APPENDIX G2

Preliminary Project Specific
Water Quality Management Plan

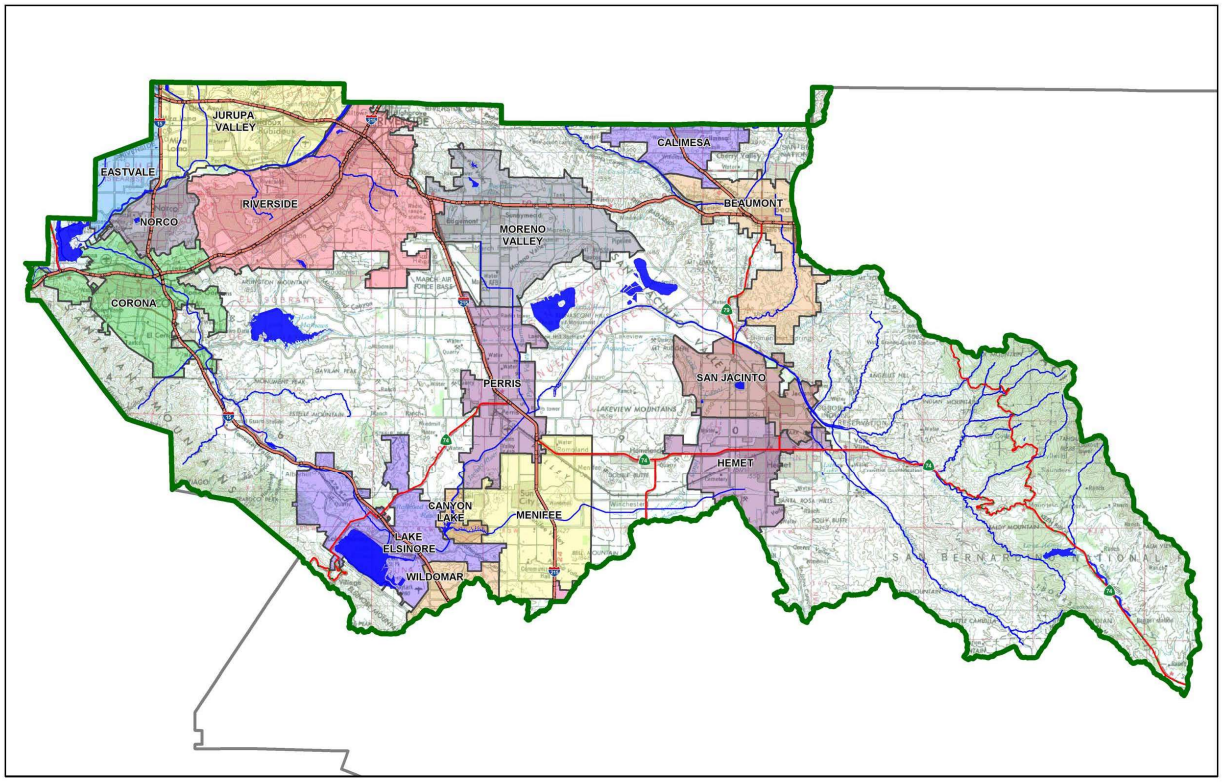
Project Specific Water Quality Management Plan

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

Project Title: JD Ranch – Norco Site

Development No: Tentative Tract No. 38330

Design Review/Case No: N/A



☒ **Preliminary**
☐ **Final**

Original Date Prepared: 04/01/22

Revision Date(s): 02/16/24

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

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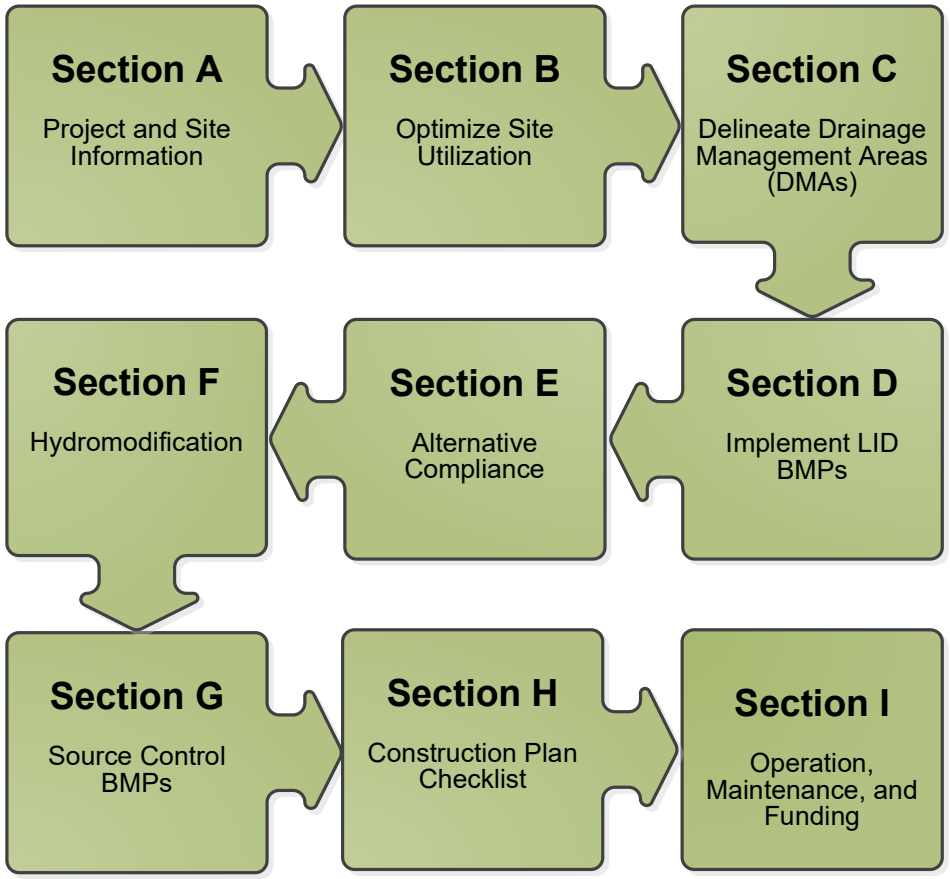
A Brief Introduction

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 TACRD Investment, L.P. by MDS Consulting for the JD Ranch project.

This WQMP is intended to comply with the requirements of Riverside County for Ordinance No. 754.2 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 No 754.2.

"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: 2.16.24
Tom Dallape Owner's Printed Name	Owner 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	February 16, 2024 Date
Ed Lenth, PE Preparer's Printed Name	Principal Preparer's Title/Position

Preparer's Licensure:

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Section A: Project and Site Information

PROJECT INFORMATION	
Type of Project:	Residential
Planning Area:	Open Space
Community Name:	JD Ranch
Development Name:	JD Ranch
PROJECT LOCATION	
Latitude & Longitude (DMS): 33° 55’ 10.34” N -117° 35’ 36.37” W	
Project Watershed and Sub-Watershed: Santa Ana River Watershed: River Reach 3	
Gross Acres: 38.48 ac APN(s): 121-110-001 & 121-110-003	
Map Book and Page No.: Thomas Bros Map Page 713 Grid A6	
PROJECT CHARACTERISTICS	
Proposed or Potential Land Use(s)	Single Family Residential
Proposed or Potential SIC Code(s)	152101
Area of Impervious Project Footprint (SF)	0 SF
Total Area of proposed Impervious Surfaces within the Project Footprint (SF)/or Replacement	581,179 SF
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 existing Impervious Surfaces within the Project limits Footprint (SF)	78,750 SF
Is the project located within any MSHCP Criteria Cell?	☐ Y ☒ N
If so, identify the Cell number:	N/A
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)	B, C, & D
What is the Water Quality Design Storm Depth for the project?	0.80 in

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
Santa Ana River Reach 3	Copper (78216), Indicator Bacteria (97066), Lead (100184)	MUN, AGR, IND, PROC, GWR, NAV, POW, REC1, REC 2, COMM, WARM, COLD, BIOL, WILD, RARE, SPWN, MAR, and SHEL.	48 Miles
Santa Ana River Reach 2	Indicator Bacteria	AGR, GWR, REC1, REC2, WARM, WILD, RARE	52 Miles
Santa Ana River Reach 1	None	REC1, REC2, WARM, WILD	N/A
Pacific Ocean	None	IND, NAV, REC1, REC2, COMM, WILD, RARE, SPWN, MAR, SHEL	N/A

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)*	☐ 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?

In the existing condition the site is open space and operates as a dairy farm. The site is relatively flat, and slopes from the north east to the southwest. The proposed condition involves full development of the property as a residential housing tract. The project will maintain the direction of flow as much as possible, and the runoff will be directed to a water quality basin before entering the Santa Ana River.

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

Presently, dense vegetation or areas of well-established vegetation do not exist. However, 7.20 Acres of open space will be deeded to the city of Norco to remain as is.

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

Natural Infiltration was preserved where possible. Native soil will remain wherever possible, and a natural park will be deeded to the city where the soil and natural landscape will remain. Future basin location and Landscaped areas will be staked to prevent potential compaction of natural soils during construction.

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

Yes. Width of roads and sidewalks are as narrow as possible per City of Norco standards. Landscape will be utilized when possible.

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

Yes. All runoff drains to Water Quality basin via an on-site storm drain system. Project will be able to drain to adjacent pervious area within each residential lot since the project is zoned as single family residential and each lot has pervious area.

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-A	Mixed Use	1,128,579	Type "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)
N/A	N/A	N/A	N/A

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) [A]	Storm Depth (inches) [B]	DMA Name / ID	[C] from Table C.4 = [C]	Required Retention Depth (inches) [D]
N/A	N/A	N/A	N/A	N/A	N/A	N/A

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

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]
N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Table C.5 Type 'D', Areas Draining to BMPs

DMA Name or ID	BMP Name or ID
DMA A	Infiltration Basin "A"

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?		X
If Yes, list affected DMAs:		
…have any DMAs located within 100 feet of a water supply well?		X
If Yes, list affected DMAs: Water Supply Well is located 750' away from Infiltration Basin. This satisfies the requirement laid out in Chapter 2 of the TGD and the requirements set forth by the MS4 permit.		
…have any areas identified by the geotechnical report as posing a public safety risk where infiltration of stormwater could have a negative impact?		X
If Yes, list affected DMAs:		
…have measured in-situ infiltration rates of less than 1.6 inches / hour?		X
If Yes, list affected DMAs: infiltration Tests at the proposed basin location were encountered to be 36.4 in/hr. a FOS of 10 was used.		
…have significant cut and/or fill conditions that would preclude in-situ testing of infiltration rates at the final infiltration surface?		X
If Yes, list affected DMAs:		
…geotechnical report identify other site-specific factors that would preclude effective and safe infiltration?		X
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: Insert Area (Acres)

Type of Landscaping (Conservation Design or Active Turf): List Landscaping 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 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: Insert Area (Acres)

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: 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: Insert Area (Acres)

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)
Insert Area (Acres)	Insert Area (Acres)

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: Number of daily Toilet Users

Project Type: Enter 'Residential', 'Commercial', 'Industrial' or 'Schools'

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: Insert Area (Acres)

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: 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: Required 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)**
Insert Area (Acres)	Insert Area (Acres)

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.

Insert narrative description here.

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: Projected Average Daily Use (gpd)

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: Insert Area (Acres)

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: Enter Value

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	
DMA A	☒	☐	☐	☐	☐
	☐	☐	☐	☐	☐
	☐	☐	☐	☐	☐
	☐	☐	☐	☐	☐
	☐	☐	☐	☐	☐
	☐	☐	☐	☐	☐

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.

Project site is feasible for infiltration. Due to the LID hierarchy, no other BMP's were analyzed.

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.

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*		
	[A]		[B]	[C]	[A] x [C]			
DMA-A1(Impervious)	*581180*	*Concrete or Asphalt*	*1*	*.89*	*518413*	*Design Storm Depth (in)*	*Design Capture Volume,* $\mathbf{V_{BMP}}$ *(cubic feet)*	*Proposed Volume on Plans (cubic feet)*
DMA-A2(Pervious)	*547399*	*Ornamental Landscaping*	*.1*	*.11*	*60465*			
	$A_T = \Sigma[A]$	***1128580***			Σ= 578877	0.80 in	38592	***38,600***

[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

Section E: 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.

E.1 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 E.1 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

E.2 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 E.2 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

E.3 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 E.3 Treatment Control BMP Sizing

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

[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

E.4 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 E.4 Treatment Control BMP Selection

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

[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 F: Hydromodification

F.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 F.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:

Santa Ana River Channel (See Appendix 7)

F.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 G: 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 G.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 inlets	Location of inlets/CB shown on WQMP Site Plan 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 ww.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."
Landscape/ Outdoor Pesticide Use	Final landscaping plans will 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. Consider using pest-resistant plants, especially adjacent to hardscape. Consider using pest-resistant plants, especially adjacent to hardscape. To ensure 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" Provide IPM information to new owners, lessees and operators
Plazas, sidewalks, and parking lots.	N/A	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 wash water containing any cleaning agent or degreaser and discharge to the sanitary sewer not to a storm drain.
Pools, spas, ponds, decorative fountains, And other water features.	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/

Vehicle and Equipment Cleaning	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.	Wash water from vehicle and equipment washing operations shall not be discharged to the storm drain system. Refer to "Outdoor Cleaning Activities and Professional Mobile Services Providers" for many of the Potential Sources of Runoff Pollutants categories below. Brochure can be found at http:// rcflood.or/stormwater/
Roofing, gutters, and trim.	Rooftop equipment with potential to produce pollutants shall be roofed and/or have secondary containment. Avoid roofing, gutters, and trim made of copper or other unprotected metals that may leach into runoff.	N/A

Section H: 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 H.1 Construction Plan Cross-reference

BMP No. or ID	BMP Identifier and Description	Corresponding Plan Sheet(s)	BMP Location (Lat/Long)
Basin "A"	Infiltration basin	Tentative Tract Map. 38330 & WQMP Plan Sheet 2	33° 55'06.58" N & -117° 35'47.74" W

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 I: 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: JD Ranch will be responsible for maintenance and Funding until proper turn over to HOA and City of Norco.

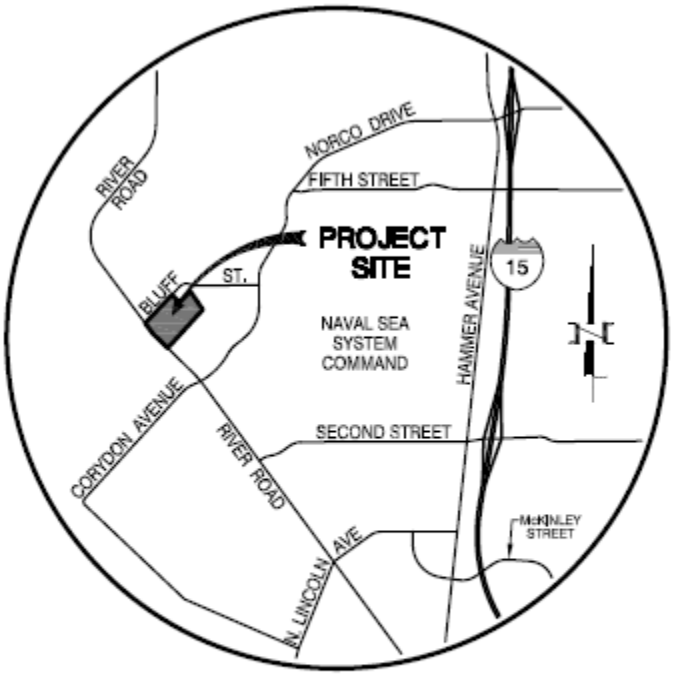
Will the proposed BMPs be maintained by a Home Owners' Association (HOA) or Property Owners Association (POA)?

☒ 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.

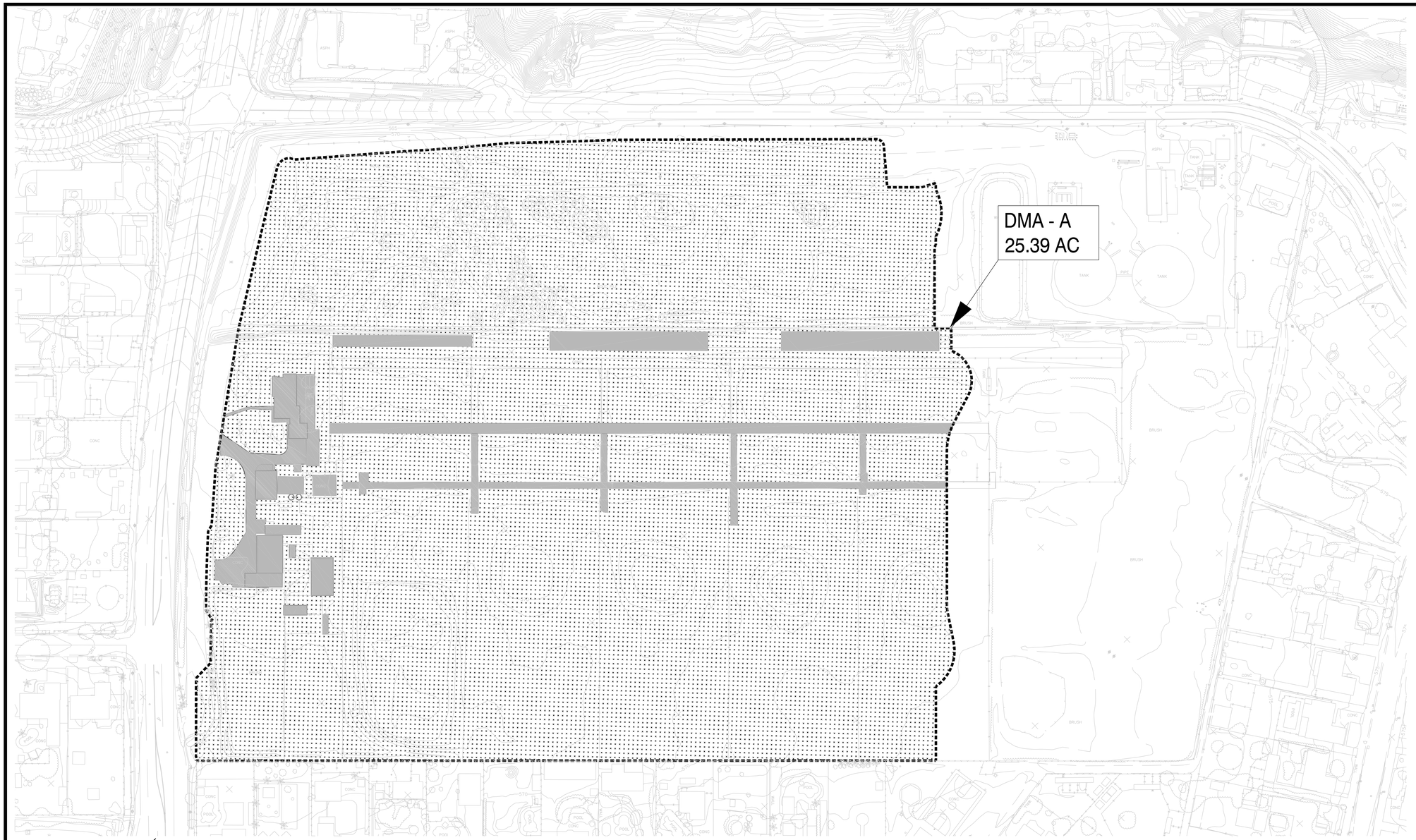
Appendix 1: Maps and Site Plans

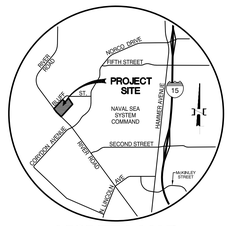
Location Map, WQMP Site Plan and Receiving Waters Map



VICINITY MAP

NOT TO SCALE





VICINITY MAP

NOT TO SCALE

GENERAL INFORMATION

EXISTING LAND USE: UNDEVELOPED, PREVIOUS DAIRY FACILITIES, SINGLE FAMILY RESIDENCE.
EXISTING ZONING: OS (OPEN SPACE)
A-1-20 (AGRICULTURAL - LOW DENSITY (20,000 SF)
EXISTING GENERAL PLAN: RA (RESIDENTIAL AGRICULTURAL)
PL (PUBLIC LAND)
PROPOSED LAND USE: SINGLE-FAMILY RESIDENTIAL, WATER QUALITY BASIN, SEWER LIFT
PROPOSED ZONING: R-1-10 (RESIDENTIAL - SINGLE FAMILY 10,000 SF)
PROPOSED GENERAL PLAN: RL
ADJACENT LAND USES:
NORTH: CITY RESERVOIR FACILITY, VACANT
EAST: SINGLE-FAMILY RESIDENTIAL, PARK
SOUTH: SINGLE-FAMILY RESIDENTIAL, PARK
WEST: SINGLE-FAMILY RESIDENTIAL
PARK REQUIREMENTS TO BE MET BY IN LIEU FEES PER CITY OF NORCO MUNICIPAL CODE SECTION 17.14.08.
SCHOOL DISTRICTS: (CORONA-NORCO UNIFIED SCHOOL DIST.)
ELEMENTARY: WASHINGTON ELEMENTARY
MIDDLE SCHOOL: AUBURNDALE INTERMEDIATE
HIGH SCHOOL: NORCO HIGH SCHOOL
PAD ELEVATIONS SHOWN ON THE TENTATIVE TRACT MAP MAY BE ADJUSTED PLUS OR MINUS 3.0 FEET.
MULTIPLE FINAL MAPS MAY BE FILED PURSUANT TO SECTION 66456.1 OF THE CALIFORNIA GOVERNMENT CODE.
PROPOSED TENTATIVE TRACT 38330 IS NOT WITHIN AN APPROVED SPECIFIC PLAN BOUNDARY.
ALL PROPOSED MANUFACTURED SLOPES SHALL BE CONSTRUCTED AT A MAXIMUM OF 2:1, UNLESS OTHERWISE NOTED ON THE PLAN.
ESTIMATED EARTHWORK QUANTITIES:
ADJUSTED CUT: 171,624 C.Y.
ADJUSTED FILL: 186,190 C.Y.
IMPORT: 14,566 C.Y.
THE PRELIMINARY GEOTECHNICAL/SOILS REPORT WAS PREPARED BY LGC GEOTECHNICAL, INC., JANUARY 21, 2022.
THERE IS ONE EXISTING HABITABLE STRUCTURE THAT IS WITHIN THE BOUNDARIES OF THE PROPOSED TENTATIVE TRACT MAP THAT SHALL REMAIN IN PLACE.
ALL PROPOSED STREETS WITHIN TENTATIVE TRACT 38330 SHALL BE PUBLIC AND SHALL BE DEDICATED AND MAINTAINED BY THE CITY OF NORCO.
THE PROPOSED LANDSCAPE PARKWAYS AND EQUESTRIAN TRAILS WITHIN THE PROPOSED PUBLIC STREETS SHALL BE OWNED AND MAINTAINED BY THE CITY OF NORCO.
THE DEVELOPER (APPLICANT) RESERVES THE RIGHT TO MERGE LOTS ON THE FINAL MAP.
THERE IS ONE ACTIVE WELL, OWNED AND MAINTAINED BY THE CITY OF NORCO, WITHIN THE BOUNDARIES OF THE TENTATIVE TRACT MAP THAT WILL REMAIN IN PLACE.
PROPOSED TENTATIVE TRACT MAP 38330 USES WITHIN ZONE "X" (AREAS DETERMINED TO BE OUTSIDE THE 0.2% ANNUAL CHANCE OF FLOODING) PER F.I.R.M. MAP NO.06065C0697G, DATED AUGUST 28, 2008
PROPOSED TENTATIVE TRACT MAP 38330 CONTAINS PARCELS OWNED BY THE CITY OF NORCO AND BY THOMAS Q. DALLAPE AND DIANE L. DALLAPE, TRUSTEES OF THE DALLAPE FAMILY TRUST AND TACRD INSTRUMENTS. PROPOSED TENTATIVE TRACT MAP 38330 DOES NOT CONTAIN A CONTIGUOUS OWNERSHIP OF LAND BEING SUBDIVIDED.
THOMAS BROTHERS MAP PAGE 38, GRIDS B-4, C-4, B-5 AND B-6, RIVERSIDE COUNTY.
PROPOSED TENTATIVE TRACT MAP 38330 IS NOT WITHIN A COMMUNITY SERVICE DISTRICT.
PROPOSED TENTATIVE TRACT MAP 38330 IS WITHIN THE RIVERSIDE COUNTY FLOOD CONTROL DISTRICT (RCFCD)
PROPOSED TENTATIVE TRACT MAP 38330 IS NOT SUBJECT TO LIQUEFACTION OR OTHER GEOLOGICAL HAZARD AND IS NOT WITHIN A SPECIAL STUDIES ZONE.
TOPOGRAPHIC SURVEY WAS FLOWN AND COMPILED BY DON READ AERIAL CORPORATION ON JUNE 16, 2021.
THERE ARE NO PROPOSED OPEN STORM DRAIN CHANNEL WITHIN THE BOUNDARIES OF THE TENTATIVE TRACT MAP.
PROPOSED TENTATIVE TRACT MAP 38330 IS NOT A GATED COMMUNITY.
PROPOSED VEHICULAR ACCESS SHALL BE RESTRICTED ON RIVER ROAD AND BLUFF STREET.
FINAL DESIGN OF THE TENTATIVE TRACT MAP 38330 SHALL COMPLY WITH N.P.D.E.S. REQUIREMENTS AS OUTLINED BY N.P.D.E.S., SUPPLEMENT NO. 'A'.
PROPOSED LANDSCAPE, SPARE LOTS 'D', E', 'F', ARE PRIVATE AND SHALL BE OWNED AND MAINTAINED BY A LANDSCAPE MAINTENANCE DISTRICT.
PROPOSED TENTATIVE TRACT MAP 38330 IS NOT WITHIN A HIGH FIRE HAZARD AREA.
ALL PROPOSED RESIDENTIAL LOTS SHALL MAINTAIN A 2.0% MINIMUM GRADE FROM REAR YARD TO THE PUBLIC STREET.
THE PROPOSED TENTATIVE TRACT MAP 38330 IS WITHIN THE COUNTY'S 2ND SUPERVISORY DISTRICT.
THE CURRENT PROPERTY ADDRESS IS 2977 RIVER ROAD, NORCO, CA.
THERE ARE NO EXISTING SEWER SYSTEM PIPES WITHIN THE TENTATIVE TRACT MAP BOUNDARIES. THE EXISTING SINGLE FAMILY RESIDENCE TO REMAIN IS SEWERED BY A SEPTIC SYSTEM.
ALL EXISTING ON-SITE CONCRETE PADS SHALL BE REMOVED, AND WHERE POSSIBLE, CRUSHED AND PLACED IN PROPOSED FILL AREAS.
LOT 'A', STORM DETENTION WATER QUALITY AND INFILTRATION BASIN WILL BE OWNED AND MAINTAINED BY A LANDSCAPE MAINTENANCE DISTRICT.
THE EXISTING 60.0' WIDE CALIFORNIA ELECTRIC POWER COMPANY EASEMENT SHALL BE PROTECTED IN PLACE.
PROPOSED KNUCKLES (PUBLIC) SHALL BE DESIGNED PER CITY STANDARD PLAN NO. 145A.
PROPOSED CUL-DE-SACS (PUBLIC) SHALL BE DESIGNED PER CITY STANDARD PLAN NO. 140C.
PROPOSED STREETS WITHIN TENTATIVE TRACT MAP 38330 SHALL BE DESIGNED PER CITY STANDARD PLAN NO. 100.
PROPOSED TENTATIVE TRACT MAP 38330 IS NOT SUBJECT TO FLOOD WATERS, OVERFLOW OR INUNDATION. ALL PROPOSED RESIDENTIAL PADS ARE A MINIMUM OF 2.0' FEET ABOVE THE 577 SANTA ANA FLOOD ELEVATION.
THERE ARE NO REGULATED TREES OR PLANTS IDENTIFIED WITHIN THE TENTATIVE TRACT MAP BOUNDARIES.
PROPOSED STREET TREES SHALL BE PROVIDED ALONG ALL PROPOSED PUBLIC STREETS WITHIN THE TENTATIVE TRACT MAP BOUNDARIES (SEE CONCEPTUAL LANDSCAPE PLANS).
PROPOSED OPEN SPACE LOT 'B' SHALL BE DEEDED IN FEE TO THE CITY OF NORCO FOR OWNERSHIP AND MAINTENANCE.
PROPOSED LOT 'C', EXISTING WELL SITE, SHALL BE OWNED AND MAINTAINED BY THE CITY OF NORCO.
PROPOSED LOT 69, EXISTING SINGLE FAMILY RESIDENCE, SHALL REMAIN IN PLACE.
PROPOSED LOT 70 IS FOR A PROPOSED SEWER LIFT STATION AND WILL BE OWNED AND MAINTAINED BY THE CITY OF NORCO.
PROPOSED STANDARD ROUNDED CURB FOR LOCAL PUBLIC 'A'-'F' PER CITY STANDARD PLAN NO. 205.
PROPOSED CROSS GUTTERS FOR LOCAL STREETS 'A'-'F' PER CITY STANDARD PLAN NO. 225.
PROPOSED HANDICAP RAMP AT THE INTERSECTION OF PROPOSED STREET 'A' AT RIVER ROAD PER CITY STANDARD NO. 235.
RIVER ROAD IMPROVEMENTS PER A MODIFIED CITY STANDARD PLAN NO. 120A.
PROPOSED LOCAL STREETS 'A'-'F' TO BE CONSTRUCTED PER CITY STANDARD NO. 100.
BLUFF STREET IMPROVEMENTS PER A MODIFIED CITY STANDARD NO. 100.

GRAPHIC SCALE
60 0 30 60 120 240
(IN FEET)
1 inch = 60 ft.

DRAINAGE AREA BREAKDOWN

DRAINAGE AREA COLOR CODE	AREA	ACREAGE	SQUARE FOOTAGE	PERCENTAGE
	IMPERVIOUS	1.81	78750	7.1%
	PERVIOUS	23.58	1027411	92.9%

UTILITIES

ELECTRIC:
SOUTHERN CALIFORNIA EDISON
1351 EAST FRANCIS STREET
ONTARIO, CA. 91761
(909) 930-8431

SOLID WASTE:
WASTE MANAGEMENT
800 SOUTH TEMESCAL STREET
JURUPA VALLEY, CA. 92509
(951) 736-0539

CABLE:
CHARTER COMMUNICATIONS
7337 CENTRAL AVE
RIVERSIDE, CA. 92504
(951) 343-4100 EXT. 4156

WATER & SEWER:
CITY OF NORCO
2870 CLARK AVE
NORCO, CA. 92860
(951) 270-5678

GAS:
SOUTHERN CALIFORNIA GAS COMPANY
1981 WEST LUGONIA AVENUE
RANCHO CUCAMONGA, CA. 91730
(909) 335-7715

TELEPHONE:
A.T.&T.
1265 NORTH VAN BUREN STREET
RM. 180
ANAHEIM, CA. 92807
(714) 666-5503

LEGEND

EXISTING STORM DRAIN — SD —
EXISTING GAS LINE — G —
EXISTING WATER LINE — W —
EXISTING UTILITY EASEMENT
PROPOSED STORM DRAIN — SD —
PROPOSED SEWER LINE — SS —
PROPOSED WATER LINE — W —
PROPOSED SEWER MANHOLE
PROPOSED FORCE MAIN — FM —
PROPOSED UTILITY EASEMENT
PROPOSED STREET CENTERLINE
PROPOSED CENTERLINE RADIUS R=150'
PROPOSED TENTATIVE TRACT BOUNDARY
PROPOSED BUILDING SETBACK LINE — BSL —
LIMITS OF GRADING (DAYLIGHT LINE)
PROPOSED LOT NUMBER 67
PROPOSED HIGHEST LOT NUMBER 69
PROPOSED PAD ELEVATION 757.0
PROPOSED STREET ELEVATION 765.5
PROPOSED 2:1 SLOPE
PROPOSED 4:1 SLOPE 4:1
PROPOSED RETAINING WALL 775.0 TRW / 772.0 TF
PROPOSED RETAINING WALL HEIGHT A=2'
PROPOSED STREET LIGHT
PROPOSED FIRE HYDRANT
PROPOSED LIMITED USE AREA
PROPOSED 18' X 32' PAKA
PROPOSED DG EQUESTRIAN TRAIL

DATE:	NO.	REVISIONS

ENGINEER

MDS CONSULTING
MORSE SCHULTZ
17320 Redhill Avenue
Suite 350
Irvine, CA 92614
Voice: 949-251-8821
PLANNERS ENGINEERS SURVEYORS

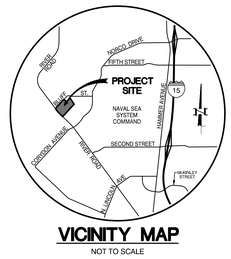
REG'D REGISTERED PROFESSIONAL ENGINEER
EDWARD J. LENTH
No. 052496
EXP. 12-31-22
CIVIL
STATE OF CALIFORNIA

EDWARD J. LENTH RCE 052496
EXP. DATE: DECEMBER 31, 2022

J.D. RANCH
TENTATIVE TRACT NO. 38330
EXISTING CONDITION WQMP PLAN
CITY OF NORCO, COUNTY OF RIVERSIDE, STATE OF CALIFORNIA
SHEET 1 OF 1

TENTATIVE TRACT MAP NO. 37714

I:\90800\DRAINAGE\WQMP\PRELIMINARY\Drawing\90800-WQMP-EXISTING Existing Condition.dwg 4/01/22



LEGEND

DMA - A
25.91 AC — DRAINAGE MANAGEMENT AREA DESIGNATION; DRAINAGE AREA (ACRE)

- CB — CATCHBASIN
- STORMDRAIN PIPE
- DIRECTION OF SURFACE FLOW
- DRAINAGE AREA BOUNDARY
- 69 — PROPOSED HIGHEST LOT NUMBER
- 757.0 — PROPOSED PAD ELEVATION
- 758.5 — PROPOSED STREET ELEVATION
- PROPOSED 2:1 SLOPE
- 4:1 — PROPOSED 4:1 SLOPE
- PROPOSED LIMITED USE AREA
- PROPOSED PAKA
- PROPOSED RESIDENTIAL LOTS (IMPERVIOUS FACTOR 0.55 ASSUMED).
- PROPOSED A.C. PAVEMENT AND CONCRETE CURB & GUTTER
- PROPOSED DECOMPOSED GRANITE EQUESTRIAN TRAIL
- CONCRETE

GRAPHIC SCALE
0 30 60 120
(IN FEET)
1 inch = 60 ft.

STRUCTURAL CONTROL BMP LEGEND:

STRUCTURAL SOURCE CONTROL BMPS

- A — MS4 STENCILING AND SIGNAGE (CASQA BMP SD-13)
- B — LANDSCAPE AND IRRIGATION SYSTEM DESIGN (CASQA BMP SD-12, TYPICAL FOR ALL LANDSCAPED AREAS)
- C — PROTECT SLOPES AND CHANNELS (TYPICAL FOR ALL SLOPE AREAS)

STRUCTURAL TREATMENT CONTROL BMPS

- D — INFILTRATION

DRAINAGE AREA AND BMP SUMMARY

DRAINAGE AREA DESIGNATION	DRAINAGE AREA ACREAGE	IMPERVIOUS PERCENTAGE	BMP DESIGNATION	BMP PROPOSED	TREATMENT VOLUME Vbmp (CU-FT)	VOLUME PROVIDED IN BMP (CU-FT)
DA-A	25.91	53.4%	BMP 1	INFILTRATION BASIN	38,590	38,600

OWNER

THOMAS G. DALLAPE & DIANE L. DALLAPE, TRUSTEES OF THE DALLAPE FAMILY TRUST, DATED NOVEMBER 18,1993
TACRD INVESTMENT, L.P.
C/O. TOM DALLAPE
18881 VON KARMAN AVENUE
SUITE 150
IRVINE, CA. 92612
(949) 553-2020

APPLICANT/DEVELOPER

TACRD INVESTMENT L.P.
THE HOFFMAN COMPANY
18881 VON KARMAN AVENUE
SUITE 150
IRVINE, CA. 92612
(949) 553-2020
ATTN: TOM DALLAPE

ENGINEER

MDS CONSULTING
17320 REDHILL AVENUE
SUITE 350
IRVINE, CA. 92614
PHONE: (949) 251-8821
ATTN: BOB ZOLLER

DATE:	NO.	REVISIONS

ENGINEER

MDS CONSULTING
5 PETERS CANYON ROAD
SUITE 305
IRVINE, CA 92606
(949) 251-8821
WWW.MDSCONSULTING.NET
PLANNERS ENGINEERS SURVEYORS

REGISTERED PROFESSIONAL ENGINEER
EDWARD J. LENTH
No. 052496
CIVIL
STATE OF CALIFORNIA

EDWARD J. LENTH RCE 052496
EXP. DATE: DECEMBER 31, 2024

DATE PREPARED: FEBRUARY 16, 2024

J.D. RANCH
TENTATIVE TRACT NO. 38330
WQMP PLAN
CITY OF NORCO, COUNTY OF RIVERSIDE, STATE OF CALIFORNIA
SHEET 1 OF 1

TENTATIVE TRACT MAP NO. 37714

I:\90800\DRAINAGE\WQMP\PRELIMINARY\Drawing\90800-WQMP.dwg 2/16/24

Project Area

JURUPA VALLEY
EASTVALE
NORCO
CORONA
RIVERSIDE
ZONE 1
ZONE 2
ZONE 3
ZONE 4
ZONE 5
ZONE 7
PRADO DAM
LAKE MATHEWS
LAKE ELSINORE
CANYON LAKE
MORENO VALLEY
CALIMESA
BEAUMONT
BANNING
MYSTIC LAKE
SAN JACINTO
HEMET
PERRIS
MENIFEE
WILDOMAR
MURRIETA
LAKE PERRIS
DIAMOND VALLEY LAKE
LAKE SKINNER

Chino
Redlands
Loma Linda
Grand Terrace
Yucaipa
Banning
Beaumont
Calimesa
Moreno Valley
Riverside
Corona
Norco
Eastvale
Jurupa Valley
Perris
San Jacinto
Hemet
Menifee
Canyon Lake
Lake Elsinore
Wildomar
Murrieta
Temecula
Lake Mathews
Prado Dam
Mystic Lake
Lake Perris
Diamond Valley Lake
Lake Skinner

Legend

Stream Type
- Not Susceptible Stream Channels
- Potentially Susceptible Stream Channels
- Large River (Not Susceptible)
- Santa Ana River
- Adequate Sump

Watershed Areas
- Not Applicable Area
- Applicable Area
- Applicable Area Watershed Boundaries

- Flood Control and Water Conservation District Boundary
- Study Area
- County Boundary

RBF CONSULTING
GIS

0 1 2 3 4 Miles

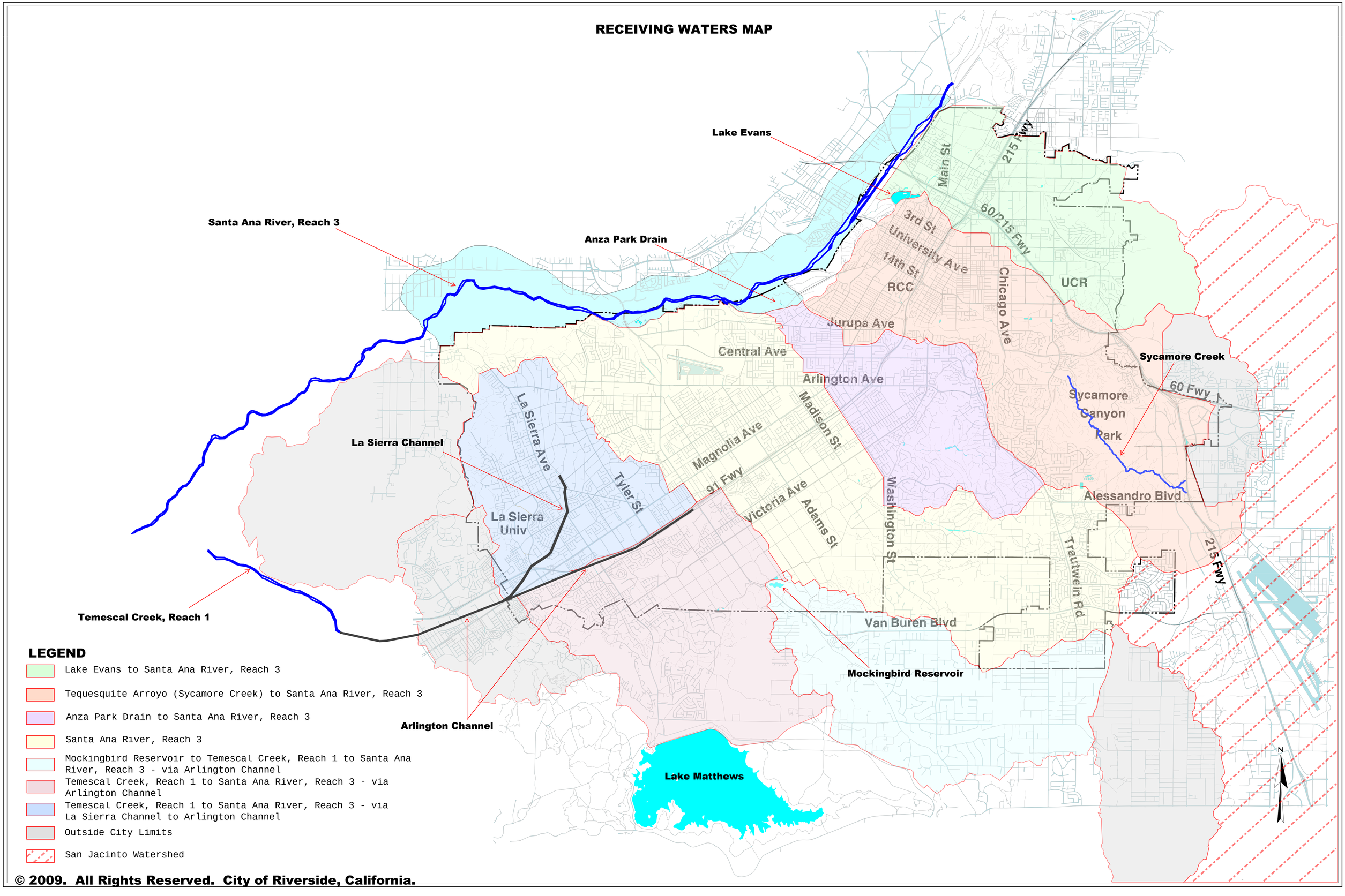
Map Document: (M:\Models\2019\05\PROPOSED_HydromodModule_Large_5000.mxd mxd - RH) - 10/2/19

HCOC Applicability Map

Hydromodification Susceptibility Documentation Report and Mapping
Riverside County Flood Control and Water Conservation District

Map 2

RECEIVING WATERS MAP

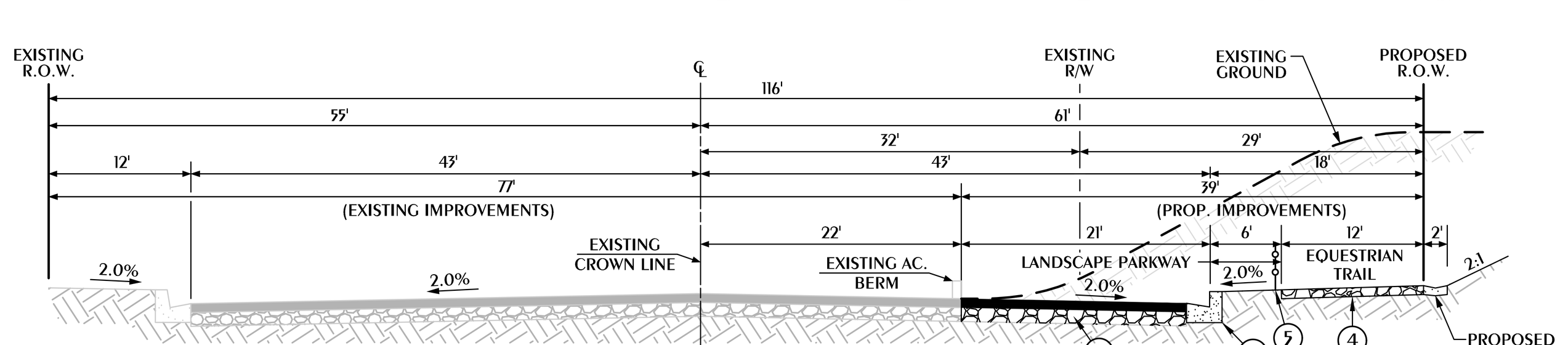


LEGEND

- Lake Evans to Santa Ana River, Reach 3
- Tequesquite Arroyo (Sycamore Creek) to Santa Ana River, Reach 3
- Anza Park Drain to Santa Ana River, Reach 3
- Santa Ana River, Reach 3
- Mockingbird Reservoir to Temescal Creek, Reach 1 to Santa Ana River, Reach 3 - via Arlington Channel
- Temescal Creek, Reach 1 to Santa Ana River, Reach 3 - via Arlington Channel
- Temescal Creek, Reach 1 to Santa Ana River, Reach 3 - via La Sierra Channel to Arlington Channel
- Outside City Limits
- San Jacinto Watershed

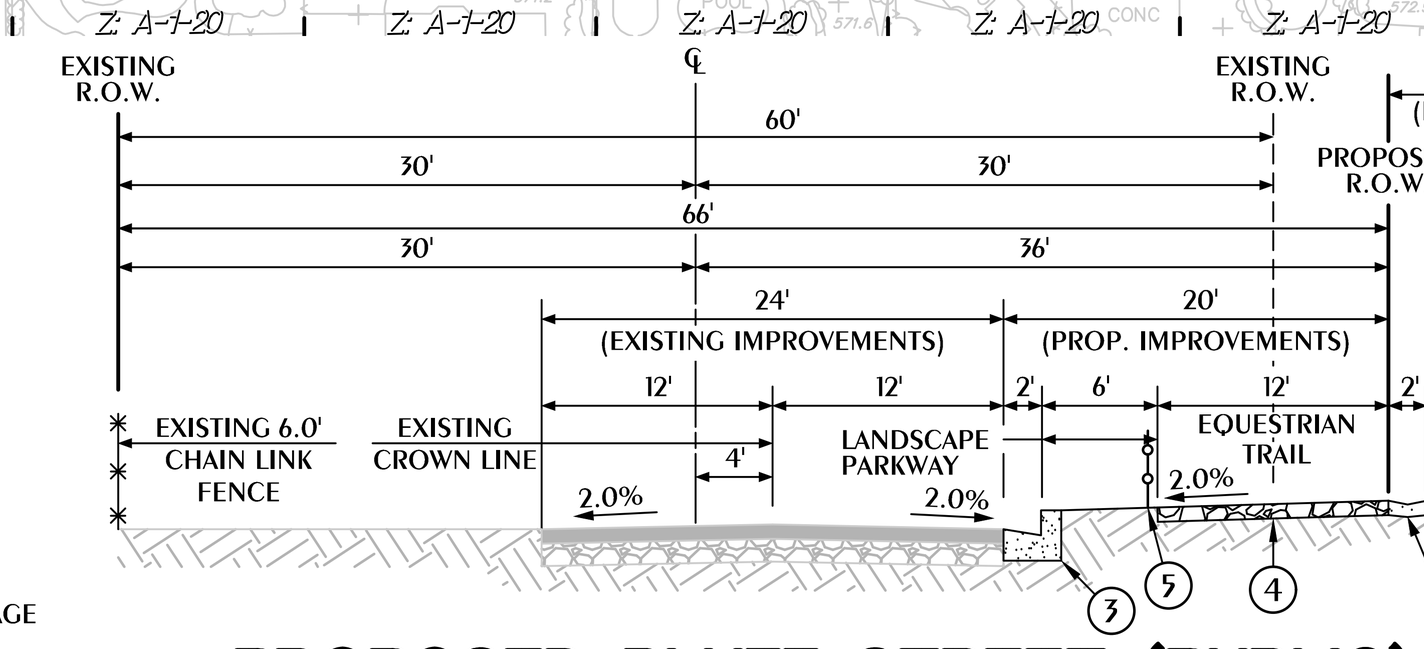
Appendix 2: Construction Plans

Grading and Drainage Plans



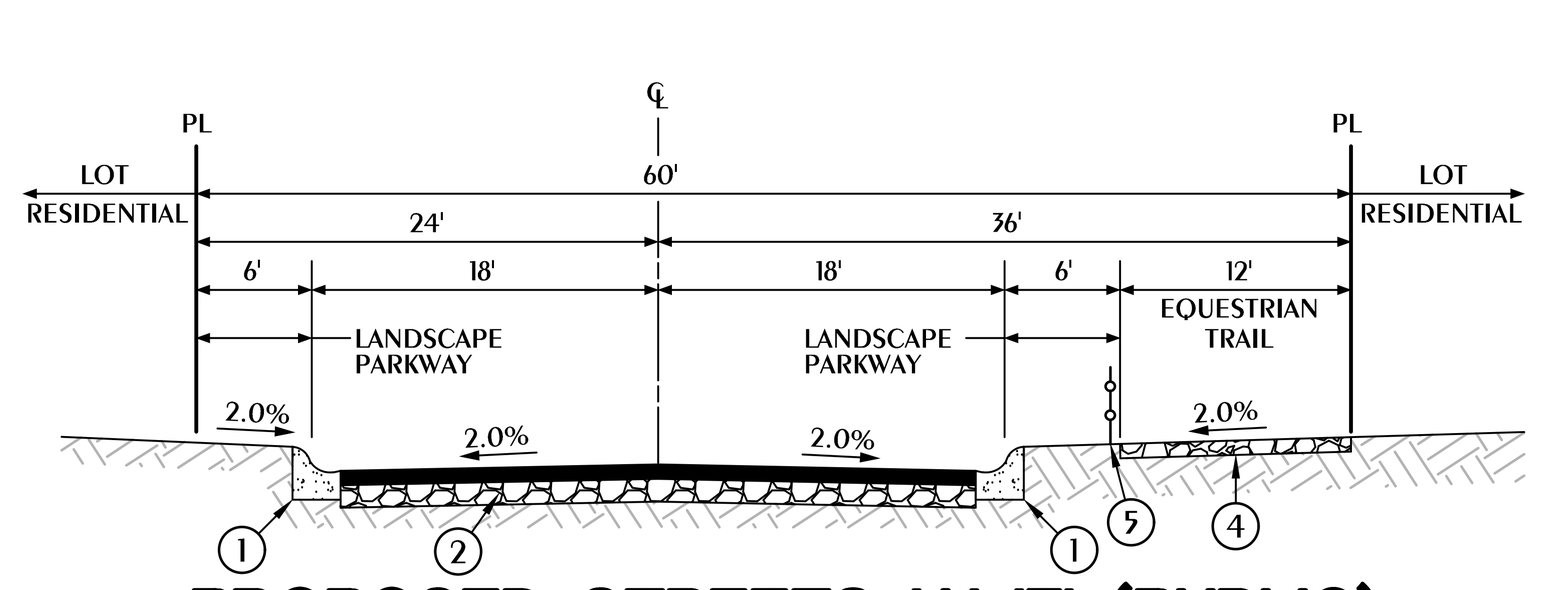
PROPOSED RIVER ROAD (PUBLIC)

(NORTH OF STREET 'A')
SCALE: 1"=10'



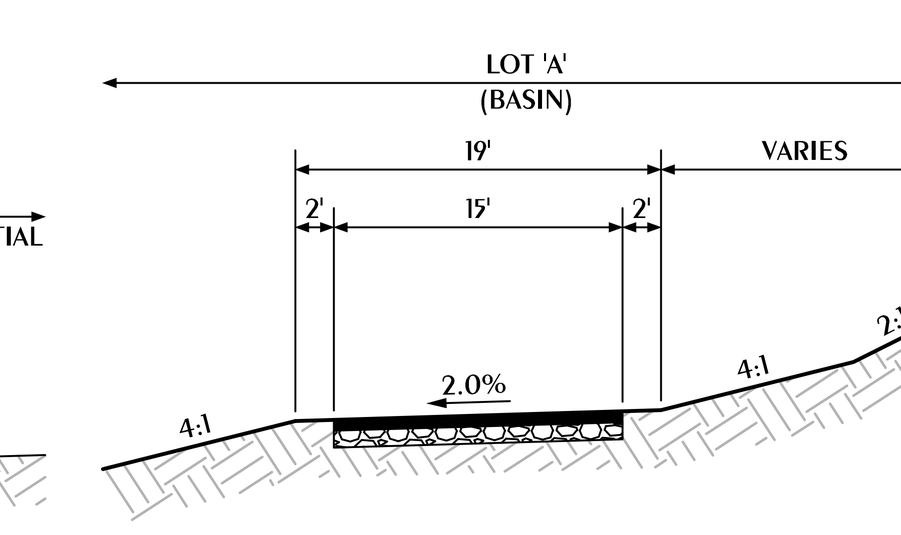
PROPOSED BLUFF STREET (PUBLIC)

SCALE: 1"=10'



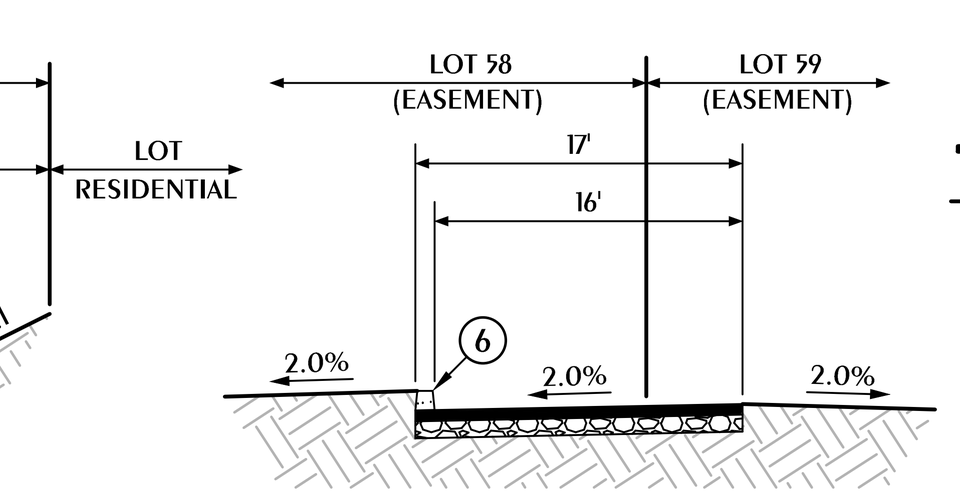
PROPOSED STREETS 'A'-'F' (PUBLIC)

SCALE: 1"=10'



PROPOSED BASIN MAINTENANCE ACCESS

SCALE: 1"=10'



PROPOSED WELL FACILITY MAINTENANCE ACCESS

SCALE: 1"=10'

LOT AREA SUMMARY

LOT #	LOT AREA (SF.)	PAD AREA (SF.)	LOT WIDTH @ R.O.W.	LOT DEPTH	P.A.K.A. AREA (SF.)
1	10,241	10,154	85.0	160.0	578
2	10,201	10,201	85.0	132.0	578
3	10,201	10,201	85.0	120.0	578
4	10,201	10,201	85.0	120.0	578
5	10,201	10,201	85.0	120.0	578
6	10,202	10,202	85.0	120.0	578
7	10,202	10,202	85.0	120.0	578
8	10,202	10,202	85.0	120.0	578
9	10,202	10,202	85.0	120.0	578
10	10,571	10,571	92.0	118.0	578
11	13,518	13,518	65.0	119.0	1,150
12	11,902	11,902	65.0	101.0	1,150
13	11,302	10,427	95.0	120.0	578
14	10,200	10,200	85.0	120.0	578

LOT AREA SUMMARY

LOT #	LOT AREA (SF.)	PAD AREA (SF.)	LOT WIDTH @ R.O.W.	LOT DEPTH	P.A.K.A. AREA (SF.)
15	10,200	10,200	85.0	120.0	578
16	10,200	10,200	85.0	120.0	578
17	12,153	12,153	95.0	120.0	578
18	14,304	14,304	89.0	164.0	1,150
19	13,787	13,571	85.0	160.0	1,150
20	10,776	10,236	90.0	120.0	578
21	10,200	9,690	85.0	120.0	578
22	10,200	9,690	85.0	120.0	578
23	10,200	9,690	85.0	120.0	578
24	10,200	9,690	85.0	120.0	578
25	10,200	9,690	85.0	120.0	578
26	10,776	9,477	90.0	120.0	578
27	10,734	9,953	90.0	120.0	578
28	10,200	10,200	85.0	120.0	578

LOT AREA SUMMARY

LOT #	LOT AREA (SF.)	PAD AREA (SF.)	LOT WIDTH @ R.O.W.	LOT DEPTH	P.A.K.A. AREA (SF.)
29	10,200	10,200	85.0	120.0	578
30	10,200	10,200	85.0	120.0	578
31	10,200	10,200	85.0	120.0	578
32	10,200	10,200	85.0	120.0	578
33	10,734	10,734	90.0	120.0	578
34	10,776	10,776	90.0	120.0	578
35	10,200	10,200	85.0	120.0	578
36	10,200	10,200	85.0	120.0	578
37	10,200	10,200	85.0	120.0	578
38	10,200	10,200	85.0	120.0	578
39	10,200	10,200	85.0	120.0	578
40	10,776	9,975	90.0	120.0	578
41	10,734	9,977	90.0	120.0	578
42	10,200	10,200	85.0	120.0	578

LOT AREA SUMMARY

LOT #	LOT AREA (SF.)	PAD AREA (SF.)	LOT WIDTH @ R.O.W.	LOT DEPTH	P.A.K.A. AREA (SF.)
43	10,200	10,200	85.0	120.0	578
44	10,200	10,200	85.0	120.0	578
45	10,200	10,200	85.0	120.0	578
46	10,200	10,200	85.0	120.0	578
47	10,733	10,733	90.0	120.0	578
48	10,702	10,702	90.0	120.0	578
49	10,200	10,200	85.0	120.0	578
50	10,200	10,200	85.0	120.0	578
51	10,200	10,200	85.0	120.0	578
52	10,200	10,200	85.0	120.0	578
53	10,200	10,200	85.0	120.0	578
54	11,263	10,558	90.0	120.0	578
55	13,959	13,071	90.0	153.0	1,150
56	13,012	12,502	85.0	153.0	1,150

LOT AREA SUMMARY

LOT #	LOT AREA (SF.)	PAD AREA (SF.)	LOT WIDTH @ R.O.W.	LOT DEPTH	P.A.K.A. AREA (SF.)
57	17,986	16,724	90.0	203.0	2,310
58	20,812	20,585	90.0	161.0	2,310
59	23,703	22,865	169.0	137.0	2,310
60	10,425	10,425	85.0	125.0	578
61	11,050	11,050	85.0	133.0	578
62	11,475	11,475	85.0	136.0	578
63	11,687	11,687	85.0	139.0	578
64	11,857	11,857	85.0	140.0	578
65	11,900	11,900	85.0	140.0	578
66	11,900	11,900	85.0	140.0	578
67	11,900	11,900	85.0	140.0	578
68	12,404	12,058	73.0	140.0	578
69	44,261	36,935	211.0	222.0	2,310

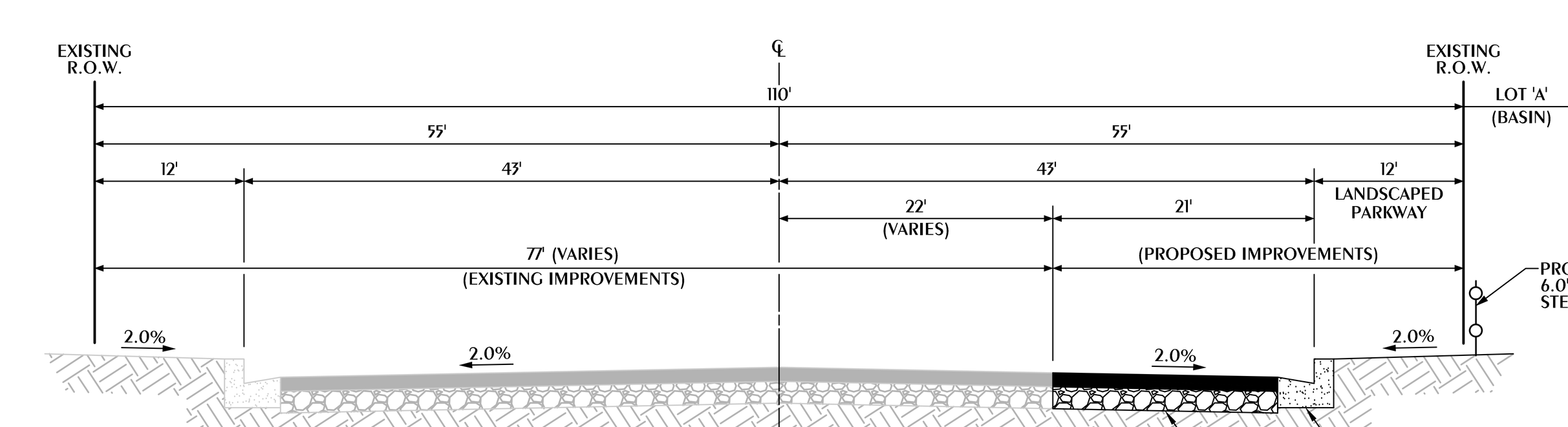
DATE:	NO.	REVISIONS

ENGINEER

MDS CONSULTING
5 PETERS CANYON ROAD
SUITE 305
IRVINE, CA 92606
(949) 251-8821
WWW.MDSCONSULTING.NET
PLANNERS ENGINEERS SURVEYORS

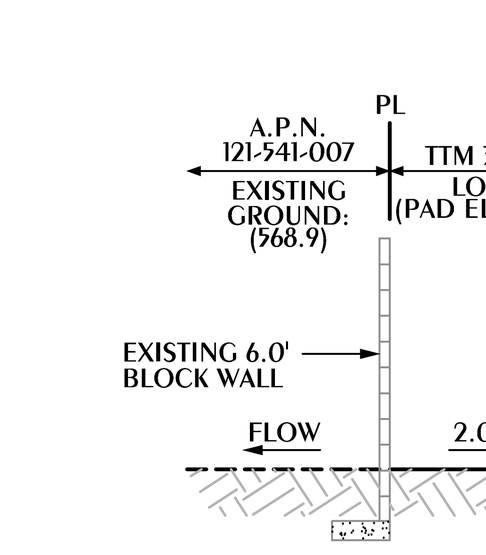
REGISTERED PROFESSIONAL ENGINEER EDWARD J. LENTH No. 52496 CIVIL STATE OF CALIFORNIA

EDWARD J. LENTH RCE 052496
EXP. DATE: DECEMBER 31, 2024



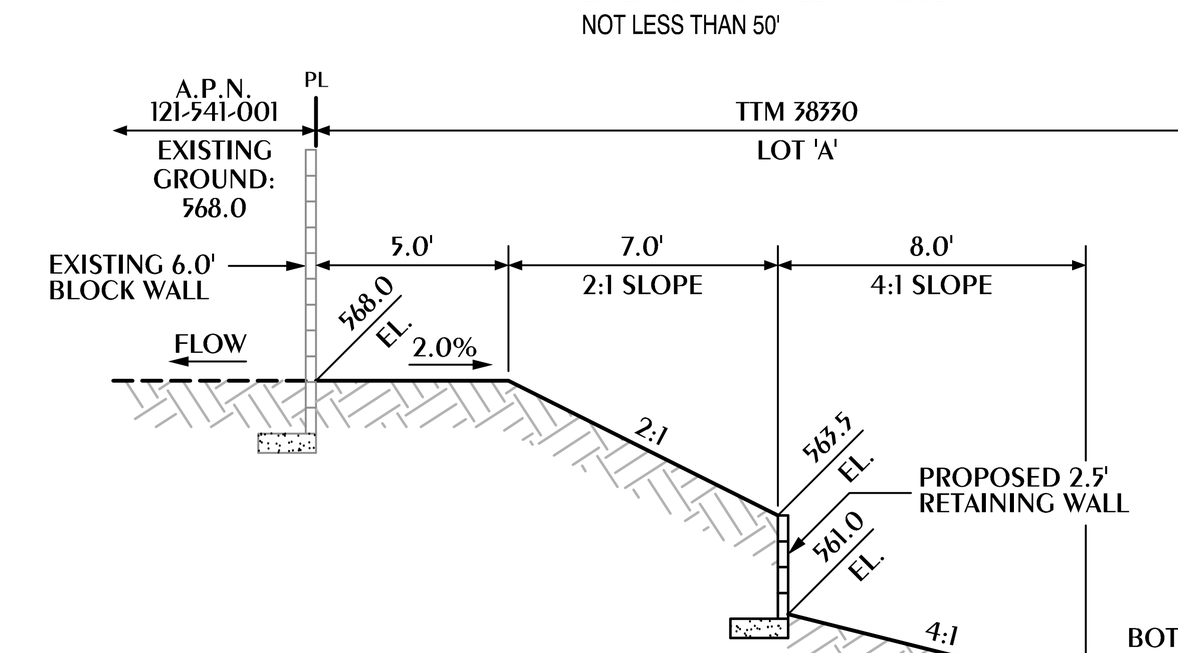
PROPOSED RIVER ROAD

(SOUTH OF STREET 'A' TO TRACT BOUNDARY)
SCALE: 1"=10'



