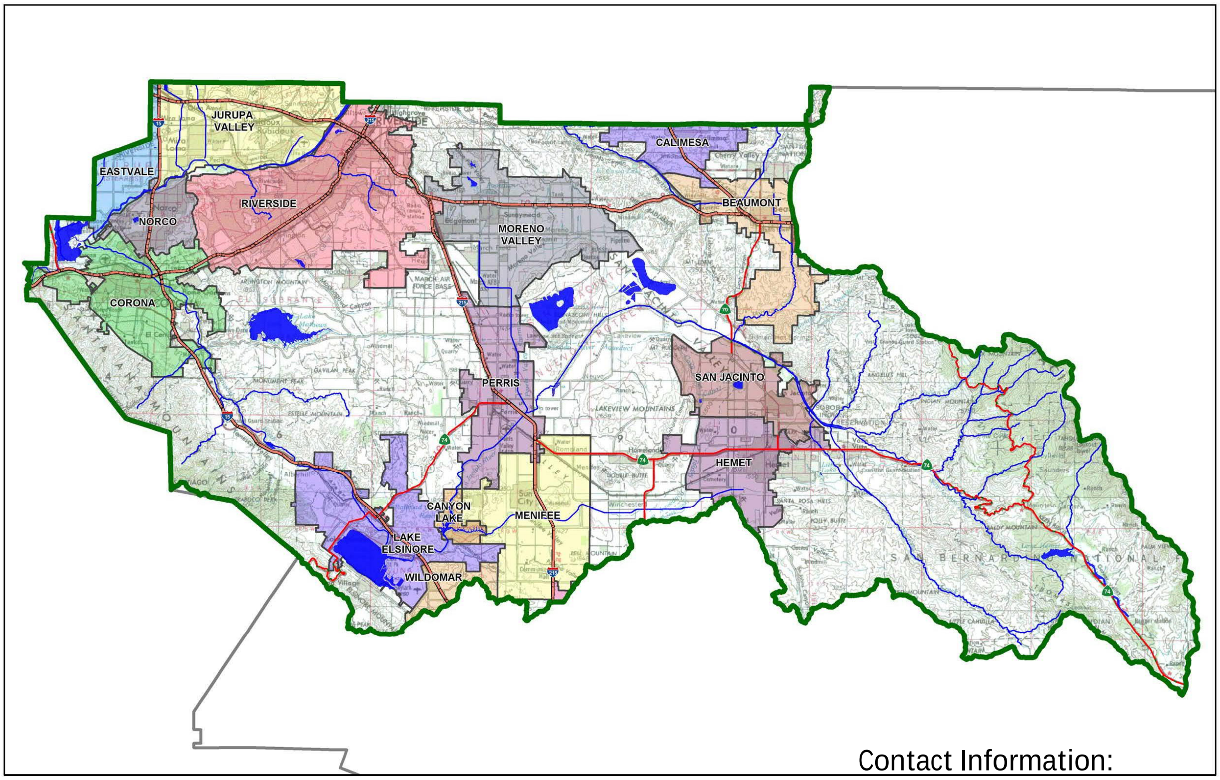
Project Specific Water Quality Management Plan

A Template for Projects located within the Santa Ana Watershed Region of Riverside County

Project Title: Center of Excellence and Wildlife Conservancy

Development No: CUP21-0005

Design Review/Case No: CUP21-0005



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☒ Preliminary
☐ Final

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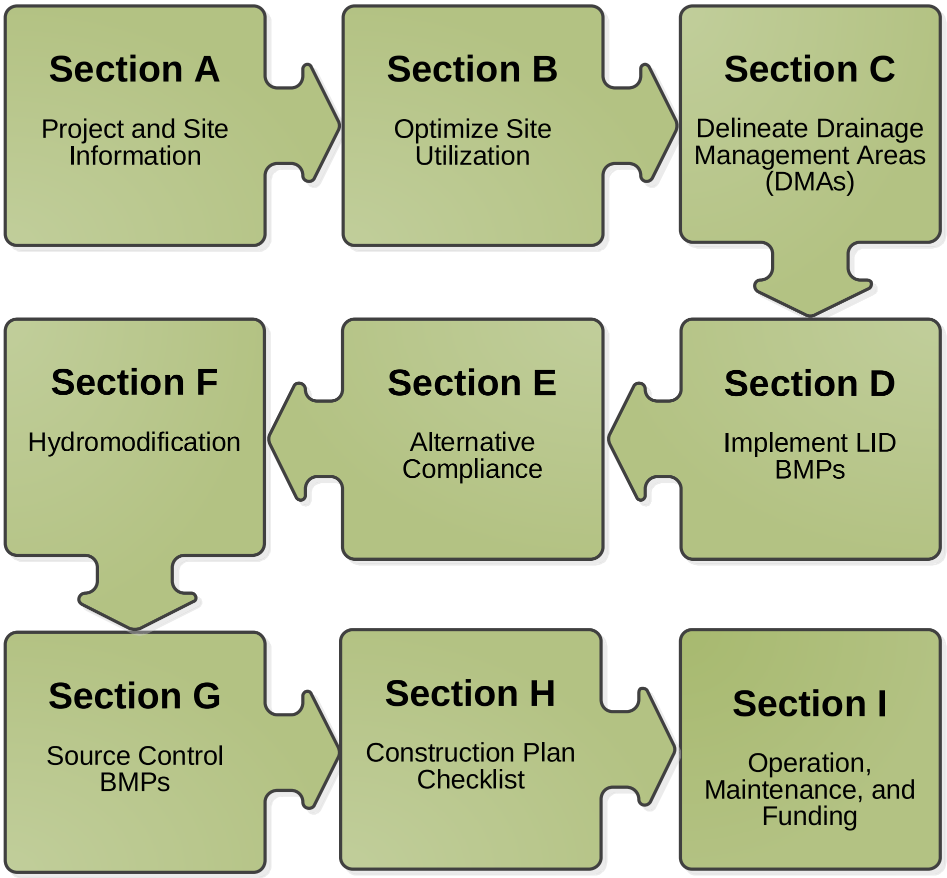
Prepared for Compliance with
Regional Board Order No. R8-2010-0033
Template revised June 30, 2016

A Brief Introduction

This Project-Specific WQMP Template for the Santa Ana Region has been prepared to help guide you in documenting compliance for your project. Because this document has been designed to specifically document compliance, you will need to utilize the WQMP Guidance Document as your "how-to" manual to help guide you through this process. Both the Template and Guidance Document go hand-in-hand, and will help facilitate a well prepared Project-Specific WQMP. Below is a flowchart for the layout of this Template that will provide the steps required to document compliance.



OWNER’S CERTIFICATION

This Project-Specific Water Quality Management Plan (WQMP) has been prepared for Rahn Conservation Consulting by Valued Engineering for the Center of Excellence and Wildlife Conservancy project.

This WQMP is intended to comply with the requirements of Riverside County for 754 which includes the requirement for the preparation and implementation of a Project-Specific WQMP.

The undersigned, while owning the property/project described in the preceding paragraph, shall be responsible for the implementation and funding of this WQMP and will ensure that this WQMP is amended as appropriate to reflect up-to-date conditions on the site. In addition, the property owner accepts responsibility for interim operation and maintenance of Stormwater BMPs until such time as this responsibility is formally transferred to a subsequent owner. This WQMP will be reviewed with the facility operator, facility supervisors, employees, tenants, maintenance and service contractors, or any other party (or parties) having responsibility for implementing portions of this WQMP. At least one copy of this WQMP will be maintained at the project site or project office in perpetuity. The undersigned is authorized to certify and to approve implementation of this WQMP. The undersigned is aware that implementation of this WQMP is enforceable under Riverside County Water Quality Ordinance (Municipal Code Section754).

"I, the undersigned, certify under penalty of law that the provisions of this WQMP have been reviewed and accepted and that the WQMP will be transferred to future successors in interest."

Owner’s Signature

Date

Owner’s Printed Name

Owner’s Title/Position

PREPARER’S CERTIFICATION

“The selection, sizing and design of stormwater treatment and other stormwater quality and quantity control measures in this plan meet the requirements of Regional Water Quality Control Board Order No. R8-2010-0033 and any subsequent amendments thereto.”

Preparer’s Signature

Date

Preparer’s Printed Name

Preparer’s Title/Position

Preparer’s Licensure:

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Section A: Project and Site Information

PROJECT INFORMATION

Type of Project:	Residential Care Facility
Planning Area:	San Jacinto Valley
Community Name:	Cactus Valley
Development Name:	Center of Excellence and Wildlife Conservancy

PROJECT LOCATION

Latitude & Longitude (DMS): 33°40'2.52"N, 116°54'8.54"W

Project Watershed and Sub-Watershed: Santa Ana - San Johns Canyon

Gross Acres: Approximately 48 acres (Per LLA210115)

APN(s): Portion of 569-020-024, -025, -026

Map Book and Page No.: Riverside County Roadbook & Page 123

PROJECT CHARACTERISTICS

Proposed or Potential Land Use(s)	Residential Care
Proposed or Potential SIC Code(s)	8361
Area of Impervious Project Footprint (SF)	24692
Total Area of <u>proposed</u> Impervious Surfaces within the Project Footprint (SF)/or Replacement	24692
Does the project consist of offsite road improvements?	☐ Y ☒ N
Does the project propose to construct unpaved roads?	☐ Y ☒ N
Is the project part of a larger common plan of development (phased project)?	☐ Y ☒ N

EXISTING SITE CHARACTERISTICS

Total area of <u>existing</u> Impervious Surfaces within the Project limits Footprint (SF)	186644
Is the project located within any MSHCP Criteria Cell?	☒ Y ☐ N
If so, identify the Cell number:	4634,4636,4731,4732
Are there any natural hydrologic features on the project site?	☒ Y ☐ N
Is a Geotechnical Report attached?	☐ Y ☒ N
If no Geotech. Report, list the NRCS soils type(s) present on the site (A, B, C and/or D)	A & B, D
What is the Water Quality Design Storm Depth for the project?	0.706

<u>Provide a brief description of the project:</u>

The Paradise Valley Ranch property is located in the unincorporated southwest Riverside County, east of the City of Hemet, approximately 4 miles east of State Street, at the terminus of Cactus Valley Road. The site address is 43700 Cactus Valley Road. Currently, the County of Riverside is processing a Lot Line Adjustment (LLA) involving three parcels [Assessor Parcel Numbers (APN) 569-020-024, -025, and -026] on the Paradise Valley Ranch property. Once this LLA has been processed (LLA210115), one of the three parcels (approximately 48-acres) will be used for a Conditional Use Permit (CUP) that is required for the proposed Project. This parcel will be referred to as the "CUP Parcel". The ultimate APN for the CUP Parcel will be determined upon finalization and recordation of the LLA.

The Paradise Valley Ranch Project CUP proposes the remodeling of five (5) existing structures and potential future development of two (2) new structures into the west coast "Center of Excellence" for firefighter drug and alcohol addiction recovery and a research/training site for the Wildfire Conservancy hereby known as Facility 6 (located in Northeast) and Facility 7 (located in Southwest). Other improvements will include pervious parking area, landscape, curbs, and Class II base roadway for fire access.

A.1 Maps and Site Plans

When completing your Project-Specific WQMP, include a map of the local vicinity and existing site. In addition, include all grading, drainage, landscape/plant palette and other pertinent construction plans in Appendix 2. At a minimum, your WQMP Site Plan should include the following:

- Drainage Management Areas
- Proposed Structural BMPs
- Drainage Path
- Drainage Infrastructure, Inlets, Overflows
- Source Control BMPs
- Buildings, Roof Lines, Downspouts
- Impervious Surfaces
- Standard Labeling
- BMP Locations (Lat/Long)

Use your discretion on whether or not you may need to create multiple sheets or can appropriately accommodate these features on one or two sheets. Keep in mind that the Co-Permittee plan reviewer must be able to easily analyze your project utilizing this template and its associated site plans and maps.

A.2 Identify Receiving Waters

Using Table A.1 below, list in order of upstream to downstream, the receiving waters that the project site is tributary to. Continue to fill each row with the Receiving Water's 303(d) listed impairments (if any), designated beneficial uses, and proximity, if any, to a RARE beneficial use. Include a map of the receiving waters in Appendix 1.

Table A.1 Identification of Receiving Waters

Receiving Waters	EPA Approved 303(d) List Impairments	Designated Beneficial Uses	Proximity to RARE Beneficial Use
Canyon Lake (Railroad Canyon Resevior)	Nutrients	MUN, AGR, GWR, REC1,REC2, COMM, WARM, WILD	
Lake elsinore	DDT, Nutrients, Orangic Encrichmenet/Low Dissolved Oxygen,PCB, Toxicity	GWR, REC1, REC2, COMM, WARM, WILD, RARE	

A.3 Additional Permits/Approvals required for the Project:

Table A.2 Other Applicable Permits

Agency	Permit Required	
State Department of Fish and Game, 1602 Streambed Alteration Agreement	☐ Y	☒ N
State Water Resources Control Board, Clean Water Act (CWA) Section 401 Water Quality Cert.	☐ Y	☒ N
US Army Corps of Engineers, CWA Section 404 Permit	☐ Y	☒ N
US Fish and Wildlife, Endangered Species Act Section 7 Biological Opinion	☐ Y	☒ N
Statewide Construction General Permit Coverage	☒ Y	☐ N
Statewide Industrial General Permit Coverage	☐ Y	☒ N
Western Riverside MSHCP Consistency Approval (e.g., JPR, DBESP)	☒ Y	☐ N
Other (please list in the space below as required) County of Riverside Grading Permit	☒ Y	☐ N

If yes is answered to any of the questions above, the Co-Permittee may require proof of approval/coverage from those agencies as applicable including documentation of any associated requirements that may affect this Project-Specific WQMP.

Section B: Optimize Site Utilization (LID Principles)

Review of the information collected in Section 'A' will aid in identifying the principal constraints on site design and selection of LID BMPs as well as opportunities to reduce imperviousness and incorporate LID Principles into the site and landscape design. For example, constraints might include impermeable soils, high groundwater, groundwater pollution or contaminated soils, steep slopes, geotechnical instability, high-intensity land use, heavy pedestrian or vehicular traffic, utility locations or safety concerns. Opportunities might include existing natural areas, low areas, oddly configured or otherwise unbuildable parcels, easements and landscape amenities including open space and buffers (which can double as locations for bioretention BMPs), and differences in elevation (which can provide hydraulic head). Prepare a brief narrative for each of the site optimization strategies described below. This narrative will help you as you proceed with your LID design and explain your design decisions to others.

The 2010 Santa Ana MS4 Permit further requires that LID Retention BMPs (Infiltration Only or Harvest and Use) be used unless it can be shown that those BMPs are infeasible. Therefore, it is important that your narrative identify and justify if there are any constraints that would prevent the use of those categories of LID BMPs. Similarly, you should also note opportunities that exist which will be utilized during project design. Upon completion of identifying Constraints and Opportunities, include these on your WQMP Site plan in Appendix 1.

Consideration of "highest and best use" of the discharge should also be considered. For example, Lake Elsinore is evaporating faster than runoff from natural precipitation can recharge it. Requiring infiltration of 85% of runoff events for projects tributary to Lake Elsinore would only exacerbate current water quality problems associated with Pollutant concentration due to lake water evaporation. In cases where rainfall events have low potential to recharge Lake Elsinore (i.e. no hydraulic connection between groundwater to Lake Elsinore, or other factors), requiring infiltration of Urban Runoff from projects is counterproductive to the overall watershed goals. Project proponents, in these cases, would be allowed to discharge Urban Runoff, provided they used equally effective filtration-based BMPs.

Site Optimization

The following questions are based upon Section 3.2 of the WQMP Guidance Document. Review of the WQMP Guidance Document will help you determine how best to optimize your site and subsequently identify opportunities and/or constraints, and document compliance.

Did you identify and preserve existing drainage patterns? If so, how? If not, why?

Yes, the historical drainage pattern will not be altered. Utilizing existing flowlines.

Did you identify and protect existing vegetation? If so, how? If not, why?

Yes, development is proposing two ±9,000 SF building and required parking lot on 48 Acre parcel after LLA210115 has been recorded. Minimized distrubed area in and around building for grading and parking lot. Utilizing pervious concrete for parking lot.

Did you identify and preserve natural infiltration capacity? If so, how? If not, why?

Yes, the majority of the site will be left unaltered to prevserve the natural infiltration. Only areas under the proposed building will be compacted for strutrual integrity. Graded slopes around the proposed building will be compacted to prevent erosion and sediement downstream. Proposed parking lot will utilize pervious concrete/pavers to promote infiltration.

Did you identify and minimize impervious area? If so, how? If not, why?

Yes, development is proposing two ±9,000 SF building and required parking lot on 48 Acre parcel after LLA210115 has been recorded. Minimized distrubed area in and around building for grading and parking lot. Utilizing pervious concrete for parking lot.

Did you identify and disperse runoff to adjacent pervious areas? If so, how? If not, why?

Yes, roof drain will discharge to natural pervious area and captured in an infiltration basin.

Section C: Delineate Drainage Management Areas (DMAs)

Utilizing the procedure in Section 3.3 of the WQMP Guidance Document which discusses the methods of delineating and mapping your project site into individual DMAs, complete Table C.1 below to appropriately categorize the types of classification (e.g., Type A, Type B, etc.) per DMA for your project site. Upon completion of this table, this information will then be used to populate and tabulate the corresponding tables for their respective DMA classifications.

Table C.1 DMA Classifications

DMA Name or ID	Surface Type(s)[1,2]	Area (Sq. Ft.)	DMA Type
DMA 1	Roof,Pervious Concrete, Ornamental Landscape, Decomposed Granite	139,208	D
DMA 2	Roof,Pervious Concrete, Ornamental Landscape	32,735	D

[1] Reference Table 2-1 in the WQMP Guidance Document to populate this column

[2] If multi-surface provide back-up

Table C.2 Type 'A', Self-Treating Areas

DMA Name or ID	Area (Sq. Ft.)	Stabilization Type	Irrigation Type (if any)

Table C.3 Type 'B', Self-Retaining Areas

Self-Retaining Area				Type 'C' DMAs that are draining to the Self-Retaining Area		
DMA Name/ ID	Post-project surface type	Area (square feet)	Storm Depth (inches)	DMA Name / ID	[C] from Table C.4 =	Required Retention Depth (inches)
		[A]	[B]		[C]	[D]

$$[D] = [B] + \frac{[B] \cdot [C]}{[A]}$$

Table C.4 Type ‘C’, Areas that Drain to Self-Retaining Areas

DMA					Receiving Self-Retaining DMA		
DMA Name/ ID	Area (square feet)	Post-project surface type	Impervious fraction	Product	DMA name /ID	Area (square feet)	Ratio
	[A]		[B]	[C] = [A] x [B]		[D]	[C]/[D]

Table C.5 Type ‘D’, Areas Draining to BMPs

DMA Name or ID	BMP Name or ID
DMA 1	Infiltration Basin 1
DMA 2	Infiltration Basin 2

Note: More than one drainage management area can drain to a single LID BMP, however, one drainage management area may not drain to more than one BMP.

Section D: Implement LID BMPs

D.1 Infiltration Applicability

Is there an approved downstream ‘Highest and Best Use’ for stormwater runoff (see discussion in Chapter 2.4.4 of the WQMP Guidance Document for further details)? ☒ Y ☒ N

If yes has been checked, Infiltration BMPs shall not be used for the site; proceed to section D.3

If no, continue working through this section to implement your LID BMPs. It is recommended that you contact your Co-Permittee to verify whether or not your project discharges to an approved downstream ‘Highest and Best Use’ feature.

Geotechnical Report

A Geotechnical Report or Phase I Environmental Site Assessment may be required by the Copermittee to confirm present and past site characteristics that may affect the use of Infiltration BMPs. In addition, the Co-Permittee, at their discretion, may not require a geotechnical report for small projects as described in Chapter 2 of the WQMP Guidance Document. If a geotechnical report has been prepared, include it in Appendix 3. In addition, if a Phase I Environmental Site Assessment has been prepared, include it in Appendix 4.

Is this project classified as a small project consistent with the requirements of Chapter 2 of the WQMP Guidance Document? ☐ Y ☒ N

Infiltration Feasibility

Table D.1 below is meant to provide a simple means of assessing which DMAs on your site support Infiltration BMPs and is discussed in the WQMP Guidance Document in Chapter 2.4.5. Check the appropriate box for each question and then list affected DMAs as applicable. If additional space is needed, add a row below the corresponding answer.

Table D.1 Infiltration Feasibility

Does the project site...	YES	NO
...have any DMAs with a seasonal high groundwater mark shallower than 10 feet?	☐	☒
If Yes, list affected DMAs:		
...have any DMAs located within 100 feet of a water supply well?	☐	☐
If Yes, list affected DMAs:		
...have any areas identified by the geotechnical report as posing a public safety risk where infiltration of stormwater could have a negative impact?	☐	☒
If Yes, list affected DMAs:		
...have measured in-situ infiltration rates of less than 1.6 inches / hour?	☐	☒
If Yes, list affected DMAs:	ALL	
...have significant cut and/or fill conditions that would preclude in-situ testing of infiltration rates at the final infiltration surface?	☐	☒
If Yes, list affected DMAs:		
...geotechnical report identify other site-specific factors that would preclude effective and safe infiltration?	☐	☒
Describe here:		

If you answered “Yes” to any of the questions above for any DMA, Infiltration BMPs should not be used for those DMAs and you should proceed to the assessment for Harvest and Use below.

D.2 Harvest and Use Assessment

Please check what applies:

☐ Reclaimed water will be used for the non-potable water demands for the project.

☐ Downstream water rights may be impacted by Harvest and Use as approved by the Regional Board (verify with the Copermittee).

☒ The Design Capture Volume will be addressed using Infiltration Only BMPs. In such a case, Harvest and Use BMPs are still encouraged, but it would not be required if the Design Capture Volume will be infiltrated or evapotranspired.

If any of the above boxes have been checked, Harvest and Use BMPs need not be assessed for the site. If none of the above criteria applies, follow the steps below to assess the feasibility of irrigation use, toilet use and other non-potable uses (e.g., industrial use).

Irrigation Use Feasibility

Complete the following steps to determine the feasibility of harvesting stormwater runoff for Irrigation Use BMPs on your site:

Step 1: Identify the total area of irrigated landscape on the site, and the type of landscaping used.

Total Area of Irrigated Landscape:

Type of Landscaping (Conservation Design or Active Turf):

Step 2: Identify the planned total of all impervious areas on the proposed project from which runoff might be feasibly captured and stored for irrigation use. Depending on the configuration of buildings and other impervious areas on the site, you may consider the site as a whole, or parts of the site, to evaluate reasonable scenarios for capturing and storing runoff and directing the stored runoff to the potential use(s) identified in Step 1 above.

Total Area of Impervious Surfaces:

Step 3: Cross reference the Design Storm depth for the project site (see Exhibit A of the WQMP Guidance Document) with the left column of Table 2-3 in Chapter 2 to determine the minimum area of Effective Irrigated Area per Tributary Impervious Area (EIATIA).

Enter your EIATIA factor:

Step 4: Multiply the unit value obtained from Step 3 by the total of impervious areas from Step 2 to develop the minimum irrigated area that would be required.

Minimum required irrigated area:

Step 5: Determine if harvesting stormwater runoff for irrigation use is feasible for the project by comparing the total area of irrigated landscape (Step 1) to the minimum required irrigated area (Step 4).

Minimum required irrigated area (Step 4)	Available Irrigated Landscape (Step 1)

Toilet Use Feasibility

Complete the following steps to determine the feasibility of harvesting stormwater runoff for toilet flushing uses on your site:

Step 1: Identify the projected total number of daily toilet users during the wet season, and account for any periodic shut downs or other lapses in occupancy:

Projected Number of Daily Toilet Users:

Project Type:

Step 2: Identify the planned total of all impervious areas on the proposed project from which runoff might be feasibly captured and stored for toilet use. Depending on the configuration of buildings and other impervious areas on the site, you may consider the site as a whole, or parts of the site, to evaluate reasonable scenarios for capturing and storing runoff and directing the stored runoff to the potential use(s) identified in Step 1 above.

Total Area of Impervious Surfaces:

Step 3: Enter the Design Storm depth for the project site (see Exhibit A) into the left column of Table 2-2 in Chapter 2 to determine the minimum number or toilet users per tributary impervious acre (TUTIA).

Enter your TUTIA factor:

Step 4: Multiply the unit value obtained from Step 3 by the total of impervious areas from Step 2 to develop the minimum number of toilet users that would be required.

Minimum number of toilet users:

Step 5: Determine if harvesting stormwater runoff for toilet flushing use is feasible for the project by comparing the Number of Daily Toilet Users (Step 1) to the minimum required number of toilet users (Step 4).

Minimum required Toilet Users (Step 4)	Projected number of toilet users (Step 1)

Other Non-Potable Use Feasibility

Are there other non-potable uses for stormwater runoff on the site (e.g. industrial use)? See Chapter 2 of the Guidance for further information. If yes, describe below. If no, write N/A.

Step 1: Identify the projected average daily non-potable demand, in gallons per day, during the wet season and accounting for any periodic shut downs or other lapses in occupancy or operation.

Average Daily Demand:

Step 2: Identify the planned total of all impervious areas on the proposed project from which runoff might be feasibly captured and stored for the identified non-potable use. Depending on the configuration of buildings and other impervious areas on the site, you may consider the site as a whole, or parts of the site, to evaluate reasonable scenarios for capturing and storing runoff and directing the stored runoff to the potential use(s) identified in Step 1 above.

Total Area of Impervious Surfaces:

Step 3: Enter the Design Storm depth for the project site (see Exhibit A) into the left column of Table 2-4 in Chapter 2 to determine the minimum demand for non-potable uses per tributary impervious acre.

Enter the factor from Table 2-4:

Step 4: Multiply the unit value obtained from Step 3 by the total of impervious areas from Step 2 to develop the minimum number of gallons per day of non-potable use that would be required.

Minimum required use: Minimum use required (gpd)

Step 5: Determine if harvesting stormwater runoff for other non-potable use is feasible for the project by comparing the projected average daily use (Step 1) to the minimum required non-potable use (Step 4).

Minimum required non-potable use (Step 4)	Projected average daily use (Step 1)
Minimum use required (gpd)	Projected Average Daily Use (gpd)

If Irrigation, Toilet and Other Use feasibility anticipated demands are less than the applicable minimum values, Harvest and Use BMPs are not required and you should proceed to utilize LID Bioretention and Biotreatment per Section 3.4.2 of the WQMP Guidance Document.

D.3 Bioretention and Biotreatment Assessment

Other LID Bioretention and Biotreatment BMPs as described in Chapter 2.4.7 of the WQMP Guidance Document are feasible on nearly all development sites with sufficient advance planning.

Select one of the following:

☒ LID Bioretention/Biotreatment BMPs will be used for some or all DMAs of the project as noted below in Section D.4 (note the requirements of Section 3.4.2 in the WQMP Guidance Document).

☐ A site-specific analysis demonstrating the technical infeasibility of all LID BMPs has been performed and is included in Appendix 5. If you plan to submit an analysis demonstrating the technical infeasibility of LID BMPs, request a pre-submittal meeting with the Copermittee to discuss this option. Proceed to Section E to document your alternative compliance measures.

D.4 Feasibility Assessment Summaries

From the Infiltration, Harvest and Use, Bioretention and Biotreatment Sections above, complete Table D.2 below to summarize which LID BMPs are technically feasible, and which are not, based upon the established hierarchy.

Table D.2 LID Prioritization Summary Matrix

DMA Name/ID	LID BMP Hierarchy				No LID (Alternative Compliance)
	1. Infiltration	2. Harvest and use	3. Bioretention	4. Biotreatment	
DA 1	☒	☐	☐	☐	☐
DA 2	☒	☐	☐	☐	☐
	☐	☐	☐	☐	☐
	☐	☐	☐	☐	☐
	☐	☐	☐	☐	☐
	☐	☐	☐	☐	☐

For those DMAs where LID BMPs are not feasible, provide a brief narrative below summarizing why they are not feasible, include your technical infeasibility criteria in Appendix 5, and proceed to Section E below to document Alternative Compliance measures for those DMAs. Recall that each proposed DMA must pass through the LID BMP hierarchy before alternative compliance measures may be considered.

Insert narrative description here.

D.5 LID BMP Sizing

Each LID BMP must be designed to ensure that the Design Capture Volume will be addressed by the selected BMPs. First, calculate the Design Capture Volume for each LID BMP using the V_{BMP} worksheet in Appendix F of the LID BMP Design Handbook. Second, design the LID BMP to meet the required V_{BMP} using a method approved by the Copermittee. Utilize the worksheets found in the LID BMP Design Handbook or consult with your Copermittee to assist you in correctly sizing your LID BMPs. Complete Table D.3 below to document the Design Capture Volume and the Proposed Volume for each LID BMP. Provide the completed design procedure sheets for each LID BMP in Appendix 6. You may add additional rows to the table below as needed.

V_{BMP} Infiltration Basin

Table D.3 DCV Calculations for LID BMPs

DMA Type/ID	DMA Area (square feet)	Post-Project Surface Type	Effective Impervious Fraction, I_f	**DMA Runoff Factor**	DMA Areas x Runoff Factor	Infiltration Basin 1 (DMA 1)		
	[A]		[B]	[C]	[A] x [C]			
D/1a	22,150	Pervious Concrete	0.1	.11	2446.6	Design Storm Depth (in)	Design Capture Volume, V_{BMP} (cubic feet)	Proposed Volume on Plans (cubic feet)
D/1b	9,717	Roofs	1	0.89	8667.6			
D/1c	1,500	Ornamental Landscaping	0.1	0.11	165.7			
D/1d	87,820	Natural (A Soil)	0.03	.0 3	938.1			
D/1e	5,350	Concrete	1	0.89	4772.2			
D/1f	12,671	Decomposed Granite	0.4	0.28	3544.2			
	$A_T = \Sigma[A]$ 139,208				Σ= [D] 25,088.7	[E] 0.706	$[F] = \frac{[D]x[E]}{12}$ 1476.1	[G] 2,570

[B], [C] is obtained as described in Section 2.3.1 of the WQMP Guidance Document
[E] is obtained from Exhibit A in the WQMP Guidance Document
[G] is obtained from a design procedure sheet, such as in LID BMP Design Handbook and placed in Appendix 6

DMA Type/ID	DMA Area (square feet)	Post-Project Surface Type	Effective Impervious Fraction, I_f	**DMA Runoff Factor**	DMA Areas x Runoff Factor	Infiltration Basin 2 (DMA 2)		
	[A]		[B]	[C]	[A] x [C]			
D/2a	8,110	Pervious Concrete	0.1	.01	895.8	Design Storm Depth (in)	Design Capture Volume, V_{BMP} (cubic feet)	Proposed Volume on Plans (cubic feet)
D/2a	1,270	Concrete	1	0.89	1132.8			
D/2a	8,355	Landscaping	0.1	0.1	7452.7			
D/2a	15,000	Natural (B Soil)	.15	0.15	2121.7			
	$A_T = \Sigma[A]$ 32,735				Σ= [D] 11,603	[E] 0.706	$[F] = \frac{[D]x[E]}{12}$ 682.6	[G] 683

Alternative Compliance (LID Waiver Program)

LID BMPs are expected to be feasible on virtually all projects. Where LID BMPs have been demonstrated to be infeasible as documented in Section D, other Treatment Control BMPs must be used (subject to LID waiver approval by the Copermittee). Check one of the following Boxes:

☒ LID Principles and LID BMPs have been incorporated into the site design to fully address all Drainage Management Areas. No alternative compliance measures are required for this project and thus this Section is not required to be completed.

- Or -

☐ The following Drainage Management Areas are unable to be addressed using LID BMPs. A site-specific analysis demonstrating technical infeasibility of LID BMPs has been approved by the Co-Permittee and included in Appendix 5. Additionally, no downstream regional and/or sub-regional LID BMPs exist or are available for use by the project. The following alternative compliance measures on the following pages are being implemented to ensure that any pollutant loads expected to be discharged by not incorporating LID BMPs, are fully mitigated.

List DMAs here.

D.6 Identify Pollutants of Concern

Utilizing Table A.1 from Section A above which noted your project's receiving waters and their associated EPA approved 303(d) listed impairments, cross reference this information with that of your selected Priority Development Project Category in Table E.1 below. If the identified General Pollutant Categories are the same as those listed for your receiving waters, then these will be your Pollutants of Concern and the appropriate box or boxes will be checked on the last row. The purpose of this is to document compliance and to help you appropriately plan for mitigating your Pollutants of Concern in lieu of implementing LID BMPs.

Table D.4 Potential Pollutants by Land Use Type

Priority Development Project Categories and/or Project Features (check those that apply)		General Pollutant Categories							
		Bacterial Indicators	Metals	Nutrients	Pesticides	Toxic Organic Compounds	Sediments	Trash & Debris	Oil & Grease
☒	Detached Residential Development	P	N	P	P	N	P	P	P
☐	Attached Residential Development	P	N	P	P	N	P	P	P(2)
☐	Commercial/Industrial Development	P(3)	P	P(1)	P(1)	P(5)	P(1)	P	P
☐	Automotive Repair Shops	N	P	N	N	P(4, 5)	N	P	P
☐	Restaurants (>5,000 ft^2)	P	N	N	N	N	N	P	P
☐	Hillside Development (>5,000 ft^2)	P	N	P	P	N	P	P	P
☒	Parking Lots (>5,000 ft^2)	P(6)	P	P(1)	P(1)	P(4)	P(1)	P	P
☐	Retail Gasoline Outlets	N	P	N	N	P	N	P	P
Project Priority Pollutant(s) of Concern		☒	☒	☒	☒	☒	☒	☒	☒

P = Potential

N = Not Potential

(1) A potential Pollutant if non-native landscaping exists or is proposed onsite; otherwise not expected

(2) A potential Pollutant if the project includes uncovered parking areas; otherwise not expected

(3) A potential Pollutant is land use involving animal waste

(4) Specifically petroleum hydrocarbons

(5) Specifically solvents

(6) Bacterial indicators are routinely detected in pavement runoff

D.7 Stormwater Credits

Projects that cannot implement LID BMPs but nevertheless implement smart growth principles are potentially eligible for Stormwater Credits. Utilize Table 3-8 within the WQMP Guidance Document to identify your Project Category and its associated Water Quality Credit. If not applicable, write N/A.

Table D.5 Water Quality Credits

Qualifying Project Categories	Credit Percentage[2]
N/A	
Total Credit Percentage[1]	

[1] Cannot Exceed 50%

[2] Obtain corresponding data from Table 3-8 in the WQMP Guidance Document

D.8 Sizing Criteria

After you appropriately considered Stormwater Credits for your project, utilize Table E.3 below to appropriately size them to the DCV, or Design Flow Rate, as applicable. Please reference Chapter 3.5.2 of the WQMP Guidance Document for further information.

Table D.6 Treatment Control BMP Sizing

<table>
<tr><td>DMA Type/ID</td><td>DMA Area (square feet)</td><td>Post-Project Surface Type</td><td>Effective Impervious Fraction, I_f</td><td>DMA Runoff Factor</td><td>DMA Area x Runoff Factor</td><td></td><td colspan="3" rowspan="2">Enter BMP Name / Identifier Here</td></tr>
<tr><td></td><td>[A]</td><td></td><td>[B]</td><td>[C]</td><td>[A] x [C]</td><td></td></tr>
<tr><td></td><td></td><td></td><td></td><td></td><td></td><td rowspan="6">Design Storm Depth (in)</td><td rowspan="6">Minimum Design Capture Volume or Design Flow Rate (cubic feet or cfs)</td><td rowspan="6">Total Storm Water Credit % Reduction</td><td rowspan="6">Proposed Volume or Flow on Plans (cubic feet or cfs)</td></tr>
<tr><td></td><td></td><td></td><td></td><td></td><td></td></tr>
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<tr><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td></td><td>$A_T = \Sigma[A]$</td><td colspan="3"></td><td>$\Sigma = [D]$</td><td>[E]</td><td>$[F] = \frac{[D]x[E]}{[G]}$</td><td>[F] X (1-[H])</td><td>[I]</td></tr>
</table>

[B], [C] is obtained as described in Section 2.3.1 from the WQMP Guidance Document

[E] is for Flow-Based Treatment Control BMPs [E] = .2, for Volume-Based Control Treatment BMPs, [E] obtained from Exhibit A in the WQMP Guidance Document

[G] is for Flow-Based Treatment Control BMPs [G] = 43,560, for Volume-Based Control Treatment BMPs, [G] = 12

[H] is from the Total Credit Percentage as Calculated from Table E.2 above

[I] as obtained from a design procedure sheet from the BMP manufacturer and should be included in Appendix 6

D.9 Treatment Control BMP Selection

Treatment Control BMPs typically provide proprietary treatment mechanisms to treat potential pollutants in runoff, but do not sustain significant biological processes. Treatment Control BMPs must have a removal efficiency of a medium or high effectiveness as quantified below:

- High: equal to or greater than 80% removal efficiency
- Medium: between 40% and 80% removal efficiency

Such removal efficiency documentation (e.g., studies, reports, etc.) as further discussed in Chapter 3.5.2 of the WQMP Guidance Document, must be included in Appendix 6. In addition, ensure that proposed Treatment Control BMPs are properly identified on the WQMP Site Plan in Appendix 1.

Table D.7 Treatment Control BMP Selection

Selected Treatment Control BMP Name or ID[1]	Priority Pollutant(s) of Concern to Mitigate[2]	Removal Efficiency Percentage[3]

[1] Treatment Control BMPs must not be constructed within Receiving Waters. In addition, a proposed Treatment Control BMP may be listed more than once if they possess more than one qualifying pollutant removal efficiency.

[2] Cross Reference Table E.1 above to populate this column.

[3] As documented in a Co-Permittee Approved Study and provided in Appendix 6.

Section E: Hydromodification

E.1 Hydrologic Conditions of Concern (HCOC) Analysis

Once you have determined that the LID design is adequate to address water quality requirements, you will need to assess if the proposed LID Design may still create a HCOC. Review Chapters 2 and 3 (including Figure 3-7) of the WQMP Guidance Document to determine if your project must mitigate for Hydromodification impacts. If your project meets one of the following criteria which will be indicated by the check boxes below, you do not need to address Hydromodification at this time. However, if the project does not qualify for Exemptions 1, 2 or 3, then additional measures must be added to the design to comply with HCOC criteria. This is discussed in further detail below in Section F.2.

HCOC EXEMPTION 1: The Priority Development Project disturbs less than one acre. The Copermittee has the discretion to require a Project-Specific WQMP to address HCOCs on projects less than one acre on a case by case basis. The disturbed area calculation should include all disturbances associated with larger common plans of development.

Does the project qualify for this HCOC Exemption? ☐ Y ☒ N

If Yes, HCOC criteria do not apply.

HCOC EXEMPTION 2: The volume and time of concentration[1] of storm water runoff for the post-development condition is not significantly different from the pre-development condition for a 2-year return frequency storm (a difference of 5% or less is considered insignificant) using one of the following methods to calculate:

- Riverside County Hydrology Manual
- Technical Release 55 (TR-55): Urban Hydrology for Small Watersheds (NRCS 1986), or derivatives thereof, such as the Santa Barbara Urban Hydrograph Method
- Other methods acceptable to the Co-Permittee

Does the project qualify for this HCOC Exemption? ☐ Y ☒ N

If Yes, report results in Table F.1 below and provide your substantiated hydrologic analysis in Appendix 7.

Table E.1 Hydrologic Conditions of Concern Summary

	2 year – 24 hour		
	Pre-condition	Post-condition	% Difference
Time of Concentration	INSERT VALUE	INSERT VALUE	INSERT VALUE
Volume (Cubic Feet)	INSERT VALUE	INSERT VALUE	INSERT VALUE

[1] Time of concentration is defined as the time after the beginning of the rainfall when all portions of the drainage basin are contributing to flow at the outlet.

HCOC EXEMPTION 3: All downstream conveyance channels to an adequate sump (for example, Prado Dam, Lake Elsinore, Canyon Lake, Santa Ana River, or other lake, reservoir or naturally erosion resistant feature) that will receive runoff from the project are engineered and regularly maintained to ensure design flow capacity; no sensitive stream habitat areas will be adversely affected; or are not identified on the Co-Permittees Hydromodification Susceptibility Maps.

Does the project qualify for this HCOC Exemption? ☐ Y ☒ N

If Yes, HCOC criteria do not apply and note below which adequate sump applies to this HCOC qualifier:

Lake Elsinore

E.2 HCOC Mitigation

If none of the above HCOC Exemption Criteria are applicable, HCOC criteria is considered mitigated if they meet one of the following conditions:

a. Additional LID BMPS are implemented onsite or offsite to mitigate potential erosion or habitat impacts as a result of HCOCs. This can be conducted by an evaluation of site-specific conditions utilizing accepted professional methodologies published by entities such as the California Stormwater Quality Association (CASQA), the Southern California Coastal Water Research Project (SCCRWP), or other Co-Permittee approved methodologies for site-specific HCOC analysis.

b. The project is developed consistent with an approved Watershed Action Plan that addresses HCOC in Receiving Waters.

c. Mimicking the pre-development hydrograph with the post-development hydrograph, for a 2-year return frequency storm. Generally, the hydrologic conditions of concern are not significant, if the post-development hydrograph is no more than 10% greater than pre-development hydrograph. In cases where excess volume cannot be infiltrated or captured and reused, discharge from the site must be limited to a flow rate no greater than 110% of the pre-development 2-year peak flow.

Be sure to include all pertinent documentation used in your analysis of the items a, b or c in Appendix 7.

Section F: Source Control BMPs

Source control BMPs include permanent, structural features that may be required in your project plans — such as roofs over and berms around trash and recycling areas — and Operational BMPs, such as regular sweeping and "housekeeping", that must be implemented by the site's occupant or user. The MEP standard typically requires both types of BMPs. In general, Operational BMPs cannot be substituted for a feasible and effective permanent BMP. Using the Pollutant Sources/Source Control Checklist in Appendix 8, review the following procedure to specify Source Control BMPs for your site:

1. Identify Pollutant Sources: Review Column 1 in the Pollutant Sources/Source Control Checklist. Check off the potential sources of Pollutants that apply to your site.

2. Note Locations on Project-Specific WQMP Exhibit: Note the corresponding requirements listed in Column 2 of the Pollutant Sources/Source Control Checklist. Show the location of each Pollutant source and each permanent Source Control BMP in your Project-Specific WQMP Exhibit located in Appendix 1.

3. Prepare a Table and Narrative: Check off the corresponding requirements listed in Column 3 in the Pollutant Sources/Source Control Checklist. In the left column of Table G.1 below, list each potential source of runoff Pollutants on your site (from those that you checked in the Pollutant Sources/Source Control Checklist). In the middle column, list the corresponding permanent, Structural Source Control BMPs (from Columns 2 and 3 of the Pollutant Sources/Source Control Checklist) used to prevent Pollutants from entering runoff. Add additional narrative in this column that explains any special features, materials or methods of construction that will be used to implement these permanent, Structural Source Control BMPs.

4. Identify Operational Source Control BMPs: To complete your table, refer once again to the Pollutant Sources/Source Control Checklist. List in the right column of your table the Operational BMPs that should be implemented as long as the anticipated activities continue at the site. Copermittee stormwater ordinances require that applicable Source Control BMPs be implemented; the same BMPs may also be required as a condition of a use permit or other revocable Discretionary Approval for use of the site.

Table F.1 Permanent and Operational Source Control Measures

Potential Sources of Runoff pollutants	Permanent Structural Source Control BMPs	Operational Source Control BMPs
On-site storm drain inlet	Mark all inlets with the words "Only Rain Down the Storm Drain" or similar. Catch Basin Markers may be available from the Riverside County Flood control and Water Conservation District, call 951.955.1200 to verify.	Maintain and periodically repaint or replace inlet markings. Provide stormwater pollution prevention information to new site owners, lessees, or operators. See applicable operational BMPs in Fact Sheet SC-44, "Drainage System Maintenance," in the CASQA Stormwater Quality Handbooks at www.cabmphandbooks.com. Include the following in lease

		agreements: “Tenants shall not allow anyone to discharge anything to storm drains or to store or deposit materials so as to create a potential discharge to storm drains.”
Interior floor drains and elevator shaft pumps	Interior floor drains and will be plumbed to sanitary sewer.	Inspect and maintain drains to prevent blockages and overflows.
Need for future indoor & structural pest control	Food processing prohibited on-site.	Provide Integrated Pest Management information to owners, lessees, and operators.
Landscape/Outdoor Pesticide Use	Landscape plans will include; Preserve existing native trees, shrubs, and ground cover to the maximum extent possible. Design landscaping to minimize irrigation and runoff, to promote surface infiltration where appropriate, and to minimize the use of fertilizers and pesticides that can contribute to stormwater pollution. Where landscaped areas are used to retain or detain stormwater, specify plants that are tolerant of saturated soil conditions. Consider using pest-resistant plants, especially adjacent to hardscape. To insure successful establishment, select plants appropriate to site soils, slopes, climate, sun, wind, rain, land use, air movement, ecological consistency, and plant interactions.	Maintain landscaping using minimum or no pesticides. See applicable operational BMPs in “What you should know for….Landscape and Gardening” at http://rcflood.org/stormwater/.com Provide IPM information to new owners, lessees and operators.
Food Service	Designated cleaning areas shall be in enclosed outside areas behind the restaurants near the trash enclosures. Items to be cleaned in this facility shall be dishes, floors, containers, and other items	See the brochure, “The Food Service Industry Best Management Practices for: Restaurants, Grocery Stores, Delicatessens and Bakeries” at http://rcflood.org/stormwater

	relevant to food preparation and service. Sinks shall be sized to accommodate dishes.	
Refuse areas	Site refuse will be deposited into on-site trash receptacles. Trash receptacles will be emptied out by city garbage service on a weekly basis. Signs will be posted on or near dumpsters with the words "Do no dump hazardous materials here" or similar.	Provide adequate number of receptacles. Inspect receptacles regularly; repair or replace leaky receptacles. Keep receptacles covered. Prohibit/prevent dumping of liquid or hazardous wastes. Post "no hazardous materials" signs. Inspect and pick up litter daily and clean up spills immediately. Keep spill control materials available on-site. See Fact Sheet SC-34, "Waste Handling and Disposal" in the CASQA Stormwater Quality Handbooks at www.cabmphandbooks.com
Outdoor storage of equipment or materials	Detailed description of materials to be stored and location of storage areas will be provided during final engineering when the exact locations have been determined. Project site includes a gas station that will have underground storage tanks of fuel. A Hazardous Materials Management Plan will be prepared as part of a separate study.	See the Fact Sheets SC-31, "Outdoor Liquid Container Storage" and SC-33, "Outdoor Storage of Raw Materials" in the CASQA Stormwater Quality Handbooks at www.cabmphandbooks.com
Vehicle and Equipment Cleaning		Washwater from vehicle and equipment washing operations shall not be discharged to the storm drain system. Refer to "Outdoor Cleaning Activities and Professional Mobile Service Providers" for the Potential Sources of Runoff Pollutants categories below. Brochure can be found at http://rcflood.org/stormwater/
Fuel Dispensing Area		The property owner shall dry sweep the fueling area routinely. See the Fact Sheet SD-41, "Building and Grounds Maintenance," in the

		CASQA Stormwater Quality Handbooks at www.cabmphandbook.com
Fire Sprinkler Test Water	Provide a means to drain fire sprinkler test water to the sanitary sewer.	See the note in Fact Sheet SC-41, “Building and Grounds Maintenance,” in the CASQA Stormwater Quality Handbooks at www.cabmphandbook.com
Roofing, gutters, and trim	Any drainage sumps on-site shall feature a sediment sump to reduce the quantity of sediment in pumped water.	
Plazas, sidewalks, and parking lots		Sweep plazas, sidewalks, and parking lots regularly to prevent accumulation of litter and debris. Collect debris from pressure washing to prevent entry into the storm drain system. Collect washwater containing any cleaning agent or degreaser and discharge to the sanitary sewer not to a storm drain.
Infiltration Basin	Inspect soil and repair eroded areas. Inspect for erosion or damage to vegetation, preferably at the end of the wet season to schedule maintenance and before major fall runoff to be sure the strips are ready for winter. However, additional inspection after periods of heavy runoff is required. Inspection to ensure ground cover is well established. If not, prepare soil and reseed. Install erosion control blankets, as needed. Remove and replace dead and diseased vegetation.	See the note in Fact Sheet TC-11, “Infiltration Basin,” in the CASQA Stormwater Quality Handbooks at www.cabmphandbook.com

Section G: Construction Plan Checklist

Populate Table H.1 below to assist the plan checker in an expeditious review of your project. The first two columns will contain information that was prepared in previous steps, while the last column will be populated with the corresponding plan sheets. This table is to be completed with the submittal of your final Project-Specific WQMP.

Table G.1 Construction Plan Cross-reference

BMP No. or ID	BMP Identifier and Description	Corresponding Plan Sheet(s)	BMP Location (Lat/Long)
1	Infiltration Basin 1	Site Plan: Appendix 1.C	33.6676, -116.9011
2	Infiltration Basin 2	Site Plan: Appendix 1.C	33.6513, -116.6059

Note that the updated table — or Construction Plan WQMP Checklist — is only a reference tool to facilitate an easy comparison of the construction plans to your Project-Specific WQMP. Co-Permittee staff can advise you regarding the process required to propose changes to the approved Project-Specific WQMP.

Section H: Operation, Maintenance and Funding

The Copermittee will periodically verify that Stormwater BMPs on your site are maintained and continue to operate as designed. To make this possible, your Copermittee will require that you include in Appendix 9 of this Project-Specific WQMP:

1. A means to finance and implement facility maintenance in perpetuity, including replacement cost.
2. Acceptance of responsibility for maintenance from the time the BMPs are constructed until responsibility for operation and maintenance is legally transferred. A warranty covering a period following construction may also be required.
3. An outline of general maintenance requirements for the Stormwater BMPs you have selected.
4. Figures delineating and designating pervious and impervious areas, location, and type of Stormwater BMP, and tables of pervious and impervious areas served by each facility. Geo-locating the BMPs using a coordinate system of latitude and longitude is recommended to help facilitate a future statewide database system.
5. A separate list and location of self-retaining areas or areas addressed by LID Principles that do not require specialized O&M or inspections but will require typical landscape maintenance as noted in Chapter 5, pages 85-86, in the WQMP Guidance. Include a brief description of typical landscape maintenance for these areas.

Your local Co-Permittee will also require that you prepare and submit a detailed Stormwater BMP Operation and Maintenance Plan that sets forth a maintenance schedule for each of the Stormwater BMPs built on your site. An agreement assigning responsibility for maintenance and providing for inspections and certification may also be required.

Details of these requirements and instructions for preparing a Stormwater BMP Operation and Maintenance Plan are in Chapter 5 of the WQMP Guidance Document.

Maintenance Mechanism: See Appendix 9 for "Operation & Maintenance" of proposed BMPs

Will the proposed BMPs be maintained by a Home Owners' Association (HOA) or Property Owners Association (POA)?

☐ Y ☒ N

Include your Operation and Maintenance Plan and Maintenance Mechanism in Appendix 9. Additionally, include all pertinent forms of educational materials for those personnel that will be maintaining the proposed BMPs within this Project-Specific WQMP in Appendix 10.

Appendix 1: Maps and Site Plans

Location Map, WQMP Site Plan and Receiving Waters Map

VICINITY MAP

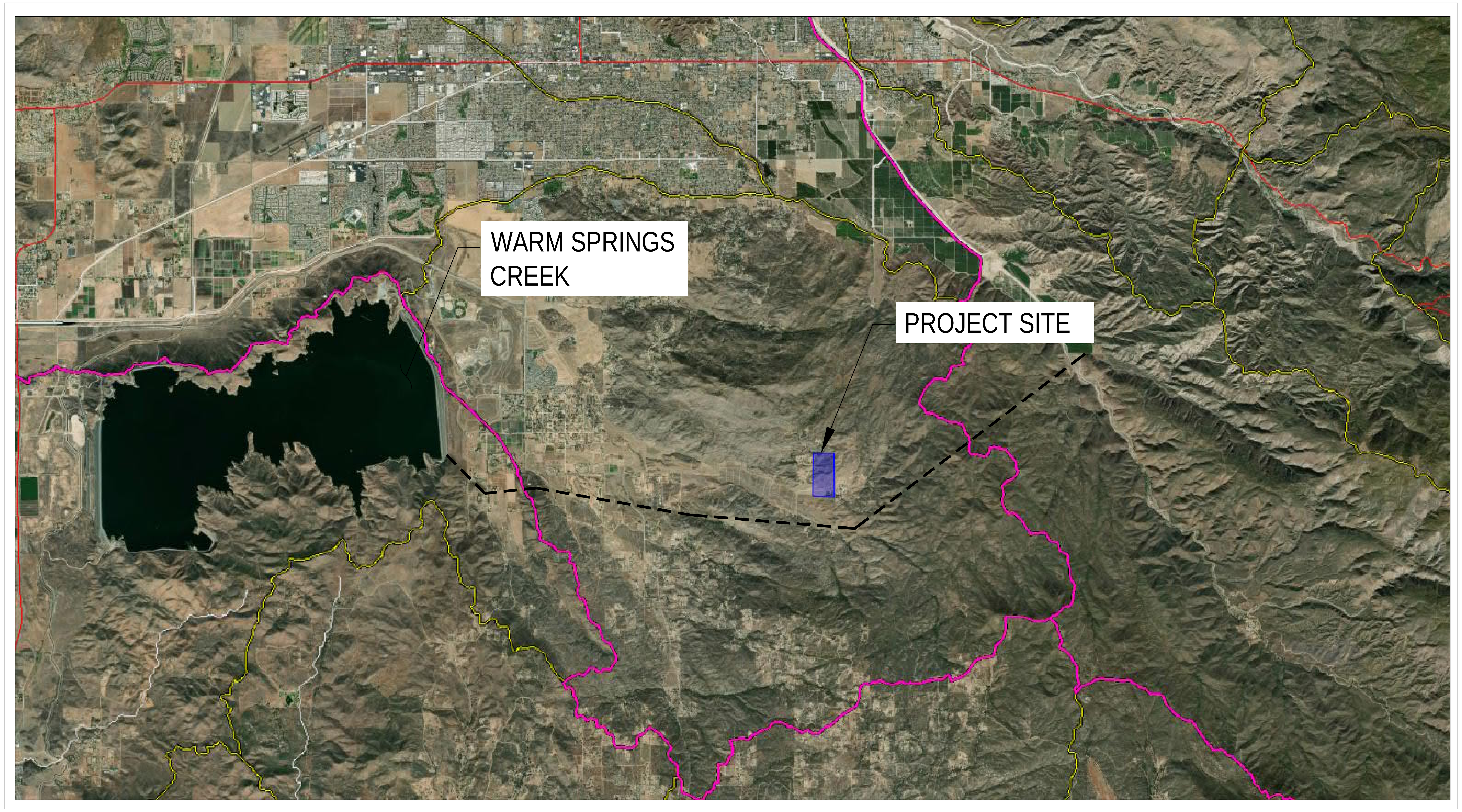
VALUED
ENGINEERING, INC
CIVIL ENGINEERING • LAND SURVEYING • LAND PLANNING
600 N. MOUNTAIN AVE, STE C102, UPLAND, CA 91786
PHONE: (909) 982-4601

DATE: MARCH 2020
PREPARED BY:
REVIEWED BY:

CITY OF HEMET

VICINITY MAP
WILDFIRE CONSERVANCY
APN(s): 569-020-010, -013, -024, -025, -026

FOR: RAHN CONSERVATION CONSULTING
W.O.



LEGEND

━━━ REGIONAL BOUNDARY

━━━ HYDROLOGIC UNIT BOUNDARY (HUI)

- - - - - - FLOW PATH

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ENGINEERING, INC
CIVIL ENGINEERING • LAND SURVEYING • LAND PLANNING
600 N. MOUNTAIN AVE, STE C102, UPLAND, CA 91786
PHONE: (909) 982-4601

DATE: MARCH 2020

PREPARED BY:
REVIEWED BY:

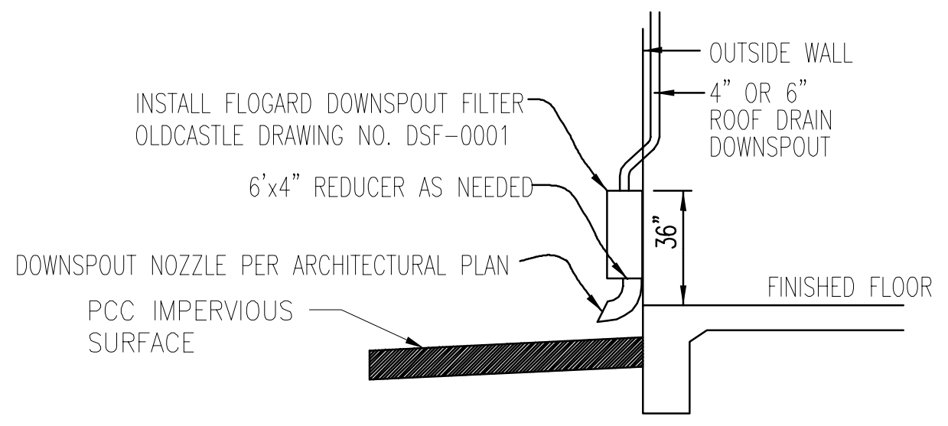
CITY OF HEMET

RECEIVING WATER MAP
WILDFIRE CONSERVANCY
APN(s): PORTION OF 569-020-024, -025, -026

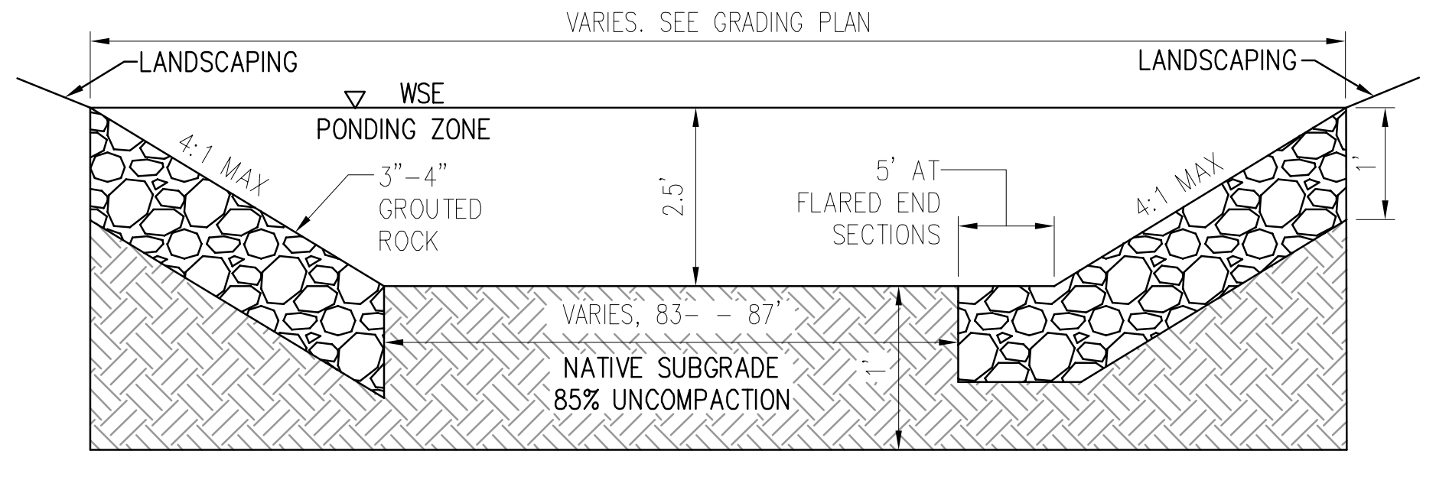
FOR: RAHN CONSERVATION CONSULTING

W.O.

