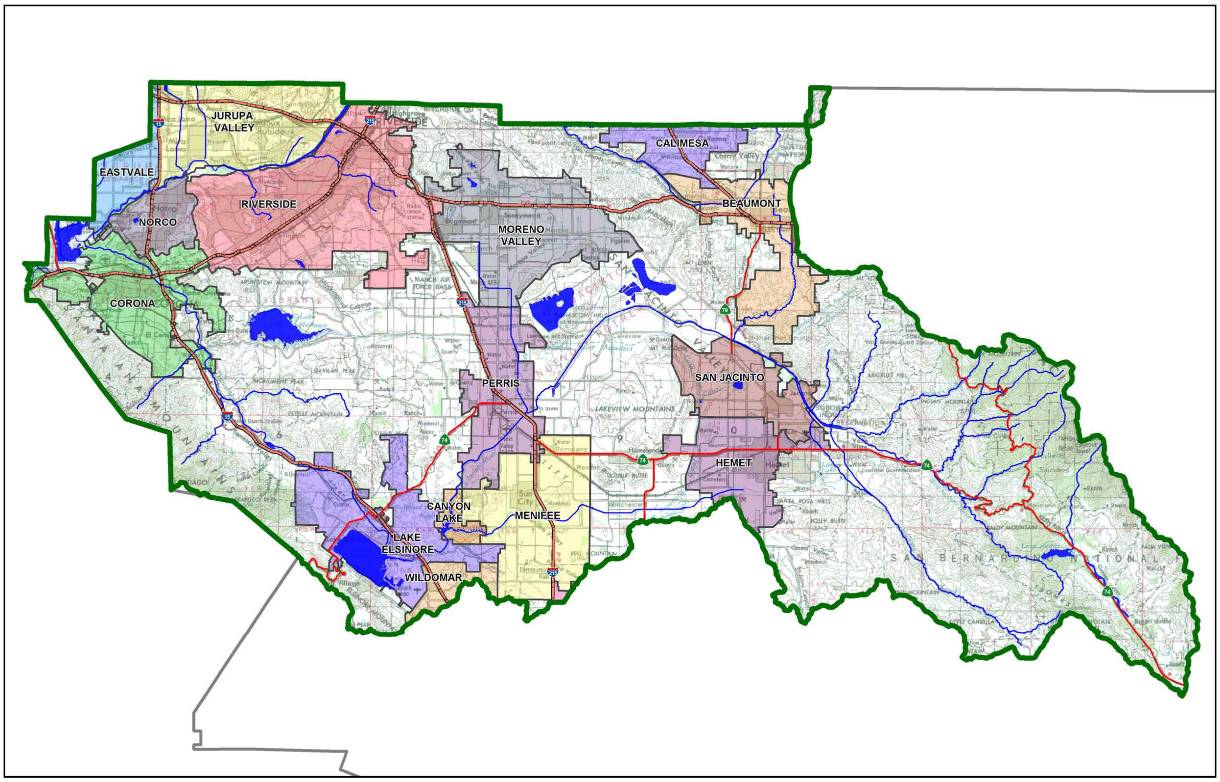
Project Specific Water Quality Management Plan

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

Project Title: ROCKPORT RANCH

Development No: __________

Design Review/Case No: 2016-285



☒ **Preliminary**
☐ **Final**

Original Date Prepared: December 8, 2016

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February 8, 2018
June 17, 2019

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

Contact Information:

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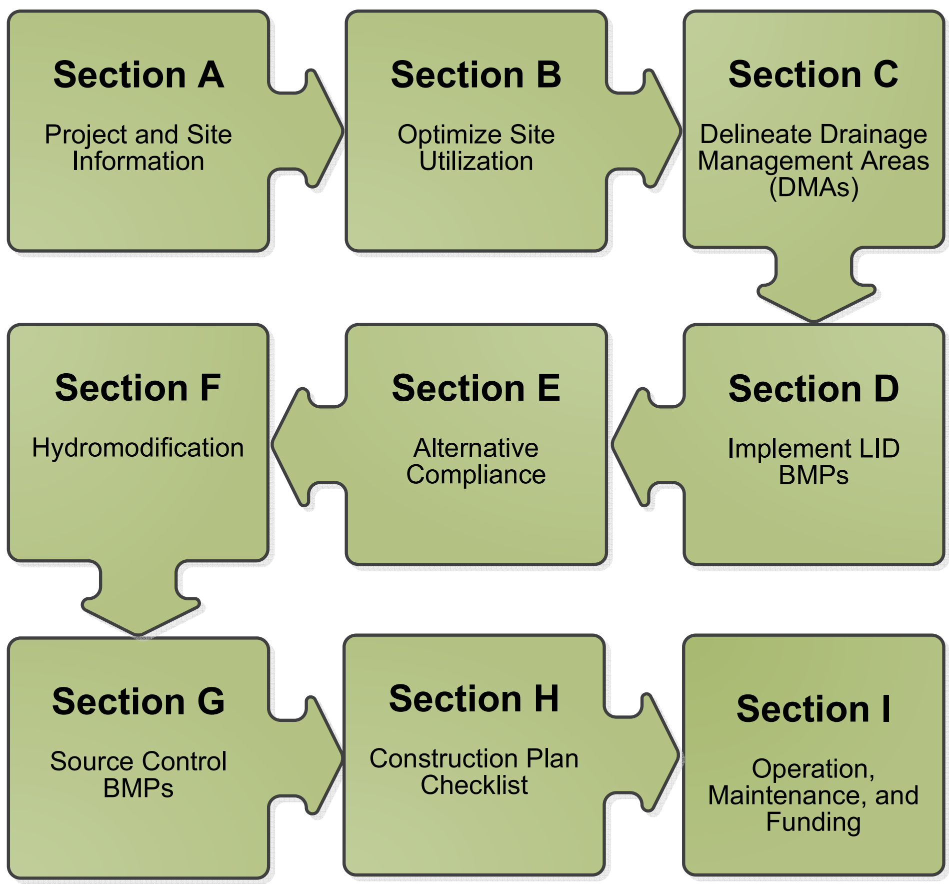
A Brief Introduction

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 Abacherli UDT by Excel Engineering for the Rockport Development project.

This WQMP is intended to comply with the requirements of City of Menifee for Ordinance No.457 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 City of Menifee Water Quality Ordinance (Municipal Code Section2, Chapter 15.01).

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

Owner's Signature	Date
Owner's Printed Name	Owner's Title/Position

PREPARER'S CERTIFICATION

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

Preparer's Signature	Date
Robert D. Dentino	Engineer of Work
Preparer's Printed Name	Preparer's Title/Position

Preparer's Licensure:

Table of Contents

List of Tables

List of Appendices

Section A: Project and Site Information

PROJECT INFORMATION	
Type of Project:	Residential
Planning Area:	Agriculture (AG)
Community Name:	Rockport Ranch
Development Name:	Rockport Ranch Specific Plan
PROJECT LOCATION	
Latitude & Longitude (DMS): 33.6786324, -117.1423969	
Project Watershed and Sub-Watershed: San Jacinto Subbasin of larger Santa Ana River Watershed	
Gross Acres: 79.688 APN(s): 364-190-004 & 005 Map Book and Page No.: N/A	
PROJECT CHARACTERISTICS	
Proposed or Potential Land Use(s)	Residential
Proposed or Potential SIC Code(s)	8811
Total Area Project Footprint (SF)	3,471,221.43
Total Area of proposed Impervious Surfaces within the Project Footprint (SF)/or Replacement	2,344,546.08
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 Footprint (SF)	246,476
Is the project located within any MSHCP Criteria Cell?	☐ Y ☒ N
If so, identify the Cell number:	Insert text here.
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)	SOIL TYPE D
What is the Water Quality Design Storm Depth for the project?	0.58

A.1 Maps and Site Plans

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

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

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

A.2 Identify Receiving Waters

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

Table A.1 Identification of Receiving Waters

Receiving Waters	EPA Approved 303(d) List Impairments	Designated Beneficial Uses	Proximity to RARE Beneficial Use
Canyon Lake/ Salt Creek	Nutrients, Pathogens.	REC1, REC2, WARM, WILD	None
Lake Elsinore	Nutrients, Organic enrichment/low dissolved oxygen, Polychlorinated biphenyls (PCBs), Sediment Toxicity and unknown toxicity.	WARM, REC1, REC2	None

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.

NOI document will be provided at the final WQMP.

Section B: Optimize Site Utilization (LID Principles)

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

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

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

Site Optimization

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

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

Yes, Drainage patterns along east boundary (Briggs Rd.) will not be altered. There will be curb inlets at the intersection of Briggs Rd. and Tres Lagos Dr. which collects water and directs flows to the proposed box culvert that travels parallel with Tres Lagos Dr. on the south of the site. This project also utilized depressed landscape areas, vegetated buffer and biofiltration areas as amenities and focal points within the site and landscape design.

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

No, there is no existing vegetation to protect. The existing condition does not contain dense vegetation nor well-established trees.

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

Based on the soils report, the percolation tests were conducted on four point locations. The results confirmed the site is soil type C and D with low infiltration. However, we preserve natural infiltration by means of detention/ wet ponds as a public amenity and integrated into a park setting.

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

Yes, the impervious area is 50% of the total area. The impervious area is minimized as much as possible to reduce the peakflow. This project limits overall coverage of paving and roofs by having sharing driveways.

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

Yes, we collect and disperse runoff throughout the site and direct roof runoff into landscaped areas such as back yards and a depressed garden below surrounding walkways as self-retaining areas. Since the site has type D soil therefore, underdrains are provided to ensure no standing water more than 24 hrs.

Section C: Delineate Drainage Management Areas (DMAs)

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

Table C.1 DMA Classifications

DMA Name or ID	Surface Type(s)[1][2]	Area (Sq. Ft.)	DMA Type
DMA - 1	*Natural (D Soil)*	*75,664.47*	*Type A*
DMA - 2	*Concrete or Asphalt*	*11,713.00*	*Type D*
	Natural (D Soil)	*7,233.47*	*Type D*
DMA - 3	*Concrete or Asphalt*	*25,072.00*	*Type D*
	Natural (D Soil)	*16,347.21*	*Type D*
DMA-4	*Mixed Surface Types*	*841,023.38*	*Type D*
DMA-5	*Mixed Surface Types*	*926,149.47*	*Type D*
DMA-6	*Mixed Surface Types*	*86,228.98*	*Type D*
DMA-8	*Mixed Surface Types*	*158,409.72*	*Type D*
DMA-9	*Mixed Surface Types*	*272,649.13*	*Type D*
DMA-11	*Mixed Surface Types*	*315,604.81*	*Type D*
DMA - 12	*Natural (D Soil)*	*16,864.42*	*Type A*
DMA - 14	*Concrete or Asphalt*	*28,638.01*	*Type D*
	Natural (D Soil)	*20988.681*	
DMA - 15	*Concrete or Asphalt*	*27351.72*	*Type D*
	Natural (D Soil)	*26180.26*	
DMA - 16	*Concrete or Asphalt*	*65,180.38*	*Type D*
	Natural (D Soil)	*51,029.91*	*Type D*
DMA - 17	*Concrete or Asphalt*	*30,534.44*	*Type D*
	Natural (D Soil)	*22,525.29*	*Type D*
DMA - 18	*Concrete or Asphalt*	*24,002.84*	*Type D*
	Natural (D Soil)	*23,152.37*	*Type D*

[1]*Reference Table 2-1 in the WQMP Guidance Document to populate this column*
[2]*If multi-surface provide back-up*

****See Next Page for breakdown of entire site area including Lake/Wetpond.***

Area Break down of Entire Site with Lake/Wetpond					
Name	**Impervious (sqft)**	**Pervious (sqft)**	**Pond (water) (sqft)**	**Total Sqft**	**Acres**
DMA-1	-	75,664.47	-	75,664.47	1.74
DMA-2	11,713.00	7,233.47	-	18,946.47	0.43
DMA-3	25,072.00	16,347.21	-	41,419.21	0.95
DMA-4	689,639.17	151,384.21	-	841,023.38	19.31
DMA-5	759,442.56	166,706.90	-	926,149.47	21.26
DMA-6	70,707.76	15,521.22	-	86,228.98	1.98
DMA-8	129,895.97	28,513.75	-	158,409.72	3.64
DMA-9	223,572.28	49,076.84	-	272,649.13	6.26
DMA-11	258,795.94	56,808.87	-	315,604.81	7.25
Bmp-H (wetpond)	-	25,163.69	19,325.7	44,489.39	1.02
Bmp-H (wetpond)	-	148,589.327	205,598.77	354,188.10	8.13
DMA-12	-	16,864.422	-	16,864.42	0.39
DMA-14	28,638.009	20,988.681	-	49,626.69	1.14
DMA-15	27,351.72	26,180.26	-	53,531.98	1.23
DMA-16	65,180.38	51,029.91	-	116,210.29	2.67
DMA-17	30,534.44	22,525.29	-	53,059.73	1.22
DMA-18	24,002.84	23,152.37	-	47,155.21	1.08
Total (sqft)	**2,344,546.08**	826,086.41	224,924.47	**3,471,221.43**	**79.69**
Total (Acres)	**53.82**	**18.96**	5.16	**79.69**	

Note 1: Areas are to match areas from Calculations in Appendix 6

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

DMA Name or ID	Area (Sq. Ft.)	Stabilization Type	Irrigation Type (if any)
DMA - 1	*75,664.47*		
DMA - 12	*75,664.47*		

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]

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

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

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

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

DMA Name or ID	BMP Name or ID
DMA - 2	***BMP - A***
DMA - 3	***BMP - B***
DMA-4	***BMP - H***
DMA-5	***BMP - H***
DMA-6	***BMP - H***
DMA-8	***BMP - H***
DMA-9	***BMP - H***
DMA-11	***BMP - H***
DMA - 14	***BMP - C***
DMA - 15	***BMP - D***
DMA - 16	***BMP - E***
DMA - 17	***BMP - F***
DMA - 18	***BMP - G***

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:		**x**
…have any DMAs located within 100 feet of a water supply well?		**x**
If Yes, list affected DMAs:		**x**
…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: All DMAs (DMA 1-18)		
…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: 18.96 (Acres)

Type of Landscaping (Conservation Design or Active Turf): Conservation Design

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: 53.82 (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: 0.79

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: 42.52 (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)**
42.52 (Acres)	18.96 (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: 1525

Project Type: Residential

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: 53.82 (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: 101

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: 5,436.16 tu

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)
5,436.16 (users)	1525 (Users)

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.

