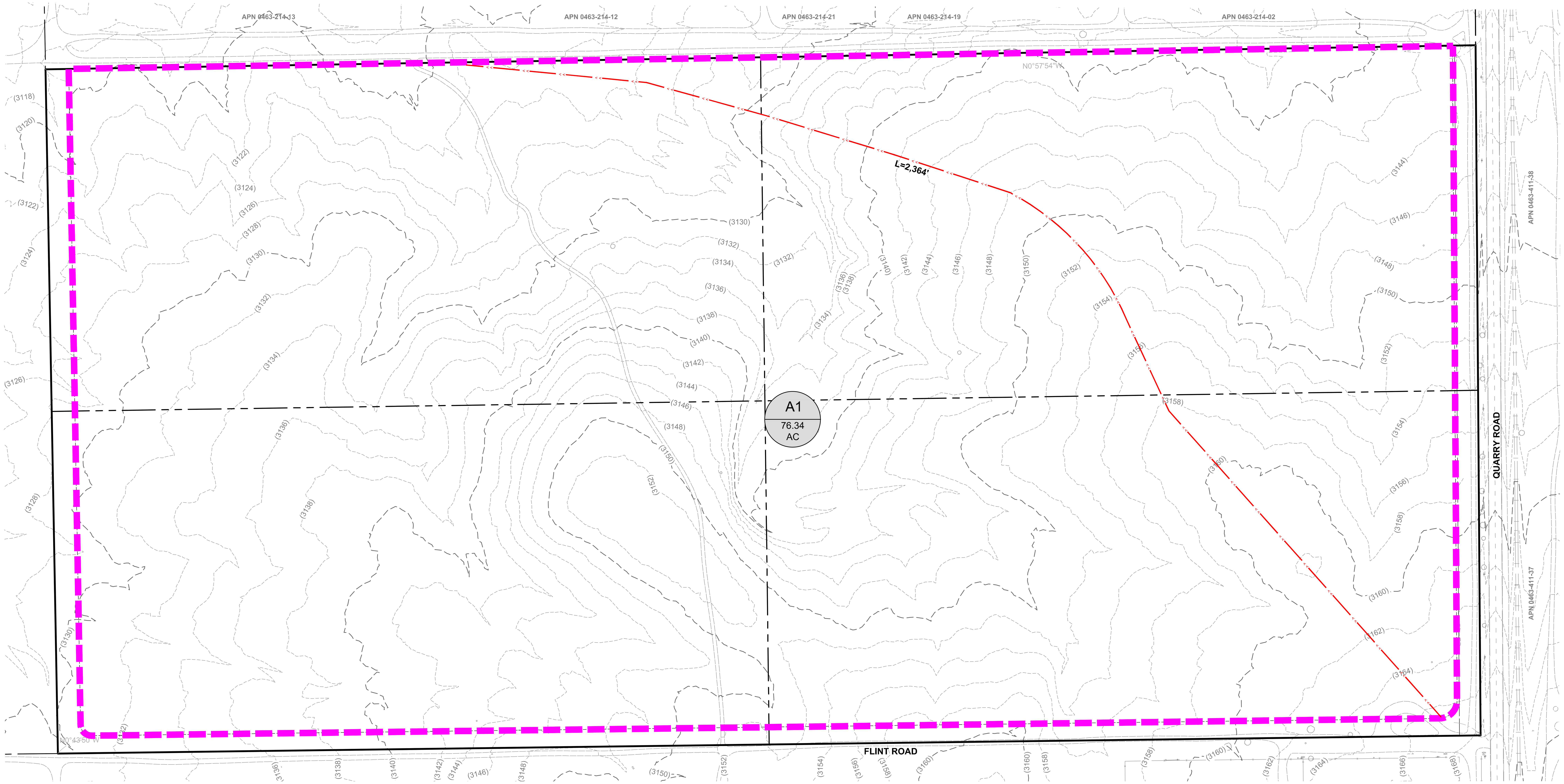
Appendix D

HCOC Analysis

Quarry Site 10-Year Hydrology Summary Table (Rational)			
Area ID	**Acreage (ac)**	**Flow Rate (cfs)**	**Time of Concentration (min)**
Existing Condition (Area A1)	76.34	55.6	25.81
Proposed Condition (Area Area A1)	76.34	85.19	20.33

```
                San Bernardino County Rational Hydrology Program

                    (Hydrology Manual Date - August 1986)

 CIVILCADD/CIVILDESIGN  Engineering Software, (c) 1989-2004 Version 7.0
        Rational Hydrology Study        Date: 11/01/22
------------------------------------------------------------------------
Quarry Complex Site
Rational Method
Existing Condition
10-Year, 24-hours Storm
------------------------------------------------------------------------


Program License Serial Number 4009

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

------------------------------------------------------------------------
Rational hydrology study storm event year is    10.0
Computed rainfall intensity:
Storm year =    10.00   1 hour rainfall =     0.609 (In.)
Slope used for rainfall intensity curve b =  0.7000
Soil antecedent moisture condition (AMC) = 2


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      101.000 to Point/Station      102.000
**** INITIAL AREA EVALUATION ****
______________________________________________________________________
UNDEVELOPED (poor cover) subarea
Decimal fraction soil group A = 0.110
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.660
Decimal fraction soil group D = 0.230
SCS curve number for soil(AMC 2)  = 84.60
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.290(In/Hr)
Initial subarea data:
Initial area flow distance =  2364.000(Ft.)
Top (of initial area) elevation =  3166.000(Ft.)
Bottom (of initial area) elevation =  3120.000(Ft.)
Difference in elevation =    46.000(Ft.)
Slope =    0.01946  s(%)=       1.95
TC = k(0.525)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =   25.810 min.
Rainfall intensity =      1.099(In/Hr) for a    10.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.663
Subarea runoff =     55.595(CFS)
Total initial stream area =       76.340(Ac.)
Pervious area fraction = 1.000
Initial area Fm value =    0.290(In/Hr)
End of computations, Total Study Area =           76.34 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.
Note: These figures do not consider reduced effective area
effects caused by confluences in the rational equation.

Area averaged pervious area fraction(Ap) = 1.000
Area averaged SCS curve number =  84.6
```

```
                San Bernardino County Rational Hydrology Program

                    (Hydrology Manual Date - August 1986)

 CIVILCADD/CIVILDESIGN  Engineering Software, (c) 1989-2004 Version 7.0
        Rational Hydrology Study        Date: 11/01/22
------------------------------------------------------------------------
Quarry Complex Site
Rational Method
Post-Development Condition
10-Year, 24-hours Storm
------------------------------------------------------------------------


Program License Serial Number 4009

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

------------------------------------------------------------------------
Rational hydrology study storm event year is    10.0
Computed rainfall intensity:
Storm year =    10.00   1 hour rainfall =     0.609 (In.)
Slope used for rainfall intensity curve b =  0.7000
Soil antecedent moisture condition (AMC) = 2


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      101.000 to Point/Station      102.000
**** INITIAL AREA EVALUATION ****
______________________________________________________________________
COMMERCIAL subarea type
Decimal fraction soil group A = 0.110
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.660
Decimal fraction soil group D = 0.230
SCS curve number for soil(AMC 2)  = 66.31
Pervious ratio(Ap) = 0.1000     Max loss rate(Fm)=     0.059(In/Hr)
Initial subarea data:
Initial area flow distance =  3347.000(Ft.)
Top (of initial area) elevation =  3148.000(Ft.)
Bottom (of initial area) elevation =  3120.000(Ft.)
Difference in elevation =    28.000(Ft.)
Slope =    0.00837  s(%)=       0.84
TC = k(0.304)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =   20.335 min.
Rainfall intensity =      1.299(In/Hr) for a    10.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.859
Subarea runoff =     85.194(CFS)
Total initial stream area =       76.340(Ac.)
Pervious area fraction = 0.100
Initial area Fm value =    0.059(In/Hr)
End of computations, Total Study Area =           76.34 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.
Note: These figures do not consider reduced effective area
effects caused by confluences in the rational equation.

Area averaged pervious area fraction(Ap) = 0.100
Area averaged SCS curve number =  66.3
```



N

100 0 100 200
scale 1"= 100' feet

MAP LEGEND:

DRAINGE AREA BOUNDARY

FLOW LINE

A1 76.34 AC — DRAINAGE MANAGEMENT AREA _DMA ID
AREA ACREAGE

ENGINEER

DAVID EVANS AND ASSOCIATES INC.

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QUARRY ROAD INDUSTRIAL COMPLEX

PRE-DEVELOPMENT UH METHOD EXHIBIT

FILE NO.

DRAWING NO.

SH. 1 OF 1

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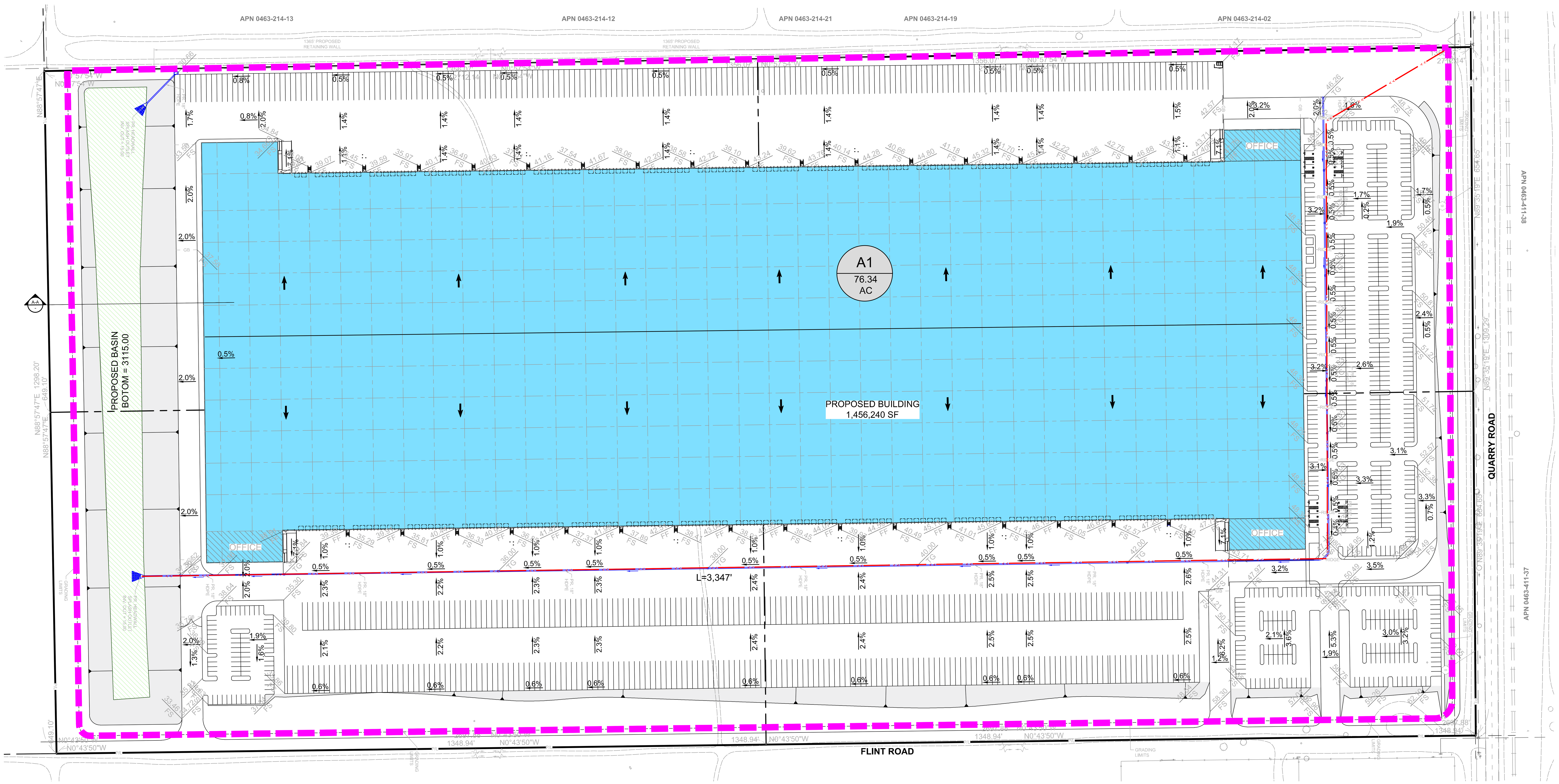


MAP LEGEND:

DRAINGE AREA BOUNDARY

PROPOSED STORM DRAIN

FLOW LINE

PROPOSED BUILDING

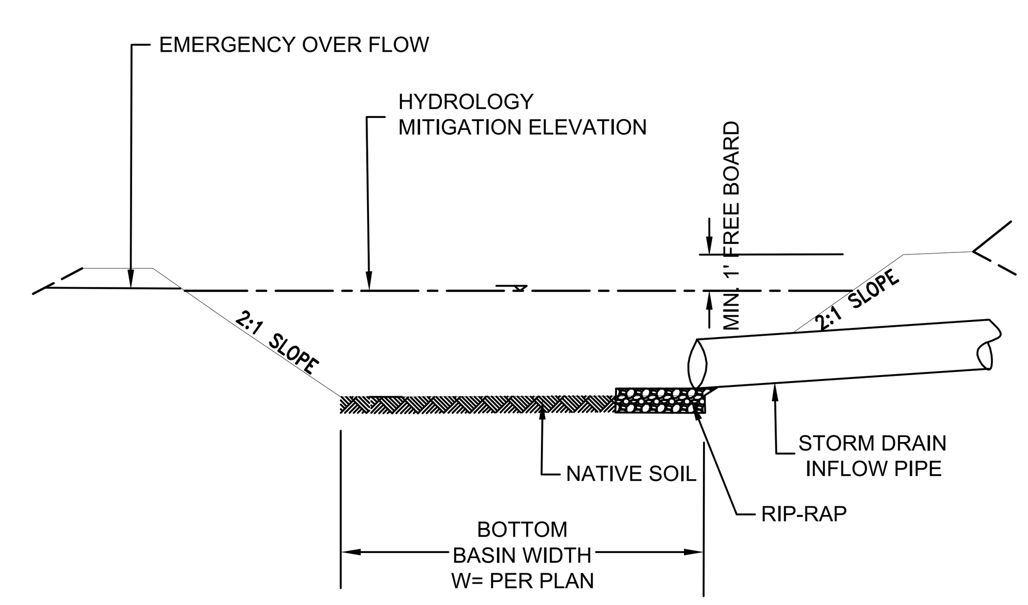
INFILTRATION BASIN

ROOF DRAIN DIRECTION

A1 5.0 AC — DRAINAGE MANAGEMENT AREA _DMA ID / AREA ACREAGE

NOTE:

ALL CATCH BASIN SHOULD INSTALL FLOGARD CATCH BASIN INSERT FILTER OR EQUAL'S APPROVAL PRODUCTS



A-A
TYPICAL DETENTION/ INFILTRATION BASIN SECTION
N.T.S.

N

100 0 100 200
scale 1"= 100' feet

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SSchubert@deainc.com

QUARRY ROAD INDUSTRIAL COMPLEX	
POST-DEVELOPMENT UH METHOD EXHIBIT	FILE NO.
	DRAWING NO.
	SH. 1 OF 1

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Quarry Site HCOC Summary:

Hydromodification Analysis - 10 Year 24 Hour Storm Event					
Condition	**Area ID**	**Area (Ac)**	**Qpeak (cfs)**	**Volume (acft)**	**Volume (cuft)**
Existing Condition	A1	76.34	54.10	6.61	287,931.60
Proposed Condition	A1	76.34	75.51	11.32	493,099.20
Mitigated Condition	A1	76.34	1.49	11.32	493,099.20

Note: 100% volume is mitigated in the basin

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

        Copyright (c) CIVILCADD/CIVILDESIGN, 1989 - 2004, Version 7.0

                Study date  11/01/22

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

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


Program License Serial Number 4009

---------------------------------------------------------------------
Quarry Complex Site
Unit Hydrogragh Method
Existing Condition
10-year, 24-hours Storm
--------------------------------------------------------------------

        Storm Event Year = 10

        Antecedent Moisture Condition = 2

 English (in-lb) Input Units Used

 English Rainfall Data (Inches) Input Values Used

 English Units used in output format




Area averaged rainfall intensity isohyetal data:
        Sub-Area        Duration        Isohyetal
        (Ac.)            (hours)         (In)
Rainfall data for year 10
            76.34            1           0.61
--------------------------------------------------------------------
Rainfall data for year 10
            76.34            6           1.23
--------------------------------------------------------------------
Rainfall data for year 10
            76.34           24           2.14
--------------------------------------------------------------------
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++

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


SCS curve  SCS curve     Area     Area     Fp(Fig C6)    Ap      Fm
No.(AMCII) NO.(AMC 2)    (Ac.)    Fraction     (In/Hr)  (dec.)   (In/Hr)
 84.6      84.6         76.34      1.000     0.290    1.000    0.290

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

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

Area       Area          SCS CN    SCS CN      S     Pervious
 (Ac.)      Fract         (AMC2)    (AMC2)           Yield Fr
    76.34   1.000         84.6      84.6       1.82     0.410

Area-averaged catchment yield fraction, Y =  0.410
Area-averaged low loss fraction, Yb =  0.590
User entry of time of concentration  =   0.430 (hours)
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Watershed area =      76.34(Ac.)
Catchment Lag time =   0.344 hours
Unit interval =   5.000 minutes
```

```
Unit interval percentage of lag time = 24.2248
Hydrograph baseflow =     0.00(CFS)
Average maximum watershed loss rate(Fm) =  0.290(In/Hr)
Average low loss rate fraction (Yb) = 0.590 (decimal)
VALLEY UNDEVELOPED S-Graph Selected
Computed peak 5-minute rainfall =  0.289(In)
Computed peak 30-minute rainfall =  0.495(In)
Specified peak 1-hour rainfall =  0.609(In)
Computed peak 3-hour rainfall =  0.937(In)
Specified peak 6-hour rainfall =  1.230(In)
Specified peak 24-hour rainfall =  2.140(In)


Rainfall depth area reduction factors:
Using a total area of      76.34(Ac.) (Ref: fig. E-4)

5-minute factor = 0.996     Adjusted rainfall =  0.288(In)
30-minute factor = 0.996    Adjusted rainfall =  0.493(In)
1-hour factor = 0.996       Adjusted rainfall =  0.607(In)
3-hour factor = 1.000       Adjusted rainfall =  0.937(In)
6-hour factor = 1.000       Adjusted rainfall =  1.230(In)
24-hour factor = 1.000      Adjusted rainfall =  2.140(In)
---------------------------------------------------------------------

                       U n i t  H y d r o g r a p h
+++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Interval          'S' Graph          Unit Hydrograph
Number            Mean values            ((CFS))
---------------------------------------------------------------------
                (K =       923.24 (CFS))

  1                2.217                 20.464
  2                9.456                 66.839
  3               22.279                118.384
  4               39.049                154.825
  5               54.617                143.736
  6               64.578                 91.962
  7               70.998                 59.269
  8               75.276                 39.499
  9               78.687                 31.491
 10               81.493                 25.910
 11               83.869                 21.930
 12               85.934                 19.068
 13               87.647                 15.815
 14               89.122                 13.617
 15               90.517                 12.874
 16               91.621                 10.200
 17               92.653                  9.521
 18               93.466                  7.509
 19               94.237                  7.117
 20               94.972                  6.784
 21               95.686                  6.594
 22               96.258                  5.287
 23               96.787                  4.881
 24               97.247                  4.247
 25               97.681                  4.002
 26               98.048                  3.395
 27               98.386                  3.119
 28               98.662                  2.546
 29               98.904                  2.237
 30               99.146                  2.237
 31               99.389                  2.237
 32               99.631                  2.237
 33               99.873                  2.237
 34              100.000                  1.172
---------------------------------------------------------------------
Peak Unit   Adjusted mass rainfall  Unit rainfall
Number              (In)               (In)
  1              0.2879              0.2879
  2              0.3545              0.0666
  3              0.4004              0.0459
  4              0.4364              0.0361
  5              0.4667              0.0302
```

6	0.4929	0.0262
7	0.5162	0.0233
8	0.5373	0.0211
9	0.5566	0.0193
10	0.5745	0.0179
11	0.5912	0.0167
12	0.6068	0.0156
13	0.6263	0.0195
14	0.6449	0.0186
15	0.6628	0.0178
16	0.6799	0.0171
17	0.6964	0.0165
18	0.7123	0.0159
19	0.7277	0.0154
20	0.7426	0.0149
21	0.7570	0.0145
22	0.7711	0.0140
23	0.7847	0.0137
24	0.7980	0.0133
25	0.8110	0.0130
26	0.8237	0.0127
27	0.8361	0.0124
28	0.8482	0.0121
29	0.8600	0.0118
30	0.8716	0.0116
31	0.8830	0.0114
32	0.8941	0.0111
33	0.9051	0.0109
34	0.9158	0.0107
35	0.9263	0.0106
36	0.9367	0.0104
37	0.9468	0.0101
38	0.9568	0.0100
39	0.9666	0.0098
40	0.9763	0.0097
41	0.9858	0.0095
42	0.9952	0.0094
43	1.0044	0.0092
44	1.0135	0.0091
45	1.0225	0.0090
46	1.0313	0.0089
47	1.0401	0.0087
48	1.0487	0.0086
49	1.0573	0.0085
50	1.0657	0.0084
51	1.0740	0.0083
52	1.0822	0.0082
53	1.0903	0.0081
54	1.0984	0.0080
55	1.1063	0.0079
56	1.1142	0.0079
57	1.1219	0.0078
58	1.1296	0.0077
59	1.1372	0.0076
60	1.1448	0.0075
61	1.1522	0.0075
62	1.1596	0.0074
63	1.1669	0.0073
64	1.1741	0.0072
65	1.1813	0.0072
66	1.1884	0.0071
67	1.1954	0.0070
68	1.2024	0.0070
69	1.2093	0.0069
70	1.2162	0.0069
71	1.2230	0.0068
72	1.2297	0.0067
73	1.2365	0.0068
74	1.2432	0.0067
75	1.2499	0.0067
76	1.2566	0.0066
77	1.2631	0.0066
78	1.2697	0.0065

79	1.2762	0.0065
80	1.2826	0.0064
81	1.2890	0.0064
82	1.2953	0.0063
83	1.3016	0.0063
84	1.3078	0.0062
85	1.3140	0.0062
86	1.3202	0.0062
87	1.3263	0.0061
88	1.3324	0.0061
89	1.3384	0.0060
90	1.3444	0.0060
91	1.3503	0.0059
92	1.3562	0.0059
93	1.3621	0.0059
94	1.3680	0.0058
95	1.3737	0.0058
96	1.3795	0.0058
97	1.3852	0.0057
98	1.3909	0.0057
99	1.3966	0.0057
100	1.4022	0.0056
101	1.4078	0.0056
102	1.4133	0.0056
103	1.4189	0.0055
104	1.4243	0.0055
105	1.4298	0.0055
106	1.4352	0.0054
107	1.4406	0.0054
108	1.4460	0.0054
109	1.4513	0.0053
110	1.4566	0.0053
111	1.4619	0.0053
112	1.4672	0.0052
113	1.4724	0.0052
114	1.4776	0.0052
115	1.4827	0.0052
116	1.4879	0.0051
117	1.4930	0.0051
118	1.4981	0.0051
119	1.5031	0.0051
120	1.5082	0.0050
121	1.5132	0.0050
122	1.5182	0.0050
123	1.5231	0.0050
124	1.5281	0.0049
125	1.5330	0.0049
126	1.5379	0.0049
127	1.5427	0.0049
128	1.5476	0.0048
129	1.5524	0.0048
130	1.5572	0.0048
131	1.5620	0.0048
132	1.5667	0.0048
133	1.5714	0.0047
134	1.5761	0.0047
135	1.5808	0.0047
136	1.5855	0.0047
137	1.5902	0.0046
138	1.5948	0.0046
139	1.5994	0.0046
140	1.6040	0.0046
141	1.6085	0.0046
142	1.6131	0.0045
143	1.6176	0.0045
144	1.6221	0.0045
145	1.6266	0.0045
146	1.6311	0.0045
147	1.6356	0.0045
148	1.6400	0.0044
149	1.6444	0.0044
150	1.6488	0.0044
151	1.6532	0.0044

152	1.6576	0.0044
153	1.6619	0.0043
154	1.6662	0.0043
155	1.6706	0.0043
156	1.6749	0.0043
157	1.6791	0.0043
158	1.6834	0.0043
159	1.6877	0.0042
160	1.6919	0.0042
161	1.6961	0.0042
162	1.7003	0.0042
163	1.7045	0.0042
164	1.7087	0.0042
165	1.7128	0.0042
166	1.7170	0.0041
167	1.7211	0.0041
168	1.7252	0.0041
169	1.7293	0.0041
170	1.7334	0.0041
171	1.7374	0.0041
172	1.7415	0.0041
173	1.7455	0.0040
174	1.7496	0.0040
175	1.7536	0.0040
176	1.7576	0.0040
177	1.7615	0.0040
178	1.7655	0.0040
179	1.7695	0.0040
180	1.7734	0.0039
181	1.7773	0.0039
182	1.7813	0.0039
183	1.7852	0.0039
184	1.7891	0.0039
185	1.7929	0.0039
186	1.7968	0.0039
187	1.8007	0.0039
188	1.8045	0.0038
189	1.8083	0.0038
190	1.8121	0.0038
191	1.8159	0.0038
192	1.8197	0.0038
193	1.8235	0.0038
194	1.8273	0.0038
195	1.8311	0.0038
196	1.8348	0.0037
197	1.8385	0.0037
198	1.8423	0.0037
199	1.8460	0.0037
200	1.8497	0.0037
201	1.8534	0.0037
202	1.8570	0.0037
203	1.8607	0.0037
204	1.8644	0.0037
205	1.8680	0.0036
206	1.8716	0.0036
207	1.8753	0.0036
208	1.8789	0.0036
209	1.8825	0.0036
210	1.8861	0.0036
211	1.8897	0.0036
212	1.8932	0.0036
213	1.8968	0.0036
214	1.9004	0.0036
215	1.9039	0.0035
216	1.9074	0.0035
217	1.9110	0.0035
218	1.9145	0.0035
219	1.9180	0.0035
220	1.9215	0.0035
221	1.9250	0.0035
222	1.9284	0.0035
223	1.9319	0.0035
224	1.9354	0.0035

225	1.9388	0.0034
226	1.9422	0.0034
227	1.9457	0.0034
228	1.9491	0.0034
229	1.9525	0.0034
230	1.9559	0.0034
231	1.9593	0.0034
232	1.9627	0.0034
233	1.9661	0.0034
234	1.9694	0.0034
235	1.9728	0.0034
236	1.9761	0.0034
237	1.9795	0.0033
238	1.9828	0.0033
239	1.9861	0.0033
240	1.9895	0.0033
241	1.9928	0.0033
242	1.9961	0.0033
243	1.9994	0.0033
244	2.0026	0.0033
245	2.0059	0.0033
246	2.0092	0.0033
247	2.0124	0.0033
248	2.0157	0.0033
249	2.0189	0.0032
250	2.0222	0.0032
251	2.0254	0.0032
252	2.0286	0.0032
253	2.0318	0.0032
254	2.0350	0.0032
255	2.0382	0.0032
256	2.0414	0.0032
257	2.0446	0.0032
258	2.0478	0.0032
259	2.0509	0.0032
260	2.0541	0.0032
261	2.0573	0.0032
262	2.0604	0.0031
263	2.0635	0.0031
264	2.0667	0.0031
265	2.0698	0.0031
266	2.0729	0.0031
267	2.0760	0.0031
268	2.0791	0.0031
269	2.0822	0.0031
270	2.0853	0.0031
271	2.0884	0.0031
272	2.0915	0.0031
273	2.0945	0.0031
274	2.0976	0.0031
275	2.1007	0.0031
276	2.1037	0.0030
277	2.1068	0.0030
278	2.1098	0.0030
279	2.1128	0.0030
280	2.1158	0.0030
281	2.1189	0.0030
282	2.1219	0.0030
283	2.1249	0.0030
284	2.1279	0.0030
285	2.1309	0.0030
286	2.1338	0.0030
287	2.1368	0.0030
288	2.1398	0.0030

Unit Period (number)	Unit Rainfall (In)	Unit Soil-Loss (In)	Effective Rainfall (In)
1	0.0030	0.0018	0.0012
2	0.0030	0.0018	0.0012
3	0.0030	0.0018	0.0012
4	0.0030	0.0018	0.0012

5	0.0030	0.0018	0.0012
6	0.0030	0.0018	0.0012
7	0.0030	0.0018	0.0012
8	0.0030	0.0018	0.0012
9	0.0030	0.0018	0.0012
10	0.0031	0.0018	0.0013
11	0.0031	0.0018	0.0013
12	0.0031	0.0018	0.0013
13	0.0031	0.0018	0.0013
14	0.0031	0.0018	0.0013
15	0.0031	0.0018	0.0013
16	0.0031	0.0018	0.0013
17	0.0031	0.0018	0.0013
18	0.0031	0.0019	0.0013
19	0.0032	0.0019	0.0013
20	0.0032	0.0019	0.0013
21	0.0032	0.0019	0.0013
22	0.0032	0.0019	0.0013
23	0.0032	0.0019	0.0013
24	0.0032	0.0019	0.0013
25	0.0032	0.0019	0.0013
26	0.0032	0.0019	0.0013
27	0.0032	0.0019	0.0013
28	0.0033	0.0019	0.0013
29	0.0033	0.0019	0.0013
30	0.0033	0.0019	0.0013
31	0.0033	0.0019	0.0013
32	0.0033	0.0019	0.0014
33	0.0033	0.0020	0.0014
34	0.0033	0.0020	0.0014
35	0.0033	0.0020	0.0014
36	0.0034	0.0020	0.0014
37	0.0034	0.0020	0.0014
38	0.0034	0.0020	0.0014
39	0.0034	0.0020	0.0014
40	0.0034	0.0020	0.0014
41	0.0034	0.0020	0.0014
42	0.0034	0.0020	0.0014
43	0.0034	0.0020	0.0014
44	0.0035	0.0020	0.0014
45	0.0035	0.0021	0.0014
46	0.0035	0.0021	0.0014
47	0.0035	0.0021	0.0014
48	0.0035	0.0021	0.0014
49	0.0035	0.0021	0.0014
50	0.0035	0.0021	0.0015
51	0.0036	0.0021	0.0015
52	0.0036	0.0021	0.0015
53	0.0036	0.0021	0.0015
54	0.0036	0.0021	0.0015
55	0.0036	0.0021	0.0015
56	0.0036	0.0021	0.0015
57	0.0037	0.0022	0.0015
58	0.0037	0.0022	0.0015
59	0.0037	0.0022	0.0015
60	0.0037	0.0022	0.0015
61	0.0037	0.0022	0.0015
62	0.0037	0.0022	0.0015
63	0.0038	0.0022	0.0015
64	0.0038	0.0022	0.0015
65	0.0038	0.0022	0.0016
66	0.0038	0.0022	0.0016
67	0.0038	0.0023	0.0016
68	0.0038	0.0023	0.0016
69	0.0039	0.0023	0.0016
70	0.0039	0.0023	0.0016
71	0.0039	0.0023	0.0016
72	0.0039	0.0023	0.0016
73	0.0039	0.0023	0.0016
74	0.0040	0.0023	0.0016
75	0.0040	0.0024	0.0016
76	0.0040	0.0024	0.0016
77	0.0040	0.0024	0.0016

78	0.0040	0.0024	0.0017
79	0.0041	0.0024	0.0017
80	0.0041	0.0024	0.0017
81	0.0041	0.0024	0.0017
82	0.0041	0.0024	0.0017
83	0.0042	0.0025	0.0017
84	0.0042	0.0025	0.0017
85	0.0042	0.0025	0.0017
86	0.0042	0.0025	0.0017
87	0.0042	0.0025	0.0017
88	0.0043	0.0025	0.0017
89	0.0043	0.0025	0.0018
90	0.0043	0.0025	0.0018
91	0.0043	0.0026	0.0018
92	0.0044	0.0026	0.0018
93	0.0044	0.0026	0.0018
94	0.0044	0.0026	0.0018
95	0.0045	0.0026	0.0018
96	0.0045	0.0026	0.0018
97	0.0045	0.0027	0.0018
98	0.0045	0.0027	0.0019
99	0.0046	0.0027	0.0019
100	0.0046	0.0027	0.0019
101	0.0046	0.0027	0.0019
102	0.0046	0.0027	0.0019
103	0.0047	0.0028	0.0019
104	0.0047	0.0028	0.0019
105	0.0048	0.0028	0.0019
106	0.0048	0.0028	0.0020
107	0.0048	0.0028	0.0020
108	0.0048	0.0029	0.0020
109	0.0049	0.0029	0.0020
110	0.0049	0.0029	0.0020
111	0.0050	0.0029	0.0020
112	0.0050	0.0029	0.0020
113	0.0050	0.0030	0.0021
114	0.0051	0.0030	0.0021
115	0.0051	0.0030	0.0021
116	0.0051	0.0030	0.0021
117	0.0052	0.0031	0.0021
118	0.0052	0.0031	0.0021
119	0.0053	0.0031	0.0022
120	0.0053	0.0031	0.0022
121	0.0054	0.0032	0.0022
122	0.0054	0.0032	0.0022
123	0.0055	0.0032	0.0022
124	0.0055	0.0032	0.0022
125	0.0056	0.0033	0.0023
126	0.0056	0.0033	0.0023
127	0.0057	0.0033	0.0023
128	0.0057	0.0034	0.0023
129	0.0058	0.0034	0.0024
130	0.0058	0.0034	0.0024
131	0.0059	0.0035	0.0024
132	0.0059	0.0035	0.0024
133	0.0060	0.0035	0.0025
134	0.0060	0.0036	0.0025
135	0.0061	0.0036	0.0025
136	0.0062	0.0036	0.0025
137	0.0062	0.0037	0.0026
138	0.0063	0.0037	0.0026
139	0.0064	0.0038	0.0026
140	0.0064	0.0038	0.0026
141	0.0065	0.0039	0.0027
142	0.0066	0.0039	0.0027
143	0.0067	0.0039	0.0027
144	0.0067	0.0040	0.0028
145	0.0067	0.0040	0.0028
146	0.0068	0.0040	0.0028
147	0.0069	0.0041	0.0028
148	0.0070	0.0041	0.0029
149	0.0071	0.0042	0.0029
150	0.0072	0.0042	0.0029

151	0.0073	0.0043	0.0030
152	0.0074	0.0044	0.0030
153	0.0075	0.0044	0.0031
154	0.0076	0.0045	0.0031
155	0.0078	0.0046	0.0032
156	0.0079	0.0046	0.0032
157	0.0080	0.0047	0.0033
158	0.0081	0.0048	0.0033
159	0.0083	0.0049	0.0034
160	0.0084	0.0050	0.0035
161	0.0086	0.0051	0.0035
162	0.0087	0.0052	0.0036
163	0.0090	0.0053	0.0037
164	0.0091	0.0054	0.0037
165	0.0094	0.0055	0.0038
166	0.0095	0.0056	0.0039
167	0.0098	0.0058	0.0040
168	0.0100	0.0059	0.0041
169	0.0104	0.0061	0.0042
170	0.0106	0.0062	0.0043
171	0.0109	0.0065	0.0045
172	0.0111	0.0066	0.0046
173	0.0116	0.0068	0.0048
174	0.0118	0.0070	0.0049
175	0.0124	0.0073	0.0051
176	0.0127	0.0075	0.0052
177	0.0133	0.0079	0.0055
178	0.0137	0.0081	0.0056
179	0.0145	0.0085	0.0059
180	0.0149	0.0088	0.0061
181	0.0159	0.0094	0.0065
182	0.0165	0.0097	0.0068
183	0.0178	0.0105	0.0073
184	0.0186	0.0110	0.0076
185	0.0156	0.0092	0.0064
186	0.0167	0.0098	0.0068
187	0.0193	0.0114	0.0079
188	0.0211	0.0125	0.0086
189	0.0262	0.0155	0.0108
190	0.0302	0.0178	0.0124
191	0.0459	0.0242	0.0217
192	0.0666	0.0242	0.0424
193	0.2879	0.0242	0.2638
194	0.0361	0.0213	0.0148
195	0.0233	0.0138	0.0096
196	0.0179	0.0105	0.0073
197	0.0195	0.0115	0.0080
198	0.0171	0.0101	0.0070
199	0.0154	0.0091	0.0063
200	0.0140	0.0083	0.0058
201	0.0130	0.0077	0.0053
202	0.0121	0.0071	0.0050
203	0.0114	0.0067	0.0047
204	0.0107	0.0063	0.0044
205	0.0101	0.0060	0.0042
206	0.0097	0.0057	0.0040
207	0.0092	0.0055	0.0038
208	0.0089	0.0052	0.0036
209	0.0085	0.0050	0.0035
210	0.0082	0.0049	0.0034
211	0.0079	0.0047	0.0033
212	0.0077	0.0045	0.0032
213	0.0075	0.0044	0.0031
214	0.0072	0.0043	0.0030
215	0.0070	0.0042	0.0029
216	0.0069	0.0040	0.0028
217	0.0068	0.0040	0.0028
218	0.0066	0.0039	0.0027
219	0.0065	0.0038	0.0027
220	0.0063	0.0037	0.0026
221	0.0062	0.0037	0.0025
222	0.0061	0.0036	0.0025
223	0.0059	0.0035	0.0024

224	0.0058	0.0034	0.0024
225	0.0057	0.0034	0.0023
226	0.0056	0.0033	0.0023
227	0.0055	0.0033	0.0023
228	0.0054	0.0032	0.0022
229	0.0053	0.0031	0.0022
230	0.0052	0.0031	0.0022
231	0.0052	0.0030	0.0021
232	0.0051	0.0030	0.0021
233	0.0050	0.0030	0.0021
234	0.0049	0.0029	0.0020
235	0.0049	0.0029	0.0020
236	0.0048	0.0028	0.0020
237	0.0047	0.0028	0.0019
238	0.0047	0.0028	0.0019
239	0.0046	0.0027	0.0019
240	0.0045	0.0027	0.0019
241	0.0045	0.0027	0.0018
242	0.0044	0.0026	0.0018
243	0.0044	0.0026	0.0018
244	0.0043	0.0026	0.0018
245	0.0043	0.0025	0.0018
246	0.0042	0.0025	0.0017
247	0.0042	0.0025	0.0017
248	0.0041	0.0024	0.0017
249	0.0041	0.0024	0.0017
250	0.0041	0.0024	0.0017
251	0.0040	0.0024	0.0016
252	0.0040	0.0023	0.0016
253	0.0039	0.0023	0.0016
254	0.0039	0.0023	0.0016
255	0.0039	0.0023	0.0016
256	0.0038	0.0023	0.0016
257	0.0038	0.0022	0.0015
258	0.0037	0.0022	0.0015
259	0.0037	0.0022	0.0015
260	0.0037	0.0022	0.0015
261	0.0036	0.0022	0.0015
262	0.0036	0.0021	0.0015
263	0.0036	0.0021	0.0015
264	0.0036	0.0021	0.0015
265	0.0035	0.0021	0.0014
266	0.0035	0.0021	0.0014
267	0.0035	0.0020	0.0014
268	0.0034	0.0020	0.0014
269	0.0034	0.0020	0.0014
270	0.0034	0.0020	0.0014
271	0.0034	0.0020	0.0014
272	0.0033	0.0020	0.0014
273	0.0033	0.0020	0.0014
274	0.0033	0.0019	0.0013
275	0.0033	0.0019	0.0013
276	0.0032	0.0019	0.0013
277	0.0032	0.0019	0.0013
278	0.0032	0.0019	0.0013
279	0.0032	0.0019	0.0013
280	0.0031	0.0019	0.0013
281	0.0031	0.0018	0.0013
282	0.0031	0.0018	0.0013
283	0.0031	0.0018	0.0013
284	0.0031	0.0018	0.0013
285	0.0030	0.0018	0.0012
286	0.0030	0.0018	0.0012
287	0.0030	0.0018	0.0012
288	0.0030	0.0018	0.0012

Total soil rain loss = 1.10(In)
Total effective rainfall = 1.04(In)
Peak flow rate in flood hydrograph = 54.14(CFS)

++
24 - H O U R S T O R M

```
                 R u n o f f     H y d r o g r a p h
      ----------------------------------------------------------------------
              Hydrograph in   5   Minute intervals ((CFS))

      ----------------------------------------------------------------------
Time(h+m) Volume Ac.Ft   Q(CFS)  0       15.0      30.0      45.0      60.0
-----------------------------------------------------------------------
  0+ 5       0.0002      0.02  Q         |         |         |         |
  0+10       0.0009      0.11  Q         |         |         |         |
  0+15       0.0026      0.25  Q         |         |         |         |
  0+20       0.0057      0.44  Q         |         |         |         |
  0+25       0.0099      0.62  Q         |         |         |         |
  0+30       0.0149      0.73  Q         |         |         |         |
  0+35       0.0205      0.80  Q         |         |         |         |
  0+40       0.0264      0.86  Q         |         |         |         |
  0+45       0.0325      0.90  Q         |         |         |         |
  0+50       0.0390      0.93  Q         |         |         |         |
  0+55       0.0456      0.96  Q         |         |         |         |
  1+ 0       0.0524      0.99  Q         |         |         |         |
  1+ 5       0.0593      1.01  Q         |         |         |         |
  1+10       0.0664      1.03  Q         |         |         |         |
  1+15       0.0736      1.05  Q         |         |         |         |
  1+20       0.0810      1.06  Q         |         |         |         |
  1+25       0.0884      1.08  Q         |         |         |         |
  1+30       0.0959      1.09  Q         |         |         |         |
  1+35       0.1035      1.10  Q         |         |         |         |
  1+40       0.1112      1.12  Q         |         |         |         |
  1+45       0.1190      1.13  Q         |         |         |         |
  1+50       0.1268      1.14  Q         |         |         |         |
  1+55       0.1347      1.15  Q         |         |         |         |
  2+ 0       0.1427      1.16  Q         |         |         |         |
  2+ 5       0.1507      1.17  Q         |         |         |         |
  2+10       0.1588      1.17  Q         |         |         |         |
  2+15       0.1670      1.18  QV        |         |         |         |
  2+20       0.1752      1.19  QV        |         |         |         |
  2+25       0.1834      1.20  QV        |         |         |         |
  2+30       0.1917      1.20  QV        |         |         |         |
  2+35       0.2000      1.21  QV        |         |         |         |
  2+40       0.2084      1.22  QV        |         |         |         |
  2+45       0.2169      1.22  QV        |         |         |         |
  2+50       0.2253      1.23  QV        |         |         |         |
  2+55       0.2338      1.24  QV        |         |         |         |
  3+ 0       0.2424      1.24  QV        |         |         |         |
  3+ 5       0.2509      1.24  QV        |         |         |         |
  3+10       0.2595      1.25  QV        |         |         |         |
  3+15       0.2682      1.25  QV        |         |         |         |
  3+20       0.2769      1.26  QV        |         |         |         |
  3+25       0.2856      1.26  QV        |         |         |         |
  3+30       0.2943      1.27  QV        |         |         |         |
  3+35       0.3031      1.27  QV        |         |         |         |
  3+40       0.3119      1.28  QV        |         |         |         |
  3+45       0.3207      1.28  QV        |         |         |         |
  3+50       0.3296      1.29  QV        |         |         |         |
  3+55       0.3385      1.29  Q V       |         |         |         |
  4+ 0       0.3474      1.30  Q V       |         |         |         |
  4+ 5       0.3564      1.30  Q V       |         |         |         |
  4+10       0.3654      1.31  Q V       |         |         |         |
  4+15       0.3744      1.31  Q V       |         |         |         |
  4+20       0.3835      1.32  Q V       |         |         |         |
  4+25       0.3927      1.32  Q V       |         |         |         |
  4+30       0.4018      1.33  Q V       |         |         |         |
  4+35       0.4110      1.34  Q V       |         |         |         |
  4+40       0.4203      1.34  Q V       |         |         |         |
  4+45       0.4295      1.35  Q V       |         |         |         |
  4+50       0.4388      1.35  Q V       |         |         |         |
  4+55       0.4482      1.36  Q V       |         |         |         |
  5+ 0       0.4576      1.36  Q V       |         |         |         |
  5+ 5       0.4670      1.37  Q V       |         |         |         |
  5+10       0.4765      1.38  Q V       |         |         |         |
  5+15       0.4860      1.38  Q V       |         |         |         |
  5+20       0.4956      1.39  Q V       |         |         |         |
  5+25       0.5052      1.39  Q  V      |         |         |         |
  5+30       0.5149      1.40  Q  V      |         |         |         |
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 5+35       0.5246      1.41  Q  V      |         |         |         |
 5+40       0.5343      1.41  Q  V      |         |         |         |
 5+45       0.5441      1.42  Q  V      |         |         |         |
 5+50       0.5539      1.43  Q  V      |         |         |         |
 5+55       0.5638      1.43  Q  V      |         |         |         |
 6+ 0       0.5737      1.44  Q  V      |         |         |         |
 6+ 5       0.5837      1.45  Q  V      |         |         |         |
 6+10       0.5937      1.45  Q  V      |         |         |         |
 6+15       0.6038      1.46  Q  V      |         |         |         |
 6+20       0.6139      1.47  Q  V      |         |         |         |
 6+25       0.6240      1.48  Q  V      |         |         |         |
 6+30       0.6343      1.48  Q  V      |         |         |         |
 6+35       0.6445      1.49  Q  V      |         |         |         |
 6+40       0.6548      1.50  Q  V      |         |         |         |
 6+45       0.6652      1.51  |Q  V     |         |         |         |
 6+50       0.6756      1.51  |Q  V     |         |         |         |
 6+55       0.6861      1.52  |Q  V     |         |         |         |
 7+ 0       0.6966      1.53  |Q  V     |         |         |         |
 7+ 5       0.7072      1.54  |Q  V     |         |         |         |
 7+10       0.7179      1.55  |Q  V     |         |         |         |
 7+15       0.7286      1.55  |Q  V     |         |         |         |
 7+20       0.7393      1.56  |Q  V     |         |         |         |
 7+25       0.7502      1.57  |Q  V     |         |         |         |
 7+30       0.7610      1.58  |Q  V     |         |         |         |
 7+35       0.7720      1.59  |Q  V     |         |         |         |
 7+40       0.7830      1.60  |Q  V     |         |         |         |
 7+45       0.7940      1.61  |Q  V     |         |         |         |
 7+50       0.8052      1.62  |Q  V     |         |         |         |
 7+55       0.8164      1.62  |Q  V     |         |         |         |
 8+ 0       0.8276      1.63  |Q   V    |         |         |         |
 8+ 5       0.8389      1.64  |Q   V    |         |         |         |
 8+10       0.8503      1.65  |Q   V    |         |         |         |
 8+15       0.8618      1.66  |Q   V    |         |         |         |
 8+20       0.8733      1.67  |Q   V    |         |         |         |
 8+25       0.8849      1.68  |Q   V    |         |         |         |
 8+30       0.8966      1.69  |Q   V    |         |         |         |
 8+35       0.9083      1.71  |Q   V    |         |         |         |
 8+40       0.9201      1.72  |Q   V    |         |         |         |
 8+45       0.9320      1.73  |Q   V    |         |         |         |
 8+50       0.9440      1.74  |Q   V    |         |         |         |
 8+55       0.9561      1.75  |Q   V    |         |         |         |
 9+ 0       0.9682      1.76  |Q   V    |         |         |         |
 9+ 5       0.9804      1.77  |Q   V    |         |         |         |
 9+10       0.9927      1.79  |Q    V   |         |         |         |
 9+15       1.0051      1.80  |Q    V   |         |         |         |
 9+20       1.0175      1.81  |Q    V   |         |         |         |
 9+25       1.0301      1.82  |Q    V   |         |         |         |
 9+30       1.0427      1.84  |Q    V   |         |         |         |
 9+35       1.0555      1.85  |Q    V   |         |         |         |
 9+40       1.0683      1.86  |Q    V   |         |         |         |
 9+45       1.0812      1.88  |Q    V   |         |         |         |
 9+50       1.0942      1.89  |Q    V   |         |         |         |
 9+55       1.1073      1.90  |Q    V   |         |         |         |
10+ 0       1.1205      1.92  |Q    V   |         |         |         |
10+ 5       1.1339      1.93  |Q    V   |         |         |         |
10+10       1.1473      1.95  |Q    V   |         |         |         |
10+15       1.1608      1.96  |Q     V  |         |         |         |
10+20       1.1744      1.98  |Q     V  |         |         |         |
10+25       1.1882      2.00  |Q     V  |         |         |         |
10+30       1.2020      2.01  |Q     V  |         |         |         |
10+35       1.2160      2.03  |Q     V  |         |         |         |
10+40       1.2301      2.05  |Q     V  |         |         |         |
10+45       1.2443      2.06  |Q     V  |         |         |         |
10+50       1.2586      2.08  |Q     V  |         |         |         |
10+55       1.2731      2.10  |Q     V  |         |         |         |
11+ 0       1.2877      2.12  |Q     V  |         |         |         |
11+ 5       1.3024      2.14  |Q     V  |         |         |         |
11+10       1.3173      2.16  |Q     V  |         |         |         |
11+15       1.3323      2.18  |Q      V |         |         |         |
11+20       1.3475      2.20  |Q      V |         |         |         |
11+25       1.3628      2.22  |Q      V |         |         |         |
11+30       1.3782      2.24  |Q      V |         |         |         |
11+35       1.3938      2.27  |Q      V |         |         |         |
```

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11+40       1.4096      2.29  |Q      V |         |         |         |
11+45       1.4255      2.31  |Q      V |         |         |         |
11+50       1.4416      2.34  |Q      V |         |         |         |
11+55       1.4579      2.36  |Q      V |         |         |         |
12+ 0       1.4744      2.39  |Q      V |         |         |         |
12+ 5       1.4910      2.42  |Q       V|         |         |         |
12+10       1.5078      2.44  |Q       V|         |         |         |
12+15       1.5248      2.46  |Q       V|         |         |         |
12+20       1.5419      2.48  |Q       V|         |         |         |
12+25       1.5591      2.51  |Q       V|         |         |         |
12+30       1.5766      2.53  |Q       V|         |         |         |
12+35       1.5942      2.56  |Q       V|         |         |         |
12+40       1.6121      2.60  |Q       V|         |         |         |
12+45       1.6302      2.63  |Q       V|         |         |         |
12+50       1.6486      2.66  |Q       V|         |         |         |
12+55       1.6672      2.70  |Q        V         |         |         |
13+ 0       1.6860      2.74  |Q        V         |         |         |
13+ 5       1.7051      2.78  |Q        V         |         |         |
13+10       1.7245      2.82  |Q        V         |         |         |
13+15       1.7442      2.86  |Q        V         |         |         |
13+20       1.7642      2.91  |Q        V         |         |         |
13+25       1.7846      2.95  |Q        V         |         |         |
13+30       1.8053      3.00  | Q       V         |         |         |
13+35       1.8263      3.05  | Q       |V        |         |         |
13+40       1.8477      3.11  | Q       |V        |         |         |
13+45       1.8695      3.16  | Q       |V        |         |         |
13+50       1.8917      3.22  | Q       |V        |         |         |
13+55       1.9143      3.29  | Q       |V        |         |         |
14+ 0       1.9374      3.35  | Q       |V        |         |         |
14+ 5       1.9610      3.42  | Q       |V        |         |         |
14+10       1.9851      3.50  | Q       |V        |         |         |
14+15       2.0097      3.58  | Q       | V       |         |         |
14+20       2.0350      3.67  | Q       | V       |         |         |
14+25       2.0609      3.76  | Q       | V       |         |         |
14+30       2.0875      3.86  | Q       | V       |         |         |
14+35       2.1148      3.96  | Q       | V       |         |         |
14+40       2.1429      4.08  | Q       | V       |         |         |
14+45       2.1718      4.20  | Q       |  V      |         |         |
14+50       2.2016      4.33  | Q       |  V      |         |         |
14+55       2.2323      4.47  | Q       |  V      |         |         |
15+ 0       2.2642      4.62  |  Q      |  V      |         |         |
15+ 5       2.2972      4.79  |  Q      |  V      |         |         |
15+10       2.3315      4.98  |  Q      |   V     |         |         |
15+15       2.3673      5.19  |  Q      |   V     |         |         |
15+20       2.4046      5.43  |  Q      |   V     |         |         |
15+25       2.4436      5.66  |  Q      |   V     |         |         |
15+30       2.4838      5.84  |  Q      |    V    |         |         |
15+35       2.5249      5.96  |  Q      |    V    |         |         |
15+40       2.5668      6.08  |   Q     |    V    |         |         |
15+45       2.6102      6.30  |   Q     |    V    |         |         |
15+50       2.6568      6.77  |   Q     |     V   |         |         |
15+55       2.7093      7.62  |    Q    |     V   |         |         |
16+ 0       2.7742      9.43  |     Q   |     V   |         |         |
16+ 5       2.8924     17.16  |         |Q     V  |         |         |
16+10       3.1079     31.29  |         |       V Q         |         |
16+15       3.4223     45.65  |         |         V         Q         |
16+20       3.7951     54.14  |         |         | V       |     Q   |
16+25       4.1347     49.30  |         |         |   V     | Q       |
16+30       4.3728     34.58  |         |         |  Q  V   |         |
16+35       4.5446     24.94  |         |     Q   |      V  |         |
16+40       4.6759     19.07  |         | Q       |       V |         |
16+45       4.7885     16.34  |         Q         |       V |         |
16+50       4.8871     14.32  |        Q|         |        V|         |
16+55       4.9751     12.77  |       Q |         |         V         |
17+ 0       5.0545     11.54  |      Q  |         |         V         |
17+ 5       5.1254     10.29  |     Q   |         |         V         |
17+10       5.1899      9.37  |     Q   |         |         |V        |
17+15       5.2505      8.80  |    Q    |         |         |V        |
17+20       5.3044      7.83  |    Q    |         |         | V       |
17+25       5.3551      7.35  |   Q     |         |         | V       |
17+30       5.4007      6.62  |   Q     |         |         | V       |
17+35       5.4441      6.31  |   Q     |         |         | V       |
17+40       5.4856      6.03  |   Q     |         |         |  V      |
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17+45       5.5254      5.77  |  Q      |         |         |  V      |
17+50       5.5617      5.27  |  Q      |         |         |  V      |
17+55       5.5961      5.00  |  Q      |         |         |  V      |
18+ 0       5.6285      4.69  |  Q      |         |         |   V     |
18+ 5       5.6593      4.48  | Q       |         |         |   V     |
18+10       5.6883      4.20  | Q       |         |         |   V     |
18+15       5.7159      4.01  | Q       |         |         |   V     |
18+20       5.7419      3.77  | Q       |         |         |   V     |
18+25       5.7667      3.60  | Q       |         |         |   V     |
18+30       5.7908      3.51  | Q       |         |         |    V    |
18+35       5.8145      3.43  | Q       |         |         |    V    |
18+40       5.8374      3.34  | Q       |         |         |    V    |
18+45       5.8596      3.21  | Q       |         |         |    V    |
18+50       5.8791      2.84  |Q        |         |         |    V    |
18+55       5.8961      2.47  |Q        |         |         |    V    |
19+ 0       5.9126      2.40  |Q        |         |         |    V    |
19+ 5       5.9287      2.34  |Q        |         |         |    V    |
19+10       5.9445      2.29  |Q        |         |         |    V    |
19+15       5.9599      2.24  |Q        |         |         |     V   |
19+20       5.9749      2.19  |Q        |         |         |     V   |
19+25       5.9897      2.15  |Q        |         |         |     V   |
19+30       6.0042      2.10  |Q        |         |         |     V   |
19+35       6.0184      2.07  |Q        |         |         |     V   |
19+40       6.0324      2.03  |Q        |         |         |     V   |
19+45       6.0461      1.99  |Q        |         |         |     V   |
19+50       6.0597      1.96  |Q        |         |         |     V   |
19+55       6.0729      1.93  |Q        |         |         |     V   |
20+ 0       6.0860      1.90  |Q        |         |         |     V   |
20+ 5       6.0989      1.87  |Q        |         |         |     V   |
20+10       6.1116      1.84  |Q        |         |         |     V   |
20+15       6.1241      1.82  |Q        |         |         |      V  |
20+20       6.1364      1.79  |Q        |         |         |      V  |
20+25       6.1486      1.77  |Q        |         |         |      V  |
20+30       6.1606      1.74  |Q        |         |         |      V  |
20+35       6.1725      1.72  |Q        |         |         |      V  |
20+40       6.1842      1.70  |Q        |         |         |      V  |
20+45       6.1957      1.68  |Q        |         |         |      V  |
20+50       6.2071      1.66  |Q        |         |         |      V  |
20+55       6.2184      1.64  |Q        |         |         |      V  |
21+ 0       6.2296      1.62  |Q        |         |         |      V  |
21+ 5       6.2406      1.60  |Q        |         |         |      V  |
21+10       6.2515      1.58  |Q        |         |         |      V  |
21+15       6.2622      1.56  |Q        |         |         |      V  |
21+20       6.2729      1.55  |Q        |         |         |      V  |
21+25       6.2834      1.53  |Q        |         |         |      V  |
21+30       6.2938      1.51  |Q        |         |         |       V |
21+35       6.3042      1.50  Q         |         |         |       V |
21+40       6.3144      1.48  Q         |         |         |       V |
21+45       6.3245      1.47  Q         |         |         |       V |
21+50       6.3345      1.45  Q         |         |         |       V |
21+55       6.3444      1.44  Q         |         |         |       V |
22+ 0       6.3543      1.43  Q         |         |         |       V |
22+ 5       6.3640      1.41  Q         |         |         |       V |
22+10       6.3737      1.40  Q         |         |         |       V |
22+15       6.3832      1.39  Q         |         |         |       V |
22+20       6.3927      1.38  Q         |         |         |       V |
22+25       6.4021      1.36  Q         |         |         |       V |
22+30       6.4114      1.35  Q         |         |         |       V |
22+35       6.4206      1.34  Q         |         |         |       V |
22+40       6.4298      1.33  Q         |         |         |       V |
22+45       6.4389      1.32  Q         |         |         |       V |
22+50       6.4479      1.31  Q         |         |         |       V |
22+55       6.4568      1.30  Q         |         |         |        V|
23+ 0       6.4657      1.29  Q         |         |         |        V|
23+ 5       6.4745      1.28  Q         |         |         |        V|
23+10       6.4832      1.27  Q         |         |         |        V|
23+15       6.4919      1.26  Q         |         |         |        V|
23+20       6.5005      1.25  Q         |         |         |        V|
23+25       6.5090      1.24  Q         |         |         |        V|
23+30       6.5175      1.23  Q         |         |         |        V|
23+35       6.5259      1.22  Q         |         |         |        V|
23+40       6.5342      1.21  Q         |         |         |        V|
23+45       6.5425      1.20  Q         |         |         |        V|
```

23+50	6.5507	1.20	Q	|	|	|	V|
23+55	6.5589	1.19	Q	|	|	|	V|
24+ 0	6.5670	1.18	Q	|	|	|	V|
24+ 5	6.5749	1.15	Q	|	|	|	V|
24+10	6.5822	1.06	Q	|	|	|	V|
24+15	6.5884	0.91	Q	|	|	|	V|
24+20	6.5933	0.71	Q	|	|	|	V|
24+25	6.5970	0.53	Q	|	|	|	V|
24+30	6.5999	0.42	Q	|	|	|	V|
24+35	6.6022	0.34	Q	|	|	|	V|
24+40	6.6042	0.29	Q	|	|	|	V|
24+45	6.6060	0.25	Q	|	|	|	V|
24+50	6.6075	0.22	Q	|	|	|	V|
24+55	6.6088	0.19	Q	|	|	|	V|
25+ 0	6.6099	0.17	Q	|	|	|	V|
25+ 5	6.6109	0.15	Q	|	|	|	V|
25+10	6.6118	0.13	Q	|	|	|	V|
25+15	6.6126	0.11	Q	|	|	|	V|
25+20	6.6133	0.10	Q	|	|	|	V|
25+25	6.6139	0.09	Q	|	|	|	V|
25+30	6.6144	0.08	Q	|	|	|	V|
25+35	6.6148	0.07	Q	|	|	|	V|
25+40	6.6153	0.06	Q	|	|	|	V|
25+45	6.6156	0.05	Q	|	|	|	V|
25+50	6.6159	0.04	Q	|	|	|	V|
25+55	6.6162	0.04	Q	|	|	|	V|
26+ 0	6.6164	0.03	Q	|	|	|	V|
26+ 5	6.6166	0.03	Q	|	|	|	V|
26+10	6.6167	0.02	Q	|	|	|	V|
26+15	6.6168	0.02	Q	|	|	|	V|
26+20	6.6169	0.02	Q	|	|	|	V|
26+25	6.6170	0.01	Q	|	|	|	V|
26+30	6.6171	0.01	Q	|	|	|	V|
26+35	6.6171	0.01	Q	|	|	|	V|
26+40	6.6172	0.00	Q	|	|	|	V|
26+45	6.6172	0.00	Q	|	|	|	V|

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

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                Study date  11/01/22

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

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


Program License Serial Number 4009

---------------------------------------------------------------------
Quarry Complex Site
Unit Hydrogragh Method
Post-Development Condition
10-year, 24-hours Storm
--------------------------------------------------------------------