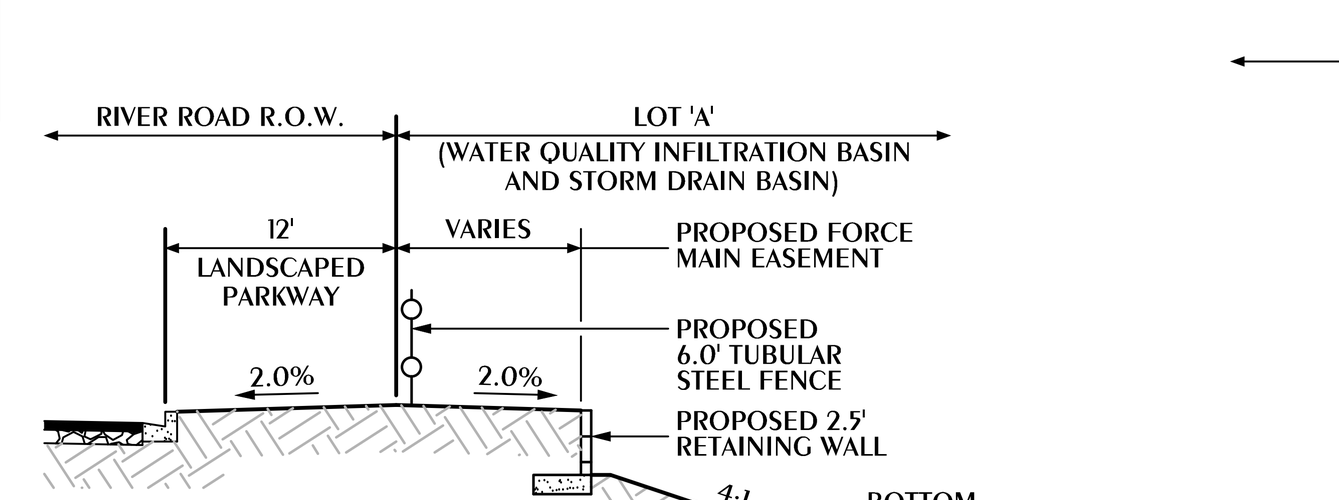
SECTION 'A'-'A'

SCALE: 1"=5'



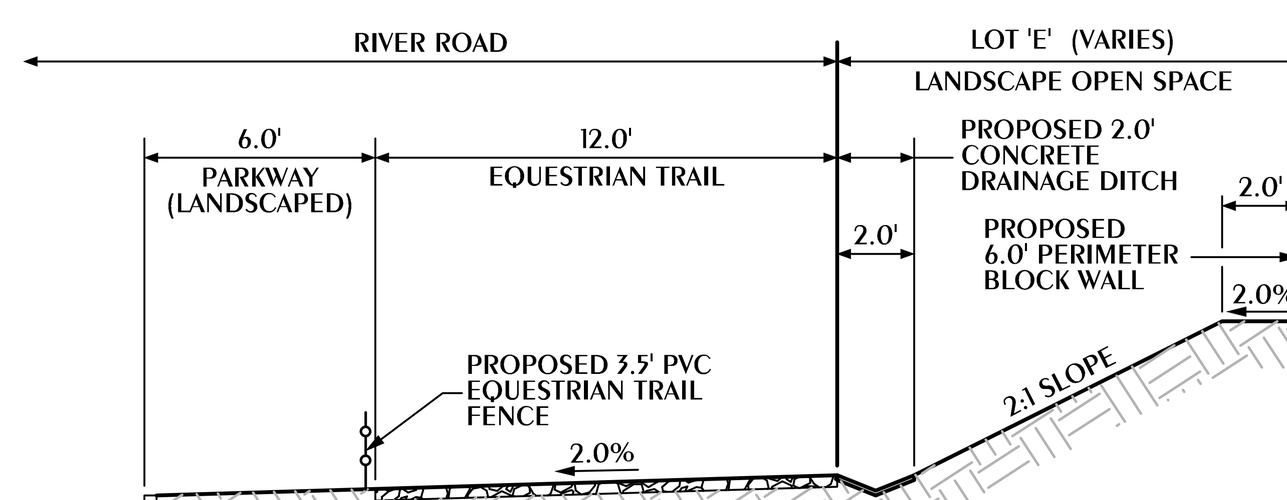
SECTION 'B'-'B'

SCALE: 1"=5'



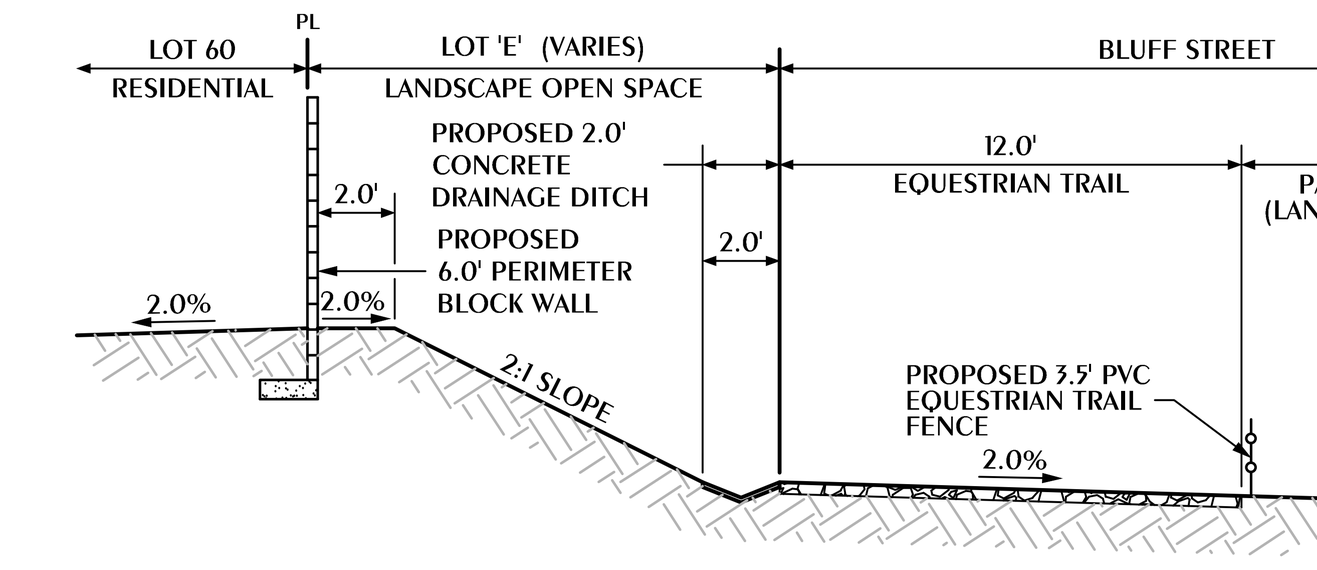
SECTION 'C'-'C'

SCALE: 1"=10'



SECTION 'D'-'D'

SCALE: 1"=5'

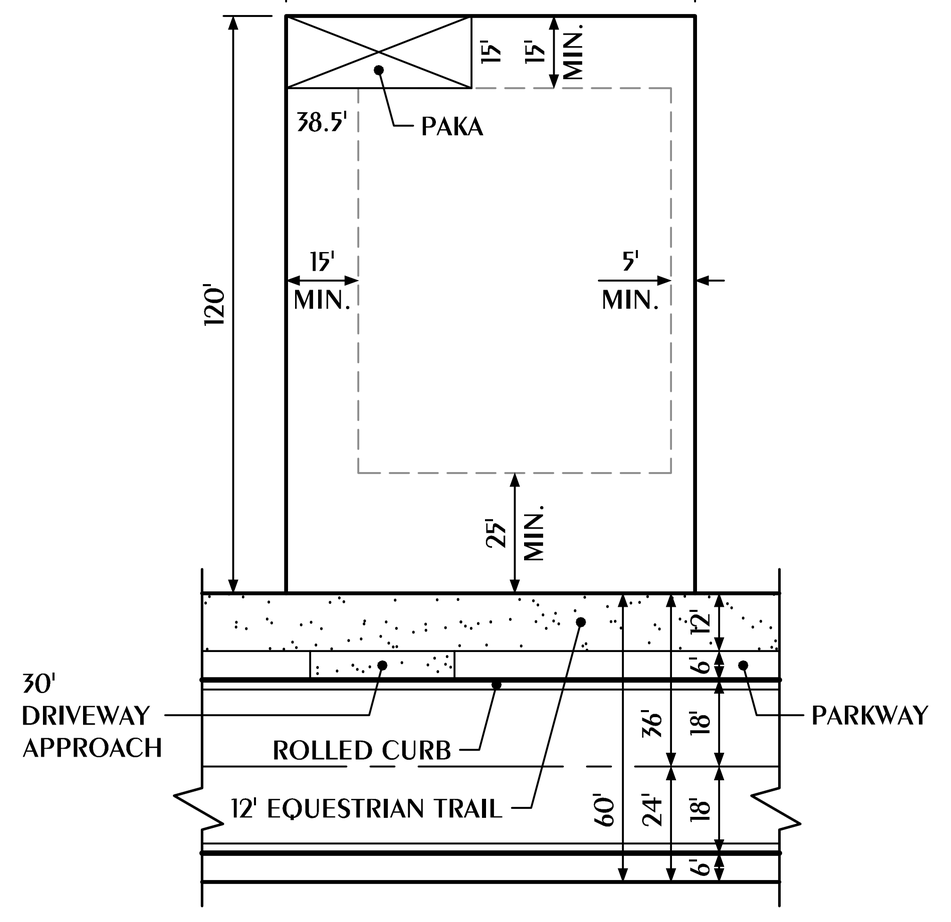


SECTION 'E'-'E'

SCALE: 1"=5'

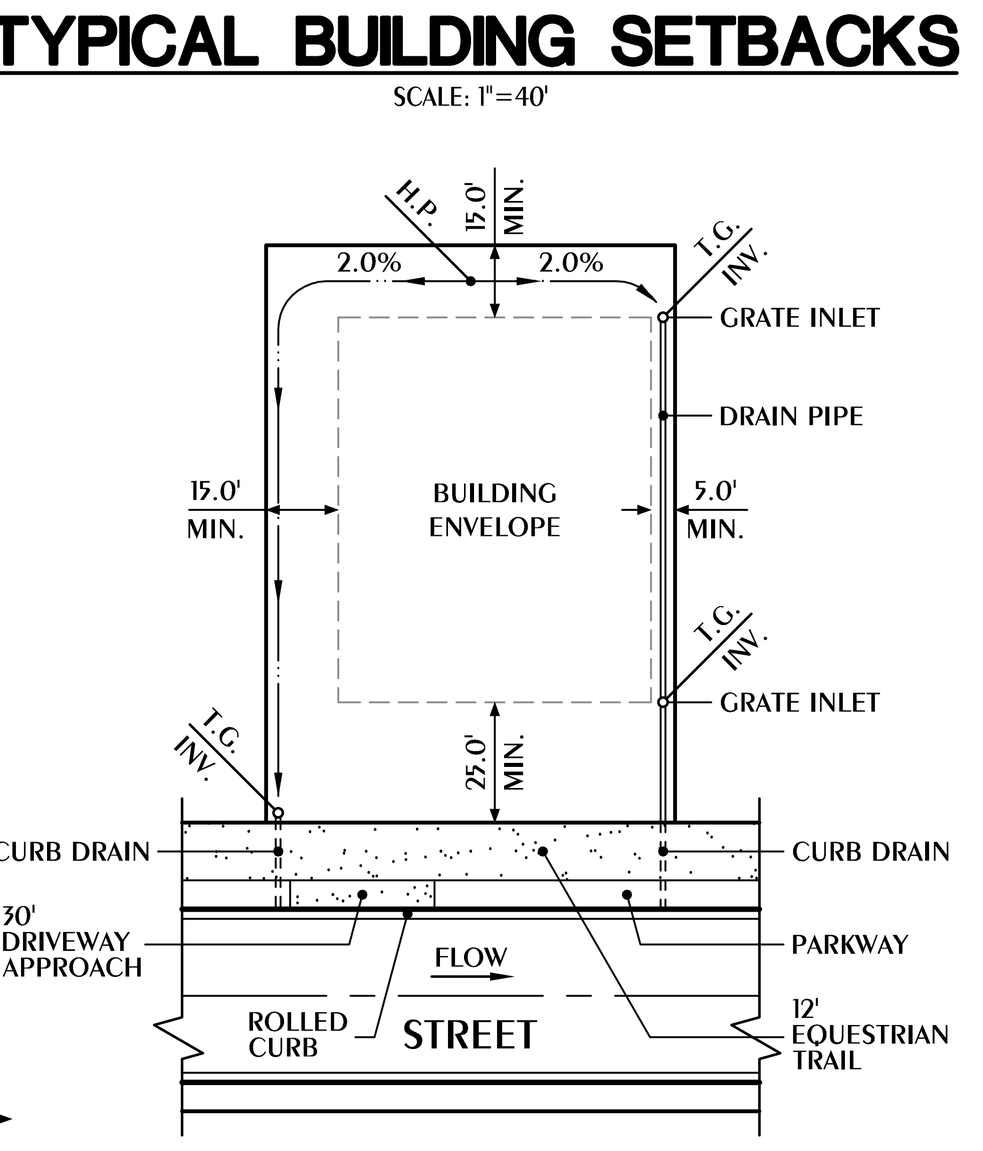
LEGEND

- EXISTING STORM DRAIN
- EXISTING GAS LINE
- EXISTING WATER LINE
- EXISTING RECLAIM WATER LINE
- EXISTING SEWER FORCEMAIN
- EXISTING UTILITY EASEMENT
- PROPOSED STORM DRAIN
- PROPOSED SEWER LINE
- PROPOSED WATER LINE
- PROPOSED SEWER MANHOLE
- PROPOSED FORCE MAIN
- PROPOSED UTILITY EASEMENT
- PROPOSED STREET CENTERLINE
- PROPOSED CENTERLINE RADIUS — R=150'
- PROPOSED TENTATIVE TRACT BOUNDARY
- PROPOSED BUILDING SETBACK LINE — BSL
- LIMITS OF GRADING (DAYLIGHT LINE)
- PROPOSED LOT NUMBER — 67
- PROPOSED HIGHEST LOT NUMBER — 69
- PROPOSED PAD ELEVATION — 757.0
- PROPOSED STREET ELEVATION — 730.5
- PROPOSED 2:1 SLOPE
- PROPOSED 4:1 SLOPE — 4:1
- PROPOSED RETAINING WALL / PROPOSED RETAINING WALL HEIGHT — 775.0 TRW / 772.0 TF (3.0')
- PROPOSED STREET LIGHT
- PROPOSED FIRE HYDRANT
- PROPOSED LIMITED USE AREA
- PROPOSED P.A.K.A. (BASED ON LOT AREA)
- PROPOSED DG EQUESTRIAN TRAIL
- PROPOSED STOP SIGN
- PROPOSED TRAFFIC SIGNAL



TYPICAL BUILDING SETBACKS

SCALE: 1"=40'



TYPICAL LOT DRAINAGE

SCALE: 1"=40'

LOT SUMMARY

SINGLE-FAMILY RESIDENTIAL	69
MINIMUM LOT WIDTH:	85 FT *
MINIMUM LOT DEPTH:	100 FT
MINIMUM LOT AREA:	10,200 SF
MAXIMUM LOT AREA:	44,261 SF
AVERAGE LOT AREA:	11,758 SF
MINIMUM PAD AREA:	9,477 SF
AVERAGE PAD AREA:	11,468 SF
GROSS ACREAGE:	34.38 AC
NET ACREAGE	33.54 AC
GROSS DENSITY:	2.0 DU/AC
NET DENSITY:	2.06 DU/AC

* EXCEPT ON A KNUCKLE OR CUL-DE-SAC NOT LESS THAN 50'

EXISTING CONDITIONS

1. EXISTING RESIDENCE TO REMAIN.
2. EXISTING 6.0' HIGH BLOCK WALL TO REMAIN.
3. EXISTING 5.0 HIGH WROUGHT IRON FENCE TO BE REMOVED.
4. EXISTING 5.0' HIGH WOOD FENCE TO BE REMOVED.
5. EXISTING OVERHANG TO REMAIN.
6. EXISTING 6.0' HIGH CHAIN LINK FENCE W/ BARBED WIRE TO BE REMOVED.
7. EXISTING 6.0' HIGH CHAIN LINK FENCE TO REMAIN.
8. EXISTING 5.0' HIGH BARBED WIRE FENCE TO BE REMOVED.
9. EXISTING PCC DRIVEWAY TO BE PROTECTED IN PLACE.
10. EXISTING TANK TO BE REMOVED.
11. EXISTING BUILDING/CANOPY TO BE REMOVED.
12. EXISTING TREE/PALM TO BE REMOVED.
13. EXISTING SCE OVERHEAD/WIRE POWER POLE TO REMAIN IN PLACE.
14. EXISTING SCE OVERHEAD/WIRE POWER POLE TO BE UNDERGROUND UNDER SEPARATE PERMIT.
15. EXISTING A.C. PAVEMENT TO BE REMOVED.
16. EXISTING IDLE OVERHEAD POLES/WIRES TO BE REMOVED.
17. EXISTING SCE IDLE OVERHEAD POLE/WIRES TO BE REMOVED.
18. EXISTING 8.0' HIGH CHAIN LINK FENCE TO BE REMOVED
19. EXISTING CITY WELL FACILITY TO REMAIN IN PLACE.
20. EXISTING CATCH BASIN TO REMAIN.
21. EXISTING A.C. PAVEMENT TO BE PROTECTED IN PLACE.
22. EXISTING LIGHT TO BE PROTECTED IN PLACE.
23. EXISTING WATER VALVE TO BE RELOCATED.
24. EXISTING STREET SIGNAGE TO BE RELOCATED.
25. EXISTING ELECTRICAL EQUIPMENT TO BE RELOCATED.
26. EXISTING 6.0' CHAIN LINK FENCE WITH BARBED WIRE TO BE RELOCATED.
27. EXISTING ELECTRICAL FACILITY TO BE RELOCATED.

CONSTRUCTION NOTES

1. CONSTRUCT STANDARD ROLLED CURB PER CITY STANDARD PLAN 205.
2. CONSTRUCT 4" AC OVER 6" CAB OR AS APPROVED BY CITY ENGINEER PER CITY STANDARD PLAN 830.
3. CONSTRUCT TYPE 'C' INTEGRAL CURB AND GUTTER PER CITY STANDARD PLAN 200.
4. CONSTRUCT 12.0' EQUESTRIAN TRAIL PER CITY STANDARD PLAN 700.
5. CONSTRUCT 3'-6" PVC EQUESTRIAN TRAIL FENCING PER CITY STANDARD PLAN 705.
6. CONSTRUCT TYPE 'A' CURB ONLY, PER CITY STANDARD PLAN 200.

UTILITIES

ELECTRIC:
SOUTHERN CALIFORNIA EDISON
1351 EAST FRANCIS STREET
ONTARIO, CA. 91761
(909) 930-8431

WATER & SEWER:
CITY OF NORCO
2870 CLARK AVE
NORCO, CA. 92860
(951) 270-5678

SOLID WASTE:
WASTE MANAGEMENT
800 SOUTH TEMESCAL STREET
JURUPA VALLEY, CA. 92509
(951) 786-0639

GAS:
SOUTHERN CALIFORNIA GAS COMPANY
1981 WEST LUGONIA AVENUE
RANCHO CUCAMONGA, CA. 91730
(909) 335-7715

CABLE:
CHARTER COMMUNICATIONS
7337 CENTRAL AVE
RIVERSIDE, CA. 92504
(951) 343-4100 EXT. 4156

TELEPHONE:
A.T.&T.
1265 NORTH VAN BUREN STREET
RM. 180
ANAHEIM, CA. 92807
(714) 666-5503

BASIS OF BEARING

CENTERLINE OF SUNDANCE LANE
N 43° 09' 18" E AS SHOWN ON TRACT 28765
BK 274, PG 95-98

LEGAL DESCRIPTION

PARCEL 1: (APN: 121-110-001)
BLOCKS 67,68,69 AND LOTS 2 TO 23, INCLUSIVE OF BLOCK 70, TOGETHER WITH THOSE PORTIONS OF PINE STREET, 60 FEET WIDE, SPRUCE STREET, 60 FEET WIDE, SYCAMORE STREET, 60 FEET WIDE AND ALL ALLEYS AND PUBLIC WAYS APPURTENANT THERETO BETWEEN BLUFF STREET AND GILBERT STREET AS SHOWN ON THE MAP OF AUBURNDALE COLONY AND TOWNSITE ON BOOK 6 PAGES 20 AND 21 OF MAPS, SAN BERNARDINO COUNTY, CALIFORNIA.

EXCEPTING THEREFROM THAT PORTION CONVEYED TO TOMMY DALLAPE, ET UX., BY DEED RECORDED APRIL 6, 1964 AS INSTRUMENT NO. 42079 OF OFFICIAL RECORDS.

ALSO EXCEPTING THEREFROM ANY OIL, GAS, OTHER HYDROCARBON SUBSTANCES AND ALL OTHER MINERALS IN, ON OR UNDER THE ABOVE-IDENTIFIED LAND, TOGETHER WITH THE RIGHTS TO TAKE AND RECOVER POSSESSION OF SAID MINERALS AND TO ENTER UPON SAID LAND FOR THE PURPOSE OF EXPLORING FOR, MINING, DRILLING FOR, EXTRACTING, PRODUCING, TRANSPORTING OR MARKETING THE SAME OF ANY PORTION THEREOF IN ANY MANNER NOT INCONSISTENT WITH THE PUBLIC HEALTH USE FOR WHICH SAID PROPERTY IS HEREBY CONVEYED, AS RESERVED IN DOCUMENT RECORDED OCTOBER 8, 2009 AS INSTRUMENT NO 2009-0523643 OF OFFICIAL RECORDS OF SAID COUNTY.

PARCEL 2: (APN: 121-110-003)
BLOCKS 47, 48, 49 AND 50, THOSE PORTIONS OF BLOCKS 43, 44, 45 AND 46, THOSE PORTIONS OF ALL STREETS AND ALLEYS, AND THAT PORTION OF THAT CERTAIN PARCEL OF LAND MARKED "PROPOSED POMONA AND ELSINORE RAILROAD DEPOT GROUNDS", AS SHOWN ON THE MAP OF AUBURNDALE COLONY AND TOWNSITE ON FILE IN BOOK 6 PAGES 20 AND 21 OF MAPS, SAN BERNARDINO COUNTY RECORDS, LYING WITHIN THE BOUNDARIES OF THE PARCEL OF LAND DESCRIBED.

LAND EXCHANGE SUMMARY

LOT	ACREAGE	ACREAGE
B	6.78 AC	J.D. RANCH
18 - 20, 33 - 34, 47 - 48, 58 - 68 (121-110-01 PORTION)	8.20 AC	CITY OF NORCO

LAND USE SUMMARY

LOTS	LAND USE	ACREAGE	PERCENT (%)
1 - 68	SINGLE-FAMILY RESIDENTIAL	17.61 AC	46.5%
69	EXISTING SINGLE-FAMILY RES.	1.02 AC	2.7%
'A'	WATER QUALITY INFILTRATION BASIN AND STORM DETENTION BASIN	0.90 AC	2.4%
'B'	OPEN SPACE	6.78 AC	18.0%
'C'	SEWER LIFT STATION	0.13 AC	0.3%
'D' - 'E'	LANDSCAPE OPEN SPACE	0.72 AC	1.9%
'F'	TRAIL	0.04 AC	0.1%
	BLUFF STREET	0.16 AC	0.4%
	RIVER ROAD	0.68 AC	1.8%
	STREETS 'A' - 'F'	6.31 AC	16.7%
	"NOT-A-PART"	3.49 AC	9.2%
	GROSS ACREAGE	37.84 AC	100%

TENTATIVE TRACT NO. 38330

NUMBER OF LOTS: TOTAL	76
SINGLE-FAMILY RESIDENTIAL	69
WATER QUALITY INFILTRATION BASIN AND STORM DETENTION BASIN	1
SEWER LIFT STATION	1
OPEN SPACE	1
TRAIL	1
LANDSCAPE OPEN SPACE	2
N.A.P.	1

GROSS ACREAGE: 37.84 AC
CONTOUR INTERVAL: 1 FOOT
SCALE: 1"=60'
DATE: APRIL 26, 2022
REVISED: AUGUST 18, 2022
REVISED: MARCH 13, 2023
REVISED: JUNE 28, 2023
REVISED: JANUARY 25, 2024

GRAPHIC SCALE
60 0 30 60 120 240
(IN FEET)
1 inch = 60 ft.

GENERAL INFORMATION

1. EXISTING LAND USE: UNDEVELOPED, PREVIOUS DAIRY FACILITIES, SINGLE FAMILY RESIDENCE.
2. EXISTING ZONING: 0S (OPEN SPACE)
   A-1-20 (AGRICULTURAL - LOW DENSITY (20,000 SF)
3. EXISTING GENERAL PLAN: RA (RESIDENTIAL AGRICULTURAL)
   PL (PUBLIC LAND)
4. PROPOSED LAND USE: SINGLE-FAMILY RESIDENTIAL, WATER QUALITY BASIN, SEWER LIFT
5. PROPOSED ZONING: R-1-10 (RESIDENTIAL - SINGLE FAMILY 10,000 SF)
6. PROPOSED GENERAL PLAN: RL
7. ADJACENT LAND USES:
   NORTH: CITY RESERVOIR FACILITY, VACANT
   EAST: SINGLE-FAMILY RESIDENTIAL, PARK
   SOUTH: SINGLE-FAMILY RESIDENTIAL, PARK
   WEST: SINGLE-FAMILY RESIDENTIAL
8. PARK REQUIREMENTS TO BE MET BY IN LIEU FEES PER CITY OF NORCO MUNICIPAL CODE SECTION 17.14.08.
9. SCHOOL DISTRICTS: (CORONA-NORCO UNIFIED SCHOOL DIST.)
   ELEMENTARY: WASHINGTON ELEMENTARY
   MIDDLE SCHOOL: AUBURNDALE INTERMEDIATE
   HIGH SCHOOL: NORCO HIGH SCHOOL
10. PAD ELEVATIONS SHOWN ON THE TENTATIVE TRACT MAP MAY BE ADJUSTED PLUS OR MINUS 3.0 FEET.
11. MULTIPLE FINAL MAPS MAY BE FILED PURSUANT TO SECTION 66456.1 OF THE CALIFORNIA GOVERNMENT CODE.
12. PROPOSED TENTATIVE TRACT 38330 IS NOT WITHIN AN APPROVED SPECIFIC PLAN BOUNDARY.
13. ALL PROPOSED MANUFACTURED SLOPES SHALL BE CONSTRUCTED AT A MAXIMUM OF 2:1, UNLESS OTHERWISE NOTED ON THE PLAN.
14. ESTIMATED EARTHWORK QUANTITIES:
    ADJUSTED CUT: 157,920 C.Y. — APPROXIMATE QUANTITY OF ORGANICS EXPORTED
    ADJUSTED FILL: 206,320 C.Y. — CUT: 10,300 C.Y.
    IMPORT: 48,400 C.Y.
15. THE PRELIMINARY GEOTECHNICAL/SOILS REPORT WAS PREPARED BY LGC GEOTECHNICAL, INC., JANUARY 21, 2022.
16. THERE IS ONE EXISTING HABITABLE STRUCTURE THAT IS WITHIN THE BOUNDARIES OF THE PROPOSED TENTATIVE TRACT MAP THAT SHALL REMAIN IN PLACE.
17. ALL PROPOSED STREETS WITHIN TENTATIVE TRACT 38330 SHALL BE PUBLIC AND SHALL BE OWNED AND MAINTAINED BY THE CITY OF NORCO.
18. THE PROPOSED LANDSCAPE PARKWAYS AND EQUESTRIAN TRAILS WITHIN THE PROPOSED PUBLIC STREETS 'A'-'F' SHALL BE OWNED BY THE CITY OF NORCO AND MAINTAINED BY AN APPROVED H.O.A. EACH INDIVIDUAL HOMEOWNER SHALL MAINTAIN THEIR TRAIL FRONTAGE AS IT RELATES TO GENERAL WEED AND MANURE ABATEMENT.
19. THE DEVELOPER RESERVES THE RIGHT TO MERGE LOTS ON THE FINAL MAP.
20. THERE IS ONE ACTIVE WELL, OWNED AND MAINTAINED BY THE CITY OF NORCO, WITHIN THE BOUNDARIES OF THE TENTATIVE TRACT MAP THAT WILL REMAIN IN PLACE.
21. PROPOSED TENTATIVE TRACT MAP 38330 IS WITHIN ZONE "X" (AREAS DETERMINED TO BE OUTSIDE THE 0.2% ANNUAL CHANCE OF FLOODING) PER F.I.R.M. MAP NO 06065C0687G, DATED AUGUST 28, 2008
22. PROPOSED TENTATIVE TRACT MAP 38330 CONTAINS PARCELS OWNED BY THE CITY OF NORCO AND BY THOMAS Q. DALLAPE AND DIANE L. DALLAPE, TRUSTEES OF THE DALLAPE FAMILY TRUST AND TACRD INSTRUMENTS. PROPOSED TENTATIVE TRACT MAP 38330 DOES NOT CONTAIN A CONTIGUOUS OWNERSHIP OF LAND BEING SUBDIVIDED.
23. THOMAS BROTHERS MAP PAGE 38, GRIDS B-4, C-4, B-5 AND B-6, RIVERSIDE COUNTY.
24. PROPOSED TENTATIVE TRACT MAP 38330 IS NOT WITHIN A COMMUNITY SERVICE DISTRICT.
25. PROPOSED TENTATIVE TRACT MAP 38330 IS WITHIN THE RIVERSIDE COUNTY FLOOD CONTROL DISTRICT (RCFCD)
26. PROPOSED TENTATIVE TRACT MAP 38330 IS NOT SUBJECT TO LIQUEFACTION OR OTHER GEOLOGICAL HAZARD AND IS NOT WITHIN A SPECIAL STUDIES ZONE.
27. TOPOGRAPHIC SURVEY WAS FLOWN AND COMPILED BY DON READ AERIAL CORPORATION ON JUNE 16, 2021.
28. THERE ARE NO PROPOSED OPEN STORM DRAIN CHANNEL WITHIN THE BOUNDARIES OF THE TENTATIVE TRACT MAP.
29. PROPOSED TENTATIVE TRACT MAP 38330 IS NOT A GATED COMMUNITY.
30. PROPOSED VEHICULAR ACCESS SHALL BE RESTRICTED ON RIVER ROAD AND BLUFF STREET.
31. FINAL DESIGN OF THE TENTATIVE TRACT MAP 38330 SHALL COMPLY WITH N.P.D.E.S. REQUIREMENTS AS OUTLINED BY N.P.D.E.S., SUPPLEMENT NO. 'A'.
32. PROPOSED LANDSCAPE OPEN SPACE LOTS 'D'-'E' ARE PRIVATE AND SHALL BE OWNED BY AN APPROVED H.O.A. IF AVAILABLE, OPEN SPACE LOTS 'D'-'E' TO BE IRRIGATED BY RECLAIMED WATER PROVIDED BY THE CITY OF NORCO.
33. PROPOSED TENTATIVE TRACT MAP 38330 IS NOT WITHIN A HIGH FIRE HAZARD AREA.
34. ALL PROPOSED RESIDENTIAL LOTS SHALL MAINTAIN A 2.0% MINIMUM GRADE FROM THE REAR YARD TO THE FRONTING PUBLIC STREET.
35. THE PROPOSED TENTATIVE TRACT MAP 38330 IS WITHIN THE COUNTY'S 2ND SUPERVISORY DISTRICT.
36. THE CURRENT PROPERTY ADDRESS IS 2877 RIVER ROAD, NORCO, CA.
37. THERE ARE NO EXISTING SEWER SYSTEM PIPES WITHIN THE TENTATIVE TRACT MAP BOUNDARIES. THE EXISTING SINGLE FAMILY RESIDENCE IS CURRENTLY SEWERED BY A SEPTIC SYSTEM BUT WILL BE CONNECTED TO THE PROPOSED SEWER LINE.
38. ALL EXISTING ON-SITE CONCRETE PADS SHALL BE REMOVED, AND WHERE POSSIBLE, CRUSHED AND PLACED IN PROPOSED FILL AREAS AND APPROVED BY THE SOILS ENGINEER.
39. PROPOSED LOT 'A' WATER QUALITY INFILTRATION AND DETENTION BASIN, WILL BE AND MAINTAIN BY AN APPROVED H.O.A.
40. THE EXISTING 60.0' WIDE CALIFORNIA ELECTRIC POWER COMPANY EASEMENT SHALL BE PROTECTED IN PLACE.
41. PROPOSED KNUCKLES (PUBLIC) SHALL BE DESIGNED PER CITY STANDARD PLAN NO. 145A.
42. PROPOSED CUL-DE-SACS (PUBLIC) SHALL BE DESIGNED PER CITY STANDARD PLAN NO. 140C.
43. PROPOSED STREETS 'A'-'F' WITHIN TENTATIVE TRACT MAP 38330 SHALL BE DESIGNED PER CITY STANDARD PLAN NO. 100.
44. PROPOSED TENTATIVE TRACT MAP 38330 IS NOT SUBJECT TO FLOOD WATERS, OVERFLOW OR INUNDATION. ALL PROPOSED RESIDENTIAL PAD AREAS ARE A MINIMUM OF 2.0' FEET ABOVE THE 566 SANTA ANA FLOOD ELEVATION.
45. THERE ARE NO REGULATED TREES OR PLANTS IDENTIFIED WITHIN THE TENTATIVE TRACT MAP BOUNDARIES.
46. PROPOSED STREET TREES SHALL BE PROVIDED ALONG ALL PROPOSED PUBLIC STREETS WITHIN THE TENTATIVE TRACT MAP BOUNDARIES (SEE CONCEPTUAL LANDSCAPE PLANS) AND MAINTAINED BY LANDSCAPE MAINTENANCE DISTRICT.
47. PROPOSED OPEN SPACE LOT 'B' SHALL BE DEEDED IN FEE TO THE CITY OF NORCO FOR OWNERSHIP AND MAINTENANCE.
48. PROPOSED LOT 'C', SEWAGE LIFT STATION, SHALL BE DEEDED IN FEE TO THE CITY FOR OWNERSHIP AND MAINTENANCE.
49. PROPOSED LOT 69, EXISTING SINGLE FAMILY RESIDENCE, SHALL REMAIN IN PLACE.
50. PROPOSED STANDARD ROLLED CURB FOR LOCAL PUBLIC STREETS 'A'-'F' SHALL BE CONSTRUCTED PER CITY STANDARD PLAN NO. 205.
51. PROPOSED CROSS GUTTERS FOR PUBLIC LOCAL STREET 'A' SHALL BE CONSTRUCTED PER CITY STANDARD PLAN NO. 225.
52. PROPOSED HANDICAP RAMP AT THE INTERSECTION OF PROPOSED STREET 'A' AT RIVER ROAD SHALL BE CONSTRUCTED PER CITY STANDARD NO. 235.
53. RIVER ROAD IMPROVEMENTS PER A MODIFIED CITY STANDARD PLAN NO. 120A.
54. BLUFF STREET IMPROVEMENTS PER CITY STANDARD NO. 100.
55. LANDSCAPE PARKWAYS FOR LOCAL PUBLIC STREETS 'A'-'F' SHALL BE OWNED BY THE CITY AND MAINTAINED BY AN H.O.A.
56. LANDSCAPE PARKWAYS FOR RIVER ROAD AND BLUFF STREET SHALL BE OWNED BY THE CITY AND MAINTAIN BY A L.M.D.
57. PROPOSED ROLLED CURB AT THE INTERSECTION OF STREET 'A' AT RIVER ROAD AND STREET 'F' AT BLUFF STREET SHALL TRANSITION TO A STANDARD CURB PER CITY STANDARD 215.
58. PROPOSED PARKWAY DRAIN FROM PROPOSED 2-0' DRAINAGE DITCHES ALONG "TOE-OF-SLOPE" OF OPEN SPACE LOTS 'D' AND 'E' ALONG RIVER ROAD AND BLUFF STREET PER CITY STANDARD 300B.
59. PROPOSED PRIVATE PARKWAY DRAINS THROUGH CURB OUTLET FOR RESIDENTIAL ROLLED CURB SHALL BE CONSTRUCTED PER CITY STANDARD 301.
60. EXISTING WATERLINE FROM THE EXISTING CITY OWNED WELL FACILITY, CURRENTLY LOCATED WITHIN LOTS 59-68, TO BE RELOCATED WITHIN PROPOSED STREET 'F' TO RECONNECT TO THE CITY RESERVOIR LOT.
61. PROPOSED STREET LIGHTS FOR LOCAL STREETS 'A'-'F' SHALL BE OWNED BY THE CITY AND MAINTAINED BY AN APPROVED L.M.D.
62. PROPOSED EQUESTRIAN TRAIL FOR RIVER ROAD AND BLUFF STREET SHALL BE OWNED BY THE CITY AND MAINTAINED BY AN APPROVED L.M.D.
63. PROPOSED LOT 'F' TO BE OWNED AND MAINTAINED BY AN APPROVED H.O.A. AND IS NON-GATED.
64. "NOT-A-PART" TO REMAIN AS CITY OWNED AND MAINTAINED PUMP STATION AND RESERVOIRS 8 AND 9.

EASEMENTS

5. A RIGHT OF WAY RESERVED TO THE SOUTH RIVERSIDE LAND AND WATER COMPANY AND ITS ASSIGNS FOR CONSTRUCTION AND MAINTENANCE OF ALL NECESSARY WATER PIPES AND DITCHES, FLUMES AND CONDUITS, FOR ALL PURPOSES OF IRRIGATION AND DOMESTIC USE, BY DEED RECORDED AUGUST 12, 1985 IN BOOK 17, PAGE 223, OF DEEDS. EASEMENT CANNOT BE PLOTTED BASED ON RECORD INFORMATION. EASEMENT IS AN INDENTURE, CONVEYING LANDS TO INDIVIDUALS BUT RETAINING WATER RIGHTS, INCLUDING DITCHES, IRRIGATION PIPES, ETC.. THERE IS NO DESCRIPTION OTHER THAN THE LANDS BEING SOLD AND IS A BLANKET EASEMENT.

6. AN EASEMENT FOR ROAD AND INCIDENTAL PURPOSES, RECORDED OCTOBER 14, 1963 AS INSTRUMENT NO. 108259 OF OFFICIAL RECORDS. EASEMENT TO BE ABANDONED.

9. AN UNITED STATES OF AMERICA EASEMENT FOR ACCESS AND INCIDENTAL PURPOSES, RECORDED OCTOBER 8, 2009 AS INSTRUMENT NO. 2009-0523643 OF OFFICIAL RECORDS, EASEMENT CANNOT BE PLOTTED BASED ON RECORDED INFORMATION. EASEMENT TO BE PROTECTED IN PLACE.

14. A SOUTH RIVERSIDE LAND AND WATER COMPANY EASEMENT FOR WATER PIPES AND DITCHES, FLUMES AND CONDUITS FOR PURPOSE OF IRRIGATION AND DOMESTIC USE AND INCIDENTAL PURPOSE, RECORDED AUGUST 08, 1895 IN BOOK 17 OF DEEDS, PAGE 223 AND RECORDED DECEMBER 31, 1906 IN BOOK 173, PAGE 336 OF DEEDS. EASEMENT CANNOT BE PLOTTED BASED ON RECORD INFORMATION. EASEMENT IS AN INDENTURE, CONVEYING LANDS TO INDIVIDUALS BUT RETAINING WATER RIGHTS, INCLUDING DITCHES, IRRIGATION PIPES, ETC.. THERE IS NO DESCRIPTION OTHER THAN THE LANDS BEING SOLD AND IS A BLANKET EASEMENT.

15. A CALIFORNIA ELECTRIC POWER COMPANY EASEMENT FOR UTILITIES, 60 FEET WIDE, OVER THAT PORTION OF THE POMONA AND ELSINORE RAILROAD RIGHT OF WAY LYING EAST OF BLOCKS 47 AD 45, ALL OF BLOCK 24, AND THE NORTHWESTERLY HALF OF BLOCK 22 OF THE HEREIN DESCRIBED PROPERTY AND INCIDENTAL PURPOSES, RECORDED JANUARY 28, 1954 AS INSTRUMENT NO. 4649 OF OFFICIAL RECORDS. EASEMENT TO BE PROTECTED IN PLACE.

16. A SOUTHERN CALIFORNIA EDISON EASEMENT FOR UTILITIES AND INCIDENTAL PURPOSES, RECORDED APRIL 23, 1959 AS INSTRUMENT NO. 34510 OF OFFICIAL RECORDS. EASEMENT TO BE PROTECTED IN PLACE.

17. A COUNTY OF RIVERSIDE EASEMENT FOR EXCAVATION SLOPES AND INCIDENTAL PURPOSES, RECORDED SEPTEMBER 23, 1963 AS INSTRUMENT NO. 99907 OF OFFICIAL RECORDS. EASEMENT TO BE ABANDONED.

BENCHMARK

(CITY OF CORONA BENCHMARKER C-102)
A 2 ½" BRASS DISK STAMPED "C-102" SET IN THE TOP OF THE CURB LOCATED 5 FOOT NORTH OF THE E.C.R. OF THE NORTHEASTERLY CURB RETURN OF THE INTERSECTION OF CORYDON STREET AND KINGFORD DRIVE.
ELEVATION: 569.419' (DATED 4/88)

ENGINEER

MDS CONSULTING
5 PETERS CANYON DRIVE
SUITE 305
IRVINE, CA. 92606
PHONE: (949) 251-8821
ATTN: BOB ZOLLER

APPLICANT/DEVELOPER

TACRD INVESTMENT L.P.
THE HOFFMAN COMPANY
18881 VON KARMAN AVENUE
SUITE 150
IRVINE, CA. 92612
(949) 553-2020
ATTN: TOM DALLAPE

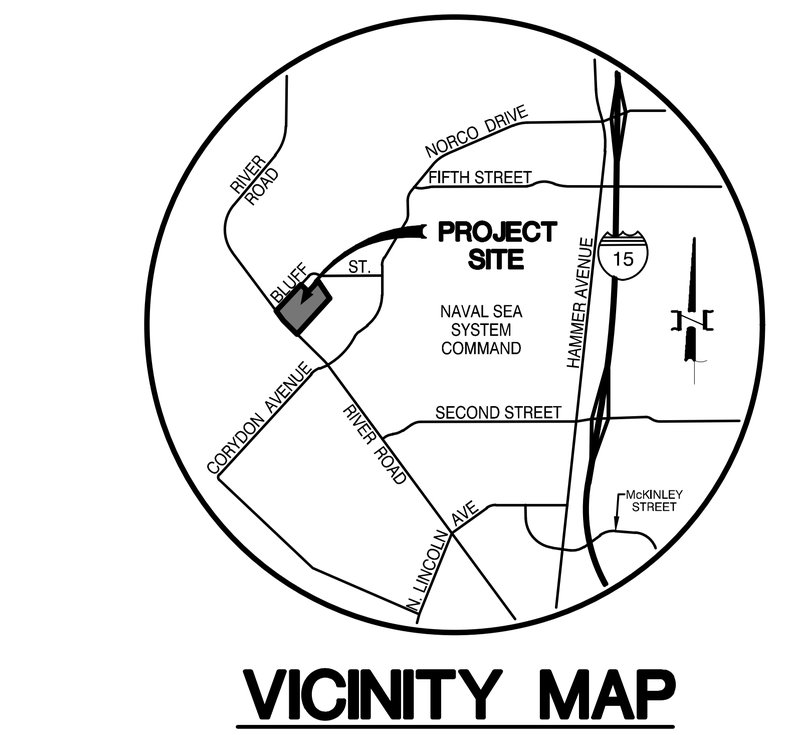
OWNER

THOMAS G. DALLAPE & DIANE L. DALLAPE, TRUSTEES OF THE DALLAPE FAMILY TRUST, DATED NOVEMBER 18,1993
TACRD INVESTMENT, L.P.

C/O. TOM DALLAPE
18881 VON KARMAN AVENUE
SUITE 150
IRVINE, CA. 92612
(949) 553-2020

ASSESSORS PARCEL NUMBERS

121-110-003, 121-110-001 (PORTION)



VICINITY MAP

NOT TO SCALE

J.D. RANCH

TENTATIVE TRACT NO. 38330

TENTATIVE TRACT MAP

CITY OF NORCO, COUNTY OF RIVERSIDE, STATE OF CALIFORNIA

SHEET 1 OF 1

TENTATIVE TRACT MAP NO. 38330

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Appendix 3: Soils Information

Geotechnical Study and Other Infiltration Testing Data

January 21, 2022 Project No. 21250-01

Mr. Tom Dallape
C/O MDS Consulting
17320 Redhill Avenue, Suite 350
Irvine, CA 92614

Subject: ***Preliminary Geotechnical Evaluation for the Proposed Residential Development, Bluff Street and River Road, City of Norco, California***

In accordance with your request, LGC Geotechnical, Inc. has performed a geotechnical evaluation including near surface organic content for the proposed 34-acre residential development located to the east of the intersection of Bluff Street and River Road in the City of Norco, California. This report summarizes the results of our background review, subsurface exploration, and geotechnical analyses of the data collected, and presents our findings, conclusions, and preliminary recommendations for the proposed residential project.

If you should have any questions regarding this report, please do not hesitate to contact our office. We appreciate this opportunity to be of service.

Respectfully,

LGC Geotechnical, Inc.

Tim Lawson, GE 2626, CEG 1821
Geotechnical Engineer/Geologist

REGISTERED PROFESSIONAL ENGINEER
TIMOTHY LAWSON
No. 2626
GEOTECHNICAL
STATE OF CALIFORNIA

Barry Graham, CEG 2749
Project Geologist

CERTIFIED ENGINEERING GEOLOGIST
BARRY GRAHAM
No. 2749
STATE OF CALIFORNIA

TJL/BPG/amm

Distribution: (1) Addressee (electronic copy, wet signed copies can be provided upon request)

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1.0 INTRODUCTION

1.1 Purpose and Scope of Services

This report presents the results of our geotechnical evaluation including near surface organic content for the proposed approximately 34-acre development in the City of Norco, California (see Site Location Map, Figure 1). The purpose of our work was to collect subsurface data in order to prepare a geotechnical report providing recommendations for design and construction of the proposed project. Our scope of services included:

- Review of pertinent readily available geotechnical information and geologic maps (Appendix A).
- Subsurface investigation including excavation, sampling, and logging of 7 small-diameter hollow stem borings.
- Excavation of 19 exploratory geotechnical trenches throughout the site to aid in estimating the depth of required removals during grading, assist in characterizing the near surface soils, and to assess the organic content of near surface "soils".
- Laboratory testing of representative samples obtained during our subsurface investigation (Appendix C).
- Geotechnical analysis and evaluation of the data obtained, including:
  - Suitability of the site for the proposed development from a geotechnical standpoint;
  - Description of the site geology, and subsurface soil and groundwater conditions;
  - Assessment of the organic content of near surface "soils" including recommendations for offsite organic export and/or mixing;
  - Evaluation of the seismic conditions at the site, including seismic design criteria based on the 2019 California Building Code (CBC); and
  - Recommendations for remedial grading operations and site preparation.
- Preparation of this report presenting our findings, conclusions and recommendations with respect to the proposed site development.

1.2 Existing Site Conditions and Proposed Improvements

The roughly rectangular shaped site is approximately 34 acres in size with minor relief. The site is composed of two neighboring parcels, and is bounded to the north by Bluff Street, the south by existing residential development, the west by River Road, and to the East by additional residential development. The southern portion of the site is a former dairy that has been inactive for several years, while the northern area has been used by the city as a spoils/staging yard. There are currently active city water wells within the northern portion of the site. A review of historic aerial photographs suggests the southern site has been used as for dairy and/or agricultural use dating back to at least 1948.

Based on the preliminary grading plans (MDS, 2021), the site will consist of residential units and associated street improvements. Storm water infiltration is planned in proposed basins in the northeast and southwest portions of the site. We expect the proposed residential development will be at-grade with relatively light building loads. The site will have little relief with proposed cuts and fills anticipated to be on the order of 5 to 10 feet, respectively.

The recommendations provided herein are based upon the estimated structural loading and expected layout information above. We understand that project plans are currently being developed at this time; LGC Geotechnical should be provided with updated project plans and any changes to the assumed structural loads when they become available, in order to either confirm or modify the recommendations provided herein.

1.3 Subsurface Evaluation

LGC Geotechnical performed a subsurface geotechnical evaluation of the site consisting of the excavation of 4 hollow-stem auger borings, 3 infiltration borings, and 19 exploratory geotechnical trenches including organic testing.

Seven hollow-stem borings (HS-1 through HS-4, I-1 through I-3) were drilled to depths ranging from approximately 5 to 51.5 feet below existing grade. An LGC Geotechnical representative observed the drilling operations, logged the borings, and collected soil samples for laboratory testing. The borings were excavated using a truck-mounted drill rig equipped with 8-inch-diameter hollow-stem augers. Driven soil samples were collected by means of the Standard Penetration Test (SPT) and Modified California Drive (MCD) sampler generally obtained at 2.5 to 5-foot vertical increments. The MCD is a split-barrel sampler with a tapered cutting tip and lined with a series of 1-inch-tall brass rings. The SPT sampler and MCD sampler were driven using a 140-pound automatic hammer falling 30 inches to advance the sampler a total depth of 18 inches. The raw blow counts for each 6-inch increment of penetration were recorded on the boring logs. Bulk samples were also collected and logged at select depths for laboratory testing. At the completion of drilling, the borings were backfilled with the native soil cuttings and tamped. Some settlement of the backfill soils may occur over time.

Field infiltration testing was performed within borings (I-1 through I-3) at total depths ranging from 5 to 11 feet below existing grade, respectively. An LGC Geotechnical staff engineer installed standpipes, backfilled the boring annulus with crushed rock, and pre-soaked the infiltration wells prior to testing. Infiltration testing was performed in accordance with the County of Riverside testing guidelines. The infiltration test wells were subsequently backfilled with native soils and at the completion of testing.

Nineteen exploratory geotechnical trenches (TP-1 through TP-19) were excavated utilizing a standard backhoe in order to estimate removal depths and obtain samples for laboratory testing. A staff geologist observed the operation, logged the geotechnical trenches and collected soil samples. Each exploratory geotechnical trench was also logged and sampled for the organic content of the near surface "soils." Organic samples were collected at various depths within each trench. The exploratory geotechnical trenches were subsequently backfilled with tamped native soils.

The approximate locations of borings and trenches are shown on the Geotechnical Map (Figure 2). Boring and geotechnical trench logs are presented in Appendix B.

1.4 Laboratory Testing

Laboratory testing was performed on representative soil samples obtained from our subsurface evaluation. Laboratory testing included in-situ moisture and density tests, fines content, Atterberg Limits (liquid limit and plastic limits), collapse/swell potential, expansion index, laboratory compaction and corrosion (sulfate and chloride). Additionally, the near surface organic content trench samples were tested for characterization of the organic content (ASTM 2974).

The following is a summary of the laboratory test results.

- Dry density of the samples collected ranged from approximately 97 pounds per cubic foot (pcf) to 125 pcf, with an average of approximately 110 pcf. Field moisture contents ranged from approximately 2 percent to 34 percent, with an average of approximately 13 percent.
- 3 fines content tests were performed (passing No. 200 sieve). Results indicated fines contents from approximately 39 to 66%, with an average of 50%. Based on the Unified Soils Classification System (USCS), tested samples would be classified as "coarse-grained" and "fine-grained."
- One Atterberg Limit (liquid limit and plastic limit) test was performed. The result indicated a Plasticity Index value of 39.
- Two swell/collapse tests were performed. The plots are provided in Appendix C.
- One Expansion Index (EI) test was performed. The result indicates an EI value of 24, corresponding to "Low" expansion potential.
- One laboratory compaction test of a near surface sample indicated maximum dry density of 117.0 pcf with an optimum moisture content of 12 percent.
- Corrosion testing indicated a soluble sulfate content of less than approximately 0.016 percent, a chloride content of 960 parts per million (ppm), pH of 9.8, and a minimum resistivity of 1,900 ohm-centimeters.
- The organic content of the samples ranged from approximately 0.5 to 60.9 percent.

A summary of the results is presented in Appendix C. The moisture and dry density test results are presented on the boring logs in Appendix B.

2.0 GEOTECHNICAL CONDITIONS

2.1 Regional Geology

The subject site is located south of the San Gabriel Mountains within the broad alluvial plain of the Santa Ana River Basin, within the Peninsular Ranges Geomorphic Province. Specifically, the site is located within the northern portion of the Perris Block, a geologic zone consisting of granitics overlain by sedimentary deposits that are bounded by active faults including the northwest-trending Whittier-Elsinore Fault Zone at the southwest and the northwest-trending San Jacinto Fault Zone at the northeast (USGS, 2002). The roughly rectangular Perris Block is transected by the southwest-trending Santa Ana River that passes approximately 1,700 feet north of the subject site.

Regional geologic mapping and local topographic expressions do not indicate the presence of large-scale landslides within or adjacent to the project area.

2.2 Site Geology and Generalized Subsurface Conditions

Based on regional mapping (USGS, 2002 & 2003), the subject site is underlain by Pleistocene-age very old alluvial channel deposits (Qvoa). These materials are locally overlain by thin areas of undocumented artificial fill. For the purposes of this study, these areas of fill are not differentiated from the native sediments.

As indicated in our field explorations, soils generally consisted of medium dense to dense sands and silty sands with thinner layers of stiff to very stiff fine-grained soils (i.e., silts and clays) to the maximum explored depth of approximately 50 feet below existing grade. Descriptions of the subsurface conditions are presented on the boring and geotechnical test pit logs located in Appendix B. A brief description of the site geologic units can be found below.

It should be noted that our excavations are only representative of the location and time where/when they are performed and varying subsurface conditions may exist outside of the performed location. In addition, subsurface conditions can change over time. The soil descriptions provided above should not be construed to mean that the subsurface profile is uniform, and that soil is homogeneous within the project area. For details on the stratigraphy at the exploration locations, refer to Appendix B.

2.3 Groundwater

Our subsurface evaluation encountered groundwater boring HS-3 at approximately 43 feet below existing grade, at an approximate elevation of 523 feet msl. Groundwater levels recorded by the California Department of Water Resources approximately 0.5 miles to the north adjacent the Santa Ana River, indicate historical groundwater elevations ranging from 536 to 539 feet msl (CDWR, 2022), or approximately 31 to 34 feet below existing site grades.

In general, groundwater levels fluctuate with the seasons and local zones of perched groundwater may be present within the near-surface deposits due to local seepage or during rainy seasons. Groundwater conditions below the site may be variable, depending on numerous factors including seasonal rainfall, local irrigation and groundwater pumping, among others.

2.4 Field Infiltration Testing

Three field percolation tests were performed on Borings I-1, I-2, and I-3 to approximate depths of 5, 5, and 10 feet below existing grade, respectively. Estimation of infiltration rates was performed in general accordance with guidelines set forth by the Riverside County Flood Control (2011). In general, a 3-inch diameter perforated PVC pipe was placed in each borehole to be tested and the annulus was backfilled with gravel, including placement of about 2 inches of gravel at the bottom of the borehole. The infiltration wells were pre-soaked prior to testing. Based on the County of Riverside methodology, the calculated (observed) infiltration rates are provided in Table 1 below. These infiltration rates do not include any factor of safety (to be determined by the project Civil Engineer); however, they have been normalized to correct the 3-D flow that occurs within the field test to 1-D flow out of the bottom of the boring only. The locations and depths of the infiltration tests were coordinated with the civil engineer. The approximate infiltration test locations are shown on the Geotechnical Map (Figure 2) and the infiltration test data is included in Appendix D and summarized below.

TABLE 1

Summary of Infiltration Testing

Infiltration Test Location	Infiltration Test Depth Below Existing Grade (ft)	Observed Infiltration Rate* (Inch/Hr.)
I-1	5	1.6
I-2	5	0.8
I-3	11	36.4

*Normalized to One-Dimensional Flow, does not include any Factor of Safety.

It should be emphasized that infiltration test results are only representative of the location and depth where they are performed. Varying subsurface conditions may exist outside of the test locations which could alter the calculated infiltration rates indicated above. Infiltration tests are performed using relatively clean water free of particulates, silt, etc. Refer to Section 4.8 for subsurface water infiltration recommendations.

2.5 Faulting and Seismic Hazards

California is located on the boundary between the Pacific and North American Lithospheric Plates. The average motion along this boundary is on the order of 50-mm/yr. in a right-lateral sense. The majority of the motion is expressed at the surface along the northwest trending San Andreas Fault Zone with lesser amounts of motion accommodated by sub-parallel faults located

predominantly west of the San Andreas including the Elsinore, Newport-Inglewood, Rose Canyon, and Coronado Bank Faults. Within Southern California, a large bend in the San Andreas Fault north of the San Gabriel Mountains has resulted in a transfer of a portion of the right-lateral motion between the plates into left-lateral displacement and vertical uplift. Compression south and west of the bend has resulted in folding, left-lateral, reverse thrust faulting, and regional uplift creating the east-west trending Transverse Ranges and several east-west trending faults. Further south within the Los Angeles Basin, "blind thrust" faults are believed to have developed below the surface also as a result of this compression, which have resulted in earthquakes such as the 1994 Northridge event along faults with little to no surface expression.

Prompted by damaging earthquakes in Northern and Southern California, State legislation and policies concerning the classification and land-use criteria associated with faults have been developed. The Alquist-Priolo Earthquake Fault Zoning Act was implemented in 1972 to prevent the construction of urban developments across the trace of active faults. California Geologic Survey Special Publication 42 was created to provide guidance for following and implementing the law requirements. Special Publication 42 was most recently revised in 2018 (CGS, 2018). According to the State Geologist, an "active" fault is defined as one which has had surface displacement within Holocene time (roughly the last 11,700 years). Regulatory Earthquake Fault Zones have been delineated to encompass traces of known, Holocene-active faults to address hazards associated with surface fault rupture within California. Where developments for human occupation are proposed within these zones, the state requires detailed fault evaluations be performed so that engineering-geologists can identify the locations of active faults and recommend setbacks from locations of possible surface fault rupture.

The subject site is <u>not</u> located within an Alquist-Priolo Earthquake Fault Zone and no faults were identified on the site during our site evaluation. The possibility of damage due to ground rupture is considered low since no active faults are known to cross the site.

Secondary effects of seismic shaking resulting from large earthquakes on the major faults in the Southern California region, which may affect the site, include ground lurching, shallow ground rupture, soil liquefaction and dynamic settlement. These secondary effects of seismic shaking are a possibility throughout the Southern California region and are dependent on the distance between the site and causative fault and the onsite geology. A discussion of these secondary effects is provided in the following sections.

2.5.1 <u>Liquefaction and Dynamic Settlement</u>

Liquefaction is a seismic phenomenon in which loose, saturated, granular soils behave similarly to a fluid when subject to high-intensity ground shaking. Liquefaction occurs when three general conditions coexist: 1) shallow groundwater; 2) low density non-cohesive (granular) soils; and 3) high-intensity ground motion. Studies indicate that loose, saturated, near-surface, cohesionless soils exhibit the highest liquefaction potential, while dry, dense, cohesionless soils, and cohesive soils exhibit low to negligible liquefaction potential. In general, cohesive soils are not considered susceptible to liquefaction. Effects of liquefaction on level ground include settlement, sand boils, and bearing capacity failures below structures. Furthermore, dynamic settlement of dry

sands can occur as the sand particles tend to settle and densify as a result of a seismic event.

Based on our review of the City of Norco Local Hazard Mitigation Plan (Norco, 2017), the subject site is in an area of potential liquefaction within which groundwater is shallower than 30 feet. The data obtained from our field evaluation indicates that the site contains isolated silty/sandy layers susceptible to liquefaction in the upper 50 feet. Liquefaction potential was evaluated using the procedures outlined by Special Publication 117A (SCEC, 1999 & CGS, 2008). Liquefaction analysis was performed on the 50-foot boring (HS-3) based on the seismic criteria (PGA_M) of the 2019 California Building Code (CBC) and the estimated high groundwater depth of 20 feet below existing grade.

Results indicate total seismic settlement, as a result of liquefaction of sand layers below 20 feet from the ground surface, on the order of 1.5-inches or less. Differential seismic settlement can be estimated as half of the total estimated settlement over a horizontal span of about 40 feet. Liquefaction calculations are provided in Appendix E.

2.5.2 Lateral Spreading

Lateral spreading is a type of liquefaction-induced ground failure associated with the lateral displacement of surficial blocks of sediment resulting from liquefaction in a subsurface layer. Once liquefaction transforms the subsurface layer into a fluid mass, gravity plus the earthquake inertial forces may cause the mass to move downslope towards a free face (such as a river channel or an embankment). Lateral spreading may cause large horizontal displacements and such movement typically damages pipelines, utilities, bridges, and structures.

The site sandy soils anticipated to be left in place (below the recommended temporary removal and recompaction depths) generally have a SPT $(N_1)_{60}$ blow count well above 15. Soils with a corrected SPT $(N_1)_{60}$ blow count of 15 or greater are generally not considered susceptible to lateral spreading (Youd, Hansen, Bartlett, 2002). Furthermore, isolated sandy layers susceptible to liquefaction were generally found not to be laterally continuous and dense formational bedrock materials were encountered at a depth of approximately 50 feet below existing grade.

Due to the subsurface data, depth of proposed earthwork removals, presence of dense sandy soils below the recommended earthwork removals, and limited nature of potentially liquefiable soils, the potential for lateral spreading is considered low.

2.6 Seismic Design Criteria

The site seismic characteristics were evaluated per the guidelines set forth in Chapter 16, Section 1613 of the 2019 California Building Code (CBC) and applicable portions of ASCE 7-16 which has been adopted by the CBC. **Please note that the following seismic parameters are only applicable for code-based acceleration response spectra and are not applicable for where site-specific ground motion procedures are required by ASCE 7-16.** Representative site coordinates of latitude 33.917662 degrees north and longitude -117.591572 degrees west were utilized in our analyses. The maximum considered earthquake (MCE) spectral response accelerations (S_{MS} and S_{M1}) and adjusted design spectral response acceleration parameters (S_{DS} and S_{D1}) for Site Class D are provided in Table 2 on the following page. Since site soils are Site Class D, additional adjustments are required to code acceleration response spectrums as outlined below and provided in ASCE 7-16. The structural designer should contact the geotechnical consultant if structural conditions (e.g., number of stories, seismically isolated structures, etc.) require site-specific ground motions.

A deaggregation of the PGA based on a 2,475-year average return period (MCE) indicates that an earthquake magnitude of 6.67 at a distance of approximately 10.49 km from the site would contribute the most to this ground motion. A deaggregation of the PGA based on a 475-year average return period (Design Earthquake) indicates that an earthquake magnitude of 6.64 at a distance of approximately 13.37 km from the site would contribute the most to this ground motion (USGS, 2014).

Section 1803.5.12 of the 2019 CBC (per Section 11.8.3 of ASCE 7) states that the maximum considered earthquake geometric mean (MCE_G) Peak Ground Acceleration (PGA) should be used for liquefaction potential. The PGA_M for the site is equal to 0.795g (SEAOC, 2022).