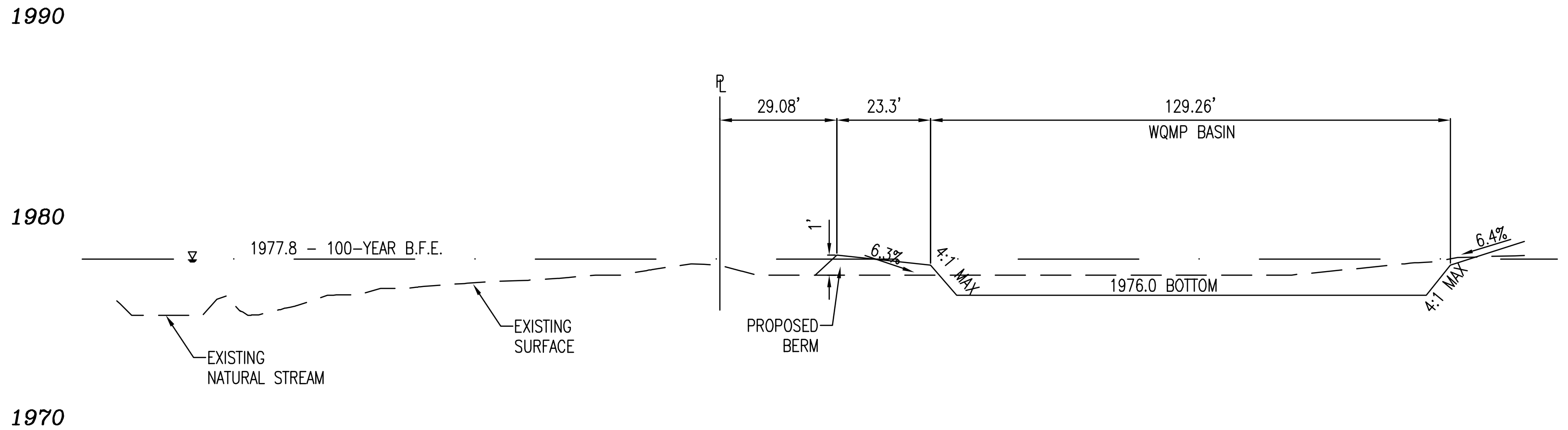
B
1
STENCIL
LETTERS 2" HIGH
NOT TO SCALE



A
1
ROOF DRAIN DOWNSPOUT FILTER
NOT TO SCALE



INFILTRATION BASIN(TYP)
NOT TO SCALE



SECTION A-A

PROJECT AREA BREAKDOWN

PROJECT TOTAL AREA:	99,123 SF
PERVIOUS AREA:	74,431 SF
IMPERVIOUS AREA:	24,692 SF

SOURCE CONTROL BMPS

Ⓐ ON-SITE STORM DRAIN INLET
Ⓑ FLOOR DRAINS
Ⓒ PEST CONTROL/HERBICIDE APPLICATION
Ⓓ FOOD SERVICE
Ⓔ TRASH STORAGE AREA
Ⓕ ROOFING, GUTTER AND TRIM
Ⓖ PLAZA, SIDEWALKS AND PARKING LOTS SWEEPING

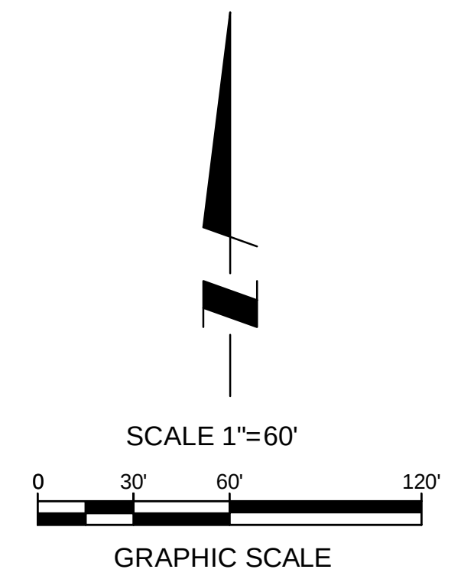
WQMP ITEMS

① 24"X24" STORM DRAIN INLET WITH STORMFLEX INLET INSERT
② #57 RIP-RAP VELOCITY REDUCER
③ ROOF DRAIN DOWNSPOUT FILTER PER DETAIL 'A' HEREON
④ STORM DRAIN STENCILING PER DETAIL 'B' HERE ON

BMP LEGEND

- - - - - - -	DRAINAGE AREA BOUNDAY
····→···→···→	FLOW LINE
■	DECOMPOSED GRANITE PAVEMENT (IMPERVIOUS)
▦	POROUS PAVEMENT (PERVIOUS)
▩	2 YR HEC-RAS WATER SURFACE
⛶	PCC CONCRETE PAVEMENT (IMPERVIOUS)
DA-X X.XX	DMA DESIGNATION ACRES

DA 1 → DMA 1 → INFILTRATION BASIN 1 → OUTLET 1
DA 2 → DMA 2 → INFILTRATION BASIN 2 → OUTLET 2



WQMP SUMMARY

DRAINAGE AREA	REQUIRED DCV (FT^3)	INFILTRATION BASIN (FT^3)
DA-1	1476	2570
DA-2	683	2763

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600 N. MOUNTAIN AVE, STE C102, UPLAND, CA 91786
PHONE: (909) 982-4601

DATE: MARCH 2021
PREPARED BY:
REVIEWED BY:

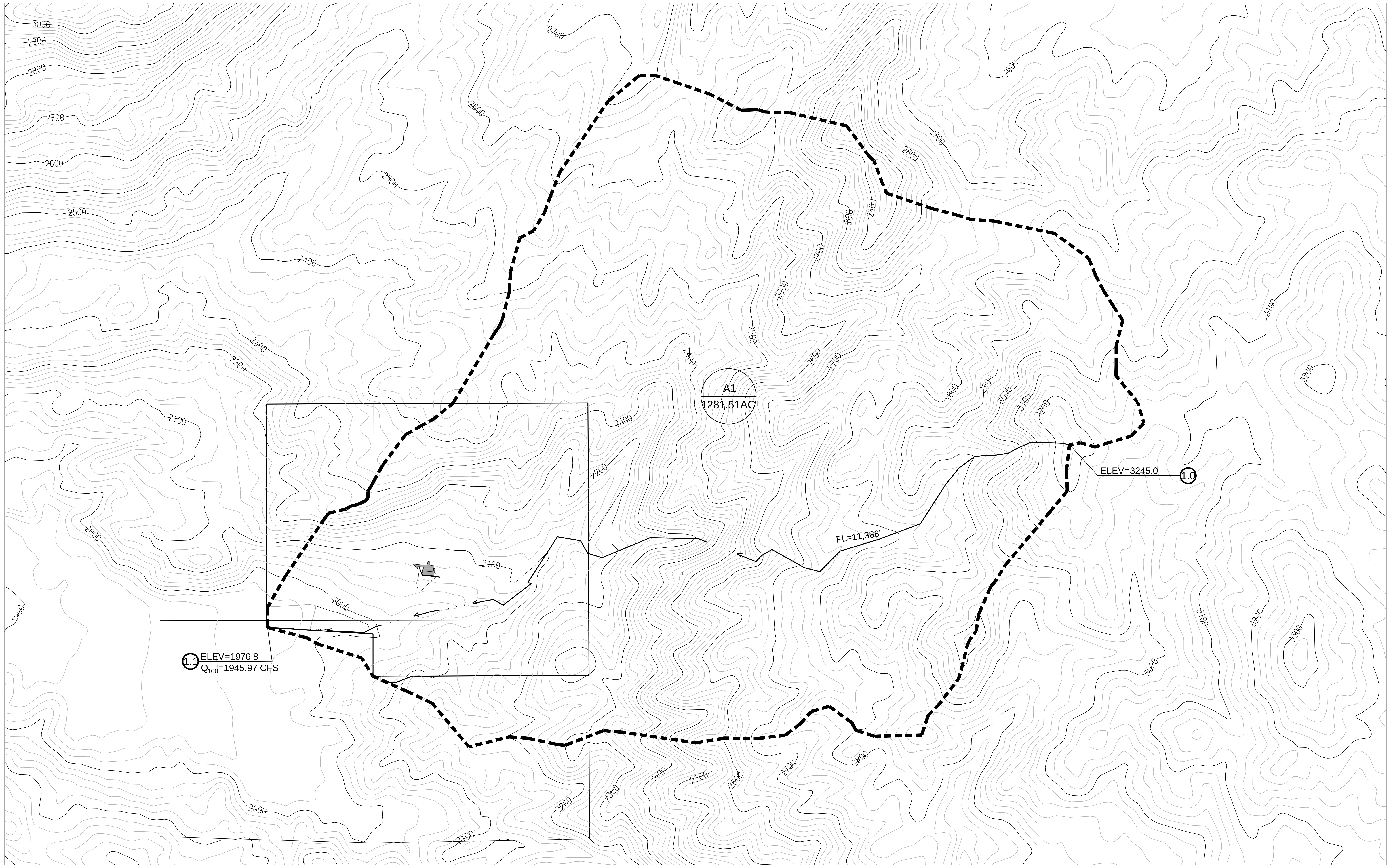
COUNTY OF RIVERSIDE
POST-CONSTRUCTION
BMP SITE PLAN
WILDFIRE CONSERVANCY
43700 CACTUS VALLEY ROAD, HEMET, CA

FOR: RAHN CONSERVANCY
W.O.

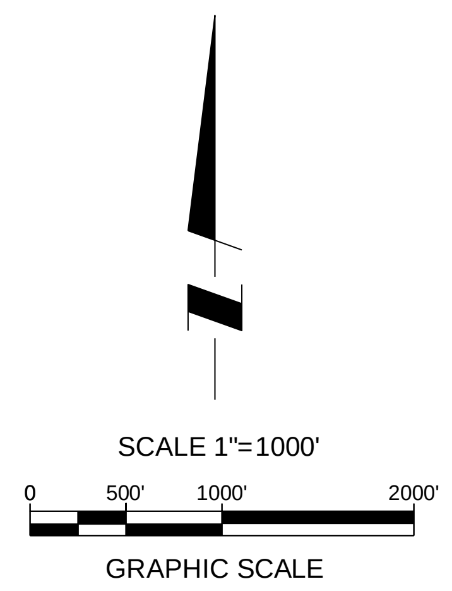
SHEET
1
OF 1

OFFSITE HYDROLOGY MAP

43700 CACTUS VALLEY ROAD, RIVERSIDE, CA



OFFSITE HYDROLOGY		
SUBAREA	ACRE	Q_{100}
A1	1281.51	1945.97
TOTAL	**1281.51**	**1945.97**



LEGEND

▬	BASIN BOUNDARY
ELEV=978.61 ⑧	DENOTES NODE No. and ELEVATION
FL	FLOW LENGTH
A	BASIN AREA
→ · · · → · · · –	FLOW PATH

SHEET 1 OF 2

JEFFEREY D. MEITER
No. 64696
CIVIL

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ENGINEERING, INC
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600 N. MOUNTAIN AVE, STE C102, UPLAND, CA 91786
PHONE: (909) 982–4601

Appendix 2: Construction Plans

Grading and Drainage Plans

Appendix 3: Soils Information

Geotechnical Study and Other Infiltration Testing Data

Sladden Engineering

45090 Golf Center Parkway, Suite F, Indio, CA. 92201 (760) 863-0713 Fax (760) 863-0847
6782 Stanton Avenue, Suite C, Buena Park, CA. 90621 (714) 523-0952 Fax (714) 523-1369
450 Egan Avenue, Beaumont, CA. 92223 (951) 845-7743 Fax (951) 845-8863
www.SladdenEngineering.com

September 1, 2021

Project No. 644-20047
20-09-102

PVR Management, LLC
c/o Camfield Partners, LLC
8895 Research Drive, Suite 200
Irvine, California 92618

Project: Proposed Recovery Facility
Paradise Valley Ranch
43700 Cactus Valley Road
Hemet Area
Riverside County, California

Subject: Percolation/Infiltration Testing for On-Site Storm Water Management

Ref: Report of Percolation Testing for On-Site Sewage Disposal Feasibility; PR 6117 prepared by Sladden Engineering dated March 10, 2021; Project No. 644-20047, Report No. 21-01-005.

In accordance with your request, we have reviewed the results of percolation testing previously performed on the subject site to evaluate on-site sewage disposal feasibility as it relates to stormwater management. It is our opinion that with proper interpretation, the percolation testing performed should be applicable for use in storm water management system design.

Percolation testing was performed on December 30, 2020 and on February 23, 2021. Testing was performed at depths of approximately 4.5 to 5.0 feet below existing grade for all test holes. The approximate locations of the tests are presented on the attached Test Location Plans (Figure 2A and Figure 2B). Testing was performed by placing water within the test bores and recording the drop in the water surface with time. Testing was performed in general accordance with the County of Riverside testing procedures for leach line feasibility. The percolation test results were converted to corresponding infiltration rates using the Porchet Method. Test results are summarized in the following table.

PERCOLATION/INFILTRATION TEST RESULTS

Test Number No.	Depth (Ft)	Percolation Rate (minutes/inch)	Porchets Method Infiltration Rate (in/hr)
P-1	5′	1.11	16.78
P-2	5′	0.23	60.00
P-3	5′	0.25	54.55
P-4	5′	0.23	60.00
P-5	5′	0.78	24.00

DA 2

P-6	4.5′	1.52	13.33
P-7	4.5′	2.22	9.39
P-8	4.5′	2.96	6.72
P-9	5′	1.67	10.91
P-10	5′	1.67	12.00
P-11	5′	1.67	12.00
P-12	5′	1.67	12.00
P-13	5′	1.67	12.00
P-14	5′	1.67	12.00

DA 1

The percolation rates determined represent ultimate field rates that do not include a safety factor. The corresponding infiltration rates were estimated using the Porchet Method. An appropriate safety factor should be applied to account for long-term saturation, subsoil inconsistencies and the potential for silting of the percolating soil. The safety factor should be determined with consideration to other factors in the storm water retention system design (specifically storm water volume estimates) and the safety factors associated with these design components.

The percolation/infiltration rates determined verify generally rapid infiltration consistent with the granular nature of the native surface soil present throughout the project site.

If you have any questions regarding this memo, please contact the undersigned.

Respectfully submitted,
SLADDEN ENGINEERING

Brett L. Anderson
Principal Engineer

REGISTERED PROFESSIONAL ENGINEER
BRETT L. ANDERSON
No. C45389
CIVIL ENGINEERING
STATE OF CALIFORNIA

Copies: 4 / Addressee

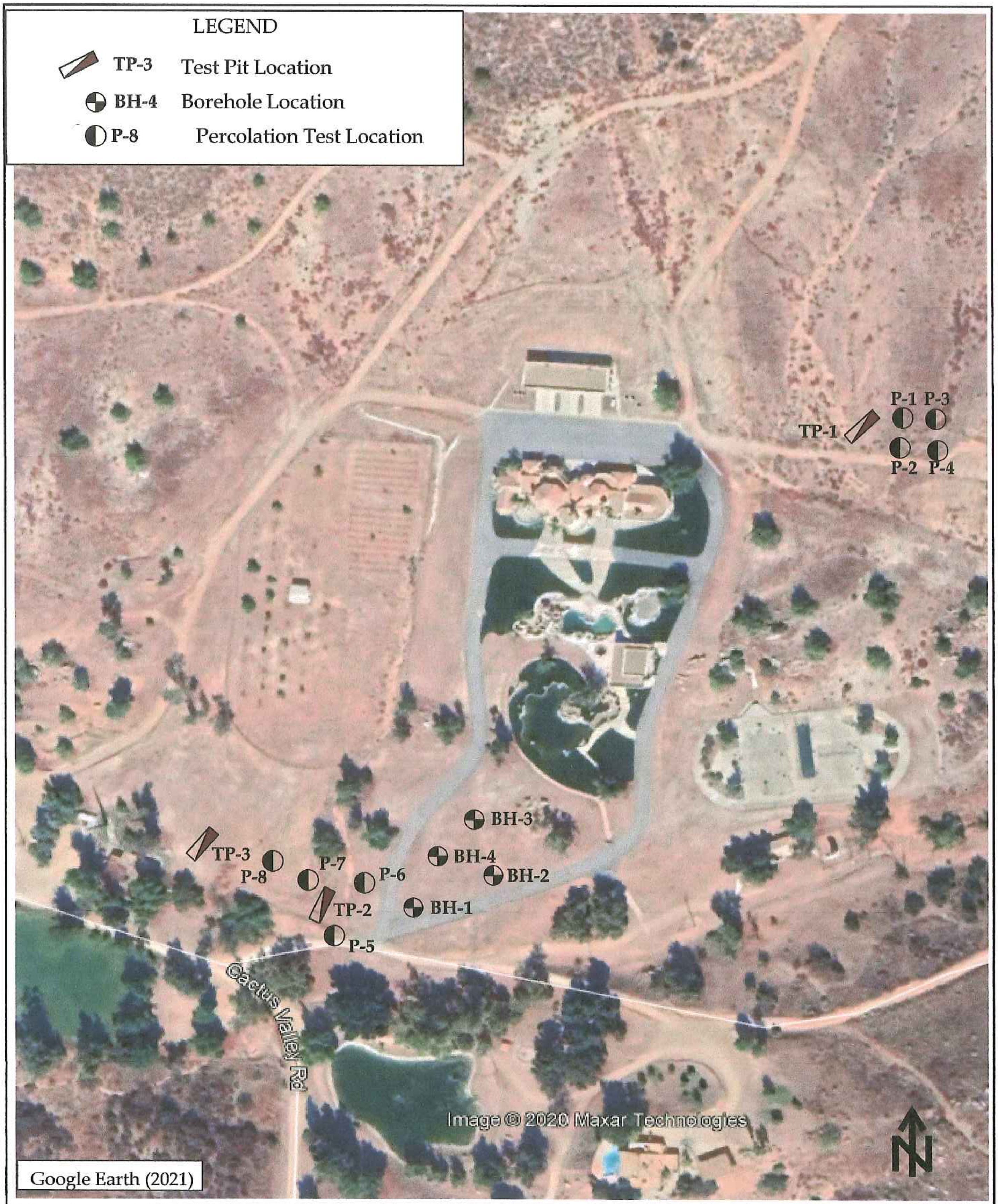
SITE LOCATION MAP

FIGURE

1

Project Number:	644-20047
Report Number:	21-01-005
Date:	March 12, 2021

Sladden Engineering



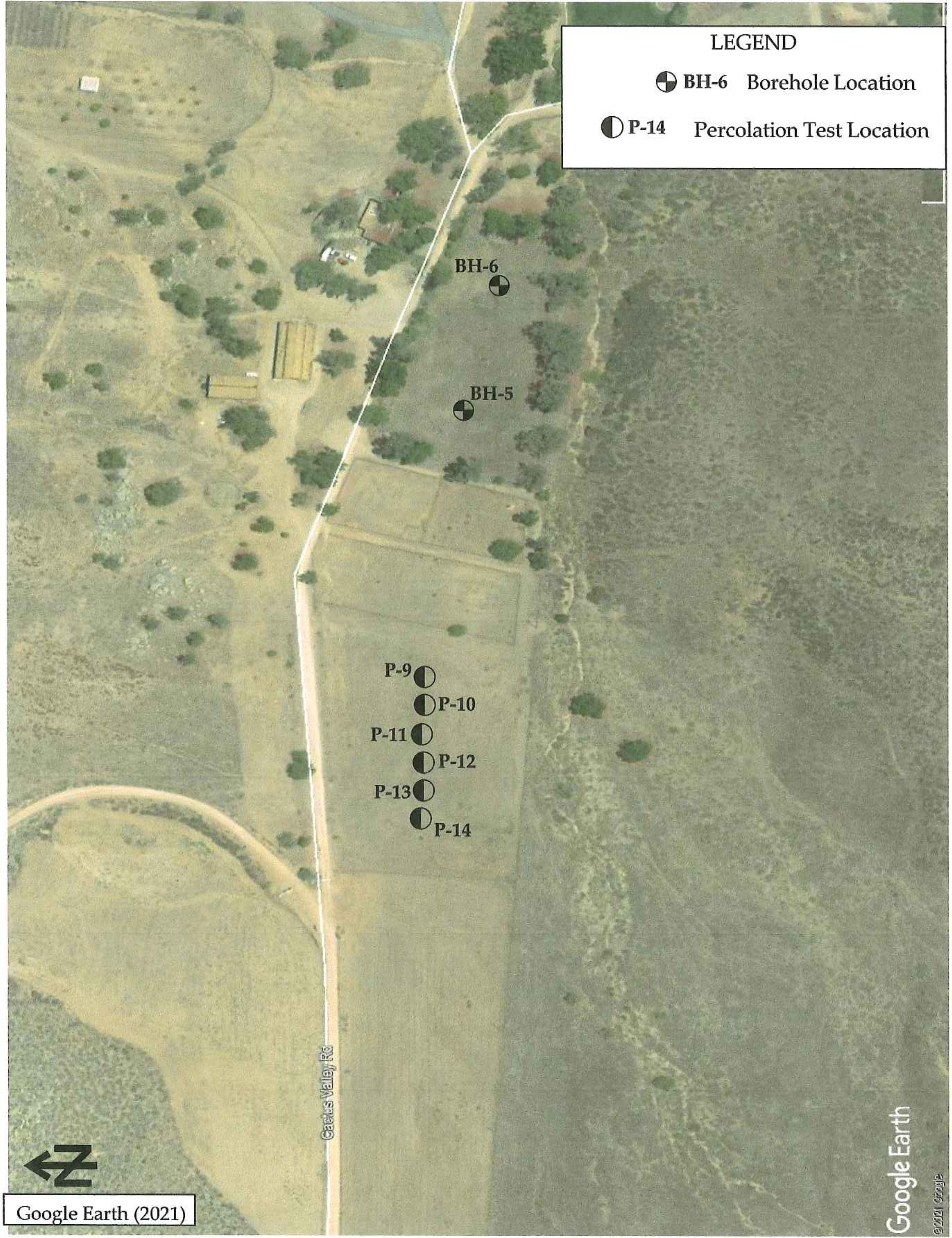
Sladden Engineering

EXPLORATION LOCATION PHOTOGRAPH

Project Number:	644-20047
Report Number:	21-01-005
Date:	March 12, 2021

FIGURE

2A



Sladden Engineering

EXPLORATION LOCATION PHOTOGRAPH

Project Number:	644-20047
Report Number:	21-01-005
Date:	March 12, 2021

FIGURE

2B

PERCOLATION RATE CONVERSION (PORCHET METHOD)

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

Δt (minutes)

D_f (Final Depth to water)

r (hole radius in inches)

D_0 (Initial Depth to water)

D_t (Total Depth of test hole)

H_0 (initial height of water at selected time interval)

$$H_0 = D_t - D_0$$

H_f (final height of water at the selected time interval)

$$H_f = D_t - D_f$$

ΔH (change in head over the time interval)

$$\Delta H = H_0 - H_f$$

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

$$H_{avg} = (H_0 + H_f)/2$$

Test Hole: **P-1**

$\Delta t =$	6.5
$D_f =$	57
r =	4.00
$D_0 =$	52
$D_t =$	58.00
$H_0 =$	6
$H_f =$	1
$\Delta H =$	5.00
$H_{avg} =$	3.50

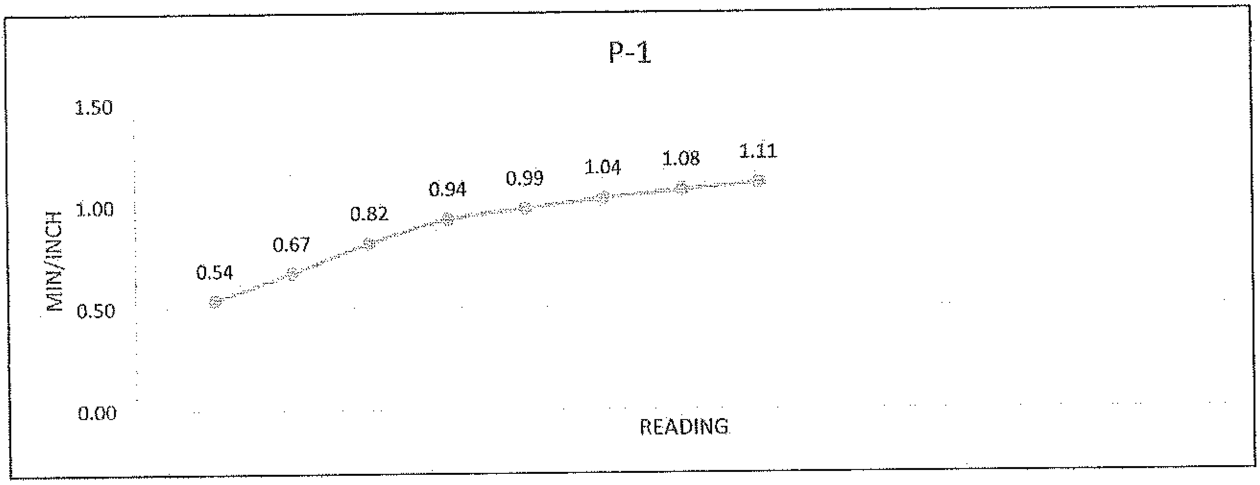
$I_t =$ 16.78 in/hr

RIVERSIDE COUNTY LEACH LINE DATA SHEETS

PR#:	6113-6117
Project:	Paradise Valley Ranch
Job No. :	644-20047
Date:	12/30/2020
Test Hole #:	P-1
Depth (ft):	4.83
Equipment:	John Deere 30
USCS Soil Class:	SM/SP
Tested By:	R.F./ A.F.

READING	TIME INTERVAL (h:m:s)	DEPTH (ft)	INITIAL W (in)	FINAL W (in)	ΔW (in)	Min/Inch
A	0:04:20	4.83	8	0	8	0.54
B	0:05:23	4.83	8	0	8	0.67

READING*	TIME INTERVAL (h:m:s)	DEPTH (ft)	INITIAL W (in)	FINAL W (in)	ΔW (in)	Min/Inch
1	0:04:55	4.83	6	0	6	0.82
2	0:05:37	4.83	6	0	6	0.94
3	0:05:55	4.83	6	0	6	0.99
4	0:06:13	4.83	6	0	6	1.04
5	0:06:27	4.83	6	0	6	1.08
6	0:06:39	4.83	6	0	6	1.11
7						
8						
9						
10						
11						



Rate (Min/Inch): 1.11

PERCOLATION RATE CONVERSION (PORCHET METHOD)

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

Δt (minutes)

D_f (Final Depth to water)

r (hole radius in inches)

D_0 (Initial Depth to water)

D_t (Total Depth of test hole)

H_0 (initial height of water at selected time interval)

$$H_0 = D_t\text{-}D_0$$

H_f (final height of water at the selected time interval)

$$H_f = D_t\text{-}D_f$$

ΔH (change in head over the time interval)

$$\Delta H = H_0\text{-}H_f$$

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

$$H_{avg} = (H_0+H_f)/2$$

Test Hole: **P-2**

Δt =	2
D_f =	57
r =	4.00
D_0 =	51
D_t =	58.00
H_0 =	7
H_f =	1
ΔH =	6.00
H_{avg} =	4.00

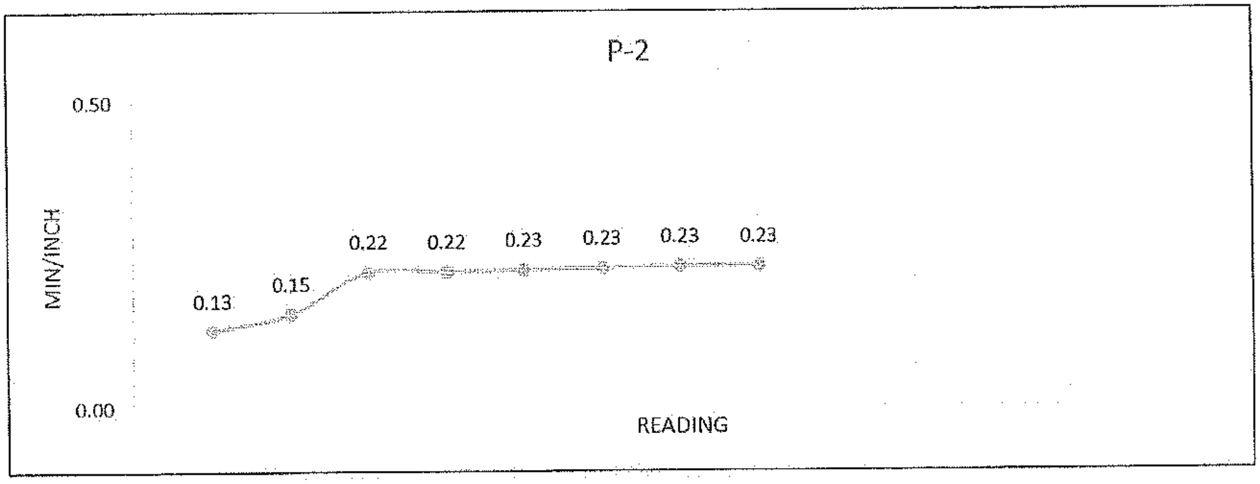
I_t= 60.00 in/hr

RIVERSIDE COUNTY LEACH LINE DATA SHEETS

PR#:	6113-6117
Project:	Paradise Valley Ranch
Job No. :	644-20047
Date:	12/30/2020
Test Hole #:	P-2
Depth (ft):	4.75
Equipment:	John Deere 30
USCS Soil Class:	SM/SP
Tested By:	R.F./ A.F.

READING	TIME INTERVAL (h:m:s)	DEPTH (ft)	INITIAL W (in)	FINAL W (in)	ΔW (in)	Min/Inch
A	0:01:01	4.75	8	0	8	0.13
B	0:01:14	4.75	8	0	8	0.15

READING*	TIME INTERVAL (h:m:s)	DEPTH (ft)	INITIAL W (in)	FINAL W (in)	ΔW (in)	Min/Inch
1	0:01:20	4.75	6	0	6	0.22
2	0:01:20	4.75	6	0	6	0.22
3	0:01:21	4.75	6	0	6	0.23
4	0:01:22	4.75	6	0	6	0.23
5	0:01:23	4.75	6	0	6	0.23
6	0:01:23	4.75	6	0	6	0.23
7						
8						
9						
10						
11						



Rate (Min/Inch): 0.23

PERCOLATION RATE CONVERSION (PORCHET METHOD)

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

Δt (minutes)

D_f (Final Depth to water)

r (hole radius in inches)

D_0 (Initial Depth to water)

D_t (Total Depth of test hole)

H_0 (initial height of water at selected time interval)

$$H_0 = D_t - D_0$$

H_f (final height of water at the selected time interval)

$$H_f = D_t - D_f$$

ΔH (change in head over the time interval)

$$\Delta H = H_0 - H_f$$

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

$$H_{avg} = (H_0+H_f)/2$$

Test Hole: **P-3**

Δt =	2
D_f =	58
r =	4.00
D_0 =	53
D_t =	59.00
H_0 =	6
H_f =	1
ΔH =	5.00
H_{avg} =	3.50

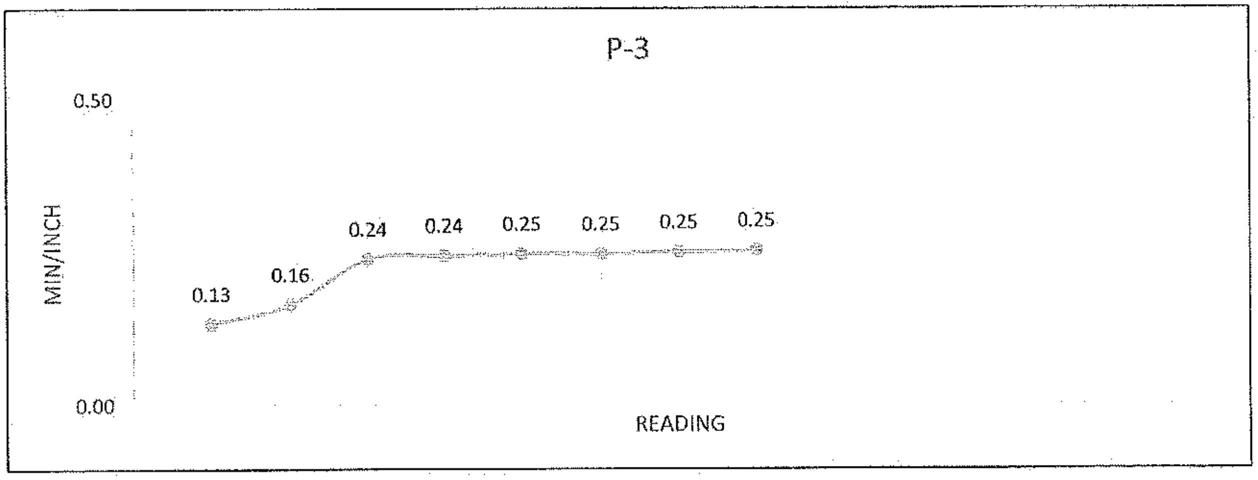
I_t= 54.55 in/hr

RIVERSIDE COUNTY LEACH LINE DATA SHEETS

PR#:	6113-6117
Project:	Paradise Valley Ranch
Job No. :	644-20047
Date:	12/30/2020
Test Hole #:	P-3
Depth (ft):	4.83
Equipment:	John Deere 30
USCS Soil Class:	SM/SP
Tested By:	R.F./ A.F.

READING	TIME INTERVAL (h:m:s)	DEPTH (ft)	INITIAL W (in)	FINAL W (in)	ΔW (in)	Min/Inch
A	0:01:04	4.83	8	0	8	0.13
B	0:01:19	4.83	8	0	8	0.16

READING*	TIME INTERVAL (h:m:s)	DEPTH (ft)	INITIAL W (in)	FINAL W (in)	ΔW (in)	Min/Inch
1	0:01:26	4.83	6	0	6	0.24
2	0:01:28	4.83	6	0	6	0.24
3	0:01:29	4.83	6	0	6	0.25
4	0:01:29	4.83	6	0	6	0.25
5	0:01:30	4.83	6	0	6	0.25
6	0:01:31	4.83	6	0	6	0.25
7						
8						
9						
10						
11						



Rate (Min/Inch): 0.25

PERCOLATION RATE CONVERSION (PORCHET METHOD)

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

Δt (minutes)

D_f (Final Depth to water)

r (hole radius in inches)

D_0 (Initial Depth to water)

D_t (Total Depth of test hole)

H_0 (initial height of water at selected time interval)

$$H_0 = D_t - D_0$$

H_f (final height of water at the selected time interval)

$$H_f = D_t - D_f$$

ΔH (change in head over the time interval)

$$\Delta H = H_0 - H_f$$

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

$$H_{avg} = (H_0 + H_f)/2$$

Test Hole: **P-4**

$\Delta t =$	2
$D_f =$	59
r =	4.00
$D_0 =$	53
$D_t =$	60.00
$H_0 =$	7
$H_f =$	1
$\Delta H =$	6.00
$H_{avg} =$	4.00

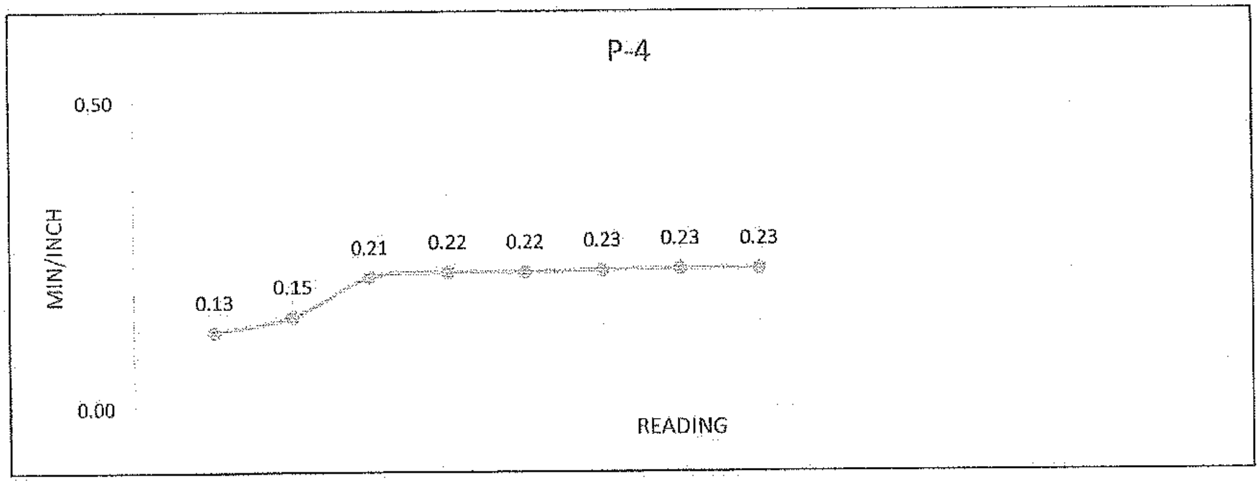
$I_t =$ 60.00 in/hr

RIVERSIDE COUNTY LEACH LINE DATA SHEETS

PR#:	6113-6117
Project:	Paradise Valley Ranch
Job No. :	644-20047
Date:	12/30/2020
Test Hole #:	P-4
Depth (ft):	5.00
Equipment:	John Deere 30
USCS Soil Class:	SM/SP
Tested By:	R.F./ A.F.

READING	TIME INTERVAL (h:m:s)	DEPTH (ft)	INITIAL W (in)	FINAL W (in)	ΔW (in)	Min/Inch
A	0:01:00	5	8	0	8	0.13
B	0:01:12	5	8	0	8	0.15

READING*	TIME INTERVAL (h:m:s)	DEPTH (ft)	INITIAL W (in)	FINAL W (in)	ΔW (in)	Min/Inch
1	0:01:17	5	6	0	6	0.21
2	0:01:20	5	6	0	6	0.22
3	0:01:20	5	6	0	6	0.22
4	0:01:21	5	6	0	6	0.23
5	0:01:22	5	6	0	6	0.23
6	0:01:22	5	6	0	6	0.23
7						
8						
9						
10						
11						



Rate (Min/Inch): 0.23

PERCOLATION RATE CONVERSION (PORCHET METHOD)

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

Δt (minutes)

D_f (Final Depth to water)

r (hole radius in inches)

D_0 (Initial Depth to water)

D_t (Total Depth of test hole)

H_0 (initial height of water at selected time interval)

$$H_0 = D_t - D_0$$

H_f (final height of water at the selected time interval)

$$H_f = D_t - D_f$$

ΔH (change in head over the time interval)

$$\Delta H = H_0 - H_f$$

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

$$H_{avg} = (H_0 + H_f)/2$$

Test Hole: **P-5**

$\Delta t =$	5
$D_f =$	53
r =	4.00
$D_0 =$	47
$D_t =$	54.00
$H_0 =$	7
$H_f =$	1
$\Delta H =$	6.00
$H_{avg} =$	4.00

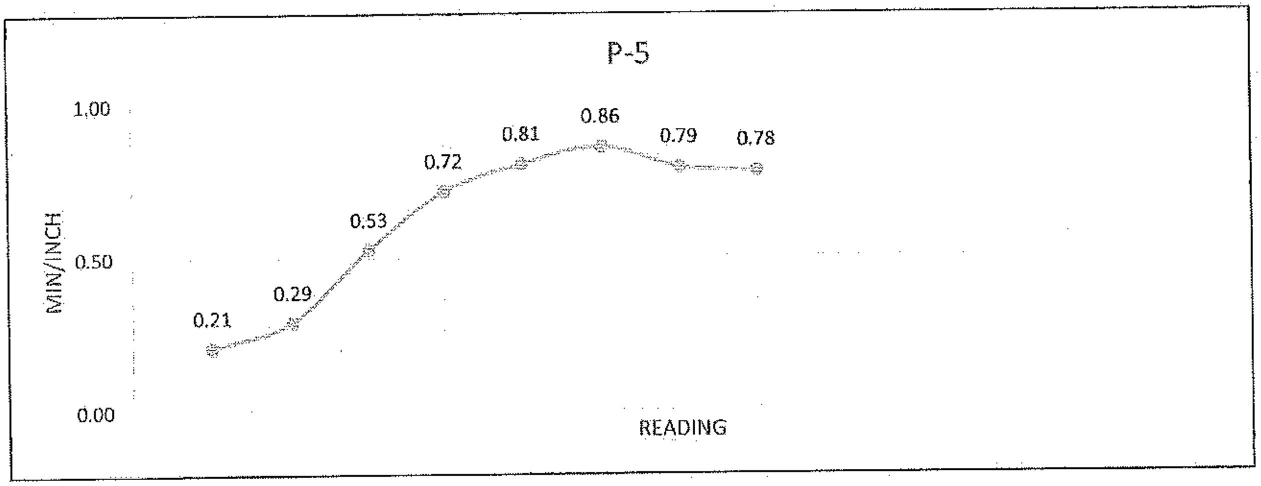
$I_t =$ 24.00 in/hr

RIVERSIDE COUNTY LEACH LINE DATA SHEETS

PR#:	6113-6117
Project:	Paradise Valley Ranch
Job No.:	644-20047
Date:	12/30/2020
Test Hole #:	P-5
Depth (ft):	4.58
Equipment:	John Deere 30
USCS Soil Class:	SM/SP
Tested By:	R.F./ A.F.

READING	TIME INTERVAL (h:m:s)	DEPTH (ft)	INITIAL W (in)	FINAL W (in)	ΔW (in)	Min/Inch
A	0:01:40	4.58	8	0	8	0.21
B	0:02:20	4.58	8	0	8	0.29

READING*	TIME INTERVAL (h:m:s)	DEPTH (ft)	INITIAL W (in)	FINAL W (in)	ΔW (in)	Min/Inch
1	0:03:10	4.58	6	0	6	0.53
2	0:04:18	4.58	6	0	6	0.72
3	0:04:50	4.58	6	0	6	0.81
4	0:05:10	4.58	6	0	6	0.86
5	0:04:46	4.58	6	0	6	0.79
6	0:04:42	4.58	6	0	6	0.78
7						
8						
9						
10						
11						



Rate (Min/Inch): 0.78

PERCOLATION RATE CONVERSION (PORCHET METHOD)

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

Δt (minutes)

D_f (Final Depth to water)

r (hole radius in inches)

D_0 (Initial Depth to water)

D_t (Total Depth of test hole)

H_0 (initial height of water at selected time interval)

$$H_0 = D_t\text{-}D_0$$

H_f (final height of water at the selected time interval)

$$H_f = D_t\text{-}D_f$$

ΔH (change in head over the time interval)

$$\Delta H = H_0\text{-}H_f$$

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

$$H_{avg} = (H_0+H_f)/2$$

Test Hole: **P-6**

Δt =	9
D_f =	53
r =	4.00
D_0 =	47
D_t =	54.00
H_0 =	7
H_f =	1
ΔH =	6.00
H_{avg} =	4.00

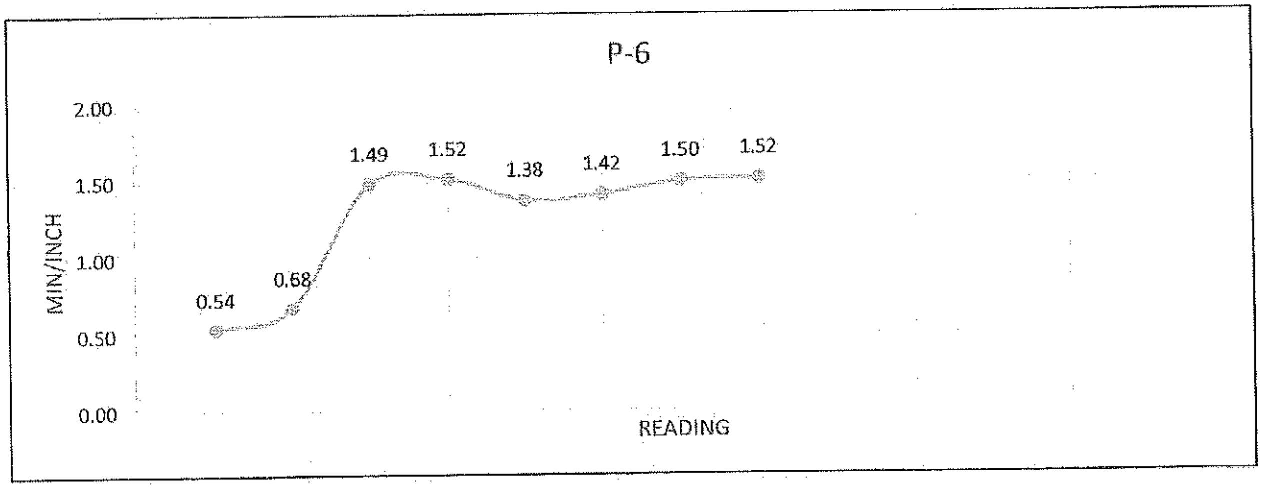
I_t= 13.33 in/hr

RIVERSIDE COUNTY LEACH LINE DATA SHEETS

PR#:	6113-6117
Project:	Paradise Valley Ranch
Job No. :	644-20047
Date:	12/30/2020
Test Hole #:	P-6
Depth (ft):	4.41
Equipment:	John Deere 30
USCS Soil Class:	SM/SP
Tested By:	R.F./ A.F.

READING	TIME INTERVAL (h:m:s)	DEPTH (ft)	INITIAL W (in)	FINAL W (in)	ΔW (in)	Min/Inch
A	0:04:20	4.41	8	0	8	0.54
B	0:05:26	4.41	8	0	8	0.68

READING*	TIME INTERVAL (h:m:s)	DEPTH (ft)	INITIAL W (in)	FINAL W (in)	ΔW (in)	Min/Inch
1	0:08:55	4.41	6	0	6	1.49
2	0:09:06	4.41	6	0	6	1.52
3	0:08:16	4.41	6	0	6	1.38
4	0:08:30	4.41	6	0	6	1.42
5	0:09:01	4.41	6	0	6	1.50
6	0:09:06	4.41	6	0	6	1.52
7						
8						
9						
10						
11						



Rate (Min/Inch): 1.52

PERCOLATION RATE CONVERSION (PORCHET METHOD)

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

Δt (minutes)

D_f (Final Depth to water)

r (hole radius in inches)

D_0 (Initial Depth to water)

D_t (Total Depth of test hole)

H_0 (initial height of water at selected time interval)

$$H_0 = D_t - D_0$$

H_f (final height of water at the selected time interval)

$$H_f = D_t - D_f$$

ΔH (change in head over the time interval)

$$\Delta H = H_0 - H_f$$

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

$$H_{avg} = (H_0 + H_f)/2$$

Test Hole: **P-7**

$\Delta t =$	10
$D_f =$	52.5
$r =$	4.00
$D_0 =$	48
$D_t =$	54.00
$H_0 =$	6
$H_f =$	1.5
$\Delta H =$	4.50
$H_{avg} =$	3.75

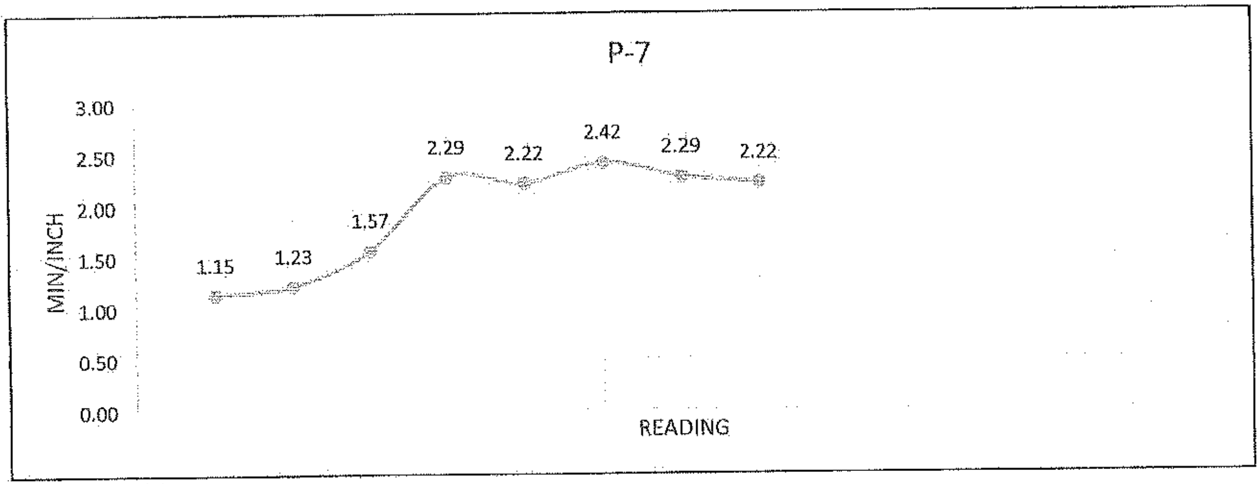
$I_t =$ 9.39 in/hr

RIVERSIDE COUNTY LEACH LINE DATA SHEETS

PR#:	6113-6117
Project:	Paradise Valley Ranch
Job No. :	644-20047
Date:	12/30/2020
Test Hole #:	P-7
Depth (ft):	4.50
Equipment:	John Deere 30
USCS Soil Class:	SM/SP
Tested By:	R.F./ A.F.

READING	TIME INTERVAL (h:m:s)	DEPTH (ft)	INITIAL W (in)	FINAL W (in)	ΔW (in)	Min/Inch
A	0:09:10	4.5	8	0	8	1.15
B	0:09:50	4.5	8	0	8	1.23

READING*	TIME INTERVAL (h:m:s)	DEPTH (ft)	INITIAL W (in)	FINAL W (in)	ΔW (in)	Min/Inch
1	0:09:26	4.5	6	0	6	1.57
2	0:10:00	4.5	6	1 5/8	4 3/8	2.29
3	0:10:00	4.5	6	1 4/8	4 4/8	2.22
4	0:10:00	4.5	6	1 7/8	4 1/8	2.42
5	0:10:00	4.5	6	1 5/8	4 3/8	2.29
6	0:10:00	4.5	6	1 4/8	4 4/8	2.22
7						
8						
9						
10						
11						



Rate (Min/Inch): 2.22

PERCOLATION RATE CONVERSION (PORCHET METHOD)

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

Δt (minutes)

D_f (Final Depth to water)

r (hole radius in inches)

D_0 (Initial Depth to water)

D_t (Total Depth of test hole)

H_0 (initial height of water at selected time interval)

$$H_0 = D_t - D_0$$

H_f (final height of water at the selected time interval)

$$H_f = D_t - D_f$$

ΔH (change in head over the time interval)

$$\Delta H = H_0 - H_f$$

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

$$H_{avg} = (H_0 + H_f)/2$$

Test Hole: **P-8**

$\Delta t =$	10
$D_f =$	52.5
$r =$	4.00
$D_0 =$	49
$D_t =$	55.00
$H_0 =$	6
$H_f =$	2.5
$\Delta H =$	3.50
$H_{avg} =$	4.25

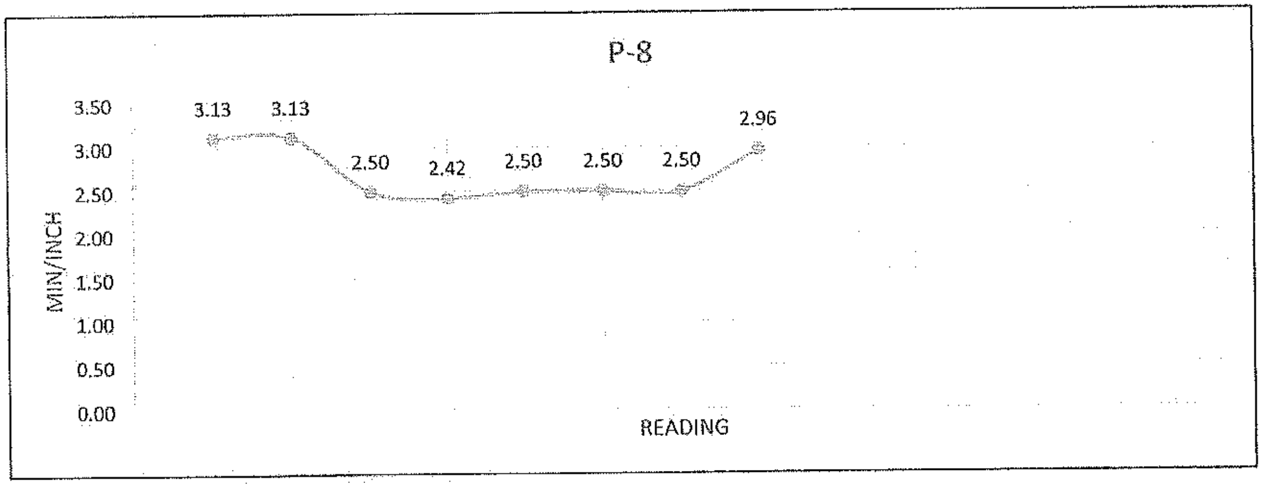
$I_t =$ 6.72 in/hr

RIVERSIDE COUNTY LEACH LINE DATA SHEETS

PR#:	6113-6117
Project:	Paradise Valley Ranch
Job No. :	644-20047
Date:	12/30/2020
Test Hole #:	P-8
Depth (ft):	4.58
Equipment:	John Deere 30
USCS Soil Class:	SM/SP
Tested By:	R.F./ A.F.

READING	TIME INTERVAL (h:m:s)	DEPTH (ft)	INITIAL W (in)	FINAL W (in)	ΔW (in)	Min/Inch
A	0:25:00	4.58	8	0	8	3.13
B	0:25:00	4.58	8	0	8	3.13

READING*	TIME INTERVAL (h:m:s)	DEPTH (ft)	INITIAL W (in)	FINAL W (in)	ΔW (in)	Min/Inch
1	0:10:00	4.58	6	2	4	2.50
2	0:10:00	4.58	6	1 7/8	4 1/8	2.42
3	0:10:00	4.58	6	2	4	2.50
4	0:10:00	4.58	6	2	4	2.50
5	0:10:00	4.58	6	2	4	2.50
6	0:10:00	4.58	6	2 5/8	3 3/8	2.96
7						
8						
9						
10						
11						



Rate (Min/Inch): 2.96

PERCOLATION RATE CONVERSION (PORCHET METHOD)

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

Δt (minutes)

D_f (Final Depth to water)

r (hole radius in inches)

D_0 (Initial Depth to water)

D_t (Total Depth of test hole)

H_0 (initial height of water at selected time interval)

$$H_0 = D_t - D_0$$

H_f (final height of water at the selected time interval)

$$H_f = D_t - D_f$$

ΔH (change in head over the time interval)

$$\Delta H = H_0 - H_f$$

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

$$H_{avg} = (H_0 + H_f)/2$$

Test Hole: **P-9**

$\Delta t =$ 10

$D_f =$ 59

$r =$ 4.00

$D_0 =$ 54

$D_t =$ 60.00

$H_0 =$ 6

$H_f =$ 1

$\Delta H =$ 5.00

$H_{avg} =$ 3.50

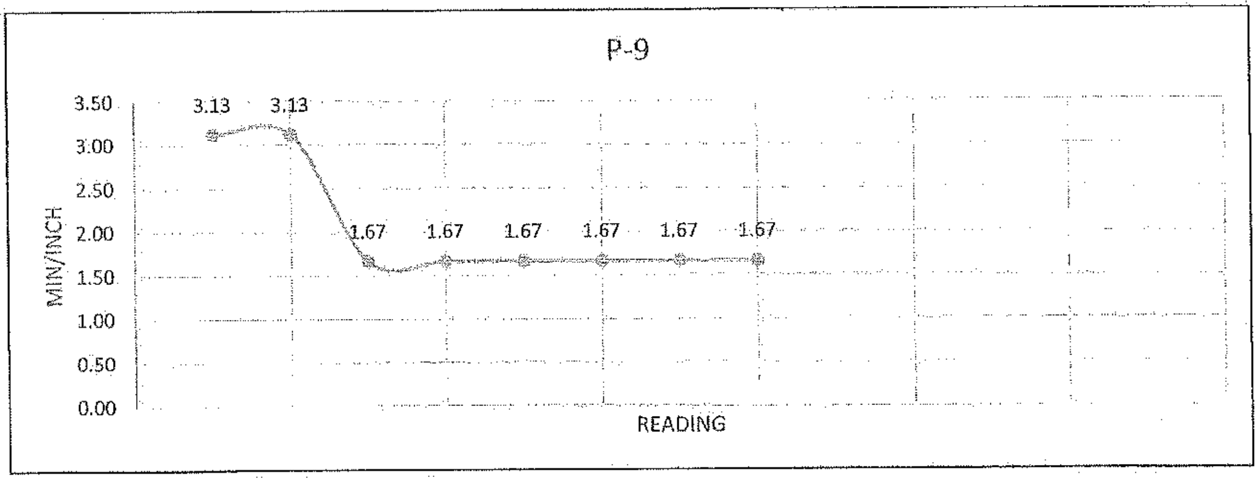
$I_t =$ 10.91 in/hr

RIVERSIDE COUNTY LEACH LINE DATA SHEETS

PR#:	6113-6117
Project:	Paradise Valley Ranch
Job No. :	644-20047
Date:	2/23/2021
Test Hole #:	P-9
Depth (ft):	5
Equipment:	John Deere 30
USCS Soil Class:	SM/SP
Tested By:	S.D./J.M.