N/A

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

Average Daily Demand: 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.

NOT REQUIRED

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-1	☒	☐	☐	☐	☐
DMA-2	☐	☐	☒	☒	☐
DMA-3	☐	☐	☐	☒	☐
DMA-4	☐	☐	☐	☒	☐
DMA-5	☐	☐	☒	☒	☐
DMA-6	☐	☐	☒	☒	☐
DMA-8	☐	☐	☒	☒	☐
DMA-9	☐	☐	☒	☒	☐
DMA-11	☐	☐	☒	☒	☐
DMA-12	☐	☐	☒	☒	☐
DMA-13	☐	☐	☒	☒	☐
DMA-14	☐	☐	☐	☒	☐
DMA-15	☐	☐	☐	☒	☐
DMA-16	☐	☐	☒	☒	☐
DMA-17	☐	☐	☒	☒	☐
DMA-18	☐	☐	☒	☒	☐

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.

Discussion on DMAs regarding the Hierarchy and determination of treatment; Please See Appendix 5

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	*Enter BMP Name / Identifier Here*		
	[A]		[B]	[C]	[A] x [C]			
						Design Storm Depth (in)	*Design Capture Volume,* V_{BMP} *(cubic feet)*	*Proposed Volume on Plans (cubic feet)*
	$A_T = \Sigma[A]$				$\Sigma = [D]$	[E]	$[F] = \frac{[D]x[E]}{12}$	[G]

[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

<u>SEE APPENDIX 6 FOR LID BMP SIZING.</u>

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

Project priority pollutants are: Bacteria, Nutrients, Pesticides, Sediments, Trash & Debris, Oil & Grease.

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)*
	$A_T = \Sigma[A]$				$\Sigma = [D]$	[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

SEE APPENDIX 6 FOR LID BMP SIZING.

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]
BMP – H	*Bacteria*	*High – CASCA TC-20*
BMP – H	*Nutrients*	*Medium – CASCA TC-20*
BMP – H	*Organics*	*High – CASCA TC-20*
BMP – H	*Sediment*	*High – CASCA TC-20*
BMP – H	*Trash*	*High – CASCA TC-20*
BMP – H	*Oil and Grease*	*High – CASCA TC-20*

[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			
Volume (Cubic Feet)			

[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:

The flows from the project site drain to Lake Elsinore.

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
1. Stenciling and signage or on-site storm drain inlets	Mark inlets with the words “ONLY RAIN DOWN THE DRAIN” or similar. See Appendix 8 for label details.	- Maintain periodically repaint or replace inlet markings - Include the following in lease agreements: “Tenant shall not allow anyone to discharge anything to storm drains”.
2. Plazas, Park, street and parking lot	- Sign with the words “NO LITTERING”. - “TRASH BINS” signs nearby trash bins. - Covered Trash bins with plastic bag inside located strategically. - Street Sweeping.	- Maintain periodically repaint or replace sign markings every 6 months. - Street sweeping frequency no less than that of City of Corona. - Washwater containing any cleaning agent/degreaser shall be collected and discharge to the sanitary sewer and not discharged to a stormdrain.
3. Landscape/ Outdoor Pesticide use	- Design landscaping to minimize irrigation and runoff, to surface promote infiltration - Where landscape areas are used to retain or detain Stormwater, a native Californian saturated soil tolerant vegetation type is used.	- Maintain landscaping using minimum or no pesticides. - Refer to SC-41 “Building and Grounds Maintenance”. CASQA Handbook.

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)
BMP - A	*BMP A (BIORETENTION)*	TBD	33°41'5.90"/ -117°08'25.02"
BMP - B	*BMP B (BIORETENTION)*	TBD	33°41'5.90"/ -117°08'15.45"
BMP - C	*BMP C (BIOTREATMENT)*	TBD	33°40'40.38"/ -117°08'24.80"
BMP - D	*BMP D (BIOTREATMENT)*	TBD	33°40'40.29"/ -117°08'15.55"
BMP - E	*BMP E (BIORETENTION)*	TBD	33°40'44.8413"/ -117°08'24.9953"
BMP - F	*BMP F (BIORETENTION)*	TBD	33°40'51.0307"/ -117°08'23.3922"
BMP - G	*BMP G (BIORENTION)*	TBD	33°40'50.6276"/ -117°08'23.4294"
BMP - H	*BMP H (BIOTREATMENT)*	TBD	33°40'45.73"/ -117°08'20.18"

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:

-BMP A, BMP-B, BMP-B, BMP-C, BMP-D, BMP-E, BMP-F, BMP-G of which are located in public right of way to treat public water, **Will be Owned and Maintained by the City of Menifee** and **Funded through the Community Facilities District.**

- BMP H will be **Privately Owned, Maintained** and, **Funded by the Future HOA**.

Will the proposed BMPs be maintained by a Home Owners' Association (HOA) or Property Owners Association (POA)? **Private BMP's will be maintained by Future HOA**, **Public BMPs will be maintained by the City of Menifee.**

☒ 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.

BMP NAME	TYPE	PUBLIC/PRIVATE	RESPONSIBLE PARTY	Funded By
BMP-A	BIORETENTION	PUBLIC	CITY OF MENIFEE	Community Facilities District
BMP-B	BIORETENTION	PUBLIC	CITY OF MENIFEE	Community Facilities District
BMP-C	BIORETENTION	PUBLIC	CITY OF MENIFEE	Community Facilities District
BMP-D	BIORETENTION	PUBLIC	CITY OF MENIFEE	Community Facilities District
BMP-E	BIORETENTION	PUBLIC	CITY OF MENIFEE	Community Facilities District
BMP-F	BIORETENTION	PUBLIC	CITY OF MENIFEE	Community Facilities District
BMP-G	BIORETENTION	PUBLIC	CITY OF MENIFEE	Community Facilities District
BMP-H	BIORETENTION	PRIVATE	FUTURE HOA	Future HOA

STRUCTURAL BMP MAINTENANCE INFORMATION
MAINTENANCE INDICATORS

TABLE I-1 Maintenance Indicators and Actions for Vegetated BMPs

Typical Maintenance Indicator(s) for Vegetated BMPs	Maintenance Actions
Accumulation of sediment, litter, or debris	Remove and properly dispose of accumulated materials, without damage to the vegetation.
Poor vegetation establishment	Re-seed, re-plant, or re-establish vegetation per original plans.
Overgrown vegetation	Mow or trim as appropriate, but not less than the design height of the vegetation per original plans when applicable (e.g. a vegetated swale may require a minimum vegetation height).
Erosion due to concentrated irrigation flow	Repair/re-seed/re-plant eroded areas and adjust the irrigation system.
Typical Maintenance Indicator(s) for Vegetated BMPs	**Maintenance Actions**
Erosion due to concentrated storm water runoff flow	Repair/re-seed/re-plant eroded areas, and make appropriate corrective measures such as adding erosion control blankets, adding stone at flow entry points, or minor re-grading to restore proper drainage according to the original plan. If the issue is not corrected by restoring the BMP to the original plan and grade, the [City Engineer] shall be contacted prior to any additional repairs or reconstruction.
Standing water in vegetated swales	Make appropriate corrective measures such as adjusting irrigation system, removing obstructions of debris or invasive vegetation, loosening or replacing top soil to allow for better infiltration, or minor re-grading for proper drainage. If the issue is not corrected by restoring the BMP to the original plan and grade, the [City Engineer] shall be contacted prior to any additional repairs or reconstruction.
Standing water in bioretention, biofiltration with partial retention, or biofiltration areas, or flow-through planter boxes for longer than 96 hours following a storm event*	Make appropriate corrective measures such as adjusting irrigation system, removing obstructions of debris or invasive vegetation, clearing underdrains (where applicable), or repairing/replacing clogged or compacted soils.
Obstructed inlet or outlet structure	Clear obstructions.
Damage to structural components such as weirs, inlet or outlet structures	Repair or replace as applicable.
*These BMPs typically include a surface ponding layer as part of their function which may take 96 hours to drain following a storm event.	

TABLE I-2. Maintenance Indicators and Actions for Non-Vegetated Infiltration BMPs

Typical Maintenance Indicator(s) for Non-Vegetated Infiltration BMPs	Maintenance Actions
Accumulation of sediment, litter, or debris in infiltration basin, pretreatment device, or on permeable pavement surface	Remove and properly dispose accumulated materials.
Standing water in infiltration basin without subsurface infiltration gallery for longer than 96 hours following a storm event	Remove and replace clogged surface soils.
Standing water in subsurface infiltration gallery for longer than 96 hours following a storm event	This condition requires investigation of why infiltration is not occurring. If feasible, corrective action shall be taken to restore infiltration (e.g. flush fine sediment or remove and replace clogged soils). BMP may require retrofit if infiltration cannot be restored. If retrofit is necessary, the [City Engineer] shall be contacted prior to any repairs or reconstruction.
Standing water in permeable paving area	Flush fine sediment from paving and subsurface gravel. Provide routine vacuuming of permeable paving areas to prevent clogging.
Note: When inspection or maintenance indicates sediment is accumulating in an infiltration BMP, the DMA draining to the infiltration BMP should be examined to determine the source of the sediment, and corrective measures should be made as applicable to minimize the sediment supply.	

TABLE I-3. Maintenance Indicators and Actions for Filtration BMPs

Typical Maintenance Indicator(s) for Filtration BMPs	Maintenance Actions
Accumulation of sediment, litter, or debris	Remove and properly dispose accumulated materials.
Obstructed inlet or outlet structure	Clear obstructions.
Clogged filter media	Remove and properly dispose filter media, and replace with fresh media.
Damage to components of the filtration system	Repair or replace as applicable.
Note: For proprietary media filters, refer to the manufacturer's maintenance guide.	

Appendix 1: Maps and Site Plans

Location Map/ WQMP Site Plan and Receiving Waters Map

TENTATIVE DMA MAP
ROCKPORT RANCH

EXCEL ENGINEERING
LAND PLANNING • ENGINEERING • SURVEYING
440 STATE PLACE, ESCONDIDO, CA 92029
PH (760)745-8118 FX (760)745-1890

FOR: | W.O. | DATE:

DEVELOPER:

RECOMMENDED FOR APPROVAL

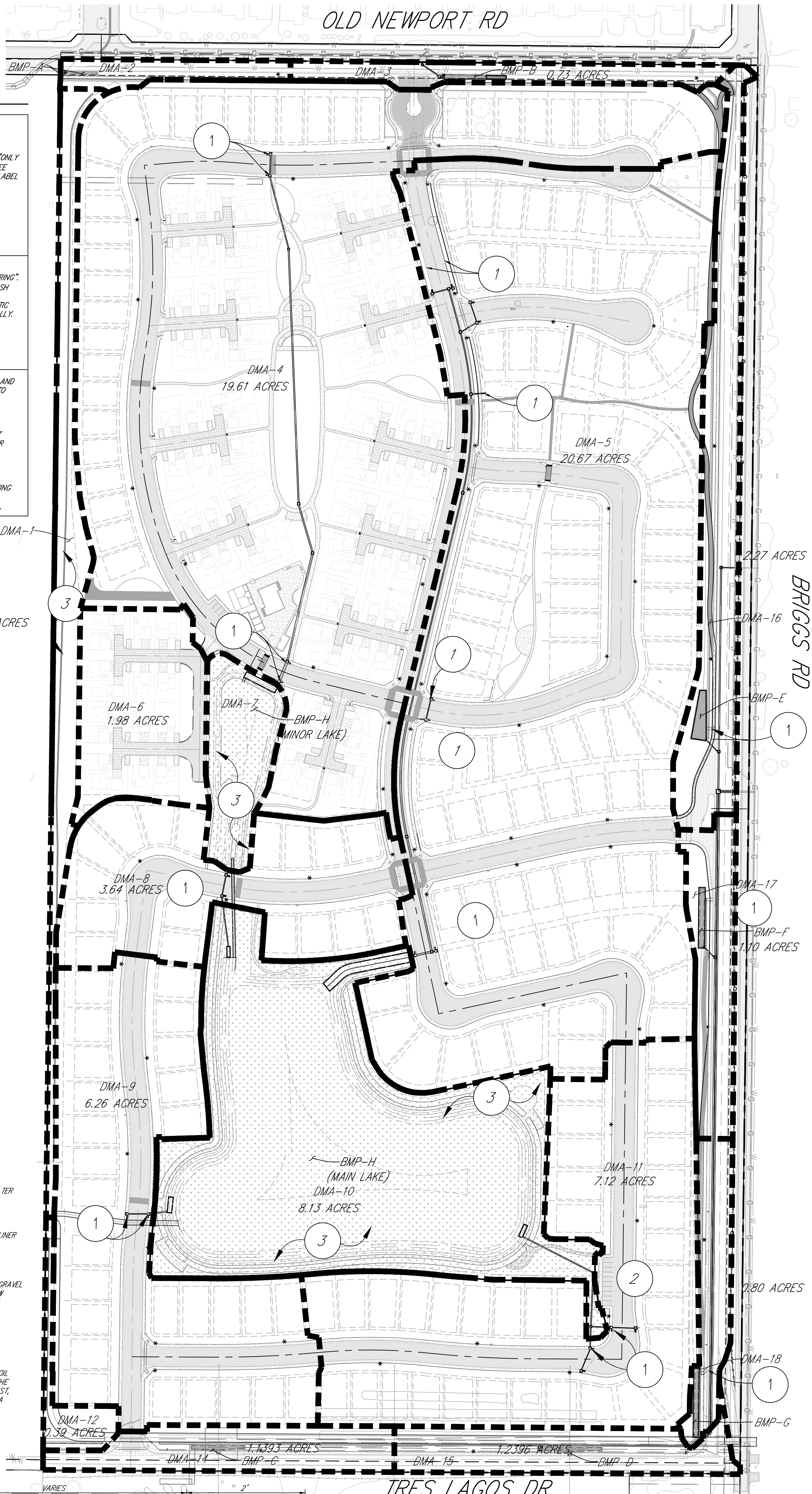
DATE:

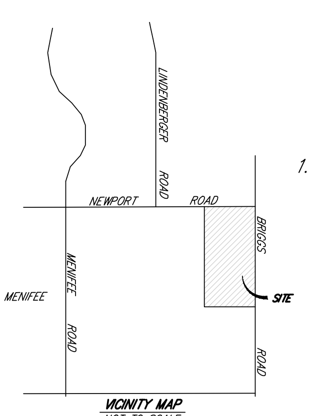
CHECKED BY:

DATE:

SOURCE CONTROL

POTENTIAL SOURCES OF RUNOFF POLLUTANS	PERMANENT CONTROLS
STORM DRAIN INLETS 1	MARK ALL INLETS WITH THE WORDS "ONLY RAIN DOWN THE STORM DRAIN" SEE APPENDIX 8 IN WQMP REPORT FOR LABEL DETAILS.
PUBLIC PLAZAS, SIDEWALKS, AND PARKING LOTS 2	• SIGN WITH THE WORDS "NO LITTERING". • "TRASH BINS" SIGNS NEARBY TRASH BINS. • COVERED TRASH BINS WITH PLASTIC BAG INSIDE LOCATED STRATEGICALLY. • STREET SWEEPING.
LANDSCAPE/ OUTDOOR PESTICIDE USE 3	• EXISTING NATIVE TREES, SHRUBS, AND GROUND COVER ARE PRESERVED TO THE MAXIMUM EXTENT POSSIBLE. • LANDSCAPING IS DESIGNED TO MINIMIZE IRRIGATION AND RUNOFF, AND TO MINIMIZE THE USE OF FERTILIZERS AND PESTICIDES THAT CAN CONTRIBUTE TO STORM WATER POLLUTION. • FOR THE LANDSCAPING IN THE BIO-RETENTION AREAS USE CALIFORNIAN DROUGHT TOLERANT NATIVE GRASSES SUCH AS: HUMMING BIRD SAGE, COMMON YARROW, POLYPODY FERN AND/OR FUSCHIA.





VICINITY MAP
NOT TO SCALE
THOMAS GUIDE PG. 868 C-3

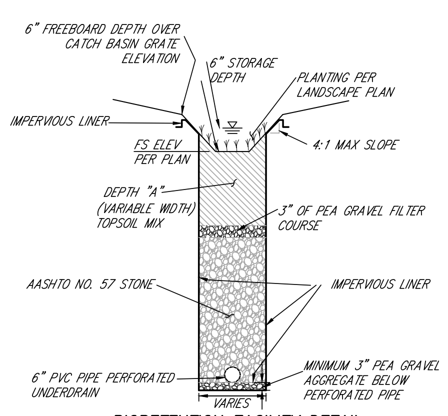
BIORETENTION

WET POND

CONCRETE

A/C SURFACE

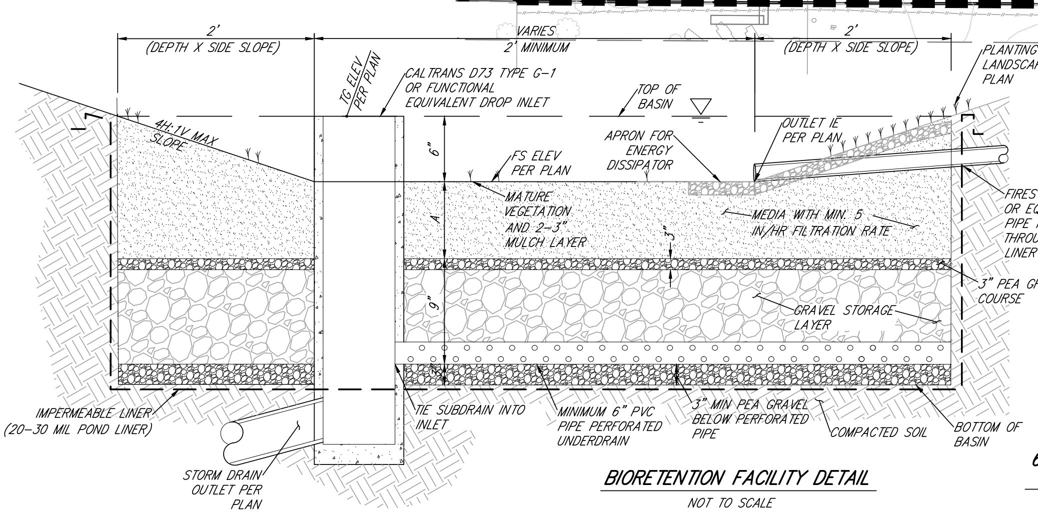
DMA BOUNDARY



BIORETENTION FACILITY DETAIL
TYPICAL SECTION
NOT TO SCALE

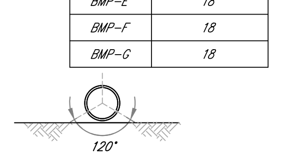
NOTE: ENGINEERED SOIL MEDIA REQUIREMENTS
85% MINERAL COMPONENT, 15% ORGANIC COMPONENT.
MINERAL COMPONENT SHALL BE CLASS A SANDY LOAM TOPSOIL THAT CONTAINS 70-80% SAND, 15-20% SILT, 5-10% CLAY. THE ORGANIC COMPONENT SHALL BE NITROGEN STABILIZED COMPOST, SUCH THAT THE NITROGEN DOES NOT LEACH FROM THE MEDIA

PEA GRAVEL REQUIREMENTS ASTM C-C33 3/8" CRUSHED AGGREGATE (OR EQUIVALENT)



BIORETENTION FACILITY DETAIL
NOT TO SCALE

BIORETENTION FACILITY SOIL MEDIA DEPTH	
BMP ID	DIMENSION "A" MEDIA (INCH)
BMP-A	36
BMP-B	21
BMP-C	24
BMP-D	18
BMP-E	18
BMP-F	18
BMP-G	18

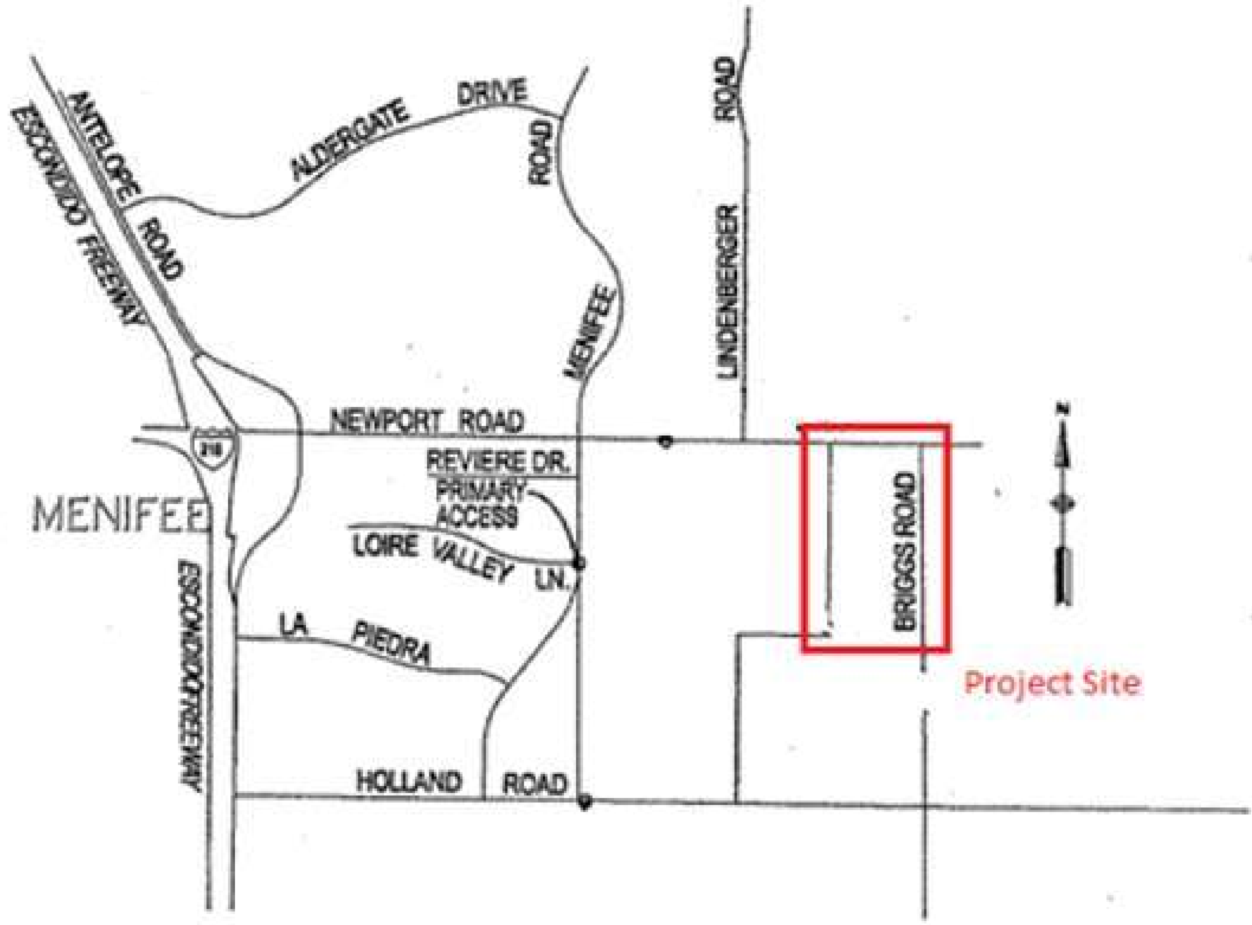


6" PVC PIPE PERFORATION UNDERDRAIN LAYOUT DETAIL
NOT TO SCALE

BMP NAME	TYPE	PUBLIC/PRIVATE	RESPONSIBLE PARTY	FUNDED BY
BMP-A	BIORETENTION	PUBLIC	CITY OF MENIFEE	COMMUNITY FACILITIES DISTRICT
BMP-B	BIORETENTION	PUBLIC	CITY OF MENIFEE	COMMUNITY FACILITIES DISTRICT
BMP-C	BIORETENTION	PUBLIC	CITY OF MENIFEE	COMMUNITY FACILITIES DISTRICT
BMP-D	BIORETENTION	PUBLIC	CITY OF MENIFEE	COMMUNITY FACILITIES DISTRICT
BMP-E	BIORETENTION	PUBLIC	CITY OF MENIFEE	COMMUNITY FACILITIES DISTRICT
BMP-F	BIORETENTION	PUBLIC	CITY OF MENIFEE	COMMUNITY FACILITIES DISTRICT
BMP-G	BIORETENTION	PUBLIC	CITY OF MENIFEE	COMMUNITY FACILITIES DISTRICT
BMP-H	BIORETENTION	PRIVATE	FUTURE HOA	FUTURE HOA