        Storm Event Year = 10

        Antecedent Moisture Condition = 2

 English (in-lb) Input Units Used

 English Rainfall Data (Inches) Input Values Used

 English Units used in output format




Area averaged rainfall intensity isohyetal data:
        Sub-Area        Duration        Isohyetal
        (Ac.)            (hours)         (In)
Rainfall data for year 10
            76.34            1           0.61
--------------------------------------------------------------------
Rainfall data for year 10
            76.34            6           1.23
--------------------------------------------------------------------
Rainfall data for year 10
            76.34           24           2.14
--------------------------------------------------------------------
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++

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


SCS curve  SCS curve     Area     Area     Fp(Fig C6)    Ap      Fm
No.(AMCII) NO.(AMC 2)    (Ac.)    Fraction     (In/Hr)  (dec.)   (In/Hr)
 66.3      66.3         76.34      1.000     0.589    0.100    0.059

Area-averaged adjusted loss rate Fm (In/Hr) =  0.059

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

Area       Area          SCS CN    SCS CN      S     Pervious
 (Ac.)      Fract         (AMC2)    (AMC2)           Yield Fr
     7.63   0.100         66.3      66.3       5.08     0.095
    68.71   0.900         98.0      98.0       0.20     0.894

Area-averaged catchment yield fraction, Y =  0.814
Area-averaged low loss fraction, Yb =  0.186
User entry of time of concentration  =   0.340 (hours)
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Watershed area =      76.34(Ac.)
Catchment Lag time =   0.272 hours
```

```
Unit interval =   5.000 minutes
Unit interval percentage of lag time = 30.6373
Hydrograph baseflow =     0.00(CFS)
Average maximum watershed loss rate(Fm) =  0.059(In/Hr)
Average low loss rate fraction (Yb) = 0.186 (decimal)
VALLEY UNDEVELOPED S-Graph Selected
Computed peak 5-minute rainfall =  0.289(In)
Computed peak 30-minute rainfall =  0.495(In)
Specified peak 1-hour rainfall =  0.609(In)
Computed peak 3-hour rainfall =  0.937(In)
Specified peak 6-hour rainfall =  1.230(In)
Specified peak 24-hour rainfall =  2.140(In)


Rainfall depth area reduction factors:
Using a total area of      76.34(Ac.) (Ref: fig. E-4)

5-minute factor = 0.996     Adjusted rainfall =  0.288(In)
30-minute factor = 0.996    Adjusted rainfall =  0.493(In)
1-hour factor = 0.996       Adjusted rainfall =  0.607(In)
3-hour factor = 1.000       Adjusted rainfall =  0.937(In)
6-hour factor = 1.000       Adjusted rainfall =  1.230(In)
24-hour factor = 1.000      Adjusted rainfall =  2.140(In)
---------------------------------------------------------------------

                        U n i t  H y d r o g r a p h
+++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Interval          'S' Graph         Unit Hydrograph
Number            Mean values           ((CFS))
---------------------------------------------------------------------
                (K =       923.24 (CFS))

  1               2.984                27.545
  2              14.030               101.989
  3              33.224               177.200
  4              53.493               187.135
  5              65.956               115.066
  6              73.084                65.808
  7              77.777                43.329
  8              81.442                33.829
  9              84.412                27.421
 10              86.848                22.491
 11              88.801                18.036
 12              90.558                16.221
 13              91.950                12.852
 14              93.135                10.933
 15              94.113                 9.029
 16              95.046                 8.620
 17              95.909                 7.962
 18              96.595                 6.337
 19              97.202                 5.604
 20              97.743                 4.993
 21              98.193                 4.153
 22              98.584                 3.612
 23              98.893                 2.855
 24              99.200                 2.829
 25              99.506                 2.829
 26              99.813                 2.829
 27             100.000                 1.731
---------------------------------------------------------------------
Peak Unit   Adjusted mass rainfall  Unit rainfall
Number              (In)                (In)
  1             0.2879              0.2879
  2             0.3545              0.0666
  3             0.4004              0.0459
  4             0.4364              0.0361
  5             0.4667              0.0302
  6             0.4929              0.0262
  7             0.5162              0.0233
  8             0.5373              0.0211
  9             0.5566              0.0193
 10             0.5745              0.0179
 11             0.5912              0.0167
```

12	0.6068	0.0156
13	0.6263	0.0195
14	0.6449	0.0186
15	0.6628	0.0178
16	0.6799	0.0171
17	0.6964	0.0165
18	0.7123	0.0159
19	0.7277	0.0154
20	0.7426	0.0149
21	0.7570	0.0145
22	0.7711	0.0140
23	0.7847	0.0137
24	0.7980	0.0133
25	0.8110	0.0130
26	0.8237	0.0127
27	0.8361	0.0124
28	0.8482	0.0121
29	0.8600	0.0118
30	0.8716	0.0116
31	0.8830	0.0114
32	0.8941	0.0111
33	0.9051	0.0109
34	0.9158	0.0107
35	0.9263	0.0106
36	0.9367	0.0104
37	0.9468	0.0101
38	0.9568	0.0100
39	0.9666	0.0098
40	0.9763	0.0097
41	0.9858	0.0095
42	0.9952	0.0094
43	1.0044	0.0092
44	1.0135	0.0091
45	1.0225	0.0090
46	1.0313	0.0089
47	1.0401	0.0087
48	1.0487	0.0086
49	1.0573	0.0085
50	1.0657	0.0084
51	1.0740	0.0083
52	1.0822	0.0082
53	1.0903	0.0081
54	1.0984	0.0080
55	1.1063	0.0079
56	1.1142	0.0079
57	1.1219	0.0078
58	1.1296	0.0077
59	1.1372	0.0076
60	1.1448	0.0075
61	1.1522	0.0075
62	1.1596	0.0074
63	1.1669	0.0073
64	1.1741	0.0072
65	1.1813	0.0072
66	1.1884	0.0071
67	1.1954	0.0070
68	1.2024	0.0070
69	1.2093	0.0069
70	1.2162	0.0069
71	1.2230	0.0068
72	1.2297	0.0067
73	1.2365	0.0068
74	1.2432	0.0067
75	1.2499	0.0067
76	1.2566	0.0066
77	1.2631	0.0066
78	1.2697	0.0065
79	1.2762	0.0065
80	1.2826	0.0064
81	1.2890	0.0064
82	1.2953	0.0063
83	1.3016	0.0063
84	1.3078	0.0062

85	1.3140	0.0062
86	1.3202	0.0062
87	1.3263	0.0061
88	1.3324	0.0061
89	1.3384	0.0060
90	1.3444	0.0060
91	1.3503	0.0059
92	1.3562	0.0059
93	1.3621	0.0059
94	1.3680	0.0058
95	1.3737	0.0058
96	1.3795	0.0058
97	1.3852	0.0057
98	1.3909	0.0057
99	1.3966	0.0057
100	1.4022	0.0056
101	1.4078	0.0056
102	1.4133	0.0056
103	1.4189	0.0055
104	1.4243	0.0055
105	1.4298	0.0055
106	1.4352	0.0054
107	1.4406	0.0054
108	1.4460	0.0054
109	1.4513	0.0053
110	1.4566	0.0053
111	1.4619	0.0053
112	1.4672	0.0052
113	1.4724	0.0052
114	1.4776	0.0052
115	1.4827	0.0052
116	1.4879	0.0051
117	1.4930	0.0051
118	1.4981	0.0051
119	1.5031	0.0051
120	1.5082	0.0050
121	1.5132	0.0050
122	1.5182	0.0050
123	1.5231	0.0050
124	1.5281	0.0049
125	1.5330	0.0049
126	1.5379	0.0049
127	1.5427	0.0049
128	1.5476	0.0048
129	1.5524	0.0048
130	1.5572	0.0048
131	1.5620	0.0048
132	1.5667	0.0048
133	1.5714	0.0047
134	1.5761	0.0047
135	1.5808	0.0047
136	1.5855	0.0047
137	1.5902	0.0046
138	1.5948	0.0046
139	1.5994	0.0046
140	1.6040	0.0046
141	1.6085	0.0046
142	1.6131	0.0045
143	1.6176	0.0045
144	1.6221	0.0045
145	1.6266	0.0045
146	1.6311	0.0045
147	1.6356	0.0045
148	1.6400	0.0044
149	1.6444	0.0044
150	1.6488	0.0044
151	1.6532	0.0044
152	1.6576	0.0044
153	1.6619	0.0043
154	1.6662	0.0043
155	1.6706	0.0043
156	1.6749	0.0043
157	1.6791	0.0043

158	1.6834	0.0043
159	1.6877	0.0042
160	1.6919	0.0042
161	1.6961	0.0042
162	1.7003	0.0042
163	1.7045	0.0042
164	1.7087	0.0042
165	1.7128	0.0042
166	1.7170	0.0041
167	1.7211	0.0041
168	1.7252	0.0041
169	1.7293	0.0041
170	1.7334	0.0041
171	1.7374	0.0041
172	1.7415	0.0041
173	1.7455	0.0040
174	1.7496	0.0040
175	1.7536	0.0040
176	1.7576	0.0040
177	1.7615	0.0040
178	1.7655	0.0040
179	1.7695	0.0040
180	1.7734	0.0039
181	1.7773	0.0039
182	1.7813	0.0039
183	1.7852	0.0039
184	1.7891	0.0039
185	1.7929	0.0039
186	1.7968	0.0039
187	1.8007	0.0039
188	1.8045	0.0038
189	1.8083	0.0038
190	1.8121	0.0038
191	1.8159	0.0038
192	1.8197	0.0038
193	1.8235	0.0038
194	1.8273	0.0038
195	1.8311	0.0038
196	1.8348	0.0037
197	1.8385	0.0037
198	1.8423	0.0037
199	1.8460	0.0037
200	1.8497	0.0037
201	1.8534	0.0037
202	1.8570	0.0037
203	1.8607	0.0037
204	1.8644	0.0037
205	1.8680	0.0036
206	1.8716	0.0036
207	1.8753	0.0036
208	1.8789	0.0036
209	1.8825	0.0036
210	1.8861	0.0036
211	1.8897	0.0036
212	1.8932	0.0036
213	1.8968	0.0036
214	1.9004	0.0036
215	1.9039	0.0035
216	1.9074	0.0035
217	1.9110	0.0035
218	1.9145	0.0035
219	1.9180	0.0035
220	1.9215	0.0035
221	1.9250	0.0035
222	1.9284	0.0035
223	1.9319	0.0035
224	1.9354	0.0035
225	1.9388	0.0034
226	1.9422	0.0034
227	1.9457	0.0034
228	1.9491	0.0034
229	1.9525	0.0034
230	1.9559	0.0034

231	1.9593	0.0034
232	1.9627	0.0034
233	1.9661	0.0034
234	1.9694	0.0034
235	1.9728	0.0034
236	1.9761	0.0034
237	1.9795	0.0033
238	1.9828	0.0033
239	1.9861	0.0033
240	1.9895	0.0033
241	1.9928	0.0033
242	1.9961	0.0033
243	1.9994	0.0033
244	2.0026	0.0033
245	2.0059	0.0033
246	2.0092	0.0033
247	2.0124	0.0033
248	2.0157	0.0033
249	2.0189	0.0032
250	2.0222	0.0032
251	2.0254	0.0032
252	2.0286	0.0032
253	2.0318	0.0032
254	2.0350	0.0032
255	2.0382	0.0032
256	2.0414	0.0032
257	2.0446	0.0032
258	2.0478	0.0032
259	2.0509	0.0032
260	2.0541	0.0032
261	2.0573	0.0032
262	2.0604	0.0031
263	2.0635	0.0031
264	2.0667	0.0031
265	2.0698	0.0031
266	2.0729	0.0031
267	2.0760	0.0031
268	2.0791	0.0031
269	2.0822	0.0031
270	2.0853	0.0031
271	2.0884	0.0031
272	2.0915	0.0031
273	2.0945	0.0031
274	2.0976	0.0031
275	2.1007	0.0031
276	2.1037	0.0030
277	2.1068	0.0030
278	2.1098	0.0030
279	2.1128	0.0030
280	2.1158	0.0030
281	2.1189	0.0030
282	2.1219	0.0030
283	2.1249	0.0030
284	2.1279	0.0030
285	2.1309	0.0030
286	2.1338	0.0030
287	2.1368	0.0030
288	2.1398	0.0030

Unit Period (number)	Unit Rainfall (In)	Unit Soil-Loss (In)	Effective Rainfall (In)
1	0.0030	0.0006	0.0024
2	0.0030	0.0006	0.0024
3	0.0030	0.0006	0.0024
4	0.0030	0.0006	0.0024
5	0.0030	0.0006	0.0025
6	0.0030	0.0006	0.0025
7	0.0030	0.0006	0.0025
8	0.0030	0.0006	0.0025
9	0.0030	0.0006	0.0025
10	0.0031	0.0006	0.0025

11	0.0031	0.0006	0.0025
12	0.0031	0.0006	0.0025
13	0.0031	0.0006	0.0025
14	0.0031	0.0006	0.0025
15	0.0031	0.0006	0.0025
16	0.0031	0.0006	0.0025
17	0.0031	0.0006	0.0025
18	0.0031	0.0006	0.0026
19	0.0032	0.0006	0.0026
20	0.0032	0.0006	0.0026
21	0.0032	0.0006	0.0026
22	0.0032	0.0006	0.0026
23	0.0032	0.0006	0.0026
24	0.0032	0.0006	0.0026
25	0.0032	0.0006	0.0026
26	0.0032	0.0006	0.0026
27	0.0032	0.0006	0.0026
28	0.0033	0.0006	0.0026
29	0.0033	0.0006	0.0027
30	0.0033	0.0006	0.0027
31	0.0033	0.0006	0.0027
32	0.0033	0.0006	0.0027
33	0.0033	0.0006	0.0027
34	0.0033	0.0006	0.0027
35	0.0033	0.0006	0.0027
36	0.0034	0.0006	0.0027
37	0.0034	0.0006	0.0027
38	0.0034	0.0006	0.0027
39	0.0034	0.0006	0.0028
40	0.0034	0.0006	0.0028
41	0.0034	0.0006	0.0028
42	0.0034	0.0006	0.0028
43	0.0034	0.0006	0.0028
44	0.0035	0.0006	0.0028
45	0.0035	0.0006	0.0028
46	0.0035	0.0006	0.0028
47	0.0035	0.0007	0.0029
48	0.0035	0.0007	0.0029
49	0.0035	0.0007	0.0029
50	0.0035	0.0007	0.0029
51	0.0036	0.0007	0.0029
52	0.0036	0.0007	0.0029
53	0.0036	0.0007	0.0029
54	0.0036	0.0007	0.0029
55	0.0036	0.0007	0.0030
56	0.0036	0.0007	0.0030
57	0.0037	0.0007	0.0030
58	0.0037	0.0007	0.0030
59	0.0037	0.0007	0.0030
60	0.0037	0.0007	0.0030
61	0.0037	0.0007	0.0030
62	0.0037	0.0007	0.0030
63	0.0038	0.0007	0.0031
64	0.0038	0.0007	0.0031
65	0.0038	0.0007	0.0031
66	0.0038	0.0007	0.0031
67	0.0038	0.0007	0.0031
68	0.0038	0.0007	0.0031
69	0.0039	0.0007	0.0031
70	0.0039	0.0007	0.0032
71	0.0039	0.0007	0.0032
72	0.0039	0.0007	0.0032
73	0.0039	0.0007	0.0032
74	0.0040	0.0007	0.0032
75	0.0040	0.0007	0.0032
76	0.0040	0.0007	0.0033
77	0.0040	0.0007	0.0033
78	0.0040	0.0008	0.0033
79	0.0041	0.0008	0.0033
80	0.0041	0.0008	0.0033
81	0.0041	0.0008	0.0033
82	0.0041	0.0008	0.0034
83	0.0042	0.0008	0.0034

84	0.0042	0.0008	0.0034
85	0.0042	0.0008	0.0034
86	0.0042	0.0008	0.0034
87	0.0042	0.0008	0.0035
88	0.0043	0.0008	0.0035
89	0.0043	0.0008	0.0035
90	0.0043	0.0008	0.0035
91	0.0043	0.0008	0.0035
92	0.0044	0.0008	0.0036
93	0.0044	0.0008	0.0036
94	0.0044	0.0008	0.0036
95	0.0045	0.0008	0.0036
96	0.0045	0.0008	0.0036
97	0.0045	0.0008	0.0037
98	0.0045	0.0008	0.0037
99	0.0046	0.0008	0.0037
100	0.0046	0.0009	0.0037
101	0.0046	0.0009	0.0038
102	0.0046	0.0009	0.0038
103	0.0047	0.0009	0.0038
104	0.0047	0.0009	0.0038
105	0.0048	0.0009	0.0039
106	0.0048	0.0009	0.0039
107	0.0048	0.0009	0.0039
108	0.0048	0.0009	0.0039
109	0.0049	0.0009	0.0040
110	0.0049	0.0009	0.0040
111	0.0050	0.0009	0.0040
112	0.0050	0.0009	0.0041
113	0.0050	0.0009	0.0041
114	0.0051	0.0009	0.0041
115	0.0051	0.0010	0.0042
116	0.0051	0.0010	0.0042
117	0.0052	0.0010	0.0042
118	0.0052	0.0010	0.0042
119	0.0053	0.0010	0.0043
120	0.0053	0.0010	0.0043
121	0.0054	0.0010	0.0044
122	0.0054	0.0010	0.0044
123	0.0055	0.0010	0.0044
124	0.0055	0.0010	0.0045
125	0.0056	0.0010	0.0045
126	0.0056	0.0010	0.0045
127	0.0057	0.0011	0.0046
128	0.0057	0.0011	0.0046
129	0.0058	0.0011	0.0047
130	0.0058	0.0011	0.0047
131	0.0059	0.0011	0.0048
132	0.0059	0.0011	0.0048
133	0.0060	0.0011	0.0049
134	0.0060	0.0011	0.0049
135	0.0061	0.0011	0.0050
136	0.0062	0.0011	0.0050
137	0.0062	0.0012	0.0051
138	0.0063	0.0012	0.0051
139	0.0064	0.0012	0.0052
140	0.0064	0.0012	0.0052
141	0.0065	0.0012	0.0053
142	0.0066	0.0012	0.0054
143	0.0067	0.0012	0.0054
144	0.0067	0.0013	0.0055
145	0.0067	0.0013	0.0055
146	0.0068	0.0013	0.0055
147	0.0069	0.0013	0.0056
148	0.0070	0.0013	0.0057
149	0.0071	0.0013	0.0058
150	0.0072	0.0013	0.0058
151	0.0073	0.0014	0.0059
152	0.0074	0.0014	0.0060
153	0.0075	0.0014	0.0061
154	0.0076	0.0014	0.0062
155	0.0078	0.0014	0.0063
156	0.0079	0.0015	0.0064

157	0.0080	0.0015	0.0065
158	0.0081	0.0015	0.0066
159	0.0083	0.0015	0.0068
160	0.0084	0.0016	0.0069
161	0.0086	0.0016	0.0070
162	0.0087	0.0016	0.0071
163	0.0090	0.0017	0.0073
164	0.0091	0.0017	0.0074
165	0.0094	0.0017	0.0076
166	0.0095	0.0018	0.0077
167	0.0098	0.0018	0.0080
168	0.0100	0.0019	0.0081
169	0.0104	0.0019	0.0084
170	0.0106	0.0020	0.0086
171	0.0109	0.0020	0.0089
172	0.0111	0.0021	0.0091
173	0.0116	0.0022	0.0094
174	0.0118	0.0022	0.0096
175	0.0124	0.0023	0.0101
176	0.0127	0.0024	0.0103
177	0.0133	0.0025	0.0108
178	0.0137	0.0025	0.0111
179	0.0145	0.0027	0.0118
180	0.0149	0.0028	0.0121
181	0.0159	0.0030	0.0130
182	0.0165	0.0031	0.0134
183	0.0178	0.0033	0.0145
184	0.0186	0.0035	0.0152
185	0.0156	0.0029	0.0127
186	0.0167	0.0031	0.0136
187	0.0193	0.0036	0.0157
188	0.0211	0.0039	0.0172
189	0.0262	0.0049	0.0214
190	0.0302	0.0049	0.0253
191	0.0459	0.0049	0.0409
192	0.0666	0.0049	0.0616
193	0.2879	0.0049	0.2830
194	0.0361	0.0049	0.0312
195	0.0233	0.0043	0.0190
196	0.0179	0.0033	0.0146
197	0.0195	0.0036	0.0159
198	0.0171	0.0032	0.0139
199	0.0154	0.0029	0.0125
200	0.0140	0.0026	0.0114
201	0.0130	0.0024	0.0106
202	0.0121	0.0022	0.0099
203	0.0114	0.0021	0.0093
204	0.0107	0.0020	0.0087
205	0.0101	0.0019	0.0082
206	0.0097	0.0018	0.0079
207	0.0092	0.0017	0.0075
208	0.0089	0.0016	0.0072
209	0.0085	0.0016	0.0069
210	0.0082	0.0015	0.0067
211	0.0079	0.0015	0.0065
212	0.0077	0.0014	0.0063
213	0.0075	0.0014	0.0061
214	0.0072	0.0013	0.0059
215	0.0070	0.0013	0.0057
216	0.0069	0.0013	0.0056
217	0.0068	0.0013	0.0055
218	0.0066	0.0012	0.0054
219	0.0065	0.0012	0.0053
220	0.0063	0.0012	0.0052
221	0.0062	0.0012	0.0050
222	0.0061	0.0011	0.0049
223	0.0059	0.0011	0.0048
224	0.0058	0.0011	0.0047
225	0.0057	0.0011	0.0047
226	0.0056	0.0010	0.0046
227	0.0055	0.0010	0.0045
228	0.0054	0.0010	0.0044
229	0.0053	0.0010	0.0043

230	0.0052	0.0010	0.0043
231	0.0052	0.0010	0.0042
232	0.0051	0.0009	0.0041
233	0.0050	0.0009	0.0041
234	0.0049	0.0009	0.0040
235	0.0049	0.0009	0.0040
236	0.0048	0.0009	0.0039
237	0.0047	0.0009	0.0039
238	0.0047	0.0009	0.0038
239	0.0046	0.0009	0.0038
240	0.0045	0.0008	0.0037
241	0.0045	0.0008	0.0037
242	0.0044	0.0008	0.0036
243	0.0044	0.0008	0.0036
244	0.0043	0.0008	0.0035
245	0.0043	0.0008	0.0035
246	0.0042	0.0008	0.0034
247	0.0042	0.0008	0.0034
248	0.0041	0.0008	0.0034
249	0.0041	0.0008	0.0033
250	0.0041	0.0008	0.0033
251	0.0040	0.0007	0.0033
252	0.0040	0.0007	0.0032
253	0.0039	0.0007	0.0032
254	0.0039	0.0007	0.0032
255	0.0039	0.0007	0.0031
256	0.0038	0.0007	0.0031
257	0.0038	0.0007	0.0031
258	0.0037	0.0007	0.0030
259	0.0037	0.0007	0.0030
260	0.0037	0.0007	0.0030
261	0.0036	0.0007	0.0030
262	0.0036	0.0007	0.0029
263	0.0036	0.0007	0.0029
264	0.0036	0.0007	0.0029
265	0.0035	0.0007	0.0029
266	0.0035	0.0006	0.0028
267	0.0035	0.0006	0.0028
268	0.0034	0.0006	0.0028
269	0.0034	0.0006	0.0028
270	0.0034	0.0006	0.0028
271	0.0034	0.0006	0.0027
272	0.0033	0.0006	0.0027
273	0.0033	0.0006	0.0027
274	0.0033	0.0006	0.0027
275	0.0033	0.0006	0.0027
276	0.0032	0.0006	0.0026
277	0.0032	0.0006	0.0026
278	0.0032	0.0006	0.0026
279	0.0032	0.0006	0.0026
280	0.0031	0.0006	0.0026
281	0.0031	0.0006	0.0025
282	0.0031	0.0006	0.0025
283	0.0031	0.0006	0.0025
284	0.0031	0.0006	0.0025
285	0.0030	0.0006	0.0025
286	0.0030	0.0006	0.0025
287	0.0030	0.0006	0.0024
288	0.0030	0.0006	0.0024

```
--------------------------------------------------------------------
--------------------------------------------------------------------
Total soil rain loss =      0.34(In)
Total effective rainfall =      1.80(In)
Peak flow rate in flood hydrograph =     75.51(CFS)
---------------------------------------------------------------------
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
                    24 - H O U R   S T O R M
               R u n o f f     H y d r o g r a p h
--------------------------------------------------------------------
            Hydrograph in   5   Minute intervals ((CFS))

--------------------------------------------------------------------
Time(h+m) Volume Ac.Ft   Q(CFS)  0       20.0      40.0      60.0      80.0
```

```
--------------------------------------------------------------------
  0+ 5       0.0005      0.07  Q         |         |         |         |
  0+10       0.0026      0.31  Q         |         |         |         |
  0+15       0.0077      0.74  Q         |         |         |         |
  0+20       0.0160      1.20  Q         |         |         |         |
  0+25       0.0262      1.48  Q         |         |         |         |
  0+30       0.0375      1.64  Q         |         |         |         |
  0+35       0.0496      1.75  Q         |         |         |         |
  0+40       0.0623      1.84  Q         |         |         |         |
  0+45       0.0754      1.91  Q         |         |         |         |
  0+50       0.0890      1.97  Q         |         |         |         |
  0+55       0.1030      2.02  VQ        |         |         |         |
  1+ 0       0.1172      2.07  VQ        |         |         |         |
  1+ 5       0.1317      2.11  VQ        |         |         |         |
  1+10       0.1465      2.14  VQ        |         |         |         |
  1+15       0.1614      2.17  VQ        |         |         |         |
  1+20       0.1766      2.20  VQ        |         |         |         |
  1+25       0.1919      2.22  VQ        |         |         |         |
  1+30       0.2074      2.25  VQ        |         |         |         |
  1+35       0.2230      2.27  VQ        |         |         |         |
  1+40       0.2387      2.29  VQ        |         |         |         |
  1+45       0.2546      2.31  VQ        |         |         |         |
  1+50       0.2706      2.32  VQ        |         |         |         |
  1+55       0.2867      2.34  VQ        |         |         |         |
  2+ 0       0.3029      2.35  |Q        |         |         |         |
  2+ 5       0.3192      2.37  |Q        |         |         |         |
  2+10       0.3356      2.38  |Q        |         |         |         |
  2+15       0.3521      2.40  |Q        |         |         |         |
  2+20       0.3687      2.40  |Q        |         |         |         |
  2+25       0.3853      2.41  |Q        |         |         |         |
  2+30       0.4020      2.42  |Q        |         |         |         |
  2+35       0.4187      2.43  |Q        |         |         |         |
  2+40       0.4355      2.44  |Q        |         |         |         |
  2+45       0.4523      2.45  |Q        |         |         |         |
  2+50       0.4692      2.46  |Q        |         |         |         |
  2+55       0.4862      2.47  |Q        |         |         |         |
  3+ 0       0.5033      2.47  |Q        |         |         |         |
  3+ 5       0.5204      2.48  |Q        |         |         |         |
  3+10       0.5375      2.49  |Q        |         |         |         |
  3+15       0.5548      2.50  |Q        |         |         |         |
  3+20       0.5721      2.51  |Q        |         |         |         |
  3+25       0.5894      2.52  |QV       |         |         |         |
  3+30       0.6069      2.53  |QV       |         |         |         |
  3+35       0.6244      2.54  |QV       |         |         |         |
  3+40       0.6419      2.55  |QV       |         |         |         |
  3+45       0.6596      2.56  |QV       |         |         |         |
  3+50       0.6773      2.57  |QV       |         |         |         |
  3+55       0.6951      2.58  |QV       |         |         |         |
  4+ 0       0.7129      2.59  |QV       |         |         |         |
  4+ 5       0.7308      2.60  |QV       |         |         |         |
  4+10       0.7488      2.61  |QV       |         |         |         |
  4+15       0.7669      2.62  |QV       |         |         |         |
  4+20       0.7850      2.63  |QV       |         |         |         |
  4+25       0.8033      2.65  |QV       |         |         |         |
  4+30       0.8215      2.66  |QV       |         |         |         |
  4+35       0.8399      2.67  |QV       |         |         |         |
  4+40       0.8584      2.68  |QV       |         |         |         |
  4+45       0.8769      2.69  |Q V      |         |         |         |
  4+50       0.8955      2.70  |Q V      |         |         |         |
  4+55       0.9142      2.71  |Q V      |         |         |         |
  5+ 0       0.9330      2.73  |Q V      |         |         |         |
  5+ 5       0.9518      2.74  |Q V      |         |         |         |
  5+10       0.9707      2.75  |Q V      |         |         |         |
  5+15       0.9898      2.76  |Q V      |         |         |         |
  5+20       1.0089      2.77  |Q V      |         |         |         |
  5+25       1.0280      2.79  |Q V      |         |         |         |
  5+30       1.0473      2.80  |Q V      |         |         |         |
  5+35       1.0667      2.81  |Q V      |         |         |         |
  5+40       1.0862      2.83  |Q V      |         |         |         |
  5+45       1.1057      2.84  |Q V      |         |         |         |
  5+50       1.1253      2.85  |Q V      |         |         |         |
  5+55       1.1451      2.87  |Q V      |         |         |         |
  6+ 0       1.1649      2.88  |Q  V     |         |         |         |
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 6+ 5       1.1848      2.89  |Q  V     |         |         |         |
 6+10       1.2048      2.91  |Q  V     |         |         |         |
 6+15       1.2250      2.92  |Q  V     |         |         |         |
 6+20       1.2452      2.94  |Q  V     |         |         |         |
 6+25       1.2655      2.95  |Q  V     |         |         |         |
 6+30       1.2859      2.96  |Q  V     |         |         |         |
 6+35       1.3064      2.98  |Q  V     |         |         |         |
 6+40       1.3270      2.99  |Q  V     |         |         |         |
 6+45       1.3478      3.01  |Q  V     |         |         |         |
 6+50       1.3686      3.03  |Q  V     |         |         |         |
 6+55       1.3896      3.04  |Q  V     |         |         |         |
 7+ 0       1.4106      3.06  |Q  V     |         |         |         |
 7+ 5       1.4318      3.07  |Q  V     |         |         |         |
 7+10       1.4531      3.09  |Q   V    |         |         |         |
 7+15       1.4745      3.11  |Q   V    |         |         |         |
 7+20       1.4960      3.12  |Q   V    |         |         |         |
 7+25       1.5176      3.14  |Q   V    |         |         |         |
 7+30       1.5394      3.16  |Q   V    |         |         |         |
 7+35       1.5613      3.18  |Q   V    |         |         |         |
 7+40       1.5833      3.20  |Q   V    |         |         |         |
 7+45       1.6054      3.21  |Q   V    |         |         |         |
 7+50       1.6277      3.23  |Q   V    |         |         |         |
 7+55       1.6501      3.25  |Q   V    |         |         |         |
 8+ 0       1.6726      3.27  |Q   V    |         |         |         |
 8+ 5       1.6952      3.29  |Q   V    |         |         |         |
 8+10       1.7180      3.31  |Q   V    |         |         |         |
 8+15       1.7410      3.33  |Q    V   |         |         |         |
 8+20       1.7640      3.35  |Q    V   |         |         |         |
 8+25       1.7873      3.37  |Q    V   |         |         |         |
 8+30       1.8106      3.39  |Q    V   |         |         |         |
 8+35       1.8341      3.41  |Q    V   |         |         |         |
 8+40       1.8578      3.44  |Q    V   |         |         |         |
 8+45       1.8816      3.46  |Q    V   |         |         |         |
 8+50       1.9056      3.48  |Q    V   |         |         |         |
 8+55       1.9297      3.50  |Q    V   |         |         |         |
 9+ 0       1.9540      3.53  |Q    V   |         |         |         |
 9+ 5       1.9784      3.55  |Q    V   |         |         |         |
 9+10       2.0031      3.58  |Q    V   |         |         |         |
 9+15       2.0279      3.60  |Q     V  |         |         |         |
 9+20       2.0528      3.63  |Q     V  |         |         |         |
 9+25       2.0780      3.65  |Q     V  |         |         |         |
 9+30       2.1033      3.68  |Q     V  |         |         |         |
 9+35       2.1288      3.70  |Q     V  |         |         |         |
 9+40       2.1545      3.73  |Q     V  |         |         |         |
 9+45       2.1804      3.76  |Q     V  |         |         |         |
 9+50       2.2065      3.79  |Q     V  |         |         |         |
 9+55       2.2328      3.82  |Q     V  |         |         |         |
10+ 0       2.2592      3.85  |Q     V  |         |         |         |
10+ 5       2.2859      3.88  |Q     V  |         |         |         |
10+10       2.3128      3.91  |Q      V |         |         |         |
10+15       2.3400      3.94  |Q      V |         |         |         |
10+20       2.3673      3.97  |Q      V |         |         |         |
10+25       2.3949      4.00  | Q     V |         |         |         |
10+30       2.4227      4.04  | Q     V |         |         |         |
10+35       2.4507      4.07  | Q     V |         |         |         |
10+40       2.4790      4.11  | Q     V |         |         |         |
10+45       2.5075      4.14  | Q     V |         |         |         |
10+50       2.5363      4.18  | Q     V |         |         |         |
10+55       2.5654      4.22  | Q     V |         |         |         |
11+ 0       2.5947      4.26  | Q      V|         |         |         |
11+ 5       2.6242      4.30  | Q      V|         |         |         |
11+10       2.6541      4.34  | Q      V|         |         |         |
11+15       2.6843      4.38  | Q      V|         |         |         |
11+20       2.7147      4.42  | Q      V|         |         |         |
11+25       2.7454      4.46  | Q      V|         |         |         |
11+30       2.7765      4.51  | Q      V|         |         |         |
11+35       2.8079      4.56  | Q      V|         |         |         |
11+40       2.8396      4.60  | Q      V|         |         |         |
11+45       2.8716      4.65  | Q       V         |         |         |
11+50       2.9040      4.70  | Q       V         |         |         |
11+55       2.9367      4.75  | Q       V         |         |         |
12+ 0       2.9699      4.81  | Q       V         |         |         |
12+ 5       3.0033      4.86  | Q       V         |         |         |
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12+10       3.0371      4.91  | Q       V         |         |         |
12+15       3.0712      4.95  | Q       V         |         |         |
12+20       3.1056      4.99  | Q       V         |         |         |
12+25       3.1403      5.04  | Q       V         |         |         |
12+30       3.1754      5.10  | Q       |V        |         |         |
12+35       3.2110      5.16  | Q       |V        |         |         |
12+40       3.2470      5.23  | Q       |V        |         |         |
12+45       3.2835      5.30  | Q       |V        |         |         |
12+50       3.3204      5.37  | Q       |V        |         |         |
12+55       3.3579      5.44  | Q       |V        |         |         |
13+ 0       3.3960      5.52  | Q       |V        |         |         |
13+ 5       3.4346      5.60  | Q       |V        |         |         |
13+10       3.4738      5.69  | Q       | V       |         |         |
13+15       3.5136      5.78  | Q       | V       |         |         |
13+20       3.5540      5.87  | Q       | V       |         |         |
13+25       3.5951      5.97  | Q       | V       |         |         |
13+30       3.6370      6.07  |  Q      | V       |         |         |
13+35       3.6795      6.18  |  Q      | V       |         |         |
13+40       3.7229      6.29  |  Q      | V       |         |         |
13+45       3.7670      6.41  |  Q      |  V      |         |         |
13+50       3.8120      6.54  |  Q      |  V      |         |         |
13+55       3.8579      6.67  |  Q      |  V      |         |         |
14+ 0       3.9048      6.81  |  Q      |  V      |         |         |
14+ 5       3.9527      6.95  |  Q      |  V      |         |         |
14+10       4.0017      7.12  |  Q      |  V      |         |         |
14+15       4.0519      7.29  |  Q      |   V     |         |         |
14+20       4.1034      7.48  |  Q      |   V     |         |         |
14+25       4.1563      7.67  |  Q      |   V     |         |         |
14+30       4.2106      7.88  |  Q      |   V     |         |         |
14+35       4.2663      8.10  |   Q     |   V     |         |         |
14+40       4.3237      8.34  |   Q     |    V    |         |         |
14+45       4.3829      8.59  |   Q     |    V    |         |         |
14+50       4.4440      8.87  |   Q     |    V    |         |         |
14+55       4.5072      9.17  |   Q     |    V    |         |         |
15+ 0       4.5726      9.51  |   Q     |    V    |         |         |
15+ 5       4.6406      9.87  |   Q     |     V   |         |         |
15+10       4.7114     10.28  |    Q    |     V   |         |         |
15+15       4.7854     10.74  |    Q    |     V   |         |         |
15+20       4.8630     11.26  |    Q    |     V   |         |         |
15+25       4.9439     11.75  |    Q    |      V  |         |         |
15+30       5.0268     12.04  |     Q   |      V  |         |         |
15+35       5.1104     12.14  |     Q   |      V  |         |         |
15+40       5.1954     12.35  |     Q   |       V |         |         |
15+45       5.2853     13.05  |     Q   |       V |         |         |
15+50       5.3839     14.32  |      Q  |       V |         |         |
15+55       5.4974     16.48  |       Q |        V|         |         |
16+ 0       5.6385     20.48  |         Q        V|         |         |
16+ 5       5.8651     32.91  |         |     Q   V         |         |
16+10       6.2512     56.05  |         |         |V      Q |         |
16+15       6.7712     75.51  |         |         |  V      |      Q  |
16+20       7.2863     74.79  |         |         |    V    |      Q  |
16+25       7.6509     52.94  |         |         |     Q   |         |
16+30       7.9074     37.25  |         |       Q |      V  |         |
16+35       8.1099     29.40  |         |   Q     |       V |         |
16+40       8.2855     25.50  |         | Q       |       V |         |
16+45       8.4408     22.55  |         |Q        |        V|         |
16+50       8.5791     20.08  |         Q         |        V|         |
16+55       8.7024     17.90  |       Q |         |         V         |
17+ 0       8.8159     16.47  |       Q |         |         V         |
17+ 5       8.9179     14.81  |      Q  |         |         |V        |
17+10       9.0115     13.60  |     Q   |         |         |V        |
17+15       9.0976     12.50  |     Q   |         |         |V        |
17+20       9.1791     11.83  |    Q    |         |         | V       |
17+25       9.2557     11.13  |    Q    |         |         | V       |
17+30       9.3263     10.25  |    Q    |         |         | V       |
17+35       9.3926      9.63  |   Q     |         |         | V       |
17+40       9.4552      9.08  |   Q     |         |         | V       |
17+45       9.5138      8.52  |   Q     |         |         |  V      |
17+50       9.5693      8.05  |   Q     |         |         |  V      |
17+55       9.6215      7.58  |  Q      |         |         |  V      |
18+ 0       9.6718      7.30  |  Q      |         |         |  V      |
18+ 5       9.7203      7.04  |  Q      |         |         |  V      |
18+10       9.7668      6.76  |  Q      |         |         |   V     |
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18+15       9.8097     6.22  |  Q      |         |         |   V     |
18+20       9.8481     5.58  | Q       |         |         |   V     |
18+25       9.8853     5.40  | Q       |         |         |   V     |
18+30       9.9214     5.25  | Q       |         |         |   V     |
18+35       9.9566     5.11  | Q       |         |         |   V     |
18+40       9.9909     4.97  | Q       |         |         |   V     |
18+45      10.0243     4.85  | Q       |         |         |   V     |
18+50      10.0569     4.74  | Q       |         |         |    V    |
18+55      10.0888     4.63  | Q       |         |         |    V    |
19+ 0      10.1200     4.53  | Q       |         |         |    V    |
19+ 5      10.1506     4.44  | Q       |         |         |    V    |
19+10      10.1806     4.35  | Q       |         |         |    V    |
19+15      10.2100     4.27  | Q       |         |         |    V    |
19+20      10.2389     4.19  | Q       |         |         |    V    |
19+25      10.2672     4.12  | Q       |         |         |    V    |
19+30      10.2951     4.04  | Q       |         |         |    V    |
19+35      10.3225     3.98  |Q        |         |         |    V    |
19+40      10.3494     3.91  |Q        |         |         |     V   |
19+45      10.3759     3.85  |Q        |         |         |     V   |
19+50      10.4020     3.79  |Q        |         |         |     V   |
19+55      10.4277     3.73  |Q        |         |         |     V   |
20+ 0      10.4531     3.68  |Q        |         |         |     V   |
20+ 5      10.4781     3.63  |Q        |         |         |     V   |
20+10      10.5027     3.58  |Q        |         |         |     V   |
20+15      10.5270     3.53  |Q        |         |         |     V   |
20+20      10.5510     3.48  |Q        |         |         |     V   |
20+25      10.5746     3.44  |Q        |         |         |     V   |
20+30      10.5980     3.39  |Q        |         |         |     V   |
20+35      10.6210     3.35  |Q        |         |         |      V  |
20+40      10.6438     3.31  |Q        |         |         |      V  |
20+45      10.6663     3.27  |Q        |         |         |      V  |
20+50      10.6886     3.23  |Q        |         |         |      V  |
20+55      10.7106     3.19  |Q        |         |         |      V  |
21+ 0      10.7323     3.16  |Q        |         |         |      V  |
21+ 5      10.7538     3.12  |Q        |         |         |      V  |
21+10      10.7751     3.09  |Q        |         |         |      V  |
21+15      10.7961     3.05  |Q        |         |         |      V  |
21+20      10.8169     3.02  |Q        |         |         |      V  |
21+25      10.8375     2.99  |Q        |         |         |      V  |
21+30      10.8579     2.96  |Q        |         |         |      V  |
21+35      10.8781     2.93  |Q        |         |         |      V  |
21+40      10.8981     2.90  |Q        |         |         |      V  |
21+45      10.9179     2.88  |Q        |         |         |       V |
21+50      10.9375     2.85  |Q        |         |         |       V |
21+55      10.9570     2.82  |Q        |         |         |       V |
22+ 0      10.9762     2.80  |Q        |         |         |       V |
22+ 5      10.9953     2.77  |Q        |         |         |       V |
22+10      11.0142     2.75  |Q        |         |         |       V |
22+15      11.0329     2.72  |Q        |         |         |       V |
22+20      11.0515     2.70  |Q        |         |         |       V |
22+25      11.0700     2.68  |Q        |         |         |       V |
22+30      11.0882     2.65  |Q        |         |         |       V |
22+35      11.1063     2.63  |Q        |         |         |       V |
22+40      11.1243     2.61  |Q        |         |         |       V |
22+45      11.1421     2.59  |Q        |         |         |       V |
22+50      11.1598     2.57  |Q        |         |         |       V |
22+55      11.1774     2.55  |Q        |         |         |       V |
23+ 0      11.1948     2.53  |Q        |         |         |        V|
23+ 5      11.2120     2.51  |Q        |         |         |        V|
23+10      11.2292     2.49  |Q        |         |         |        V|
23+15      11.2462     2.47  |Q        |         |         |        V|
23+20      11.2631     2.45  |Q        |         |         |        V|
23+25      11.2799     2.43  |Q        |         |         |        V|
23+30      11.2965     2.42  |Q        |         |         |        V|
23+35      11.3130     2.40  |Q        |         |         |        V|
23+40      11.3295     2.38  |Q        |         |         |        V|
23+45      11.3458     2.37  |Q        |         |         |        V|
23+50      11.3619     2.35  |Q        |         |         |        V|
23+55      11.3780     2.33  |Q        |         |         |        V|
24+ 0      11.3940     2.32  |Q        |         |         |        V|
24+ 5      11.4094     2.24  |Q        |         |         |        V|
24+10      11.4230     1.98  Q         |         |         |        V|
24+15      11.4336     1.54  Q         |         |         |        V|
```

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   24+20      11.4410      1.07  Q         |         |         |        V|
   24+25      11.4464      0.79  Q         |         |         |        V|
   24+30      11.4507      0.62  Q         |         |         |        V|
   24+35      11.4543      0.52  Q         |         |         |        V|
   24+40      11.4572      0.43  Q         |         |         |        V|
   24+45      11.4597      0.36  Q         |         |         |        V|
   24+50      11.4618      0.30  Q         |         |         |        V|
   24+55      11.4636      0.26  Q         |         |         |        V|
   25+ 0      11.4651      0.22  Q         |         |         |        V|
   25+ 5      11.4664      0.19  Q         |         |         |        V|
   25+10      11.4675      0.16  Q         |         |         |        V|
   25+15      11.4684      0.14  Q         |         |         |        V|
   25+20      11.4692      0.11  Q         |         |         |        V|
   25+25      11.4698      0.09  Q         |         |         |        V|
   25+30      11.4704      0.08  Q         |         |         |        V|
   25+35      11.4708      0.06  Q         |         |         |        V|
   25+40      11.4712      0.05  Q         |         |         |        V|
   25+45      11.4715      0.04  Q         |         |         |        V|
   25+50      11.4717      0.03  Q         |         |         |        V|
   25+55      11.4719      0.03  Q         |         |         |        V|
   26+ 0      11.4720      0.02  Q         |         |         |        V|
   26+ 5      11.4721      0.01  Q         |         |         |        V|
   26+10      11.4721      0.00  Q         |         |         |         V
----------------------------------------------------------------------
```

```
                      FLOOD HYDROGRAPH ROUTING PROGRAM
              Copyright (c) CIVILCADD/CIVILDESIGN, 1989 - 2004
                         Study date: 11/01/22

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

     Quarry Complex Site
     Basin Routing
     10-year, 24-hour stomr

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

     Program License Serial Number 4009

     ---------------------------------------------------------------------
     ******************** HYDROGRAPH INFORMATION *********************

                     From study/file name: QuarryUHpr10.rte
     ****************************HYDROGRAPH DATA****************************
                     Number of intervals =   314
                     Time interval =    5.0 (Min.)
                     Maximum/Peak flow rate =       75.514 (CFS)
                     Total volume =      11.472 (Ac.Ft)
             Status of hydrographs being held in storage
                        Stream 1  Stream 2  Stream 3  Stream 4  Stream 5
             Peak (CFS)      0.000     0.000     0.000     0.000     0.000
             Vol (Ac.Ft)      0.000     0.000     0.000     0.000     0.000
     **********************************************************************

     ++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
     Process from Point/Station        1.000 to Point/Station       2.000
     **** RETARDING BASIN ROUTING ****
     ______________________________________________________________________

     User entry of depth-outflow-storage data
     ---------------------------------------------------------------------
     Total number of inflow hydrograph intervals = 314
     Hydrograph time unit =  5.000 (Min.)
     Initial depth in storage basin =   0.00(Ft.)
     ---------------------------------------------------------------------
     ---------------------------------------------------------------------
     Initial basin depth =   0.00 (Ft.)
     Initial basin storage =      0.00 (Ac.Ft)
     Initial basin outflow =   0.00 (CFS)
     ----------------------------------------------------------------------
     ---------------------------------------------------------------------
     Depth vs. Storage and Depth vs. Discharge data:
      Basin Depth  Storage    Outflow   (S-O*dt/2)   (S+O*dt/2)
          (Ft.)    (Ac.Ft)    (CFS)     (Ac.Ft)    (Ac.Ft)
     ----------------------------------------------------------------------
       0.000      0.000      0.000      0.000        0.000
       1.000      2.220      1.490      2.215        2.225
       2.000      4.670      1.491      4.665        4.675
       3.000      7.120      1.492      7.115        7.125
       4.000      9.690      1.493      9.685        9.695
       5.000     13.760      1.494     13.755       13.765
       6.000     15.180    108.490     14.806       15.554
     ---------------------------------------------------------------------
                     Hydrograph Detention Basin Routing
     ----------------------------------------------------------------------

     Graph values: 'I'= unit inflow; 'O'=outflow at time shown
     ----------------------------------------------------------------------
 Time   Inflow  Outflow    Storage                                    Depth
(Hours)  (CFS)   (CFS)      (Ac.Ft) .0      18.9    37.76   56.64   75.51 (Ft.)
 0.083    0.07    0.00      0.000  O       |       |       |       |     0.00
 0.167    0.31    0.00      0.002  O       |       |       |       |     0.00
```

```
0.250   0.74   0.00    0.005  O       |       |       |       |      0.00
0.333   1.20   0.01    0.012  O       |       |       |       |      0.01
0.417   1.48   0.01    0.021  O       |       |       |       |      0.01
0.500   1.64   0.02    0.032  O       |       |       |       |      0.01
0.583   1.75   0.03    0.043  O       |       |       |       |      0.02
0.667   1.84   0.04    0.055  O       |       |       |       |      0.02
0.750   1.91   0.05    0.068  O       |       |       |       |      0.03
0.833   1.97   0.05    0.081  O       |       |       |       |      0.04
0.917   2.02   0.06    0.094  O       |       |       |       |      0.04
1.000   2.07   0.07    0.108  O       |       |       |       |      0.05
1.083   2.11   0.08    0.122  O       |       |       |       |      0.05
1.167   2.14   0.09    0.136  O       |       |       |       |      0.06
1.250   2.17   0.10    0.150  O       |       |       |       |      0.07
1.333   2.20   0.11    0.164  O       |       |       |       |      0.07
1.417   2.22   0.12    0.179  O       |       |       |       |      0.08
1.500   2.25   0.13    0.193  O       |       |       |       |      0.09
1.583   2.27   0.14    0.208  O       |       |       |       |      0.09
1.667   2.29   0.15    0.223  O       |       |       |       |      0.10
1.750   2.31   0.16    0.237  O       |       |       |       |      0.11
1.833   2.32   0.17    0.252  O       |       |       |       |      0.11
1.917   2.34   0.18    0.267  O       |       |       |       |      0.12
2.000   2.35   0.19    0.282  O       |       |       |       |      0.13
2.083   2.37   0.20    0.297  OI      |       |       |       |      0.13
2.167   2.38   0.21    0.312  OI      |       |       |       |      0.14
2.250   2.40   0.22    0.327  OI      |       |       |       |      0.15
2.333   2.40   0.23    0.342  OI      |       |       |       |      0.15
2.417   2.41   0.24    0.357  OI      |       |       |       |      0.16
2.500   2.42   0.25    0.372  OI      |       |       |       |      0.17
2.583   2.43   0.26    0.387  OI      |       |       |       |      0.17
2.667   2.44   0.27    0.402  OI      |       |       |       |      0.18
2.750   2.45   0.28    0.416  OI      |       |       |       |      0.19
2.833   2.46   0.29    0.431  OI      |       |       |       |      0.19
2.917   2.47   0.30    0.446  OI      |       |       |       |      0.20
3.000   2.47   0.31    0.461  OI      |       |       |       |      0.21
3.083   2.48   0.32    0.476  OI      |       |       |       |      0.21
3.167   2.49   0.33    0.491  OI      |       |       |       |      0.22
3.250   2.50   0.34    0.506  OI      |       |       |       |      0.23
3.333   2.51   0.35    0.521  OI      |       |       |       |      0.23
3.417   2.52   0.36    0.536  OI      |       |       |       |      0.24
3.500   2.53   0.37    0.551  OI      |       |       |       |      0.25
3.583   2.54   0.38    0.565  OI      |       |       |       |      0.25
3.667   2.55   0.39    0.580  OI      |       |       |       |      0.26
3.750   2.56   0.40    0.595  OI      |       |       |       |      0.27
3.833   2.57   0.41    0.610  OI      |       |       |       |      0.27
3.917   2.58   0.42    0.625  OI      |       |       |       |      0.28
4.000   2.59   0.43    0.640  OI      |       |       |       |      0.29
4.083   2.60   0.44    0.655  OI      |       |       |       |      0.29
4.167   2.61   0.45    0.670  OI      |       |       |       |      0.30
4.250   2.62   0.46    0.685  OI      |       |       |       |      0.31
4.333   2.63   0.47    0.700  OI      |       |       |       |      0.32
4.417   2.65   0.48    0.714  OI      |       |       |       |      0.32
4.500   2.66   0.49    0.729  OI      |       |       |       |      0.33
4.583   2.67   0.50    0.744  OI      |       |       |       |      0.34
4.667   2.68   0.51    0.759  OI      |       |       |       |      0.34
4.750   2.69   0.52    0.774  OI      |       |       |       |      0.35
4.833   2.70   0.53    0.789  OI      |       |       |       |      0.36
4.917   2.71   0.54    0.804  OI      |       |       |       |      0.36
5.000   2.73   0.55    0.819  OI      |       |       |       |      0.37
5.083   2.74   0.56    0.834  OI      |       |       |       |      0.38
5.167   2.75   0.57    0.849  OI      |       |       |       |      0.38
5.250   2.76   0.58    0.864  OI      |       |       |       |      0.39
5.333   2.77   0.59    0.879  OI      |       |       |       |      0.40
5.417   2.79   0.60    0.894  OI      |       |       |       |      0.40
5.500   2.80   0.61    0.909  OI      |       |       |       |      0.41
5.583   2.81   0.62    0.924  OI      |       |       |       |      0.42
5.667   2.83   0.63    0.939  OI      |       |       |       |      0.42
5.750   2.84   0.64    0.955  OI      |       |       |       |      0.43
5.833   2.85   0.65    0.970  OI      |       |       |       |      0.44
5.917   2.87   0.66    0.985  OI      |       |       |       |      0.44
6.000   2.88   0.67    1.000  OI      |       |       |       |      0.45
6.083   2.89   0.68    1.015  OI      |       |       |       |      0.46
6.167   2.91   0.69    1.030  OI      |       |       |       |      0.46
6.250   2.92   0.70    1.046  OI      |       |       |       |      0.47
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6.333	2.94	0.71	1.061	OI				0.48
6.417	2.95	0.72	1.076	OI				0.48
6.500	2.96	0.73	1.092	OI				0.49
6.583	2.98	0.74	1.107	OI				0.50
6.667	2.99	0.75	1.123	OI				0.51
6.750	3.01	0.76	1.138	OI				0.51
6.833	3.03	0.77	1.153	OI				0.52
6.917	3.04	0.78	1.169	OI				0.53
7.000	3.06	0.80	1.185	OI				0.53
7.083	3.07	0.81	1.200	OI				0.54
7.167	3.09	0.82	1.216	OI				0.55
7.250	3.11	0.83	1.232	OI				0.55
7.333	3.12	0.84	1.247	OI				0.56
7.417	3.14	0.85	1.263	OI				0.57
7.500	3.16	0.86	1.279	OI				0.58
7.583	3.18	0.87	1.295	OI				0.58
7.667	3.20	0.88	1.311	OI				0.59
7.750	3.21	0.89	1.327	OI				0.60
7.833	3.23	0.90	1.343	OI				0.60
7.917	3.25	0.91	1.359	OI				0.61
8.000	3.27	0.92	1.375	OI				0.62
8.083	3.29	0.93	1.391	OI				0.63
8.167	3.31	0.94	1.407	OI				0.63
8.250	3.33	0.96	1.424	OI				0.64
8.333	3.35	0.97	1.440	OI				0.65
8.417	3.37	0.98	1.456	OI				0.66
8.500	3.39	0.99	1.473	OI				0.66
8.583	3.41	1.00	1.490	OI				0.67
8.667	3.44	1.01	1.506	OI				0.68
8.750	3.46	1.02	1.523	OI				0.69
8.833	3.48	1.03	1.540	OI				0.69
8.917	3.50	1.04	1.557	OI				0.70
9.000	3.53	1.06	1.574	OI				0.71
9.083	3.55	1.07	1.591	OI				0.72
9.167	3.58	1.08	1.608	OI				0.72
9.250	3.60	1.09	1.625	OI				0.73
9.333	3.63	1.10	1.642	OI				0.74
9.417	3.65	1.11	1.660	OI				0.75
9.500	3.68	1.13	1.677	OI				0.76
9.583	3.70	1.14	1.695	OI				0.76
9.667	3.73	1.15	1.713	OI				0.77
9.750	3.76	1.16	1.731	OI				0.78
9.833	3.79	1.17	1.748	OI				0.79
9.917	3.82	1.19	1.767	OI				0.80
10.000	3.85	1.20	1.785	OI				0.80
10.083	3.88	1.21	1.803	OI				0.81
10.167	3.91	1.22	1.821	OI				0.82
10.250	3.94	1.23	1.840	OI				0.83
10.333	3.97	1.25	1.859	OI				0.84
10.417	4.00	1.26	1.877	OI				0.85
10.500	4.04	1.27	1.896	OI				0.85
10.583	4.07	1.29	1.916	OI				0.86
10.667	4.11	1.30	1.935	OI				0.87
10.750	4.14	1.31	1.954	OI				0.88
10.833	4.18	1.32	1.974	OI				0.89
10.917	4.22	1.34	1.994	OI				0.90
11.000	4.26	1.35	2.013	OI				0.91
11.083	4.30	1.36	2.034	OI				0.92
11.167	4.34	1.38	2.054	OI				0.93
11.250	4.38	1.39	2.074	OI				0.93
11.333	4.42	1.41	2.095	OI				0.94
11.417	4.46	1.42	2.116	OI				0.95
11.500	4.51	1.43	2.137	OI				0.96
11.583	4.56	1.45	2.158	OI				0.97
11.667	4.60	1.46	2.180	OI				0.98
11.750	4.65	1.48	2.201	OI				0.99
11.833	4.70	1.49	2.223	OI				1.00
11.917	4.75	1.49	2.246	O I				1.01
12.000	4.81	1.49	2.268	O I				1.02
12.083	4.86	1.49	2.291	O I				1.03
12.167	4.91	1.49	2.315	O I				1.04
12.250	4.95	1.49	2.338	O I				1.05
12.333	4.99	1.49	2.362	O I				1.06