READING	TIME INTERVAL (h:m:s)	DEPTH (ft)	INITIAL W (in)	FINAL W (in)	ΔW (in)	Min/Inch
A	0:25:00	5	8	0	8	3.13
B	0:25:00	5	8	0	8	3.13

READING*	TIME INTERVAL (h:m:s)	DEPTH (ft)	INITIAL W (in)	FINAL W (in)	ΔW (in)	Min/Inch
1	0:10:00	5	6	0	6	1.67
2	0:10:00	5	6	0	6	1.67
3	0:10:00	5	6	0	6	1.67
4	0:10:00	5	6	0	6	1.67
5	0:10:00	5	6	0	6	1.67
6	0:10:00	5	6	0	6	1.67
7						
8						
9						
10						
11						



Rate (Min/Inch): 1.67

PERCOLATION RATE CONVERSION (PORCHET METHOD)

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

Δt (minutes)

D_f (Final Depth to water)

r (hole radius in inches)

D_0 (Initial Depth to water)

D_t (Total Depth of test hole)

H_0 (initial height of water at selected time interval)

$$H_0 = D_t\text{-}D_0$$

H_f (final height of water at the selected time interval)

$$H_f = D_t\text{-}D_f$$

ΔH (change in head over the time interval)

$$\Delta H = H_0\text{-}H_f$$

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

$$H_{avg} = (H_0+H_f)/2$$

Test Hole: **P-10**

Δt =	10
D_f =	59
r =	4.00
D_0 =	53
D_t =	60.00
H_0 =	7
H_f =	1
ΔH =	6.00
H_{avg} =	4.00

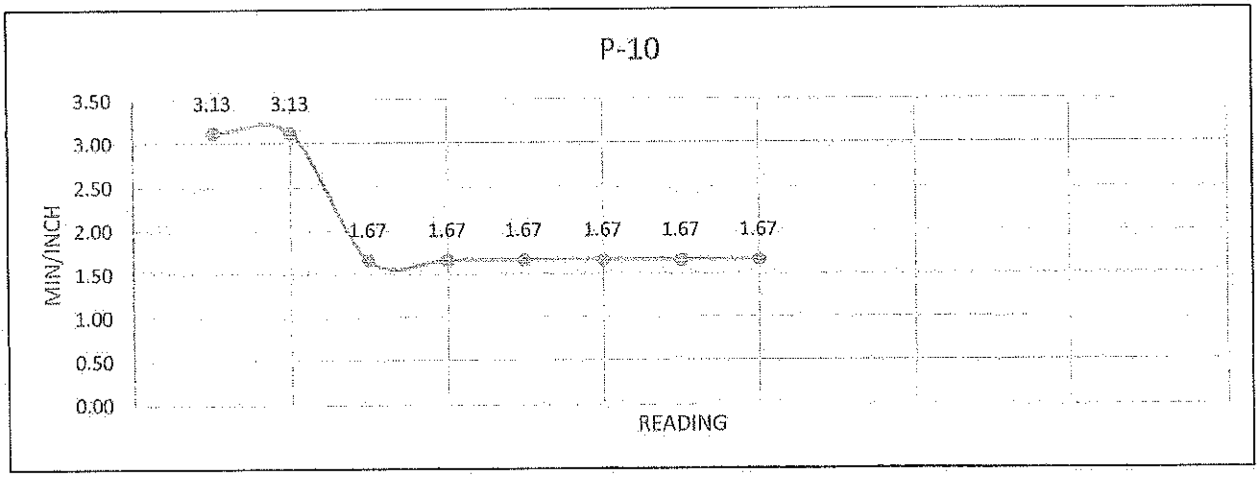
I_t= 12.00 in/hr

RIVERSIDE COUNTY LEACH LINE DATA SHEETS

PR#:	6113-6117
Project:	Paradise Valley Ranch
Job No. :	644-20047
Date:	2/23/2021
Test Hole #:	P-10
Depth (ft):	5.00
Equipment:	John Deere 30
USCS Soil Class:	SM/SP
Tested By:	S.D./J.M.

READING	TIME INTERVAL (h:m:s)	DEPTH (ft)	INITIAL W (in)	FINAL W (in)	ΔW (in)	Min/Inch
A	0:25:00	5	8	0	8	3.13
B	0:25:00	5	8	0	8	3.13

READING*	TIME INTERVAL (h:m:s)	DEPTH (ft)	INITIAL W (in)	FINAL W (in)	ΔW (in)	Min/Inch
1	0:10:00	5	6	0	6	1.67
2	0:10:00	5	6	0	6	1.67
3	0:10:00	5	6	0	6	1.67
4	0:10:00	5	6	0	6	1.67
5	0:10:00	5	6	0	6	1.67
6	0:10:00	5	6	0	6	1.67
7						
8						
9						
10						
11						



Rate (Min/Inch): 1.67

PERCOLATION RATE CONVERSION (PORCHET METHOD)

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

Δt (minutes)

D_f (Final Depth to water)

r (hole radius in inches)

D_0 (Initial Depth to water)

D_t (Total Depth of test hole)

H_0 (initial height of water at selected time interval)

$$H_0 = D_t - D_0$$

H_f (final height of water at the selected time interval)

$$H_f = D_t - D_f$$

ΔH (change in head over the time interval)

$$\Delta H = H_0 - H_f$$

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

$$H_{avg} = (H_0 + H_f)/2$$

Test Hole: **P-11**

$\Delta t =$ 10

$D_f =$ 59

$r =$ 4.00

$D_0 =$ 53

$D_t =$ 60.00

$H_0 =$ 7

$H_f =$ 1

$\Delta H =$ 6.00

$H_{avg} =$ 4.00

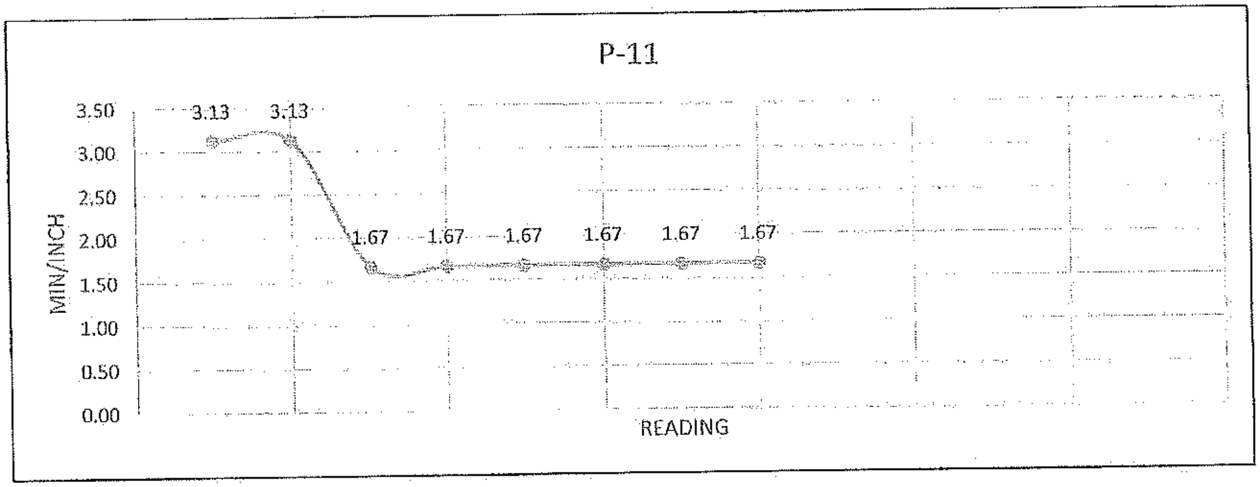
$I_t =$ 12.00 in/hr

RIVERSIDE COUNTY LEACH LINE DATA SHEETS

PR#:	6113-6117
Project:	Paradise Valley Ranch
Job No. :	644-20047
Date:	2/23/2021
Test Hole #:	P-11
Depth (ft):	5.00
Equipment:	John Deere 30
USCS Soil Class:	SM/SP
Tested By:	S.D./J.M.

READING	TIME INTERVAL (h:m:s)	DEPTH (ft)	INITIAL W (in)	FINAL W (in)	ΔW (in)	Min/Inch
A	0:25:00	5	8	0	8	3.13
B	0:25:00	5	8	0	8	3.13

READING*	TIME INTERVAL (h:m:s)	DEPTH (ft)	INITIAL W (in)	FINAL W (in)	ΔW (in)	Min/Inch
1	0:10:00	5	6	0	6	1.67
2	0:10:00	5	6	0	6	1.67
3	0:10:00	5	6	0	6	1.67
4	0:10:00	5	6	0	6	1.67
5	0:10:00	5	6	0	6	1.67
6	0:10:00	5	6	0	6	1.67
7						
8						
9						
10						
11						



Rate (Min/Inch): 1.67

PERCOLATION RATE CONVERSION (PORCHET METHOD)

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

Δt (minutes)

D_f (Final Depth to water)

r (hole radius in inches)

D_0 (Initial Depth to water)

D_t (Total Depth of test hole)

H_0 (initial height of water at selected time interval)

$$H_0 = D_t - D_0$$

H_f (final height of water at the selected time interval)

$$H_f = D_t - D_f$$

ΔH (change in head over the time interval)

$$\Delta H = H_0 - H_f$$

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

$$H_{avg} = (H_0 + H_f)/2$$

Test Hole: **P-12**

Δt =	10
D_f =	59
r =	4.00
D_0 =	53
D_t =	60.00
H_0 =	7
H_f =	1
ΔH =	6.00
H_{avg} =	4.00

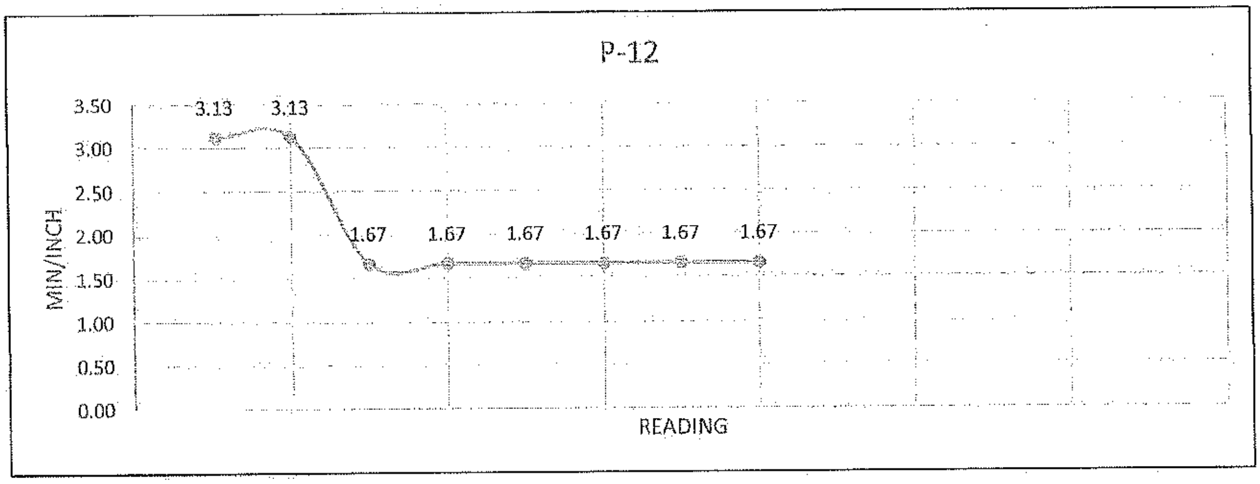
I_t= 12.00 in/hr

RIVERSIDE COUNTY LEACH LINE DATA SHEETS

PR#:	6113-6117
Project:	Paradise Valley Ranch
Job No. :	644-20047
Date:	2/23/2021
Test Hole #:	P-12
Depth (ft):	5.00
Equipment:	John Deere 30
USCS Soil Class:	SM/SP
Tested By:	S.D./J.M.

READING	TIME INTERVAL (h:m:s)	DEPTH (ft)	INITIAL W (in)	FINAL W (in)	ΔW (in)	Min/Inch
A	0:25:00	5	8	0	8	3.13
B	0:25:00	5	8	0	8	3.13

READING*	TIME INTERVAL (h:m:s)	DEPTH (ft)	INITIAL W (in)	FINAL W (in)	ΔW (in)	Min/Inch
1	0:10:00	5	6	0	6	1.67
2	0:10:00	5	6	0	6	1.67
3	0:10:00	5	6	0	6	1.67
4	0:10:00	5	6	0	6	1.67
5	0:10:00	5	6	0	6	1.67
6	0:10:00	5	6	0	6	1.67
7						
8						
9						
10						
11						



Rate (Min/Inch): 1.67

PERCOLATION RATE CONVERSION (PORCHET METHOD)

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

Δt (minutes)

D_f (Final Depth to water)

r (hole radius in inches)

D_0 (Initial Depth to water)

D_t (Total Depth of test hole)

H_0 (initial height of water at selected time interval)

$$H_0 = D_t - D_0$$

H_f (final height of water at the selected time interval)

$$H_f = D_t - D_f$$

ΔH (change in head over the time interval)

$$\Delta H = H_0 - H_f$$

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

$$H_{avg} = (H_0 + H_f)/2$$

Test Hole: **P-13**

$\Delta t =$	10
$D_f =$	59
$r =$	4.00
$D_0 =$	53
$D_t =$	60.00
$H_0 =$	7
$H_f =$	1
$\Delta H =$	6.00
$H_{avg} =$	4.00

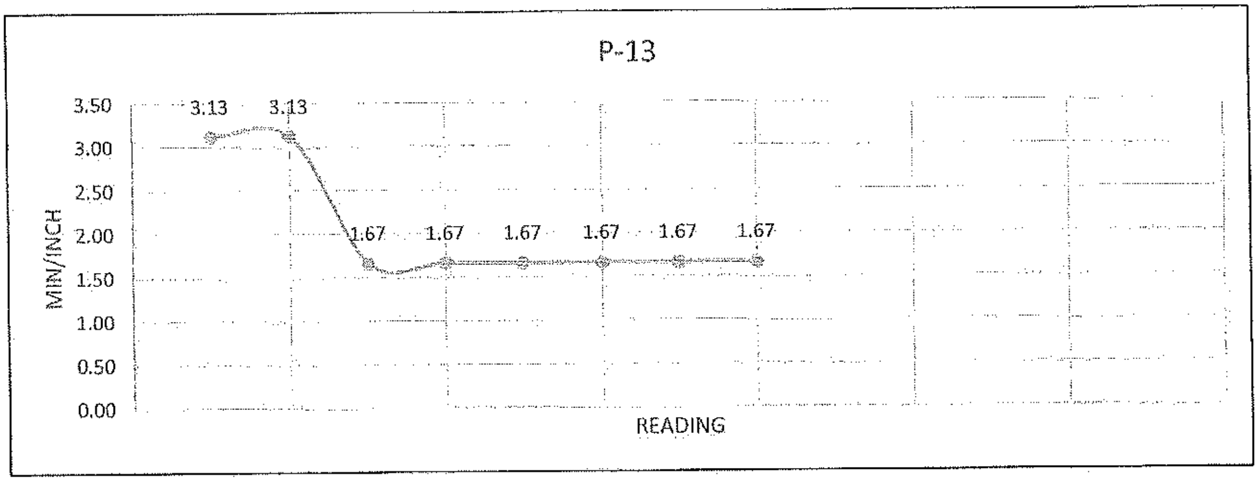
$I_t =$ 12.00 in/hr

RIVERSIDE COUNTY LEACH LINE DATA SHEETS

PR#:	6113-6117
Project:	Paradise Valley Ranch
Job No. :	644-20047
Date:	2/23/2021
Test Hole #:	P-13
Depth (ft):	5.00
Equipment:	John Deere 30
USCS Soil Class:	SM/SP
Tested By:	S.D./J.M.

READING	TIME INTERVAL (h:m:s)	DEPTH (ft)	INITIAL W (in)	FINAL W (in)	ΔW (in)	Min/Inch
A	0:25:00	5	8	0	8	3.13
B	0:25:00	5	8	0	8	3.13

READING*	TIME INTERVAL (h:m:s)	DEPTH (ft)	INITIAL W (in)	FINAL W (in)	ΔW (in)	Min/Inch
1	0:10:00	5	6	0	6	1.67
2	0:10:00	5	6	0	6	1.67
3	0:10:00	5	6	0	6	1.67
4	0:10:00	5	6	0	6	1.67
5	0:10:00	5	6	0	6	1.67
6	0:10:00	5	6	0	6	1.67
7						
8						
9						
10						
11						



Rate (Min/Inch): 1.67

PERCOLATION RATE CONVERSION (PORCHET METHOD)

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

Δt (minutes)

D_f (Final Depth to water)

r (hole radius in inches)

D_0 (Initial Depth to water)

D_t (Total Depth of test hole)

H_0 (initial height of water at selected time interval)

$H_0 = D_t - D_0$

H_f (final height of water at the selected time interval)

$H_f = D_t - D_f$

ΔH (change in head over the time interval)

$\Delta H = H_0 - H_f$

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

$H_{avg} = (H_0 + H_f)/2$

Test Hole: **P-14**

$\Delta t =$	10
$D_f =$	59
r =	4.00
$D_0 =$	53
$D_t =$	60.00
$H_0 =$	7
$H_f =$	1
$\Delta H =$	6.00
$H_{avg} =$	4.00

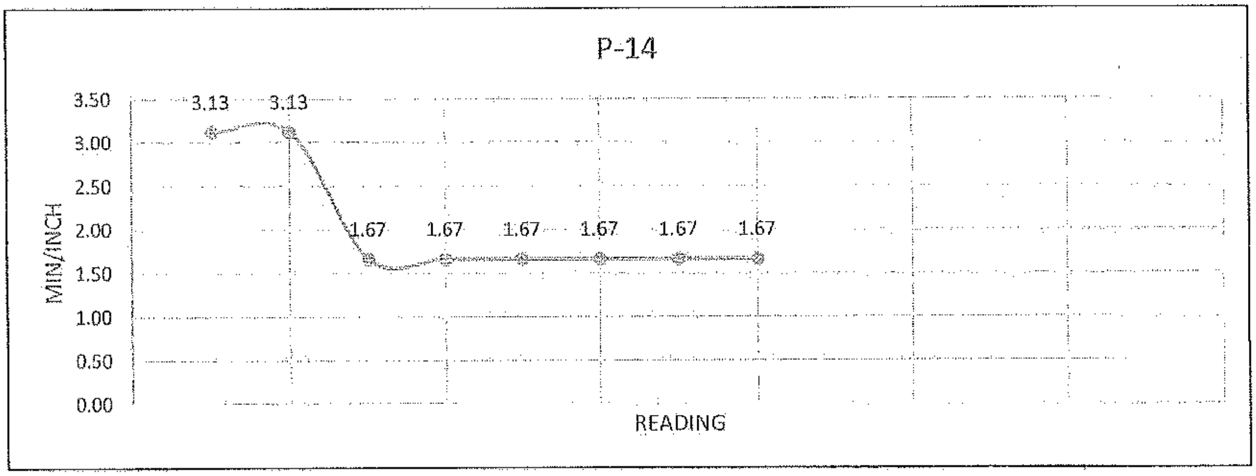
$I_t =$ 12.00 in/hr

RIVERSIDE COUNTY LEACH LINE DATA SHEETS

PR#:	6113-6117
Project:	Paradise Valley Ranch
Job No. :	644-20047
Date:	2/23/2021
Test Hole #:	P-14
Depth (ft):	5.00
Equipment:	John Deere 30
USCS Soil Class:	SM/SP
Tested By:	S.D./J.M.

READING	TIME INTERVAL (h:m:s)	DEPTH (ft)	INITIAL W (in)	FINAL W (in)	ΔW (in)	Min/Inch
A	0:25:00	5	8	0	8	3.13
B	0:25:00	5	8	0	8	3.13

READING*	TIME INTERVAL (h:m:s)	DEPTH (ft)	INITIAL W (in)	FINAL W (in)	ΔW (in)	Min/Inch
1	0:10:00	5	6	0	6	1.67
2	0:10:00	5	6	0	6	1.67
3	0:10:00	5	6	0	6	1.67
4	0:10:00	5	6	0	6	1.67
5	0:10:00	5	6	0	6	1.67
6	0:10:00	5	6	0	6	1.67
7						
8						
9						
10						
11						



Rate (Min/Inch): 1.67

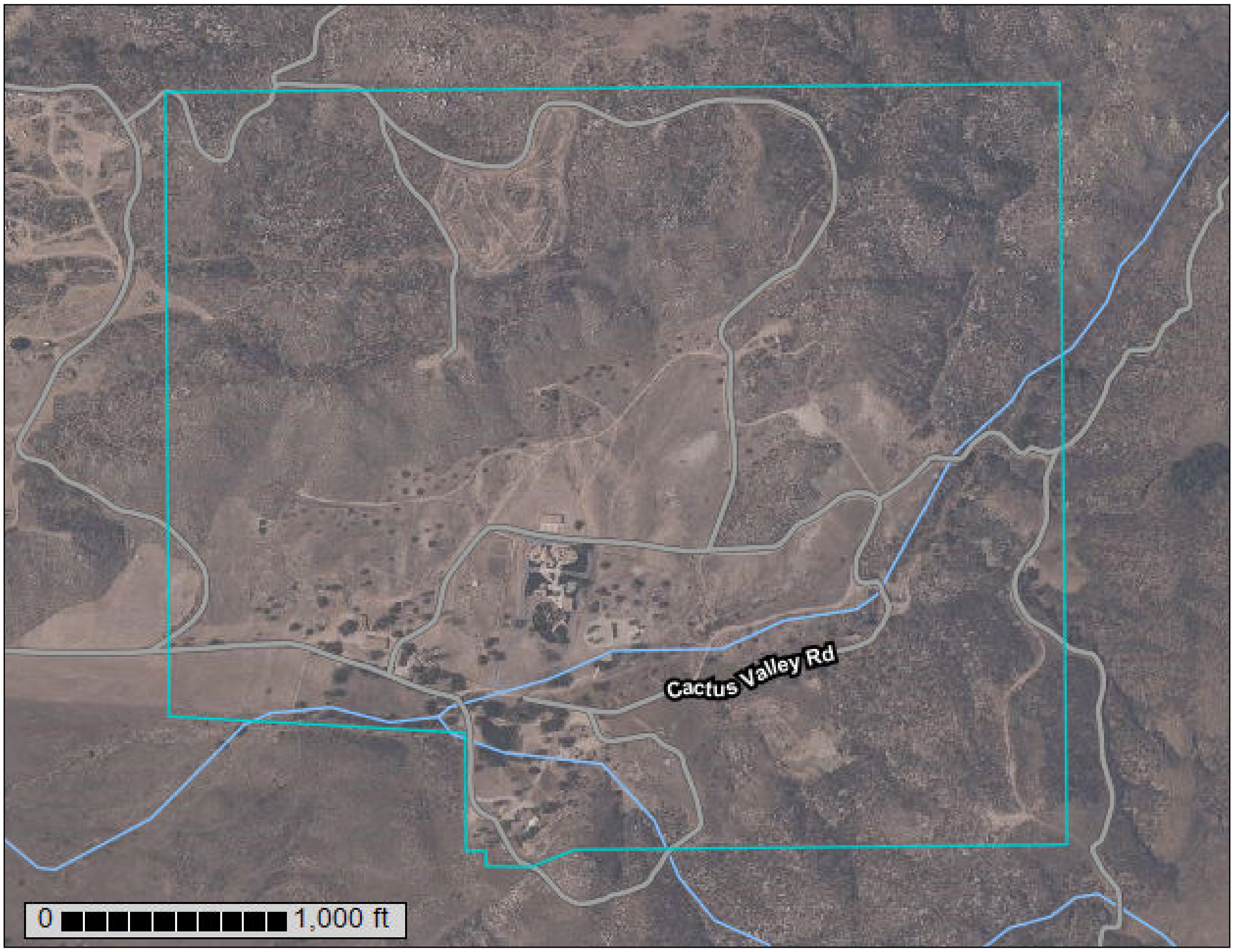
United States
Department of
Agriculture

NRCS

Natural
Resources
Conservation
Service

A product of the National
Cooperative Soil Survey,
a joint effort of the United
States Department of
Agriculture and other
Federal agencies, State
agencies including the
Agricultural Experiment
Stations, and local
participants

Custom Soil Resource Report for
Western Riverside Area, California



March 2, 2021

Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (https://offices.sc.egov.usda.gov/locator/app?agency=nrcs) or your NRCS State Soil Scientist (http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2_053951).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Web Soil Survey, the site for official soil survey information.

The U.S. Department of Agriculture (USDA) prohibits discrimination in all its programs and activities on the basis of race, color, national origin, age, disability, and where applicable, sex, marital status, familial status, parental status, religion, sexual orientation, genetic information, political beliefs, reprisal, or because all or a part of an individual's income is derived from any public assistance program. (Not all prohibited bases apply to all programs.) Persons with disabilities who require

Contents

How Soil Surveys Are Made

Soil surveys are made to provide information about the soils and miscellaneous areas in a specific area. They include a description of the soils and miscellaneous areas and their location on the landscape and tables that show soil properties and limitations affecting various uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They observed and described many soil profiles. A soil profile is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed or from the surface down to bedrock. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

Currently, soils are mapped according to the boundaries of major land resource areas (MLRAs). MLRAs are geographically associated land resource units that share common characteristics related to physiography, geology, climate, water resources, soils, biological resources, and land uses (USDA, 2006). Soil survey areas typically consist of parts of one or more MLRA.

The soils and miscellaneous areas in a survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept, or model, of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

The objective of soil mapping is not to delineate pure map unit components; the objective is to separate the landscape into landforms or landform segments that have similar use and management requirements. Each map unit is defined by a unique combination of soil components and/or miscellaneous areas in predictable proportions. Some components may be highly contrasting to the other components of the map unit. The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The delineation of such landforms and landform segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

Soil scientists make many field observations in the process of producing a soil map. The frequency of observation is dependent upon several factors, including scale of mapping, intensity of mapping, design of map units, complexity of the landscape, and experience of the soil scientist. Observations are made to test and refine the soil-landscape model and predictions and to verify the classification of the soils at specific locations. Once the soil-landscape model is refined, a significantly smaller number of measurements of individual soil properties are made and recorded. These measurements may include field measurements, such as those for color, depth to bedrock, and texture, and laboratory measurements, such as those for content of sand, silt, clay, salt, and other components. Properties of each soil typically vary from one point to another across the landscape.

Observations for map unit components are aggregated to develop ranges of characteristics for the components. The aggregated values are presented. Direct measurements do not exist for every property presented for every map unit component. Values for some properties are estimated from combinations of other properties.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

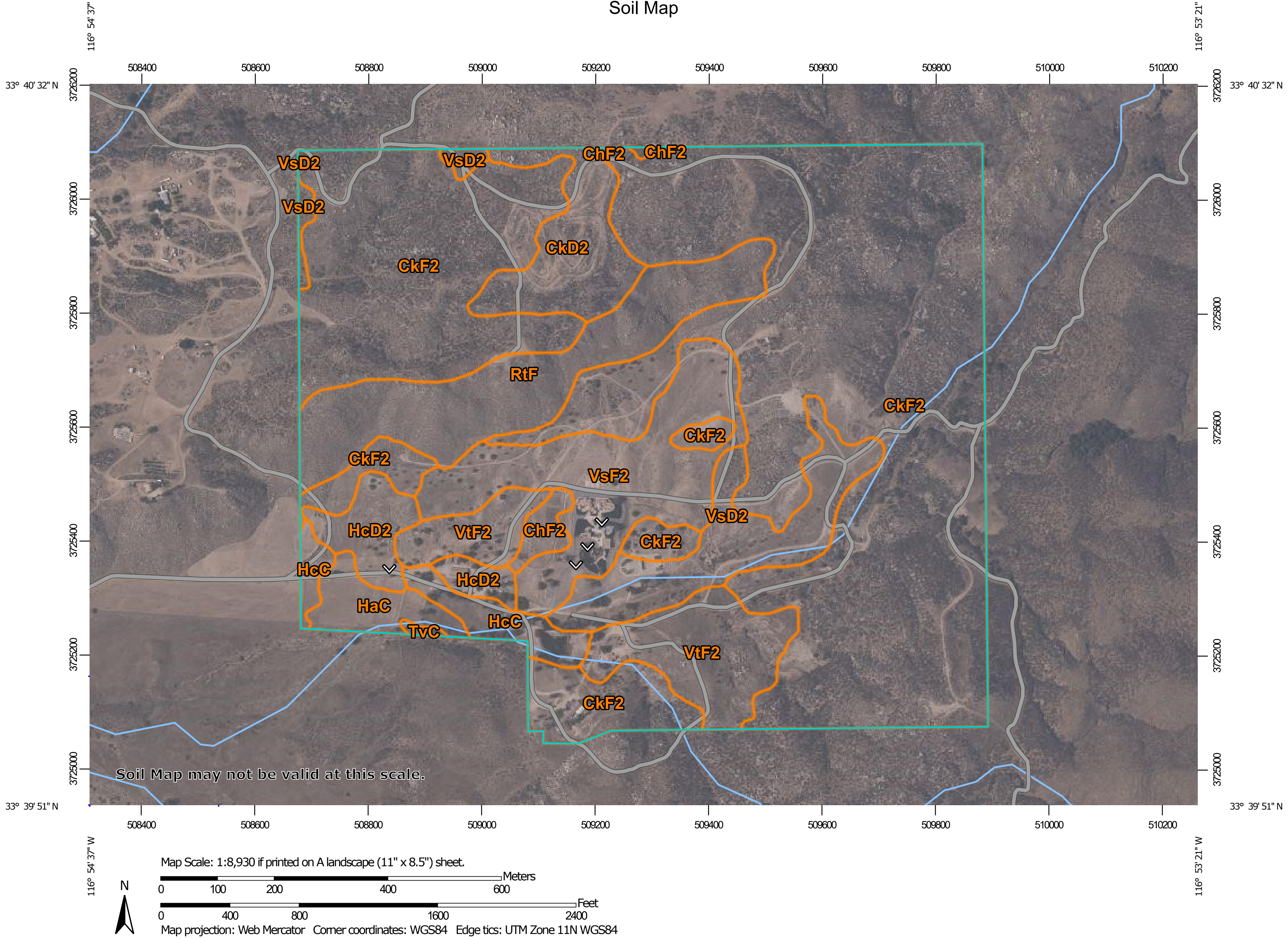
Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

Soil Map



Map Scale: 1:8,930 if printed on A landscape (11" x 8.5") sheet.

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

MAP LEGEND

Area of Interest (AOI)

▭ Area of Interest (AOI)

Soils

▭ Soil Map Unit Polygons

〰 Soil Map Unit Lines

■ Soil Map Unit Points

Special Point Features

◎ Blowout

⊠ Borrow Pit

✱ Clay Spot

◇ Closed Depression

✕ Gravel Pit

∴ Gravelly Spot

● Landfill

ʌ Lava Flow

⊥ Marsh or swamp

⚒ Mine or Quarry

◉ Miscellaneous Water

○ Perennial Water

∨ Rock Outcrop

+ Saline Spot

⁘ Sandy Spot

⊜ Severely Eroded Spot

◇ Sinkhole

≫ Slide or Slip

∅ Sodic Spot

≣ Spoil Area

◊ Stony Spot

◊◊ Very Stony Spot

ψ Wet Spot

△ Other

╌ Special Line Features

Water Features

〜 Streams and Canals

Transportation

┼┼┼ Rails

〰 Interstate Highways

〰 US Routes

〰 Major Roads

〰 Local Roads

Background

🟩 Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:15,800.

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: Western Riverside Area, California
Survey Area Data: Version 13, May 27, 2020

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

Date(s) aerial images were photographed: Aug 18, 2018—Aug 22, 2018

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.

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
ChF2	Cieneba sandy loam, 15 to 50 percent slopes, eroded	2.2	0.8%
CkD2	Cieneba rocky sandy loam, 8 to 15 percent slopes, eroded	11.9	4.1%
CkF2	Cieneba rocky sandy loam, 15 to 50 percent slopes, eroded	171.8	59.2%
HaC	Hanford loamy fine sand, 0 to 8 percent slopes	5.1	1.8%
HcC	Hanford coarse sandy loam, 2 to 8 percent slopes	6.3	2.2%
HcD2	Hanford coarse sandy loam, 8 to 15 percent slopes, eroded	7.6	2.6%
RtF	Rockland	24.6	8.5%
TvC	Tujunga loamy sand, channeled, 0 to 8 percent slopes	0.3	0.1%
VsD2	Vista coarse sandy loam, 8 to 15 percent slopes, eroded	17.5	6.0%
VsF2	Vista coarse sandy loam, 15 to 35 percent slopes, eroded	24.8	8.5%
VtF2	Vista rocky coarse sandy loam, 2 to 35 percent slopes, eroded	18.3	6.3%
Totals for Area of Interest		**290.3**	**100.0%**

Map Unit Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

Western Riverside Area, California

ChF2—Cieneba sandy loam, 15 to 50 percent slopes, eroded

Map Unit Setting

National map unit symbol: hcsc
Elevation: 500 to 4,000 feet
Mean annual precipitation: 12 to 35 inches
Mean annual air temperature: 57 to 64 degrees F
Frost-free period: 200 to 300 days
Farmland classification: Not prime farmland

Map Unit Composition

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

Description of Cieneba

Setting

Landform: Hills
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Concave
Across-slope shape: Convex
Parent material: Residuum weathered from igneous rock

Typical profile

H1 - 0 to 14 inches: sandy loam
H2 - 14 to 22 inches: weathered bedrock

Properties and qualities

Slope: 15 to 50 percent
Depth to restrictive feature: 10 to 20 inches to paralithic bedrock
Drainage class: Somewhat excessively drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.06 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Very low (about 1.4 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7e
Hydrologic Soil Group: D
Ecological site: R019XD060CA - SHALLOW LOAMY (1975)
Hydric soil rating: No

Minor Components

Friant

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

Fallbrook

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

Vista

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

CkD2—Cieneba rocky sandy loam, 8 to 15 percent slopes, eroded

Map Unit Setting

National map unit symbol: hcsd
Elevation: 500 to 4,000 feet
Mean annual precipitation: 12 to 35 inches
Mean annual air temperature: 57 to 64 degrees F
Frost-free period: 200 to 300 days
Farmland classification: Not prime farmland

Map Unit Composition

Cieneba and similar soils: 75 percent
Minor components: 25 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Cieneba

Setting

Landform: Hills
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Concave
Across-slope shape: Linear
Parent material: Residuum weathered from igneous rock

Typical profile

H1 - 0 to 14 inches: sandy loam
H2 - 14 to 22 inches: weathered bedrock

Properties and qualities

Slope: 8 to 15 percent
Depth to restrictive feature: 10 to 20 inches to paralithic bedrock
Drainage class: Somewhat excessively drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.06 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Very low (about 1.4 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: D
Ecological site: R019XD060CA - SHALLOW LOAMY (1975)
Hydric soil rating: No

Minor Components

Rock outcrop
Percent of map unit: 10 percent
Hydric soil rating: No

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

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

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

CkF2—Cieneba rocky sandy loam, 15 to 50 percent slopes, eroded

Map Unit Setting

National map unit symbol: hcsf
Elevation: 500 to 4,000 feet
Mean annual precipitation: 12 to 35 inches
Mean annual air temperature: 57 to 64 degrees F
Frost-free period: 200 to 300 days
Farmland classification: Not prime farmland

Map Unit Composition

Cieneba and similar soils: 75 percent
Minor components: 25 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Cieneba

Setting
Landform: Hills
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Concave
Across-slope shape: Convex
Parent material: Residuum weathered from igneous rock

Typical profile
H1 - 0 to 14 inches: sandy loam
H2 - 14 to 22 inches: weathered bedrock

Properties and qualities

Slope: 15 to 50 percent
Depth to restrictive feature: 14 to 22 inches to paralithic bedrock
Drainage class: Somewhat excessively drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.06 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Very low (about 1.4 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7e
Hydrologic Soil Group: D
Ecological site: R019XD060CA - SHALLOW LOAMY (1975)
Hydric soil rating: No

Minor Components

Rock outcrop

Percent of map unit: 10 percent
Hydric soil rating: No

Unnamed

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

Friant

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

Escondido

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

Vista

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

Fallbrook

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

HaC—Hanford loamy fine sand, 0 to 8 percent slopes

Map Unit Setting

National map unit symbol: hcw0
Elevation: 150 to 900 feet
Mean annual precipitation: 9 to 20 inches
Mean annual air temperature: 63 to 64 degrees F

Frost-free period: 250 to 280 days
Farmland classification: Prime farmland if irrigated

Map Unit Composition

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

Description of Hanford

Setting

Landform: Alluvial fans
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium derived from granite

Typical profile

H1 - 0 to 8 inches: loamy fine sand
H2 - 8 to 40 inches: fine sandy loam
H3 - 40 to 60 inches: stratified loamy sand to coarse sandy loam

Properties and qualities

Slope: 0 to 8 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Very low
Capacity of the most limiting layer to transmit water (Ksat): High (1.98 to 5.95 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Moderate (about 6.6 inches)

Interpretive groups

Land capability classification (irrigated): 2s
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: A
Ecological site: R020XD012CA - SANDY
Hydric soil rating: No

Minor Components

Tujunga

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

Ramona

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

Greenfield

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

HcC—Hanford coarse sandy loam, 2 to 8 percent slopes

Map Unit Setting

National map unit symbol: hcw2
Elevation: 150 to 900 feet
Mean annual precipitation: 9 to 20 inches
Mean annual air temperature: 63 to 64 degrees F
Frost-free period: 250 to 280 days
Farmland classification: Prime farmland if irrigated

Map Unit Composition

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

Description of Hanford

Setting

Landform: Alluvial fans
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium derived from granite

Typical profile

H1 - 0 to 8 inches: coarse sandy loam
H2 - 8 to 40 inches: fine sandy loam
H3 - 40 to 60 inches: stratified loamy sand to coarse sandy loam

Properties and qualities

Slope: 2 to 8 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): High (1.98 to 5.95 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Moderate (about 7.0 inches)

Interpretive groups

Land capability classification (irrigated): 2e
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: A
Ecological site: R020XD012CA - SANDY
Hydric soil rating: No

Minor Components

Greenfield

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

Ramona

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

Tujunga

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

Unnamed

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

Unnamed

Percent of map unit: 1 percent
Hydric soil rating: No

HcD2—Hanford coarse sandy loam, 8 to 15 percent slopes, eroded

Map Unit Setting

National map unit symbol: hcw3
Elevation: 150 to 900 feet
Mean annual precipitation: 9 to 20 inches
Mean annual air temperature: 63 to 64 degrees F
Frost-free period: 250 to 280 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

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

Description of Hanford

Setting

Landform: Alluvial fans
Landform position (three-dimensional): Tread
Down-slope shape: Concave
Across-slope shape: Linear
Parent material: Alluvium derived from granite

Typical profile

H1 - 0 to 8 inches: coarse sandy loam
H2 - 8 to 40 inches: fine sandy loam
H3 - 40 to 60 inches: stratified loamy sand to coarse sandy loam

Properties and qualities

Slope: 8 to 15 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat excessively drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): High (1.98 to 5.95 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Moderate (about 7.0 inches)

Interpretive groups

Land capability classification (irrigated): 3e
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: A
Ecological site: R020XD012CA - SANDY
Hydric soil rating: No

Minor Components

Greenfield

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

Ramona

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

Tujunga

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

RtF—Rockland

Map Unit Setting

National map unit symbol: hcyn
Elevation: 650 to 4,000 feet
Mean annual precipitation: 8 to 15 inches
Mean annual air temperature: 45 to 52 degrees F
Frost-free period: 110 to 180 days
Farmland classification: Not prime farmland

Map Unit Composition

Rockland: 100 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Rockland

Setting

Down-slope shape: Concave

Across-slope shape: Convex
Parent material: Residuum derived from mixed sources

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8
Hydric soil rating: No

TvC—Tujunga loamy sand, channeled, 0 to 8 percent slopes

Map Unit Setting

National map unit symbol: hczl
Elevation: 10 to 2,900 feet
Mean annual precipitation: 8 to 25 inches
Mean annual air temperature: 46 to 64 degrees F
Frost-free period: 110 to 350 days
Farmland classification: Not prime farmland

Map Unit Composition

Tujunga and similar soils: 75 percent
Minor components: 25 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Tujunga

Setting

Landform: Flood plains, alluvial fans
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Sandy alluvium derived from granite

Typical profile

H1 - 0 to 10 inches: loamy sand
H2 - 10 to 60 inches: loamy sand

Properties and qualities

Slope: 0 to 8 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Excessively drained
Runoff class: Negligible
Capacity of the most limiting layer to transmit water (Ksat): High to very high (5.95 to 19.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: OccasionalNone
Frequency of ponding: None
Available water capacity: Low (about 4.3 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7w
Hydrologic Soil Group: A
Ecological site: R019XD069CA - SANDY ALLUVIAL (1975)

Hydric soil rating: No

Minor Components

Delhi

Percent of map unit: 10 percent
Hydric soil rating: No

Riverwash

Percent of map unit: 10 percent
Landform: Drainageways
Hydric soil rating: Yes

Soboba

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

VsD2—Vista coarse sandy loam, 8 to 15 percent slopes, eroded

Map Unit Setting

National map unit symbol: hczy
Elevation: 400 to 3,900 feet
Mean annual precipitation: 10 to 18 inches
Mean annual air temperature: 59 to 64 degrees F
Frost-free period: 210 to 300 days
Farmland classification: Not prime farmland

Map Unit Composition

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

Description of Vista

Setting

Landform: Hills
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Concave
Across-slope shape: Convex
Parent material: Residuum weathered from granite and/or residuum weathered from granodiorite

Typical profile

H1 - 0 to 15 inches: coarse sandy loam
H2 - 15 to 24 inches: coarse sandy loam
H3 - 24 to 28 inches: weathered bedrock

Properties and qualities

Slope: 8 to 15 percent
Depth to restrictive feature: 20 to 40 inches to paralithic bedrock
Drainage class: Well drained

Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.06 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Very low (about 2.4 inches)

Interpretive groups

Land capability classification (irrigated): 4e
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: B
Ecological site: R019XD029CA
Hydric soil rating: No

Minor Components

Fallbrook

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

Bonsall

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

Cieneba

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

VsF2—Vista coarse sandy loam, 15 to 35 percent slopes, eroded

Map Unit Setting

National map unit symbol: hczz
Elevation: 400 to 3,900 feet
Mean annual precipitation: 10 to 18 inches
Mean annual air temperature: 59 to 64 degrees F
Frost-free period: 210 to 300 days
Farmland classification: Not prime farmland

Map Unit Composition

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

Description of Vista

Setting

Landform: Hills
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Concave

Across-slope shape: Convex
Parent material: Residuum weathered from granite and/or residuum weathered from granodiorite

Typical profile

H1 - 0 to 15 inches: coarse sandy loam
H2 - 15 to 24 inches: coarse sandy loam
H3 - 24 to 28 inches: weathered bedrock

Properties and qualities

Slope: 15 to 35 percent
Depth to restrictive feature: 20 to 40 inches to paralithic bedrock
Drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.06 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Very low (about 2.4 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: B
Ecological site: R019XD029CA
Hydric soil rating: No

Minor Components

Fallbrook

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

Cieneba

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

Bonsall

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

VtF2—Vista rocky coarse sandy loam, 2 to 35 percent slopes, eroded

Map Unit Setting

National map unit symbol: hd00
Elevation: 400 to 3,900 feet
Mean annual precipitation: 10 to 18 inches
Mean annual air temperature: 59 to 64 degrees F
Frost-free period: 210 to 300 days
Farmland classification: Not prime farmland

Map Unit Composition

Vista and similar soils: 75 percent
Minor components: 25 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Vista

Setting

Landform: Hills
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Concave
Across-slope shape: Convex
Parent material: Residuum weathered from granodiorite and/or residuum weathered from granite

Typical profile

H1 - 0 to 15 inches: coarse sandy loam
H2 - 15 to 24 inches: coarse sandy loam
H3 - 24 to 28 inches: weathered bedrock

Properties and qualities

Slope: 2 to 35 percent
Depth to restrictive feature: 20 to 40 inches to paralithic bedrock
Drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.06 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Very low (about 2.4 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: B
Ecological site: R019XD029CA
Hydric soil rating: No

Minor Components

Rock outcrop

Percent of map unit: 10 percent
Hydric soil rating: No

Cieneba

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

Bonsall

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

Fallbrook

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

Soil Information for All Uses

Soil Properties and Qualities

The Soil Properties and Qualities section includes various soil properties and qualities displayed as thematic maps with a summary table for the soil map units in the selected area of interest. A single value or rating for each map unit is generated by aggregating the interpretive ratings of individual map unit components. This aggregation process is defined for each property or quality.

Soil Physical Properties

Soil Physical Properties are measured or inferred from direct observations in the field or laboratory. Examples of soil physical properties include percent clay, organic matter, saturated hydraulic conductivity, available water capacity, and bulk density.

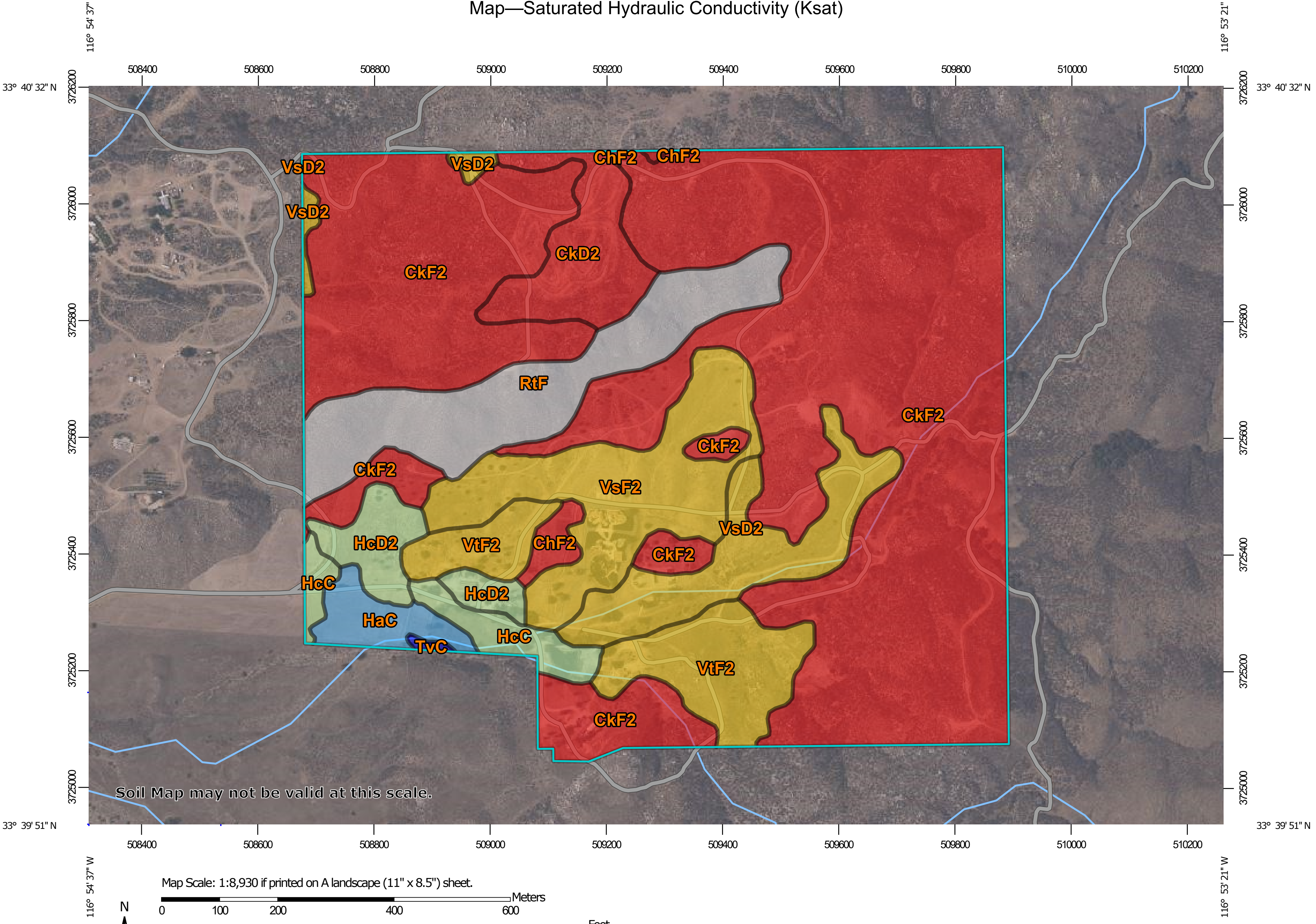
Saturated Hydraulic Conductivity (Ksat)

Saturated hydraulic conductivity (Ksat) refers to the ease with which pores in a saturated soil transmit water. The estimates are expressed in terms of micrometers per second. They are based on soil characteristics observed in the field, particularly structure, porosity, and texture. Saturated hydraulic conductivity is considered in the design of soil drainage systems and septic tank absorption fields.

For each soil layer, this attribute is actually recorded as three separate values in the database. A low value and a high value indicate the range of this attribute for the soil component. A "representative" value indicates the expected value of this attribute for the component. For this soil property, only the representative value is used.

The numeric Ksat values have been grouped according to standard Ksat class limits.

Map—Saturated Hydraulic Conductivity (Ksat)



Map Scale: 1:8,930 if printed on A landscape (11" x 8.5") sheet.

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

🟥 <= 18.0750

🟨 > 18.0750 and <= 24.0859

🟩 > 24.0859 and <= 49.0526

🟦 > 49.0526 and <= 57.4737

🟪 > 57.4737 and <= 92.0000

⬜ Not rated or not available

Soil Rating Lines

〰 <= 18.0750

〰 > 18.0750 and <= 24.0859

〰 > 24.0859 and <= 49.0526

〰 > 49.0526 and <= 57.4737

〰 > 57.4737 and <= 92.0000

〰 Not rated or not available

Soil Rating Points

🟥 <= 18.0750

🟨 > 18.0750 and <= 24.0859

🟩 > 24.0859 and <= 49.0526

🟦 > 49.0526 and <= 57.4737

🟦 > 57.4737 and <= 92.0000

⬜ Not rated or not available

Water Features

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 1:15,800.

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: Western Riverside Area, California
Survey Area Data: Version 13, May 27, 2020

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

Date(s) aerial images were photographed: Aug 18, 2018—Aug 22, 2018

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.

MAP LEGEND

~ Streams and Canals

MAP INFORMATION

Table—Saturated Hydraulic Conductivity (Ksat)

Map unit symbol	Map unit name	Rating (micrometers per second)	Acres in AOI	Percent of AOI
ChF2	Cieneba sandy loam, 15 to 50 percent slopes, eroded	18.0750	2.2	0.8%
CkD2	Cieneba rocky sandy loam, 8 to 15 percent slopes, eroded	18.0750	11.9	4.1%
CkF2	Cieneba rocky sandy loam, 15 to 50 percent slopes, eroded	18.0750	171.8	59.2%
HaC	Hanford loamy fine sand, 0 to 8 percent slopes	57.4737	5.1	1.8%
HcC	Hanford coarse sandy loam, 2 to 8 percent slopes	49.0526	6.3	2.2%
HcD2	Hanford coarse sandy loam, 8 to 15 percent slopes, eroded	49.0526	7.6	2.6%
RtF	Rockland		24.6	8.5%
TvC	Tujunga loamy sand, channeled, 0 to 8 percent slopes	92.0000	0.3	0.1%
VsD2	Vista coarse sandy loam, 8 to 15 percent slopes, eroded	24.0859	17.5	6.0%
VsF2	Vista coarse sandy loam, 15 to 35 percent slopes, eroded	24.0859	24.8	8.5%
VtF2	Vista rocky coarse sandy loam, 2 to 35 percent slopes, eroded	24.0859	18.3	6.3%
Totals for Area of Interest			**290.3**	**100.0%**

Rating Options—Saturated Hydraulic Conductivity (Ksat)

Units of Measure: micrometers per second

Aggregation Method: Dominant Component

Component Percent Cutoff: None Specified

Tie-break Rule: Fastest

Interpret Nulls as Zero: No

Layer Options (Horizon Aggregation Method): Depth Range (Weighted Average)

Top Depth: 0

Bottom Depth: 96

Units of Measure: Inches

Soil Qualities and Features

Soil qualities are behavior and performance attributes that are not directly measured, but are inferred from observations of dynamic conditions and from soil properties. Example soil qualities include natural drainage, and frost action. Soil features are attributes that are not directly part of the soil. Example soil features include slope and depth to restrictive layer. These features can greatly impact the use and management of the soil.

Hydrologic Soil Group

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.

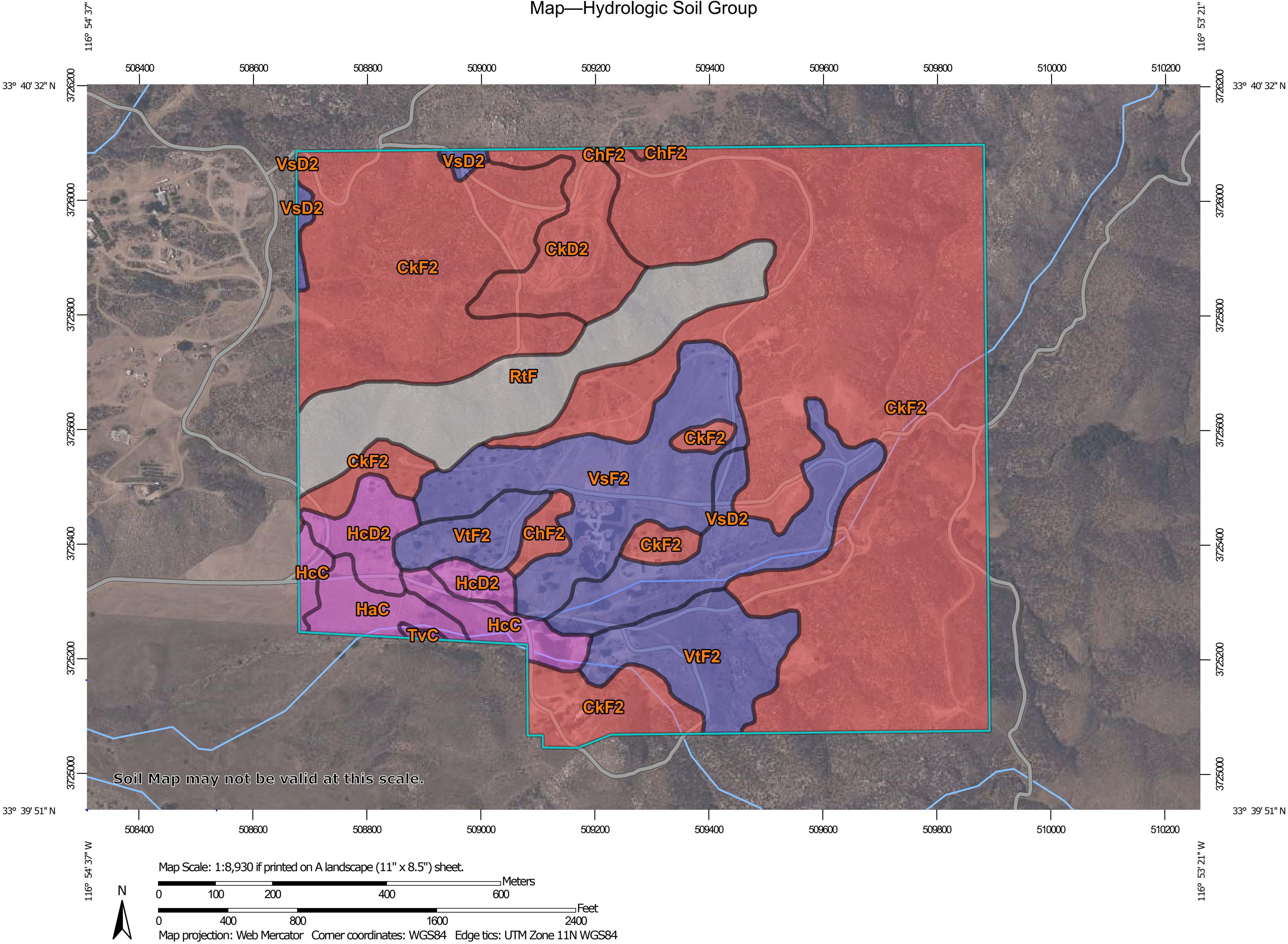
Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

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.

Map—Hydrologic Soil Group



Map Scale: 1:8,930 if printed on A landscape (11" x 8.5") sheet.

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 1:15,800.

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: Western Riverside Area, California
Survey Area Data: Version 13, May 27, 2020

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

Date(s) aerial images were photographed: Aug 18, 2018—Aug 22, 2018

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.

Table—Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
ChF2	Cieneba sandy loam, 15 to 50 percent slopes, eroded	D	2.2	0.8%
CkD2	Cieneba rocky sandy loam, 8 to 15 percent slopes, eroded	D	11.9	4.1%
CkF2	Cieneba rocky sandy loam, 15 to 50 percent slopes, eroded	D	171.8	59.2%
HaC	Hanford loamy fine sand, 0 to 8 percent slopes	A	5.1	1.8%
HcC	Hanford coarse sandy loam, 2 to 8 percent slopes	A	6.3	2.2%
HcD2	Hanford coarse sandy loam, 8 to 15 percent slopes, eroded	A	7.6	2.6%
RtF	Rockland		24.6	8.5%
TvC	Tujunga loamy sand, channeled, 0 to 8 percent slopes	A	0.3	0.1%
VsD2	Vista coarse sandy loam, 8 to 15 percent slopes, eroded	B	17.5	6.0%
VsF2	Vista coarse sandy loam, 15 to 35 percent slopes, eroded	B	24.8	8.5%
VtF2	Vista rocky coarse sandy loam, 2 to 35 percent slopes, eroded	B	18.3	6.3%
Totals for Area of Interest			**290.3**	**100.0%**

Rating Options—Hydrologic Soil Group

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

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APPENDIX B

LEACH LINE DATA SHEETS

RIVERSIDE COUNTY LEACH LINE DATA SHEETS

PR#:	6113-6117
Project:	Paradise Valley Ranch
Job No. :	644-20047
Date:	12/30/2020
Test Hole #:	P-1
Depth (ft):	4.83
Equipment:	John Deere 30
USCS Soil Class:	SM/SP
Tested By:	R.F./ A.F.