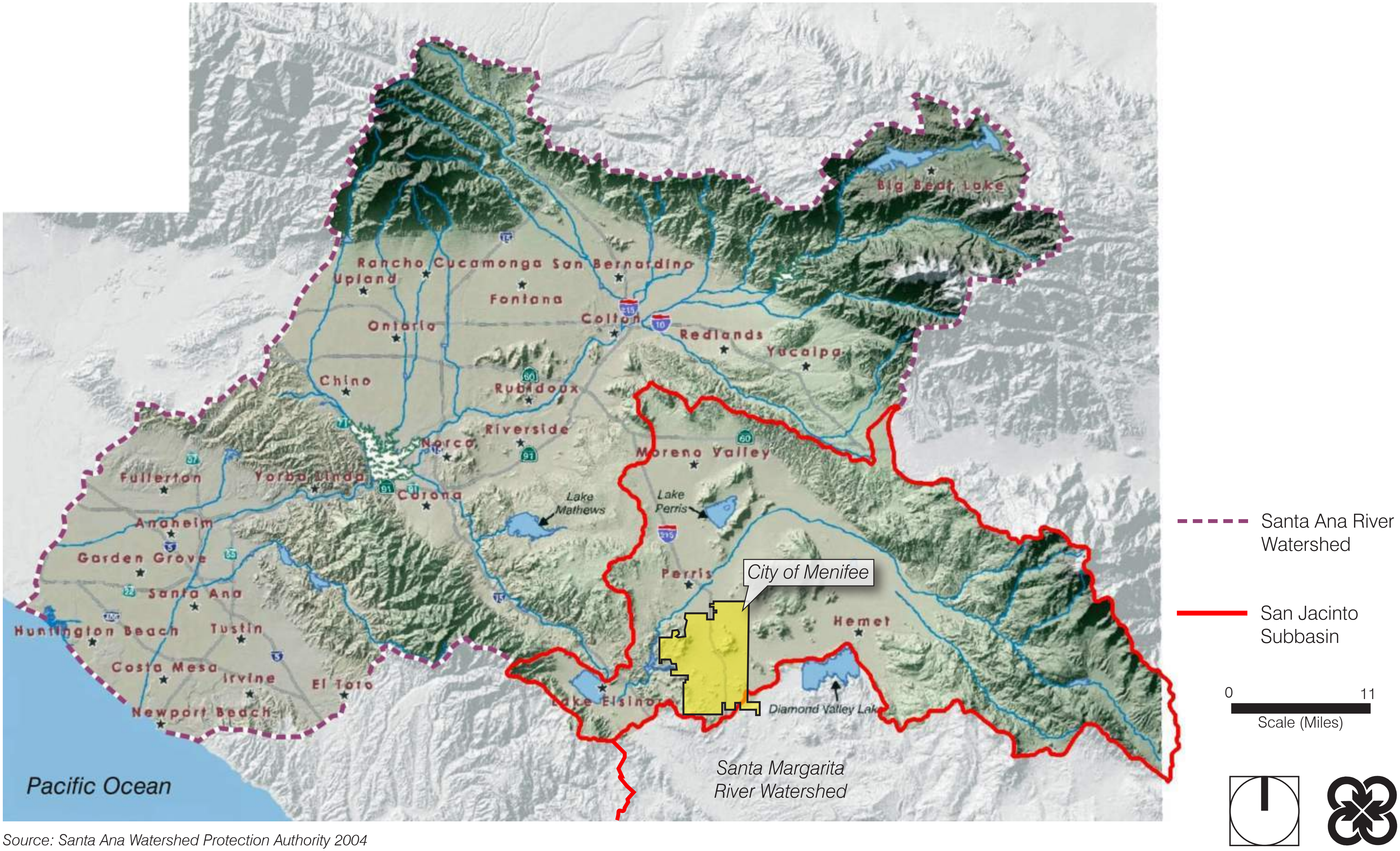
SCALE: 1"=100'
0 100 200 300 400

VICINITY MAP



NOT TO SCALE

Santa Ana and San Jacinto River Watersheds



Source: Santa Ana Watershed Protection Authority 2004

Appendix 2: Construction Plans

Grading and Drainage Plans

TENTATIVE TRACT MAP NO. 37131
FOR
ROCKPORT RANCH
MENIFEE, CA

APPLICANT
THE ABACHERLI FAMILY TRUST
29875 NEWPORT ROAD
MENIFEE, CA 92584

LANDOWNER
THE ABACHERLI FAMILY TRUST
29875 NEWPORT ROAD
MENIFEE, CA 92584

PREPARER
EXCEL ENGINEERING
440 STATE PLACE
ESCONDIDO, CA 92029
PHONE (760) 745-8118
FAX (760) 745-1890

UTILITY COMPANIES

WATER/ SEWER
EASTERN MUNICIPAL WATER DISTRICT
951-928-6177

TELEPHONE
PACIFIC BELL TELEPHONE
800-310-2355

CABLE
TIME WARNER
855-892-4357

ELECTRIC
SOUTHERN CALIFORNIA EDISON
800-655-4555

GAS
SOUTHERN CALIFORNIA GAS COMPANY
800-427-2000

ACREAGE
78.447 NET AREA
79.681 GROSS AREA

FLOOD ZONE DESIGNATION
THIS SITE IS LOCATED IN ZONE A (NO BASE FLOOD ELEVATIONS DETERMINED) AS SHOWN ON THE FLOOD INSURANCE RATE MAP, COMMUNITY-PANEL NO. 060245 2070 H
MAP REVISED AUGUST 18, 2014

GENERAL PLAN
EXISTING: AG (AGRICULTURE)
PROPOSED: SP (SPECIFIC PLAN)

ZONING
EXISTING: A-2-10
PROPOSED: SP

LEGAL DESCRIPTION
A PORTION OF THE EAST HALF OF THE NORTHEAST QUARTER OF SECTION 1, TOWNSHIP 6 SOUTH, RANGE 3 WEST, IN THE CITY OF MENIFEE, COUNTY OF RIVERSIDE, STATE OF CALIFORNIA, SAN BERNARDINO BASE AND MERIDIAN

ASSESSOR'S PARCEL NUMBER
364-190-004, 005

MAP PREPARED BY:
EXCEL ENGINEERING
440 STATE PLACE
ESCONDIDO, CA 92029
PHONE (760) 745-8118
FAX (760) 745-1890

LICENSED LAND SURVEYOR
Michael D. Levin
No. 6896
ex6/30/19
STATE OF CALIFORNIA

MICHAEL D. LEVIN, P.L.S. NO. 6896

ENGINEER OF WORK
EXCEL ENGINEERING
440 STATE PLACE
ESCONDIDO, CA 92029
PHONE (760) 745-8118
FAX (760) 745-1890

REGISTERED PROFESSIONAL ENGINEER
ROBERT D. DENTINO
No. 45629
ex12/31/20
CIVIL
STATE OF CALIFORNIA

ROBERT D. DENTINO, R.C.E. NO. 45629

OWNER
I HEREBY CERTIFY THAT I AM THE RECORD OWNER OF THE PROPERTY SHOWN ON THIS TENTATIVE SUBDIVISION MAP AND THAT SAID MAP SHOWS MY ENTIRE CONTIGUOUS OWNERSHIP. I UNDERSTAND THAT THE PROPERTY IS CONSIDERED CONTIGUOUS EVEN IF IT IS SEPARATED BY ROADS, STREETS, UTILITY EASEMENTS OR RAILROAD RIGHTS OF WAY.

THE ABACHERLI FAMILY TRUST

BY:

ROD JONES   DATE

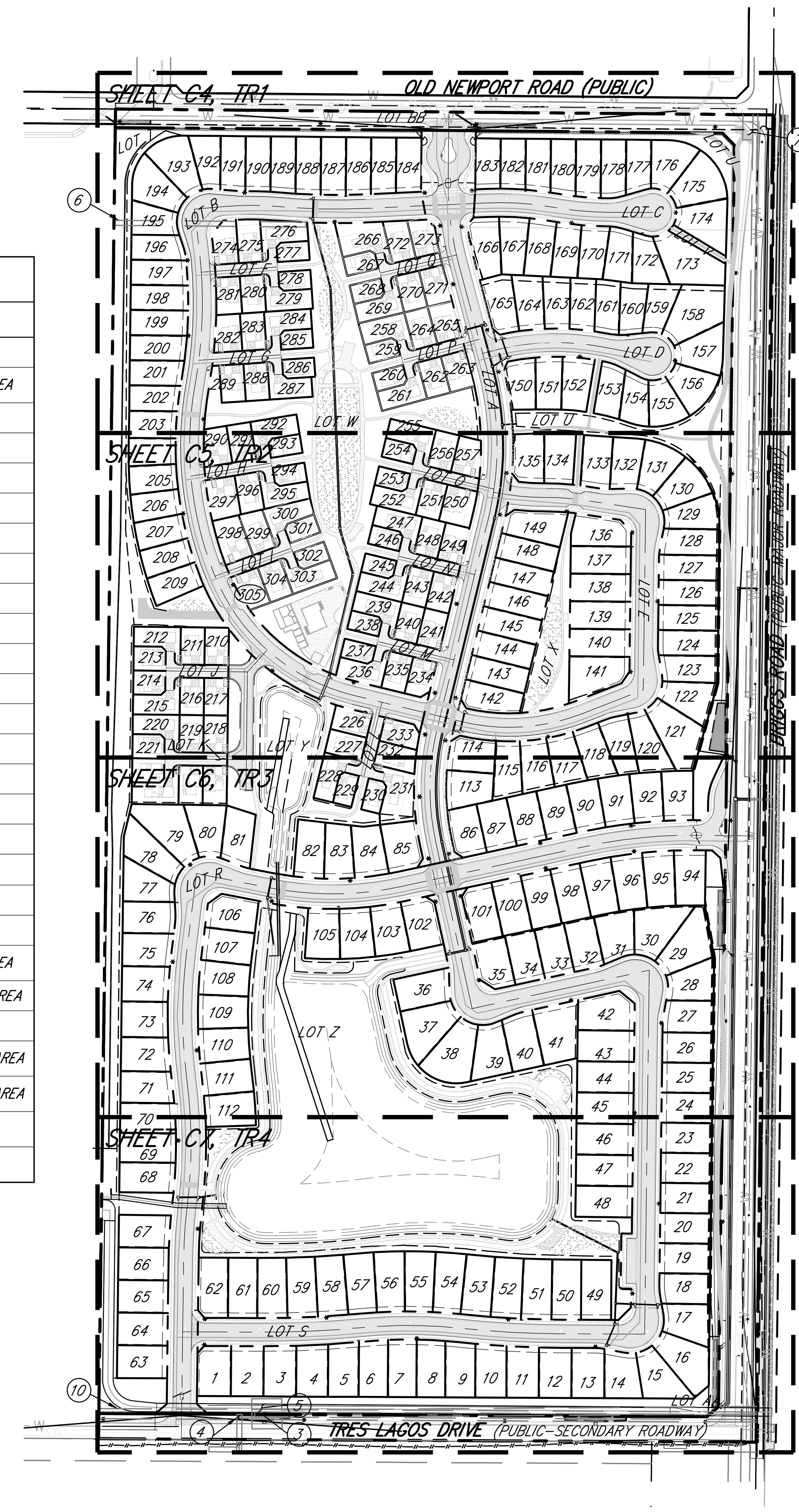
REFERENCE INFORMATION:
1. THIS TENTATIVE MAP INCLUDES ALL OF THE CONTINUOUS OWNERSHIP OF THE LANDOWNER.
2. PRELIMINARY EARTHWORK CALCULATIONS INDICATE TRACT 37131 WILL NOT BALANCE ON SITE. TRACT 37131 WILL GENERATE APPROXIMATELY 190,000 C.Y. RAW FILL.
3. THIS SITE IS NOT A LIQUEFACTION ZONE
4. THIS SITE IS NOT IN A SEISMIC SPECIAL STUDY ZONE
5. GEOLOGIC HAZARDS WERE NOT ENCOUNTERED ON THIS SITE
6. SEE HYDROLOGY REPORT FOR FLOOD INFORMATION
7. ALL IMPROVEMENTS SHALL BE PER SCHEDULE "A," SUBDIVISION ORDINANCE NO. 460

BASIS OF BEARINGS
NORTH LINE OF SECTION 1 AS SHOWN ON TRACT MAP 30422-1, RECORDED OCTOBER 23, 2006, IN BOOK 411 OF MAPS, PAGES 69-99 AS DOCUMENT NO. 2006-0777728. IE N89°28'44"W

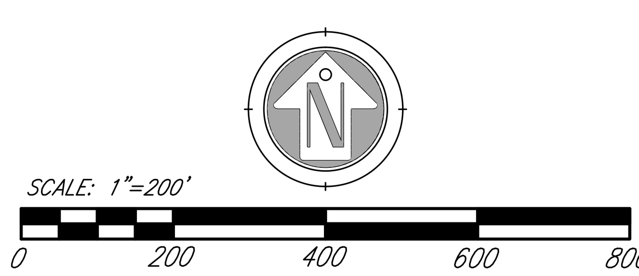
BENCHMARK
COUNTY OF RIVERSIDE, BENCHMARK M-12-B, AN ALUMINUM DISC ON TOP OF CONCRETE POST, AT THE SE CORNER OF LEON RD. AND SIMPSON RD. ELEV. = 1457.72