```
12.417    5.04    1.49      2.387  O I     |       |       |       |     1.07
12.500    5.10    1.49      2.411  O I     |       |       |       |     1.08
12.583    5.16    1.49      2.436  O I     |       |       |       |     1.09
12.667    5.23    1.49      2.462  O I     |       |       |       |     1.10
12.750    5.30    1.49      2.488  O I     |       |       |       |     1.11
12.833    5.37    1.49      2.514  O I     |       |       |       |     1.12
12.917    5.44    1.49      2.541  O I     |       |       |       |     1.13
13.000    5.52    1.49      2.569  O I     |       |       |       |     1.14
13.083    5.60    1.49      2.597  O I     |       |       |       |     1.15
13.167    5.69    1.49      2.626  O I     |       |       |       |     1.17
13.250    5.78    1.49      2.655  O I     |       |       |       |     1.18
13.333    5.87    1.49      2.685  O I     |       |       |       |     1.19
13.417    5.97    1.49      2.715  O I     |       |       |       |     1.20
13.500    6.07    1.49      2.746  O I     |       |       |       |     1.21
13.583    6.18    1.49      2.778  O I     |       |       |       |     1.23
13.667    6.29    1.49      2.811  O I     |       |       |       |     1.24
13.750    6.41    1.49      2.845  O I     |       |       |       |     1.25
13.833    6.54    1.49      2.879  O I     |       |       |       |     1.27
13.917    6.67    1.49      2.914  O I     |       |       |       |     1.28
14.000    6.81    1.49      2.950  O I     |       |       |       |     1.30
14.083    6.95    1.49      2.987  O I     |       |       |       |     1.31
14.167    7.12    1.49      3.026  O  I    |       |       |       |     1.33
14.250    7.29    1.49      3.065  O  I    |       |       |       |     1.34
14.333    7.48    1.49      3.105  O  I    |       |       |       |     1.36
14.417    7.67    1.49      3.147  O  I    |       |       |       |     1.38
14.500    7.88    1.49      3.191  O  I    |       |       |       |     1.40
14.583    8.10    1.49      3.235  O  I    |       |       |       |     1.41
14.667    8.34    1.49      3.282  O  I    |       |       |       |     1.43
14.750    8.59    1.49      3.330  O  I    |       |       |       |     1.45
14.833    8.87    1.49      3.380  O  I    |       |       |       |     1.47
14.917    9.17    1.49      3.431  O  I    |       |       |       |     1.49
15.000    9.51    1.49      3.486  O   I   |       |       |       |     1.52
15.083    9.87    1.49      3.542  O   I   |       |       |       |     1.54
15.167   10.28    1.49      3.601  O   I   |       |       |       |     1.56
15.250   10.74    1.49      3.663  O   I   |       |       |       |     1.59
15.333   11.26    1.49      3.729  O   I   |       |       |       |     1.62
15.417   11.75    1.49      3.798  O   I   |       |       |       |     1.64
15.500   12.04    1.49      3.869  O    I  |       |       |       |     1.67
15.583   12.14    1.49      3.942  O    I  |       |       |       |     1.70
15.667   12.35    1.49      4.016  O    I  |       |       |       |     1.73
15.750   13.05    1.49      4.094  O    I  |       |       |       |     1.76
15.833   14.32    1.49      4.178  O     I |       |       |       |     1.80
15.917   16.48    1.49      4.273  O     I |       |       |       |     1.84
16.000   20.48    1.49      4.390  O       I       |       |       |     1.89
16.083   32.91    1.49      4.564  O       |    I  |       |       |     1.96
16.167   56.05    1.49      4.860  O       |       |      I|       |     2.08
16.250   75.51    1.49      5.303  O       |       |       |       I     2.26
16.333   74.79    1.49      5.810  O       |       |       |      I|     2.47
16.417   52.94    1.49      6.240  O       |       |     I |       |     2.64
16.500   37.25    1.49      6.540  O       |      I|       |       |     2.76
16.583   29.40    1.49      6.759  O       |   I   |       |       |     2.85
16.667   25.50    1.49      6.938  O       | I     |       |       |     2.93
16.750   22.55    1.49      7.093  O       |I      |       |       |     2.99
16.833   20.08    1.49      7.230  O       I       |       |       |     3.04
16.917   17.90    1.49      7.350  O      I|       |       |       |     3.09
17.000   16.47    1.49      7.458  O     I |       |       |       |     3.13
17.083   14.81    1.49      7.556  O     I |       |       |       |     3.17
17.167   13.60    1.49      7.643  O    I  |       |       |       |     3.20
17.250   12.50    1.49      7.723  O    I  |       |       |       |     3.23
17.333   11.83    1.49      7.796  O    I  |       |       |       |     3.26
17.417   11.13    1.49      7.865  O   I   |       |       |       |     3.29
17.500   10.25    1.49      7.929  O   I   |       |       |       |     3.31
17.583    9.63    1.49      7.987  O   I   |       |       |       |     3.34
17.667    9.08    1.49      8.041  O  I    |       |       |       |     3.36
17.750    8.52    1.49      8.091  O  I    |       |       |       |     3.38
17.833    8.05    1.49      8.138  O  I    |       |       |       |     3.40
17.917    7.58    1.49      8.181  O  I    |       |       |       |     3.41
18.000    7.30    1.49      8.222  O  I    |       |       |       |     3.43
18.083    7.04    1.49      8.262  O I     |       |       |       |     3.44
18.167    6.76    1.49      8.299  O I     |       |       |       |     3.46
18.250    6.22    1.49      8.333  O I     |       |       |       |     3.47
18.333    5.58    1.49      8.364  O I     |       |       |       |     3.48
18.417    5.40    1.49      8.391  O I     |       |       |       |     3.49
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18.500    5.25    1.49      8.418  O I      |         |         |         |       3.50
18.583    5.11    1.49      8.443  O I      |         |         |         |       3.51
18.667    4.97    1.49      8.467  O I      |         |         |         |       3.52
18.750    4.85    1.49      8.491  O I      |         |         |         |       3.53
18.833    4.74    1.49      8.514  O I      |         |         |         |       3.54
18.917    4.63    1.49      8.536  OI       |         |         |         |       3.55
19.000    4.53    1.49      8.557  OI       |         |         |         |       3.56
19.083    4.44    1.49      8.578  OI       |         |         |         |       3.57
19.167    4.35    1.49      8.598  OI       |         |         |         |       3.57
19.250    4.27    1.49      8.617  OI       |         |         |         |       3.58
19.333    4.19    1.49      8.636  OI       |         |         |         |       3.59
19.417    4.12    1.49      8.654  OI       |         |         |         |       3.60
19.500    4.04    1.49      8.672  OI       |         |         |         |       3.60
19.583    3.98    1.49      8.689  OI       |         |         |         |       3.61
19.667    3.91    1.49      8.706  OI       |         |         |         |       3.62
19.750    3.85    1.49      8.723  OI       |         |         |         |       3.62
19.833    3.79    1.49      8.739  OI       |         |         |         |       3.63
19.917    3.73    1.49      8.754  OI       |         |         |         |       3.64
20.000    3.68    1.49      8.770  OI       |         |         |         |       3.64
20.083    3.63    1.49      8.784  OI       |         |         |         |       3.65
20.167    3.58    1.49      8.799  OI       |         |         |         |       3.65
20.250    3.53    1.49      8.813  OI       |         |         |         |       3.66
20.333    3.48    1.49      8.827  OI       |         |         |         |       3.66
20.417    3.44    1.49      8.841  OI       |         |         |         |       3.67
20.500    3.39    1.49      8.854  OI       |         |         |         |       3.67
20.583    3.35    1.49      8.867  OI       |         |         |         |       3.68
20.667    3.31    1.49      8.879  OI       |         |         |         |       3.68
20.750    3.27    1.49      8.892  OI       |         |         |         |       3.69
20.833    3.23    1.49      8.904  OI       |         |         |         |       3.69
20.917    3.19    1.49      8.916  OI       |         |         |         |       3.70
21.000    3.16    1.49      8.927  OI       |         |         |         |       3.70
21.083    3.12    1.49      8.939  OI       |         |         |         |       3.71
21.167    3.09    1.49      8.950  OI       |         |         |         |       3.71
21.250    3.05    1.49      8.961  OI       |         |         |         |       3.72
21.333    3.02    1.49      8.971  OI       |         |         |         |       3.72
21.417    2.99    1.49      8.982  OI       |         |         |         |       3.72
21.500    2.96    1.49      8.992  OI       |         |         |         |       3.73
21.583    2.93    1.49      9.002  OI       |         |         |         |       3.73
21.667    2.90    1.49      9.012  OI       |         |         |         |       3.74
21.750    2.88    1.49      9.021  OI       |         |         |         |       3.74
21.833    2.85    1.49      9.031  OI       |         |         |         |       3.74
21.917    2.82    1.49      9.040  OI       |         |         |         |       3.75
22.000    2.80    1.49      9.049  OI       |         |         |         |       3.75
22.083    2.77    1.49      9.058  OI       |         |         |         |       3.75
22.167    2.75    1.49      9.067  OI       |         |         |         |       3.76
22.250    2.72    1.49      9.075  OI       |         |         |         |       3.76
22.333    2.70    1.49      9.084  OI       |         |         |         |       3.76
22.417    2.68    1.49      9.092  OI       |         |         |         |       3.77
22.500    2.65    1.49      9.100  OI       |         |         |         |       3.77
22.583    2.63    1.49      9.108  OI       |         |         |         |       3.77
22.667    2.61    1.49      9.115  OI       |         |         |         |       3.78
22.750    2.59    1.49      9.123  OI       |         |         |         |       3.78
22.833    2.57    1.49      9.131  OI       |         |         |         |       3.78
22.917    2.55    1.49      9.138  OI       |         |         |         |       3.79
23.000    2.53    1.49      9.145  OI       |         |         |         |       3.79
23.083    2.51    1.49      9.152  OI       |         |         |         |       3.79
23.167    2.49    1.49      9.159  OI       |         |         |         |       3.79
23.250    2.47    1.49      9.166  OI       |         |         |         |       3.80
23.333    2.45    1.49      9.173  OI       |         |         |         |       3.80
23.417    2.43    1.49      9.179  OI       |         |         |         |       3.80
23.500    2.42    1.49      9.186  OI       |         |         |         |       3.80
23.583    2.40    1.49      9.192  OI       |         |         |         |       3.81
23.667    2.38    1.49      9.198  OI       |         |         |         |       3.81
23.750    2.37    1.49      9.204  OI       |         |         |         |       3.81
23.833    2.35    1.49      9.210  O        |         |         |         |       3.81
23.917    2.33    1.49      9.216  O        |         |         |         |       3.82
24.000    2.32    1.49      9.222  O        |         |         |         |       3.82
24.083    2.24    1.49      9.227  O        |         |         |         |       3.82
24.167    1.98    1.49      9.231  O        |         |         |         |       3.82
24.250    1.54    1.49      9.233  O        |         |         |         |       3.82
24.333    1.07    1.49      9.232  O        |         |         |         |       3.82
24.417    0.79    1.49      9.228  O        |         |         |         |       3.82
24.500    0.62    1.49      9.223  O        |         |         |         |       3.82
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24.583	0.52	1.49	9.216	O	3.82
24.667	0.43	1.49	9.209	O	3.81
24.750	0.36	1.49	9.202	O	3.81
24.833	0.30	1.49	9.194	O	3.81
24.917	0.26	1.49	9.185	O	3.80
25.000	0.22	1.49	9.177	O	3.80
25.083	0.19	1.49	9.168	O	3.80
25.167	0.16	1.49	9.159	O	3.79
25.250	0.14	1.49	9.149	O	3.79
25.333	0.11	1.49	9.140	O	3.79
25.417	0.09	1.49	9.130	O	3.78
25.500	0.08	1.49	9.121	O	3.78
25.583	0.06	1.49	9.111	O	3.77
25.667	0.05	1.49	9.101	O	3.77
25.750	0.04	1.49	9.091	O	3.77
25.833	0.03	1.49	9.081	O	3.76
25.917	0.03	1.49	9.071	O	3.76
26.000	0.02	1.49	9.061	O	3.76
26.083	0.01	1.49	9.051	O	3.75
26.167	0.00	1.49	9.040	O	3.75
26.250	0.00	1.49	9.030	O	3.74
26.333	0.00	1.49	9.020	O	3.74
26.417	0.00	1.49	9.010	O	3.74
26.500	0.00	1.49	8.999	O	3.73
26.583	0.00	1.49	8.989	O	3.73
26.667	0.00	1.49	8.979	O	3.72
26.750	0.00	1.49	8.968	O	3.72
26.833	0.00	1.49	8.958	O	3.72
26.917	0.00	1.49	8.948	O	3.71
27.000	0.00	1.49	8.938	O	3.71
27.083	0.00	1.49	8.927	O	3.70
27.167	0.00	1.49	8.917	O	3.70
27.250	0.00	1.49	8.907	O	3.70
27.333	0.00	1.49	8.897	O	3.69
27.417	0.00	1.49	8.886	O	3.69
27.500	0.00	1.49	8.876	O	3.68
27.583	0.00	1.49	8.866	O	3.68
27.667	0.00	1.49	8.855	O	3.68
27.750	0.00	1.49	8.845	O	3.67
27.833	0.00	1.49	8.835	O	3.67
27.917	0.00	1.49	8.825	O	3.66
28.000	0.00	1.49	8.814	O	3.66
28.083	0.00	1.49	8.804	O	3.66
28.167	0.00	1.49	8.794	O	3.65
28.250	0.00	1.49	8.783	O	3.65
28.333	0.00	1.49	8.773	O	3.64
28.417	0.00	1.49	8.763	O	3.64
28.500	0.00	1.49	8.753	O	3.64
28.583	0.00	1.49	8.742	O	3.63
28.667	0.00	1.49	8.732	O	3.63
28.750	0.00	1.49	8.722	O	3.62
28.833	0.00	1.49	8.711	O	3.62
28.917	0.00	1.49	8.701	O	3.62
29.000	0.00	1.49	8.691	O	3.61
29.083	0.00	1.49	8.681	O	3.61
29.167	0.00	1.49	8.670	O	3.60
29.250	0.00	1.49	8.660	O	3.60
29.333	0.00	1.49	8.650	O	3.60
29.417	0.00	1.49	8.640	O	3.59
29.500	0.00	1.49	8.629	O	3.59
29.583	0.00	1.49	8.619	O	3.58
29.667	0.00	1.49	8.609	O	3.58
29.750	0.00	1.49	8.598	O	3.58
29.833	0.00	1.49	8.588	O	3.57
29.917	0.00	1.49	8.578	O	3.57
30.000	0.00	1.49	8.568	O	3.56
30.083	0.00	1.49	8.557	O	3.56
30.167	0.00	1.49	8.547	O	3.56
30.250	0.00	1.49	8.537	O	3.55
30.333	0.00	1.49	8.526	O	3.55
30.417	0.00	1.49	8.516	O	3.54
30.500	0.00	1.49	8.506	O	3.54
30.583	0.00	1.49	8.496	O	3.54

30.667	0.00	1.49	8.485	O	3.53
30.750	0.00	1.49	8.475	O	3.53
30.833	0.00	1.49	8.465	O	3.52
30.917	0.00	1.49	8.454	O	3.52
31.000	0.00	1.49	8.444	O	3.52
31.083	0.00	1.49	8.434	O	3.51
31.167	0.00	1.49	8.424	O	3.51
31.250	0.00	1.49	8.413	O	3.50
31.333	0.00	1.49	8.403	O	3.50
31.417	0.00	1.49	8.393	O	3.50
31.500	0.00	1.49	8.383	O	3.49
31.583	0.00	1.49	8.372	O	3.49
31.667	0.00	1.49	8.362	O	3.48
31.750	0.00	1.49	8.352	O	3.48
31.833	0.00	1.49	8.341	O	3.48
31.917	0.00	1.49	8.331	O	3.47
32.000	0.00	1.49	8.321	O	3.47
32.083	0.00	1.49	8.311	O	3.46
32.167	0.00	1.49	8.300	O	3.46
32.250	0.00	1.49	8.290	O	3.46
32.333	0.00	1.49	8.280	O	3.45
32.417	0.00	1.49	8.269	O	3.45
32.500	0.00	1.49	8.259	O	3.44
32.583	0.00	1.49	8.249	O	3.44
32.667	0.00	1.49	8.239	O	3.44
32.750	0.00	1.49	8.228	O	3.43
32.833	0.00	1.49	8.218	O	3.43
32.917	0.00	1.49	8.208	O	3.42
33.000	0.00	1.49	8.198	O	3.42
33.083	0.00	1.49	8.187	O	3.42
33.167	0.00	1.49	8.177	O	3.41
33.250	0.00	1.49	8.167	O	3.41
33.333	0.00	1.49	8.156	O	3.40
33.417	0.00	1.49	8.146	O	3.40
33.500	0.00	1.49	8.136	O	3.40
33.583	0.00	1.49	8.126	O	3.39
33.667	0.00	1.49	8.115	O	3.39
33.750	0.00	1.49	8.105	O	3.38
33.833	0.00	1.49	8.095	O	3.38
33.917	0.00	1.49	8.084	O	3.38
34.000	0.00	1.49	8.074	O	3.37
34.083	0.00	1.49	8.064	O	3.37
34.167	0.00	1.49	8.054	O	3.36
34.250	0.00	1.49	8.043	O	3.36
34.333	0.00	1.49	8.033	O	3.36
34.417	0.00	1.49	8.023	O	3.35
34.500	0.00	1.49	8.013	O	3.35
34.583	0.00	1.49	8.002	O	3.34
34.667	0.00	1.49	7.992	O	3.34
34.750	0.00	1.49	7.982	O	3.34
34.833	0.00	1.49	7.971	O	3.33
34.917	0.00	1.49	7.961	O	3.33
35.000	0.00	1.49	7.951	O	3.32
35.083	0.00	1.49	7.941	O	3.32
35.167	0.00	1.49	7.930	O	3.32
35.250	0.00	1.49	7.920	O	3.31
35.333	0.00	1.49	7.910	O	3.31
35.417	0.00	1.49	7.899	O	3.30
35.500	0.00	1.49	7.889	O	3.30
35.583	0.00	1.49	7.879	O	3.30
35.667	0.00	1.49	7.869	O	3.29
35.750	0.00	1.49	7.858	O	3.29
35.833	0.00	1.49	7.848	O	3.28
35.917	0.00	1.49	7.838	O	3.28
36.000	0.00	1.49	7.828	O	3.28
36.083	0.00	1.49	7.817	O	3.27
36.167	0.00	1.49	7.807	O	3.27
36.250	0.00	1.49	7.797	O	3.26
36.333	0.00	1.49	7.786	O	3.26
36.417	0.00	1.49	7.776	O	3.26
36.500	0.00	1.49	7.766	O	3.25
36.583	0.00	1.49	7.756	O	3.25
36.667	0.00	1.49	7.745	O	3.24

36.750	0.00	1.49	7.735	O					3.24
36.833	0.00	1.49	7.725	O					3.24
36.917	0.00	1.49	7.714	O					3.23
37.000	0.00	1.49	7.704	O					3.23
37.083	0.00	1.49	7.694	O					3.22
37.167	0.00	1.49	7.684	O					3.22
37.250	0.00	1.49	7.673	O					3.22
37.333	0.00	1.49	7.663	O					3.21
37.417	0.00	1.49	7.653	O					3.21
37.500	0.00	1.49	7.643	O					3.20
37.583	0.00	1.49	7.632	O					3.20
37.667	0.00	1.49	7.622	O					3.20
37.750	0.00	1.49	7.612	O					3.19
37.833	0.00	1.49	7.601	O					3.19
37.917	0.00	1.49	7.591	O					3.18
38.000	0.00	1.49	7.581	O					3.18
38.083	0.00	1.49	7.571	O					3.18
38.167	0.00	1.49	7.560	O					3.17
38.250	0.00	1.49	7.550	O					3.17
38.333	0.00	1.49	7.540	O					3.16
38.417	0.00	1.49	7.529	O					3.16
38.500	0.00	1.49	7.519	O					3.16
38.583	0.00	1.49	7.509	O					3.15
38.667	0.00	1.49	7.499	O					3.15
38.750	0.00	1.49	7.488	O					3.14
38.833	0.00	1.49	7.478	O					3.14
38.917	0.00	1.49	7.468	O					3.14
39.000	0.00	1.49	7.458	O					3.13
39.083	0.00	1.49	7.447	O					3.13
39.167	0.00	1.49	7.437	O					3.12
39.250	0.00	1.49	7.427	O					3.12
39.333	0.00	1.49	7.416	O					3.12
39.417	0.00	1.49	7.406	O					3.11
39.500	0.00	1.49	7.396	O					3.11
39.583	0.00	1.49	7.386	O					3.10
39.667	0.00	1.49	7.375	O					3.10
39.750	0.00	1.49	7.365	O					3.10
39.833	0.00	1.49	7.355	O					3.09
39.917	0.00	1.49	7.345	O					3.09
40.000	0.00	1.49	7.334	O					3.08
40.083	0.00	1.49	7.324	O					3.08
40.167	0.00	1.49	7.314	O					3.08
40.250	0.00	1.49	7.303	O					3.07
40.333	0.00	1.49	7.293	O					3.07
40.417	0.00	1.49	7.283	O					3.06
40.500	0.00	1.49	7.273	O					3.06
40.583	0.00	1.49	7.262	O					3.06
40.667	0.00	1.49	7.252	O					3.05
40.750	0.00	1.49	7.242	O					3.05
40.833	0.00	1.49	7.231	O					3.04
40.917	0.00	1.49	7.221	O					3.04
41.000	0.00	1.49	7.211	O					3.04
41.083	0.00	1.49	7.201	O					3.03
41.167	0.00	1.49	7.190	O					3.03
41.250	0.00	1.49	7.180	O					3.02
41.333	0.00	1.49	7.170	O					3.02
41.417	0.00	1.49	7.160	O					3.02
41.500	0.00	1.49	7.149	O					3.01
41.583	0.00	1.49	7.139	O					3.01
41.667	0.00	1.49	7.129	O					3.00
41.750	0.00	1.49	7.118	O					3.00
41.833	0.00	1.49	7.108	O					3.00
41.917	0.00	1.49	7.098	O					2.99
42.000	0.00	1.49	7.088	O					2.99
42.083	0.00	1.49	7.077	O					2.98
42.167	0.00	1.49	7.067	O					2.98
42.250	0.00	1.49	7.057	O					2.97
42.333	0.00	1.49	7.047	O					2.97
42.417	0.00	1.49	7.036	O					2.97
42.500	0.00	1.49	7.026	O					2.96
42.583	0.00	1.49	7.016	O					2.96
42.667	0.00	1.49	7.005	O					2.95
42.750	0.00	1.49	6.995	O					2.95

42.833	0.00	1.49	6.985	O	2.94
42.917	0.00	1.49	6.975	O	2.94
43.000	0.00	1.49	6.964	O	2.94
43.083	0.00	1.49	6.954	O	2.93
43.167	0.00	1.49	6.944	O	2.93
43.250	0.00	1.49	6.933	O	2.92
43.333	0.00	1.49	6.923	O	2.92
43.417	0.00	1.49	6.913	O	2.92
43.500	0.00	1.49	6.903	O	2.91
43.583	0.00	1.49	6.892	O	2.91
43.667	0.00	1.49	6.882	O	2.90
43.750	0.00	1.49	6.872	O	2.90
43.833	0.00	1.49	6.862	O	2.89
43.917	0.00	1.49	6.851	O	2.89
44.000	0.00	1.49	6.841	O	2.89
44.083	0.00	1.49	6.831	O	2.88
44.167	0.00	1.49	6.820	O	2.88
44.250	0.00	1.49	6.810	O	2.87
44.333	0.00	1.49	6.800	O	2.87
44.417	0.00	1.49	6.790	O	2.87
44.500	0.00	1.49	6.779	O	2.86
44.583	0.00	1.49	6.769	O	2.86
44.667	0.00	1.49	6.759	O	2.85
44.750	0.00	1.49	6.749	O	2.85
44.833	0.00	1.49	6.738	O	2.84
44.917	0.00	1.49	6.728	O	2.84
45.000	0.00	1.49	6.718	O	2.84
45.083	0.00	1.49	6.707	O	2.83
45.167	0.00	1.49	6.697	O	2.83
45.250	0.00	1.49	6.687	O	2.82
45.333	0.00	1.49	6.677	O	2.82
45.417	0.00	1.49	6.666	O	2.81
45.500	0.00	1.49	6.656	O	2.81
45.583	0.00	1.49	6.646	O	2.81
45.667	0.00	1.49	6.636	O	2.80
45.750	0.00	1.49	6.625	O	2.80
45.833	0.00	1.49	6.615	O	2.79
45.917	0.00	1.49	6.605	O	2.79
46.000	0.00	1.49	6.594	O	2.79
46.083	0.00	1.49	6.584	O	2.78
46.167	0.00	1.49	6.574	O	2.78
46.250	0.00	1.49	6.564	O	2.77
46.333	0.00	1.49	6.553	O	2.77
46.417	0.00	1.49	6.543	O	2.76
46.500	0.00	1.49	6.533	O	2.76
46.583	0.00	1.49	6.523	O	2.76
46.667	0.00	1.49	6.512	O	2.75
46.750	0.00	1.49	6.502	O	2.75
46.833	0.00	1.49	6.492	O	2.74
46.917	0.00	1.49	6.481	O	2.74
47.000	0.00	1.49	6.471	O	2.74
47.083	0.00	1.49	6.461	O	2.73
47.167	0.00	1.49	6.451	O	2.73
47.250	0.00	1.49	6.440	O	2.72
47.333	0.00	1.49	6.430	O	2.72
47.417	0.00	1.49	6.420	O	2.71
47.500	0.00	1.49	6.410	O	2.71
47.583	0.00	1.49	6.399	O	2.71
47.667	0.00	1.49	6.389	O	2.70
47.750	0.00	1.49	6.379	O	2.70
47.833	0.00	1.49	6.368	O	2.69
47.917	0.00	1.49	6.358	O	2.69
48.000	0.00	1.49	6.348	O	2.68
48.083	0.00	1.49	6.338	O	2.68
48.167	0.00	1.49	6.327	O	2.68
48.250	0.00	1.49	6.317	O	2.67
48.333	0.00	1.49	6.307	O	2.67
48.417	0.00	1.49	6.296	O	2.66
48.500	0.00	1.49	6.286	O	2.66
48.583	0.00	1.49	6.276	O	2.66
48.667	0.00	1.49	6.266	O	2.65
48.750	0.00	1.49	6.255	O	2.65
48.833	0.00	1.49	6.245	O	2.64

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48.917   0.00   1.49   6.235  O       |       |       |       |     2.64
49.000   0.00   1.49   6.225  O       |       |       |       |     2.63
49.083   0.00   1.49   6.214  O       |       |       |       |     2.63
49.167   0.00   1.49   6.204  O       |       |       |       |     2.63
49.250   0.00   1.49   6.194  O       |       |       |       |     2.62
49.333   0.00   1.49   6.183  O       |       |       |       |     2.62
49.417   0.00   1.49   6.173  O       |       |       |       |     2.61
49.500   0.00   1.49   6.163  O       |       |       |       |     2.61
49.583   0.00   1.49   6.153  O       |       |       |       |     2.61
49.667   0.00   1.49   6.142  O       |       |       |       |     2.60
49.750   0.00   1.49   6.132  O       |       |       |       |     2.60
49.833   0.00   1.49   6.122  O       |       |       |       |     2.59
49.917   0.00   1.49   6.112  O       |       |       |       |     2.59
50.000   0.00   1.49   6.101  O       |       |       |       |     2.58
50.083   0.00   1.49   6.091  O       |       |       |       |     2.58
50.167   0.00   1.49   6.081  O       |       |       |       |     2.58
50.250   0.00   1.49   6.070  O       |       |       |       |     2.57
50.333   0.00   1.49   6.060  O       |       |       |       |     2.57
50.417   0.00   1.49   6.050  O       |       |       |       |     2.56
50.500   0.00   1.49   6.040  O       |       |       |       |     2.56
50.583   0.00   1.49   6.029  O       |       |       |       |     2.55
50.667   0.00   1.49   6.019  O       |       |       |       |     2.55
50.750   0.00   1.49   6.009  O       |       |       |       |     2.55
50.833   0.00   1.49   5.999  O       |       |       |       |     2.54
50.917   0.00   1.49   5.988  O       |       |       |       |     2.54
51.000   0.00   1.49   5.978  O       |       |       |       |     2.53
51.083   0.00   1.49   5.968  O       |       |       |       |     2.53
51.167   0.00   1.49   5.958  O       |       |       |       |     2.53
51.250   0.00   1.49   5.947  O       |       |       |       |     2.52
51.333   0.00   1.49   5.937  O       |       |       |       |     2.52
51.417   0.00   1.49   5.927  O       |       |       |       |     2.51
51.500   0.00   1.49   5.916  O       |       |       |       |     2.51
51.583   0.00   1.49   5.906  O       |       |       |       |     2.50
51.667   0.00   1.49   5.896  O       |       |       |       |     2.50
51.750   0.00   1.49   5.886  O       |       |       |       |     2.50
51.833   0.00   1.49   5.875  O       |       |       |       |     2.49
51.917   0.00   1.49   5.865  O       |       |       |       |     2.49
52.000   0.00   1.49   5.855  O       |       |       |       |     2.48
52.083   0.00   1.49   5.845  O       |       |       |       |     2.48
52.167   0.00   1.49   5.834  O       |       |       |       |     2.48
52.250   0.00   1.49   5.824  O       |       |       |       |     2.47
52.333   0.00   1.49   5.814  O       |       |       |       |     2.47
52.417   0.00   1.49   5.803  O       |       |       |       |     2.46
52.500   0.00   1.49   5.793  O       |       |       |       |     2.46
52.583   0.00   1.49   5.783  O       |       |       |       |     2.45
52.667   0.00   1.49   5.773  O       |       |       |       |     2.45
52.750   0.00   1.49   5.762  O       |       |       |       |     2.45
52.833   0.00   1.49   5.752  O       |       |       |       |     2.44
52.917   0.00   1.49   5.742  O       |       |       |       |     2.44
53.000   0.00   1.49   5.732  O       |       |       |       |     2.43
53.083   0.00   1.49   5.721  O       |       |       |       |     2.43
53.167   0.00   1.49   5.711  O       |       |       |       |     2.42
53.250   0.00   1.49   5.701  O       |       |       |       |     2.42
53.333   0.00   1.49   5.690  O       |       |       |       |     2.42
53.417   0.00   1.49   5.680  O       |       |       |       |     2.41
53.500   0.00   1.49   5.670  O       |       |       |       |     2.41
53.583   0.00   1.49   5.660  O       |       |       |       |     2.40
53.667   0.00   1.49   5.649  O       |       |       |       |     2.40
53.750   0.00   1.49   5.639  O       |       |       |       |     2.40
53.833   0.00   1.49   5.629  O       |       |       |       |     2.39
53.917   0.00   1.49   5.619  O       |       |       |       |     2.39
54.000   0.00   1.49   5.608  O       |       |       |       |     2.38
54.083   0.00   1.49   5.598  O       |       |       |       |     2.38
54.167   0.00   1.49   5.588  O       |       |       |       |     2.37
54.250   0.00   1.49   5.577  O       |       |       |       |     2.37
54.333   0.00   1.49   5.567  O       |       |       |       |     2.37
54.417   0.00   1.49   5.557  O       |       |       |       |     2.36
54.500   0.00   1.49   5.547  O       |       |       |       |     2.36
54.583   0.00   1.49   5.536  O       |       |       |       |     2.35
54.667   0.00   1.49   5.526  O       |       |       |       |     2.35
54.750   0.00   1.49   5.516  O       |       |       |       |     2.35
54.833   0.00   1.49   5.506  O       |       |       |       |     2.34
54.917   0.00   1.49   5.495  O       |       |       |       |     2.34
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55.000	0.00	1.49	5.485	O	|	|	|	|	2.33
55.083	0.00	1.49	5.475	O	|	|	|	|	2.33
55.167	0.00	1.49	5.464	O	|	|	|	|	2.32
55.250	0.00	1.49	5.454	O	|	|	|	|	2.32
55.333	0.00	1.49	5.444	O	|	|	|	|	2.32
55.417	0.00	1.49	5.434	O	|	|	|	|	2.31
55.500	0.00	1.49	5.423	O	|	|	|	|	2.31
55.583	0.00	1.49	5.413	O	|	|	|	|	2.30
55.667	0.00	1.49	5.403	O	|	|	|	|	2.30
55.750	0.00	1.49	5.393	O	|	|	|	|	2.29
55.833	0.00	1.49	5.382	O	|	|	|	|	2.29
55.917	0.00	1.49	5.372	O	|	|	|	|	2.29
56.000	0.00	1.49	5.362	O	|	|	|	|	2.28
56.083	0.00	1.49	5.351	O	|	|	|	|	2.28
56.167	0.00	1.49	5.341	O	|	|	|	|	2.27
56.250	0.00	1.49	5.331	O	|	|	|	|	2.27
56.333	0.00	1.49	5.321	O	|	|	|	|	2.27
56.417	0.00	1.49	5.310	O	|	|	|	|	2.26
56.500	0.00	1.49	5.300	O	|	|	|	|	2.26
56.583	0.00	1.49	5.290	O	|	|	|	|	2.25
56.667	0.00	1.49	5.280	O	|	|	|	|	2.25
56.750	0.00	1.49	5.269	O	|	|	|	|	2.24
56.833	0.00	1.49	5.259	O	|	|	|	|	2.24
56.917	0.00	1.49	5.249	O	|	|	|	|	2.24
57.000	0.00	1.49	5.239	O	|	|	|	|	2.23
57.083	0.00	1.49	5.228	O	|	|	|	|	2.23
57.167	0.00	1.49	5.218	O	|	|	|	|	2.22
57.250	0.00	1.49	5.208	O	|	|	|	|	2.22
57.333	0.00	1.49	5.197	O	|	|	|	|	2.22
57.417	0.00	1.49	5.187	O	|	|	|	|	2.21
57.500	0.00	1.49	5.177	O	|	|	|	|	2.21
57.583	0.00	1.49	5.167	O	|	|	|	|	2.20
57.667	0.00	1.49	5.156	O	|	|	|	|	2.20
57.750	0.00	1.49	5.146	O	|	|	|	|	2.19
57.833	0.00	1.49	5.136	O	|	|	|	|	2.19
57.917	0.00	1.49	5.126	O	|	|	|	|	2.19
58.000	0.00	1.49	5.115	O	|	|	|	|	2.18
58.083	0.00	1.49	5.105	O	|	|	|	|	2.18
58.167	0.00	1.49	5.095	O	|	|	|	|	2.17
58.250	0.00	1.49	5.084	O	|	|	|	|	2.17
58.333	0.00	1.49	5.074	O	|	|	|	|	2.16
58.417	0.00	1.49	5.064	O	|	|	|	|	2.16
58.500	0.00	1.49	5.054	O	|	|	|	|	2.16
58.583	0.00	1.49	5.043	O	|	|	|	|	2.15
58.667	0.00	1.49	5.033	O	|	|	|	|	2.15
58.750	0.00	1.49	5.023	O	|	|	|	|	2.14
58.833	0.00	1.49	5.013	O	|	|	|	|	2.14
58.917	0.00	1.49	5.002	O	|	|	|	|	2.14
59.000	0.00	1.49	4.992	O	|	|	|	|	2.13
59.083	0.00	1.49	4.982	O	|	|	|	|	2.13
59.167	0.00	1.49	4.972	O	|	|	|	|	2.12
59.250	0.00	1.49	4.961	O	|	|	|	|	2.12
59.333	0.00	1.49	4.951	O	|	|	|	|	2.11
59.417	0.00	1.49	4.941	O	|	|	|	|	2.11
59.500	0.00	1.49	4.930	O	|	|	|	|	2.11
59.583	0.00	1.49	4.920	O	|	|	|	|	2.10
59.667	0.00	1.49	4.910	O	|	|	|	|	2.10
59.750	0.00	1.49	4.900	O	|	|	|	|	2.09
59.833	0.00	1.49	4.889	O	|	|	|	|	2.09
59.917	0.00	1.49	4.879	O	|	|	|	|	2.09
60.000	0.00	1.49	4.869	O	|	|	|	|	2.08
60.083	0.00	1.49	4.859	O	|	|	|	|	2.08
60.167	0.00	1.49	4.848	O	|	|	|	|	2.07
60.250	0.00	1.49	4.838	O	|	|	|	|	2.07
60.333	0.00	1.49	4.828	O	|	|	|	|	2.06
60.417	0.00	1.49	4.817	O	|	|	|	|	2.06
60.500	0.00	1.49	4.807	O	|	|	|	|	2.06
60.583	0.00	1.49	4.797	O	|	|	|	|	2.05
60.667	0.00	1.49	4.787	O	|	|	|	|	2.05
60.750	0.00	1.49	4.776	O	|	|	|	|	2.04
60.833	0.00	1.49	4.766	O	|	|	|	|	2.04
60.917	0.00	1.49	4.756	O	|	|	|	|	2.04
61.000	0.00	1.49	4.746	O	|	|	|	|	2.03

61.083	0.00	1.49	4.735	O	2.03
61.167	0.00	1.49	4.725	O	2.02
61.250	0.00	1.49	4.715	O	2.02
61.333	0.00	1.49	4.705	O	2.01
61.417	0.00	1.49	4.694	O	2.01
61.500	0.00	1.49	4.684	O	2.01
61.583	0.00	1.49	4.674	O	2.00
61.667	0.00	1.49	4.663	O	2.00
61.750	0.00	1.49	4.653	O	1.99
61.833	0.00	1.49	4.643	O	1.99
61.917	0.00	1.49	4.633	O	1.98
62.000	0.00	1.49	4.622	O	1.98
62.083	0.00	1.49	4.612	O	1.98
62.167	0.00	1.49	4.602	O	1.97
62.250	0.00	1.49	4.592	O	1.97
62.333	0.00	1.49	4.581	O	1.96
62.417	0.00	1.49	4.571	O	1.96
62.500	0.00	1.49	4.561	O	1.96
62.583	0.00	1.49	4.550	O	1.95
62.667	0.00	1.49	4.540	O	1.95
62.750	0.00	1.49	4.530	O	1.94
62.833	0.00	1.49	4.520	O	1.94
62.917	0.00	1.49	4.509	O	1.93
63.000	0.00	1.49	4.499	O	1.93
63.083	0.00	1.49	4.489	O	1.93
63.167	0.00	1.49	4.479	O	1.92
63.250	0.00	1.49	4.468	O	1.92
63.333	0.00	1.49	4.458	O	1.91
63.417	0.00	1.49	4.448	O	1.91
63.500	0.00	1.49	4.438	O	1.91
63.583	0.00	1.49	4.427	O	1.90
63.667	0.00	1.49	4.417	O	1.90
63.750	0.00	1.49	4.407	O	1.89
63.833	0.00	1.49	4.396	O	1.89
63.917	0.00	1.49	4.386	O	1.88
64.000	0.00	1.49	4.376	O	1.88
64.083	0.00	1.49	4.366	O	1.88
64.167	0.00	1.49	4.355	O	1.87
64.250	0.00	1.49	4.345	O	1.87
64.333	0.00	1.49	4.335	O	1.86
64.417	0.00	1.49	4.325	O	1.86
64.500	0.00	1.49	4.314	O	1.85
64.583	0.00	1.49	4.304	O	1.85
64.667	0.00	1.49	4.294	O	1.85
64.750	0.00	1.49	4.284	O	1.84
64.833	0.00	1.49	4.273	O	1.84
64.917	0.00	1.49	4.263	O	1.83
65.000	0.00	1.49	4.253	O	1.83
65.083	0.00	1.49	4.242	O	1.83
65.167	0.00	1.49	4.232	O	1.82
65.250	0.00	1.49	4.222	O	1.82
65.333	0.00	1.49	4.212	O	1.81
65.417	0.00	1.49	4.201	O	1.81
65.500	0.00	1.49	4.191	O	1.80
65.583	0.00	1.49	4.181	O	1.80
65.667	0.00	1.49	4.171	O	1.80
65.750	0.00	1.49	4.160	O	1.79
65.833	0.00	1.49	4.150	O	1.79
65.917	0.00	1.49	4.140	O	1.78
66.000	0.00	1.49	4.130	O	1.78
66.083	0.00	1.49	4.119	O	1.78
66.167	0.00	1.49	4.109	O	1.77
66.250	0.00	1.49	4.099	O	1.77
66.333	0.00	1.49	4.088	O	1.76
66.417	0.00	1.49	4.078	O	1.76
66.500	0.00	1.49	4.068	O	1.75
66.583	0.00	1.49	4.058	O	1.75
66.667	0.00	1.49	4.047	O	1.75
66.750	0.00	1.49	4.037	O	1.74
66.833	0.00	1.49	4.027	O	1.74
66.917	0.00	1.49	4.017	O	1.73
67.000	0.00	1.49	4.006	O	1.73
67.083	0.00	1.49	3.996	O	1.72

67.167	0.00	1.49	3.986	O	|	|	|	|	1.72
67.250	0.00	1.49	3.976	O	|	|	|	|	1.72
67.333	0.00	1.49	3.965	O	|	|	|	|	1.71
67.417	0.00	1.49	3.955	O	|	|	|	|	1.71
67.500	0.00	1.49	3.945	O	|	|	|	|	1.70
67.583	0.00	1.49	3.934	O	|	|	|	|	1.70
67.667	0.00	1.49	3.924	O	|	|	|	|	1.70
67.750	0.00	1.49	3.914	O	|	|	|	|	1.69
67.833	0.00	1.49	3.904	O	|	|	|	|	1.69
67.917	0.00	1.49	3.893	O	|	|	|	|	1.68
68.000	0.00	1.49	3.883	O	|	|	|	|	1.68
68.083	0.00	1.49	3.873	O	|	|	|	|	1.67
68.167	0.00	1.49	3.863	O	|	|	|	|	1.67
68.250	0.00	1.49	3.852	O	|	|	|	|	1.67
68.333	0.00	1.49	3.842	O	|	|	|	|	1.66
68.417	0.00	1.49	3.832	O	|	|	|	|	1.66
68.500	0.00	1.49	3.822	O	|	|	|	|	1.65
68.583	0.00	1.49	3.811	O	|	|	|	|	1.65
68.667	0.00	1.49	3.801	O	|	|	|	|	1.65
68.750	0.00	1.49	3.791	O	|	|	|	|	1.64
68.833	0.00	1.49	3.780	O	|	|	|	|	1.64
68.917	0.00	1.49	3.770	O	|	|	|	|	1.63
69.000	0.00	1.49	3.760	O	|	|	|	|	1.63
69.083	0.00	1.49	3.750	O	|	|	|	|	1.62
69.167	0.00	1.49	3.739	O	|	|	|	|	1.62
69.250	0.00	1.49	3.729	O	|	|	|	|	1.62
69.333	0.00	1.49	3.719	O	|	|	|	|	1.61
69.417	0.00	1.49	3.709	O	|	|	|	|	1.61
69.500	0.00	1.49	3.698	O	|	|	|	|	1.60
69.583	0.00	1.49	3.688	O	|	|	|	|	1.60
69.667	0.00	1.49	3.678	O	|	|	|	|	1.60
69.750	0.00	1.49	3.668	O	|	|	|	|	1.59
69.833	0.00	1.49	3.657	O	|	|	|	|	1.59
69.917	0.00	1.49	3.647	O	|	|	|	|	1.58
70.000	0.00	1.49	3.637	O	|	|	|	|	1.58
70.083	0.00	1.49	3.626	O	|	|	|	|	1.57
70.167	0.00	1.49	3.616	O	|	|	|	|	1.57
70.250	0.00	1.49	3.606	O	|	|	|	|	1.57
70.333	0.00	1.49	3.596	O	|	|	|	|	1.56
70.417	0.00	1.49	3.585	O	|	|	|	|	1.56
70.500	0.00	1.49	3.575	O	|	|	|	|	1.55
70.583	0.00	1.49	3.565	O	|	|	|	|	1.55
70.667	0.00	1.49	3.555	O	|	|	|	|	1.54
70.750	0.00	1.49	3.544	O	|	|	|	|	1.54
70.833	0.00	1.49	3.534	O	|	|	|	|	1.54
70.917	0.00	1.49	3.524	O	|	|	|	|	1.53
71.000	0.00	1.49	3.514	O	|	|	|	|	1.53
71.083	0.00	1.49	3.503	O	|	|	|	|	1.52
71.167	0.00	1.49	3.493	O	|	|	|	|	1.52
71.250	0.00	1.49	3.483	O	|	|	|	|	1.52
71.333	0.00	1.49	3.472	O	|	|	|	|	1.51
71.417	0.00	1.49	3.462	O	|	|	|	|	1.51
71.500	0.00	1.49	3.452	O	|	|	|	|	1.50
71.583	0.00	1.49	3.442	O	|	|	|	|	1.50
71.667	0.00	1.49	3.431	O	|	|	|	|	1.49
71.750	0.00	1.49	3.421	O	|	|	|	|	1.49
71.833	0.00	1.49	3.411	O	|	|	|	|	1.49
71.917	0.00	1.49	3.401	O	|	|	|	|	1.48
72.000	0.00	1.49	3.390	O	|	|	|	|	1.48
72.083	0.00	1.49	3.380	O	|	|	|	|	1.47
72.167	0.00	1.49	3.370	O	|	|	|	|	1.47
72.250	0.00	1.49	3.360	O	|	|	|	|	1.47
72.333	0.00	1.49	3.349	O	|	|	|	|	1.46
72.417	0.00	1.49	3.339	O	|	|	|	|	1.46
72.500	0.00	1.49	3.329	O	|	|	|	|	1.45
72.583	0.00	1.49	3.318	O	|	|	|	|	1.45
72.667	0.00	1.49	3.308	O	|	|	|	|	1.44
72.750	0.00	1.49	3.298	O	|	|	|	|	1.44
72.833	0.00	1.49	3.288	O	|	|	|	|	1.44
72.917	0.00	1.49	3.277	O	|	|	|	|	1.43
73.000	0.00	1.49	3.267	O	|	|	|	|	1.43
73.083	0.00	1.49	3.257	O	|	|	|	|	1.42
73.167	0.00	1.49	3.247	O	|	|	|	|	1.42

73.250	0.00	1.49	3.236	O	1.41
73.333	0.00	1.49	3.226	O	1.41
73.417	0.00	1.49	3.216	O	1.41
73.500	0.00	1.49	3.206	O	1.40
73.583	0.00	1.49	3.195	O	1.40
73.667	0.00	1.49	3.185	O	1.39
73.750	0.00	1.49	3.175	O	1.39
73.833	0.00	1.49	3.165	O	1.39
73.917	0.00	1.49	3.154	O	1.38
74.000	0.00	1.49	3.144	O	1.38
74.083	0.00	1.49	3.134	O	1.37
74.167	0.00	1.49	3.123	O	1.37
74.250	0.00	1.49	3.113	O	1.36
74.333	0.00	1.49	3.103	O	1.36
74.417	0.00	1.49	3.093	O	1.36
74.500	0.00	1.49	3.082	O	1.35
74.583	0.00	1.49	3.072	O	1.35
74.667	0.00	1.49	3.062	O	1.34
74.750	0.00	1.49	3.052	O	1.34
74.833	0.00	1.49	3.041	O	1.34
74.917	0.00	1.49	3.031	O	1.33
75.000	0.00	1.49	3.021	O	1.33
75.083	0.00	1.49	3.011	O	1.32
75.167	0.00	1.49	3.000	O	1.32
75.250	0.00	1.49	2.990	O	1.31
75.333	0.00	1.49	2.980	O	1.31
75.417	0.00	1.49	2.970	O	1.31
75.500	0.00	1.49	2.959	O	1.30
75.583	0.00	1.49	2.949	O	1.30
75.667	0.00	1.49	2.939	O	1.29
75.750	0.00	1.49	2.928	O	1.29
75.833	0.00	1.49	2.918	O	1.28
75.917	0.00	1.49	2.908	O	1.28
76.000	0.00	1.49	2.898	O	1.28
76.083	0.00	1.49	2.887	O	1.27
76.167	0.00	1.49	2.877	O	1.27
76.250	0.00	1.49	2.867	O	1.26
76.333	0.00	1.49	2.857	O	1.26
76.417	0.00	1.49	2.846	O	1.26
76.500	0.00	1.49	2.836	O	1.25
76.583	0.00	1.49	2.826	O	1.25
76.667	0.00	1.49	2.816	O	1.24
76.750	0.00	1.49	2.805	O	1.24
76.833	0.00	1.49	2.795	O	1.23
76.917	0.00	1.49	2.785	O	1.23
77.000	0.00	1.49	2.775	O	1.23
77.083	0.00	1.49	2.764	O	1.22
77.167	0.00	1.49	2.754	O	1.22
77.250	0.00	1.49	2.744	O	1.21
77.333	0.00	1.49	2.733	O	1.21
77.417	0.00	1.49	2.723	O	1.21
77.500	0.00	1.49	2.713	O	1.20
77.583	0.00	1.49	2.703	O	1.20
77.667	0.00	1.49	2.692	O	1.19
77.750	0.00	1.49	2.682	O	1.19
77.833	0.00	1.49	2.672	O	1.18
77.917	0.00	1.49	2.662	O	1.18
78.000	0.00	1.49	2.651	O	1.18
78.083	0.00	1.49	2.641	O	1.17
78.167	0.00	1.49	2.631	O	1.17
78.250	0.00	1.49	2.621	O	1.16
78.333	0.00	1.49	2.610	O	1.16
78.417	0.00	1.49	2.600	O	1.16
78.500	0.00	1.49	2.590	O	1.15
78.583	0.00	1.49	2.580	O	1.15
78.667	0.00	1.49	2.569	O	1.14
78.750	0.00	1.49	2.559	O	1.14
78.833	0.00	1.49	2.549	O	1.13
78.917	0.00	1.49	2.538	O	1.13
79.000	0.00	1.49	2.528	O	1.13
79.083	0.00	1.49	2.518	O	1.12
79.167	0.00	1.49	2.508	O	1.12
79.250	0.00	1.49	2.497	O	1.11

79.333	0.00	1.49	2.487	O	|	|	|	|	1.11
79.417	0.00	1.49	2.477	O	|	|	|	|	1.10
79.500	0.00	1.49	2.467	O	|	|	|	|	1.10
79.583	0.00	1.49	2.456	O	|	|	|	|	1.10
79.667	0.00	1.49	2.446	O	|	|	|	|	1.09
79.750	0.00	1.49	2.436	O	|	|	|	|	1.09
79.833	0.00	1.49	2.426	O	|	|	|	|	1.08
79.917	0.00	1.49	2.415	O	|	|	|	|	1.08
80.000	0.00	1.49	2.405	O	|	|	|	|	1.08
80.083	0.00	1.49	2.395	O	|	|	|	|	1.07
80.167	0.00	1.49	2.385	O	|	|	|	|	1.07
80.250	0.00	1.49	2.374	O	|	|	|	|	1.06
80.333	0.00	1.49	2.364	O	|	|	|	|	1.06
80.417	0.00	1.49	2.354	O	|	|	|	|	1.05
80.500	0.00	1.49	2.343	O	|	|	|	|	1.05
80.583	0.00	1.49	2.333	O	|	|	|	|	1.05
80.667	0.00	1.49	2.323	O	|	|	|	|	1.04
80.750	0.00	1.49	2.313	O	|	|	|	|	1.04
80.833	0.00	1.49	2.302	O	|	|	|	|	1.03
80.917	0.00	1.49	2.292	O	|	|	|	|	1.03
81.000	0.00	1.49	2.282	O	|	|	|	|	1.03
81.083	0.00	1.49	2.272	O	|	|	|	|	1.02
81.167	0.00	1.49	2.261	O	|	|	|	|	1.02
81.250	0.00	1.49	2.251	O	|	|	|	|	1.01
81.333	0.00	1.49	2.241	O	|	|	|	|	1.01
81.417	0.00	1.49	2.231	O	|	|	|	|	1.00
81.500	0.00	1.49	2.220	O	|	|	|	|	1.00
81.583	0.00	1.48	2.210	O	|	|	|	|	1.00
81.667	0.00	1.48	2.200	O	|	|	|	|	0.99
81.750	0.00	1.47	2.190	O	|	|	|	|	0.99
81.833	0.00	1.46	2.180	O	|	|	|	|	0.98
81.917	0.00	1.46	2.170	O	|	|	|	|	0.98
82.000	0.00	1.45	2.160	O	|	|	|	|	0.97
82.083	0.00	1.44	2.150	O	|	|	|	|	0.97
82.167	0.00	1.44	2.140	O	|	|	|	|	0.96
82.250	0.00	1.43	2.130	O	|	|	|	|	0.96
82.333	0.00	1.42	2.120	O	|	|	|	|	0.95
82.417	0.00	1.42	2.110	O	|	|	|	|	0.95
82.500	0.00	1.41	2.101	O	|	|	|	|	0.95
82.583	0.00	1.40	2.091	O	|	|	|	|	0.94
82.667	0.00	1.40	2.081	O	|	|	|	|	0.94
82.750	0.00	1.39	2.072	O	|	|	|	|	0.93
82.833	0.00	1.38	2.062	O	|	|	|	|	0.93
82.917	0.00	1.38	2.053	O	|	|	|	|	0.92
83.000	0.00	1.37	2.043	O	|	|	|	|	0.92
83.083	0.00	1.36	2.034	O	|	|	|	|	0.92
83.167	0.00	1.36	2.024	O	|	|	|	|	0.91
83.250	0.00	1.35	2.015	O	|	|	|	|	0.91
83.333	0.00	1.35	2.006	O	|	|	|	|	0.90
83.417	0.00	1.34	1.996	O	|	|	|	|	0.90
83.500	0.00	1.33	1.987	O	|	|	|	|	0.90
83.583	0.00	1.33	1.978	O	|	|	|	|	0.89
83.667	0.00	1.32	1.969	O	|	|	|	|	0.89
83.750	0.00	1.32	1.960	O	|	|	|	|	0.88
83.833	0.00	1.31	1.951	O	|	|	|	|	0.88
83.917	0.00	1.30	1.942	O	|	|	|	|	0.87
84.000	0.00	1.30	1.933	O	|	|	|	|	0.87
84.083	0.00	1.29	1.924	O	|	|	|	|	0.87
84.167	0.00	1.29	1.915	O	|	|	|	|	0.86
84.250	0.00	1.28	1.906	O	|	|	|	|	0.86
84.333	0.00	1.27	1.897	O	|	|	|	|	0.85
84.417	0.00	1.27	1.889	O	|	|	|	|	0.85
84.500	0.00	1.26	1.880	O	|	|	|	|	0.85
84.583	0.00	1.26	1.871	O	|	|	|	|	0.84
84.667	0.00	1.25	1.863	O	|	|	|	|	0.84
84.750	0.00	1.24	1.854	O	|	|	|	|	0.84
84.833	0.00	1.24	1.846	O	|	|	|	|	0.83
84.917	0.00	1.23	1.837	O	|	|	|	|	0.83
85.000	0.00	1.23	1.829	O	|	|	|	|	0.82
85.083	0.00	1.22	1.820	O	|	|	|	|	0.82
85.167	0.00	1.22	1.812	O	|	|	|	|	0.82
85.250	0.00	1.21	1.803	O	|	|	|	|	0.81
85.333	0.00	1.20	1.795	O	|	|	|	|	0.81

85.417	0.00	1.20	1.787	O	0.80
85.500	0.00	1.19	1.779	O	0.80
85.583	0.00	1.19	1.770	O	0.80
85.667	0.00	1.18	1.762	O	0.79
85.750	0.00	1.18	1.754	O	0.79
85.833	0.00	1.17	1.746	O	0.79
85.917	0.00	1.17	1.738	O	0.78
86.000	0.00	1.16	1.730	O	0.78
86.083	0.00	1.16	1.722	O	0.78
86.167	0.00	1.15	1.714	O	0.77
86.250	0.00	1.15	1.706	O	0.77
86.333	0.00	1.14	1.698	O	0.76
86.417	0.00	1.13	1.690	O	0.76
86.500	0.00	1.13	1.683	O	0.76
86.583	0.00	1.12	1.675	O	0.75
86.667	0.00	1.12	1.667	O	0.75
86.750	0.00	1.11	1.659	O	0.75
86.833	0.00	1.11	1.652	O	0.74
86.917	0.00	1.10	1.644	O	0.74
87.000	0.00	1.10	1.637	O	0.74
87.083	0.00	1.09	1.629	O	0.73
87.167	0.00	1.09	1.621	O	0.73
87.250	0.00	1.08	1.614	O	0.73
87.333	0.00	1.08	1.607	O	0.72
87.417	0.00	1.07	1.599	O	0.72
87.500	0.00	1.07	1.592	O	0.72
87.583	0.00	1.06	1.584	O	0.71
87.667	0.00	1.06	1.577	O	0.71
87.750	0.00	1.05	1.570	O	0.71
87.833	0.00	1.05	1.563	O	0.70
87.917	0.00	1.04	1.555	O	0.70
88.000	0.00	1.04	1.548	O	0.70
88.083	0.00	1.03	1.541	O	0.69
88.167	0.00	1.03	1.534	O	0.69
88.250	0.00	1.02	1.527	O	0.69
88.333	0.00	1.02	1.520	O	0.68
88.417	0.00	1.02	1.513	O	0.68
88.500	0.00	1.01	1.506	O	0.68
88.583	0.00	1.01	1.499	O	0.68
88.667	0.00	1.00	1.492	O	0.67
88.750	0.00	1.00	1.485	O	0.67
88.833	0.00	0.99	1.478	O	0.67
88.917	0.00	0.99	1.471	O	0.66
89.000	0.00	0.98	1.465	O	0.66
89.083	0.00	0.98	1.458	O	0.66
89.167	0.00	0.97	1.451	O	0.65
89.250	0.00	0.97	1.445	O	0.65
89.333	0.00	0.97	1.438	O	0.65
89.417	0.00	0.96	1.431	O	0.64
89.500	0.00	0.96	1.425	O	0.64
89.583	0.00	0.95	1.418	O	0.64
89.667	0.00	0.95	1.412	O	0.64
89.750	0.00	0.94	1.405	O	0.63
89.833	0.00	0.94	1.399	O	0.63
89.917	0.00	0.93	1.392	O	0.63
90.000	0.00	0.93	1.386	O	0.62
90.083	0.00	0.93	1.379	O	0.62
90.167	0.00	0.92	1.373	O	0.62
90.250	0.00	0.92	1.367	O	0.62
90.333	0.00	0.91	1.360	O	0.61
90.417	0.00	0.91	1.354	O	0.61
90.500	0.00	0.90	1.348	O	0.61
90.583	0.00	0.90	1.342	O	0.60
90.667	0.00	0.90	1.335	O	0.60
90.750	0.00	0.89	1.329	O	0.60
90.833	0.00	0.89	1.323	O	0.60
90.917	0.00	0.88	1.317	O	0.59
91.000	0.00	0.88	1.311	O	0.59
91.083	0.00	0.88	1.305	O	0.59
91.167	0.00	0.87	1.299	O	0.59
91.250	0.00	0.87	1.293	O	0.58
91.333	0.00	0.86	1.287	O	0.58
91.417	0.00	0.86	1.281	O	0.58

91.500	0.00	0.86	1.275	O					0.57
91.583	0.00	0.85	1.269	O					0.57
91.667	0.00	0.85	1.263	O					0.57
91.750	0.00	0.84	1.257	O					0.57
91.833	0.00	0.84	1.252	O					0.56
91.917	0.00	0.84	1.246	O					0.56
92.000	0.00	0.83	1.240	O					0.56
92.083	0.00	0.83	1.234	O					0.56
92.167	0.00	0.82	1.229	O					0.55
92.250	0.00	0.82	1.223	O					0.55
92.333	0.00	0.82	1.217	O					0.55
92.417	0.00	0.81	1.212	O					0.55
92.500	0.00	0.81	1.206	O					0.54
92.583	0.00	0.81	1.201	O					0.54
92.667	0.00	0.80	1.195	O					0.54
92.750	0.00	0.80	1.190	O					0.54
92.833	0.00	0.79	1.184	O					0.53
92.917	0.00	0.79	1.179	O					0.53
93.000	0.00	0.79	1.173	O					0.53
93.083	0.00	0.78	1.168	O					0.53
93.167	0.00	0.78	1.162	O					0.52
93.250	0.00	0.78	1.157	O					0.52
93.333	0.00	0.77	1.152	O					0.52
93.417	0.00	0.77	1.146	O					0.52
93.500	0.00	0.77	1.141	O					0.51
93.583	0.00	0.76	1.136	O					0.51
93.667	0.00	0.76	1.131	O					0.51
93.750	0.00	0.76	1.125	O					0.51
93.833	0.00	0.75	1.120	O					0.50
93.917	0.00	0.75	1.115	O					0.50
94.000	0.00	0.74	1.110	O					0.50
94.083	0.00	0.74	1.105	O					0.50
94.167	0.00	0.74	1.100	O					0.50
94.250	0.00	0.73	1.095	O					0.49
94.333	0.00	0.73	1.090	O					0.49
94.417	0.00	0.73	1.085	O					0.49
94.500	0.00	0.72	1.080	O					0.49
94.583	0.00	0.72	1.075	O					0.48
94.667	0.00	0.72	1.070	O					0.48
94.750	0.00	0.71	1.065	O					0.48
94.833	0.00	0.71	1.060	O					0.48
94.917	0.00	0.71	1.055	O					0.48
95.000	0.00	0.70	1.050	O					0.47
95.083	0.00	0.70	1.045	O					0.47
95.167	0.00	0.70	1.040	O					0.47
95.250	0.00	0.70	1.036	O					0.47
95.333	0.00	0.69	1.031	O					0.46
95.417	0.00	0.69	1.026	O					0.46
95.500	0.00	0.69	1.021	O					0.46
95.583	0.00	0.68	1.017	O					0.46
95.667	0.00	0.68	1.012	O					0.46
95.750	0.00	0.68	1.007	O					0.45
95.833	0.00	0.67	1.003	O					0.45
95.917	0.00	0.67	0.998	O					0.45
96.000	0.00	0.67	0.993	O					0.45
96.083	0.00	0.66	0.989	O					0.45
96.167	0.00	0.66	0.984	O					0.44
96.250	0.00	0.66	0.980	O					0.44
96.333	0.00	0.65	0.975	O					0.44
96.417	0.00	0.65	0.971	O					0.44
96.500	0.00	0.65	0.966	O					0.44
96.583	0.00	0.65	0.962	O					0.43
96.667	0.00	0.64	0.957	O					0.43
96.750	0.00	0.64	0.953	O					0.43
96.833	0.00	0.64	0.949	O					0.43
96.917	0.00	0.63	0.944	O					0.43
97.000	0.00	0.63	0.940	O					0.42
97.083	0.00	0.63	0.935	O					0.42
97.167	0.00	0.62	0.931	O					0.42
97.250	0.00	0.62	0.927	O					0.42
97.333	0.00	0.62	0.923	O					0.42
97.417	0.00	0.62	0.918	O					0.41
97.500	0.00	0.61	0.914	O					0.41

97.583	0.00	0.61	0.910	O	0.41
97.667	0.00	0.61	0.906	O	0.41
97.750	0.00	0.61	0.901	O	0.41
97.833	0.00	0.60	0.897	O	0.40
97.917	0.00	0.60	0.893	O	0.40
98.000	0.00	0.60	0.889	O	0.40
98.083	0.00	0.59	0.885	O	0.40
98.167	0.00	0.59	0.881	O	0.40
98.250	0.00	0.59	0.877	O	0.39
98.333	0.00	0.59	0.873	O	0.39
98.417	0.00	0.58	0.869	O	0.39
98.500	0.00	0.58	0.865	O	0.39
98.583	0.00	0.58	0.861	O	0.39
98.667	0.00	0.58	0.857	O	0.39
98.750	0.00	0.57	0.853	O	0.38
98.833	0.00	0.57	0.849	O	0.38
98.917	0.00	0.57	0.845	O	0.38
99.000	0.00	0.56	0.841	O	0.38
99.083	0.00	0.56	0.837	O	0.38
99.167	0.00	0.56	0.833	O	0.38
99.250	0.00	0.56	0.830	O	0.37
99.333	0.00	0.55	0.826	O	0.37
99.417	0.00	0.55	0.822	O	0.37
99.500	0.00	0.55	0.818	O	0.37
99.583	0.00	0.55	0.814	O	0.37
99.667	0.00	0.54	0.811	O	0.37
99.750	0.00	0.54	0.807	O	0.36
99.833	0.00	0.54	0.803	O	0.36
99.917	0.00	0.54	0.799	O	0.36
100.000	0.00	0.53	0.796	O	0.36
100.083	0.00	0.53	0.792	O	0.36
100.167	0.00	0.53	0.788	O	0.36
100.250	0.00	0.53	0.785	O	0.35
100.333	0.00	0.52	0.781	O	0.35
100.417	0.00	0.52	0.778	O	0.35
100.500	0.00	0.52	0.774	O	0.35
100.583	0.00	0.52	0.770	O	0.35
100.667	0.00	0.51	0.767	O	0.35
100.750	0.00	0.51	0.763	O	0.34
100.833	0.00	0.51	0.760	O	0.34
100.917	0.00	0.51	0.756	O	0.34
101.000	0.00	0.51	0.753	O	0.34
101.083	0.00	0.50	0.749	O	0.34
101.167	0.00	0.50	0.746	O	0.34
101.250	0.00	0.50	0.742	O	0.33
101.333	0.00	0.50	0.739	O	0.33
101.417	0.00	0.49	0.736	O	0.33
101.500	0.00	0.49	0.732	O	0.33
101.583	0.00	0.49	0.729	O	0.33
101.667	0.00	0.49	0.725	O	0.33
101.750	0.00	0.48	0.722	O	0.33
101.833	0.00	0.48	0.719	O	0.32
101.917	0.00	0.48	0.715	O	0.32
102.000	0.00	0.48	0.712	O	0.32
102.083	0.00	0.48	0.709	O	0.32
102.167	0.00	0.47	0.706	O	0.32
102.250	0.00	0.47	0.702	O	0.32
102.333	0.00	0.47	0.699	O	0.31
102.417	0.00	0.47	0.696	O	0.31
102.500	0.00	0.46	0.693	O	0.31
102.583	0.00	0.46	0.689	O	0.31
102.667	0.00	0.46	0.686	O	0.31
102.750	0.00	0.46	0.683	O	0.31
102.833	0.00	0.46	0.680	O	0.31
102.917	0.00	0.45	0.677	O	0.30
103.000	0.00	0.45	0.674	O	0.30
103.083	0.00	0.45	0.671	O	0.30
103.167	0.00	0.45	0.668	O	0.30
103.250	0.00	0.45	0.664	O	0.30
103.333	0.00	0.44	0.661	O	0.30
103.417	0.00	0.44	0.658	O	0.30
103.500	0.00	0.44	0.655	O	0.30
103.583	0.00	0.44	0.652	O	0.29