READING	TIME INTERVAL (h:m:s)	DEPTH (ft)	INITIAL W (in)	FINAL W (in)	ΔW (in)	Min/Inch
A	0:04:20	4.83	8	0	8	0.54
B	0:05:23	4.83	8	0	8	0.67

READING*	TIME INTERVAL (h:m:s)	DEPTH (ft)	INITIAL W (in)	FINAL W (in)	ΔW (in)	Min/Inch
1	0:04:55	4.83	6	0	6	0.82
2	0:05:37	4.83	6	0	6	0.94
3	0:05:55	4.83	6	0	6	0.99
4	0:06:13	4.83	6	0	6	1.04
5	0:06:27	4.83	6	0	6	1.08
6	0:06:39	4.83	6	0	6	1.11
7						
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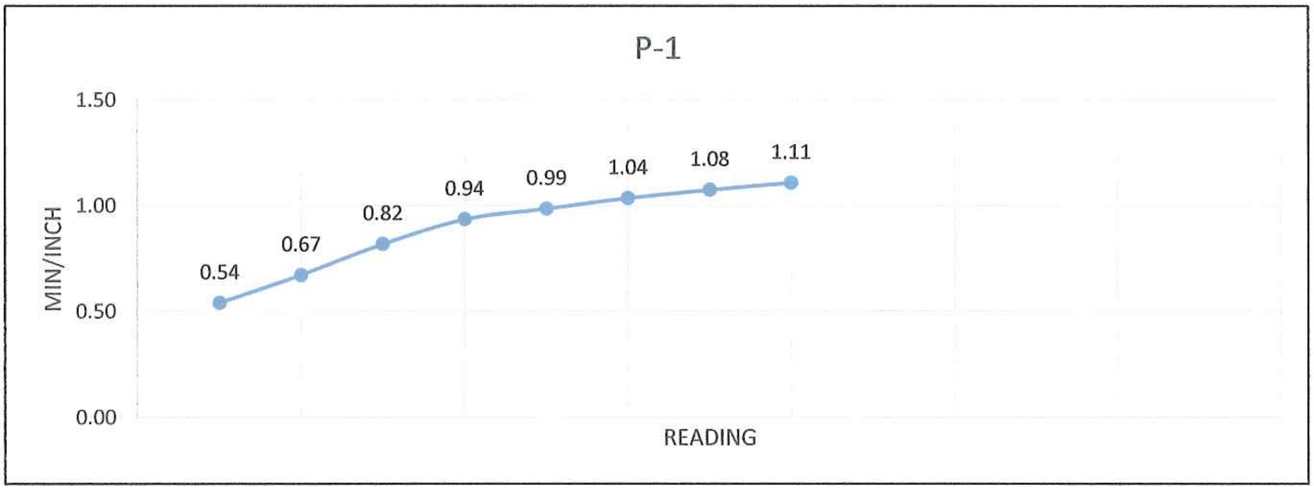
10						
11						



Rate (Min/Inch): 1.11

RIVERSIDE COUNTY LEACH LINE DATA SHEETS

PR#:	6113-6117
Project:	Paradise Valley Ranch
Job No. :	644-20047
Date:	12/30/2020
Test Hole #:	P-2
Depth (ft):	4.75
Equipment:	John Deere 30
USCS Soil Class:	SM/SP
Tested By:	R.F./ A.F.

READING	TIME INTERVAL (h:m:s)	DEPTH (ft)	INITIAL W (in)	FINAL W (in)	ΔW (in)	Min/Inch
A	0:01:01	4.75	8	0	8	0.13
B	0:01:14	4.75	8	0	8	0.15

READING*	TIME INTERVAL (h:m:s)	DEPTH (ft)	INITIAL W (in)	FINAL W (in)	ΔW (in)	Min/Inch
1	0:01:20	4.75	6	0	6	0.22
2	0:01:20	4.75	6	0	6	0.22
3	0:01:21	4.75	6	0	6	0.23
4	0:01:22	4.75	6	0	6	0.23
5	0:01:23	4.75	6	0	6	0.23
6	0:01:23	4.75	6	0	6	0.23
7						
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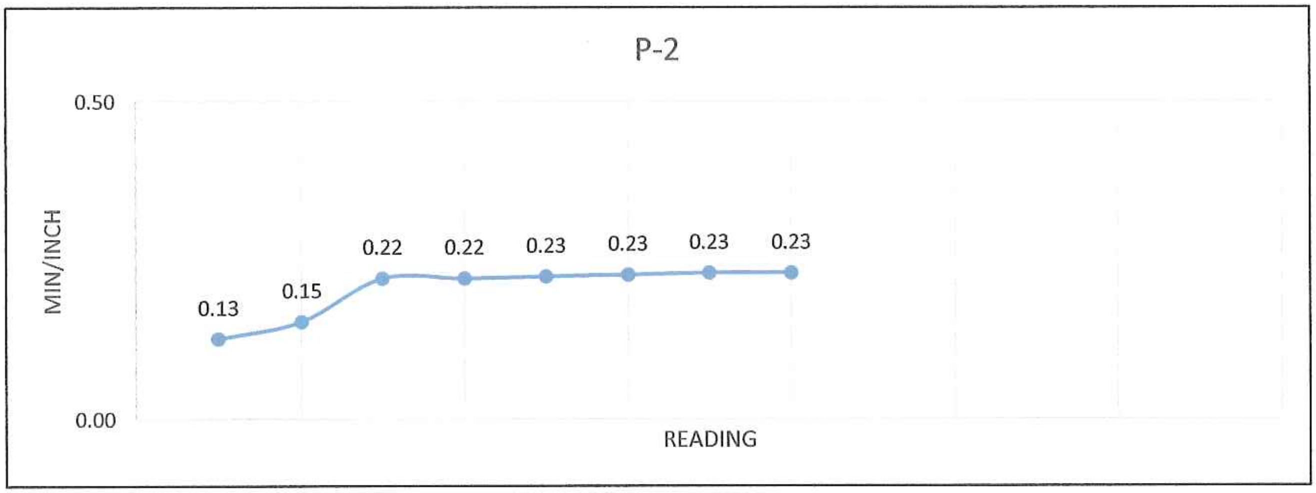
11						



Rate (Min/Inch): 0.23

RIVERSIDE COUNTY LEACH LINE DATA SHEETS

PR#:	6113-6117
Project:	Paradise Valley Ranch
Job No. :	644-20047
Date:	12/30/2020
Test Hole #:	P-3
Depth (ft):	4.83
Equipment:	John Deere 30
USCS Soil Class:	SM/SP
Tested By:	R.F./ A.F.

READING	TIME INTERVAL (h:m:s)	DEPTH (ft)	INITIAL W (in)	FINAL W (in)	ΔW (in)	Min/Inch
A	0:01:04	4.83	8	0	8	0.13
B	0:01:19	4.83	8	0	8	0.16

READING*	TIME INTERVAL (h:m:s)	DEPTH (ft)	INITIAL W (in)	FINAL W (in)	ΔW (in)	Min/Inch
1	0:01:26	4.83	6	0	6	0.24
2	0:01:28	4.83	6	0	6	0.24
3	0:01:29	4.83	6	0	6	0.25
4	0:01:29	4.83	6	0	6	0.25
5	0:01:30	4.83	6	0	6	0.25
6	0:01:31	4.83	6	0	6	0.25
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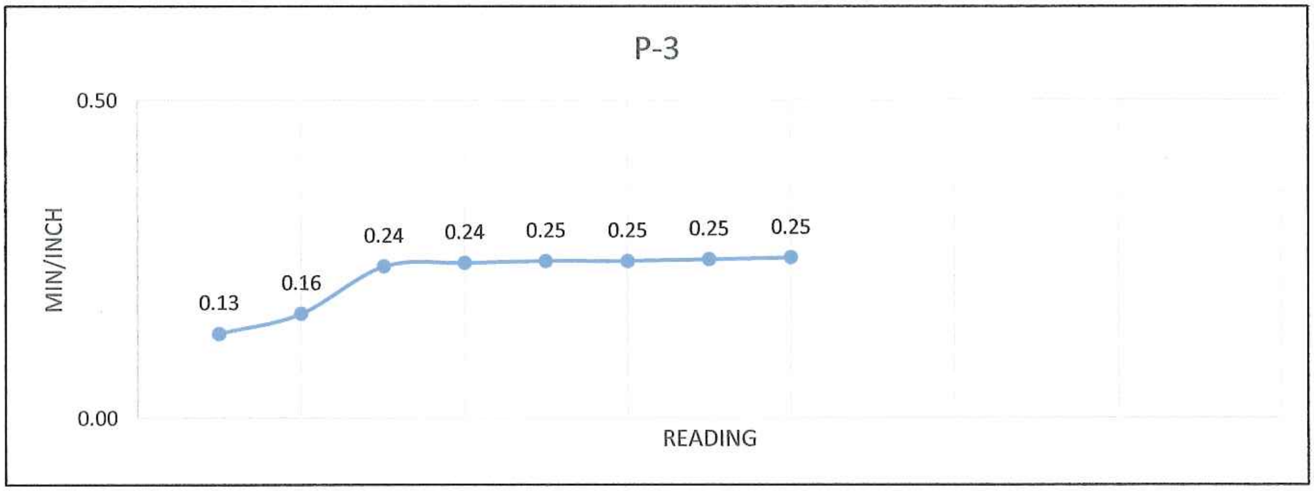
9						
10						
11						



Rate (Min/Inch): 0.25

RIVERSIDE COUNTY LEACH LINE DATA SHEETS

PR#:	6113-6117
Project:	Paradise Valley Ranch
Job No. :	644-20047
Date:	12/30/2020
Test Hole #:	P-4
Depth (ft):	5.00
Equipment:	John Deere 30
USCS Soil Class:	SM/SP
Tested By:	R.F./ A.F.

READING	TIME INTERVAL (h:m:s)	DEPTH (ft)	INITIAL W (in)	FINAL W (in)	ΔW (in)	Min/Inch
A	0:01:00	5	8	0	8	0.13
B	0:01:12	5	8	0	8	0.15

READING*	TIME INTERVAL (h:m:s)	DEPTH (ft)	INITIAL W (in)	FINAL W (in)	ΔW (in)	Min/Inch
1	0:01:17	5	6	0	6	0.21
2	0:01:20	5	6	0	6	0.22
3	0:01:20	5	6	0	6	0.22
4	0:01:21	5	6	0	6	0.23
5	0:01:22	5	6	0	6	0.23
6	0:01:22	5	6	0	6	0.23
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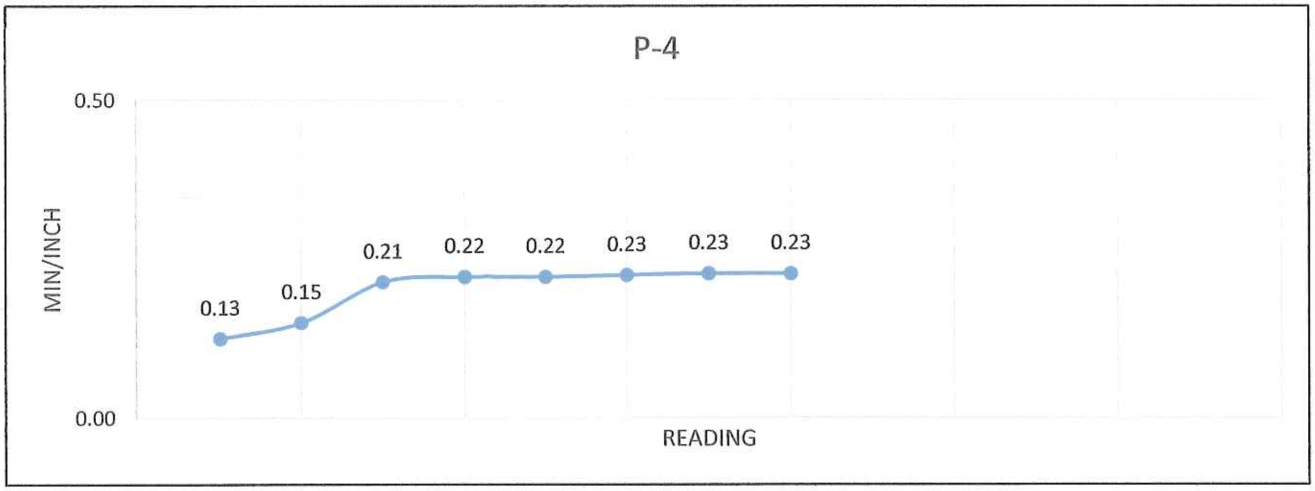

Rate (Min/Inch): 0.23

RIVERSIDE COUNTY LEACH LINE DATA SHEETS

PR#:	6113-6117
Project:	Paradise Valley Ranch
Job No. :	644-20047
Date:	12/30/2020
Test Hole #:	P-5
Depth (ft):	4.58
Equipment:	John Deere 30
USCS Soil Class:	SM/SP
Tested By:	R.F./ A.F.

READING	TIME INTERVAL (h:m:s)	DEPTH (ft)	INITIAL W (in)	FINAL W (in)	ΔW (in)	Min/Inch
A	0:01:40	4.58	8	0	8	0.21
B	0:02:20	4.58	8	0	8	0.29

READING*	TIME INTERVAL (h:m:s)	DEPTH (ft)	INITIAL W (in)	FINAL W (in)	ΔW (in)	Min/Inch
1	0:03:10	4.58	6	0	6	0.53
2	0:04:18	4.58	6	0	6	0.72
3	0:04:50	4.58	6	0	6	0.81
4	0:05:10	4.58	6	0	6	0.86
5	0:04:46	4.58	6	0	6	0.79
6	0:04:42	4.58	6	0	6	0.78
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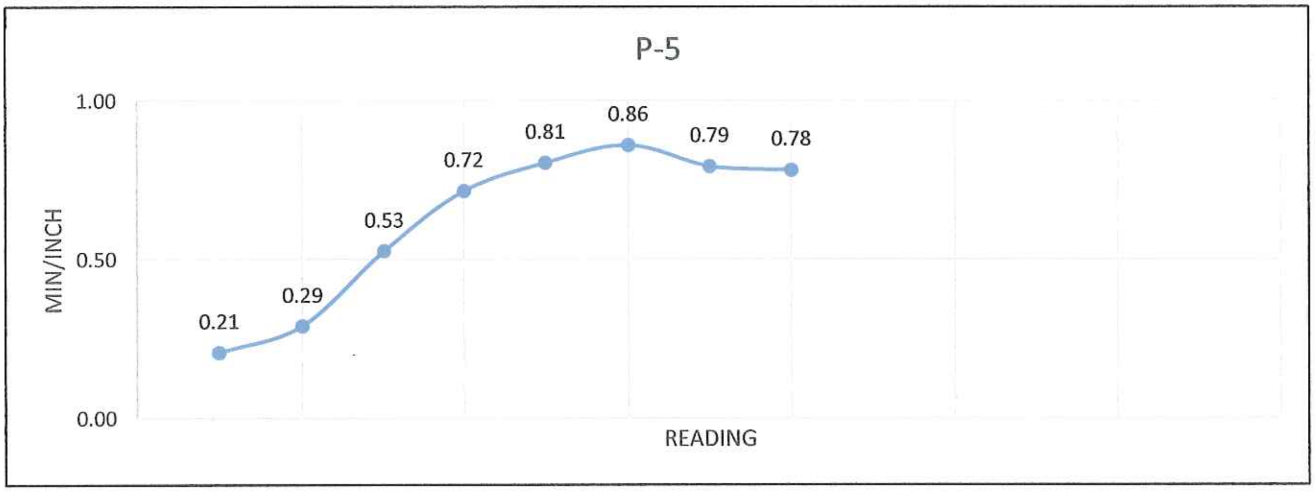
11						



Rate (Min/Inch): 0.78

RIVERSIDE COUNTY LEACH LINE DATA SHEETS

PR#: 6113-6117
Project: Paradise Valley Ranch
Job No. : 644-20047
Date: 12/30/2020
Test Hole #: P-6
Depth (ft): 4.41
Equipment: John Deere 30
USCS Soil Class: SM/SP
Tested By: R.F./ A.F.

READING	TIME INTERVAL (h:m:s)	DEPTH (ft)	INITIAL W (in)	FINAL W (in)	ΔW (in)	Min/Inch
A	0:04:20	4.41	8	0	8	0.54
B	0:05:26	4.41	8	0	8	0.68

READING*	TIME INTERVAL (h:m:s)	DEPTH (ft)	INITIAL W (in)	FINAL W (in)	ΔW (in)	Min/Inch
1	0:08:55	4.41	6	0	6	1.49
2	0:09:06	4.41	6	0	6	1.52
3	0:08:16	4.41	6	0	6	1.38
4	0:08:30	4.41	6	0	6	1.42
5	0:09:01	4.41	6	0	6	1.50
6	0:09:06	4.41	6	0	6	1.52
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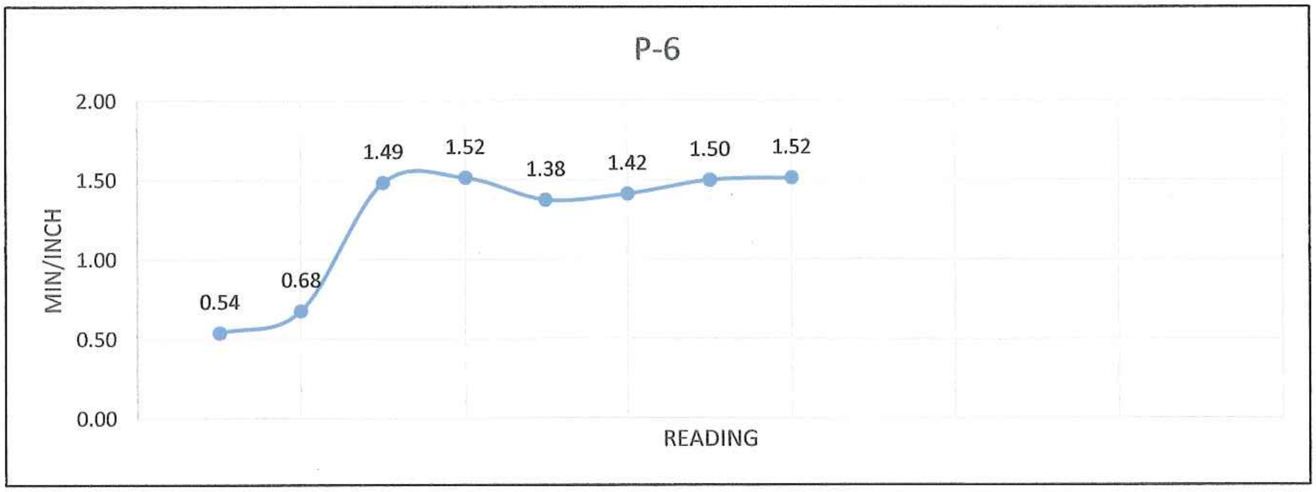

Rate (Min/Inch): 1.52

RIVERSIDE COUNTY LEACH LINE DATA SHEETS

PR#:	6113-6117
Project:	Paradise Valley Ranch
Job No. :	644-20047
Date:	12/30/2020
Test Hole #:	P-7
Depth (ft):	4.50
Equipment:	John Deere 30
USCS Soil Class:	SM/SP
Tested By:	R.F./ A.F.

READING	TIME INTERVAL (h:m:s)	DEPTH (ft)	INITIAL W (in)	FINAL W (in)	ΔW (in)	Min/Inch
A	0:09:10	4.5	8	0	8	1.15
B	0:09:50	4.5	8	0	8	1.23

READING*	TIME INTERVAL (h:m:s)	DEPTH (ft)	INITIAL W (in)	FINAL W (in)	ΔW (in)	Min/Inch
1	0:09:26	4.5	6	0	6	1.57
2	0:10:00	4.5	6	1 5/8	4 3/8	2.29
3	0:10:00	4.5	6	1 4/8	4 4/8	2.22
4	0:10:00	4.5	6	1 7/8	4 1/8	2.42
5	0:10:00	4.5	6	1 5/8	4 3/8	2.29
6	0:10:00	4.5	6	1 4/8	4 4/8	2.22
7						
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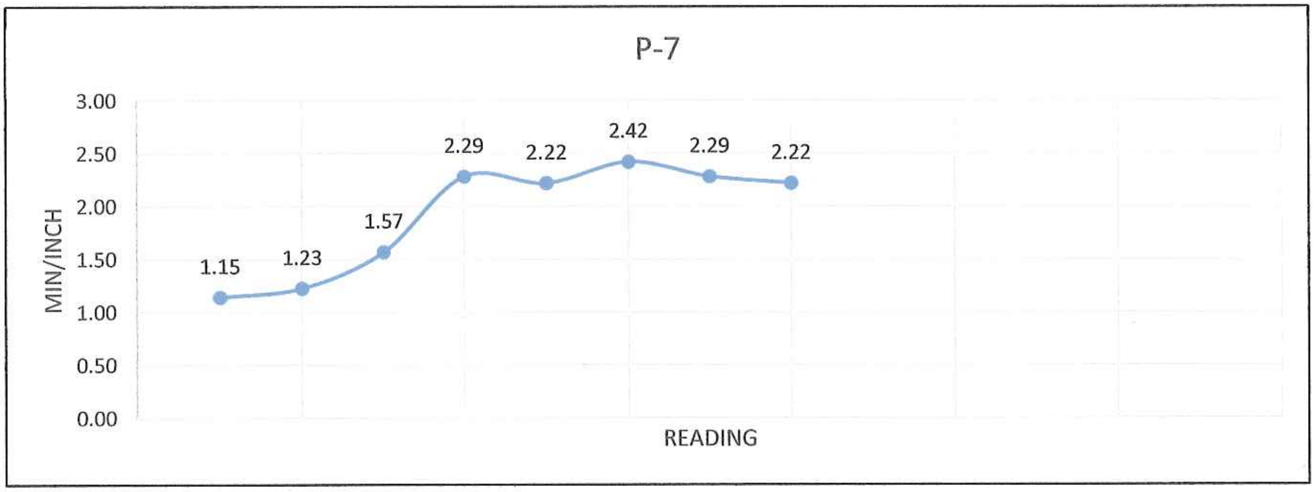
11						



Rate (Min/Inch): 2.22

RIVERSIDE COUNTY LEACH LINE DATA SHEETS

PR#:	6113-6117
Project:	Paradise Valley Ranch
Job No. :	644-20047
Date:	12/30/2020
Test Hole #:	P-8
Depth (ft):	4.58
Equipment:	John Deere 30
USCS Soil Class:	SM/SP
Tested By:	R.F./ A.F.

READING	TIME INTERVAL (h:m:s)	DEPTH (ft)	INITIAL W (in)	FINAL W (in)	ΔW (in)	Min/Inch
A	0:25:00	4.58	8	0	8	3.13
B	0:25:00	4.58	8	0	8	3.13

READING*	TIME INTERVAL (h:m:s)	DEPTH (ft)	INITIAL W (in)	FINAL W (in)	ΔW (in)	Min/Inch
1	0:10:00	4.58	6	2	4	2.50
2	0:10:00	4.58	6	1 7/8	4 1/8	2.42
3	0:10:00	4.58	6	2	4	2.50
4	0:10:00	4.58	6	2	4	2.50
5	0:10:00	4.58	6	2	4	2.50
6	0:10:00	4.58	6	2 5/8	3 3/8	2.96
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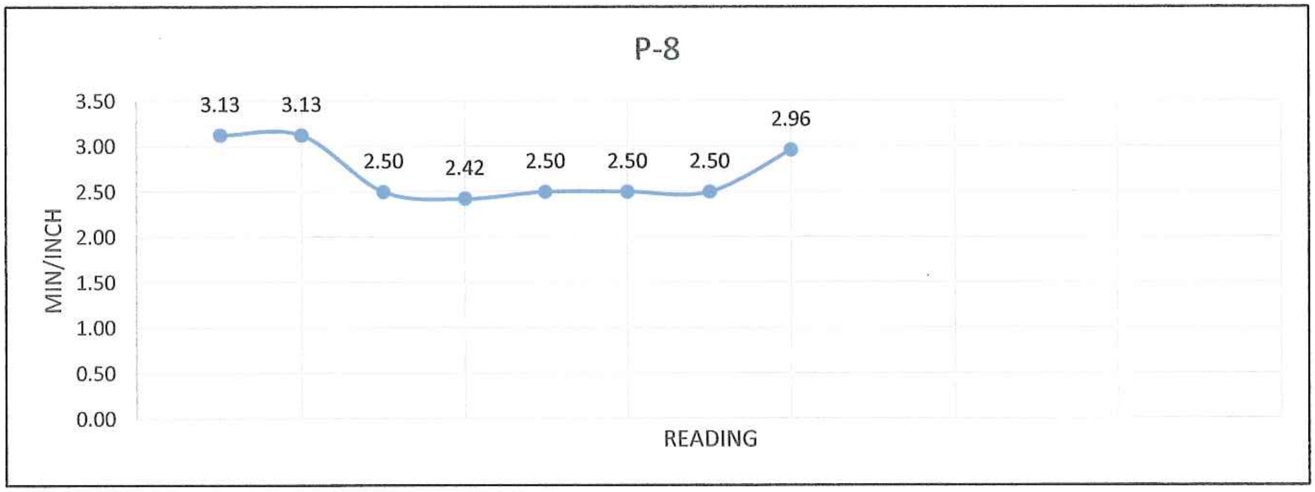
10						
11						



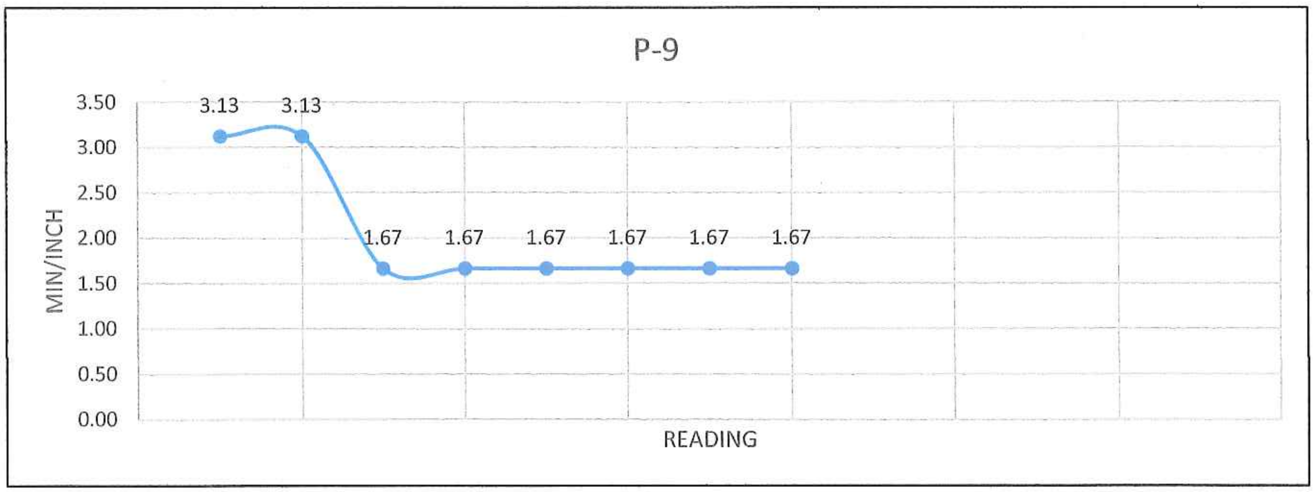
Rate (Min/Inch): 2.96

RIVERSIDE COUNTY LEACH LINE DATA SHEETS

PR#:	6113-6117
Project:	Paradise Valley Ranch
Job No. :	644-20047
Date:	2/23/2021
Test Hole #:	P-9
Depth (ft):	5
Equipment:	John Deere 30
USCS Soil Class:	SM/SP
Tested By:	S.D./J.M.

READING	TIME INTERVAL (h:m:s)	DEPTH (ft)	INITIAL W (in)	FINAL W (in)	ΔW (in)	Min/Inch
A	0:25:00	5	8	0	8	3.13
B	0:25:00	5	8	0	8	3.13

READING*	TIME INTERVAL (h:m:s)	DEPTH (ft)	INITIAL W (in)	FINAL W (in)	ΔW (in)	Min/Inch
1	0:10:00	5	6	0	6	1.67
2	0:10:00	5	6	0	6	1.67
3	0:10:00	5	6	0	6	1.67
4	0:10:00	5	6	0	6	1.67
5	0:10:00	5	6	0	6	1.67
6	0:10:00	5	6	0	6	1.67
7						
8						
9						
10						
11						



Rate (Min/Inch): 1.67

RIVERSIDE COUNTY LEACH LINE DATA SHEETS

PR#:	6113-6117
Project:	Paradise Valley Ranch
Job No. :	644-20047
Date:	2/23/2021
Test Hole #:	P-10
Depth (ft):	5.00
Equipment:	John Deere 30
USCS Soil Class:	SM/SP
Tested By:	S.D./J.M.

READING	TIME INTERVAL (h:m:s)	DEPTH (ft)	INITIAL W (in)	FINAL W (in)	ΔW (in)	Min/Inch
A	0:25:00	5	8	0	8	3.13
B	0:25:00	5	8	0	8	3.13

READING*	TIME INTERVAL (h:m:s)	DEPTH (ft)	INITIAL W (in)	FINAL W (in)	ΔW (in)	Min/Inch
1	0:10:00	5	6	0	6	1.67
2	0:10:00	5	6	0	6	1.67
3	0:10:00	5	6	0	6	1.67
4	0:10:00	5	6	0	6	1.67
5	0:10:00	5	6	0	6	1.67
6	0:10:00	5	6	0	6	1.67
7						
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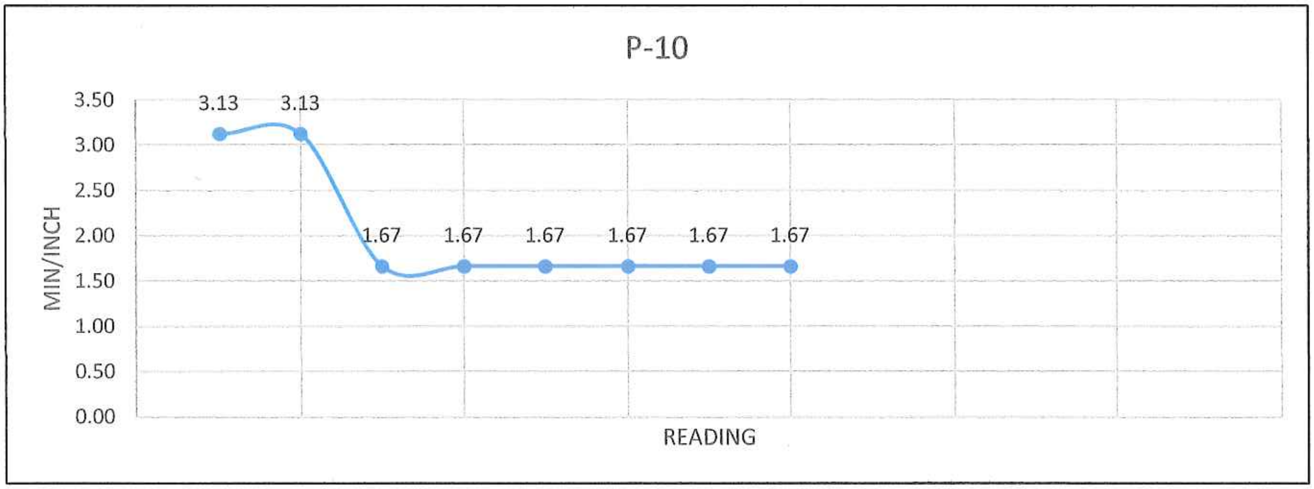
10						
11						



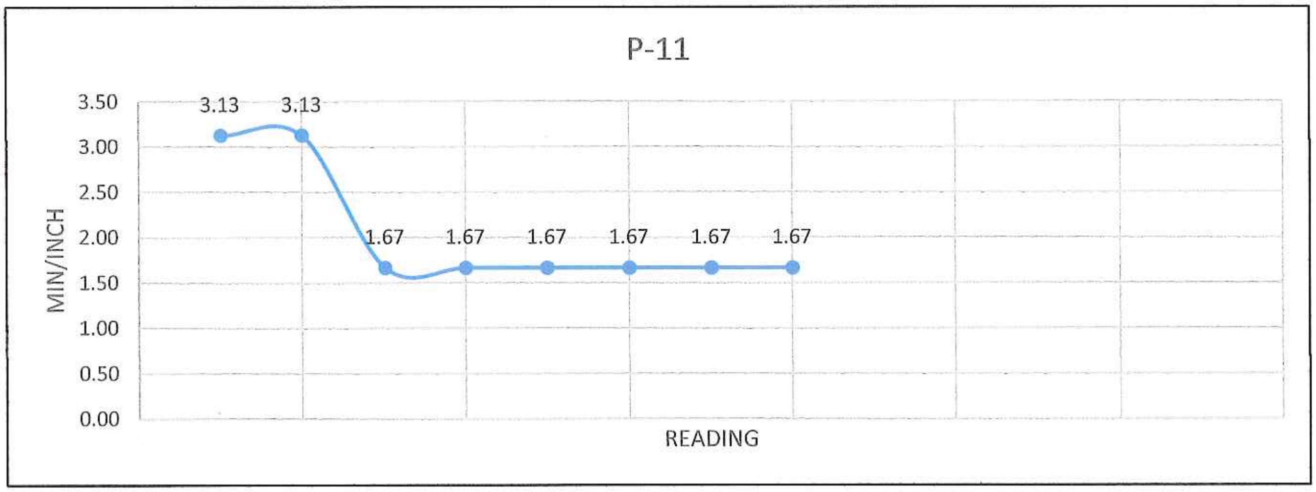
Rate (Min/Inch): 1.67

RIVERSIDE COUNTY LEACH LINE DATA SHEETS

PR#:	6113-6117
Project:	Paradise Valley Ranch
Job No. :	644-20047
Date:	2/23/2021
Test Hole #:	P-11
Depth (ft):	5.00
Equipment:	John Deere 30
USCS Soil Class:	SM/SP
Tested By:	S.D./J.M.

READING	TIME INTERVAL (h:m:s)	DEPTH (ft)	INITIAL W (in)	FINAL W (in)	ΔW (in)	Min/Inch
A	0:25:00	5	8	0	8	3.13
B	0:25:00	5	8	0	8	3.13

READING*	TIME INTERVAL (h:m:s)	DEPTH (ft)	INITIAL W (in)	FINAL W (in)	ΔW (in)	Min/Inch
1	0:10:00	5	6	0	6	1.67
2	0:10:00	5	6	0	6	1.67
3	0:10:00	5	6	0	6	1.67
4	0:10:00	5	6	0	6	1.67
5	0:10:00	5	6	0	6	1.67
6	0:10:00	5	6	0	6	1.67
7						
8						
9						
10						
11						



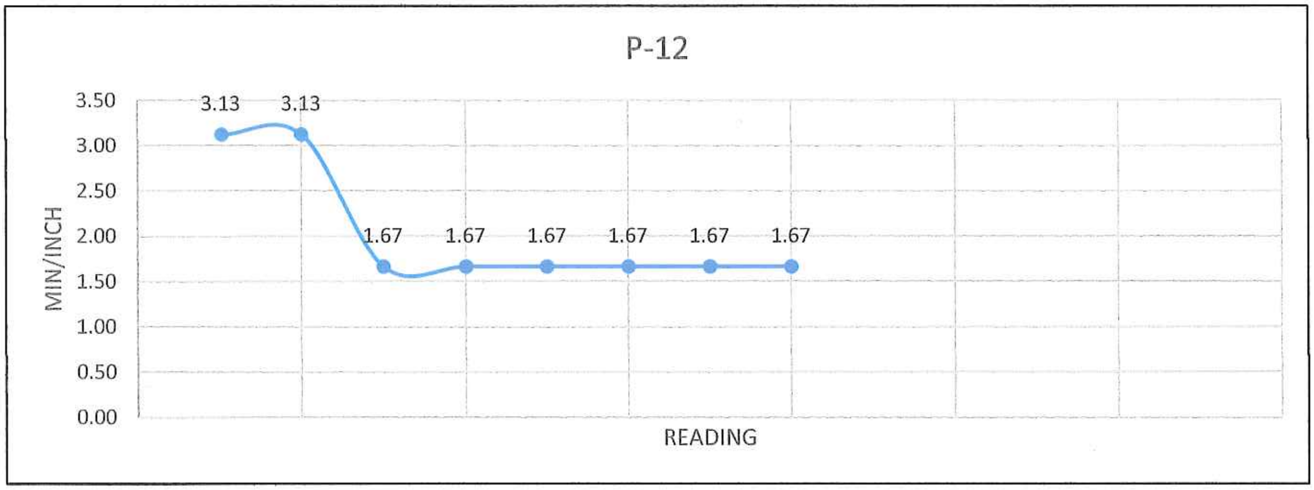
Rate (Min/Inch): 1.67

RIVERSIDE COUNTY LEACH LINE DATA SHEETS

PR#:	6113-6117
Project:	Paradise Valley Ranch
Job No. :	644-20047
Date:	2/23/2021
Test Hole #:	P-12
Depth (ft):	5.00
Equipment:	John Deere 30
USCS Soil Class:	SM/SP
Tested By:	S.D./J.M.

READING	TIME INTERVAL (h:m:s)	DEPTH (ft)	INITIAL W (in)	FINAL W (in)	ΔW (in)	Min/Inch
A	0:25:00	5	8	0	8	3.13
B	0:25:00	5	8	0	8	3.13

READING*	TIME INTERVAL (h:m:s)	DEPTH (ft)	INITIAL W (in)	FINAL W (in)	ΔW (in)	Min/Inch
1	0:10:00	5	6	0	6	1.67
2	0:10:00	5	6	0	6	1.67
3	0:10:00	5	6	0	6	1.67
4	0:10:00	5	6	0	6	1.67
5	0:10:00	5	6	0	6	1.67
6	0:10:00	5	6	0	6	1.67
7						
8						
9						
10						
11						



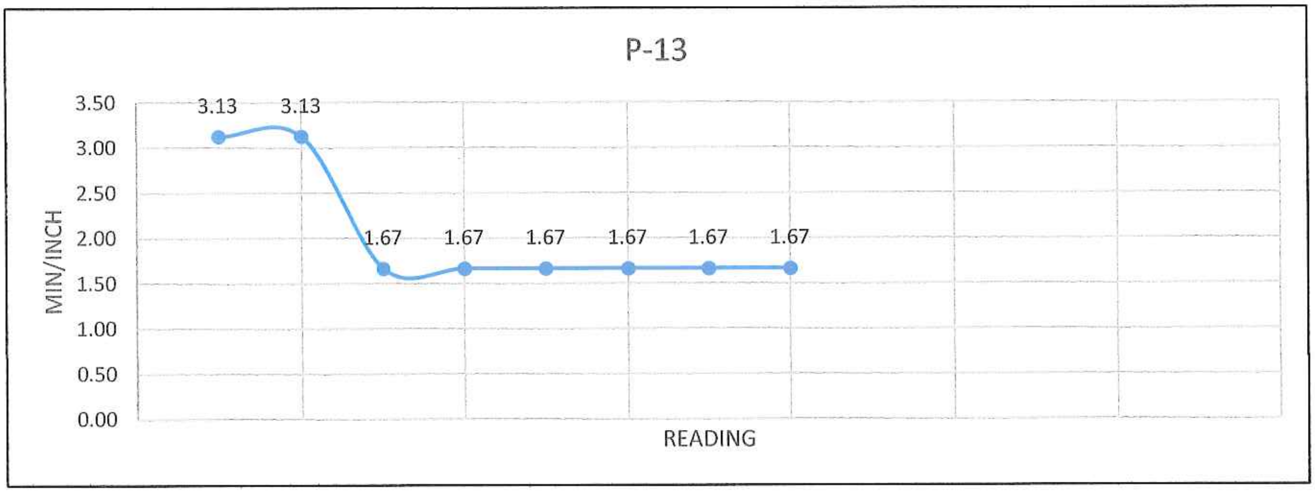
Rate (Min/Inch): 1.67

RIVERSIDE COUNTY LEACH LINE DATA SHEETS

PR#:	6113-6117
Project:	Paradise Valley Ranch
Job No. :	644-20047
Date:	2/23/2021
Test Hole #:	P-13
Depth (ft):	5.00
Equipment:	John Deere 30
USCS Soil Class:	SM/SP
Tested By:	S.D./J.M.

READING	TIME INTERVAL (h:m:s)	DEPTH (ft)	INITIAL W (in)	FINAL W (in)	ΔW (in)	Min/Inch
A	0:25:00	5	8	0	8	3.13
B	0:25:00	5	8	0	8	3.13

READING*	TIME INTERVAL (h:m:s)	DEPTH (ft)	INITIAL W (in)	FINAL W (in)	ΔW (in)	Min/Inch
1	0:10:00	5	6	0	6	1.67
2	0:10:00	5	6	0	6	1.67
3	0:10:00	5	6	0	6	1.67
4	0:10:00	5	6	0	6	1.67
5	0:10:00	5	6	0	6	1.67
6	0:10:00	5	6	0	6	1.67
7						
8						
9						
10						
11						



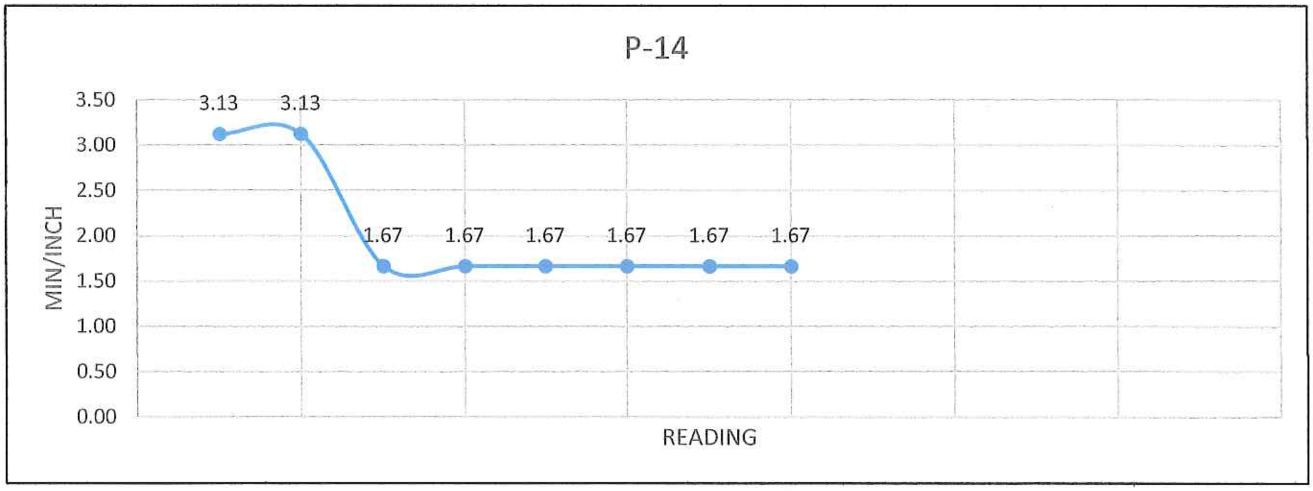
Rate (Min/Inch): 1.67

RIVERSIDE COUNTY LEACH LINE DATA SHEETS

PR#:	6113-6117
Project:	Paradise Valley Ranch
Job No. :	644-20047
Date:	2/23/2021
Test Hole #:	P-14
Depth (ft):	5.00
Equipment:	John Deere 30
USCS Soil Class:	SM/SP
Tested By:	S.D./J.M.

READING	TIME INTERVAL (h:m:s)	DEPTH (ft)	INITIAL W (in)	FINAL W (in)	ΔW (in)	Min/Inch
A	0:25:00	5	8	0	8	3.13
B	0:25:00	5	8	0	8	3.13

READING*	TIME INTERVAL (h:m:s)	DEPTH (ft)	INITIAL W (in)	FINAL W (in)	ΔW (in)	Min/Inch
1	0:10:00	5	6	0	6	1.67
2	0:10:00	5	6	0	6	1.67
3	0:10:00	5	6	0	6	1.67
4	0:10:00	5	6	0	6	1.67
5	0:10:00	5	6	0	6	1.67
6	0:10:00	5	6	0	6	1.67
7						
8						
9						
10						
11						



Rate (Min/Inch): 1.67

Appendix 4: Historical Site Conditions

Phase I Environmental Site Assessment or Other Information on Past Site Use

Appendix 5: LID Infeasibility

LID Technical Infeasibility Analysis

Appendix 6: BMP Design Details

BMP Sizing, Design Details and other Supporting Documentation

1162008 WQMP - WILDFIRE CONSERVANCY

		FT^2	AC	%	DESCRIPTION
EXISTING CONDITION	A_T=	2,079,990	47.75	---	BUILDING, LANDSCAPING, PCC - DEVELOPED
	A_{PERV}=	1,893,346	43.47	91.03%	
	A_{IMP}=	186,644	4.285	8.97%	
PROPOSED CONDITION	A_T=	2,079,990	47.75	---	BUILDING, LANDSCAPING, PCC - DEVELOPED
	A_{PERV}=	1,868,654	42.90	89.84%	
	A_{IMP}=	211,336	4.85	10.16%	
DMA 1	A_T=	139208	3.20	---	TYPE D
	A_{LS}=	124141	2.85	89.18%	
	A_{IMP}=	15067	0.35	10.82%	
DMA 2	A_T=	32735	0.75	---	TYPE D
	A_{LS}=	23110	0.53	70.60%	
	A_{IMP}=	9625	0.22	29.40%	

Santa Ana Watershed - BMP Design Volume, V_{BMP}

(Rev. 10-2011)

Legend: 🟦 Required Entries
▨ Calculated Cells

*(Note this worksheet shall **only** be used in conjunction with BMP designs from the **LID BMP Design Handbook**)*

Company Name VALUED ENGINEERING, INC

Date 3/2/2021

Designed by KK

Case No CUP210005

Company Project Number/Name WILDFIRE CONSERVANCY

BMP Identification

BMP NAME / ID INFILTRATION BASIN (DMA 1)

Must match Name/ID used on BMP Design Calculation Sheet

Design Rainfall Depth

85th Percentile, 24-hour Rainfall Depth,
from the Isohyetal Map in Handbook Appendix E

D_{85}= 0.71 inches

Drainage Management Area Tabulation

Insert additional rows if needed to accommodate all DMAs draining to the BMP

DMA Type/ID	DMA Area (square feet)	Post-Project Surface Type	Effective Imperivous Fraction, I_f	DMA Runoff Factor	DMA Areas x Runoff Factor	Design Storm Depth (in)	Design Capture Volume, V_{BMP} (cubic feet)	Proposed Volume on Plans (cubic feet)
D/1a	22150	Pervious Concrete / Porous Asphalt	0.1	0.11	2446.6			
D/1b	9717	Roofs	1	0.89	8667.6			
D/1c	1500	Ornamental Landscaping	0.1	0.11	165.7			
D/1d	87820	Natural (A Soil)	0.03	0.06	5492.4			
D/1e	5350	Concrete or Asphalt	1	0.89	4772.2			
D/1f	12671	Decomposed Granite	0.4	0.28	3544.2			
	139208	Total			25088.7	0.71	1476.1	2570

Notes:

Santa Ana Watershed - BMP Design Volume, V_{BMP}

(Rev. 10-2011)

Legend: 🟦 Required Entries
▨ Calculated Cells

*(Note this worksheet shall **only** be used in conjunction with BMP designs from the **LID BMP Design Handbook**)*

Company Name VALUED ENGINEERING, INC
Date 3/2/2021
Designed by KK
Case No CUP210005
Company Project Number/Name WILDFIRE CONSERVANCY

BMP Identification

BMP NAME / ID INFILTRATION BASIN (DMA 2)

Must match Name/ID used on BMP Design Calculation Sheet

Design Rainfall Depth

85th Percentile, 24-hour Rainfall Depth,
from the Isohyetal Map in Handbook Appendix E

D_{85}= 0.71 inches

Drainage Management Area Tabulation

Insert additional rows if needed to accommodate all DMAs draining to the BMP

DMA Type/ID	DMA Area (square feet)	Post-Project Surface Type	Effective Imperivous Fraction, I_f	DMA Runoff Factor	DMA Areas x Runoff Factor	Design Storm Depth (in)	Design Capture Volume, V_{BMP} (cubic feet)	Proposed Volume on Plans (cubic feet)
D/1a	8110	Pervious Concrete / Porous Asphalt	0.1	0.11	895.8			
D/1b	1270	Concrete or Asphalt	1	0.89	1132.8			
D/1c	8355	Roofs	1	0.89	7452.7			
D/1d	15000	Natural (B Soil)	0.15	0.14	2121.7			
	32735	Total			11603	0.71	682.6	683

Notes:

Infiltration Basin - Design Procedure (Rev. 03-2012)	BMP ID	Legend:	Required Entries Calculated Cells

Company Name: Valued Engineering
Designed by: DH
Date:
County/City Case No.: CUP210005

Design Volume

a) Tributary area (BMP subarea) $A_T =$ 3.2 acres

b) Enter V_{BMP} determined from Section 2.1 of this Handbook $V_{BMP} =$ 1,476 ft^3

Maximum Depth

a) Infiltration rate I = 10.91 in/hr

b) Factor of Safety (See Table 1, Appendix A: "Infiltration Testing" from this BMP Handbook) FS = 3

c) Calculate D_1

$$D_1 = \frac{\text{I (in/hr) x 72 hrs}}{\text{12 (in/ft) x FS}}$$

$D_1 =$ 21.8 ft

d) Enter the depth of freeboard (at least 1 ft) 1 ft

e) Enter depth to historic high ground water (measured from **top** of basin) 300 ft

f) Enter depth to top of bedrock or impermeable layer (measured from **top** of basin) 300 ft

g) D_2 is the smaller of:

Depth to groundwater - (10 ft + freeboard) and
Depth to impermeable layer - (5 ft + freeboard)

$D_2 =$ 289.0 ft

h) D_{MAX} is the smaller value of D_1 and D_2 but shall not exceed 5 feet $D_{MAX} =$ 21.8 ft

Basin Geometry

a) Basin side slopes (no steeper than 4:1) z = 4 :1

b) Proposed basin depth (excluding freeboard) $d_B =$ 1 ft

c) Minimum bottom surface area of basin ($A_S = V_{BMP}/d_B$) $A_S =$ 1476 ft^2

d) Proposed Design Surface Area $A_D =$ 1976 ft^2

Forebay

a) Forebay volume (minimum 0.5% V_{BMP}) Volume = 7 ft^3

b) Forebay depth (height of berm/splashwall. 1 foot min.) Depth = 1 ft

c) Forebay surface area (minimum) Area = 7 ft^2

d) Full height notch-type weir Width (W) = 24.0 in

Notes: The proposed infiltration basin total is 2-feet deep

Infiltration Basin - Design Procedure

(Rev. 03-2012)

BMP ID:

Legend: Required Entries / Calculated Cells

Company Name: Valued Engineering

Designed by: DH

Date: 3/4/2021

County/City Case No.: CUP210005

Design Volume

a) Tributary area (BMP subarea) A_T = 0.751 acres

b) Enter V_{BMP} determined from Section 2.1 of this Handbook V_{BMP}= 683 ft^3

Maximum Depth

a) Infiltration rate I = 16.78 in/hr

b) Factor of Safety (See Table 1, Appendix A: "Infiltration Testing" from this BMP Handbook) FS = 3

c) Calculate D_1 $D_1 = \dfrac{\text{I (in/hr) x 72 hrs}}{\text{12 (in/ft) x FS}}$ D_1 = 33.6 ft

d) Enter the depth of freeboard (at least 1 ft) 1 ft

e) Enter depth to historic high ground water (measured from **top** of basin) 300 ft

f) Enter depth to top of bedrock or impermeable layer (measured from **top** of basin) 300 ft

g) D_2 is the smaller of:

Depth to groundwater - (10 ft + freeboard) and
Depth to impermeable layer - (5 ft + freeboard)

D_2 = 289.0 ft

h) D_{MAX} is the smaller value of D_1 and D_2 but shall not exceed 5 feet D_{MAX} = 33.6 ft

Basin Geometry

a) Basin side slopes (no steeper than 4:1) z = 4 :1

b) Proposed basin depth (excluding freeboard) d_B = 1 ft

c) Minimum bottom surface area of basin (A_S= V_{BMP}/d_B) A_S = 683 ft^2

d) Proposed Design Surface Area A_D = 770 ft^2

Forebay

a) Forebay volume (minimum 0.5% V_{BMP}) Volume = 3 ft^3

b) Forebay depth (height of berm/splashwall. 1 foot min.) Depth = 1 ft

c) Forebay surface area (minimum) Area = 3 ft^2

d) Full height notch-type weir Width (W) = 24.0 in

Notes: The proposed infiltration basin total is 2-feet deep

Appendix 7: Hydromodification

Supporting Detail Relating to Hydrologic Conditions of Concern

Synthetic Unit Hydrograph - Shortcut Method

Shortcut Method Summary – FACILITY 6

		Existing Condition			Proposed Condition			Difference Volume
		Q (cfs)	V (ac.ft)	V (cu.ft)	Q (cfs)	V (ac.ft)	V(cu.ft)	V(cu.ft)
2Year	1Hour	1.10	0.017	741	1.02	0.013	566	174
2Year	3Hour	0.45	0.030	1,307	0.40	0.030	1,307	0
2Year	6Hour	0.43	0.025	1,089	0.34	0.019	828	261
2Year	24Hour	0.39	0.060	2,614	0.26	0.060	2,614	0

Shortcut Method Summary – FACILITY 7

		Existing Condition			Proposed Condition			Difference Volume
		Q (cfs)	V (ac.ft)	V (cu.ft)	Q (cfs)	V (ac.ft)	V(cu.ft)	V(cu.ft)
2Year	1Hour	4.04	0.050	2,178	3.18	0.040	1,742	436
2Year	3Hour	1.71	0.140	6,098	1.71	0.140	6,098	0
2Year	6Hour	1.17	0.070	3,049	0.49	0.061	2,657	392
2Year	24Hour	1.22	0.270	11,761	1.60	0.330	14,375	2,614

RCFC&WCD HYDROLOGY MANUAL	"SHORTCUT METHOD" SYNTHETIC UNIT HYDROGRAPH METHOD UNIT HYDROGRAPH AND EFFECT RAIN CALCULATION FORM	PROJECT	1162008 - PARADISE VALLEY RANCH FACULITY #7 - EXISTING CONDITION
		BY:	CM
		DATE:	2/17/2022
		Checked	
		DATE:	

[1] CONCENTRATION POINT		[2] AREA DESIGNATION	
[3] DRAINAGE AREA-ACRES	3.20	[4] ULTIMATE DISHCARGE-CFS-HRS/IN (645*[3])	
[5] UNIT TIME-MINUTES	5	[6] LAG TIME-MINUES	
[7] UNIT TIME-PERCENT OF LAG)100*[5]/[6])		[8] S-CURVE	
[9] STORM FREQUENCE & DURATION	2YR-1HR	[10] TOTAL ADJUSTED STORM DRAIN-INCHES	0.48
[11] VARIABLE LOSS RATE (AVG)-INCHES/HOUR		[12] MINIMUM LOSS RATE (FOR VAR. LOSS)-IN/HR	0.200
[13] CONSTANT LOSS RATE-INCHES/HOUR	0.400	[14] LOW LOSS RATE-PERCENT	80%

	UNIT HYDROGRAPH				EFFECTIVE RAIN					FLOOD HYDROGRAPH
[15]	[16]	[17]	[18]	[19]	[20]	[21]	[22]		[23]	[24]
UNIT TIME PERIOD	TIME PERCENT OF LAG	CUMULATIVE AVERAGE PERCENT OF ULTIMATE DISCHARGE	DISTRIB GRAPH PERCENT	UNIT HYDROPRAPH CFS/IN	PATTERN PERCENT	STROM RAIN IN/HR	LOS RATE		EFFECTIVE RAIN IN/HR	FLOW
m	[7]*[15]	(S-GRAPH)	[17]m-[17]m-1	$\frac{[4]*[18]}{100}$	(PL E-5.9)	$\frac{60[10][20]}{100[5]}$	IN/HR MAX	LOW	[21]-[22]	CFS
1					4.2	0.240	0.400	0.192	0.048	0.15
2					4.3	0.246	0.400	0.196	0.049	0.16
3					5	0.286	0.400	0.228	0.057	0.18
4					5	0.286	0.400	0.228	0.057	0.18
5					5.8	0.331	0.400	0.265	0.066	0.21
6					6.5	0.371	0.400	0.297	0.074	0.24
7					7.4	0.423	0.400	0.338	0.085	0.27
8					8.6	0.491	0.400	0.393	0.098	0.31
9					12.3	0.703	0.400	0.562	0.303	0.97
10					29.1	1.662	0.400	1.330	1.262	4.04
11					6.8	0.388	0.400	0.311	0.078	0.25
12					5	0.286	0.400	0.228	0.057	0.18
					100				2.23	4.04

EFFECTIVE RAIN ([23]*T): 0.186 INCHES

VOLUME (EFF RAIN X AREA): 0.050 AC-FT

RCFC&WCD HYDROLOGY MANUAL	"SHORTCUT METHOD" SYNTHETIC UNIT HYDROGRAPH METHOD UNIT HYDROGRAPH AND EFFECT RAIN CALCULATION FORM	PROJECT	1162008 - PARADISE VALLEY RANCH FACULITY #7 - EXISTING CONDITION		
		BY:	CM	DATE:	2/17/2022
		Checked		DATE:	

[1] CONCENTRATION POINT		[2] AREA DESIGNATION	
[3] DRAINAGE AREA-ACRES	3.20	[4] ULTIMATE DISHCARGE-CFS-HRS/IN (645*[3])	
[5] UNIT TIME-MINUTES	5	[6] LAG TIME-MINUES	
[7] UNIT TIME-PERCENT OF LAG)100*[5]/[6])		[8] S-CURVE	
[9] STORM FREQUENCE & DURATION	2YR-3HR	[10] TOTAL ADJUSTED STORM DRAIN-INCHES	0.81
[11] VARIABLE LOSS RATE (AVG)-INCHES/HOUR		[12] MINIMUM LOSS RATE (FOR VAR. LOSS)-IN/HR	0.200
[13] CONSTANT LOSS RATE-INCHES/HOUR	0.400	[14] LOW LOSS RATE-PERCENT	33%

	UNIT HYDROGRAPH				EFFECTIVE RAIN					FLOOD HYDROGRAPH
[15] UNIT TIME PERIOD m	[16] TIME PERCENT OF LAG [7]*[15]	[17] CUMULATIVE AVERAGE PERCENT OF ULTIMATE DISCHARGE (S-GRAPH)	[18] DISTRIB GRAPH PERCENT [17]m-[17]m-1	[19] UNIT HYDROGRAPH CFS/IN $\frac{[4]*[18]}{100}$	[20] PATTERN PERCENT (PL E-5.9)	[21] STROM RAIN IN/HR $\frac{60[10][20]}{100[5]}$	[22] LOS RATE IN/HR MAX	LOW	[23] EFFECTIVE RAIN IN/HR [21]-[22]	[24] FLOW CFS
1					1.3	0.127	0.400	0.042	0.085	0.27
2					1.3	0.127	0.400	0.042	0.085	0.27
3					1.1	0.107	0.400	0.035	0.072	0.23
4					1.5	0.146	0.400	0.048	0.098	0.31
5					1.5	0.146	0.400	0.048	0.098	0.31
6					1.8	0.175	0.400	0.058	0.117	0.38
7					1.5	0.146	0.400	0.048	0.098	0.31
8					1.8	0.175	0.400	0.058	0.117	0.38
9					1.8	0.175	0.400	0.058	0.117	0.38
10					1.5	0.146	0.400	0.048	0.098	0.31
11					1.6	0.156	0.400	0.051	0.104	0.33
12					1.8	0.175	0.400	0.058	0.117	0.38
13					2.2	0.214	0.400	0.071	0.143	0.46
14					2.2	0.214	0.400	0.071	0.143	0.46
15					2.2	0.214	0.400	0.071	0.143	0.46
16					2	0.195	0.400	0.064	0.130	0.42
17					2.6	0.253	0.400	0.084	0.170	0.54
18					2.7	0.263	0.400	0.087	0.176	0.56
19					2.4	0.234	0.400	0.077	0.156	0.50
20					2.7	0.263	0.400	0.087	0.176	0.56
21					3.3	0.321	0.400	0.106	0.215	0.69