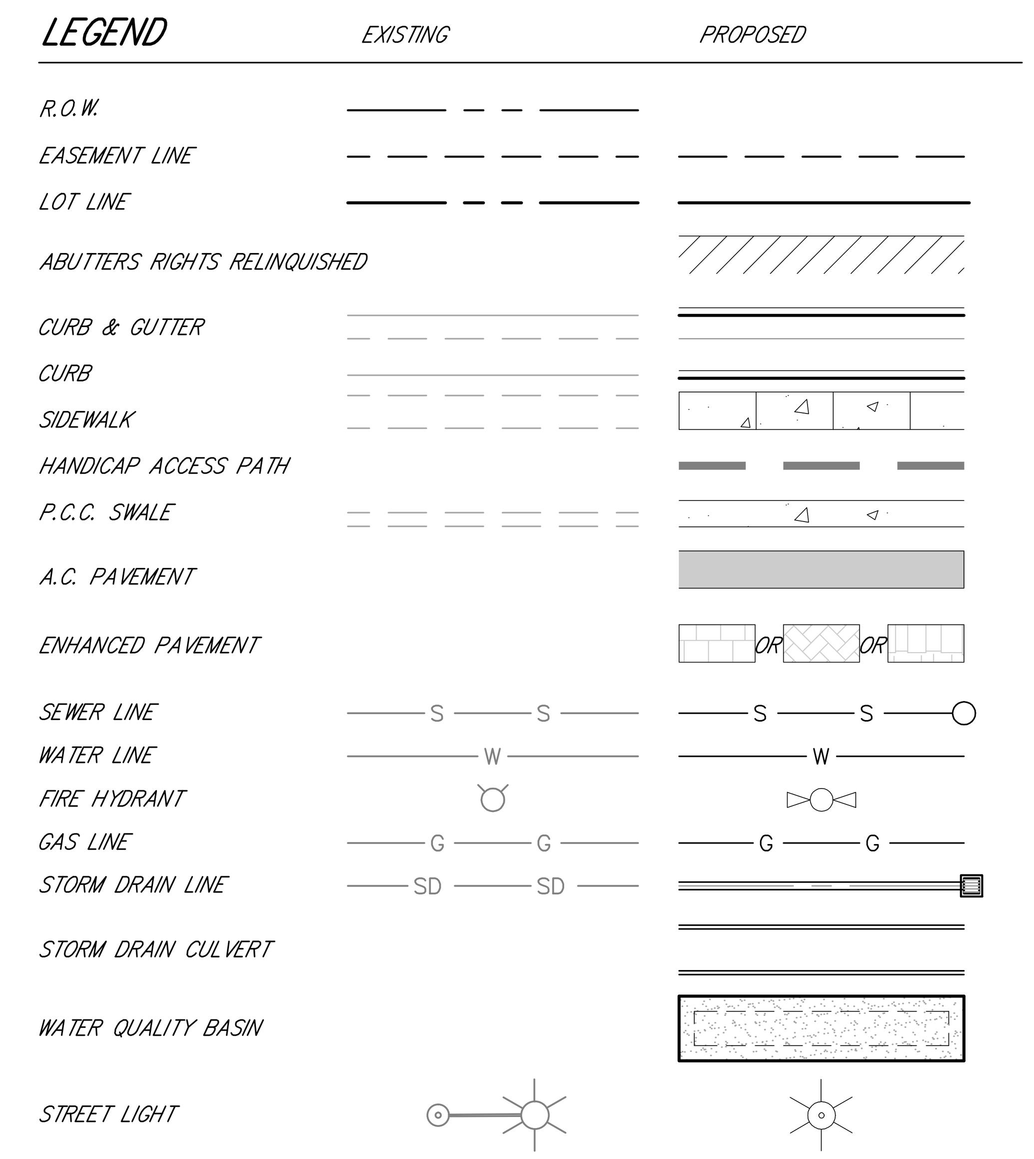
LETTERED LOT TABLE

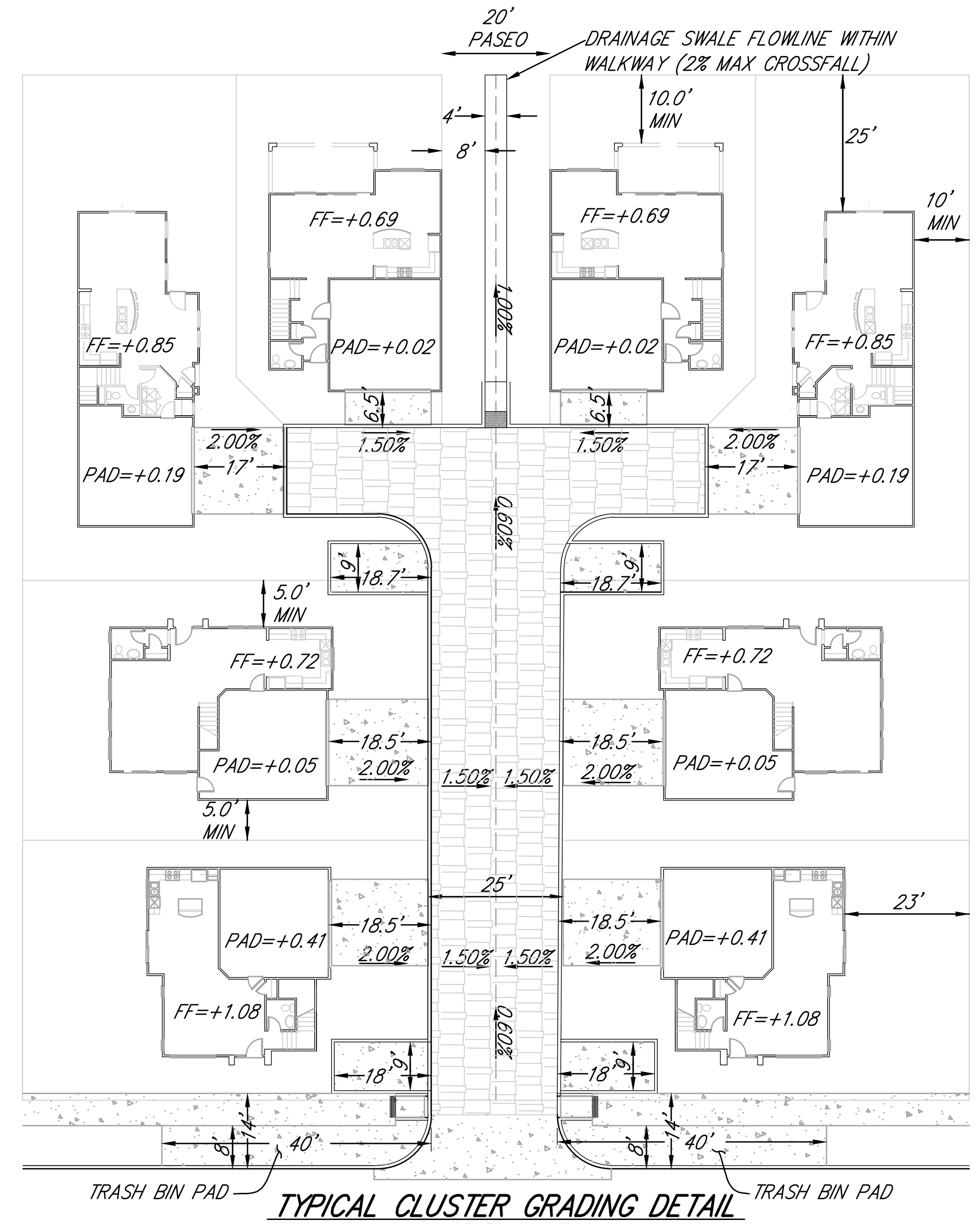
LOT	AREA (SF)	USE
LOT A	102987.91	PRIVATE ROAD
LOT AA	61709.94	OPEN SPACE/LANDSCAPE AREA
LOT B	97943.19	PRIVATE ROAD
LOT C	25237.28	PRIVATE ROAD
LOT D	22834.20	PRIVATE ROAD
LOT E	60131.37	PRIVATE ROAD
LOT F	4252.00	PRIVATE ACCESS
LOT G	4559.44	PRIVATE ACCESS
LOT H	4514.60	PRIVATE ACCESS
LOT I	4511.76	PRIVATE ACCESS
LOT J	4257.85	PRIVATE ACCESS
LOT K	4257.85	PRIVATE ACCESS
LOT L	4257.93	PRIVATE ACCESS
LOT M	4257.85	PRIVATE ACCESS
LOT N	4257.85	PRIVATE ACCESS
LOT O	4562.16	PRIVATE ACCESS
LOT P	4311.44	PRIVATE ACCESS
LOT Q	4255.55	PRIVATE ACCESS
LOT R	135006.21	PRIVATE ROAD
LOT S	130523.19	PRIVATE ROAD
LOT T	134019.96	OPEN SPACE/LANDSCAPE AREA
LOT U	68789.74	OPEN SPACE/LANDSCAPE AREA
LOT V	1772.73	ACCESS LOT
LOT W	132920.59	OPEN SPACE/COMMON USE AREA
LOT X	20236.06	OPEN SPACE/COMMON USE AREA
LOT Y	70491.54	OPEN SPACE/DRAINAGE LOT
LOT Z	357867.86	OPEN SPACE/DRAINAGE LOT



KEY MAP

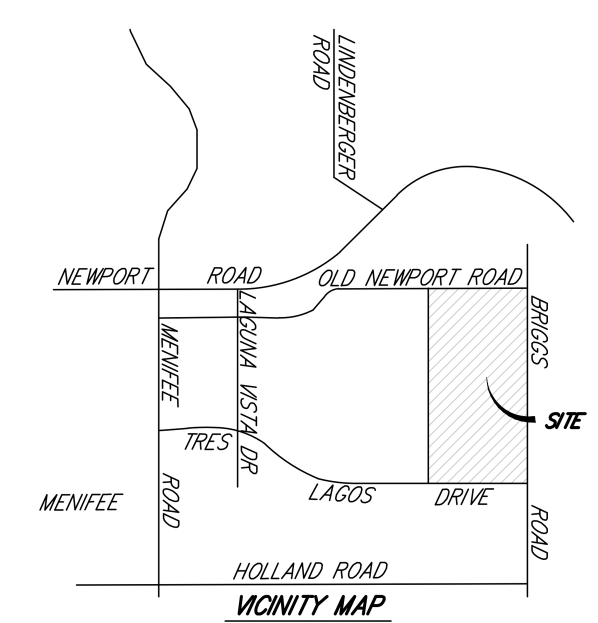






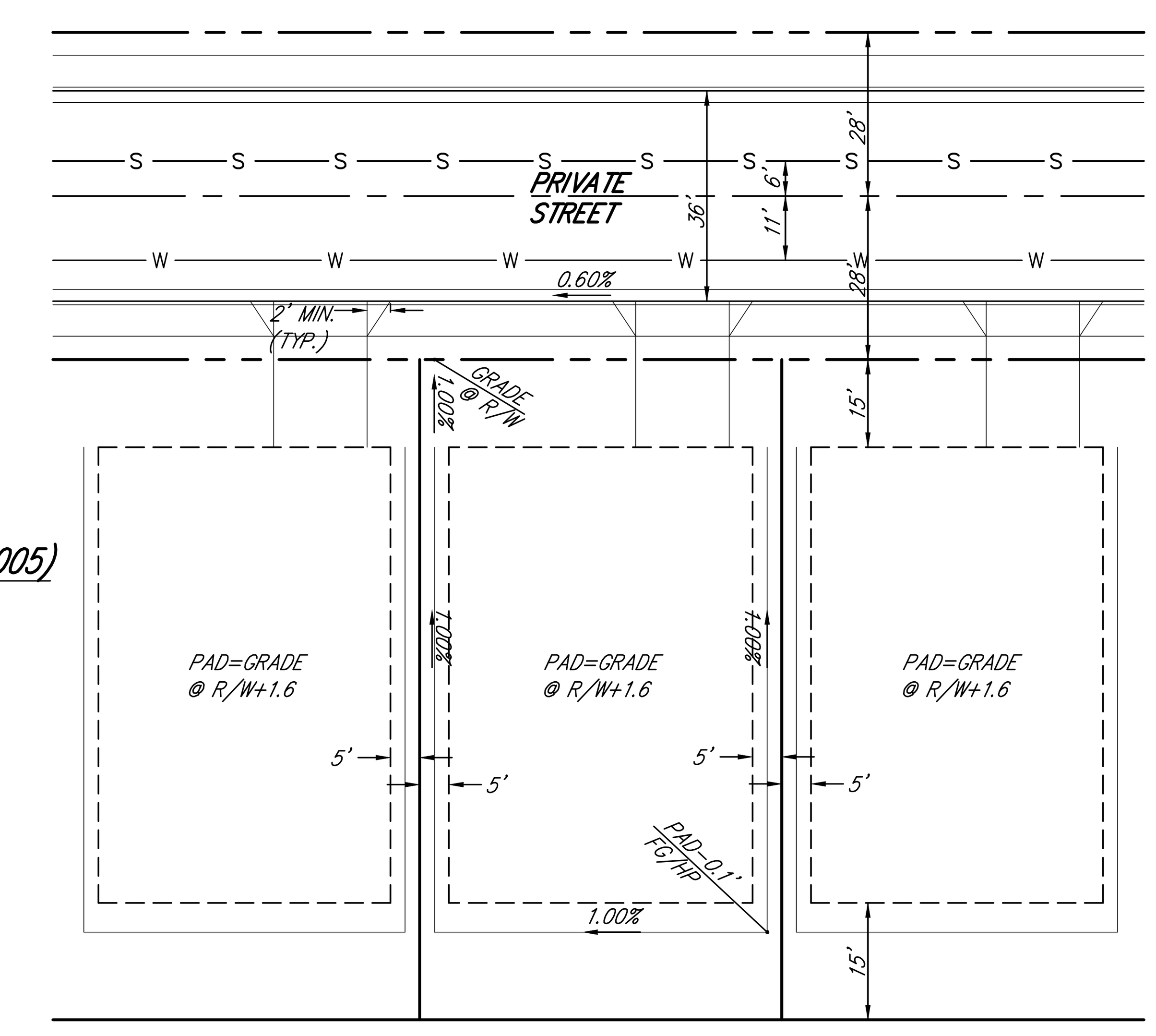
TYPICAL CLUSTER GRADING DETAIL
NOT TO SCALE

INDEX OF SHEETS (OF 21 SHEETS)



VICINITY MAP
NOT TO SCALE
THOMAS GUIDE PG. 868 C-3

GRADING QUANTITIES
CUT- 177,500
FILL- 412,350
IMPORT- 234,850



TYPICAL LOT GRADING DETAIL
NOT TO SCALE

EXISTING EASEMENTS AS NOTED AND NUMBERED IN PRELIMINARY TITLE REPORT ORDER NO. 12206013-993-SD2, DATED 9/5/2017 (APNS 364-190-004,005)

(2) AN EASEMENT FOR PIPELINE PURPOSES, RECORDED AUGUST 20, 1958 PER BOOK 2320, PAGE 458 OF O.R. -NOT PLOTTABLE

(3) AN EASEMENT FOR UTILITY PURPOSES, RECORDED SEPTEMBER 26, 1978 AS INSTRUMENT NUMBER 78-203652 OF O.R.

(4) AN EASEMENT FOR PUBLIC UTILITY PURPOSES, RECORDED AUGUST 10, 1979 AS INSTRUMENT NUMBER 169507 OF O.R.

(5) AN EASEMENT FOR WATER WELL PURPOSES, RECORDED OCTOBER 07, 1980 AS INSTRUMENT NUMBER 80-183606 OF O.R.

(6) AN EASEMENT FOR PUBLIC UTILITIES, RECORDED MAY 22, 1981 AS INSTRUMENT NUMBER 81-94452 OF O.R.

(7) AN EASEMENT FOR WATER AND INCIDENTAL PURPOSES, RECORDED MARCH 11, 1988 AS INSTRUMENT NUMBER 88-064642 OF O.R.

(10) AN EASEMENT FOR PIPELINE PURPOSES, RECORDED SEPTEMBER 17, 2001 AS INSTRUMENT NUMBER 2001-0449760 OF O.R.

DATE	BY	MARK	REVISIONS	APPVD	DATE
	ENGINEER			COUNTY	
DESIGNED BY:			DRAWN BY:	CHECKED BY:	

RECOMMENDED FOR APPROVAL

DATE:

CHECKED BY:

DATE:

DEVELOPER:

EXCEL ENGINEERING
LAND PLANNING • ENGINEERING • SURVEYING
440 STATE PLACE, ESCONDIDO, CA 92029
PH (760)745-8118 FX (760)745-1890

FOR:

TENTATIVE TRACT MAP
ROCKPORT RANCH
TITLE SHEET & NOTES

W.O.