103.667	0.00	0.44	0.649	O					0.29
103.750	0.00	0.43	0.646	O					0.29
103.833	0.00	0.43	0.643	O					0.29
103.917	0.00	0.43	0.640	O					0.29
104.000	0.00	0.43	0.637	O					0.29
104.083	0.00	0.43	0.634	O					0.29
104.167	0.00	0.42	0.632	O					0.28
104.250	0.00	0.42	0.629	O					0.28
104.333	0.00	0.42	0.626	O					0.28
104.417	0.00	0.42	0.623	O					0.28
104.500	0.00	0.42	0.620	O					0.28
104.583	0.00	0.41	0.617	O					0.28
104.667	0.00	0.41	0.614	O					0.28
104.750	0.00	0.41	0.611	O					0.28
104.833	0.00	0.41	0.609	O					0.27
104.917	0.00	0.41	0.606	O					0.27
105.000	0.00	0.40	0.603	O					0.27
105.083	0.00	0.40	0.600	O					0.27
105.167	0.00	0.40	0.597	O					0.27
105.250	0.00	0.40	0.595	O					0.27
105.333	0.00	0.40	0.592	O					0.27
105.417	0.00	0.40	0.589	O					0.27
105.500	0.00	0.39	0.586	O					0.26
105.583	0.00	0.39	0.584	O					0.26
105.667	0.00	0.39	0.581	O					0.26
105.750	0.00	0.39	0.578	O					0.26
105.833	0.00	0.39	0.576	O					0.26
105.917	0.00	0.38	0.573	O					0.26
106.000	0.00	0.38	0.570	O					0.26
106.083	0.00	0.38	0.568	O					0.26
106.167	0.00	0.38	0.565	O					0.25
106.250	0.00	0.38	0.563	O					0.25
106.333	0.00	0.38	0.560	O					0.25
106.417	0.00	0.37	0.557	O					0.25
106.500	0.00	0.37	0.555	O					0.25
106.583	0.00	0.37	0.552	O					0.25
106.667	0.00	0.37	0.550	O					0.25
106.750	0.00	0.37	0.547	O					0.25
106.833	0.00	0.37	0.545	O					0.25
106.917	0.00	0.36	0.542	O					0.24
107.000	0.00	0.36	0.540	O					0.24
107.083	0.00	0.36	0.537	O					0.24
107.167	0.00	0.36	0.535	O					0.24
107.250	0.00	0.36	0.532	O					0.24
107.333	0.00	0.36	0.530	O					0.24
107.417	0.00	0.35	0.527	O					0.24
107.500	0.00	0.35	0.525	O					0.24
107.583	0.00	0.35	0.522	O					0.24
107.667	0.00	0.35	0.520	O					0.23
107.750	0.00	0.35	0.518	O					0.23
107.833	0.00	0.35	0.515	O					0.23
107.917	0.00	0.34	0.513	O					0.23
108.000	0.00	0.34	0.511	O					0.23
108.083	0.00	0.34	0.508	O					0.23
108.167	0.00	0.34	0.506	O					0.23
108.250	0.00	0.34	0.504	O					0.23
108.333	0.00	0.34	0.501	O					0.23
108.417	0.00	0.33	0.499	O					0.22
108.500	0.00	0.33	0.497	O					0.22
108.583	0.00	0.33	0.494	O					0.22
108.667	0.00	0.33	0.492	O					0.22
108.750	0.00	0.33	0.490	O					0.22
108.833	0.00	0.33	0.487	O					0.22
108.917	0.00	0.33	0.485	O					0.22
109.000	0.00	0.32	0.483	O					0.22
109.083	0.00	0.32	0.481	O					0.22
109.167	0.00	0.32	0.479	O					0.22
109.250	0.00	0.32	0.476	O					0.21
109.333	0.00	0.32	0.474	O					0.21
109.417	0.00	0.32	0.472	O					0.21
109.500	0.00	0.32	0.470	O					0.21
109.583	0.00	0.31	0.468	O					0.21
109.667	0.00	0.31	0.465	O					0.21

109.750	0.00	0.31	0.463	O					0.21
109.833	0.00	0.31	0.461	O					0.21
109.917	0.00	0.31	0.459	O					0.21
110.000	0.00	0.31	0.457	O					0.21
110.083	0.00	0.31	0.455	O					0.20
110.167	0.00	0.30	0.453	O					0.20
110.250	0.00	0.30	0.451	O					0.20
110.333	0.00	0.30	0.449	O					0.20
110.417	0.00	0.30	0.446	O					0.20
110.500	0.00	0.30	0.444	O					0.20
110.583	0.00	0.30	0.442	O					0.20
110.667	0.00	0.30	0.440	O					0.20
110.750	0.00	0.29	0.438	O					0.20
110.833	0.00	0.29	0.436	O					0.20
110.917	0.00	0.29	0.434	O					0.20
111.000	0.00	0.29	0.432	O					0.19
111.083	0.00	0.29	0.430	O					0.19
111.167	0.00	0.29	0.428	O					0.19
111.250	0.00	0.29	0.426	O					0.19
111.333	0.00	0.28	0.424	O					0.19
111.417	0.00	0.28	0.422	O					0.19
111.500	0.00	0.28	0.420	O					0.19
111.583	0.00	0.28	0.419	O					0.19
111.667	0.00	0.28	0.417	O					0.19
111.750	0.00	0.28	0.415	O					0.19
111.833	0.00	0.28	0.413	O					0.19
111.917	0.00	0.28	0.411	O					0.19
112.000	0.00	0.27	0.409	O					0.18
112.083	0.00	0.27	0.407	O					0.18
112.167	0.00	0.27	0.405	O					0.18
112.250	0.00	0.27	0.403	O					0.18
112.333	0.00	0.27	0.401	O					0.18
112.417	0.00	0.27	0.400	O					0.18
112.500	0.00	0.27	0.398	O					0.18
112.583	0.00	0.27	0.396	O					0.18
112.667	0.00	0.26	0.394	O					0.18
112.750	0.00	0.26	0.392	O					0.18
112.833	0.00	0.26	0.390	O					0.18
112.917	0.00	0.26	0.389	O					0.18
113.000	0.00	0.26	0.387	O					0.17
113.083	0.00	0.26	0.385	O					0.17
113.167	0.00	0.26	0.383	O					0.17
113.250	0.00	0.26	0.382	O					0.17
113.333	0.00	0.25	0.380	O					0.17
113.417	0.00	0.25	0.378	O					0.17
113.500	0.00	0.25	0.376	O					0.17
113.583	0.00	0.25	0.375	O					0.17
113.667	0.00	0.25	0.373	O					0.17
113.750	0.00	0.25	0.371	O					0.17
113.833	0.00	0.25	0.369	O					0.17
113.917	0.00	0.25	0.368	O					0.17
114.000	0.00	0.25	0.366	O					0.16
114.083	0.00	0.24	0.364	O					0.16
114.167	0.00	0.24	0.363	O					0.16
114.250	0.00	0.24	0.361	O					0.16
114.333	0.00	0.24	0.359	O					0.16
114.417	0.00	0.24	0.358	O					0.16
114.500	0.00	0.24	0.356	O					0.16
114.583	0.00	0.24	0.354	O					0.16
114.667	0.00	0.24	0.353	O					0.16
114.750	0.00	0.24	0.351	O					0.16
114.833	0.00	0.23	0.349	O					0.16
114.917	0.00	0.23	0.348	O					0.16
115.000	0.00	0.23	0.346	O					0.16
115.083	0.00	0.23	0.345	O					0.16
115.167	0.00	0.23	0.343	O					0.15
115.250	0.00	0.23	0.341	O					0.15
115.333	0.00	0.23	0.340	O					0.15
115.417	0.00	0.23	0.338	O					0.15
115.500	0.00	0.23	0.337	O					0.15
115.583	0.00	0.23	0.335	O					0.15
115.667	0.00	0.22	0.334	O					0.15
115.750	0.00	0.22	0.332	O					0.15

115.833	0.00	0.22	0.331	O	|	|	|	|	0.15
115.917	0.00	0.22	0.329	O	|	|	|	|	0.15
116.000	0.00	0.22	0.328	O	|	|	|	|	0.15
116.083	0.00	0.22	0.326	O	|	|	|	|	0.15
116.167	0.00	0.22	0.325	O	|	|	|	|	0.15
116.250	0.00	0.22	0.323	O	|	|	|	|	0.15
116.333	0.00	0.22	0.322	O	|	|	|	|	0.14
116.417	0.00	0.21	0.320	O	|	|	|	|	0.14
116.500	0.00	0.21	0.319	O	|	|	|	|	0.14
116.583	0.00	0.21	0.317	O	|	|	|	|	0.14
116.667	0.00	0.21	0.316	O	|	|	|	|	0.14
116.750	0.00	0.21	0.314	O	|	|	|	|	0.14
116.833	0.00	0.21	0.313	O	|	|	|	|	0.14
116.917	0.00	0.21	0.311	O	|	|	|	|	0.14
117.000	0.00	0.21	0.310	O	|	|	|	|	0.14
117.083	0.00	0.21	0.308	O	|	|	|	|	0.14
117.167	0.00	0.21	0.307	O	|	|	|	|	0.14
117.250	0.00	0.21	0.306	O	|	|	|	|	0.14
117.333	0.00	0.20	0.304	O	|	|	|	|	0.14
117.417	0.00	0.20	0.303	O	|	|	|	|	0.14
117.500	0.00	0.20	0.301	O	|	|	|	|	0.14
117.583	0.00	0.20	0.300	O	|	|	|	|	0.14
117.667	0.00	0.20	0.299	O	|	|	|	|	0.13
117.750	0.00	0.20	0.297	O	|	|	|	|	0.13
117.833	0.00	0.20	0.296	O	|	|	|	|	0.13
117.917	0.00	0.20	0.295	O	|	|	|	|	0.13
118.000	0.00	0.20	0.293	O	|	|	|	|	0.13
118.083	0.00	0.20	0.292	O	|	|	|	|	0.13
118.167	0.00	0.19	0.290	O	|	|	|	|	0.13
118.250	0.00	0.19	0.289	O	|	|	|	|	0.13
118.333	0.00	0.19	0.288	O	|	|	|	|	0.13
118.417	0.00	0.19	0.286	O	|	|	|	|	0.13
118.500	0.00	0.19	0.285	O	|	|	|	|	0.13
118.583	0.00	0.19	0.284	O	|	|	|	|	0.13
118.667	0.00	0.19	0.283	O	|	|	|	|	0.13
118.750	0.00	0.19	0.281	O	|	|	|	|	0.13
118.833	0.00	0.19	0.280	O	|	|	|	|	0.13
118.917	0.00	0.19	0.279	O	|	|	|	|	0.13
119.000	0.00	0.19	0.277	O	|	|	|	|	0.12
119.083	0.00	0.19	0.276	O	|	|	|	|	0.12
119.167	0.00	0.18	0.275	O	|	|	|	|	0.12
119.250	0.00	0.18	0.274	O	|	|	|	|	0.12
119.333	0.00	0.18	0.272	O	|	|	|	|	0.12
119.417	0.00	0.18	0.271	O	|	|	|	|	0.12
119.500	0.00	0.18	0.270	O	|	|	|	|	0.12
119.583	0.00	0.18	0.269	O	|	|	|	|	0.12
119.667	0.00	0.18	0.267	O	|	|	|	|	0.12
119.750	0.00	0.18	0.266	O	|	|	|	|	0.12
119.833	0.00	0.18	0.265	O	|	|	|	|	0.12
119.917	0.00	0.18	0.264	O	|	|	|	|	0.12
120.000	0.00	0.18	0.262	O	|	|	|	|	0.12
120.083	0.00	0.18	0.261	O	|	|	|	|	0.12
120.167	0.00	0.17	0.260	O	|	|	|	|	0.12
120.250	0.00	0.17	0.259	O	|	|	|	|	0.12
120.333	0.00	0.17	0.258	O	|	|	|	|	0.12
120.417	0.00	0.17	0.256	O	|	|	|	|	0.12
120.500	0.00	0.17	0.255	O	|	|	|	|	0.11
120.583	0.00	0.17	0.254	O	|	|	|	|	0.11
120.667	0.00	0.17	0.253	O	|	|	|	|	0.11
120.750	0.00	0.17	0.252	O	|	|	|	|	0.11
120.833	0.00	0.17	0.251	O	|	|	|	|	0.11
120.917	0.00	0.17	0.249	O	|	|	|	|	0.11
121.000	0.00	0.17	0.248	O	|	|	|	|	0.11
121.083	0.00	0.17	0.247	O	|	|	|	|	0.11
121.167	0.00	0.17	0.246	O	|	|	|	|	0.11
121.250	0.00	0.16	0.245	O	|	|	|	|	0.11
121.333	0.00	0.16	0.244	O	|	|	|	|	0.11
121.417	0.00	0.16	0.243	O	|	|	|	|	0.11
121.500	0.00	0.16	0.241	O	|	|	|	|	0.11
121.583	0.00	0.16	0.240	O	|	|	|	|	0.11
121.667	0.00	0.16	0.239	O	|	|	|	|	0.11
121.750	0.00	0.16	0.238	O	|	|	|	|	0.11
121.833	0.00	0.16	0.237	O	|	|	|	|	0.11

121.917	0.00	0.16	0.236	O	0.11
122.000	0.00	0.16	0.235	O	0.11
122.083	0.00	0.16	0.234	O	0.11
122.167	0.00	0.16	0.233	O	0.10
122.250	0.00	0.16	0.232	O	0.10
122.333	0.00	0.15	0.231	O	0.10
122.417	0.00	0.15	0.229	O	0.10
122.500	0.00	0.15	0.228	O	0.10
122.583	0.00	0.15	0.227	O	0.10
122.667	0.00	0.15	0.226	O	0.10
122.750	0.00	0.15	0.225	O	0.10
122.833	0.00	0.15	0.224	O	0.10
122.917	0.00	0.15	0.223	O	0.10
123.000	0.00	0.15	0.222	O	0.10
123.083	0.00	0.15	0.221	O	0.10
123.167	0.00	0.15	0.220	O	0.10
123.250	0.00	0.15	0.219	O	0.10
123.333	0.00	0.15	0.218	O	0.10
123.417	0.00	0.15	0.217	O	0.10
123.500	0.00	0.15	0.216	O	0.10
123.583	0.00	0.14	0.215	O	0.10
123.667	0.00	0.14	0.214	O	0.10
123.750	0.00	0.14	0.213	O	0.10
123.833	0.00	0.14	0.212	O	0.10
123.917	0.00	0.14	0.211	O	0.10
124.000	0.00	0.14	0.210	O	0.09
124.083	0.00	0.14	0.209	O	0.09
124.167	0.00	0.14	0.208	O	0.09
124.250	0.00	0.14	0.207	O	0.09
124.333	0.00	0.14	0.206	O	0.09
124.417	0.00	0.14	0.205	O	0.09
124.500	0.00	0.14	0.204	O	0.09
124.583	0.00	0.14	0.203	O	0.09
124.667	0.00	0.14	0.203	O	0.09
124.750	0.00	0.14	0.202	O	0.09
124.833	0.00	0.13	0.201	O	0.09
124.917	0.00	0.13	0.200	O	0.09
125.000	0.00	0.13	0.199	O	0.09
125.083	0.00	0.13	0.198	O	0.09
125.167	0.00	0.13	0.197	O	0.09
125.250	0.00	0.13	0.196	O	0.09
125.333	0.00	0.13	0.195	O	0.09
125.417	0.00	0.13	0.194	O	0.09
125.500	0.00	0.13	0.193	O	0.09
125.583	0.00	0.13	0.193	O	0.09
125.667	0.00	0.13	0.192	O	0.09
125.750	0.00	0.13	0.191	O	0.09
125.833	0.00	0.13	0.190	O	0.09
125.917	0.00	0.13	0.189	O	0.09
126.000	0.00	0.13	0.188	O	0.08
126.083	0.00	0.13	0.187	O	0.08
126.167	0.00	0.13	0.186	O	0.08
126.250	0.00	0.12	0.186	O	0.08
126.333	0.00	0.12	0.185	O	0.08
126.417	0.00	0.12	0.184	O	0.08
126.500	0.00	0.12	0.183	O	0.08
126.583	0.00	0.12	0.182	O	0.08
126.667	0.00	0.12	0.181	O	0.08
126.750	0.00	0.12	0.180	O	0.08
126.833	0.00	0.12	0.180	O	0.08
126.917	0.00	0.12	0.179	O	0.08
127.000	0.00	0.12	0.178	O	0.08
127.083	0.00	0.12	0.177	O	0.08
127.167	0.00	0.12	0.176	O	0.08
127.250	0.00	0.12	0.176	O	0.08
127.333	0.00	0.12	0.175	O	0.08
127.417	0.00	0.12	0.174	O	0.08
127.500	0.00	0.12	0.173	O	0.08
127.583	0.00	0.12	0.172	O	0.08
127.667	0.00	0.12	0.172	O	0.08
127.750	0.00	0.11	0.171	O	0.08
127.833	0.00	0.11	0.170	O	0.08
127.917	0.00	0.11	0.169	O	0.08

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128.000    0.00    0.11      0.168  O        |       |       |       |      0.08
128.083    0.00    0.11      0.168  O        |       |       |       |      0.08
128.167    0.00    0.11      0.167  O        |       |       |       |      0.08
128.250    0.00    0.11      0.166  O        |       |       |       |      0.07
128.333    0.00    0.11      0.165  O        |       |       |       |      0.07
128.417    0.00    0.11      0.165  O        |       |       |       |      0.07
128.500    0.00    0.11      0.164  O        |       |       |       |      0.07
128.583    0.00    0.11      0.163  O        |       |       |       |      0.07
128.667    0.00    0.11      0.162  O        |       |       |       |      0.07
128.750    0.00    0.11      0.162  O        |       |       |       |      0.07
128.833    0.00    0.11      0.161  O        |       |       |       |      0.07
128.917    0.00    0.11      0.160  O        |       |       |       |      0.07
129.000    0.00    0.11      0.159  O        |       |       |       |      0.07
129.083    0.00    0.11      0.159  O        |       |       |       |      0.07
129.167    0.00    0.11      0.158  O        |       |       |       |      0.07
129.250    0.00    0.11      0.157  O        |       |       |       |      0.07
129.333    0.00    0.10      0.156  O        |       |       |       |      0.07
129.417    0.00    0.10      0.156  O        |       |       |       |      0.07
129.500    0.00    0.10      0.155  O        |       |       |       |      0.07
129.583    0.00    0.10      0.154  O        |       |       |       |      0.07
129.667    0.00    0.10      0.153  O        |       |       |       |      0.07
129.750    0.00    0.10      0.153  O        |       |       |       |      0.07
129.833    0.00    0.10      0.152  O        |       |       |       |      0.07
129.917    0.00    0.10      0.151  O        |       |       |       |      0.07
130.000    0.00    0.10      0.151  O        |       |       |       |      0.07
130.083    0.00    0.10      0.150  O        |       |       |       |      0.07
130.167    0.00    0.10      0.149  O        |       |       |       |      0.07
130.250    0.00    0.10      0.149  O        |       |       |       |      0.07

        Remaining water in basin =    0.15 (Ac.Ft)

        ****************************HYDROGRAPH DATA****************************
                        Number of intervals =  1563
                        Time interval =    5.0 (Min.)
                        Maximum/Peak flow rate =        1.493 (CFS)
                        Total volume =      11.324 (Ac.Ft)
                Status of hydrographs being held in storage
                           Stream 1  Stream 2  Stream 3  Stream 4  Stream 5
                Peak (CFS)      0.000     0.000     0.000     0.000     0.000
                Vol (Ac.Ft)      0.000     0.000     0.000     0.000     0.000
        ***********************************************************************

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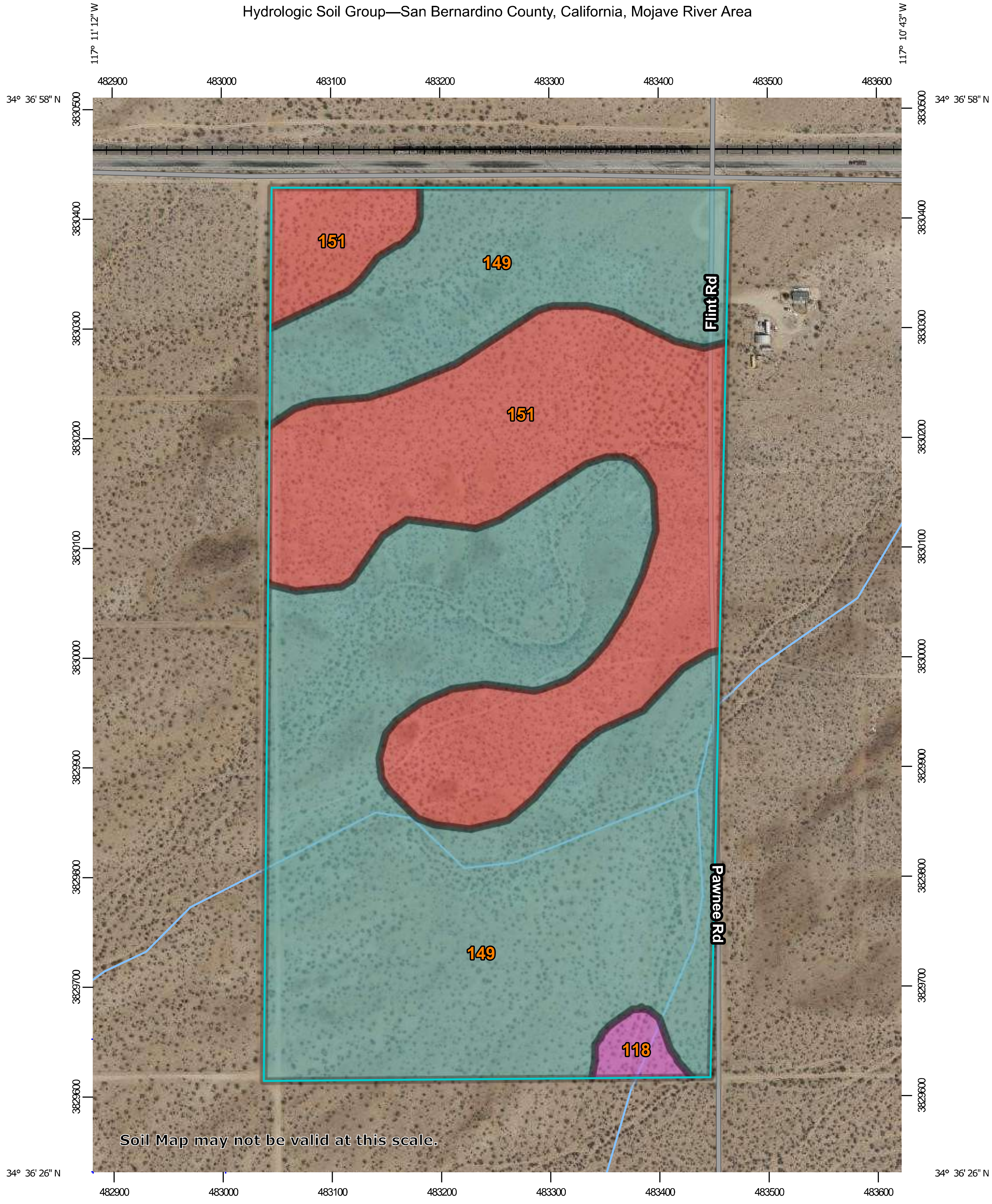
Appendix E

Soil Information

- USGS Soil Survey
- Geotechnical Report



Map Scale: 1:4,780 if printed on A portrait (8.5" x 11") sheet.

Meters: 0, 50, 100, 200, 300

Feet: 0, 200, 400, 800, 1200

N

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

MAP LEGEND

Area of Interest (AOI)

Area of Interest (AOI)

Soils

Soil Rating Polygons

A

A/D

B

B/D

C

C/D

D

Not rated or not available

Soil Rating Lines

A

A/D

B

B/D

C

C/D

D

Not rated or not available

Soil Rating Points

A

A/D

B

B/D

C

C/D

D

Not rated or not available

Water Features

Streams and Canals

Transportation

Rails

Interstate Highways

US Routes

Major Roads

Local Roads

Background

Aerial Photography

MAP INFORMATION

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

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

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

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

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

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

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

Soil Survey Area: San Bernardino County, California, Mojave River Area
Survey Area Data: Version 14, Sep 1, 2022

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

Date(s) aerial images were photographed: Mar 17, 2022—Jun 12, 2022

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

Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
118	CAJON-ARIZO COMPLEX, 2 TO 15 PERCENT SLOPES*	A	1.0	1.1%
149	MIRAGE-JOSHUA COMPLEX, 2 TO 5 PERCENT SLOPES*	C	55.5	66.5%
151	NEBONA-CUDDEBACK COMPLEX, 2 TO 9 PERCENT SLOPES*	D	27.0	32.4%
Totals for Area of Interest			**83.5**	**100.0%**

Description

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

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

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

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

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

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

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

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

INFILTRATION TEST SUMMARY TABLE

PRELIMINARY RESULTS

Boring	Test Zone (ft)	Soil Classification (% fines)	Raw Infiltration Rates (in./hr)
13673.001 Parcel A Apple Valley			
LI-1	10 to 15	Silty Sand (23% fines)	2.0
LI-2	10 to 15	Silty Sand (24% fines)	1.5
LI-3	9 to 14	Silty Sand (21% fines)	2.8
LI-4	10 to 15	Silty Sand (13-20% fines)	10.0
13673.002 Parcel B Victorville			
LI-1	10 to 15	Silty Sand (28% fines)	0.2
LI-2	7 to 12	Silty Sand (26% fines)	1.8
13673.003 Cordova Road			
LI-1	10 to 15	Silty Sand (17% fines)	0.4
LI-2	10 to 15	Sand with Silt (9% fines)	2.5
13673.004 Quarry Road			
LI-1	10 to 15	Silty Sand (16% fines)	2.3
LI-2	0 to 5	Silty Sand (24% fines)	$\boxed{1.5}$

Results of Well Permeameter, from USBR 7300-89 Method

Project:	13673.001	Initial estimated Depth to Water Surface (in.):	126
Exploration #/Location:	*LI-1*	Average depth of water in well, "h" (in.):	53
Depth Boring drilled, bgs (ft):	15	approx. h/r:	13.4
Tested by:	AA	Tu (Fig. 8) (ft):	89.5
USCS Soil Type in test zone:	SP-SM	Tu>3h?:	yes, OK
Weather (start to finish):	Sunny		
Water Source/pH:	H2O		
Measured boring diameter:	8 in.	4 in. Well Radius	
Depth to GW or aquitard, bgs:	100 ft		
Well Prep:	Drill to 15', bottom 10' screen pipe, sand backfilll in test zone		

Cross-sectional area for flow calcs based on Δh

Well pack sand porosity	0.4
Casing outer diameter, in.	2.3
Casing inner diameter, in.	2.1
Cross-sectional area, in.^2	21.9

Use of Barrels:	No
Use of Flow Meter:	Yes
Test Type:	Constant Head

	ft	in.	Total (in.)
Depth to bottom of well measured from top of auger (or ground surfa	15.1 ft	0. in.	181
Casing stickup measured above top of auger (or ground surface) (+ i	0. ft	2. in.	2
Depth to top of sand from top of casing			

Depth of well bottom below top of casing (in): 183

Flow Meter ID: 2497 Meter Units: Gallons 0.05 gallons/pulse Data logger ID:

Field Data **Calculations**

Date	Time	Data from Flow Meter: Reading (gallons)	Interval Pulse Count	Depth to WL in Boring (measured from top of casing) ft	in.	Water Temp (deg F)	Refilled? (or Comments)	Δt (min)	Total Elapsed Time (min)	Depth to WL in well (in.)	h, Height of Water in Well (in.)	Δh (in.)	Avg. h	Vol Change (in.^3) from supply	from Δh	Total	Flow (in^3/ min)	q, Flow (in^3/ hr)	Average Infiltration Surface Area, (in^2)	V (Fig 9)	K20, Coef. Of Perme-ability at 20 deg C (in./hr)	Infiltration Rate [flow/surf area] (in./hr) (FS=1)
Start Date 9/27/2022	Start time: 11:37	Gallons																				
9/27/22	11:37	1590.14		11.23					0	132.8	48.4											
9/27/22	11:40	1591.45		11.08				3	3	131.0	50.2	1.8	49	303	-39	263	88	5264	1290	0.9	0.70	3.76
9/27/22	11:45	1593.6		10.90				5	8	128.8	52.4	2.16	51	497	-47	449	90	5392	1340	0.9	0.67	3.71
9/27/22	11:53	1597.04		10.61				8	16	125.3	55.9	3.48	54	795	-76	718	90	5388	1411	0.9	0.60	3.52
9/27/22	12:03	1601.35		10.32				10	26	121.8	59.4	3.48	58	996	-76	919	92	5516	1498	0.9	0.56	3.39
9/27/22							adjust flow															
9/27/22	12:05	1601.95		10.54					28	124.5	56.7											
9/27/22	12:15	1604.3		10.97				10	38	129.6	51.6	-5.16	54	543	113	656	66	3935	1411	0.9	0.51	2.57
9/27/22	12:25	1606.67		11.00				10	48	130.0	51.2	-0.36	51	547	8	555	56	3332	1342	0.9	0.43	2.29
9/27/22	12:35	1609.04		10.95				10	58	129.4	51.8	0.6	52	547	-13	534	53	3206	1345	0.9	0.41	2.20
9/27/22	12:45	1611.38		10.90				10	68	128.8	52.4	0.6	52	541	-13	527	53	3164	1360	0.9	0.39	2.15
9/27/22	12:55	1613.73		10.83				10	78	128.0	53.2	0.84	53	543	-18	524	52	3147	1378	0.9	0.38	2.11
9/27/22	13:05	1616.08		10.80				10	88	127.6	53.6	0.36	53	543	-8	535	53	3210	1393	0.9	0.39	2.12
9/27/22	13:15	1618.44		10.78				10	98	127.4	53.8	0.24	54	545	-5	540	54	3239	1400	0.9	0.39	2.13
9/27/22	13:25	1620.78		10.71				10	108	126.5	54.7	0.84	54	541	-18	522	52	3133	1414	0.9	0.36	2.04
9/27/22	13:35	1623.12		10.70				10	118	126.4	54.8	0.12	55	541	-3	538	54	3227	1426	0.9	0.38	2.09
9/27/22	13:46	1625.69		10.69				11	129	126.3	54.9	0.12	55	594	-3	591	54	3224	1429	0.9	0.37	2.08
9/27/22	13:56	1628.03		10.68				10	139	126.2	55.0	0.12	55	541	-3	538	54	3227	1432	0.9	0.37	2.08
9/27/22	14:00	1628.95		10.68				4	143	126.2	55.0	0	55	213	0	213	53	3188	1434	0.9	0.37	2.05
																			Minimum Rate:			2.0
														Raw Rate for design, prior to application of adjustment factors:								**2.0**

Results of Well Permeameter, from USBR 7300-89 Method

Leighton 60 Anniversary

Project:	13673.001
Exploration #/Location:	*LI-2*
Depth Boring drilled, bgs (ft):	15
Tested by:	AA
USCS Soil Type in test zone:	SP-SM
Weather (start to finish):	Sunny
Water Source/pH:	H2O
Measured boring diameter:	8 in. — 4 in. Well Radius
Depth to GW or aquitard, bgs:	100 ft
Well Prep:	Drill to 15', bottom 5' screen pipe, sand backfilll in test zone

Initial estimated Depth to Water Surface (in.):	150
Average depth of water in well, "h" (in.):	42
approx. h/r:	10.6
Tu (Fig. 8) (ft):	87.5
Tu>3h?:	yes, OK

Cross-sectional area for flow calcs based on Δh

Well pack sand porosity	0.4
Casing outer diameter, in.	2.3
Casing inner diameter, in.	2.1
Cross-sectional area, in.^2	21.9

	ft	in.	Total (in.)
Depth to bottom of well measured from top of auger (or ground surfa	15.5 ft	0. in.	186
Casing stickup measured above top of auger (or ground surface) (+ i	0. ft	-6. in.	-6
Depth to top of sand from top of casing			

Depth of well bottom below top of casing (in): 180

Use of Barrels:	No
Use of Flow Meter:	Yes
Test Type:	Constant Head

Flow Meter ID: 2497 Meter Units: Gallons 0.05 gallons/pulse

Data logger ID:

Field Data / **Calculations**

Date	Time	Data from Flow Meter: Reading (gallons)	Interval Pulse Count	Depth to WL in Boring (measured from top of casing) ft	in.	Water Temp (deg F)	Refilled? (or Comments)	Δt (min)	Total Elapsed Time (min)	Depth to WL in well (in.)	h, Height of Water in Well (in.)	Δh (in.)	Avg. h	Vol Change (in.^3) from supply	from Δh	Total	Flow (in^3/ min)	q, Flow (in^3/ hr)	Average Infiltration Surface Area, (in^2)	V (Fig 9)	K20, Coef. Of Perme-ability at 20 deg C (in./hr)	Infiltration Rate [flow/surf area] (in./hr) (FS=1)
Start Date	Start time:	Gallons																				
9/26/2022	14:28																					
9/26/22	14:28	1540.69		11.56					0	144.7	41.3											
9/26/22	14:30	1541.31		11.5				2	2	144.0	42.0	0.72	42	143	-16	127	64	3823	1097	0.9	0.68	3.21
9/26/22							Flow Change															
9/26/22	14:35	1542.75		11.55					7	144.6	41.4											
9/26/22	14:40	1544.72		11.07				5	12	138.8	47.2	5.76	44	455	-126	329	66	3947	1163	0.9	0.57	3.13
9/26/22	14:42	1545.48		10.5				2	14	132.0	54.0	6.84	51	176	-150	26	13	771	1321	0.9	0.09	0.54
9/26/22	14:45	1546.01		11.28			Adjust flow	3	17	141.4	44.6	-9.36	49	122	205	327	109	6550	1290	0.9	1.10	4.68
9/26/22	14:50	1546.26		11.48				5	22	143.8	42.2	-2.4	43	58	53	110	22	1324	1142	0.9	0.24	1.07
9/26/22	15:00	1547.56		11.6				10	32	145.2	40.8	-1.44	42	300	32	332	33	1991	1094	0.9	0.37	1.68
9/26/22	15:10	1548.83		11.7				10	42	146.4	39.6	-1.2	40	293	26	320	32	1918	1061	0.9	0.38	1.67
9/26/22	15:20	1550.15		11.73				10	52	146.8	39.2	-0.36	39	305	8	313	31	1877	1041	0.9	0.37	1.66
9/26/22	15:30	1551.43		11.73				10	62	146.8	39.2	0	39	296	0	296	30	1774	1036	0.9	0.35	1.58
9/26/22	15:40	1552.7		11.72				10	72	146.6	39.4	0.12	39	293	-3	291	29	1744	1038	0.9	0.34	1.55
9/26/22	15:50	1553.98		11.7				10	82	146.4	39.6	0.24	39	296	-5	290	29	1743	1043	0.9	0.34	1.54
9/26/22	16:00	1555.26		11.7				10	92	146.4	39.6	0	40	296	0	296	30	1774	1046	0.9	0.35	1.56
																				Minimum Rate:		1.1
														Raw Rate for design, prior to application of adjustment factors:								**1.5**

Results of Well Permeameter, from USBR 7300-89 Method

Leighton 60 Anniversary

Project: 13673.001
Exploration #/Location: *LI-3*
Depth Boring drilled, bgs (ft): 14
Tested by: AA
USCS Soil Type in test zone: SM / SP-SM
Weather (start to finish): Sunny
Water Source/pH: H2O
Measured boring diameter: 8 in. 4 in. Well Radius
Depth to GW or aquitard, bgs: 100 ft
Well Prep: Drill to 14', bottom 5' screen pipe, sand backfilll in test zone

Initial estimated Depth to Water Surface (in.): 122
Average depth of water in well, "h" (in.): 38
approx. h/r: 9.5
Tu (Fig. 8) (ft): 89.8
Tu>3h?: yes, OK

Cross-sectional area for flow calcs based on Δh
Well pack sand porosity: 0.4
Casing outer diameter, in.: 2.3
Casing inner diameter, in.: 2.1
Cross-sectional area, in.^2: 21.9

Use of Barrels: No
Use of Flow Meter: Yes
Test Type: Constant Head

	ft	in.	Total (in.)
Depth to bottom of well measured from top of auger (or ground surfa	14. ft	4. in.	172
Casing stickup measured above top of auger (or ground surface) (+ i	0. ft	12. in.	12
Depth to top of sand from top of casing			

Depth of well bottom below top of casing (in): 184

Flow Meter ID: 2497 Meter Units: Gallons 0.05 gallons/pulse
Data logger ID:

Field Data / **Calculations**

Date	Time	Data from Flow Meter: Reading (gallons)	Interval Pulse Count	Depth to WL in Boring (measured from top of casing): ft	in.	Water Temp (deg F)	Refilled? (or Comments)	Δt (min)	Total Elapsed Time (min)	Depth to WL in well (in.)	h, Height of Water in Well (in.)	Δh (in.)	Avg. h	Vol Change (in.^3): from supply	from Δh	Total	Flow (in^3/ min)	q, Flow (in^3/ hr)	Average Infiltration Surface Area, (in^2)	V (Fig 9)	K20, Coef. Of Perme-ability at 20 deg C (in./hr)	Infiltration Rate [flow/surf area] (in./hr) (FS=1)
Start Date	Start time:																					
9/28/2022	8:42	Gallons		ft	in.																	
9/28/22	8:42	1639.65		12.16					0	133.9	38.1											
9/28/22	8:45	1640.34		12.2				3	3	134.4	37.6	-0.48	38	159	11	170	57	3398	1001	0.9	0.72	3.13
9/28/22	8:50	1641.48		12.28				5	8	135.4	36.6	-0.96	37	263	21	284	57	3412	983	0.9	0.76	3.20
9/28/22	9:00	1643.76		12.45				10	18	137.4	34.6	-2.04	36	527	45	571	57	3428	945	0.9	0.84	3.34
9/28/22							Adjust Flow															
9/28/22	9:05	1645.32		12.21					23	134.5	37.5											
9/28/22	9:15	1648.59		12.05				10	33	132.6	39.4	1.92	38	755	-42	713	71	4280	1016	0.9	0.83	3.88
9/28/22	9:25	1651.86		11.9				10	43	130.8	41.2	1.8	40	755	-39	716	72	4296	1063	0.9	0.78	3.72
9/28/22	9:35	1655.07		11.78				10	53	129.4	42.6	1.44	42	742	-32	710	71	4260	1104	0.9	0.73	3.56
9/28/22	9:45	1657.75		11.83			Adjust Flow	10	63	130.0	42.0	-0.6	42	619	13	632	63	3793	1114	0.9	0.68	3.14
9/28/22	9:55	1659.89		12.27				10	73	135.2	36.8	-5.28	39	494	116	610	61	3660	1040	0.9	0.83	3.24
9/28/22	10:05	1662.01		12.3				10	83	135.6	36.4	-0.36	37	490	8	498	50	2986	970	0.9	0.67	2.84
9/28/22	10:15	1664.14		12.3				10	93	135.6	36.4	0	36	492	0	492	49	2952	965	0.9	0.66	2.82
9/28/22	10:25	1666.25		12.3				10	103	135.6	36.4	0	36	487	0	487	49	2924	965	0.9	0.65	2.79
9/28/22	10:35	1668.38		12.3				10	113	135.6	36.4	0	36	492	0	492	49	2952	965	0.9	0.66	2.82
9/28/22	10:45	1670.48		12.3				10	123	135.6	36.4	0	36	485	0	485	49	2911	965	0.9	0.65	2.78
																			Minimum Rate:			2.8
														Raw Rate for design, prior to application of adjustment factors:								**2.8**

Results of Well Permeameter, from USBR 7300-89 Method

Leighton 60th Anniversary

Project:	13673.001	Initial estimated Depth to Water Surface (in.):	142
Exploration #/Location:	*LI-4*	Average depth of water in well, "h" (in.):	39
Depth Boring drilled, bgs (ft):	15	approx. h/r:	9.7
Tested by:	AA	Tu (Fig. 8) (ft):	88.1
USCS Soil Type in test zone:	SP	Tu>3h?:	yes, OK
Weather (start to finish):	Sunny		
Water Source/pH:	H2O		
Measured boring diameter:	8 in.	4 in. Well Radius	
Depth to GW or aquitard, bgs:	100 ft		
Well Prep:	Drill to 15', bottom 5' screen pipe, sand backfilll in test zone		

Cross-sectional area for flow calcs based on Δh

Well pack sand porosity	0.4
Casing outer diameter, in.	2.3
Casing inner diameter, in.	2.1
Cross-sectional area, in.^2	21.9

	ft	in.	Total (in.)
Depth to bottom of well measured from top of auger (or ground surfa	15.1 ft	0. in.	181
Casing stickup measured above top of auger (or ground surface) (+ i	0. ft	0. in.	0
Depth to top of sand from top of casing			

Depth of well bottom below top of casing (in): 181

Use of Barrels: No
Use of Flow Meter: Yes
Test Type: Constant Head

Flow Meter ID: 2497 Meter Units: Gallons 0.05 gallons/pulse

Data logger ID:

Field Data | **Calculations**

Date	Time	Data from Flow Meter		Depth to WL in Boring (measured from top of casing)		Water Temp (deg F)	Refilled? (or Comments)	Δt (min)	Total Elapsed Time (min)	Depth to WL in well (in.)	h, Height of Water in Well (in.)	Δh (in.)	Avg. h	Vol Change (in.^3)			Flow (in^3/ min)	q, Flow (in^3/ hr)	Average Infiltration Surface Area, (in^2)	V (Fig 9)	K20, Coef. Of Perme-ability at 20 deg C (in./hr)	Infiltration Rate [flow/surf area] (in./hr) (FS=1)
Start Date	Start time:	Reading (gallons)	Interval Pulse Count	ft	in.									from supply	from Δh	Total						
9/26/2022	11:55	Gallons																				
9/26/22	11:55	1433.44		12.11					0	145.3	35.9											
9/26/22	12:00	1437.29		12.07				5	5	144.8	36.4	0.48	36	889	-11	879	176	10546	958	0.9	2.34	10.15
9/26/22	12:05	1441.44		12.04				5	10	144.5	36.7	0.36	37	959	-8	951	190	11409	969	0.9	2.50	10.86
9/26/22	12:15	1450.07		11.95				10	20	143.4	37.8	1.08	37	1994	-24	1970	197	11819	987	0.9	2.46	11.04
9/26/22	12:25	1458.15		11.91				10	30	142.9	38.3	0.48	38	1866	-11	1856	186	11136	1006	0.9	2.28	10.20
9/26/22	12:35	1466.53		11.88				10	40	142.6	38.6	0.36	38	1936	-8	1928	193	11567	1017	0.9	2.34	10.49
9/26/22	12:45	1474.92		11.86				10	50	142.3	38.9	0.24	39	1938	-5	1933	193	11597	1024	0.9	2.32	10.44
9/26/22	12:55	1483.35		11.82				10	60	141.8	39.4	0.48	39	1947	-11	1937	194	11621	1033	0.9	2.28	10.37
9/26/22	13:05	1491.16		11.78				10	70	141.4	39.8	0.48	40	1804	-11	1794	179	10762	1046	0.9	2.07	9.49
9/26/22	13:15	1500.17		11.72				10	80	140.6	40.6	0.72	40	2081	-16	2066	207	12393	1061	0.9	2.32	10.77
9/26/22	13:25	1508.65		11.73				10	90	140.8	40.4	-0.12	41	1959	3	1962	196	11769	1068	0.9	2.22	10.16
9/26/22	13:35	1517.01		11.75				10	100	141.0	40.2	-0.24	40	1931	5	1936	194	11619	1064	0.9	2.22	10.07
9/26/22	13:45	1525.53		11.7				10	110	140.4	40.8	0.6	41	1968	-13	1955	195	11730	1068	0.9	2.18	10.12
9/26/22	13:55	1533.89		11.72				10	120	140.6	40.6	-0.24	41	1931	5	1936	194	11619	1073	0.9	2.18	9.99
9/26/22																						
9/26/22																						
																				Minimum Rate:		9.5
														Raw Rate for design, prior to application of adjustment factors:								**10.0**

Results of Falling Head Infiltration Test

Project: 13673.002
Exploration #/Location: *LI-1*
Depth Boring drilled, bgs (ft): 15
Tested by: AA
USCS Soil Type in test zone: SM
Weather (start to finish): Sunny
Water Source/pH: H_2O
Measured boring diameter: 8 in. 4 in. Well Radius
Depth to GW or aquitard, bgs: 100 ft
Well Prep: Drill to 15', bottom 5' screen pipe, sand backfilll in test zone

Initial estimated Depth to Water Surface (in.): 138
Average depth of water in well, "h" (in.): 37
approx. h/r: 9.2
Tu (Fig. 8) (ft): 88.5
Tu>3h?: yes, OK

Cross-sectional area for flow calcs based on Δh
Well pack sand porosity: 0.4
Casing outer diameter, in.: 2.3
Casing inner diameter, in.: 2.1
Cross-sectional area, in.^2: 21.9

	ft	in.	Total (in.)
Depth to bottom of well measured from top of auger (or ground surfa	15. ft	0. in.	180
Casing stickup measured above top of auger (or ground surface) (+ i	0. ft	5.5 in.	5.5
Depth to top of sand from top of casing			

Depth of well bottom below top of casing (in): 186

Use of Barrels: No
Use of Flow Meter: No
Test Type: Falling Head

Flow Meter ID: Meter Units: Gallons 0.05 gallons/pulse Data logger ID:

Field Data / **Calculations**

Date	Time	Data from Flow Meter: Reading (gallons)	Data from Flow Meter: Interval Pulse Count	Depth to WL in Boring (measured from top of casing) ft	in.	Water Temp (deg F)	Refilled? (or Comments)	Δt (min)	Total Elapsed Time (min)	Depth to WL in well (in.)	h, Height of Water in Well (in.)	Δh (in.)	Avg. h	Vol Change (in.^3) from supply	from Δh	Total	Flow (in^3/ min)	q, Flow (in^3/ hr)	Average Infiltration Surface Area, (in^2)	V (Fig 9)	K20, Coef. Of Perme-ability at 20 deg C (in./hr)	Infiltration Rate [flow/surf area] (in./hr) (FS=1)
Start Date 9/26/2022	Start time: 9:05	Gallons																				
9/26/22	9:05			11.15					0	128.3	51.7											
9/26/22	9:10			11.38				5	5	131.1	48.9	-2.76	50	0	60	60	12	726	1315	0.9	0.10	0.51
9/26/22	9:15			11.5				5	10	132.5	47.5	-1.44	48	0	32	32	6	379	1262	0.9	0.06	0.28
9/26/22	9:25			11.83				10	20	136.5	43.5	-3.96	46	0	87	87	9	521	1194	0.9	0.09	0.40
9/26/22	9:35			12.02				10	30	138.7	41.3	-2.28	42	0	50	50	5	300	1116	0.9	0.06	0.25
9/26/22	9:45			12.25				10	40	141.5	38.5	-2.76	40	0	60	60	6	363	1053	0.9	0.08	0.32
9/26/22	9:55			12.43				10	50	143.7	36.3	-2.16	37	0	47	47	5	284	991	0.9	0.06	0.26
9/26/22	10:05			12.56				10	60	145.2	34.8	-1.56	36	0	34	34	3	205	944	0.9	0.05	0.20
9/26/22	10:14			12.73				9	69	147.3	32.7	-2.04	34	0	45	45	5	298	899	0.9	0.08	0.31
9/26/22	10:25			12.83				11	80	148.5	31.5	-1.2	32	0	26	26	2	143	858	0.9	0.04	0.15
9/26/22	10:34			12.95				9	89	149.9	30.1	-1.44	31	0	32	32	4	210	825	0.9	0.06	0.24
9/26/22	10:45			13.05				11	100	151.1	28.9	-1.2	30	0	26	26	2	143	792	0.9	0.05	0.17
9/26/22	10:55			13.15				10	110	152.3	27.7	-1.2	28	0	26	26	3	158	762	0.9	0.05	0.19
9/26/22	11:05			13.25				10	120	153.5	26.5	-1.2	27	0	26	26	3	158	731	0.9	0.06	0.20

Minimum Rate: 0.2
Raw Rate for design, prior to application of adjustment factors: **0.2**

Results of Well Permeameter, from USBR 7300-89 Method

Project:	13673.002	Initial estimated Depth to Water Surface (in.):	108
Exploration #/Location:	*LI-2*	Average depth of water in well, "h" (in.):	34
Depth Boring drilled, bgs (ft):	12	approx. h/r:	8.5
Tested by:	AA	Tu (Fig. 8) (ft):	91.0
USCS Soil Type in test zone:	SP-SM	Tu>3h?:	yes, OK
Weather (start to finish):	Sunny		
Water Source/pH:	H2O		
Measured boring diameter:	8 in.	4 in. Well Radius	
Depth to GW or aquitard, bgs:	100 ft		
Well Prep:	Drill to 12', bottom 5' screen pipe, sand backfilll in test zone		

Cross-sectional area for flow calcs based on Δh

Well pack sand porosity	0.4
Casing outer diameter, in.	2.3
Casing inner diameter, in.	2.1
Cross-sectional area, in.^2	21.9

Use of Barrels:	No
Use of Flow Meter:	Yes
Test Type:	Constant Head

	ft	in.	Total (in.)
Depth to bottom of well measured from top of auger (or ground surfa	11. ft	10. in.	142
Casing stickup measured above top of auger (or ground surface) (+ i	0. ft	0. in.	0
Depth to top of sand from top of casing			

Depth of well bottom below top of casing (in): 142

Flow Meter ID: 2497 Meter Units: Gallons 0.05 gallons/pulse

Data logger ID:

Field Data | **Calculations**

Date	Time	Data from Flow Meter: Reading (gallons)	Data from Flow Meter: Interval Pulse Count	Depth to WL in Boring (measured from top of casing) ft	Depth to WL in Boring in.	Water Temp (deg F)	Refilled? (or Comments)	Δt (min)	Total Elapsed Time (min)	Depth to WL in well (in.)	h, Height of Water in Well (in.)	Δh (in.)	Avg. h	Vol Change (in.^3) from supply	Vol Change from Δh	Vol Change Total	Flow (in^3/ min)	q, Flow (in^3/ hr)	Average Infiltration Surface Area, (in^2)	V (Fig 9)	K20, Coef. Of Perme-ability at 20 deg C (in./hr)	Infiltration Rate [flow/surf area] (in./hr) (FS=1)
Start Date 9/27/2022	Start time: 8:47	Gallons																				
9/27/22	8:47	1563.15		8.62					0	103.4	38.6											
9/27/22	8:50	1563.23		8.92				3	3	107.0	35.0	-3.6	37	18	79	97	32	1947	974	0.9	0.47	1.84
9/27/22	8:55	1563.89		9				5	8	108.0	34.0	-0.96	34	152	21	173	35	2082	917	0.9	0.52	2.09
9/27/22	9:00	1564.54		9.05				5	13	108.6	33.4	-0.6	34	150	13	163	33	1960	897	0.9	0.50	2.01
9/27/22	9:10	1565.86		9.05				10	23	108.6	33.4	0	33	305	0	305	30	1830	890	0.9	0.46	1.90
9/27/22	9:20	1567.16		9.05				10	33	108.6	33.4	0	33	300	0	300	30	1802	890	0.9	0.46	1.87
9/27/22	9:30	1568.47		9.03				10	43	108.4	33.6	0.24	34	303	-5	297	30	1784	893	0.9	0.45	1.84
9/27/22	9:40	1569.78		9.02				10	53	108.2	33.8	0.12	34	303	-3	300	30	1800	897	0.9	0.45	1.85
9/27/22	9:50	1571.08		9.01				10	63	108.1	33.9	0.12	34	300	-3	298	30	1786	900	0.9	0.44	1.83
9/27/22	10:00	1572.38		9				10	73	108.0	34.0	0.12	34	300	-3	298	30	1786	903	0.9	0.44	1.82
9/27/22	10:10	1573.69		9				10	83	108.0	34.0	0	34	303	0	303	30	1816	905	0.9	0.45	1.85
9/27/22	10:20	1574.98		9				10	93	108.0	34.0	0	34	298	0	298	30	1788	905	0.9	0.44	1.82
9/27/22	10:30	1576.28		8.98				10	103	107.8	34.2	0.24	34	300	-5	295	30	1770	908	0.9	0.43	1.80
9/27/22	10:40	1577.58		8.98				10	113	107.8	34.2	0	34	300	0	300	30	1802	911	0.9	0.44	1.82
9/27/22	10:50	1578.79		9.04				10	123	108.5	33.5	-0.72	34	280	16	295	30	1772	902	0.9	0.45	1.81

Minimum Rate:	1.8
Raw Rate for design, prior to application of adjustment factors:	**1.8**

Results of Well Permeameter, from USBR 7300-89 Method

Leighton 60th Anniversary

Project: 13673.003
Exploration #/Location: *LI-1*
Depth Boring drilled, bgs (ft): 15
Tested by: AA
USCS Soil Type in test zone: SM / SP-SM
Weather (start to finish): Sunny
Water Source/pH: H2O
Measured boring diameter: 8 in. — 4 in. Well Radius
Depth to GW or aquitard, bgs: 100 ft
Well Prep: Drill to 15', bottom 10' screen pipe, sand backfilll in test zone

Initial estimated Depth to Water Surface (in.): 133
Average depth of water in well, "h" (in.): 51
approx. h/r: 12.7
Tu (Fig. 8) (ft): 88.9
Tu>3h?: yes, OK

Cross-sectional area for flow calcs based on Δh
Well pack sand porosity: 0.4
Casing outer diameter, in.: 2.3
Casing inner diameter, in.: 2.1
Cross-sectional area, in.^2: 21.9

	ft	in.	Total (in.)
Depth to bottom of well measured from top of auger (or ground surfa	15. ft	3.5 in.	184
Casing stickup measured above top of auger (or ground surface) (+ i	0. ft	0. in.	0
Depth to top of sand from top of casing			

Depth of well bottom below top of casing (in): 184

Use of Barrels: No
Use of Flow Meter: Yes
Test Type: Constant Head

Flow Meter ID: 2497 Meter Units: Gallons 0.05 gallons/pulse
Data logger ID:

Field Data — **Calculations**

Date	Time	Data from Flow Meter: Reading (gallons)	Data from Flow Meter: Interval Pulse Count	Depth to WL in Boring (measured from top of casing) ft	in.	Water Temp (deg F)	Refilled? (or Comments)	Δt (min)	Total Elapsed Time (min)	Depth to WL in well (in.)	h, Height of Water in Well (in.)	Δh (in.)	Avg. h	Vol Change (in.^3) from supply	from Δh	Total	Flow (in^3/ min)	q, Flow (in^3/ hr)	Average Infiltration Surface Area, (in^2)	V (Fig 9)	K20, Coef. Of Perme-ability at 20 deg C (in./hr)	Infiltration Rate [flow/surf area] (in./hr) (FS=1)
Start Date 9/28/2022	Start time: 11:35	Gallons		ft	in.																	
9/28/22	11:35	1677.77		11.9					0	142.8	40.7											
9/28/22	11:37	1677.95		11.85				2	2	142.2	41.3	0.6	41	42	-13	28	14	853	1081	0.9	0.16	0.73
9/28/22	11:40	1678.23		11.78				3	5	141.4	42.1	0.84	42	65	-18	46	15	926	1099	0.9	0.16	0.78
9/28/22							Adjust Flow															
9/28/22	11:42	1678.3		11.82					7	141.8	41.7											
9/28/22	11:52	1678.92		11.67				10	17	140.0	43.5	1.8	43	143	-39	104	10	623	1120	0.9	0.10	0.51
9/28/22	12:02	1679.57		11.5				10	27	138.0	45.5	2.04	44	150	-45	105	11	633	1168	0.9	0.10	0.50
9/28/22	12:12	1680.21		11.26				10	37	135.1	48.4	2.88	47	148	-63	85	8	508	1230	0.9	0.07	0.38
9/28/22	12:21	1680.8		11.08				9	46	133.0	50.5	2.16	49	136	-47	89	10	593	1293	0.9	0.08	0.42
9/28/22	12:31	1681.44		10.87				10	56	130.4	53.1	2.52	52	148	-55	93	9	556	1352	0.9	0.07	0.38
9/28/22	12:42	1682.16		10.6				11	67	127.2	56.3	3.24	55	166	-71	95	9	520	1425	0.9	0.06	0.34
9/28/22	12:51	1682.76		10.45				9	76	125.4	58.1	1.8	57	139	-39	99	11	661	1488	0.9	0.07	0.41
9/28/22							Adjust Flow															
9/28/22	12:57	1682.82		10.62			(slow for readings)		82	127.4	56.1											
9/28/22	13:00	1682.86		10.54			(slow for readings)	3	85	126.5	57.0	0.96	57	9	-21	-12	-4	-236	1471	0.9	-0.03	-0.15
9/28/22	13:09	1682.87		10.54			(slow for readings)	9	94	126.5	57.0	0	57	2	0	2	0	15	1483	0.9	0.00	0.01
9/28/22	13:20	1683.03		10.52			(slow for readings)	11	105	126.2	57.3	0.24	57	37	-5	32	3	173	1486	0.9	0.02	0.11
9/28/22							Switch to Falling Head															
9/28/22	13:36			9.5					121	114.0	69.5											
9/28/22	13:38			9.54				2	123	114.5	69.0	-0.48	69	0	11	11	5	315	1791	0.9	0.03	0.16
9/28/22	13:40			9.58				2	125	115.0	68.5	-0.48	69	0	11	11	5	315	1779	0.9	0.03	0.16
9/28/22	13:44			9.75				4	129	117.0	66.5	-2.04	68	0	45	45	11	670	1747	0.9	0.06	0.35
9/28/22	13:54			10.73				10	139	128.8	54.7	-11.76	61	0	258	258	26	1546	1574	0.9	0.19	0.91
9/28/22	13:59			11.07				5	144	132.8	50.7	-4.08	53	0	89	89	18	1073	1375	0.9	0.14	0.72
9/28/22	14:05			11.58				6	150	139.0	44.5	-6.12	48	0	134	134	22	1341	1247	0.9	0.22	0.99
9/28/22	14:10			11.98				5	155	143.8	39.7	-4.8	42	0	105	105	21	1262	1109	0.9	0.25	1.05
9/28/22	14:15			12.3				5	160	147.6	35.9	-3.84	38	0	84	84	17	1010	1001	0.9	0.23	0.93
9/28/22	14:21			12.56				6	166	150.7	32.8	-3.12	34	0	68	68	11	684	913	0.9	0.18	0.69
9/28/22	14:30			12.65				9	175	151.8	31.7	-1.08	32	0	24	24	3	158	861	0.9	0.04	0.17
9/28/22																						
9/28/22																						
																			Minimum Rate:			0.3
														Raw Rate for design, prior to application of adjustment factors:								**0.4**

Results of Well Permeameter, from USBR 7300-89 Method

Leighton 60th Anniversary

Project: 13673.003

Exploration #/Location:	LI-2	Initial estimated Depth to Water Surface (in.):	155
Depth Boring drilled, bgs (ft):	15	Average depth of water in well, "h" (in.):	25
Tested by:	AA	approx. h/r:	6.3
USCS Soil Type in test zone:	SM / SP-SM	Tu (Fig. 8) (ft):	87.1
Weather (start to finish):	Sunny	Tu>3h?:	yes, OK
Water Source/pH:	H2O		
Measured boring diameter:	8 in.	4 in. Well Radius	
Depth to GW or aquitard, bgs:	100 ft		
Well Prep:	Drill to 15', bottom 10' screen pipe, sand backfilll in test zone		

Cross-sectional area for flow calcs based on Δh

Well pack sand porosity	0.4
Casing outer diameter, in.	2.3
Casing inner diameter, in.	2.1
Cross-sectional area, in.^2	21.9