22					3.1	0.302	0.400	0.100	0.202	0.65
23					2.9	0.282	0.400	0.093	0.189	0.61
24					3	0.292	0.400	0.096	0.196	0.63
25					3.1	0.302	0.400	0.100	0.202	0.65
26					4.2	0.409	0.400	0.135	0.274	0.88
27					5	0.487	0.400	0.161	0.326	1.04
28					3.5	0.341	0.400	0.112	0.228	0.73
29					6.8	0.662	0.400	0.218	0.443	1.42
30					7.3	0.710	0.400	0.234	0.476	1.52
31					8.2	0.798	0.400	0.263	0.535	1.71
32					5.9	0.574	0.400	0.189	0.385	1.23
33					2	0.195	0.400	0.064	0.130	0.42
34					1.8	0.175	0.400	0.058	0.117	0.38
35					1.8	0.175	0.400	0.058	0.117	0.38
36					0.6	0.058	0.400	0.019	0.039	0.13
					100				6.52	1.71

EFFECTIVE RAIN ([23]*T): 0.543 INCHES

VOLUME (EFF RAIN X AREA): 0.14 AC-FT

RCFC&WCD HYDROLOGY
MANUAL

"SHORTCUT METHOD"
SYNTHETIC UNIT HYDROGRAPH METHOD
UNIT HYDROGRAPH AND EFFECT RAIN
CALCULATION FORM

PROJECT 1162008 - PARADISE VALLEY RANCH
FACULITY #7 - EXISTING CONDITION
BY: CM DATE: 2/17/2022
Checked DATE:

[1] CONCENTRATION POINT
[2] AREA DESIGNATION
[3] DRAINAGE AREA-ACRES 3.20
[4] ULTIMATE DISHCARGE-CFS-HRS/IN (645*[3])
[5] UNIT TIME-MINUTES 5
[6] LAG TIME-MINUES
[7] UNIT TIME-PERCENT OF LAG)100*[5]/[6])
[8] S-CURVE
[9] STORM FREQUENCE & DURATION 2YR-6HR
[10] TOTAL ADJUSTED STORM DRAIN-INCHES 1.14
[11] VARIABLE LOSS RATE (AVG)-INCHES/HOUR
[12] MINIMUM LOSS RATE (FOR VAR. LOSS)-IN/HR 0.200
[13] CONSTANT LOSS RATE-INCHES/HOUR 0.400
[14] LOW LOSS RATE-PERCENT 80%

	UNIT HYDROGRAPH				EFFECTIVE RAIN					FLOOD HYDROGRAPH
[15]	[16]	[17]	[18]	[19]	[20]	[21]	[22]		[23]	[24]
UNIT TIME PERIOD	TIME PERCENT OF LAG	CUMULATIVE AVERAGE PERCENT OF ULTIMATE DISCHARGE	DISTRIB GRAPH PERCENT	UNIT HYDROGRAPH CFS/IN	PATTERN PERCENT	STROM RAIN IN/HR	LOS RATE		EFFECTIVE RAIN IN/HR	FLOW
							IN/HR			
m	[7]*[15]	(S-GRAPH)	[17]m-[17]m-1	$\frac{[4]*[18]}{100}$	(PL E-5.9)	$\frac{60[10][20]}{100[5]}$	MAX	LOW	[21]-[22]	CFS
1					0.5	0.068	0.400	0.055	0.014	0.04
2					0.6	0.082	0.400	0.066	0.016	0.05
3					0.6	0.082	0.400	0.066	0.016	0.05
4					0.6	0.082	0.400	0.066	0.016	0.05
5					0.6	0.082	0.400	0.066	0.016	0.05
6					0.7	0.096	0.400	0.077	0.019	0.06
7					0.7	0.096	0.400	0.077	0.019	0.06
8					0.7	0.096	0.400	0.077	0.019	0.06
9					0.7	0.096	0.400	0.077	0.019	0.06
10					0.7	0.096	0.400	0.077	0.019	0.06
11					0.7	0.096	0.400	0.077	0.019	0.06
12					0.8	0.109	0.400	0.088	0.022	0.07
13					0.8	0.109	0.400	0.088	0.022	0.07
14					0.8	0.109	0.400	0.088	0.022	0.07
15					0.8	0.109	0.400	0.088	0.022	0.07
16					0.8	0.109	0.400	0.088	0.022	0.07
17					0.8	0.109	0.400	0.088	0.022	0.07
18					0.8	0.109	0.400	0.088	0.022	0.07
19					0.8	0.109	0.400	0.088	0.022	0.07
20					0.8	0.109	0.400	0.088	0.022	0.07
21					0.8	0.109	0.400	0.088	0.022	0.07

22					0.8	0.109	0.400	0.088	0.022	0.07
23					0.8	0.109	0.400	0.088	0.022	0.07
24					0.9	0.123	0.400	0.098	0.025	0.08
25					0.8	0.109	0.400	0.088	0.022	0.07
26					0.9	0.123	0.400	0.098	0.025	0.08
27					0.9	0.123	0.400	0.098	0.025	0.08
28					0.9	0.123	0.400	0.098	0.025	0.08
29					0.9	0.123	0.400	0.098	0.025	0.08
30					0.9	0.123	0.400	0.098	0.025	0.08
31					0.9	0.123	0.400	0.098	0.025	0.08
32					0.9	0.123	0.400	0.098	0.025	0.08
33					1.0	0.137	0.400	0.109	0.027	0.09
34					1.0	0.137	0.400	0.109	0.027	0.09
35					1.0	0.137	0.400	0.109	0.027	0.09
36					1.0	0.137	0.400	0.109	0.027	0.09
37					1.0	0.137	0.400	0.109	0.027	0.09
38					1.1	0.150	0.400	0.120	0.030	0.10
39					1.1	0.150	0.400	0.120	0.030	0.10
40					1.1	0.150	0.400	0.120	0.030	0.10
41					1.2	0.164	0.400	0.131	0.033	0.11
42					1.3	0.178	0.400	0.142	0.036	0.11
43					1.4	0.192	0.400	0.153	0.038	0.12
44					1.4	0.192	0.400	0.153	0.038	0.12
45					1.5	0.205	0.400	0.164	0.041	0.13
46					1.5	0.205	0.400	0.164	0.041	0.13
47					1.6	0.219	0.400	0.175	0.044	0.14
48					1.6	0.219	0.400	0.175	0.044	0.14
49					1.7	0.233	0.400	0.186	0.047	0.15
50					1.8	0.246	0.400	0.197	0.049	0.16
51					1.9	0.260	0.400	0.208	0.052	0.17
52					2.0	0.274	0.400	0.219	0.055	0.18
53					2.1	0.287	0.400	0.230	0.057	0.18
54					2.1	0.287	0.400	0.230	0.057	0.18
55					2.2	0.301	0.400	0.241	0.060	0.19
56					2.3	0.315	0.400	0.252	0.063	0.20
57					2.4	0.328	0.400	0.263	0.066	0.21
58					2.4	0.328	0.400	0.263	0.066	0.21
59					2.5	0.342	0.400	0.274	0.068	0.22
60					2.6	0.356	0.400	0.285	0.071	0.23
61					3.1	0.424	0.400	0.339	0.085	0.27
62					3.6	0.492	0.400	0.394	0.098	0.32
63					3.9	0.534	0.400	0.427	0.134	0.43

64					4.2	0.575	0.400	0.460	0.175	0.56
65					4.7	0.643	0.400	0.514	0.243	0.78
66					5.6	0.766	0.400	0.613	0.366	1.17
67					1.9	0.260	0.400	0.208	0.052	0.17
68					0.9	0.123	0.400	0.098	0.025	0.08
69					0.6	0.082	0.400	0.066	0.016	0.05
70					0.5	0.068	0.400	0.055	0.014	0.04
71					0.3	0.041	0.400	0.033	0.008	0.03
72					0.2	0.027	0.400	0.022	0.005	0.02
					100				3.15	1.17

EFFECTIVE RAIN ([23]*T): 0.262 INCHES

VOLUME (EFF RAIN X AREA): 0.070 AC-FT

RCFC&WCD HYDROLOGY MANUAL	"SHORTCUT METHOD" SYNTHETIC UNIT HYDROGRAPH METHOD UNIT HYDROGRAPH AND EFFECT RAIN CALCULATION FORM	PROJECT	1162008 - PARADISE VALLEY RANCH		
			FACULITY #7 - EXISTING CONDITION		
		BY:	CM	DATE:	2/17/2022
		Checked		DATE:	

[1] CONCENTRATION POINT		[2] AREA DESIGNATION	
[3] DRAINAGE AREA-ACRES	3.20	[4] ULTIMATE DISHCARGE-CFS-HRS/IN (645*[3])	
[5] UNIT TIME-MINUTES	5	[6] LAG TIME-MINUES	
[7] UNIT TIME-PERCENT OF LAG)100*[5]/[6])		[8] S-CURVE	
[9] STORM FREQUENCE & DURATION	2YR-24HR	[10] TOTAL ADJUSTED STORM DRAIN-INCHES	2.04
[11] VARIABLE LOSS RATE (AVG)-INCHES/HOUR		[12] MINIMUM LOSS RATE (FOR VAR. LOSS)-IN/HR	0.200
[13] CONSTANT LOSS RATE-INCHES/HOUR	0.400	[14] LOW LOSS RATE-PERCENT	40%

	UNIT HYDROGRAPH				EFFECTIVE RAIN					FLOOD HYDROGRAPH
[15]	[16]	[17]	[18]	[19]	[20]	[21]	[22]		[23]	[24]
UNIT TIME PERIOD	TIME PERCENT OF LAG	CUMULATIVE AVERAGE PERCENT OF ULTIMATE DISCHARGE	DISTRIB GRAPH PERCENT	UNIT HYDROGRAPH CFS/IN	PATTERN PERCENT	STROM RAIN IN/HR	LOS RATE		EFFECTIVE RAIN IN/HR	FLOW
m	[7]*[15]	(S-GRAPH)	[17]m-[17]m-1	$\frac{[4]*[18]}{100}$	(PL E-5.9)	$\frac{60[10][20]}{100[5]}$	IN/HR		[21]-[22]	CFS
							MAX	LOW		
1					0.2	0.0490	0.709	0.0196	0.0294	0.09
2					0.3	0.0734	0.708	0.0294	0.0441	0.14
3					0.3	0.0734	0.706	0.0294	0.0441	0.14
4					0.4	0.0979	0.705	0.0392	0.0588	0.19
5					0.3	0.0734	0.704	0.0294	0.0441	0.14
6					0.3	0.0734	0.702	0.0294	0.0441	0.14
7					0.3	0.0734	0.701	0.0294	0.0441	0.14
8					0.4	0.0979	0.700	0.0392	0.0588	0.19
9					0.4	0.0979	0.698	0.0392	0.0588	0.19
10					0.4	0.0979	0.697	0.0392	0.0588	0.19
11					0.5	0.1224	0.695	0.0490	0.0734	0.24
12					0.5	0.1224	0.694	0.0490	0.0734	0.24
13					0.5	0.1224	0.693	0.0490	0.0734	0.24
14					0.5	0.1224	0.691	0.0490	0.0734	0.24
15					0.5	0.1224	0.690	0.0490	0.0734	0.24
16					0.6	0.1469	0.689	0.0588	0.0881	0.28
17					0.6	0.1469	0.687	0.0588	0.0881	0.28
18					0.7	0.1714	0.686	0.0685	0.1028	0.33
19					0.7	0.1714	0.685	0.0685	0.1028	0.33
20					0.8	0.1958	0.683	0.0783	0.1175	0.38
21					0.6	0.1469	0.682	0.0588	0.0881	0.28

22					0.7	0.1714	0.681	0.0685	0.1028	0.33
23					0.8	0.1958	0.679	0.0783	0.1175	0.38
24					0.8	0.1958	0.678	0.0783	0.1175	0.38
25					0.9	0.2203	0.677	0.0881	0.1322	0.42
26					0.9	0.2203	0.675	0.0881	0.1322	0.42
27					1	0.2448	0.674	0.0979	0.1469	0.47
28					1	0.2448	0.673	0.0979	0.1469	0.47
29					1	0.2448	0.671	0.0979	0.1469	0.47
30					1.1	0.2693	0.670	0.1077	0.1616	0.52
31					1.2	0.2938	0.669	0.1175	0.1763	0.56
32					1.3	0.3182	0.667	0.1273	0.1909	0.61
33					1.5	0.3672	0.666	0.1469	0.2203	0.71
34					1.5	0.3672	0.665	0.1469	0.2203	0.71
35					1.6	0.3917	0.663	0.1567	0.2350	0.75
36					1.7	0.4162	0.662	0.1665	0.2497	0.80
37					1.9	0.4651	0.661	0.1860	0.2791	0.89
38					2	0.4896	0.659	0.1958	0.2938	0.94
39					2.1	0.5141	0.658	0.2056	0.3084	0.99
40					2.2	0.5386	0.657	0.2154	0.3231	1.03
41					1.5	0.3672	0.655	0.1469	0.2203	0.71
42					1.5	0.3672	0.654	0.1469	0.2203	0.71
43					2	0.4896	0.653	0.1958	0.2938	0.94
44					2	0.4896	0.651	0.1958	0.2938	0.94
45					1.9	0.4651	0.650	0.1860	0.2791	0.89
46					1.9	0.4651	0.649	0.1860	0.2791	0.89
47					1.7	0.4162	0.647	0.1665	0.2497	0.80
48					1.8	0.4406	0.646	0.1763	0.2644	0.85
49					2.5	0.6120	0.645	0.2448	0.3672	1.18
50					2.6	0.6365	0.643	0.2546	0.3819	1.22
51					2.8	0.6854	0.642	0.2742	0.0433	0.14
52					2.9	0.7099	0.641	0.2840	0.0691	0.22
53					3.4	0.8323	0.640	0.3329	0.1928	0.62
54					3.4	0.8323	0.638	0.3329	0.1941	0.62
55					2.3	0.5630	0.637	0.2252	0.3378	1.08
56					2.3	0.5630	0.636	0.2252	0.3378	1.08
57					2.7	0.6610	0.634	0.2644	0.0266	0.09
58					2.6	0.6365	0.633	0.2546	0.0034	0.01
59					2.6	0.6365	0.632	0.2546	0.0047	0.02
60					2.5	0.6120	0.630	0.2448	0.3672	1.18
61					2.4	0.5875	0.629	0.2350	0.3525	1.13
62					2.3	0.5630	0.628	0.2252	0.3378	1.08
63					1.9	0.4651	0.627	0.1860	0.2791	0.89

64					1.9	0.4651	0.625	0.1860	0.2791	0.89
65					0.4	0.0979	0.624	0.0392	0.0588	0.19
66					0.4	0.0979	0.623	0.0392	0.0588	0.19
67					0.3	0.0734	0.621	0.0294	0.0441	0.14
68					0.3	0.0734	0.620	0.0294	0.0441	0.14
69					0.5	0.1224	0.619	0.0490	0.0734	0.24
70					0.5	0.1224	0.618	0.0490	0.0734	0.24
71					0.5	0.1224	0.616	0.0490	0.0734	0.24
72					0.4	0.0979	0.615	0.0392	0.0588	0.19
73					0.4	0.0979	0.614	0.0392	0.0588	0.19
74					0.4	0.0979	0.612	0.0392	0.0588	0.19
75					0.3	0.0734	0.611	0.0294	0.0441	0.14
76					0.2	0.0490	0.610	0.0196	0.0294	0.09
77					0.3	0.0734	0.609	0.0294	0.0441	0.14
78					0.4	0.0979	0.607	0.0392	0.0588	0.19
79					0.3	0.0734	0.606	0.0294	0.0441	0.14
80					0.2	0.0490	0.605	0.0196	0.0294	0.09
81					0.3	0.0734	0.604	0.0294	0.0441	0.14
82					0.3	0.0734	0.602	0.0294	0.0441	0.14
83					0.3	0.0734	0.601	0.0294	0.0441	0.14
84					0.2	0.0490	0.600	0.0196	0.0294	0.09
85					0.3	0.0734	0.599	0.0294	0.0441	0.14
86					0.2	0.0490	0.597	0.0196	0.0294	0.09
87					0.3	0.0734	0.596	0.0294	0.0441	0.14
88					0.2	0.0490	0.595	0.0196	0.0294	0.09
89					0.3	0.0734	0.594	0.0294	0.0441	0.14
90					0.2	0.0490	0.592	0.0196	0.0294	0.09
91					0.2	0.0490	0.591	0.0196	0.0294	0.09
92					0.2	0.0490	0.590	0.0196	0.0294	0.09
93					0.2	0.0490	0.589	0.0196	0.0294	0.09
94					0.2	0.0490	0.587	0.0196	0.0294	0.09
95					0.2	0.0490	0.586	0.0196	0.0294	0.09
96					0.2	0.0490	0.585	0.0196	0.0294	0.09
					100				12.23	1.22

EFFECTIVE RAIN ([23]*T): 1.019 INCHES

VOLUME (EFF RAIN X AREA): 0.27 AC-FT

RCFC&WCD HYDROLOGY MANUAL	"SHORTCUT METHOD" SYNTHETIC UNIT HYDROGRAPH METHOD UNIT HYDROGRAPH AND EFFECT RAIN CALCULATION FORM	PROJECT BY: Checked	1162008 - PARADISE VALLEY RANCH FACULITY #6 - EXISTING CONDITION CM DATE: 2/17/2022 DATE:

[1] CONCENTRATION POINT		[2] AREA DESIGNATION	
[3] DRAINAGE AREA-ACRES	0.75	[4] ULTIMATE DISHCARGE-CFS-HRS/IN (645*[3])	
[5] UNIT TIME-MINUTES	5	[6] LAG TIME-MINUES	
[7] UNIT TIME-PERCENT OF LAG)100*[5]/[6])		[8] S-CURVE	
[9] STORM FREQUENCE & DURATION	2YR-1HR	[10] TOTAL ADJUSTED STORM DRAIN-INCHES	0.48
[11] VARIABLE LOSS RATE (AVG)-INCHES/HOUR		[12] MINIMUM LOSS RATE (FOR VAR. LOSS)-IN/HR	0.100
[13] CONSTANT LOSS RATE-INCHES/HOUR	0.200	[14] LOW LOSS RATE-PERCENT	80%

	UNIT HYDROGRAPH				EFFECTIVE RAIN					FLOOD HYDROGRAPH
[15] UNIT TIME PERIOD m	[16] TIME PERCENT OF LAG [7]*[15]	[17] CUMULATIVE AVERAGE PERCENT OF ULTIMATE DISCHARGE (S-GRAPH)	[18] DISTRIB GRAPH PERCENT [17]m-[17]m-1	[19] UNIT HYDROPRAPH CFS/IN [4]*[18] / 100	[20] PATTERN PERCENT (PL E-5.9)	[21] STROM RAIN IN/HR 60[10][20] / 100[5]	[22] LOS RATE IN/HR MAX	LOW	[23] EFFECTIVE RAIN IN/HR [21]-[22]	[24] FLOW CFS
1					4.2	0.240	0.200	0.192	0.048	0.04
2					4.3	0.246	0.200	0.196	0.049	0.04
3					5	0.286	0.200	0.228	0.086	0.06
4					5	0.286	0.200	0.228	0.086	0.06
5					5.8	0.331	0.200	0.265	0.131	0.10
6					6.5	0.371	0.200	0.297	0.171	0.13
7					7.4	0.423	0.200	0.338	0.223	0.17
8					8.6	0.491	0.200	0.393	0.291	0.22
9					12.3	0.703	0.200	0.562	0.503	0.38
10					29.1	1.662	0.200	1.330	1.462	1.10
11					6.8	0.388	0.200	0.311	0.188	0.14
12					5	0.286	0.200	0.228	0.086	0.06
					100				3.32	1.10

EFFECTIVE RAIN ([23]*T): 0.277 INCHES

VOLUME (EFF RAIN X AREA): 0.017 AC-FT

RCFC&WCD HYDROLOGY MANUAL	"SHORTCUT METHOD" SYNTHETIC UNIT HYDROGRAPH METHOD UNIT HYDROGRAPH AND EFFECT RAIN CALCULATION FORM	PROJECT	1162008 - PARADISE VALLEY RANCH FACULITY #6 - EXISTING CONDITION		
		BY:	CM	DATE:	2/17/2022
		Checked		DATE:	

[1] CONCENTRATION POINT		[2] AREA DESIGNATION	
[3] DRAINAGE AREA-ACRES	0.75	[4] ULTIMATE DISHCARGE-CFS-HRS/IN (645*[3])	
[5] UNIT TIME-MINUTES	5	[6] LAG TIME-MINUES	
[7] UNIT TIME-PERCENT OF LAG)100*[5]/[6])		[8] S-CURVE	
[9] STORM FREQUENCE & DURATION	2YR-3HR	[10] TOTAL ADJUSTED STORM DRAIN-INCHES	0.81
[11] VARIABLE LOSS RATE (AVG)-INCHES/HOUR		[12] MINIMUM LOSS RATE (FOR VAR. LOSS)-IN/HR	0.100
[13] CONSTANT LOSS RATE-INCHES/HOUR	0.200	[14] LOW LOSS RATE-PERCENT	33%

	UNIT HYDROGRAPH				EFFECTIVE RAIN					FLOOD HYDROGRAPH
[15] UNIT TIME PERIOD m	[16] TIME PERCENT OF LAG [7]*[15]	[17] CUMULATIVE AVERAGE PERCENT OF ULTIMATE DISCHARGE (S-GRAPH)	[18] DISTRIB GRAPH PERCENT [17]m-[17]m-1	[19] UNIT HYDROPGRAPH CFS/IN [4]*[18] 100	[20] PATTERN PERCENT (PL E-5.9)	[21] STROM RAIN IN/HR 60[10][20] 100[5]	[22] LOS RATE IN/HR MAX	LOW	[23] EFFECTIVE RAIN IN/HR [21]-[22]	[24] FLOW CFS
1					1.3	0.127	0.200	0.042	0.085	0.06
2					1.3	0.127	0.200	0.042	0.085	0.06
3					1.1	0.107	0.200	0.035	0.072	0.05
4					1.5	0.146	0.200	0.048	0.098	0.07
5					1.5	0.146	0.200	0.048	0.098	0.07
6					1.8	0.175	0.200	0.058	0.117	0.09
7					1.5	0.146	0.200	0.048	0.098	0.07
8					1.8	0.175	0.200	0.058	0.117	0.09
9					1.8	0.175	0.200	0.058	0.117	0.09
10					1.5	0.146	0.200	0.048	0.098	0.07
11					1.6	0.156	0.200	0.051	0.104	0.08
12					1.8	0.175	0.200	0.058	0.117	0.09
13					2.2	0.214	0.200	0.071	0.143	0.11
14					2.2	0.214	0.200	0.071	0.143	0.11
15					2.2	0.214	0.200	0.071	0.143	0.11
16					2	0.195	0.200	0.064	0.130	0.10
17					2.6	0.253	0.200	0.084	0.170	0.13
18					2.7	0.263	0.200	0.087	0.176	0.13
19					2.4	0.234	0.200	0.077	0.156	0.12
20					2.7	0.263	0.200	0.087	0.176	0.13
21					3.3	0.321	0.200	0.106	0.215	0.16

22					3.1	0.302	0.200	0.100	0.202	0.15
23					2.9	0.282	0.200	0.093	0.189	0.14
24					3	0.292	0.200	0.096	0.196	0.15
25					3.1	0.302	0.200	0.100	0.202	0.15
26					4.2	0.409	0.200	0.135	0.274	0.21
27					5	0.487	0.200	0.161	0.326	0.25
28					3.5	0.341	0.200	0.112	0.228	0.17
29					6.8	0.662	0.200	0.218	0.462	0.35
30					7.3	0.710	0.200	0.234	0.510	0.38
31					8.2	0.798	0.200	0.263	0.598	0.45
32					5.9	0.574	0.200	0.189	0.385	0.29
33					2	0.195	0.200	0.064	0.130	0.10
34					1.8	0.175	0.200	0.058	0.117	0.09
35					1.8	0.175	0.200	0.058	0.117	0.09
36					0.6	0.058	0.200	0.019	0.039	0.03
					100				6.64	0.45

EFFECTIVE RAIN ([23]*T): 0.553 INCHES

VOLUME (EFF RAIN X AREA): 0.03 AC-FT

RCFC&WCD HYDROLOGY MANUAL	"SHORTCUT METHOD" SYNTHETIC UNIT HYDROGRAPH METHOD UNIT HYDROGRAPH AND EFFECT RAIN CALCULATION FORM	PROJECT	1162008 - PARADISE VALLEY RANCH FACULITY #6 - EXISTING CONDITION		
		BY:	CM	DATE:	2/17/2022
		Checked		DATE:	

[1] CONCENTRATION POINT		[2] AREA DESIGNATION	
[3] DRAINAGE AREA-ACRES	0.75	[4] ULTIMATE DISHCARGE-CFS-HRS/IN (645*[3])	
[5] UNIT TIME-MINUTES	5	[6] LAG TIME-MINUES	
[7] UNIT TIME-PERCENT OF LAG)100*[5]/[6])		[8] S-CURVE	
[9] STORM FREQUENCE & DURATION	2YR-6HR	[10] TOTAL ADJUSTED STORM DRAIN-INCHES	1.14
[11] VARIABLE LOSS RATE (AVG)-INCHES/HOUR		[12] MINIMUM LOSS RATE (FOR VAR. LOSS)-IN/HR	0.100
[13] CONSTANT LOSS RATE-INCHES/HOUR	0.200	[14] LOW LOSS RATE-PERCENT	80%

	UNIT HYDROGRAPH				EFFECTIVE RAIN					FLOOD HYDROGRAPH
[15]	[16]	[17]	[18]	[19]	[20]	[21]	[22]		[23]	[24]
UNIT TIME PERIOD	TIME PERCENT OF LAG	CUMULATIVE AVERAGE PERCENT OF ULTIMATE DISCHARGE	DISTRIB GRAPH PERCENT	UNIT HYDROPRAPH CFS/IN	PATTERN PERCENT	STROM RAIN IN/HR	LOS RATE		EFFECTIVE RAIN IN/HR	FLOW
m	[7]*[15]	(S-GRAPH)	[17]m-[17]m-1	[4]*[18]	(PL E-5.9)	60[10][20]	IN/HR		[21]-[22]	CFS
				100		100[5]	MAX	LOW		
1					0.5	0.068	0.200	0.055	0.014	0.01
2					0.6	0.082	0.200	0.066	0.016	0.01
3					0.6	0.082	0.200	0.066	0.016	0.01
4					0.6	0.082	0.200	0.066	0.016	0.01
5					0.6	0.082	0.200	0.066	0.016	0.01
6					0.7	0.096	0.200	0.077	0.019	0.01
7					0.7	0.096	0.200	0.077	0.019	0.01
8					0.7	0.096	0.200	0.077	0.019	0.01
9					0.7	0.096	0.200	0.077	0.019	0.01
10					0.7	0.096	0.200	0.077	0.019	0.01
11					0.7	0.096	0.200	0.077	0.019	0.01
12					0.8	0.109	0.200	0.088	0.022	0.02
13					0.8	0.109	0.200	0.088	0.022	0.02
14					0.8	0.109	0.200	0.088	0.022	0.02
15					0.8	0.109	0.200	0.088	0.022	0.02
16					0.8	0.109	0.200	0.088	0.022	0.02
17					0.8	0.109	0.200	0.088	0.022	0.02
18					0.8	0.109	0.200	0.088	0.022	0.02
19					0.8	0.109	0.200	0.088	0.022	0.02
20					0.8	0.109	0.200	0.088	0.022	0.02
21					0.8	0.109	0.200	0.088	0.022	0.02

22					0.8	0.109	0.200	0.088	0.022	0.02
23					0.8	0.109	0.200	0.088	0.022	0.02
24					0.9	0.123	0.200	0.098	0.025	0.02
25					0.8	0.109	0.200	0.088	0.022	0.02
26					0.9	0.123	0.200	0.098	0.025	0.02
27					0.9	0.123	0.200	0.098	0.025	0.02
28					0.9	0.123	0.200	0.098	0.025	0.02
29					0.9	0.123	0.200	0.098	0.025	0.02
30					0.9	0.123	0.200	0.098	0.025	0.02
31					0.9	0.123	0.200	0.098	0.025	0.02
32					0.9	0.123	0.200	0.098	0.025	0.02
33					1.0	0.137	0.200	0.109	0.027	0.02
34					1.0	0.137	0.200	0.109	0.027	0.02
35					1.0	0.137	0.200	0.109	0.027	0.02
36					1.0	0.137	0.200	0.109	0.027	0.02
37					1.0	0.137	0.200	0.109	0.027	0.02
38					1.1	0.150	0.200	0.120	0.030	0.02
39					1.1	0.150	0.200	0.120	0.030	0.02
40					1.1	0.150	0.200	0.120	0.030	0.02
41					1.2	0.164	0.200	0.131	0.033	0.02
42					1.3	0.178	0.200	0.142	0.036	0.03
43					1.4	0.192	0.200	0.153	0.038	0.03
44					1.4	0.192	0.200	0.153	0.038	0.03
45					1.5	0.205	0.200	0.164	0.041	0.03
46					1.5	0.205	0.200	0.164	0.041	0.03
47					1.6	0.219	0.200	0.175	0.044	0.03
48					1.6	0.219	0.200	0.175	0.044	0.03
49					1.7	0.233	0.200	0.186	0.047	0.03
50					1.8	0.246	0.200	0.197	0.049	0.04
51					1.9	0.260	0.200	0.208	0.060	0.05
52					2.0	0.274	0.200	0.219	0.074	0.06
53					2.1	0.287	0.200	0.230	0.087	0.07
54					2.1	0.287	0.200	0.230	0.087	0.07
55					2.2	0.301	0.200	0.241	0.101	0.08
56					2.3	0.315	0.200	0.252	0.115	0.09
57					2.4	0.328	0.200	0.263	0.128	0.10
58					2.4	0.328	0.200	0.263	0.128	0.10
59					2.5	0.342	0.200	0.274	0.142	0.11
60					2.6	0.356	0.200	0.285	0.156	0.12
61					3.1	0.424	0.200	0.339	0.224	0.17
62					3.6	0.492	0.200	0.394	0.292	0.22
63					3.9	0.534	0.200	0.427	0.334	0.25

64					4.2	0.575	0.200	0.460	0.375	0.28
65					4.7	0.643	0.200	0.514	0.443	0.33
66					5.6	0.766	0.200	0.613	0.566	0.43
67					1.9	0.260	0.200	0.208	0.060	0.05
68					0.9	0.123	0.200	0.098	0.025	0.02
69					0.6	0.082	0.200	0.066	0.016	0.01
70					0.5	0.068	0.200	0.055	0.014	0.01
71					0.3	0.041	0.200	0.033	0.008	0.01
72					0.2	0.027	0.200	0.022	0.005	0.00
					100				4.75	0.43

EFFECTIVE RAIN ([23]*T):	0.396 INCHES
VOLUME (EFF RAIN X AREA):	0.025 AC-FT

RCFC&WCD HYDROLOGY
MANUAL

"SHORTCUT METHOD"
SYNTHETIC UNIT HYDROGRAPH METHOD
UNIT HYDROGRAPH AND EFFECT RAIN
CALCULATION FORM

PROJECT 1162008 - PARADISE VALLEY RANCH
FACULITY #6 - EXISTING CONDITION
BY: CM DATE: 2/17/2022
Checked DATE:

[1] CONCENTRATION POINT
[3] DRAINAGE AREA-ACRES 0.75
[5] UNIT TIME-MINUTES 5
[7] UNIT TIME-PERCENT OF LAG)100*[5]/[6])
[9] STORM FREQUENCE & DURATION 2YR-24HR
[11] VARIABLE LOSS RATE (AVG)-INCHES/HOUR
[13] CONSTANT LOSS RATE-INCHES/HOUR 0.200

[2] AREA DESIGNATION
[4] ULTIMATE DISHCARGE-CFS-HRS/IN (645*[3])
[6] LAG TIME-MINUES
[8] S-CURVE
[10] TOTAL ADJUSTED STORM DRAIN-INCHES 2.04
[12] MINIMUM LOSS RATE (FOR VAR. LOSS)-IN/HR 0.100
[14] LOW LOSS RATE-PERCENT 40%

	UNIT HYDROGRAPH				EFFECTIVE RAIN					FLOOD HYDROGRAPH
[15] UNIT TIME PERIOD m	[16] TIME PERCENT OF LAG [7]*[15]	[17] CUMULATIVE AVERAGE PERCENT OF ULTIMATE DISCHARGE (S-GRAPH)	[18] DISTRIB GRAPH PERCENT [17]m-[17]m-1	[19] UNIT HYDROGRAPH CFS/IN [4]*[18] 100	[20] PATTERN PERCENT (PL E-5.9)	[21] STROM RAIN IN/HR 60[10][20] 100[5]	[22] LOS RATE IN/HR MAX	LOW	[23] EFFECTIVE RAIN IN/HR [21]-[22]	[24] FLOW CFS
1					0.2	0.0490	0.355	0.0196	0.0294	0.02
2					0.3	0.0734	0.354	0.0294	0.0441	0.03
3					0.3	0.0734	0.353	0.0294	0.0441	0.03
4					0.4	0.0979	0.352	0.0392	0.0588	0.04
5					0.3	0.0734	0.352	0.0294	0.0441	0.03
6					0.3	0.0734	0.351	0.0294	0.0441	0.03
7					0.3	0.0734	0.350	0.0294	0.0441	0.03
8					0.4	0.0979	0.350	0.0392	0.0588	0.04
9					0.4	0.0979	0.349	0.0392	0.0588	0.04
10					0.4	0.0979	0.348	0.0392	0.0588	0.04
11					0.5	0.1224	0.348	0.0490	0.0734	0.06
12					0.5	0.1224	0.347	0.0490	0.0734	0.06
13					0.5	0.1224	0.346	0.0490	0.0734	0.06
14					0.5	0.1224	0.346	0.0490	0.0734	0.06
15					0.5	0.1224	0.345	0.0490	0.0734	0.06
16					0.6	0.1469	0.344	0.0588	0.0881	0.07
17					0.6	0.1469	0.344	0.0588	0.0881	0.07
18					0.7	0.1714	0.343	0.0685	0.1028	0.08
19					0.7	0.1714	0.342	0.0685	0.1028	0.08
20					0.8	0.1958	0.342	0.0783	0.1175	0.09
21					0.6	0.1469	0.341	0.0588	0.0881	0.07

22					0.7	0.1714	0.340	0.0685	0.1028	0.08
23					0.8	0.1958	0.340	0.0783	0.1175	0.09
24					0.8	0.1958	0.339	0.0783	0.1175	0.09
25					0.9	0.2203	0.338	0.0881	0.1322	0.10
26					0.9	0.2203	0.338	0.0881	0.1322	0.10
27					1	0.2448	0.337	0.0979	0.1469	0.11
28					1	0.2448	0.336	0.0979	0.1469	0.11
29					1	0.2448	0.336	0.0979	0.1469	0.11
30					1.1	0.2693	0.335	0.1077	0.1616	0.12
31					1.2	0.2938	0.334	0.1175	0.1763	0.13
32					1.3	0.3182	0.334	0.1273	0.1909	0.14
33					1.5	0.3672	0.333	0.1469	0.0343	0.03
34					1.5	0.3672	0.332	0.1469	0.0349	0.03
35					1.6	0.3917	0.332	0.1567	0.0601	0.05
36					1.7	0.4162	0.331	0.1665	0.0852	0.06
37					1.9	0.4651	0.330	0.1860	0.1348	0.10
38					2	0.4896	0.330	0.1958	0.1600	0.12
39					2.1	0.5141	0.329	0.2056	0.1851	0.14
40					2.2	0.5386	0.328	0.2154	0.2103	0.16
41					1.5	0.3672	0.328	0.1469	0.0396	0.03
42					1.5	0.3672	0.327	0.1469	0.0402	0.03
43					2	0.4896	0.326	0.1958	0.1633	0.12
44					2	0.4896	0.326	0.1958	0.1639	0.12
45					1.9	0.4651	0.325	0.1860	0.1401	0.11
46					1.9	0.4651	0.324	0.1860	0.1408	0.11
47					1.7	0.4162	0.324	0.1665	0.0925	0.07
48					1.8	0.4406	0.323	0.1763	0.1176	0.09
49					2.5	0.6120	0.322	0.2448	0.2896	0.22
50					2.6	0.6365	0.322	0.2546	0.3148	0.24
51					2.8	0.6854	0.321	0.2742	0.3644	0.27
52					2.9	0.7099	0.320	0.2840	0.3895	0.29
53					3.4	0.8323	0.320	0.3329	0.5126	0.39
54					3.4	0.8323	0.319	0.3329	0.5132	0.39
55					2.3	0.5630	0.318	0.2252	0.2446	0.18
56					2.3	0.5630	0.318	0.2252	0.2452	0.18
57					2.7	0.6610	0.317	0.2644	0.3438	0.26
58					2.6	0.6365	0.317	0.2546	0.3200	0.24
59					2.6	0.6365	0.316	0.2546	0.3206	0.24
60					2.5	0.6120	0.315	0.2448	0.2968	0.22
61					2.4	0.5875	0.315	0.2350	0.2729	0.21
62					2.3	0.5630	0.314	0.2252	0.2491	0.19
63					1.9	0.4651	0.313	0.1860	0.1518	0.11

64					1.9	0.4651	0.313	0.1860	0.1525	0.11
65					0.4	0.0979	0.312	0.0392	0.0588	0.04
66					0.4	0.0979	0.311	0.0392	0.0588	0.04
67					0.3	0.0734	0.311	0.0294	0.0441	0.03
68					0.3	0.0734	0.310	0.0294	0.0441	0.03
69					0.5	0.1224	0.309	0.0490	0.0734	0.06
70					0.5	0.1224	0.309	0.0490	0.0734	0.06
71					0.5	0.1224	0.308	0.0490	0.0734	0.06
72					0.4	0.0979	0.308	0.0392	0.0588	0.04
73					0.4	0.0979	0.307	0.0392	0.0588	0.04
74					0.4	0.0979	0.306	0.0392	0.0588	0.04
75					0.3	0.0734	0.306	0.0294	0.0441	0.03
76					0.2	0.0490	0.305	0.0196	0.0294	0.02
77					0.3	0.0734	0.304	0.0294	0.0441	0.03
78					0.4	0.0979	0.304	0.0392	0.0588	0.04
79					0.3	0.0734	0.303	0.0294	0.0441	0.03
80					0.2	0.0490	0.302	0.0196	0.0294	0.02
81					0.3	0.0734	0.302	0.0294	0.0441	0.03
82					0.3	0.0734	0.301	0.0294	0.0441	0.03
83					0.3	0.0734	0.301	0.0294	0.0441	0.03
84					0.2	0.0490	0.300	0.0196	0.0294	0.02
85					0.3	0.0734	0.299	0.0294	0.0441	0.03
86					0.2	0.0490	0.299	0.0196	0.0294	0.02
87					0.3	0.0734	0.298	0.0294	0.0441	0.03
88					0.2	0.0490	0.297	0.0196	0.0294	0.02
89					0.3	0.0734	0.297	0.0294	0.0441	0.03
90					0.2	0.0490	0.296	0.0196	0.0294	0.02
91					0.2	0.0490	0.296	0.0196	0.0294	0.02
92					0.2	0.0490	0.295	0.0196	0.0294	0.02
93					0.2	0.0490	0.294	0.0196	0.0294	0.02
94					0.2	0.0490	0.294	0.0196	0.0294	0.02
95					0.2	0.0490	0.293	0.0196	0.0294	0.02
96					0.2	0.0490	0.292	0.0196	0.0294	0.02
					100				11.21	0.39

EFFECTIVE RAIN ([23]*T): 0.934 INCHES

VOLUME (EFF RAIN X AREA): 0.06 AC-FT

RCFC&WCD HYDROLOGY MANUAL

"SHORTCUT METHOD"
SYNTHETIC UNIT HYDROGRAPH METHOD
UNIT HYDROGRAPH AND EFFECT RAIN
CALCULATION FORM

PROJECT 1162008 - PARADISE VALLEY RANCH
FACULITY #7 - PROPOSED CONDITION
BY: CM DATE: 2/17/2022
Checked DATE:

[1] CONCENTRATION POINT		[2] AREA DESIGNATION	
[3] DRAINAGE AREA-ACRES	3.20	[4] ULTIMATE DISHCARGE-CFS-HRS/IN (645*[3])	
[5] UNIT TIME-MINUTES	5	[6] LAG TIME-MINUES	
[7] UNIT TIME-PERCENT OF LAG)100*[5]/[6])		[8] S-CURVE	
[9] STORM FREQUENCE & DURATION	2YR-1HR	[10] TOTAL ADJUSTED STORM DRAIN-INCHES	0.48
[11] VARIABLE LOSS RATE (AVG)-INCHES/HOUR		[12] MINIMUM LOSS RATE (FOR VAR. LOSS)-IN/HR	0.334
[13] CONSTANT LOSS RATE-INCHES/HOUR	0.668	[14] LOW LOSS RATE-PERCENT	80%

	UNIT HYDROGRAPH				EFFECTIVE RAIN					FLOOD HYDROGRAPH
[15]	[16]	[17]	[18]	[19]	[20]	[21]	[22]		[23]	[24]
UNIT TIME PERIOD	TIME PERCENT OF LAG	CUMULATIVE AVERAGE PERCENT OF ULTIMATE DISCHARGE	DISTRIB GRAPH PERCENT	UNIT HYDROGRAPH CFS/IN	PATTERN PERCENT	STROM RAIN IN/HR	LOS RATE IN/HR		EFFECTIVE RAIN IN/HR	FLOW
m	[7]*[15]	(S-GRAPH)	[17]m-[17]m-1	$\frac{[4]*[18]}{100}$	(PL E-5.9)	$\frac{60[10][20]}{100[5]}$	MAX	LOW	[21]-[22]	CFS
1					4.2	0.240	0.668	0.192	0.048	0.15
2					4.3	0.246	0.668	0.196	0.049	0.16
3					5	0.286	0.668	0.228	0.057	0.18
4					5	0.286	0.668	0.228	0.057	0.18
5					5.8	0.331	0.668	0.265	0.066	0.21
6					6.5	0.371	0.668	0.297	0.074	0.24
7					7.4	0.423	0.668	0.338	0.085	0.27
8					8.6	0.491	0.668	0.393	0.098	0.31
9					12.3	0.703	0.668	0.562	0.141	0.45
10					29.1	1.662	0.668	1.330	0.994	3.18
11					6.8	0.388	0.668	0.311	0.078	0.25
12					5	0.286	0.668	0.228	0.057	0.18
					100				1.80	3.18

EFFECTIVE RAIN ([23]*T): 0.150 INCHES

VOLUME (EFF RAIN X AREA): 0.040 AC-FT

RCFC&WCD HYDROLOGY MANUAL	"SHORTCUT METHOD" SYNTHETIC UNIT HYDROGRAPH METHOD UNIT HYDROGRAPH AND EFFECT RAIN CALCULATION FORM	PROJECT	1162008 - PARADISE VALLEY RANCH FACULITY #7 - PROPOSED CONDITION		
		BY:	CM	DATE:	2/17/2022
		Checked		DATE:	

[1] CONCENTRATION POINT		[2] AREA DESIGNATION	
[3] DRAINAGE AREA-ACRES	3.20	[4] ULTIMATE DISHCARGE-CFS-HRS/IN (645*[3])	
[5] UNIT TIME-MINUTES	5	[6] LAG TIME-MINUES	
[7] UNIT TIME-PERCENT OF LAG)100*[5]/[6])		[8] S-CURVE	
[9] STORM FREQUENCE & DURATION	2YR-3HR	[10] TOTAL ADJUSTED STORM DRAIN-INCHES	0.81
[11] VARIABLE LOSS RATE (AVG)-INCHES/HOUR		[12] MINIMUM LOSS RATE (FOR VAR. LOSS)-IN/HR	0.334
[13] CONSTANT LOSS RATE-INCHES/HOUR	0.668	[14] LOW LOSS RATE-PERCENT	33%

	UNIT HYDROGRAPH				EFFECTIVE RAIN					FLOOD HYDROGRAPH
[15] UNIT TIME PERIOD m	[16] TIME PERCENT OF LAG [7]*[15]	[17] CUMULATIVE AVERAGE PERCENT OF ULTIMATE DISCHARGE (S-GRAPH)	[18] DISTRIB GRAPH PERCENT [17]m-[17]m-1	[19] UNIT HYDROGRAPH CFS/IN [4]*[18] 100	[20] PATTERN PERCENT (PL E-5.9)	[21] STROM RAIN IN/HR 60[10][20] 100[5]	[22] LOS RATE IN/HR MAX	LOW	[23] EFFECTIVE RAIN IN/HR [21]-[22]	[24] FLOW CFS
1					1.3	0.127	0.668	0.042	0.085	0.27
2					1.3	0.127	0.668	0.042	0.085	0.27
3					1.1	0.107	0.668	0.035	0.072	0.23
4					1.5	0.146	0.668	0.048	0.098	0.31
5					1.5	0.146	0.668	0.048	0.098	0.31
6					1.8	0.175	0.668	0.058	0.117	0.38
7					1.5	0.146	0.668	0.048	0.098	0.31
8					1.8	0.175	0.668	0.058	0.117	0.38
9					1.8	0.175	0.668	0.058	0.117	0.38
10					1.5	0.146	0.668	0.048	0.098	0.31
11					1.6	0.156	0.668	0.051	0.104	0.33
12					1.8	0.175	0.668	0.058	0.117	0.38
13					2.2	0.214	0.668	0.071	0.143	0.46
14					2.2	0.214	0.668	0.071	0.143	0.46
15					2.2	0.214	0.668	0.071	0.143	0.46
16					2	0.195	0.668	0.064	0.130	0.42
17					2.6	0.253	0.668	0.084	0.170	0.54
18					2.7	0.263	0.668	0.087	0.176	0.56
19					2.4	0.234	0.668	0.077	0.156	0.50
20					2.7	0.263	0.668	0.087	0.176	0.56
21					3.3	0.321	0.668	0.106	0.215	0.69

22					3.1	0.302	0.668	0.100	0.202	0.65
23					2.9	0.282	0.668	0.093	0.189	0.61
24					3	0.292	0.668	0.096	0.196	0.63
25					3.1	0.302	0.668	0.100	0.202	0.65
26					4.2	0.409	0.668	0.135	0.274	0.88
27					5	0.487	0.668	0.161	0.326	1.04
28					3.5	0.341	0.668	0.112	0.228	0.73
29					6.8	0.662	0.668	0.218	0.443	1.42
30					7.3	0.710	0.668	0.234	0.476	1.52
31					8.2	0.798	0.668	0.263	0.535	1.71
32					5.9	0.574	0.668	0.189	0.385	1.23
33					2	0.195	0.668	0.064	0.130	0.42
34					1.8	0.175	0.668	0.058	0.117	0.38
35					1.8	0.175	0.668	0.058	0.117	0.38
36					0.6	0.058	0.668	0.019	0.039	0.13
					100				6.52	1.71

EFFECTIVE RAIN ([23]*T): 0.543 INCHES

VOLUME (EFF RAIN X AREA): 0.14 AC-FT

RCFC&WCD HYDROLOGY MANUAL	"SHORTCUT METHOD" SYNTHETIC UNIT HYDROGRAPH METHOD UNIT HYDROGRAPH AND EFFECT RAIN CALCULATION FORM	PROJECT	1162008 - PARADISE VALLEY RANCH FACULITY #7 - PROPOSED CONDITION		
		BY:	CM	DATE:	2/17/2022
		Checked		DATE:	

[1] CONCENTRATION POINT
[3] DRAINAGE AREA-ACRES 3.20
[5] UNIT TIME-MINUTES 5
[7] UNIT TIME-PERCENT OF LAG)100*[5]/[6])
[9] STORM FREQUENCE & DURATION 2YR-6HR
[11] VARIABLE LOSS RATE (AVG)-INCHES/HOUR
[13] CONSTANT LOSS RATE-INCHES/HOUR 0.668

[2] AREA DESIGNATION
[4] ULTIMATE DISHCARGE-CFS-HRS/IN (645*[3])
[6] LAG TIME-MINUES
[8] S-CURVE
[10] TOTAL ADJUSTED STORM DRAIN-INCHES 1.14
[12] MINIMUM LOSS RATE (FOR VAR. LOSS)-IN/HR 0.334
[14] LOW LOSS RATE-PERCENT 80%

	UNIT HYDROGRAPH				EFFECTIVE RAIN					FLOOD HYDROGRAPH
[15]	[16]	[17]	[18]	[19]	[20]	[21]	[22]		[23]	[24]
UNIT TIME PERIOD	TIME PERCENT OF LAG	CUMULATIVE AVERAGE PERCENT OF ULTIMATE DISCHARGE	DISTRIB GRAPH PERCENT	UNIT HYDROGRAPH CFS/IN	PATTERN PERCENT	STROM RAIN IN/HR	LOS RATE		EFFECTIVE RAIN IN/HR	FLOW
m	[7]*[15]	(S-GRAPH)	[17]m-[17]m-1	$\frac{[4]*[18]}{100}$	(PL E-5.9)	$\frac{60[10][20]}{100[5]}$	IN/HR		[21]-[22]	CFS
							MAX	LOW		
1					0.5	0.068	0.668	0.055	0.014	0.04
2					0.6	0.082	0.668	0.066	0.016	0.05
3					0.6	0.082	0.668	0.066	0.016	0.05
4					0.6	0.082	0.668	0.066	0.016	0.05
5					0.6	0.082	0.668	0.066	0.016	0.05
6					0.7	0.096	0.668	0.077	0.019	0.06
7					0.7	0.096	0.668	0.077	0.019	0.06
8					0.7	0.096	0.668	0.077	0.019	0.06
9					0.7	0.096	0.668	0.077	0.019	0.06
10					0.7	0.096	0.668	0.077	0.019	0.06
11					0.7	0.096	0.668	0.077	0.019	0.06
12					0.8	0.109	0.668	0.088	0.022	0.07
13					0.8	0.109	0.668	0.088	0.022	0.07
14					0.8	0.109	0.668	0.088	0.022	0.07
15					0.8	0.109	0.668	0.088	0.022	0.07
16					0.8	0.109	0.668	0.088	0.022	0.07
17					0.8	0.109	0.668	0.088	0.022	0.07
18					0.8	0.109	0.668	0.088	0.022	0.07
19					0.8	0.109	0.668	0.088	0.022	0.07
20					0.8	0.109	0.668	0.088	0.022	0.07
21					0.8	0.109	0.668	0.088	0.022	0.07

22					0.8	0.109	0.668	0.088	0.022	0.07
23					0.8	0.109	0.668	0.088	0.022	0.07
24					0.9	0.123	0.668	0.098	0.025	0.08
25					0.8	0.109	0.668	0.088	0.022	0.07
26					0.9	0.123	0.668	0.098	0.025	0.08
27					0.9	0.123	0.668	0.098	0.025	0.08
28					0.9	0.123	0.668	0.098	0.025	0.08
29					0.9	0.123	0.668	0.098	0.025	0.08
30					0.9	0.123	0.668	0.098	0.025	0.08
31					0.9	0.123	0.668	0.098	0.025	0.08
32					0.9	0.123	0.668	0.098	0.025	0.08
33					1.0	0.137	0.668	0.109	0.027	0.09
34					1.0	0.137	0.668	0.109	0.027	0.09
35					1.0	0.137	0.668	0.109	0.027	0.09
36					1.0	0.137	0.668	0.109	0.027	0.09
37					1.0	0.137	0.668	0.109	0.027	0.09
38					1.1	0.150	0.668	0.120	0.030	0.10
39					1.1	0.150	0.668	0.120	0.030	0.10
40					1.1	0.150	0.668	0.120	0.030	0.10
41					1.2	0.164	0.668	0.131	0.033	0.11
42					1.3	0.178	0.668	0.142	0.036	0.11
43					1.4	0.192	0.668	0.153	0.038	0.12
44					1.4	0.192	0.668	0.153	0.038	0.12
45					1.5	0.205	0.668	0.164	0.041	0.13
46					1.5	0.205	0.668	0.164	0.041	0.13
47					1.6	0.219	0.668	0.175	0.044	0.14
48					1.6	0.219	0.668	0.175	0.044	0.14
49					1.7	0.233	0.668	0.186	0.047	0.15
50					1.8	0.246	0.668	0.197	0.049	0.16
51					1.9	0.260	0.668	0.208	0.052	0.17
52					2.0	0.274	0.668	0.219	0.055	0.18
53					2.1	0.287	0.668	0.230	0.057	0.18
54					2.1	0.287	0.668	0.230	0.057	0.18
55					2.2	0.301	0.668	0.241	0.060	0.19
56					2.3	0.315	0.668	0.252	0.063	0.20
57					2.4	0.328	0.668	0.263	0.066	0.21
58					2.4	0.328	0.668	0.263	0.066	0.21
59					2.5	0.342	0.668	0.274	0.068	0.22
60					2.6	0.356	0.668	0.285	0.071	0.23
61					3.1	0.424	0.668	0.339	0.085	0.27
62					3.6	0.492	0.668	0.394	0.098	0.32
63					3.9	0.534	0.668	0.427	0.107	0.34

64						4.2	0.575	0.668	0.460	0.115	0.37
65						4.7	0.643	0.668	0.514	0.129	0.41
66						5.6	0.766	0.668	0.613	0.153	0.49
67						1.9	0.260	0.668	0.208	0.052	0.17
68						0.9	0.123	0.668	0.098	0.025	0.08
69						0.6	0.082	0.668	0.066	0.016	0.05
70						0.5	0.068	0.668	0.055	0.014	0.04
71						0.3	0.041	0.668	0.033	0.008	0.03
72						0.2	0.027	0.668	0.022	0.005	0.02
						100				2.74	0.49

EFFECTIVE RAIN ([23]*T): 0.228 INCHES

VOLUME (EFF RAIN X AREA): 0.061 AC-FT

RCFC&WCD HYDROLOGY MANUAL	"SHORTCUT METHOD" SYNTHETIC UNIT HYDROGRAPH METHOD UNIT HYDROGRAPH AND EFFECT RAIN CALCULATION FORM	PROJECT	1162008 - PARADISE VALLEY RANCH		
		FACULITY #7 - PROPOSED CONDITION			
		BY:	CM	DATE:	2/17/2022
		Checked		DATE:	

[1] CONCENTRATION POINT		[2] AREA DESIGNATION	
[3] DRAINAGE AREA-ACRES	3.20	[4] ULTIMATE DISHCARGE-CFS-HRS/IN (645*[3])	
[5] UNIT TIME-MINUTES	5	[6] LAG TIME-MINUES	
[7] UNIT TIME-PERCENT OF LAG)100*[5]/[6])		[8] S-CURVE	
[9] STORM FREQUENCE & DURATION	2YR-24HR	[10] TOTAL ADJUSTED STORM DRAIN-INCHES	2.04
[11] VARIABLE LOSS RATE (AVG)-INCHES/HOUR		[12] MINIMUM LOSS RATE (FOR VAR. LOSS)-IN/HR	0.334
[13] CONSTANT LOSS RATE-INCHES/HOUR	0.668	[14] LOW LOSS RATE-PERCENT	40%

	UNIT HYDROGRAPH				EFFECTIVE RAIN					FLOOD HYDROGRAPH
[15] UNIT TIME PERIOD m	[16] TIME PERCENT OF LAG [7]*[15]	[17] CUMULATIVE AVERAGE PERCENT OF ULTIMATE DISCHARGE (S-GRAPH)	[18] DISTRIB GRAPH PERCENT [17]m-[17]m-1	[19] UNIT HYDROGRAPH CFS/IN $\frac{[4]*[18]}{100}$	[20] PATTERN PERCENT (PL E-5.9)	[21] STROM RAIN IN/HR $\frac{60[10][20]}{100[5]}$	[22] LOS RATE IN/HR MAX	LOW	[23] EFFECTIVE RAIN IN/HR [21]-[22]	[24] FLOW CFS
1					0.2	0.0490	1.184	0.0196	0.0294	0.09
2					0.3	0.0734	1.182	0.0294	0.0441	0.14
3					0.3	0.0734	1.180	0.0294	0.0441	0.14
4					0.4	0.0979	1.177	0.0392	0.0588	0.19
5					0.3	0.0734	1.175	0.0294	0.0441	0.14
6					0.3	0.0734	1.173	0.0294	0.0441	0.14
7					0.3	0.0734	1.170	0.0294	0.0441	0.14
8					0.4	0.0979	1.168	0.0392	0.0588	0.19
9					0.4	0.0979	1.166	0.0392	0.0588	0.19
10					0.4	0.0979	1.164	0.0392	0.0588	0.19
11					0.5	0.1224	1.161	0.0490	0.0734	0.24
12					0.5	0.1224	1.159	0.0490	0.0734	0.24
13					0.5	0.1224	1.157	0.0490	0.0734	0.24
14					0.5	0.1224	1.155	0.0490	0.0734	0.24
15					0.5	0.1224	1.152	0.0490	0.0734	0.24
16					0.6	0.1469	1.150	0.0588	0.0881	0.28
17					0.6	0.1469	1.148	0.0588	0.0881	0.28
18					0.7	0.1714	1.146	0.0685	0.1028	0.33
19					0.7	0.1714	1.143	0.0685	0.1028	0.33
20					0.8	0.1958	1.141	0.0783	0.1175	0.38
21					0.6	0.1469	1.139	0.0588	0.0881	0.28

22					0.7	0.1714	1.137	0.0685	0.1028	0.33
23					0.8	0.1958	1.134	0.0783	0.1175	0.38
24					0.8	0.1958	1.132	0.0783	0.1175	0.38
25					0.9	0.2203	1.130	0.0881	0.1322	0.42
26					0.9	0.2203	1.128	0.0881	0.1322	0.42
27					1	0.2448	1.125	0.0979	0.1469	0.47
28					1	0.2448	1.123	0.0979	0.1469	0.47
29					1	0.2448	1.121	0.0979	0.1469	0.47
30					1.1	0.2693	1.119	0.1077	0.1616	0.52
31					1.2	0.2938	1.116	0.1175	0.1763	0.56
32					1.3	0.3182	1.114	0.1273	0.1909	0.61
33					1.5	0.3672	1.112	0.1469	0.2203	0.71
34					1.5	0.3672	1.110	0.1469	0.2203	0.71
35					1.6	0.3917	1.108	0.1567	0.2350	0.75
36					1.7	0.4162	1.105	0.1665	0.2497	0.80
37					1.9	0.4651	1.103	0.1860	0.2791	0.89
38					2	0.4896	1.101	0.1958	0.2938	0.94
39					2.1	0.5141	1.099	0.2056	0.3084	0.99
40					2.2	0.5386	1.097	0.2154	0.3231	1.03
41					1.5	0.3672	1.094	0.1469	0.2203	0.71
42					1.5	0.3672	1.092	0.1469	0.2203	0.71
43					2	0.4896	1.090	0.1958	0.2938	0.94
44					2	0.4896	1.088	0.1958	0.2938	0.94
45					1.9	0.4651	1.086	0.1860	0.2791	0.89
46					1.9	0.4651	1.083	0.1860	0.2791	0.89
47					1.7	0.4162	1.081	0.1665	0.2497	0.80
48					1.8	0.4406	1.079	0.1763	0.2644	0.85
49					2.5	0.6120	1.077	0.2448	0.3672	1.18
50					2.6	0.6365	1.075	0.2546	0.3819	1.22
51					2.8	0.6854	1.072	0.2742	0.4113	1.32
52					2.9	0.7099	1.070	0.2840	0.4260	1.36
53					3.4	0.8323	1.068	0.3329	0.4994	1.60
54					3.4	0.8323	1.066	0.3329	0.4994	1.60
55					2.3	0.5630	1.064	0.2252	0.3378	1.08
56					2.3	0.5630	1.062	0.2252	0.3378	1.08
57					2.7	0.6610	1.059	0.2644	0.3966	1.27
58					2.6	0.6365	1.057	0.2546	0.3819	1.22
59					2.6	0.6365	1.055	0.2546	0.3819	1.22
60					2.5	0.6120	1.053	0.2448	0.3672	1.18
61					2.4	0.5875	1.051	0.2350	0.3525	1.13
62					2.3	0.5630	1.049	0.2252	0.3378	1.08
63					1.9	0.4651	1.046	0.1860	0.2791	0.89