TABLE 2

Seismic Design Parameters

Selected Parameters from 2019 CBC, Section 1613 - Earthquake Loads	Seismic Design Values	Notes/Exceptions
Distance to applicable faults classifies the site as a "Near-Fault" site.		Section 11.4.1 of ASCE 7
Site Class	D*	Chapter 20 of ASCE 7
Ss (Risk-Targeted Spectral Acceleration for Short Periods)	1.713g	From SEAOC, 2021
S_1 (Risk-Targeted Spectral Accelerations for 1-Second Periods)	0.666g	From SEAOC, 2021
F_a (per Table 1613.2.3(1))	1.0	For Simplified Design Procedure of Section 12.14 of ASCE 7, F_a shall be taken as 1.4 (Section 12.14.8.1)
F_v (per Table 1613.2.3(2))	1.7	Value is only applicable per requirements/exceptions per Section 11.4.8 of ASCE 7
S_{MS} for Site Class D [Note: $S_{MS} = F_aS_S$]	1.713g	-
S_{M1} for Site Class D [Note: $S_{M1} = F_vS_1$]	1.132g	Value is only applicable per requirements/exceptions per Section 11.4.8 of ASCE 7
S_{DS} for Site Class D [Note: $S_{DS} = (^2/_3)S_{MS}$]	1.142g	-
S_{D1} for Site Class D [Note: $S_{D1} = (^2/_3)S_{M1}$]	0.755g	Value is only applicable per requirements/exceptions per Section 11.4.8 of ASCE 7
C_{RS} (Mapped Risk Coefficient at 0.2 sec)	0.925	ASCE 7 Chapter 22
C_{R1} (Mapped Risk Coefficient at 1 sec)	0.915	ASCE 7 Chapter 22
*Since site soils are Site Class D and S_1 is greater than or equal to 0.2, the seismic response coefficient Cs is determined by Eq. 12.8-2 for values of $T \leq 1.5T_s$ and taken equal to 1.5 times the value calculated in accordance with either Eq. 12.8-3 for $T_L \geq T > T_s$, or Eq. 12.8-4 for $T > T_L$. Refer to ASCE 7-16.		

2.7 Organic Rich Soils

A total of 32 bag soil samples were collected to determine their organic content (based on ASTM 2974). The organic content of the samples ranged from approximately 0.5 to 60.9 percent. In general, the organic content is higher near existing grade and decreases with depth. Table 7 (Appendix C) summarizes the measured organic content. The Geotechnical Map (Figure 2) and Table 7 provide our recommended depth of high organic export, which is based on a combination

of the organic content laboratory test results and our visual observations of the trenches.

On average, the upper approximately 6 inches (0.5-foot) of "soil" across the southern portion previously used as a dairy of the site is recommended for export and disposal off-site due to high organic content (greater than 5.0 percent). It is expected that the next approximately 1 foot (at maximum) of soil below the recommended high organic export depth, within the transition zone, has an organic content between approximately 2 and 5 percent and can remain onsite. Below this, the materials are generally "clean" low organic soils. Recommendations for handling of organic rich soils are provided in the following "Organic Rich Soil Recommendations" Section 4.1.2.

3.0 CONCLUSIONS

Based on the results of our subsurface geotechnical evaluation, it is our opinion that the proposed improvements are feasible from a geotechnical standpoint, provided that the recommendations contained in the following sections are incorporated during site grading and development. A summary of our geotechnical conclusions are as follows:

- The near-surface loose and compressible soils are not suitable for the planned improvements in their present condition (refer to Section 4.1). Organic rich soils (total organic carbon content generally greater than 5 percent) are not suitable for compacted fill soils from a geotechnical perspective.
- From a geotechnical perspective, onsite soils are anticipated to be suitable for use as general compacted fill provided the high organic content soils (soils with organic content greater than 5 percent) are removed from the site and the remaining soils with organic content between 2 and 5 percent are blended and mixed with "clean" soils and screened of construction debris and any oversized material (8 inches in greatest dimension).
- Groundwater was encountered in boring HS-3 at approximately 43 feet below existing grade. Historical levels recorded in the area indicate groundwater highs from approximately 31 to 34 feet below ground surface.
- The subject study area is not located within a mapped State of California Earthquake Fault Zone, and based upon our review of published geologic mapping, no known active or potentially active faults are known to exist within or in the immediate vicinity of the site. Therefore, the potential for ground rupture as a result of faulting is considered very low.
- The main seismic hazard that may affect the site is ground shaking from one of the active regional faults. The subject site will likely experience strong seismic ground shaking during its design life.
- Based on our review of the City of Norco Local Hazard Mitigation Plan (Norco, 2017), the subject site is bounded in an area of potential liquefaction within which groundwater is shallower than 30 feet. Total dynamic settlement is estimated to be on the order 1.5 inches or less. Differential settlement may be estimated as half of the total settlement over a horizontal span of 40 feet.
- Based on the results of preliminary laboratory testing, site soils are anticipated to have "Low" expansion potential. Final design expansion potential must be determined at the completion of grading.
- Based on the corrosion test results, soils are considered corrosive per the Caltrans criteria (Caltrans, 2018).
- Excavations into the existing site soils should be feasible with heavy construction equipment in good working order. We anticipate that the sandy and silty earth materials generated from the excavations will be generally suitable for re-use as compacted fill, provided they are relatively free of rocks larger than 8 inches in dimension, construction debris, and significant organic material.
- Some portion of the onsite soils have high fines content; therefore, are not suitable for backfill of site retaining walls. Therefore, import of sandy soils meeting project recommendations is required for retaining wall backfill.
- Field testing resulted in observed infiltration rates ranging from 0.8 to 36.4 inches per hour. The observed infiltration rates do not include a factor of safety. Discussion regarding infiltration is provided in Section 4.8.

4.0 RECOMMENDATIONS

The following recommendations are to be considered preliminary and should be confirmed upon completion of grading and earthwork operations. In addition, they should be considered minimal from a geotechnical viewpoint, as there may be more restrictive requirements from the architect, structural engineer, building codes, governing agencies, or the owner.

It should be noted that the following geotechnical recommendations are intended to provide sufficient information to develop the site in general accordance with the 2019 CBC requirements. With regard to the possible occurrence of potentially catastrophic geotechnical hazards such as fault rupture, earthquake-induced landslides, liquefaction, etc. the following geotechnical recommendations should provide adequate protection for the proposed development to the extent required to reduce seismic risk to an "acceptable level." The "acceptable level" of risk is defined by the California Code of Regulations as "that level that provides reasonable protection of the public safety, though it does not necessarily ensure continued structural integrity and functionality of the project" [Section 3721(a)]. Therefore, repair and remedial work of the proposed improvement may be required after a significant seismic event. With regards to the potential for less significant geologic hazards to the proposed development, the recommendations contained herein are intended as a reasonable protection against the potential damaging effects of geotechnical phenomena such as expansive soils, fill settlement, groundwater seepage, etc. It should be understood, however, that our recommendations are intended to maintain the structural integrity of the proposed development and structures given the site geotechnical conditions but cannot preclude the potential for some cosmetic distress or nuisance issues to develop as a result of the site geotechnical conditions.

The geotechnical recommendations contained herein must be confirmed to be suitable or modified based on the actual as-graded conditions.

4.1 Site Earthwork

Rough grading shall include export of high organic content soils, remedial earthwork grading including mixing and blending followed by placement of engineered compacted fill to design grades. Geotechnical recommendations for precise grading and construction of the proposed new improvements will be provided, as necessary.

We recommend that earthwork onsite be performed in accordance with the following recommendations, future grading plan review report(s), the 2019 CBC/City of Norco requirements, and the General Earthwork and Grading Specifications for Rough Grading included in Appendix E. In case of conflict, the following recommendations shall supersede those included in Appendix E. The following recommendations may be revised within future grading plan review reports or based on the actual conditions encountered during site grading.

4.1.1 Site Preparation

Prior to grading, areas to be developed should undergo the stripping and clearing of vegetation, high organic content soil removal/export and clearing of surface obstructions, pavements, foundation and slab elements from the site. Vegetation, debris and excessive organic material from livestock holding areas should be removed and properly disposed of offsite. Recommendations for removal of organic rich soils are provided in the following section. Holes resulting from removals of buried obstructions, which extend below proposed remedial and/or finish grades, should be replaced with suitable compacted fill material.

If cesspools or septic systems are encountered, they should be removed in their entirety. The resulting excavation should be backfilled with properly compacted fill soils. As an alternative, cesspools can be backfilled with lean sand-cement slurry. Any encountered wells should be properly abandoned in accordance with regulatory requirements.

4.1.2 Organic Rich Soil Recommendations

We recommend soils with an organic content greater than 5 percent be removed and exported from the site. For most of the site this is the top 6 inches (0.5-foot). Figure 2 outlines areas that contains high organic content needing removal and export. Our recommendations are based on the following assumptions; 1) all soils with "high" organic contents greater than 5 percent shall be removed and disposed of off-site, 2) "transitional" soils (soils with organic content ranging from 2 to 5 percent) shall be adequately mixed or blended with the "clean" soils (soils with organic content less than 2.0 percent), and 3) There will be sufficient "clean" soils to dilute the limited "transitional" soils during the grading operation. From a geotechnical perspective, organic content of compacted fill soils should not exceed 2 percent.

After export of the top 6 inches (0.5-foot) of material, remedial grading as described in the following section should result in organic content of the fill materials to be less than approximately 2 percent. If necessary to satisfy City requirements of documenting the organic content in the fill, samples should be collected during grading and tested for organic content.

We recommend the geotechnical consultant be present during grading to observe the mixing of the onsite soils and perform periodic testing of the compacted fill. Organic materials shall be thoroughly mixed such that no nesting of organic materials occurs. Removal of organic materials is to satisfy geotechnical concerns and does not mitigate the potential for methane gas. Some methane gas should be expected after grading especially in former wastewater areas. Methane potential shall be evaluated by others.

Areas were buried or mounded/stockpiled unsuitable materials (i.e., trash, debris and organic rich farming soil mix) are found shall not be reused as compacted fill. Some of the unsuitable materials such as trash/soil mixes and debris/soil mixes may be processed and cleaned on-site by separating the unsuitable materials (i.e., trash, debris and organics) from the soil prior to placing as fill. However, if cleaning and separating trash,

debris and organics from the soil is not practical, the unsuitable materials shall be removed and exported from the site.

4.1.3 Removal Depths and Limits

In order to provide a relatively uniform bearing condition for the planned improvements, we recommend the site soils be removed and recompacted. We recommend that soils within building pads be removed and recompacted to a minimum depth of 5 feet below existing grade (prior to organic removal). The envelope for removal and recompaction should extend laterally a minimum distance of 5 feet beyond the edges of the proposed improvements.

In areas of design cut, over-excavation shall extend a minimum of 5 feet below existing grade or a minimum of 3 feet below finished grade, whichever is deeper. In the design cut areas, this depth may be reduced if in-place alluvial materials are tested and found to have an in-situ dry density equal or greater than 90 percent relative compaction (based on American Standard of Testing and Materials [ASTM] Test Method D1557) and exhibit uniform conditions. A representative from LGC geotechnical should be on site to approve the removal bottom to ensure it is acceptable from a geotechnical standpoint, and free of organic content.

For minor site structures such as free-standing and screen walls, the removals should extend at least 3 feet beneath the existing grade or 2 feet beneath the base of foundations, whichever is deeper. Within pavement and hardscape areas, removals should extend to a depth of at least 2 feet below the existing grade. The over-excavation in any design cut areas of the pavement may be reduced by the depth of the design cut but should not be less than 1-foot below the finished subgrade (i.e., below planned aggregate base/asphalt concrete). In general, the envelope for over-excavation should extend laterally a minimum distance of 2 feet beyond the edges of the proposed improvements mentioned above.

Local conditions may be encountered during excavation that could require additional over-excavation beyond the above-noted minimum in order to obtain an acceptable subgrade. The actual depths and lateral extents of grading will be determined by the geotechnical consultant, based on subsurface conditions encountered during grading. Removal areas and areas to be over-excavated should be accurately staked in the field by the Project Surveyor.

4.1.4 Temporary Excavations

Temporary excavations should be performed in accordance with project plans, specifications, and applicable Occupational Safety and Health Administration (OSHA) requirements. Excavations should be laid back or shored in accordance with OSHA requirements before personnel or equipment are allowed to enter. Based on our field investigation, the majority of site soils are anticipated to be OSHA Type "B" soils (refer to the attached boring logs). Sandy soils are present and should be considered susceptible to caving. Soil conditions should be regularly evaluated during construction to verify

conditions are as anticipated. The contractor shall be responsible for providing the "competent person" required by OSHA standards to evaluate soil conditions. Close coordination with the geotechnical consultant should be maintained to facilitate construction while providing safe excavations. Excavation safety is the sole responsibility of the contractor.

Vehicular traffic, stockpiles, and equipment storage should be set back from the perimeter of excavations a minimum distance equivalent to a 1:1(horizontal to vertical) projection from the bottom of the excavation or 5 feet, whichever is greater. Once an excavation has been initiated, it should be backfilled as soon as practical. Prolonged exposure of temporary excavations may result in some localized instability. Excavations should be planned so that they are not initiated without sufficient time to shore/fill them prior to weekends, holidays, or forecasted rain.

It should be noted that any excavation that extends below a 1:1 (horizontal to vertical) projection of an existing foundation will remove existing support of the structure foundation. If requested, temporary shoring parameters will be provided.

4.1.5 Subgrade Preparation

In general, areas to receive compacted fill should be scarified to a minimum depth of 6 inches, brought to a near-optimum moisture condition (generally within optimum and 2 percent above optimum moisture content), and re-compacted per project requirements. Removal bottoms and areas to receive fill should be observed and accepted by the geotechnical consultant prior to subsequent fill placement.

4.1.6 Material for Fill

From a geotechnical perspective, the onsite soils are generally considered suitable for use as general compacted fill, provided they are screened of organic materials, construction debris and any oversized material (8 inches in greatest dimension). From a geotechnical perspective, soils with an organic content of less than 2 percent are generally considered suitable for re-use as compacted fill.

From a geotechnical viewpoint, import soils for general fill (i.e., non-retaining wall backfill) should consist of clean, granular soils of Very Low expansion potential (expansion index 20 or less based on ASTM D4829). Import for retaining wall backfill should meet the criteria outlined in the paragraph below. Source samples should be provided to the geotechnical consultant for laboratory testing a minimum of three working days prior to any planned importation.

Retaining wall backfill should consist of granular free draining soils (sand equivalent of 30 or greater as determined by ASTM D2419 or CTM 217). Soils should also be screened of organic materials, construction debris, and any material greater than 3 inches in maximum dimension. The onsite soils are not considered suitable for retaining wall backfill due to

their fines content (i.e., silt and clay content). Therefore, import of suitable soils meeting the criteria outlined above will be required.

Aggregate base should conform to the requirements of Section 200-2 of the most recent version of the Standard Specifications for Public Works Construction ("Greenbook") for untreated base materials and/or City of Norco requirements.

4.1.7 Placement and Compaction of Fills

Material to be placed as fill should be brought to near-optimum moisture content (generally within optimum and 2 percent above optimum moisture content) and recompacted to at least 90 percent relative compaction (per ASTM D1557). Moisture conditioning of site soils will be required in order to achieve adequate compaction. Drying and/or mixing the very moist soils will be required prior to reusing the materials in compacted fills. Soils are also present that will require additional moisture in order to achieve the required compaction.

The optimum lift thickness to produce a uniformly compacted fill will depend on the type and size of compaction equipment used. In general, fill should be placed in uniform lifts not exceeding 8 inches in compacted thickness. Each lift should be thoroughly compacted and accepted prior to subsequent lifts. Generally, placement and compaction of fill should be performed in accordance with local grading ordinances and with observation and testing by LGC Geotechnical. Oversized material as previously defined should be removed from site fills.

During backfill of excavations, the fill should be properly benched into firm and competent soils of temporary backcut slopes as it is placed in lifts.

Aggregate base material should be compacted to a minimum of 95 percent relative compaction at or slightly above optimum moisture content per ASTM D1557. Subgrade below aggregate base should be compacted to a minimum of 90 percent relative compaction per ASTM D1557 at near-optimum moisture content (generally within optimum and 2 percent above optimum moisture content).

4.1.8 Trench and Retaining Wall Backfill and Compaction

The onsite soils may generally be suitable as trench backfill, provided the soils are screened of rocks and other material greater than 6 inches in diameter and organic matter. If trenches are shallow or the use of conventional equipment may result in damage to the utilities, sand having a sand equivalent (SE) of 30 or greater (per California Test Method [CTM] 217) may be used to bed and shade the pipes. Sand backfill within the pipe bedding zone may be densified by jetting or flooding and then tamping to ensure adequate compaction. Subsequent trench backfill should be compacted in uniform thin lifts by mechanical means to at least the recommended minimum relative compaction (per ASTM D1557).

Retaining wall backfill should consist of sandy soils as outlined in preceding Section 4.1.6. The contractor should anticipate the importing of soils for the required retaining wall backfill. The limits of select sandy backfill should extend a minimum ½ the height of the retaining wall or the width of the heel (if applicable), whichever is greater, refer to Figures 3 and 4 (rear of text). Retaining wall backfill soils should be compacted in relatively uniform thin lifts to at least 90 percent relative compaction (per ASTM D1557). Jetting or flooding of retaining wall backfill materials should not be permitted.

A representative from LGC Geotechnical should observe, probe, and test the backfill to verify compliance with the project recommendations.

4.1.9 Shrinkage and Subsidence

Allowance in the earthwork volumes budget should be made for an estimated 10 to 15 percent reduction in volume of near-surface (upper approximate 5 feet) soils. It should be stressed that these values are only estimates and that an actual shrinkage factor would be extremely difficult to predetermine. Subsidence due to earthwork equipment is expected to be up to 0.1 feet. These values are estimates only and exclude losses due to removal of vegetation or debris. The effective change in volume of onsite soils will depend primarily on the type of compaction equipment, method of compaction used onsite by the contractor, and accuracy of the topographic survey.

Due to the combined variability in topographic surveys, inability to precisely model the removals and variability of on-site near-surface conditions, it is our opinion that the site will not balance at the end of grading. If importing/exporting a large volume of soils is not considered feasible or economical, we recommend a balance area be designated onsite that can fluctuate up or down based on the actual volume of soil. We recommend a "balance" area that can accommodate a minimum of 5 percent (the greater the better) of the total grading volume be considered.

4.2 Preliminary Foundation Recommendations

Given that the expansion index exceeds 20, the foundation systems shall be designed for effects of expansive soil. Preliminary conventional and post-tensioned foundation recommendations are provided in the following sections. Recommended soil bearing and estimated static settlement are provided in Section 4.3. Please note that the following foundation recommendations are preliminary and must be confirmed by LGC Geotechnical at the completion of project plans (i.e., foundation, grading and site layout plans) as well as completion of earthwork.

Preliminary foundation recommendations are provided in the following sections. Recommended soil bearing and estimated settlement due to structural loads are provided in Section 4.3.

4.2.1 Provisional Conventional Foundation Design

Conventional foundations may be designed in accordance with Wire Reinforcement

Institute (WRI) procedure for slab-on-ground foundations per Section 1808 of the 2019 CBC to resist expansive soils. The following preliminary soil parameters may be used:

- Effective Plasticity Index: 15
- Climatic Rating: Cw = 15
- Reinforcement: Per structural designer.
- Moisture condition subgrade soils to 100 % of optimum moisture content to a depth of 12 inches prior to trenching for footings.

4.2.2 Provisional Post-Tensioned Foundation Design Parameters

The geotechnical parameters provided herein may be used for post-tensioned slab foundations with a deepened perimeter footing or a post-tensioned mat slab. These parameters have been determined in general accordance with the Post-Tensioning Institute (PTI) Standard Requirements for Design of Shallow Post-Tensioned Concrete Foundations on Expansive Soils, referenced in Chapter 18 of the 2019 CBC. In utilizing these parameters, the foundation engineer should design the foundation system in accordance with the allowable deflection criteria of applicable codes and the requirements of the structural designer/architect. Other types of stiff slabs may be used in place of the CBC post-tensioned slab design provided that, in the opinion of the foundation structural designer, the alternative type of slab is at least as stiff and strong as that designed by the CBC/PTI method.

Our design parameters are based on our experience with similar projects, laboratory test results, and the anticipated nature of the soil (with respect to expansion potential). Please note that implementation of our recommendations will not eliminate foundation movement (and related distress) should the moisture content of the subgrade soils fluctuate. It is the intent of these recommendations to help maintain the integrity of the proposed structures and reduce (not eliminate) movement, based upon the anticipated site soil conditions. Should future owners and/or property maintenance personnel not properly maintain the areas surrounding the foundation, for example by overwatering, then we anticipate for highly expansive soils the maximum differential movement of the perimeter of the foundation to the center of the foundation to be on the order of a couple of inches. Soils of lower expansion potential are anticipated to show less movement.

TABLE 3

Preliminary Geotechnical Foundation Design Parameters

Parameter	PT Slab with Perimeter Footing	PT Mat with Thickened Edge
Expansion Index	Low[1]	Low[1]
Thornthwaite Moisture Index	-20	-20
Constant Soil Suction	PF 3.9	PF 3.9
Center Lift Edge moisture variation distance, e_m Center lift, y_m	 9.0 feet 0.25 inch	 9.0 feet 0.30 inch
Edge Lift Edge moisture variation distance, e_m Edge lift, y_m	 5.5 feet 0.55 inch	 5.5 feet 0.66 inch
Modulus of Subgrade Reaction, k (assuming presoaking as indicated below)	200 pci	200 pci
Minimum perimeter footing/thickened edge embedment below finish grade	15 inches	6 inches

1. Assumed for preliminary design purposes. Further evaluation is needed at the completion of grading.
2. Recommendations for foundation reinforcement and slab thickness are ultimately the purview of the foundation engineer/structural engineer based upon geotechnical criteria and structural engineering considerations.
3. Recommendations for sand below slabs have traditionally been included with geotechnical foundation recommendations, although they are not the purview of the geotechnical consultant. The sand layer requirements are the purview of the foundation engineer/structural engineer and should be provided in accordance with ACI Publication 302 "Guide for Concrete Floor and Slab Construction".
4. Recommendations for vapor retarders below slabs are also the purview of the foundation engineer/structural engineer and should be provided in accordance with applicable code requirements.
5. Moisture condition to 100 % of optimum moisture content to a depth of 12 inches prior to trenching.

4.2.3 Shallow Foundation Maintenance

The geotechnical parameters provided herein assume that if the areas adjacent to the foundation are planted and irrigated, these areas will be designed with proper drainage and adequately maintained so that ponding, which causes significant moisture changes below the foundation, does not occur. Our recommendations do not account for excessive irrigation and/or incorrect landscape design. Plants should only be provided with sufficient irrigation for life and not overwatered to saturate subgrade soils. Sunken planters placed adjacent to the foundation, should either be designed with an efficient

drainage system or liners to prevent moisture infiltration below the foundation. Some lifting of the perimeter foundation beam should be expected even with properly constructed planters.

In addition to the factors mentioned above, future owners/property management personnel should be made aware of the potential negative influences of trees and/or other large vegetation. Roots that extend near the vicinity of foundations can cause distress to foundations. Future owners (and the owner's landscape architect) should not plant trees/large shrubs closer to the foundations than a distance equal to half the mature height of the tree or 20 feet, whichever is more conservative unless specifically provided with root barriers to prevent root growth below the building foundation.

It is the owner's responsibility to perform periodic maintenance during hot and dry periods to ensure that adequate watering has been provided to keep soil from separating or pulling back from the foundation. Future owners and property management personnel should be informed and educated regarding the importance of maintaining a constant level of soil-moisture. The owners should be made aware of the potential negative consequences of both excessive watering, as well as allowing potentially expansive soils to become too dry. Expansive soils can undergo shrinkage during drying, and swelling during the rainy winter season, or when irrigation is resumed. This can result in distress to building structures and hardscape improvements. The builder should provide these recommendations to future owners and property management personnel.

4.2.4 Slab Underlayment Guidelines

The following is for informational purposes only since slab underlayment (e.g., moisture retarder, sand or gravel layers for concrete curing and/or capillary break) is unrelated to the geotechnical performance of the foundation and thereby not the purview of the geotechnical consultant. Post-construction moisture migration should be expected below the foundation. The foundation engineer/architect should determine whether the use of a capillary break (sand or gravel layer), in conjunction with the vapor retarder, is necessary or required by code. Sand layer thickness and location (above and/or below vapor retarder) should also be determined by the foundation engineer/architect.

4.3 Soil Bearing and Lateral Resistance

Provided our earthwork recommendations are implemented, an allowable soil bearing pressure of 2,000 pounds per square foot (psf) may be used for the design of footings having a minimum width of 12 inches and minimum embedment of 12 inches below lowest adjacent ground surface. This value may be increased by 400 psf for each additional foot of embedment and 200 psf for each additional foot of foundation width to a maximum value of 3,000 psf. A mat foundation a minimum of 6 inches below lowest adjacent grade may be designed for an allowable soil bearing pressure of 1,200 psf. These allowable bearing pressures are applicable for level (ground slope equal to or flatter than 5H:1V) conditions only. Bearing values indicated are for total dead loads and frequently applied live loads and may be increased by ⅓ for short duration loading (i.e., wind or seismic loads).

Soil settlement is a function of footing dimensions and applied soil bearing pressure. In utilizing the above-mentioned allowable bearing capacity, assumed structural loads, and provided our earthwork recommendations are implemented, foundation settlement due to structural loads is anticipated to be on the order of 1-inch or less and ½-inch over a horizontal span of 40 feet for total and differential settlement, respectively. Differential settlement should be anticipated between nearby columns or walls where a large differential loading condition exists Furthermore, seismic settlement due to dry-sand settlement is anticipated to be 0.5 inches or less. Differential seismic settlement may be taken as half of the seismic settlement (i.e., ¼-inch over a horizontal span of 40 feet).

Resistance to lateral loads can be provided by friction acting at the base of foundations and by passive earth pressure. For concrete/soil frictional resistance, an allowable coefficient of friction of 0.35 may be assumed with dead-load forces. An allowable passive lateral earth pressure of 270 psf per foot of depth (or pcf) to a maximum of 2,700 psf may be used for the sides of footings poured against properly compacted fill. Allowable passive pressure may be increased to 360 pcf (maximum of 3,600 psf) for short duration seismic loading. This passive pressure is applicable for level (ground slope equal to or flatter than 5H:1V) conditions only. Frictional resistance and passive pressure may be used in combination without reduction. We recommend that the upper foot of passive resistance be neglected if finished grade will not be covered with concrete or asphalt. The provided allowable passive pressures are based on a factor of safety of 1.5 and 1.1 for static and seismic loading conditions, respectively. The structural designer should incorporate appropriate factors of safety and/or load factors in their design.

4.4 Retaining Wall Recommendations

4.4.1 Toe-of-Slope Retaining Wall Earthwork Recommendations

The toe-of-slope retaining wall may be designed as a conventional retaining wall. Prior to the construction of the retaining wall the existing soil should be removed and recompacted to a minimum of 2 feet below existing grade or 1-foot below proposed footings, whichever is greater. Where space is available, the envelope for removal and recompaction should extend laterally a minimum distance of 2 feet beyond the edges of the structure improvements.

In general, removal bottom areas and any areas to receive compacted fill should be scarified to a minimum depth of 6 inches, brought to near-optimum moisture content (generally within optimum and 2 percent above optimum moisture content), and recompacted per project recommendations. Removal bottoms, over-excavation bottoms and areas to receive fill should be observed and accepted by the geotechnical consultant prior to subsequent fill placement. Soil subgrade for planned footings and improvements should be firm and competent.

Material to be placed as fill should be brought to near-optimum moisture content (generally within optimum and 2 percent above optimum moisture content) and recompacted to at least 90 percent relative compaction (per ASTM D1557). Moisture conditioning of site soils will be required in order to achieve adequate compaction. Soils

are present that will require additional moisture in order to achieve the required compaction. Drying and/or mixing the very moist soils may also be required prior to reusing the materials in compacted fill.

The optimum lift thickness to produce a uniformly compacted fill will depend on the type and size of compaction equipment used. In general, fill should be placed in uniform lifts not exceeding 8 inches in compacted thickness. Each lift should be thoroughly compacted and accepted prior to subsequent lifts. Generally, placement and compaction of fill should be performed in accordance with local grading ordinances and with observation and testing performed by the geotechnical consultant. Oversized material as previously defined should be removed from site fills. During backfill of excavations, the fill should be properly benched into firm and competent soils of temporary backcut slopes as it is placed in lifts.

Retaining wall backfill should consist of sandy soils as outlined in Figures 3 and 4 (Rear of Text) and in the following Section (Toe-of-Slope Retaining Wall Lateral Earth Pressures). The limits of select sandy backfill should extend at minimum ½ the height of the retaining wall or the width of the heel (if applicable), whichever is greater (Figures 3 & 4). Retaining wall backfill soils should be compacted in relatively uniform thin lifts to at least 90 percent relative compaction (per ASTM D1557). Jetting or flooding of retaining wall backfill materials should not be permitted.

4.4.2 Toe-of-Slope Retaining Wall Lateral Earth Pressures

Lateral earth pressures for approved native sandy or import soils meeting indicated project requirements are provided below. Lateral earth pressures are provided as equivalent fluid unit weights, in psf per foot of depth (or pcf). These values do not contain an appreciable factor of safety, so the retaining wall designer should apply the applicable factors of safety and/or load factors during design. A soil unit weight of 120 pcf may be assumed for calculating the actual weight of soil over the wall footing.

The following lateral earth pressures are presented in Table 4 on the following page for approved granular soils with a maximum of 35 percent fines (passing the No. 200 sieve per ASTM D-421/422) and a "Very Low" expansion potential (EI of 20 or less per ASTM D4829). Retaining wall backfill should be free of material greater than 3 inches in maximum dimension. The site contains soils that are not suitable for retaining wall backfill due to their expansion potential; therefore, import should be anticipated by the contractor for obtaining suitable retaining wall backfill soil. The wall designer should clearly indicate on the retaining wall plans the required select sandy soil backfill criteria. These preliminary findings should be confirmed during grading. Should the inclination of the slope above the proposed toe-of-slope retaining wall be steeper than a 2:1 (horizontal to vertical) slope, the provided recommendations should be reevaluated. If this is the case, additional analysis and updated recommendations should be expected.

TABLE 4

Lateral Earth Pressures – Approved Imported Select Sandy Soils

Conditions	Equivalent Fluid Unit Weight (pcf)	Equivalent Fluid Unit Weight (pcf)
	Level Backfill	2:1 Sloped Backfill
	Approved Imported Sandy Soils	Approved Imported Sandy Soils
Active	35	55
At-Rest	55	70

If the wall can yield enough to mobilize the full shear strength of the soil, it can be designed for "active" pressure. If the wall cannot yield under the applied load, the earth pressure will be higher. This would include 90-degree corners of retaining walls. Such walls should be designed for "at-rest." The equivalent fluid pressure values assume free-draining conditions. If conditions other than those assumed above are anticipated, the equivalent fluid pressure values should be provided on an individual-case basis by the geotechnical engineer.

Retaining wall structures should be provided with appropriate drainage and appropriately waterproofed. To reduce, but not eliminate, saturation of near-surface (upper approximate 1-foot) soils in front of the retaining walls, the perforated subdrain pipe should be located as low as possible behind the retaining wall. The outlet pipe should be sloped to drain to a suitable outlet. In general, we do not recommend retaining wall outlet pipes be connected to area drains. If subdrains are connected to area drains, special care and information should be provided to homeowners to maintain these drains. Typical retaining wall drainage is illustrated in Figures 3 and 4 (Rear of Text). It should be noted that the recommended subdrain does not provide protection against seepage through the face of the wall and/or efflorescence. Efflorescence is generally a white crystalline powder (discoloration) that results when water containing soluble salts migrates over a period of time through the face of a retaining wall and evaporates. If such seepage or efflorescence is undesirable, retaining walls should be waterproofed to reduce this potential. Please note that waterproofing and outlet systems are not the purview of the geotechnical consultant.

Surcharge loading effects from any adjacent structures should be evaluated by the retaining wall designer. In general, structural loads within a 1:1 (horizontal to vertical) upward projection from the bottom of the proposed retaining wall footing will surcharge the proposed retaining wall. In addition to the recommended earth pressure, retaining walls adjacent to streets should be designed to resist a uniform lateral pressure of 80 pounds per square foot (psf) due to normal street vehicle traffic if applicable. Uniform lateral surcharges may be estimated using the applicable coefficient of lateral earth pressure using a rectangular distribution. A factor of 0.45 and 0.3 may be used for at-rest

and active conditions, respectively. The retaining wall designer should contact the geotechnical engineer for any required geotechnical input in estimating any applicable surcharge loads.

If required, the retaining wall designer may use the seismic lateral earth pressure increment as indicated in Table 5. This seismic increment should be applied in addition to the provided static lateral earth pressure using a triangular distribution with the resultant acting at H/3 in relation to the base of the retaining structure (where H is the retained height). Per Section 1803.5.12 of the 2019 CBC, the seismic lateral earth pressure is applicable to structures assigned to Seismic Design Category D through F for retaining wall structures supporting more than 6 feet of backfill height. This seismic lateral earth pressure is estimated using the procedure outlined by the Structural Engineers Association of California (Lew, et al, 2010) and the Federal Highway Administration (FHA, 2011). While not anticipated at this time, if a retaining wall greater than indicated in Table 5 is proposed, the retaining wall designer should contact the geotechnical consultant for specific seismic lateral earth pressure increments based on the proposed layout.

TABLE 5

Seismic Lateral Earth Pressure Increment

Maximum Retained Height (feet)	Equivalent Fluid Unit Weight (pcf)	
	Level Backfill	2:1 Sloped Backfill
8	10	15

4.4.3 Top-of-Slope Retaining Wall Design Recommendations

Due to the moderately expansive nature of the onsite soils, special design considerations are needed for improvements located near the top-of-slope. As a result of the many factors, which influence the rate and magnitude of slope creep, it is not possible to accurately determine the extent or amount of slope creep that will occur. The amount of distress that occurs to these improvements as a result of slope creep depends to a certain extent on how much movement occurs and the flexibility of the improvements. For the purpose of this report, conventional retaining walls are generally considered to consist of masonry or concrete blocks.

The following recommendations have been developed by experience generated in working in similar geotechnical conditions rather than a calculated solution. These recommendations will not eliminate all movement of the relatively small top-of-slope retaining walls at the site but should limit movement to within tolerable limits of the structures thereby maintaining their function ability and reducing cosmetic distress. The following recommendations also assume proper homeowner/homeowner association maintenance, landscaping, and irrigation practices. Should future owners not properly maintain the subject slopes then additional distress may be observed.
In recognition that the subject top-of-slope retaining wall will be subject to slope creep and that

the proposed retaining wall will be retaining a maximum of 3 feet of select sandy backfill, we recommend incorporating a shallow grade beam and pile system into the design. Each pile should be a minimum of 12 inches in diameter, be longitudinally reinforced with a minimum of four No. 4 rebar and wrapped laterally. The top of all piles should be connected with a shallow grade beam. This grade beam should be a minimum of 12 inches deep by 12 inches wide and longitudinally reinforced with four No. 5 rebar and have a maximum embedment of 12 inches below finished grade. The walls should be provided with construction joints at each pile.

The actual design of the pile depth and components mentioned above should be carried out by the structural engineer based on the geotechnical design parameters presented on Figure 5 (Rear of Text). Additionally, we recommend the structural engineer incorporate into the design as much flexibility as possible so that the visual impact of movement is minimized. It should be noted that without deepened foundations such as piles, rigid improvements constructed near the top-of-slope area of the site may be subjected to rotation, vertical and horizontal separations and cracking, requiring additional maintenance over the life of the improvements. Should the retaining wall designer choose an alternative foundation system than what is recommended, these conditions may occur.

4.4.4 Top-of-Slope Retaining Wall Backfill and Drainage Recommendations

Lateral earth pressures are provided as equivalent fluid unit weights, in pound per square foot (psf) per foot of depth or pcf on Figure 5 (Rear of Text). The Active earth pressure values do not contain an appreciable factor of safety, so the retaining wall designer should apply the applicable factors of safety and/or load factors during design. The provided allowable passive pressure (Figure 5) is based on a factor of safety of 1.5 for static loading conditions. A soil unit weight of 120 pcf may be assumed.

Retaining wall backfill should consist of sandy soils with a maximum of 35 percent fines (passing the No. 200 sieve) per American Society for Testing and Materials (ASTM) Test Method D1140 (or ASTM D6913/D422) and a Very Low expansion potential (EI of 20 or less per ASTM D4829). Soils should also be screened of organic materials, construction debris and any material greater than 3 inches. The site contains soils that are not suitable for retaining wall backfill due to their expansion potential; therefore, import should be anticipated by the contractor for obtaining suitable retaining wall backfill soil.

For conventional retaining walls, the select sandy zone should extend a minimum of a 1:1 (horizontal to vertical) upward projection from the bottom of the retaining wall subdrain, refer to Figure 5. Retaining wall backfill soils should be compacted in relatively uniform thin lifts to a minimum of 90 percent relative compaction (per ASTM D1557). Jetting or flooding of retaining wall backfill materials should not be permitted. A representative from LGC Geotechnical should observe, probe, and test the backfill to verify compliance with the project recommendations.

Retaining wall structures should be provided with appropriate drainage and appropriately waterproofed. To reduce, but not eliminate, saturation of near-surface (upper approximate 1-foot) soils in front of the retaining walls, the perforated subdrain pipe should be located as low as possible behind the retaining wall. The outlet pipe should be sloped to drain to a suitable outlet. In general, we do not recommend retaining wall outlet pipes be connected to area drains.

If subdrains are connected to area drains, special care should be taken to maintain these drains. Typical retaining wall drainage is shown on Figure 5. It should be noted that the recommended subdrain does not provide protection against seepage through the face of the wall and/or efflorescence. Waterproofing and outlet systems are not the purview of the geotechnical consultant.

As mentioned above, top-of-slope retaining walls in moderately expansive soils are susceptible to rotation and lateral movement, although rarely fail. The recommendation for top-of-slope retaining walls are included in Figure 5 of this report. These recommendations are intended to minimize and reduce movement of this type of wall but will not completely eliminate it.

The proposed retaining wall should be designed in accordance with the California Building Code (CBC) with respect to foundation setback from the top-of-slope.

4.5 Pile Construction

Pile boreholes should be plumb and free of loose or softened material. Extreme care in drilling, placement of reinforcement steel, and the pouring of concrete will be essential to avoid excessive disturbance of pile borehole walls. The pile reinforcing cage should be installed and the concrete pumped immediately after drilling is completed. Where applicable, concrete placement by pumping or tremie tube to the bottom of pile excavations is recommended. No borehole should be left open overnight. We recommend that pile boreholes not be drilled immediately adjacent to another pile until the concrete in the other pile has attained its initial set. A representative from LGC Geotechnical should be onsite during the drilling of pile boreholes in order to verify the assumptions made during the design stages.

The contractor should anticipate easy to moderately difficult drilling conditions. Some caving of drilled holes should be anticipated. The contractor should anticipate that any borehole left open for any extended period of time will likely experience additional caving and perched groundwater conditions. If caving occurs during CIDH construction, a temporary casing may be required.

4.6 Slope Creep

As with most natural and manufactured fill slopes and pad areas, some degree of slope creep should be expected for this site. The amount of slope creep is usually influenced by such factors as the slope geometry, slope exposure, aspect, height, composition, as well as plant type, precipitation, irrigation and landscaping programs. Since the industry understanding of the slope creep is analytically in its infancy, our estimates of the extent and magnitude of slope creep are, therefore, based on our observations at previous sites with similar soil conditions. In general, the impacts of slope creep are most prevalent in the outer approximate 20 feet of the slope but can extend further into the lot. In general, more slope creep occurs as the slope height increases, expansion potential increases and changes in the moisture content of the soil occur. Slope creep is not expected to significantly influence the building structures that meet or exceed setback requirements but is anticipated to impact rear yard improvements like side yard walls, fences, retaining walls, swimming pool/spas, associated flatwork and other miscellaneous landscaping improvements.

To account for slope creep/lot stretching, a lateral earth equivalent fluid pressure of 60 pounds per cubic foot (pcf) should be applied to structural foundation improvements within the defined creep zone. The defined creep zone depends on the expansion potential of the fill soils comprising the slope. In general, for design purposes the lot stretching/creep zone should be any portion of the lot that is within 20 horizontal feet of the slope face. The creep zone may be defined by a line parallel to the surface and at a depth based on the table shown on Figures 5 and 6 (rear of text).

4.7 Lot Stretching

Lot stretching is a term used to describe the predominately lateral deformation or extension of lots, which are located near the top-of-slopes generally containing expansive soils. Based on our previous experience, the effects of lot stretching generally extend further back from the top-of-slope than slope creep and have been observed up to 100 feet from the top-of-slope. In general, the effects of lot stretching manifest themselves in the form of distortion of improvements and/or separation of flatwork from adjacent improvements. It has been our experience that the effects of lot stretching generally do not significantly influence the performance of post-tensioned foundations. Although the effects of lot stretching have been observed for many years, it is still not completely understood. Based on limited theoretical models, lot stretching is believed to occur as a result of the wetting front gradually penetrating through expansive soils.

Although rear yard top-of-slope improvements are generally not considered structural, we recommend that decorative walkways, patios, pools and spas, and other landscaping features be constructed with flexibility to accommodate the effects of slope creep. Typical remediation methods include construction joints, separation joints, flexible pavers, flexible structures, or additional reinforcement to limit (not eliminate) cracking, rotation, etc. The exact amount of movement due to slope creep cannot be determined at this time; it is dependent to some extent upon irrigation practices of homeowners and homeowner associations. Lateral and vertical deflections on the order of 3 inches or more and/or angular rotation have been observed on projects with similar geotechnical conditions. More specific geotechnical recommendations for freestanding walls and fences close to the top-of-slopes are provided in this report. Please see previous section ("Slope Creep") for design recommendations to help reduce the effects of lot stretching. Estimated design loads due to lot stretching/slope creep are outlined in the above Section, "Slope Creep."

4.8 Fences and Freestanding Walls

As their name indicates, freestanding walls are those walls, which are not designed to retain soil and/or water. These walls are generally located at the rear of the lot, or along the side yard or between lots.

Due to the expansive nature of the onsite soils, special design considerations are needed for improvements located near the top-of-slope. As a result of the many factors that influence the rate and magnitude of slope creep, it is not possible to accurately determine at the present time the extent or amount of slope creep. The amount of distress that occurs to these improvements

as a result of slope creep depends, to a certain extent, on how much movement occurs and the flexibility of the improvements. For the purpose of this report, freestanding walls are generally considered to consist of masonry or concrete blocks, while flexible fences generally consist of wood or tube steel.

The following recommendations have been developed by experience generated in working in similar geotechnical conditions rather than a calculated solution. These recommendations will not eliminate all movement of freestanding walls at the site but should limit movement to within tolerable limits of the structures, thereby maintaining their functionality and reducing cosmetic distress. The following recommendations also assume proper homeowner/homeowner association maintenance, landscaping, and irrigation practices. Should future homeowners/homeowner associations not properly maintain the subject slopes, then additional distress may be observed.

4.8.1 Freestanding Walls at the Top-of-Slopes

In recognition that the subject walls will be subject to slope creep, we recommend incorporating a shallow grade beam and CIDH pile system into the design as follows:

1. Freestanding walls located parallel to the top-of-slope should be supported on a shallow grade beam founded on 12-foot-long pile (as measured from finished grade) with a center-to-center spacing of 10 feet;
2. Freestanding walls located perpendicular to the top-of-slope should be supported on 12-foot-long caissons (as measured from finished grade) with a center-to-center spacing of 15 feet. Pile support is only required for the portion of the walls located within 15 feet of the top-of-slope;
3. Regardless of pile length, each caisson should be a minimum of 12 inches in diameter, be longitudinally reinforced with a minimum of four No. 4 rebar and wrapped laterally;
4. The top of all piles should be connected with a shallow grade beam. This grade beam should be a minimum of 12 inches deep by 12 inches wide and longitudinally reinforced with four No. 5 rebar and have a maximum embedment of 12 inches below finished grade; and
5. The walls should be provided with construction joints at each caisson.

As an alternative to the minimum recommendations above, the caissons may be designed using the geotechnical parameters for CIDH piles and the estimated creep zone provided in Figure 6 (rear of text). The actual design of the components mentioned above should be carried out by the structural designer. Additionally, we recommend the structural designer incorporate into the design as much flexibility as possible so that the visual impact of movement is minimized.

The above-recommendations are applicable to freestanding walls, which are within 15 horizontal feet of slopes, greater than 10 feet in height. For slope heights between 4 and 10 feet, the length of the pile need not be greater than the height of the slope. For slopes

less than 4 feet, the pile recommendation may be waived, and the walls designed for level ground conditions.

4.9 Corrosivity to Concrete and Metal

Although not corrosion engineers (LGC Geotechnical is not a corrosion consultant), several governing agencies in Southern California require the geotechnical consultant to determine the corrosion potential of soils to buried concrete and metal facilities. We therefore present the results of our testing with regard to corrosion for the use of the client and other consultants, as they determine necessary.

Corrosion testing of near-surface bulk samples indicated a soluble sulfate content value of 156 ppm (less than 0.02 percent) and a chloride content of 960 ppm. Based on Caltrans Corrosion Guidelines (2018), soils are considered corrosive if the pH is 5.5 or less, or the chloride concentration is 500 ppm or greater, or the sulfate concentration is 1,500 ppm (0.15 percent) or greater. Based on the test results, soils are not considered corrosive using Caltrans criteria.

Based on laboratory sulfate test results, the near surface soils are designated to a class "S0" per ACI 318, Table 19.3.1.1 with respect to sulfates. Concrete in direct contact with the onsite soils can be designed according to ACI 318, Table 19.3.2.1 using the "S0" sulfate classification.

Laboratory testing may need to be performed at the completion of grading by the project corrosion engineer to further evaluate the as-graded soil corrosivity characteristics. Accordingly, revision of the corrosion potential may be needed, should future test results differ substantially from the conditions reported herein. The client and/or other members of the development team should consider this during the design and planning phase of the project and formulate an appropriate course of action.

4.10 Preliminary Asphalt Concrete Pavement Sections

For the purposes of these preliminary recommendations, we have selected a preliminary design R-value of 25 and calculated pavement sections for Traffic Indices of 4.5, 5.0 and 5.5. R-value testing of the street subgrade will need to be performed to confirm our preliminary testing results/assumptions once the streets have been graded to finish subgrade elevations and the final Traffic Index is determined by the Civil Engineer.

TABLE 6

Preliminary Pavement Sections

Assumed Traffic Index	4.5	5.0	5.5
R -Value Subgrade	25	25	25
AC Thickness	4.0 inches	4.0 inches	4.0 inches
CAB Thickness	3.0 inches	4.0 inches	6.0 inches

Increasing the thickness of asphalt or adding additional base material will reduce the likelihood of the pavement experiencing distress during its service life. The above recommendations are based on the assumption that proper maintenance and irrigation of the areas adjacent to the roadway will occur through the design life of the pavement. Failure to maintain a proper maintenance and/or irrigation program may jeopardize the integrity of the pavement.

Earthwork recommendations regarding aggregate base and subgrade are provided in the previous Section "Site Earthwork" and the related sub-sections of this report.

4.11 Nonstructural Concrete Flatwork

Nonstructural concrete (such as flatwork, sidewalks, patios, etc.) has a potential for cracking due to changes in soil volume related to soil-moisture fluctuations. To reduce the potential for excessive cracking and lifting, concrete should be designed in accordance with the minimum guidelines outlined in Table 7 below. These guidelines will reduce the potential for irregular cracking and promote cracking along construction joints but will not eliminate all cracking or lifting. Thickening the concrete and/or adding additional reinforcement will further reduce cosmetic distress.

TABLE 7

Preliminary Geotechnical Parameters for Nonstructural Concrete Flatwork Placed on Low Expansion Potential Subgrade

	Homeowner Sidewalks	**Private Drives**	**Patios/Entryways**	**City Sidewalk Curb and Gutters**
Minimum Thickness (in.)	4 (nominal)	4 (full)	4 (full)	City/Agency Standard
Presoaking	Wet down prior to placing	Wet down prior to placing	Wet down prior to placing	City/Agency Standard
Reinforcement	—	No. 3 at 24 inches on centers	No. 3 at 24 inches on centers	City/Agency Standard
Thickened Edge (in.)	—	8 x 8	—	City/Agency Standard
Crack Control Joints	Saw cut or deep open tool joint to a minimum of $^1/_3$ the concrete thickness	Saw cut or deep open tool joint to a minimum of $^1/_3$ the concrete thickness	Saw cut or deep open tool joint to a minimum of $^1/_3$ the concrete thickness	City/Agency Standard

Maximum Joint Spacing	5 feet	10 feet or quarter cut whichever is closer	6 feet	City/Agency Standard
Aggregate Base Thickness (in.)	—	—	—	City/Agency Standard

To reduce the potential for driveways to separate from the garage slab, the builder may elect to install dowels to tie these two elements together. Similarly, future homeowners should consider the use of dowels to connect flatwork to the foundation.

4.12 Subsurface Water Infiltration

Recent regulatory changes have occurred that mandate storm water be infiltrated below grade rather than collected in a conventional storm drain system. Typically, a combination of methods are implemented to reduce surface water runoff and increase infiltration including; permeable pavements/pavers for roadways and walkways, directing surface water runoff to grass-lined swales, retention areas, and/or drywells, etc. It should be noted that collecting and concentrating surface water for the purpose of intentionally infiltrating below grade, conflicts with the geotechnical engineering objective of directing surface water away from slopes, structures and other improvements. The geotechnical stability and integrity of a site is reliant upon appropriately handling surface water. From a geotechnical perspective, we do not recommend that surface water be intentionally infiltrated into the subsurface soils.

Considering the results of the infiltration testing, if required, stormwater may be infiltrated into the subsurface soils at the depths tested below existing grade, using the values presented in Table 1 and the appropriate County of Riverside Flood Control (2011) safety factors. The Civil Engineer should determine the appropriate safety factor applicable to the proposed infiltration system. Results of field infiltration testing are provided in Appendix D.

The following should be considered for design of any required infiltration system:

- Water discharge from any infiltration systems should not occur within the zone of influence of foundation footings (column and load bearing wall locations). For preliminary purposes we recommend a minimum setback of 15 feet from the structural improvements, or the County recommended minimum setback, whichever is more conservative.
- An adequate setback distance between any infiltration facility and adjacent private property should be maintained.
- It may be prudent to provide an overflow system directly connected to the storm drain system in order to prevent failure of the infiltration system, either as a result of lower than anticipated infiltration and/or very high flow volumes. It should be noted that if pretreatment of runoff to remove debris, soil particles, etc., cannot be performed, design infiltration rates may need to be further reduced. Over time, siltation and plugging may reduce the infiltration rate and subsequent effectiveness of the infiltration system.

- Any designed infiltration system will require routine periodic maintenance.
- As with any systems that are designed to concentrate the surface flow and direct the water into the subsurface soils, some type of nuisance water and/or other water-related issues should be expected.

LGC Geotechnical should be provided with details for any planned required infiltration system early in the design process for geotechnical input.

4.13 Control of Surface Water and Drainage Control

From a geotechnical perspective, we recommend that compacted finished grade soils adjacent to proposed structures be sloped away from the proposed structures and towards an approved drainage device or unobstructed swale. Drainage swales, wherever feasible, should not be constructed within 5 feet of buildings. Where lot and building geometry necessitates that drainage swales be routed closer than 5 feet to structural foundations, we recommend the use of area drains together with drainage swales. Drainage swales used in conjunction with area drains should be designed by the project civil engineer so that a properly constructed and maintained system will prevent ponding within 5 feet of the foundation. Code compliance of grades is not the purview of the geotechnical consultant.

Planters with open bottoms adjacent to buildings should be avoided. Planters should not be designed adjacent to buildings unless provisions for drainage, such as catch basins, liners, and/or area drains, are made. Overwatering must be avoided.

4.14 Geotechnical Plan Review

Project plans (grading, foundation, etc.) should be reviewed by this office prior to construction to verify that our geotechnical recommendations have been incorporated. Additional or modified geotechnical recommendations may be required based on the proposed layout.

4.15 Geotechnical Observation and Testing

The recommendations provided in this report are based on limited subsurface observations and geotechnical analysis. The interpolated subsurface conditions should be checked in the field during construction by a representative of LGC Geotechnical. Geotechnical observation and testing is required per Section 1705 of the 2019 California Building Code (CBC).

Geotechnical observation and/or testing should be performed by LGC Geotechnical at the following stages:

- During grading (removal bottoms, fill placement, etc.);
- During retaining wall backfill and compaction;
- During utility trench backfill and compaction;

- After presoaking building pad and other concrete-flatwork subgrades, and prior to placement of aggregate base or concrete;
- Preparation of pavement subgrade and placement of aggregate base;
- After building and wall footing excavation and prior to placement of steel reinforcement and/or concrete; and
- When any unusual soil conditions are encountered during any construction operation subsequent to issuance of this report.

5.0 LIMITATIONS

Our services were performed using the degree of care and skill ordinarily exercised, under similar circumstances, by reputable soils engineers and geologists practicing in this or similar localities. No other warranty, expressed or implied, is made as to the conclusions and professional advice included in this report.

This report is based on data obtained from limited observations of the site, which have been extrapolated to characterize the site. While the scope of services performed is considered suitable to adequately characterize the site geotechnical conditions relative to the proposed development, no practical evaluation can completely eliminate uncertainty regarding the anticipated geotechnical conditions in connection with a subject site. Variations may exist and conditions not observed or described in this report may be encountered during grading and construction.

This report is issued with the understanding that it is the responsibility of the owner, or of his/her representative, to ensure that the information and recommendations contained herein are brought to the attention of the other consultants (at a minimum the civil engineer, structural engineer, landscape architect) and incorporated into their plans. The contractor should properly implement the recommendations during construction and notify the owner if they consider any of the recommendations presented herein to be unsafe, or unsuitable.

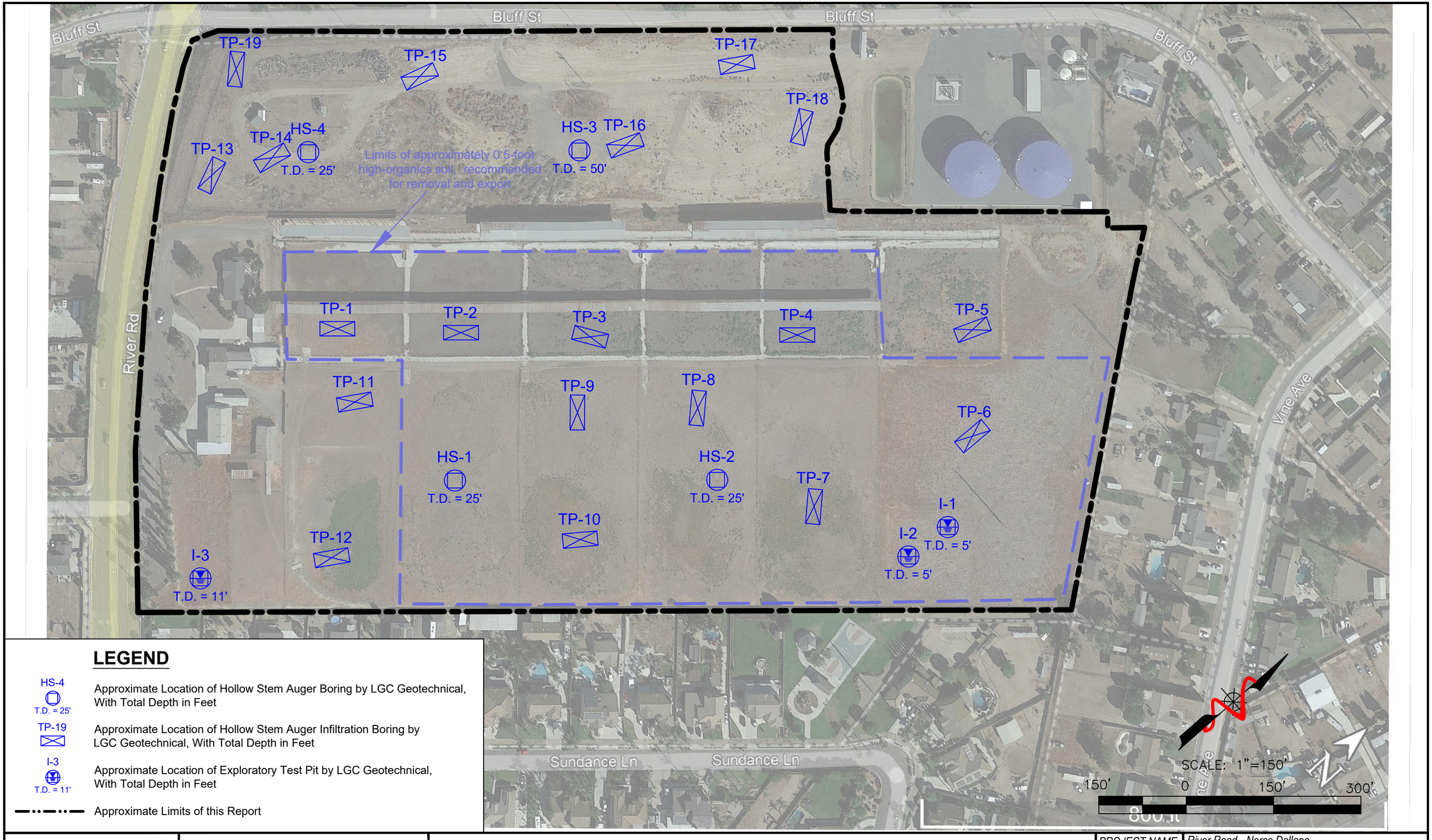
The findings of this report are valid as of the present date. However, changes in the conditions of a site can and do occur with the passage of time, whether they be due to natural processes or the works of man on this or adjacent properties. The findings, conclusions, and recommendations presented in this report can be relied upon only if LGC Geotechnical has the opportunity to observe the subsurface conditions during grading and construction of the project, in order to confirm that our preliminary findings are representative for the site. This report is intended exclusively for use by the client, any use of or reliance on this report by a third party shall be at such party's sole risk.

In addition, changes in applicable or appropriate standards may occur, whether they result from legislation or the broadening of knowledge. Accordingly, the findings of this report may be invalidated wholly or partially by changes outside our control. Therefore, this report is subject to review and modification.

PROJECT NAME	River Road - Norco, Dallape
PROJECT NO.	21250-01
ENG. / GEOL.	TJL / BPG
SCALE	Not to Scale
DATE	January 2022

LGC Geotechnical, Inc.

FIGURE 1
Site Location Map



LEGEND

HS-4 T.D. = 25'	Approximate Location of Hollow Stem Auger Boring by LGC Geotechnical, With Total Depth in Feet
TP-19	Approximate Location of Hollow Stem Auger Infiltration Boring by LGC Geotechnical, With Total Depth in Feet
I-3 T.D. = 11'	Approximate Location of Exploratory Test Pit by LGC Geotechnical, With Total Depth in Feet
	Approximate Limits of this Report

LGC Geotechnical, Inc.