C1

OF 21 SHTS

DATE: 02/25/2019

BIORETENTION FACILITY SOIL MEDIA DEPTH

BMP ID	DIMENSION "A" MEDIA (INCH)
BMP-A	36
BMP-B	21
BMP-C	24
BMP-D	18
BMP-E	18
BMP-F	18
BMP-G	18

NOTE: ENGINEERED SOIL MEDIA REQUIREMENTS 85% MINERAL COMPONENT, 15% ORGANIC COMPONENT. MINERAL COMPONENT SHALL BE CLASS A SANDY LOAM TOPSOIL THAT CONTAINS 70-80% SAND, 15-20% SILT, 5-10% CLAY. THE ORGANIC COMPONENT SHALL BE NITROGEN STABILIZED COMPOST, SUCH THAT THE NITROGEN DOES NOT LEACH FROM THE MEDIA

RECOMMENDED FOR APPROVAL
DATE:
CHECKED BY:
DATE:

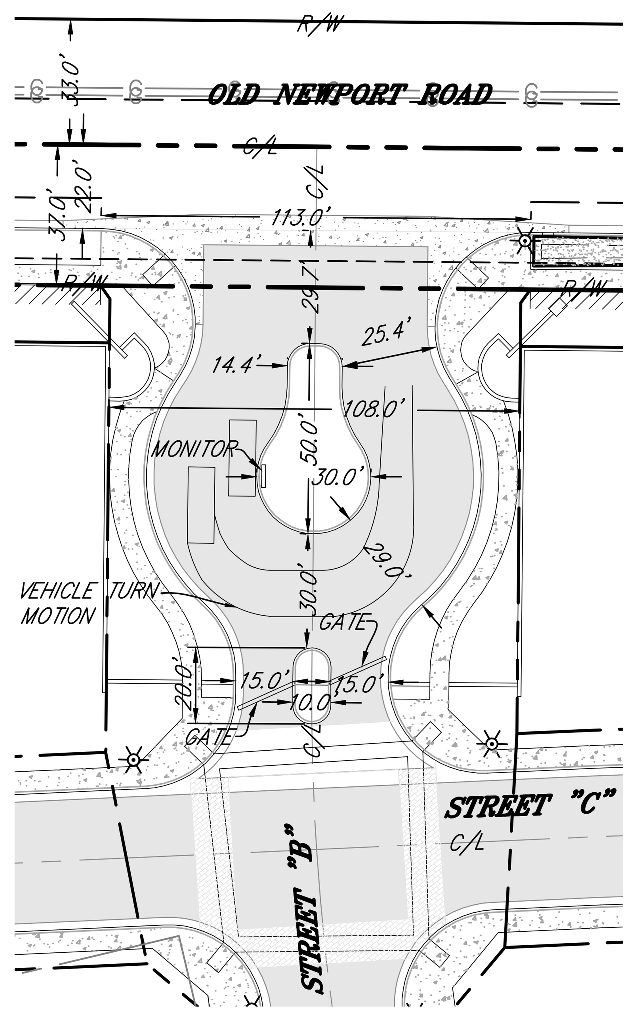
DEVELOPER:

EXCEL ENGINEERING
LAND PLANNING • ENGINEERING • SURVEYING
440 STATE PLACE, ESCONDIDO, CA 92029
PH (760)745-8118 FX (760)745-1890

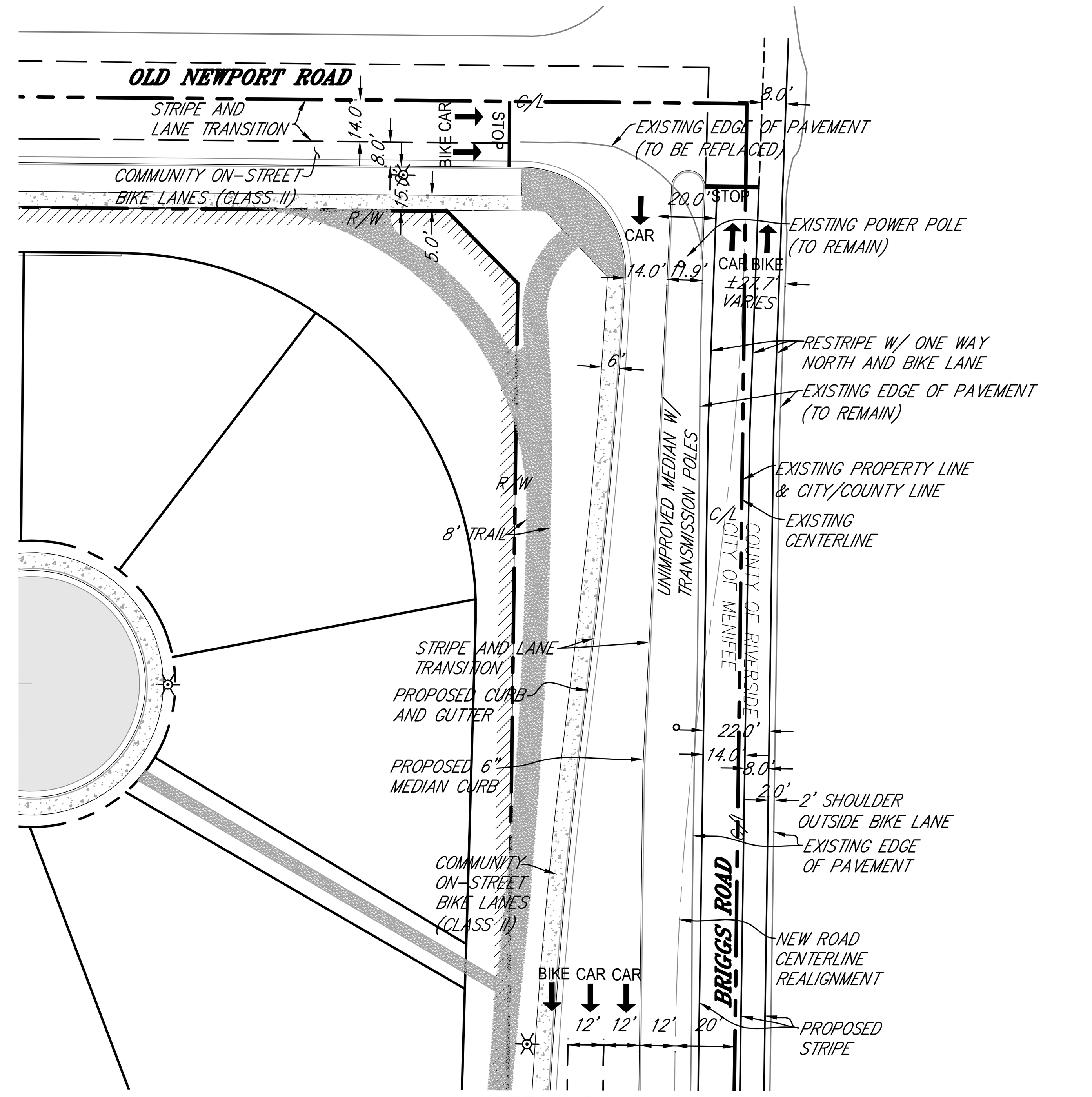
TENTATIVE TRACT MAP
ROCKPORT RANCH
DETAILS & SECTIONS

C2
OF 21 SHTS

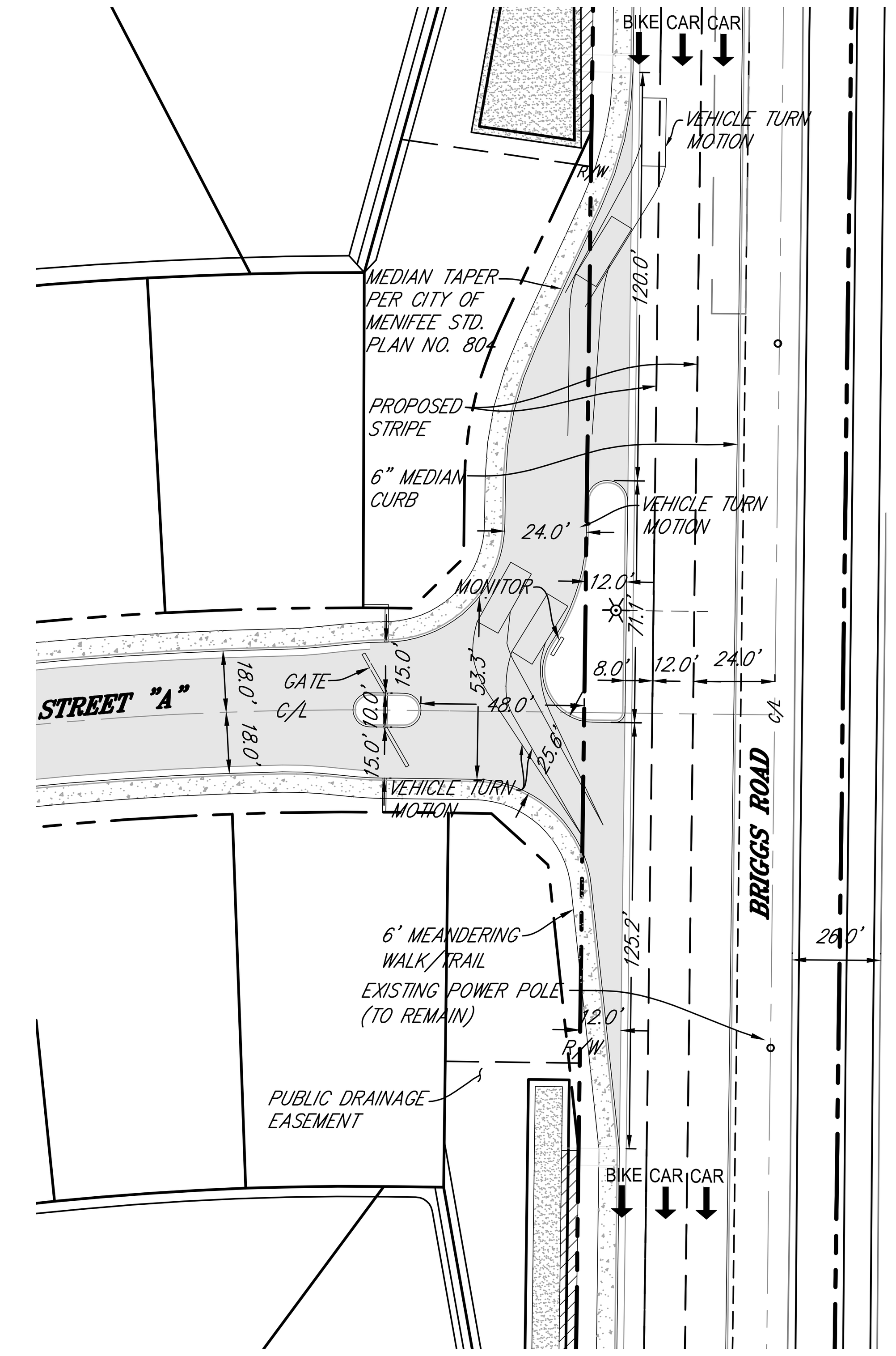
FOR:
W.O.
DATE: 02/25/2019



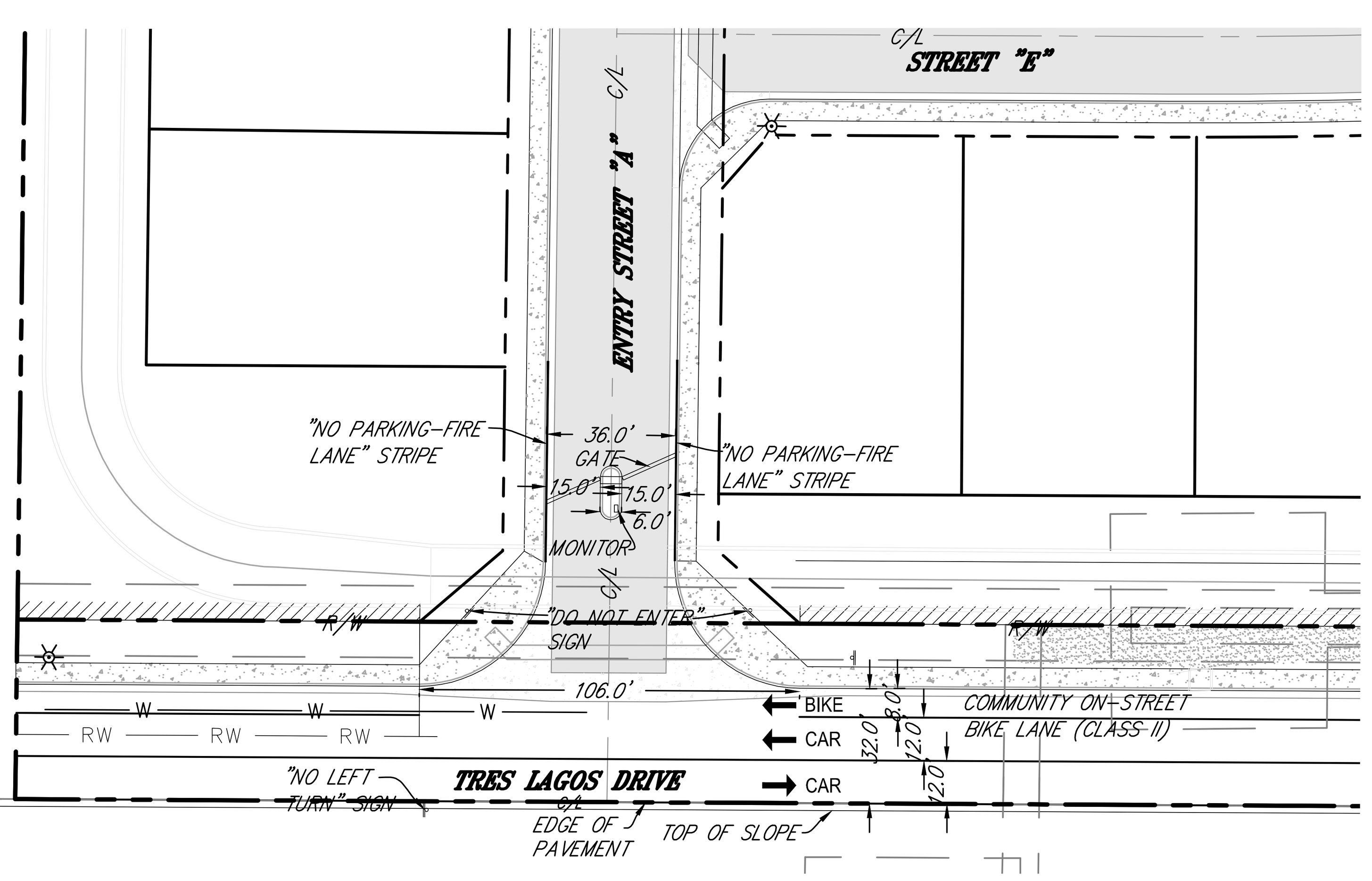
DETAIL A
SCALE: 1"=40'