64					1.9	0.4651	1.044	0.1860	0.2791	0.89
65					0.4	0.0979	1.042	0.0392	0.0588	0.19
66					0.4	0.0979	1.040	0.0392	0.0588	0.19
67					0.3	0.0734	1.038	0.0294	0.0441	0.14
68					0.3	0.0734	1.036	0.0294	0.0441	0.14
69					0.5	0.1224	1.034	0.0490	0.0734	0.24
70					0.5	0.1224	1.031	0.0490	0.0734	0.24
71					0.5	0.1224	1.029	0.0490	0.0734	0.24
72					0.4	0.0979	1.027	0.0392	0.0588	0.19
73					0.4	0.0979	1.025	0.0392	0.0588	0.19
74					0.4	0.0979	1.023	0.0392	0.0588	0.19
75					0.3	0.0734	1.021	0.0294	0.0441	0.14
76					0.2	0.0490	1.019	0.0196	0.0294	0.09
77					0.3	0.0734	1.016	0.0294	0.0441	0.14
78					0.4	0.0979	1.014	0.0392	0.0588	0.19
79					0.3	0.0734	1.012	0.0294	0.0441	0.14
80					0.2	0.0490	1.010	0.0196	0.0294	0.09
81					0.3	0.0734	1.008	0.0294	0.0441	0.14
82					0.3	0.0734	1.006	0.0294	0.0441	0.14
83					0.3	0.0734	1.004	0.0294	0.0441	0.14
84					0.2	0.0490	1.002	0.0196	0.0294	0.09
85					0.3	0.0734	1.000	0.0294	0.0441	0.14
86					0.2	0.0490	0.997	0.0196	0.0294	0.09
87					0.3	0.0734	0.995	0.0294	0.0441	0.14
88					0.2	0.0490	0.993	0.0196	0.0294	0.09
89					0.3	0.0734	0.991	0.0294	0.0441	0.14
90					0.2	0.0490	0.989	0.0196	0.0294	0.09
91					0.2	0.0490	0.987	0.0196	0.0294	0.09
92					0.2	0.0490	0.985	0.0196	0.0294	0.09
93					0.2	0.0490	0.983	0.0196	0.0294	0.09
94					0.2	0.0490	0.981	0.0196	0.0294	0.09
95					0.2	0.0490	0.979	0.0196	0.0294	0.09
96					0.2	0.0490	0.977	0.0196	0.0294	0.09
					100				14.69	1.60

EFFECTIVE RAIN ([23]*T): 1.224 INCHES

VOLUME (EFF RAIN X AREA): 0.33 AC-FT

RCFC&WCD HYDROLOGY MANUAL	"SHORTCUT METHOD" SYNTHETIC UNIT HYDROGRAPH METHOD UNIT HYDROGRAPH AND EFFECT RAIN CALCULATION FORM	PROJECT 1162008 - PARADISE VALLEY RANCH FACULITY #6 - PROPOSED CONDITION BY: CM DATE: 2/17/2022 Checked DATE:	

[1] CONCENTRATION POINT		[2] AREA DESIGNATION	
[3] DRAINAGE AREA-ACRES	0.75	[4] ULTIMATE DISHCARGE-CFS-HRS/IN (645*[3])	
[5] UNIT TIME-MINUTES	5	[6] LAG TIME-MINUES	
[7] UNIT TIME-PERCENT OF LAG)100*[5]/[6])		[8] S-CURVE	
[9] STORM FREQUENCE & DURATION	2YR-1HR	[10] TOTAL ADJUSTED STORM DRAIN-INCHES	0.48
[11] VARIABLE LOSS RATE (AVG)-INCHES/HOUR		[12] MINIMUM LOSS RATE (FOR VAR. LOSS)-IN/HR	0.154
[13] CONSTANT LOSS RATE-INCHES/HOUR	0.309	[14] LOW LOSS RATE-PERCENT	80%

	UNIT HYDROGRAPH				EFFECTIVE RAIN					FLOOD HYDROGRAPH
[15] UNIT TIME PERIOD m	[16] TIME PERCENT OF LAG [7]*[15]	[17] CUMULATIVE AVERAGE PERCENT OF ULTIMATE DISCHARGE (S-GRAPH)	[18] DISTRIB GRAPH PERCENT [17]m-[17]m-1	[19] UNIT HYDROPRAPH CFS/IN $\frac{[4]*[18]}{100}$	[20] PATTERN PERCENT (PL E-5.9)	[21] STROM RAIN IN/HR $\frac{60[10][20]}{100[5]}$	[22] LOS RATE IN/HR		[23] EFFECTIVE RAIN IN/HR [21]-[22]	[24] FLOW CFS
							MAX	LOW		
1					4.2	0.240	0.309	0.192	0.048	0.04
2					4.3	0.246	0.309	0.196	0.049	0.04
3					5	0.286	0.309	0.228	0.057	0.04
4					5	0.286	0.309	0.228	0.057	0.04
5					5.8	0.331	0.309	0.265	0.066	0.05
6					6.5	0.371	0.309	0.297	0.074	0.06
7					7.4	0.423	0.309	0.338	0.114	0.09
8					8.6	0.491	0.309	0.393	0.182	0.14
9					12.3	0.703	0.309	0.562	0.394	0.30
10					29.1	1.662	0.309	1.330	1.353	1.02
11					6.8	0.388	0.309	0.311	0.080	0.06
12					5	0.286	0.309	0.228	0.057	0.04
					100				2.53	1.02

EFFECTIVE RAIN ([23]*T): 0.211 INCHES

VOLUME (EFF RAIN X AREA): 0.013 AC-FT

RCFC&WCD HYDROLOGY
MANUAL

"SHORTCUT METHOD"
SYNTHETIC UNIT HYDROGRAPH METHOD
UNIT HYDROGRAPH AND EFFECT RAIN
CALCULATION FORM

PROJECT 1162008 - PARADISE VALLEY RANCH
FACULITY #6 - PROPOSED CONDITION
BY: CM DATE: 2/17/2022
Checked DATE:

[1] CONCENTRATION POINT
[2] AREA DESIGNATION
[3] DRAINAGE AREA-ACRES 0.75
[4] ULTIMATE DISHCARGE-CFS-HRS/IN (645*[3])
[5] UNIT TIME-MINUTES 5
[6] LAG TIME-MINUES
[7] UNIT TIME-PERCENT OF LAG)100*[5]/[6])
[8] S-CURVE
[9] STORM FREQUENCE & DURATION 2YR-3HR
[10] TOTAL ADJUSTED STORM DRAIN-INCHES 0.81
[11] VARIABLE LOSS RATE (AVG)-INCHES/HOUR
[12] MINIMUM LOSS RATE (FOR VAR. LOSS)-IN/HR 0.154
[13] CONSTANT LOSS RATE-INCHES/HOUR 0.309
[14] LOW LOSS RATE-PERCENT 33%

	UNIT HYDROGRAPH				EFFECTIVE RAIN					FLOOD HYDROGRAPH
[15]	[16]	[17]	[18]	[19]	[20]	[21]	[22]		[23]	[24]
UNIT TIME PERIOD	TIME PERCENT OF LAG	CUMULATIVE AVERAGE PERCENT OF ULTIMATE DISCHARGE	DISTRIB GRAPH PERCENT	UNIT HYDROGRAPH CFS/IN	PATTERN PERCENT	STROM RAIN IN/HR	LOS RATE IN/HR		EFFECTIVE RAIN IN/HR	FLOW
m	[7]*[15]	(S-GRAPH)	[17]m-[17]m-1	[4]*[18] 100	(PL E-5.9)	60[10][20] 100[5]	MAX	LOW	[21]-[22]	CFS
1					1.3	0.127	0.309	0.042	0.085	0.06
2					1.3	0.127	0.309	0.042	0.085	0.06
3					1.1	0.107	0.309	0.035	0.072	0.05
4					1.5	0.146	0.309	0.048	0.098	0.07
5					1.5	0.146	0.309	0.048	0.098	0.07
6					1.8	0.175	0.309	0.058	0.117	0.09
7					1.5	0.146	0.309	0.048	0.098	0.07
8					1.8	0.175	0.309	0.058	0.117	0.09
9					1.8	0.175	0.309	0.058	0.117	0.09
10					1.5	0.146	0.309	0.048	0.098	0.07
11					1.6	0.156	0.309	0.051	0.104	0.08
12					1.8	0.175	0.309	0.058	0.117	0.09
13					2.2	0.214	0.309	0.071	0.143	0.11
14					2.2	0.214	0.309	0.071	0.143	0.11
15					2.2	0.214	0.309	0.071	0.143	0.11
16					2	0.195	0.309	0.064	0.130	0.10
17					2.6	0.253	0.309	0.084	0.170	0.13
18					2.7	0.263	0.309	0.087	0.176	0.13
19					2.4	0.234	0.309	0.077	0.156	0.12
20					2.7	0.263	0.309	0.087	0.176	0.13
21					3.3	0.321	0.309	0.106	0.215	0.16

22					3.1	0.302	0.309	0.100	0.202	0.15
23					2.9	0.282	0.309	0.093	0.189	0.14
24					3	0.292	0.309	0.096	0.196	0.15
25					3.1	0.302	0.309	0.100	0.202	0.15
26					4.2	0.409	0.309	0.135	0.274	0.21
27					5	0.487	0.309	0.161	0.326	0.25
28					3.5	0.341	0.309	0.112	0.228	0.17
29					6.8	0.662	0.309	0.218	0.443	0.33
30					7.3	0.710	0.309	0.234	0.476	0.36
31					8.2	0.798	0.309	0.263	0.535	0.40
32					5.9	0.574	0.309	0.189	0.385	0.29
33					2	0.195	0.309	0.064	0.130	0.10
34					1.8	0.175	0.309	0.058	0.117	0.09
35					1.8	0.175	0.309	0.058	0.117	0.09
36					0.6	0.058	0.309	0.019	0.039	0.03
					100				6.52	0.40

EFFECTIVE RAIN ([23]*T): 0.543 INCHES

VOLUME (EFF RAIN X AREA): 0.03 AC-FT

RCFC&WCD HYDROLOGY MANUAL	"SHORTCUT METHOD" SYNTHETIC UNIT HYDROGRAPH METHOD UNIT HYDROGRAPH AND EFFECT RAIN CALCULATION FORM	PROJECT	1162008 - PARADISE VALLEY RANCH		
			FACULITY #6 - PROPOSED CONDITION		
		BY:	CM	DATE:	2/17/2022
		Checked		DATE:	

[1] CONCENTRATION POINT		[2] AREA DESIGNATION	
[3] DRAINAGE AREA-ACRES	0.75	[4] ULTIMATE DISHCARGE-CFS-HRS/IN (645*[3])	
[5] UNIT TIME-MINUTES	5	[6] LAG TIME-MINUES	
[7] UNIT TIME-PERCENT OF LAG)100*[5]/[6])		[8] S-CURVE	
[9] STORM FREQUENCE & DURATION	2YR-6HR	[10] TOTAL ADJUSTED STORM DRAIN-INCHES	1.14
[11] VARIABLE LOSS RATE (AVG)-INCHES/HOUR		[12] MINIMUM LOSS RATE (FOR VAR. LOSS)-IN/HR	0.154
[13] CONSTANT LOSS RATE-INCHES/HOUR	0.309	[14] LOW LOSS RATE-PERCENT	80%

	UNIT HYDROGRAPH				EFFECTIVE RAIN					FLOOD HYDROGRAPH
[15]	[16]	[17]	[18]	[19]	[20]	[21]	[22]		[23]	[24]
UNIT TIME PERIOD	TIME PERCENT OF LAG	CUMULATIVE AVERAGE PERCENT OF ULTIMATE DISCHARGE	DISTRIB GRAPH PERCENT	UNIT HYDROGRAPH CFS/IN	PATTERN PERCENT	STROM RAIN IN/HR	LOS RATE		EFFECTIVE RAIN IN/HR	FLOW
m	[7]*[15]	(S-GRAPH)	[17]m-[17]m-1	[4]*[18] 100	(PL E-5.9)	60[10][20] 100[5]	IN/HR		[21]-[22]	CFS
							MAX	LOW		
1					0.5	0.068	0.309	0.055	0.014	0.01
2					0.6	0.082	0.309	0.066	0.016	0.01
3					0.6	0.082	0.309	0.066	0.016	0.01
4					0.6	0.082	0.309	0.066	0.016	0.01
5					0.6	0.082	0.309	0.066	0.016	0.01
6					0.7	0.096	0.309	0.077	0.019	0.01
7					0.7	0.096	0.309	0.077	0.019	0.01
8					0.7	0.096	0.309	0.077	0.019	0.01
9					0.7	0.096	0.309	0.077	0.019	0.01
10					0.7	0.096	0.309	0.077	0.019	0.01
11					0.7	0.096	0.309	0.077	0.019	0.01
12					0.8	0.109	0.309	0.088	0.022	0.02
13					0.8	0.109	0.309	0.088	0.022	0.02
14					0.8	0.109	0.309	0.088	0.022	0.02
15					0.8	0.109	0.309	0.088	0.022	0.02
16					0.8	0.109	0.309	0.088	0.022	0.02
17					0.8	0.109	0.309	0.088	0.022	0.02
18					0.8	0.109	0.309	0.088	0.022	0.02
19					0.8	0.109	0.309	0.088	0.022	0.02
20					0.8	0.109	0.309	0.088	0.022	0.02
21					0.8	0.109	0.309	0.088	0.022	0.02

22					0.8	0.109	0.309	0.088	0.022	0.02
23					0.8	0.109	0.309	0.088	0.022	0.02
24					0.9	0.123	0.309	0.098	0.025	0.02
25					0.8	0.109	0.309	0.088	0.022	0.02
26					0.9	0.123	0.309	0.098	0.025	0.02
27					0.9	0.123	0.309	0.098	0.025	0.02
28					0.9	0.123	0.309	0.098	0.025	0.02
29					0.9	0.123	0.309	0.098	0.025	0.02
30					0.9	0.123	0.309	0.098	0.025	0.02
31					0.9	0.123	0.309	0.098	0.025	0.02
32					0.9	0.123	0.309	0.098	0.025	0.02
33					1.0	0.137	0.309	0.109	0.027	0.02
34					1.0	0.137	0.309	0.109	0.027	0.02
35					1.0	0.137	0.309	0.109	0.027	0.02
36					1.0	0.137	0.309	0.109	0.027	0.02
37					1.0	0.137	0.309	0.109	0.027	0.02
38					1.1	0.150	0.309	0.120	0.030	0.02
39					1.1	0.150	0.309	0.120	0.030	0.02
40					1.1	0.150	0.309	0.120	0.030	0.02
41					1.2	0.164	0.309	0.131	0.033	0.02
42					1.3	0.178	0.309	0.142	0.036	0.03
43					1.4	0.192	0.309	0.153	0.038	0.03
44					1.4	0.192	0.309	0.153	0.038	0.03
45					1.5	0.205	0.309	0.164	0.041	0.03
46					1.5	0.205	0.309	0.164	0.041	0.03
47					1.6	0.219	0.309	0.175	0.044	0.03
48					1.6	0.219	0.309	0.175	0.044	0.03
49					1.7	0.233	0.309	0.186	0.047	0.03
50					1.8	0.246	0.309	0.197	0.049	0.04
51					1.9	0.260	0.309	0.208	0.052	0.04
52					2.0	0.274	0.309	0.219	0.055	0.04
53					2.1	0.287	0.309	0.230	0.057	0.04
54					2.1	0.287	0.309	0.230	0.057	0.04
55					2.2	0.301	0.309	0.241	0.060	0.05
56					2.3	0.315	0.309	0.252	0.063	0.05
57					2.4	0.328	0.309	0.263	0.066	0.05
58					2.4	0.328	0.309	0.263	0.066	0.05
59					2.5	0.342	0.309	0.274	0.068	0.05
60					2.6	0.356	0.309	0.285	0.071	0.05
61					3.1	0.424	0.309	0.339	0.115	0.09
62					3.6	0.492	0.309	0.394	0.184	0.14
63					3.9	0.534	0.309	0.427	0.225	0.17

64					4.2	0.575	0.309	0.460	0.266	0.20
65					4.7	0.643	0.309	0.514	0.334	0.25
66					5.6	0.766	0.309	0.613	0.457	0.34
67					1.9	0.260	0.309	0.208	0.052	0.04
68					0.9	0.123	0.309	0.098	0.025	0.02
69					0.6	0.082	0.309	0.066	0.016	0.01
70					0.5	0.068	0.309	0.055	0.014	0.01
71					0.3	0.041	0.309	0.033	0.008	0.01
72					0.2	0.027	0.309	0.022	0.005	0.00
					100				3.63	0.34

EFFECTIVE RAIN ([23]*T): 0.302 INCHES

VOLUME (EFF RAIN X AREA): 0.019 AC-FT

RCFC&WCD HYDROLOGY MANUAL	"SHORTCUT METHOD" SYNTHETIC UNIT HYDROGRAPH METHOD UNIT HYDROGRAPH AND EFFECT RAIN CALCULATION FORM	PROJECT	1162008 - PARADISE VALLEY RANCH		
			FACULITY #6 - PROPOSED CONDITION		
		BY:	CM	DATE:	2/17/2022
		Checked		DATE:	

[1] CONCENTRATION POINT		[2] AREA DESIGNATION	
[3] DRAINAGE AREA-ACRES	0.75	[4] ULTIMATE DISHCARGE-CFS-HRS/IN (645*[3])	
[5] UNIT TIME-MINUTES	5	[6] LAG TIME-MINUES	
[7] UNIT TIME-PERCENT OF LAG)100*[5]/[6])		[8] S-CURVE	
[9] STORM FREQUENCE & DURATION	2YR-24HR	[10] TOTAL ADJUSTED STORM DRAIN-INCHES	2.04
[11] VARIABLE LOSS RATE (AVG)-INCHES/HOUR		[12] MINIMUM LOSS RATE (FOR VAR. LOSS)-IN/HR	0.154
[13] CONSTANT LOSS RATE-INCHES/HOUR	0.309	[14] LOW LOSS RATE-PERCENT	40%

	UNIT HYDROGRAPH				EFFECTIVE RAIN					FLOOD HYDROGRAPH
[15] UNIT TIME PERIOD m	[16] TIME PERCENT OF LAG [7]*[15]	[17] CUMULATIVE AVERAGE PERCENT OF ULTIMATE DISCHARGE (S-GRAPH)	[18] DISTRIB GRAPH PERCENT [17]m-[17]m-1	[19] UNIT HYDROPRAPH CFS/IN $\frac{[4]*[18]}{100}$	[20] PATTERN PERCENT (PL E-5.9)	[21] STROM RAIN IN/HR $\frac{60[10][20]}{100[5]}$	[22] LOS RATE IN/HR MAX	LOW	[23] EFFECTIVE RAIN IN/HR [21]-[22]	[24] FLOW CFS
1					0.2	0.0490	0.548	0.0196	0.0294	0.02
2					0.3	0.0734	0.546	0.0294	0.0441	0.03
3					0.3	0.0734	0.545	0.0294	0.0441	0.03
4					0.4	0.0979	0.544	0.0392	0.0588	0.04
5					0.3	0.0734	0.543	0.0294	0.0441	0.03
6					0.3	0.0734	0.542	0.0294	0.0441	0.03
7					0.3	0.0734	0.541	0.0294	0.0441	0.03
8					0.4	0.0979	0.540	0.0392	0.0588	0.04
9					0.4	0.0979	0.539	0.0392	0.0588	0.04
10					0.4	0.0979	0.538	0.0392	0.0588	0.04
11					0.5	0.1224	0.537	0.0490	0.0734	0.06
12					0.5	0.1224	0.536	0.0490	0.0734	0.06
13					0.5	0.1224	0.535	0.0490	0.0734	0.06
14					0.5	0.1224	0.534	0.0490	0.0734	0.06
15					0.5	0.1224	0.533	0.0490	0.0734	0.06
16					0.6	0.1469	0.532	0.0588	0.0881	0.07
17					0.6	0.1469	0.531	0.0588	0.0881	0.07
18					0.7	0.1714	0.530	0.0685	0.1028	0.08
19					0.7	0.1714	0.529	0.0685	0.1028	0.08
20					0.8	0.1958	0.528	0.0783	0.1175	0.09
21					0.6	0.1469	0.527	0.0588	0.0881	0.07

22					0.7	0.1714	0.525	0.0685	0.1028	0.08
23					0.8	0.1958	0.524	0.0783	0.1175	0.09
24					0.8	0.1958	0.523	0.0783	0.1175	0.09
25					0.9	0.2203	0.522	0.0881	0.1322	0.10
26					0.9	0.2203	0.521	0.0881	0.1322	0.10
27					1	0.2448	0.520	0.0979	0.1469	0.11
28					1	0.2448	0.519	0.0979	0.1469	0.11
29					1	0.2448	0.518	0.0979	0.1469	0.11
30					1.1	0.2693	0.517	0.1077	0.1616	0.12
31					1.2	0.2938	0.516	0.1175	0.1763	0.13
32					1.3	0.3182	0.515	0.1273	0.1909	0.14
33					1.5	0.3672	0.514	0.1469	0.2203	0.17
34					1.5	0.3672	0.513	0.1469	0.2203	0.17
35					1.6	0.3917	0.512	0.1567	0.2350	0.18
36					1.7	0.4162	0.511	0.1665	0.2497	0.19
37					1.9	0.4651	0.510	0.1860	0.2791	0.21
38					2	0.4896	0.509	0.1958	0.2938	0.22
39					2.1	0.5141	0.508	0.2056	0.0061	0.00
40					2.2	0.5386	0.507	0.2154	0.0316	0.02
41					1.5	0.3672	0.506	0.1469	0.2203	0.17
42					1.5	0.3672	0.505	0.1469	0.2203	0.17
43					2	0.4896	0.504	0.1958	0.2938	0.22
44					2	0.4896	0.503	0.1958	0.2938	0.22
45					1.9	0.4651	0.502	0.1860	0.2791	0.21
46					1.9	0.4651	0.501	0.1860	0.2791	0.21
47					1.7	0.4162	0.500	0.1665	0.2497	0.19
48					1.8	0.4406	0.499	0.1763	0.2644	0.20
49					2.5	0.6120	0.498	0.2448	0.1142	0.09
50					2.6	0.6365	0.497	0.2546	0.1397	0.10
51					2.8	0.6854	0.496	0.2742	0.1896	0.14
52					2.9	0.7099	0.495	0.2840	0.2151	0.16
53					3.4	0.8323	0.494	0.3329	0.3385	0.25
54					3.4	0.8323	0.493	0.3329	0.3395	0.26
55					2.3	0.5630	0.492	0.2252	0.0712	0.05
56					2.3	0.5630	0.491	0.2252	0.0722	0.05
57					2.7	0.6610	0.490	0.2644	0.1712	0.13
58					2.6	0.6365	0.489	0.2546	0.1477	0.11
59					2.6	0.6365	0.488	0.2546	0.1487	0.11
60					2.5	0.6120	0.487	0.2448	0.1252	0.09
61					2.4	0.5875	0.486	0.2350	0.1017	0.08
62					2.3	0.5630	0.485	0.2252	0.0782	0.06
63					1.9	0.4651	0.484	0.1860	0.2791	0.21

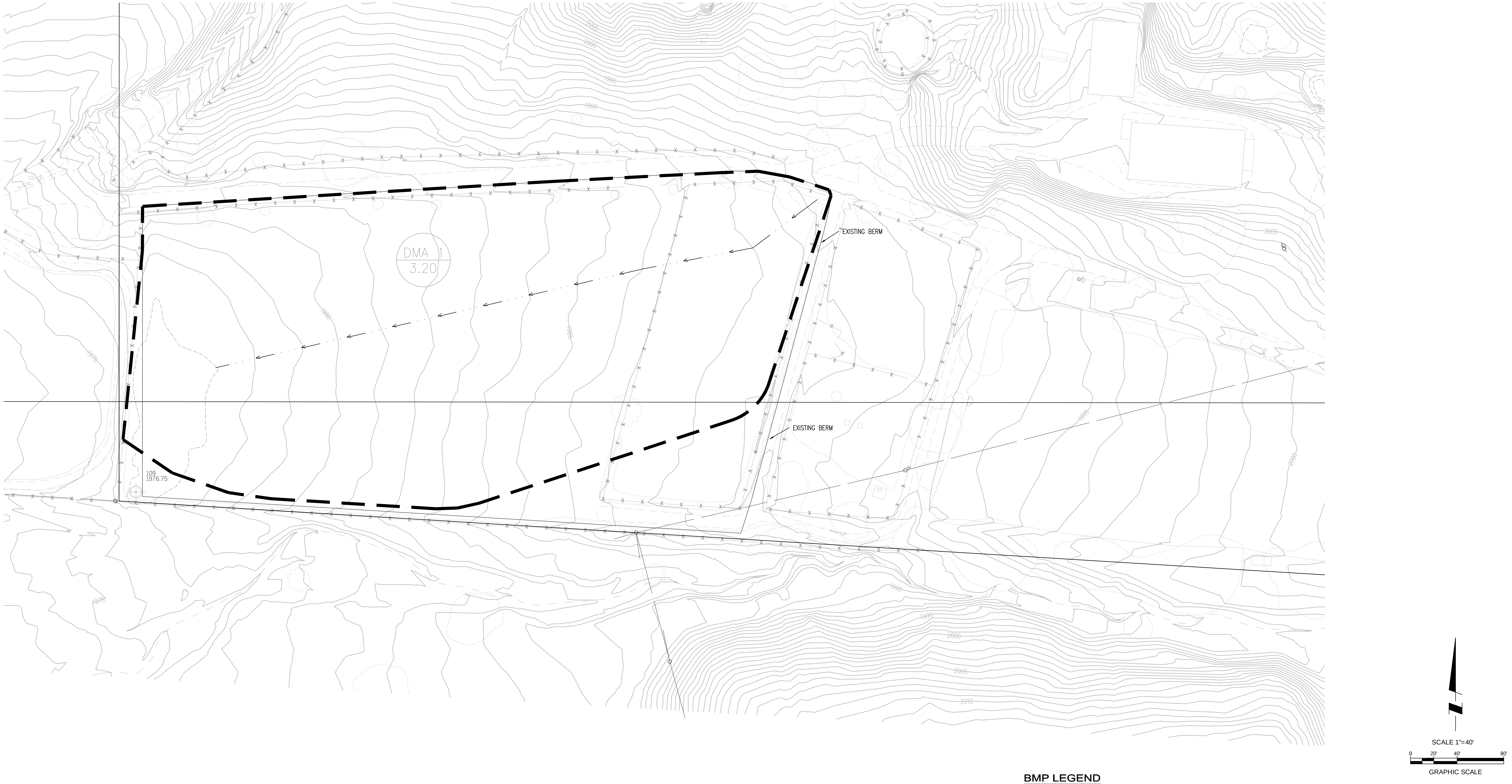
64					1.9	0.4651	0.483	0.1860	0.2791	0.21
65					0.4	0.0979	0.482	0.0392	0.0588	0.04
66					0.4	0.0979	0.481	0.0392	0.0588	0.04
67					0.3	0.0734	0.480	0.0294	0.0441	0.03
68					0.3	0.0734	0.479	0.0294	0.0441	0.03
69					0.5	0.1224	0.478	0.0490	0.0734	0.06
70					0.5	0.1224	0.477	0.0490	0.0734	0.06
71					0.5	0.1224	0.476	0.0490	0.0734	0.06
72					0.4	0.0979	0.475	0.0392	0.0588	0.04
73					0.4	0.0979	0.474	0.0392	0.0588	0.04
74					0.4	0.0979	0.473	0.0392	0.0588	0.04
75					0.3	0.0734	0.472	0.0294	0.0441	0.03
76					0.2	0.0490	0.471	0.0196	0.0294	0.02
77					0.3	0.0734	0.470	0.0294	0.0441	0.03
78					0.4	0.0979	0.469	0.0392	0.0588	0.04
79					0.3	0.0734	0.468	0.0294	0.0441	0.03
80					0.2	0.0490	0.467	0.0196	0.0294	0.02
81					0.3	0.0734	0.466	0.0294	0.0441	0.03
82					0.3	0.0734	0.465	0.0294	0.0441	0.03
83					0.3	0.0734	0.464	0.0294	0.0441	0.03
84					0.2	0.0490	0.463	0.0196	0.0294	0.02
85					0.3	0.0734	0.462	0.0294	0.0441	0.03
86					0.2	0.0490	0.461	0.0196	0.0294	0.02
87					0.3	0.0734	0.460	0.0294	0.0441	0.03
88					0.2	0.0490	0.459	0.0196	0.0294	0.02
89					0.3	0.0734	0.458	0.0294	0.0441	0.03
90					0.2	0.0490	0.457	0.0196	0.0294	0.02
91					0.2	0.0490	0.456	0.0196	0.0294	0.02
92					0.2	0.0490	0.455	0.0196	0.0294	0.02
93					0.2	0.0490	0.454	0.0196	0.0294	0.02
94					0.2	0.0490	0.453	0.0196	0.0294	0.02
95					0.2	0.0490	0.453	0.0196	0.0294	0.02
96					0.2	0.0490	0.452	0.0196	0.0294	0.02
					100				10.87	0.26

EFFECTIVE RAIN ([23]*T): 0.906 INCHES

VOLUME (EFF RAIN X AREA): 0.06 AC-FT

PRE-DEVELOPED UNIT HYDROGRAPHIC EXHIBIT

43700 CACTUS VALLEY ROAD, RIVERSIDE, CA
FACILITY 7



BMP LEGEND

DRAINAGE AREA BOUNDARY

DMA 8 / 0.03 — DMA DESIGNATION / ACRES

JEFFEREY D. MEITER
No. 64696
CIVIL

VALUED
ENGINEERING, INC
CIVIL ENGINEERING • LAND SURVEYING • LAND PLANNING
600 N. MOUNTAIN AVE, STE C102, UPLAND, CA 91786
PHONE: (909) 982-4601

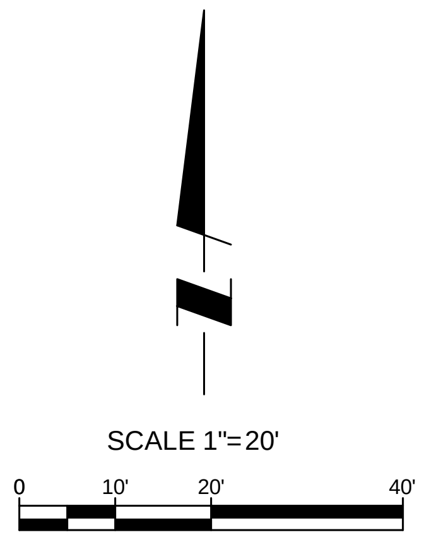
PRE-DEVELOPED UNIT HYDROGRAPHIC EXHIBIT

43700 CACTUS VALLEY ROAD, RIVERSIDE, CA
FACILITY 6

BMP LEGEND

▬ ▬ ▬ ▬ DRAINAGE AREA BOUNDARY

DMA 8 / 0.03 — DMA DESIGNATION / ACRES



REGISTERED PROFESSIONAL ENGINEER
JEFFEREY D. MEITER
No. 64696
CIVIL
STATE OF CALIFORNIA

VALUED
ENGINEERING, INC
CIVIL ENGINEERING • LAND SURVEYING • LAND PLANNING
600 N. MOUNTAIN AVE, STE C102, UPLAND, CA 91786
PHONE: (909) 982–4601

POST-DEVELOPED UNIT HYDROGRAPHIC EXHIBIT

43700 CACTUS VALLEY ROAD, RIVERSIDE, CA
FACILITY 7

SCALE 1"=40'

0 20' 40' 80'

GRAPHIC SCALE

BMP LEGEND

▬ ▬ ▬ DRAINAGE AREA BOUNDARY

DMA 8 / 0.03 — DMA DESIGNATION / ACRES

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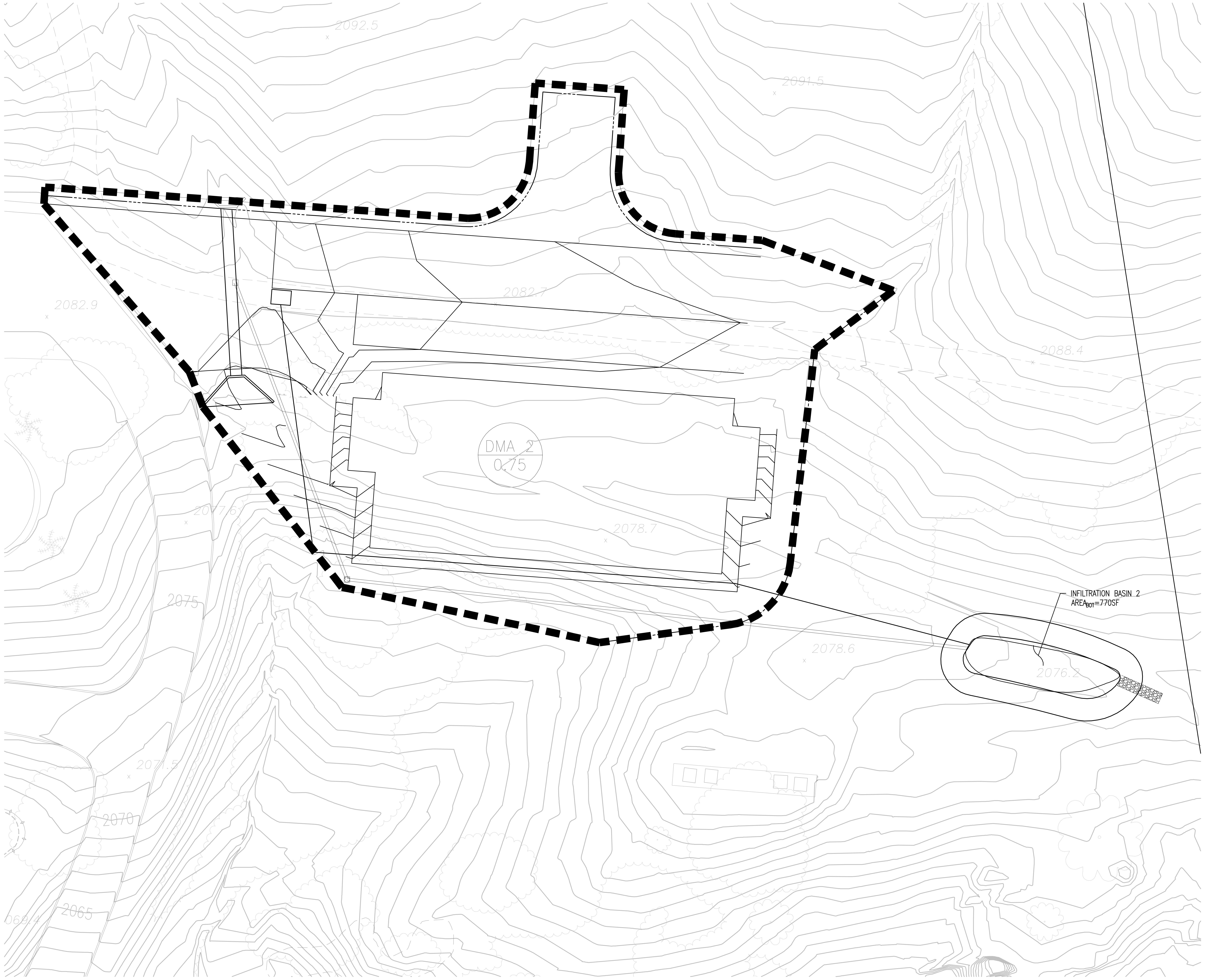
POST-DEVELOPED UNIT HYDROGRAPHIC EXHIBIT

43700 CACTUS VALLEY ROAD, RIVERSIDE, CA
FACILITY 6



BMP LEGEND

▬ ▬ ▬ ▬	DRAINAGE AREA BOUNDARY
DMA 8 0.03	DMA DESIGNATION ACRES

SCALE 1"=20'

0 10' 20' 40'

GRAPHIC SCALE

JEFFEREY D. MEITER
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PHONE: (909) 982–4601

Appendix 8: Source Control

Pollutant Sources/Source Control Checklist

STORMWATER POLLUTANT SOURCES/SOURCE CONTROL CHECKLIST

How to use this worksheet (also see instructions in Section G of the WQMP Template):

1. Review Column 1 and identify which of these potential sources of stormwater pollutants apply to your site. Check each box that applies.
2. Review Column 2 and incorporate all of the corresponding applicable BMPs in your WQMP Exhibit.
3. Review Columns 3 and 4 and incorporate all of the corresponding applicable permanent controls and operational BMPs in your WQMP. Use the format shown in Table G.1on page 23 of this WQMP Template. Describe your specific BMPs in an accompanying narrative, and explain any special conditions or situations that required omitting BMPs or substituting alternative BMPs for those shown here.

IF THESE SOURCES WILL BE ON THE PROJECT SITE ...	... THEN YOUR WQMP SHOULD INCLUDE THESE SOURCE CONTROL BMPs, AS APPLICABLE		
1 Potential Sources of Runoff Pollutants	2 Permanent Controls—Show on WQMP Drawings	3 Permanent Controls—List in WQMP Table and Narrative	4 Operational BMPs—Include in WQMP Table and Narrative
☒ A. **On-site storm drain inlets**	☒ **Locations of inlets.**	☒ **Mark all inlets with the words "Only Rain Down the Storm Drain" or similar. Catch Basin Markers may be available from the Riverside County Flood Control and Water Conservation District, call 951.955.1200 to verify.**	☒ **Maintain and periodically repaint or replace inlet markings.** ☒ **Provide stormwater pollution prevention information to new site owners, lessees, or operators.** ☒ **See applicable operational BMPs in Fact Sheet SC-44, "Drainage System Maintenance," in the CASQA Stormwater Quality Handbooks at www.cabmphandbooks.com** ☒ **Include the following in lease agreements: "Tenant shall not allow anyone to discharge anything to storm drains or to store or deposit materials so as to create a potential discharge to storm drains."**
☐ B. **Interior floor drains and elevator shaft sump pumps**		☐ **State that interior floor drains and elevator shaft sump pumps will be plumbed to sanitary sewer.**	☐ **Inspect and maintain drains to prevent blockages and overflow.**
☐ C. **Interior parking garages**		☐ **State that parking garage floor drains will be plumbed to the sanitary sewer.**	☐ **Inspect and maintain drains to prevent blockages and overflow.**

STORMWATER POLLUTANT SOURCES/SOURCE CONTROL CHECKLIST

IF THESE SOURCES WILL BE ON THE PROJECT SITE …	… THEN YOUR WQMP SHOULD INCLUDE THESE SOURCE CONTROL BMPs, AS APPLICABLE		
1 Potential Sources of Runoff Pollutants	2 Permanent Controls—Show on WQMP Drawings	3 Permanent Controls—List in WQMP Table and Narrative	4 Operational BMPs—Include in WQMP Table and Narrative
☑ D1. **Need for future indoor & structural pest control**		☑ **Note building design features that discourage entry of pests.**	☑ **Provide Integrated Pest Management information to owners, lessees, and operators.**
☑ D2. **Landscape/ Outdoor Pesticide Use**	☐ **Show locations of native trees or areas of shrubs and ground cover to be undisturbed and retained.** ☐ **Show self-retaining landscape areas, if any.** ☑ **Show stormwater treatment and hydrograph modification management BMPs. (See instructions in Chapter 3, Step 5 and guidance in Chapter 5.)**	**State that final landscape plans will accomplish all of the following.** ☑ **Preserve existing native trees, shrubs, and ground cover to the maximum extent possible.** ☑ **Design landscaping to minimize irrigation and runoff, to promote surface infiltration where appropriate, and to minimize the use of fertilizers and pesticides that can contribute to stormwater pollution.** ☑ **Where landscaped areas are used to retain or detain stormwater, specify plants that are tolerant of saturated soil conditions.** ☑ **Consider using pest-resistant plants, especially adjacent to hardscape.** ☑ **To insure successful establishment, select plants appropriate to site soils, slopes, climate, sun, wind, rain, land use, air movement, ecological consistency, and plant interactions.**	☑ **Maintain landscaping using minimum or no pesticides.** ☑ **See applicable operational BMPs in "What you should know for…..Landscape and Gardening"** at http://rcflood.org/stormwater/**Error! Hyperlink reference not valid.** ☑ **Provide IPM information to new owners, lessees and operators.**

STORMWATER POLLUTANT SOURCES/SOURCE CONTROL CHECKLIST

IF THESE SOURCES WILL BE ON THE PROJECT SITE ...	... THEN YOUR WQMP SHOULD INCLUDE THESE SOURCE CONTROL BMPs, AS APPLICABLE		
1 Potential Sources of Runoff Pollutants	2 Permanent Controls—Show on WQMP Drawings	3 Permanent Controls—List in WQMP Table and Narrative	4 Operational BMPs—Include in WQMP Table and Narrative
☐ E. Pools, spas, ponds, decorative fountains, and other water features.	☐ Show location of water feature and a sanitary sewer cleanout in an accessible area within 10 feet. (Exception: Public pools must be plumbed according to County Department of Environmental Health Guidelines.)	If the Co-Permittee requires pools to be plumbed to the sanitary sewer, place a note on the plans and state in the narrative that this connection will be made according to local requirements.	☐ See applicable operational BMPs in "Guidelines for Maintaining Your Swimming Pool, Jacuzzi and Garden Fountain" at http://rcflood.org/stormwater/
☐ F. Food service	☐ For restaurants, grocery stores, and other food service operations, show location (indoors or in a covered area outdoors) of a floor sink or other area for cleaning floor mats, containers, and equipment. ☐ On the drawing, show a note that this drain will be connected to a grease interceptor before discharging to the sanitary sewer.	☐ Describe the location and features of the designated cleaning area. ☐ Describe the items to be cleaned in this facility and how it has been sized to insure that the largest items can be accommodated.	☐ See the brochure, "The Food Service Industry Best Management Practices for: Restaurants, Grocery Stores, Delicatessens and Bakeries" at http://rcflood.org/stormwater/ Provide this brochure to new site owners, lessees, and operators.
☑ G. Refuse areas	☑ Show where site refuse and recycled materials will be handled and stored for pickup. See local municipal requirements for sizes and other details of refuse areas. ☑ If dumpsters or other receptacles are outdoors, show how the designated area will be covered, graded, and paved to prevent run-on and show locations of berms to prevent runoff from the area. ☐ Any drains from dumpsters, compactors, and tallow bin areas shall be connected to a grease removal device before discharge to sanitary sewer.	☑ State how site refuse will be handled and provide supporting detail to what is shown on plans. ☑ State that signs will be posted on or near dumpsters with the words "Do not dump hazardous materials here" or similar.	☑ State how the following will be implemented: Provide adequate number of receptacles. Inspect receptacles regularly; repair or replace leaky receptacles. Keep receptacles covered. Prohibit/prevent dumping of liquid or hazardous wastes. Post "no hazardous materials" signs. Inspect and pick up litter daily and clean up spills immediately. Keep spill control materials available on-site. See Fact Sheet SC-34, "Waste Handling and Disposal" in the CASQA Stormwater Quality Handbooks at www.cabmphandbooks.com

STORMWATER POLLUTANT SOURCES/SOURCE CONTROL CHECKLIST

IF THESE SOURCES WILL BE ON THE PROJECT SITE …	… THEN YOUR WQMP SHOULD INCLUDE THESE SOURCE CONTROL BMPs, AS APPLICABLE		
1 Potential Sources of Runoff Pollutants	2 Permanent Controls—Show on WQMP Drawings	3 Permanent Controls—List in WQMP Table and Narrative	4 Operational BMPs—Include in WQMP Table and Narrative
☐ H. **Industrial processes.**	☐ **Show process area.**	☐ **If industrial processes are to be located on site, state: "All process activities to be performed indoors. No processes to drain to exterior or to storm drain system."**	☐ **See Fact Sheet SC-10, "Non-Stormwater Discharges" in the CASQA Stormwater Quality Handbooks at www.cabmphandbooks.com** See the brochure "Industrial & Commercial Facilities Best Management Practices for: Industrial, Commercial Facilities" at http://rcflood.org/stormwater/

STORMWATER POLLUTANT SOURCES/SOURCE CONTROL CHECKLIST

IF THESE SOURCES WILL BE ON THE PROJECT SITE …	… THEN YOUR WQMP SHOULD INCLUDE THESE SOURCE CONTROL BMPs, AS APPLICABLE		
1 Potential Sources of Runoff Pollutants	2 Permanent Controls—Show on WQMP Drawings	3 Permanent Controls—List in WQMP Table and Narrative	4 Operational BMPs—Include in WQMP Table and Narrative
☐ I. **Outdoor storage of equipment or materials. (See rows J and K for source control measures for vehicle cleaning, repair, and maintenance.)**	☐ **Show any outdoor storage areas, including how materials will be covered. Show how areas will be graded and bermed to prevent run-on or run-off from area.** ☐ **Storage of non-hazardous liquids shall be covered by a roof and/or drain to the sanitary sewer system, and be contained by berms, dikes, liners, or vaults.** ☐ **Storage of hazardous materials and wastes must be in compliance with the local hazardous materials ordinance and a Hazardous Materials Management Plan for the site.**	**Include a detailed description of materials to be stored, storage areas, and structural features to prevent pollutants from entering storm drains.** **Where appropriate, reference documentation of compliance with the requirements of Hazardous Materials Programs for:** ▪ **Hazardous Waste Generation** ▪ **Hazardous Materials Release Response and Inventory** ▪ **California Accidental Release (CalARP)** ▪ **Aboveground Storage Tank** ▪ **Uniform Fire Code Article 80 Section 103(b) & (c) 1991** ▪ **Underground Storage Tank** **www.cchealth.org/groups/hazmat/**	☐ **See the Fact Sheets SC-31, "Outdoor Liquid Container Storage" and SC-33, "Outdoor Storage of Raw Materials " in the CASQA Stormwater Quality Handbooks at www.cabmphandbooks.com**

STORMWATER POLLUTANT SOURCES/SOURCE CONTROL CHECKLIST

IF THESE SOURCES WILL BE ON THE PROJECT SITE ...	... THEN YOUR WQMP SHOULD INCLUDE THESE SOURCE CONTROL BMPs, AS APPLICABLE		
1 Potential Sources of Runoff Pollutants	2 Permanent Controls—Show on WQMP Drawings	3 Permanent Controls—List in WQMP Table and Narrative	4 Operational BMPs—Include in WQMP Table and Narrative
☐ J. **Vehicle and Equipment Cleaning**	☐ **Show on drawings as appropriate:** **(1) Commercial/industrial facilities having vehicle/equipment cleaning needs shall either provide a covered, bermed area for washing activities or discourage vehicle/equipment washing by removing hose bibs and installing signs prohibiting such uses.** **(2) Multi-dwelling complexes shall have a paved, bermed, and covered car wash area (unless car washing is prohibited on-site and hoses are provided with an automatic shut-off to discourage such use).** **(3) Washing areas for cars, vehicles, and equipment shall be paved, designed to prevent run-on to or runoff from the area, and plumbed to drain to the sanitary sewer.** **(4) Commercial car wash facilities shall be designed such that no runoff from the facility is discharged to the storm drain system. Wastewater from the facility shall discharge to the sanitary sewer, or a wastewater reclamation system shall be installed.**	☐ **If a car wash area is not provided, describe any measures taken to discourage on-site car washing and explain how these will be enforced.**	**Describe operational measures to implement the following (if applicable):** ☐ **Washwater from vehicle and equipment washing operations shall not be discharged to the storm drain system.** Refer to "Outdoor Cleaning Activities and Professional Mobile Service Providers" for many of the Potential Sources of Runoff Pollutants categories below. Brochure can be found at http://rcflood.org/stormwater/ ☐**Car dealerships and similar may rinse cars with water only.**

IF THESE SOURCES WILL BE ON THE PROJECT SITE …	… THEN YOUR WQMP SHOULD INCLUDE THESE SOURCE CONTROL BMPs, AS APPLICABLE		
1 Potential Sources of Runoff Pollutants	2 Permanent Controls—Show on WQMP Drawings	3 Permanent Controls—List in WQMP Table and Narrative	4 Operational BMPs—Include in WQMP Table and Narrative
☐ K. **Vehicle/Equipment Repair and Maintenance**	☐ **Accommodate all vehicle equipment repair and maintenance indoors. Or designate an outdoor work area and design the area to prevent run-on and runoff of stormwater.** ☐ **Show secondary containment for exterior work areas where motor oil, brake fluid, gasoline, diesel fuel, radiator fluid, acid-containing batteries or other hazardous materials or hazardous wastes are used or stored. Drains shall not be installed within the secondary containment areas.** ☐ **Add a note on the plans that states either (1) there are no floor drains, or (2) floor drains are connected to wastewater pretreatment systems prior to discharge to the sanitary sewer and an industrial waste discharge permit will be obtained.**	☐ **State that no vehicle repair or maintenance will be done outdoors, or else describe the required features of the outdoor work area.** ☐ **State that there are no floor drains or if there are floor drains, note the agency from which an industrial waste discharge permit will be obtained and that the design meets that agency's requirements.** ☐ **State that there are no tanks, containers or sinks to be used for parts cleaning or rinsing or, if there are, note the agency from which an industrial waste discharge permit will be obtained and that the design meets that agency's requirements.**	**In the Stormwater Control Plan, note that all of the following restrictions apply to use the site:** ☐ **No person shall dispose of, nor permit the disposal, directly or indirectly of vehicle fluids, hazardous materials, or rinsewater from parts cleaning into storm drains.** ☐ **No vehicle fluid removal shall be performed outside a building, nor on asphalt or ground surfaces, whether inside or outside a building, except in such a manner as to ensure that any spilled fluid will be in an area of secondary containment. Leaking vehicle fluids shall be contained or drained from the vehicle immediately.** ☐ **No person shall leave unattended drip parts or other open containers containing vehicle fluid, unless such containers are in use or in an area of secondary containment.** Refer to "Automotive Maintenance & Car Care Best Management Practices for Auto Body Shops, Auto Repair Shops, Car Dealerships, Gas Stations and Fleet Service Operations". Brochure can be found at http://rcflood.org/stormwater/ Refer to Outdoor Cleaning Activities and Professional Mobile Service Providers for many of the Potential Sources of Runoff Pollutants categories below. Brochure can be found at http://rcflood.org/stormwater/

IF THESE SOURCES WILL BE ON THE PROJECT SITE ...	... THEN YOUR WQMP SHOULD INCLUDE THESE SOURCE CONTROL BMPs, AS APPLICABLE		
1 Potential Sources of Runoff Pollutants	2 Permanent Controls—Show on WQMP Drawings	3 Permanent Controls—List in WQMP Table and Narrative	4 Operational BMPs—Include in WQMP Table and Narrative
☐ L. **Fuel Dispensing Areas**	☐ **Fueling areas[6] shall have impermeable floors (i.e., portland cement concrete or equivalent smooth impervious surface) that are: a) graded at the minimum slope necessary to prevent ponding; and b) separated from the rest of the site by a grade break that prevents run-on of stormwater to the maximum extent practicable.** ☐ **Fueling areas shall be covered by a canopy that extends a minimum of ten feet in each direction from each pump. [Alternative: The fueling area must be covered and the cover's minimum dimensions must be equal to or greater than the area within the grade break or fuel dispensing area[1].] The canopy [or cover] shall not drain onto the fueling area.**		☐ **The property owner shall dry sweep the fueling area routinely.** ☐ **See the Fact Sheet SD-30 , "Fueling Areas" in the CASQA Stormwater Quality Handbooks at www.cabmphandbooks.com**

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[6] **The fueling area shall be defined as the area extending a minimum of 6.5 feet from the corner of each fuel dispenser or the length at which the hose and nozzle assembly may be operated plus a minimum of one foot, whichever is greater.**

STORMWATER POLLUTANT SOURCES/SOURCE CONTROL CHECKLIST

IF THESE SOURCES WILL BE ON THE PROJECT SITE ...	... THEN YOUR WQMP SHOULD INCLUDE THESE SOURCE CONTROL BMPs, AS APPLICABLE		
1 Potential Sources of Runoff Pollutants	2 Permanent Controls—Show on WQMP Drawings	3 Permanent Controls—List in WQMP Table and Narrative	4 Operational BMPs—Include in WQMP Table and Narrative
☑ M. **Loading Docks**	☐ **Show a preliminary design for the loading dock area, including roofing and drainage. Loading docks shall be covered and/or graded to minimize run-on to and runoff from the loading area. Roof downspouts shall be positioned to direct stormwater away from the loading area. Water from loading dock areas shall be drained to the sanitary sewer, or diverted and collected for ultimate discharge to the sanitary sewer.** ☐ **Loading dock areas draining directly to the sanitary sewer shall be equipped with a spill control valve or equivalent device, which shall be kept closed during periods of operation.** ☑ **Provide a roof overhang over the loading area or install door skirts (cowling) at each bay that enclose the end of the trailer.**		☑ **Move loaded and unloaded items indoors as soon as possible.** ☑ **See Fact Sheet SC-30, "Outdoor Loading and Unloading," in the CASQA Stormwater Quality Handbooks at www.cabmphandbooks.com**

STORMWATER POLLUTANT SOURCES/SOURCE CONTROL CHECKLIST

IF THESE SOURCES WILL BE ON THE PROJECT SITE ...	... THEN YOUR WQMP SHOULD INCLUDE THESE SOURCE CONTROL BMPs, AS APPLICABLE		
1 Potential Sources of Runoff Pollutants	2 Permanent Controls—Show on WQMP Drawings	3 Permanent Controls—List in WQMP Table and Narrative	4 Operational BMPs—Include in WQMP Table and Narrative
☐ N. **Fire Sprinkler Test Water**		☐ Provide a means to drain fire sprinkler test water to the sanitary sewer.	☐ See the note in Fact Sheet SC-41, "Building and Grounds Maintenance," in the CASQA Stormwater Quality Handbooks at www.cabmphandbooks.com
O. **Miscellaneous Drain or Wash Water or Other Sources** ☐ Boiler drain lines ☐ Condensate drain lines ☐ Rooftop equipment ☐ Drainage sumps ☒ Roofing, gutters, and trim. ☐ Other sources		☐ Boiler drain lines shall be directly or indirectly connected to the sanitary sewer system and may not discharge to the storm drain system. ☐ Condensate drain lines may discharge to landscaped areas if the flow is small enough that runoff will not occur. Condensate drain lines may not discharge to the storm drain system. ☐ Rooftop equipment with potential to produce pollutants shall be roofed and/or have secondary containment. ☐ Any drainage sumps on-site shall feature a sediment sump to reduce the quantity of sediment in pumped water. ☒ Avoid roofing, gutters, and trim made of copper or other unprotected metals that may leach into runoff. ☐ Include controls for other sources as specified by local reviewer.	

STORMWATER POLLUTANT SOURCES/SOURCE CONTROL CHECKLIST

IF THESE SOURCES WILL BE ON THE PROJECT SITE ...	... THEN YOUR WQMP SHOULD INCLUDE THESE SOURCE CONTROL BMPs, AS APPLICABLE		
1 Potential Sources of Runoff Pollutants	2 Permanent Controls—Show on WQMP Drawings	3 Permanent Controls—List in WQMP Table and Narrative	4 Operational BMPs—Include in WQMP Table and Narrative
☒ P. **Plazas, sidewalks, and parking lots.**			☒ **Sweep plazas, sidewalks, and parking lots regularly to prevent accumulation of litter and debris. Collect debris from pressure washing to prevent entry into the storm drain system. Collect washwater containing any cleaning agent or degreaser and discharge to the sanitary sewer not to a storm drain.**

Appendix 9: O&M

Operation and Maintenance Plan and Documentation of Finance, Maintenance and Recording Mechanisms

Covenant and Agreement

Water Quality Management Plan and Urban Runoff BMP Transfer, Access and Maintenance Agreement (adapted from documents from the Ventura County Stormwater Management Program)

Recorded at the request of:

City of HEMET

After recording, return to:

City of HEMET

City Clerk ____________________

Water Quality Management Plan and Urban Runoff BMP Transfer, Access and Maintenance Agreement

OWNER: RAHN CONSERVATION CONSULTING

PROPERTY ADDRESS: 32787 CLEVELAND STREET
TEMECULA, CA 92592

APN: PORTION OF 569-020-024, 569-020-025, 569-020-026

THIS AGREEMENT is made and entered into in

____________________, California, this ______ day of

________________, by and between

RAHN CONSERVATION CONSULTING, herein after referred to as "Owner" and the CITY OF HEMET, a municipal corporation, located in the County of Riverside, State of California hereinafter referred to as "CITY";

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

WHEREAS, at the time of initial approval of development project known as RAHN CONSERVATION CONSULTING within the Property described herein, the City required the project to employ Best Management Practices, hereinafter referred to as "BMPs," to minimize pollutants in urban runoff;

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

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

WHEREAS, said BMPs, with installation and/or implementation on private property and draining only private property, are part of a private facility with all maintenance or replacement, therefore, the sole responsibility of the Owner in accordance with the terms of this Agreement;

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

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

1. Owner hereby provides the City of City's designee complete access, of any duration, to the BMPs and their immediate vicinity at any time, upon reasonable notice, or in the event of emergency, as determined by City's Director of Public Works no advance notice, for the purpose of inspection, sampling, testing of the Device, and in case of emergency, to undertake all necessary repairs or other preventative measures at owner's expense as provided in paragraph 3 below. City shall make every effort at all times to minimize or avoid interference with Owner's use of the Property.

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

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

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

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

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

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

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

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

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

IF TO CITY:	**IF TO OWNER:**
______________________________	______________________________
______________________________	______________________________
______________________________	______________________________
______________________________	______________________________

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

APPROVED AS TO FORM:	**OWNER:**
______________________________ City Attorney	______________________________ Name
______________________________ CITY OF	______________________________ Title
______________________________ Name	**OWNER:**
______________________________ Title	______________________________ Name
ATTEST:	______________________________ Title
______________________________ City Clerk Date	

NOTARIES ON FOLLOWING PAGE

EXHIBIT A

(Legal Description)

SEE ATTACHED LOT LINE ADJUSTMENT
RECORDATION IN PROCESS.