LGC Geotechnical, Inc.
131 Calle Iglesia, Ste. 200
San Clemente, CA 92672
TEL (949) 369-6141 FAX (949) 369-6142

Geotechnical Map

PROJECT NAME	*River Road - Norco Dallape*
PROJECT NO.	*21250-01*
ENG. / GEOL.	*TJL/BPG*
SCALE	*1" = 150'*
DATE	*January 2022*

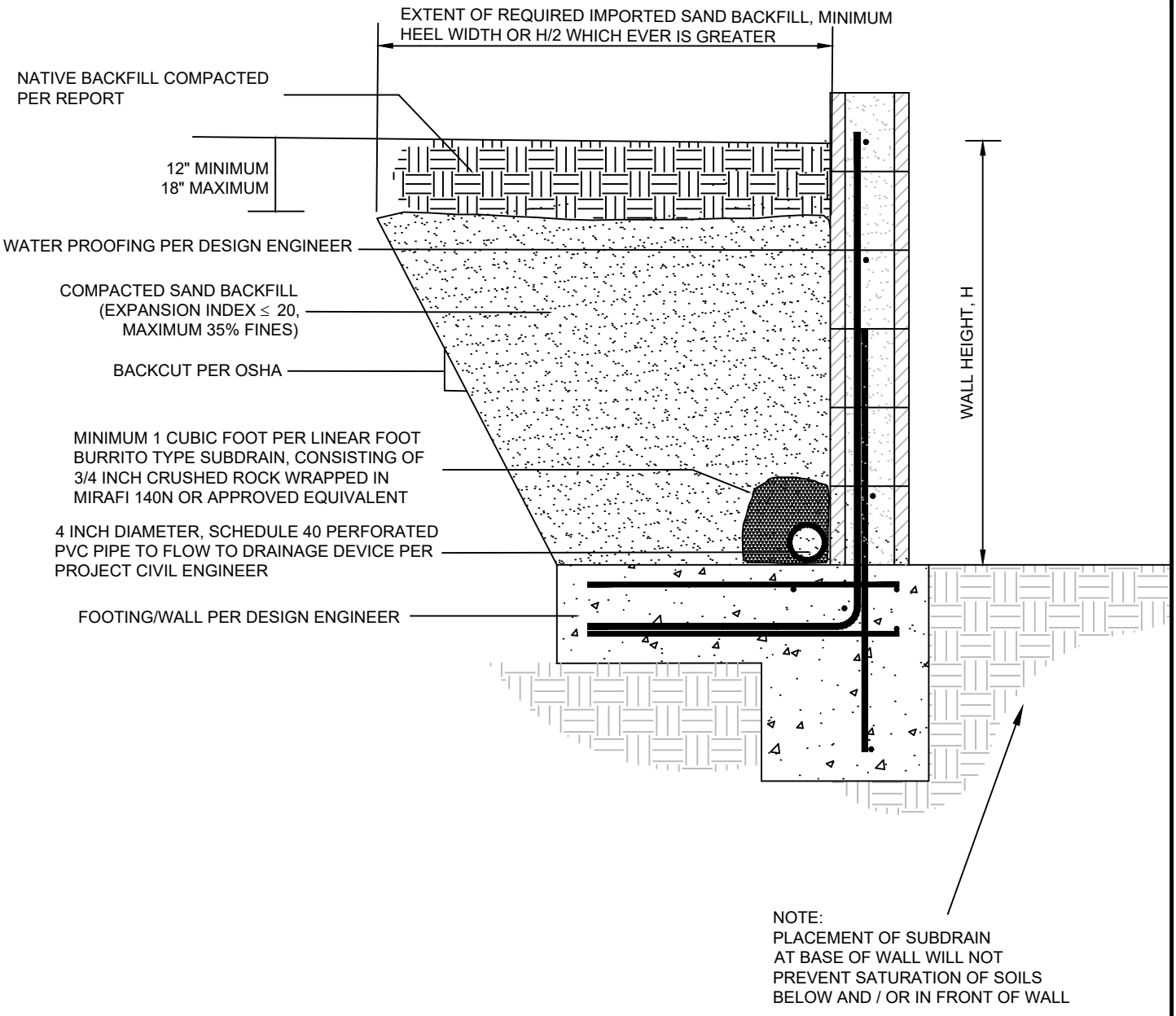


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FIGURE 3
Retaining Wall Backfill Detail

PROJECT NAME	River Road - Norco, Dallape
PROJECT NO.	21250-01
ENG. / GEOL.	TJL / BPG
SCALE	Not to Scale
DATE	January 2022

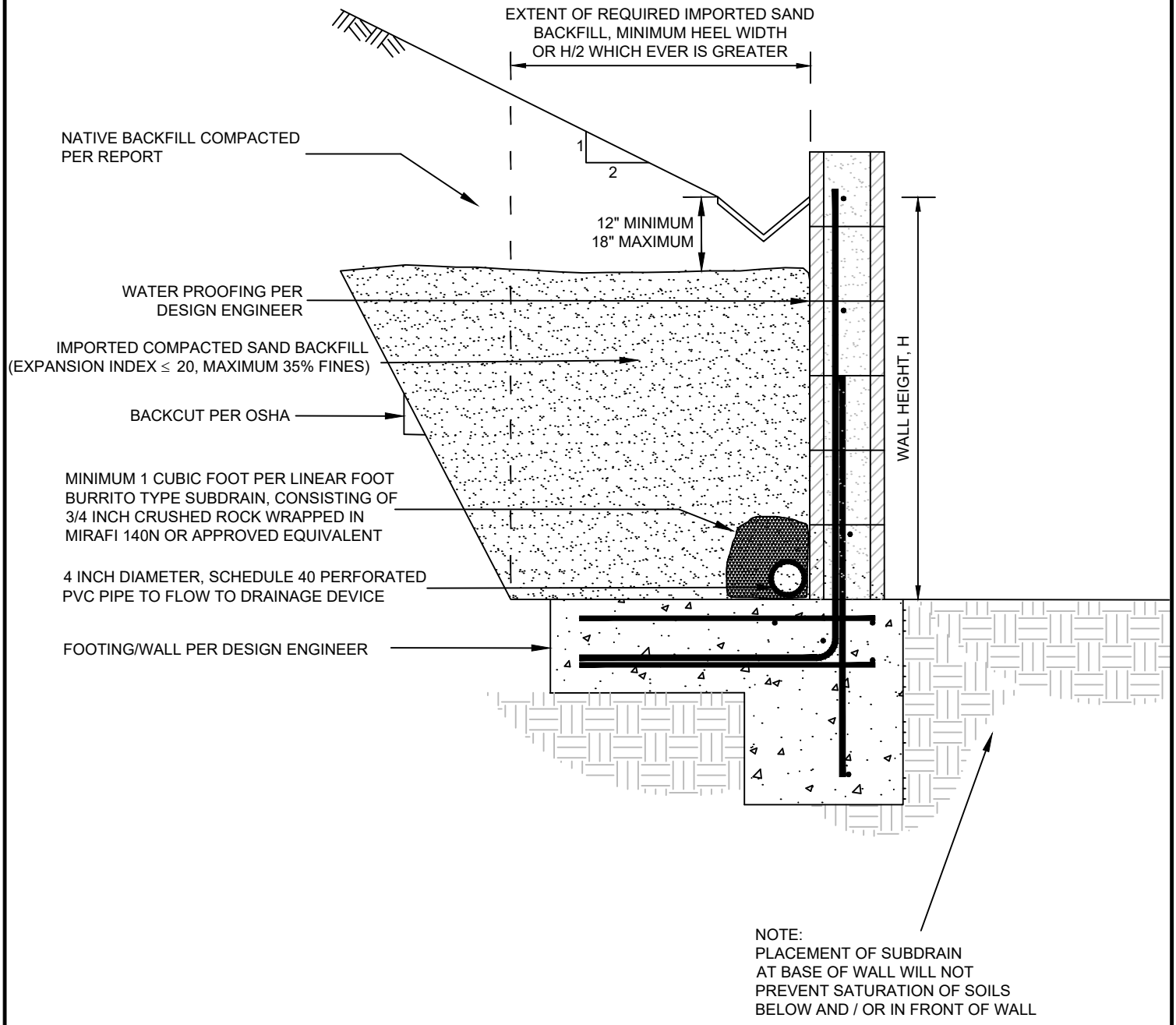

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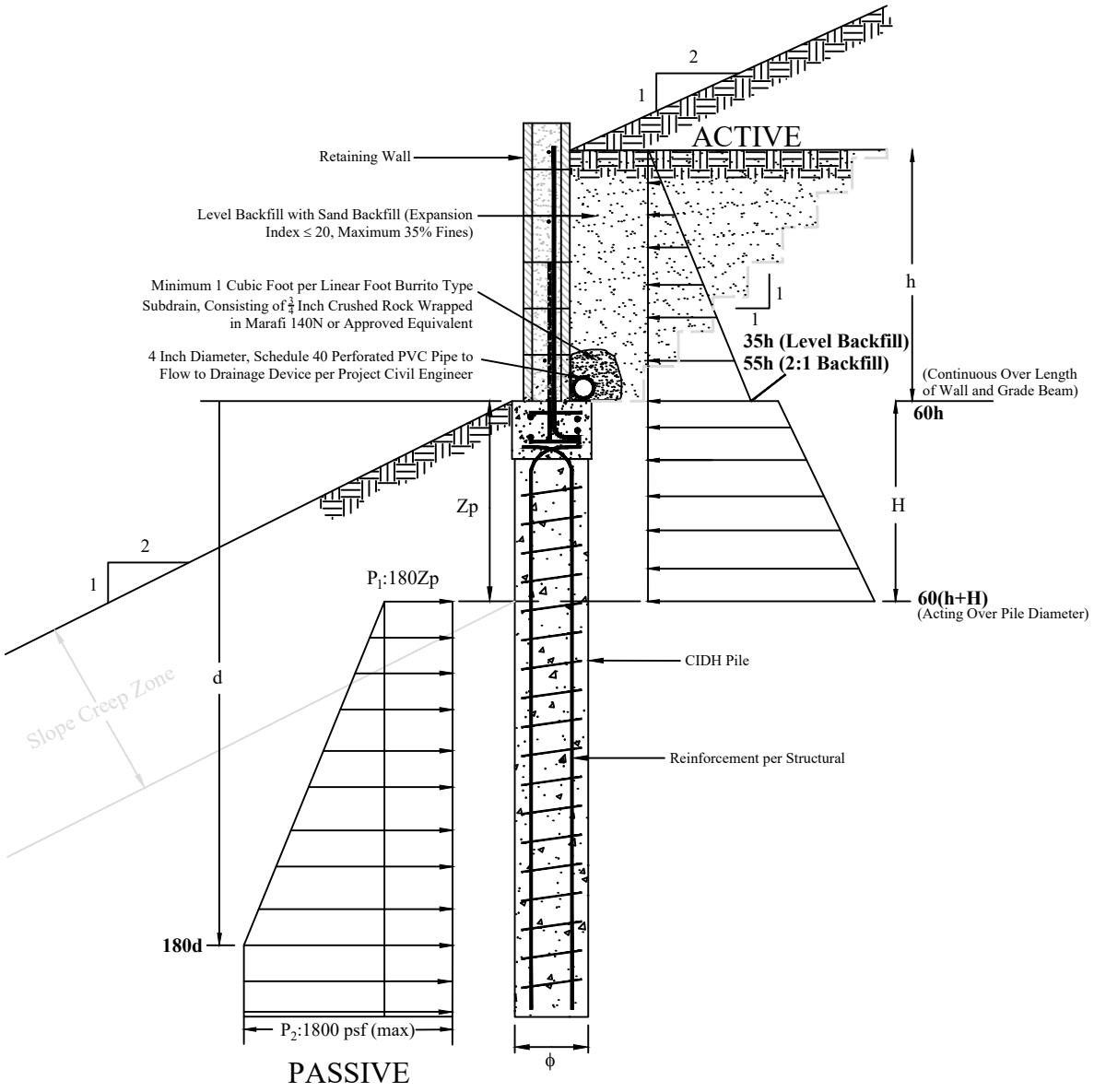
FIGURE 4
Retaining Wall Backfill Detail
2:1 Backfill

PROJECT NAME	River Road - Norco, Dallape
PROJECT NO.	21250-01
ENG. / GEOL.	TJL / BPG
SCALE	Not to Scale
DATE	January 2022



LATERAL EARTH PRESSURES

Soil Creep	
A_1	Pier & Grade Beam: 60 pcf
Passive	
P_1[ab]	180Zp (psf)
P_2[ab]	1800 psf (max)

a) Includes Arching Factor of 2 Based on Isolated Piers Spaced a Minimum of 3 Diameters on Center

b) Where Foundation is in Fill Neglect Upper 1ft

Note: Structural Engineer to Apply Suitable Factor of Safety and/or Load Factor in Design

ALLOWABLE VERTICAL LOADS

Allowable Skin Friction: 450 psf per foot depth (Neglecting Creep Zone).

Height of Slope	Estimated Vertical Slope Creep Zone Depth (Zp)
H_s < 4 feet	NA
4 ft < H_s < 20 ft	$\frac{1}{5}$ of H_s
$H_s \geq$ 20 ft	4 ft

Note: Round Zp up to nearest foot

h = Depth to Bottom of Grade Beam from Finish Grade (ft)
H = Length of Pile From Bottom Grade Beam to the Creep Zone Limit
H_s = Height of Slope
ϕ = Pile Diameter (ft)
Zp = Depth of Creep Zone Below Top of Finish Grade
d = Depth Below Top of Finish Grade (ft)

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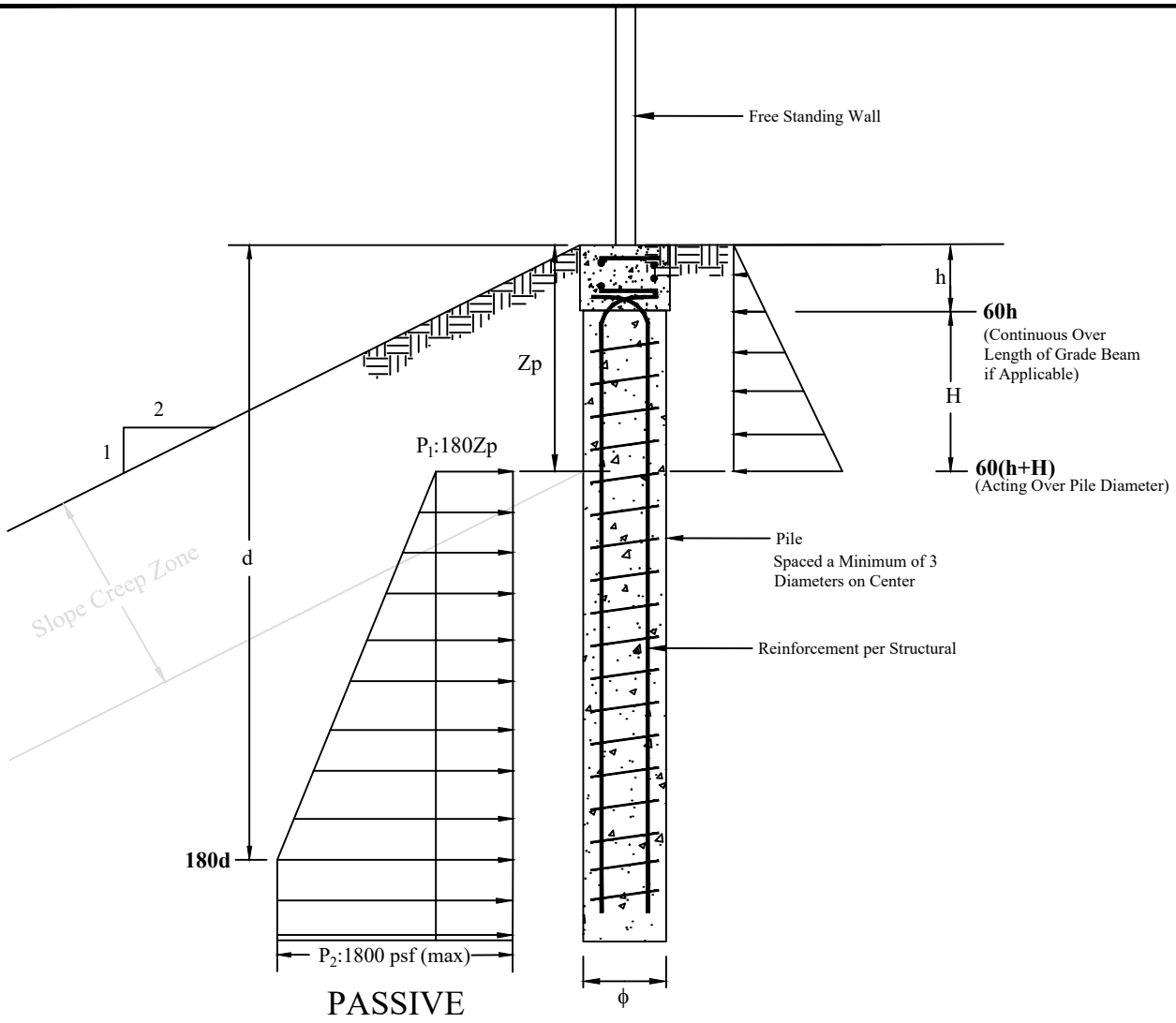
FIGURE 5
Geotechnical Design Parameters for Top-of-Slope Retaining Wall

PROJECT NAME	River Road - Norco, Dallape
PROJECT NO.	21250-01
ENG. / GEOL.	TJL / BPG
SCALE	Not to Scale
DATE	January 2022



PASSIVE

ALLOWABLE LATERAL LOADS

Lateral Earth Pressure	
A_1	60·(H+h) psf
P_{1*}	180Zp
P_{2*}	1800 psf (max)

* Includes Arching Factor of 2 Based on Isolated Piers Spaced a Minimum of 3 Diameters on Center

Note: Structural Engineer to Apply Suitable Factor of Safety and/or Load Factor in Design

ALLOWABLE VERTICAL LOADS

Allowable Skin Friction: 450 psf per foot depth (Neglecting Creep Zone).

Height of Slope	Estimated Vertical Slope Creep Zone Depth (Zp)
H_s < 4 feet	NA
4 ft < H_s < 20 ft	$\frac{1}{5}$ of H_s
H_s > 20 ft	4 ft

h = Depth to Bottom of Grade Beam from Finish Grade (ft)
H = Length of Pile From Bottom Grade Beam to the Creep Zone Limit
H_s = Height of Slope
ϕ = Pile Diameter (ft)
Zp = Depth of Creep Zone Below Top of Finish Grade
d = Depth Below Top of Grade Beam (ft)

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FIGURE 6
Geotechnical Parameters for Top-of-Slope Drilled Piles

PROJECT NAME	River Road - Norco, Dallape
PROJECT NO.	21250-01
ENG. / GEOL.	TJL / BPG
SCALE	Not to Scale
DATE	January 2022

Appendix A
References

APPENDIX A

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Appendix B
Boring & Geotechnical Trench Logs

Geotechnical Boring Log Borehole HS-1

Date: 12/3/2021 | **Drilling Company:** Cal Pac Drilling

Project Name: River Road - Norco Dallape | **Type of Rig:** Truck Mounted

Project Number: 21250-01 | **Drop:** 30" | **Hole Diameter:** 8"

Elevation of Top of Hole: ~572' MSL | **Drive Weight:** 140 pounds

Hole Location: See Geotechnical Map

Logged By CMP
Sampled By CMP
Checked By BPG

Elevation (ft)	Depth (ft)	Sample Number	Blow Count	Dry Density (pcf)	Moisture (%)	USCS Symbol	DESCRIPTION	Type of Test
570	0						@0' - Topsoil, dry plant debris to 6"	EI, MD
							Quaternary Alluvium - Very Old (Qvoa)	
		R-1	4 6 13	109.5	17.8	SM	@2.5' - Silty SAND: yellow-brown, moist, medium dense, majority medium grain sand, trace gravel to 1/4", calcite layers, porous, trace rootlets	
	5	R-2	10 19 22	103.5	12.2		@5' - Silty Fine SAND: gray-brown, moist, dense	
565		R-3	6 10 14	107.1	8.0	ML	@7.5' - SILT with Sand: light olive-brown, slightly moist, very stiff, sample disturbed, trace cobbles	CO
	10	SPT-1	8 12 12		25.4	CL	@10' - Lean CLAY with Sand: yellow-brown, very moist, very stiff, high plasticity	
560								
	15	R-4	6 18 25	99.3	8.7		@15' - Sandy Lean CLAY: gray-brown, slightly moist, hard, increase in medium and fine grained sand	
555								
	20	SPT-2	2 3 4		34.2		@20' - CLAY with Sand: brown, wet, stiff, porous	
550								
	25	R-5	4 14 24	109.3	20.2		@25' - Lean CLAY: brown, very moist, hard, sample slightly disturbed	
545							Total Depth = 26.5'	
							Groundwater Not Encountered	
							Backfilled with Cuttings on 12/3/2021	
	30							

B-1

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THIS SUMMARY APPLIES ONLY AT THE LOCATION OF THIS BORING AND AT THE TIME OF DRILLING. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH THE PASSAGE OF TIME. THE DATA PRESENTED IS A SIMPLIFICATION OF THE ACTUAL CONDITIONS ENCOUNTERED. THE DESCRIPTIONS PROVIDED ARE QUALITATIVE FIELD DESCRIPTIONS AND ARE NOT BASED ON QUANTITATIVE ENGINEERING ANALYSIS.

SAMPLE TYPES:

B	BULK SAMPLE
R	RING SAMPLE (CA Modified Sampler)
G	GRAB SAMPLE
SPT	STANDARD PENETRATION TEST SAMPLE
⏚	GROUNDWATER TABLE

TEST TYPES:

DS	DIRECT SHEAR
MD	MAXIMUM DENSITY
SA	SIEVE ANALYSIS
S&H	SIEVE AND HYDROMETER
EI	EXPANSION INDEX
CN	CONSOLIDATION
CR	CORROSION
AL	ATTERBERG LIMITS
CO	COLLAPSE/SWELL
RV	R-VALUE
-#200	% PASSING # 200 SIEVE

Geotechnical Boring Log Borehole HS-2

Date: 12/3/2021 | **Drilling Company:** Cal Pac Drilling

Project Name: River Road - Norco, Dallape | **Type of Rig:** Truck Mounted

Project Number: 21250-01 | **Drop:** 30" | **Hole Diameter:** 6"

Elevation of Top of Hole: ~573' MSL | **Drive Weight:** 140 pounds

Hole Location: See Geotechnical Map

Logged By CMP
Sampled By CMP
Checked By BPG

Elevation (ft)	Depth (ft)	Graphic Log	Sample Number	Blow Count	Dry Density (pcf)	Moisture (%)	USCS Symbol	DESCRIPTION	Type of Test
	0	B-1						@0' - Topsoil, straw, dead plant debris to 4"	
								Quaternary Alluvium - Very Old (Qvoa)	CR
570			R-1	4 4 4	100.3	5.0	SM	@2.5' - Silty SAND: yellow-brown, slightly moist, loose, majority medium grained sand	
	5		R-2	3 2 3	106.5	6.9		@5' - Silty SAND: brown, slightly moist, very loose, calcite stringers, pinhole porosity, trace rootlets	
565			R-3	9 19 21	108.7	5.0	SP-SM	@7.5' - SAND with SILT: gray-brown, slightly moist, dense, calcite stringers, poorly graded	
	10		SPT-1	7 10 8		5.5		@10' - SAND with SILT: red-brown, slightly moist, medium dense	
560									
	15		R-4	8 12 23	114.3	13.2	ML	@15' - Sandy SILT: gray-brown, moist, very stiff	
555									
	20		SPT-2	3 5 6		30.2		@20' - Sandy SILT: brown, wet, stiff	
550									
	25		R-5	9 16 21	112.4	18.9	CL	@25' - Sandy Lean CLAY: brown, very moist, hard	
545								Total Depth = 26.5'	
	30							Groundwater Not Encountered	
								Backfilled with Cuttings on 12/3/2021	

LGC Geotechnical, Inc.

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SAMPLE TYPES:

B	BULK SAMPLE
R	RING SAMPLE (CA Modified Sampler)
G	GRAB SAMPLE
SPT	STANDARD PENETRATION TEST SAMPLE
⏚	GROUNDWATER TABLE

TEST TYPES:

DS	DIRECT SHEAR
MD	MAXIMUM DENSITY
SA	SIEVE ANALYSIS
S&H	SIEVE AND HYDROMETER
EI	EXPANSION INDEX
CN	CONSOLIDATION
CR	CORROSION
AL	ATTERBERG LIMITS
CO	COLLAPSE/SWELL
RV	R-VALUE
-#200	% PASSING # 200 SIEVE

Geotechnical Boring Log Borehole HS-3

Date: 12/3/2021 | **Drilling Company:** Cal Pac Drilling

Project Name: River Road - Norco, Dallape | **Type of Rig:** Truck Mounted

Project Number: 21250-01 | **Drop:** 30" | **Hole Diameter:** 8"

Elevation of Top of Hole: ~566' MSL | **Drive Weight:** 140 pounds

Hole Location: See Geotechnical Map

Logged By CMP
Sampled By CMP
Checked By BPG

Elevation (ft)	Depth (ft)	Graphic Log	Sample Number	Blow Count	Dry Density (pcf)	Moisture (%)	USCS Symbol	DESCRIPTION	Type of Test
565	0	B-1						Artificial Fill - Undocumented @0' - Weathered gravel, cobbles & surficial debris to 2"	
			R-1	5 7 7	103.8	7.1	SM	@2.5' Silty SAND: yellow-brown, slightly moist, medium dense	
								Quaternary Alluvium - Very Old (Qvoa)	
	5		R-2	8 20 32	97.3	18.2	ML	@5' - Sandy SILT: light yellow-brown, very moist, hard, chalky	
560			R-3	12 19 22	113.3	5.4	SM	@7.5' - Silty SAND: gray-brown, slightly moist, dense, slight increase in coarse grained sand	
	10		SPT-1	10 12 11		10.6		@10' - Silty SAND: olive-brown, moist, medium dense, majority fine grained sand, trace calcite	-#200
555									
	15		R-4	5 12 15	105.0	13.3	SW-SM	@15 - SAND with SILT: gray-brown, moist medium dense, well-graded	
550									
	20		SPT-2	3 5 6		32.7	CH	@20' - Fat CLAY: pale brown, wet, stiff, high plasticity	AL
545									
	25		R-5	9 15 21	116.6	16.5	SC	@25' - Clayey SAND: brown, moist, medium dense, mottled with iron oxide deposits	-#200
540									
	30								

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SAMPLE TYPES:

B	BULK SAMPLE
R	RING SAMPLE (CA Modified Sampler)
G	GRAB SAMPLE
SPT	STANDARD PENETRATION TEST SAMPLE
⏚	GROUNDWATER TABLE

TEST TYPES:

DS	DIRECT SHEAR
MD	MAXIMUM DENSITY
SA	SIEVE ANALYSIS
S&H	SIEVE AND HYDROMETER
EI	EXPANSION INDEX
CN	CONSOLIDATION
CR	CORROSION
AL	ATTERBERG LIMITS
CO	COLLAPSE/SWELL
RV	R-VALUE
-#200	% PASSING # 200 SIEVE

Geotechnical Boring Log Borehole HS-3

Date: 12/3/2021 | **Drilling Company:** Cal Pac Drilling

Project Name: River Road - Norco, Dallape | **Type of Rig:** Truck Mounted

Project Number: 21250-01 | **Drop:** 30" | **Hole Diameter:** 8"

Elevation of Top of Hole: ~566' MSL | **Drive Weight:** 140 pounds

Hole Location: See Geotechnical Map

Logged By CMP
Sampled By CMP
Checked By BPG

Elevation (ft)	Depth (ft)	Sample Number	Blow Count	Dry Density (pcf)	Moisture (%)	USCS Symbol	DESCRIPTION	Type of Test
535	30	SPT-3	8 13 23		12.7	SC	@30' - Clayey SAND: brown, slightly moist to moist, dense	
530	35	R-6	9 15 28	111.3	19.0	SM	@35' - Silty SAND: gray-brown, wet, dense	
525	40	SPT-4	7 10 10		17.9		@40' - Silty SAND: gray-brown, wet, medium dense, well graded @43' - Groundwater	-#200
520	45	R-7	8 13 16	115.8	17.3	ML	@45' - Sandy SILT: olive-gray, very moist, very stiff, increase in coarse grained sand, visible free-water on sampler	-#200
515	50	SPT-5	11 38 50/6"		13.7	SP-SM	@50' - Poorly Graded SAND with SILT: light brown, moist, very dense, iron-oxide deposit, decrease in moisture @50.5', highly weathered decomposed granitics at sample tip	
510	55						Total Depth = 51.5' Groundwater Encountered at Approximately 523' MSL Backfilled with Cuttings on 12/3/2021	
	60							

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SAMPLE TYPES:

B	BULK SAMPLE
R	RING SAMPLE (CA Modified Sampler)
G	GRAB SAMPLE
SPT	STANDARD PENETRATION TEST SAMPLE
	GROUNDWATER TABLE

TEST TYPES:

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MD	MAXIMUM DENSITY
SA	SIEVE ANALYSIS
S&H	SIEVE AND HYDROMETER
EI	EXPANSION INDEX
CN	CONSOLIDATION
CR	CORROSION
AL	ATTERBERG LIMITS
CO	COLLAPSE/SWELL
RV	R-VALUE
-#200	% PASSING # 200 SIEVE

Geotechnical Boring Log Borehole HS-4

Date: 12/3/2021	**Drilling Company:** Cal Pac Drilling
Project Name: River Road - Norco, Dallape	**Type of Rig:** Truck Mounted
Project Number: 21250-01	**Drop:** 30" **Hole Diameter:** 8"
Elevation of Top of Hole: ~574' MSL	**Drive Weight:** 140 pounds
Hole Location: See Geotechnical Map	Page 1 of 1

Logged By CMP
Sampled By CMP
Checked By BPG

Elevation (ft)	Depth (ft)	Graphic Log	Sample Number	Blow Count	Dry Density (pcf)	Moisture (%)	USCS Symbol	DESCRIPTION	Type of Test
	0	B-1						@0' - Topsoil, plant debris to 8"	
								Quaternary Alluvium - Very Old (Qvoa)	
570			R-1	22 26 31	117.1	3.8	SP	@2.5 - SAND with cobbles and gravel, brown, dry, dense, poorly graded, approximately 20% cobbles and gravels	
	5		R-2	22 32 43	125.0	3.1	SP-SM	@5' - SAND with SILT: brown, dry, very dense, poorly graded	
565			R-3	16 24 32	110.7	5.9		@7.5' - SAND: brown, slightly moist, dense, poorly graded	
	10		SPT-1	13 19 22		6.0	SW-SM	@10' - SAND: brown, slightly moist, very dense, well graded	
560									
	15		R-4	14 35 32	109.6	6.0	SW-SM	@15' - SAND with SILT: brown, slightly moist, very dense, well graded	
555									
	20		SPT-2	4 8 29		27.9	SM	@20' - Silty SAND: olive-brown, wet, dense, at sampler tip SAND with Silt, light brown, poorly graded, observed in sampler	
550									
	25		R-5	22 50/6"	107.6	6.3		@25' - Silty SAND, brown, slightly moist, very dense	
545								Total Depth = 26.5' Groundwater Not Encountered Backfilled with Cuttings on 12/3/2021	
	30								

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SAMPLE TYPES:

B	BULK SAMPLE
R	RING SAMPLE (CA Modified Sampler)
G	GRAB SAMPLE
SPT	STANDARD PENETRATION TEST SAMPLE
	GROUNDWATER TABLE

TEST TYPES:

DS	DIRECT SHEAR
MD	MAXIMUM DENSITY
SA	SIEVE ANALYSIS
S&H	SIEVE AND HYDROMETER
EI	EXPANSION INDEX
CN	CONSOLIDATION
CR	CORROSION
AL	ATTERBERG LIMITS
CO	COLLAPSE/SWELL
RV	R-VALUE
-#200	% PASSING # 200 SIEVE

Geotechnical Boring Log Borehole I-1

Date: 12/3/2021 | **Drilling Company:** Cal Pac Drilling

Project Name: River Road - Norco, Dallape | **Type of Rig:** Truck Mounted

Project Number: 21250-01 | **Drop:** 30" | **Hole Diameter:** 8"

Elevation of Top of Hole: ~571' MSL | **Drive Weight:** 140 pounds

Hole Location: See Geotechnical Map

Logged By CMP
Sampled By CMP
Checked By BPG

Elevation (ft)	Depth (ft)	Graphic Log	Sample Number	Blow Count	Dry Density (pcf)	Moisture (%)	USCS Symbol	DESCRIPTION	Type of Test
570	0		R-1	4 6 7	119.5	5.6	SM	@0' - Topsoil and dried plant debris to 8" Quaternary Alluvium - Very Old (Qvoa) @2.5' - Silty SAND: brown, slightly moist, medium dense	
565	5							Total Depth = 5.2' Groundwater Not Encountered 3" Perforated Pipe Surrounded by Gravel Installed on 12/3/2021 Backfilled with Cuttings on 12/6/2021	
560	10								
555	15								
550	20								
545	25								
	30								

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THIS SUMMARY APPLIES ONLY AT THE LOCATION OF THIS BORING AND AT THE TIME OF DRILLING. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH THE PASSAGE OF TIME. THE DATA PRESENTED IS A SIMPLIFICATION OF THE ACTUAL CONDITIONS ENCOUNTERED. THE DESCRIPTIONS PROVIDED ARE QUALITATIVE FIELD DESCRIPTIONS AND ARE NOT BASED ON QUANTITATIVE ENGINEERING ANALYSIS.

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B	BULK SAMPLE
R	RING SAMPLE (CA Modified Sampler)
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TEST TYPES:

DS	DIRECT SHEAR
MD	MAXIMUM DENSITY
SA	SIEVE ANALYSIS
S&H	SIEVE AND HYDROMETER
EI	EXPANSION INDEX
CN	CONSOLIDATION
CR	CORROSION
AL	ATTERBERG LIMITS
CO	COLLAPSE/SWELL
RV	R-VALUE
-#200	% PASSING # 200 SIEVE

Geotechnical Boring Log Borehole I-2

Date: 12/3/2021	**Drilling Company:** Cal Pac Drilling
Project Name: River Road - Norco, Dallape	**Type of Rig:** Truck Mounted
Project Number: 21250-01	**Drop:** 30" **Hole Diameter:** 8"
Elevation of Top of Hole: ~572' MSL	**Drive Weight:** 140 pounds
Hole Location: See Geotechnical Map	Page 1 of 1

Logged By CMP
Sampled By CMP
Checked By BPG

Elevation (ft)	Depth (ft)	Graphic Log	Sample Number	Blow Count	Dry Density (pcf)	Moisture (%)	USCS Symbol	DESCRIPTION	Type of Test
570	0		R-1	15 14 21	114.2	3.1	SM	@0' - Topsoil and dried plant debris to 8" Quaternary Alluvium - Very Old (Qvoa) @2.5' - Silty SAND: brown, dry, medium dense	
565	5							Total Depth = 5' Groundwater Not Encountered 3" Perforated Pipe Surrounded by Gravel Installed on 12/3/2021 Backfilled with Cuttings on 12/6/2021	
560	10								
555	15								
550	20								
545	25								
	30								

LGC Geotechnical, Inc.

THIS SUMMARY APPLIES ONLY AT THE LOCATION OF THIS BORING AND AT THE TIME OF DRILLING. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH THE PASSAGE OF TIME. THE DATA PRESENTED IS A SIMPLIFICATION OF THE ACTUAL CONDITIONS ENCOUNTERED. THE DESCRIPTIONS PROVIDED ARE QUALITATIVE FIELD DESCRIPTIONS AND ARE NOT BASED ON QUANTITATIVE ENGINEERING ANALYSIS.

SAMPLE TYPES:

B	BULK SAMPLE
R	RING SAMPLE (CA Modified Sampler)
G	GRAB SAMPLE
SPT	STANDARD PENETRATION TEST SAMPLE
⏚	GROUNDWATER TABLE

TEST TYPES:

DS	DIRECT SHEAR
MD	MAXIMUM DENSITY
SA	SIEVE ANALYSIS
S&H	SIEVE AND HYDROMETER
EI	EXPANSION INDEX
CN	CONSOLIDATION
CR	CORROSION
AL	ATTERBERG LIMITS
CO	COLLAPSE/SWELL
RV	R-VALUE
-#200	% PASSING # 200 SIEVE

Geotechnical Boring Log Borehole I-3

Date: 12/3/2021 | **Drilling Company:** Cal Pac Drilling

Project Name: River Road - Norco, Dallape | **Type of Rig:** Truck Mounted

Project Number: 21250-01 | **Drop:** 30" | **Hole Diameter:** 8"

Elevation of Top of Hole: ~567' MSL | **Drive Weight:** 140 pounds

Hole Location: See Geotechnical Map

Logged By CMP
Sampled By CMP
Checked By BPG

Elevation (ft)	Depth (ft)	Graphic Log	Sample Number	Blow Count	Dry Density (pcf)	Moisture (%)	USCS Symbol	DESCRIPTION	Type of Test
565	0							@0' - Topsoil and dried plant debris to 8"	
								Quaternary Alluvium - Very Old (Qvoa)	
			R-1	6 6 11	113.9	15.7	SC-SM	@2.5' - Clayey SAND with SILT: brown, moist, medium dense, trace rootlets, calcite stringers	
	5		R-2	6 5 7	113.0	2.2	SW	@5' - SAND with SILT: brown, dry, medium dense, well graded	
560			R-3	4 7 11	109.0	1.9	SP	@7.5' - SAND: yellow-brown, dry, medium dense, poorly graded	CO
	10								
555								Total Depth = 11' Groundwater Not Encountered 3" Perforated Pipe Surrounded by Gravel Installed on 12/3/2021 Backfilled with Cuttings on 12/6/2021	
	15								
550									
	20								
545									
	25								
540									
	30								

LGC Geotechnical, Inc.

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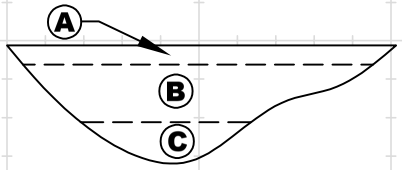
CR	CORROSION
AL	ATTERBERG LIMITS
CO	COLLAPSE/SWELL
RV	R-VALUE
-#200	% PASSING # 200 SIEVE

Project Name: River Road, Norco - Dallape	**Logged By: BPG**	**Trench No.: TP-1**	LGC Geotechnical, Inc.
Project Number: 21250-01	**Date: 12/1/2021**	**Engineering Properties:**	
Equipment: Backhoe	**Location: See Geotechnical Map**		

Geologic Attitudes	Unit	SOIL DESCRIPTION:	GEOLOGIC UNIT	USCS	SAMPLE No	MOISTURE (%)	DRY DENSITY (PCF)
	A	**Topsoil/Organics** @ 0 to 0.5' - Silty SAND: gray brown, dry, loose, desiccated, many rootlets and organics, manure smell, distinct contact to cleaner soils below	Qvoa	SM	O-1 @ 0.5'		
	B	**Quaternary Alluvium** @ 0.5 to 2' - Silty Fine SAND to Fine Sandy SILT: light to medium brown, dense to stiff, slightly moist, slightly friable at top, less so with depth, some root hairs and pinhole porosity		SM/ML	O-2 @ 1.5'		
	C	@ 2 to 3' - Silty Fine SAND with trace of CLAY: medium brown, slightly moist, dense, more cohesive			O-3 @ 2.5' O-4 @ 3.0'		

GRAPHICAL REPRESENTATION BELOW: **Elevation: 566' MSL** **Surface Slope: 0 deg.** **Trend: N45E**



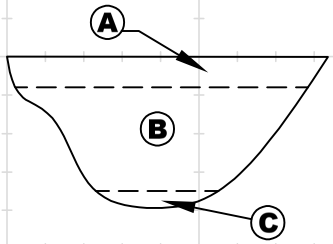
Total Depth: 3'
Groundwater: None
Backfilled: 12/01/21

scale: 1 in = 5 ft

Project Name: River Road, Norco - Dallape	Logged By: BPG	Trench No.: TP-2	LGC Geotechnical, Inc.
Project Number: 21250-01	Date: 12/1/2021	Engineering Properties:	
Equipment: Backhoe	Location: See Geotechnical Map		

Geologic Attitudes	Unit	SOIL DESCRIPTION:	GEOLOGIC UNIT	USCS	SAMPLE No	MOISTURE (%)	DRY DENSITY (PCF)
	A	Topsoil/Organics @ 0 to 10" - Sandy SILT to Silty SAND: black brown, dry, loose, desiccated, manure smell, mostly organics/manure, roots, distinct contact to cleaner soils below	Qvoa	SM/ML	O-1 @ 0.5'		
	B	Quaternary Alluvium @ 10" to 3.5' - Silty Fine SAND with trace CLAY: brown with some light gray and darker brown mottling, slightly moist, medium dense to very dense		SM	O-2 @ 1.5' O-3 @ 2.5'		
	C	@ 3.5' to 4' - Gravelly SAND: light brown to medium brown, slightly moist, dense, moderately indurated			O-4 @ 3.5'		

GRAPHICAL REPRESENTATION BELOW: **Elevation: 567' MSL** **Surface Slope: 0 deg.** **Trend: N45E**



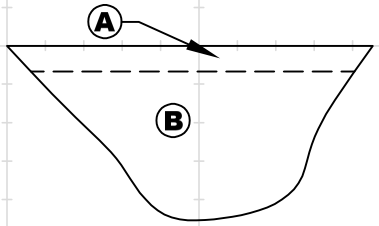
Total Depth: 4'
Groundwater: None
Backfilled: 12/01/21

scale: 1 in = 5 ft

Project Name: River Road, Norco - Dallape	Logged By: BPG	Trench No.: TP-3	
Project Number: 21250-01	Date: 12/1/2021	Engineering Properties:	
Equipment: Backhoe	Location: See Geotechnical Map		

Geologic Attitudes	Unit	SOIL DESCRIPTION:	GEOLOGIC UNIT	USCS	SAMPLE No	MOISTURE (%)	DRY DENSITY (PCF)
	A	**Topsoil/Organics** @ 0 to 8" - Sandy SILT to Silty SAND: black to brown and gray, dry, loose, desiccated, some roots, native soils tilled in		SM/ML	O-1 @ 0.5'		
	B	**Quaternary Alluvium** @ 8" to 4' - Clayey Silty SAND: reddish brown with little dark gray mottle, slightly moist, dense, trace of rootlets, density increases with depth @ 4' to 4.5' - increase in sand, some fine gravels	Qvoa	SM	O-2 @ 1.5' O-3 @ 2.5'		

GRAPHICAL REPRESENTATION BELOW: **Elevation: 571' MSL** **Surface Slope: 0 deg.** **Trend: N60E**



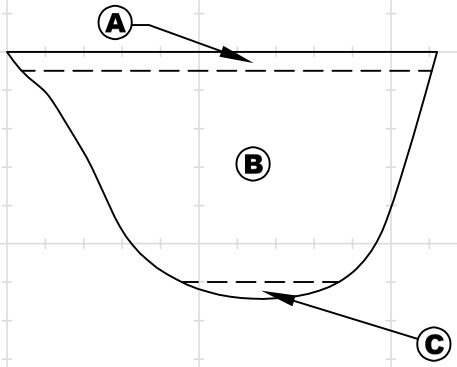
Total Depth: 4.5'
Groundwater: None
Backfilled: 12/01/21

scale: 1 in = 5 ft

Project Name: River Road, Norco - Dallape	**Logged By: BPG**	**Trench No.: TP-4**	LGC Geotechnical, Inc.
Project Number: 21250-01	**Date: 12/1/2021**	**Engineering Properties:**	
Equipment: Backhoe	**Location: See Geotechnical Map**		

Geologic Attitudes	Unit	SOIL DESCRIPTION:	GEOLOGIC UNIT	USCS	SAMPLE No	MOISTURE (%)	DRY DENSITY (PCF)
	A	**Topsoil/Organics** @ 0 to 0.5' - Sandy SILT to Silty SAND: black to gray, dry, loose, desiccated roots		SM	O-1 @ 0.5'		
	B	**Quaternary Alluvium** @ 0.5' to 6' - Slightly clayey silty SAND: medium brown to reddish brown, slightly moist, medium dense to dense, density increases in depth, trace rootlets to approximately 3' deep	Qvoa		O-2 @ 1.0' O-3 @ 2.0' O-4 @ 3.0'		
	C	@ 6' to 6.5' - SAND: light brown, loose, slightly moist to dry, fairly clean			B-1 @ 6.0' to 6.5'		

GRAPHICAL REPRESENTATION BELOW: **Elevation: 572' MSL** **Surface Slope: 0 deg.** **Trend: N45E**



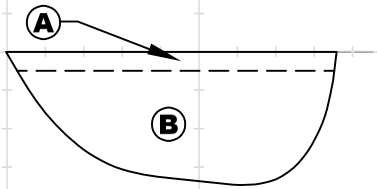
Total Depth: 6.5'
Groundwater: None
Backfilled: 12/01/21

scale: 1 in = 5 ft

Project Name: River Road, Norco - Dallape	**Logged By: BPG**	**Trench No.: TP-5**	LGC Geotechnical, Inc.
Project Number: 21250-01	**Date: 12/1/2021**	**Engineering Properties:**	
Equipment: Backhoe	**Location: See Geotechnical Map**		

Geologic Attitudes	Unit	SOIL DESCRIPTION:	GEOLOGIC UNIT	USCS	SAMPLE No	MOISTURE (%)	DRY DENSITY (PCF)
	A	**Topsoil** **@ 0 to 0.5' - Sandy SILT to Silty SAND: dark gray, dry, loose, desiccated, many rootlets/roots throughout, minimal visible organics/manure**		**SM/ML**	**O-1 @ 0.5'**		
	B	**Quaternary Alluvium** **@ 0.5 to 3.5' - Sandy SILT to Silty SAND: dry to slightly moist, dense to stiff, rootlets to 1.5', density and moisture increases with depth, some minor pinhole porosity in upper 1.5'**	**Qvoa**		**O-2 @ 1.0'** **O-3 @ 2.0'**		

GRAPHICAL REPRESENTATION BELOW: **Elevation: 572' MSL** **Surface Slope: 0 deg.** **Trend: N25E**



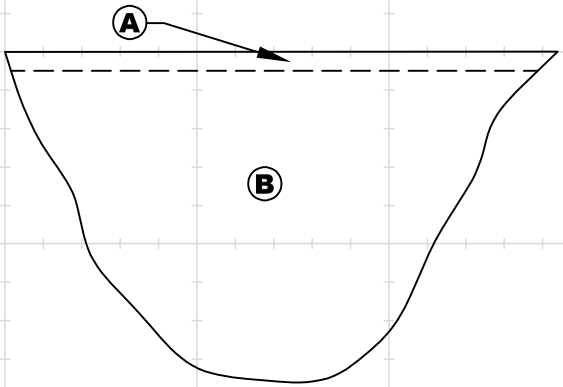
Total Depth: 3.5'
Groundwater: None
Backfilled: 12/01/21

scale: 1 in = 5 ft

Project Name: River Road, Norco - Dallape	**Logged By: BPG**	**Trench No.: TP-6**	LGC Geotechnical, Inc.
Project Number: 21250-01	**Date: 12/1/2021**	**Engineering Properties:**	
Equipment: Backhoe	**Location: See Geotechnical Map**		

Geologic Attitudes	Unit	SOIL DESCRIPTION:	GEOLOGIC UNIT	USCS	SAMPLE No	MOISTURE (%)	DRY DENSITY (PCF)
	A	**Topsoil** @ 0 to 0.5' - Silty SAND to Sandy SILT: black to gray, loose dry, desiccated, many roots		SM/ML	O-1 @ 0.5'		
	B	**Quaternary Alluvium** @ 0.5 to 8.5' - Silty SAND to Sandy SILT: slightly moist, medium brown, medium dense, increase in density and moisture with depth	Qvoa		O-2 @ 1.5' O-3 @ 2.5' B-1 @ 1-3'		

GRAPHICAL REPRESENTATION BELOW: **Elevation: 572' MSL** **Surface Slope: 0 deg.** **Trend: N5E**



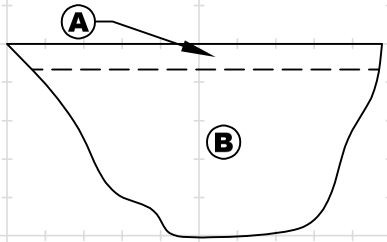
Total Depth: 8.5'
Groundwater: None
Backfilled: 12/01/21

scale: 1 in = 5 ft

Project Name: River Road, Norco - Dallape	**Logged By: BPG**	**Trench No.: TP-7**	LGC Geotechnical, Inc.
Project Number: 21250-01	**Date: 12/1/2021**	**Engineering Properties:**	
Equipment: Backhoe	**Location: See Geotechnical Map**		

Geologic Attitudes	Unit	SOIL DESCRIPTION:	GEOLOGIC UNIT	USCS	SAMPLE No	MOISTURE (%)	DRY DENSITY (PCF)
	A	**Topsoil** **@ 0 to 8" - Clayey SAND to Sandy CLAY: dark gray, dry, loose, desiccated, minimal organics visible, few rootlets**		SC	O-1 @ 0.5'		
	B	**Quaternary Alluvium** **@ 8" to 5' - Silty Fine SAND: brown to red brown, slightly moist, medium dense, homogeneous appearance, slight increase in coarse sand at 2.5', increase density at 4'**	Qvoa	SM/ML	O-2 @ 1.5' O-3 @ 2.5'		

GRAPHICAL REPRESENTATION BELOW: **Elevation: 574' MSL** **Surface Slope: 0 deg.** **Trend: N40W**



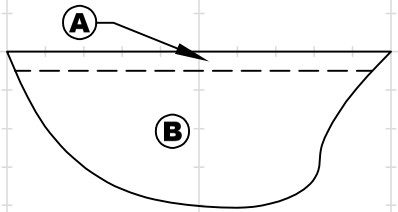
Total Depth: 5'
Groundwater: None
Backfilled: 12/01/21

scale: 1 in = 5 ft

Project Name: River Road, Norco - Dallape	Logged By: BPG	Trench No.: TP-8	LGC Geotechnical, Inc.
Project Number: 21250-01	Date: 12/1/2021	Engineering Properties:	
Equipment: Backhoe	Location: See Geotechnical Map		

Geologic Attitudes	Unit	SOIL DESCRIPTION:	GEOLOGIC UNIT	USCS	SAMPLE No	MOISTURE (%)	DRY DENSITY (PCF)
	A	**Topsoil** @ 0 to 0.5' - Silty SAND and CLAY: gray brown, dry, loose, desiccated many roots, rootlets, little visible organics/manure		SM/ML	O-1 @ 0.5'		
	B	**Quaternary Alluvium** @ 0.5 to 4' - Sandy SILT to Silty SAND: medium brown to reddish brown, dry to slightly moist (upper 1.5' dry/weathered), increase in moisture with depth, dense to very dense to 4'	Qvoa		O-2 @ 1.5' O-3 @ 2.5'		

GRAPHICAL REPRESENTATION BELOW: **Elevation: 571' MSL** **Surface Slope: 0 deg.** **Trend: N40W**



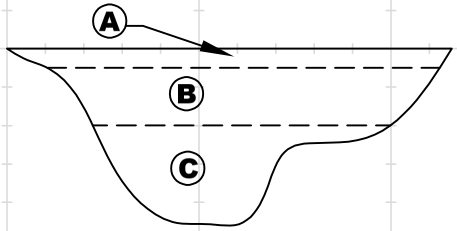
Total Depth: 4'
Groundwater: None
Backfilled: 12/01/21

scale: 1 in = 5 ft

Project Name: River Road, Norco - Dallape	Logged By: BPG	Trench No.: TP-9	LGC Geotechnical, Inc.
Project Number: 21250-01	Date: 12/1/2021	Engineering Properties:	
Equipment: Backhoe	Location: See Geotechnical Map		

Geologic Attitudes	Unit	SOIL DESCRIPTION:	GEOLOGIC UNIT	USCS	SAMPLE No	MOISTURE (%)	DRY DENSITY (PCF)
	A	**Topsoil** @ 0 to 0.5' - Silty SAND to Sandy SILT: dark gray to brown, dry, loose, many roots		SM/ML	O-1 @ 0.5'		
	B	**Quaternary Alluvium** @ 0.5 to 2' - Sandy SILT: light to medium brown, dry, loose to medium dense, weathered, desiccated	Qvoa		O-2 @ 1.5' O-3 @ 2.5'		
	C	@ 2' to 4.5' - Sandy SILT to Silty Fine SAND: medium brown to red brown, slightly moist, dense, probed tight			O-4 @ 3.5'		

GRAPHICAL REPRESENTATION BELOW: **Elevation: 572' MSL** **Surface Slope: 0 deg.** **Trend: N45W**



Total Depth: 4.5'
Groundwater: None
Backfilled: 12/01/21

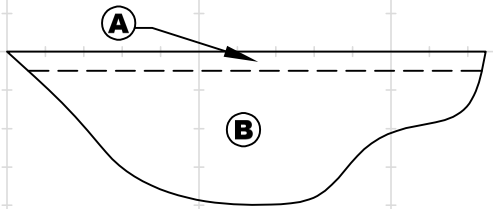
scale: 1 in = 5 ft

Project Name: River Road, Norco - Dallape	**Logged By: BPG**	**Trench No.: TP-10**
Project Number: 21250-01	**Date: 12/1/2021**	**Engineering Properties:**
Equipment: Backhoe	**Location: See Geotechnical Map**	

LGC Geotechnical, Inc.

Geologic Attitudes	Unit	SOIL DESCRIPTION:	GEOLOGIC UNIT	USCS	SAMPLE No	MOISTURE (%)	DRY DENSITY (PCF)
	A	**Topsoil** @ 0 to 0.5' - Silty SAND to Sandy SILT: brown, dry, loose, visible organics/manure		SM/ML	O-1 @ 0.5'		
	B	**Quaternary Alluvium** @ 0.5 to 4' - Silty SAND to Sandy SILT: light to medium brown, slightly moist, dense, rootlets to 3.5', probed tight at 2', drier and weathered in upper 2', increase in density and sand with depth	Qvoa		O-2 @ 1.5' O-3 @ 2.5' O-4 @ 3.5' B-1 @ 1-4'		

GRAPHICAL REPRESENTATION BELOW: **Elevation: 572' MSL** **Surface Slope: 0 deg.** **Trend: N40E**



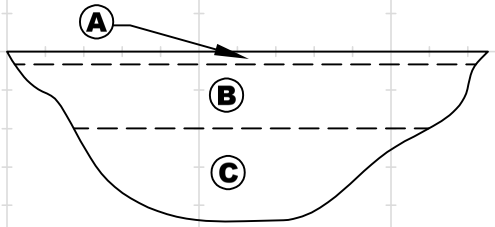
Total Depth: 4'
Groundwater: None
Backfilled: 12/01/21

scale: 1 in = 5 ft

Project Name: River Road, Norco - Dallape	**Logged By: BPG**	**Trench No.: TP-11**	LGC Geotechnical, Inc.
Project Number: 21250-01	**Date: 12/1/2021**	**Engineering Properties:**	
Equipment: Backhoe	**Location: See Geotechnical Map**		

Geologic Attitudes	Unit	SOIL DESCRIPTION:	GEOLOGIC UNIT	USCS	SAMPLE No	MOISTURE (%)	DRY DENSITY (PCF)
	A	**Topsoil** @ 0 to 4" - Sandy SILT: gray, dry, loose, desiccated, many roots	Qvoa	SM/ML			
	B	**Quaternary Alluvium** @ 4" to 2' - Slightly Sandy SILT: medium gray to brown, dry, loose, slightly weathered and desiccated, rootlets to 2'			O-1 @ 0.5' O-2 @ 1.5'		
	C	@ 2 to 4.5' - Sandy SILT to silty fine SAND: medium brown to slightly reddish brown, slightly moist, dense, probes very tight			O-3 @ 2.5' O-4 @ 3.5'		

GRAPHICAL REPRESENTATION BELOW: **Elevation: 567' MSL** **Surface Slope: 0 deg.** **Trend: N35E**



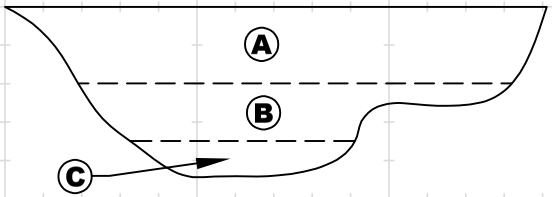
Total Depth: 4.5'
Groundwater: None
Backfilled: 12/01/21

scale: 1 in = 5 ft

Project Name: River Road, Norco - Dallape	Logged By: BPG	Trench No.: TP-12	LGC Geotechnical, Inc.
Project Number: 21250-01	Date: 12/1/2021	Engineering Properties:	
Equipment: Backhoe	Location: See Geotechnical Map		

Geologic Attitudes	Unit	SOIL DESCRIPTION:	GEOLOGIC UNIT	USCS	SAMPLE No	MOISTURE (%)	DRY DENSITY (PCF)
	A B C	Quaternary Alluvium @ 0 to 2' - slightly clayey SILT: light brown, dry, medium stiff, rootlets, upper few inches includes roots from plants above @1.5' - 2" to 3" bed of white chalky silt, dry, loose @ 2 to 3.5' - Sand and Fine GRAVEL: medium brown, dry, loose to medium dense @ 3.5 to 4.5' - Silty Fine SAND to Fine Sandy SILT: medium brown, slightly moist, dense to very dense, trace rootlets	Qvoa	SM/ML	O-1 @ 0.5' O-2 @ 1.5' B-1 @ 2.0' - 3.5' O-3 @ 2.5'		

GRAPHICAL REPRESENTATION BELOW: **Elevation: 567' MSL** **Surface Slope: 0 deg.** **Trend: N35E**



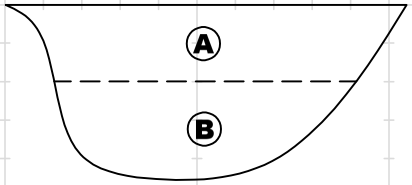
Total Depth: 4.5'
Groundwater: None
Backfilled: 12/01/21

scale: 1 in = 5 ft

Project Name: River Road, Norco - Dallape	Logged By: BPG	Trench No.: TP-13	LGC Geotechnical, Inc.
Project Number: 21250-01	Date: 12/2/2021	Engineering Properties:	
Equipment: Backhoe	Location: See Geotechnical Map		

Geologic Attitudes	Unit	SOIL DESCRIPTION:	GEOLOGIC UNIT	USCS	SAMPLE No	MOISTURE (%)	DRY DENSITY (PCF)
	A	Quaternary Alluvium @ 0 to 2' - Sandy SILT to Silty SAND: medium brown to reddish brown, dry, loose, weathered and desiccated in upper 2', excavates somewhat blocky, roots/rootlets in upper 2', pinhole porosity throughout, trace clay	Qvoa	ML	B-1 @ 0-2' O-1 @ 0.5' O-2 @ 1.5'		
	B	@ 2 to 4.5' - Increase in sand content to Silty SAND: red brown, slightly moist, dense, trace clay, trace pinhole porosity, trace rootlets, density increases with depth, very dense, difficult excavating with backhoe @ 4.5'		SM			

GRAPHICAL REPRESENTATION BELOW: **Elevation: 573' MSL** **Surface Slope: 0 deg.** **Trend: N20W**



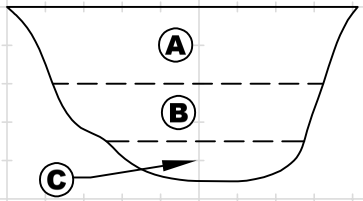
Total Depth: 4.5'
Groundwater: None
Backfilled: 12/02/21

scale: 1 in = 5 ft

Project Name: River Road, Norco - Dallape	Logged By: BPG	Trench No.: TP-14	LGC Geotechnical, Inc.
Project Number: 21250-01	Date: 12/2/2021	Engineering Properties:	
Equipment: Backhoe	Location: See Geotechnical Map		

Geologic Attitudes	Unit	SOIL DESCRIPTION:	GEOLOGIC UNIT	USCS	SAMPLE No	MOISTURE (%)	DRY DENSITY (PCF)
	A	Quaternary Alluvium @ 0 to 2' - Silty SAND with Clay: red brown, dry to slightly moist, medium dense, weathered, fractured, desiccated, some rootlets	Qvoa	SM			
	B	@ 2 to 3.5' - similar to above, less weathered, increase in moisture and density @ 3.5 to 4' - increase in density to very dense, some white caliche staining, along healed fractures, few light gray cobbles, well rounded, some coarse sand					
	C	@ 4 to 4.5' - SAND with gravel, medium brown, slightly moist, very dense, gravels to 2" diameter, rounded, moderately indurated, difficult excavating					

GRAPHICAL REPRESENTATION BELOW: **Elevation: 574' MSL** **Surface Slope: 0 deg.** **Trend: N15E**



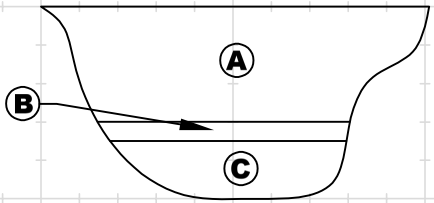
Total Depth: 4.5'
Groundwater: None
Backfilled: 12/02/21

scale: 1 in = 5 ft

Project Name: River Road, Norco - Dallape	Logged By: BPG	Trench No.: TP-15	LGC Geotechnical, Inc.
Project Number: 21250-01	Date: 12/2/2021	Engineering Properties:	
Equipment: Backhoe	Location: See Geotechnical Map		

Geologic Attitudes	Unit	SOIL DESCRIPTION:	GEOLOGIC UNIT	USCS	SAMPLE No	MOISTURE (%)	DRY DENSITY (PCF)
	A	Artificial Fill - Undocumented @ 0 to 3' - Sandy SILT to Silty SAND: light brown, dry to slightly moist, medium dense, weathered/desiccated, few clasts of well-cemented siltstone, few rounded cobbles to 3" across, wood debris at base of unit	Afu	SM/ML	B-1 @ 0 to 3.0'		
	B	Topsoil @ 3 to 3.5' - Silty SAND to Sandy SILT: red brown, loose dry, many rootlets, weathered					
	C	Quaternary Alluvium @ 3.5 to 5' - Silty Fine SAND with trace Clay: red brown, slightly moist, dense, difficult excavating at 5'	Qvoa	SM			

GRAPHICAL REPRESENTATION BELOW: **Elevation: 568' MSL** **Surface Slope: 0 deg.** **Trend: N20E**



Total Depth: 5'
Groundwater: None
Backfilled: 12/02/21

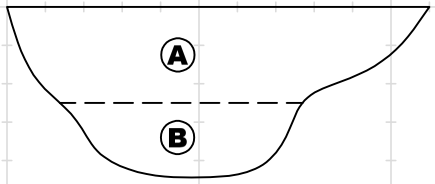
scale: 1 in = 5 ft

Project Name: River Road, Norco - Dallape	**Logged By: BPG**	**Trench No.: TP-16**
Project Number: 21250-01	**Date: 12/2/2021**	**Engineering Properties:**
Equipment: Backhoe	**Location: See Geotechnical Map**	

LGC Geotechnical, Inc.

Geologic Attitudes	Unit	SOIL DESCRIPTION:	GEOLOGIC UNIT	USCS	SAMPLE No	MOISTURE (%)	DRY DENSITY (PCF)
	A	**Artificial Fill - Undocumented** @ 0 to 2.5' - Silty SAND to Sandy Silt: red brown to gray and light brown mottled, slightly moist, medium dense, angular gravels throughout, asphalt and some granitics, trace clay, visible lifts including 4" gravel lift near surface and at 2'	Afu	SM/ML	B-1 @ 0 to 2.5'		
	B	**Quaternary Alluvium** @ 2.5 to 4.5' - Silty Fine SAND: red brown, slightly moist, dense, difficult excavating, some pinhole porosity, trace root hairs, trace clay	Qvoa	SM			

GRAPHICAL REPRESENTATION BELOW: **Elevation: 565' MSL** **Surface Slope: 0 deg.** **Trend: N25E**



Total Depth: 4.5'
Groundwater: None
Backfilled: 12/02/21

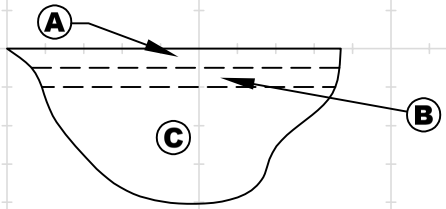
scale: 1 in = 5 ft

Project Name: River Road, Norco - Dallape	**Logged By: BPG**	**Trench No.: TP-17**
Project Number: 21250-01	**Date: 12/2/2021**	**Engineering Properties:**
Equipment: Backhoe	**Location: See Geotechnical Map**	

LGC Geotechnical, Inc.

Geologic Attitudes	Unit	SOIL DESCRIPTION:	GEOLOGIC UNIT	USCS	SAMPLE No	MOISTURE (%)	DRY DENSITY (PCF)
	A	**Artificial Fill - Undocumented** @ 0 to 0.5' - Silty SAND to Sandy SILT: light brown, loose, dry, many gravels	Afu	SM/ML	O-1 @ 0.5'		
	B	**Quaternary Alluvium** @ 0.5 to 1' - Silty SAND: red brown, dry to slightly moist, medium dense, weathered, slightly desiccated, slightly clayey	Qvoa	SM	O-2 @ 1.5'		
	C	@ 1 to 4' - Increase in moisture and density, decrease in silt with depth, difficult excavating at 4'					

GRAPHICAL REPRESENTATION BELOW: **Elevation: 573' MSL** **Surface Slope: 0 deg.** **Trend: N35E**



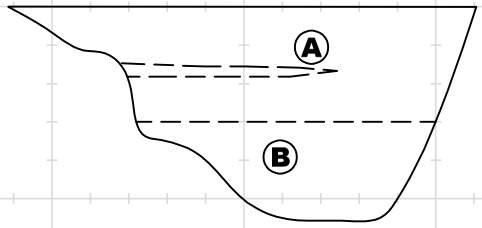
Total Depth: 4'
Groundwater: None
Backfilled: 12/02/21

scale: 1 in = 5 ft

Project Name: River Road, Norco - Dallape	Logged By: BPG	Trench No.: TP-18	LGC Geotechnical, Inc.
Project Number: 21250-01	Date: 12/2/2021	Engineering Properties:	
Equipment: Backhoe	Location: See Geotechnical Map		

Geologic Attitudes	Unit	SOIL DESCRIPTION:	GEOLOGIC UNIT	USCS	SAMPLE No	MOISTURE (%)	DRY DENSITY (PCF)
	A	**Artificial Fill - Undocumented** @ 0 to 3' - Silty SAND with Gravel: red brown, dry, loose to medium dense, many gravels, lense or lift of vegetation approximately 3" thick @1.5' (non-continuous)	Afu	SM			
	B	**Quaternary Alluvium** @ 3 to 5.5' - Silty SAND: red brown, slightly moist, dense, increase in moisture and density with depth, difficult excavating at 5.5', some pinhole porosity and root hairs	Qvoa				

GRAPHICAL REPRESENTATION BELOW: **Elevation: 571' MSL** **Surface Slope: 0 deg.** **Trend: N30W**



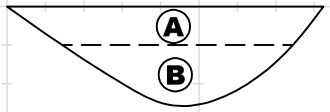
Total Depth: 5.5'
Groundwater: None
Backfilled: 12/02/21

scale: 1 in = 5 ft

Project Name: River Road, Norco - Dallape	**Logged By: BPG**	**Trench No.: TP-19**	LGC Geotechnical, Inc.
Project Number: 21250-01	**Date: 12/2/2021**	**Engineering Properties:**	
Equipment: Backhoe	**Location: See Geotechnical Map**		

Geologic Attitudes	Unit	SOIL DESCRIPTION:	GEOLOGIC UNIT	USCS	SAMPLE No	MOISTURE (%)	DRY DENSITY (PCF)
	A	**Quaternary Alluvium** **@ 0 to 1' - Silty SAND: red brown, dry, loose, weathered, desiccated, many roots, rootlets, pinhole porosity**	Qvoa	SM/ML	O-1 @ 0.5'		
	B	**@ 1 to 2.5' - Silty SAND: red brown, dry, loose, weathered, desiccated, many roots, rootlets, increase in moisture and density, excavated hard/blocky, increase in sand @2.5', some pinhole porosity**			O-2 @ 1.5'		

GRAPHICAL REPRESENTATION BELOW: **Elevation: 572' MSL** **Surface Slope: 0 deg.** **Trend: N40W**



Total Depth: 2.5'
Groundwater: None
Backfilled: 12/02/21

scale: 1 in = 5 ft

Appendix C
Laboratory Test Results

APPENDIX C

Laboratory Test Results

The laboratory testing program was directed towards providing quantitative data relating to the relevant engineering properties of the site soils. Samples considered representative of site conditions were tested in general accordance with American Society for Testing and Materials (ASTM) procedure and/or California Test Methods (CTM), where applicable. The following summary is a brief outline of the test type and a table summarizing the test results.

Moisture and Density Determination Tests: Moisture content (ASTM D2216) and dry density determinations (ASTM D2937) were performed on driven samples obtained from the test borings. The results of these tests are presented in the boring logs. Where applicable, only moisture content was determined from undisturbed or disturbed samples.

Grain Size Distribution/Fines Content: Representative samples were dried, weighed, and soaked in water until individual soil particles were separated (per ASTM D421) and then washed on a No. 200 sieve (ASTM D1140). Where applicable, the portion retained on the No. 200 sieve was dried and then sieved on a U.S. Standard brass sieve set in accordance with ASTM D6913 (sieve).