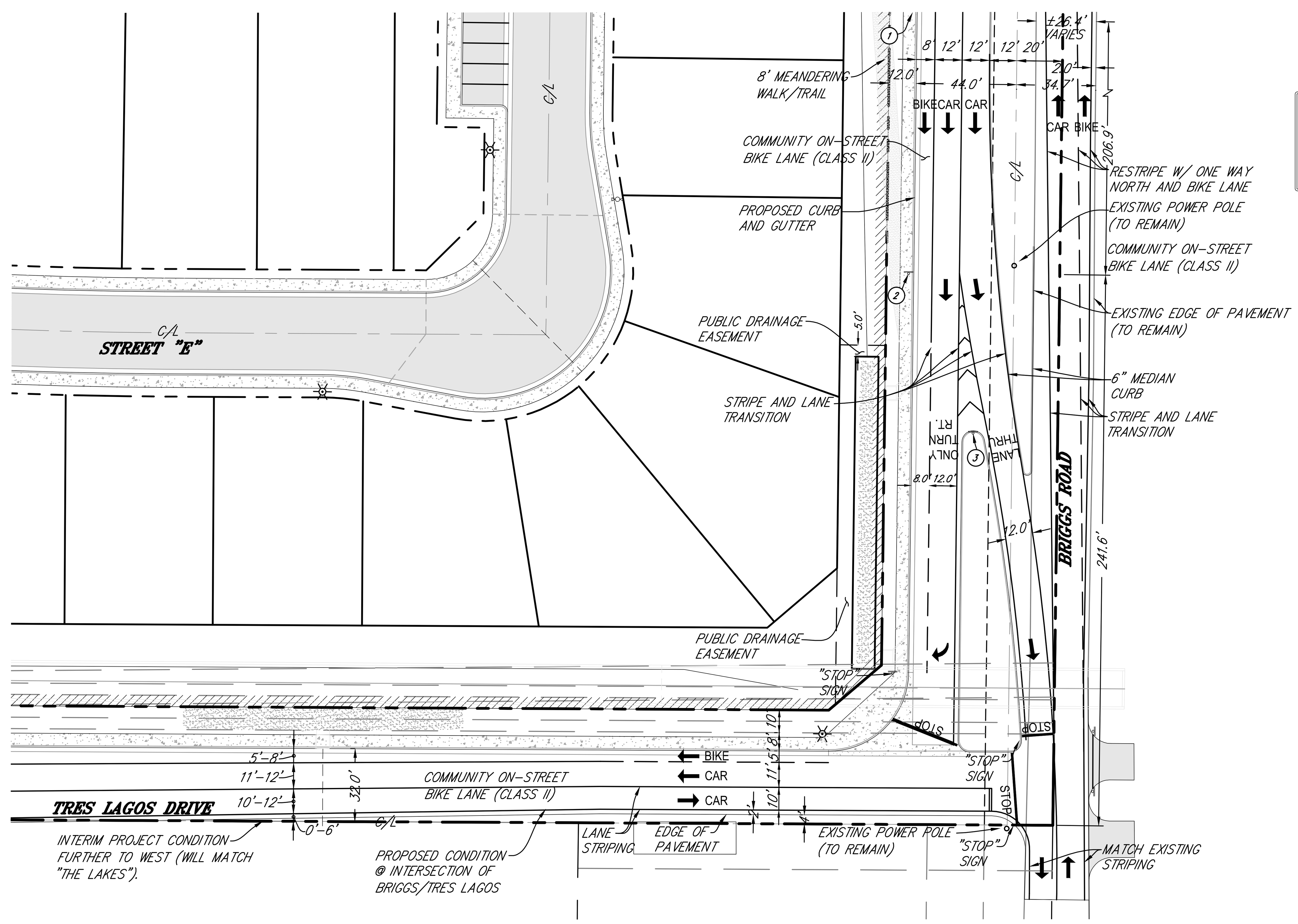
DETAIL B
SCALE: 1"=40'



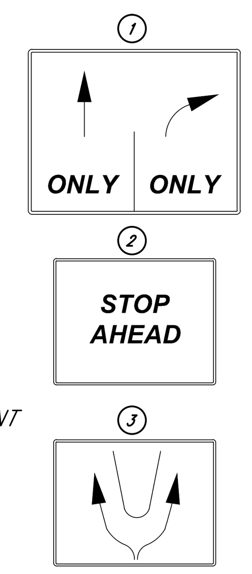
DETAIL C
SCALE: 1"=40'



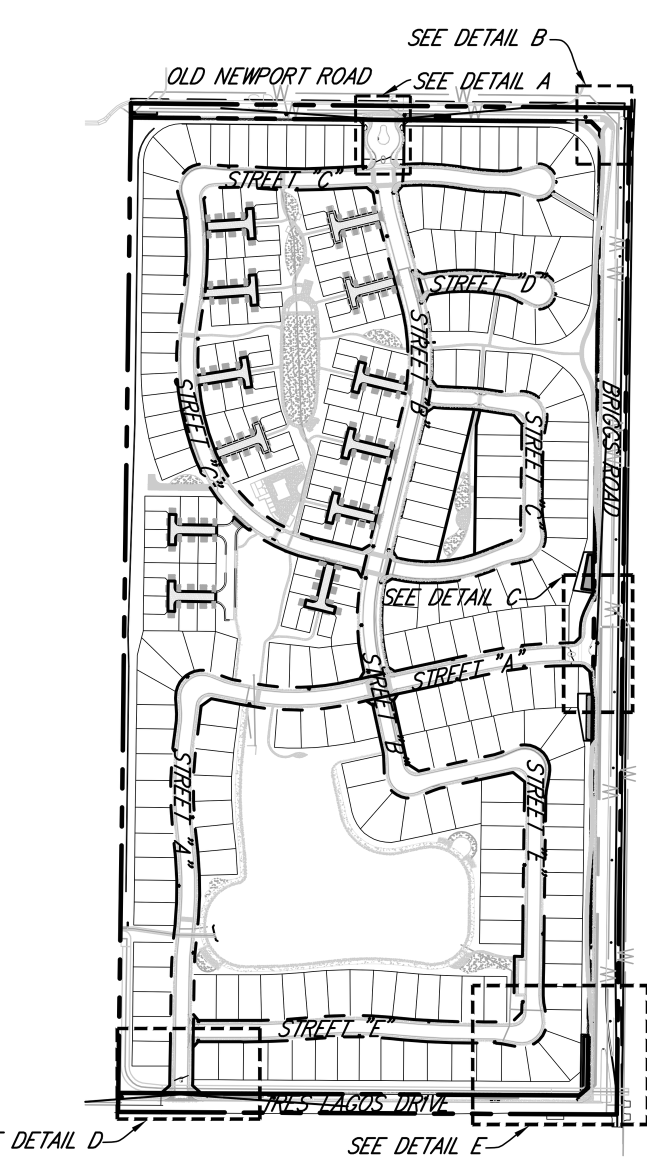
DETAIL D
SCALE: 1"=40'



DETAIL E
SCALE: 1"=40'



SIGN DETAILS



KEY MAP
NOT TO SCALE

RECOMMENDED FOR APPROVAL	DEVELOPER:	EXCEL ENGINEERING	TENTATIVE TRACT MAP ROCKPORT RANCH DETAILS	C3
DATE:		LAND PLANNING • ENGINEERING • SURVEYING 440 STATE PLACE, ESCONDIDO, CA 92029 PH (760)745-8118 FX (760)745-1890	FOR: W.O.	OF 21 SHTS
CHECKED BY: DATE:				DATE: 02/25/2019

BMP NAME	TYPE	PUBLIC/PRIVATE	RESPONSIBLE PARTY	FUNDED BY
BMP-A	BIORETENTION	PUBLIC	CITY OF MENIFEE	COMMUNITY FACILITIES DISTRICT
BMP-B	BIORETENTION	PUBLIC	CITY OF MENIFEE	COMMUNITY FACILITIES DISTRICT

CENTERLINE DATA

NO	DELTA/BRG	RADIUS	LENGTH
1	N00°31'16"E	--	140.55'
2	Δ=04°12'16"	602.00'	44.18'
3	Δ=09°41'05"	602.00'	101.76'
4	Δ=01°39'43"	602.00'	17.46'
5	N15°01'48"W	--	156.74'
6	N15°01'48"W	--	28.83'
7	N15°01'48"W	--	31.72'
8	*Δ=28°41'16"	598.00'	130.04'
9	N89°45'33"W	--	90.00'
10	Δ=08°23'31"	600.00'	87.88'
11	N81°22'02"W	--	38.09'
12	Δ=11°14'43"	600.00'	117.76'
13	N87°23'15"E	--	73.84'
14	N87°23'15"E	--	165.34'
15	Δ=07°43'00"	1300.00'	175.08'
16	Δ=10°06'04"	600.00'	105.78'
17	N85°00'10"E	--	61.71'
18	N06°59'50"W	--	75.92'
19	Δ=03°09'16"	920.00'	50.65'
20	Δ=10°57'56"	920.00'	176.07'
21	Δ=03°04'38"	920.00'	49.41'
22	*Δ=32°06'04"	690.00'	96.82'
23	N74°58'12"E	--	17.04'
24	Δ=25°41'15"	500.00'	224.17'
25	N79°20'34"W	--	101.40'
26	N86°09'26"E	--	152.58'
27	N86°09'26"E	--	164.90'
28	N74°58'12"E	--	154.88'
29	N76°38'02"E	--	155.58'

* PORTION SHOWN

AVOID CUTTING UNDERGROUND UTILITY LINES. ITS COSTLY.

811 Know what's below. Call before you dig.

OR

1-800-227-2600

PUBLIC UTILITIES NOTE:

A BLANKET EASEMENT FOR PUBLIC UTILITIES ACCESS AND MAINTENANCE TO EMWD WILL BE PROVIDED ALL LOTS THAT FORM THE PRIVATE STREETS AND DRIVEWAYS THAT ENCOMPASS PUBLIC WATERLINES, PUBLIC SEWER LINES, AND APPURTENANCES.

NOTE: SEE TITLE SHEET FOR EASEMENT INFORMATION

SCALE 1":40'

0 40 80 120 160

DATE	BY	MARK		APPVD	DATE
ENGINEER			REVISIONS		COUNTY

DESIGNED BY: DRAWN BY: CHECKED BY:

RECOMMENDED FOR APPROVAL

DATE:

CHECKED BY:

DATE:

DEVELOPER:

EXCEL ENGINEERING

LAND PLANNING • ENGINEERING • SURVEYING
440 STATE PLACE, ESCONDIDO, CA 92029
PH (760)745-8118 FX (760)745-1890

FOR:

W.O.

TENTATIVE TRACT MAP
ROCKPORT RANCH
NORTH GRADING PLAN

C4

OF 21 SHTS

DATE: 02/25/2019

CENTERLINE DATA			
NO	DELTA/BRG	RADIUS	LENGTH
1	*Δ=23°10'26"	598.00'	118.68'
2	Δ=00°39'24"	598.00'	6.85'
3	Δ=04°51'26"	598.00'	50.70'
4	N13°39'28"E	--	117.54'
5	N13°39'28"E	--	175.00'
6	N13°39'28"E	--	115.86'
7	N13°39'28"E	--	26.05'

* PORTION SHOWN

NO	DELTA/BRG	RADIUS	LENGTH
8	*Δ=25°55'56"	502.00'	57.79'
9	*Δ=15°10'05"	690.00'	85.84'
10	Δ=16°55'59"	690.00'	203.92'
11	Δ=00°15'38"	400.00'	1.82'
12	Δ=26°03'22"	400.00'	181.91'
13	Δ=28°07'28"	400.00'	196.35'
14	N76°20'32"W	--	177.91'
15	N76°20'32"W	--	44.51'

* PORTION SHOWN

NO	DELTA/BRG	RADIUS	LENGTH
16	Δ=34°55'56"	400.00'	243.87'
17	N68°43'32"E	--	130.66'
18	N00°43'32"E	--	359.44'
19	N81°16'28"W	--	121.87'
20	Δ=08°54'41"	500.00'	77.77'
21	Δ=08°59'11"	500.00'	78.42'
22	N81°11'58"W	--	27.10'
23	N80°43'49"E	--	162.83'
24	N69°55'34"E	--	162.68'

NO	DELTA/BRG	RADIUS	LENGTH
25	N41°46'56"E	--	58.61'
26	N89°16'05"W	--	163.33'
27	N00°43'55"E	--	170.86'

NO	DELTA/BRG	RADIUS	LENGTH
28	N89°16'05"W	--	163.33'
29	N76°20'32"W	--	154.83'

NO	DELTA/BRG	RADIUS	LENGTH
30	N76°20'32"W	--	156.83'
31	N76°20'32"W	--	168.74'

SCALE 1":40'
0 40 80 120 160

BMP NAME	TYPE	PUBLIC/PRIVATE	RESPONSIBLE PARTY	FUNDED BY
BMP-E	BIORETENTION	PUBLIC	CITY OF MENIFEE	COMMUNITY FACILITIES DISTRICT
BMP-H	BIORETENTION	PRIVATE	FUTURE HOA	FUTURE HOA

PUBLIC UTILITIES NOTE:

A BLANKET EASEMENT FOR PUBLIC UTILITIES ACCESS AND MAINTENANCE TO EMWD WILL BE PROVIDED ALL LOTS THAT FORM THE PRIVATE STREETS AND DRIVEWAYS THAT ENCOMPASS PUBLIC WATERLINES, PUBLIC SEWER LINES, AND APPURTENANCES.