RECORDING REQUESTED BY
RIVERSIDE COUNTY

When recorded, return to:

Riverside County Transportation Department
8th Floor County Administrative Center
4080 Lemon Street, Riverside, Ca. 92502-1409

Mail Stop # 1080

No Fee, 6103 Government Code
Benefit of Riverside County Transportation Dept.

THIS AREA FOR RECORDER'S USE ONLY

NOTICE OF LOT LINE ADJUSTMENT NO. LLA210115

RECORD OWNERS	EXISTING PARCELS (Assessor Parcel Numbers)
PVR Management, LLC, a California limited liability company	569-020-024, 025 and 026

LEGAL DESCRIPTION OF ADJUSTED PARCELS

See attached Legal Description- Exhibit "A"

SIGNATURE(S) OF RECORDED OWNER(S) *(Must be Notarized)*

Kenneth W. Jackson, Managing Owner	Signature:

RIVERSIDE COUNTY SURVEYOR'S APPROVAL

This document reviewed and approved by Riverside County Surveyor.

By:____ Date: ________________

NOTARY ACKNOWLEDGEMENT

STATE OF CALIFORNIA)
COUNTY OF_________________)

A notary public or other officer completing this certificate verifies only the identity of the individual who signed the document to which this certificate is attached, and not the truthfulness, accuracy, or validity of that document.

On_______________________________, before me, ___________________________,Notary Public, personally appeared_____________________________________ who proved to me on the basis of satisfactory evidence to be the person(s) whose name(s) is/are subscribed to the within instrument and acknowledged to me that he/she/they executed the same in his/her/their authorized capacity(ies), and that by his/her/their signature(s) on the instrument the person(s), or the entity upon behalf of which the person(s) acted, executed the instrument.

I certify under PENALTY OF PERJURY under the laws of the State of California that the foregoing paragraph is true and correct.

WITNESS my hand and official seal

____
Notary Public

EXHIBIT "A"– LEGAL DESCRIPTION
LOT LINE ADJUSTMENT NO. LLA210115

SHEET 1 OF 4 SHEETS

PARCEL 1:

IN THE COUNTY OF RIVERSIDE, STATE OF CALIFORNIA, THAT PORTION OF THE EAST ONE HALF OF THE NORTHWEST ONE QUARTER OF SECTION 8, TOWNSHIP 6 SOUTH, RANGE 1 EAST, SAN BERNARDINO MERIDIAN, ALSO BEING A PORTION OF PARCEL "A" OF LOT LINE ADJUSTMENT NO. 4431, REC. JULY 15, 2002 AS DOC. NO. 2002-386378 OF OFFICIAL RECORDS, DESCRIBED AS FOLLOWS:

BEGINNING AT THE NORTHWEST CORNER OF THE EAST ONE HALF OF THE NORTHWEST ONE QUARTER OF SAID SECTION 8;

THENCE ALONG THE WEST LINE OF THE EAST ONE HALF OF THE NORTHWEST ONE QUARTER OF SAID SECTION 8, ALSO BEING THE WEST LINE OF PARCEL "A" OF SAID LOT LINE ADJUSTMENT 4431, SOUTH 00°01'09" WEST, 2216.93 FEET;

THENCE LEAVING SAID LINE, NORTH 89°30'38" EAST, 1178.16 FEET;

THENCE NORTH 37°37"58" EAST, 223.68 FEET TO A POINT ON THE EAST LINE OF THE EAST ONE HALF OF THE NORTHWEST ONE QUARTER OF SAID SECTION 8, ALSO BEING THE EAST LINE OF PARCEL "A" OF SAID LOT LINE ADJUSTMENT 4431;

THENCE ALONG SAID EAST LINE, NORTH 00°02'27" EAST, 2032.82 FEET TO THE NORTHEAST CORNER OF THE EAST ONE HALF OF THE NORTHWEST ONE QUARTER OF SAID SECTION 8, ALSO BEING THE NORTH ONE QUARTER CORNER OF SAID SECTION 8;

THENCE ALONG THE NORTH LINE OF THE EAST ONE HALF OF THE NORTHWEST ONE QUARTER OF SAID SECTION 8, ALSO BEING THE NORTH LINE OF PARCEL "A" OF SAID LOT LINE ADJUSTMENT 4431, SOUTH 89°51'55" WEST, 1315.40 FEET TO THE **POINT OF BEGINNING**.

THE ABOVE DESCRIBED PARCEL OF LAND CONTAINS 66.53 ACRES (2,897,853 S.F.), MORE OR LESS.

SEE EXHIBIT "B" ATTACHED HERETO AND BY THIS REFERENCE MADE A PART HEREOF.

PARCEL 2:

IN THE COUNTY OF RIVERSIDE, STATE OF CALIFORNIA, THAT PORTION OF THE SOUTH ONE HALF OF THE NORTHEAST ONE QUARTER OF SECTION 8, TOWNSHIP 6 SOUTH, RANGE 1 EAST, SAN BERNARDINO MERIDIAN, AND THAT PORTION OF THE NORTH ONE HALF OF THE NORTHWEST ONE QUARTER OF THE SOUTHEAST ONE QUARTER OF SAID SECTION 8, AND THAT PORTION OF THE SOUTHEAST ONE QUARTER OF SAID SECTION 8, ALSO BEING A PORTION OF PARCEL "B" AND PARCEL "C" OF LOT LINE ADJUSTMENT NO. 4431, REC. JULY 15, 2002 AS DOC. NO. 2002-386378 OF OFFICIAL RECORDS, DESCRIBED AS FOLLOWS:

BEGINNING AT THE NORTHEAST CORNER OF THE SOUTH ONE HALF OF THE NORTHEAST ONE QUARTER OF SAID SECTION 8;

THENCE ALONG THE NORTH LINE OF THE SOUTH ONE HALF OF THE NORTHEAST ONE QUARTER OF SAID SECTION 8, ALSO BEING THE NORTH LINE OF SAID PARCEL "B" OF SAID LOT LINE ADJUSTMENT 4431, SOUTH 89°55'40" WEST, 2656.99 FEET TO THE NORTHWEST CORNER OF THE SOUTH ONE HALF OF THE NORTHEAST ONE QUARTER OF SAID SECTION 8;

EXHIBIT "A"– LEGAL DESCRIPTION
LOT LINE ADJUSTMENT NO. LLA210115

SHEET 2 OF 4 SHEETS

PARCEL 2 Cont.:

THENCE ALONG THE WEST LINE OF THE SOUTH ONE HALF OF THE NORTHEAST ONE QUARTER OF SAID SECTION 8, ALSO BEING THE WEST LINE OF SAID PARCEL "B" OF SAID LOT LINE ADJUSTMENT 4431, SOUTH 00°02'27" WEST, 694.07 FEET;

THENCE LEAVING SAID LINE, NORTH 37°37'58" EAST, 469.57 FEET;

THENCE NORTH 57°23'58" EAST, 158.22 FEET;

THENCE SOUTH 23°39'34" EAST, 343.16 FEET;

THENCE SOUTH 88°20'26" EAST, 311.44 FEET;

THENCE SOUTH 08°52'02" EAST, 833.92 FEET;

THENCE SOUTH 63°11'51" WEST, 86.65 FEET;

THENCE SOUTH 60°03'33" WEST, 128.58 FEET;

THENCE SOUTH 34°18'20" WEST, 672.14 FEET TO A POINT ON THE SOUTH LINE OF PARCEL "C" OF SAID LOT LINE ADJUSTMENT 4431;

THENCE ALONG SAID SOUTH LINE, NORTH 68°55'32" EAST, 55.03 FEET TO A POINT ON THE SOUTH LINE OF THE NORTH ONE HALF OF THE NORTHWEST ONE QUARTER OF THE SOUTHEAST ONE QUARTER OF SAID SECTION 8;

THENCE ALONG THE SOUTH LINE OF THE NORTH ONE HALF OF THE NORTHWEST ONE QUARTER OF THE SOUTHEAST ONE QUARTER OF SAID SECTION 8, ALSO BEING THE SOUTH LINE OF SAID PARCEL "C" OF SAID LOT LINE ADJUSTMENT 4431, NORTH 89°46'22" EAST, 850.45 FEET TO THE SOUTHEAST CORNER OF THE NORTH ONE HALF OF THE NORTHWEST ONE QUARTER OF THE SOUTHEAST ONE QUARTER OF SAID SECTION 8;

THENCE ALONG THE EAST LINE OF THE NORTH ONE HALF OF THE NORTHWEST ONE QUARTER OF THE SOUTHEAST ONE QUARTER OF SAID SECTION 8, ALSO BEING THE EAST LINE OF SAID PARCEL "C" OF SAID LOT LINE ADJUSTMENT 4431, NORTH 00°04'45" WEST, 679.29 FEET TO THE NORTHEAST CORNER OF THE NORTH ONE HALF OF THE NORTHWEST ONE QUARTER OF THE SOUTHEAST ONE QUARTER OF SAID SECTION 8, ALSO BEING A POINT ON THE SOUTH LINE OF THE SOUTH ONE HALF OF THE NORTHEAST ONE QUARTER OF SAID SECTION 8, ALSO BEING A POINT ON THE SOUTH LINE OF SAID PARCEL "B" OF SAID LOT LINE ADJUSTMENT 4431;

THENCE ALONG SAID LINE, SOUTH 89°56'09" EAST 1331.30 FEET TO THE SOUTHEAST CORNER OF THE SOUTH ONE HALF OF THE NORTHEAST ONE QUARTER OF SAID SECTION 8;

Prepared: June, 2021

Assessor's Parcel Numbers: 569-020-024, 025, 026

EXHIBIT "A"– LEGAL DESCRIPTION
LOT LINE ADJUSTMENT NO. LLA210115

SHEET 3 OF 4 SHEETS

PARCEL 2 Cont.:

THENCE ALONG THE EAST LINE OF THE SOUTH ONE HALF OF THE NORTHEAST ONE QUARTER OF SAID SECTION 8, ALSO BEING THE EAST LINE OF SAID PARCEL "B" OF SAID LOT LINE ADJUSTMENT, NORTH 00°11'55" WEST, 1345.11 FEET TO THE **POINT OF BEGINNING**.

THE ABOVE DESCRIBED PARCEL OF LAND CONTAINS 73.55 ACRES (3,204,025 S.F.), MORE OR LESS.

SEE EXHIBIT "B", ATTACHED HERETO AND BY THIS REFERENCE MADE A PART HEREOF.

PARCEL 3:

IN THE COUNTY OF RIVERSIDE, STATE OF CALIFORNIA, THAT PORTION OF THE EAST ONE HALF OF THE NORTHWEST ONE QUARTER AND THAT PORTION OF THE EAST ONE HALF OF THE SOUTHWEST ONE QUARTER OF SECTION 8, TOWNSHIP 6 SOUTH, RANGE 1 EAST, SAN BERNARDINO MERIDIAN, AND THAT PORTION OF THE SOUTH ONE HALF OF THE NORTHEAST ONE QUARTER OF SECTION 8, TOWNSHIP 6 SOUTH, RANGE 1 EAST, AND THAT PORTION OF THE NORTH ONE HALF OF THE NORTHWEST ONE QUARTER OF THE SOUTHEAST ONE QUARTER OF SAID SECTION 8 AND THAT PORTION OF THE SOUTHEAST QUARTER OF SAID SECTION 8, ALSO BEING A PORTION OF PARCEL "A", PARCEL "B" AND PARCEL "C" OF LOT LINE ADJUSTMENT NO. 4431, REC. JULY 15, 2002 AS DOC. NO. 2002-386378 OF OFFICIAL RECORDS, DESCRIBED AS FOLLOWS:

COMMENCING AT THE NORTHWEST CORNER OF THE EAST ONE HALF OF THE NORTHWEST ONE QUARTER OF SAID SECTION 8;

THENCE ALONG THE WEST LINE OF THE EAST ONE HALF OF THE NORTHWEST ONE QUARTER OF SAID SECTION 8, ALSO BEING THE WEST LINE OF SAID PARCEL "A" OF SAID LOT LINE ADJUSTMENT 4431, SOUTH 00°01'09" WEST, 2216.93 FEET TO THE **TRUE POINT OF BEGINNING;**

THENCE LEAVING SAID LINE, NORTH 89°30'38" EAST, 1178.16 FEET;

THENCE NORTH 37°37"58" EAST, 223.68 FEET TO A POINT ON THE EAST LINE OF THE EAST ONE HALF OF THE NORTHWEST ONE QUARTER OF SAID SECTION 8, ALSO BEING THE EAST LINE OF SAID PARCEL "A" OF SAID LOT LINE ADJUSTMENT 4431;

THENCE LEAVING SAID LINE, NORTH 37°37'58" EAST, 469.57 FEET;

THENCE NORTH 57°23'58" EAST, 158.22 FEET;

THENCE SOUTH 23°39'34" EAST, 343.16 FEET;

THENCE SOUTH 88°20'26" EAST, 311.44 FEET;

THENCE SOUTH 08°52'02" EAST, 833.92 FEET;

EXHIBIT "A"– LEGAL DESCRIPTION
LOT LINE ADJUSTMENT NO. LLA210115

SHEET 4 OF 4 SHEETS

PARCEL 3 Cont.:

THENCE SOUTH 63°11'51" WEST, 86.65 FEET;

THENCE SOUTH 60°03'33" WEST, 128.58 FEET;

THENCE SOUTH 34°18'20" WEST, 672.14 FEET TO A POINT ON THE SOUTH LINE OF SAID PARCEL "C" OF SAID LOT LINE ADJUSTMENT 4431;

THENCE ALONG SAID SOUTH LINE, SOUTH 68°55'32" WEST, 153.63 FEET;

THENCE ALONG SAID SOUTH LINE, NORTH 88°51'54" WEST, 200.06 FEET;

THENCE ALONG SAID SOUTH LINE, NORTH 00°13'30" EAST, 69.50 FEET;

THENCE SOUTH 89°46'22" WEST, 87.29 FEET TO THE SOUTHWEST CORNER OF SAID PARCEL "C" OF SAID LOT LINE ADJUSTMENT 4431, ALSO BEING THE SOUTHWEST CORNER OF THE NORTH ONE HALF OF THE NORTHWEST ONE QUARTER OF THE SOUTHEAST ONE QUARTER OF SAID SECTION 8;

THENCE ALONG THE WEST LINE OF SAID PARCEL "C" OF SAID LOT LINE ADJUSTMENT 4431, ALSO BEING THE WEST LINE OF THE NORTH ONE HALF OF THE NORTHWEST ONE QUARTER OF THE SOUTHEAST ONE QUARTER OF SAID SECTION 8, NORTH 00°02'27" EAST, 521.67 FEET TO THE SOUTHEAST CORNER OF SAID PARCEL "A" OF SAID LOT LINE ADJUSTMENT 4431;

THENCE ALONG THE SOUTH LINE OF SAID PARCEL "A" OF SAID LOT LINE ADJUSTMENT 4431, NORTH 86°29'15" WEST, 1316.77 FEET TO THE SOUTHWEST CORNER OF SAID PARCEL "A";

THENCE ALONG THE WEST LINE OF SAID PARCEL "A", NORTH 00°01'09" EAST, 541.21 FEET TO THE ***TRUE POINT OF BEGINNING.***

THE ABOVE DESCRIBED PARCEL OF LAND CONTAIN 47.75 ACRES (2,079,978 S.F.), MORE OR LESS.

SEE EXHIBIT "B" ATTACHED HERETO AND BY THIS REFERENCE MADE A PART HEREOF.

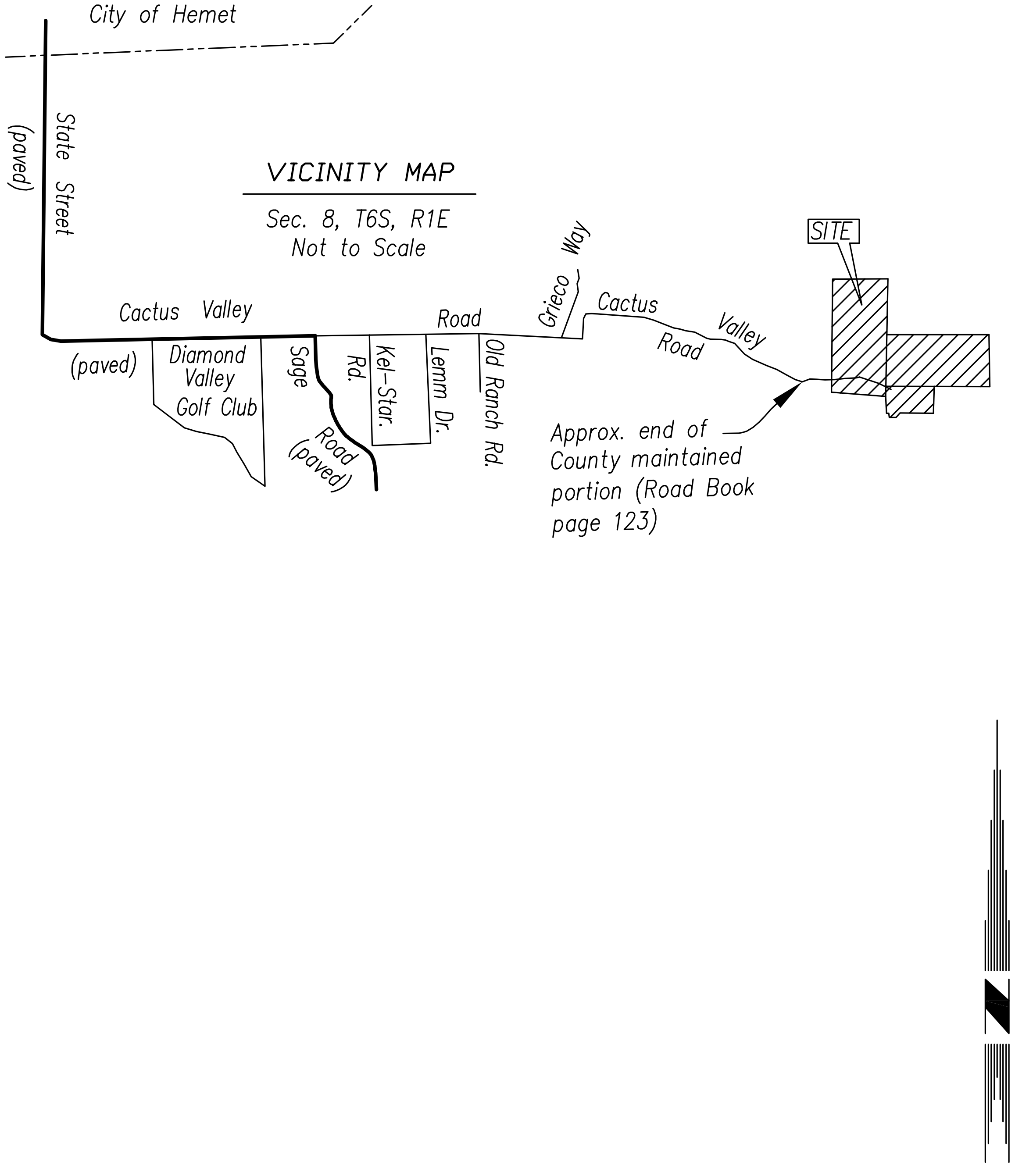
LICENSED LAND SURVEYOR
MATTHEW W. SPIRO
LS8461
EXPIRES
12-31-22
STATE OF CALIFORNIA

Matthew W. Spiro
LS 8461, Exp. 12/31/22
Dated: ____________

Prepared: June, 2021
Assessor's Parcel Numbers: 569-020-024, 025, 026

EXHIBIT "B"– VICINITY MAP
LOT LINE ADJUSTMENT NO. LLA210115

SHEET 1 OF 4 SHEETS



VICINITY MAP

Sec. 8, T6S, R1E

Not to Scale

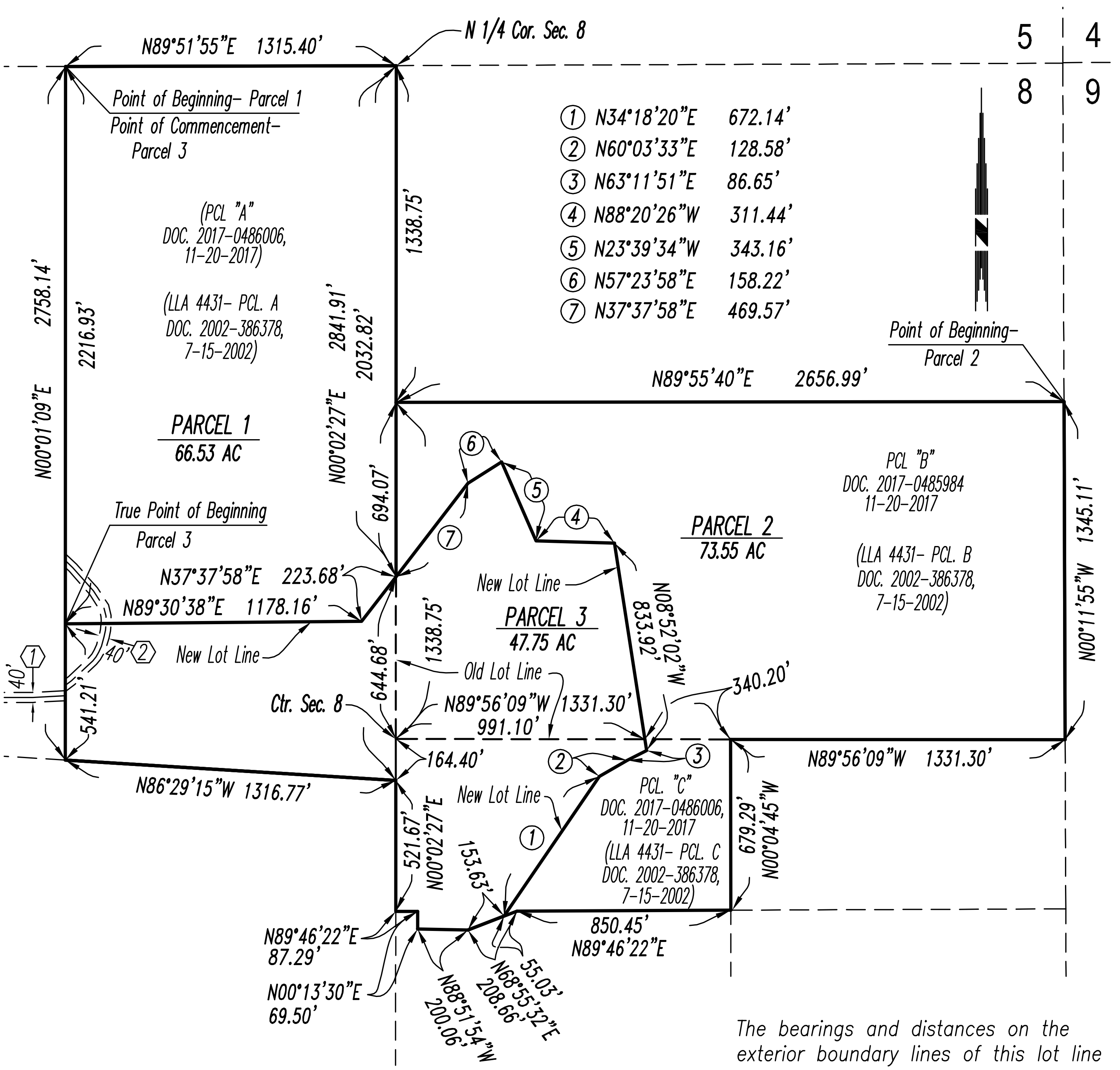
Sec. 8, T6S, R1E

Prepared: June, 2021

Assessor's Parcel Numbers: 569-020-024, 025, 026

EXHIBIT "B"– MAP
LOT LINE ADJUSTMENT NO. LLA210115

SHEET 2 OF 4 SHEETS



The bearings and distances on the exterior boundary lines of this lot line adjustment are based on Record of Survey 21–027 filed in Book xxxx/xxx.

See Sheet B-3 for Easement Detail.

The proposed lot line will not laterally intersect a graded manufactured slope.

No drainage from the tributary area above a manufactured slope will sheet flow over the slope face.

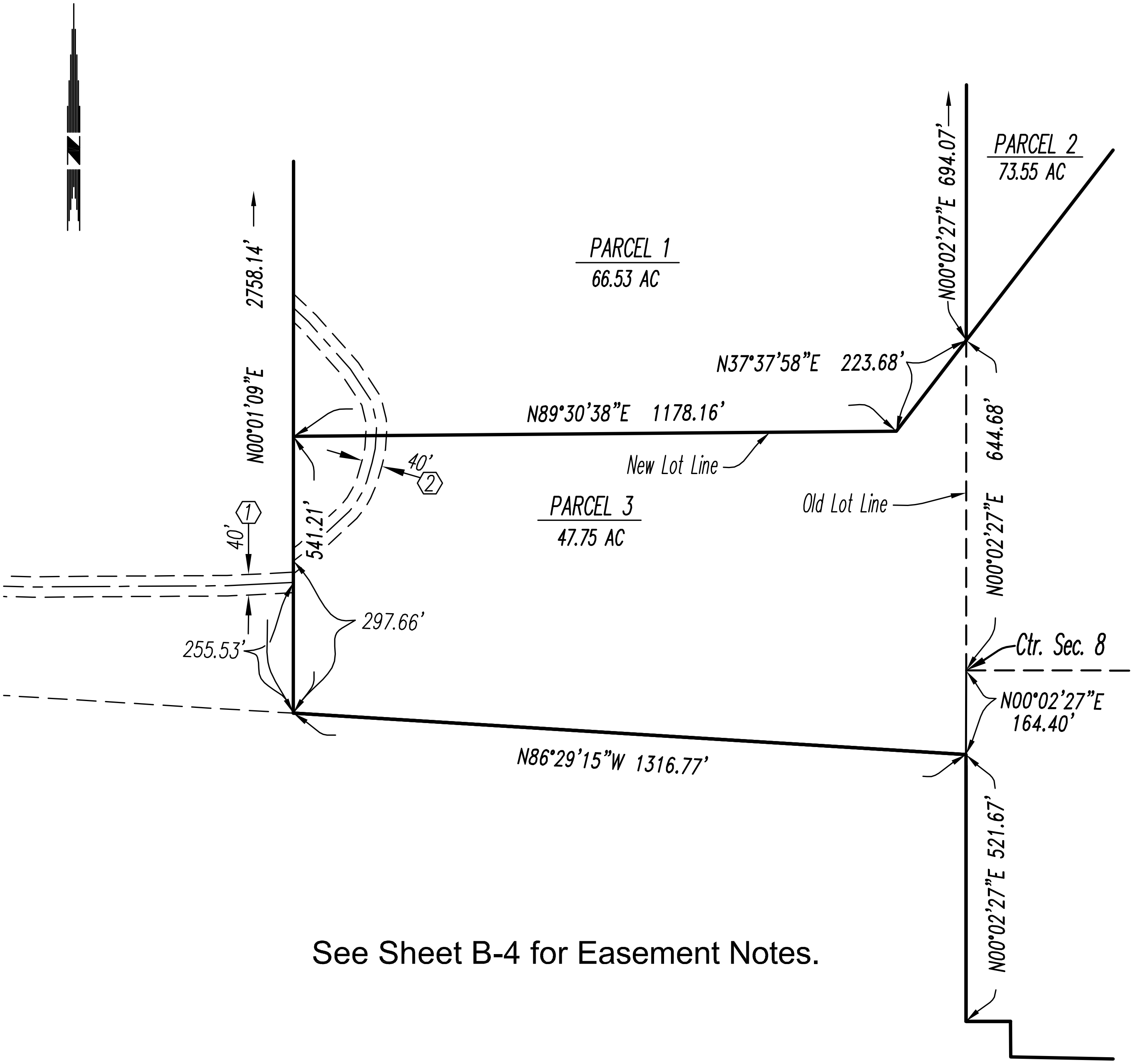
LICENSED LAND SURVEYOR
MATTHEW W. SPIRO
LS8461
EXPIRES
12–31–22
STATE OF CALIFORNIA

Matthew W. Spiro
LS 8461, Exp. 12/31/22
Dated:_____________

Sec. 8, T6S, R1E
Scale: 1"= 600'
Prepared: June, 2021
Assessor's Parcel Numbers: 569-020-024, 025, 026

EXHIBIT "B"– EASEMENTS
LOT LINE ADJUSTMENT NO. LLA210115

SHEET 3 OF 4 SHEETS



See Sheet B-4 for Easement Notes.

Sec. 8, T6S, R1E
Scale: 1"= 300'
Prepared: June, 2021
Assessor's Parcel Numbers: 569-020-024, 025, 026

EXHIBIT "B"– EASEMENT NOTES
LOT LINE ADJUSTMENT NO. LLA210115

SHEET 4 OF 4 SHEETS

⟨1⟩ AN EASEMENT AGREEMENT FOR INGRESS AND EGRESS PER DOC. NO. 2021–0496033, REC. 8–18–2021.

⟨2⟩ AN EASEMENT AGREEMENT FOR INGRESS AND EGRESS PER DOC. NO. 2021–0496034, REC. 8–18–2021.

3. AN EASEMENT IN FAVOR OF GENERAL TELEPHONE CO. OF CALIFORNIA FOR CONDUITS AND INCIDENTAL PURPOSES PER INST. NO. 190406, REC. 9–27–1977. THE EXACT LOCATION AND EXTENT OF EASEMENT CANNOT BE DETERMINED.

4. A RESERVATION OF RIGHT OF WAY FOR DITCHES OR RESERVOIRS PER BOOK 2, PAGE 359 OF PATENTS, REC. 9–28–1900. THE EXACT LOCATION AND EXTENT OF RESERVATION CANNOT BE DETERMINED.

5. A RESERVATION OF RIGHT OF WAY FOR DITCHES OR CANALS PER BOOK 6, PAGE 151 OF PATENTS, REC. 10–28–1912. THE EXACT LOCATION AND EXTENT OF RESERVATION CANNOT BE DETERMINED.

6. A RESERVATION OF RIGHT OF WAY FOR DITCHES OR RESERVOIRS PER BOOK 8, PAGE 349 OF PATENTS, REC. 5–14–1923. THE EXACT LOCATION AND EXTENT OF RESERVATION CANNOT BE DETERMINED.

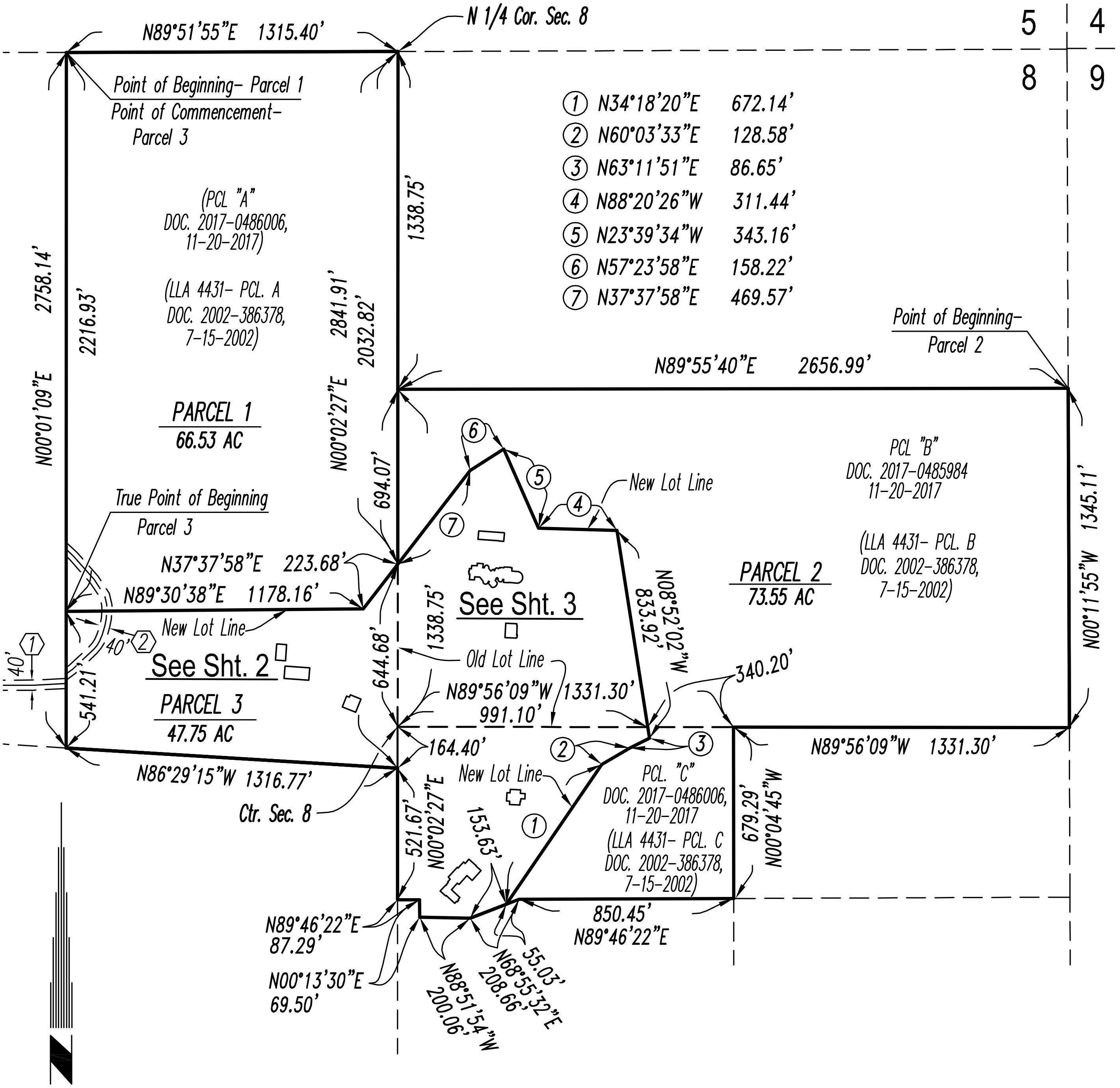
7. A RESERVATION OF RIGHT OF WAY FOR DITCHES AND RESERVOIRS PER BOOK 1107, PAGE 281 OF OFFICIAL RECORDS, REC. 9–10–1949. THE EXACT LOCATION AND EXTENT OF RESERVATION CANNOT BE DETERMINED.

8. A RESERVATION OF RIGHT OF WAY FOR DITCHES AND RESERVOIRS PER BOOK 1161, PAGE 429 OF OFFICIAL RECORDS, REC. 4–4–1950. THE EXACT LOCATION AND EXTENT OF RESERVATION CANNOT BE DETERMINED.

Sec. 8, T6S, R1E
Prepared: June, 2021
Assessor's Parcel Numbers: 569-020-024, 025, 026

EXHIBIT "C"– SITE PLAN
LOT LINE ADJUSTMENT NO. LLA210115

SHEET 1 OF 3 SHEETS



①	N34°18'20"E	672.14'
②	N60°03'33"E	128.58'
③	N63°11'51"E	86.65'
④	N88°20'26"W	311.44'
⑤	N23°39'34"W	343.16'
⑥	N57°23'58"E	158.22'
⑦	N37°37'58"E	469.57'

See Sheet B-4 for Easement Notes.

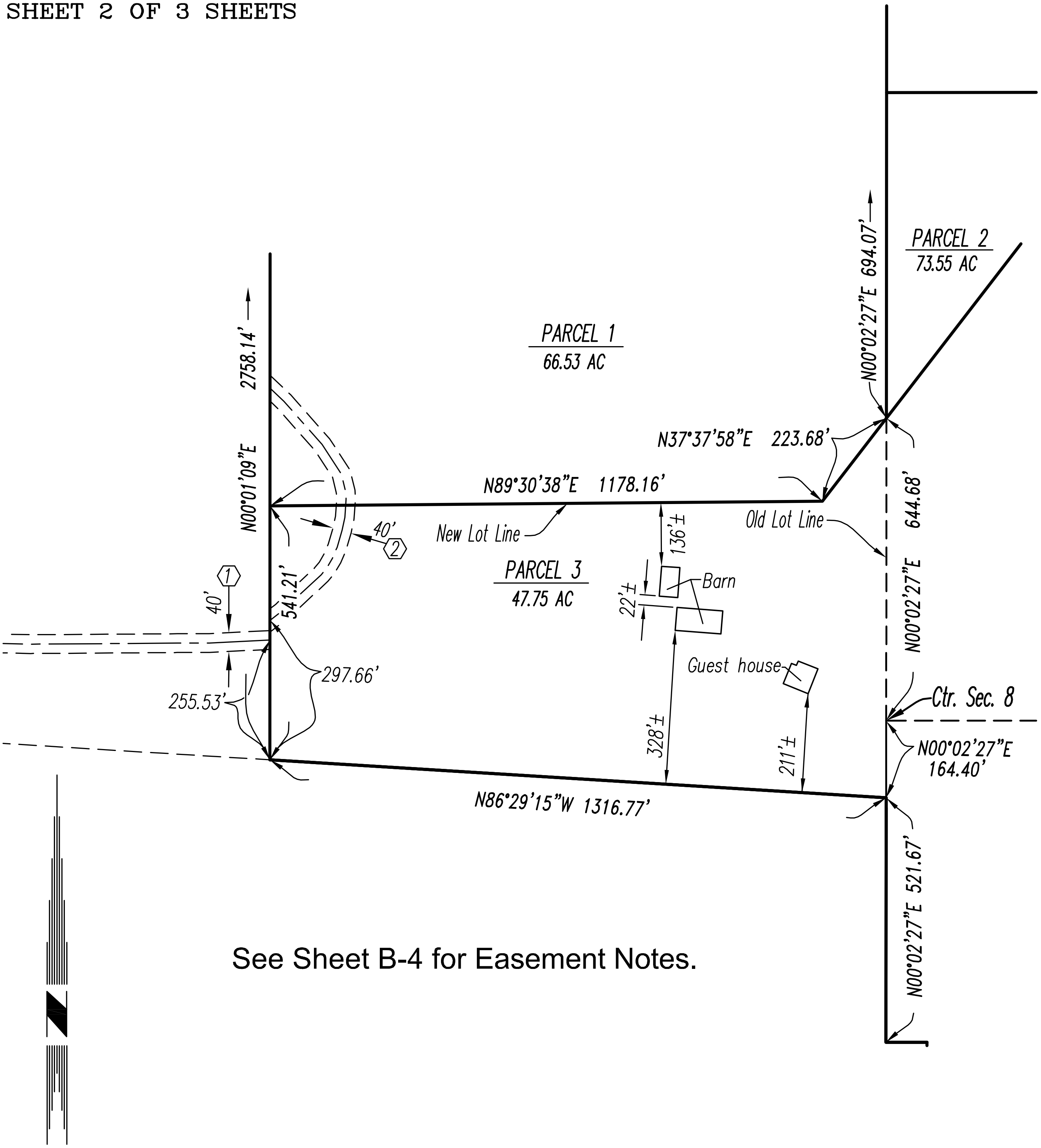
Sec. 8, T6S, R1E
Scale: 1"= 600'
Prepared: June, 2021
Assessor's Parcel Numbers: 569-020-024, 025, 026

Matthew W. Spiro
LS 8461, Exp. 12/31/22
Dated:____________

LICENSED LAND SURVEYOR
MATTHEW W. SPIRO
LS8461
EXPIRES 12-31-22
STATE OF CALIFORNIA

EXHIBIT "C"– SITE PLAN
LOT LINE ADJUSTMENT NO. LLA210115

SHEET 2 OF 3 SHEETS

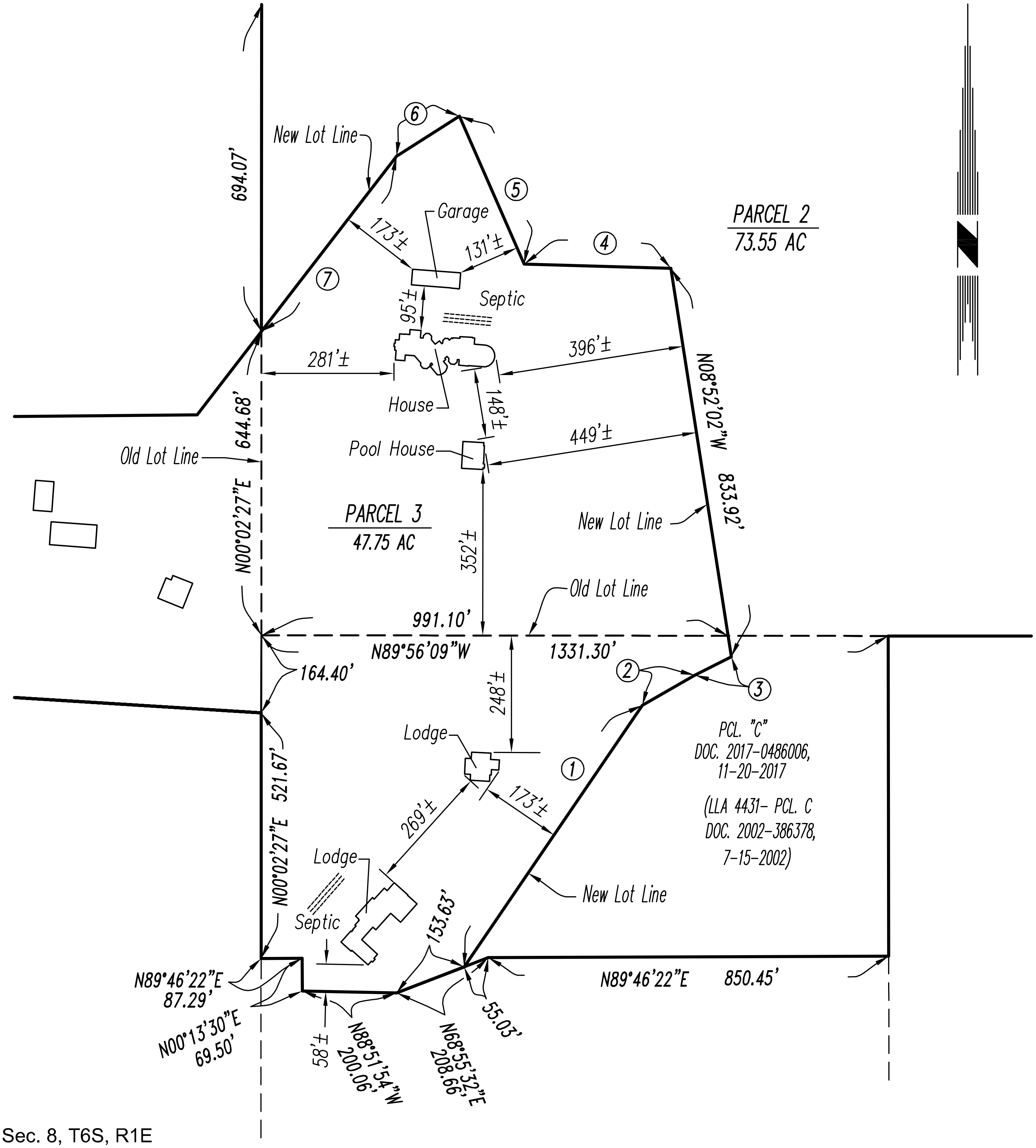


See Sheet B-4 for Easement Notes.

Sec. 8, T6S, R1E
Scale: 1"= 300'
Prepared: June, 2021
Assessor's Parcel Numbers: 569-020-024, 025, 026

EXHIBIT "C"– SITE PLAN
LOT LINE ADJUSTMENT NO. LLA210115

SHEET 3 OF 3 SHEETS



Sec. 8, T6S, R1E
Scale: 1"= 300'
Prepared: June, 2021
Assessor's Parcel Numbers: 569-020-024, 025, 026

EXHIBIT B

(Map/Illustration)

SEE NEXT PAGE

Operation and Maintenance

Responsible Party	BMP	Description of BMP and Method of Implementation	Maintenance Schedule
Owner	Education for Property Owners and Tenants	The property owner shall familiarize him/herself with the WQMP document and content, including BMP educational materials in Appendix 6 this WQMP and shall ensure that all occupants are also educated on stormwater BMPs.	Yearly
Owner	Activity Restrictions	Owner shall control site activities to prevent or reduce runoff pollutant. Activity restriction listed per attachment in this WQMP and owner or owner's representative shall monitor all activities on site during business hours to prevent pollutants in site runoff.	N/A
Owner	Landscape Management	Maintenance shall be conducted by a landscape contractor on a weekly basis to verify that the irrigation system is functioning properly and to repair as needed. Landscape contractor will also verify that there are no leaks or run-off from landscape areas. Adjust irrigation heads and systems run times as necessary to prevent overwatering of vegetation, overspray or run-off from landscape areas to ensure the health and aesthetic quality of the landscape. Mowing and trimming waste shall be properly removed from the site and herbicides, pesticides and fertillizers shall be properly applied to prevent storm drainage contamination.	Weekly
Owner	BMP Maintenance	The owner and/or his maintenance contractor shall regularly inspect the proposed BMP systems for signs of erosion or sediment and debris buildup and clean/repair as needed (see form 5-1 for a listing of all BMP maintenance items).	As Needed
Owner	Spill Contingency Plan	All hazardous and non-hazardous material spills will be cleaned up and disposed of immediately. The Property Owner shall report all spill incidents to the City of Menifee and County Fire Hazmat and shall provide Documentation, Education of Cleanup Procedure, Notify Responsible Agency.	Yearly
Owner	Litter/Debris Control Program	Litter and debris will be collected and deposited in appropriate covered receptacles as part of the regular sweeping/cleaning program. Any accumulated trash or debris onsite will be removed and disposed of properly on a weekly basis.	Weekly or as needed
Owner	Employee Training	The owner will ensure that tenants are also familiar with onsite BMPs and necessary maintenance required by the tenants/employees. Owner will check with City and County at least once a year to obtain new or updated educational materials and provide these materials to tenants/employees. Employees shall be trained to cleanup spills and participate in ongoing maintenance. The WQMP requires annual employee training and new hires within 2 months.	Yearly
Owner	Catch Basin Inspection Program	On-site catch basin drains and drain filters shall be inspected monthly for debris/trash accumulation evidence of illegal dumping into these drains and cleaned as necessary. Illegal dumping incidents shall be investigated.	Inspect Semi-Annually (by Oct 1 and Feb 1) and after Major storm events

Operation and Maintenance

Responsible Party	BMP	Description of BMP and Method of Implementation	Maintenance Schedule
Owner	Parking Lot Sweeping	The parking lots will be swept regularly. Private onsite street entrances and parking lots will be thoroughly swept annually before the rainy season and weekly to remove accumulated sediment and debris.	Weekly or as needed
Owner	Comply with all other applicable NPDES	During the construction phase of this project, the applicant shall file a Notice of Intent for coverage under the GCP and acquire a WDID # to demonstrate compliance with the General Construction Permit. As necessary, future occupants of this site shall apply for coverage under the General Industrial Permit or Region 8, Sector Specific Permit.	N/A
Owner	Storm Drain Signage	All on-site drainage inlets will be stenciled, or signage will be provided that indicates "NO DUMPING, DRAINS TO RIVER" or equivalent.	Annually or as needed to maintain legibility
Owner	Trash Storage Area	All trash enclosures on this site shall have a solid roof cover to prevent dumpster contents and enclosure from coming into contact with rainwater. Shall comply with CASQA SD-32.	Weekly
Owner	Efficient Irrigation	The irrigation system will include devices to prevent low head drainage, overspray and run off through the use of pressure regulating devices, check valves, flow sensors, proper spacing, low precipitation emission devices and ET or weather-based controllers. Landscaping and irrigation shall be consistent with the State Model Water Efficient Landscape Ordinance and the County of Riverside Landscape Development Standards. Plants installed will be arranged according to similar hydro-zones and meet the required water budget for the site. Landscape areas used for water quality swales or infiltration areas shall have proper plants for saturated soils, drought tolerance and erosion control qualities. Shade trees shall be used to intercept rainwater and reduce heat gain on paving.	Weekly or as needed for repair
Owner	Site Design and Landscape Planning	Inspect side slope of basin for erosion. Repair eroded areas. Inspect riprap at basin, replace misplaced/missing rock. Inspect depth of riprap and replace as necessary.	Annually or after storm event
Owner	Infiltration Basin (Private)	Inspect soil and repair eroded areas. Inspect for erosion or damage to vegetation, preferably at the end of the wet season to schedule maintenance and before major fall runoff to be sure the strips are ready for winter. However, additional inspection after periods of heavy runoff is required. Inspection to ensure ground cover is well established. If not, prepare soil and reseed. Install erosion control blankets, as needed. Remove and replace dead and diseased vegetation.	Semi-Annual, before Wet Season (October 1) and midway through the wet season or by Feb 1.

Operation and Maintenance

Responsible Party	BMP	Description of BMP and Method of Implementation	Maintenance Schedule
Owner	Drain Inserts	Owner shall hire maintenance crew to inspect before the wet season and after each major rain event. Inspection will include chekcing for build-up of sediment, trash/debris and general clogging that prevents insert from filtering	Before Wet Season (October 1) and After Each Major Rain Event

			Maintenance Responsibility				Funding Mechanism for Maintenance			Maintenance Costs	
BMP	Used	Not Used	Owner **	City	County	Flood District	Owner	Developer	Public *	1-year ($)	2-year ($)
Hydro seeding & Mulching Private	☐	☒	☐	☐	☐	☐	☐	☐	☐	N/A	N/A
Landscape Private	☒	☐	☒	☐	☐	☐	☒	☐	☐	1000	2000
Landscape Public	☒	☐	☐	☒	☐	☐	☐	☐	☒	250	500
Lawns	☐	☒	☐	☐	☐	☐	☐	☐	☐	N/A	N/A
Impervious permanent cover (concrete/ asphalt) Private	☒	☐	☒	☐	☐	☐	☒	☐	☐	1,000	2,000
Impervious permanent cover (concrete/ asphalt) Public	☐	☒	☐	☐	☐	☐	☐	☐	☐	250	500

Pervious permanent cover (gravel)	☒	☐	☒	☐	☐	☐	☒	☐	☐	N/A	N/A
Down drains	☒	☐	☒	☐	☐	☐	☒	☐	☐	100	200
Ribbon Gutter Private	☐	☒	☐	☐	☐	☐	☐	☐	☐	N/A	N/A
Ribbon Gutter Public	☐	☒	☐	☐	☐	☐	☐	☐	☐	N/A	N/A
Curb & gutter Private	☒	☐	☒	☐	☐	☐	☒	☐	☐	250	500
Curb & gutter Public	☒	☐	☐	☒	☐	☐	☐	☐	☒	250	500
Storm Drain Private	☒	☐	☒	☐	☐	☐	☒	☐	☐	500	1000
Storm Drain Public	☒	☐	☐	☒	☐	☐	☐	☐	☒	200	400
Underground Detention Chambers	☐	☒	☐	☐	☐	☐	☐	☐	☐	400	800
Bioretention Basins	☐	☒	☐	☐	☐	☐	☐	☐	☐	500	1000
Modular Wetlands	☐	☒	☐	☐	☐	☐	☐	☐	☐	500	1000
Education Materials	☒	☐	☒	☐	☐	☐	☒	☐	☐	Free	Free
Vehicle Wash Area	☐	☒	☐	☐	☐	☐	☐	☐	☐	N/A	N/A
Catch Basin/Inlet Stenciling	☒	☐	☒	☐	☐	☐	☒	☐	☐	100	200
FlexStorm Inlet Filters	☒	☐	☒	☐	☐	☐	☒	☐	☐	200	400

Appendix 10: Educational Materials

BMP Fact Sheets, Maintenance Guidelines and Other End-User BMP Information

Sample Employee Training Sign-in

EMPLOYEE NAME	DATE COMPLETED	TRAINING PERFORMED	SUPERVISOR INITIALS

Riverside County Stormwater Program Members

City of Banning	(951) 922-3105
City of Beaumont	(951) 769-8520
City of Calimesa	(909) 795-9801
City of Canyon Lake	(951) 244-2955
City of Cathedral City	(760) 770-0340
City of Coachella	(760) 398-3502
City of Corona	(951) 736-2447
City of Desert Hot Springs	(760) 329-6411
City of Eastvale	(951) 361-0900
City of Hemet	(951) 765-2300
City of Indian Wells	(760) 346-2489
City of Indio	(760) 391-4000
City of Jurupa Valley	(951) 332-6464
City of Lake Elsinore	(951) 674-3124
City of La Quinta	(760) 777-7000
City of Menifee	(951) 672-6777
City of Moreno Valley	(951) 413-3000
City of Murrieta	(951) 304-2489
City of Norco	(951) 270-5607
City of Palm Desert	(760) 346-0611
City of Palm Springs	(760) 323-8299
City of Perris	(951) 943-6100
City of Rancho Mirage	(760) 324-4511
City of Riverside	(951) 826-5311
City of San Jacinto	(951) 487-7330
City of Temecula	(951) 694-6444
City of Wildomar	(951) 677-7751
Coachella Valley Water District	(760) 398-2651
County of Riverside	(951) 955-1000
Riverside County Flood Control District	(951) 955-1200

Stormwater Pollution

What you should know for...

Industrial & Commercial Facilities

Best Management Practices (BMPS) for:

- Industrial Facilities
- Commercial Facilities

YOU can prevent Stormwater Pollution following these practices...

Industrial and Commercial Facilities

The Riverside County Stormwater Program has identified a number of Best Management Practices (BMPs) for Industrial and Commercial Facilities. These BMPs control and reduce stormwater pollutants from reaching our storm drain system and ultimately our local water bodies. City and County ordinances require businesses to use these BMPs to protect our water quality. Local cities and the County are required to verify implementation of these BMPs by performing regular facility inspections.

Prohibited Discharges

Discontinue all non-stormwater discharges to the storm drain system. It is *prohibited* to discharge any chemicals, paints, debris, wastes or wastewater into the gutter, street or storm drain.

Outdoor Storage BMPs

- Install covers and secondary containment areas for all hazardous materials and wastes stored outdoors in accordance with County and/or City standards.
- Keep all temporary waste containers covered, at all times when not in use.
- Sweep outdoor areas instead of using a hose or pressure washer.
- Move all process operations including vehicle/equipment maintenance inside of the building or under a covered and contained area.
- Wash equipment and vehicles in a contained and covered wash bay which is closed-loop or connected to a clarifier sized to local standards and discharged to a sanitary sewer or take them to a commercial car wash.

Spills and Clean Up BMPs

- Keep the work site clean and orderly. Remove debris in a timely fashion. Sweep up the area.
- Clean up spills immediately when they occur, using dry clean up methods such as absorbent materials or sweep followed by proper disposal of materials.
- Always have a spill kit available near chemical loading dock doors and vehicle maintenance and fueling areas.
- Follow your Business Emergency Plan, as filed with the local Fire Department.
- Report all prohibited discharges and non-implementation of BMPs to your local Stormwater Coordinator as listed on the back of this pamphlet.
- Report hazardous materials spills to 951-358-5055 or call after hours to 951-782-2973 or, if an emergency, call the Fire Department's Haz Mat Team at 911.

Plastic Manufacturing Facilities BMPs

AB 258 requires plastic product manufacturers to use BMPs, such as safe storage and clean-up procedures to prevent plastic pellets (nurdles) from entering the waterway. The plastic pellets are released into the environment during transporting, packaging and processing and migrate to waterways through the storm drain system. AB 258 will help protect fish and wildlife from the hazards of plastic pollution.

Training BMPs

As prescribed by your City and County Stormwater Ordinance(s), train employees in spill procedures and prohibit non-stormwater discharges to the storm drain system. Applicable BMP examples can be found at www.cabmphandbooks.com.

Permitting

Stormwater discharges associated with specific categories for industrial facilities are regulated by the State Water Resources Control Board through an Industrial Stormwater General Permit. A copy of this General Permit and application forms are available at: www.waterboards.ca.gov, select stormwater then the industrial quick link.

To report illegal dumping or for more information on stormwater pollution prevention call: 1-800-506-2555 or e-mail us at: fcnpdes@rcflood.org.

Resources

State Water Resources Control Board
Division of Water Quality
1001 I Street
Sacramento CA 95814
(916) 341-5455
www.swrcb.ca.gov/water_issues/programs/stormwater

Colorado River Basin Regional Water
Quality Control Board - Region 7
73-720 Fred Waring Drive, Suite 100
Palm Desert, CA 92260
(760) 346-7491
www.waterboards.ca.gov/coloradoriver

Santa Ana Regional Water
Quality Control Board - Region 8
3737 Main Street, Suite 500
Riverside, CA 92501-3348
(951) 782-4130
www.waterboards.ca.gov/santaana

San Diego Regional Water
Quality Control Board - Region 9
2375 Northside Drive Suite 100
San Diego, CA 92108
(619) 516-1990
www.waterboards.ca.gov/sandiego

To report a hazardous materials spill, call:

During normal business hours
(7:00 a.m. to 5:30 p.m.)
Riverside County Department of
Environmental Health
(951)-358-5172 or **1-888-722-4234**
www.rivcoeh.org.

After business hours, on weekends or
holidays, call **(951)-782-2968**

In an emergency, dial **911**

For hazardous waste disposal information call:

(951) 358-5055

To report an illegal discharge or a clogged storm drain, call:

1-800-506-2555

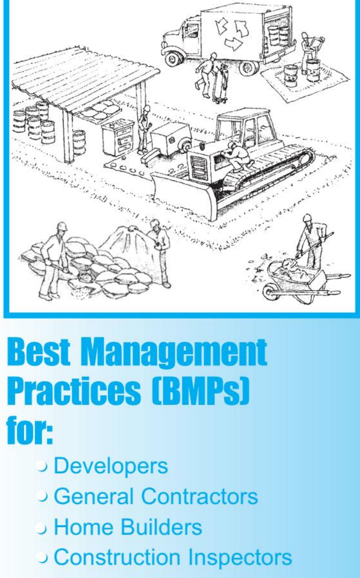
For more information, please call the Riverside County's "Only Rain Down the Storm Drain" Water Pollution Prevention Program at 1-800-506-2555 or www.rcflood.org

The "Only Rain Down the Storm Drain" Pollution Prevention Program acknowledges The City of Coronado for the information provided in brochure.

Water Pollution Prevention

What you should know for...

GENERAL CONSTRUCTION & SITE SUPERVISION



Best Management Practices (BMPs) for:

- Developers
- General Contractors
- Home Builders
- Construction Inspectors
- Anyone in the construction business

Stormwater Pollution . . . What You Should Know

Riverside County has two drainage systems - sewers and storm drains. The storm drain system was designed to reduce flooding by carrying excess rainwater away from streets and developed areas. The storm drain system does not provide water treatment. It is connected directly to our local waterways.

Unlike sanitary sewers, storm drains are not connected to a wastewater treatment plant – they flow directly to our local streams, rivers and lakes.

Stormwater runoff is a part of the natural hydrologic process. However, land development and construction activities can affect the natural drainage processes and introduce pollutants into stormwater runoff. Polluted stormwater runoff from construction sites has been identified as a major source of water pollution in California. It jeopardizes the quality of our local waterways and can pose a serious threat to the health of our aquatic ecosystems.