Sample Location	Description	% Passing # 200 Sieve
HS-3, SPT-1 @ 10’	Olive Brown Silty Sand	38.5
HS-3, R-5 @ 25’	Brown Sandy Lean Clay	65.5
HS-3, SPT-4 @ 40’	Gray Silty Sand	43.8
HS-3, R-7 @ 45’	Olive Gray Sandy Silt	50.9

Atterberg Limits: The liquid and plastic limits (“Atterberg Limits”) were determined per ASTM D4318 for engineering classification of fine-grained material and presented in the table below. The USCS soil classification indicated in the table below is based on the portion of sample passing the No. 40 sieve and may not necessarily be representative of the entire sample. The plot is provided in this Appendix.

Sample Location	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	USCS Soil Classification
HS-3 @ 20 ft	66	27	39	CL

Collapse/Swell Potential: Two collapse tests were performed per ASTM D4546. A sample (2.4 inches in diameter and 1-inch in height) was placed in a consolidometer and loaded to the approximate in-situ effective stress. The curve is presented in this Appendix.

Maximum Density Tests: The maximum dry density and optimum moisture content of a typical material was determined in accordance with ASTM D1557. The result of this test is presented in the table below:

Sample Location	Sample Description	Maximum Dry Density (pcf)	Optimum Moisture Content (%)
HS-1 @ 0-5 ft	Brown Silty Sand	117.0	12.0

Expansion Index: The expansion potential of selected representative samples was evaluated by the Expansion Index Test per ASTM D4829.

Sample Location	Expansion Index	Expansion Potential*
HS-1 @ 0-5 ft	24	Low

* Per ASTM D4829

Soluble Sulfates: The soluble sulfate content of a select sample was determined by standard geochemical methods (CTM 417). The test result is presented in the table below.

Sample Location	Sulfate Content, ppm
HS-2 @ 0-5 ft	156

Chloride Content: Chloride content was tested per CTM 422. The results are presented below.

Sample Location	Chloride Content, ppm
HS-2 @ 0-5 ft	960

Organic Matter Content of Soils: Organic matter content tests were performed in general accordance with ASTM D 2974 (Test Methods A & C). The results are presented in attached Table 7.

Boring No.	HS-1	HS-1	HS-1	HS-1	HS-1	HS-2	HS-2	HS-2
Sample No.	R-1	R-2	R-3	R-4	R-5	R-1	R-2	R-3
Depth (ft.)	2.5	5.0	7.5	15.0	25.0	2.5	5.0	7.5
Sample Type	Ring	Ring	Ring	Ring	Ring	Ring	Ring	Ring
Soil Identification	Brown silty sand (SM)	Brown silty sand (SM)	Light olive brown silt with sand (ML)s	Grayish brown lean clay (CL)	Brown lean clay (CL)	Brown silty sand (SM)	Brown silty sand (SM)	Grayish brown poorly-graded sand with silt (SP-SM), loose
Pocket Penetrometer (tons/ft^2)	>4.50	>4.50	4.00/>4.50	4.00	>4.50	3.50	3.50	<0.25
Weight Soil + Rings / Tube (g)	1197.3	1104.3	917.4	1045.7	1011.7	1026.6	906.8	1089.7
Weight of Rings / Tube (g)	266.4	266.4	222.0	266.4	222.0	266.4	222.0	266.4
Average Length (in.)	6.00	6.00	5.00	6.00	5.00	6.00	5.00	6.00
Average Diameter (in.)	2.415	2.415	2.415	2.415	2.415	2.415	2.415	2.415
Wet. Wt. of Soil + Cont. (g)	238.6	216.8	181.2	210.5	212.5	228.0	241.2	258.3
Dry Wt. of Soil + Cont. (g)	213.4	199.5	172.1	197.7	186.5	219.9	229.6	248.9
Weight of Container (g)	72.1	57.5	58.2	51.2	57.8	58.9	62.6	60.1
Container No.								
Wet Density	129.0	116.1	115.7	108.0	131.4	105.4	113.9	114.1
Moisture Content (%)	**17.8**	**12.2**	**8.0**	**8.7**	**20.2**	**5.0**	**6.9**	**5.0**
Dry Density (pcf)	**109.5**	**103.5**	**107.1**	**99.3**	**109.3**	**100.3**	**106.5**	**108.7**
Degree of Saturation (%)	89.3	52.4	37.6	33.9	100.5	20.0	32.2	24.4

Leighton

MOISTURE & DENSITY of SOILS

ASTM D 2216 & ASTM D 2937

Project Name: River Rd - Norco

Project No.: 21250-01

Tested By: SF/GB Date: 12/15/21

Boring No.	HS-2	HS-2	HS-3	HS-3	HS-3	HS-3	HS-3	HS-3
Sample No.	R-4	R-5	R-1	R-2	R-3	R-4	R-5	R-6
Depth (ft.)	15.0	25.0	2.5	5.0	7.5	15.0	25.0	35.0
Sample Type	Ring	Ring	Ring	Ring	Ring	Ring	Ring	Ring
Soil Identification	Brown silt (ML)	Brown sandy lean clay s(CL)	Brown silty sand (SM)	Light brown silt (ML)	Light brown silty sand (SM)	Grayish brown well-graded sand with silt (SW-SM)	Brown clayey sand (SC)	Grayish brown silty sand (SM)
Pocket Penetrometer (tons/ft^2)	>4.50	>4.50	>4.50	>4.50	>4.50	>4.50	>4.50	>4.50
Weight Soil + Rings / Tube (g)	1200.1	1025.4	1068.1	1096.0	1127.8	1124.5	1038.9	1222.0
Weight of Rings / Tube (g)	266.4	222.0	266.4	266.4	266.4	266.4	222.0	266.4
Average Length (in.)	6.00	5.00	6.00	6.00	6.00	6.00	5.00	6.00
Average Diameter (in.)	2.415	2.415	2.415	2.415	2.415	2.415	2.415	2.415
Wet. Wt. of Soil + Cont. (g)	230.5	213.3	203.4	214.7	212.3	210.3	1066.1	219.1
Dry Wt. of Soil + Cont. (g)	210.3	189.8	193.8	190.4	203.4	192.4	930.4	193.2
Weight of Container (g)	57.6	65.7	57.7	56.8	37.4	57.6	107.7	56.7
Container No.								
Wet Density	129.4	133.6	111.1	115.0	119.4	118.9	135.9	132.5
Moisture Content (%)	**13.2**	**18.9**	**7.1**	**18.2**	**5.4**	**13.3**	**16.5**	**19.0**
Dry Density (pcf)	**114.3**	**112.4**	**103.8**	**97.3**	**113.3**	**105.0**	**116.6**	**111.3**
Degree of Saturation (%)	75.2	102.2	30.5	67.0	29.7	59.2	100.0	99.7

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MOISTURE & DENSITY of SOILS

ASTM D 2216 & ASTM D 2937

Project Name: River Rd - Norco

Project No.: 21250-01

Tested By: S. Felter Date: 12/15/21

Boring No.	HS-3	HS-4	HS-4	HS-4	HS-4	HS-4	I-1	I-2
Sample No.	R-7	R-1	R-2	R-3	R-4	R-5	R-1	R-1
Depth (ft.)	45.0	2.5	5.0	7.5	15.0	25.0	3.0	3.0
Sample Type	Ring	Ring	Ring	Ring	Ring	Ring	Ring	Ring
Soil Identification	Olive gray sandy silt s(ML)	Brown poorly-graded sand (SP), loose	Brown poorly-graded sand with silt (SP-SM)	Brown poorly-graded sand with silt (SP-SM)	Brown well-graded sand with silt (SW-SM)	Brown silty sand (SM)	Brown silty sand (SM)	Brown silty sand (SM)
Pocket Penetrometer (tons/ft^2)	>4.50	<0.25	>4.50	>4.50	>4.50	4.50	4.00	>4.50
Weight Soil + Rings / Tube (g)	1246.3	1142.9	1195.6	1111.8	1104.3	1091.2	1176.7	1115.8
Weight of Rings / Tube (g)	266.4	266.4	266.4	266.4	266.4	266.4	266.4	266.4
Average Length (in.)	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00
Average Diameter (in.)	2.415	2.415	2.415	2.415	2.415	2.415	2.415	2.415
Wet. Wt. of Soil + Cont. (g)	1090.3	270.3	234.4	226.1	230.5	224.4	228.0	230.5
Dry Wt. of Soil + Cont. (g)	945.4	262.6	228.5	216.8	221.9	214.5	219.7	225.3
Weight of Container (g)	108.1	58.7	36.7	58.2	77.4	57.1	71.8	57.4
Container No.								
Wet Density	135.8	121.5	128.8	117.2	116.1	114.3	126.2	117.7
Moisture Content (%)	**17.3**	**3.8**	**3.1**	**5.9**	**6.0**	**6.3**	**5.6**	**3.1**
Dry Density (pcf)	**115.8**	**117.1**	**125.0**	**110.7**	**109.6**	**107.6**	**119.5**	**114.2**
Degree of Saturation (%)	102.5	23.2	23.8	30.3	29.9	29.9	36.9	17.6

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MOISTURE & DENSITY of SOILS

ASTM D 2216 & ASTM D 2937

Project Name: River Rd - Norco

Project No.: 21250-01

Tested By: S. Felter Date: 12/15/21

Boring No.	I-3	I-3	I-3					
Sample No.	R-1	R-2	R-3					
Depth (ft.)	2.5	5.0	7.5					
Sample Type	Ring	Ring	Ring					
Soil Identification	Brown silty, clayey sand (SC-SM)	Brown well-graded sand (SW)	Yellowish brown poorly-graded sand (SP)					
Pocket Penetrometer (tons/ft^2)	>4.50	3.25	0.50/1.00					
Weight Soil + Rings / Tube (g)	1216.9	916.8	1067.6					
Weight of Rings / Tube (g)	266.4	222.0	266.4					
Average Length (in.)	6.00	5.00	6.00					
Average Diameter (in.)	2.415	2.415	2.415					
Wet. Wt. of Soil + Cont. (g)	233.7	273.6	208.7					
Dry Wt. of Soil + Cont. (g)	209.6	268.8	205.9					
Weight of Container (g)	55.7	54.4	60.9					
Container No.								
Wet Density	131.7	115.6	111.1					
Moisture Content (%)	**15.7**	**2.2**	**1.9**					
Dry Density (pcf)	**113.9**	**113.0**	**109.0**					
Degree of Saturation (%)	88.1	12.3	9.5					

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MOISTURE & DENSITY of SOILS

ASTM D 2216 & ASTM D 2937

Project Name: River Rd - Norco

Project No.: 21250-01

Tested By: SF/GB Date: 12/16/21

Leighton

MOISTURE CONTENT

ASTM D 2216

Project Name: River Rd - Norco
Project No.: 21250-01

Tested By: S. Felter
Date: 12/15/21
Checked By: J. Ward
Date: 01/06/22

Boring No.	HS-1	HS-1	HS-2	HS-2	HS-3
Sample No.	SP-1	SP-2	SP-1	SP-2	SP-1
Depth (ft)	10.0	20.0	10.0	20.0	10.0
Sample Type	SPT	SPT	SPT	SPT	SPT
Sample Description	Olive brown lean clay (CL)	Olive brown lean clay (CL)	Brown well-graded sand with silt (SW-SM)	Brown silt (ML)	Olive brown silty sand (SM)
Wt. wet soil + container (g)	230.4	233.2	320.8	224.6	817.9
Wt. dry soil + container (g)	196.0	192.2	306.8	188.1	749.9
Weight of container (g)	60.3	72.2	54.3	67.2	108.1
Moisture Content (%)	**25.4**	**34.2**	**5.5**	**30.2**	**10.6**

Boring No.	HS-3	HS-3	HS-3	HS-3	HS-4
Sample No.	SP-2	SP-3	SP-4	SP-5	SP-1
Depth (ft)	20.0	30.0	40.0	50.0	10.0
Sample Type	SPT	SPT	SPT	SPT	SPT
Sample Description	Pale brown fat clay (CH)	Brown clayey sand (SC)	Gray silty sand (SM)	Grayish brown poorly-graded sand with silt (SP-SM)	Brown well-graded sand with silt (SW-SM)
Wt. wet soil + container (g)	292.4	336.1	1071.9	269.4	218.8
Wt. dry soil + container (g)	234.4	304.7	925.1	243.9	209.7
Weight of container (g)	57.1	57.8	107.2	58.3	57.7
Moisture Content (%)	**32.7**	**12.7**	**17.9**	**13.7**	**6.0**

Leighton

MOISTURE CONTENT

ASTM D 2216

Project Name: River Rd - Norco
Project No.: 21250-01

Tested By: S. Felter
Date: 12/15/21
Checked By: J. Ward
Date: 01/06/22

Boring No.	HS-4				
Sample No.	SP-2				
Depth (ft)	20.0				
Sample Type	SPT				
Sample Description	Olive brown silty sand (SM)				
Wt. wet soil + container (g)	243.8				
Wt. dry soil + container (g)	201.8				
Weight of container (g)	51.2				
Moisture Content (%)	**27.9**				

Boring No.					
Sample No.					
Depth (ft)					
Sample Type					
Sample Description					
Wt. wet soil + container (g)					
Wt. dry soil + container (g)					
Weight of container (g)					
Moisture Content (%)					

ONE-DIMENSIONAL SWELL OR SETTLEMENT POTENTIAL OF COHESIVE SOILS

ASTM D 4546

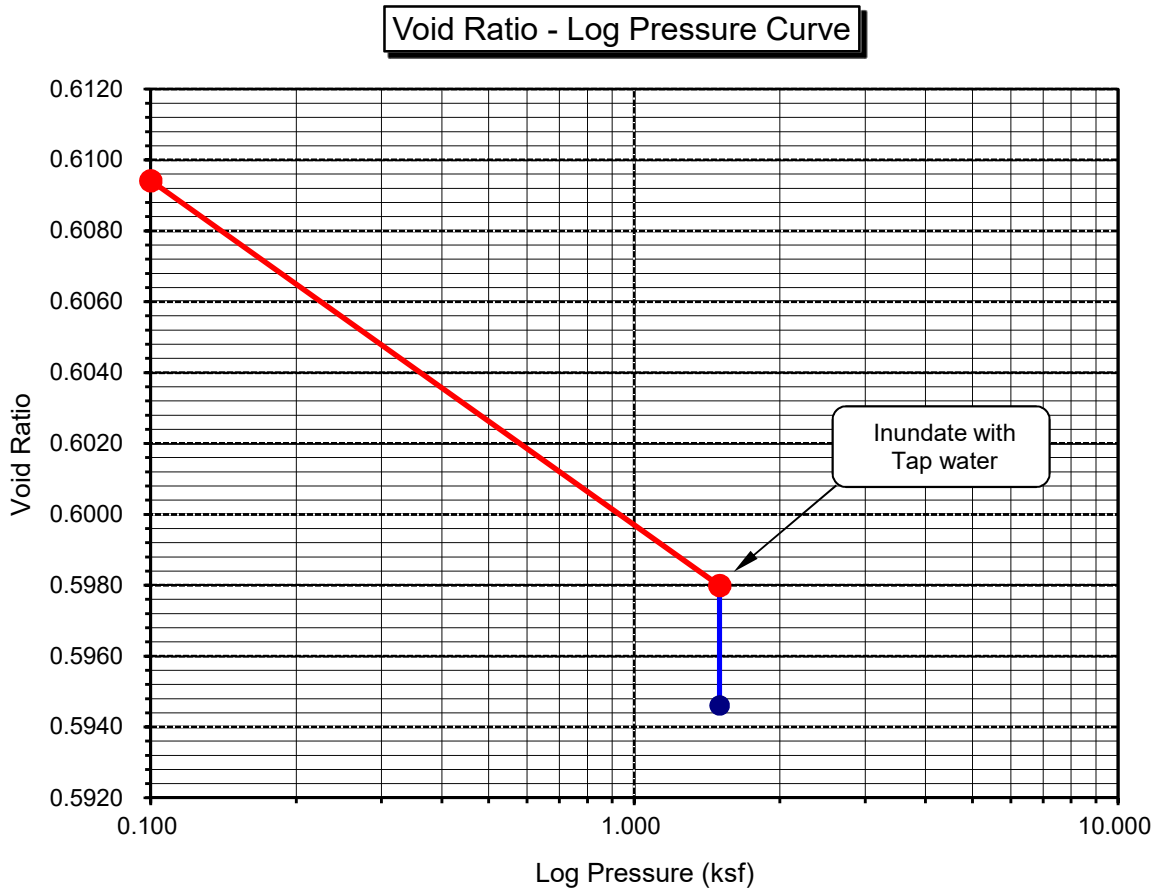
Project Name:	River Rd - Norco	Tested By:	G. Bathala	Date:	12/17/21
Project No.:	21250-01	Checked By:	J. Ward	Date:	01/07/22
Boring No.:	HS-1	Sample Type:	Ring		
Sample No.:	R-3	Depth (ft.)	7.5		
Sample Description:	Light olive brown silt with sand (ML)s				

Initial Dry Density (pcf):	104.7
Initial Moisture (%):	8.00
Initial Length (in.):	1.0000
Initial Dial Reading:	0.3285
Diameter(in):	2.415

Final Dry Density (pcf):	105.7
Final Moisture (%) :	21.1
Initial Void Ratio:	0.6096
Specific Gravity(assumed):	2.70
Initial Saturation (%)	35.4

Pressure (p) (ksf)	Final Reading (in)	Apparent Thickness (in)	Load Compliance (%)	Swell (+) Settlement (-) % of Sample Thickness	Void Ratio	Corrected Deformation (%)
0.100	0.3284	0.9999	0.00	-0.01	0.6094	-0.01
1.500	0.3204	0.9919	0.09	-0.81	0.5980	-0.72
H2O	0.3183	0.9898	0.09	-1.02	0.5946	-0.93

Percent Swell (+) / Settlement (-) After Inundation = -0.21



ONE-DIMENSIONAL SWELL OR SETTLEMENT POTENTIAL OF COHESIVE SOILS

ASTM D 4546

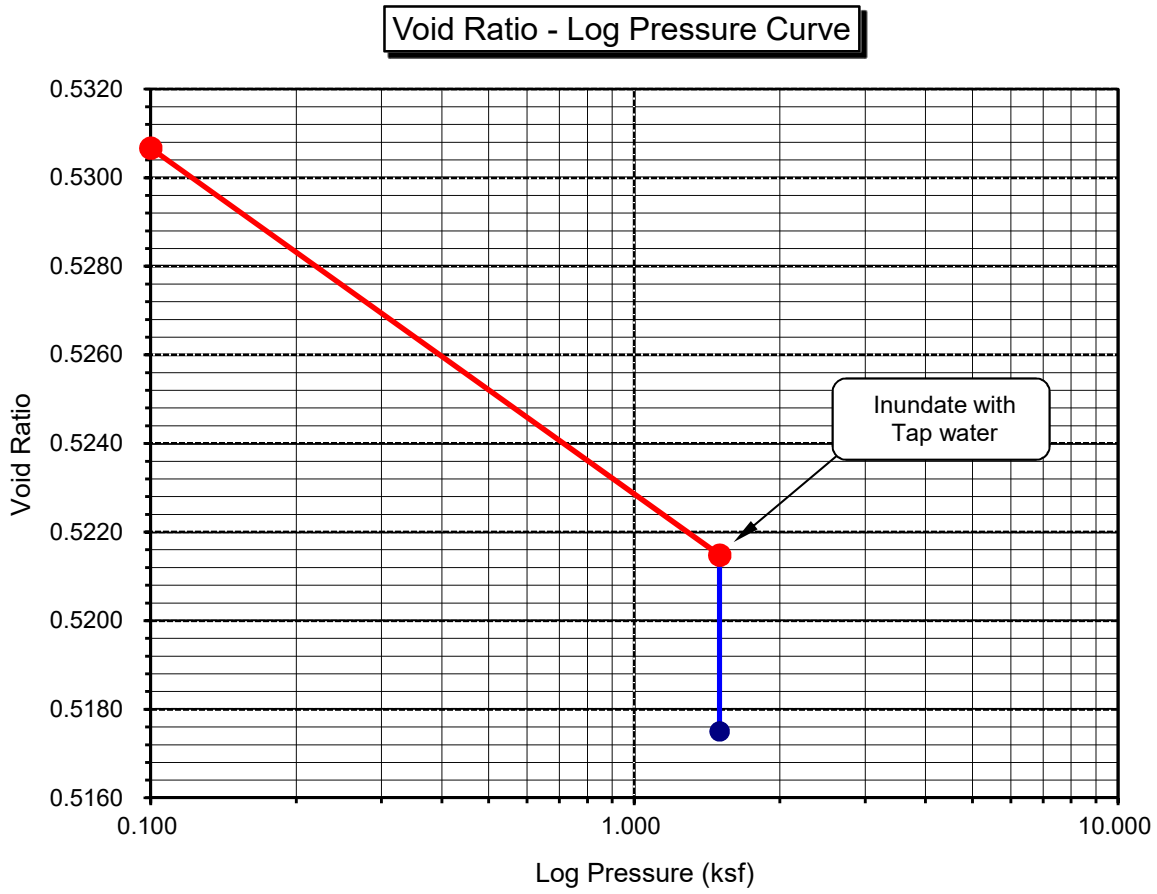
Project Name:	River Rd - Norco	Tested By:	G. Bathala	Date:	12/17/21
Project No.:	21250-01	Checked By:	J. Ward	Date:	01/07/22
Boring No.:	I-3	Sample Type:	Ring		
Sample No.:	R-3	Depth (ft.)	7.5		
Sample Description:	Yellowish brown poorly-graded sand (SP)				

Initial Dry Density (pcf):	110.1
Initial Moisture (%):	1.99
Initial Length (in.):	1.0000
Initial Dial Reading:	0.3144
Diameter(in):	2.415

Final Dry Density (pcf):	111.1
Final Moisture (%) :	13.9
Initial Void Ratio:	0.5308
Specific Gravity(assumed):	2.70
Initial Saturation (%)	10.1

Pressure (p) (ksf)	Final Reading (in)	Apparent Thickness (in)	Load Compliance (%)	Swell (+) Settlement (-) % of Sample Thickness	Void Ratio	Corrected Deformation (%)
0.100	0.3143	0.9999	0.00	-0.01	0.5307	-0.01
1.500	0.3074	0.9930	0.09	-0.70	0.5215	-0.61
H2O	0.3048	0.9904	0.09	-0.96	0.5175	-0.87

Percent Swell (+) / Settlement (-) After Inundation = -0.26



TP-1 (0.5')*		TP-2 (0.5')*		TP-3 (0.5')*		TP-4 (0.5')*	
Depth (ft)	% Organics	Depth (ft)	% Organics	Depth (ft)	% Organics	Depth (ft)	% Organics
0-0.5'	11.1	0-0.5'	54.4	0-0.5'	60.3	0-0.5'	60.9
0.5-1.5'	0.6	0.5-1.5'	1.1	0.5-1.5'	1.6	0.5-1.5'	1.5
1.5-2.5'	0.5	1.5-2.5'	0.7	1.5-2.5'	0.9	1.5-2.5'	1.3

TP-5 (0.0')*		TP-6 (0.5')*		TP-7 (0.5')*		TP-8 (0.5')*	
Depth (ft)	% Organics	Depth (ft)	% Organics	Depth (ft)	% Organics	Depth (ft)	% Organics
0-0.5'	1.9	0-0.5'	21.5	0-0.5'	10.8	0-0.5'	7.7
0.5'-1.5'	0.9	0.5'-1.5'	1.0	0.5'-1.5'	1.2	0.5'-1.5'	1.7

TP-9 (0.5')*		TP-10 (0.5')*		TP-11 (0.0')*		TP-12 (0.0')*	
Depth (ft)	% Organics	Depth (ft)	% Organics	Depth (ft)	% Organics	Depth (ft)	% Organics
0-0.5'	7.8	0-0.5'	11.5	0-0.5'	4.1	0-0.5'	2.3
0.5'-1.5'	1.9	0.5'-1.5'	1.6	0.5'-1.5'	3.7	0.5'-1.5'	0.8

TP-13 (0.0')*		TP-17 (0.0')*		TP-19 (0.0')*	
Depth (ft)	% Organics	Depth (ft)	% Organics	Depth (ft)	% Organics
0-0.5'	2.0	0-0.5'	1.7	0-0.5'	1.6
0.5'-1.5'	1.4				

Legend

> 5%	**"High" Organic Content "Soils" Recommended for Export from Site**
2 to 5%	**"Transitional" Soils Recommended for Mix/Blend w/ "Clean" Soils**
< 2%	**"Clean" Soils**

Note: (#')* Indicates Recommended Organic Export Depth in Feet. Export depth may exceed the depths highlighted boxes.

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Table 8
Summary of Measured Organic Content vs Depth of Sample

Project Name	River Rd., Norco - Dallape
Project Number	21250-01
ENG./GEOL.	TJL / BPG
Date	January 2022

Appendix D
Infiltration Test Data

Infiltration Test Data Sheet

LGC Geotechnical, Inc
131 Calle Iglesia Suite 200, San Clemente, CA 92672 tel. (949) 369-6141

Project Name: River Rd - Norco- Dallape
Project Number: 21250-01
Date: 12/6/2021
Boring Number: I-1

Test hole dimensions (if circular)	
Boring Depth (feet)*:	5
Boring Diameter (inches):	8
Pipe Diameter (inches):	3

*measured at time of test

Test pit dimensions (if rectangular)	
Pit Depth (feet):	
Pit Length (feet):	
Pit Breadth (feet):	

Pre-Test (Sandy Soil Criteria)*

Trial No.	Start Time (24:HR)	Stop Time (24:HR)	Time Interval (min)	Initial Depth to Water (feet)	Final Depth to Water (feet)	Total Change in Water Level (feet)	Greater Than or Equal to 0.5 feet (yes/no)
1	8:11	8:24	13.0	1.50	2.5	1	yes
2	8:39	8:50	11.0	1.4	2	0.6	yes

*If two consecutive measurements show that six inches of water seeps away in less than 25 minutes, the test shall be run for an additional hour with measurements taken every 10 minutes. Otherwise, pre-soak (fill) overnight, and then obtain at least twelve measurements per hole over at least six hours (approximately 30 minute intervals) with a precision of at least 0.25 inches

Main Test Data

Trial No.	Start Time (24:HR)	Stop Time (24:HR)	Time Interval, Δt (min)	Initial Depth to Water, D_o (feet)	Final Depth to Water, D_f (feet)	Change in Water Level, ΔD (feet)	Observed Infiltration Rate (in/hr)
1	8:52	9:02	10.0	1.4	1.95	0.55	1.9
2	9:03	9:13	10.0	1.35	1.85	0.5	1.7
3	9:14	9:24	10.0	1.25	1.85	0.6	2.0
4	9:25	9:35	10.0	1.05	1.65	0.6	1.9
5	9:36	9:46	10.0	0.95	1.6	0.65	2.0
6	9:47	9:57	10.0	1.5	1.95	0.45	1.6
7							
8							
9							
10							
11							
12							
					Observed Infiltration Rate (Does Not Include Any Factor of Safety)		**1.6**

Sketch:

Notes:

LGC Geotechnical, Inc.

Infiltration Test Data Sheet

LGC Geotechnical, Inc
131 Calle Iglesia Suite 200, San Clemente, CA 92672 tel. (949) 369-6141

Project Name: River Rd - Norco- Dallape
Project Number: 21250-01
Date: 12/6/2021
Boring Number: I-2

Test hole dimensions (if circular)	
Boring Depth (feet)*:	5
Boring Diameter (inches):	8
Pipe Diameter (inches):	3

*measured at time of test

Test pit dimensions (if rectangular)	
Pit Depth (feet):	
Pit Length (feet):	
Pit Breadth (feet):	

Pre-Test (Sandy Soil Criteria)*

Trial No.	Start Time (24:HR)	Stop Time (24:HR)	Time Interval (min)	Initial Depth to Water (feet)	Final Depth to Water (feet)	Total Change in Water Level (feet)	Greater Than or Equal to 0.5 feet (yes/no)
1	8:36	8:48	12.0	1.60	2.1	0.5	yes
2	8:49	9:04	15.0	1.2	1.75	0.55	yes

*If two consecutive measurements show that six inches of water seeps away in less than 25 minutes, the test shall be run for an additional hour with measurements taken every 10 minutes. Otherwise, pre-soak (fill) overnight, and then obtain at least twelve measurements per hole over at least six hours (approximately 30 minute intervals) with a precision of at least 0.25 inches

Main Test Data

Trial No.	Start Time (24:HR)	Stop Time (24:HR)	Time Interval, Δt (min)	Initial Depth to Water, D_o (feet)	Final Depth to Water, D_f (feet)	Change in Water Level, ΔD (feet)	Observed Infiltration Rate (in/hr)
1	9:06	9:16	10.0	1.3	1.6	0.3	1.0
2	9:17	9:27	10.0	1.35	1.6	0.25	0.8
3	9:28	9:38	10.0	1.15	1.45	0.3	0.9
4	9:39	9:49	10.0	1.25	1.5	0.25	0.8
5	9:50	10:00	10.0	1.25	1.5	0.25	0.8
6	10:01	10:11	10.0	1.25	1.5	0.25	0.8
7							
8							
9							
10							
11							
12							
					Observed Infiltration Rate (Does Not Include Any Factor of Safety)		**0.8**

Sketch:

Notes:

LGC Geotechnical, Inc.

Infiltration Test Data Sheet

LGC Geotechnical, Inc
131 Calle Iglesia Suite 200, San Clemente, CA 92672 tel. (949) 369-6141

Project Name: River Rd - Norco- Dallape
Project Number: 21250-01
Date: 12/6/2021
Boring Number: I-3

Test hole dimensions (if circular)	
Boring Depth (feet)*:	11
Boring Diameter (inches):	8
Pipe Diameter (inches):	3

*measured at time of test

Test pit dimensions (if rectangular)	
Pit Depth (feet):	
Pit Length (feet):	
Pit Breadth (feet):	

Pre-Test (Sandy Soil Criteria)*

Trial No.	Start Time (24:HR)	Stop Time (24:HR)	Time Interval (min)	Initial Depth to Water (feet)	Final Depth to Water (feet)	Total Change in Water Level (feet)	Greater Than or Equal to 0.5 feet (yes/no)
1	7:42	7:44	2.0	10.00	11	1	yes
2	7:45	7:47	2.0	9.67	11	1.33	yes

*If two consecutive measurements show that six inches of water seeps away in less than 25 minutes, the test shall be run for an additional hour with measurements taken every 10 minutes. Otherwise, pre-soak (fill) overnight, and then obtain at least twelve measurements per hole over at least six hours (approximately 30 minute intervals) with a precision of at least 0.25 inches

Main Test Data

Trial No.	Start Time (24:HR)	Stop Time (24:HR)	Time Interval, Δt (min)	Initial Depth to Water, D_o (feet)	Final Depth to Water, D_f (feet)	Change in Water Level, ΔD (feet)	Observed Infiltration Rate (in/hr)
1	10:29	10:31	2.0	9.6	11.2	1.6	125.2
2	10:33	10:35	2.0	9.7	10.95	1.25	89.1
3	10:36	10:38	2.0	9.35	10.6	1.25	62.9
4	10:39	10:41	2.0	8.7	10.25	1.55	55.0
5	10:42	10:44	2.0	8.5	10.15	1.65	53.8
6	10:45	10:47	2.0	7.75	9.7	1.95	47.9
7	10:49	10:51	2.0	7.75	9.5	1.75	41.3
8	10:55	10:57	2.0	7.3	9.7	2.4	54.0
9	11:01	11:03	2.0	7.3	9.35	2.05	43.3
10	11:07	11:09	2.0	7.3	9.2	1.9	39.1
11	11:13	11:15	2.0	7.3	9.1	1.8	36.4
12	11:19	11:21	2.0	7.2	9.2	2	40.4
						Observed Infiltration Rate (Does Not Include Any Factor of Safety)	**36.4**

Sketch:

Notes:

LGC Geotechnical, Inc.

Appendix E
General Earthwork and Grading Specifications for Rough Grading

General Earthwork and Grading Specifications for Rough Grading

1.0 General

1.1 Intent

These General Earthwork and Grading Specifications are for the grading and earthwork shown on the approved grading plan(s) and/or indicated in the geotechnical report(s). These Specifications are a part of the recommendations contained in the geotechnical report(s). In case of conflict, the specific recommendations in the geotechnical report shall supersede these more general Specifications. Observations of the earthwork by the project Geotechnical Consultant during the course of grading may result in new or revised recommendations that could supersede these specifications or the recommendations in the geotechnical report(s).

1.2 The Geotechnical Consultant of Record

Prior to commencement of work, the owner shall employ a qualified Geotechnical Consultant of Record (Geotechnical Consultant). The Geotechnical Consultant shall be responsible for reviewing the approved geotechnical report(s) and accepting the adequacy of the preliminary geotechnical findings, conclusions, and recommendations prior to the commencement of the grading.

Prior to commencement of grading, the Geotechnical Consultant shall review the "work plan" prepared by the Earthwork Contractor (Contractor) and schedule sufficient personnel to perform the appropriate level of observation, mapping, and compaction testing.

During the grading and earthwork operations, the Geotechnical Consultant shall observe, map, and document the subsurface exposures to verify the geotechnical design assumptions. If the observed conditions are found to be significantly different than the interpreted assumptions during the design phase, the Geotechnical Consultant shall inform the owner, recommend appropriate changes in design to accommodate the observed conditions, and notify the review agency where required.

The Geotechnical Consultant shall observe the moisture-conditioning and processing of the subgrade and fill materials and perform relative compaction testing of fill to confirm that the attained level of compaction is being accomplished as specified. The Geotechnical Consultant shall provide the test results to the owner and the Contractor on a routine and frequent basis.

1.3 The Earthwork Contractor

The Earthwork Contractor (Contractor) shall be qualified, experienced, and knowledgeable in earthwork logistics, preparation and processing of ground to receive fill, moisture-conditioning and processing of fill, and compacting fill. The Contractor shall review and accept the plans, geotechnical report(s), and these Specifications prior to commencement of grading. The Contractor shall be solely responsible for performing the grading in accordance with the project plans and specifications. The Contractor shall prepare and submit to the owner and the Geotechnical Consultant a work plan that indicates the sequence of earthwork grading, the number of “equipment” of work and the estimated quantities of daily earthwork

contemplated for the site prior to commencement of grading. The Contractor shall inform the owner and the
Geotechnical Consultant of changes in work schedules and updates to the work plan at least 24 hours in advance of such changes so that appropriate personnel will be available for observation and testing. The Contractor shall not assume that the Geotechnical Consultant is aware of all grading operations.

The Contractor shall have the sole responsibility to provide adequate equipment and methods to accomplish the earthwork in accordance with the applicable grading codes and agency ordinances, these Specifications, and the recommendations in the approved geotechnical report(s) and grading plan(s). If, in the opinion of the Geotechnical Consultant, unsatisfactory conditions, such as unsuitable soil, improper moisture condition, inadequate compaction, insufficient buttress key size, adverse weather, etc., are resulting in a quality of work less than required in these specifications, the Geotechnical Consultant shall reject the work and may recommend to the owner that construction be stopped until the conditions are rectified. It is the contractor's sole responsibility to provide proper fill compaction.

2.0 Preparation of Areas to be Filled

2.1 Clearing and Grubbing

Vegetation, such as brush, grass, roots, and other deleterious material shall be sufficiently removed and properly disposed of in a method acceptable to the owner, governing agencies, and the Geotechnical Consultant.

The Geotechnical Consultant shall evaluate the extent of these removals depending on specific site conditions. Earth fill material shall not contain more than 1 percent of organic materials (by volume). Nesting of the organic materials shall not be allowed.

If potentially hazardous materials are encountered, the Contractor shall stop work in the affected area, and a hazardous material specialist shall be informed immediately for proper evaluation and handling of these materials prior to continuing to work in that area.

As presently defined by the State of California, most refined petroleum products (gasoline, diesel fuel, motor oil, grease, coolant, etc.) have chemical constituents that are considered to be hazardous waste. As such, the indiscriminate dumping or spillage of these fluids onto the ground may constitute a misdemeanor, punishable by fines and/or imprisonment, and shall not be allowed. The contractor is responsible for all hazardous waste relating to his work. The Geotechnical Consultant does not have expertise in this area. If hazardous waste is a concern, then the Client should acquire the services of a qualified environmental assessor.

2.2 Processing

Existing ground that has been declared satisfactory for support of fill by the Geotechnical Consultant shall be scarified to a minimum depth of 6 inches. Existing ground that is not satisfactory shall be over-excavated as specified in the following section. Scarification shall continue until soils are broken down and free of oversize material and the working surface is reasonably uniform, flat, and free of uneven features that would inhibit uniform compaction.

2.3 Over-excavation

In addition to removals and over-excavations recommended in the approved geotechnical report(s) and the grading plan, soft, loose, dry, saturated, spongy, organic-rich, highly fractured or otherwise unsuitable ground shall be over-excavated to competent ground as evaluated by the Geotechnical Consultant during grading.

2.4 Benching

Where fills are to be placed on ground with slopes steeper than 5:1 (horizontal to vertical units), the ground shall be stepped or benched. Please see the Standard Details for a graphic illustration. The lowest bench or key shall be a minimum of 15 feet wide and at least 2 feet deep, into competent material as evaluated by the Geotechnical Consultant. Other benches shall be excavated a minimum height of 4 feet into competent material or as otherwise recommended by the Geotechnical Consultant. Fill placed on ground sloping flatter than 5:1 shall also be benched or otherwise over-excavated to provide a flat subgrade for the fill.

2.5 Evaluation/Acceptance of Fill Areas

All areas to receive fill, including removal and processed areas, key bottoms, and benches, shall be observed, mapped, elevations recorded, and/or tested prior to being accepted by the Geotechnical Consultant as suitable to receive fill. The Contractor shall obtain a written acceptance from the Geotechnical Consultant prior to fill placement. A licensed surveyor shall provide the survey control for determining elevations of processed areas, keys, and benches.

3.0 Fill Material

3.1 General

Material to be used as fill shall be essentially free of organic matter and other deleterious substances evaluated and accepted by the Geotechnical Consultant prior to placement. Soils of poor quality, such as those with unacceptable gradation, high expansion potential, or low strength shall be placed in areas acceptable to the Geotechnical Consultant or mixed with other soils to achieve satisfactory fill material.

3.2 Oversize

Oversize material defined as rock, or other irreducible material with a maximum dimension greater than 8 inches, shall not be buried or placed in fill unless location, materials, and placement methods are specifically accepted by the Geotechnical Consultant. Placement operations shall be such that nesting of oversized material does not occur and such that oversize material is completely surrounded by compacted or densified fill. Oversize material shall not be placed within 10 vertical feet of finish grade or within 2 feet of future utilities or underground construction.

3.3 Import

If importing of fill material is required for grading, proposed import material shall meet the requirements of the geotechnical consultant. The potential import source shall be given to the Geotechnical Consultant at least 48 hours (2 working days) before importing begins so that its suitability can be determined and appropriate tests performed.

4.0 Fill Placement and Compaction

4.1 Fill Layers

Approved fill material shall be placed in areas prepared to receive fill (per Section 3.0) in near-horizontal layers not exceeding 8 inches in loose thickness. The Geotechnical Consultant may accept thicker layers if testing indicates the grading procedures can adequately compact the thicker layers. Each layer shall be spread evenly and mixed thoroughly to attain relative uniformity of material and moisture throughout.

4.2 Fill Moisture Conditioning

Fill soils shall be watered, dried back, blended, and/or mixed, as necessary to attain a relatively uniform moisture content at or slightly over optimum. Maximum density and optimum soil moisture content tests shall be performed in accordance with the American Society of Testing and Materials (ASTM Test Method D1557).

4.3 Compaction of Fill

After each layer has been moisture-conditioned, mixed, and evenly spread, it shall be uniformly compacted to not less than 90 percent of maximum dry density (ASTM Test Method D1557). Compaction equipment shall be adequately sized and be either specifically designed for soil compaction or of proven reliability to efficiently achieve the specified level of compaction with uniformity.

4.4 Compaction of Fill Slopes

In addition to normal compaction procedures specified above, compaction of slopes shall be accomplished by backrolling of slopes with sheepsfoot rollers at increments of 3 to 4 feet in fill elevation, or by other methods producing satisfactory results acceptable to the Geotechnical Consultant. Upon completion of grading, relative compaction of the fill, out to the slope face, shall be at least 90 percent of maximum density per ASTM Test Method D1557.

4.5 Compaction Testing

Field tests for moisture content and relative compaction of the fill soils shall be performed by the Geotechnical Consultant. Location and frequency of tests shall be at the Consultant's discretion based on field conditions encountered. Compaction test locations will not necessarily be selected on a random basis. Test locations shall be selected to verify adequacy of compaction levels in areas that are judged to be prone to inadequate compaction (such as close to slope faces and at the fill/bedrock benches).

4.6 Frequency of Compaction Testing

Tests shall be taken at intervals not exceeding 2 feet in vertical rise and/or 1,000 cubic yards of compacted fill soils embankment. In addition, as a guideline, at least one test shall be taken on slope faces for each 5,000 square feet of slope face and/or each 10 feet of vertical height of slope. The Contractor shall assure that fill construction is such that the testing schedule can be accomplished by the Geotechnical Consultant. The Contractor shall stop or slow down the earthwork construction if these minimum standards are not met.

4.7 Compaction Test Locations

The Geotechnical Consultant shall document the approximate elevation and horizontal coordinates of each test location. The Contractor shall coordinate with the project surveyor to assure that sufficient grade stakes are established so that the Geotechnical Consultant can determine the test locations with sufficient accuracy. At a minimum, two grade stakes within a horizontal distance of 100 feet and vertically less than
5 feet apart from potential test locations shall be provided.

5.0 Subdrain Installation

Subdrain systems shall be installed in accordance with the approved geotechnical report(s), the grading plan, and the Standard Details. The Geotechnical Consultant may recommend additional subdrains and/or changes in subdrain extent, location, grade, or material depending on conditions encountered during grading. All subdrains shall be surveyed by a land surveyor/civil engineer for line and grade after installation and prior to burial. Sufficient time should be allowed by the Contractor for these surveys.

6.0 Excavation

Excavations, as well as over-excavation for remedial purposes, shall be evaluated by the Geotechnical Consultant during grading. Remedial removal depths shown on geotechnical plans are estimates only. The actual extent of removal shall be determined by the Geotechnical Consultant based on the field evaluation of exposed conditions during grading. Where fill-over-cut slopes are to be graded, the cut portion of the slope shall be made, evaluated, and accepted by the Geotechnical Consultant prior to placement of materials for construction of the fill portion of the slope, unless otherwise recommended by the Geotechnical Consultant.

7.0 Trench Backfills

7.1 The Contractor shall follow all OHSA and Cal/OSHA requirements for safety of trench excavations.

7.2 All bedding and backfill of utility trenches shall be done in accordance with the applicable provisions of Standard Specifications of Public Works Construction. Bedding material shall have a Sand Equivalent greater than 30 (SE>30). The bedding shall be placed to 1 foot over

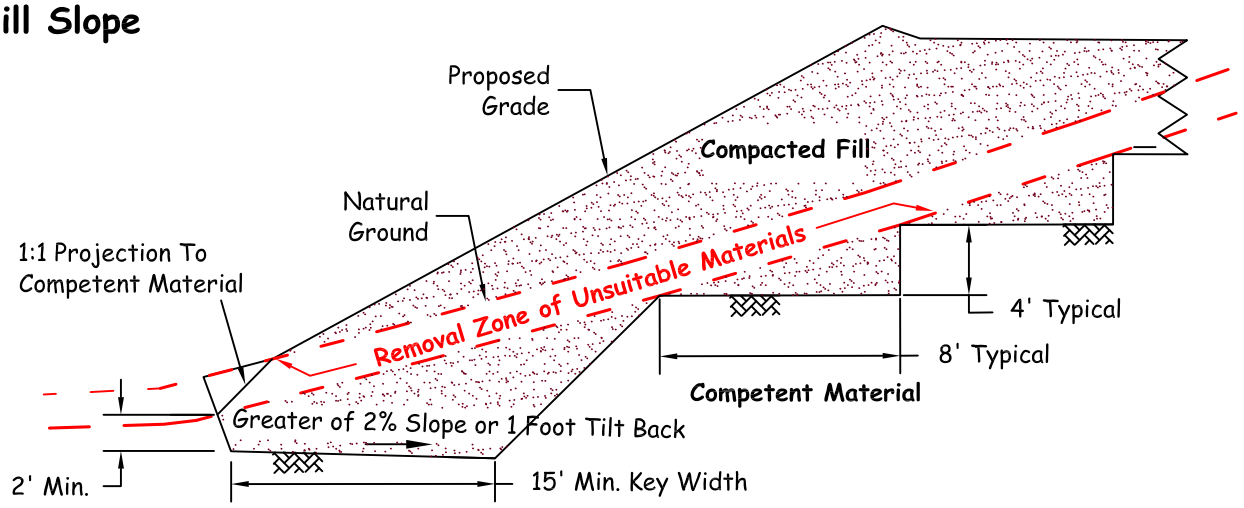
the top of the conduit and densified by jetting. Backfill shall be placed and densified to a minimum of 90 percent of maximum from 1 foot above the top of the conduit to the surface.

7.3 The jetting of the bedding around the conduits shall be observed by the Geotechnical Consultant.

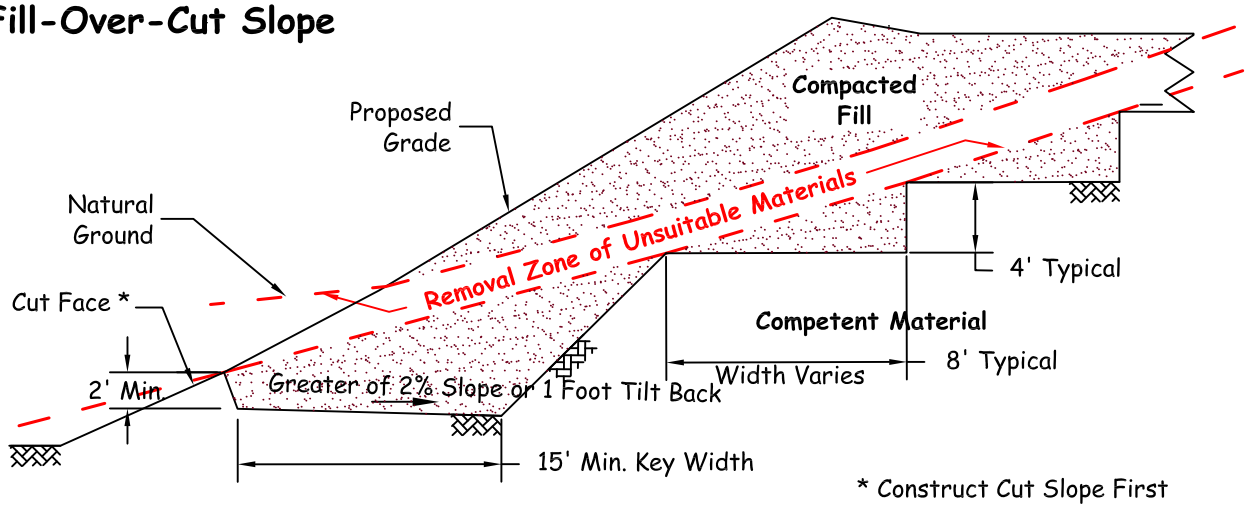
7.4 The Geotechnical Consultant shall test the trench backfill for relative compaction. At least one test should be made for every 300 feet of trench and 2 feet of fill.

7.5 Lift thickness of trench backfill shall not exceed those allowed in the Standard Specifications of Public Works Construction unless the Contractor can demonstrate to the Geotechnical Consultant that the fill lift can be compacted to the minimum relative compaction by his alternative equipment and method.

Fill Slope

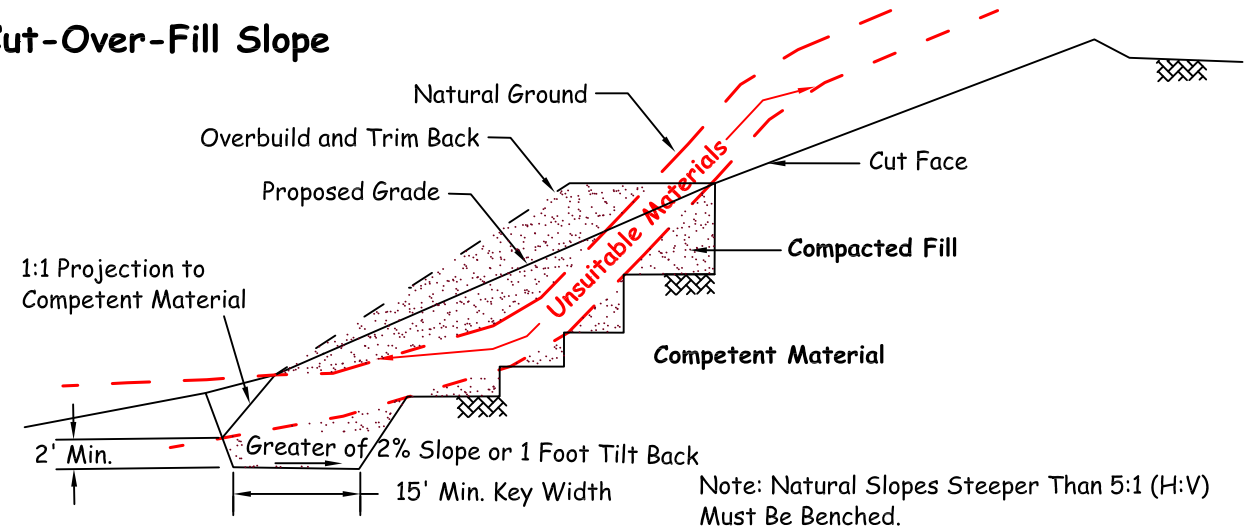


Fill-Over-Cut Slope



* Construct Cut Slope First

Cut-Over-Fill Slope



Note: Natural Slopes Steeper Than 5:1 (H:V) Must Be Benched.

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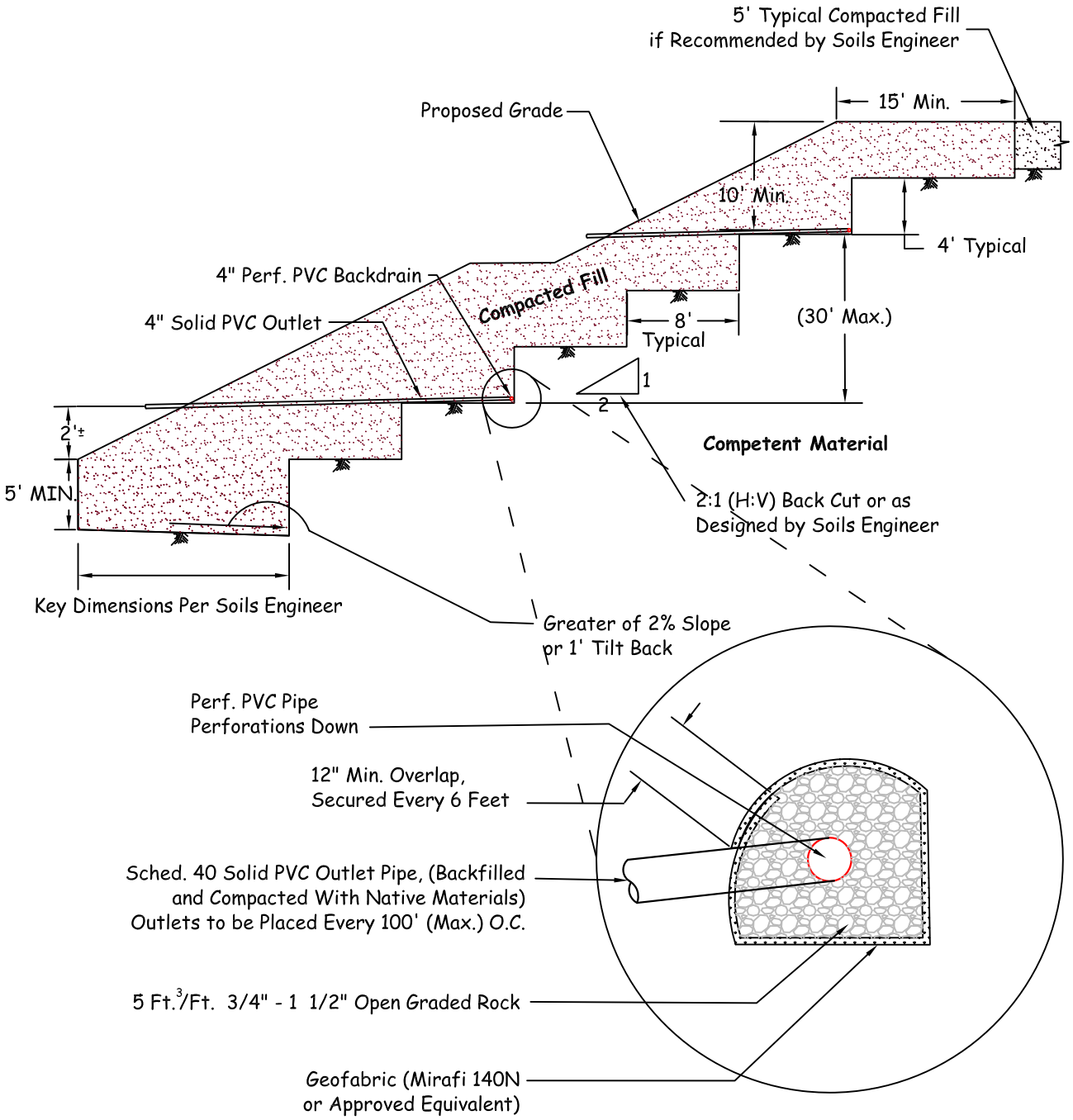
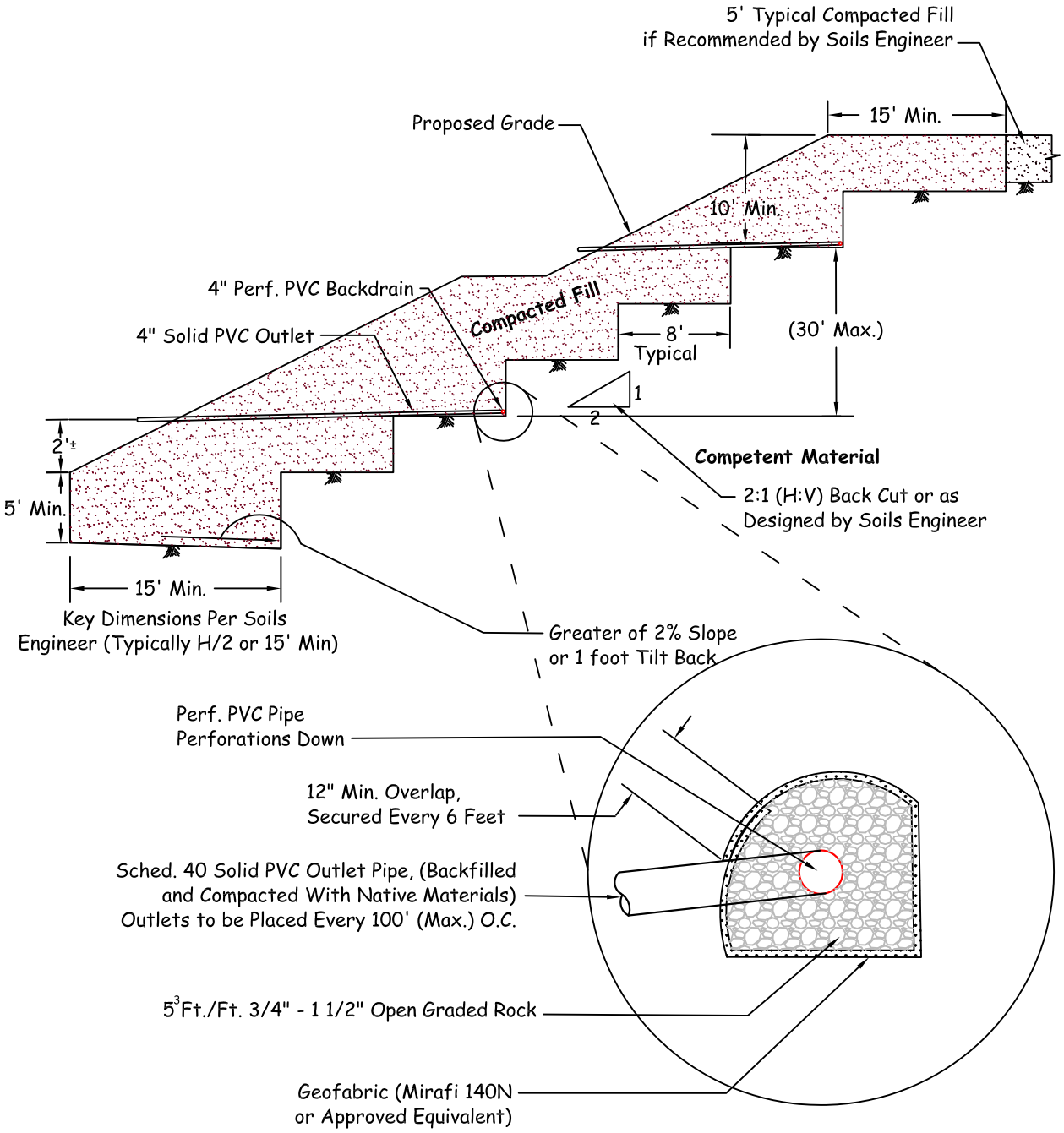
KEYING AND BENCHING



LGC Geotechnical, Inc.

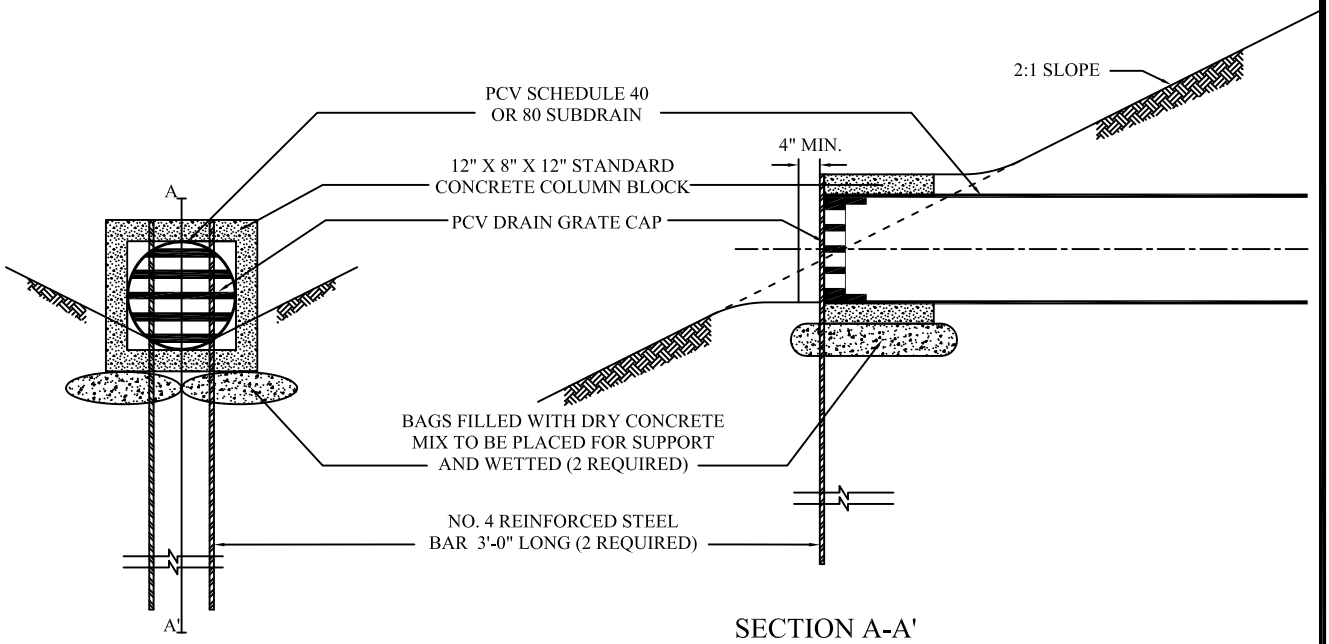
TYPICAL BUTTRESS DETAIL



LGC Geotechnical, Inc.

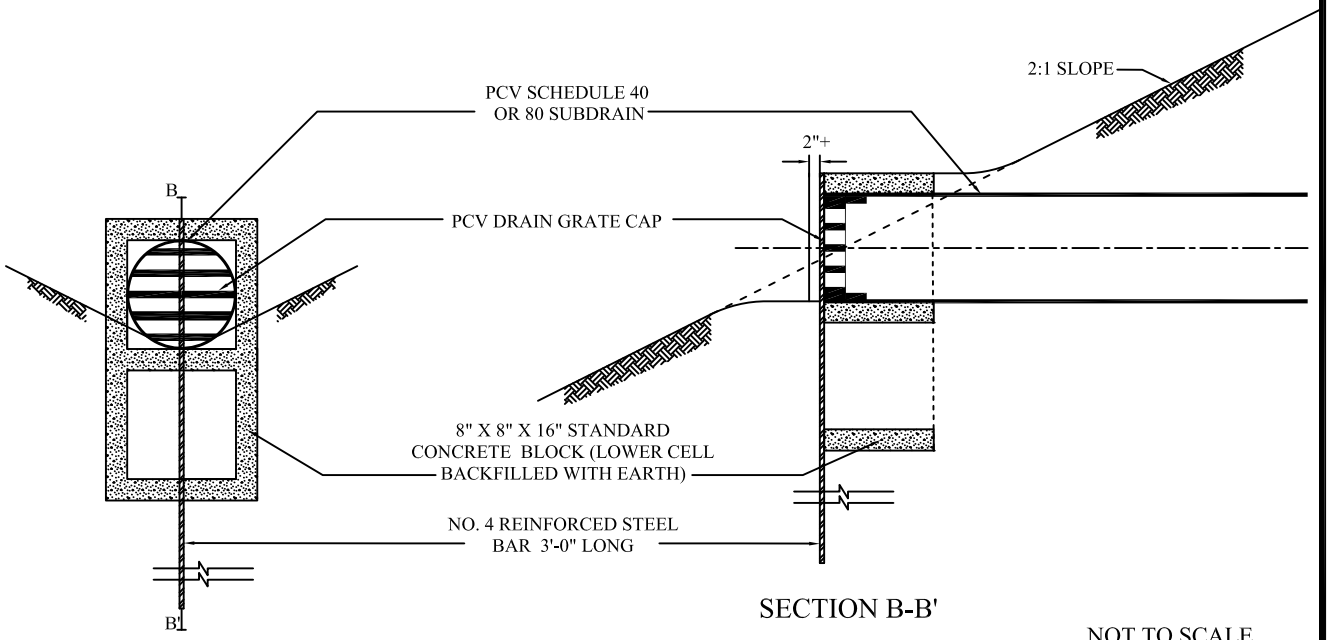
TYPICAL STABILIZATION FILL DETAIL

SUBDRAIN OUTLET MARKER -6" & 8" PIPE



SECTION A-A'

SUBDRAIN OUTLET MARKER -4" PIPE



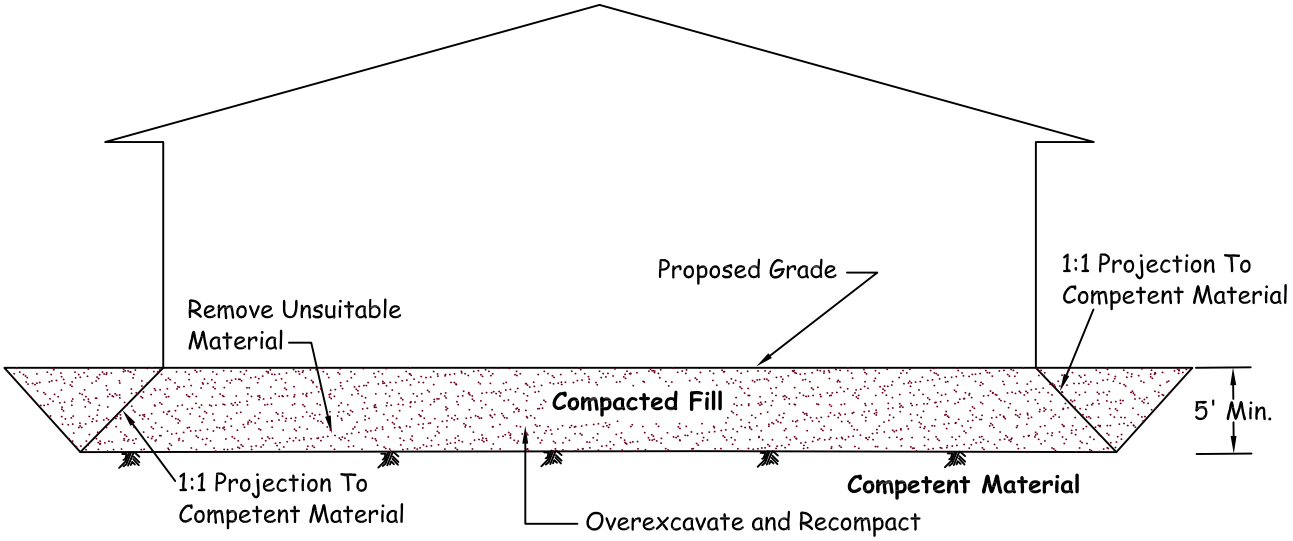
SECTION B-B'

NOT TO SCALE

LGC Geotechnical, Inc.