Use of Barrels:	No
Use of Flow Meter:	Yes
Test Type:	Constant Head

	ft	in.	Total (in.)
Depth to bottom of well measured from top of auger (or ground surfa	15. ft	1.5 in.	182
Casing stickup measured above top of auger (or ground surface) (+ i	0. ft	1.5 in.	1.5
Depth to top of sand from top of casing			

Depth of well bottom below top of casing (in): 183

Flow Meter ID: 2497 Meter Units: Gallons 0.05 gallons/pulse

Data logger ID:

Field Data / **Calculations**

Date	Time	Data from Flow Meter: Reading (gallons)	Interval Pulse Count	Depth to WL in Boring (measured from top of casing) ft	in.	Water Temp (deg F)	Refilled? (or Comments)	Δt (min)	Total Elapsed Time (min)	Depth to WL in well (in.)	h, Height of Water in Well (in.)	Δh (in.)	Avg. h	Vol Change (in.^3) from supply	from Δh	Total	Flow (in^3/min)	q, Flow (in^3/hr)	Average Infiltration Surface Area, (in^2)	V (Fig 9)	K20, Coef. Of Permeability at 20 deg C (in./hr)	Infiltration Rate [flow/surf area] (in./hr) (FS=1)
Start Date	Start time:																					
9/29/2022	9:12	Gallons		ft	in.																	
9/29/22	9:12	1694.11		13.5					0	160.5	21.0											
9/29/22	9:14	1694.46		13.47				2	2	160.1	21.4	0.36	21	81	-8	73	36	2189	583	0.9	1.08	3.46
9/29/22	9:19	1695.34		13.32				5	7	158.3	23.2	1.8	22	203	-39	164	33	1966	610	0.9	0.85	2.97
9/29/22	9:24	1696.28		13.27			Adjust Flow	5	12	157.7	23.8	0.6	23	217	-13	204	41	2448	640	0.9	1.03	3.53
9/29/22	9:34	1697.98		13.18				10	22	156.7	24.8	1.08	24	393	-24	369	37	2214	661	0.9	0.87	3.09
9/29/22	9:45	1699.91		13.1				11	33	155.7	25.8	0.96	25	446	-21	425	39	2317	687	0.9	0.86	3.11
9/29/22	9:55	1701.65		13.04				10	43	155.0	26.5	0.72	26	402	-16	386	39	2317	708	0.9	0.83	3.02
9/29/22	10:05	1703.4		13				10	53	154.5	27.0	0.48	27	404	-11	394	39	2362	723	0.9	0.83	3.01
9/29/22																						
9/29/22	10:10			11.3					58	134.1	47.4											
9/29/22	10:11			11.69				1	59	138.8	42.7	-4.68	45	0	103	103	103	6152	1183	0.9	1.09	4.79
9/29/22	10:12			12.15				1	60	144.3	37.2	-5.52	40	0	121	121	121	7256	1055	0.9	1.61	6.34
9/29/22	10:13			12.39				1	61	147.2	34.3	-2.88	36	0	63	63	63	3786	949	0.9	0.94	3.68
9/29/22	10:14			12.64				1	62	150.2	31.3	-3	33	0	66	66	66	3943	875	0.9	1.13	4.15
9/29/22	10:16			12.93				2	64	153.7	27.8	-3.48	30	0	76	76	38	2287	794	0.9	0.79	2.66
9/29/22	10:18			13.23				2	66	157.3	24.2	-3.6	26	0	79	79	39	2366	705	0.9	1.01	3.10
9/29/22	10:20			13.5				2	68	160.5	21.0	-3.24	23	0	71	71	35	2129	619	0.9	1.13	3.17
9/29/22	10:22			13.8				2	70	164.1	17.4	-3.6	19	0	79	79	39	2366	533	0.9	1.67	4.09
9/29/22	10:27			14.14				5	75	168.2	13.3	-4.08	15	0	89	89	18	1073	436	0.9	1.14	2.27
9/29/22	10:32			14.43				5	80	171.7	9.8	-3.48	12	0	76	76	15	915	341	0.9	1.49	2.47
9/29/22	10:37			14.71				5	85	175.0	6.5	-3.36	8	0	74	74	15	883	255	0.9	2.59	3.19
9/29/22																						
9/29/22	10:50			11.1					98	131.7	49.8											
9/29/22	10:52			11.23				2	100	133.3	48.2	-1.56	49	0	34	34	17	1025	1282	0.9	0.15	0.74
9/29/22	10:57			12.98				5	105	154.3	27.2	-21	38	0	460	460	92	5521	999	0.9	2.23	5.10
9/29/22	11:00			13.33				3	108	158.5	23.0	-4.2	25	0	92	92	31	1840	682	0.9	0.86	2.49
9/29/22	11:05			14.05				5	113	167.1	14.4	-8.64	19	0	189	189	38	2271	521	0.9	2.31	4.02
9/29/22	11:10			14.37				5	118	170.9	10.6	-3.84	12	0	84	84	17	1010	364	0.9	1.50	2.56
9/29/22	11:12			14.5				2	120	172.5	9.0	-1.56	10	0	34	34	17	1025	296	0.9	1.77	3.19
9/29/22																						
9/29/22																						
																			Minimum Rate:			2.3
														Raw Rate for design, prior to application of adjustment factors:								**2.5**

Results of Well Permeameter, from USBR 7300-89 Method

Project: 13673.004

Exploration #/Location:	*LI-1*	Initial estimated Depth to Water Surface (in.):	95
Depth Boring drilled, bgs (ft):	10.5	Average depth of water in well, "h" (in.):	31
Tested by:	AA	approx. h/r:	7.6
USCS Soil Type in test zone:	SM / SP-SM	Tu (Fig. 8) (ft):	92.0
Weather (start to finish):	Sunny	Tu>3h?:	yes, OK
Water Source/pH:	H2O		
Measured boring diameter:	8 in.	4 in. Well Radius	
Depth to GW or aquitard, bgs:	100 ft		

Cross-sectional area for flow calcs based on Δh

Well pack sand porosity	0.4
Casing outer diameter, in.	2.3
Casing inner diameter, in.	2.1
Cross-sectional area, in.^2	21.9

Well Prep: Drill to 5', hit refusal, set 5' screen, sand backfilll in test zone

	Use of Barrels:	No
	Use of Flow Meter:	Yes
	Test Type:	Constant Head

	ft	in.	Total (in.)
Depth to bottom of well measured from top of auger (or ground surfa	10. ft	0. in.	120
Casing stickup measured above top of auger (or ground surface) (+ i	0. ft	-6. in.	-6
Depth to top of sand from top of casing			

Depth of well bottom below top of casing (in): 114

Flow Meter ID: 2497 Meter Units: Gallons 0.05 gallons/pulse Data logger ID:

Field Data **Calculations**

Date	Time	Data from Flow Meter: Reading (gallons)	Interval Pulse Count	Depth to WL in Boring (measured from top of casing) ft	in.	Water Temp (deg F)	Refilled? (or Comments)	Δt (min)	Total Elapsed Time (min)	Depth to WL in well (in.)	h, Height of Water in Well (in.)	Δh (in.)	Avg. h	Vol Change (in.^3) from supply	from Δh	Total	Flow (in^3/ min)	q, Flow (in^3/ hr)	Average Infiltration Surface Area, (in^2)	V (Fig 9)	K20, Coef. Of Perme-ability at 20 deg C (in./hr)	Infiltration Rate [flow/surf area] (in./hr) (FS=1)
Start Date 9/29/2022	Start time: 14:29	Gallons																				
9/29/22	14:29	1736.91		7.03					0	90.4	29.6											
9/29/22	14:31	1737.22		7.07				2	2	90.8	29.2	-0.48	29	72	11	82	41	2464	789	0.9	0.77	2.88
9/29/22	14:35	1737.84		7.11				4	6	91.3	28.7	-0.48	29	143	11	154	38	2306	777	0.9	0.74	2.74
9/29/22	14:45	1739.35		7.07				10	16	90.8	29.2	0.48	29	349	-11	338	34	2030	777	0.9	0.63	2.41
9/29/22	14:55	1740.87		7				10	26	90.0	30.0	0.84	30	351	-18	333	33	1996	794	0.9	0.59	2.32
9/29/22	15:05	1742.39		6.95				10	36	89.4	30.6	0.6	30	351	-13	338	34	2028	812	0.9	0.59	2.30
9/29/22	15:15	1743.9		6.92				10	46	89.0	31.0	0.36	31	349	-8	341	34	2046	824	0.9	0.58	2.29
9/29/22	15:25	1745.4		6.9				10	56	88.8	31.2	0.24	31	347	-5	341	34	2047	831	0.9	0.58	2.27
9/29/22	15:35	1746.92		6.87				10	66	88.4	31.6	0.36	31	351	-8	343	34	2059	839	0.9	0.57	2.26
9/29/22	15:45	1748.43		6.86				10	76	88.3	31.7	0.12	32	349	-3	346	35	2077	845	0.9	0.57	2.27
9/29/22	15:55	1749.94		6.85				10	86	88.2	31.8	0.12	32	349	-3	346	35	2077	848	0.9	0.57	2.26
9/29/22	16:05	1751.48		6.83				10	96	88.0	32.0	0.24	32	356	-5	350	35	2103	853	0.9	0.57	2.27

Minimum Rate:	2.3
Raw Rate for design, prior to application of adjustment factors:	**2.3**

Results of Well Permeameter, from USBR 7300-89 Method

Leighton 60 Anniversary

Project: 13673.004
Exploration #/Location: LI-2
Depth Boring drilled, bgs (ft): 5
Tested by: AA
USCS Soil Type in test zone: SM / SP-SM
Weather (start to finish): Sunny
Water Source/pH: H2O
Measured boring diameter: 8 in. — 4 in. Well Radius
Depth to GW or aquitard, bgs: 100 ft
Well Prep: Drill to 5', hit refusal, set 5' screen, sand backfilll in test zone

Initial estimated Depth to Water Surface (in.): 21
Average depth of water in well, "h" (in.): 39
approx. h/r: 9.7
Tu (Fig. 8) (ft): 98.2
Tu>3h?: yes, OK

Cross-sectional area for flow calcs based on Δh
Well pack sand porosity: 0.4
Casing outer diameter, in.: 2.3
Casing inner diameter, in.: 2.1
Cross-sectional area, in.^2: 21.9

Use of Barrels: No
Use of Flow Meter: Yes
Test Type: Constant Head

	ft	in.	Total (in.)
Depth to bottom of well measured from top of auger (or ground surfa	5. ft	0. in.	60
Casing stickup measured above top of auger (or ground surface) (+ i	0. ft	0. in.	0
Depth to top of sand from top of casing			

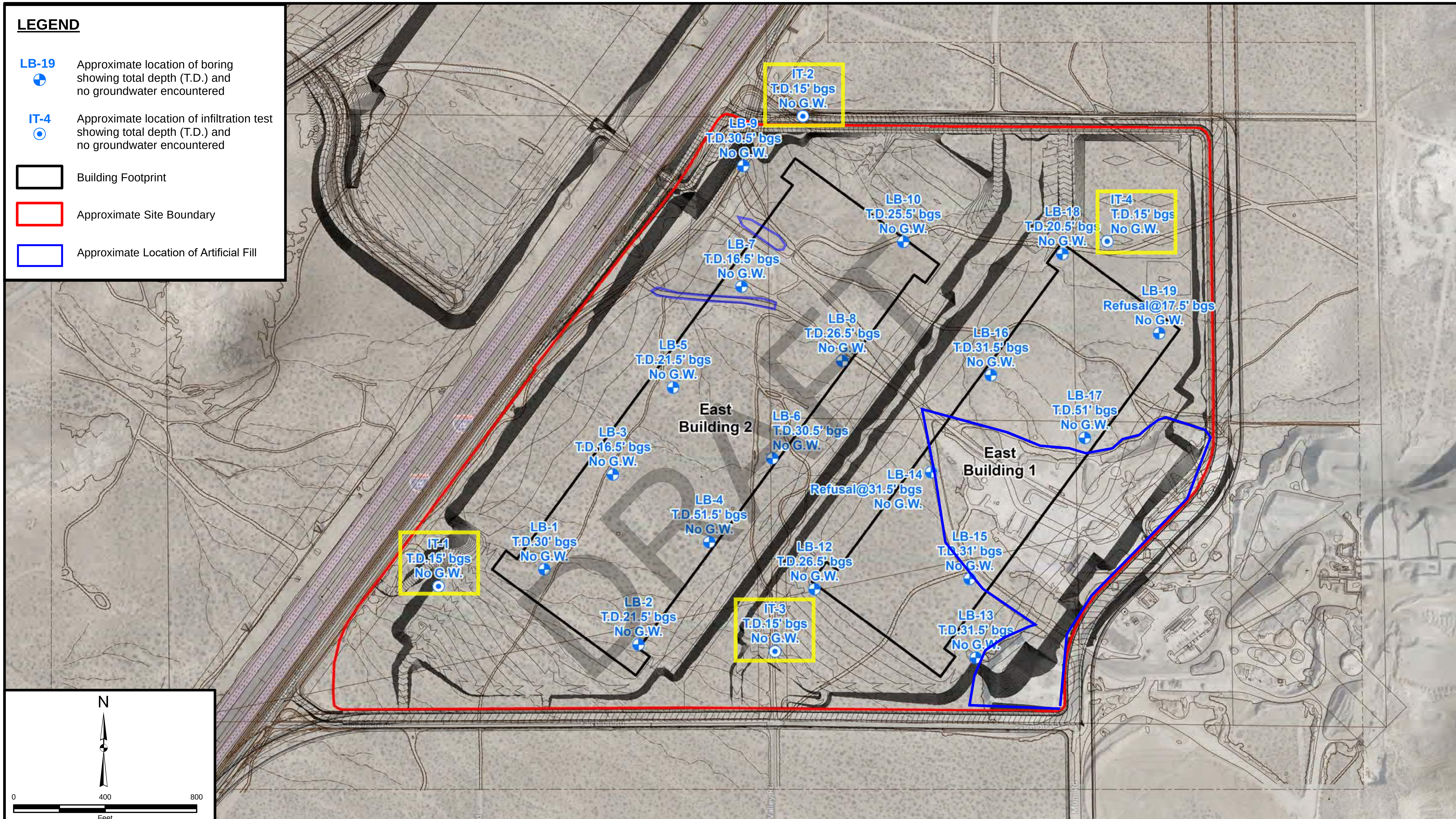
Depth of well bottom below top of casing (in): 60

Flow Meter ID: 2497 Meter Units: Gallons 0.05 gallons/pulse
Data logger ID:

Field Data / **Calculations**

Date	Time	Data from Flow Meter: Reading (gallons)	Data from Flow Meter: Interval Pulse Count	Depth to WL in Boring (measured from top of casing): ft	in.	Water Temp (deg F)	Refilled? (or Comments)	Δt (min)	Total Elapsed Time (min)	Depth to WL in well (in.)	h, Height of Water in Well (in.)	Δh (in.)	Avg. h	Vol Change (in.^3): from supply	Vol Change: from Δh	Vol Change: Total	Flow (in^3/ min)	q, Flow (in^3/ hr)	Average Infiltration Surface Area, (in^2)	V (Fig 9)	K20, Coef. Of Perme-ability at 20 deg C (in./hr)	Infiltration Rate [flow/surf area] (in./hr) (FS=1)
Start Date 9/29/2022	Start time: 11:53	Gallons																				
9/29/22	11:53	1712.22		2.72					0	32.6	27.4											
9/29/22	11:55	1712.73		2.44				2	2	29.3	30.7	3.36	29	118	-74	44	22	1326	780	0.9	0.37	1.57
9/29/22	12:00	1713.52		2.25				5	7	27.0	33.0	2.28	32	182	-50	133	27	1590	851	0.9	0.40	1.72
9/29/22	12:05	1714.22		2.11				5	12	25.3	34.7	1.68	34	162	-37	125	25	1499	901	0.9	0.36	1.53
9/29/22	12:15	1715.62		1.89				10	22	22.7	37.3	2.64	36	323	-58	266	27	1593	955	0.9	0.34	1.54
9/29/22	12:25	1717.05		1.74				10	32	20.9	39.1	1.8	38	330	-39	291	29	1745	1011	0.9	0.34	1.59
9/29/22	12:35	1718.42		1.66				10	42	19.9	40.1	0.96	40	316	-21	295	30	1773	1046	0.9	0.34	1.56
9/29/22	12:45	1719.81		1.6				10	52	19.2	40.8	0.72	40	321	-16	305	31	1832	1067	0.9	0.34	1.58
9/29/22	12:55	1721.22		1.54				10	62	18.5	41.5	0.72	41	326	-16	310	31	1860	1085	0.9	0.34	1.58
9/29/22	13:05	1722.62		1.52				10	72	18.2	41.8	0.24	42	323	-5	318	32	1909	1097	0.9	0.34	1.60
9/29/22	13:18	1724.43		1.47				13	85	17.6	42.4	0.6	42	418	-13	405	31	1869	1107	0.9	0.33	1.56
9/29/22	13:29	1725.91		1.45				11	96	17.4	42.6	0.24	42	342	-5	337	31	1836	1118	0.9	0.32	1.51
9/29/22	13:40	1727.5		1.45				11	107	17.4	42.6	0	43	367	0	367	33	2003	1121	0.9	0.35	1.65
9/29/22	13:50	1728.9		1.44				10	117	17.3	42.7	0.12	43	323	-3	321	32	1925	1122	0.9	0.33	1.58
9/29/22	14:00	1730.28		1.42				10	127	17.0	43.0	0.24	43	319	-5	314	31	1881	1127	0.9	0.32	1.54

Minimum Rate: 1.5
Raw Rate for design, prior to application of adjustment factors: **1.5**



Project: 13673.001	Eng/Geol: JDH/SGO
Scale:1 " = 400 '	Date: September 2022

Reference: Conceptual Site Plan, Sheet A1-0
Date: March 5, 2022 by Rexford Industrial Realty

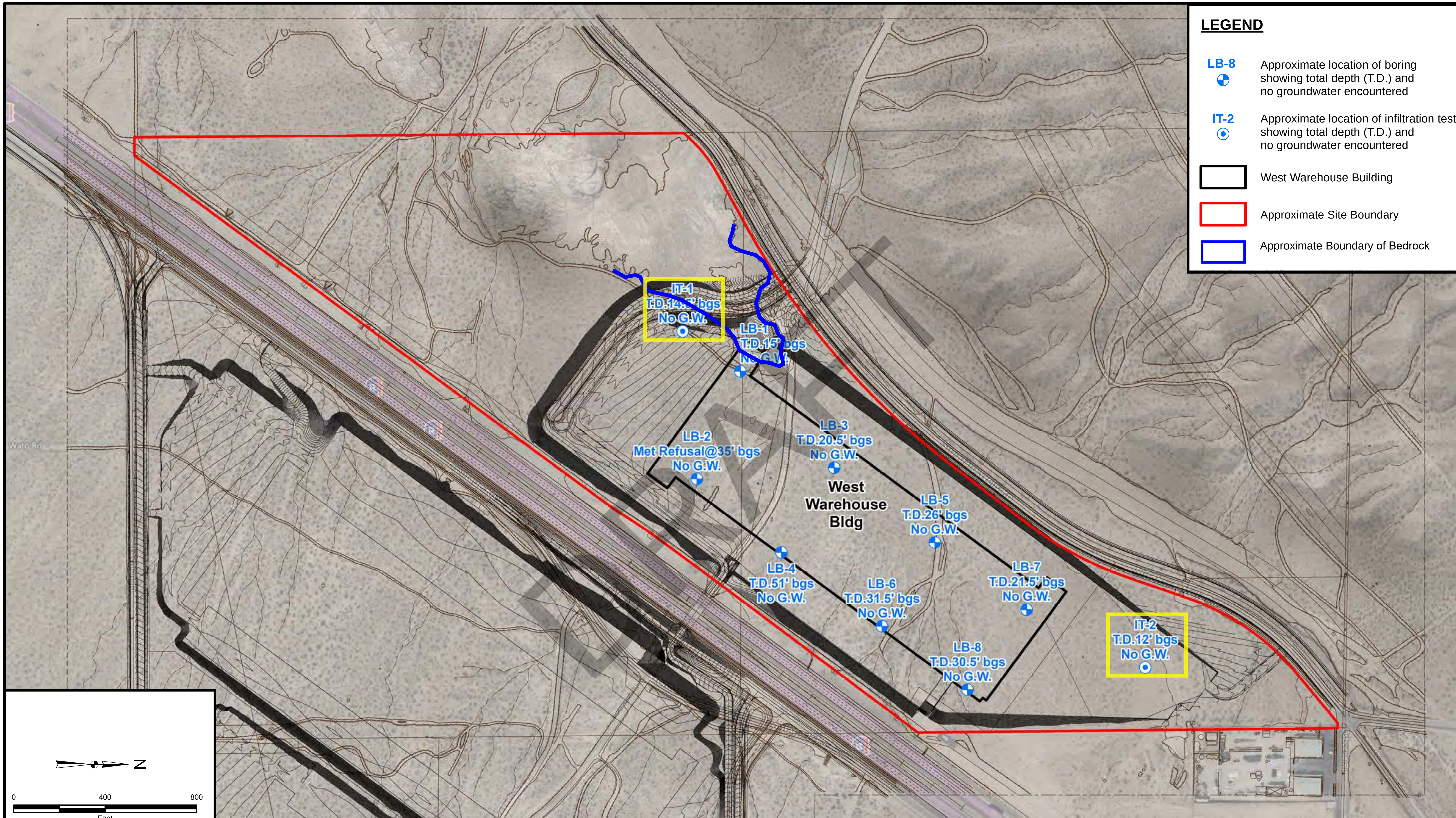
EXPLORATION LOCATION MAP

Proposed Warehouse Building Development
Parcel A APN 0472-031-08,
Apple Valley, California

FIGURE 2

Leighton

Map Saved as J:\Drafting\13673\001\Maps\13673-001_F02_ELM_2022-09-28.mxd on 9/28/2022 9:57:22 AM Author: KVM (btran)



Project: 13673.002	Eng/Geol: JDH/SGO
Scale:1 " = 400 '	Date: September 2022

Reference: Conceptual Site Plan, Sheet A1-0
Date: March 5, 2022 by Rexford Industrial Realty

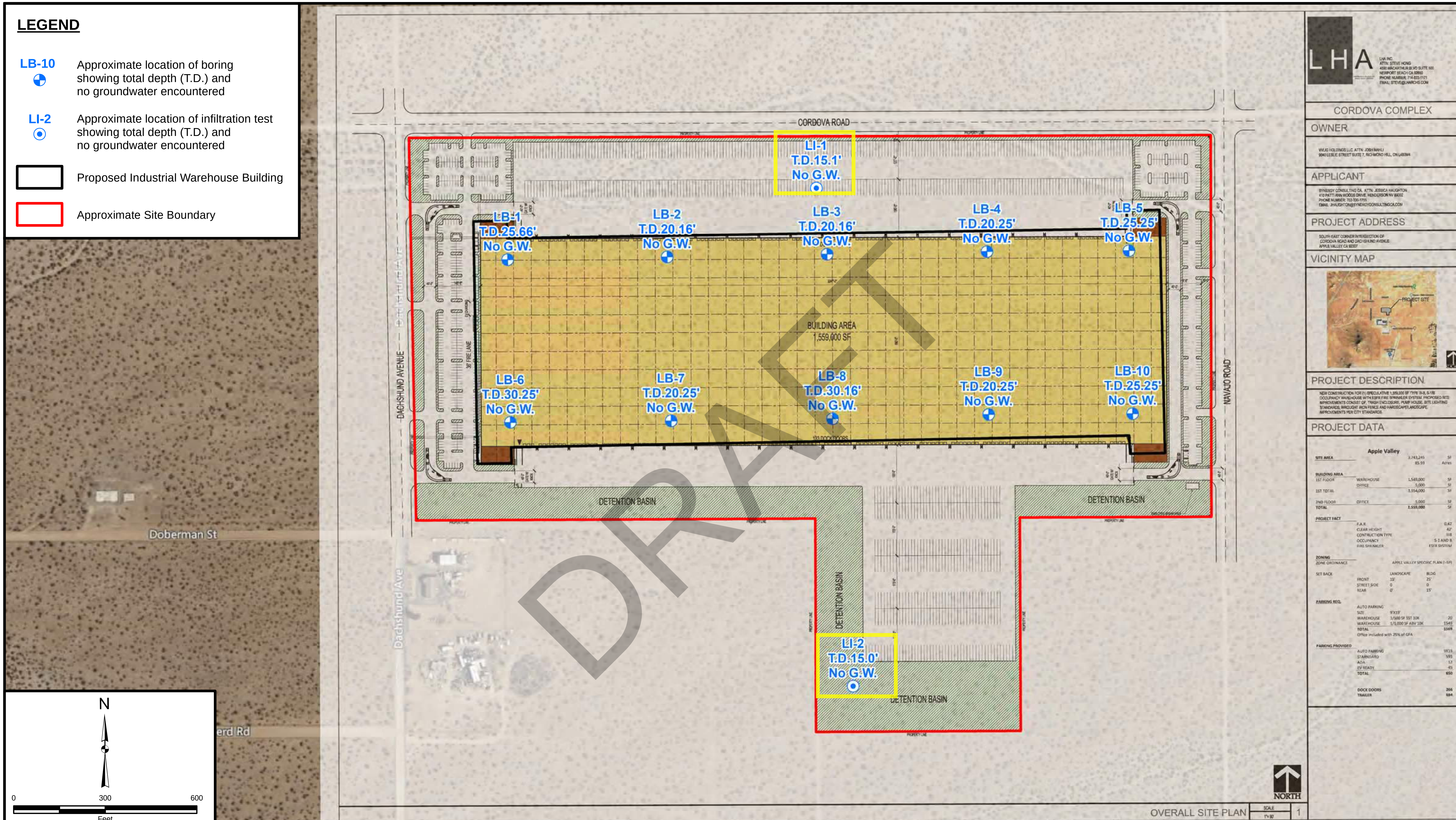
EXPLORATION LOCATION MAP

Proposed Warehouse Building Development
Parcel B APNs 0472-031-60, 61, 62, 63, and 64
Victorville, California

FIGURE 2

Leighton

Map Saved as J:\Drafting\13673\002\Maps\13673-002_F02_ELM_2022-09-28.mxd on 9/28/2022 9:47:44 AM Author: KVM (btran)



Project: 13673.003	Eng/Geol: JDH/SGO
Scale:1 " = 300 '	Date: October 2022

Reference: Conceptual Site Plan, Sheet 1 by LHA

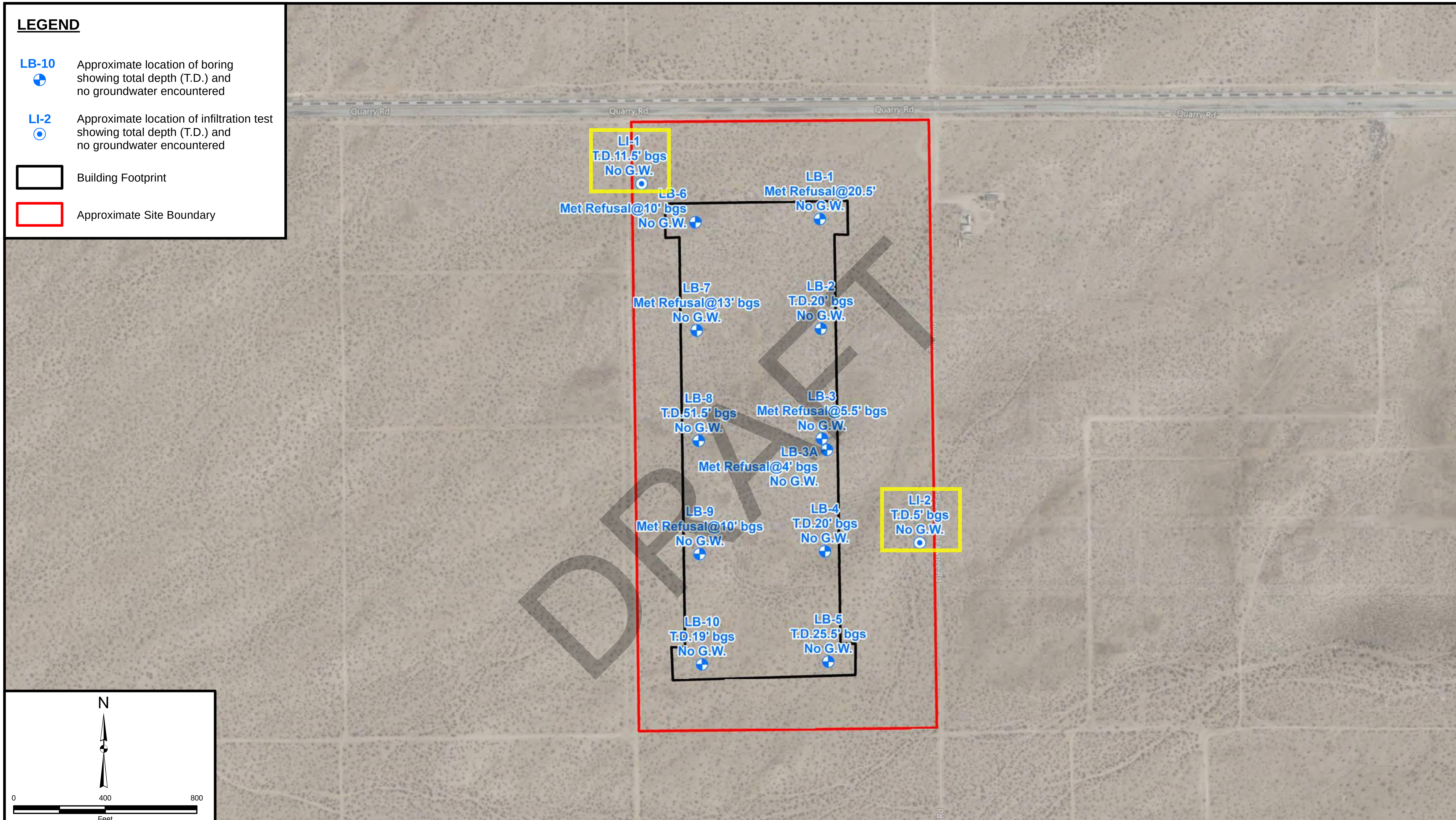
GEOTECHNICAL MAP

Proposed Industrial Warehouse Building Development
Southeast of Cordova Road and Dachshund Avenue
Apple Valley, California

FIGURE 2

Leighton

Map Saved as J:\Drafting\13673\003\Maps\13673-003_F02_ELM_2022-10-04.mxd on 10/4/2022 10:26:05 AM Author: KVM (btran)



Project: 13673.004	Eng/Geol: JDH/SGO
Scale:1 " = 400 '	Date: September 2022

Reference: Conceptual Site Plan, Sheet A1-0
Date: March 5, 2022 by Rexford Industrial Realty

EXPLORATION LOCATION MAP

Proposed Warehouse Building Development
Parcel B APNs 0463-213-05, 07, 08, 09, 16, 33, 34, 35, and 36
Apple Valley, California

FIGURE 2

Leighton

Map Saved as J:\Drafting\13673\004\Maps\13673-004_F02_ELM_2022-09-27.mxd on 9/26/2022 2:22:01 PM Author: KVM (btran)

Appendix F

- BMP Fact Sheets

Section 3
Source Control BMPs

3.1 Introduction

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

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

Table 3-1 Municipal Fixed Facility BMPs

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

Table 3-2 Municipal Field Program BMPs

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

3.2 Fact Sheet Format

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

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

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

SC-xx Example Fact Sheet

Description of the BMP

Approach

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

Requirements

- Costs
- Maintenance

Supplemental Information

- Further Details on the BMP
- Examples

References and Resources

Figure 3-1
Example Fact Sheet

3.3 BMP Fact Sheets

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

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.

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Designing New Installations

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

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

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

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

Conserve Natural Areas during Landscape Planning

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

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

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

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

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

- Preserve riparian areas and wetlands.

Maximize Natural Water Storage and Infiltration Opportunities Within the Landscape Unit

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

- Maintain natural storage reservoirs and drainage corridors, including depressions, areas of permeable soils, swales, and intermittent streams. Develop and implement policies and

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

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

Protection of Slopes and Channels during Landscape Design

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

Redeveloping Existing Installations

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

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

Other Resources

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

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

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

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

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

Spill Prevention, Control & Cleanup SC-11

Objectives

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

Targeted Constituents

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

Description

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

Approach

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

Pollution Prevention

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

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

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

Suggested Protocols

Spill/Leak Prevention Measures

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

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

Training

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

Spill Response and Prevention

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

SC-11 Spill Prevention, Control & Cleanup

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

Spill Cleanup Procedures

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

Reporting

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

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

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

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

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

Other Considerations

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

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

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

Requirements

Costs

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

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

Maintenance

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

Supplemental Information

Further Detail of the BMP

Reporting

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

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

These records should contain the following information:

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

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

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

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

Examples

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

References and Resources

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

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

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

Efficient Irrigation SD-12

Design Objectives

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

Description

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

Approach

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

Suitable Applications

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

Design Considerations

Designing New Installations

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

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

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

Redeveloping Existing Installations

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

Other Resources

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

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

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

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

Storm Drain Signage SD-13

Design Objectives

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

Description

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

Approach

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

Suitable Applications

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

Design Considerations

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

Designing New Installations

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

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

– DRAINS TO OCEAN" and/or other graphical icons to discourage illegal dumping.

- Post signs with prohibitive language and/or graphical icons, which prohibit illegal dumping at public access points along channels and creeks within the project area.

Note - Some local agencies have approved specific signage and/or storm drain message placards for use. Consult local agency stormwater staff to determine specific requirements for placard types and methods of application.

Redeveloping Existing Installations

Various jurisdictional stormwater management and mitigation plans (SUSMP, WQMP, etc.) define "redevelopment" in terms of amounts of additional impervious area, increases in gross floor area and/or exterior construction, and land disturbing activities with structural or impervious surfaces. If the project meets the definition of "redevelopment", then the requirements stated under " designing new installations" above should be included in all project design plans.

Additional Information

Maintenance Considerations

- Legibility of markers and signs should be maintained. If required by the agency with jurisdiction over the project, the owner/operator or homeowner's association should enter into a maintenance agreement with the agency or record a deed restriction upon the property title to maintain the legibility of placards or signs.

Placement

- Signage on top of curbs tends to weather and fade.

- Signage on face of curbs tends to be worn by contact with vehicle tires and sweeper brooms.

Supplemental Information

Examples

- Most MS4 programs have storm drain signage programs. Some MS4 programs will provide stencils, or arrange for volunteers to stencil storm drains as part of their outreach program.

Other Resources

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

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

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

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

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

Redeveloping Existing Installations

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

Additional Information

Maintenance Considerations

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

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

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

Building & Grounds Maintenance SC-41

Objectives

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

Targeted Constituents

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

Description

Stormwater runoff from building and grounds maintenance activities can be contaminated with toxic hydrocarbons in solvents, fertilizers and pesticides, suspended solids, heavy metals, abnormal pH, and oils and greases. Utilizing the protocols in this fact sheet will prevent or reduce the discharge of pollutants to stormwater from building and grounds maintenance activities by washing and cleaning up with as little water as possible, following good landscape management practices, preventing and cleaning up spills immediately, keeping debris from entering the storm drains, and maintaining the stormwater collection system.

Approach

Reduce potential for pollutant discharge through source control pollution prevention and BMP implementation. Successful implementation depends on effective training of employees on applicable BMPs and general pollution prevention strategies and objectives.

Pollution Prevention

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

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- Encourage use of Integrated Pest Management techniques for pest control.
- Encourage proper onsite recycling of yard trimmings.
- Recycle residual paints, solvents, lumber, and other material as much as possible.

Suggested Protocols

Pressure Washing of Buildings, Rooftops, and Other Large Objects

- In situations where soaps or detergents are used and the surrounding area is paved, pressure washers must use a water collection device that enables collection of wash water and associated solids. A sump pump, wet vacuum or similarly effective device must be used to collect the runoff and loose materials. The collected runoff and solids must be disposed of properly.
- If soaps or detergents are not used, and the surrounding area is paved, wash runoff does not have to be collected but must be screened. Pressure washers must use filter fabric or some other type of screen on the ground and/or in the catch basin to trap the particles in wash water runoff.
- If you are pressure washing on a grassed area (with or without soap), runoff must be dispersed as sheet flow as much as possible, rather than as a concentrated stream. The wash runoff must remain on the grass and not drain to pavement.

Landscaping Activities

- Dispose of grass clippings, leaves, sticks, or other collected vegetation as garbage, or by composting. Do not dispose of collected vegetation into waterways or storm drainage systems.
- Use mulch or other erosion control measures on exposed soils.

Building Repair, Remodeling, and Construction

- Do not dump any toxic substance or liquid waste on the pavement, the ground, or toward a storm drain.
- Use ground or drop cloths underneath outdoor painting, scraping, and sandblasting work, and properly dispose of collected material daily.
- Use a ground cloth or oversized tub for activities such as paint mixing and tool cleaning.
- Clean paintbrushes and tools covered with water-based paints in sinks connected to sanitary sewers or in portable containers that can be dumped into a sanitary sewer drain. Brushes and tools covered with non-water-based paints, finishes, or other materials must be cleaned in a manner that enables collection of used solvents (e.g., paint thinner, turpentine, etc.) for recycling or proper disposal.
- Use a storm drain cover, filter fabric, or similarly effective runoff control mechanism if dust, grit, wash water, or other pollutants may escape the work area and enter a catch basin. This is particularly necessary on rainy days. The containment device(s) must be in place at the beginning of the work day, and accumulated dirty runoff and solids must be collected and disposed of before removing the containment device(s) at the end of the work day.

- If you need to de-water an excavation site, you may need to filter the water before discharging to a catch basin or off-site. If directed off-site, you should direct the water through hay bales and filter fabric or use other sediment filters or traps.
- Store toxic material under cover during precipitation events and when not in use. A cover would include tarps or other temporary cover material.

Mowing, Trimming, and Planting

- Dispose of leaves, sticks, or other collected vegetation as garbage, by composting or at a permitted landfill. Do not dispose of collected vegetation into waterways or storm drainage systems.
- Use mulch or other erosion control measures when soils are exposed.
- Place temporarily stockpiled material away from watercourses and drain inlets, and berm or cover stockpiles to prevent material releases to the storm drain system.
- Consider an alternative approach when bailing out muddy water: do not put it in the storm drain; pour over landscaped areas.
- Use hand weeding where practical.

Fertilizer and Pesticide Management

- Follow all federal, state, and local laws and regulations governing the use, storage, and disposal of fertilizers and pesticides and training of applicators and pest control advisors.
- Use less toxic pesticides that will do the job when applicable. Avoid use of copper-based pesticides if possible.
- Do not use pesticides if rain is expected.
- Do not mix or prepare pesticides for application near storm drains.
- Use the minimum amount needed for the job.
- Calibrate fertilizer distributors to avoid excessive application.
- Employ techniques to minimize off-target application (e.g., spray drift) of pesticides, including consideration of alternative application techniques.
- Apply pesticides only when wind speeds are low.
- Fertilizers should be worked into the soil rather than dumped or broadcast onto the surface.
- Irrigate slowly to prevent runoff and then only as much as is needed.
- Clean pavement and sidewalk if fertilizer is spilled on these surfaces before applying irrigation water.
- Dispose of empty pesticide containers according to the instructions on the container label.

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

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

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

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

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

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

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

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

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

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

- Clean up spills immediately.

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

Requirements

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

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

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

Supplemental Information

Further Detail of the BMP

Fire Sprinkler Line Flushing

Building fire sprinkler line flushing may be a source of non-stormwater runoff pollution. The water entering the system is usually potable water, though in some areas it may be non-potable reclaimed wastewater. There are subsequent factors that may drastically reduce the quality of the water in such systems. Black iron pipe is usually used since it is cheaper than potable piping, but it is subject to rusting and results in lower quality water. Initially, the black iron pipe has an oil coating to protect it from rusting between manufacture and installation; this will contaminate the water from the first flush but not from subsequent flushes. Nitrates, poly-phosphates and other corrosion inhibitors, as well as fire suppressants and antifreeze may be added to the sprinkler water system. Water generally remains in the sprinkler system a long time (typically a year) and between flushes may accumulate iron, manganese, lead, copper, nickel, and zinc. The water generally becomes anoxic and contains living and dead bacteria and breakdown products from chlorination. This may result in a significant BOD problem and the water often smells. Consequently dispose fire sprinkler line flush water into the sanitary sewer. Do not allow discharge to storm drain or infiltration due to potential high levels of pollutants in fire sprinkler line water.

References and Resources

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

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

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

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

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

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

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

Parking/Storage Area Maintenance SC-43

Objectives

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

Targeted Constituents

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

Description

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

Approach

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

Pollution Prevention

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

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Suggested Protocols

General

- Keep the parking and storage areas clean and orderly. Remove debris in a timely fashion.
- Allow sheet runoff to flow into biofilters (vegetated strip and swale) and/or infiltration devices.
- Utilize sand filters or oleophilic collectors for oily waste in low quantities.
- Arrange rooftop drains to prevent drainage directly onto paved surfaces.
- Design lot to include semi-permeable hardscape.
- Discharge soapy water remaining in mop or wash buckets to the sanitary sewer through a sink, toilet, clean-out, or wash area with drain.

Controlling Litter

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

Surface Cleaning

- Use dry cleaning methods (e.g., sweeping, vacuuming) to prevent the discharge of pollutants into the stormwater conveyance system if possible.
- Establish frequency of public parking lot sweeping based on usage and field observations of waste accumulation.
- Sweep all parking lots at least once before the onset of the wet season.
- Follow the procedures below if water is used to clean surfaces:
  - Block the storm drain or contain runoff.
  - Collect and pump wash water to the sanitary sewer or discharge to a pervious surface. Do not allow wash water to enter storm drains.
  - Dispose of parking lot sweeping debris and dirt at a landfill.
- Follow the procedures below when cleaning heavy oily deposits:
  - Clean oily spots with absorbent materials.
  - Use a screen or filter fabric over inlet, then wash surfaces.

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

Surface Repair

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

Inspection

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

Training

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

Spill Response and Prevention

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

Other Considerations

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

SC-43 Parking/Storage Area Maintenance

Requirements

Costs

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

Maintenance

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

Supplemental Information

Further Detail of the BMP

Surface Repair

Apply concrete, asphalt, and seal coat during dry weather to prevent contamination from contacting stormwater runoff. Where applicable, cover and seal nearby storm drain inlets (with waterproof material or mesh) and manholes before applying seal coat, slurry seal, etc. Leave covers in place until job is complete and all water from emulsified oil sealants has drained or evaporated. Clean any debris from these covered manholes and drains for proper disposal. Only use only as much water as is necessary for dust control to avoid runoff.

References and Resources

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

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

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

Pollution from Surface Cleaning Folder. 1996. Bay Area Stormwater Management Agencies Association (BASMAA). http://www.basmaa.org/

Oregon Association of Clean Water Agencies. Oregon Municipal Stormwater Toolbox for Maintenance Practices. June 1998.

Santa Clara Valley Urban Runoff Pollution Prevention Program http://www.scvurppp.org

The Storm Water Managers Resource Center http://www.stormwatercenter.net/

Description

Promote efficient and safe housekeeping practices (storage, use, and cleanup) when handling potentially harmful materials such as fertilizers, pesticides, cleaning solutions, paint products, automotive products, and swimming pool chemicals. Related information is provided in BMP fact sheets SC-11 Spill Prevention, Control & Cleanup and SC-34 Waste Handling & Disposal.

Objectives

- Cover
- Contain
- Educate
- Reduce/Minimize
- Product Substitution

Targeted Constituents

Sediment	☑
Nutrients	☑
Trash	☑
Metals	☑
Bacteria	☑
Oil and Grease	☑
Organics	☑
Oxygen Demanding	☑

Approach

Pollution Prevention

- Purchase only the amount of material that will be needed for foreseeable use. In most cases this will result in cost savings in both purchasing and disposal. See SC-61 Safer Alternative Products for additional information.

- Be aware of new products that may do the same job with less environmental risk and for less or the equivalent cost. Total cost must be used here; this includes purchase price, transportation costs, storage costs, use related costs, clean up costs and disposal costs.

Suggested Protocols

General

- Keep work sites clean and orderly. Remove debris in a timely fashion. Sweep the area.

- Dispose of wash water, sweepings, and sediments, properly.

- Recycle or dispose of fluids properly.

- Establish a daily checklist of office, yard and plant areas to confirm cleanliness and adherence to proper storage and security. Specific employees should be assigned specific inspection responsibilities and given the authority to remedy any problems found.

- Post waste disposal charts in appropriate locations detailing for each waste its hazardous nature (poison, corrosive, flammable), prohibitions on its disposal (dumpster, drain, sewer) and the recommended disposal method (recycle, sewer, burn, storage, landfill).

- Summarize the chosen BMPs applicable to your operation and post them in appropriate conspicuous places.

- Require a signed checklist from every user of any hazardous material detailing amount taken, amount used, amount returned and disposal of spent material.
- Do a before audit of your site to establish baseline conditions and regular subsequent audits to note any changes and whether conditions are improving or deteriorating.
- Keep records of water, air and solid waste quantities and quality tests and their disposition.
- Maintain a mass balance of incoming, outgoing and on hand materials so you know when there are unknown losses that need to be tracked down and accounted for.
- Use and reward employee suggestions related to BMPs, hazards, pollution reduction, work place safety, cost reduction, alternative materials and procedures, recycling and disposal.
- Have, and review regularly, a contingency plan for spills, leaks, weather extremes etc. Make sure all employees know about it and what their role is so that it comes into force automatically.

Training

- Train all employees, management, office, yard, manufacturing, field and clerical in BMPs and pollution prevention and make them accountable.
- Train municipal employees who handle potentially harmful materials in good housekeeping practices.
- Train personnel who use pesticides in the proper use of the pesticides. The California Department of Pesticide Regulation license pesticide dealers, certify pesticide applicators and conduct onsite inspections.
- Train employees and contractors in proper techniques for spill containment and cleanup. The employee should have the tools and knowledge to immediately begin cleaning up a spill if one should occur.

Spill Response and Prevention

- Refer to SC-11, Spill Prevention, Control & Cleanup.
- Keep your Spill Prevention Control and Countermeasure (SPCC) plant up-to-date, and implement accordingly.
- Have spill cleanup materials readily available and in a known location.
- Cleanup spills immediately and use dry methods if possible.
- Properly dispose of spill cleanup material.

Other Considerations

- There are no major limitations to this best management practice.
- There are no regulatory requirements to this BMP. Existing regulations already require municipalities to properly store, use, and dispose of hazardous materials

Requirements

Costs

- Minimal cost associated with this BMP. Implementation of good housekeeping practices may result in cost savings as these procedures may reduce the need for more costly BMPs.

Maintenance

- Ongoing maintenance required to keep a clean site. Level of effort is a function of site size and type of activities.

Supplemental Information

Further Detail of the BMP

- The California Integrated Waste Management Board's Recycling Hotline, 1-800-553-2962, provides information on household hazardous waste collection programs and facilities.

Examples

There are a number of communities with effective programs. The most pro-active include Santa Clara County and the City of Palo Alto, the City and County of San Francisco, and the Municipality of Metropolitan Seattle (Metro).

References and Resources

British Columbia Lake Stewardship Society. Best Management Practices to Protect Water Quality from Non-Point Source Pollution. March 2000. http://www.nalms.org/bclss/bmphome.html#bmp

King County Stormwater Pollution Control Manual - http://dnr.metrokc.gov/wlr/dss/spcm.htm

Model Urban Runoff Program: A How-To Guide for Developing Urban Runoff Programs for Small Municipalities, Prepared by City of Monterey, City of Santa Cruz, California Coastal Commission, Monterey Bay National Marine Sanctuary, Association of Monterey Bay Area Governments, Woodward-Clyde, Central Coast Regional Water Quality Control Board. July, 1998, Revised by California Coastal Commission, February 2002.

Orange County Stormwater Program http://www.ocwatersheds.com/stormwater/swp_introduction.asp

San Mateo STOPPP - (http://stoppp.tripod.com/bmp.html)

Trash Storage Areas SD-32

Design Objectives

- Maximize Infiltration
- Provide Retention
- Slow Runoff
- Minimize Impervious Land Coverage
- Prohibit Dumping of Improper Materials
- ☑ Contain Pollutants
- Collect and Convey

Description

Trash storage areas are areas where a trash receptacle (s) are located for use as a repository for solid wastes. Stormwater runoff from areas where trash is stored or disposed of can be polluted. In addition, loose trash and debris can be easily transported by water or wind into nearby storm drain inlets, channels, and/or creeks. Waste handling operations that may be sources of stormwater pollution include dumpsters, litter control, and waste piles.

Approach

This fact sheet contains details on the specific measures required to prevent or reduce pollutants in stormwater runoff associated with trash storage and handling. Preventative measures including enclosures, containment structures, and impervious pavements to mitigate spills, should be used to reduce the likelihood of contamination.

Suitable Applications

Appropriate applications include residential, commercial and industrial areas planned for development or redevelopment. (Detached residential single-family homes are typically excluded from this requirement.)

Design Considerations

Design requirements for waste handling areas are governed by Building and Fire Codes, and by current local agency ordinances and zoning requirements. The design criteria described in this fact sheet are meant to enhance and be consistent with these code and ordinance requirements. Hazardous waste should be handled in accordance with legal requirements established in Title 22, California Code of Regulation.

Wastes from commercial and industrial sites are typically hauled by either public or commercial carriers that may have design or access requirements for waste storage areas. The design criteria in this fact sheet are recommendations and are not intended to be in conflict with requirements established by the waste hauler. The waste hauler should be contacted prior to the design of your site trash collection areas. Conflicts or issues should be discussed with the local agency.

Designing New Installations

Trash storage areas should be designed to consider the following structural or treatment control BMPs:

- Design trash container areas so that drainage from adjoining roofs and pavement is diverted around the area(s) to avoid run-on. This might include berming or grading the waste handling area to prevent run-on of stormwater.
- Make sure trash container areas are screened or walled to prevent off-site transport of trash.

CASQA
CALIFORNIA STORMWATER QUALITY ASSOCIATION

- Use lined bins or dumpsters to reduce leaking of liquid waste.
- Provide roofs, awnings, or attached lids on all trash containers to minimize direct precipitation and prevent rainfall from entering containers.
- Pave trash storage areas with an impervious surface to mitigate spills.
- Do not locate storm drains in immediate vicinity of the trash storage area.
- Post signs on all dumpsters informing users that hazardous materials are not to be disposed of therein.

Redeveloping Existing Installations

Various jurisdictional stormwater management and mitigation plans (SUSMP, WQMP, etc.) define "redevelopment" in terms of amounts of additional impervious area, increases in gross floor area and/or exterior construction, and land disturbing activities with structural or impervious surfaces. The definition of " redevelopment" must be consulted to determine whether or not the requirements for new development apply to areas intended for redevelopment. If the definition applies, the steps outlined under "designing new installations" above should be followed.

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Maintenance Considerations

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Ventura Countywide Technical Guidance Manual for Stormwater Quality Control Measures, July 2002.

Appendix G

- Educational Materials

The Updated Model Water Efficient Landscape Ordinance

CALIFORNIA DEPARTMENT OF WATER RESOURCES

Landscapes are essential to the quality of life in California. They provide areas for recreation, enhance the environment, clean the air and water, prevent erosion, offer fire protection and replace ecosystems lost to development.

California's economic prosperity and environmental quality are dependant on an adequate supply of water for beneficial uses. In California, about half of the urban water used is for landscape irrigation. Ensuring **efficient landscapes** in new developments and reducing water waste in existing landscapes are the most cost-effective ways to stretch our limited water supplies and ensure that we continue to have sufficient water for California to prosper.

The Water Conservation in Landscaping Act of 2006 (Assembly Bill 1881, Laird) requires cities, counties, and charter cities and charter counties, to adopt landscape water conservation ordinances by January 1, 2010. Pursuant to this law, the Department of Water Resources (DWR) has prepared a Model Water Efficient Landscape Ordinance (Model Ordinance) for use by local agencies. The Model Ordinance was approved by the Office of Administrative Law on September 10, 2009. The Model Ordinance became effective on September 10.

All local agencies must adopt a water efficient landscape ordinance by **January 1, 2010**. The local agencies may adopt the state Model Ordinance, or craft an ordinance to fit local conditions. In addition, several local agencies may collaborate and craft a region-wide ordinance. In any case, the adopted ordinance must be as effective as the Model Ordinance in regard to water conservation.

For more information, please visit our web site at
http://www.water.ca.gov/wateruseefficiency/landscapeordinance/

DWR October 2009

Important points to consider...

Water purveyors have an important role.

The enabling statute was directed to local agencies that make land use decisions and approve land development. Active participation by water purveyors can make the implementation, enforcement and follow-up actions of an ordinance more effective.

Most new and rehabilitated landscapes are subject to a water efficient landscape ordinance. Public landscapes and private development projects including developer installed single family and multi-family residential landscapes with at least 2500 sq. ft. of landscape area are subject to the Model Ordinance .

Homeowner provided landscaping at single family and multi-family homes are subject to the Model Ordinance if the landscape area is at least 5000 sq. ft

Existing landscapes are also subject to the Model Ordinance.

Water waste is common in landscapes that are poorly designed or not well maintained. Water waste (from runoff, overspray, low head drainage, leaks and excessive amounts of applied irrigation water in landscapes is prohibited by Section 2, Article X of the California Constitution.

Any landscape installed prior to January 1, 2010, that is at least one acre in size may be subject to irrigation audits, irrigation surveys or water use analysis programs for evaluating irrigation system performance and adherence to the Maximum Applied Water Allowance as defined in the 1992 Model Ordinance with an Evapotranspiration Adjustment Factor (ETAF) of 0.8. Local agencies and water purveyors (designated by the local agency) may institute these or other programs to increase efficiency in existing landscapes.

All new landscapes will be assigned a water budget.

The water budget approach is a provision in the statute that ensures a landscape is allowed sufficient water. There are two water budgets in the Model Ordinance; the Maximum Applied Water Allowance (MAWA) and the Estimated Total Water Use (ETWU).

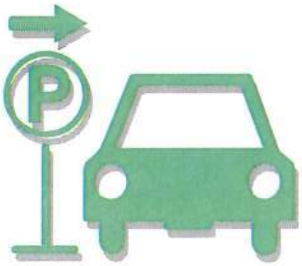
The MAWA, is the water budget used for compliance and is an annual water allowance based on landscape area, local evapotranspiration and ETAF of 0.7. The ETWU is an annual water use estimation for design purposes and is based on the water needs of the plants actually chosen for a given landscape. The ETWU may not exceed the MAWA.

Water efficient landscapes offer multiple benefits.

Water efficient landscapes will stretch our limited water supplies. Other benefits include reduced irrigation runoff, reduced pollution of waterways, less property damage, less green waste, increased drought resistance and a smaller carbon footprint.

The Department of Water Resources will offer technical assistance.

The Department plans to offer a series of workshops, publications and other assistance for successful adoption and implementation of the Model Ordinance or local water efficient landscape ordinances. Information regarding these resources may be found on the DWR website: **http://www.water.ca.gov/wateruseefficiency/landscapeordinance/**
Questions on the Model Ordinance may be sent by e-mail to DWR staff at: **mweo@water.ca.gov.**



R-3
AUTOMOBILE PARKING

Parked automobiles may contribute pollutants to the storm drain because poorly maintained vehicles may leak fluids containing hydrocarbons, metals, and other pollutants. In addition, heavily soiled automobiles may drop clods of dirt onto the parking surface, contributing to the sediment load when runoff is present. During rain events, or wash-down activities, the pollutants may be carried into the storm drain system. The pollution prevention activities outlined in this fact sheets are used to prevent the discharge of pollutants to the storm drain system.

The activities outlined in this fact sheet target the following pollutants:	
Sediment	x
Nutrients	
Bacteria	
Foaming Agents	
Metals	X
Hydrocarbons	X
Hazardous Materials	x
Pesticides and Herbicides	
Other	

Think before parking your car. Remember - The ocean starts at your front door.

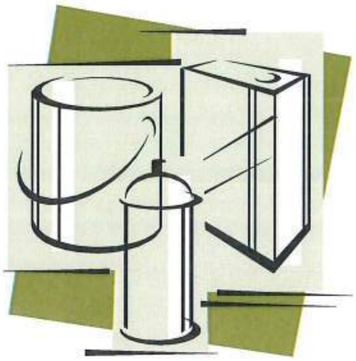
Required Activities

- If required, vehicles have to be removed from the street during designated street sweeping/cleaning times.
- If the automobile is leaking, place a pan or similar collection device under the automobile, until such time as the leak may be repaired.
- Use dry cleaning methods to remove any materials deposited by vehicles (e.g. adsorbents for fluid leaks, sweeping for soil clod deposits).

Recommended Activities

- Park automobiles over permeable surfaces (e.g. gravel, or porous cement).
- Limit vehicle parking to covered areas.
- Perform routine maintenance to minimize fluid leaks, and maximize fuel efficiency.

For additional information contact:
County of Orange, **OC Watershed**
Main: (714) 955-0600/ 24hr Water Pollution Discharge Hotline 1-877-89-SPILL
or visit our website at: www.ocwatersheds.com



R-7
HOUSEHOLD HAZARDOUS WASTE

Household hazardous wastes (HHW) are defined as waste materials which are typically found in homes or similar sources, which exhibit characteristics such as: corrosivity, ignitability, reactivity, and/or toxicity, or are listed as hazardous materials by EPA.

The activities outlined in this fact sheet target the following pollutants:	
Sediment	
Nutrients	
Bacteria	
Foaming Agents	x
Metals	x
Hydrocarbons	x
Hazardous Materials	x
Pesticides and Herbicides	x
Other	x

List of most common HHW products:

- Drain openers
- Oven cleaners
- Wood and metal cleaners and polishes
- Automotive oil and fuel additives
- Grease and rust solvents
- Carburetor and fuel injection cleaners
- Starter fluids
- Batteries
- Paint Thinners
- Paint strippers and removers
- Adhesives
- Herbicides
- Pesticides
- Fungicides/wood preservatives

Many types of waste can be recycled, however options for each waste type are limited. Recycling is always preferable to disposal of unwanted materials. All gasoline, antifreeze, waste oil, and lead-acid batteries can be recycled. Latex and oil-based paint can be reused, as well as recycled. Materials that cannot be reused or recycled should be disposed of at a properly permitted landfill.

Think before disposing of any household hazardous waste. Remember - The ocean starts at your front door.

RECYCLE USED OIL

Required Activities

- Dispose of HHW at a local collection facility. Call (714) 834-6752 for the household hazardous waste center closest to your area.
- Household hazardous materials must be stored indoors or under cover, and in closed and labeled containers.
- If safe, contain, clean up, and properly dispose all household hazardous waste spills. If an unsafe condition exists, call 911 to activate the proper response team.

Recommended Activities

- Use non-hazardous or less-hazardous products.
- Participate in HHW reuse and recycling. Call (714) 834-6752 for the participating household hazardous waste centers.

The California Integrated Waste Management Board has a Recycling Hotline (800) 553-2962, that provides information and recycling locations for used oil.

For additional information contact:
County of Orange, **OC Watershed**
Main: (714) 955-0600/ 24hr Water Pollution Discharge Hotline 1-877-89-SPILL
or visit our website at: www.ocwatersheds.com

R-8
WATER CONSERVATION

Excessive irrigation and/or the overuse of water is often the most significant factor in transporting pollutants to the storm drain system. Pollutants from a wide variety of sources including automobile repair and maintenance, automobile washing, automobile parking, home and garden care activities and pet care may dissolve in the water and be transported to the storm drain. In addition, particles and materials coated with fertilizers and pesticides may be suspended in the flow and be transported to the storm drain.

The activities outlined in this fact sheet target the following pollutants:	
Sediment	x
Nutrients	x
Bacteria	x
Foaming Agents	x
Metals	x
Hydrocarbons	x
Hazardous Materials	x
Pesticides and Herbicides	x
Other	x

Hosing off outside areas to wash them down not only consumes large quantities of water, but also transports any pollutants, sediments, and waste to the storm drain system. The pollution prevention activities outlined in this fact sheets are used to prevent the discharge of pollutants to the storm drain system.

Think before using water. Remember - The ocean starts at your front door.

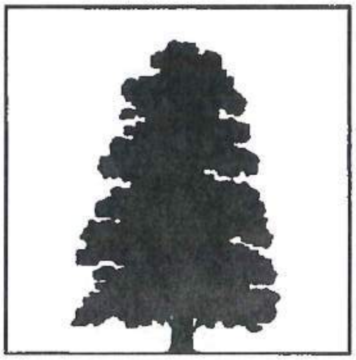
Required Activities

- Irrigation systems must be properly adjusted to reflect seasonal water needs.
- Do not hose off outside surfaces to clean, sweep with a broom instead.

Recommended Activities

- Fix any leaking faucets and eliminate unnecessary water sources.
- Use xeroscaping and drought tolerant landscaping to reduce the watering needs.
- Do not over watering lawns or gardens. Over watering wastes water and promotes diseases.
- Use a bucket to re-soak sponges/rags while washing automobiles and other items outdoors. Use hose only for rinsing.
- Wash automobiles at a commercial car wash employing water recycling.