The Cities and County of Riverside Water Pollution Prevention Program

Because preventing pollution is much easier and less costly than cleaning up "after the fact," Cities and County of Riverside's "Only Rain Down the Storm Drain" Water Pollution Prevention Program informs residents and businesses on pollution prevention activities. This pamphlet describes various Best Management Practices (BMPs) that construction site operators can use to prevent stormwater pollution.

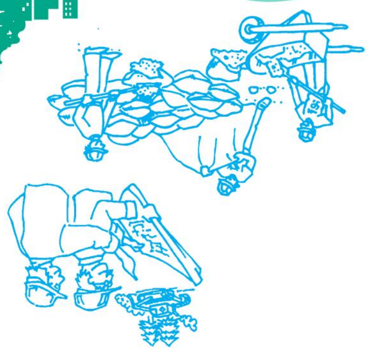
In accordance with applicable federal and state law, the Cities and County of Riverside have adopted ordinances for stormwater management that prohibit the discharge of pollutants into the storm drain system or local surface water. This includes discharges from construction sites containing sediment, concrete, mortar, paint, solvents, lubricants, vehicle fluids, fuel, pesticides, and construction debris.

PLEASE NOTE: The Federal, State and local regulations strictly prohibit the discharge of sediment and pollutants into the streets, the storm drain system or waterways. As an owner, operator or supervisor of a construction site, you may be held financially responsible for any environmental damage caused by your subcontractors or employees.

WATER POLLUTION PREVENTION FOR CONSTRUCTION ACTIVITIES

The two most common sources of stormwater pollution problems associated with construction activities are ***erosion*** and ***sedimentation***. Failure to maintain adequate erosion and sediment controls at construction sites often results in sediment discharges into the storm drain system, creating multiple problems once it enters local waterways.

Construction vehicles and heavy equipment can also track significant amounts of mud and sediment onto adjacent streets. Additionally, wind may transport construction materials and wastes into streets storm drains, or directly into our local waterways.



What Should You Do?

Advance Planning to Prevent Pollution

- ☐ Remove existing vegetation only as needed.
- ☐ Schedule excavation, grading, and paving operations for dry weather periods, if possible.
- ☐ Designate a specific area of the construction site, well away from storm drain inlets or watercourses, for material storage and equipment maintenance.
- ☐ Develop and implement an effective combination of erosion and sediment controls for the construction site.
- ☐ Practice source reduction by ordering only the amount of materials that are needed to finish the project.
- ☐ Educate your employees and subcontractors about stormwater management requirements and their pollution prevention responsibilities.
- ☐ Control the amount of surface runoff at the construction site by impeding internally generated flows and using berms or drainage ditches to direct incoming offsite flows to go around the site. ***Note:*** *Consult local drainage policies for more information.*

BEST MANAGEMENT PRACTICES

The following Best Management Practices (BMPs) can significantly reduce pollutant discharges from your construction site. Compliance with stormwater regulations can be as simple as minimizing stormwater contact with potential pollutants by providing covers and secondary containment for construction materials, designating areas away from storm drain systems for storing equipment and materials and implementing good housekeeping practices at the construction site.

- ☐ Protect all storm drain inlets and streams located near the construction site to prevent sediment-laden water from entering the storm drain system.
- ☐ Limit access to and from the site. Stabilize construction entrances/exits to minimize the track out of dirt and mud onto adjacent streets. Conduct frequent street sweeping.
- ☐ Protect stockpiles and construction materials from winds and rain by storing them under a roof, secured impermeable tarp or plastic sheeting.
- ☐ Avoid storing or stockpiling materials near storm drain inlets, gullies or streams.
- ☐ Phase grading operations to limit disturbed areas and duration of exposure.
- ☐ Perform major maintenance and repairs of vehicles and equipment offsite.
- ☐ Wash out concrete mixers only in designated washout areas at the construction site.
- ☐ Set-up and operate small concrete mixers on tarps or heavy plastic drop cloths.
- ☐ Keep construction sites clean by removing trash, debris, wastes, etc. on a regular basis.
- ☐ Clean-up spills immediately using dry clean-up methods (e.g., absorbent materials such as cat litter, sand or rags for liquid spills; sweeping for dry spills such as cement, mortar or fertilizer) and by removing the contaminated soil from spills on dirt areas. .
- ☐ Prevent erosion by implementing any or a combination of soil stabilization practices such as mulching, surface roughening, permanent or temporary seeding.
- ☐ Maintain all vehicles and equipment in good working condition. Inspect frequently for leaks, and repair promptly.
- ☐ Practice proper waste disposal. Many construction materials and wastes, including solvents, water-based paint, vehicle fluids, broken asphalt and concrete, wood, and cleared vegetation can be recycled. Materials that cannot be recycled must be taken to an appropriate landfill or disposed of as hazardous waste.
- ☐ Cover open dumpsters with secured tarps or plastic sheeting. Never clean out a dumpster by washing it down on the construction site.
- ☐ Arrange for an adequate debris disposal schedule to insure that dumpsters do not overflow.

GENERAL CONSTRUCTION ACTIVITIES STORMWATER PERMIT

(Construction Activities General Permit)

The State Water Resources Control Board (SWRCB) adopted a new Construction Activities General Permit (Order No. 2010-0014-DWQ) on September 2, 2009, This permit is administered and enforced by the SWRCB and the local Regional Water Quality Control Boards (RWQCB). The updated Construction Activities General Permit establishes a number of new stormwater management requirements for construction site operator.

NOTE: *Some construction activies stormwater permits are issued on a regional basis. Consult your local RWQCB to find out if your project requires coverage under any of these permits.*

Frequently Asked Questions:

How do I know if I need a Construction Activities General Permit?

If your construction project requires a land disturbance of one acre or more, or less than one acre but part of a larger common plan of development or sale.

How do I obtain coverage under the Construction Activities General Permit?

The Legally Responsible Person (LRP) must electronically submit Permit Registration Documents (PRDs) prior to commencement of construction activities in the Storm Water Multi-Application Report Tracking System (SMARTS).

PRDs consist of the Notice of Intent, Risk Assessment, Post-Construction Calculations, a Site Map, the SWPPP, a signed certification statement by the LRP, and the first annual fee. Once these components have been submitted and are deemed complete by the SMARTS system, a WDID number will automatically be emailed to the LRP.

What must I do to comply with the requirements of the Construction Activities General Permit?

- ● Have a qualified SWPPP Developer (QSD) prepare a Stormwater Pollution Prevention Plan (SWPPP) prior to commencing construction activities.
- ● Have a qualified SWPPP Practitioner (QSP) implement the SWPPP.
- ● Keep a copy of the SWPPP at the construction site for the entire duration of the project.
- ● Implement an effective combination of erosion and sediment control on all soil disturbed areas.
- ● Conduct site inspections prior to anticipated storm events, every 24-hours during extended storm events, and after an actual storm event.
- ● Implement BMPs for non-stormwater discharges year-round.
- ● Perform repair and maintenance of BMPs as soon as possible after storm events depending upon worker safety.
- ● Update the SWPPP as needed, to manage pollutants or reflect changes in site conditions.
- ● Include description of post construction BMPs at the construction site, including parties responsible for long-term maintenance.

NOTE: *Please refer to the Construction Activities General Permit for detailed information. You may contact the SWRCB, your local RWQCB, or visit the SWRCB website at* www.swrcb.ca.gov/water_issues/programs/stormwater/ *for more information.*

Revised July 2014

After the Storm

A Citizen's Guide to Understanding Stormwater

For more information contact:

or visit
www.epa.gov/npdes/stormwater
www.epa.gov/nps

United States
Environmental Protection
Agency

EPA 833-B-03-002
January 2003

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What is stormwater runoff?

Stormwater runoff occurs when precipitation from rain or snowmelt flows over the ground. Impervious surfaces like driveways, sidewalks, and streets prevent stormwater from naturally soaking into the ground.

Why is stormwater runoff a problem?

Stormwater can pick up debris, chemicals, dirt, and other pollutants and flow into a storm sewer system or directly to a lake, stream, river, wetland, or coastal water. Anything that enters a storm sewer system is discharged untreated into the waterbodies we use for swimming, fishing, and providing drinking water.

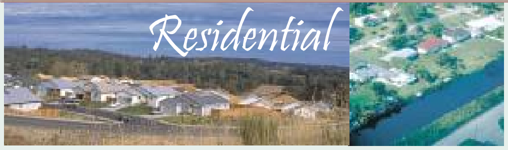
The effects of pollution

Polluted stormwater runoff can have many adverse effects on plants, fish, animals, and people.

- Sediment can cloud the water and make it difficult or impossible for aquatic plants to grow. Sediment also can destroy aquatic habitats.
- Excess nutrients can cause algae blooms. When algae die, they sink to the bottom and decompose in a process that removes oxygen from the water. Fish and other aquatic organisms can't exist in water with low dissolved oxygen levels.
- Bacteria and other pathogens can wash into swimming areas and create health hazards, often making beach closures necessary.
- Debris—plastic bags, six-pack rings, bottles, and cigarette butts—washed into waterbodies can choke, suffocate, or disable aquatic life like ducks, fish, turtles, and birds.
- Household hazardous wastes like insecticides, pesticides, paint, solvents, used motor oil, and other auto fluids can poison aquatic life. Land animals and people can become sick or die from eating diseased fish and shellfish or ingesting polluted water.
- Polluted stormwater often affects drinking water sources. This, in turn, can affect human health and increase drinking water treatment costs.

Stormwater Pollution Solutions

Residential



Recycle or properly dispose of household products that contain chemicals, such as insecticides, pesticides, paint, solvents, and used motor oil and other auto fluids. Don't pour them onto the ground or into storm drains.

Lawn care

Excess fertilizers and pesticides applied to lawns and gardens wash off and pollute streams. In addition, yard clippings and leaves can wash into storm drains and contribute nutrients and organic matter to streams.

- ♦ Don't overwater your lawn. Consider using a soaker hose instead of a sprinkler.
- ♦ Use pesticides and fertilizers sparingly. When use is necessary, use these chemicals in the recommended amounts. Use organic mulch or safer pest control methods whenever possible.
- ♦ Compost or mulch yard waste. Don't leave it in the street or sweep it into storm drains or streams.
- ♦ Cover piles of dirt or mulch being used in landscaping projects.

Auto care

Washing your car and degreasing auto parts at home can send detergents and other contaminants through the storm sewer system. Dumping automotive fluids into storm drains has the same result as dumping the materials directly into a waterbody.

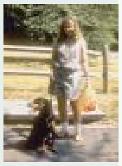
- ♦ Use a commercial car wash that treats or recycles its wastewater, or wash your car on your yard so the water infiltrates into the ground.
- ♦ Repair leaks and dispose of used auto fluids and batteries at designated drop-off or recycling locations.

Septic systems

Leaking and poorly maintained septic systems release nutrients and pathogens (bacteria and viruses) that can be picked up by stormwater and discharged into nearby waterbodies. Pathogens can cause public health problems and environmental concerns.

- ♦ Inspect your system every 3 years and pump your tank as necessary (every 3 to 5 years).
- ♦ Don't dispose of household hazardous waste in sinks or toilets.

Pet waste



Pet waste can be a major source of bacteria and excess nutrients in local waters.

- ♦ When walking your pet, remember to pick up the waste and dispose of it properly. Flushing pet waste is the best disposal method. Leaving pet waste on the ground increases public health risks by allowing harmful bacteria and nutrients to wash into the storm drain and eventually into local waterbodies.

Education is essential to changing people's behavior. Signs and markers near storm drains warn residents that pollutants entering the drains will be carried untreated into a local waterbody.

Residential landscaping

Permeable Pavement—Traditional concrete and asphalt don't allow water to soak into the ground. Instead these surfaces rely on storm drains to divert unwanted water. Permeable pavement systems allow rain and snowmelt to soak through, decreasing stormwater runoff.

Rain Barrels—You can collect rainwater from rooftops in mosquito-proof containers. The water can be used later on lawn or garden areas.

Rain Gardens and Grassy Swales—Specially designed areas planted with native plants can provide natural places for rainwater to collect and soak into the ground. Rain from rooftop areas or paved areas can be diverted into these areas rather than into storm drains.

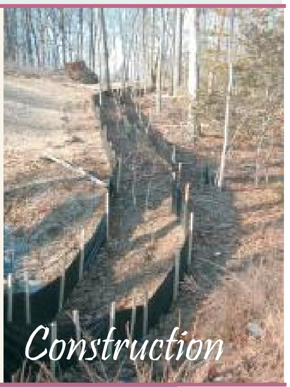
Vegetated Filter Strips—Filter strips are areas of native grass or plants created along roadways or streams. They trap the pollutants stormwater picks up as it flows across driveways and streets.

Commercial

Dirt, oil, and debris that collect in parking lots and paved areas can be washed into the storm sewer system and eventually enter local waterbodies.

- ♦ Sweep up litter and debris from sidewalks, driveways and parking lots, especially around storm drains.
- ♦ Cover grease storage and dumpsters and keep them clean to avoid leaks.
- ♦ Report any chemical spill to the local hazardous waste cleanup team. They'll know the best way to keep spills from harming the environment.

Construction



Erosion controls that aren't maintained can cause excessive amounts of sediment and debris to be carried into the stormwater system. Construction vehicles can leak fuel, oil, and other harmful fluids that can be picked up by stormwater and deposited into local waterbodies.

- ♦ Divert stormwater away from disturbed or exposed areas of the construction site.
- ♦ Install silt fences, vehicle mud removal areas, vegetative cover, and other sediment and erosion controls and properly maintain them, especially after rainstorms.
- ♦ Prevent soil erosion by minimizing disturbed areas during construction projects, and seed and mulch bare areas as soon as possible.

Agriculture

Lack of vegetation on streambanks can lead to erosion. Overgrazed pastures can also contribute excessive amounts of sediment to local waterbodies. Excess fertilizers and pesticides can poison aquatic animals and lead to destructive algae blooms. Livestock in streams can contaminate waterways with bacteria, making them unsafe for human contact.

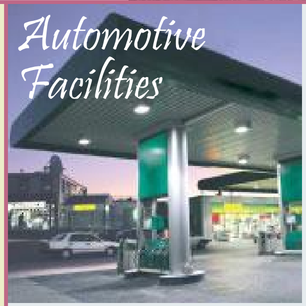
- ♦ Keep livestock away from streambanks and provide them a water source away from waterbodies.
- ♦ Store and apply manure away from waterbodies and in accordance with a nutrient management plan.
- ♦ Vegetate riparian areas along waterways.
- ♦ Rotate animal grazing to prevent soil erosion in fields.
- ♦ Apply fertilizers and pesticides according to label instructions to save money and minimize pollution.

Forestry

Improperly managed logging operations can result in erosion and sedimentation.

- ♦ Conduct preharvest planning to prevent erosion and lower costs.
- ♦ Use logging methods and equipment that minimize soil disturbance.
- ♦ Plan and design skid trails, yard areas, and truck access roads to minimize stream crossings and avoid disturbing the forest floor.
- ♦ Construct stream crossings so that they minimize erosion and physical changes to streams.
- ♦ Expedite revegetation of cleared areas.

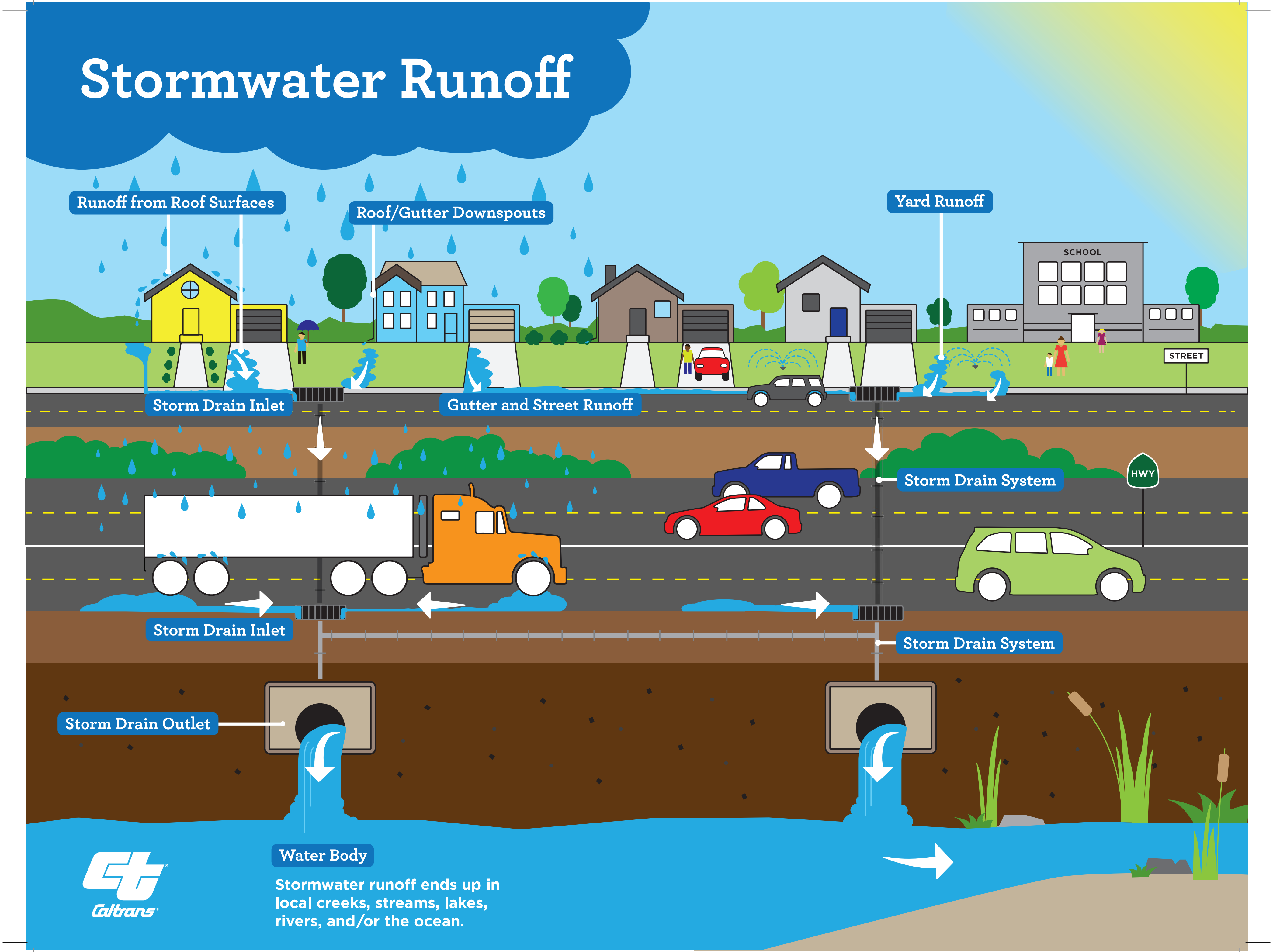
Automotive Facilities



Uncovered fueling stations allow spills to be washed into storm drains. Cars waiting to be repaired can leak fuel, oil, and other harmful fluids that can be picked up by stormwater.

- ♦ Clean up spills immediately and properly dispose of cleanup materials.
- ♦ Provide cover over fueling stations and design or retrofit facilities for spill containment.
- ♦ Properly maintain fleet vehicles to prevent oil, gas, and other discharges from being washed into local waterbodies.
- ♦ Install and maintain oil/water separators.

Stormwater Runoff



Stormwater runoff ends up in local creeks, streams, lakes, rivers, and/or the ocean.

Caltrans

I Pledge to Protect Every Drop

ILLEGAL DUMPING IS RUBBISH

Properly dump your garbage to reduce
California's stormwater pollution!
Five easy tips to reduce pollutants:

APPLIANCES

When illegally dumped, appliances can release toxins that get washed away with rain and end up in our water bodies, polluting our water.

TIP 1: Donate or recycle appliances.
TIP 2: Properly dispose at your local dump.

FURNITURE

When dumped on the side of the roadway all furniture not only causes a safety hazard, but can also breakdown and get into local water bodies, causing pollution.

TIP 3: Contact local waste management for bulky pick-up or locate a dump for drop-off.

VEGETATION

Improperly dumped vegetation can flow to waterways, creating an imbalance of nitrates in water and thus harm aquatic life.

TIP 4: Tarp loads to reduce biodegradable waste on highways.
TIP 5: Use a green waste bin or consider composting biodegradable waste.

Don't risk a $10k fine & up to 6 months in jail

Simple changes in disposal of rubbish can help keep California's highways, waterways and bodies of water clean!

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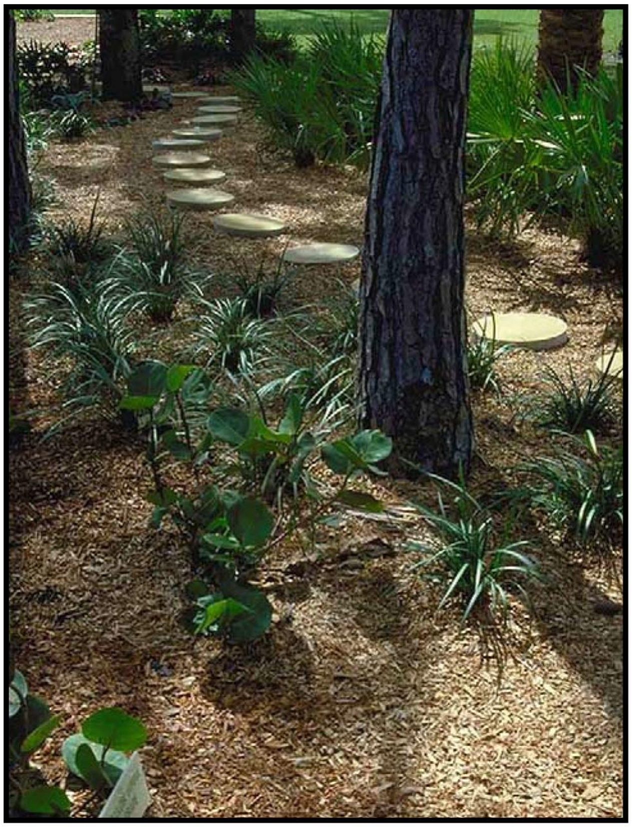
FIND US ONLINE

www.protecteverydrop.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.

Roof Runoff Controls SD-11

Rain Garden

Design Objectives

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

Description

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

Approach

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

Suitable Applications

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

Design Considerations

Designing New Installations

Cisterns or Rain Barrels

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

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

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

Dry wells and Infiltration Trenches

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

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

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

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

Pop-up Drainage Emitter

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

Foundation Planting

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

Redeveloping Existing Installations

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

Supplemental Information

Examples

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

Other Resources

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

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

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

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

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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.

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.

Vegetated Buffer Strip TC-31

Design Considerations

- Tributary Area
- Slope
- Water Availability
- Aesthetics

Description

Grassed buffer strips (vegetated filter strips, filter strips, and grassed filters) are vegetated surfaces that are designed to treat sheet flow from adjacent surfaces. Filter strips function by slowing runoff velocities and allowing sediment and other pollutants to settle and by providing some infiltration into underlying soils. Filter strips were originally used as an agricultural treatment practice and have more recently evolved into an urban practice. With proper design and maintenance, filter strips can provide relatively high pollutant removal. In addition, the public views them as landscaped amenities and not as stormwater infrastructure. Consequently, there is little resistance to their use.

California Experience

Caltrans constructed and monitored three vegetated buffer strips in southern California and is currently evaluating their performance at eight additional sites statewide. These strips were generally effective in reducing the volume and mass of pollutants in runoff. Even in the areas where the annual rainfall was only about 10 inches/yr, the vegetation did not require additional irrigation. One factor that strongly affected performance was the presence of large numbers of gophers at most of the southern California sites. The gophers created earthen mounds, destroyed vegetation, and generally reduced the effectiveness of the controls for TSS reduction.

Advantages

- Buffers require minimal maintenance activity (generally just erosion prevention and mowing).
- If properly designed, vegetated, and operated, buffer strips can provide reliable water quality benefits in conjunction with high aesthetic appeal.

Targeted Constituents

☑	Sediment	■
☑	Nutrients	●
☑	Trash	▲
☑	Metals	■
☑	Bacteria	●
☑	Oil and Grease	■
☑	Organics	▲

Legend ***(Removal Effectiveness)***

● Low ■ High

▲ Medium

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- Flow characteristics and vegetation type and density can be closely controlled to maximize BMP effectiveness.
- Roadside shoulders act as effective buffer strips when slope and length meet criteria described below.

Limitations

- May not be appropriate for industrial sites or locations where spills may occur.
- Buffer strips cannot treat a very large drainage area.
- A thick vegetative cover is needed for these practices to function properly.
- Buffer or vegetative filter length must be adequate and flow characteristics acceptable or water quality performance can be severely limited.
- Vegetative buffers may not provide treatment for dissolved constituents except to the extent that flows across the vegetated surface are infiltrated into the soil profile.
- This technology does not provide significant attenuation of the increased volume and flow rate of runoff during intense rain events.

Design and Sizing Guidelines

- Maximum length (in the direction of flow towards the buffer) of the tributary area should be 60 feet.
- Slopes should not exceed 15%.
- Minimum length (in direction of flow) is 15 feet.
- Width should be the same as the tributary area.
- Either grass or a diverse selection of other low growing, drought tolerant, native vegetation should be specified. Vegetation whose growing season corresponds to the wet season is preferred.

Construction/Inspection Considerations

- Include directions in the specifications for use of appropriate fertilizer and soil amendments based on soil properties determined through testing and compared to the needs of the vegetation requirements.
- Install strips at the time of the year when there is a reasonable chance of successful establishment without irrigation; however, it is recognized that rainfall in a given year may not be sufficient and temporary irrigation may be required.
- If sod tiles must be used, they should be placed so that there are no gaps between the tiles; stagger the ends of the tiles to prevent the formation of channels along the strip.
- Use a roller on the sod to ensure that no air pockets form between the sod and the soil.

- Where seeds are used, erosion controls will be necessary to protect seeds for at least 75 days after the first rainfall of the season.

Performance

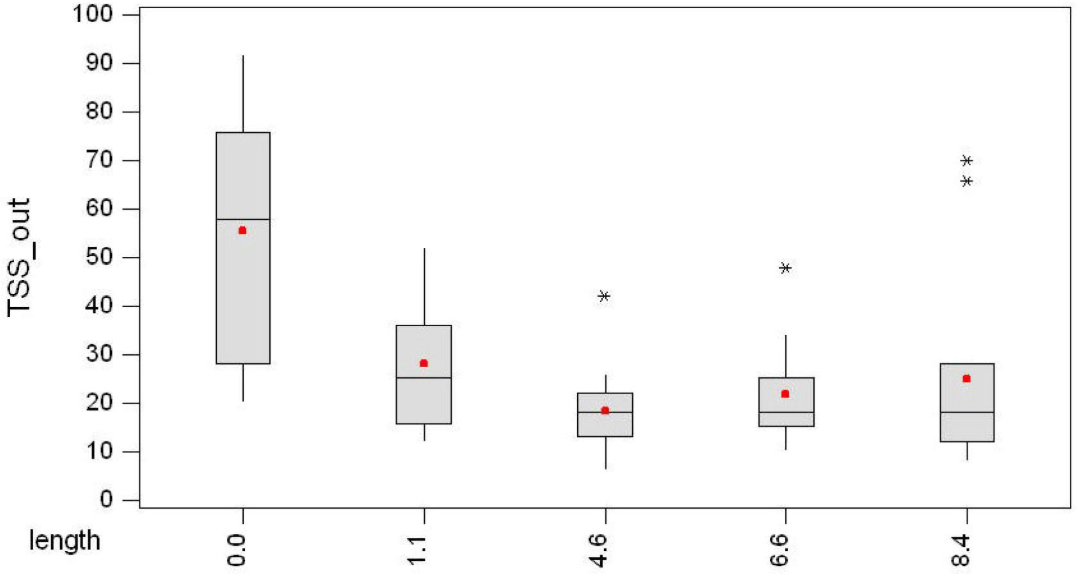
Vegetated buffer strips tend to provide somewhat better treatment of stormwater runoff than swales and have fewer tendencies for channelization or erosion. Table 1 documents the pollutant removal observed in a recent study by Caltrans (2002) based on three sites in southern California. The column labeled "Significance" is the probability that the mean influent and effluent EMCs are not significantly different based on an analysis of variance.

The removal of sediment and dissolved metals was comparable to that observed in much more complex controls. Reduction in nitrogen was not significant and all of the sites exported phosphorus for the entire study period. This may have been the result of using salt grass, a warm weather species that is dormant during the wet season, and which leaches phosphorus when dormant.

Another Caltrans study (unpublished) of vegetated highway shoulders as buffer strips also found substantial reductions often within a very short distance of the edge of pavement. Figure 1 presents a box and whisker plot of the concentrations of TSS in highway runoff after traveling various distances (shown in meters) through a vegetated filter strip with a slope of about 10%. One can see that the TSS median concentration reaches an irreducible minimum concentration of about 20 mg/L within 5 meters of the pavement edge.

Table 1 Pollutant Reduction in a Vegetated Buffer Strip

Constituent	Mean EMC		Removal %	Significance
	Influent (mg/L)	Effluent (mg/L)		P
TSS	119	31	74	<0.000
NO_3-N	0.67	0.58	13	0.367
TKN-N	2.50	2.10	16	0.542
Total N[a]	3.17	2.68	15	-
Dissolved P	0.15	0.46	-206	0.047
Total P	0.42	0.62	-52	0.035
Total Cu	0.058	0.009	84	<0.000
Total Pb	0.046	0.006	88	<0.000
Total Zn	0.245	0.055	78	<0.000
Dissolved Cu	0.029	0.007	77	0.004
Dissolved Pb	0.004	0.002	66	0.006
Dissolved Zn	0.099	0.035	65	<0.000



Filter strips also exhibit good removal of litter and other floatables because the water depth in these systems is well below the vegetation height and consequently these materials are not easily transported through them. Unfortunately little attenuation of peak runoff rates and volumes (particularly for larger events) is normally observed, depending on the soil properties. Therefore it may be prudent to follow the strips with another practice than can reduce flooding and channel erosion downstream.

Siting Criteria

The use of buffer strips is limited to gently sloping areas where the vegetative cover is robust and diffuse, and where shallow flow characteristics are possible. The practical water quality benefits can be effectively eliminated with the occurrence of significant erosion or when flow concentration occurs across the vegetated surface. Slopes should not exceed 15 percent or be less than 1 percent. The vegetative surface should extend across the full width of the area being drained. The upstream boundary of the filter should be located contiguous to the developed area. Use of a level spreading device (vegetated berm, sawtooth concrete border, rock trench, etc) to facilitate overland sheet flow is not normally recommended because of maintenance considerations and the potential for standing water.

Filter strips are applicable in most regions, but are restricted in some situations because they consume a large amount of space relative to other practices. Filter strips are best suited to treating runoff from roads and highways, roof downspouts, small parking lots, and pervious surfaces. They are also ideal components of the "outer zone" of a stream buffer or as pretreatment to a structural practice. In arid areas, however, the cost of irrigating the grass on the practice will most likely outweigh its water quality benefits, although aesthetic considerations may be sufficient to overcome this constraint. Filter strips are generally impractical in ultra-urban areas where little pervious surface exists.

Some cold water species, such as trout, are sensitive to changes in temperature. While some treatment practices, such as wet ponds, can warm stormwater substantially, filter strips do not are not expected to increase stormwater temperatures. Thus, these practices are good for protection of cold-water streams.

Filter strips should be separated from the ground water by between 2 and 4 ft to prevent contamination and to ensure that the filter strip does not remain wet between storms.

Additional Design Guidelines

Filter strips appear to be a minimal design practice because they are basically no more than a grassed slope. In general the slope of the strip should not exceed 15fc% and the strip should be at least 15 feet long to provide water quality treatment. Both the top and toe of the slope should be as flat as possible to encourage sheet flow and prevent erosion. The top of the strip should be installed 2-5 inches below the adjacent pavement, so that vegetation and sediment accumulation at the edge of the strip does not prevent runoff from entering.

A major question that remains unresolved is how large the drainage area to a strip can be. Research has conclusively demonstrated that these are effective on roadside shoulders, where the contributing area is about twice the buffer area. They have also been installed on the perimeter of large parking lots where they performed fairly effectively; however much lower slopes may be needed to provide adequate water quality treatment.

The filter area should be densely vegetated with a mix of erosion-resistant plant species that effectively bind the soil. Native or adapted grasses, shrubs, and trees are preferred because they generally require less fertilizer and are more drought resistant than exotic plants. Runoff flow velocities should not exceed about 1 fps across the vegetated surface.

For engineered vegetative strips, the facility surface should be graded flat prior to placement of vegetation. Initial establishment of vegetation requires attentive care including appropriate watering, fertilization, and prevention of excessive flow across the facility until vegetation completely covers the area and is well established. Use of a permanent irrigation system may help provide maximal water quality performance.

In cold climates, filter strips provide a convenient area for snow storage and treatment. If used for this purpose, vegetation in the filter strip should be salt-tolerant (e.g., creeping bentgrass), and a maintenance schedule should include the removal of sand built up at the bottom of the slope. In arid or semi-arid climates, designers should specify drought-tolerant grasses to minimize irrigation requirements.

Maintenance

Filter strips require mainly vegetation management; therefore little special training is needed for maintenance crews. Typical maintenance activities and frequencies include:

- Inspect strips at least twice annually for erosion or damage to vegetation, preferably at the end of the wet season to schedule summer maintenance and before major fall run-off to be sure the strip is ready for winter. However, additional inspection after periods of heavy run-off is most desirable. The strip should be checked for debris and litter and areas of sediment accumulation.

- Recent research on biofiltration swales, but likely applicable to strips (Colwell et al., 2000), indicates that grass height and mowing frequency have little impact on pollutant removal;

consequently, mowing may only be necessary once or twice a year for safety and aesthetics or to suppress weeds and woody vegetation.

- Trash tends to accumulate in strip areas, particularly along highways. The need for litter removal should be determined through periodic inspection but litter should always be removed prior to mowing.
- Regularly inspect vegetated buffer strips for pools of standing water. Vegetated buffer strips can become a nuisance due to mosquito breeding in level spreaders (unless designed to dewater completely in 48-72 hours), in pools of standing water if obstructions develop (e.g. debris accumulation, invasive vegetation), and/or if proper drainage slopes are not implemented and maintained.

Cost

Construction Cost

Little data is available on the actual construction costs of filter strips. One rough estimate can be the cost of seed or sod, which is approximately 30¢ per ft^2 for seed or 70¢ per ft^2 for sod. This amounts to between $13,000 and $30,000 per acre of filter strip. This cost is relatively high compared with other treatment practices. However, the grassed area used as a filter strip may have been seeded or sodded even if it were not used for treatment. In these cases, the only additional cost is the design. Typical maintenance costs are about $350/acre/year (adapted from SWRPC, 1991). This cost is relatively inexpensive and, again, might overlap with regular landscape maintenance costs.

The true cost of filter strips is the land they consume. In some situations this land is available as wasted space beyond back yards or adjacent to roadsides, but this practice is cost-prohibitive when land prices are high and land could be used for other purposes.

Maintenance Cost

Maintenance of vegetated buffer strips consists mainly of vegetation management (mowing, irrigation if needed, weeding) and litter removal. Consequently the costs are quite variable depending on the frequency of these activities and the local labor rate.

References and Sources of Additional Information

Caltrans, 2002, BMP Retrofit Pilot Program Proposed Final Report, Rpt. CTSW-RT-01-050, California Dept. of Transportation, Sacramento, CA.

Center for Watershed Protection (CWP). 1996. *Design of Stormwater Filtering Systems*. Prepared for Chesapeake Research Consortium, Solomons, MD, and EPA Region V, Chicago, IL.

Desbonette, A., P. Pogue, V. Lee, and N. Wolff. 1994. *Vegetated Buffers in the Coastal Zone: A Summary Review and Bibliography*. Coastal Resources Center. University of Rhode Island, Kingston, RI.

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Information Resources

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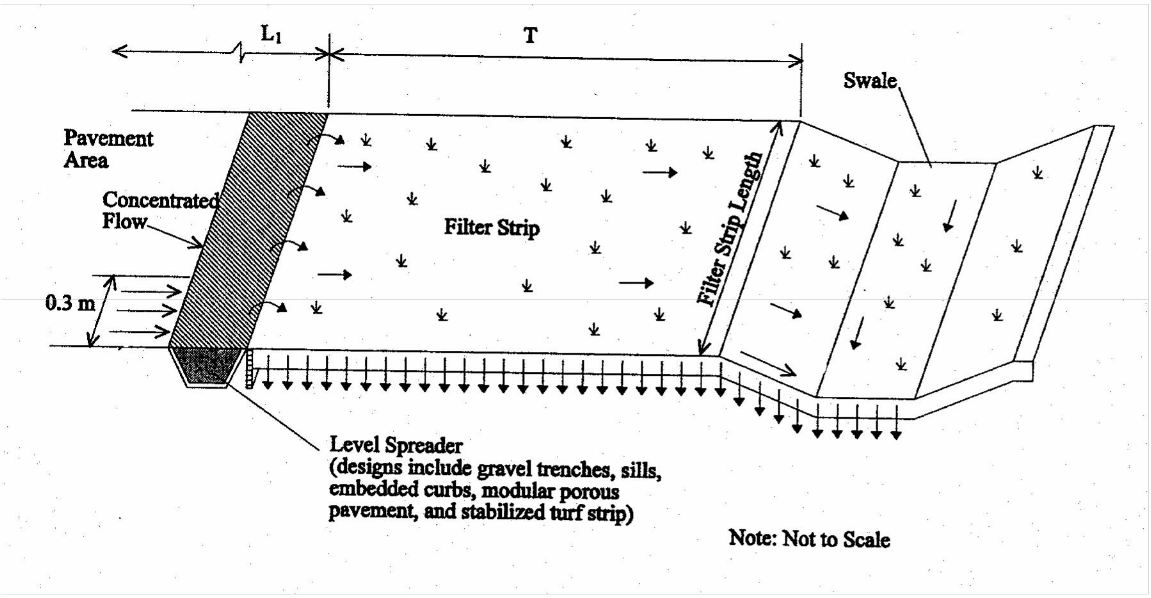
Maryland Department of the Environment (MDE). 2000. *Maryland Stormwater Design Manual*. http://www.mde.state.md.us/environment/wma/stormwatermanual. Accessed May 22, 2001.


L₁
T
Swale
Pavement Area
Concentrated Flow
Filter Strip
Filter Strip Length
0.3 m
Level Spreader
(designs include gravel trenches, sills, embedded curbs, modular porous pavement, and stabilized turf strip)
Note: Not to Scale

Drain Inserts MP-52

Description

Drain inserts are manufactured filters or fabric placed in a drop inlet to remove sediment and debris. There are a multitude of inserts of various shapes and configurations, typically falling into one of three different groups: socks, boxes, and trays. The sock consists of a fabric, usually constructed of polypropylene. The fabric may be attached to a frame or the grate of the inlet holds the sock. Socks are meant for vertical (drop) inlets. Boxes are constructed of plastic or wire mesh. Typically a polypropylene "bag" is placed in the wire mesh box. The bag takes the form of the box. Most box products are one box; that is, the setting area and filtration through media occur in the same box. Some products consist of one or more trays or mesh grates. The trays may hold different types of media. Filtration media vary by manufacturer. Types include polypropylene, porous polymer, treated cellulose, and activated carbon.

California Experience

The number of installations is unknown but likely exceeds a thousand. Some users have reported that these systems require considerable maintenance to prevent plugging and bypass.

Advantages

- Does not require additional space as inserts as the drain inlets are already a component of the standard drainage systems.
- Easy access for inspection and maintenance.
- As there is no standing water, there is little concern for mosquito breeding.
- A relatively inexpensive retrofit option.

Limitations

Performance is likely significantly less than treatment systems that are located at the end of the drainage system such as ponds and vaults. Usually not suitable for large areas or areas with trash or leaves than can plug the insert.

Design and Sizing Guidelines

Refer to manufacturer's guidelines. Drain inserts come any many configurations but can be placed into three general groups: socks, boxes, and trays. The sock consists of a fabric, usually constructed of polypropylene. The fabric may be attached to a frame or the grate of the inlet holds the sock. Socks are meant for vertical (drop) inlets. Boxes are constructed of plastic or wire mesh. Typically a polypropylene "bag" is placed in the wire mesh box. The bag takes the form of the box. Most box products are

Design Considerations

- Use with other BMPs
- Fit and Seal Capacity within Inlet

Targeted Constituents

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

Removal Effectiveness

See New Development and Redevelopment Handbook-Section 5.

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one box; that is, the setting area and filtration through media occurs in the same box. One manufacturer has a double-box. Stormwater enters the first box where setting occurs. The stormwater flows into the second box where the filter media is located. Some products consist of one or more trays or mesh grates. The trays can hold different types of media. Filtration media vary with the manufacturer: types include polypropylene, porous polymer, treated cellulose, and activated carbon.

Construction/Inspection Considerations

Be certain that installation is done in a manner that makes certain that the stormwater enters the unit and does not leak around the perimeter. Leakage between the frame of the insert and the frame of the drain inlet can easily occur with vertical (drop) inlets.

Performance

Few products have performance data collected under field conditions.

Siting Criteria

It is recommended that inserts be used only for retrofit situations or as pretreatment where other treatment BMPs presented in this section area used.

Additional Design Guidelines

Follow guidelines provided by individual manufacturers.

Maintenance

Likely require frequent maintenance, on the order of several times per year.

Cost

- The initial cost of individual inserts ranges from less than $100 to about $2,000. The cost of using multiple units in curb inlet drains varies with the size of the inlet.

- The low cost of inserts may tend to favor the use of these systems over other, more effective treatment BMPs. However, the low cost of each unit may be offset by the number of units that are required, more frequent maintenance, and the shorter structural life (and therefore replacement).

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Interagency Catch Basin Insert Committee, Evaluation of Commercially-Available Catch Basin Inserts for the Treatment of Stormwater Runoff from Developed Sites, 1995

Larry Walker Associates, June 1998, NDMP Inlet/In-Line Control Measure Study Report

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Parking Area Maintenance SC-43

Description

Parking lots 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 areas and include using good housekeeping practices, following appropriate cleaning BMPs, and training employees.

BMPs for other outdoor areas on site (loading/unloading, material storage, and equipment operations) are described in SC-30 through SC-33.

Approach

The goal of this program is to ensure stormwater pollution prevention practices are considered when conducting activities on or around parking 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.

General Pollution Prevention Protocols

☐ Encourage advanced designs and maintenance strategies for impervious parking lots. Refer to the treatment control BMP fact sheets in this manual for additional information.

☐ Keep accurate maintenance logs to evaluate BMP implementation.

Good Housekeeping

☐ Keep all parking areas clean and orderly. Remove debris, litter, and sediments in a timely fashion.

☐ Post "No Littering" signs and enforce anti-litter laws.

Objectives

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

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

Minimum BMPs Covered

Good Housekeeping	✓
Preventative Maintenance	✓
Spill and Leak Prevention and Response	✓
Material Handling & Waste Management	
Erosion and Sediment Controls	
Employee Training Program	✓
Quality Assurance Record Keeping	✓

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- ☐ Provide an adequate number of litter receptacles.
- ☐ Clean out and cover litter receptacles frequently to prevent spillage.

Preventative Maintenance

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.

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.
- ☐ Dispose of parking lot sweeping debris and dirt at a landfill.
- ☐ 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.
- ☐ 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.
  - ✓ Dispose of spilled materials and absorbents appropriately.

Surface Repair

- ☐ Check local ordinance for SUSMP/LID ordinance.
- ☐ 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 during sweeping 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.

Spill Response and Prevention Procedures

☐ 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.

Employee Training Program

☐ 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.

☐ Use a training log or similar method to document training.

Quality Assurance and Record Keeping

☐ Keep accurate maintenance logs that document minimum BMP activities performed for parking area maintenance, types and quantities of waste disposed of, and any improvement actions.

☐ Keep accurate logs of spill response actions that document what was spilled, how it was cleaned up, and how the waste was disposed.

☐ Establish procedures to complete logs and file them in the central office.

Potential Capital Facility Costs and Operation & Maintenance Requirements

Facilities

☐ Capital investments may be required at some sites to purchase sweeping equipment, train sweeper operators, install oil/water/sand separators, or implement advanced BMPs. These costs can vary significantly depending upon site conditions and the amount of BMPs required.

Maintenance

☐ Sweep and clean parking lots regularly to minimize pollutant transport into storm drains from stormwater runoff.

☐ Clean out oil/water/sand separators regularly, especially after heavy storms.

☐ Maintain advanced BMPs such as vegetated swales, infiltration trenches, or detention basins as appropriate. Refer to the treatment control fact sheets for more information.

Supplemental Information

Advanced BMPs

Some parking areas may require advanced BMPs to further reduce pollutants in stormwater runoff, and a few examples are listed below. Refer to the Treatment Control Fact Sheets and the New Development and Redevelopment Manual for more information.

☐ When possible, direct 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.

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Sacramento Stormwater Management Program. *Best Management Practices for Industrial Storm Water Pollution Control*. Available online at: http://www.msa.saccounty.net/sactostormwater/documents/guides/industrial-BMP-manual.pdf.

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

US EPA. *Post-Construction Stormwater Management in New Development and Redevelopment*. BMP Fact Sheets. Available online at: http://cfpub.epa.gov/npdes/stormwater/menuofbmps/index.cfm?action=min_measure&min_measure_id=5.

Infiltration Basin TC-11

Description

An infiltration basin is a shallow impoundment that is designed to infiltrate stormwater. Infiltration basins use the natural filtering ability of the soil to remove pollutants in stormwater runoff. Infiltration facilities store runoff until it gradually exfiltrates through the soil and eventually into the water table. This practice has high pollutant removal efficiency and can also help recharge groundwater, thus helping to maintain low flows in stream systems. Infiltration basins can be challenging to apply on many sites, however, because of soils requirements. In addition, some studies have shown relatively high failure rates compared with other management practices.

California Experience

Infiltration basins have a long history of use in California, especially in the Central Valley. Basins located in Fresno were among those initially evaluated in the National Urban Runoff Program and were found to be effective at reducing the volume of runoff, while posing little long-term threat to groundwater quality (EPA, 1983; Schroeder, 1995). Proper siting of these devices is crucial as underscored by the experience of Caltrans in siting two basins in Southern California. The basin with marginal separation from groundwater and soil permeability failed immediately and could never be rehabilitated.

Advantages

- Provides 100% reduction in the load discharged to surface waters.
- The principal benefit of infiltration basins is the approximation of pre-development hydrology during which a

Design Considerations

- Soil for Infiltration
- Slope
- Aesthetics

Targeted Constituents

☑	Sediment	■
☑	Nutrients	■
☑	Trash	■
☑	Metals	■
☑	Bacteria	■
☑	Oil and Grease	■
☑	Organics	■

Legend ***(Removal Effectiveness)***

● Low ■ High

▲ Medium

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significant portion of the average annual rainfall runoff is infiltrated and evaporated rather than flushed directly to creeks.

- If the water quality volume is adequately sized, infiltration basins can be useful for providing control of channel forming (erosion) and high frequency (generally less than the 2-year) flood events.

Limitations

- May not be appropriate for industrial sites or locations where spills may occur.
- Infiltration basins require a minimum soil infiltration rate of 0.5 inches/hour, not appropriate at sites with Hydrologic Soil Types C and D.
- If infiltration rates exceed 2.4 inches/hour, then the runoff should be fully treated prior to infiltration to protect groundwater quality.
- Not suitable on fill sites or steep slopes.
- Risk of groundwater contamination in very coarse soils.
- Upstream drainage area must be completely stabilized before construction.
- Difficult to restore functioning of infiltration basins once clogged.

Design and Sizing Guidelines

- Water quality volume determined by local requirements or sized so that 85% of the annual runoff volume is captured.
- Basin sized so that the entire water quality volume is infiltrated within 48 hours.
- Vegetation establishment on the basin floor may help reduce the clogging rate.

Construction/Inspection Considerations

- Before construction begins, stabilize the entire area draining to the facility. If impossible, place a diversion berm around the perimeter of the infiltration site to prevent sediment entrance during construction or remove the top 2 inches of soil after the site is stabililized. Stabilize the entire contributing drainage area, including the side slopes, before allowing any runoff to enter once construction is complete.
- Place excavated material such that it can not be washed back into the basin if a storm occurs during construction of the facility.
- Build the basin without driving heavy equipment over the infiltration surface. Any equipment driven on the surface should have extra-wide ("low pressure") tires. Prior to any construction, rope off the infiltration area to stop entrance by unwanted equipment.
- After final grading, till the infiltration surface deeply.
- Use appropriate erosion control seed mix for the specific project and location.

Performance

As water migrates through porous soil and rock, pollutant attenuation mechanisms include precipitation, sorption, physical filtration, and bacterial degradation. If functioning properly, this approach is presumed to have high removal efficiencies for particulate pollutants and moderate removal of soluble pollutants. Actual pollutant removal in the subsurface would be expected to vary depending upon site-specific soil types. This technology eliminates discharge to surface waters except for the very largest storms; consequently, complete removal of all stormwater constituents can be assumed.

There remain some concerns about the potential for groundwater contamination despite the findings of the NURP and Nightingale (1975; 1987a,b,c; 1989). For instance, a report by Pitt et al. (1994) highlighted the potential for groundwater contamination from intentional and unintentional stormwater infiltration. That report recommends that infiltration facilities not be sited in areas where high concentrations are present or where there is a potential for spills of toxic material. Conversely, Schroeder (1995) reported that there was no evidence of groundwater impacts from an infiltration basin serving a large industrial catchment in Fresno, CA.

Siting Criteria

The key element in siting infiltration basins is identifying sites with appropriate soil and hydrogeologic properties, which is critical for long term performance. In one study conducted in Prince George's County, Maryland (Galli, 1992), all of the infiltration basins investigated clogged within 2 years. It is believed that these failures were for the most part due to allowing infiltration at sites with rates of less than 0.5 in/hr, basing siting on soil type rather than field infiltration tests, and poor construction practices that resulted in soil compaction of the basin invert.

A study of 23 infiltration basins in the Pacific Northwest showed better long-term performance in an area with highly permeable soils (Hilding, 1996). In this study, few of the infiltration basins had failed after 10 years. Consequently, the following guidelines for identifying appropriate soil and subsurface conditions should be rigorously adhered to.

- Determine soil type (consider RCS soil type 'A, B or C' only) from mapping and consult USDA soil survey tables to review other parameters such as the amount of silt and clay, presence of a restrictive layer or seasonal high water table, and estimated permeability. The soil should not have more than 30% clay or more than 40% of clay and silt combined. Eliminate sites that are clearly unsuitable for infiltration.

- Groundwater separation should be at least 3 m from the basin invert to the measured ground water elevation. There is concern at the state and regional levels of the impact on groundwater quality from infiltrated runoff, especially when the separation between groundwater and the surface is small.

- Location away from buildings, slopes and highway pavement (greater than 6 m) and wells and bridge structures (greater than 30 m). Sites constructed of fill, having a base flow or with a slope greater than 15% should not be considered.

- Ensure that adequate head is available to operate flow splitter structures (to allow the basin to be offline) without ponding in the splitter structure or creating backwater upstream of the splitter.

- Base flow should not be present in the tributary watershed.

Secondary Screening Based on Site Geotechnical Investigation

- At least three in-hole conductivity tests shall be performed using USBR 7300-89 or Bouwer-Rice procedures (the latter if groundwater is encountered within the boring), two tests at different locations within the proposed basin and the third down gradient by no more than approximately 10 m. The tests shall measure permeability in the side slopes and the bed within a depth of 3 m of the invert.

- The minimum acceptable hydraulic conductivity as measured in any of the three required test holes is 13 mm/hr. If any test hole shows less than the minimum value, the site should be disqualified from further consideration.

- Exclude from consideration sites constructed in fill or partially in fill unless no silts or clays are present in the soil boring. Fill tends to be compacted, with clays in a dispersed rather than flocculated state, greatly reducing permeability.

- The geotechnical investigation should be such that a good understanding is gained as to how the stormwater runoff will move in the soil (horizontally or vertically) and if there are any geological conditions that could inhibit the movement of water.

Additional Design Guidelines

(1) Basin Sizing - The required water quality volume is determined by local regulations or sufficient to capture 85% of the annual runoff.

(2) Provide pretreatment if sediment loading is a maintenance concern for the basin.

(3) Include energy dissipation in the inlet design for the basins. Avoid designs that include a permanent pool to reduce opportunity for standing water and associated vector problems.

(4) Basin invert area should be determined by the equation:

$$A = \frac{WQV}{kt}$$

where A = Basin invert area (m^2)

WQV = water quality volume (m^3)

k = 0.5 times the lowest field-measured hydraulic conductivity (m/hr)

t = drawdown time (48 hr)

(5) The use of vertical piping, either for distribution or infiltration enhancement shall not be allowed to avoid device classification as a Class V injection well per 40 CFR146.5(e)(4).

Maintenance

Regular maintenance is critical to the successful operation of infiltration basins. Recommended operation and maintenance guidelines include:

- Inspections and maintenance to ensure that water infiltrates into the subsurface completely (recommended infiltration rate of 72 hours or less) and that vegetation is carefully managed to prevent creating mosquito and other vector habitats.

- Observe drain time for the design storm after completion or modification of the facility to confirm that the desired drain time has been obtained.

- Schedule semiannual inspections for beginning and end of the wet season to identify potential problems such as erosion of the basin side slopes and invert, standing water, trash and debris, and sediment accumulation.

- Remove accumulated trash and debris in the basin at the start and end of the wet season.

- Inspect for standing water at the end of the wet season.

- Trim vegetation at the beginning and end of the wet season to prevent establishment of woody vegetation and for aesthetic and vector reasons.

- Remove accumulated sediment and regrade when the accumulated sediment volume exceeds 10% of the basin.

- If erosion is occurring within the basin, revegetate immediately and stabilize with an erosion control mulch or mat until vegetation cover is established.

- To avoid reversing soil development, scarification or other disturbance should only be performed when there are actual signs of clogging, rather than on a routine basis. Always remove deposited sediments before scarification, and use a hand-guided rotary tiller, if possible, or a disc harrow pulled by a very light tractor.

Cost

Infiltration basins are relatively cost-effective practices because little infrastructure is needed when constructing them. One study estimated the total construction cost at about $2 per ft (adjusted for inflation) of storage for a 0.25-acre basin (SWRPC, 1991). As with other BMPs, these published cost estimates may deviate greatly from what might be incurred at a specific site. For instance, Caltrans spent about $18/ft^3 for the two infiltration basins constructed in southern California, each of which had a water quality volume of about 0.34 ac.-ft. Much of the higher cost can be attributed to changes in the storm drain system necessary to route the runoff to the basin locations.

Infiltration basins typically consume about 2 to 3% of the site draining to them, which is relatively small. Additional space may be required for buffer, landscaping, access road, and fencing. Maintenance costs are estimated at 5 to 10% of construction costs.

One cost concern associated with infiltration practices is the maintenance burden and longevity. If improperly maintained, infiltration basins have a high failure rate. Thus, it may be necessary to replace the basin with a different technology after a relatively short period of time.

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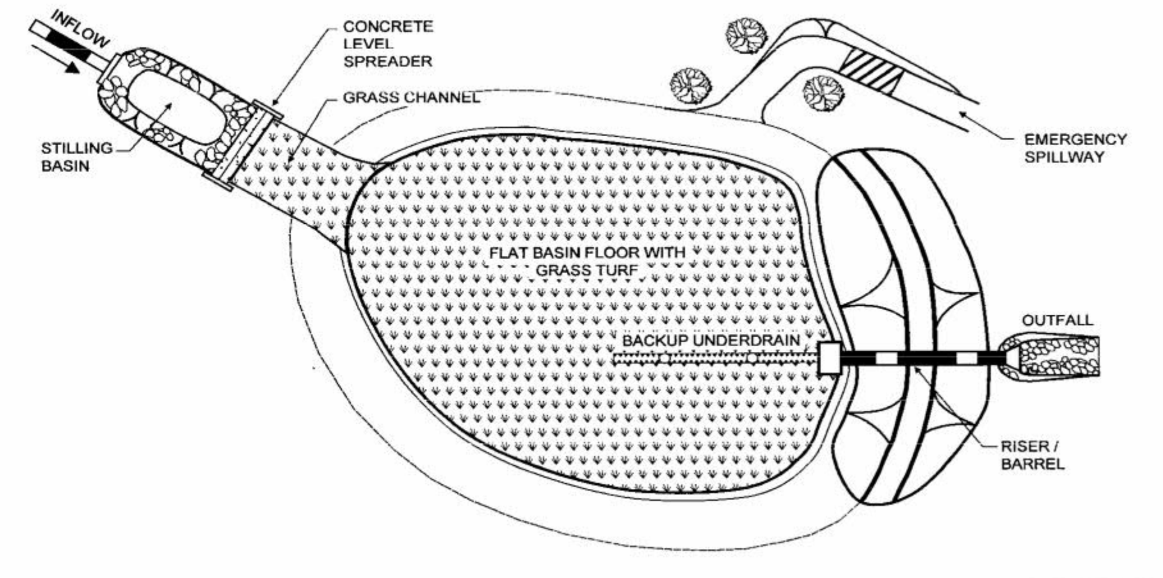

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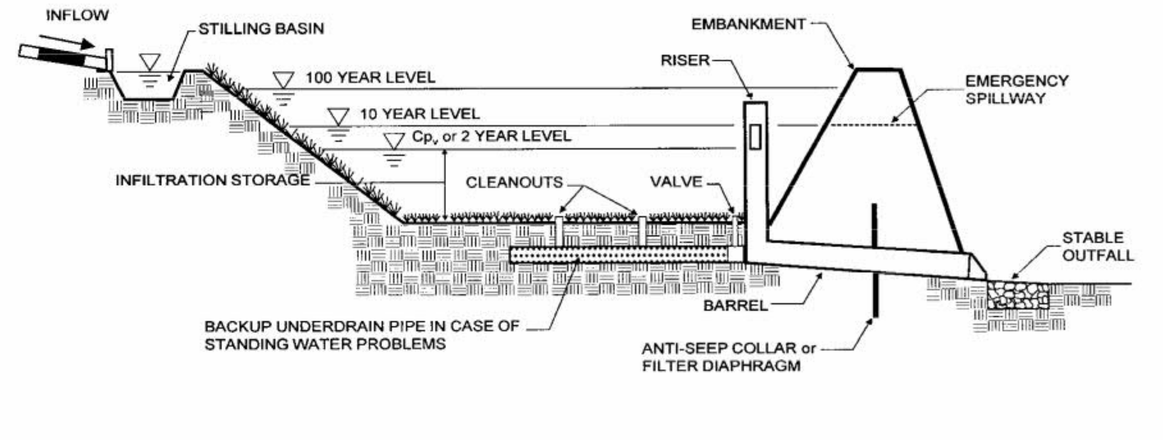

PROFILE