SUBDRAIN OUTLET MARKER DETAIL

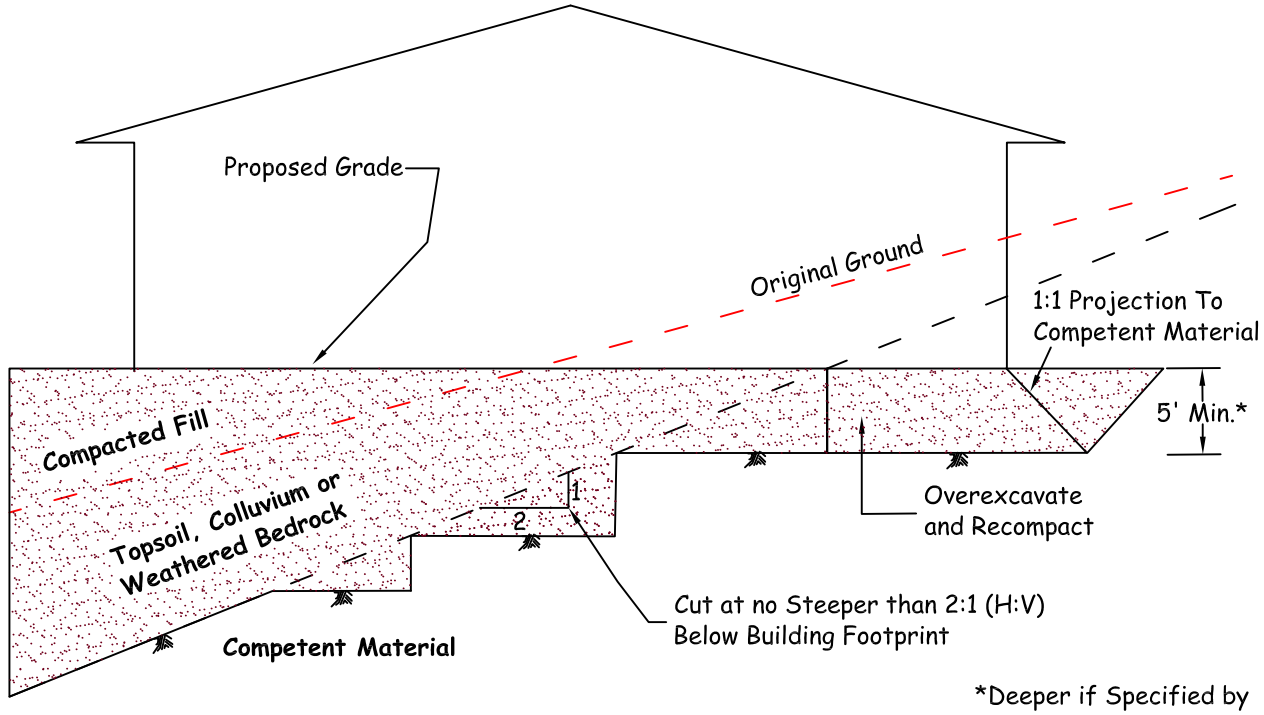
Cut Lot
(Exposing Unsuitable Soils at Design Grade)



Note 1: Removal Bottom Should be Graded With Minimum 2% Fall Towards Street or Other Suitable Area (as Determined by Soils Engineer) to Avoid Ponding Below Building

Note 2: Where Design Cut Lots are Excavated Entirely Into Competent Material, Overexcavation May Still be Required for Hard-Rock Conditions or for Materials With Variable Expansion Characteristics.

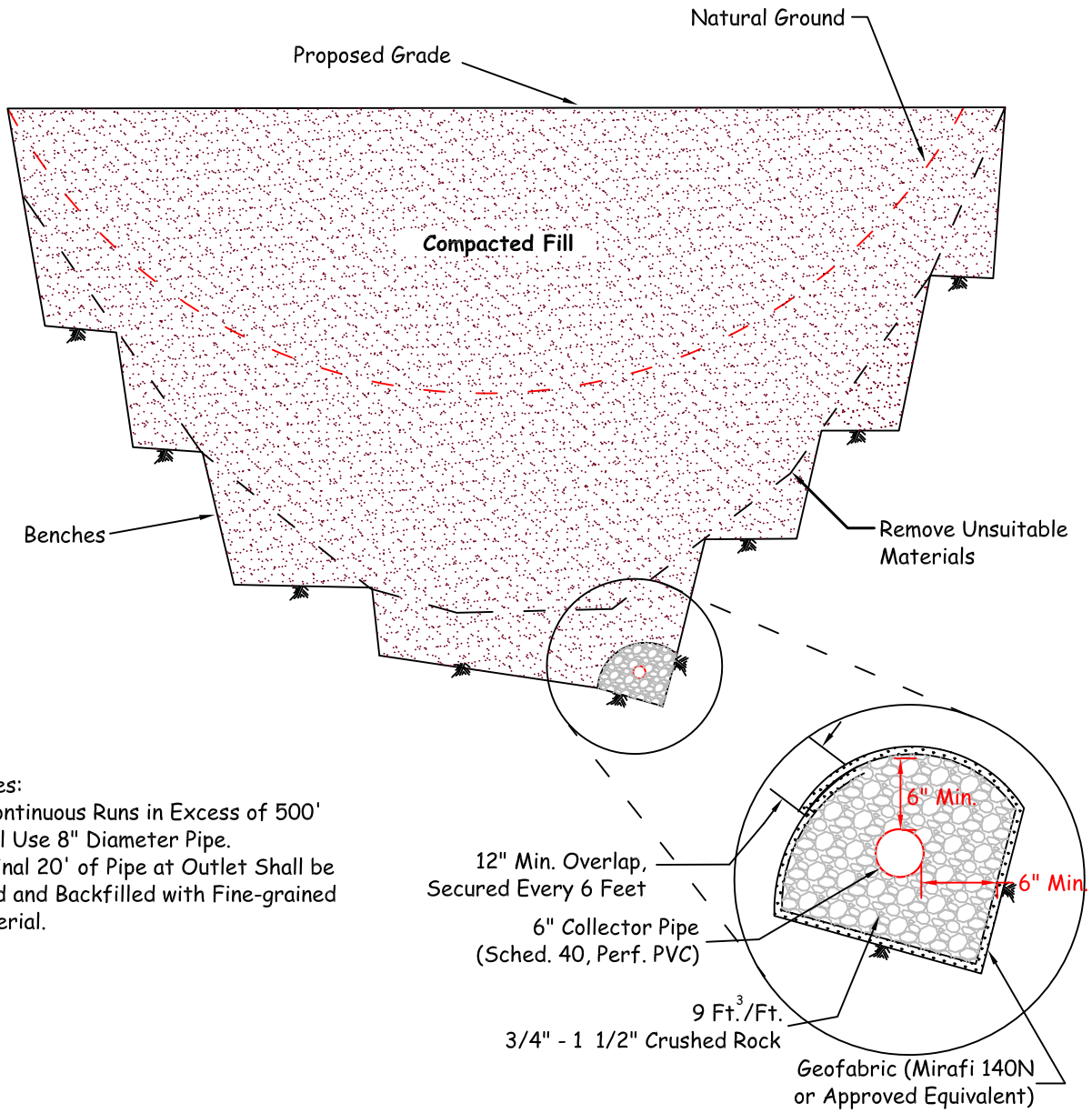
Cut/Fill Transition Lot



*Deeper if Specified by Soils Engineer

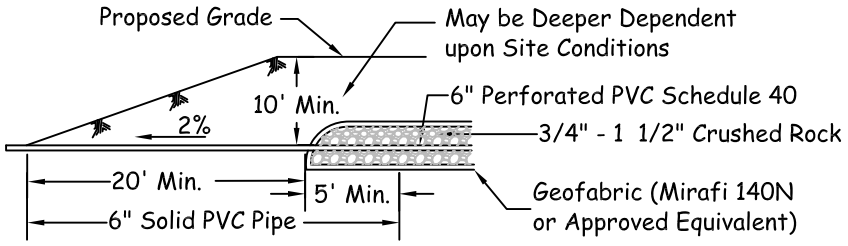
LGC Geotechnical, Inc.

CUT AND TRANSITION LOT OVEREXCAVATION DETAIL



Notes:
1) Continuous Runs in Excess of 500' Shall Use 8" Diameter Pipe.
2) Final 20' of Pipe at Outlet Shall be Solid and Backfilled with Fine-grained Material.

Proposed Outlet Detail



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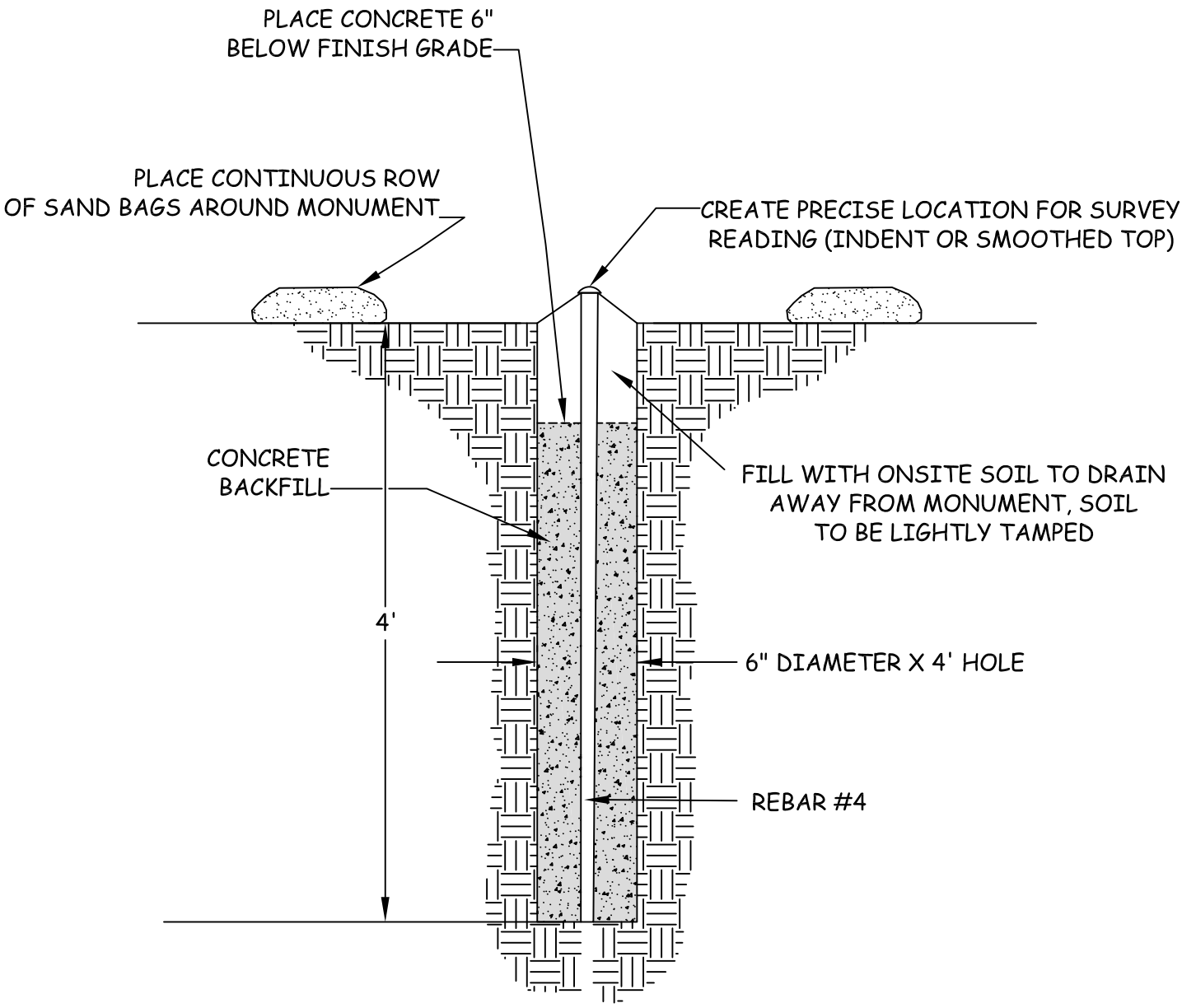
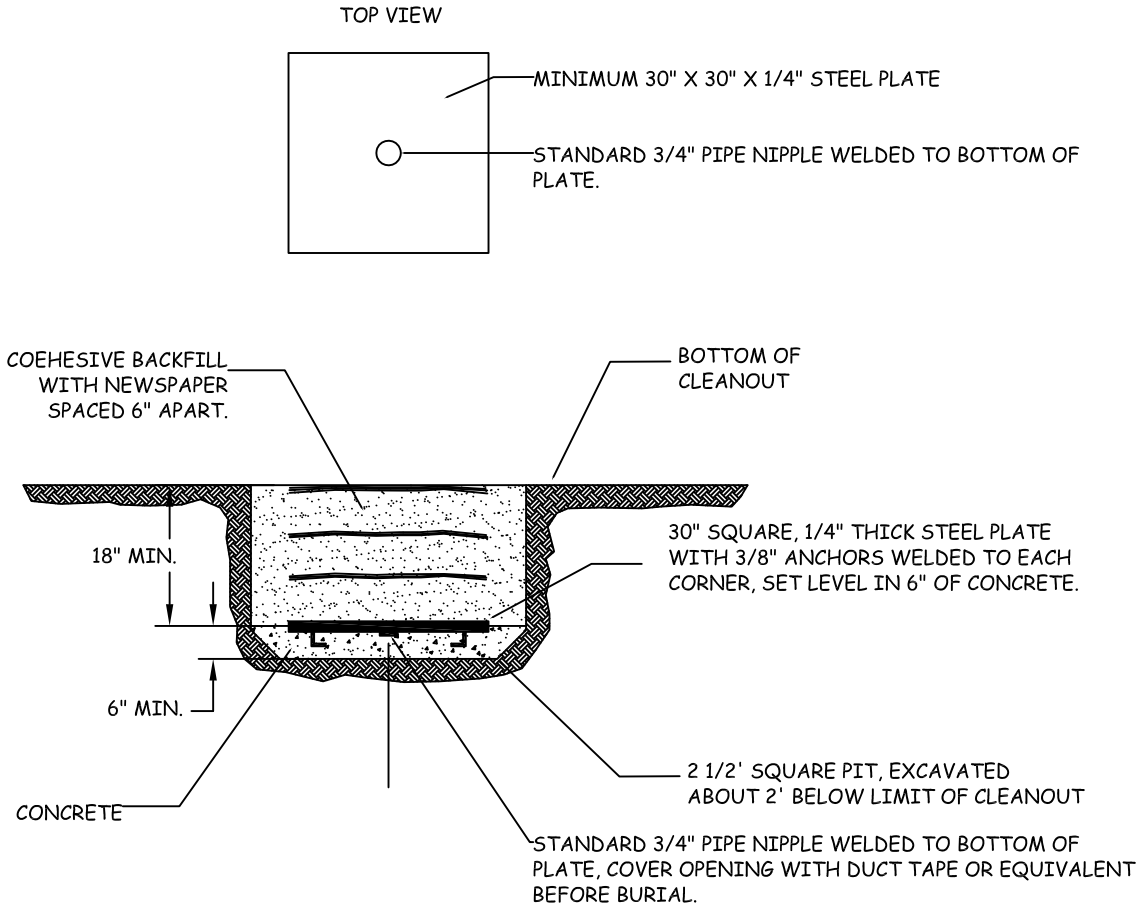
CANYON SUBDRAINS



NO CONSTRUCTION EQUIPMENT WITHIN 25 FEET
OF ANY INSTALLED SETTLEMENT MONUMENTS

LGC Geotechnical, Inc.

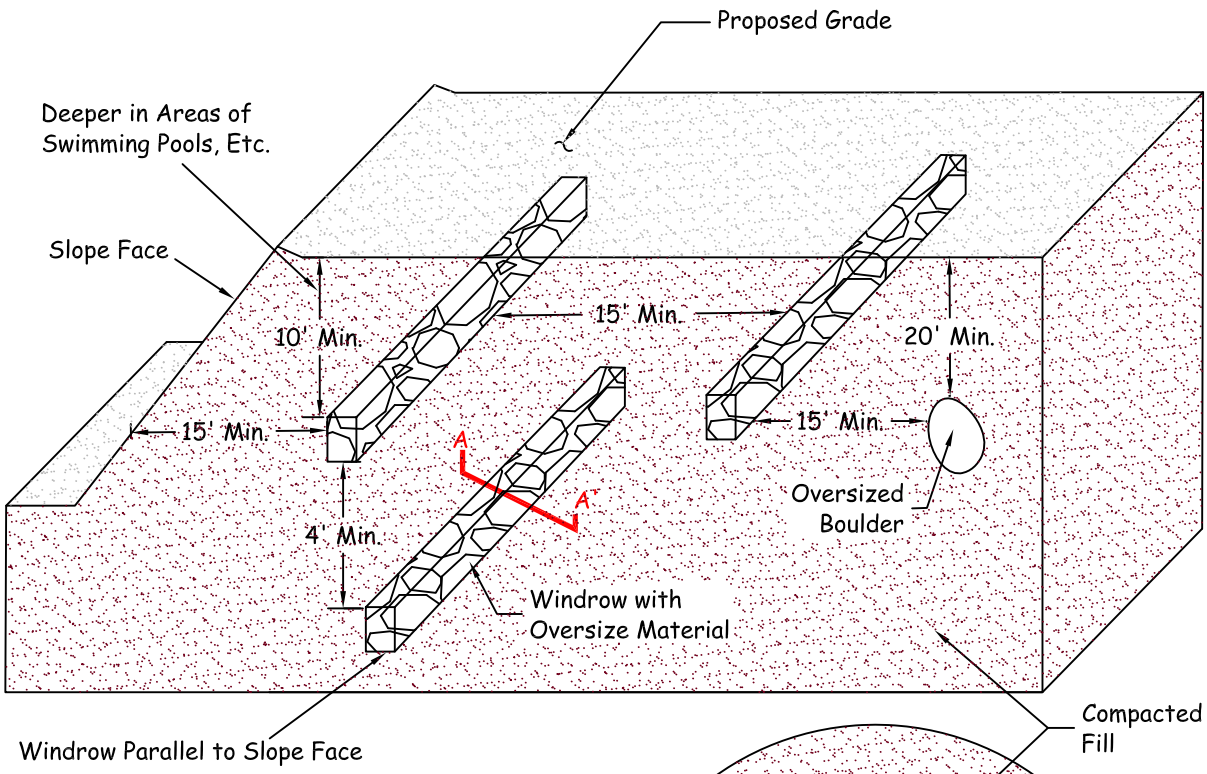
TYPICAL SURFACE SETTLEMENT MONUMENT

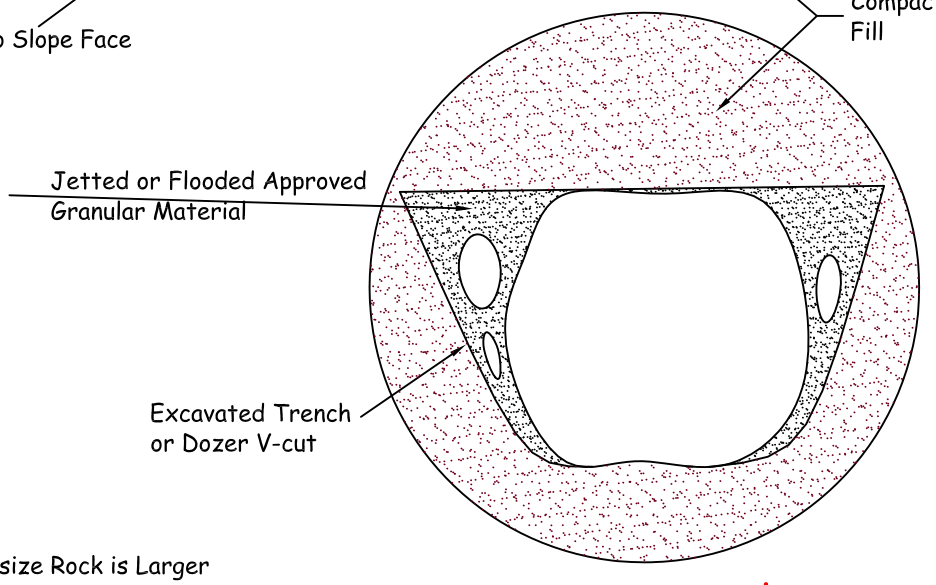


1. SURVEY FOR HORIZONTAL AND VERTICAL LOCATION TO NEAREST .01 INCH PRIOR TO BACKFILL USING KNOW LOCATIONS THAT WILL REMAIN INTACT DURING THE DURATION OF THE MONITORING PROGRAM. KNOW POINTS EXPLICITELY NOT ALLOWED ARE THOSE LOCATED ON FILL OR THAT WILL BE DESTROYED DURING GRADING.
2. IN THE EVENT OF DAMAGE TO SETTLEMENT PLATE DURING GRADING, CONTRACTOR SHALL IMMEDIATELY NOTIFY THE GEOTECHNICAL ENGINEER AND SHALL BE RESPONSIBLE FOR RESTORING THE SETTLEMENT PLATES TO WORKING ORDER.
3. DRILL TO RECOVER AND ATTACH RISER PIPE.

LGC Geotechnical, Inc.

TYPICAL SETTLEMENT PLATE AND RISER





Note: Oversize Rock is Larger
than 8" in Maximum Dimension.

Section A-A'

LGC Geotechnical, Inc.

OVERSIZE ROCK DISPOSAL DETAIL

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

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: MDS Consulting | Date: 3/11/2022

Designed by: Jack Wagner | Case No:

Company Project Number/Name: JN 90800

BMP Identification

BMP NAME / ID: Detention Basin Norco

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}= 0.80 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)*
		Natural (A Soil)						
A1 (Impervious)	*581180*	*Concrete or Asphalt*	*1*	*0.89*	*518412.6*			
A2(Pervious)	*547399*	*Ornamental Landscaping*	*0.1*	*0.11*	*60464.6*			
	1128579	**Total**			**578877.2**	**0.80**	**38591.8**	**38600**

Notes:

Infiltration Basin - Design Procedure (Rev. 03-2012)	BMP ID: DMA A	Legend:	Required Entries / Calculated Cells
Company Name: MDS Consulting			Date: 7/19/2022
Designed by: Jack Wagner			County/City Case No.: Norco

Design Volume

a) Tributary area (BMP subarea)	A_T =	25.91	acres
b) Enter V_{BMP} determined from Section 2.1 of this Handbook	V_{BMP}=	38,600	ft^3

Maximum Depth

a) Infiltration rate	I =	36.4	in/hr
b) Factor of Safety (See Table 1, Appendix A: "Infiltration Testing" from this BMP Handbook)	FS =	10	
c) Calculate D_1 $D_1 = \frac{I\ (in/hr) \times 72\ hrs}{12\ (in/ft) \times FS}$	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)		30	ft
f) Enter depth to top of bedrock or impermeable layer (measured from **top** of basin)		51.5	ft
g) D_2 is the smaller of: Depth to groundwater - (10 ft + freeboard) and Depth to impermeable layer - (5 ft + freeboard)	D_2 =	19.0	ft
h) D_{MAX} is the smaller value of D_1 and D_2 but shall not exceed 5 feet	D_{MAX} =	19.0	ft

Basin Geometry

a) Basin side slopes (no steeper than 4:1)	z =	4	:1
b) Proposed basin depth (excluding freeboard)	d_B =	5	ft
c) Minimum bottom surface area of basin ($A_S = V_{BMP}/d_B$)	A_S =	7720	ft^2
d) Proposed Design Surface Area	A_D =	20737	ft^2

Forebay

a) Forebay volume (minimum 0.5% V_{BMP})	Volume =	193	ft^3
b) Forebay depth (height of berm/splashwall. 1 foot min.)	Depth =	4	ft
c) Forebay surface area (minimum)	Area =	48	ft^2
d) Full height notch-type weir	Width (W) =	3.0	in

Notes:

3.1 INFILTRATION BASIN

Type of BMP	LID - Infiltration
Treatment Mechanisms	Infiltration, Evapotranspiration (when vegetated), Evaporation, and Sedimentation
Maximum Treatment Area	50 acres
Other Names	Bioinfiltration Basin

Description

An Infiltration Basin is a flat earthen basin designed to capture the design capture volume, V_{BMP}. The stormwater infiltrates through the bottom of the basin into the underlying soil over a 72 hour drawdown period. Flows exceeding V_{BMP} must discharge to a downstream conveyance system. Trash and sediment accumulate within the forebay as stormwater passes into the basin. Infiltration basins are highly effective in removing all targeted pollutants from stormwater runoff.

Figure 1 – Infiltration Basin

See Appendix A, and Appendix C, Section 1 of *Basin Guidelines*, for additional requirements.

Siting Considerations

The use of infiltration basins may be restricted by concerns over ground water contamination, soil permeability, and clogging at the site. See the applicable WQMP for any specific feasibility considerations for using infiltration BMPs. Where this BMP is being used, the soil beneath the basin must be thoroughly evaluated in a geotechnical report since the underlying soils are critical to the basin's long term performance. To protect the basin from erosion, the sides and bottom of the basin must be vegetated, preferably with native or low water use plant species.

In addition, these basins may not be appropriate for the following site conditions:

- Industrial sites or locations where spills of toxic materials may occur
- Sites with very low soil infiltration rates
- Sites with high groundwater tables or excessively high soil infiltration rates, where pollutants can affect ground water quality
- Sites with unstabilized soil or construction activity upstream
- On steeply sloping terrain
- Infiltration basins located in a fill condition should refer to Appendix A of this Handbook for details on special requirements/restrictions

Setbacks

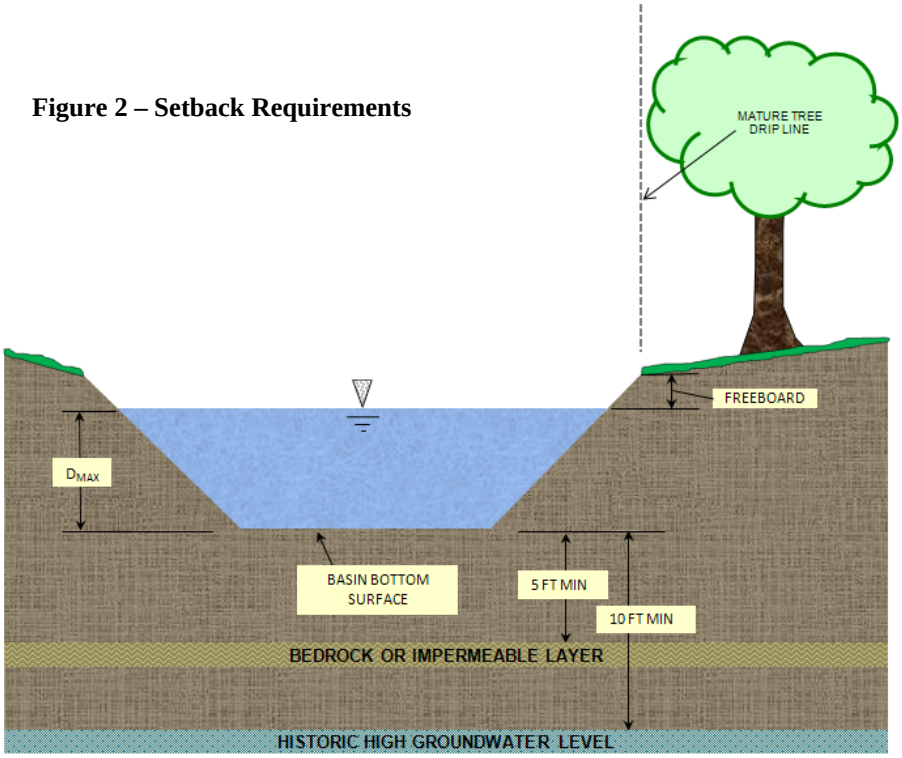
Always consult your geotechnical engineer for site specific recommendations regarding setbacks for infiltration trenches. Recommended setbacks are needed to protect buildings, existing trees, walls, onsite or nearby wells, streams, and tanks. Setbacks should be considered early in the design process since they can affect where infiltration facilities may be placed and how deep they are allowed to be. For instance, depth setbacks can dictate fairly shallow facilities that will have a larger footprint and, in some cases, may make an infiltration basin infeasible. In that instance, another BMP must be selected.

Infiltration basins typically must be set back:

- 10 feet from the historic high groundwater (measured vertically from the bottom of the basin, as shown in Figure 2)
- 5 feet from bedrock or impermeable surface layer (measured vertically from the bottom of the basin, as shown in Figure 2)
- From all existing mature tree drip lines as indicated in Figure 2 (to protect their root structure)
- 100 feet horizontally from wells, tanks or springs

Setbacks to walls and foundations must be included as part of the Geotechnical Report. All other setbacks shall be in accordance with applicable standards of the District's *Basin Guidelines* (Appendix C).

Figure 2 – Setback Requirements



Forebay

A concrete forebay shall be provided to reduce sediment clogging and to reduce erosion. The forebay shall have a design volume of at least 0.5% V_{BMP} and a minimum 1 foot high concrete splashwall / berm. Full height notch-type weir(s), offset from the line of flow from the basin inlet to prevent short circuiting, shall be used to outlet the forebay. It is recommended that two weirs be used and that they be located on opposite sides of the forebay (see Figure 2).

Overflow

Flows exceeding V_{BMP} must discharge to an acceptable downstream conveyance system. Where an adequate outlet is present, an overflow structure may be used. Where an embankment is present, an emergency spillway may be used instead. Overflows must be placed just above the design water surface for V_{BMP} and be near the outlet of the system. The overflow structure shall be similar to the District's Standard Drawing CB 110. Additional details may be found in the District's *Basin Guidelines* (Appendix C).

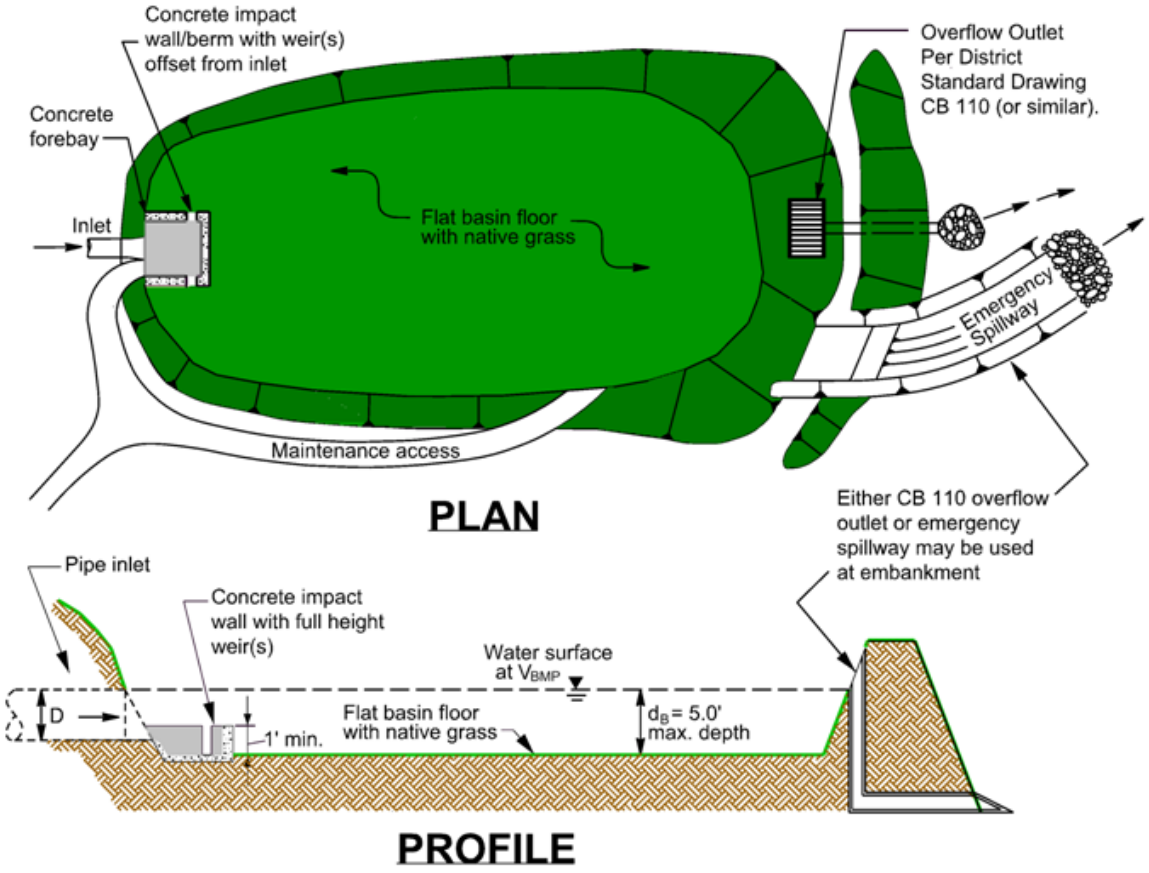


Figure 3 – Infiltration Basin

Landscaping Requirements

Basin vegetation provides erosion protection, improves sediment removal and assists in allowing infiltration to occur. The basin surface and side slopes shall be planted with native grasses. Proper landscape management is also required to ensure that the vegetation does not contribute to water pollution through pesticides, herbicides, or fertilizers. Landscaping shall be in accordance with County of Riverside Ordinance 859 and the District's *Basin Guidelines* (Appendix C), or other guidelines issued by the Engineering Authority.

Maintenance

Normal maintenance of an infiltration basin includes the maintenance of landscaping, debris and trash removal from the surface of the basin, and tending to problems associated with standing water (vectors, odors, etc.). Significant ponding, especially more than 72 hours after an event, may indicate that the basin surface is no longer providing sufficient infiltration and requires aeration. See the District's *Basin Guidelines* (Appendix C) for additional requirements (i.e., fencing, maintenance access, etc.).

Table 1 - Inspection and Maintenance

Schedule	Inspection and Maintenance Activity
Ongoing including just before annual storm seasons and following rainfall events.	• Maintain vegetation as needed. Use of fertilizers, pesticides and herbicides should be strenuously avoided to ensure they don't contribute to water pollution. If appropriate native plant selections and other IPM methods are used, such products shouldn't be needed. If such projects are used, o Products shall be applied in accordance with their labeling, especially in relation to application to water, and in areas subjected to flooding. o Fertilizers should not be applied within 15 days before, after, or during the rain season. • Remove debris and litter from the entire basin to minimize clogging and improve aesthetics. • Check for obvious problems and repair as needed. Address odor, insects, and overgrowth issues associated with stagnant or standing water in the basin bottom. There should be no long-term ponding water. • Check for erosion and sediment laden areas in the basin. Repair as needed. Clean forebay if needed. • Revegetate side slopes where needed.
Annually. If possible, schedule these inspections within 72 hours after a significant rainfall.	• Inspection of hydraulic and structural facilities. Examine the inlet for blockage, the embankment and spillway integrity, as well as damage to any structural element. • Check for erosion, slumping and overgrowth. Repair as needed. • Check basin depth for sediment build up and reduced total capacity. Scrape bottom as needed and remove sediment. Restore to original cross-section and infiltration rate. Replant basin vegetation. • Verify the basin bottom is allowing acceptable infiltration. Use a disc or other method to aerate basin bottom only if there is actual significant loss of infiltrative capacity, rather than on a routine basis[1]. • No water should be present 72 hours after an event. No long term standing water should be present at all. No algae formation should be visible. Correct problem as needed.

1. **CA Stormwater BMP Handbook for New Development and Significant Redevelopment**

Table 2 - Design and Sizing Criteria for Infiltration Basins

Design Parameter	Infiltration Basin
Design Volume	V_{BMP}
Forebay Volume	0.5% V_{BMP}
Drawdown time (maximum)	72 hours
Maximum tributary area	50 acres [2]
Minimum infiltration rate	Must be sufficient to drain the basin within the required Drawdown time over the life of the BMP. The WQMP may include specific requirements for minimum tested infiltration rates.
Maximum Depth	5 feet
Spillway erosion control	Energy dissipators to reduce velocities[1]
Basin Slope	0%
Freeboard (minimum)	1 foot [1]
Historic High Groundwater Setback (max)	10 feet
Bedrock/impermeable layer setback (max)	5 feet
Tree setbacks	Mature tree drip line must not overhang the basin
Set back from wells, tanks or springs	100 feet
Set back from foundations	As recommended in Geotechnical Report

1. **Ventura County's Technical Guidance Manual for Stormwater Quality Control Measures**
2. **CA Stormwater BMP Handbook for New Development and Significant Redevelopment**

Note: The information contained in this BMP Factsheet is intended to be a summary of design considerations and requirements. Additional information which applies to all detention basins may be found in the District's Basin Guidelines (Appendix C). In addition, information herein may be superseded by other guidelines issued by the co-permittee.

INFILTRATION BASIN SIZING PROCEDURE

1. Find the Design Volume, V_{BMP}.
   a) Enter the Tributary Area, $A_{T.}$
   b) Enter the Design Volume, V_{BMP}, determined from Section 2.1 of this Handbook.
2. Determine the Maximum Depth.
   a) Enter the infiltration rate. The infiltration rate shall be established as described in Appendix A: "Infiltration Testing".
   b) Enter the design Factor of Safety from Table 1 in Appendix A: "Infiltration Testing".
   c) The spreadsheet will determine D_1, the maximum allowable depth of the basin based on the infiltration rate along with the maximum drawdown time (72 hours) and the Factor of Safety.

$$D_1 = [(t) \times (I)] / 12s$$

Where I = site infiltration rate (in/hr)
s = safety factor
t = drawdown time (maximum 72 hours)

d) Enter the depth of freeboard.

e) Enter the depth to the historic high groundwater level measured from the top of the basin.

f) Enter the depth to the top of bedrock or other impermeable layer measured from the finished grade.

g) The spreadsheet will determine D_2, the total basin depth (including freeboard, if used) of the basin, based on restrictions to the depth by groundwater and an impermeable layer.

D_2 = Depth to groundwater – (10 + freeboard) (ft);

or

D_2 = Depth to impermeable layer – (5 + freeboard) (ft)

Whichever is least.

h) The spreadsheet will determine the maximum allowable effective depth of basin, D_{MAX}, based on the smallest value between D_1 and D_2. D_{MAX} is the maximum depth of water only and does not include freeboard. D_{MAX} shall not exceed 5 feet.

3. Basin Geometry

a) Enter the basin side slopes, z (no steeper than 4:1).

b) Enter the proposed basin depth, d_B excluding freeboard.

c) The spreadsheet will determine the minimum required surface area of the basin:

$$A_s = V_{BMP} / d_B$$

Where A_s = minimum area required (ft^2)
V_{BMP} = volume of the infiltration basin (ft^3)
d_B= proposed depth not to exceed maximum allowable depth, D_{MAX} (ft)

d) Enter the proposed bottom surface area. This area shall not be less than the minimum required surface area.

4. Forebay

A concrete forebay with a design volume of at least 0.5% V_{BMP} and a minimum 1 foot high concrete splashwall shall be provided. Full-height rectangular weir(s) shall be used to outlet the forebay. The weir(s) must be offset from the line of flow from the basin inlet. It is recommended that two weirs be used and that they be located on opposite sides of the forebay (see Figure 2).

a) The spreadsheet will determine the minimum required forebay volume based on 0.5% V_{BMP}.

b) Enter the proposed depth of the forebay berm/splashwall (1foot minimum).

c) The spreadsheet will determine the minimum required forebay surface area.

d) Enter the width of rectangular weir to be used (minimum 1.5 inches). Weir width should be established based on a 5 minute drawdown time.

Appendix 7: Hydromodification

Supporting Detail Relating to Hydrologic Conditions of Concern

Project Area

JURUPA VALLEY
EASTVALE
NORCO
CORONA
RIVERSIDE
ZONE 1
ZONE 2
ZONE 3
ZONE 4
ZONE 5
ZONE 7
PRADO DAM
LAKE MATHEWS
LAKE ELSINORE
CANYON LAKE
MORENO VALLEY
CALIMESA
BEAUMONT
BANNING
MYSTIC LAKE
SAN JACINTO
HEMET
PERRIS
MENIFEE
WILDOMAR
MURRIETA
LAKE PERRIS
DIAMOND VALLEY LAKE
LAKE SKINNER

Chino
Redlands
Loma Linda
Grand Terrace
Yucaipa
Banning
Beaumont
Calimesa
Moreno Valley
Riverside
Corona
Norco
Eastvale
Jurupa Valley
Perris
San Jacinto
Hemet
Menifee
Canyon Lake
Lake Elsinore
Wildomar
Murrieta
Temecula
Lake Mathews
Prado Dam
Mystic Lake
Lake Perris
Diamond Valley Lake
Lake Skinner

Legend

Stream Type
- Not Susceptible Stream Channels
- Potentially Susceptible Stream Channels
- Large River (Not Susceptible)
- Santa Ana River
- Adequate Sump

Watershed Areas
- Not Applicable Area
- Applicable Area
- Applicable Area Watershed Boundaries

- Flood Control and Water Conservation District Boundary
- Study Area
- County Boundary

RBF CONSULTING
GIS

0 1 2 3 4 Miles

Map Document: (M:\Models\2019\05\PROPOSED_HydromodModule_Large_5000.mxd mxd - RH) - 10/2/19

HCOC Applicability Map

Hydromodification Susceptibility Documentation Report and Mapping
Riverside County Flood Control and Water Conservation District

Map 2

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

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.**

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**
❑ **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

[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.

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

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❑ **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		
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☒ **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

Non-Structural Source BMP Operation and Maintenance

BMP Description	Responsible Party	Procedure and Inspection Requirements	Frequency/Schedule
Education for Property Owners, Operators, Tenants, Occupants, or Employees	Developer then HOA	Educational materials will be available to employees, maintenance crews and contractors. Materials will include environmental awareness such as proper use of chemicals, discharges of wastes, dry cleaning, catch basins and storm drain maintenance, watershed protection. Provide educational materials on an annual basis and upon hiring of employees or any new tenant	Annually
Activity Restrictions	Developer then HOA	Once project has been turned over, certain restrictions may be enacted thru the formation of conditions and CCRs to protect surface water runoff. Provide copy of WQMP to all employees and contractors that do the maintenance work	Annually
Irrigation System and Landscape Management	Developer then HOA and Property Owners	Inspect all Common landscape areas and replace dead vegetation Properly manage pesticides and fertilizers per City/County Ordinances Inspect, adjust, and repair irrigation system. AB 1881 Compliant	Monthly during regular maintenance. Weekly during regular maintenance. Weekly, during regular maintenance
Common Area Litter Control	Developer then Owner and/or Maintenance Contractors	The HOA will be responsible for funding the common areas and slopes within the development. The City of Norco will be responsible funding for areas within public right-of-way or property transferred to City (i.e. detention basins, riparian area, parks). Inspect and remove all litter and debris located in all common areas, including streets, parkways and sidewalks. Empty trash dumpsters located within delivery area.	Weekly
Street Sweeping Public Streets	City of Norco	Inspect and remove all litter and debris. Clean up oil spills.	Twice a month

Drainage Facility Inspection and Maintenance	Developer then HOA	Inspect all catch basin and stormdrain pipes, remove litter, debris and any liquids Drainage facilities shall be cleaned if accumulated sediment/debris fills 25% or more of the sediment/debris capacity.	Minimum 3 times annually During the rainy season, beginning October 1st, inspections and maintenance activities shall be required following each rain event.

Structural Source Control BMP Operation and Maintenance

BMP Description	Responsible Party	Procedure and Inspection Requirements	Frequency/Schedule
MS4 Stenciling and Signage	Developer then City of Norco	The property owner to provide stenciling or labeling of all storm drain inlets and catch basins for one year following completion of construction. At that time, the public storm drain inlets shall be maintained by the City of Norco. Catch Basin Stenciling shall include prohibitive language such as: "NO DUMPING, ONLY RAIN IN THE DRAIN" and/or graphical icons to discourage illegal dumping. Inspection/maintenance of the storm drain stenciling may be performed by the City employees or contracted maintenance personnel. During inspection, the inspector(s) shall check for the maintenance indicators given below: • Faded, vandalized, or otherwise unreadable concrete stamping There are no routine maintenance activities for the concrete stamping. If inspection indicates the storm drain stenciling is intact, no action is required. If inspection indicates the concrete stamping is not legible, the storm drain stenciling shall be repaired or replaced, as necessary.	Every 6 months or as needed
Use efficient irrigation and landscape design	Developer then Owner and HOA	Inspect and repair landscape irrigation timers. Inspect and repair all sprinkler heads as needed. Remove and replace dead vegetation as needed.	Weekly

Protect Slopes and Channels	Developer then HOA	The HOA will be responsible for funding of the protection of slopes and channels within the development. HOA will be responsible for funding of areas within property transferred to HOA/ County Transportation (i.e. detention basins, riparian area, parks). Inspect Slopes for erosion for earthen or landscaped slopes. Inspect falling debris for stabilized slopes with reinforcing materials. Repair slopes whenever necessary.	Weekly and whenever necessary
Trash Storage Areas	Developer then Owner	A private contract shall be prepared between the HOA and CR&R, Incorporated (the current Trash Company). Listed below are minimal requirements from the Riverside County Water Quality Management Plan: • Paved with an impervious surface, designed not to allow run-on from adjoining areas, designed to divert drainage from adjoining roofs and pavements diverted around the area, screened or walled to prevent offsite transport of trash. • Trash dumpsters shall be leak proof and have attached covers or lids. • Connection of trash area drains to MS4 is prohibited. • Trash compactors shall be roofed and set on a concrete pad. The pad shall be minimum of one foot larger all around than the trash compactor and sloped to drain to a sanitary sewer line.	Weekly

Post Development Site Design BMP Operation and Maintenance

BMP Description	Responsible Party	Procedure and Inspection Requirements	Frequency/Schedule

Infiltration Basins	Developer then HOA	The BMP sizing calculations and design details for the proposed Infiltration Basins are located in Appendix 6. The Infiltration Basins shall be maintained on a quarterly basis and prior to the rainy season, October 1st of each year. The basin shall be inspected for the following maintenance indicators: Maintenance procedures for the basin include: • Remove debris and gross pollutants from the entire basin and structural facilities. • The basin side slopes should be mowed at least twice a year to discourage woody growth. After the first or second growing season, the side slopes should be evaluated to determine if reinforcement planting is needed. If needed, the additional planting shall be installed at the onset of the second growing season after construction. • Use of fertilizer, pesticides, and herbicides should be avoided. Appropriate native plant selection and other IPM methods shall be employed to use of such products. • Repair slopes that are eroded or slumping. • Sediment deposit in the basin will monitored after each storm event. Whenever substantial sediment accumulation has occurred, remove accumulated sediment from the bottom of the basin. Removal shall extend to the original basin depth. Accumulated sediment will be tested for heavy metals and organics to determine the appropriate disposal method.	See left.

Appendix 10: Educational Materials

BMP Fact Sheets, Maintenance Guidelines and Other End-User BMP Information

For Information:

Local Sewering Agencies in Riverside County:

City of Beaumont	(909) 769-8520
Belair Homeowners Association	(909) 277-1414
City of Banning	(909) 922-3130
City of Blythe	(760) 922-6161
City of Coachella	(760) 391-5008
Coachella Valley Water District	(760) 398-2651
City of Corona	(909) 736-2259
Desert Center, CSA #51	(760) 227-3203
Eastern Municipal Water District	(909) 928-3777
Elsinore Valley MWD	(909) 674-3146
Farm Mutual Water Company	(909) 244-4198
Idyllwild Water District	(909) 659-2143
Jurupa Community Services Dist.	(909) 685-7434
Lake Hemet MWD	(909) 658-3241
Lee Lake Water District	(909) 277-1414
March Air Force Base	(909) 656-7000
Mission Springs Water District	(760) 329-6448
City of Palm Springs	(760) 323-8242
Rancho Caballero	(909) 780-9272
Rancho California Water Dist.	(909) 676-4101
Ripley, CSA #62	(760) 922-4909
Rubidoux Community Services Dist.	(909) 684-7580
City of Riverside	(909) 782-5341
Silent Valley Club, Inc	(909) 849-4501
Valley Sanitary District	(760) 347-2356
Western Municipal Water District	(909) 780-4170

Spill Response Agency:
Haz-Mat: (909) 358-5055
Hazardous Waste Disposal: (909) 358-5055
To Report Illegal Dumping or a Clogged Storm Drain: 1-800-506-2555

StormWater CleanWater
PROTECTION PROGRAM

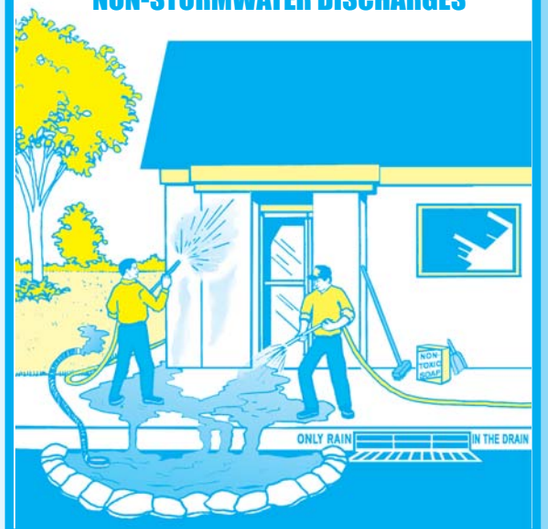
Riverside County gratefully acknowledges the Bay Area Stormwater Management Agencies Association and the Cleaning Equipment Trade Association for information provided in this brochure.

StormWater Pollution

What you should know for...

OUTDOOR CLEANING ACTIVITIES

NON-STORMWATER DISCHARGES



GUIDELINES for disposal of washwater from:

- Sidewalk, plaza or parking lot cleaning
- Vehicle washing or detailing
- Building exterior cleaning
- Waterproofing
- Equipment cleaning or degreasing

Do you know . . . where the water should go?

Riverside County has two drainage systems - sanitary sewers and storm drains. The storm drain system is designed to prevent flooding by carrying excess rainwater away from streets. . . it's not designed to be a waste disposal system. Since the storm drain system does not provide for water treatment, it often serves the unintended function of transporting pollutants directly to our waterways.

Unlike sanitary sewers, storm drains are not connected to a treatment plant - they flow directly to our local streams, rivers and lakes.

Non-stormwater discharges such as washwater generated from outdoor cleaning projects often transport harmful pollutants into storm drains and our local waterways. Polluted runoff contaminates local waterways and poses a threat to groundwater resources.

Soaps, degreasers, automotive fluids, litter, and a host of other materials washed off buildings, sidewalks, plazas, parking areas, vehicles, and equipment can all pollute our waterways.

The Cities and County of Riverside StormWater/CleanWater Protection Program

Since preventing pollution is much easier, and less costly than cleaning up "after the fact," the Cities and County of Riverside StormWater/CleanWater Protection Program informs residents and businesses of pollution prevention activities such as those described in this pamphlet.

The Cities and County of Riverside have adopted ordinances for stormwater management and discharge control. In accordance with state and federal law, these local stormwater ordinances **prohibit** the discharge of wastes into the storm drain system or local surface waters. This includes non-stormwater discharges containing oil, grease, detergents, degreasers, trash, or other waste materials.

PLEASE NOTE: The discharge of pollutants into the street, gutters, storm drain system, or waterways - without a Regional Water Quality Control Board permit or waiver - is ***strictly prohibited*** by local ordinances and state and federal law.

Help Protect Our Waterways!

Use These Guidelines For Outdoor Cleaning Activities and Washwater Disposal

DO . . . Dispose of **small amounts** of **washwater from cleaning building exteriors, sidewalks, or plazas** onto landscaped or unpaved surfaces provided you have the owner's permission and the discharge will not cause flooding or nuisance problems, or flow into a storm drain.

DO NOT . . . Discharge **large amounts** of these types of washwater onto landscaped areas or soil where water may run to a street or storm drain. Wastewater from exterior cleaning may be pumped to a sewer line with specific permission from the local sewering agency.

DO . . . Check with your local sewering agency's policies and requirements concerning waste water disposal. **Water from many outdoor cleaning activities** may be acceptable for disposal to the sewer system. See the list on the back of this flyer for phone numbers of the sewering agencies in your area.

DO NOT . . . Pour **hazardous wastes** or toxic materials into the storm drain or sewer system . . . properly dispose of it instead. When in doubt, contact the local sewering agency! The agency will tell you what types of liquid wastes can be accepted.

DO . . . Understand that **water (without soap) used to remove dust from clean vehicles** may be discharged to a street or storm drain. **Washwater from sidewalk, plaza, and building surface cleaning** may go into a street or storm drain if ALL of the following conditions are met:

1) The surface being washed is free of residual oil stains, debris and similar pollutants by using dry cleanup methods (sweeping, and cleaning any oil or chemical spills with rags or other absorbent materials before using water).
2) Washing is done with water only - no soap or other cleaning materials.
3) You have not used the water to remove paint from surfaces during cleaning.

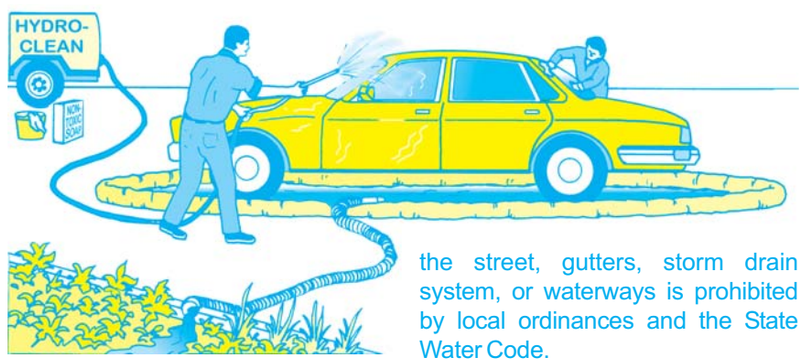
DO NOT . . . Dispose of water containing **soap or any other type of cleaning agent** into a storm drain or water body. This is a direct violation of state and/or local regulations. Because **wastewater from cleaning parking areas or roadways** normally contains metallic brake pad dust, oil and other automotive fluids, it should never be discharged to a street, gutter, or storm drain.

DO . . . Understand that **mobile auto detailers** should divert washwater to landscaped or dirt areas. Note: Be aware that soapy washwater may adversely affect landscaping; consult with the property owner. Residual washwater may remain on paved surfaces to evaporate; sweep up any remaining residue. If there is sufficient water volume to reach the storm drain, collect the runoff and obtain permission to pump it into the sanitary sewer. Follow local sewering agency's requirements for disposal.

DO NOT . . . Dispose of left over cleaning agents into the gutter, storm drain or sanitary sewer.

Regarding Cleaning Agents:

If you must use soap, use biodegradable/phosphate free cleaners. Avoid use of petroleum based cleaning products. Although the use of nontoxic cleaning products is strongly encouraged, ***do*** understand that these products can still degrade water quality and, therefore, the discharge of these products into



the street, gutters, storm drain system, or waterways is prohibited by local ordinances and the State Water Code.

Note: When cleaning surfaces with a high pressure washer or steam cleaning methods, additional precautions should be taken to prevent the discharge of pollutants into the storm drain system. These two methods of surface cleaning, as compared to the use of a low pressure hose, can remove additional materials that can contaminate local waterways.

Other Tips to Help Protect Our Water . . .

Screening Wash Water

A thorough dry cleanup before washing (without soap) surfaces such as building exteriors and decks without loose paint, sidewalks, or plaza areas, *should be sufficient to protect storm drains.* **However**, if any debris (solids) could enter storm drains or remain in the gutter or street after cleaning, washwater should first pass through a "20 mesh" or finer screen to catch the solid material, which should then be disposed of in the trash.

Drain Inlet Protection/ Containing & Collecting Wash Water

- Sand bags can be used to create a barrier around storm drain inlets.
- Plugs or rubber mats can be used to temporarily seal storm drain openings.
- You can also use vacuum booms, containment pads, or temporary berms to keep wash water away from the street, gutter, or storm drain.

Equipment and Supplies

Special materials such as absorbents, storm drain plugs and seals, small sump pumps, and vacuum booms are available from many vendors. For more information check catalogs such as New Pig (800-468-4647), Lab Safety Supply (800-356-0783), C&H (800-558-9966), and W.W. Grainger (800-994-9174); or call the Cleaning Equipment Trade Association (800-441-0111) or the Power Washers of North America (800-393-PWNA).

For Information:

For more information on the General Industrial Storm Water Permit contact:

State Water Resources Control Board (SWRCB)
(916) 657-1146 or www.swrcb.ca.gov/ or, at your Regional Water Quality Control Board (RWQCB).

Santa Ana Region (8)
California Tower
3737 Main Street, Ste. 500
Riverside, CA 92501-3339
(909) 782-4130

San Diego Region (9)
9771 Clairemont Mesa Blvd., Ste. A
San Diego, CA 92124
(619) 467-2952

Colorado River Basin Region (7)
73-720 Fred Waring Dr., Ste. 100
Palm Desert, CA 92260
(760) 346-7491

SPILL RESPONSE AGENCY:
HAZ-MAT: (909) 358-5055
HAZARDOUS WASTE DISPOSAL: (909) 358-5055
RECYCLING INFORMATION: 1-800-366-SAVE
TO REPORT ILLEGAL DUMPING OR A CLOGGED STORM DRAIN: 1-800-506-2555

To order additional brochures or to obtain information on other pollution prevention activities, call: (909) 955-1111.

StormWater
CleanWater
PROTECTION PROGRAM

Riverside County gratefully acknowledges the State Water Quality Control Board and the American Public Works Association, Storm Water Quality Task Force for the information provided in this brochure.

DID YOU KNOW . . .

YOUR FACILITY MAY NEED A STORM WATER PERMIT?

Many industrial facilities and manufacturing operations must obtain coverage under the Industrial Activities Storm Water General Permit

FIND OUT IF YOUR FACILITY MUST OBTAIN A PERMIT

StormWater Pollution . . . What you should know

Riverside County has two drainage systems - sanitary sewers and storm drains. The storm drain system is designed to help prevent flooding by carrying excess rainwater away from streets. Since the storm drain system does not provide for water treatment, it also serves the *unintended* function of transporting pollutants directly to our waterways.

Unlike sanitary sewers, storm drains are not connected to a treatment plant - they flow directly to our local streams, rivers and lakes.

In recent years, awareness of the need to protect water quality has increased. As a result, federal, state, and local programs have been established to reduce polluted stormwater discharges to our waterways. The emphasis of these programs is to prevent stormwater pollution since it's much easier, and less costly, than cleaning up "after the fact."

National Pollutant Discharge Elimination System (NPDES)

In 1987, the Federal Clean Water Act was amended to establish a framework for regulating industrial stormwater discharges under the NPDES permit program. In California, NPDES permits are issued by the State Water Resources Control Board (SWRCB) and the nine (9) Regional Water Quality Control Boards (RWQCB). In general, certain industrial facilities and manufacturing operations must obtain coverage under the Industrial Activities Storm Water General Permit if the type of facilities or operations falls into one of the several categories described in this brochure.

How Do I Know If I Need A Permit?

Following are ***general descriptions*** of the industry categories types that are regulated by the Industrial Activities Storm Water General Permit. Contact your local Region Water Quality Control Board to determine if your facility/operation requires coverage under the Permit.

➜ Facilities such as cement manufacturing; feedlots; fertilizer manufacturing; petroleum refining; phosphate manufacturing; steam electric power generation; coal mining; mineral mining and processing; ore mining and dressing; and asphalt emulsion;

➜ Facilities classified as lumber and wood products (except wood kitchen cabinets); pulp, paper, and paperboard mills; chemical producers (except some pharmaceutical and biological products); petroleum and coal products; leather production and products; stone, clay and glass products; primary metal industries; fabricated structural metal; ship and boat building and repairing;

➜ Active or inactive mining operations and oil and gas exploration, production, processing, or treatment operations;

➜ Hazardous waste treatment, storage, or disposal facilities;

➜ Landfills, land application sites and open dumps that receive or have received any industrial waste; unless there is a new overlying land use such as a golf course, park, etc., and there is no discharge associated with the landfill;

➜ Facilities involved in the recycling of materials, including metal scrap yards, battery reclaimers, salvage yards, and automobile junkyards;

➜ Steam electric power generating facilities, facilities that generate steam for electric power by combustion;

➜ Transportation facilities that have vehicle maintenance shops, fueling facilities, equipment cleaning operations, or airport deicing operations. This includes school bus maintenance facilities operated by a school district;

➜ Sewage treatment facilities;

➜ Facilities that have areas where material handling equipment or activities, raw materials, intermediate products, final products, waste materials, by-products, or industrial machinery are exposed to storm water.

How do I obtain coverage under the Industrial Activities Storm Water General Permit?

Obtain a permit application package from your local Regional Water Quality Control Board listed on the back of this brochure or the State Water Resources Control Board (SWRCB). Submit a completed Notice of Intent (NOI) form, site map and the appropriate fee ($250 or $500) to the SWRCB. Facilities must submit an NOI thirty (30) days prior to beginning operation. Once you submit the NOI, the State Board will send you a letter acknowledging receipt of your NOI and will assign your facility a waste discharge identification number (WDID No.). You will also receive an annual fee billing. These billings should roughly coincide with the date the State Board processed your original NOI submittal.

What are the requirements of the Industrial Activities Storm Water General Permit?

The basic requirements of the Permit are:

1. The facility must eliminate any non-stormwater discharges or obtain a separate permit for such discharges.

2. The facility must develop and implement a Storm Water Pollution Prevention Plan (SWPPP). The SWPPP must identify sources of pollutants that may be exposed to stormwater. Once the sources of pollutants have been identified, the facility operator must develop and implement Best Management Practices (BMPs) to minimize or prevent polluted runoff.

   Guidance in preparing a SWPPP is available from a document prepared by the California Storm Water Quality Task Force called the California Storm Water Best Management Practice Handbook.

3. The facility must develop and implement a Monitoring Program that includes conducting visual observations and collecting samples of the facility's storm water discharges associated with industrial activity. The General Permit requires that the analysis be conducted by a laboratory that is certified by the State of California.

4. The facility must submit to the Regional Board, every July 1, an annual report that includes the results of its monitoring program.

A Non-Storm Water Discharge is... *any discharge to a storm drain system that is not composed entirely of storm water. The following non-storm water discharges are authorized by the General Permit: fire hydrant flushing; potable water sources, including potable water related to the operation, maintenance, or testing of potable water systems; drinking fountain water; atmospheric condensates including refrigeration, air conditioning, and compressor condensate; irrigation drainage; landscape watering; springs; non-contaminated ground water; foundation or footing drainage; and sea water infiltration where the sea waters are discharged back into the sea water source.*

A BMP is . . . *a technique, process, activity, or structure used to reduce the pollutant content of a storm water discharge. BMPs may include simple, non-structural methods such as good housekeeping, staff training and preventive maintenance. Additionally, BMPs may include structural modifications such as the installation of berms, canopies or treatment control (e.g. setting basins, oil/water separators, etc.)*

WARNING*: There are significant penalties for non-compliance: a minimum fine of $5,000 for failing to obtain permit coverage, and, up to $10,000 per day, per violation plus $10 per gallon of discharge in excess of 1,000 gallons.*

After the Storm

A Citizen's Guide to Understanding Stormwater

EPA 833-B-03-002

January 2003

For more information contact:

or visit
www.epa.gov/npdes/stormwater
www.epa.gov/nps

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.