For additional information contact:
County of Orange, **OC Watershed**
Main: (714) 955-0600/ 24hr Water Pollution Discharge Hotline 1-877-89-SPILL
or visit our website at: www.ocwatersheds.com



FP-2

LANDSCAPE MAINTENANCE

The model procedures described below focus on minimizing the discharge of pesticides and fertilizers, landscape waste, trash, debris, and other pollutants to the storm drain system and receiving waters. Landscape maintenance practices may involve one or more of the following activities:

1. **Mowing, Trimming/Weeding, and Planting**
2. **Irrigation**
3. **Fertilizer and Pesticide Management**
4. **Managing Landscape Waste**
5. **Erosion Control**

POLLUTION PREVENTION:

Pollution prevention measures have been considered and incorporated in the model procedures. Implementation of these measures may be more effective and reduce or eliminate the need to implement other more complicated or costly procedures. Possible pollution prevention measures for landscape maintenance include:

- Implement an integrated pest management (IPM) program. IPM is a sustainable approach to managing pests by combining biological, cultural, physical, and chemical tools. Refer to Appendix D, Fertilizer and Pesticide Management Guidance for further details.
- Choose low water using flowers, trees, shrubs, and groundcover.
- Appropriate maintenance (i.e. properly timed fertilizing, weeding, pest control, and pruning) will preserve the landscapes water efficiency.
- Once per year, educate municipal staff on pollution prevention measures.

MODEL PROCEDURES:

1. Mowing, Trimming/Weeding, and Planting

Mowing, Trimming/Weeding

✓ Whenever possible, use mechanical methods of vegetation removal rather than applying herbicides. Use hand weeding where practical.

✓ When conducting mechanical or manual weed control, avoid loosening the soil, which could erode into streams or storm drains.

✓ Use coarse textured mulches or geotextiles to suppress weed growth and reduce the use of herbicides.

✓ Do not blow or rake leaves, etc. into the street or place yard waste in gutters or on dirt shoulders. Sweep up any leaves, litter or residue in gutters or on street.

✓ Collect lawn and garden clippings, pruning waste, tree trimmings, and weeds. Chip if necessary, and compost or dispose of at a landfill (see waste management section of this procedure sheet).

✓ Place temporarily stockpiled material away from watercourses, and berm or cover stockpiles to prevent material releases to storm drains.

Planting

✓ Where feasible, retain and/or plant selected native vegetation whose features are determined to be beneficial. Native vegetation usually requires less maintenance (e.g., irrigation, fertilizer) than planting ornamental vegetation.

✓ When planting or replanting consider using low water use groundcovers.

OPTIONAL:

- Careful soil mixing and layering techniques using a topsoil mix or composted organic material can be used as an effective measure to reduce herbicide use and watering.

2. Irrigation

✓ Utilize water delivery rates that do not exceed the infiltration rate of the soil.

✓ Use timers appropriately or a drip system to prevent runoff and then only irrigate as much as is needed.

✓ Inspect irrigation system periodically to ensure that the right amount of water is being applied and that excessive runoff is not occurring. Minimize excess watering, and repair leaks in the irrigation system as soon as they are observed.

✓ Where practical, use automatic timers to minimize runoff.

✓ Use popup sprinkler heads in areas with a lot of activity or where there is a chance the pipes may be broken. Consider the use of mechanisms that reduce water flow to sprinkler heads if broken.

✓ If re-claimed water is used for irrigation, ensure that there is no runoff from the landscaped area(s).

✓ If bailing of muddy water is required (e.g. when repairing a water line leak), do not put it in the storm drain; pour over landscaped areas.

3. Fertilizer and Pesticide Management

Usage

✓ Utilize a comprehensive management system that incorporates integrated pest management techniques.

✓ Follow all federal, state, and local laws and regulations governing the use, storage, and disposal of fertilizers and pesticides and training of applicators and pest control advisors.

✓ Educate and train employees on use of pesticides and in pesticide application techniques to prevent pollution.

✓ Pesticide application must be under the supervision of a California qualified pesticide applicator.

✓ When applicable use the least toxic pesticides that will do the job. Avoid use of copper-based pesticides if possible.

✓ Do not mix or prepare pesticides or fertilizers for application near storm drains.

✓ Prepare the minimum amount of pesticide needed for the job and use the lowest rate that will effectively control the pest.

✓ Employ techniques to minimize off-target application (e.g. spray drift) of pesticides, including consideration of alternative application techniques.

✓ Calibrate fertilizer and pesticide application equipment to avoid excessive application.

✓ Periodically test soils for determining proper fertilizer use.

✓ Sweep pavement and sidewalk if fertilizer is spilled on these surfaces before applying irrigation water.

✓ Inspect pesticide/fertilizer equipment and transportation vehicles daily.

✓ Refer to Appendix D for further guidance on Fertilizer and Pesticide management

OPTIONAL:

- Work fertilizers into the soil rather than dumping or broadcasting them onto the surface.
- Use beneficial insects where possible to control pests (green lacewings, ladybugs, praying mantis, ground beetles, parasitic nematodes, trichogramma wasps, seedhead weevils, and spiders prey on detrimental pest species).
- Use slow release fertilizers whenever possible to minimize leaching.

Scheduling

✓ Do not use pesticides if rain is expected within 24 hours.

✓ Apply pesticides only when wind speeds are low (less than 5 mph).

Disposal

- ✓ Purchase only the amount of pesticide that you can reasonably use in a given time period (month or year depending on the product).
- ✓ Triple rinse containers, and use rinse water as product. Dispose of unused pesticide as hazardous waste.
- ✓ Dispose of empty pesticide containers according to the instructions on the container label.

4. Managing Landscape Waste

Also see Waste Handling and Disposal procedure sheet

- ✓ Compost leaves, sticks, or other collected vegetation or dispose of at a permitted landfill. Do not dispose of collected vegetation into waterways or storm drainage systems.
- ✓ Place temporarily stockpiled material away from watercourses and storm drain inlets, and berm or cover stockpiles to prevent material releases to the storm drain system.
- ✓ Reduce the use of high nitrogen fertilizers that produce excess growth requiring more frequent mowing or trimming.
- ✓ Inspection of drainage facilities should be conducted to detect illegal dumping of clippings/cuttings in or near these facilities. Materials found should be picked up and properly disposed of.
- ✓ Landscape wastes in and around storm drain inlets should be avoided by either using bagging equipment or by manually picking up the material.

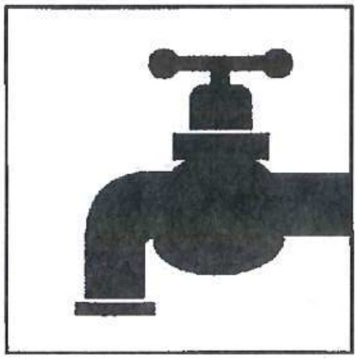
5. Erosion Control

Also see Waste Handling and Disposal procedure sheet

- ✓ Maintain vegetative cover on medians and embankments to prevent soil erosion. Apply mulch or leave clippings to serve as additional cover for soil stabilization and to reduce the velocity of storm water runoff.
- ✓ Minimize the use of disking as a means of vegetation management because the practice may result in erodable barren soil.
- ✓ Confine excavated materials to pervious surfaces away from storm drain inlets, sidewalks, pavement, and ditches. Material must be covered if rain is expected.

LIMITATIONS:

Alternative pest/weed controls may not be available, suitable, or effective in every case.



FP-6

WATER AND SEWER UTILITY OPERATION AND MAINTENANCE

Although the operation and maintenance of public utilities are not considered themselves a chronic source of stormwater pollution, some activities and accidents can result in the discharge of pollutants that can pose a threat to both human health and the quality of receiving waters if they enter the storm drain system. Activities associated with the operation and maintenance of water and sewer utilities to prevent and handle such incidents include the following:

1. **Water Line Maintenance**
2. **Sanitary Sewer Maintenance**
3. **Spill/Leak/Overflow Control, Response, and Containment**

Cities that do not provide maintenance of water and sewer utilities should coordinate with the contracting agency responsible for these activities and ensure that these model procedures are followed.

POLLUTION PREVENTION:

Pollution prevention measures have been considered and incorporated in the model procedures. Implementation of these measures may be more effective and reduce or eliminate the need to implement other more complicated or costly procedures. Possible pollution prevention measures for water and sewer utility operation and maintenance include:

- Inspect potential non-storm water discharge flow paths and clear/cleanup any debris or pollutants found (i.e. remove trash, leaves, sediment, and wipe up liquids, including oil spills).
- Once per year, educate municipal staff on pollution prevention measures.

MODEL PROCEDURES:

1. Water Line Maintenance

Procedures can be employed to reduce pollutants from discharges associated with water utility operation and maintenance activities. Planned discharges may include fire hydrant testing, flushing water supply mains after new construction, flushing lines due to complaints of taste and odor, dewatering mains for maintenance work. Unplanned discharges from treated, recycled water, raw water, and groundwater systems operation and maintenance activities can occur from water main breaks, sheared fire hydrants, equipment malfunction, and operator error.

Planned Discharges

✓ For planned discharges use one of the following options:

- Reuse water for dust suppression, irrigation, or construction compaction
- Discharge to the sanitary sewer system with approval
- Discharge to the storm drain system or to a creek using applicable pollution control measures listed below (this option is ONLY applicable to uncontaminated pumped ground water, water line flushing, fire hydrant testing and flushing, discharges from potable water sources other than water main breaks) and may require a permit from the Regional Water Quality Control Board.

✓ If water is discharged to a storm drain inlet (catch basin), control measures must be put in place to control potential pollutants (i.e. sediment, chlorine, etc.). Examples of some storm drain inlet protection options include:

- Silt fence – appropriate where the inlet drains a relatively flat area.
- Gravel and wire mesh sediment filter – Appropriate where concentrated flows are expected.
- Wooden weir and fabric – use at curb inlets where a compact installation is desired.

✓ Prior to discharge, inspect discharge flow path and clear/cleanup any debris or pollutants found (i.e. remove trash, leaves, sediment, and wipe up liquids, including oil spills).

✓ Select appropriate pollution control measure(s) considering the receiving system (i.e. curb inlet, drop inlet, culvert, creek, etc.) and ensure that the control device(s) fit properly.

✓ General design considerations for inlet protection devices include the following:

- The device should be constructed such that cleaning and disposal of trapped sediment is made easy, while minimizing interference with discharge activities.
- Devices should be constructed so that any standing water resulting from the discharge will not cause excessive inconvenience or flooding/damage to adjacent land or structures.

✓ The effectiveness of control devices must be monitored during the discharge period and any necessary repairs or modifications made as needed.

OPTIONAL:

- Sediment removal may be enhanced by placing filter fabric, gravel bags, etc. at storm drain inlets.

Unplanned Discharges

✓ Stop the discharge as quickly as possible by turning off water source.

✓ Inspect flow path of the discharged water:

- Control erosion along the flow path.
- Identify areas that may produce significant sediment or gullies, use sandbags to redirect the flow.
- Identify erodible areas which may need to be repaired or protected during subsequent repairs or corrective actions

✓ If repairs or corrective action will cause additional discharges of water, select the appropriate procedures for erosion control, chlorine residual, turbidity, and chemical additives. Prevent potential pollutants from entering the flow path and ensure that no additional discharged water enters storm drain inlets.

2. Sanitary Sewer Maintenance

Applicable to municipalities who own and operated a sewage collection system. Facilities that are covered under this program include sanitary sewer pipes and pump stations owned and operated by the Permittee. The owner of the sanitary sewer facilities is the entity responsible for carrying out this prevention and response program.

Sewer System Cleaning

✓ Sewer lines should be cleaned on a regular basis to remove grease, grit, and other debris that may lead to sewer backups.

✓ Establish routine maintenance program. Cleaning should be conducted at an established minimum frequency and more frequently for problem areas such as restaurants that are identified

✓ Cleaning activities may require removal of tree roots and other identified obstructions.

Preventative and Corrective Maintenance

✓ During routine maintenance and inspection note the condition of sanitary sewer structures and identify areas that need repair or maintenance. Items to note may include the following:

- cracked/deteriorating pipes
- leaking joints/seals at manhole
- frequent line plugs
- line generally flows at or near capacity
- suspected infiltration or exfiltration

✓ Document suggestions and requests for repair and report the information to the appropriate manager or supervisor.

✓ Prioritize repairs based on the nature and severity of the problem. Immediate clearing of blockage or repair is required where an overflow is currently occurring or for urgent problems that may cause an imminent overflow (e.g. pump station failures, sewer line ruptures, sewer line blockages). These repairs may be temporary until scheduled or capital improvements can be completed.

✓ Review previous sewer maintenance records to help identify "hot spots" or areas with frequent maintenance problems and locations of potential system failure.

3. Spill/Leak/Overflow Control, Response, and Containment

Control

Also see Drainage System procedures sheet

✓ Refer to countywide *Illicit Discharge Detection and Elimination Program.* Components of this program include:

- Investigation/inspection and follow-up
- Elimination of illicit discharges and connections
- Enforcement of ordinances
- Respond to sewage spills

- Facilitate public reporting of illicit discharges and connections. A citizen's hotline for reporting observed overflow conditions should be established to supplement the field screening efforts being conducted by the Principal Permittee.

Response and Containment

✓ Establish lead department/agency responsible for spill response and containment. Provide coordination within departments.

✓ When a spill, leak, and/or overflow occurs, keep sewage from entering the storm drain system to the maximum extent practicable by covering or blocking storm drain inlets or by containing and diverting the sewage away from open channels and other storm drain facilities (using sandbags, inflatable dams, etc.).

✓ If a spill reaches the storm drain notify County of Orange Health Care Agency through Control One at (714) 628-7208.

✓ Remove the sewage using vacuum equipment or use other measures to divert it back to the sanitary sewer system.

✓ Record required information at the spill site.

✓ Perform field tests as necessary to determine the source of the spill.

✓ Develop additional notification procedures regarding spill reporting as needed.

LIMITATIONS:

Private property access rights needed to perform testing along storm drain right-of-ways. Requirements of municipal ordinance authority for suspected source verification testing necessary for guaranteed rights of entry.

REFERENCES:

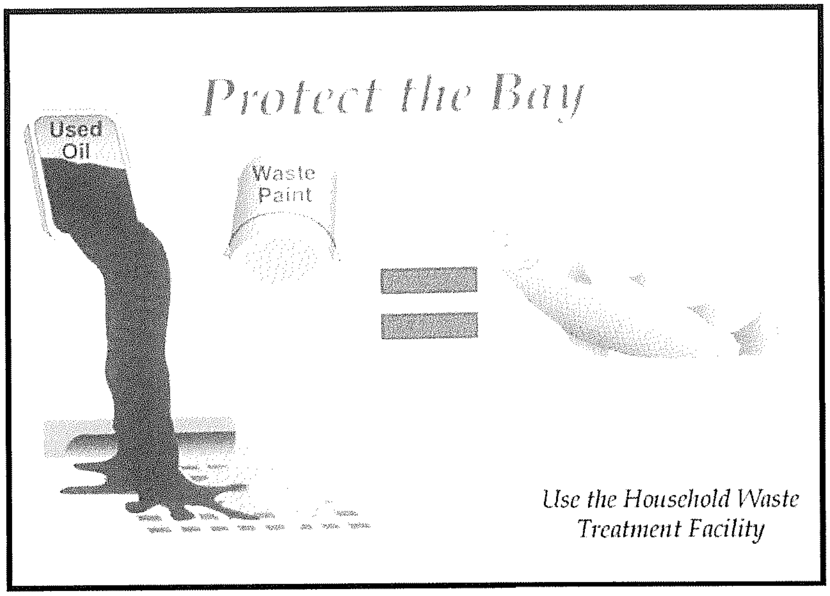
California Storm Water Best Management Practice Handbooks. Municipal Best Management Practice Handbook. Prepared by Camp Dresser & McKee, Larry Walker Associates, Uribe and Associates, Resources Planning Associates for Stormwater Quality Task Force. March 1993.

Los Angeles County Stormwater Quality. Public Agency Activities Model Program. On-line: http://ladpw.org/wmd/npdes/public_TC.cfm

Santa Clara Valley Urban Runoff Pollution Prevention Program. 1997 Urban Runoff Management Plan. September 1997, updated October 2000.

Santa Clara Valley Urban Runoff Pollution Prevention Program. Water Utility Pollution Prevention Plan.

Non-Stormwater Discharges SC-10



Graphic by: Margie Winter

Objectives

- Contain
- Educate
- Reduce/Minimize

Targeted Constituents

Sediment	✓
Nutrients	✓
Trash	✓
Metals	✓
Bacteria	✓
Oil and Grease	✓
Organics	✓
Oxygen Demanding	✓

Description

Non-stormwater discharges are those flows that do not consist entirely of stormwater. For municipalities non-stormwater discharges present themselves in two situations. One is from fixed facilities owned and/or operated by the municipality. The other situation is non-stormwater discharges that are discovered during the normal operation of a field program. Some non-stormwater discharges do not include pollutants and may be discharged to the storm drain. These include uncontaminated groundwater and natural springs. There are also some non-stormwater discharges that typically do not contain pollutants and may be discharged to the storm drain with conditions. These include car washing, and surface cleaning. However, there are certain non-stormwater discharges that pose environmental concern. These discharges may originate from illegal dumping or from internal floor drains, appliances, industrial processes, sinks, and toilets that are connected to the nearby storm drainage system. These discharges (which may include: process waste waters, cooling waters, wash waters, and sanitary wastewater) can carry substances (such as paint, oil, fuel and other automotive fluids, chemicals and other pollutants) into storm drains. The ultimate goal is to effectively eliminate non-stormwater discharges to the stormwater drainage system through implementation of measures to detect, correct, and enforce against illicit connections and illegal discharges.

Approach

The municipality must address non-stormwater discharges from its fixed facilities by assessing the types of non-stormwater discharges and implementing BMPs for the discharges determined to pose environmental concern. For field programs the field staff must be

CASQA California Stormwater Quality Association

trained to now what to look for regarding non-stormwater discharges and the procedures to follow in investigating the detected discharges.

Suggested Protocols

Fixed Facility

General

- Post "No Dumping" signs with a phone number for reporting dumping and disposal. Signs should also indicate fines and penalties for illegal dumping.
- Stencil storm drains, where applicable, to prevent illegal disposal of pollutants. Storm drain inlets should have messages such as "Dump No Waste Drains to Stream" stenciled next to them to warn against ignorant or intentional dumping of pollutants into the storm drainage system.
- Landscaping and beautification efforts of hot spots might also discourage future dumping, as well as provide open space and increase property values.
- Lighting or barriers may also be needed to discourage future dumping.

Illicit Connections

- Locate discharges from the fixed facility drainage system to the municipal storm drain system through review of "as-built" piping schematics.
- Use techniques such as smoke testing, dye testing and television camera inspection (as noted below) to verify physical connections.
- Isolate problem areas and plug illicit discharge points.

Visual Inspection and Inventory

- Inventory and inspect each discharge point during dry weather.
- Keep in mind that drainage from a storm event can continue for several days following the end of a storm and groundwater may infiltrate the underground stormwater collection system. Also, non-stormwater discharges are often intermittent and may require periodic inspections.

Review Infield Piping

- Review the "as-built" piping schematic as a way to determine if there are any connections to the stormwater collection system.
- Inspect the path of floor drains in older buildings.

Smoke Testing

- Smoke testing of wastewater and stormwater collection systems is used to detect connections between the two systems.

- During dry weather the stormwater collection system is filled with smoke and then traced to sources. The appearance of smoke at the base of a toilet indicates that there may be a connection between the sanitary and the stormwater system.

  Dye Testing

- A dye test can be performed by simply releasing a dye into either your sanitary or process wastewater system and examining the discharge points from the stormwater collection system for discoloration.

TV Inspection of Storm Sewer

- TV Cameras can be employed to visually identify illicit connections to the fixed facility storm drain system.

Illegal Dumping

- Regularly inspect and clean up hot spots and other storm drainage areas where illegal dumping and disposal occurs.
- Clean up spills on paved surfaces with as little water as possible. Use a rag for small spills, a damp mop for general cleanup, and absorbent material for larger spills. If the spilled material is hazardous, then the used cleanup materials are also hazardous and must be sent to a certified laundry (rags) or disposed of as hazardous waste.
- Never hose down or bury dry material spills. Sweep up the material and dispose of properly.
- Use adsorbent materials on small spills rather than hosing down the spill. Remove the adsorbent materials promptly and dispose of properly.
- For larger spills, a private spill cleanup company or Hazmat team may be necessary.
- See fact sheet SC-11 Spill Prevention, Control, and Clean Up.

Field Program

General

- Develop clear protocols and lines of communication for effectively prohibiting non-stormwater discharges, especially ones that involve more than one jurisdiction and those that are not classified as hazardous, which are often not responded to as effectively as they need to be.
- Stencil storm drains, where applicable, to prevent illegal disposal of pollutants. Storm drain inlets should have messages such as "Dump No Waste Drains to Stream" stenciled next to them to warn against ignorant or intentional dumping of pollutants into the storm drainage system.
- See SC-74 Stormwater Drainage System Maintenance for additional information.

Field Inspection

- Regularly inspect and clean up hot spots and other storm drainage areas where illegal dumping and disposal occurs.
- During routine field program maintenance field staff should look for evidence of illegal discharges or illicit connection:
  - Is there evidence of spills such as paints, discoloring, etc.
  - Are there any odors associated with the drainage system
  - Record locations of apparent illegal discharges/illicit connections and notify appropriate investigating agency.
- If trained, conduct field investigation of non-stormwater discharges to determine whether they pose a threat to water quality.

Recommended Complaint Investigation Equipment

- Field Screening Analysis
  - pH paper or meter
  - Commercial stormwater pollutant screening kit that can detect for reactive phosphorus, nitrate nitrogen, ammonium nitrogen, specific conductance, and turbidity
  - Sample jars
  - Sample collection pole
  - A tool to remove access hole covers
- Laboratory Analysis
  - Sample cooler
  - Ice
  - Sample jars and labels
  - Chain of custody forms.
- Documentation
  - Camera
  - Notebook
  - Pens
  - Notice of Violation forms

- Educational materials

Reporting

- A database is useful for defining and tracking the magnitude and location of the problem.
- Report prohibited non-stormwater discharges observed during the course of normal daily activities so they can be investigated, contained and cleaned up or eliminated.
- Document that non-stormwater discharges have been eliminated by recording tests performed, methods used, dates of testing, and any onsite drainage points observed.
- Maintain documentation of illicit connection and illegal dumping incidents, including significant conditionally exempt discharges that are not properly managed.

Enforcement

- Educate the responsible party if identified on the impacts of their actions, explain the stormwater requirements, and provide information regarding Best Management Practices (BMP), as appropriate. Initiate follow-up and/or enforcement procedures.
- If an illegal discharge is traced to a commercial, residential or industrial source, conduct the following activities or coordinate the following activities with the appropriate agency:
  - Contact the responsible party to discuss methods of eliminating the non-stormwater discharge, including disposal options, recycling, and possible discharge to the sanitary sewer (if within POTW limits).
  - Provide information regarding BMPs to the responsible party, where appropriate.
  - Begin enforcement procedures, if appropriate.
  - Continue inspection and follow-up activities until the illicit discharge activity has ceased.
- If an illegal discharge is traced to a commercial or industrial activity, coordinate information on the discharge with the jurisdiction's commercial and industrial facility inspection program.

Training

- Train technical staff to identify and document illegal dumping incidents.
- Well-trained employees can reduce human errors that lead to accidental releases or spills. The employee should have the tools and knowledge to immediately begin cleaning up a spill if one should occur. Employees should be familiar with the Spill Prevention Control and Countermeasure Plan.
- Train employees to identify non-stormwater discharges and report them to the appropriate departments.
- Train staff who have the authority to conduct surveillance and inspections, and write citations for those caught illegally dumping.

- Train municipal staff responsible for surveillance and inspection in the following:
  - OSHA-required Health and Safety Training (29 CFR 1910.120) plus annual refresher training (as needed).
  - OSHA Confined Space Entry training (Cal-OSHA Confined Space, Title 8 and federal OSHA 29 CFR 1910.146).
  - Procedural training (field screening, sampling, smoke/dye testing, TV inspection).
- Educate the identified responsible party on the impacts of his or her actions.

Spill Response and Prevention

- See SC-11 Spill Prevention Control and Clean Up

Other Considerations

- The elimination of illegal dumping is dependent on the availability, convenience, and cost of alternative means of disposal. The cost of fees for dumping at a proper waste disposal facility are often more than the fine for an illegal dumping offense, thereby discouraging people from complying with the law. The absence of routine or affordable pickup service for trash and recyclables in some communities also encourages illegal dumping. A lack of understanding regarding applicable laws or the inadequacy of existing laws may also contribute to the problem.
- Municipal codes should include sections prohibiting the discharge of soil, debris, refuse, hazardous wastes, and other pollutants into the storm drain system.
- Many facilities do not have accurate, up-to-date schematic drawings.
- Can be difficult to locate illicit connections especially if there is groundwater infiltration.

Requirements

Costs

- Eliminating illicit connections can be expensive especially if structural modifications are required such re-plumbing cross connections under an existing slab.
- Minor cost to train field crews regarding the identification of non-stormwater discharges. The primary cost is for a fully integrated program to identify and eliminate illicit connections and illegal dumping. However, by combining with other municipal programs (i.e. pretreatment program) cost may be lowered.
- Municipal cost for containment and disposal may be borne by the discharger.

Maintenance

Not applicable

Supplemental Information

Further Detail of the BMP

What constitutes a "non-stormwater" discharge?

- Non-stormwater discharges are discharges not made up entirely of stormwater and include water used directly in the manufacturing process (process wastewater), air conditioning condensate and coolant, non-contact cooling water, cooling equipment condensate, outdoor secondary containment water, vehicle and equipment wash water, landscape irrigation, sink and drinking fountain wastewater, sanitary wastes, or other wastewaters.

Permit Requirements

- Current municipal NPDES permits require municipalities to effectively prohibit non-stormwater discharges unless authorized by a separate NPDES permit or allowed in accordance with the current NPDES permit conditions. Typically the current permits allow certain non-stormwater discharges in the storm drain system as long as the discharges are not significant sources of pollutants. In this context the following non-stormwater discharges are typically allowed:
  - Diverted stream flows;
  - Rising found waters;
  - Uncontaminated ground water infiltration (as defined at 40 CFR 35.2005(20));
  - Uncontaminated pumped ground water;
  - Foundation drains;
  - Springs;
  - Water from crawl space pumps;
  - Footing drains;
  - Air conditioning condensation;
  - Flows from riparian habitats and wetlands;
  - Water line and hydrant flushing ;
  - Landscape irrigation;
  - Planned and unplanned discharges from potable water sources;
  - Irrigation water;
  - Individual residential car washing; and
  - Lawn watering.

Municipal facilities subject to industrial general permit requirements must include a certification that the stormwater collection system has been tested or evaluated for the presence of non-stormwater discharges. The state's General Industrial Stormwater Permit requires that non-stormwater discharges be eliminated prior to implementation of the facility's SWPPP.

Illegal Dumping

- Establish a system for tracking incidents. The system should be designed to identify the following:
  - Illegal dumping hot spots
  - Types and quantities (in some cases) of wastes
  - Patterns in time of occurrence (time of day/night, month, or year)
  - Mode of dumping (abandoned containers, "midnight dumping" from moving vehicles, direct dumping of materials, accidents/spills)
  - Responsible parties

Outreach

One of the keys to success of reducing or eliminating illegal dumping is increasing the number of people on the street who are aware of the problem and who have the tools to at least identify the incident, if not correct it. There we a number of ways of accomplishing this:

- Train municipal staff from all departments (public works, utilities, street cleaning, parks and recreation, industrial waste inspection, hazardous waste inspection, sewer maintenance) to recognize and report the incidents.
- Deputize municipal staff who may come into contact with illegal dumping with the authority to write illegal dumping tickets for offenders caught in the act (see below).
- Educate the public. As many as 3 out of 4 people do not understand that in most communities the storm drain does not go to the wastewater treatment plant. Unfortunately, with the heavy emphasis in recent years on public education about solid waste management, including recycling and household hazardous waste, the sewer system (both storm and sanitary) has been the likely recipient of cross-media transfers of waste.
- Provide the public with a mechanism for reporting incidents such as a hot line and/or door hanger (see below).
- Help areas where incidents occur more frequently set up environmental watch programs (like crime watch programs).
- Train volunteers to notice and report the presence and suspected source of an observed pollutant to the appropriate public agency.

What constitutes a "non-stormwater" discharge?

- Non-stormwater discharges are discharges not made up entirely of stormwater and include water used directly in the manufacturing process (process wastewater), air conditioning condensate and coolant, non-contact cooling water, cooling equipment condensate, outdoor secondary containment water, vehicle and equipment wash water, landscape irrigation, sink and drinking fountain wastewater, sanitary wastes, or other wastewaters.

Permit Requirements

- Current municipal NPDES permits require municipalities to effectively prohibit non-stormwater discharges unless authorized by a separate NPDES permit or allowed in accordance with the current NPDES permit conditions. Typically the current permits allow certain non-stormwater discharges in the storm drain system as long as the discharges are not significant sources of pollutants. In this context the following non-stormwater discharges are typically allowed:

  - Diverted stream flows;
  - Rising found waters;
  - Uncontaminated ground water infiltration (as defined at 40 CFR 35.2005(20));
  - Uncontaminated pumped ground water;
  - Foundation drains;
  - Springs;
  - Water from crawl space pumps;
  - Footing drains;
  - Air conditioning condensation;
  - Flows from riparian habitats and wetlands;
  - Water line and hydrant flushing ;
  - Landscape irrigation;
  - Planned and unplanned discharges from potable water sources;
  - Irrigation water;
  - Individual residential car washing; and
  - Lawn watering.

Municipal facilities subject to industrial general permit requirements must include a certification that the stormwater collection system has been tested or evaluated for the presence of non-stormwater discharges. The state's General Industrial Stormwater Permit requires that non-stormwater discharges be eliminated prior to implementation of the facility's SWPPP.

Storm Drain Stenciling

- Stencil storm drain inlets with a message to prohibit illegal dumpings, especially in areas with waste handling facilities.
- Encourage public reporting of improper waste disposal by a HOTLINE number stenciled onto the storm drain inlet.
- See Supplemental Information section of this fact sheet for further detail on stenciling program approach.

Oil Recycling

- Contract collection and hauling of used oil to a private licensed used oil hauler/recycler.
- Comply with all applicable state and federal regulations regarding storage, handling, and transport of petroleum products.
- Create procedures for collection such as; collection locations and schedule, acceptable containers, and maximum amounts accepted.
- The California Integrated Waste Management Board has a Recycling Hotline, (800) 553-2962, that provides information and recycling locations for used oil.

Household Hazardous Waste

- Provide household hazardous waste (HHW) collection facilities. Several types of collection approaches are available including permanent, periodic, or mobile centers, curbside collection, or a combination of these systems.

Training

- Train municipal employees and contractors in proper and consistent methods for waste disposal.
- Train municipal employees to recognize and report illegal dumping.
- Train employees and subcontractors in proper hazardous waste management.

Spill Response and Prevention

- Refer to SC-11, Spill Prevention, Control & Cleanup
- Have spill cleanup materials readily available and in a known location.
- Cleanup spills immediately and use dry methods if possible.
- Properly dispose of spill cleanup material.

Other Considerations

- Federal Regulations (RCRA, SARA, CERCLA) and state regulations exist regarding the disposal of hazardous waste.
- Municipalities are required to have a used oil recycling and a HHW element within their integrate waste management plan.
- Significant liability issues are involved with the collection, handling, and disposal of HHW.

Examples

The City of Palo Alto has developed a public participation program for reporting dumping violations. When a concerned citizen or public employee encounters evidence of illegal dumping, a door hanger (similar in format to hotel "Do Not Disturb" signs) is placed on the front doors in the neighborhood. The door hanger notes that a violation has occurred in the neighborhood, informs the reader why illegal dumping is a problem, and notes that illegal dumping carries a significant financial penalty. Information is also provided on what citizens can do as well as contact numbers for more information or to report a violation.

The Port of Long Beach has a state of the art database incorporating storm drain infrastructure, potential pollutant sources, facility management practices, and a pollutant tracking system.

The State Department of Fish and Game has a hotline for reporting violations called CalTIP (1-800-952-5400). The phone number may be used to report any violation of a Fish and Game code (illegal dumping, poaching, etc.).

The California Department of Toxic Substances Control's Waste Alert Hotline, 1-800-69TOXIC, can be used to report hazardous waste violations.

References and Resources

http://www.stormwatercenter.net/

California's Nonpoint Source Program Plan http://www.co.clark.wa.us/pubworks/bmpman.pdf

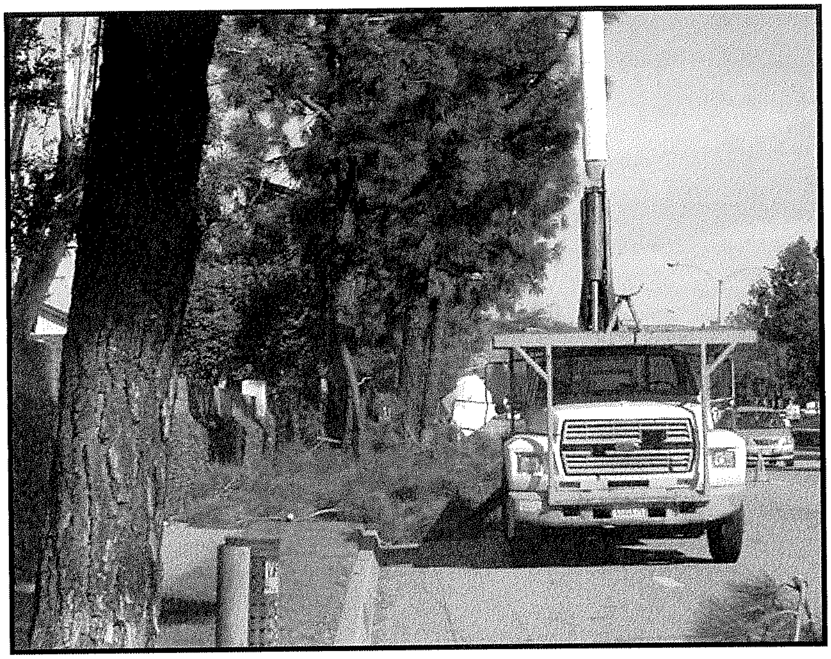
King County Stormwater Pollution Control Manual - http://dnr.metrokc.gov/wlr/dss/spcm.htm

Orange County Stormwater Program,
http://www.ocwatersheds.com/stormwater/swp_introduction.asp

San Diego Stormwater Co-permittees Jurisdictional Urban Runoff Management Program (http://www.projectcleanwater.org)

Santa Clara Valley Urban Runoff Pollution Prevention Program
http://www.scvurppp-w2k.com/pdf%20documents/PS_ICID.PDF

Landscape Maintenance SC-73



Objectives

- Contain
- Educate
- Reduce/Minimize
- Product Substitution

Targeted Constituents

Sediment	☑
Nutrients	☑
Trash	☑
Metals	
Bacteria	
Oil and Grease	
Organics	
Oxygen Demanding	☑

Description

Landscape maintenance activities include vegetation removal; herbicide and insecticide application; fertilizer application; watering; and other gardening and lawn care practices. Vegetation control typically involves a combination of chemical (herbicide) application and mechanical methods. All of these maintenance practices have the potential to contribute pollutants to the storm drain system. The major objectives of this BMP are to minimize the discharge of pesticides, herbicides and fertilizers to the storm drain system and receiving waters; prevent the disposal of landscape waste into the storm drain system by collecting and properly disposing of clippings and cuttings, and educating employees and the public.

Approach

Pollution Prevention

- Implement an integrated pest management (IPM) program. IPM is a sustainable approach to managing pests by combining biological, cultural, physical, and chemical tools.
- Choose low water using flowers, trees, shrubs, and groundcover.
- Consider alternative landscaping techniques such as naturescaping and xeriscaping.
- Conduct appropriate maintenance (i.e. properly timed fertilizing, weeding, pest control, and pruning) to help preserve the landscapes water efficiency.

- Consider grass cycling (grass cycling is the natural recycling of grass by leaving the clippings on the lawn when mowing. Grass clippings decompose quickly and release valuable nutrients back into the lawn).

Suggested Protocols

Mowing, Trimming, and Weeding

- Whenever possible use mechanical methods of vegetation removal (e.g mowing with tractor-type or push mowers, hand cutting with gas or electric powered weed trimmers) rather than applying herbicides. Use hand weeding where practical.

- Avoid loosening the soil when conducting mechanical or manual weed control, this could lead to erosion. Use mulch or other erosion control measures when soils are exposed.

- Performing mowing at optimal times. Mowing should not be performed if significant rain events are predicted.

- Mulching mowers may be recommended for certain flat areas. Other techniques may be employed to minimize mowing such as selective vegetative planting using low maintenance grasses and shrubs.

- Collect lawn and garden clippings, pruning waste, tree trimmings, and weeds. Chip if necessary, and compost or dispose of at a landfill (see waste management section of this fact sheet).

- Place temporarily stockpiled material away from watercourses, and berm or cover stockpiles to prevent material releases to storm drains.

Planting

- Determine existing native vegetation features (location, species, size, function, importance) and consider the feasibility of protecting them. Consider elements such as their effect on drainage and erosion, hardiness, maintenance requirements, and possible conflicts between preserving vegetation and the resulting maintenance needs.

- Retain and/or plant selected native vegetation whose features are determined to be beneficial, where feasible. Native vegetation usually requires less maintenance (e.g., irrigation, fertilizer) than planting new vegetation.

- Consider using low water use groundcovers when planting or replanting.

Waste Management

- Compost leaves, sticks, or other collected vegetation or dispose of at a permitted landfill. Do not dispose of collected vegetation into waterways or storm drainage systems.

- Place temporarily stockpiled material away from watercourses and storm drain inlets, and berm or cover stockpiles to prevent material releases to the storm drain system.

- Reduce the use of high nitrogen fertilizers that produce excess growth requiring more frequent mowing or trimming.

- Avoid landscape wastes in and around storm drain inlets by either using bagging equipment or by manually picking up the material.

Irrigation

- Where practical, use automatic timers to minimize runoff.
- Use popup sprinkler heads in areas with a lot of activity or where there is a chance the pipes may be broken. Consider the use of mechanisms that reduce water flow to sprinkler heads if broken.
- Ensure that there is no runoff from the landscaped area(s) if re-claimed water is used for irrigation.
- If bailing of muddy water is required (e.g. when repairing a water line leak), do not put it in the storm drain; pour over landscaped areas.
- Irrigate slowly or pulse irrigate to prevent runoff and then only irrigate as much as is needed.
- Apply water at rates that do not exceed the infiltration rate of the soil.

Fertilizer and Pesticide Management

- Utilize a comprehensive management system that incorporates integrated pest management (IPM) techniques. There are many methods and types of IPM, including the following:
  - Mulching can be used to prevent weeds where turf is absent, fencing installed to keep rodents out, and netting used to keep birds and insects away from leaves and fruit.
  - Visible insects can be removed by hand (with gloves or tweezers) and placed in soapy water or vegetable oil. Alternatively, insects can be sprayed off the plant with water or in some cases vacuumed off of larger plants.
  - Store-bought traps, such as species-specific, pheromone-based traps or colored sticky cards, can be used.
  - Slugs can be trapped in small cups filled with beer that are set in the ground so the slugs can get in easily.
  - In cases where microscopic parasites, such as bacteria and fungi, are causing damage to plants, the affected plant material can be removed and disposed of (pruning equipment should be disinfected with bleach to prevent spreading the disease organism).
  - Small mammals and birds can be excluded using fences, netting, tree trunk guards.
  - Beneficial organisms, such as bats, birds, green lacewings, ladybugs, praying mantis, ground beetles, parasitic nematodes, trichogramma wasps, seed head weevils, and spiders that prey on detrimental pest species can be promoted.
- Follow all federal, state, and local laws and regulations governing the use, storage, and disposal of fertilizers and pesticides and training of applicators and pest control advisors.

- Use pesticides only if there is an actual pest problem (not on a regular preventative schedule).
- Do not use pesticides if rain is expected. Apply pesticides only when wind speeds are low (less than 5 mph).
- Do not mix or prepare pesticides for application near storm drains.
- Prepare the minimum amount of pesticide needed for the job and use the lowest rate that will effectively control the pest.
- Employ techniques to minimize off-target application (e.g. spray drift) of pesticides, including consideration of alternative application techniques.
- Fertilizers should be worked into the soil rather than dumped or broadcast onto the surface.
- Calibrate fertilizer and pesticide application equipment to avoid excessive application.
- Periodically test soils for determining proper fertilizer use.
- Sweep pavement and sidewalk if fertilizer is spilled on these surfaces before applying irrigation water.
- Purchase only the amount of pesticide that you can reasonably use in a given time period (month or year depending on the product).
- Triple rinse containers, and use rinse water as product. Dispose of unused pesticide as hazardous waste.
- Dispose of empty pesticide containers according to the instructions on the container label.

Inspection

- Inspect irrigation system periodically to ensure that the right amount of water is being applied and that excessive runoff is not occurring. Minimize excess watering, and repair leaks in the irrigation system as soon as they are observed.
- Inspect pesticide/fertilizer equipment and transportation vehicles daily.

Training

- Educate and train employees on use of pesticides and in pesticide application techniques to prevent pollution. Pesticide application must be under the supervision of a California qualified pesticide applicator.
- Train/encourage municipal maintenance crews to use IPM techniques for managing public green areas.
- Annually train employees within departments responsible for pesticide application on the appropriate portions of the agency's IPM Policy, SOPs, and BMPs, and the latest IPM techniques.

- Employees who are not authorized and trained to apply pesticides should be periodically (at least annually) informed that they cannot use over-the-counter pesticides in or around the workplace.

- Use a training log or similar method to document training.

Spill Response and Prevention

- Refer to SC-11, Spill Prevention, Control & Cleanup

- Have spill cleanup materials readily available and in a know in location

- Cleanup spills immediately and use dry methods if possible.

- Properly dispose of spill cleanup material.

Other Considerations

- The Federal Pesticide, Fungicide, and Rodenticide Act and California Title 3, Division 6, Pesticides and Pest Control Operations place strict controls over pesticide application and handling and specify training, annual refresher, and testing requirements. The regulations generally cover: a list of approved pesticides and selected uses, updated regularly; general application information; equipment use and maintenance procedures; and record keeping. The California Department of Pesticide Regulations and the County Agricultural Commission coordinate and maintain the licensing and certification programs. All public agency employees who apply pesticides and herbicides in "agricultural use" areas such as parks, golf courses, rights-of-way and recreation areas should be properly certified in accordance with state regulations. Contracts for landscape maintenance should include similar requirements.

- All employees who handle pesticides should be familiar with the most recent material safety data sheet (MSDS) files.

- Municipalities do not have the authority to regulate the use of pesticides by school districts, however the California Healthy Schools Act of 2000 (AB 2260) has imposed requirements on California school districts regarding pesticide use in schools. Posting of notification prior to the application of pesticides is now required, and IPM is stated as the preferred approach to pest management in schools.

Requirements

Costs

Additional training of municipal employees will be required to address IPM techniques and BMPs. IPM methods will likely increase labor cost for pest control which may be offset by lower chemical costs.

Maintenance

Not applicable

Supplemental Information

Further Detail of the BMP

Waste Management

Composting is one of the better disposal alternatives if locally available. Most municipalities either have or are planning yard waste composting facilities as a means of reducing the amount of waste going to the landfill. Lawn clippings from municipal maintenance programs as well as private sources would probably be compatible with most composting facilities

Contractors and Other Pesticide Users

Municipal agencies should develop and implement a process to ensure that any contractor employed to conduct pest control and pesticide application on municipal property engages in pest control methods consistent with the IPM Policy adopted by the agency. Specifically, municipalities should require contractors to follow the agency's IPM policy, SOPs, and BMPs; provide evidence to the agency of having received training on current IPM techniques when feasible; provide documentation of pesticide use on agency property to the agency in a timely manner.

References and Resources

King County Stormwater Pollution Control Manual. Best Management Practices for Businesses. 1995. King County Surface Water Management. July. On-line: http://dnr.metrokc.gov/wlr/dss/spcm.htm

Los Angeles County Stormwater Quality Model Programs. Public Agency Activities http://ladpw.org/wmd/npdes/model_links.cfm

Model Urban Runoff Program: A How-To Guide for Developing Urban Runoff Programs for Small Municipalities. Prepared by City of Monterey, City of Santa Cruz, California Coastal Commission, Monterey Bay National Marine Sanctuary, Association of Monterey Bay Area Governments, Woodward-Clyde, Central Coast Regional Water Quality Control Board. July. 1998.

Orange County Stormwater Program http://www.ocwatersheds.com/StormWater/swp_introduction.asp

Santa Clara Valley Urban Runoff Pollution Prevention Program. 1997 Urban Runoff Management Plan. September 1997, updated October 2000.

United States Environmental Protection Agency (USEPA). 2002. Pollution Prevention/Good Housekeeping for Municipal Operations Landscaping and Lawn Care. Office of Water. Office of Wastewater Management. On-line: http://www.epa.gov/npdes/menuofbmps/poll_8.htm

Drainage System Maintenance SC-74

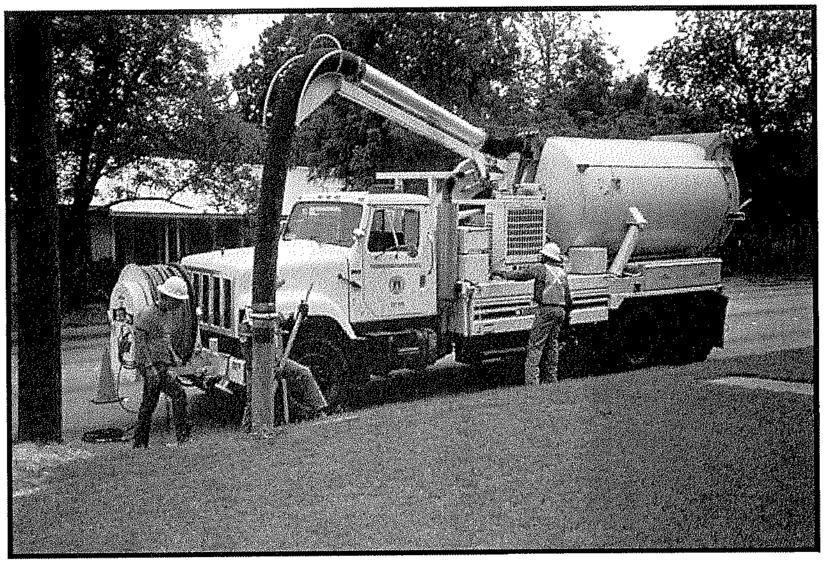


Photo Credit: Geoff Brosseau

Objectives

- Contain
- Educate
- Reduce/Minimize

Targeted Constituents

Sediment	☑
Nutrients	☑
Trash	☑
Metals	☑
Bacteria	☑
Oil and Grease	☑
Organics	☑
Oxygen Demanding	☑

Description

As a consequence of its function, the stormwater conveyance system collects and transports urban runoff that may contain certain pollutants. Maintaining catch basins, stormwater inlets, and other stormwater conveyance structures on a regular basis will remove pollutants, prevent clogging of the downstream conveyance system, restore catch basins' sediment trapping capacity, and ensure the system functions properly hydraulically to avoid flooding.

Approach

Suggested Protocols

Catch Basins/Inlet Structures

- Municipal staff should regularly inspect facilities to ensure the following:
  - Immediate repair of any deterioration threatening structural integrity.
  - Cleaning before the sump is 40% full. Catch basins should be cleaned as frequently as needed to meet this standard.
  - Stenciling of catch basins and inlets (see SC-75 Waste Handling and Disposal).
- Clean catch basins, storm drain inlets, and other conveyance structures in high pollutant load areas just before the wet season to remove sediments and debris accumulated during the summer.

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- Conduct inspections more frequently during the wet season for problem areas where sediment or trash accumulates more often. Clean and repair as needed.
- Keep accurate logs of the number of catch basins cleaned.
- Record the amount of waste collected.
- Store wastes collected from cleaning activities of the drainage system in appropriate containers or temporary storage sites in a manner that prevents discharge to the storm drain.
- Dewater the wastes with outflow into the sanitary sewer if permitted. Water should be treated with an appropriate filtering device prior to discharge to the sanitary sewer. If discharge to the sanitary sewer is not allowed, water should be pumped or vacuumed to a tank and properly disposed of. Do not dewater near a storm drain or stream.
- Except for small communities with relatively few catch basins that may be cleaned manually, most municipalities will require mechanical cleaners such as eductors, vacuums, or bucket loaders.

Storm Drain Conveyance System

- Locate reaches of storm drain with deposit problems and develop a flushing schedule that keeps the pipe clear of excessive buildup.
- Collect flushed effluent and pump to the sanitary sewer for treatment.

Pump Stations

- Clean all storm drain pump stations prior to the wet season to remove silt and trash.
- Do not allow discharge from cleaning a storm drain pump station or other facility to reach the storm drain system.
- Conduct quarterly routine maintenance at each pump station.
- Inspect, clean, and repair as necessary all outlet structures prior to the wet season.
- Sample collected sediments to determine if landfill disposal is possible, or illegal discharges in the watershed are occurring.

Open Channel

- Consider modification of storm channel characteristics to improve channel hydraulics, to increase pollutant removals, and to enhance channel/creek aesthetic and habitat value.
- Conduct channel modification/improvement in accordance with existing laws. Any person, government agency, or public utility proposing an activity that will change the natural (emphasis added) state of any river, stream, or lake in California, must enter into a steam or Lake Alteration Agreement with the Department of Fish and Game. The developer-applicant should also contact local governments (city, county, special districts), other state agencies

(SWRCB, RWQCB, Department of Forestry, Department of Water Resources), and Federal Corps of Engineers and USFWS

Illicit Connections and Discharges

- During routine maintenance of conveyance system and drainage structures field staff should look for evidence of illegal discharges or illicit connections:
  - Is there evidence of spills such as paints, discoloring, etc.
  - Are there any odors associated with the drainage system
  - Record locations of apparent illegal discharges/illicit connections
  - Track flows back to potential dischargers and conduct aboveground inspections. This can be done through visual inspection of up gradient manholes or alternate techniques including zinc chloride smoke testing, fluorometric dye testing, physical inspection testing, or television camera inspection.
  - Once the origin of flow is established, require illicit discharger to eliminate the discharge.
- Stencil storm drains, where applicable, to prevent illegal disposal of pollutants. Storm drain inlets should have messages such as "Dump No Waste Drains to Stream" stenciled next to them to warn against ignorant or intentional dumping of pollutants into the storm drainage system.
- Refer to fact sheet SC-10 Non-Stormwater Discharges.

Illegal Dumping

- Regularly inspect and clean up hot spots and other storm drainage areas where illegal dumping and disposal occurs.
- Establish a system for tracking incidents. The system should be designed to identify the following:
  - Illegal dumping hot spots
  - Types and quantities (in some cases) of wastes
  - Patterns in time of occurrence (time of day/night, month, or year)
  - Mode of dumping (abandoned containers, "midnight dumping" from moving vehicles, direct dumping of materials, accidents/spills)
  - Responsible parties
- Post "No Dumping" signs in problem areas with a phone number for reporting dumping and disposal. Signs should also indicate fines and penalties for illegal dumping.
- Refer to fact sheet SC-10 Non-Stormwater Discharges.

- The State Department of Fish and Game has a hotline for reporting violations called Cal TIP (1-800-952-5400). The phone number may be used to report any violation of a Fish and Game code (illegal dumping, poaching, etc.).
- The California Department of Toxic Substances Control's Waste Alert Hotline, 1-800-69TOXIC, can be used to report hazardous waste violations.

Training

- Train crews in proper maintenance activities, including record keeping and disposal.
- Only properly trained individuals are allowed to handle hazardous materials/wastes.
- Train municipal employees from all departments (public works, utilities, street cleaning, parks and recreation, industrial waste inspection, hazardous waste inspection, sewer maintenance) to recognize and report illegal dumping.
- Train municipal employees and educate businesses, contractors, and the general public in proper and consistent methods for disposal.
- Train municipal staff regarding non-stormwater discharges (See SC-10 Non-Stormwater Discharges).

Spill Response and Prevention

- Refer to SC-11, Prevention, Control & Cleanup
- Have spill cleanup materials readily available and in a known location.
- Cleanup spills immediately and use dry methods if possible.
- Properly dispose of spill cleanup material.

Other Considerations

- Cleanup activities may create a slight disturbance for local aquatic species. Access to items and material on private property may be limited. Trade-offs may exist between channel hydraulics and water quality/riparian habitat. If storm channels or basins are recognized as wetlands, many activities, including maintenance, may be subject to regulation and permitting.
- Storm drain flushing is most effective in small diameter pipes (36-inch diameter pipe or less, depending on water supply and sediment collection capacity). Other considerations associated with storm drain flushing may include the availability of a water source, finding a downstream area to collect sediments, liquid/sediment disposal, and disposal of flushed effluent to sanitary sewer may be prohibited in some areas.
- Regulations may include adoption of substantial penalties for illegal dumping and disposal.
- Municipal codes should include sections prohibiting the discharge of soil, debris, refuse, hazardous wastes, and other pollutants into the storm drain system.
- Private property access rights may be needed to track illegal discharges up gradient.

- Requirements of municipal ordinance authority for suspected source verification testing for illicit connections necessary for guaranteed rights of entry.

Requirements

Costs

- An aggressive catch basin cleaning program could require a significant capital and O&M budget. A careful study of cleaning effectiveness should be undertaken before increased cleaning is implemented. Catch basin cleaning costs are less expensive if vacuum street sweepers are available; cleaning catch basins manually can cost approximately twice as much as cleaning the basins with a vacuum attached to a sweeper.

- Methods used for illicit connection detection (smoke testing, dye testing, visual inspection, and flow monitoring) can be costly and time-consuming. Site-specific factors, such as the level of impervious area, the density and ages of buildings, and type of land use will determine the level of investigation necessary. Encouraging reporting of illicit discharges by employees can offset costs by saving expense on inspectors and directing resources more efficiently. Some programs have used funds available from "environmental fees" or special assessment districts to fund their illicit connection elimination programs.

Maintenance

- Two-person teams may be required to clean catch basins with vactor trucks.

- Identifying illicit discharges requires teams of at least two people (volunteers can be used), plus administrative personnel, depending on the complexity of the storm sewer system.

- Arrangements must be made for proper disposal of collected wastes.

- Requires technical staff to detect and investigate illegal dumping violations, and to coordinate public education.

Supplemental Information

Further Detail of the BMP

Storm Drain flushing

Sanitary sewer flushing is a common maintenance activity used to improve pipe hydraulics and to remove pollutants in sanitary sewer systems. The same principles that make sanitary sewer flushing effective can be used to flush storm drains. Flushing may be designed to hydraulically convey accumulated material to strategic locations, such as to an open channel, to another point where flushing will be initiated, or over to the sanitary sewer and on to the treatment facilities, thus preventing re-suspension and overflow of a portion of the solids during storm events. Flushing prevents "plug flow" discharges of concentrated pollutant loadings and sediments. The deposits can hinder the designed conveyance capacity of the storm drain system and potentially cause backwater conditions in severe cases of clogging.

Storm drain flushing usually takes place along segments of pipe with grades that are too flat to maintain adequate velocity to keep particles in suspension. An upstream manhole is selected to place an inflatable device that temporarily plugs the pipe. Further upstream, water is pumped into the line to create a flushing wave. When the upstream reach of pipe is sufficiently full to cause a flushing wave, the inflated device is rapidly deflated with the assistance of a vacuum pump, releasing the backed up water and resulting in the cleaning of the storm drain segment.

To further reduce the impacts of stormwater pollution, a second inflatable device, placed well downstream, may be used to re-collect the water after the force of the flushing wave has dissipated. A pump may then be used to transfer the water and accumulated material to the sanitary sewer for treatment. In some cases, an interceptor structure may be more practical or required to re-collect the flushed waters.

It has been found that cleansing efficiency of periodic flush waves is dependent upon flush volume, flush discharge rate, sewer slope, sewer length, sewer flow rate, sewer diameter, and population density. As a rule of thumb, the length of line to be flushed should not exceed 700 feet. At this maximum recommended length, the percent removal efficiency ranges between 65-75 percent for organics and 55-65 percent for dry weather grit/inorganic material. The percent removal efficiency drops rapidly beyond that. Water is commonly supplied by a water truck, but fire hydrants can also supply water. To make the best use of water, it is recommended that reclaimed water be used or that fire hydrant line flushing coincide with storm drain flushing.

Flow Management

Flow management has been one of the principal motivations for designing urban stream corridors in the past. Such needs may or may not be compatible with the stormwater quality goals in the stream corridor.

Downstream flood peaks can be suppressed by reducing through flow velocity. This can be accomplished by reducing gradient with grade control structures or increasing roughness with boulders, dense vegetation, or complex banks forms. Reducing velocity correspondingly increases flood height, so all such measures have a natural association with floodplain open space. Flood elevations laterally adjacent to the stream can be lowered by increasing through flow velocity.

However, increasing velocity increases flooding downstream and inherently conflicts with channel stability and human safety. Where topography permits, another way to lower flood elevation is to lower the level of the floodway with drop structures into a large but subtly excavated bowl where flood flows we allowed to spread out.

Stream Corridor Planning

Urban streams receive and convey stormwater flows from developed or developing watersheds. Planning of stream corridors thus interacts with urban stormwater management programs. If local programs are intended to control or protect downstream environments by managing flows delivered to the channels, then it is logical that such programs should be supplemented by management of the materials, forms, and uses of the downstream riparian corridor. Any proposal for steam alteration or management should be investigated for its potential flow and stability effects on upstream, downstream, and laterally adjacent areas. The timing and rate of flow from various tributaries can combine in complex ways to alter flood hazards. Each section of channel is unique, influenced by its own distribution of roughness elements, management activities, and stream responses.

Flexibility to adapt to stream features and behaviors as they evolve must be included in stream reclamation planning. The amenity and ecology of streams may be enhanced through the landscape design options of 1) corridor reservation, 2) bank treatment, 3) geomorphic restoration, and 4) grade control.

Corridor reservation - Reserving stream corridors and valleys to accommodate natural stream meandering, aggradation, degradation, and over bank flows allows streams to find their own form and generate less ongoing erosion. In California, open stream corridors in recent urban developments have produced recreational open space, irrigation of streamside plantings, and the aesthetic amenity of flowing water.

Bank treatment - The use of armoring, vegetative cover, and flow deflection may be used to influence a channel's form, stability, and biotic habitat. To prevent bank erosion, armoring can be done with rigid construction materials, such as concrete, masonry, wood planks and logs, riprap, and gabions. Concrete linings have been criticized because of their lack of provision of biotic habitat. In contrast, riprap and gabions make relatively porous and flexible linings. Boulders, placed in the bed reduce velocity and erosive power.

Riparian vegetation can stabilize the banks of streams that are at or near a condition of equilibrium. Binding networks of roots increase bank shear strength. During flood flows, resilient vegetation is forced into erosion-inhibiting mats. The roughness of vegetation leads to lower velocity, further reducing erosive effects. Structural flow deflection can protect banks from erosion or alter fish habitat. By concentrating flow, a deflector causes a pool to be scoured in the bed.

Geomorphic restoration – Restoration refers to alteration of disturbed streams so their form and behavior emulate those of undisturbed streams. Natural meanders are retained, with grading to gentle slopes on the inside of curves to allow point bars and riffle-pool sequences to develop. Trees are retained to provide scenic quality, biotic productivity, and roots for bank stabilization, supplemented by plantings where necessary.

A restorative approach can be successful where the stream is already approaching equilibrium. However, if upstream urbanization continues new flow regimes will be generated that could disrupt the equilibrium of the treated system.

Grade Control - A grade control structure is a level shelf of a permanent material, such as stone, masonry, or concrete, over which stream water flows. A grade control structure is called a sill, weir, or drop structure, depending on the relation of its invert elevation to upstream and downstream channels.

A sill is installed at the preexisting channel bed elevation to prevent upstream migration of nick points. It establishes a firm base level below which the upstream channel can not erode.

A weir or check dam is installed with invert above the preexisting bed elevation. A weir raises the local base level of the stream and causes aggradation upstream. The gradient, velocity, and erosive potential of the stream channel are reduced. A drop structure lowers the downstream invert below its preexisting elevation, reducing downstream gradient and velocity. Weirs and drop structure control erosion by dissipating energy and reducing slope velocity.

When carefully applied, grade control structures can be highly versatile in establishing human and environmental benefits in stabilized channels. To be successful, application of grade control structures should be guided by analysis of the stream system both upstream and downstream from the area to he reclaimed.

Examples

The California Department of Water Resources began the Urban Stream Restoration Program in 1985. The program provides grant funds to municipalities and community groups to implement stream restoration projects. The projects reduce damages from streambank aid watershed instability arid floods while restoring streams' aesthetic, recreational, and fish and wildlife values.

In Buena Vista Park, upper floodway slopes are gentle and grassed to achieve continuity of usable park land across the channel of small boulders at the base of the slopes.

The San Diego River is a large, vegetative lined channel, which was planted in a variety of species to support riparian wildlife while stabilizing the steep banks of the floodway.

References and Resources

Ferguson, B.K. 1991. Urban Stream Reclamation, p. 324-322, Journal of Soil and Water Conservation.

Los Angeles County Stormwater Quality. Public Agency Activities Model Program. On-line: http://ladpw.org/wmd/npdes/public_TC.cfm

Model Urban Runoff Program: A How-To Guide for Developing Urban Runoff Programs for Small Municipalities. Prepared by City of Monterey, City of Santa Cruz, California Coastal Commission, Monterey Bay National Marine Sanctuary, Association of Monterey Bay Area Governments, Woodward-Clyde, Central Coast Regional Water Quality Control Board. July. 1998.