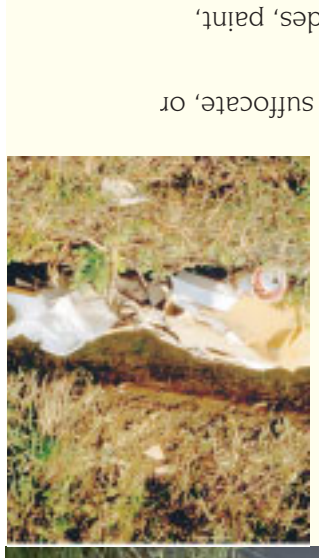
Stormwater can pick up debris, chemicals, dirt, and other pollutants and flow into a storm sewer system or directly to a lake, stream, river, wetland, or coastal water. Anything that enters a storm sewer system is discharged untreated into the waterbodies we use for swimming, fishing, and providing drinking water.

Why is stormwater runoff a problem?

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.



EPA United States Environmental Protection Agency

THE YEAR OF CLEAN WATER
Celebration of Recommitment

WHEN IT RAINS IT DRAINS

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.

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.

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.

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

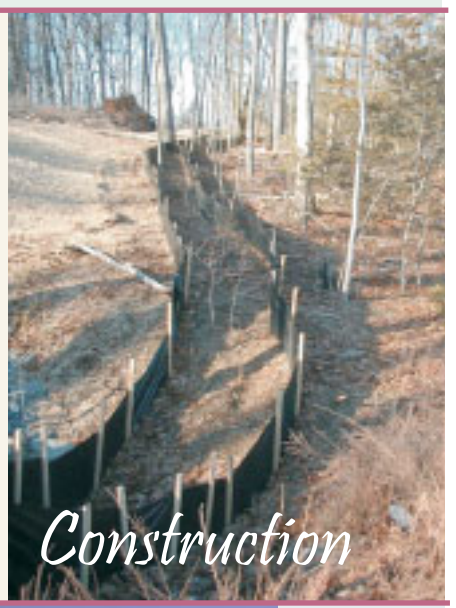
Dirt, oil, and debris that collect in parking lots and paved areas can be washed into the storm sewer system and eventually enter local waterbodies.

- 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

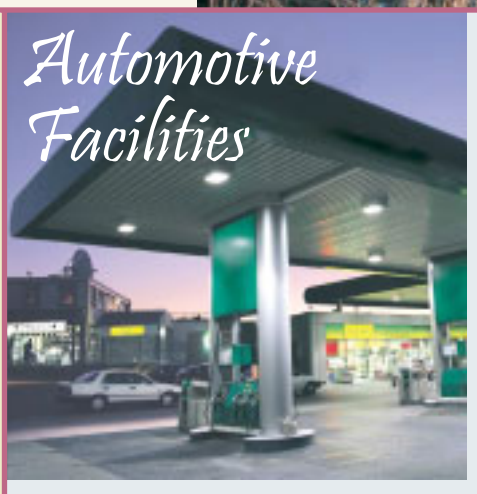
Lack of vegetation on streambanks can lead to erosion. Overgrazed pastures can also contribute excessive amounts of sediment to local waterbodies. Excess fertilizers and pesticides can poison aquatic animals and lead to destructive algae blooms. Livestock in streams can contaminate waterways with bacteria, 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.

For Information:

For more information on the General Industrial Storm Water Permit contact:

State Water Resources Control Board (SWRCB)
(916) 657-1146 or www.swrcb.ca.gov/ or, at your Regional Water Quality Control Board (RWQCB).

Santa Ana Region (8)
California Tower
3737 Main Street, Ste. 500
Riverside, CA 92501-3339
(909) 782-4130

San Diego Region (9)
9771 Clairemont Mesa Blvd., Ste. A
San Diego, CA 92124
(619) 467-2952

Colorado River Basin Region (7)
73-720 Fred Waring Dr., Ste. 100
Palm Desert, CA 92260
(760) 346-7491

SPILL RESPONSE AGENCY:
HAZ-MAT: (909) 358-5055
HAZARDOUS WASTE DISPOSAL: (909) 358-5055
RECYCLING INFORMATION: 1-800-366-SAVE
TO REPORT ILLEGAL DUMPING OR A CLOGGED STORM DRAIN: 1-800-506-2555

To order additional brochures or to obtain information on other pollution prevention activities, call: (909) 955-1111.

StormWater
CleanWater
PROTECTION PROGRAM

Riverside County gratefully acknowledges the State Water Quality Control Board and the American Public Works Association, Storm Water Quality Task Force for the information provided in this brochure.

DID YOU KNOW . . .

YOUR FACILITY MAY NEED A STORM WATER PERMIT?

Many industrial facilities and manufacturing operations must obtain coverage under the Industrial Activities Storm Water General Permit

FIND OUT IF YOUR FACILITY MUST OBTAIN A PERMIT

StormWater Pollution . . . What you should know

Riverside County has two drainage systems - sanitary sewers and storm drains. The storm drain system is designed to help prevent flooding by carrying excess rainwater away from streets. Since the storm drain system does not provide for water treatment, it also serves the *unintended* function of transporting pollutants directly to our waterways.

Unlike sanitary sewers, storm drains are not connected to a treatment plant - they flow directly to our local streams, rivers and lakes.

In recent years, awareness of the need to protect water quality has increased. As a result, federal, state, and local programs have been established to reduce polluted stormwater discharges to our waterways. The emphasis of these programs is to prevent stormwater pollution since it's much easier, and less costly, than cleaning up "after the fact."

National Pollutant Discharge Elimination System (NPDES)

In 1987, the Federal Clean Water Act was amended to establish a framework for regulating industrial stormwater discharges under the NPDES permit program. In California, NPDES permits are issued by the State Water Resources Control Board (SWRCB) and the nine (9) Regional Water Quality Control Boards (RWQCB). In general, certain industrial facilities and manufacturing operations must obtain coverage under the Industrial Activities Storm Water General Permit if the type of facilities or operations falls into one of the several categories described in this brochure.

How Do I Know If I Need A Permit?

Following are ***general descriptions*** of the industry categories types that are regulated by the Industrial Activities Storm Water General Permit. Contact your local Region Water Quality Control Board to determine if your facility/operation requires coverage under the Permit.

➜ Facilities such as cement manufacturing; feedlots; fertilizer manufacturing; petroleum refining; phosphate manufacturing; steam electric power generation; coal mining; mineral mining and processing; ore mining and dressing; and asphalt emulsion;

➜ Facilities classified as lumber and wood products (except wood kitchen cabinets); pulp, paper, and paperboard mills; chemical producers (except some pharmaceutical and biological products); petroleum and coal products; leather production and products; stone, clay and glass products; primary metal industries; fabricated structural metal; ship and boat building and repairing;

➜ Active or inactive mining operations and oil and gas exploration, production, processing, or treatment operations;

➜ Hazardous waste treatment, storage, or disposal facilities;

➜ Landfills, land application sites and open dumps that receive or have received any industrial waste; unless there is a new overlying land use such as a golf course, park, etc., and there is no discharge associated with the landfill;

➜ Facilities involved in the recycling of materials, including metal scrap yards, battery reclaimers, salvage yards, and automobile junkyards;

➜ Steam electric power generating facilities, facilities that generate steam for electric power by combustion;

➜ Transportation facilities that have vehicle maintenance shops, fueling facilities, equipment cleaning operations, or airport deicing operations. This includes school bus maintenance facilities operated by a school district;

➜ Sewage treatment facilities;

➜ Facilities that have areas where material handling equipment or activities, raw materials, intermediate products, final products, waste materials, by-products, or industrial machinery are exposed to storm water.

How do I obtain coverage under the Industrial Activities Storm Water General Permit?

Obtain a permit application package from your local Regional Water Quality Control Board listed on the back of this brochure or the State Water Resources Control Board (SWRCB). Submit a completed Notice of Intent (NOI) form, site map and the appropriate fee ($250 or $500) to the SWRCB. Facilities must submit an NOI thirty (30) days prior to beginning operation. Once you submit the NOI, the State Board will send you a letter acknowledging receipt of your NOI and will assign your facility a waste discharge identification number (WDID No.). You will also receive an annual fee billing. These billings should roughly coincide with the date the State Board processed your original NOI submittal.

What are the requirements of the Industrial Activities Storm Water General Permit?

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Stormwater Pollution Found in Your Area!

This is not a citation.

This is to inform you that our staff found the following pollutants in the storm sewer system in your area. This storm sewer system leads directly to

_____ .

- ❑ Motor oil
- ❑ Oil filters
- ❑ Antifreeze/ transmission fluid
- ❑ Paint
- ❑ Solvent/degreaser
- ❑ Cooking grease
- ❑ Detergent
- ❑ Home improvement waste (concrete, mortar)
- ❑ Pet waste
- ❑ Yard waste (leaves, grass, mulch)
- ❑ Excessive dirt and gravel
- ❑ Trash
- ❑ Construction debris
- ❑ Pesticides and fertilizers
- ❑ Other

_____

For more information or to report an illegal discharge of pollutants, please call:

WHEN IT RAINS IT DRAINS

www.epa.gov/npdes/stormwater

EPA
United States Environmental Protection Agency

EPA 833-F-03-002
April 2003

Stormwater runoff is precipitation from rain or snowmelt that flows over the ground. As it flows, it can pick up debris, chemicals, dirt, and other pollutants and deposit them into a storm sewer system or waterbody.

Anything that enters a storm sewer system is discharged *untreated* into the waterbodies we use for swimming, fishing, and providing drinking water.

Remember: Only Rain Down the Drain

To keep the stormwater leaving your home or workplace clean, follow these simple guidelines:

- Use pesticides and fertilizers sparingly.
- Repair auto leaks.
- Dispose of household hazardous waste, used auto fluids (antifreeze, oil, etc.), and batteries at designated collection or recycling locations.
- Clean up after your pet.
- Use a commercial car wash or wash your car on a lawn or other unpaved surface.
- Sweep up yard debris rather than hosing down areas. Compost or recycle yard waste when possible.
- Clean paint brushes in a sink, not outdoors. Properly dispose of excess paints through a household hazardous waste collection program.
- Sweep up and properly dispose of construction debris like concrete and mortar.

EPA · · · · · · Clean Water State Revolving Fund

ACTIVITY *UPDATE*

Innovative use of Clean Water State Revolving Funds for Nonpoint Source Pollution

States are successfully using linked deposit and pass-through loans to fund important nonpoint source pollution remediation projects

Many states are successfully using the USEPA's Office of Water, Clean Water State Revolving Fund (CWSRF) loan program to fund important nonpoint source pollution remediation projects. Nonpoint source pollution is widely viewed as one of the most serious threats to our nation's water quality. State and local governments, local watershed and agricultural organizations, and many others are working to devise solutions that address nonpoint source pollution. The CWSRF program provides very attractive low-interest loans that spread project costs over a repayment period of up to 20 years. Today, CWSRF programs are funding projects that address agriculture runoff, leaking on-site septic systems, and urban nonpoint source pollution, including stormwater runoff and brownfield contamination.

During the initial operating phase of CWSRF programs, states designed loan options and implemented administrative procedures that would best serve municipal wastewater system projects. However, when considering how the CWSRF program could be used to address nonpoint source pollution, a number of states recognized that they would need to go beyond the typical municipal borrower and provide loan assistance to farmers, homeowners, and nonprofit organizations. States also recognized that providing loans to small private borrowers could be challenging. The loans would fund a variety of small projects, there would be more of them to service and manage, and there would be a greater risk of loan defaults.

States have taken different approaches to addressing these challenges. In some states, the CWSRF program has called upon internal expertise and the expertise of other state personnel to help manage loans to private borrowers. Other states have used creative lending approaches that pass loan risks and loan servicing responsibilities to financial institutions, local governments, or other state agencies. These lending methods include linked deposit loan programs with local financial institutions and pass-through loan programs with local government or state agencies. This activity update will highlight these loan structures with three case studies of successful state programs.

What is a linked deposit loan?

Under a linked deposit loan approach, a state works with local private lending institutions to provide assistance for nonpoint source pollution control. The state agrees to accept a reduced rate of return on an investment (e.g., a certificate of deposit) and the lending institution agrees to provide a loan to a borrower at a similarly reduced interest rate. For example, if the typical earnings rate for a certificate of deposit (CD) is five percent, a state might agree to purchase a CD that earns two percent interest, and in exchange, the lending institution agrees to provide a loan to a borrower at an interest rate that is three percentage points lower than the market rate for the borrower. In this program, the CWSRF investment (deposit) is linked to a low-interest loan, thereby earning the description "linked deposit loan."

Linked deposit loan programs provide benefits for CWSRF programs, local financial institutions, and borrowers. The linked-deposit approach benefits CWSRF programs because they support high priority nonpoint source projects and because they place risk and management responsibilities with local financial institutions. Financial institutions earn profits from the linked deposit agreements and add an additional service for their customers. Borrowers find linked deposit programs to be economical and comfortable; they save money with low-interest loans, and they are comfortable working with local financial institutions.

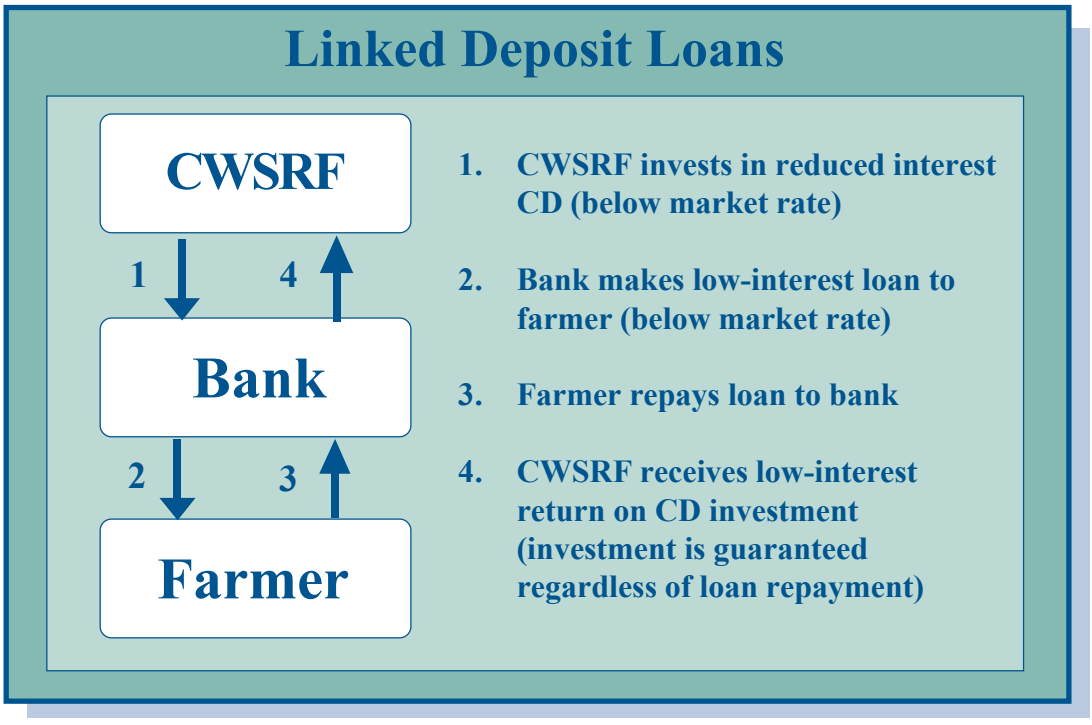

Figure 1. Linked deposit program flow chart

What is a pass-through loan?

In a pass-through loan, a CWSRF program makes a loan to another state or local government agency and that agency then lends the funds to private borrowers to address nonpoint source pollution. The town, county, or state agency reviews the project and the finances of each borrower. CWSRF loan funds are "passed-through" another government agency to private borrowers.

Pass-through loan programs benefit CWSRF programs, pass-through partners (towns, counties, and state agencies), and borrowers. These programs benefit CWSRF programs because they support high-priority nonpoint source projects and because they place risk and management responsibilities with program partners. Towns, counties, and state agencies benefit from pass-through programs because CWSRF funds support their nonpoint source priorities. Pass-through loans can offer two potential benefits to borrowers. First, pass-through loans are not provided by private lenders and, as a result, are likely to have lower interest rates. Second, local government agencies may have greater flexibility to provide loans to borrowers with relatively weak credit conditions if the borrower's nonpoint source project is a high priority for the state or local government agency.

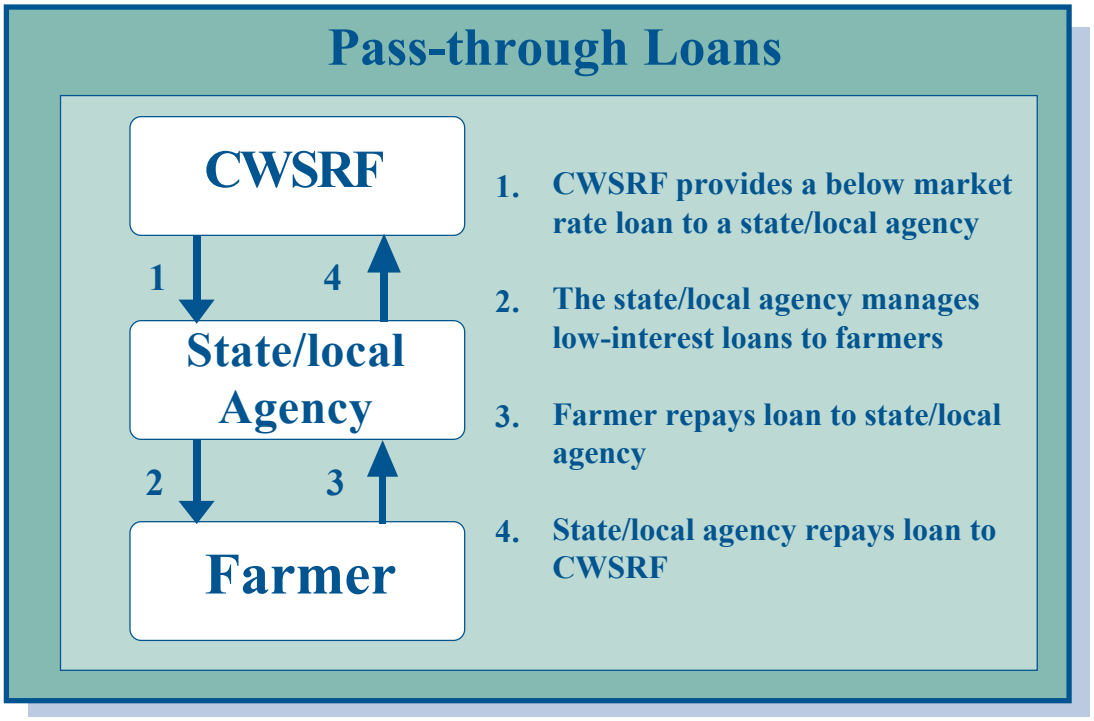

Figure 2. Pass-through program flow chart

Who has benefited from these programs and what have they funded?

CWSRF linked deposit and pass-through loan programs have supported borrowers implementing a variety of nonpoint source projects:

- Homeowners have implemented stormwater runoff best management practices and repaired or replaced failing on-site septic systems.
- Homeowner associations have addressed failing stormwater management facilities.
- Farmers have addressed agricultural runoff with a wide variety of agricultural best management practices including the construction of manure storage facilities, the restoration of filter strips and grassed waterways, and the use of conservation tillage equipment.

Ohio Case Study — Linked Deposit Loan Program

Ohio has used a linked-deposit loan program since 1993 to fund projects that support county watershed management plans. This program has funded more than 300 projects, including the repair of onsite wastewater treatment systems and the implementation of best management practices for agriculture, forestry, stormwater, and land development. The CWSRF program developed this program with the help of county soil and water conservation districts and local banks.

The CWSRF program implements its linked deposit loan program one county at a time. Each county's program is developed with two concurrent steps: the county soil and water conservation district develops a watershed management plan, and the CWSRF program and local financial institutions enter into agreements describing requirements and procedures for linked deposit loans.

Watershed management plans describe a watershed, identify sources of pollution, suggest actions that would address those pollution sources, prioritize water quality problems, identify sources of funding, and establish an implementation schedule. The county soil and water district's draft plan is reviewed by Ohio EPA and by a formal public review process. If Ohio EPA approves a plan after this review, the CWSRF program and the soil and water conservation district sign a memorandum of understanding that describes how these two entities will coordinate their implementation of the management plan.

At the same time that a watershed management plan is developed and reviewed, soil and conservation districts contact local banks to identify institutions that would like to participate in a linked deposit program. Interested banks enter into agreements with the CWSRF program that describe requirements and procedures for linked deposit loans.

Any borrower with a project that helps to implement a watershed management plan is eligible for a linked deposit loan. Participating banks review borrowers' credit using their own credit standards. If a bank approves a linked deposit loan, the CWSRF program purchases a CD of equal value from the bank. The CWSRF program accepts a CD interest rate that is five percentage points lower than the rate of a U.S. Treasury Note or Bond with the same term. The borrower's loan interest rate is also reduced by five percentage points. The bank makes semiannual payments of principal and interest to repay the CWSRF for its investment in the CD, and it makes these payments even if the borrower defaults on the linked deposit loan.

Massachusetts Case Study — Lending through Local Government

Since 1995, Massachusetts' Community Septic Management Program has used pass-through loans with local municipalities to fund the repair and replacement of failing septic systems. The program has funded more than 3,000 projects across the state. The CWSRF has developed this program with the cooperation of local municipalities.

Communities that participate in Massachusetts' Community Septic Management Program can borrow hundreds of thousands of dollars from the CWSRF program, but communities must first develop a septic management plan and procedures for a local betterment loan program (the community uses betterment assessments to secure the loans). Massachusetts provides grants of up to $20,000 to municipalities to support these planning activities and the administration of the program.

Massachusetts law defines a betterment assessment as a charge imposed on real property that receives a benefit from a public improvement. Municipalities have traditionally imposed betterments to pay for improvements such as roads, sidewalks and sewer lines. In the Community Septic Management Program, however, betterment agreements allow individuals to receive community support (a betterment loan) for septic system improvements, and the agreements allow communities to ensure that the loans are repaid as part of a property tax bill. The community can place a municipal lien on property if a homeowner defaults on a betterment loan.

Septic management plans identify and prioritize areas with septic systems that require monitoring, maintaining, and upgrading. As part of the planning process, communities develop maintenance schedules for septic systems, and they develop databases that track the inspection, maintenance, and upgrade of these systems. The Massachusetts Department of Environmental Protection reviews all community septic management plans.

Before a community can receive a CWSRF loan from the state, however, it also develops the framework for a local betterment loan program. Communities create administrative structures to manage the programs, devise a method for selecting priority projects, and work with their tax assessors to ensure that homeowners will repay their betterment loans as part of their local tax assessments.

Communities that develop septic management plans and procedures for a local betterment loan program receive loans from the CWSRF program for 20 years at zero percent interest. Communities typically borrow $200,000 from this program. Homeowners typically receive twenty-year loans from communities at two to five percent interest. Communities can use interest accrued on betterment loans to support the administrative costs of the loan programs. Communities must begin to repay the CWSRF within one year after they have finished dispersing the proceeds of each CWSRF loan.

Missouri Case Study — Lending through State Agencies

Missouri's Nonpoint Source Animal Waste Treatment Facility Loan Program is a pass-through loan program that uses a state agency as a loan intermediary. Since 1995, the Missouri Agriculture and Small Business Development Authority (MASBDA) has borrowed $5 million from the CWSRF program, and MASBDA has used these funds to support the construction of 88 animal waste treatment systems for livestock and poultry producers. The agricultural operation of each borrower in this loan program produces fewer than 1,000 animal units -- concentrated animal feeding operations are ineligible.

Missouri's Nonpoint Source Animal Waste Treatment Facility Loan Program does not require a regional planning effort similar to the soil and water conservation plans required in Ohio' linked deposit program or the septic management plans required in Massachusetts' pass-through loan program. Engineers with Missouri's CWSRF program review each project application to ensure that CWSRF-financed structures and equipment support the goals of the program.

Missouri's CWSRF program provides 10-year loans to MASBDA that have a 1.8 percent interest rate. Individual agricultural producers access these resources by submitting applications to MASBDA. MASBDA reviews the financial component of each application, assessing cash flows and establishing security requirements. Borrowers must provide a dedicated source of repayment and a first or second deed of trust on their property. Agricultural producers typically receive 10-year loans from MASBDA that have interest rates from 5.3-5.8 percent. However, MASBDA does not offer construction financing for animal waste treatment systems. Typically, agricultural producers use loans from the Nonpoint Source Animal Waste Treatment Facility Loan Program to pay off construction loans from a private lender. MASBDA uses the repayments from agricultural producers to repay its loan from the CWSRF.

Case Study Contact Information

More information on the programs outlined in this update can be found on the state program web sites or by contacting the programs themselves.

Ohio Environmental Protection Agency
Div. of Environmental & Financial Assistance
Contact: Bob Monsarrat
Phone: 614-644-3655
Web site:
www.epa.state.oh.us/defa/linkdepo.html

Massachusetts Department of Environmental Protection
Massachusetts' Community Septic Management Program
Contact: Joseph McNealy
Phone: 617-556-1068
Web site: www.state.ma.us/dep/brp

Missouri Department of Agriculture
Animal Waste Facility Loan Program
Contact: Steve Townley
Phone: 573-751-1397
Web site: www.mda.state.mo.us/a2c.htm

For more information about the Clean Water Revolving Fund, or for a program representative in your State, please contact:

Clean Water State Revolving Fund Branch

U.S. Environmental Protection Agency

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Clean Water
State Revolving Fund

Clean Water

Everybody's Business

10 Things You Can Do to Prevent Stormwater Runoff Pollution

- Use fertilizers sparingly and sweep up driveways, sidewalks, and roads
- Never dump anything down storm drains
- Vegetate bare spots in your yard
- Compost your yard waste
- Avoid pesticides; learn about Integrated Pest Management (IPM)
- Direct downspouts away from paved surfaces
- Take your car to the car wash instead of washing it in the driveway
- Check car for leaks, and recycle motor oil
- Pick up after your pet
- Have your septic tank pumped and system inspected regularly

EPA United States Environmental Protection Agency

For more information, visit www.epa.gov/nps or www.epa.gov/npdes/stormwater

EPA
United States
Environmental Protection
Agency

EPA 841-F-03-003

Protecting Water Quality *from* URBAN RUNOFF

Clean Water Is Everybody's Business

In urban and suburban areas, much of the land surface is covered by buildings and pavement, which do not allow rain and snowmelt to soak into the ground. Instead, most developed areas rely on storm drains to carry large amounts of runoff from roofs and paved areas to nearby waterways. The stormwater runoff carries pollutants such as oil, dirt, chemicals, and lawn fertilizers directly to streams and rivers, where they seriously harm water quality. To protect surface water quality and groundwater resources, development should be designed and built to minimize increases in runoff.

The most recent National Water Quality Inventory reports that runoff from urbanized areas is the leading source of water quality impairments to surveyed estuaries and the third-largest source of impairments to surveyed lakes.

Did you know that because of impervious surfaces like pavement and rooftops, a typical city block generates more than 5 times more runoff than a woodland area of the same size?

How Urbanized Areas Affect Water Quality

Increased Runoff

The porous and varied terrain of natural landscapes like forests, wetlands, and grasslands traps rainwater and snowmelt and allows them to filter slowly into the ground. In contrast, impervious (nonporous) surfaces like roads, parking lots, and rooftops prevent rain and snowmelt from infiltrating, or soaking, into the ground. Most of the rainfall and snowmelt remains above the surface, where it runs off rapidly in unnaturally large amounts.

Storm sewer systems concentrate runoff into smooth, straight conduits. This runoff gathers speed and erosional power as it travels underground. When this runoff leaves the storm drains and empties into a stream, its excessive volume and power blast out streambanks, damaging streamside vegetation and wiping out aquatic habitat. These increased storm flows carry sediment loads from construction sites and other denuded surfaces and eroded streambanks. They often carry higher water temperatures from streets, roof tops, and parking lots, which are harmful to the health and reproduction of aquatic life.

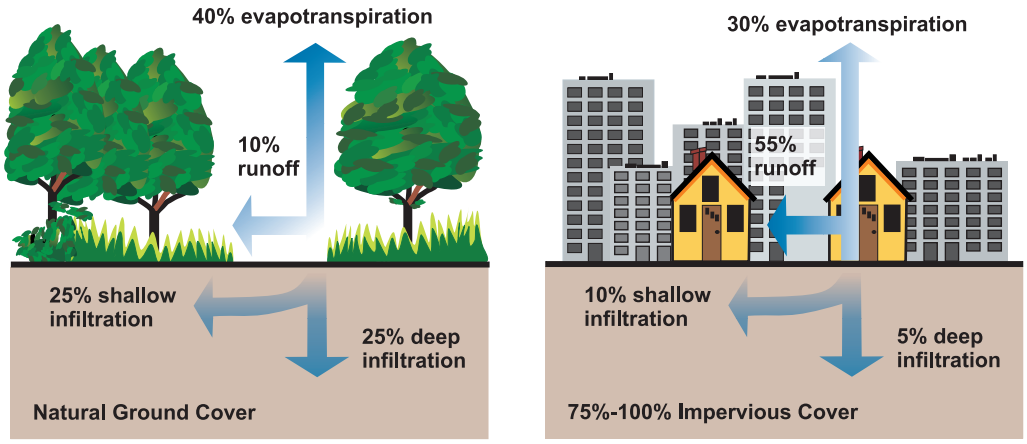
The loss of infiltration from urbanization may also cause profound groundwater changes. Although urbanization leads to great increases in flooding during and immediately after wet weather, in many instances it results in lower stream flows during dry weather. Many native fish and other aquatic life cannot survive when these conditions prevail.

Increased Pollutant Loads

Urbanization increases the variety and amount of pollutants carried into streams, rivers, and lakes. The pollutants include:

- Sediment
- Oil, grease, and toxic chemicals from motor vehicles
- Pesticides and nutrients from lawns and gardens
- Viruses, bacteria, and nutrients from pet waste and failing septic systems
- Road salts
- Heavy metals from roof shingles, motor vehicles, and other sources
- Thermal pollution from dark impervious surfaces such as streets and rooftops

These pollutants can harm fish and wildlife populations, kill native vegetation, foul drinking water supplies, and make recreational areas unsafe and unpleasant.



Relationship between impervious cover and surface runoff. Impervious cover in a watershed results in increased surface ruunoff. As little as 10 percent impervious cover in a watershed can result in stream degradation.

Managing Urban Runoff

What Homeowners Can Do

To decrease polluted runoff from paved surfaces, households can develop alternatives to areas traditionally covered by impervious surfaces. Porous pavement materials are available for driveways and sidewalks, and native vegetation and mulch can replace high maintenance grass lawns. Homeowners can use fertilizers sparingly and sweep driveways, sidewalks, and roads instead of using a hose. Instead of disposing of yard waste, they can use the materials to start a compost pile. And homeowners can learn to use Integrated Pest Management (IPM) to reduce dependence on harmful pesticides.

In addition, households can prevent polluted runoff by picking up after pets and using, storing, and disposing of chemicals properly. Drivers should check their cars for leaks and recycle their motor oil and antifreeze when these fluids are changed. Drivers can also avoid impacts from car wash runoff (e.g., detergents, grime, etc.) by using car wash facilities that do not generate runoff. Households served by septic systems should have them professionally inspected and pumped every 3 to 5 years. They should also practice water conservation measures to extend the life of their septic systems.

Controlling Impacts from New Development

Developers and city planners should attempt to control the volume of runoff from new development by using low impact development, structural controls, and pollution prevention strategies. Low impact development includes measures that conserve natural areas (particularly sensitive hydrologic areas like riparian buffers and infiltrable soils); reduce development impacts; and reduce site runoff rates by maximizing surface roughness, infiltration opportunities, and flow paths.

Controlling Impacts from Existing Development

Controlling runoff from existing urban areas is often more costly than controlling runoff from new developments. Economic efficiencies are often realized through approaches that target "hot spots" of runoff pollution or have multiple benefits, such as high-efficiency street sweeping (which addresses aesthetics, road safety, and water quality). Urban planners and others responsible for managing urban and suburban areas can first identify and implement pollution prevention strategies and examine source control opportunities. They should seek out priority pollutant reduction opportunities, then protect natural areas that help control runoff, and finally begin ecological restoration and retrofit activities to clean up degraded water bodies. Local governments are encouraged to take lead roles in public education efforts through public signage, storm drain marking, pollution prevention outreach campaigns, and partnerships with citizen groups and businesses. Citizens can help prioritize the clean-up strategies, volunteer to become involved in restoration efforts, and mark storm drains with approved "don't dump" messages.

Related Publications

Turn Your Home into a Stormwater Pollution Solution!
www.epa.gov/nps

This web site links to an EPA homeowner's guide to healthy habits for clean water that provides tips for better vehicle and garage care, lawn and garden techniques, home improvement, pet care, and more.

National Management Measures to Control Nonpoint Source Pollution from Urban Areas
www.epa.gov/owow/nps/urbanmm

This technical guidance and reference document is useful to local, state, and tribal managers in implementing management programs for polluted runoff. Contains information on the best available, economically achievable means of reducing pollution of surface waters and groundwater from urban areas.

Onsite Wastewater Treatment System Resources
www.epa.gov/owm/onsite

This web site contains the latest brochures and other resources from EPA for managing onsite wastewater treatment systems (OWTS) such as conventional septic systems and alternative decentralized systems. These resources provide basic information to help individual homeowners, as well as detailed, up-to-date technical guidance of interest to local and state health departments.

Low Impact Development Center
www.lowimpactdevelopment.org

This center provides information on protecting the environment and water resources through integrated site design techniques that are intended to replicate preexisting hydrologic site conditions.

Stormwater Manager's Resource Center (SMRC)
www.stormwatercenter.net

Created and maintained by the Center for Watershed Protection, this resource center is designed specifically for stormwater practitioners, local government officials, and others that need technical assistance on stormwater management issues.

Strategies: Community Responses to Runoff Pollution
www.nrdc.org/water/pollution/storm/stoinx.asp

The Natural Resources Defense Council developed this interactive web document to explore some of the most effective strategies that communities are using around the nation to control urban runoff pollution. The document is also available in print form and as an interactive CD-ROM.

For More Information

U.S. Environmental Protection Agency
Nonpoint Source Control Branch (4503T)
1200 Pennsylvania Avenue, NW
Washington, DC 20460

www.epa.gov/nps

February 2003

Stormwater Management

A Guide for Auto Recycler Owners and Operators

Only Rain in the Drain

Stormwater Protection
Starts With You

The facility operator's attitude toward stormwater management can make all the difference. It's your responsibility to communicate to your employees that stormwater management is a priority. Make sure your employees understand why stormwater management is important, both to your business and to the environment. Start by having them review the enclosed video and fact sheet.

Protecting stormwater can benefit your business in several important ways:

- **Professionalism and pride in your business** – Both workers and customers appreciate a clean and responsible facility.
- **It's the law** – Not complying with stormwater rules can put your business in jeopardy. Regulators and environmental groups across the country are increasingly targeting auto dismantlers for stormwater violations.
- **Environmental protection** – We all want clean streams, rivers, lakes, bays, and oceans for our families and for our future. Your business can protect the environment by following some straightforward and commonsense practices.

Protect the environment to protect your business

The following practices describe options that your facility can implement to help address its stormwater issues. Although following all of the practices described below may help improve performance with regard to stormwater management, it does not guarantee that your facility will be in compliance with all applicable stormwater rules. Check with your state regulatory agency or EPA for more information.

The Stormwater Permit

All vehicle dismantling facilities in the United States (except those in a combined sewer service area or facilities that do not discharge stormwater from their property) are required by the Clean Water Act to obtain a stormwater permit either from the U.S. Environmental Protection Agency or from an appropriate state agency. You must first file a Notice of Intent (NOI) with the appropriate state agency. You must also prepare a Storm Water Pollution Prevention Plan (SWPPP) to describe how you will address your facility's stormwater issues.

The practices below are organized by facility area or activity. Links and contact information to obtain additional information about stormwater and other environmental issues related to auto dismantling are listed at the end of this document.

What are Best Management Practices (BMPs)?

The term "BMP" is used to describe management practices that many different industries use to address a range of environmental issues. We'll use BMP to describe the practices that you can implement to address your auto dismantling facility's stormwater issues.

› Training

Employee training is critical! Train appropriate employees on relevant stormwater management procedures, especially during the wet season and prior to rain or snow events. All employees must be trained upon their initial hire and at least once per year thereafter. Be sure to document employee training. Also, place signs around activity areas as reminders to your workers; for example, "No fluids in the drain" or "Sweep up loose absorbent daily." Make up your own signs that make sense for your operation.

› Incoming Vehicles

Inspect all incoming vehicles for leaking fluids and unwanted materials as they enter your facility. Promptly contain leaks with drip pans or absorbent materials.

› Fluid Removal

Establish a procedure for processing vehicles and stick to it. First, before any vehicle is placed in the yard for long-term storage or crushed, and before fluid-containing parts are dismantled, drain the following fluids from the vehicle in the order that best fits your operation:

- Fuel
- Motor oil
- Transmission fluid
- Brake fluid
- Antifreeze
- Freon

Draining these fluids before placing the vehicle in the yard reduces 1) the possibility of spills when parts are removed later, and 2) time and cost to your business of cleaning up leaks and spills.

› Fluid Draining and Vehicle Dismantling Area

Ideally, these activities should be conducted in the same area, which should be covered with a roof. Your fluid draining and vehicle dismantling areas have more potential to contaminate stormwater than any other areas of your facility. Properly covering this area can eliminate contact with rainfall and is a great way to get a big bang for your buck in preventing stormwater pollution. Rain or snow can carry harmful materials like oil or gasoline into the soil and nearby streams, rivers, and lakes. Roofs not only keep out rain and snow, but also make the work area more comfortable for your workers.

If you don't currently dismantle fluid-containing parts and drain fluids under cover, you don't necessarily have to put up an entirely new and expensive building. One low-cost roofing option available is the "VersaTube" offered by Tuff Shed. (See http://www.tuffshed.com/versatube.htm or call (800) BUY-TUFF for more information.)

Another option includes building your own temporary cover using low-cost materials. Plans and materials for such temporary roofs can be obtained from vendors like South Bay Canopy (408) 998-8280.

You should also have a concrete pad in the draining and dismantling area, and you should drain all vehicles on this surface. Draining over concrete makes spills and leaks easier to clean up and minimizes the chance of environmental harm. Use appropriate fluid removal and handling equipment, such as suction systems, drain racks, and funnels for the containers.

Prevent stormwater pollution by minimizing the exposure of dismantling and fluid removal activities to stormwater. In addition to overhead cover, possible options include installing intercept trenches, berming the perimeter of the area, or using channels, swales, or grade breaks to divert the flow of stormwater around these areas.

› Fluid Storage

Storing fluids properly helps cut down on the amount of contaminants that end up in stormwater. When you remove fluids, transfer them to the proper container. Confine fluid storage to designated areas that are covered and have adequate secondary containment. Keep drums containing fluids away from storm drains; consider storing fluids near the location where fluids are drained. Maintain good integrity of all storage containers. Do not leave open drain pans that contain fluids around the shop.

You are responsible for ensuring that your fluids are handled by an authorized processor, transporter, and treatment/disposal facility.

› Spill Cleanup

Clean up spills promptly and thoroughly. Keep appropriately sized and stocked "spill kits" available in the areas where you conduct the following activities:

- Dismantling and fluid removal
- Fluid storage
- Battery and parts storage
- Fueling
- Equipment maintenance

For smaller spills, use shop rags and oil dry. Used absorbents should be placed in a designated container for proper disposal.

What should be in your spill kit?

- Absorbent socks or booms
- Absorbent pillows and pads
- Oil dry
- Broom and shovel
- Disposal bags or other containers
- Safety goggles
- Plastic gloves

- **Never use vehicle fluids for dust control!**
- **Don't mix your used oil with solvents, brake cleaner, or antifreeze.**
  This creates a hazardous waste, which can't be recycled and is very expensive to get rid of.
- **Don't pour fluids into your septic system, sanitary sewer, dry well, on the ground, or in the trash.**

› Parts Storage

Store engines, transmissions, and other oily parts (resale, core, or scrap) in a way that avoids exposure to rain or snowfall. This can include:

1) Storing parts indoors
2) Storing parts under a permanent roof on impervious surface
3) Storing parts in weather-proof, leak-proof, covered containers
4) Placing parts in vehicle bodies
5) Providing temporary cover (like tarps) for these parts as an interim measure

Lead acid battery components are toxic and corrosive and can contaminate the soil and water if handled improperly. Store batteries inside a building or outside in covered, non-leaking containers. Separate batteries from other wastes like paper, rags, garbage and flammable or hazardous chemicals. Monitor your battery storage area for leaks or deterioration, and take quick action to address any spills or leaks. Lime can be used to neutralize spilled battery acid. *Never pour battery acid on the ground or into a storm drain!*

Radiators removed from vehicles should be stored under a roof, tarp, or other cover, and raised up off the ground such that there is no contact with rainfall and surface drainage.

› Crushing

Never crush a vehicle without draining all the fluids and removing gas tanks, tires, and batteries. Capture and properly dispose of residual fluids released during crushing. You're responsible for ensuring fluids are captured and don't run off your property, even if you use a contractor to crush your vehicles.

› Vehicle Storage

If engines or fluid-containing parts remain in the vehicle when it is placed in the yard, place a hood or other cover, such as a well-secured tarp, over the vehicle engine. Use drip pans under stored vehicles with leaks.

Don't place vehicles on the ground where there is a heavy stormwater flow or close to a storm drain.

After vehicles are moved, scrape up dirt or gravel that was stained from leaks and drips. Manage the contaminated material in accordance with applicable regulations.

- Never wash spills into storm drains!
- Sweep up absorbent material and properly dispose at least daily.

› Equipment Maintenance

Schedule and perform periodic inspections of equipment. Regular maintenance of equipment such as forklifts reduces risk of breakdown and fluid release. Check for leaks and spills and for malfunctioning, worn, or corroded parts. Equipment maintenance should be done indoors or, where practical, on an impervious surface. If maintenance can't be done under cover, take adequate spill control and/or cleanup measures.

› Fueling

Pave refueling areas with concrete to prevent contamination of the soil and to enable cleanup. Don't leave vehicles unattended while fueling.

› Housekeeping

Sweep and clean paved surfaces daily to reduce sediment and contaminant buildup. Routine housekeeping is important. Catchments, inlets, oil-water separators, oil booms, waddles, tarps, and other pollutant-collecting materials need to be maintained regularly or they can become ineffective. Clean out drain inlets periodically, especially before the wet season, during the wet season, and after the wet season ends.

› Erosion Control

Tackle TSS! You may have heard of TSS or total suspended solids – in other words, dirt. Controlling the amount of dirt that runs off your property is important because metals and other harmful pollutants can attach themselves to the dirt particles and end up flowing off the property with stormwater. Eroded soil can also smother aquatic life.

Implement appropriate vegetative, structural, or stabilization measures such as basins, sediment traps, geotextiles, buffer strips, or filter berms in areas without much vegetation where soil erosion is evident.

› Non-Stormwater Discharges

Wash water from equipment, work areas, or shop floors cannot come into contact or mix with rainfall or surface drainage, or drain offsite. Vehicle and hand wash water is OK to be discharged to the sanitary sewer where allowed (be sure to check with your local sanitary sewer district). Most states prohibit all non-stormwater discharges from your property, including, but not limited to, discharges of wash water, rinse water and spilled fluids. If you are permitted to use sewers, make sure your drain is connected to the sanitary sewer. If this is not possible in your area, the wash water must be managed on-site. Management options include recycling, re-use, or off-site disposal. If you let the water soak into the ground (infiltration), take appropriate steps to prevent groundwater contamination and infestation by mosquitoes or other pests. For additional information consult your local regulatory agency.

- Residues from dried wash water cannot come into contact with rainfall or surface drainage.

- **Know where your drains go. Plug any floor drains that would let a spill run into septic systems or storm drains.**
  Automotive fluids and solvents can contaminate drinking water if they end up in drains that discharge to soil.

- Following washing, collect and clean up any accumulated sediments, oil deposits, debris, and paint particles.
- Do not steam clean or pressure wash parts without proper wash water management.
- Do not hose down the shop floor if water will run into a storm drain or off the property.

› Stormwater Filter Systems

Inexpensive filter systems or absorbents can provide an extra level of defense against stormwater pollution. Examples include: absorbent socks or booms, silt fences, straw bales, rock filters, and inlet filters. Regular maintenance of these products is essential – if they're not maintained, they won't work. Further, these measures are not a substitute for good stormwater management practices.

› Inspection

Inspect your site regularly to ensure all appropriate BMPs are being implemented. Increase inspections during periods of rainy weather. Based on permit or management needs, maintain a record of visual inspections.

Inspect oil containers, fresh water systems, irrigation lines, fueling areas, and other piping systems for leaks. If evidence of leaks is found, promptly repair or replace damaged parts to prevent polluted runoff and non-stormwater discharges.

› Customer Education

Inform customers who remove parts to do so properly and to appropriately dispose of fluids. For example, make fluid receptacles readily available, post signs that require the use of drip pans for parts removal, and prohibit waste generating activities like vehicle maintenance in parking lots.

Mercury Switches

Mercury switches are an important issue. Many older vehicles contain mercury, which is highly toxic and can cause learning disabilities and mental retardation in newborn children. When vehicles are crushed and mercury remains inside, it can get onto the ground and into waterways. Also, mercury can be released into the air and water bodies after scrapped vehicles go to the shredder.

What to do about mercury

Mercury switches are commonly found under vehicle hoods and trunks and less frequently in automatic braking systems (ABS). These switches can easily be removed to prevent contamination of the environment and human health problems.

Information on removing mercury from vehicles is available online at:

epa.gov/glnpo/bnsdocs/hgsbook/auto.pdf

epa.gov/region5/air/mercury/autoswitch.htm

switchout.ca

Some states require mercury switches to be removed before vehicles are crushed. Some auto dismantlers remove the switches even if they are not required to do so. If you choose to address this important environmental issue and remove mercury switches before your vehicles are crushed, store the switches in a leak-proof, clearly marked, closed container. Also take care to ensure that the switches do not break during handling or storage. A licensed metals recycler that reclaims mercury can dispose of the switches. Contact your state environmental agency for more information.

You
>> CAN <<
Make a Difference!

Auto recyclers do their part to conserve natural resources by recycling valuable materials. Build on this good work and protect the environment from polluted runoff by implementing the BMPs described in this fact sheet. Make sure that your employees understand that stormwater management is important and are trained to implement your BMPs.

Remember,
stormwater protection
starts with YOU!

"It's critical for owners to set an example and be actively involved in implementing BMPs." – Brian Werth, Select Auto & Truck Recyclers

Where to find more information

Check out the following sources for additional information on BMPs for auto recyclers:

Manuals

- An Environmental Compliance Workbook for Automotive Recyclers, Florida DEP
  www.dep.state.fl.us/central/home/ps/asyca/fl_gyb.pdf
- Environmental Compliance Guide for Motor Vehicle Salvage Yards, OH Small Bus. Assistance Office
  www.epa.state.oh.us/other/sbao/salvageguide.pdf
- Vehicle Recycling Manual: A Guide for Vehicle Recyclers, Washington State Department of Ecology
  www.ecy.wa.gov/pubs/97433.pdf
- Automotive Recyclers Guide to a Cleaner Environment, New York DEC
  www.dec.state.ny.us/website/reg8/press/autorec/autorec0.pdf
- Certified Auto Recycler (CAR) Guidance Manual, Automotive Recyclers Association
  www.autorecyc.org (Available to members only)

Other Sources

- The National Compliance Assistance Clearinghouse is your guide to compliance information on the Internet. It provides quick access to compliance tools and contacts from EPA and other compliance assistance providers. The clearinghouse has an entire section devoted to the auto salvage industry.
  cfpub.epa.gov/clearinghouse
- A list of state and local environmental contacts can be found on the internet at:
  www.epa.gov/epapages/statelocal/envrolst.htm
- The EPA Small Business Ombudsman can help you understand environmental regulations, or refer you to local contacts. Their toll-free small business hotline provides regulatory and technical assistance information: (800) 368-5888

Vendors

Call for catalogs or more information

Low-Cost Roofs:		**Fluid Removal and Storage Equipment**:		**Spill Kits and Absorbent Materials**:	
Tuff Shed	(800) BUY-TUFF	Hy-Tec Environmental	(800) 336-4499	Stormtech	(888) 549-5374
South Bay Canopy	(408) 998-8280	Spill Cleanup Direct	(800) 356-0783	New Pig	(800) 468-4647

Note: Sustainable Conservation and U.S. EPA do not endorse any of these products.
This list is not complete: other vendors may provide similar or identical products and services.

Developed by

Sustainable Conservation
www.suscon.org

Supervisión de la Precipitación Pluvial

Una Guía para los Dueños y Operadores de Recicladoras de Autos

La Protección de la Precipitación Pluvial Comienza Con Usted

La actitud del operador de la compañía hacia la supervisión de la precipitación pluvial puede hacer la diferencia. Es su responsabilidad comunicar a sus empleados que la supervisión de la precipitación pluvial es una prioridad. Asegúrese que sus empleados entiendan por qué es importante la supervisión de la precipitación pluvial tanto para su negocio como para el medio ambiente. Comienze mostrándoles el video y hoja informativa que aquí se adjuntan.

Proteger la precipitación pluvial puede beneficiar a su negocio de varias maneras importantes:

- **Profesionalismo y orgullo en su negocio** - Tanto los trabajadores como sus clientes aprecian una compañía limpia y responsable.
- **Es la ley** - El no cumplir con las normas de precipitación pluvial puede poner su negocio en juego. Los grupos reguladores y ambientalistas en todo el país estan enfocándose cada vez más en las desmanteladoras de autos por violaciones en cuanto a la precipitación pluvial.
- **Protección ambiental** - Todos queremos arroyos, ríos, lagos, bahías, y oceanos limpios para nuestras familias y nuestro futuro. Su compañía puede proteger el medio ambiente siguiendo algunas prácticas directas y de sentido común.

Proteja el medio ambiente para proteger a su negocio

Las siguientes prácticas describen opciones que su compañía puede aplicar para ayudarse a administrar lo relativo a la precipitación pluvial. Aunque el seguir todas las prácticas descritas abajo puede ayudar a mejorar el desempeño respecto a la supervición de la precipitación pluvial, ello no garantiza que su compañía estará en cumplimiento con todas las normas aplicables de la precipitación pluvial. Comuníquese con una agencia reguladora del estado o la EPA si desea más información.

El Permiso de precipitación pluvial

Todas las instalaciones desmanteladoras de vehículos en los Estados Unidos (excepto aquellas en una área de servicio de desagüe combinado o instalaciones que no desechen precipitación pluvial de su propiedad) están obligadas por la Ley de Agua Limpia (Clean Water Act) a obtener un permiso de precipitación pluvial, ya sea de la Agencia de Protección del Medio Ambiente de los EE.UU. o de una agencia estatal correspondiente. Usted primero debe archivar un Aviso de Intención (Notice of Intent, o N.O.I.) ante la agencia estatal correspondiente. También debe preparar un Plan de Prevención de Contaminación de la precipitación pluvial (SWPPP) para describir cómo es que su compañía administrará lo referente a la precipitación pluvial.

Las siguientes prácticas están organizadas por área o actividad de la compañía. Para referencias y contactos para obtener información adicional acerca de la precipitación pluvial y otros asuntos ambientales relacionados la desmantelación de vehículos, vea el final de este documento.

¿Cuáles son las prácticas de mejor manejo (BMPs)?

El término “BMP” es utilizado para describir prácticas de manejo que muchas diferentes industrias usan para dirigir un gran número de asuntos ambientales. Nosotros utilizaremos BMP para describir las prácticas que usted puede aplicar para administrar lo referente a la precipitación pluvial en su desmanteladora de autos.

Supervisión de la Precipitación Pluvial

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› La capacitación

¡La capacitación de los empleados es fundamental! Capacite a sus empleados en procedimientos referentes al manejo de la precipitación pluvial, especialmente durante la temporada de lluvia y nieve y antes de que éstas lleguen. Todos los empleados deben ser capacitados al inicio de su contratación y al menos una vez al año después de ella. Asegúrese de documentar la capacitación de sus empleados. También debe colocar letreros alrededor de las áreas de actividad con recordatorios para sus trabajadores. Por ejemplo, "Evite los fluidos en el drenaje" o "Barra diariamente el absorbente." Diseñe sus propios letreros que den sentido a su operación.

› Ingreso de vehículos

Inspeccione todos los vehículos de reciente ingreso por posibles fugas de fluidos y materiales no deseados, cuando vayan entrando a las instalaciones. Contenga rápidamente las fugas con charolas o materiales absorbentes.

› Extracción de fluidos

Establezca un procedimiento para procesar vehículos y apéguese a él. Primero, antes de que cualquier vehículo sea colocado en la yarda por un término largo de almacenamiento o para compactarse, y antes que se desmantelen las partes que contengan fluidos, extraiga los siguientes fluidos del vehículo, en el orden que mejor funcione para su operación:

- Combustible
- Aceite de motor
- Líquido de transmisión
- Líquido de frenos
- Anticongelante
- Gas freón

Extraer estos fluidos antes de colocar el vehículo en la yarda disminuye 1) la posibilidad de derrames cuando las partes son removidas posteriormente, y 2) el tiempo y costo requerido en su negocio para limpiar fugas y derrames.

› Área de extracción de fluidos y de desmantelamiento de vehículos

Lo ideal es que estas actividades se realicen en la misma área, la cual debe estar cubierta con un techo. Sus áreas de extracción de fluidos y de desmantelación de vehículos tienen mayor potencial de contaminar la precipitación pluvial que cualquier otra área de su compañía. El cubrir apropiadamente esta área puede eliminar el contacto con la caída de la lluvia y es una gran forma de economizar, al prevenir la contaminación de la precipitación pluvial. La lluvia y la nieve pueden acarrear materiales dañinos como aceite o gasolina al suelo y cerca de arroyos, ríos, y lagos. Los techos no solo

detienen la lluvia y la nieve, sino que también hacen el área de trabajo más cómoda para sus trabajadores.

Si usted no desmantela actualmente partes que contengan fluidos y extrae fluidos debajo de un techo, usted no necesariamente tiene que construir un edificio nuevo y costoso. Una opción disponible es el techo de bajo costo "Versa Tube" ofrecido por Tuff Shed. (Vea http://www.tuffshed.com/versatube.htm o llame (800) BUY TUFF para más información.) Otra opción incluye construir su propio techo temporal utilizando materiales de bajo costo. Puede obtener planos y materiales de dichos techos temporales de vendedores como South Bay Canopy (408) 998-8280.

Usted también debe tener una plataforma de concreto en el área de extracción y desmantelamiento, y dee drenar todos los vehículos sobre la superficie. El drenar sobre concreto hace que los derrames y fugas sean más fáciles de limpiar y minimiza la posibilidad de daño ambiental. Utilice equipo apropiado para la extracción y manejo de fluidos, tales como sistemas de succión, racas de drenaje y embudos para contenedores.

Prevenga la contaminación de la precipitación pluvial minimizando la exposición de las actividades de desmantelamiento y de extracción de fluidos a la precipitación pluvial. Además de un techo, otras opciones posibles incluyen instalar zanjas interceptoras, bordear el perímetro del área, o utilizar canales, o cortes para desviar el flujo de la precipitación pluvial fuera del alcance de estas áreas.

› Almacenamiento de fluidos

El almacenar los fluidos apropiadamente ayuda a reducir la cantidad de contaminantes que terminan en la precipitación pluvial. Cuando extraiga fluidos, colóquelos en el contenedor apropiado. Destine el almacenamiento de fluidos a áreas designadas que estén cubiertas y que tengan un adecuado contenimiento secundario. Mantenga los barriles que contengan fluidos alejados de los drenajes de agua; considere almacenar los fluidos cerca del área donde los fluidos son extraidos. Mantenga en buenas condiciones todos los contenedores de almacenamiento. No deje charolas abiertas que contengan fluidos alrededor del taller.

Usted es responsable de asegurarse que sus fluidos sean manejados por procesadores, transportistas, y compañías de tratamiento/desechos autorizados.

› Limpieza de derrames

Limpie los derrames rápida y completamente. Guarde kits para derrames, del tamaño apropiado, en todas las áreas donde realice las siguientes actividades:

- Desmantelamiento y extracción de fluidos
- Almacenamiento de fluidos
- Almacenamiento de baterías y partes
- Abastecimiento de combustible
- Mantenimiento de equipo

Para derrames menores utilice trapos y "oil dry". Los materiales absorbentes usados deberán colocarse en un contenedor designado para su desecho.

¿Qué debería haber en su kit para derrames?

- Tubos ("socks") absorbentes
- Cojines y almohadas absorbentes
- "Oil dry"
- Escoba y pala
- Lentes de seguridad
- Guantes de plástico
- Bolsas para desecho y otros contenedores

- **¡Nunca utilice fluidos de vehículo para controlar el polvo!**
- **No mezcle su aceite usado con solventes, limpiador de frenos, ni anticongelante.** Esto crea un desperdicio peligroso el cual no puede ser reciclado y es muy costoso deshacerse de él.
- **No vierta fluidos dentro del sistema séptico, el drenaje sanitario, los pozos, en la tierra, ni en la basura.**

› Almacenamiento de partes

Almacene motores, transmisiones, y otras partes grasosas (reventa, core, o chatarra) de forma que se evite la exposición a la lluvia o caída de nieve. Esto puede incluir:

1) Almacenar partes a puerta cerrada
2) Almacenar partes bajo un techo permanente sobre una superficie impenetrable
3) Almacenar partes en contenedores cubiertos a prueba del clima y de fugas
4) Colocar partes en las carrocerías de los vehículos
5) Proveer cobertura temporal (como lonas) para estas partes como medida alterna

Los componentes de la batería de acido de plomo son tóxicos y corrosivos y pueden contaminar el suelo y agua si son manejados incorrectamente. Almacene las baterías dentro o fuera de un edificio en contenedores cubiertos y sin fugas. Separe las baterías de otros desperdicios como el papel, trapos, basura y químicos inflamables o peligrosos. Monitoree su área de almacenamiento de baterías por posibles fugas o deterioraciones, y tome acción rapida para evitar cualquier derrame o fuga. La cal puede utilizarse para neutralizar el acido de batería derramado. *¡Nunca vierta acido de batería en la tierra o dentro del drenaje de agua!*

Los radiadores extraidos de los vehículos deben almacenarse bajo techo, lona, u otro cobertizo, y a cierta altura del suelo de tal manera que no haya contacto con la lluvia o el drenaje de la superficie.

› Compactación

Nunca compacte un vehículo sin haber extraido todos los fluidos y quitado los tanques de gasolina, las llantas y las baterías. Contenga y deseche apropiadamente los residuos de fluidos que escurran mientras se está compactando. Usted es responsable de asegurarse que se contangan todos los fluidos y que no escurran fuera de su propiedad, aún si compacta sus vehículos a través de un contratista.

› Almacenamiento de vehículos

En caso de que haya motores o partes que contengan fluidos dentro del vehículo cuando éste se coloque en la yarda, coloque un cofre u otro cobertor tal como una lona bien asegurada sobre el motor del vehículo. Coloque charolas debajo de los vehículos que tengan fugas. No ponga vehículos en la tierra donde haya una corriente fuerte de precipitación pluvial o cerca de un drenaje. Después de que los vehículos sean retirados, levante la tierra o grava que ha sido manchada por fugas y goteos. Maneje el material contaminado de acuerdo con las regulaciones correspondientes.

- **¡Nunca dirija derrames hacia los drenajes!**
- **Barra el material absorbente y deséchelo apropiadamente al menos una vez al día.**

› Mantenimiento del equipo

Programe y realice inspecciones periódicas del equipo. El mantenimiento regular del equipo, tal como los montacargas, reduce el riesgo de que se descomponga y que tire fluidos. Revise por posibles fugas y derrames, el mal funcionamiento, desgaste, o partes corroídas. El mantenimiento del equipo debe hacerse en un lugar cerrado o, cuando sea práctico, en una superficie impenetrable. Si el mantenimiento no puede hacerse bajo techo, tome medidas adecuadas de control de derrames y/o limpieza.

› Abastecimiento de combustible

Pavimente las áreas de abastecimiento de combustible con concreto para prevenir la contaminación del suelo y facilitar la limpieza. No deje los vehículos sin atender mientras se estén cargando de combustible.

› Mantenimiento

Barra y limpie las superficies pavimentadas diariamente para reducir la sedimentación y acumulación de contaminantes. El mantenimiento como rutina es importante. Recipientes, zanjas, separadores de agua/aceite, repelentes de aceite, lonas, y demas materiales para retener contaminantes deben recibir mantenimiento regular o pueden llegar a ser ineficaces. Limpie las zanjas de drenaje periódicamente, antes, durante y después de la temporada de lluvias.

› Control de la erosión

¡Elimine los TSS! Quizás haya oído hablar de los TSS o sólidos totalmente suspendidos: en otras palabras, la tierra. Controlar la cantidad de tierra que se escurre fuera de su propiedad es importante porque los metales y otros contaminantes dañinos pueden adherirse a las particulas de tierra y terminar escurriéndose fuera de la propiedad hacia la precipitación pluvial. El suelo erosionado puede también extinguir la vida acuática.

Tome medidas adecuadas en cuanto a la vegetación, estructuración o estabilización, tales como desagües, retenedores de sedimentación, geotextiles, o bordos de filtración en áreas sin mucha vegetación, donde la erosión del suelo es evidente.

› Los escurrimientos que no provienen de la precipitación pluvial

El agua para lavar equipo, áreas de trabajo, o pisos del taller no puede entrar en contacto o mezclarse con la lluvia o el drenaje superficial ni el drenaje común. El agua para lavarse las manos o lavar vehículos puede descargarse en el drenaje sanitario donde sea permitido (asegúrese de contactar a su distrito local de drenaje sanitario). La mayoría de los estados prohiben los escurrimientos de su propiedad que no provengan de la precipitación pluvial, incluyendo, pero sin limitarse a, los escurrimientos de agua para lavar, para enjuagar y de fluidos derramados. Si usted tiene permiso para usar drenajes, asegúrese que su drenaje esté conectado al drenaje sanitario. Si esto no es posible en su área, el agua para lavar debe ser manejada dentro de su propiedad. Las opciones de manejo incluyen el reciclaje, el reuso o su desecho fuera de la propiedad. Si usted deja que el agua se acumule en la tierra (filtración), tome los pasos adecuados para prevenir contaminación en la tierra o que se infeste con mosquitos u otras plagas. Para información adicional consulte su agencia reguladora local.

- Los residuos secos del agua para lavar no pueden entrar en contacto con la lluvia o drenaje de la superficie.

- **Usted debe saber hacia dónde están dirigidos sus drenajes. Tape cualquier drenaje en el suelo que pudiera dejar escurrir un derrame hacia un sistema séptico o drenaje de agua.**
  Los fluidos y solventes de los autómoviles pueden contaminar el agua potable si caen en drenajes que se descargan sobre el suelo.

- Después de lavar, recoja y limpie cualquier sedimentación acumulada, depósitos de aceite, chatarra, y partículas de pintura.
- No lave partes a vapor o a presión sin el manejo apropiado del agua para lavar.
- No lave el piso del taller con manguera si el agua va a escurrir hacia el drenaje o fuera de la propiedad.

› Sistemas de filtración de la precipitación pluvial

Los sistemas de filtración no costosos o absorbentes pueden ofrecer un nivel de defensa adicional contra la contaminación de la precipitación pluvial. Algunos ejemplos incluyen: tubos absorbentes, cercos, pacas de paja, filtros de roca, y zanjas para filtrar. El mantenimiento regular de estos productos es esencial: si no reciben mantenimiento, no van a funcionar. Además, estas medidas no sustituyen a las prácticas del buen manejo de la precipitación pluvial.

› Inspección

Inspeccione sus instalaciones con regularidad para asegurarse que se estén aplicando todas las BMPs correctas. Aumente las inspecciones durante los periodos de clima lluvioso. Basándose en el permiso o necesidades de supervisión, mantenga un registro de las inspecciones visuales. Inspeccione los contenedores de aceite, los sistemas de agua fresca, las líneas de irrigación, las áreas de abastecimiento de combustible, y demás sistemas de tuberías por posibles fugas. Si existe evidencia de alguna fuga, repárela rápidamente o reemplace las partes dañadas para prevenir escurrimientos contaminados y descargas de agua que no provengan de la precipitación pluvial.

› Educación de los clientes

Notifique a sus clientes que sustraen partes que lo hagan correctamente y que desechen los fluidos debidamente. Por ejemplo, coloque recipientes para fluidos a disposición de los clientes, coloque letreros que requieran el uso de charolas para quitar partes, y prohiba actividades que generen desperdicios, como el dar mantenimiento a vehículos en el estacionamiento.

Switches de mercurio

Los switches o interrruptores de mercurio son un aspecto importante. Muchos vehículos viejos contienen mercurio, el cual es altamente tóxico y puede causar discapacidades del aprendizaje y el retardo mental en niños recién nacidos. Cuando los vehículos son compactados y el mercurio se mantiene adentro, éste puede caer en el suelo y en las corrientes de agua. El mercurio también puede esparcirse en el aire y en los mantos acuíferos después de que los vehículos compactados van a la cortadora.

Puede obtener información acerca de como remover el mercurio de los vehículos por el internet en:

epa.gov/glnpo/bnsdocs/hgsbook/auto.pdf

epa.gov/region5/air/mercury/autoswitch.htm

switchout.ca

Qué hacer acerca del mercurio

Los switches de mercurio se hayan normalmente debajo de los cofres y cajuelas de los vehículos y menos frecuentemente en sistemas de frenado automático (ABS). Estos switches se pueden extraer antes de compactar los vehículos. Algunas desmanteladoras de autos quitan los switches aunque no se les requiera. Si usted decidiera participar en este importante aspecto ambiental y removiera los switches de mercurio antes de compactar sus vehículos, debe almacenar los switches en un contenedor cerrado claramente marcado y a prueba de fugas. También asegúrese de que los switches no se quiebren cuando se manejen o almacenen. Una recicladora de metales con licencia que recolecte mercurio puede desechar los switches. Contacte a su agencia ambiental del estado si desea más información.

¡Usted
>> PUEDE <<
Hacer la Diferencia!

Las recicladoras de autos hacen su labor para conservar los recursos naturales al reciclar materiales valiosos. Coopere en esta buena labor y proteja al medio ambiente de los escurrimientos contaminados, aplicando las BMPs descritas en este documento. Asegúrese que sus empleados entiendan que el manejo de la precipitación pluvial es importante y que se les capacite para aplicar las BMPs.

Recuerde, ¡la protección de la precipitación pluvial

Comienza con USTED!

"Es fundamental para los propietarios poner el ejemplo y participar activamente en la aplicación de las BMPs."

— Brian Werth, Select Auto & Truck Recyclers

Dónde puede encontrar más información

Consulte las siguientes fuentes si desea más información acerca de las BMPs para recicladoras de autos:

Manuales

- An Environmental Compliance Workbook for Automotive Recyclers, Florida DEP
  www.dep.state.fl.us/central/home/ps/asyca/fl_gyb.pdf
- Environmental Compliance Guide for Motor Vehicle Salvage Yards, OH Small Bus. Assistance Office
  www.epa.state.oh.us/other/sbao/salvageguide.pdf
- Vehicle Recycling Manual: A Guide for Vehicle Recyclers, Washington State Department of Ecology
  www.ecy.wa.gov/pubs/97433.pdf
- Automotive Recyclers Guide to a Cleaner Environment, New York DEC
  www.dec.state.ny.us/website/reg8/press/autorec/autorec0.pdf
- Certified Auto Recycler (CAR) Guidance Manual, Automotive Recyclers Association
  www.autorecyc.org (Disponible para miembros solamente)

Otras fuentes

- La National Compliance Assistance Clearinghouse es su guía sobre cómo obtener información acerca de los requerimientos por el internet. Ésta le proporciona al rápido acceso a las herramientas requeridas y los contactos de la EPA y de otros proveedores de asistencia en cuanto a los requerimientos. Dicha agencia tiene una sección entera dedicada a la industria del salvamento de autos. http://cfpub.epa.gov/clearinghouse
- Puede hallar una lista de contactos ambientalistas del estado y locales por el internet en:
  epa.gov/epapages/statelocal/envrolst.htm
- El EPA Small Business Ombudsman le puede ayudar a comprender las regulaciones ambientales, o proporcionarle contactos locales. La línea libre de cobro para pequeños empresarios provee información sobre asistencia regulatoria y técnica: (800) 368 5888.

Información sobre vendedores

Techos de bajo costo:

Tuff Shed	(800) BUY-TUFF
South Bay Canopy	(408) 998-8280

Extracción de fluidos y equipo de almacenamiento:

Hy-Tec Environmental	(800) 336-4499
Spill Cleanup Direct	(800) 356-0783

Kits para derrames y materiales absorbentes:

Stormtech	(888) 549-5374
New Pig	(800) 468-4647

Nota: Sustainable Conservation y U.S. EPA no endosa ninguno de estos productos.
Esta lista no esta completa: otros vendedores pueden proveer productos y servicios similares o idénticos.

Creado por
Sustainable Conservation
www.suscon.org

Clean Water State Revolving Fund

FACT SHEET

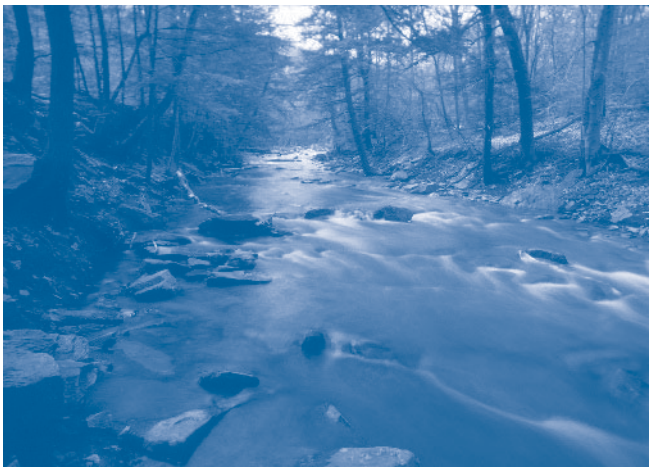
Cleaning Up Polluted Runoff with the Clean Water State Revolving Fund

What's In It For You?

The Clean Water State Revolving Fund (CWSRF) program has become a major source of funding to address polluted runoff. To date, 30 of the 51 CWSRF programs have provided funding for nonpoint source and estuary protection projects. Today annual funding to address polluted runoff exceeds $200 million. CWSRF loans are issued at below market rates (zero percent to less than market), offering borrowers significant savings over the life of the loan.

History

In creating the CWSRF program, Congress ensured that it would be able to fund most types of water quality projects, including nonpoint source, wetlands, estuary, and other types of watershed projects, as well as more traditional municipal wastewater treatment systems. The CWSRF program provisions in the Clean Water Act give no more preference to one category or type of project than any other.



Capacity of the CWSRF

The 51 CWSRF programs work like banks (each state and Puerto Rico has one). Federal and state contributions are used to capitalize or set-up the programs. These assets are used to make low-interest loans for important water quality projects. Repaid funds are then recycled to fund other important water quality projects.

The CWSRF programs have in excess of $42 billion in assets and average funding for the past three years exceedes $4 billion annually. The funding of polluted runoff projects with the CWSRF is gaining momentum. Since 1989, the CWSRF program has funded 3,400 projects, investing more than $1.6 billion in polluted runoff projects.

Who May Qualify?

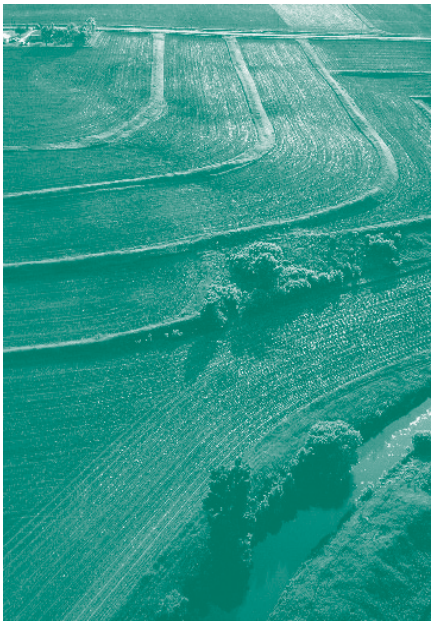
Included in a long list of eligible loan recipients are communities, citizens groups, businesses, farmers, homeowners, watershed groups, and nonprofit organizations. Since the program is managed largely by the states, project eligibility may vary according to the priorities within each state. Contact your state's CWSRF program for details.

Polluted Runoff and the CWSRF

The CWSRF can fund virtually any type or category of polluted runoff that is included in a state approved nonpoint source (NPS) management plan.

Polluted runoff occurs when rainfall, snowmelt, or irrigation runs over land or through the ground, picks up pollutants, and deposits them into surface or ground

water. For instance, polluted runoff from agricultural sources is the leading contributor to water quality impairments in rivers, degrading over 60% of impaired river miles.



Terraces, conservation tillage and conservation buffers save soil and improve water quality

Here are a few actual project examples from states that demonstrate what the CWSRF can do:

- **California -** Stormwater management facilities, including sediment basins and constructed wetlands. Purchasing easements for wetland protection
- **Delaware -** Animal waste management facilities, including manure storage facilities and dead chicken composters
- **Massachusetts -** Septic system improvements and replacement
- **Minnesota -** Agricultural best management practices (BMPs) to prevent and reduce runoff. Purchasing conservation tillage equipment and implementing soil erosion controls
- **New York** - Purchasing land and easements for source water protection projects
- **Washington -** Rehabilitation of streambanks, riparian corridors and buffers
- **Wisconsin** - Water protection and improvement projects on brownfield redevelopment sites
- **Wyoming -** Removal of leaking underground storage tanks and remediation of contaminated ground water and soil

State of the art lagoon animal waste management system

These are just a sample of the projects that have been funded. Contact your state or visit the CWSRF web site for more examples and information **(www.epa.gov/owm/cwfinance/index.htm)**

Benefits of Loans

First, Funds are Available. CWSRF loans can usually be obtained much faster than grants and each year over $200 million is spent on nonpoint source projects.

Second, No Cash Up-Front. Most grant programs require significant cost shares (as much as 40 percent or more). A CWSRF loan can cover 100 percent of project costs with no cash up-front.

Third, Significant Cost Savings. CWSRF loans provide significant cost savings over the life of the loan. The total cost of a zero percent CWSRF loan will be approximately 50 percent less than the same project financed by a commercial loan at 7.5 percent.

Fourth, Loans can Complement other Funding Sources. It may be possible to combine a CWSRF loan with grant dollars from other sources. Check with your state.

Sources of Repayment

Many users of the CWSRF program have demonstrated a high level of creativity in developing sources of repayments. The source of repayment need not come from the project itself. Some possible sources include:

- Fees paid by property owner or homeowner
- Fees paid by a developer
- Dedicated portion of local, county, or state taxes or fees
- Recreational fees (fishing license, park entrance fees)
- Stormwater management fees
- Wastewater user charges
- Donations or dues made to nonprofit groups
- Business revenues

Making Funding Accessible - Ohio Examples

The state of Ohio employs several innovative funding methods to ensure a variety of watershed projects receive funding. Two unique funding methods used in Ohio are the Linked-Deposit Loan Program and the Watershed Resource Restoration Sponsorship Program (WRRSP). In both examples the state shows creativity by taking existing institutional arrangements and modifying them to achieve the state's goals and meet the needs of loan recipents.

Linked Deposit Lending Program

In Ohio's linked-deposit program, the state makes arrangements with local banks to provide loans for agricultural BMPs and on-site wastewater treatment projects. Under a linked-deposit arrangement the state agrees to buy a bank's investment (CD) and receive a lower than market rate of return on the investment. The bank agrees to provide reduced interest rate loans for eligible projects. The linked-deposit loan interest rate reflects the difference between the state's reduced rate of return on the investment and the market rate of return.

The linked-deposit approach benefits CWSRF programs because they support high priority nonpoint source projects and because they place risk and management responsibilities with local financial institutions. Financial institutions earn profits from the linked deposit agreements and add an additional service for their customers. Borrowers find linked deposit programs to be economical and comfortable; they save money with low-interest loans, and they are comfortable working with local financial institutions.

For more information on linked-deposit loans see EPA's Activity Update ***"Innovative Use of Clean Water State Revolving Funds for Nonpoint Source Pollution"*** (EPA 832-F-02-004) found on the CWSRF web site.

Watershed Resource Restoration Sponsorship Program (WRRSP)

The WRRSP offers communities very low interest rates on loans for wastewater treatment plant improvements if the communities also sponsor projects that protect or restore water resources. The end payment for the wastewater treatment plant project is the same because of the lower interest rate and the simultaneous funding for the restoration project by the wastewater treatment plant. The benefit of this program is water restoration projects that normally would not receive funding are completed with the help of the wastewater treatment plants.

To date, the WRRSP program has supported projects that have acquired wetlands and riparian lands, acquired conservation easements, restored habitat, and removed dams.

Over the past two years under the WRRSP, communities in Ohio have used $24 million of CWSRF loan funds to protect and restore 1850 acres of riparian lands and wetlands and 38 miles of Ohio's stream corridors.

For more information on Ohio's WRRSP see EPA's Activity Update ***"Ohio's Restoration Sponsor Program Integrates Point Source and Nonpoint Source Projects"*** (EPA 832-F-02-001) found on the CWSRF web site.

Challenges Ahead

With increasing emphasis on watershed-based program management and implementation of Total Maximum Daily Loads (TMDLs) in impaired water bodies, it will be even more important to take advantage of the tremendous buying power of the CWSRF program.

How to Get More From the CWSRF

- Share information on polluted runoff priorities with CWSRF managers
- Work to enhance CWSRF programs to include funding of polluted runoff projects
- Become involved in the annual CWSRF planning and priority setting process
- Help market the program and encourage loan applications

The water quality community needs to work together to increase understanding of polluted runoff issues and facilitate the use of the powerful resources of the CWSRF to address these significant problems. EPA has been encouraging the states to open their CWSRFs to the widest variety of water quality projects and to use their CWSRFs to fund the highest priority projects in targeted watersheds. Those interested in cleaning up polluted runoff must seek out their CWSRF programs, gain an understanding of how their state program works, and participate in the annual process that determines which projects are funded.

For more information about the Clean Water Revolving Fund, or for a program representative in your State, please contact:

Clean Water State Revolving Fund Branch

U.S. Environmental Protection Agency

1200 Pennsylvania Avenue, NW (Mailcode 4204M)

Washington, DC 20460

Phone: (202) 564-0752 **Fax:** (202) 501-2403

Internet: www.epa.gov/owm/cwfinance/index.htm

Clean Water
State Revolving Fund

What is WaterSense?

WaterSense is a voluntary public-private partnership program sponsored by the U.S. Environmental Protection Agency. Its mission is to protect the future of our nation's water supply by promoting and enhancing the market for water-efficient products and services.

www.epa.gov/watersense

U.S. EPA WaterSense

5 Simple Ways to Save Water

United States Environmental Protection Agency
(4204M)

EPA-832-F-06-007
May 2006
www.epa.gov/watersense

Saving water is simple and smart.

1 Be smart when irrigating your lawn or landscape.

- Water the lawn or garden during the coolest part of the day. Early morning is best.
- Water plants according to their water needs; you'll have healthier plants and a lower water bill.
- Set sprinklers to water lawns and gardens only—not the street or sidewalk.
- Use soaker hoses or trickle irrigation systems for trees and shrubs.

2 Use your appliances wisely.

- Wash only full loads or set small loads to the appropriate water level.
- Scrape rather than rinse dishes before loading them into the dishwasher.
- Replace old clothes washers with ENERGY STAR qualified appliances that use less water.

3 Don't flush your money down the drain/Toilets.

- A leaky toilet can waste 200 gallons of water per day. Check your toilet for leaks by adding food coloring to the tank. If the toilet is leaking, color will appear in the bowl within 15 minutes. Look for worn out, corroded or bent parts in the leaky toilet. Most replacement parts are inexpensive, readily available and easily installed. (Flush as soon as test is done, since food coloring may stain the tank.)
- When replacing your toilet, look for high-efficiency models that use less than 1.3 gallons per flush.

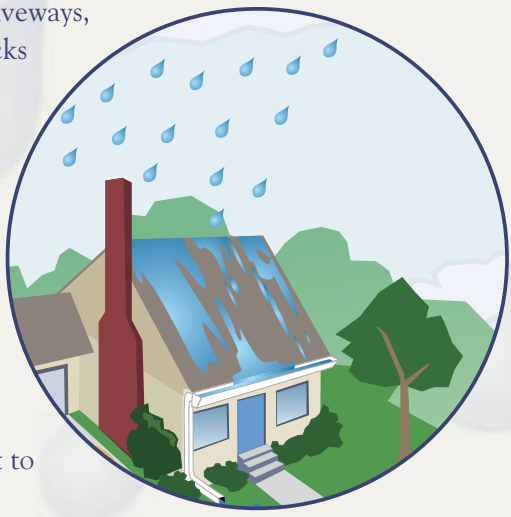
4 Conserve around the house.

- Keep drinking water in the refrigerator instead of letting the faucet run until cool. A running tap can use about 2 gallons of water per minute.
- Try not to leave the tap running while you brush your teeth or shave.
- Don't pour water down the drain if you can use it for other projects such as watering a plant or cleaning.

5 Stop those leaks.

- Verify that your home is leak-free. Many homes have hidden water leaks that can waste more than 10 percent, costing both you and the environment. Read your water meter before and after a two-hour period where no water is being used. If the meter does not read exactly the same, you probably have a leak.
- Repair dripping faucets and showers. If your faucet is dripping at the rate of one drop per second, you can expect to waste 2,700 gallons per year. This waste will add to the cost of water and sewer utilities or strain your septic system.

As stormwater flows over driveways, lawns, and sidewalks, it picks up debris, chemicals, dirt, and other pollutants. Stormwater can 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. Polluted runoff is the nation's greatest threat to clean water.



By practicing healthy household habits, homeowners can keep common pollutants like pesticides, pet waste, grass clippings, and automotive fluids off the ground and out of stormwater. Adopt these healthy household habits and help protect lakes, streams, rivers, wetlands, and coastal waters. Remember to share the habits with your neighbors!

Healthy Household Habits for Clean Water

Vehicle and Garage

- Use a commercial car wash or wash your car on a lawn or other unpaved surface to **minimize** the amount of dirty, soapy water flowing into the storm drain and eventually into your local waterbody.

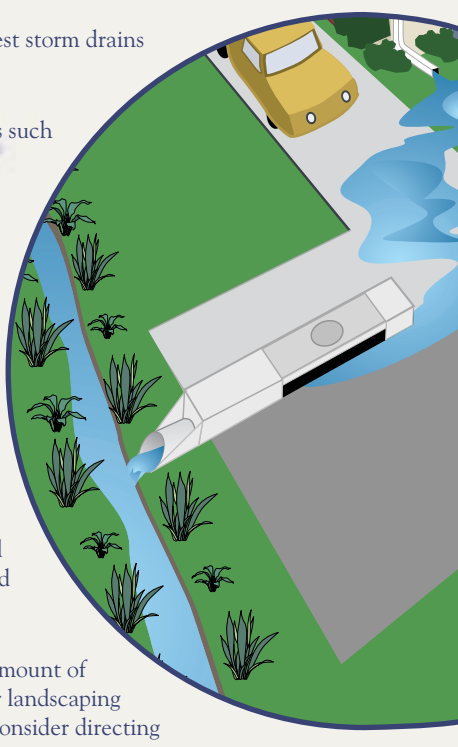
- Check your car, boat, motorcycle, and other machinery and equipment for leaks and spills. Make repairs as soon as possible. Clean up **spilled fluids** with an absorbent material like kitty litter or sand, and don't rinse the spills into a nearby storm drain. Remember to properly dispose of the absorbent material.
- **Recycle** used oil and other automotive fluids at participating service stations. Don't dump these chemicals down the storm drain or dispose of them in your trash.

Lawn and Garden

- Use pesticides and fertilizers **sparingly**. When use is necessary, use these chemicals in the recommended amounts. Avoid application if the forecast calls for rain; otherwise, chemicals will be washed into your local stream.
- Select **native** plants and grasses that are drought- and pest-resistant. Native plants require less water, fertilizer, and pesticides.
- **Sweep up** yard debris, rather than hosing down areas. Compost or recycle yard waste when possible.
- Don't overwater your lawn. Water during the **cool** times of the day, and don't let water run off into the storm drain.
- Cover piles of dirt and mulch being used in landscaping projects to prevent these pollutants from blowing or washing off your yard and into local waterbodies. **Vegetate** bare spots in your yard to prevent soil erosion.

Home Repair and Improvement

- Before beginning an outdoor project, locate the nearest storm drains and **protect** them from debris and other materials.
- **Sweep up** and properly dispose of construction debris such as concrete and mortar.
- Use hazardous substances like paints, solvents, and cleaners in the **smallest amounts possible**, and follow the directions on the label. Clean up spills **immediately**, and dispose of the waste safely. Store substances properly to avoid leaks and spills.
- Purchase and use **nontoxic**, **biodegradable**, **recycled**, and **recyclable** products whenever possible.
- **Clean** paint brushes in a sink, not outdoors. Filter and reuse paint thinner when using oil-based paints. Properly dispose of excess paints through a household hazardous waste collection program, or donate unused paint to local organizations.



- **Reduce** the amount of paved area and increase the amount of vegetated area in your yard. Use native plants in your landscaping to reduce the need for watering during dry periods. Consider directing downspouts away from paved surfaces onto lawns and other measures to increase infiltration and reduce polluted runoff.

Pet Care

- 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.

Swimming Pool and Spa

- **Drain** your swimming pool only when a test kit does not detect chlorine levels.
- Whenever possible, drain your pool or spa into the **sanitary** sewer system.
- Properly store pool and spa chemicals to **prevent** leaks and spills, preferably in a covered area to avoid exposure to stormwater.

Septic System Use and Maintenance

- Have your septic system **inspected** by a professional at least every 3 years, and have the septic tank **pumped** as necessary (usually every 3 to 5 years).
- Care for the septic system drainfield by **not** driving or parking vehicles on it. Plant only grass over and near the drainfield to avoid damage from roots.
- Flush responsibly. Flushing household chemicals like paint, pesticides, oil, and antifreeze can **destroy** the biological treatment taking place in the system. Other items, such as diapers, paper towels, and cat litter, can **clog** the septic system and potentially damage components.

Storm drains connect to waterbodies!

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EPA 833-B-03-003
January 2003

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Celebrate Recommitment

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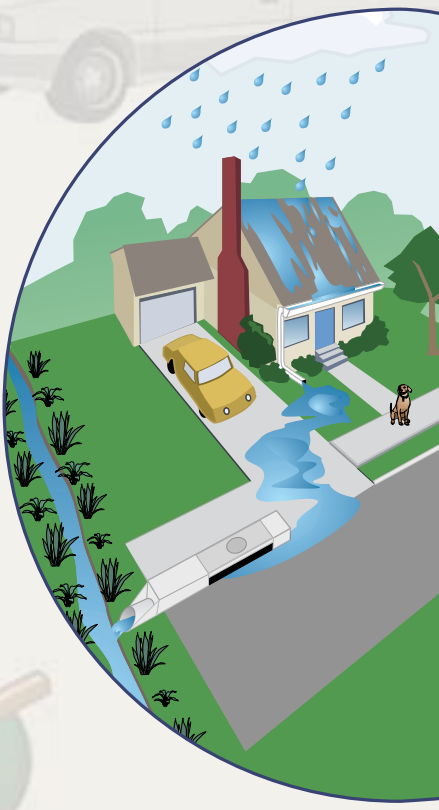
Make your home

The

SOLUTION TO STORMWATER POLLUTION!

A homeowner's guide to healthy habits for clean water



EPA United States Environmental Protection Agency

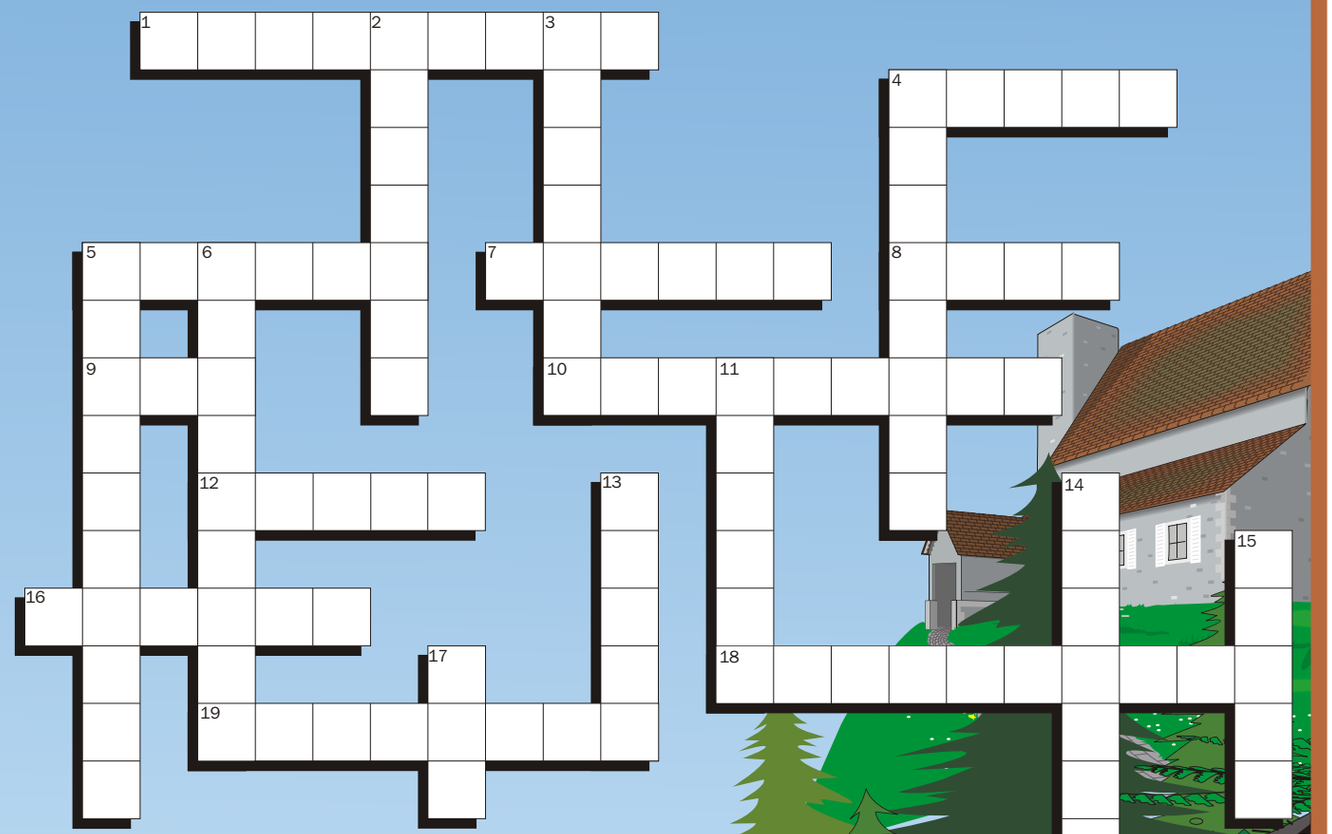
Take the Stormwater Runoff Challenge

Across:

1) The area of land that drains into an estuary, lake, stream, or groundwater is known as a _____.
4) The _____ of speeding boats can erode shorelines.
5) Maintaining your _____ tank will help to prevent bacteria and nutrients from leaking into groundwater and surface waters.
7) Wetland plants act like a natural water _____, removing harmful pollutants from stormwater runoff.
8) Leave your grass clippings on your _____ to reduce the need for commercial fertilizers.
9) A single quart of motor _____, if disposed of improperly, can pollute 2 million gallons of water.
10) Fertilizers and animal wastes contain _____ that "feed" algae and other aquatic plants harmful to water quality.
12) Polluted runoff from both rural and _____ sources has a significant impact on water quality.
16) Storm _____ don't always connect to sewage treatment plants, so runoff can flow directly to rivers, lakes, and coastal waters.
18) Follow directions carefully when applying _____ on your lawn—more isn't always better.
19) Polluted runoff (also called_____ source pollution) comes from so many places that it's hard to "pinpoint" a source.
20) Yard and vegetable food waste are suitable additions to a _____ pile.

Down:

2) Don't dump used motor oil into storm drains. _____ it!
3) _____ of soil from barren land can cloud nearby streams.
4) _____ prevent flooding, improve water quality, and provide habitat for waterfowl, fish, and wildlife.
5) Marking "Do Not Dump, Drains to Bay" on a _____ is one way to educate people about polluted runoff.
6) Excess sediment, nutrients, toxics, and pathogens are all types of runoff _____.
11) Polluted _____ is the nation's #1 water quality problem.
13) The cattail is one wetland _____ that helps purify polluted runoff.
14) Too much _____ in water can harm aquatic life.
15) Proper crop and animal management on _____ helps to control water pollution.
17) _____ impact development helps control stormwater pollution through conservation approaches and techniques.



Choices:

compost	nonpoint	sediment
drains	nutrients	septic
erosion	oil	storm drain
farms	plant	urban
fertilizer	pollution	wakes
filter	recycle	watershed
lawn	runoff	wetlands
Low		

EPA United States Environmental Protection Agency

For more information, please visit EPA's Polluted Runoff web site at www.epa.gov/nps

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Water-Efficient Landscaping:

Preventing Pollution & Using Resources Wisely

A Message from the Administrator

Christine Todd Whitman

I believe water is the biggest environmental issue we face in the 21st Century in terms of both quality and quantity. In the 30 years since its passage, the Clean Water Act has dramatically increased the number of waterways that are once again safe for fishing and swimming. Despite this great progress in reducing water pollution, many of the nation's waters still do not meet water quality goals. I challenge you to join with me to finish the business of restoring and protecting our nation's waters for present and future generations.

United States Environmental Protection Agency
Office of Water (4204M)
EPA832-F-02-002
September 2002
www.epa.gov/owm/water-efficiency/index.htm

Contents

What is Water-efficient Landscaping?

Water, many agree, is our most precious natural resource; without it, life ceases. Yet judging by our water use and consumption practices, many of us in the United States seem to take it for granted. A typical household uses approximately 260 gallons of water per day. "Water conscious" individuals often install high-efficiency shower heads and toilets and wash only full loads of clothes and dishes to reduce consumption. But in the summer, the amount of water used outdoors by a household can exceed the amount used for all other purposes in the entire year. This is especially true in hot, dry climates.

Gardening and lawn care account for the majority of this seasonal increase, but other outdoor activities, such as washing cars and filling swimming pools, also contribute. According to the U.S. Geological Survey, of the 26 billion gallons of water consumed daily in the United States[1], approximately 7.8 billion gallons, or 30 percent[2], is devoted to outdoor uses. The majority of this is used for landscaping. In fact, it is estimated that the typical suburban lawn consumes 10,000 gallons of water above and beyond rainwater each year (Vickers, p 140).

Many mistakenly believe that stunning gardens and beautiful lawns are only possible through extensive watering, fertilization, and pesticide application. As this booklet will demonstrate, eye-catching gardens and landscapes that save water, prevent pollution, and protect the environment are, in fact, easily achieved by employing water-efficient landscaping. Water-efficient landscaping produces attractive landscapes because it utilizes designs and plants suited to local conditions.

This booklet describes the benefits of water-efficient landscaping. It includes several examples of successful projects and programs, as well as contacts, references, and a short bibliography. For specific information about how to best apply water-efficient landscaping principles to your geographical area, consult with your county extension service and local garden and nursery centers. Local governments and water utilities also possess a wealth of information and suggestions for using water more efficiently in all aspects of your life, including landscaping.

Xeriscape garden at Denver Water

1 W.B. Solley, R.R. Pierce, and H.A. Perlman. 1998. *Estimated Use of Water in the United States in 1995* (USGS Circular 1200). USGS. Reston, VA. p.27.

2 Amy Vickers. 2001. *Handbook of Water Use and Conservation*. WaterPlow Press. Amherst, MA. p. 140.

Xeriscaped front yard in Colorado Springs

Many terms and schools of thought have been used to describe approaches to water-efficient landscaping. Some examples include "water-wise," "water-smart," "low-water," and "natural landscaping." While each of these terms varies in philosophy and approach, they are all based on the same principles and are commonly used interchangeably. One of the first conceptual approaches developed to formalize these principles is known as "Xeriscape[3] landscaping." Xeriscape landscaping is defined as "quality landscaping that conserves water and protects the environment." The word "Xeriscape" was coined and copyrighted by Denver Water Department in 1981 to help make water conserving landscaping an easily recognized concept. The word is a combination of the Greek word "*xeros*," which means "dry," and "landscape."

The seven principles upon which Xeriscape landscaping is based are:

- Proper planning and design
- Soil analysis and improvement
- Appropriate plant selection
- Practical turf areas
- Efficient irrigation
- Use of mulches
- Appropriate maintenance

The eight fundamentals of water-wise landscaping, below, illustrate the similarities in the underlaying concepts and principles of Xeriscape landscaping and other water-efficient approaches.

- Group plants according to their water needs.
- Use native and low-water-use plants.
- Limit turf areas to those needed for practical uses.
- Use efficient irrigation systems.
- Schedule irrigation wisely.
- Make sure soil is healthy.
- Remember to mulch.
- Provide regular maintenance.

In short, plan and maintain your landscape with these principles of water efficiency in mind and it will continue to conserve water and be attractive.

3 Denver Water welcomes the use of the term Xeriscape in books, articles, and speeches promoting water conserving landscape. EPA is using this term with permission from Denver Water. For permission to use "Xeriscape" in your publications, call Denver Water at 303 628-6330.

Why Use Water-efficient Landscaping?

Proper landscaping techniques not only create beautiful landscapes, but also benefit the environment and save water. In addition, attractive, water-efficient, low-maintenance landscapes can increase home values.

Water-efficient landscaping offers many economic and environmental benefits, including:

- Lower water bills from reduced water use.
- Conservation of natural resources and preservation of habitat for plants and wildlife such as fish and waterfowl.
- Decreased energy use (and air pollution associated with its generation) because less pumping and treatment of water is required.
- Reduced home or office heating and cooling costs through the careful placement of trees and plants.
- Reduced runoff of stormwater and irrigation water that carries top soils, fertilizers, and pesticides into lakes, rivers, and streams.
- Fewer yard trimmings to be managed or landfilled.
- Reduced landscaping labor and maintenance costs.
- Extended life for water resources infrastructure (e.g., reservoirs, treatment plants, groundwater aquifers), thus reduced taxpayer costs.

Meadow Sage (Salvia pratensis) *is the background for New Mexico Evening Primrose* (Oenothera berlandieri 'siskiyou')

How is Water-efficient Landscaping Applied?

Landscaping that conserves water and protects the environment is not limited to arid landscapes with only rocks and cacti. Through careful planning, landscapes can be designed to be both pleasing to the senses and kind to the environment. One simple approach to achieving this is applying and adopting the basic principles of water-efficient landscaping to suit your climatic region. The seven principles of Xeriscape landscaping are used below to describe these basic concepts in greater detail.

Dragon's Blood Sedum (Sedum spurium) *under Honeylocust Trees* (Gleditsia triaconthos)

Proper planning and design

Developing a landscape plan is the first and most important step in creating a water-efficient landscape. Your plan should take into account the regional and microclimatic conditions of the site, existing vegetation, topography, intended uses of the property, and most importantly, the grouping of plants by their water needs. Also consider the plants' sun or shade requirements and preferred soil conditions. A well-thought-out landscape plan can serve as your roadmap in creating beautiful, water-efficient landscapes and allow you to continually improve your landscape over time.

Soil analysis and improvements

Because soils vary from site to site, test your soil before beginning your landscape improvements. Your county extension service can analyze the pH levels; nutrient levels (e.g., nitrogen, phosphorus, potassium); and the sand, silt, clay, and organic matter content of your soil. It can also suggest ways to improve your soil's ability to support plants and retain water (e.g., through aeration or the addition of soil amendments or fertilizers).

Appropriate plant selection

Your landscape design should take into account your local climate as well as soil conditions. Focus on preserving as many existing trees and shrubs as possible because established plants usually require less water and maintenance. Choose plants native to your region. Native plants, once established, require very little to no additional water beyond normal rainfall. Also, because they are adapted to local soils and climatic conditions, native plants commonly do not require the addition of fertilizers and are more resistant to pests and disease.

When selecting plants, avoid those labeled "hard to establish," "susceptible to disease," or "needs frequent attention," as these types of plants frequently require large amounts of supplemental water, fertilizers, and pesticides. Be careful when selecting non-indigenous species as some of them may become invasive. An invasive plant might be a water guzzler and will surely choke out native species. Your state or county extension service or local nursery can help you select appropriate plants for your area.

The key to successful planting and transplanting is getting the roots to grow into the surrounding soil as quickly as possible. Knowing when and where to plant is crucial to speeding the establishment of new plants. The best time to plant will vary from species to species. Some plants will thrive when planted in a dormant or inactive state. Others succeed when planted during the season when root generation is highest and sufficient moisture is available to support new growth (generally, spring is the best season, but check plant tags or consult with your local nursery for specific species).

Wine Cup (Callirhoe involucrata) *and Sunset Hyssop* (Agastache rupestris) *in the Denver Water Xeriscape Garden*

Practical turf areas

How and where turf is placed in the landscape can significantly reduce the amount of irrigation water needed to support the landscape. Lawns require a large amount of supplemental water and generally greater maintenance than other vegetation. Use turf where it aesthetically highlights the house or buildings and where it has practical function, such as in play or recreation areas. Grouping turf areas can increase watering efficiency and significantly reduce evaporative and runoff losses. Select a type of grass that can withstand drought periods and become dormant during hot, dry seasons. Reducing or eliminating turf areas altogether further reduces water use.

Efficient irrigation

Efficient irrigation is a very important part of using water efficiently outdoors, and applies in any landscape—whether Xeriscape or conventional. For this reason, an entire section of this booklet addresses efficient irrigation; it can be found on page 6.

Use of mulches

Mulches aid in greater retention of water by minimizing evaporation, reducing weed growth, moderating soil temperatures, and preventing erosion. Organic mulches also improve the condition of your soil as they decompose. Mulches are typically composed of wood bark chips, wood grindings, pine straws, nut shells, small gravel, or shredded landscape clippings. Avoid using rock mulches in sunny areas or around non-arid climate plants, as they radiate large amounts of heat and promote water loss that can lead to scorching. Too much mulch can restrict water flow to plant roots and should be avoided.

Appropriate maintenance

Water and fertilize plants only as needed. Too much water promotes weak growth and increases pruning and mowing requirements. Like any landscape, a water-efficient yard will require regular pruning, weeding, fertilization, pest control, and irrigation. As your water-efficient landscape matures, however, it will require less maintenance and less water. Cutting turf grass only when it reaches two to three inches promotes deeper root growth and a more drought-resistant lawn. As a rule of thumb, mow your turf grass before it requires more than one inch to be removed. The proper cutting height varies, however, with the type of grass, so you should contact your county extension service or local nursery to find out the ideal cutting height for your lawn. Avoid shearing plants or giving them high nitrogen fertilizers during dry periods because these practices encourage water-demanding new growth.

Water-efficient Landscape Irrigation Methods

With common watering practices, a large portion of the water applied to lawns and gardens is not absorbed by the plants. It is lost through evaporation, runoff, or being pushed beyond the root zone because it is applied too quickly or in excess of the plants' needs. The goal of efficient irrigation is to reduce these losses by applying only as much water as is needed to keep your plants healthy. This goal is applicable whether you have a Xeriscape or a conventional landscape.

To promote the strong root growth that supports a plant during drought, water deeply and only when the plant needs water. For clay soils, watering less deeply and more often is recommended. Irrigating with consideration to soil type, the condition of your plants, the season, and weather conditions—rather than on a fixed schedule—significantly increases your watering efficiency. Grouping plants according to similar water needs also makes watering easier and more efficient.

Purple Fountain Grass (Pennisetum setaceum "Rubrum") *and Marigolds* (Calendula officinalis) *in planter bed*

Irrigating lawns, gardens, and landscapes can be accomplished either manually or with an automatic irrigation system. Manual watering with a hand-held hose tends to be the most water-efficient method. According to the AWWA Research Foundation's outdoor end use study, households that manually water with a hose typically use 33 percent less water outdoors than the average household. The study also showed that households with in-ground sprinkler systems used 35 percent more water, those with automatic timers used 47 percent more water, and those with drip irrigation systems used 16 percent more water than households without these types of systems. These results show that in-ground sprinkler and drip irrigation systems must be operated properly to be water-efficient.

You can use a hand-held hose or a sprinkler for manual irrigation. To reduce water losses from evaporation and wind, avoid sprinklers that produce a fine mist or spray high into the air. Soaker hoses can also be very efficient and effective when used properly. Use a hand-held soil moisture probe to determine when irrigation is needed.

To make automatic irrigation systems more efficient, install system controllers such as rain sensors that prevent sprinkler systems from turning on during and immediately after rainfall, or soil moisture sensors that activate sprinklers only when soil moisture levels drop below pre-programmed levels. You can also use a weather-

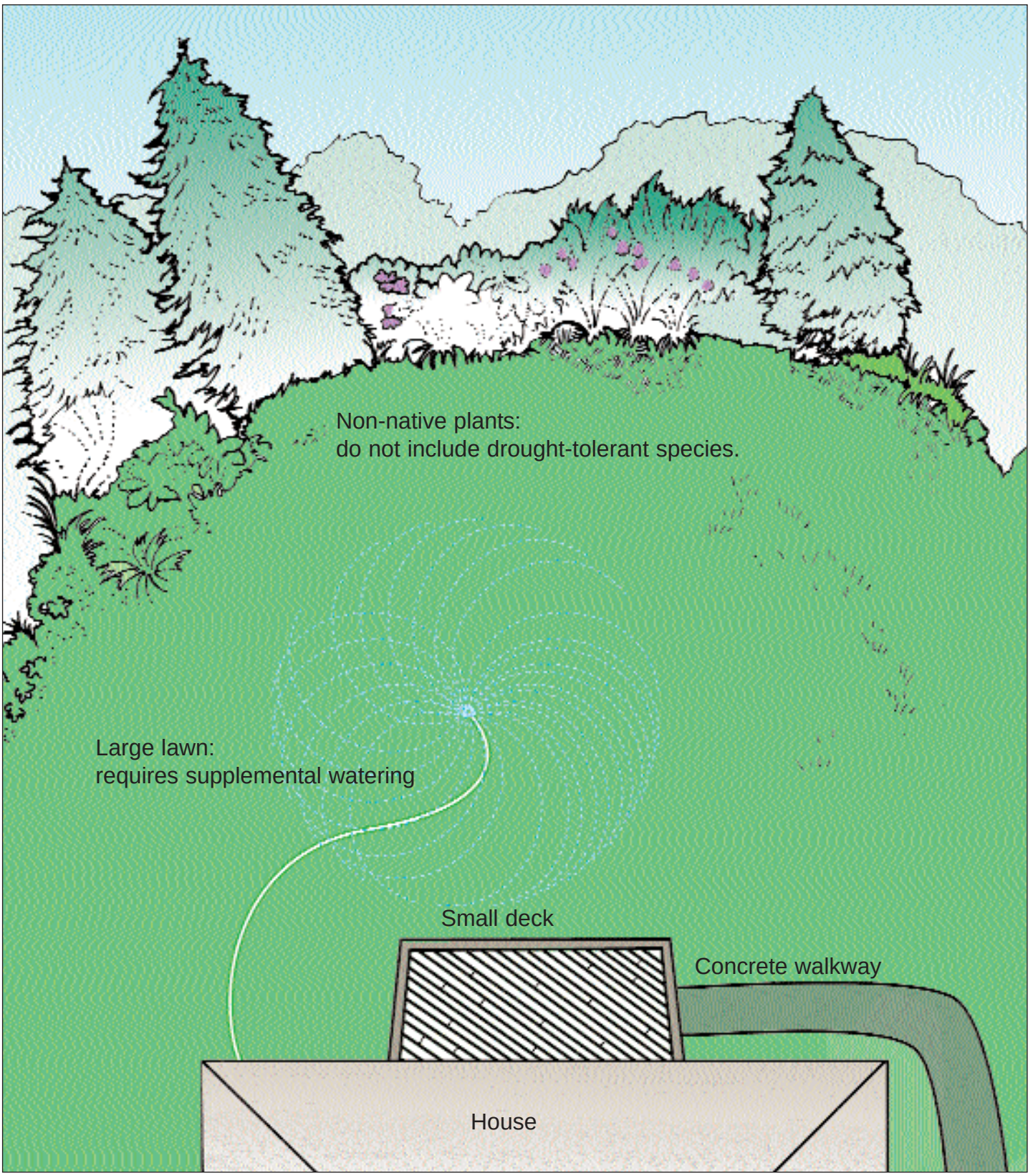
driven programming system. Drip-type irrigation systems are considered the most efficient of the automated irrigation methods because they deliver water directly to the plants' roots. It is also important to revise your watering schedule as the seasons change. Over-watering is most common during the fall when summer irrigation schedules have not been adjusted to the cooler temperatures.

To further reduce your water consumption, consider using alternative sources of irrigation water, such as gray water, reclaimed water, and collected rainwater. According to the AWWA Research Foundation, homes with access to alternative sources of irrigation reduce their water bills by as much as 25 percent.[4] Graywater is untreated household waste water from bathroom sinks, showers, bathtubs, and clothes washing machines. Graywater systems pipe this used water to a storage tank for later outdoor watering use. State and local graywater laws and policies vary, so you should investigate what qualifies as gray water and if any limitations or restrictions apply. Reclaimed water is waste water that has been treated to levels suitable for nonpotable uses. Check with local water officials to determine if it is available in your area. Collected rainwater is rainwater collected in cisterns, barrels, or storage tanks. Commercial rooftop collection systems are available, but simply diverting your downspout into a covered barrel is an easy, low-cost approach. When collecting rainwater, cover all collection vessels to prevent animals and children from entering and to prevent mosquito breeding. Some states might have laws which do not allow collection of rainwater, so be sure to check with your state's water resource agency before implementing a rainwater collection system.

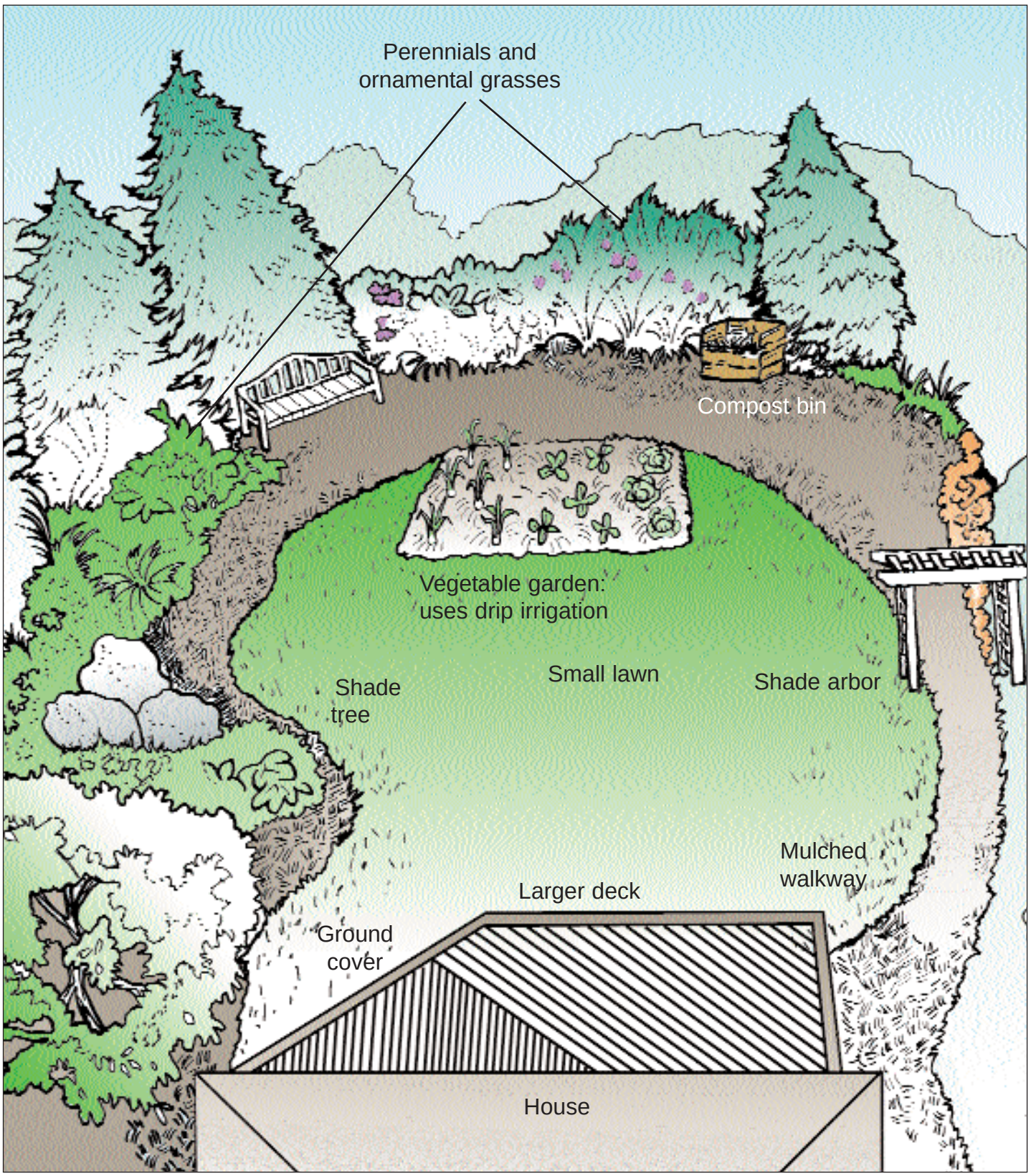
Red Valerian (Centranthus ruber)

4 AWWA Research Foundation. 1999. *Residential End Uses of Water*. <www.waterwiser.org>

Non-xeriscaping



Xeriscaping



Examples of Successful Water-efficient Landscaping Projects

Water-efficient landscaping techniques can be used by individuals, companies, state, tribal, and local governments, and businesses to physically enhance their properties, reduce long-term maintenance costs, and create environmentally conscious landscapes. The following examples illustrate how water-efficient landscapes can be used in various situations.

Oriental Poppies (Paparer orientale)

Homeowner–public/private partnership

- The South Florida Water Management District, the Florida Nurserymen and Growers Association, the Florida Irrigation Society, and local businesses worked together to produce a television video called "Plant It Smart with Xeriscape." The video shows how a typical Florida residential yard can be retrofitted with Xeriscape landscaping to save energy, time, and money. The showcase yard (selected from 70 applicants) had a history of heavy water use—more than 90,000 gallons per month. After the retrofit, the yard's aesthetic value was enhanced; plus it now uses 75 percent less water and relies on yard trimmings for mulch and compost.
- The Southwest Florida Water Management District (SWFWMD), the City of St. Petersburg, and Pinellas County, Florida, produced a video called "Xeriscape It!" It shows a landscape being installed using the seven Xeriscape principles. The SWFWMD also funded several Xeriscape demonstration sites and maintains a Xeriscape demonstration garden at its Brooksville, Florida, headquarters. The garden features a variety of native and non-native plants and is available for public viewing, along with a landscape plant identification guide.
- Residents of Glendale, Arizona, can receive a $100 cash rebate for installing or converting more than half of their landscapable area to non-grass vegetation. The Glendale Water Conservation Office conducts an inspection of the converted lawn to ensure compliance with rebate requirements and then issues a rebate check to the homeowner. The purpose of the Landscape Rebate Program is to permanently reduce the amount of water used to irrigate grass throughout Glendale.

State government

- Although perceived as a water-rich state, Florida became the first to enact a statewide Xeriscape law. Florida's legislature recognized that its growing population and vulnerable environment necessitated legal safeguards for its water resources. The Xeriscape law requires Florida's Departments of Management Ser-

vices and Transportation to use Xeriscape landscaping on all new public properties and to develop a 5-year program to phase in Xeriscape on properties constructed before July 1992. All local governments must also consider requiring the use of Xeriscape and offering incentives to install Xeriscaping.

- Texas also developed legislation requiring Xeriscape landscaping on new construction projects on state property beginning on or after January 1994. Additional legislation, enacted in 1995, requires the Department of Transportation to use Xeriscape practices in the construction and maintenance of roadside parks. All municipalities may consider enacting ordinances requiring Xeriscape to conserve water.

City government

In Las Vegas, Nevada, homeowners can receive up to $1,000 for converting their lawn to Xeriscape, while commercial landowners can receive up to a $50,000 credit on their water bill. The city and several other surrounding communities hope these eye-catching figures will help Las Vegas meet its goal of saving 25 percent of the water it would otherwise have used by the year 2010; to date, it has saved 17 percent. Local officials plan to reach the target with the assistance of incentive programs encouraging Xeriscape, a city ordinance limiting turf to no more than 50 percent of new landscapes, grassroots information programs, and a landscape awards program specifically for Xeriscaped properties. Preliminary results of a five-year study show that residents who converted a portion of their lawns to Xeriscape reduced total water consumption by an average of 33 percent. The xeric vegetation required less than a quarter of the water typically used and one-third the maintenance (both in labor and expenditures) compared to traditional turf.

Yellow Ice Plant (Delosperma nubigenum) *close-up*

Developers

Howard Hughes Properties (HHP), a developer and manager of more than 25,000 acres of residential, commercial, and office development property, has enthusiastically used drought tolerant landscaping on all of its properties since 1990. Most of the company's properties are located in Las Vegas, one of the country's fastest growing metropolitan areas. To conserve resources, the city and county have implemented regulations requiring developers to employ certain Xeriscape principles in new projects. Specifically, a limited percentage of grass can be used on projects, and it must be kept away from streets. As the area's first large-scale developer to recognize the need and value in incorporating drought tolerant landscaping in parks, streetscapes, and open spaces, HHP uses native and desert-adaptive plants that survive and thrive in the Las Vegas climate with minimal to moderate amounts of water.

Drip system irrigation controllers are linked to weather stations that monitor the evapotranspiration rate. This allows HHP to determine the correct amount of water to be applied to plants at any given time. HHP tests the irrigation systems regularly and adds appropriate soil amendments to promote healthy plant growth. The maintenance program also includes pest management, the use of mulching mowers, and the use of rock mulch top dressing on all non-turf planting areas. These measures combine to ensure a beautiful, healthy, and responsible landscape.

Public/private partnerships

Even the most water-conscious homeowners in Southern California are over-watering by 50 to 70 gallons per day. The excess water washes away fertilizers and pesticides, which pollute natural waterways. The quantity of water wasted (and the dollars that pay for it) are even more substantial for large-scale commercial properties and developments.

An innovative partnership in Orange County links landscape water management, green material management, and non-point source pollution prevention goals into one program—the Landscape Performance Certification Program. This program emphasizes efficient landscape irrigation and features a "landscape irrigation budget" based on a property's landscape area, type, and the daily weather. The Municipal Water District monitors actual water use through a system of 12,000 dedicated water meters installed by participating landscape managers.

Participants, including landscapers, property managers, and homeowner associations, can compare the actual cost of water used on their property with the calculated budget. Those staying within budget are awarded certification, a proven marketing tool. This new voluntary program is implemented by the Municipal Water District with input from the California Landscape Contractors' Association, the Orange County Integrated Management Department, the Metropolitan Water District of Southern California, and local nurseries and has the support of 32 retailing water suppliers. The program is already credited with increasing the use of arid-climate shrubs and landscaping to accommodate drip irrigation, and has resulted in cost savings to water customers.

Miscanthus sinensis (Miscanthus grass, also called Maiden grass) *variety with leaves turning yellow for fall.*

For More Information

Turkish Speedwell (Veronica liwanensis) *in background and tulips in foreground.*

The following list of organizations can provide more information on water-efficient landscaping. This is not meant to be an exhaustive list, rather it is intended to help you locate local information sources and possible technical assistance.

Water Management Districts or Utilities

Your local water management district often can provide information on water conservation, including water efficient landscaping practices. Your city, town, or county water management district can be found in the Blue Pages section of your local phone book or through your city, town, or county's Web site if it has one. If you do not know your city, town, or county's Web site, check for a link on your state's Web site. URLs for state Web sites typically follow this format: <www.state.(two letter state abbreviation).us>.

State/County Extension Services

Your state or county extension service is also an excellent source of information. Many extension services provide free publications and advice on home landscaping issues including tips on plant selection and soil improvement. Some also offer a soil analysis service for a nominal fee. Your county extension service can be found in the Blue Pages section of your local phone book under the county government section or through your county's Web site if it has one. The U.S. Department of Agriculture's Cooperative State Research, Education, and Extension Service (www.reeusda.gov/statepartners/usa.htm) provides an online directory of land-grant universities which can help you locate your state extension service. Government Guide (www.governmentguide.com) is yet another online resource that might prove helpful in locating state or local agencies.

Organizations

The following is a partial list of organizations located across the United States that provide helpful information on water-efficient landscaping.

American Water Works Association (AWWA)
6666 West Quincy Avenue
Denver, CO 80235
Telephone: 303 794-7711
and
1401 New York Avenue, NW, Suite 640
Washington, DC 20005
Telephone: 202 628-8303
Web: <www.awwa.org>

Arizona Municipal Water Users Association (AMWUA)
Web: <www.amwua.org/program-xeriscape.htm>

BASIN
City of Boulder Environmental Affairs
P.O. Box 791
Boulder, CO 80306
Phone: 303 441-1964
E-mail: basin@bcn.boulder.co. us
Web: <bcn.boulder.co.us/basin/local/seven.html>

Denver Water
1600 West 12th Avenue
Denver, CO 80204
Phone: 303 628-6000
Fax: 303 628-6199
TDDY: 303 534-4116
Office of Water Conservation hotline:
303 628-6343
E-mail: jane.earle@denverwater.org
Web: <www.water.denver.co.gov/conservation/conservframe.html>

New Mexico Water Conservation Program/Water Conservation Clearinghouse
P. O. Box 25102
Santa Fe, NM 87504
Phone: 800 WATER-NM
E-mail: waternm@ose.state.nm.us
Fax: 505 827-3813
Web: <www.ose.state.nm.us/water-info/conservation/index.html>

Project WET - Water Education for Teachers
201 Culbertson Hall
Montana State University
Bozeman, MT 59717
Phone: 406 994-5392
Web: <www.montana.edu/wwwwet>

Rocky Mountain Institute
1739 Snowmass Creek Road
Snowmass, CO 81654-9199
Phone: 970 927-3851
Web: <www.rmi.org>

Southern Nevada Water Authority
1001 S. Valley View Boulevard, Mailstop #440
Las Vegas, NV 89153
Phone: 702 258-3930
Web: <www.snwa.com>

Southwest Florida Water Management District
2379 Broad Street
Brooksville, FL 34604-6899
Phone: 352 796-7211 or 800 423-1476 (Florida only)
Web: <www.swfwmd.state.fl.us/watercon/xeris/swfxeris.html>

Sustainable Sources Green Building Program: Sustainable Building Source Book
E-mail: info@greenbuilder.com
Web: <www.greenbuilder.com/sourcebook/xeriscape.html>

Water Conservation Garden – San Diego County
12122 Cuyamaca College Drive West
El Cajon, CA 92019
Phone: 619 660-0614
Fax: 619 660-1687
E-mail: info@thegarden.org
Web: <www.thegarden.org/garden/xeriscape/index.html> and <www.sdcwa.org/manage/conservation-xeriscape.phtml>\

WaterWiser: The Water Efficiency Clearing House
(Operated by AWWA in cooperation with the U.S. Bureau of Reclamation)
6666 West Quincy Avenue
Denver, CO 80235
Phone: 800 559-9855
Fax: 303 794-6303
E-mail: bewiser@waterwiser.org
Web: <www.waterwiser.org>

Xeriscape Colorado!, Inc.
P.O. Box 40202
Denver, CO 80204-0202
Web: <www.xeriscape.org>

Resources

The following is a partial list of publications on resource efficient landscaping. For even more information, particularly on plants suited to your locale, consult your local library, county extension service, nursery, garden clubs, or water utility.

Ball, Ken and American Water Works Association Water Conservation Committee. *Xeriscape Programs for Water Utilities*. Denver: American Water Works Association, 1990.

Bennett, Jennifer. *Dry-Land Gardening: A Xeriscaping Guide for Dry-Summer, Cold-Winter Climates*. Buffalo: Firefly, 1998.

Bennett, Richard E. and Michael S. Hazinski. *Water-Efficient Landscape Guidelines*. Denver: American Water Works Association, 1993.

Brenzel, Kathleen N., ed. *Western Garden Book*, 2001 Edition. Menlo Park: Sunset Publishing Corporation, 2001.

City of Aurora, Colorado Utilities Department. *Landscaping for Water Conservation: Xeriscape!* Aurora: Colorado Utilities Department, 1989.

Johnson, Eric and Scott Millard. *The Low-Water Flower Gardener: 270 Unthirsty Plants for Color, Including Perennials, Ground Covers, Grasses & Shrubs*. Tucson: Ironwood Press, 1993.

Knopf, James M. *The Xeriscape Flower Gardener*. Boulder: Johnson Books, 1991.

Knopf, James M., ed. *Waterwise Landscaping with Trees, Shrubs, and Vines: A Xeriscape Guide for the Rocky Mountain Region, California, and the Desert Southwest*. Boulder: Chamisa Books, 1999.

Knox, Kim, ed. *Landscaping for Water Conservation: Xeriscape*. Denver: City of Aurora and Denver Water, 1989.

Nellis, David W. *Seashore Plants of South Florida and the Caribbean: A Guide to Identification and Propagation of Xeriscape Plants*. Sarasota: Pineapple Press, Inc., 1994.

Perry, Bob. *Landscape Plants for Western Regions: An Illustrated Guide to Plants for Water Conservation*. Claremont: Land Design Publishing, 1992.

Phillips, Judith. *Natural by Design: Beauty and Balance in Southwest Gardens*. Santa Fe: Museum of New Mexico Press, 1995.

Phillips, Judith. *Plants for Natural Gardens: Southwestern Native & Adaptive Trees, Shrubs, Wildflowers & Grasses*. Santa Fe: Museum of New Mexico Press, 1995.

Robinette, Gary O. *Water Conservation in Landscape Design and Maintenance*. New York: Nostrand Reinhold, 1984.

Rumary, Mark. *The Dry Garden*. New York: Sterling Publishing Co., Inc., 1995.

Springer, Lauren. *The Undaunted Garden: Planting for Weather-Resilient Beauty*. Golden: Fulcrum Publishing, 1994.

Springer, Lauren. *Waterwise Gardening*. New York: Prentice Hall Gardening, 1994.

Stephens, Tom, Doug Welsh, and Connie Ellefson. *Xeriscape Gardening, Water Conservation for the American Landscape*. New York: Macmillan Publishing, 1992.

Sunset Books, eds. *Waterwise Gardening: Beautiful Gardens with Less Water*. Menlo Park: Lane Publishing Company, 1989.

Vickers, Amy. *Handbook of Water Use and Conservation*. Amherst, MA: WaterPlow Press, 2001.

Weinstein, Gayle. *Xeriscape Handbook : A How-To Guide to Natural, Resource-Wise Gardening*. Golden: Fulcrum Publishing, 1998.

Williams, Sara. *Creating the Prairie Xeriscape*. Saskatchewan: University Extension Press, 1997.

Winger, David, ed. *Xeriscape Plant Guide: 100 Water-Wise Plants for Gardens and Landscapes*. Golden: Fulcrum Publishing, 1998.

Winger, David, ed. *Xeriscape Color Guide*. Golden: Fulcrum Publishing, 1998.

Winger, David, ed. *Evidence of Care: The Xeriscape Maintenance Journal, 2002, Vol. 1*, Colorado WaterWise Council, 2001.

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U.S. Environmental Protection Agency
Ariel Rios Building, 1200 Pennsylvania Avenue, NW.
Washington, DC 20460

For more information regarding water efficiency, please contact:
Water Efficiency Program (4204M)
U.S. Environmental Protection Agency
Ariel Rios Building, 1200 Pennsylvania Avenue, NW.
Washington, DC 20460
<www.epa.gov/OWM/water-efficiency/index.htm>

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