Orange County Stormwater Program http://www.ocwatersheds.com/StormWater/swp_introduction.asp

Santa Clara Valley Urban Runoff Pollution Prevention Program. 1997 Urban Runoff Management Plan. September 1997, updated October 2000.

San Diego Stormwater Co-permittees Jurisdictional Urban Runoff Management Program (URMP) Municipal Activities Model Program Guidance. 2001. Project Clean Water. November.

United States Environmental Protection Agency (USEPA). 1999. Stormwater Management Fact Sheet Non-stormwater Discharges to Storm Sewers. EPA 832-F-99-022. Office of Water, Washington, D.C. September.

United States Environmental Protection Agency (USEPA). 1999. Stormwater O&M Fact Sheet Catch Basin Cleaning. EPA 832-F-99-011. Office of Water, Washington, D.C. September.

United States Environmental Protection Agency (USEPA). 2002. Pollution Prevention/Good Housekeeping for Municipal Operations Illegal Dumping Control. On line: http://www.epa.gov/npdes/menuofbmps/poll_7.htm

United States Environmental Protection Agency (USEPA). 2002. Pollution Prevention/Good Housekeeping for Municipal Operations Storm Drain System Cleaning. On line: http://www.epa.gov/npdes/menuofbmps/poll_16.htm

Appendix H

- Maintenance Manual & Covenant Agreement

Will be provided in final engineering stage

6. BMP Fact Sheets

Section 3
Source Control BMPs

3.1 Introduction

This section provides a description of specific source control Best Management Practices (BMPs) for activities related to municipal operations. As noted in Sections 1 and 2, municipal fixed facilities conduct activities that have the potential to generate pollutants. The source control BMPs in this section address these activities (see Table 3-1).

In addition, municipalities conduct various field programs where activities may occur and create pollutants. BMPs for these field programs and associated activities are listed in Table 3-2.

Table 3-1	Municipal Fixed Facility BMPs
Non-Stormwater Management	
SC-10	Non-Stormwater Discharges
SC-11	Spill Prevention, Control and Cleanup
Vehicle and Equipment Management	
SC-20	Vehicle and Equipment Fueling
SC-21	Vehicle and Equipment Cleaning
SC-22	Vehicle and Equipment Repair
Material and Waste Management	
SC-30	Outdoor Loading/Unloading
SC-31	Outdoor Container Storage
SC-32	Outdoor Equipment Maintenance
SC-33	Outdoor Storage of Raw Materials
SC-34	Waste Handling and Disposal
Building and Grounds Management	
SC-41	Building and Grounds Maintenance
SC-43	Parking/Storage Area Maintenance
Over Water Activities	
SC-50	Over Water Activities
General Stormwater Management	
SC-60	Housekeeping Practices
SC-61	Safer Alternative Products

Table 3-2	Municipal Field Program BMPs
SC-70	Road and Street Maintenance
SC-71	Plaza and Sidewalk Cleaning
SC-72	Fountains & Pools Maintenance
SC-73	Landscape Maintenance
SC-74	Drainage System Maintenance
SC-75	Waste Handling and Disposal
SC-76	Water and Sewer Utility Maintenance

3.2 Fact Sheet Format

Each BMP fact sheet is a short document that gives all the information about a particular BMP. Typically, each fact sheet contains the information outlined in Figure 3-1. Completed fact sheets for each of the activities listed in Tables 3-1 and 3-2 are provided in Section 3.3.

The fact sheets also contain side bar presentations with information on BMP objectives and targeted constituents.

The information provided in each fact sheet is extensive and may not be applicable to all municipal operations. The readers may find it helpful to modify and simplify the BMP fact sheets to better reflect their existing operations.

SC-xx Example Fact Sheet

Description of the BMP

Approach

- Pollution Prevention
- Suggested Protocols
- Training
- Spill Response and Prevention
- Other Considerations

Requirements

- Costs
- Maintenance

Supplemental Information

- Further Details on the BMP
- Examples

References and Resources

Figure 3-1
Example Fact Sheet

3.3 BMP Fact Sheets

BMP fact sheets for fixed facilities activities and field programs follow. The BMP fact sheets are individually page numbered and are suitable for photocopying and inclusions in stormwater quality management plans. Fresh copies of the fact sheets can be individually downloaded from the California Stormwater BMP Handbook website at http://www.cabmphandbooks.com

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SC-32	Outdoor Equipment Maintenance
SC-33	Outdoor Storage of Raw Materials
SC-34	Waste Handling and Disposal
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SC-43	Parking/Storage Area Maintenance
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- Maintenance

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Site Design & Landscape Planning SD-10

Design Objectives

- ☑ Maximize Infiltration
- ☑ Provide Retention
- ☑ Slow Runoff
- ☑ Minimize Impervious Land Coverage
- Prohibit Dumping of Improper Materials
- Contain Pollutants
- Collect and Convey

Description

Each project site possesses unique topographic, hydrologic, and vegetative features, some of which are more suitable for development than others. Integrating and incorporating appropriate landscape planning methodologies into the project design is the most effective action that can be done to minimize surface and groundwater contamination from stormwater.

Approach

Landscape planning should couple consideration of land suitability for urban uses with consideration of community goals and projected growth. Project plan designs should conserve natural areas to the extent possible, maximize natural water storage and infiltration opportunities, and protect slopes and channels.

Suitable Applications

Appropriate applications include residential, commercial and industrial areas planned for development or redevelopment.

Design Considerations

Design requirements for site design and landscapes planning should conform to applicable standards and specifications of agencies with jurisdiction and be consistent with applicable General Plan and Local Area Plan policies.

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Designing New Installations

Begin the development of a plan for the landscape unit with attention to the following general principles:

- Formulate the plan on the basis of clearly articulated community goals. Carefully identify conflicts and choices between retaining and protecting desired resources and community growth.

- Map and assess land suitability for urban uses. Include the following landscape features in the assessment: wooded land, open unwooded land, steep slopes, erosion-prone soils, foundation suitability, soil suitability for waste disposal, aquifers, aquifer recharge areas, wetlands, floodplains, surface waters, agricultural lands, and various categories of urban land use. When appropriate, the assessment can highlight outstanding local or regional resources that the community determines should be protected (e.g., a scenic area, recreational area, threatened species habitat, farmland, fish run). Mapping and assessment should recognize not only these resources but also additional areas needed for their sustenance.

Project plan designs should conserve natural areas to the extent possible, maximize natural water storage and infiltration opportunities, and protect slopes and channels.

Conserve Natural Areas during Landscape Planning

If applicable, the following items are required and must be implemented in the site layout during the subdivision design and approval process, consistent with applicable General Plan and Local Area Plan policies:

- Cluster development on least-sensitive portions of a site while leaving the remaining land in a natural undisturbed condition.

- Limit clearing and grading of native vegetation at a site to the minimum amount needed to build lots, allow access, and provide fire protection.

- Maximize trees and other vegetation at each site by planting additional vegetation, clustering tree areas, and promoting the use of native and/or drought tolerant plants.

- Promote natural vegetation by using parking lot islands and other landscaped areas.

- Preserve riparian areas and wetlands.

Maximize Natural Water Storage and Infiltration Opportunities Within the Landscape Unit

- Promote the conservation of forest cover. Building on land that is already deforested affects basin hydrology to a lesser extent than converting forested land. Loss of forest cover reduces interception storage, detention in the organic forest floor layer, and water losses by evapotranspiration, resulting in large peak runoff increases and either their negative effects or the expense of countering them with structural solutions.

- Maintain natural storage reservoirs and drainage corridors, including depressions, areas of permeable soils, swales, and intermittent streams. Develop and implement policies and

regulations to discourage the clearing, filling, and channelization of these features. Utilize them in drainage networks in preference to pipes, culverts, and engineered ditches.

- Evaluating infiltration opportunities by referring to the stormwater management manual for the jurisdiction and pay particular attention to the selection criteria for avoiding groundwater contamination, poor soils, and hydrogeological conditions that cause these facilities to fail. If necessary, locate developments with large amounts of impervious surfaces or a potential to produce relatively contaminated runoff away from groundwater recharge areas.

Protection of Slopes and Channels during Landscape Design

- Convey runoff safely from the tops of slopes.
- Avoid disturbing steep or unstable slopes.
- Avoid disturbing natural channels.
- Stabilize disturbed slopes as quickly as possible.
- Vegetate slopes with native or drought tolerant vegetation.
- Control and treat flows in landscaping and/or other controls prior to reaching existing natural drainage systems.
- Stabilize temporary and permanent channel crossings as quickly as possible, and ensure that increases in run-off velocity and frequency caused by the project do not erode the channel.
- Install energy dissipaters, such as riprap, at the outlets of new storm drains, culverts, conduits, or channels that enter unlined channels in accordance with applicable specifications to minimize erosion. Energy dissipaters shall be installed in such a way as to minimize impacts to receiving waters.
- Line on-site conveyance channels where appropriate, to reduce erosion caused by increased flow velocity due to increases in tributary impervious area. The first choice for linings should be grass or some other vegetative surface, since these materials not only reduce runoff velocities, but also provide water quality benefits from filtration and infiltration. If velocities in the channel are high enough to erode grass or other vegetative linings, riprap, concrete, soil cement, or geo-grid stabilization are other alternatives.
- Consider other design principles that are comparable and equally effective.

Redeveloping Existing Installations

Various jurisdictional stormwater management and mitigation plans (SUSMP, WQMP, etc.) define "redevelopment" in terms of amounts of additional impervious area, increases in gross floor area and/or exterior construction, and land disturbing activities with structural or impervious surfaces. The definition of " redevelopment" must be consulted to determine whether or not the requirements for new development apply to areas intended for redevelopment. If the definition applies, the steps outlined under "designing new installations" above should be followed.

Redevelopment may present significant opportunity to add features which had not previously been implemented. Examples include incorporation of depressions, areas of permeable soils, and swales in newly redeveloped areas. While some site constraints may exist due to the status of already existing infrastructure, opportunities should not be missed to maximize infiltration, slow runoff, reduce impervious areas, disconnect directly connected impervious areas.

Other Resources

A Manual for the Standard Urban Stormwater Mitigation Plan (SUSMP), Los Angeles County Department of Public Works, May 2002.

Stormwater Management Manual for Western Washington, Washington State Department of Ecology, August 2001.

Model Standard Urban Storm Water Mitigation Plan (SUSMP) for San Diego County, Port of San Diego, and Cities in San Diego County, February 14, 2002.

Model Water Quality Management Plan (WQMP) for County of Orange, Orange County Flood Control District, and the Incorporated Cities of Orange County, Draft February 2003.

Ventura Countywide Technical Guidance Manual for Stormwater Quality Control Measures, July 2002.

Spill Prevention, Control & Cleanup SC-11

Objectives

- Cover
- Contain
- Educate
- Reduce/Minimize
- Product Substitution

Description

Spills and leaks, if not properly controlled, can adversely impact the storm drain system and receiving waters. Due to the type of work or the materials involved, many activities that occur either at a municipal facility or as a part of municipal field programs have the potential for accidental spills and leaks. Proper spill response planning and preparation can enable municipal employees to effectively respond to problems when they occur and minimize the discharge of pollutants to the environment.

Targeted Constituents

Sediment	
Nutrients	☑
Trash	
Metals	☑
Bacteria	
Oil and Grease	☑
Organics	☑
Oxygen Demanding	☑

Approach

- An effective spill response and control plan should include:
  - Spill/leak prevention measures;
  - Spill response procedures;
  - Spill cleanup procedures;
  - Reporting; and
  - Training
- A well thought out and implemented plan can prevent pollutants from entering the storm drainage system and can be used as a tool for training personnel to prevent and control future spills as well.

Pollution Prevention

- Develop and implement a Spill Prevention Control and Response Plan. The plan should include:

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- A description of the facility, the address, activities and materials involved
- Identification of key spill response personnel
- Identification of the potential spill areas or operations prone to spills/leaks
- Identification of which areas should be or are bermed to contain spills/leaks
- Facility map identifying the key locations of areas, activities, materials, structural BMPs, etc.
- Material handling procedures
- Spill response procedures including:
    - Assessment of the site and potential impacts
    - Containment of the material
    - Notification of the proper personnel and evacuation procedures
    - Clean up of the site
    - Disposal of the waste material and
    - Proper record keeping

- Product substitution – use less toxic materials (i.e. use water based paints instead of oil based paints)
- Recycle, reclaim, or reuse materials whenever possible. This will reduce the amount of materials that are brought into the facility or into the field.

Suggested Protocols

Spill/Leak Prevention Measures

- If possible, move material handling indoors, under cover, or away from storm drains or sensitive water bodies.
- Properly label all containers so that the contents are easily identifiable.
- Berm storage areas so that if a spill or leak occurs, the material is contained.
- Cover outside storage areas either with a permanent structure or with a seasonal one such as a tarp so that rain can not come into contact with the materials.
- Check containers (and any containment sumps) often for leaks and spills. Replace containers that are leaking, corroded, or otherwise deteriorating with containers in good condition. Collect all spilled liquids and properly dispose of them.

- Store, contain and transfer liquid materials in such a manner that if the container is ruptured or the contents spilled, they will not discharge, flow or be washed into the storm drainage system, surface waters, or groundwater.
- Place drip pans or absorbent materials beneath all mounted taps and at all potential drip and spill locations during the filling and unloading of containers. Any collected liquids or soiled absorbent materials should be reused/recycled or properly disposed of.
- For field programs, only transport the minimum amount of material needed for the daily activities and transfer materials between containers at a municipal yard where leaks and spill are easier to control.
- If paved, sweep and clean storage areas monthly, do not use water to hose down the area unless all of the water will be collected and disposed of properly.
- Install a spill control device (such as a tee section) in any catch basins that collect runoff from any storage areas if the materials stored are oil, gas, or other materials that separate from and float on water. This will allow for easier cleanup if a spill occurs.
- If necessary, protect catch basins while conducting field activities so that if a spill occurs, the material will be contained.

Training

- Educate employees about spill prevention, spill response and cleanup on a routine basis.
- Well-trained employees can reduce human errors that lead to accidental releases or spills:
  - The employees should have the tools and knowledge to immediately begin cleaning up a spill if one should occur.
  - Employees should be familiar with the Spill Prevention Control and Countermeasure Plan if one is available.
- Training of staff from all municipal departments should focus on recognizing and reporting potential or current spills/leaks and who they should contact.
- Employees responsible for aboveground storage tanks and liquid transfers for large bulk containers should be thoroughly familiar with the Spill Prevention Control and Countermeasure Plan and the plan should be readily available.

Spill Response and Prevention

- Identify key spill response personnel and train employees on who they are.
- Store and maintain appropriate spill cleanup materials in a clearly marked location near storage areas; and train employees to ensure familiarity with the site's spill control plan and/or proper spill cleanup procedures.
- Locate spill cleanup materials, such as absorbents, where they will be readily accessible (e.g. near storage and maintenance areas, on field trucks).

SC-11 Spill Prevention, Control & Cleanup

- Follow the Spill Prevention Control and Countermeasure Plan if one is available.

- If a spill occurs, notify the key spill response personnel immediately. If the material is unknown or hazardous, the local fire department may also need to be contacted.

- If safe to do so, attempt to contain the material and block the nearby storm drains so that the area impacted is minimized. If the material is unknown or hazardous wait for properly trained personnel to contain the materials.

- Perform an assessment of the area where the spill occurred and the downstream area that it could impact. Relay this information to the key spill response and clean up personnel.

Spill Cleanup Procedures

- Small non-hazardous spills
  - Use a rag, damp cloth or absorbent materials for general clean up of liquids
  - Use brooms or shovels for the general clean up of dry materials
  - If water is used, it must be collected and properly disposed of. The wash water can not be allowed to enter the storm drain.
  - Dispose of any waste materials properly
  - Clean or dispose of any equipment used to clean up the spill properly

- Large non-hazardous spills
  - Use absorbent materials for general clean up of liquids
  - Use brooms, shovels or street sweepers for the general clean up of dry materials
  - If water is used, it must be collected and properly disposed of. The wash water can not be allowed to enter the storm drain.
  - Dispose of any waste materials properly
  - Clean or dispose of any equipment used to clean up the spill properly

- For hazardous or very large spills, a private cleanup company or Hazmat team may need to be contacted to assess the situation and conduct the cleanup and disposal of the materials.

- Chemical cleanups of material can be achieved with the use of absorbents, gels, and foams. Remove the adsorbent materials promptly and dispose of according to regulations.

- If the spilled material is hazardous, then the used cleanup materials are also hazardous and must be sent to a certified laundry (rags) or disposed of as hazardous waste.

Reporting

- Report any spills immediately to the identified key municipal spill response personnel.

- Report spills in accordance with applicable reporting laws. Spills that pose an immediate threat to human health or the environment must be reported immediately to the Office of Emergency Service (OES)

- Spills that pose an immediate threat to human health or the environment may also need to be reported within 24 hours to the Regional Water Quality Control Board.

- Federal regulations require that any oil spill into a water body or onto an adjoining shoreline be reported to the National Response Center (NRC) at 800-424-8802 (24 hour)

- After the spill has been contained and cleaned up, a detailed report about the incident should be generated and kept on file (see the section on Reporting below). The incident may also be used in briefing staff about proper procedures

Other Considerations

- State regulations exist for facilities with a storage capacity of 10,000 gallons or more of petroleum to prepare a Spill Prevention Control and Countermeasure Plan (SPCC) Plan (Health & Safety Code Chapter 6.67).

- State regulations also exist for storage of hazardous materials (Health & Safety Code Chapter 6.95), including the preparation of area and business plans for emergency response to the releases or threatened releases.

- Consider requiring smaller secondary containment areas (less than 200 sq. ft.) to be connected to the sanitary sewer, if permitted to do so, prohibiting any hard connections to the storm drain.

Requirements

Costs

- Will vary depending on the size of the facility and the necessary controls.

- Prevention of leaks and spills is inexpensive. Treatment and/or disposal of wastes, contaminated soil and water is very expensive

Maintenance

- This BMP has no major administrative or staffing requirements. However, extra time is needed to properly handle and dispose of spills, which results in increased labor costs

Supplemental Information

Further Detail of the BMP

Reporting

Record keeping and internal reporting represent good operating practices because they can increase the efficiency of the response and containment of a spill. A good record keeping system helps the municipality minimize incident recurrence, correctly respond with appropriate containment and cleanup activities, and comply with legal requirements.

A record keeping and reporting system should be set up for documenting spills, leaks, and other discharges, including discharges of hazardous substances in reportable quantities. Incident records describe the quality and quantity of non-stormwater discharges to the storm drain.

These records should contain the following information:

- Date and time of the incident
- Weather conditions
- Duration of the spill/leak/discharge
- Cause of the spill/leak/discharge
- Response procedures implemented
- Persons notified
- Environmental problems associated with the spill/leak/discharge

Separate record keeping systems should be established to document housekeeping and preventive maintenance inspections, and training activities. All housekeeping and preventive maintenance inspections should be documented. Inspection documentation should contain the following information:

- The date and time the inspection was performed
- Name of the inspector
- Items inspected
- Problems noted
- Corrective action required
- Date corrective action was taken

Other means to document and record inspection results are field notes, timed and dated photographs, videotapes, and drawings and maps.

Examples

The City of Palo Alto includes spill prevention and control as a major element of its highly effective program for municipal vehicle maintenance shops.

References and Resources

King County Stormwater Pollution Control Manual - http://dnr.metrokc.gov/wlr/dss/spcm.htm

Orange County Stormwater Program
http://www.ocwatersheds.com/stormwater/swp_introduction.asp

San Diego Stormwater Co-permittees Jurisdictional Urban Runoff Management Program (URMP)
http://www.projectcleanwater.org/pdf/Model%20Program%20Municipal%20Facilities.pdf

Efficient Irrigation SD-12

Design Objectives

- ☑ Maximize Infiltration
- ☑ Provide Retention
- ☑ Slow Runoff
- Minimize Impervious Land Coverage
- Prohibit Dumping of Improper Materials
- Contain Pollutants
- Collect and Convey

Description

Irrigation water provided to landscaped areas may result in excess irrigation water being conveyed into stormwater drainage systems.

Approach

Project plan designs for development and redevelopment should include application methods of irrigation water that minimize runoff of excess irrigation water into the stormwater conveyance system.

Suitable Applications

Appropriate applications include residential, commercial and industrial areas planned for development or redevelopment. (Detached residential single-family homes are typically excluded from this requirement.)

Design Considerations

Designing New Installations

The following methods to reduce excessive irrigation runoff should be considered, and incorporated and implemented where determined applicable and feasible by the Permittee:

- Employ rain-triggered shutoff devices to prevent irrigation after precipitation.
- Design irrigation systems to each landscape area's specific water requirements.
- Include design featuring flow reducers or shutoff valves triggered by a pressure drop to control water loss in the event of broken sprinkler heads or lines.
- Implement landscape plans consistent with County or City water conservation resolutions, which may include provision of water sensors, programmable irrigation times (for short cycles), etc.

- Design timing and application methods of irrigation water to minimize the runoff of excess irrigation water into the storm water drainage system.
- Group plants with similar water requirements in order to reduce excess irrigation runoff and promote surface filtration. Choose plants with low irrigation requirements (for example, native or drought tolerant species). Consider design features such as:
  - Using mulches (such as wood chips or bar) in planter areas without ground cover to minimize sediment in runoff
  - Installing appropriate plant materials for the location, in accordance with amount of sunlight and climate, and use native plant materials where possible and/or as recommended by the landscape architect
  - Leaving a vegetative barrier along the property boundary and interior watercourses, to act as a pollutant filter, where appropriate and feasible
  - Choosing plants that minimize or eliminate the use of fertilizer or pesticides to sustain growth
- Employ other comparable, equally effective methods to reduce irrigation water runoff.

Redeveloping Existing Installations

Various jurisdictional stormwater management and mitigation plans (SUSMP, WQMP, etc.) define "redevelopment" in terms of amounts of additional impervious area, increases in gross floor area and/or exterior construction, and land disturbing activities with structural or impervious surfaces. The definition of " redevelopment" must be consulted to determine whether or not the requirements for new development apply to areas intended for redevelopment. If the definition applies, the steps outlined under "designing new installations" above should be followed.

Other Resources

A Manual for the Standard Urban Stormwater Mitigation Plan (SUSMP), Los Angeles County Department of Public Works, May 2002.

Model Standard Urban Storm Water Mitigation Plan (SUSMP) for San Diego County, Port of San Diego, and Cities in San Diego County, February 14, 2002.

Model Water Quality Management Plan (WQMP) for County of Orange, Orange County Flood Control District, and the Incorporated Cities of Orange County, Draft February 2003.

Ventura Countywide Technical Guidance Manual for Stormwater Quality Control Measures, July 2002.

Storm Drain Signage SD-13

Design Objectives

- Maximize Infiltration
- Provide Retention
- Slow Runoff
- Minimize Impervious Land Coverage
- ☑ Prohibit Dumping of Improper Materials
- Contain Pollutants
- Collect and Convey

Description

Waste materials dumped into storm drain inlets can have severe impacts on receiving and ground waters. Posting notices regarding discharge prohibitions at storm drain inlets can prevent waste dumping. Storm drain signs and stencils are highly visible source controls that are typically placed directly adjacent to storm drain inlets.

Approach

The stencil or affixed sign contains a brief statement that prohibits dumping of improper materials into the urban runoff conveyance system. Storm drain messages have become a popular method of alerting the public about the effects of and the prohibitions against waste disposal.

Suitable Applications

Stencils and signs alert the public to the destination of pollutants discharged to the storm drain. Signs are appropriate in residential, commercial, and industrial areas, as well as any other area where contributions or dumping to storm drains is likely.

Design Considerations

Storm drain message markers or placards are recommended at all storm drain inlets within the boundary of a development project. The marker should be placed in clear sight facing toward anyone approaching the inlet from either side. All storm drain inlet locations should be identified on the development site map.

Designing New Installations

The following methods should be considered for inclusion in the project design and show on project plans:

- Provide stenciling or labeling of all storm drain inlets and catch basins, constructed or modified, within the project area with prohibitive language. Examples include "NO DUMPING

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– DRAINS TO OCEAN" and/or other graphical icons to discourage illegal dumping.

- Post signs with prohibitive language and/or graphical icons, which prohibit illegal dumping at public access points along channels and creeks within the project area.

Note - Some local agencies have approved specific signage and/or storm drain message placards for use. Consult local agency stormwater staff to determine specific requirements for placard types and methods of application.

Redeveloping Existing Installations

Various jurisdictional stormwater management and mitigation plans (SUSMP, WQMP, etc.) define "redevelopment" in terms of amounts of additional impervious area, increases in gross floor area and/or exterior construction, and land disturbing activities with structural or impervious surfaces. If the project meets the definition of "redevelopment", then the requirements stated under " designing new installations" above should be included in all project design plans.

Additional Information

Maintenance Considerations

- Legibility of markers and signs should be maintained. If required by the agency with jurisdiction over the project, the owner/operator or homeowner's association should enter into a maintenance agreement with the agency or record a deed restriction upon the property title to maintain the legibility of placards or signs.

Placement

- Signage on top of curbs tends to weather and fade.

- Signage on face of curbs tends to be worn by contact with vehicle tires and sweeper brooms.

Supplemental Information

Examples

- Most MS4 programs have storm drain signage programs. Some MS4 programs will provide stencils, or arrange for volunteers to stencil storm drains as part of their outreach program.

Other Resources

A Manual for the Standard Urban Stormwater Mitigation Plan (SUSMP), Los Angeles County Department of Public Works, May 2002.

Model Standard Urban Storm Water Mitigation Plan (SUSMP) for San Diego County, Port of San Diego, and Cities in San Diego County, February 14, 2002.

Model Water Quality Management Plan (WQMP) for County of Orange, Orange County Flood Control District, and the Incorporated Cities of Orange County, Draft February 2003.

Ventura Countywide Technical Guidance Manual for Stormwater Quality Control Measures, July 2002.

- Use lined bins or dumpsters to reduce leaking of liquid waste.
- Provide roofs, awnings, or attached lids on all trash containers to minimize direct precipitation and prevent rainfall from entering containers.
- Pave trash storage areas with an impervious surface to mitigate spills.
- Do not locate storm drains in immediate vicinity of the trash storage area.
- Post signs on all dumpsters informing users that hazardous materials are not to be disposed of therein.

Redeveloping Existing Installations
Various jurisdictional stormwater management and mitigation plans (SUSMP, WQMP, etc.) define "redevelopment" in terms of amounts of additional impervious area, increases in gross floor area and/or exterior construction, and land disturbing activities with structural or impervious surfaces. The definition of " redevelopment" must be consulted to determine whether or not the requirements for new development apply to areas intended for redevelopment. If the definition applies, the steps outlined under "designing new installations" above should be followed.

Additional Information
Maintenance Considerations
The integrity of structural elements that are subject to damage (i.e., screens, covers, and signs) must be maintained by the owner/operator. Maintenance agreements between the local agency and the owner/operator may be required. Some agencies will require maintenance deed restrictions to be recorded of the property title. If required by the local agency, maintenance agreements or deed restrictions must be executed by the owner/operator before improvement plans are approved.

Other Resources
A Manual for the Standard Urban Stormwater Mitigation Plan (SUSMP), Los Angeles County Department of Public Works, May 2002.

Model Standard Urban Storm Water Mitigation Plan (SUSMP) for San Diego County, Port of San Diego, and Cities in San Diego County, February 14, 2002.

Model Water Quality Management Plan (WQMP) for County of Orange, Orange County Flood Control District, and the Incorporated Cities of Orange County, Draft February 2003.

Ventura Countywide Technical Guidance Manual for Stormwater Quality Control Measures, July 2002.

Objectives

- Cover
- Contain
- Educate
- Reduce/Minimize
- Product Substitution

Targeted Constituents

Sediment	✓
Nutrients	✓
Trash	
Metals	✓
Bacteria	✓
Oil and Grease	
Organics	

Description

Stormwater runoff from building and grounds maintenance activities can be contaminated with toxic hydrocarbons in solvents, fertilizers and pesticides, suspended solids, heavy metals, abnormal pH, and oils and greases. Utilizing the protocols in this fact sheet will prevent or reduce the discharge of pollutants to stormwater from building and grounds maintenance activities by washing and cleaning up with as little water as possible, following good landscape management practices, preventing and cleaning up spills immediately, keeping debris from entering the storm drains, and maintaining the stormwater collection system.

Approach

Reduce potential for pollutant discharge through source control pollution prevention and BMP implementation. Successful implementation depends on effective training of employees on applicable BMPs and general pollution prevention strategies and objectives.

Pollution Prevention

- Switch to non-toxic chemicals for maintenance when possible.
- Choose cleaning agents that can be recycled.
- Encourage proper lawn management and landscaping, including use of native vegetation.

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- Encourage use of Integrated Pest Management techniques for pest control.
- Encourage proper onsite recycling of yard trimmings.
- Recycle residual paints, solvents, lumber, and other material as much as possible.

Suggested Protocols

Pressure Washing of Buildings, Rooftops, and Other Large Objects

- In situations where soaps or detergents are used and the surrounding area is paved, pressure washers must use a water collection device that enables collection of wash water and associated solids. A sump pump, wet vacuum or similarly effective device must be used to collect the runoff and loose materials. The collected runoff and solids must be disposed of properly.
- If soaps or detergents are not used, and the surrounding area is paved, wash runoff does not have to be collected but must be screened. Pressure washers must use filter fabric or some other type of screen on the ground and/or in the catch basin to trap the particles in wash water runoff.
- If you are pressure washing on a grassed area (with or without soap), runoff must be dispersed as sheet flow as much as possible, rather than as a concentrated stream. The wash runoff must remain on the grass and not drain to pavement.

Landscaping Activities

- Dispose of grass clippings, leaves, sticks, or other collected vegetation as garbage, or by composting. Do not dispose of collected vegetation into waterways or storm drainage systems.
- Use mulch or other erosion control measures on exposed soils.

Building Repair, Remodeling, and Construction

- Do not dump any toxic substance or liquid waste on the pavement, the ground, or toward a storm drain.
- Use ground or drop cloths underneath outdoor painting, scraping, and sandblasting work, and properly dispose of collected material daily.
- Use a ground cloth or oversized tub for activities such as paint mixing and tool cleaning.
- Clean paintbrushes and tools covered with water-based paints in sinks connected to sanitary sewers or in portable containers that can be dumped into a sanitary sewer drain. Brushes and tools covered with non-water-based paints, finishes, or other materials must be cleaned in a manner that enables collection of used solvents (e.g., paint thinner, turpentine, etc.) for recycling or proper disposal.
- Use a storm drain cover, filter fabric, or similarly effective runoff control mechanism if dust, grit, wash water, or other pollutants may escape the work area and enter a catch basin. This is particularly necessary on rainy days. The containment device(s) must be in place at the beginning of the work day, and accumulated dirty runoff and solids must be collected and disposed of before removing the containment device(s) at the end of the work day.

- If you need to de-water an excavation site, you may need to filter the water before discharging to a catch basin or off-site. If directed off-site, you should direct the water through hay bales and filter fabric or use other sediment filters or traps.

- Store toxic material under cover during precipitation events and when not in use. A cover would include tarps or other temporary cover material.

Mowing, Trimming, and Planting

- Dispose of leaves, sticks, or other collected vegetation as garbage, by composting or at a permitted landfill. Do not dispose of collected vegetation into waterways or storm drainage systems.

- Use mulch or other erosion control measures when soils are exposed.

- Place temporarily stockpiled material away from watercourses and drain inlets, and berm or cover stockpiles to prevent material releases to the storm drain system.

- Consider an alternative approach when bailing out muddy water: do not put it in the storm drain; pour over landscaped areas.

- Use hand weeding where practical.

Fertilizer and Pesticide Management

- Follow all federal, state, and local laws and regulations governing the use, storage, and disposal of fertilizers and pesticides and training of applicators and pest control advisors.

- Use less toxic pesticides that will do the job when applicable. Avoid use of copper-based pesticides if possible.

- Do not use pesticides if rain is expected.

- Do not mix or prepare pesticides for application near storm drains.

- Use the minimum amount needed for the job.

- Calibrate fertilizer distributors to avoid excessive application.

- Employ techniques to minimize off-target application (e.g., spray drift) of pesticides, including consideration of alternative application techniques.

- Apply pesticides only when wind speeds are low.

- Fertilizers should be worked into the soil rather than dumped or broadcast onto the surface.

- Irrigate slowly to prevent runoff and then only as much as is needed.

- Clean pavement and sidewalk if fertilizer is spilled on these surfaces before applying irrigation water.

- Dispose of empty pesticide containers according to the instructions on the container label.

- Use up the pesticides. Rinse containers, and use rinse water as product. Dispose of unused pesticide as hazardous waste.

- Implement storage requirements for pesticide products with guidance from the local fire department and County Agricultural Commissioner. Provide secondary containment for pesticides.

Inspection

- Inspect irrigation system periodically to ensure that the right amount of water is being applied and that excessive runoff is not occurring. Minimize excess watering and repair leaks in the irrigation system as soon as they are observed.

Training

- Educate and train employees on pesticide use and in pesticide application techniques to prevent pollution.

- Train employees and contractors in proper techniques for spill containment and cleanup.

- Be sure the frequency of training takes into account the complexity of the operations and the nature of the staff.

Spill Response and Prevention

- Keep your Spill Prevention Control and Countermeasure (SPCC) Plan up-to-date.

- Place a stockpile of spill cleanup materials, such as brooms, dustpans, and vacuum sweepers (if desired) near the storage area where it will be readily accessible.

- Have employees trained in spill containment and cleanup present during the loading/unloading of dangerous wastes, liquid chemicals, or other materials.

- Familiarize employees with the Spill Prevention Control and Countermeasure Plan.

- Clean up spills immediately.

Other Considerations

Alternative pest/weed controls may not be available, suitable, or effective in many cases.

Requirements

Costs

- Cost will vary depending on the type and size of facility.

- Overall costs should be low in comparison to other BMPs.

Maintenance

Sweep paved areas regularly to collect loose particles. Wipe up spills with rags and other absorbent material immediately, do not hose down the area to a storm drain.

Supplemental Information

Further Detail of the BMP

Fire Sprinkler Line Flushing

Building fire sprinkler line flushing may be a source of non-stormwater runoff pollution. The water entering the system is usually potable water, though in some areas it may be non-potable reclaimed wastewater. There are subsequent factors that may drastically reduce the quality of the water in such systems. Black iron pipe is usually used since it is cheaper than potable piping, but it is subject to rusting and results in lower quality water. Initially, the black iron pipe has an oil coating to protect it from rusting between manufacture and installation; this will contaminate the water from the first flush but not from subsequent flushes. Nitrates, poly-phosphates and other corrosion inhibitors, as well as fire suppressants and antifreeze may be added to the sprinkler water system. Water generally remains in the sprinkler system a long time (typically a year) and between flushes may accumulate iron, manganese, lead, copper, nickel, and zinc. The water generally becomes anoxic and contains living and dead bacteria and breakdown products from chlorination. This may result in a significant BOD problem and the water often smells. Consequently dispose fire sprinkler line flush water into the sanitary sewer. Do not allow discharge to storm drain or infiltration due to potential high levels of pollutants in fire sprinkler line water.

References and Resources

California's Nonpoint Source Program Plan http://www.swrcb.ca.gov/nps/index.html

Clark County Storm Water Pollution Control Manual http://www.co.clark.wa.us/pubworks/bmpman.pdf

King County Storm Water Pollution Control Manual http://dnr.metrokc.gov/wlr/dss/spcm.htm

Mobile Cleaners Pilot Program: Final Report. 1997. Bay Area Stormwater Management Agencies Association (BASMAA). http://www.basmaa.org/

Pollution from Surface Cleaning Folder. 1996. Bay Area Stormwater Management Agencies Association (BASMAA). http://www.basmaa.org/

Santa Clara Valley Urban Runoff Pollution Prevention Program http://www.scvurppp.org

The Storm Water Managers Resource Center http://www.stormwatercenter.net/

Parking/Storage Area Maintenance SC-43

Objectives

- Cover
- Contain
- Educate
- Reduce/Minimize
- Product Substitution

Targeted Constituents

Sediment	✓
Nutrients	
Trash	✓
Metals	✓
Bacteria	
Oil and Grease	✓
Organics	✓

Description

Parking lots and storage areas can contribute a number of substances, such as trash, suspended solids, hydrocarbons, oil and grease, and heavy metals that can enter receiving waters through stormwater runoff or non-stormwater discharges. The protocols in this fact sheet are intended to prevent or reduce the discharge of pollutants from parking/storage areas and include using good housekeeping practices, following appropriate cleaning BMPs, and training employees.

Approach

The goal of this program is to ensure stormwater pollution prevention practices are considered when conducting activities on or around parking areas and storage areas to reduce potential for pollutant discharge to receiving waters. Successful implementation depends on effective training of employees on applicable BMPs and general pollution prevention strategies and objectives.

Pollution Prevention

- Encourage alternative designs and maintenance strategies for impervious parking lots. (See New Development and Redevelopment BMP Handbook)
- Keep accurate maintenance logs to evaluate BMP implementation.

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Suggested Protocols

General

- Keep the parking and storage areas clean and orderly. Remove debris in a timely fashion.
- Allow sheet runoff to flow into biofilters (vegetated strip and swale) and/or infiltration devices.
- Utilize sand filters or oleophilic collectors for oily waste in low quantities.
- Arrange rooftop drains to prevent drainage directly onto paved surfaces.
- Design lot to include semi-permeable hardscape.
- Discharge soapy water remaining in mop or wash buckets to the sanitary sewer through a sink, toilet, clean-out, or wash area with drain.

Controlling Litter

- Post "No Littering" signs and enforce anti-litter laws.
- Provide an adequate number of litter receptacles.
- Clean out and cover litter receptacles frequently to prevent spillage.
- Provide trash receptacles in parking lots to discourage litter.
- Routinely sweep, shovel, and dispose of litter in the trash.

Surface Cleaning

- Use dry cleaning methods (e.g., sweeping, vacuuming) to prevent the discharge of pollutants into the stormwater conveyance system if possible.
- Establish frequency of public parking lot sweeping based on usage and field observations of waste accumulation.
- Sweep all parking lots at least once before the onset of the wet season.
- Follow the procedures below if water is used to clean surfaces:
  - Block the storm drain or contain runoff.
  - Collect and pump wash water to the sanitary sewer or discharge to a pervious surface. Do not allow wash water to enter storm drains.
  - Dispose of parking lot sweeping debris and dirt at a landfill.
- Follow the procedures below when cleaning heavy oily deposits:
  - Clean oily spots with absorbent materials.
  - Use a screen or filter fabric over inlet, then wash surfaces.

  - Do not allow discharges to the storm drain.
  - Vacuum/pump discharges to a tank or discharge to sanitary sewer.
  - Appropriately dispose of spilled materials and absorbents.

Surface Repair

- Preheat, transfer or load hot bituminous material away from storm drain inlets.
- Apply concrete, asphalt, and seal coat during dry weather to prevent contamination from contacting stormwater runoff.
- Cover and seal nearby storm drain inlets where applicable (with waterproof material or mesh) and manholes before applying seal coat, slurry seal, etc. Leave covers in place until job is complete and all water from emulsified oil sealants has drained or evaporated. Clean any debris from these covered manholes and drains for proper disposal.
- Use only as much water as necessary for dust control, to avoid runoff.
- Catch drips from paving equipment that is not in use with pans or absorbent material placed under the machines. Dispose of collected material and absorbents properly.

Inspection

- Have designated personnel conduct inspections of parking facilities and stormwater conveyance systems associated with parking facilities on a regular basis.
- Inspect cleaning equipment/sweepers for leaks on a regular basis.

Training

- Provide regular training to field employees and/or contractors regarding cleaning of paved areas and proper operation of equipment.
- Train employees and contractors in proper techniques for spill containment and cleanup.

Spill Response and Prevention

- Keep your Spill Prevention Control and Countermeasure (SPCC) Plan up-to-date.
- Place a stockpile of spill cleanup materials where it will be readily accessible or at a central location.
- Clean up fluid spills immediately with absorbent rags or material.
- Dispose of spilled material and absorbents properly.

Other Considerations

Limitations related to sweeping activities at large parking facilities may include high equipment costs, the need for sweeper operator training, and the inability of current sweeper technology to remove oil and grease.

SC-43 Parking/Storage Area Maintenance

Requirements

Costs

Cleaning/sweeping costs can be quite large. Construction and maintenance of stormwater structural controls can be quite expensive as well.

Maintenance

- Sweep parking lot regularly to minimize cleaning with water.
- Clean out oil/water/sand separators regularly, especially after heavy storms.
- Clean parking facilities regularly to prevent accumulated wastes and pollutants from being discharged into conveyance systems during rainy conditions.

Supplemental Information

Further Detail of the BMP

Surface Repair

Apply concrete, asphalt, and seal coat during dry weather to prevent contamination from contacting stormwater runoff. Where applicable, cover and seal nearby storm drain inlets (with waterproof material or mesh) and manholes before applying seal coat, slurry seal, etc. Leave covers in place until job is complete and all water from emulsified oil sealants has drained or evaporated. Clean any debris from these covered manholes and drains for proper disposal. Only use only as much water as is necessary for dust control to avoid runoff.

References and Resources

California's Nonpoint Source Program Plan http://www.swrcb.ca.gov/nps/index.html

Clark County Storm Water Pollution Control Manual http://www.co.clark.wa.us/pubworks/bmpman.pdf

King County Storm Water Pollution Control Manual http://dnr.metrokc.gov/wlr/dss/spcm.htm

Pollution from Surface Cleaning Folder. 1996. Bay Area Stormwater Management Agencies Association (BASMAA). http://www.basmaa.org/

Oregon Association of Clean Water Agencies. Oregon Municipal Stormwater Toolbox for Maintenance Practices. June 1998.

Santa Clara Valley Urban Runoff Pollution Prevention Program http://www.scvurppp.org

The Storm Water Managers Resource Center http://www.stormwatercenter.net/

Description

Promote efficient and safe housekeeping practices (storage, use, and cleanup) when handling potentially harmful materials such as fertilizers, pesticides, cleaning solutions, paint products, automotive products, and swimming pool chemicals. Related information is provided in BMP fact sheets SC-11 Spill Prevention, Control & Cleanup and SC-34 Waste Handling & Disposal.

Objectives

- Cover
- Contain
- Educate
- Reduce/Minimize
- Product Substitution

Approach

Pollution Prevention

- Purchase only the amount of material that will be needed for foreseeable use. In most cases this will result in cost savings in both purchasing and disposal. See SC-61 Safer Alternative Products for additional information.

- Be aware of new products that may do the same job with less environmental risk and for less or the equivalent cost. Total cost must be used here; this includes purchase price, transportation costs, storage costs, use related costs, clean up costs and disposal costs.

Targeted Constituents

Sediment	☑
Nutrients	☑
Trash	☑
Metals	☑
Bacteria	☑
Oil and Grease	☑
Organics	☑
Oxygen Demanding	☑

Suggested Protocols

General

- Keep work sites clean and orderly. Remove debris in a timely fashion. Sweep the area.

- Dispose of wash water, sweepings, and sediments, properly.

- Recycle or dispose of fluids properly.

- Establish a daily checklist of office, yard and plant areas to confirm cleanliness and adherence to proper storage and security. Specific employees should be assigned specific inspection responsibilities and given the authority to remedy any problems found.

- Post waste disposal charts in appropriate locations detailing for each waste its hazardous nature (poison, corrosive, flammable), prohibitions on its disposal (dumpster, drain, sewer) and the recommended disposal method (recycle, sewer, burn, storage, landfill).

- Summarize the chosen BMPs applicable to your operation and post them in appropriate conspicuous places.

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- Require a signed checklist from every user of any hazardous material detailing amount taken, amount used, amount returned and disposal of spent material.
- Do a before audit of your site to establish baseline conditions and regular subsequent audits to note any changes and whether conditions are improving or deteriorating.
- Keep records of water, air and solid waste quantities and quality tests and their disposition.
- Maintain a mass balance of incoming, outgoing and on hand materials so you know when there are unknown losses that need to be tracked down and accounted for.
- Use and reward employee suggestions related to BMPs, hazards, pollution reduction, work place safety, cost reduction, alternative materials and procedures, recycling and disposal.
- Have, and review regularly, a contingency plan for spills, leaks, weather extremes etc. Make sure all employees know about it and what their role is so that it comes into force automatically.

Training

- Train all employees, management, office, yard, manufacturing, field and clerical in BMPs and pollution prevention and make them accountable.
- Train municipal employees who handle potentially harmful materials in good housekeeping practices.
- Train personnel who use pesticides in the proper use of the pesticides. The California Department of Pesticide Regulation license pesticide dealers, certify pesticide applicators and conduct onsite inspections.
- Train employees and contractors in proper techniques for spill containment and cleanup. The employee should have the tools and knowledge to immediately begin cleaning up a spill if one should occur.

Spill Response and Prevention

- Refer to SC-11, Spill Prevention, Control & Cleanup.
- Keep your Spill Prevention Control and Countermeasure (SPCC) plant up-to-date, and implement accordingly.
- Have spill cleanup materials readily available and in a known location.
- Cleanup spills immediately and use dry methods if possible.
- Properly dispose of spill cleanup material.

Other Considerations

- There are no major limitations to this best management practice.
- There are no regulatory requirements to this BMP. Existing regulations already require municipalities to properly store, use, and dispose of hazardous materials

Requirements

Costs

- Minimal cost associated with this BMP. Implementation of good housekeeping practices may result in cost savings as these procedures may reduce the need for more costly BMPs.

Maintenance

- Ongoing maintenance required to keep a clean site. Level of effort is a function of site size and type of activities.

Supplemental Information

Further Detail of the BMP

- The California Integrated Waste Management Board's Recycling Hotline, 1-800-553-2962, provides information on household hazardous waste collection programs and facilities.

Examples

There are a number of communities with effective programs. The most pro-active include Santa Clara County and the City of Palo Alto, the City and County of San Francisco, and the Municipality of Metropolitan Seattle (Metro).

References and Resources

British Columbia Lake Stewardship Society. Best Management Practices to Protect Water Quality from Non-Point Source Pollution. March 2000. http://www.nalms.org/bclss/bmphome.html#bmp

King County Stormwater Pollution Control Manual - http://dnr.metrokc.gov/wlr/dss/spcm.htm

Model Urban Runoff Program: A How-To Guide for Developing Urban Runoff Programs for Small Municipalities, Prepared by City of Monterey, City of Santa Cruz, California Coastal Commission, Monterey Bay National Marine Sanctuary, Association of Monterey Bay Area Governments, Woodward-Clyde, Central Coast Regional Water Quality Control Board. July, 1998, Revised by California Coastal Commission, February 2002.

Orange County Stormwater Program http://www.ocwatersheds.com/stormwater/swp_introduction.asp

San Mateo STOPPP - (http://stoppp.tripod.com/bmp.html)

Trash Storage Areas SD-32

Design Objectives

Maximize Infiltration

Provide Retention

Slow Runoff

Minimize Impervious Land Coverage

Prohibit Dumping of Improper Materials

☑ Contain Pollutants

Collect and Convey

Description

Trash storage areas are areas where a trash receptacle (s) are located for use as a repository for solid wastes. Stormwater runoff from areas where trash is stored or disposed of can be polluted. In addition, loose trash and debris can be easily transported by water or wind into nearby storm drain inlets, channels, and/or creeks. Waste handling operations that may be sources of stormwater pollution include dumpsters, litter control, and waste piles.

Approach

This fact sheet contains details on the specific measures required to prevent or reduce pollutants in stormwater runoff associated with trash storage and handling. Preventative measures including enclosures, containment structures, and impervious pavements to mitigate spills, should be used to reduce the likelihood of contamination.

Suitable Applications

Appropriate applications include residential, commercial and industrial areas planned for development or redevelopment. (Detached residential single-family homes are typically excluded from this requirement.)

Design Considerations

Design requirements for waste handling areas are governed by Building and Fire Codes, and by current local agency ordinances and zoning requirements. The design criteria described in this fact sheet are meant to enhance and be consistent with these code and ordinance requirements. Hazardous waste should be handled in accordance with legal requirements established in Title 22, California Code of Regulation.

Wastes from commercial and industrial sites are typically hauled by either public or commercial carriers that may have design or access requirements for waste storage areas. The design criteria in this fact sheet are recommendations and are not intended to be in conflict with requirements established by the waste hauler. The waste hauler should be contacted prior to the design of your site trash collection areas. Conflicts or issues should be discussed with the local agency.

Designing New Installations

Trash storage areas should be designed to consider the following structural or treatment control BMPs:

- Design trash container areas so that drainage from adjoining roofs and pavement is diverted around the area(s) to avoid run-on. This might include berming or grading the waste handling area to prevent run-on of stormwater.
- Make sure trash container areas are screened or walled to prevent off-site transport of trash.

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- 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.

Attachment H

- Maintenance Manual & Covenant Agreement

Will provided in final WQMP report

Appendix I

Supporting Information

- NOAA Atlas 14 Rainfall
- Basin Factor Safety Calculation
- Catch Basin Filter Insert Details

NOAA Atlas 14, Volume 6, Version 2
Location name: Apple Valley, California, USA*
Latitude: 34.6082°, Longitude: -117.198°
Elevation: 3063.9 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	0.083 (0.068-0.102)	0.117 (0.096-0.143)	0.163 (0.134-0.201)	0.204 (0.166-0.253)	0.262 (0.207-0.336)	0.310 (0.239-0.406)	0.361 (0.272-0.484)	0.417 (0.306-0.575)	0.498 (0.350-0.714)	0.564 (0.384-0.838)
10-min	0.119 (0.098-0.146)	0.167 (0.137-0.205)	0.234 (0.192-0.288)	0.292 (0.238-0.362)	0.376 (0.296-0.482)	0.444 (0.343-0.582)	0.518 (0.390-0.694)	0.598 (0.438-0.824)	0.713 (0.502-1.02)	0.809 (0.550-1.20)
15-min	0.144 (0.119-0.176)	0.202 (0.166-0.248)	0.283 (0.232-0.349)	0.353 (0.287-0.438)	0.454 (0.358-0.583)	0.537 (0.415-0.703)	0.626 (0.472-0.840)	0.723 (0.530-0.996)	0.863 (0.607-1.24)	0.978 (0.665-1.45)
30-min	0.197 (0.162-0.242)	0.277 (0.228-0.340)	0.388 (0.318-0.477)	0.484 (0.394-0.600)	0.622 (0.490-0.798)	0.736 (0.568-0.963)	0.858 (0.646-1.15)	0.990 (0.726-1.36)	1.18 (0.831-1.70)	1.34 (0.911-1.99)
60-min	0.248 (0.204-0.304)	0.348 (0.286-0.427)	0.488 (0.400-0.601)	0.609 (0.495-0.755)	0.783 (0.617-1.00)	0.926 (0.715-1.21)	1.08 (0.813-1.45)	1.25 (0.913-1.72)	1.49 (1.05-2.13)	1.69 (1.15-2.50)
2-hr	0.351 (0.289-0.431)	0.475 (0.391-0.583)	0.646 (0.530-0.796)	0.793 (0.645-0.984)	1.00 (0.790-1.29)	1.17 (0.905-1.54)	1.35 (1.02-1.81)	1.55 (1.14-2.13)	1.83 (1.29-2.62)	2.05 (1.40-3.05)
3-hr	0.426 (0.351-0.523)	0.569 (0.468-0.699)	0.765 (0.628-0.942)	0.933 (0.759-1.16)	1.17 (0.922-1.50)	1.36 (1.05-1.78)	1.57 (1.18-2.10)	1.78 (1.31-2.46)	2.09 (1.47-3.00)	2.34 (1.59-3.48)
6-hr	0.580 (0.477-0.711)	0.766 (0.630-0.940)	1.02 (0.836-1.25)	1.23 (1.00-1.53)	1.54 (1.21-1.97)	1.78 (1.37-2.32)	2.03 (1.53-2.72)	2.30 (1.68-3.16)	2.67 (1.88-3.83)	2.97 (2.02-4.42)
12-hr	0.744 (0.613-0.913)	0.989 (0.813-1.21)	1.32 (1.08-1.62)	1.59 (1.30-1.98)	1.97 (1.56-2.53)	2.28 (1.76-2.98)	2.59 (1.95-3.47)	2.92 (2.14-4.02)	3.38 (2.38-4.85)	3.74 (2.55-5.55)
24-hr	0.977 (0.867-1.12)	1.32 (1.17-1.52)	1.77 (1.56-2.04)	2.14 (1.87-2.49)	2.65 (2.25-3.19)	3.05 (2.53-3.75)	3.46 (2.81-4.36)	3.90 (3.07-5.05)	4.49 (3.39-6.06)	4.96 (3.62-6.93)
2-day	1.15 (1.02-1.33)	1.58 (1.40-1.82)	2.14 (1.89-2.47)	2.61 (2.28-3.03)	3.24 (2.75-3.90)	3.73 (3.10-4.59)	4.24 (3.44-5.34)	4.77 (3.76-6.17)	5.49 (4.15-7.41)	6.06 (4.42-8.46)
3-day	1.25 (1.11-1.44)	1.73 (1.54-2.00)	2.37 (2.09-2.73)	2.89 (2.53-3.36)	3.60 (3.05-4.33)	4.15 (3.44-5.10)	4.71 (3.82-5.93)	5.30 (4.18-6.86)	6.10 (4.61-8.24)	6.74 (4.92-9.41)
4-day	1.33 (1.18-1.53)	1.84 (1.63-2.12)	2.52 (2.23-2.91)	3.08 (2.70-3.58)	3.84 (3.25-4.62)	4.43 (3.67-5.44)	5.03 (4.07-6.33)	5.65 (4.45-7.32)	6.51 (4.92-8.79)	7.18 (5.25-10.0)
7-day	1.45 (1.29-1.67)	1.99 (1.77-2.30)	2.72 (2.40-3.14)	3.31 (2.90-3.85)	4.13 (3.50-4.97)	4.76 (3.95-5.85)	5.41 (4.38-6.81)	6.09 (4.79-7.88)	7.01 (5.30-9.47)	7.74 (5.65-10.8)
10-day	1.53 (1.36-1.76)	2.10 (1.86-2.42)	2.85 (2.52-3.30)	3.48 (3.05-4.05)	4.34 (3.68-5.22)	5.01 (4.16-6.15)	5.69 (4.61-7.17)	6.41 (5.05-8.31)	7.40 (5.60-9.99)	8.18 (5.98-11.4)
20-day	1.76 (1.56-2.02)	2.42 (2.14-2.78)	3.30 (2.92-3.81)	4.04 (3.54-4.70)	5.06 (4.29-6.10)	5.87 (4.87-7.22)	6.70 (5.43-8.44)	7.58 (5.97-9.82)	8.79 (6.64-11.9)	9.75 (7.12-13.6)
30-day	1.99 (1.76-2.29)	2.74 (2.43-3.16)	3.76 (3.33-4.35)	4.62 (4.05-5.38)	5.83 (4.94-7.01)	6.78 (5.63-8.34)	7.77 (6.30-9.79)	8.82 (6.95-11.4)	10.3 (7.76-13.9)	11.4 (8.35-16.0)
45-day	2.34 (2.07-2.69)	3.23 (2.86-3.72)	4.46 (3.94-5.15)	5.50 (4.82-6.41)	6.98 (5.92-8.41)	8.17 (6.78-10.0)	9.41 (7.63-11.9)	10.7 (8.46-13.9)	12.6 (9.51-17.0)	14.1 (10.3-19.6)
60-day	2.56 (2.27-2.95)	3.53 (3.13-4.07)	4.88 (4.32-5.64)	6.04 (5.29-7.03)	7.70 (6.52-9.26)	9.04 (7.50-11.1)	10.5 (8.47-13.2)	12.0 (9.43-15.5)	14.1 (10.7-19.1)	15.9 (11.6-22.2)

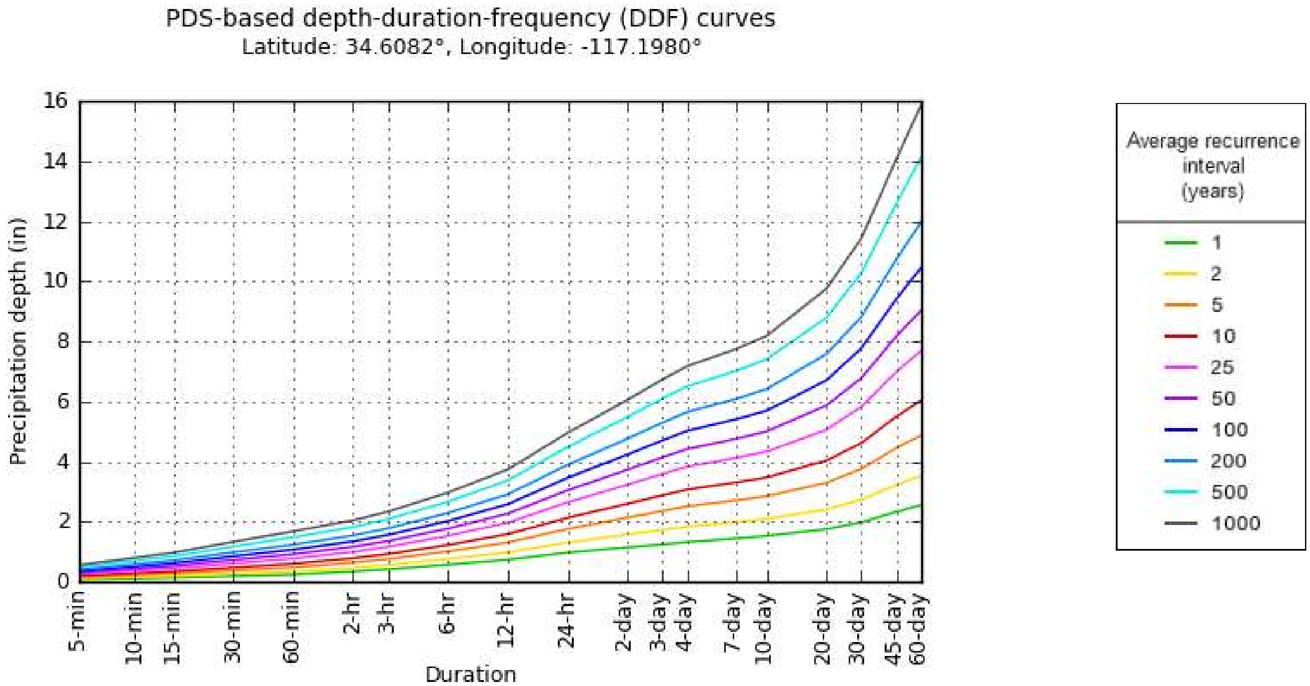
[1] Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

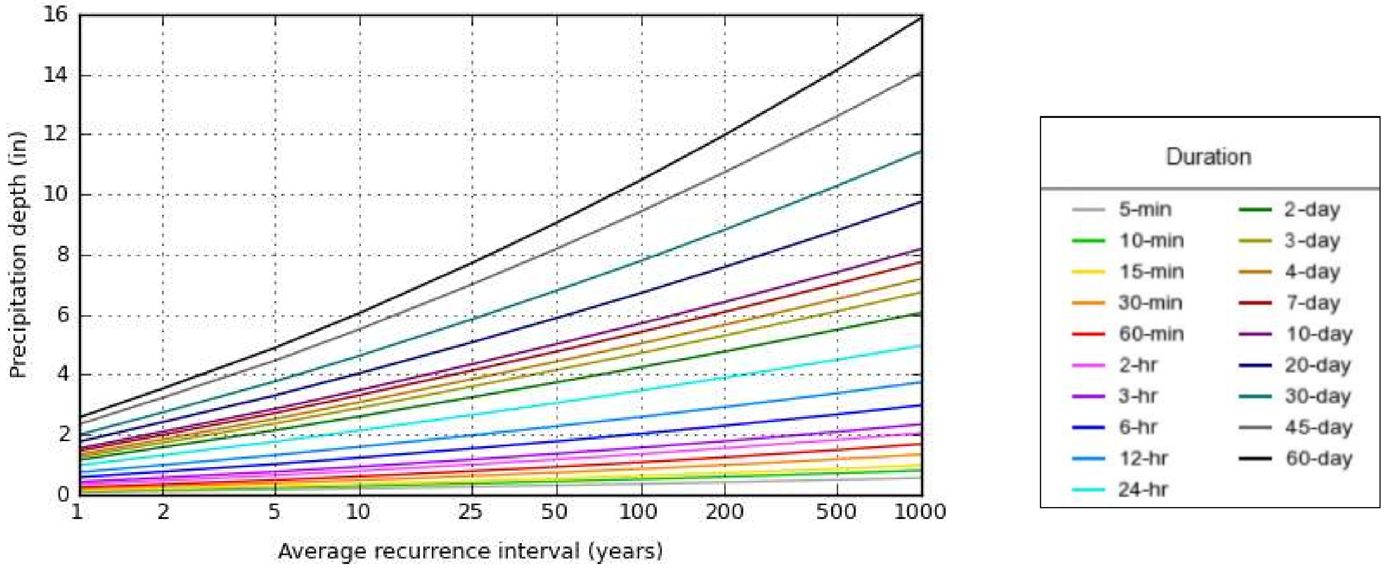
Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values.

Please refer to NOAA Atlas 14 document for more information.

Back to Top

PF graphical





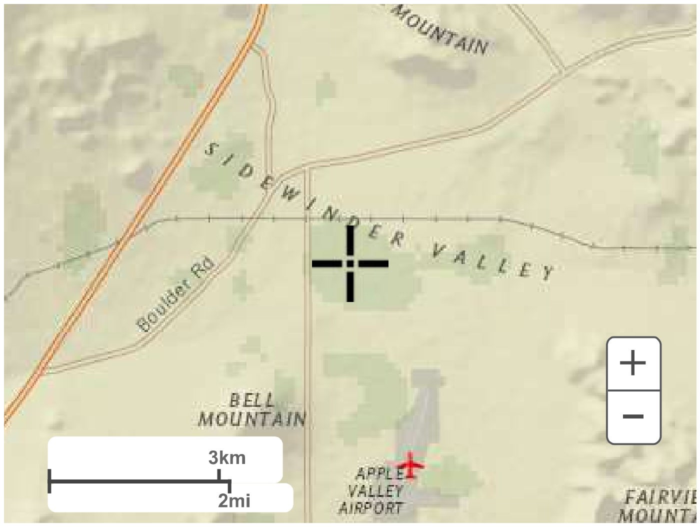
NOAA Atlas 14, Volume 6, Version 2

Created (GMT): Thu Oct 13 23:21:12 2022

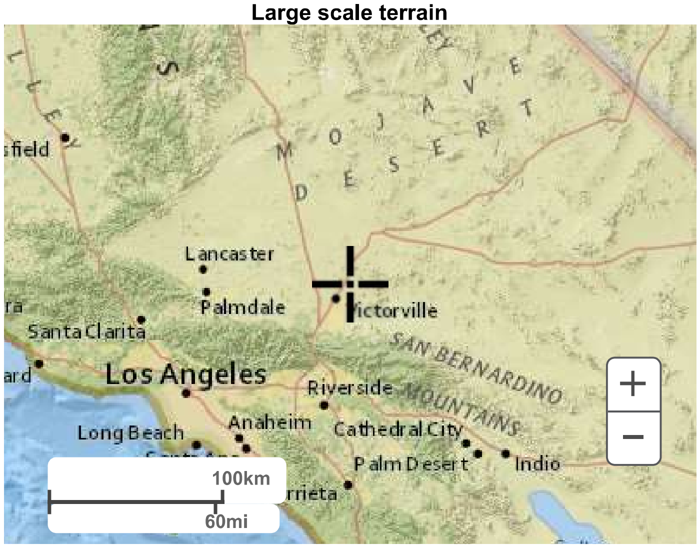
Back to Top

Maps & aerials

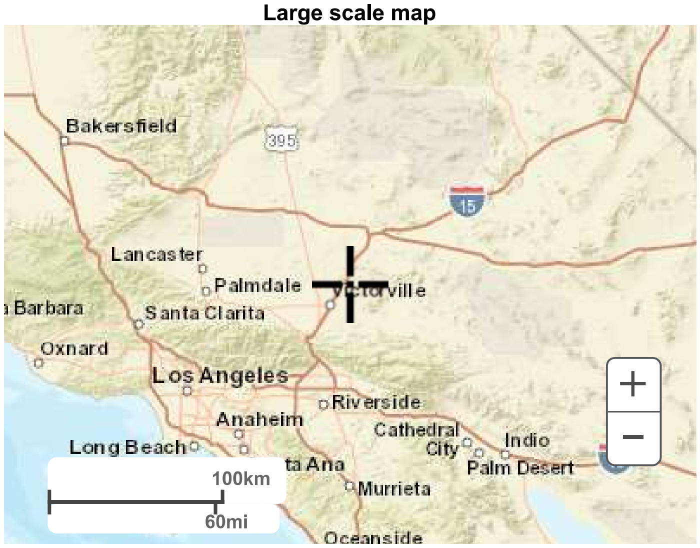
Small scale terrain



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

Disclaimer

Infiltration Rate Factor of Safety Calculation Summary					
Drainage Area DA1-A1					
Factor Category		**Factor Description**	**Assigned Weight (w)**	**Factor Value (v)[2]**	**Product (p) p=w*v**
A	Suitability Assesment	Soil Assesment Methods	0.25	2	0.50
		Predominant Soil Texture	0.25	1	0.25
		Site Soil Variability	0.25	1	0.25
		Depth to Groundwater / Impervious Layer	0.25	1	0.25
		Suitability Assessment Safety Factor = Σp			1.25
B	Design	Tributary Area Size	0.25	1	0.50
		Level of Pretreatment / Expected Sediment Loads	0.25	3	0.50
		Redundancy*	0.25	2	0.50
		Compaction During Construction	0.25	1	0.25
		Design Safety Factor SB = Σp			1.75
Calculated Safety Factor					2.19
Minimum Allowable Safety Factor					2.00
Safety Factor Applied					2.19

Oldcastle Infrastructure™
A CRH COMPANY

FLOGARD®
Catch Basin Insert Filter

Catch basin insert designed to capture sediment, gross solids, trash and petroleum hydrocarbons from low ("first flush") flows, even during the most extreme weather conditions

Example Types, Sizes and Capacities: Additional sizes, including regional and custom options are available.

FloGard Combination Inlet
SPECIFIER CHART

MODEL NO. STANDARD DEPTH	STANDARD & SHALLOW DEPTH (Data in these columns is the same for both STANDARD & SHALLOW versions)			STANDARD DEPTH -20 Inches-		MODEL NO. SHALLOW DEPTH	SHALLOW DEPTH -12 Inches-	
	INLET ID Inside Dimension (inch x inch)	GRADE OD Outside Dimension (inch x inch)	TOTAL BYPASS CAPACITY (cu. ft. / sec.)	SOLIDS STORAGE CAPACITY (cu. ft.)	FILTERED FLOW (cu. ft. / sec.)		SOLIDS STORAGE CAPACITY (cu. ft.)	FILTERED FLOW (cu. ft. / sec.)
FGP-1633FGO	16 X 33	18 X 36	7.0	2.5	1.7	FGP-1633FGO8	1.4	1.1
FGP-1836FGO	18 X 36	18 X 40	6.9	2.3	1.6	FGP-1836FGO8	1.3	.9
FGP-2234FGO	22 X 34	24 X 36	8.1	3.6	2.1	FGP-2234FGO8	2.1	1.4
FGP-2436FGO	24 X 36	24 X 40	8.0	3.4	2.0	FGP-2436FGO8	1.95	1.15

FloGard Flat Grated Inlet
SPECIFIER CHART

MODEL NO. STANDARD DEPTH	STANDARD & SHALLOW DEPTH (Data in these columns is the same for both STANDARD & SHALLOW versions)			STANDARD DEPTH -20 Inches-		MODEL NO. SHALLOW DEPTH	SHALLOW DEPTH -12 Inches-	
	INLET ID Inside Dimension (inch x inch)	GRADE OD Outside Dimension (inch x inch)	TOTAL BYPASS CAPACITY (cu. ft. / sec.)	SOLIDS STORAGE CAPACITY (cu. ft.)	FILTERED FLOW (cu. ft. / sec.)		SOLIDS STORAGE CAPACITY (cu. ft.)	FILTERED FLOW (cu. ft. / sec.)
FGP-12F	12 X 12	12 X 14	2.8	0.3	0.4	FGP-12F8	.15	.25
FGP-16F	16 X 16	16 X 19	4.7	0.8	0.7	FGP-16F8	.45	.4
FGP-18F	18 X 18	18 X 20	4.7	0.8	0.7	FGP-18F8	.45	.4
FGP-1836F	18 X 36	18 X 40	6.9	2.3	1.6	FGP-1836F8	1.3	.9
FGP-21F	22 X 22	22 X 24	6.1	2.2	1.5	FGP-21F8	1.25	.85
FGP-24F	24 X 24	24 X 27	6.1	2.2	1.5	FGP-24F8	1.25	.85
FGP-2436F	24 X 36	24 X 40	8.0	3.4	2.0	FGP-2436F8	1.95	1.15
FGP-2448F	24 X 48	24 X 48	9.3	4.4	2.4	FGP-2448F8	2.5	1.35
FGP-32F-TN	28 X 28	32 X 32	6.3	2.2	1.5	FGP-32F8-TN	1.25	.85
FGP-30F	30 X 30	30 X 34	8.1	3.6	2.0	FGP-30F8	2.05	1.15
FGP-36F	36 X 36	36 X 40	9.1	4.6	2.4	FGP-36F8	2.65	1.35
FGP-3648F	36 X 48	40 X 48	11.5	6.8	3.2	FGP-3648F8	3.9	1.85
FGP-48F	48 X 48	48 X 54	13.2	9.5	3.9	FGP-48F8	5.45	2.25
FGP-1633F	16 X 34	18 X 36	6.9	2.3	1.6	FGP-1633F8	1.3	.9
FGP-2234F	22 X 34	24 X 36	8.0	3.4	2.0	FGP-2234F8	1.95	1.15

FloGard Circular Grated Inlet
SPECIFIER CHART

MODEL NUMBER	INLET ID (inches)	GRADE OD (inches)	SOLIDS STORAGE CAPACITY (CU FT)	FILTERED FLOW (CSF)	TOTAL BYPASS CAPACITY (CFS)
FGP-RF15F	15	18	0.3	0.4	2.8
FGP-RF18F	18	20	0.8	0.7	4.7
FGP-RF20F	20	23	0.8	0.7	4.7
FGP-RF21F	21	23.5	0.8	0.7	4.7
FGP-RF22F	22	24	0.8	0.7	4.7
FGP-RF24F	24	26	0.8	0.7	4.7
FGP-RF30F	30	32	2.2	1.5	6.1
FGP-RF36F	36	39	3.6	2.0	8.1


Combination Inlet

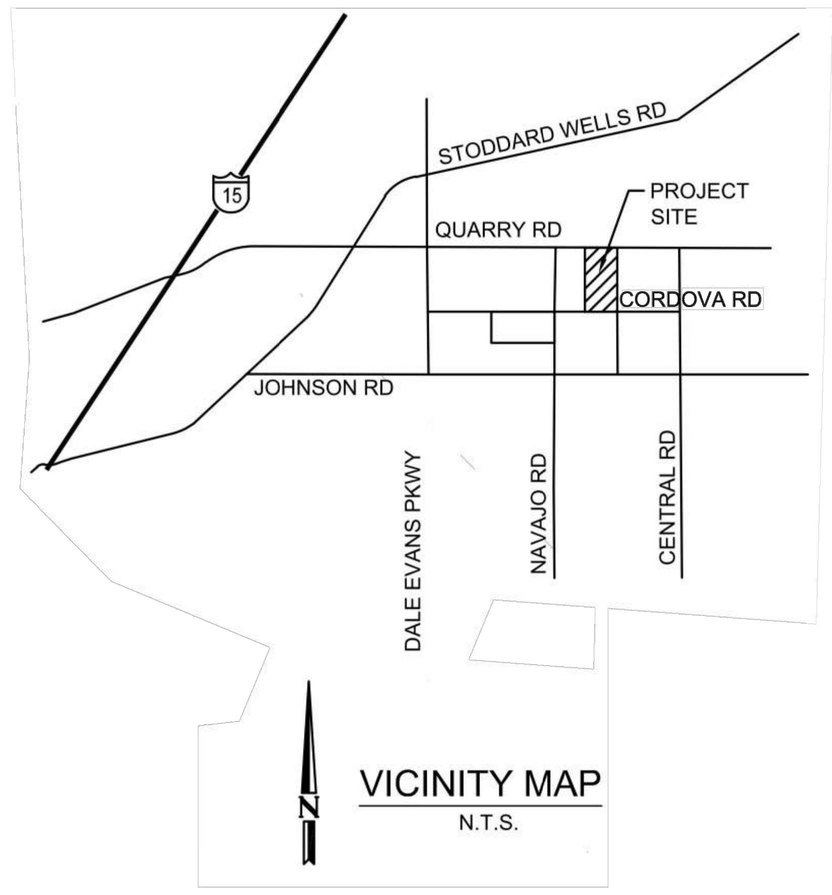

Flat-Grated Inlet


Circular Frame Inlet

Appendix J

Grading Plan

QUARRY ROAD
INDUSTRIAL COMPLEX
TOWN OF APPLE VALLEY



VICINITY MAP
N.T.S.

OWNER/DEVELOPER:

VVLIG INDUSTRIAL
RAMSEY SHEEHAN
JOSH MALHI
9040 LESLIE STREET
RICHMOND, ON
L4B3M4

OWNER'S REPRESENTATIVE :

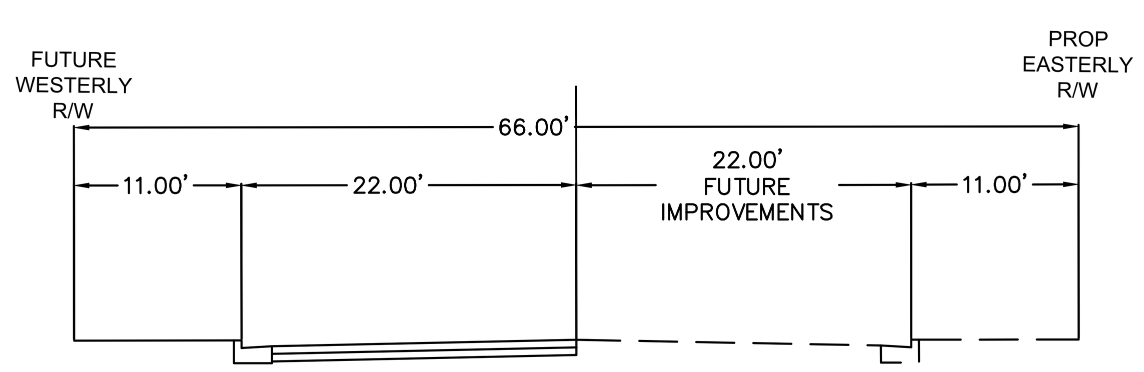
JESSICA HAUGHTON
PRESIDENT
SYNERGY CONSULTING CA.
(760) 330-1715
JHAUGHTON@SYNERGYCONSULTINGCA.COM

ARCHITECT:

STEVE HONG
LHA
4590 MACARTHUR BLVD. SUITE 500
NEWPORT BEACH, CA 92660
(714) 822-1171

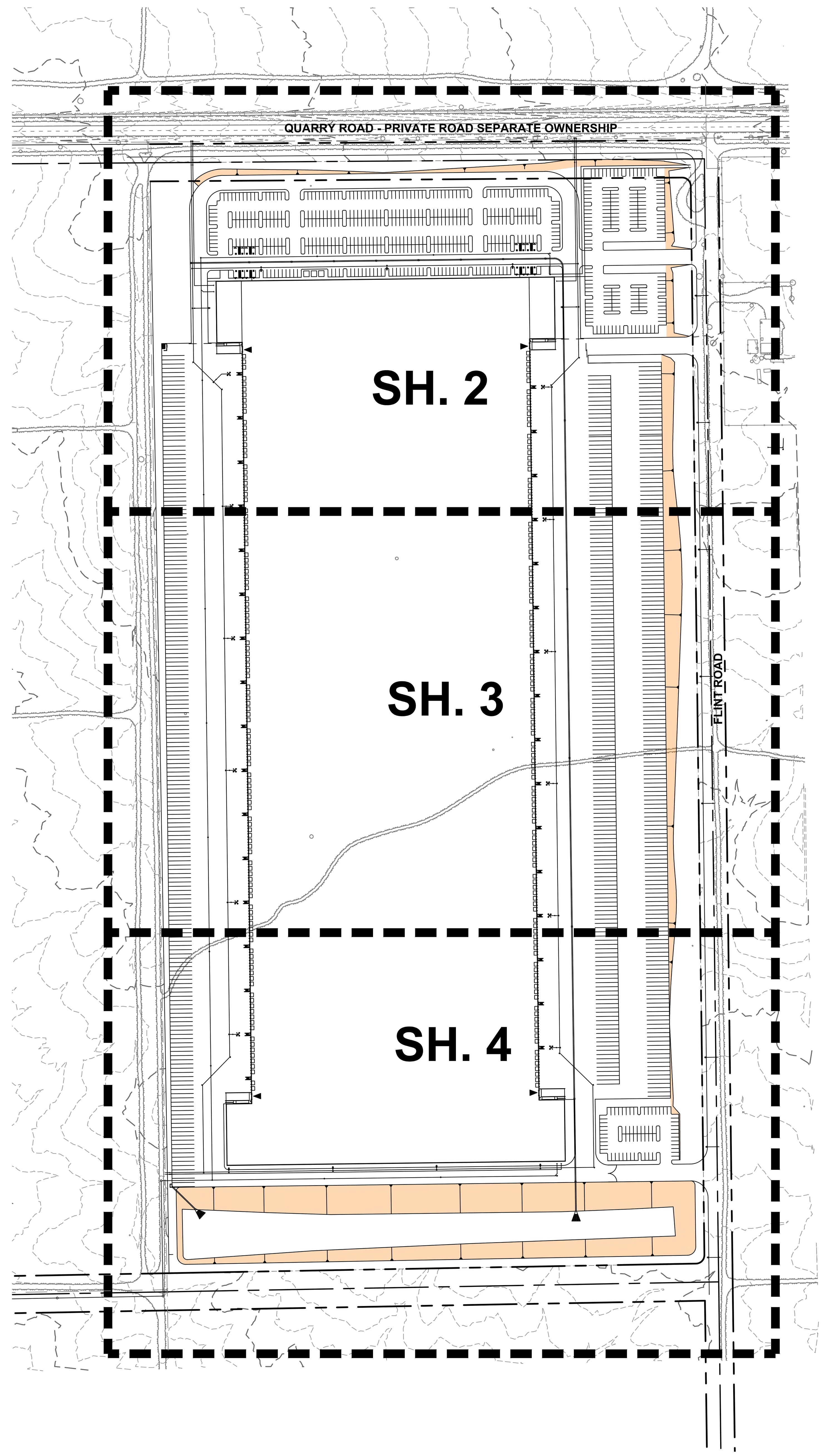
CIVIL ENGINEER:

DEAN PARADISE
DAVID EVANS AND ASSOC. INC
18484 OUTER HWY 18 NORTH SUITE 225
APPLE VALLEY, CA 92307
(760) 524-9123



FLINT ROAD

NOTE:
No construction or
access to Quarry Road.



SHEET INDEX

LAND USE CALCULATION:

GROSS AREA:	11.45 AC
LANDSCAPE AREA	1.72 AC

EARTHWORK NUMBERS:

RAW CUT	423,000 C.Y.
RAW FILL	351,000 C.Y.
NET CUT	72,000 C.Y.

LEGEND:

2800.00 FS	-	PROPOSED FINISHED SURFACE
2800.00 FG	-	PROPOSED FINISHED GRADE
2800.00 TG	-	PROPOSED TOP OF GRATE
(2800.00) FG	-	EXISTING FINISHED GRADE
2800	-	PROPOSED SLOPE
(2800)	-	EXISTING SLOPE
INV	-	INVERT
EX.	-	EXISTING
PROP.	-	PROPOSED
R/W	-	RIGHT OF WAY
P/L	-	PROPERTY LINE
—2800—	-	PROPOSED CONTOUR
—(2800)—	-	EXISTING CONTOUR
	-	PROPOSED RIGHT OF WAY
	-	FUTURE RIGHT OF WAY
	-	DAYLIGHT LINE / LIMITS OF GRADING
	-	CUT/FILL LINE

TOP TOE PROPOSED SLOPE 2:1 MAX.

PROPOSED AC PAVEMENT

PROPOSED PCC PAVEMENT

PROPOSED STORM DRAIN PIPE

PROPOSED STORM DRAIN PIPE FLOW DIRECTION

NOTE:

ALL ELEVATIONS SHOWN ON THIS PLAN HAVE BEEN LOWERED 3100'.

NOT FOR CONSTRUCTION

ENGINEER

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18484 Outer Highway 18 N Suite 225
Apple Valley California 92307
Phone: 760.524.9100
SSchubert@deainc.com

DATE: 10/27/2022

QUARRY ROAD INDUSTRIAL COMPLEX
APN: 0436-214-06 - 09

SITE PLAN REVIEW

KEY MAP AND
GENERAL INFO

FILE NO.

DRAWING NO.

SH. 1 OF 9

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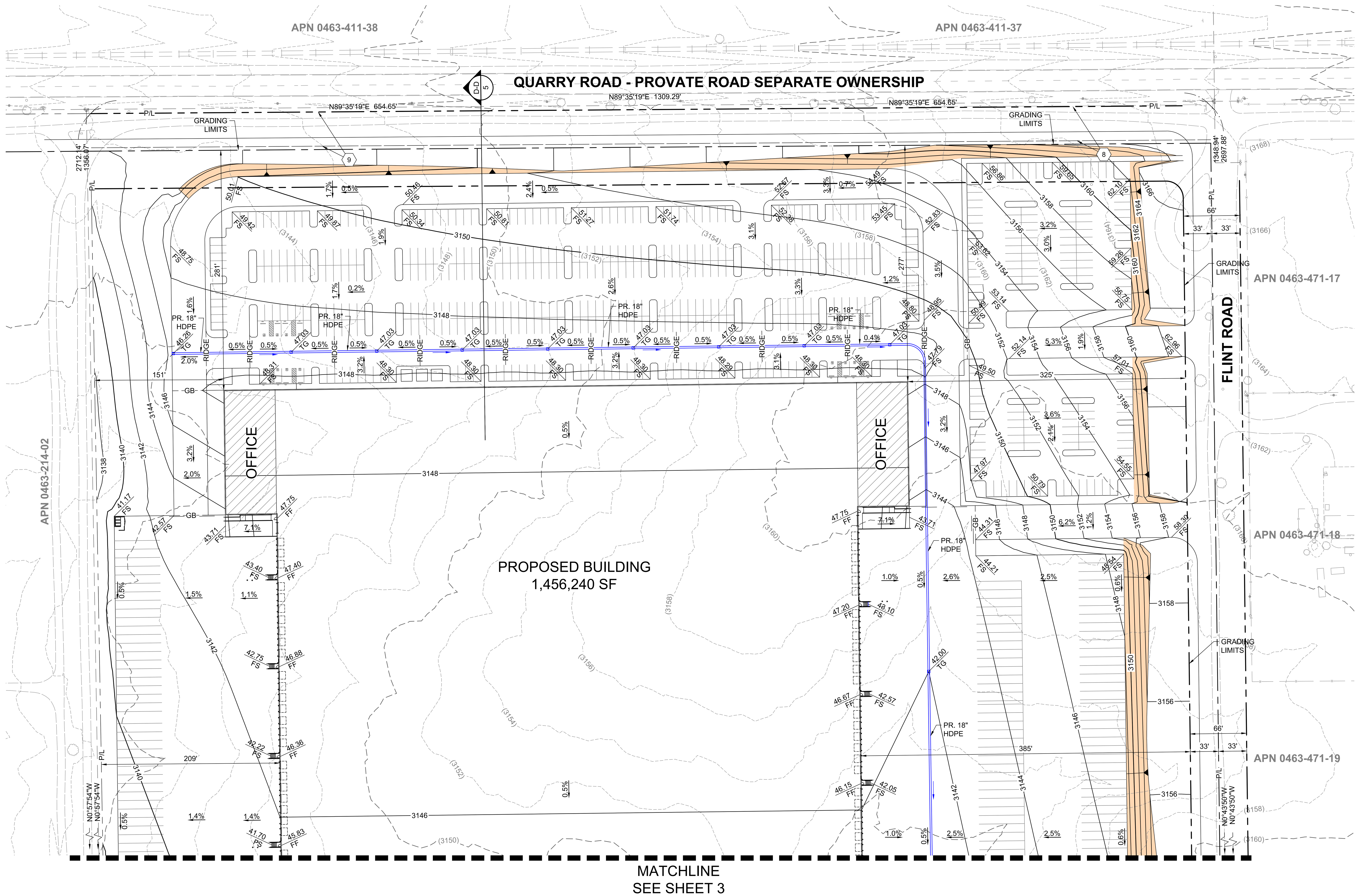


ABBREVIATIONS

BFP	BACK FLOW PREVENTER
C/L	CENTERLINE
C&G	CURB AND GUTTER
CB	CATCH BASIN
EG	EXISTING GROUND
EL.	ELEVATION
ELEC.	ELECTRIC
EX.	EXISTING
FF	FINISH FLOOR
FG	FINISH GRADE
FL	FLOW LINE
FH	FIRE HYDRANT
FS	FINISH SURFACE
FUT.	FUTURE
GB	GRADE BREAK
GUY	GUY ANCHOR
HP	HIGH POINT
INV	INVERT
LF	LINEAR FEET
LP	LOW POINT
P/L	PROPERTY LINE
PE	PAD ELEVATION
PP	POWER POLE
PS	PIPE SLOPE
PR.	PROPOSED
R/W	RIGHT OF WAY
ST.	STREET
SWR	SEWER
TG	TOP OF GRATE
TYP	TYPICAL
WTR	WATER

EASEMENTS

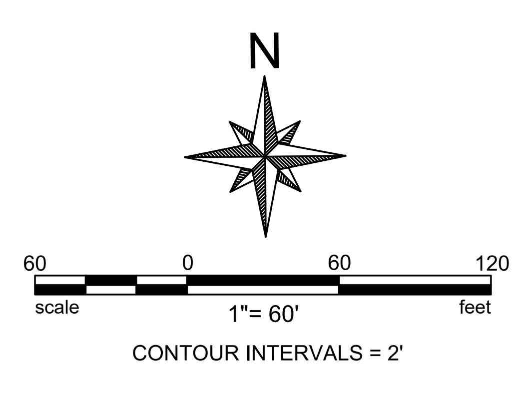
8 A 40' WIDE EASEMENT FOR PIPE LINES, UTILITIES, ACCESS RIGHTS AND INCIDENTAL PURPOSES, RECORDED JUNE 3, 1987 AS INSTRUMENT NO. 87-187992 OF OFFICIAL RECORDS.

9 A 40' WIDE EASEMENT FOR PIPE LINES, UTILITIES, ACCESS RIGHTS AND INCIDENTAL PURPOSES, RECORDED JUNE 3, 1987 AS INSTRUMENT NO. 87-187992 OF OFFICIAL RECORDS.

LEGEND

- TOP / TOE — PROPOSED SLOPE 2:1 MAX.
- PROPOSED AC PAVEMENT
- PROPOSED PCC PAVEMENT
- PROPOSED STORM DRAIN PIPE
- PROPOSED STORM DRAIN PIPE FLOW DIRECTION

NOT FOR CONSTRUCTION



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Apple Valley California 92307
Phone: 760.524.9100
SSchubert@deainc.com

DATE: 10/27/2022

QUARRY ROAD INDUSTRIAL COMPLEX
APN: 0436-214-06 - 09

SITE PLAN REVIEW
CONCEPTUAL GRADING AND DRAINAGE

FILE NO.

DRAWING NO.

SH. 2 OF 9

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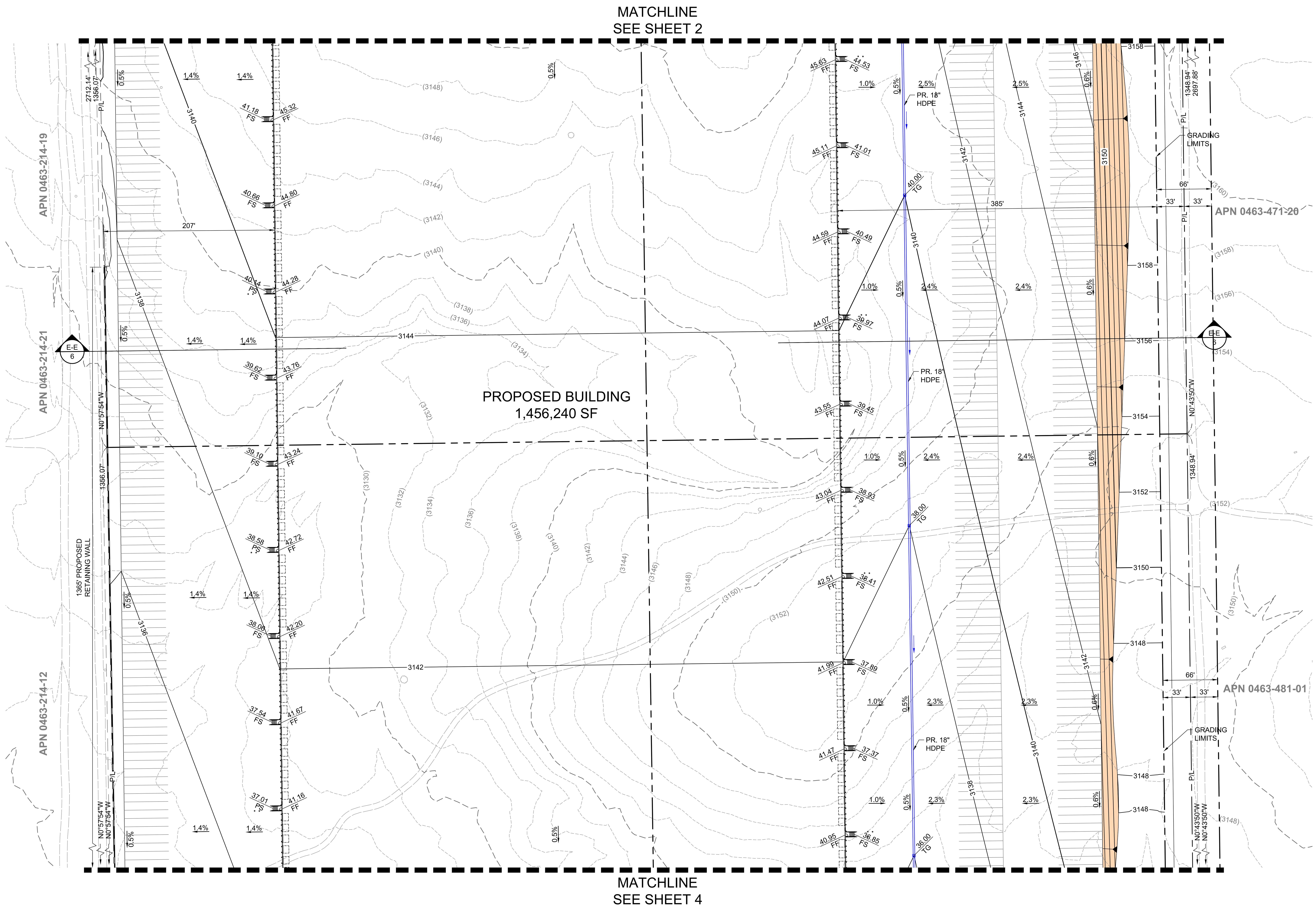

ABBREVIATIONS

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GUY	GUY ANCHOR
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INV	INVERT
LF	LINEAR FEET
LP	LOW POINT
P/L	PROPERTY LINE
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PP	POWER POLE
PS	PIPE SLOPE
PR.	PROPOSED
R/W	RIGHT OF WAY
ST.	STREET
SWR	SEWER
TG	TOP OF GRATE
TYP	TYPICAL
WTR	WATER

LEGEND

TOP / TOE PROPOSED SLOPE 2:1 MAX.

PROPOSED AC PAVEMENT

PROPOSED PCC PAVEMENT

PROPOSED STORM DRAIN PIPE

PROPOSED STORM DRAIN PIPE FLOW DIRECTION

NOT FOR CONSTRUCTION

N

60 0 60 120
scale 1"= 60' feet
CONTOUR INTERVALS = 2'

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Save Date: 11/2/2022 2:21 PM By: Jfa

ENGINEER

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Phone: 760.524.9100
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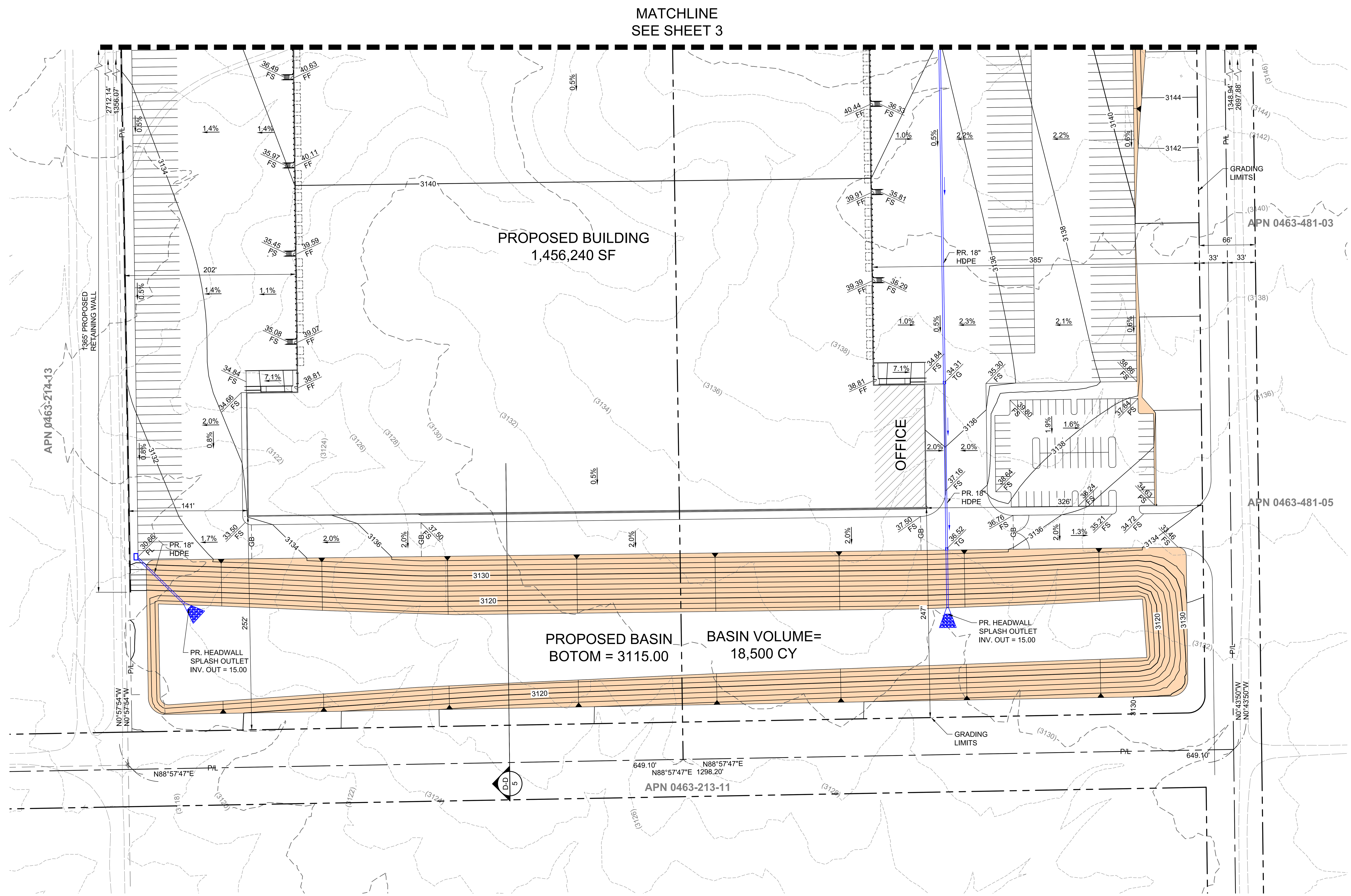
DATE: 10/27/2022

QUARRY ROAD INDUSTRIAL COMPLEX
APN: 0436-214-06 - 09

SITE PLAN REVIEW
CONCEPTUAL GRADING
AND DRAINAGE

FILE NO.

DRAWING NO.



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FG	FINISH GRADE
FL	FLOW LINE
FH	FIRE HYDRANT
FS	FINISH SURFACE
FUT.	FUTURE
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GUY	GUY ANCHOR
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SWR	SEWER
TG	TOP OF GRATE
TYP	TYPICAL
WTR	WATER

LEGEND

TOP / TOE — PROPOSED SLOPE 2:1 MAX.

PROPOSED AC PAVEMENT

PROPOSED PCC PAVEMENT

PROPOSED STORM DRAIN PIPE

PROPOSED STORM DRAIN PIPE FLOW DIRECTION

NOT FOR CONSTRUCTION

N

60 0 60 120
scale 1"= 60' feet
CONTOUR INTERVALS = 2'

ENGINEER
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SSchubert@deainc.com

DATE: 10/27/2022

QUARRY ROAD INDUSTRIAL COMPLEX
APN: 0436-214-06 - 09

SITE PLAN REVIEW

CONCEPTUAL GRADING
AND DRAINAGE

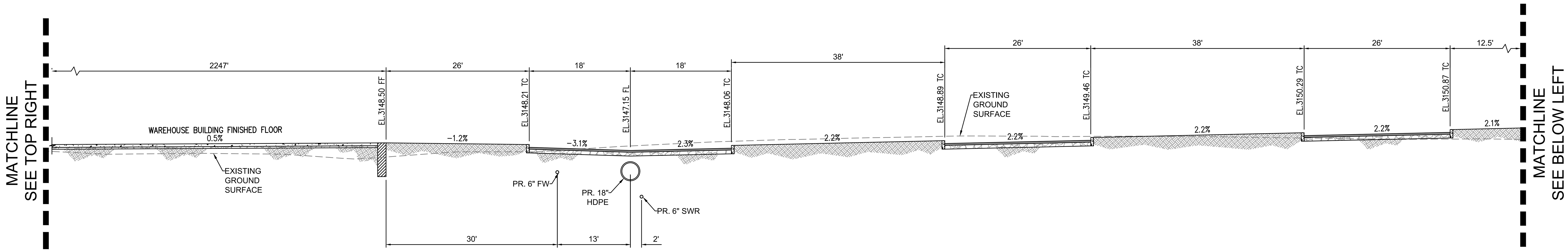
FILE NO.

DRAWING NO.

SH. 4 OF 9

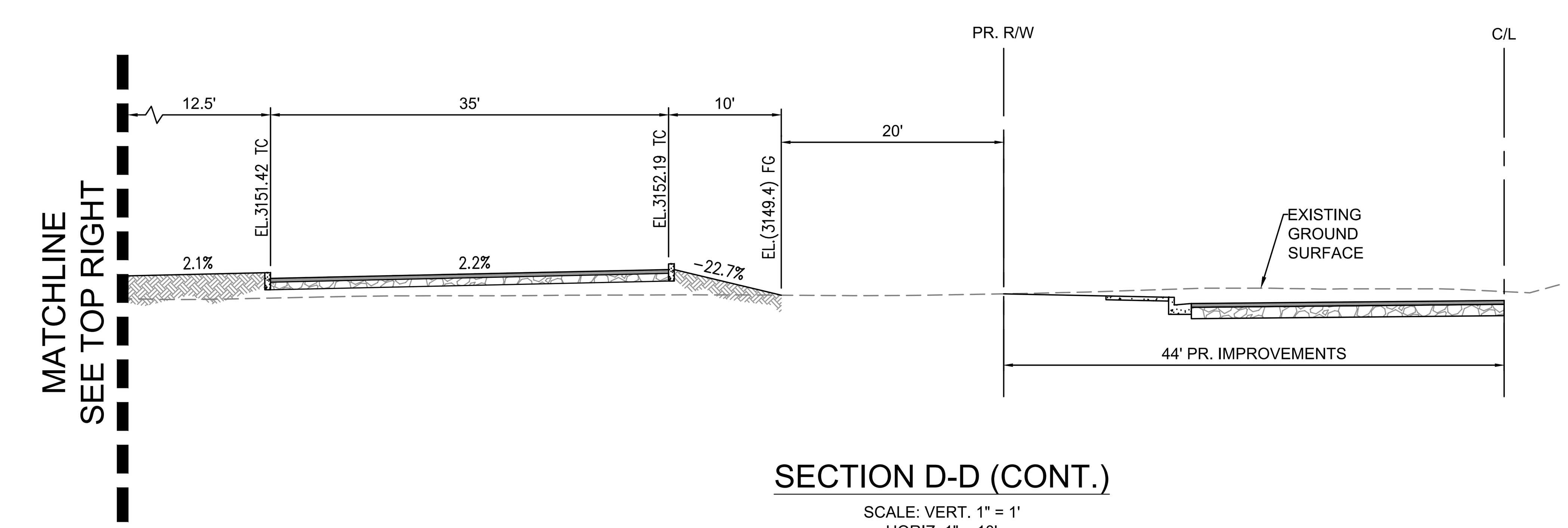
SECTION D-D

SCALE: VERT. 1" = 1'
HORIZ. 1" = 10'



SECTION D-D (CONT.)

SCALE: VERT. 1" = 1'
HORIZ. 1" = 10'



SECTION D-D (CONT.)

SCALE: VERT. 1" = 1'
HORIZ. 1" = 10'

NOT FOR CONSTRUCTION

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QUARRY ROAD INDUSTRIAL COMPLEX APN: 0436-214-06 - 09	
SITE PLAN REVIEW	FILE NO.
CONCEPTUAL GRADING SECTIONS	DRAWING NO. SH. 5 OF 9

Plot Date: 11/2/2022 2:23 PM By: Jose Aguilar
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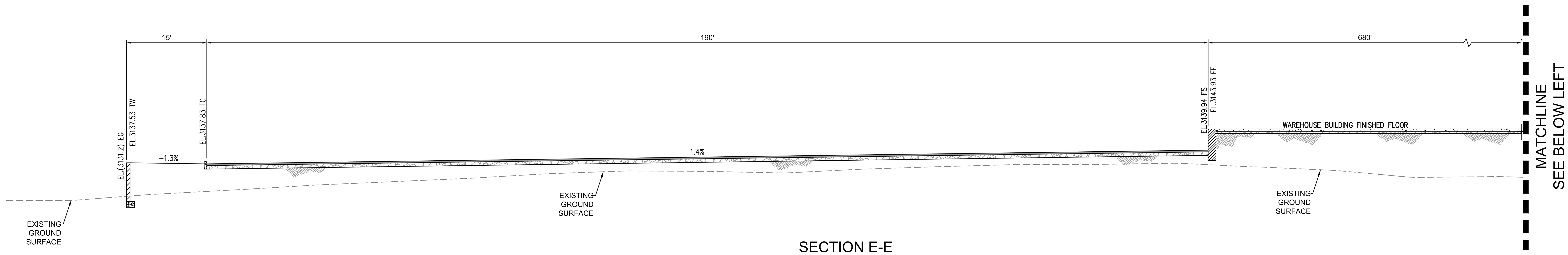
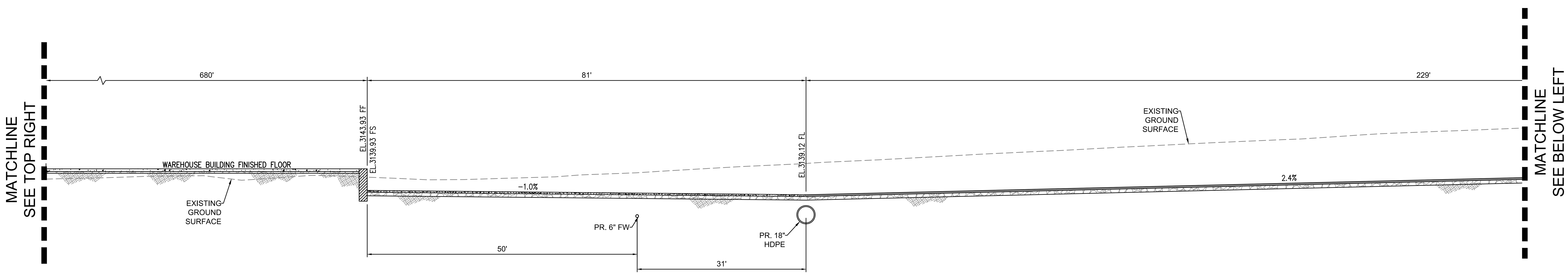


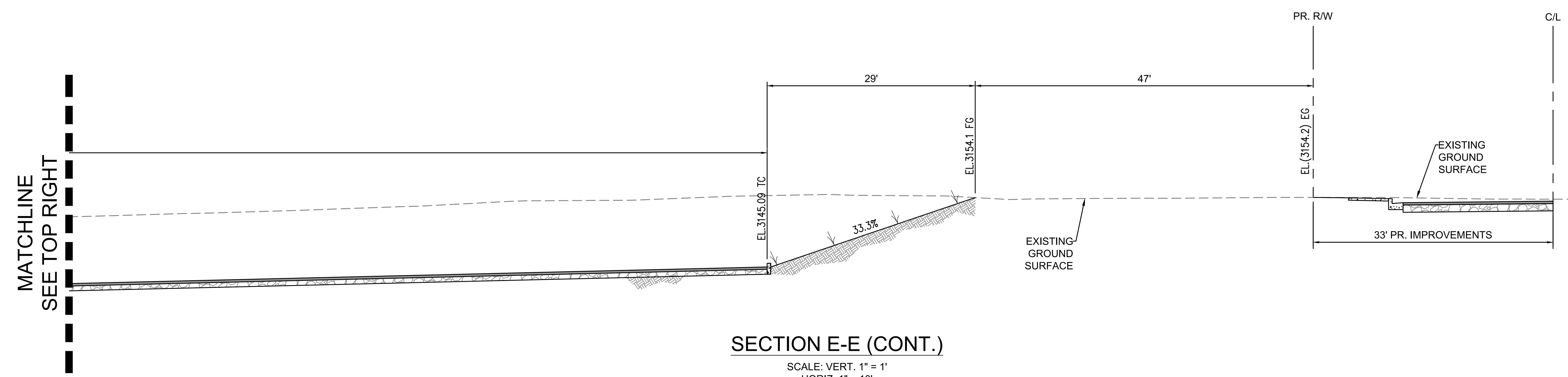
SECTION E-E

SCALE: VERT. 1" = 1'
HORIZ. 1" = 10'



SECTION E-E (CONT.)

SCALE: VERT. 1" = 1'
HORIZ. 1" = 10'



SECTION E-E (CONT.)

SCALE: VERT. 1" = 1'
HORIZ. 1" = 10'

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SITE PLAN REVIEW
CONCEPTUAL GRADING
SECTIONS

FILE NO.

DRAWING NO.

SH. 6 OF 9

Plot Date: 11/2/2022 2:23 PM By: Jose Aguilar File: P:\V\VVLI00000001\0400CAD\SHEETS\EC\Conceptual Grading\005-Quarry-Conceptual Grading-VVLI00000001.dwg
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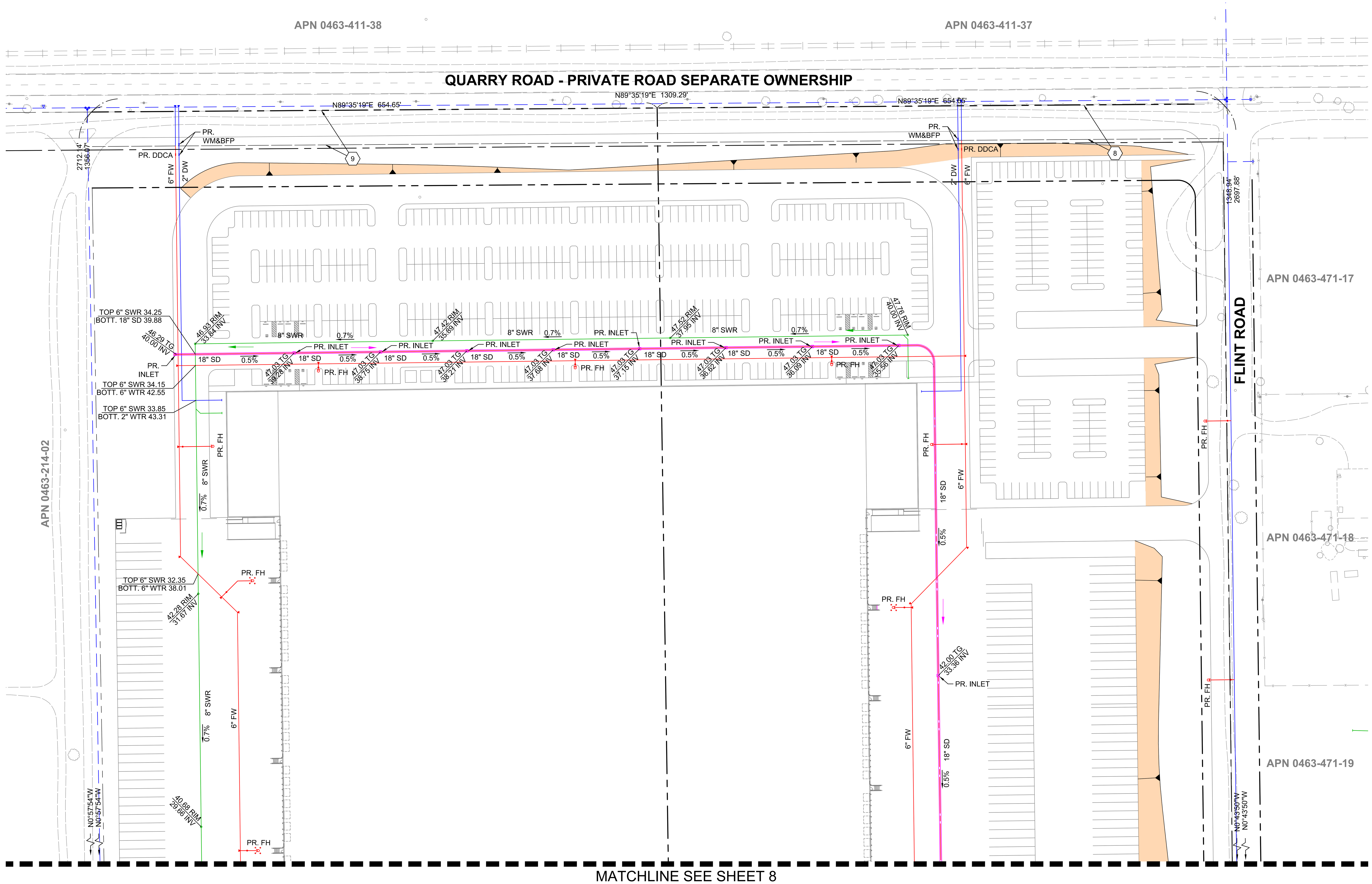

ABBREVIATIONS

BFP	BACK FLOW PREVENTER
C/L	CENTERLINE
C&G	CURB AND GUTTER
CB	CATCH BASIN
EG	EXISTING GROUND
EL.	ELEVATION
ELEC.	ELECTRIC
EX.	EXISTING
FF	FINISH FLOOR
FG	FINISH GRADE
FL	FLOW LINE
FH	FIRE HYDRANT
FS	FINISH SURFACE
FUT.	FUTURE
GB	GRADE BREAK
GUY	GUY ANCHOR
HP	HIGH POINT
INV	INVERT
LF	LINEAR FEET
LP	LOW POINT
P/L	PROPERTY LINE
PE	PAD ELEVATION
PP	POWER POLE
PS	PIPE SLOPE
PR.	PROPOSED
R/W	RIGHT OF WAY
ST.	STREET
SWR	SEWER
TG	TOP OF GRATE
TYP	TYPICAL
WTR	WATER

EASEMENTS

8 A 40' WIDE EASEMENT FOR PIPE LINES, UTILITIES, ACCESS RIGHTS AND INCIDENTAL PURPOSES, RECORDED JUNE 3, 1987 AS INSTRUMENT NO. 87-187992 OF OFFICIAL RECORDS.

9 A 40' WIDE EASEMENT FOR PIPE LINES, UTILITIES, ACCESS RIGHTS AND INCIDENTAL PURPOSES, RECORDED JUNE 3, 1987 AS INSTRUMENT NO. 87-187992 OF OFFICIAL RECORDS.

UTILITY LEGEND

- PROPOSED FIRE WATER SERVICE/MAIN
- PROPOSED DOMESTIC WATER SERVICE/MAIN
- PROPOSED SEWER SERVICE/MAIN
- PROPOSED STORM DRAIN
- PROPOSED SEWER PIPE FLOW DIRECTION
- PROPOSED STORM DRAIN PIPE FLOW DIRECTION

LEGEND

- TOP / TOE PROPOSED SLOPE 2:1 MAX.
- PROPOSED AC PAVEMENT
- PROPOSED PCC PAVEMENT
- PROPOSED STORM DRAIN PIPE
- PROPOSED STORM DRAIN PIPE FLOW DIRECTION

NOT FOR CONSTRUCTION

N

60 0 60 120
scale feet
1"= 60'
CONTOUR INTERVALS = 2'

Plot Date: 11/2/2022 2:24 PM By: Jose Aguilar
Save Date: 11/2/2022 1:47 PM By: Jla
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QUARRY ROAD INDUSTRIAL COMPLEX
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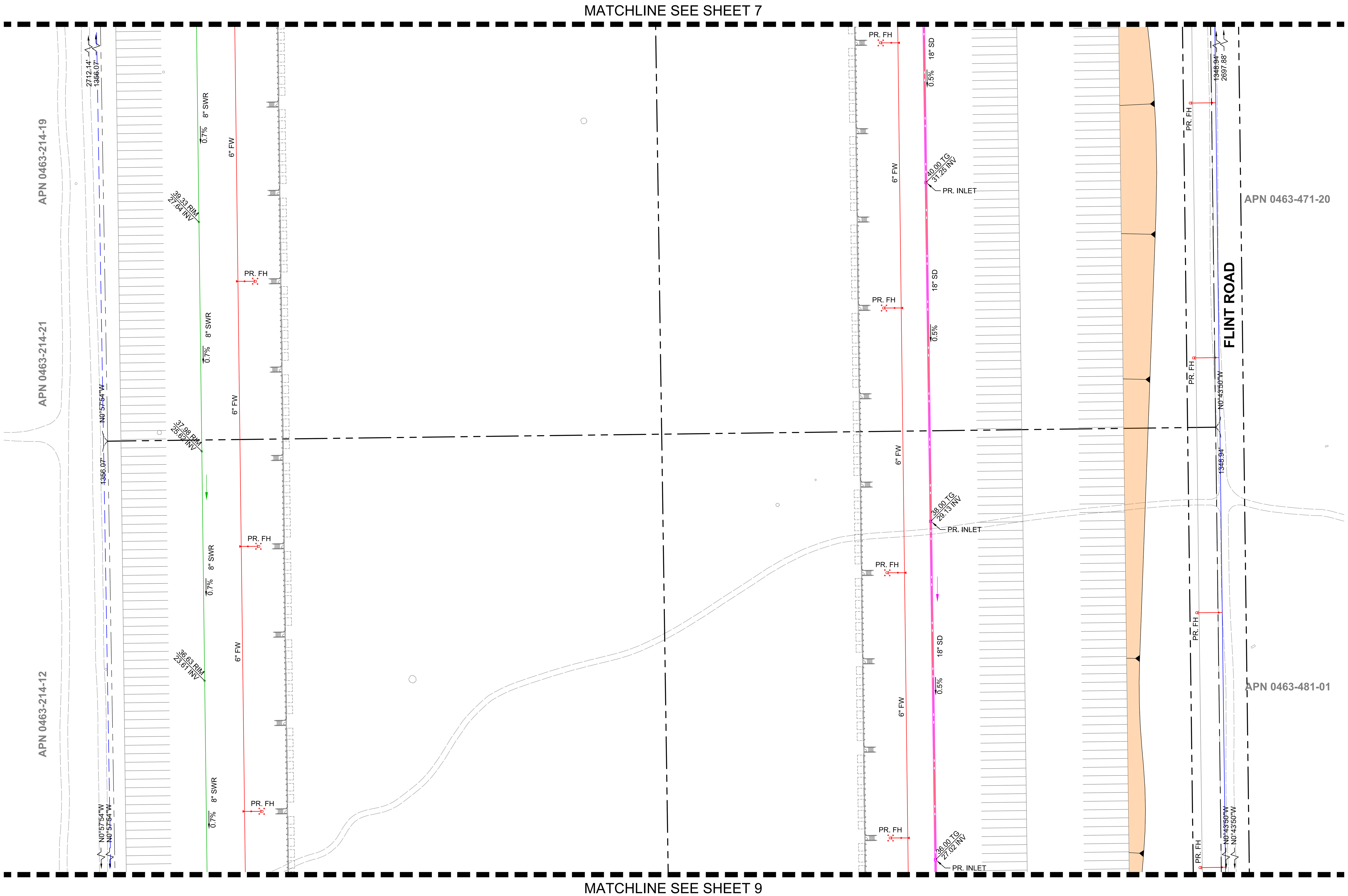
SITE PLAN REVIEW
CONCEPTUAL WET
UTILITY PLAN

FILE NO.

DRAWING NO.

SH. 7 OF 9



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- PROPOSED SEWER SERVICE/MAIN
- PROPOSED STORM DRAIN
- PROPOSED SEWER PIPE FLOW DIRECTION
- PROPOSED STORM DRAIN PIPE FLOW DIRECTION

LEGEND

- TOP / TOE PROPOSED SLOPE 2:1 MAX.
- PROPOSED AC PAVEMENT
- PROPOSED PCC PAVEMENT
- PROPOSED STORM DRAIN PIPE
- PROPOSED STORM DRAIN PIPE FLOW DIRECTION

NOT FOR CONSTRUCTION

N

60 0 60 120
scale 1"= 60' feet
CONTOUR INTERVALS = 2'

Plot Date: 11/2/2022 2:24 PM By: Jose Aguilar
Save Date: 11/2/2022 1:48 PM By: Jfa
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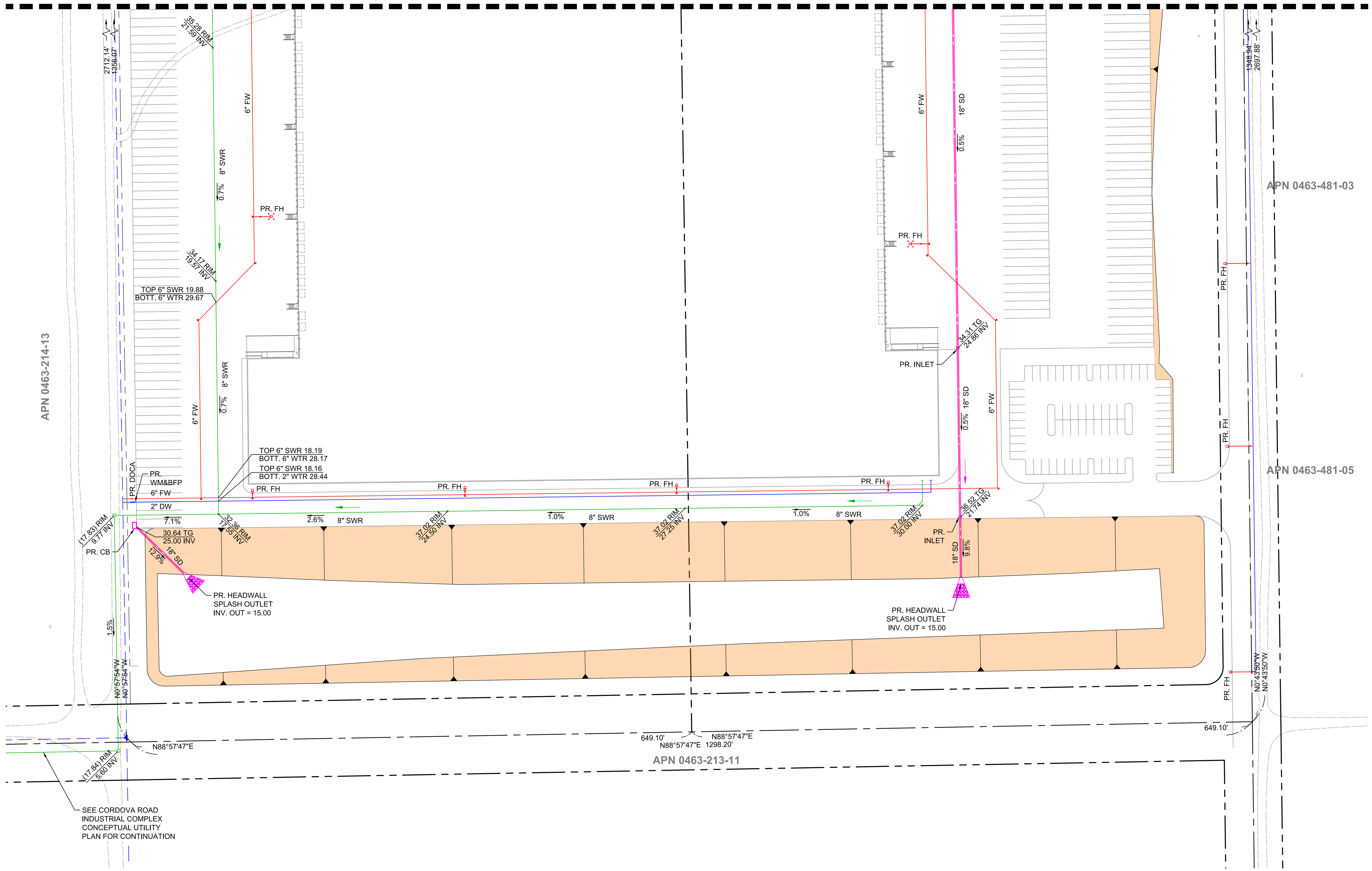
SITE PLAN REVIEW
CONCEPTUAL WET
UTILITY PLAN

FILE NO.

DRAWING NO.

MATCHLINE SEE SHEET 8



N

60 0 60 120
scale 1"= 60' feet

CONTOUR INTERVALS = 2'

ABBREVIATIONS

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SITE PLAN REVIEW
CONCEPTUAL WET UTILITY PLAN

FILE NO.

DRAWING NO.