DATE	BY	MARK	REVISIONS	APPVD	DATE
		1			

ENGINEER — COUNTY
DESIGNED BY: DRAWN BY: CHECKED BY:

RECOMMENDED FOR APPROVAL
DATE:
CHECKED BY:
DATE:

DEVELOPER:

EXCEL ENGINEERING
LAND PLANNING • ENGINEERING • SURVEYING
440 STATE PLACE, ESCONDIDO, CA 92029
PH (760)745-8118 FX (760)745-1890

TENTATIVE TRACT MAP
ROCKPORT RANCH
NORTH CENTRAL GRADING PLAN

FOR: W.O.

C5
OF 21 SHTS
DATE: 02/25/2019

CENTERLINE DATA			
NO	DELTA/BRG	RADIUS	LENGTH
1	*Δ=25°55'56"	502.00'	169.42'
2	N12°16'28"W	--	71.93'
3	N89°16'28"W	--	111.87'
4	Δ=13°00'00"	1000.00'	226.89'
5	N77°43'32"E	--	287.96'
6	N77°43'32"E	--	85.27'

* PORTION SHOWN

NO	DELTA/BRG	RADIUS	LENGTH
7	Δ=23°21'58"	650.00'	265.08'
8	N78°54'30"W	--	148.25'
9	N07°05'30"E	--	159.91'
10	Δ=14°28'47"	1000.00'	252.72'
11	*Δ=14°23'54"	1000.00'	75.54'
12	N12°16'28"W	--	268.00'
13	N77°43'32"E	--	361.37'

* PORTION SHOWN

NO	DELTA/BRG	RADIUS	LENGTH
14	*N00°43'32"E	--	293.24'
15	*N00°43'55"E	--	4.14'
16	N89°16'05"W	--	163.33'
17	N00°43'55"E	--	60.00'
18	*N13°39'28"E	--	39.31'

* PORTION SHOWN

PUBLIC UTILITIES NOTE:
A BLANKET EASEMENT FOR PUBLIC UTILITIES ACCESS AND MAINTENANCE TO EMWD WILL BE PROVIDED ALL LOTS THAT FORM THE PUBLIC STREETS AND DRIVEWAYS THAT ENCOMPASS PUBLIC WATERLINES, PUBLIC SEWER LINES, AND APPURTENANCES.

BMP NAME	TYPE	PUBLIC/PRIVATE	RESPONSIBLE PARTY	FUNDED BY
BMP-F	BIORETENTION	PUBLIC	CITY OF MENIFEE	COMMUNITY FACILITIES DISTRICT
BMP-H	BIORETENTION	PRIVATE	FUTURE HOA	FUTURE HOA

DATE	BY	MARK	REVISIONS	APPVD	DATE
		1			
ENGINEER				COUNTY	

DESIGNED BY: DRAWN BY: CHECKED BY:

RECOMMENDED FOR APPROVAL

DATE:

CHECKED BY:

DATE:

DEVELOPER:

EXCEL ENGINEERING
LAND PLANNING • ENGINEERING • SURVEYING
440 STATE PLACE, ESCONDIDO, CA 92029
PH (760)745-8118 FX (760)745-1890

TENTATIVE TRACT MAP
ROCKPORT RANCH
SOUTH CENTRAL GRADING PLAN

FOR:

W.O.

C6

OF 21 SHTS

DATE: 02/25/2019

PUBLIC UTILITIES NOTE:

A BLANKET EASEMENT FOR PUBLIC UTILITIES ACCESS AND MAINTENANCE TO EMWD WILL BE PROVIDED ALL LOTS THAT FORM THE PRIVATE STREETS AND DRIVEWAYS THAT ENCOMPASS PUBLIC WATERLINES, PUBLIC SEWER LINES, AND APPURTENANCES.

CENTERLINE DATA

NO	DELTA/BRG	RADIUS	LENGTH
1	*Δ=14°23'54"	1000.00'	175.76'
2	Δ=06°16'42"	1000.00'	109.58'
3	N00°43'55"E	--	143.16'
4	N00°43'55"E	--	214.04'
5	N89°41'58"W	--	153.85'
6	Δ=05°43'55"	2000.00'	200.08'
7	Δ=11°27'50"	1000.00'	200.08'
8	Δ=05°43'55"	2000.00'	200.08'
9	N89°41'58"W	--	167.33'
10	*N00°43'32"E	--	432.71'

* PORTION SHOWN

BMP NAME	TYPE	PUBLIC/PRIVATE	RESPONSIBLE PARTY	FUNDED BY
BMP-C	BIORETENTION	PUBLIC	CITY OF MENIFEE	COMMUNITY FACILITIES DISTRICT
BMP-D	BIORETENTION	PUBLIC	CITY OF MENIFEE	COMMUNITY FACILITIES DISTRICT
BMP-G	BIORETENTION	PUBLIC	CITY OF MENIFEE	COMMUNITY FACILITIES DISTRICT
BMP-H	BIORETENTION	PRIVATE	FUTURE HOA	FUTURE HOA

SCALE 1":40'

0 40 80 120 160

DATE	BY	MARK	REVISIONS	APPVD	DATE
	ENGINEER	1		COUNTY	

DESIGNED BY: DRAWN BY: CHECKED BY:

RECOMMENDED FOR APPROVAL

DATE:

CHECKED BY:

DATE:

DEVELOPER:

EXCEL ENGINEERING
LAND PLANNING • ENGINEERING • SURVEYING
440 STATE PLACE, ESCONDIDO, CA 92029
PH (760)745-8118 FX (760)745-1890

TENTATIVE TRACT MAP
ROCKPORT RANCH
SOUTH GRADING PLAN

FOR: W.O.

C7

OF 21 SHTS

DATE: 02/25/2019

PUBLIC UTILITIES NOTE:

A BLANKET EASEMENT FOR PUBLIC UTILITIES ACCESS AND MAINTENANCE TO EMWD WILL BE PROVIDED ALL LOTS THAT FORM THE PRIVATE STREETS AND DRIVEWAYS THAT ENCOMPASS PUBLIC WATERLINES, PUBLIC SEWER LINES, AND APPURTENANCES.

BASIS OF BEARINGS

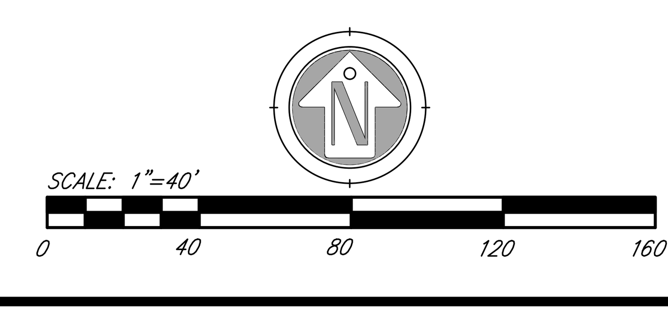
NORTH LINE OF SECTION 1 AS SHOWN ON TRACT MAP 30422-1, RECORDED OCTOBER 23, 2006, IN BOOK 411 OF MAPS, PAGES 69-99 AS DOCUMENT NO. 2006-0777728. IE N89°28'44"W

CENTERLINE DATA

NO	DELTA/BRG	RADIUS	LENGTH
1	N00°31'16"E	--	140.55'
2	Δ=04°12'16"	602.00'	44.18'
3	Δ=09°41'05"	602.00'	101.76'
4	Δ=01°39'43"	602.00'	17.46'
5	N15°01'48"W	--	156.74'
6	N15°01'48"W	--	28.83'
7	N15°01'48"W	--	31.72'
8	*Δ=28°41'16"	598.00'	130.04'
9	N89°45'33"W	--	90.00'
10	Δ=08°23'31"	600.00'	87.88'
11	N81°22'02"W	--	38.09'
12	Δ=11°14'43"	600.00'	117.76'
13	N87°23'15"E	--	73.84'
14	N87°23'15"E	--	165.34'
15	Δ=07°43'00"	1300.00'	175.08'
16	Δ=10°06'04"	600.00'	105.78'
17	N85°00'10"E	--	61.71'
18	N06°59'50"W	--	75.92'
19	Δ=03°09'16"	920.00'	50.65'
20	Δ=10°57'56"	920.00'	176.07'
21	Δ=03°04'38"	920.00'	49.41'
22	*Δ=32°06'04"	690.00'	96.82'
23	N74°58'12"E	--	17.04'
24	Δ=25°41'15"	500.00'	224.17'
25	N79°20'34"W	--	101.40'
26	N86°09'26"E	--	152.58'
27	N86°09'26"E	--	164.90'
28	N74°58'12"E	--	154.88'
29	N76°38'02"E	--	155.58'

* PORTION SHOWN

* PORTION SHOWN



DATE	BY	MARK	REVISIONS	APPVD	DATE
	ENGINEER			COUNTY	

DESIGNED BY: DRAWN BY: CHECKED BY:

RECOMMENDED FOR APPROVAL

DATE:

CHECKED BY:

DATE:

DEVELOPER:

EXCEL ENGINEERING
LAND PLANNING • ENGINEERING • SURVEYING
440 STATE PLACE, ESCONDIDO, CA 92029
PH (760)745-8118 FX (760)745-1890

TENTATIVE TRACT MAP
ROCKPORT RANCH
NORTH QUARTER MAP SHEET

TR1

OF 21 SHTS

FOR: W.O. DATE: 02/25/2019

CENTERLINE DATA			
NO	DELTA/BRG	RADIUS	LENGTH
1	*Δ=23°10'26"	598.00'	118.68'
2	Δ=00°39'24"	598.00'	6.85'
3	Δ=04°51'26"	598.00'	50.70'
4	N13°39'28"E	--	117.54'
5	N13°39'28"E	--	175.00'
6	N13°39'28"E	--	115.86'
7	N13°39'28"E	--	26.05'
8	*Δ=25°55'56"	502.00'	57.79'
9	*Δ=15°10'05"	690.00'	85.84'
10	Δ=16°55'59"	690.00'	203.92'

* PORTION SHOWN

NO	DELTA/BRG	RADIUS	LENGTH
11	Δ=00°15'38"	400.00'	1.82'
12	Δ=26°03'22"	400.00'	181.91'
13	Δ=28°07'28"	400.00'	196.35'
14	N76°20'32"W	--	177.91'
15	N76°20'32"W	--	44.51'
16	Δ=34°55'56"	400.00'	243.87'
17	N68°43'32"E	--	130.66'
18	N00°43'32"E	--	359.44'
19	N81°16'28"W	--	121.87'
20	Δ=08°54'41"	500.00'	77.77'
21	Δ=08°59'11"	500.00'	78.42'

NO	DELTA/BRG	RADIUS	LENGTH
22	N81°11'58"W	--	27.10'
23	N80°43'49"E	--	162.83'
24	N69°55'34"E	--	162.68'
25	N41°46'56"E	--	58.61'
26	N89°16'05"W	--	163.33'
27	N00°43'55"E	--	175.00'
28	N89°16'05"W	--	163.33'
29	*N00°43'55"E	--	25.55'
30	N76°20'32"W	--	154.83'
31	N76°20'32"W	--	156.83'
32	N76°20'32"W	--	168.74'

* PORTION SHOWN

BASIS OF BEARINGS

NORTH LINE OF SECTION 1 AS SHOWN ON TRACT MAP 30422-1, RECORDED OCTOBER 23, 2006, IN BOOK 411 OF MAPS, PAGES 69-99 AS DOCUMENT NO. 2006-0777728. IE N89°28'44"W

SCALE: 1"=40'

0 40 80 120 160

PUBLIC UTILITIES NOTE:

A BLANKET EASEMENT FOR PUBLIC UTILITIES ACCESS AND MAINTENANCE TO EMWD WILL BE PROVIDED ALL LOTS THAT FORM THE PRIVATE STREETS AND DRIVEWAYS THAT ENCOMPASS PUBLIC WATERLINES, PUBLIC SEWER LINES, AND APPURTENANCES.

DATE	BY	MARK	REVISIONS	APPVD	DATE
		1			
ENGINEER				COUNTY	

DESIGNED BY: DRAWN BY: CHECKED BY:

RECOMMENDED FOR APPROVAL

DATE:

CHECKED BY:

DATE:

DEVELOPER:

EXCEL ENGINEERING
LAND PLANNING • ENGINEERING • SURVEYING
440 STATE PLACE, ESCONDIDO, CA 92029
PH (760)745-8118 FX (760)745-1890

TENTATIVE TRACT MAP
ROCKPORT RANCH
NORTH CENTRAL MAP SHEET

TR2

OF 21 SHTS

FOR:

W.O.

DATE: 02/25/2019

CENTERLINE DATA			
NO	DELTA/BRG	RADIUS	LENGTH
1	*Δ=25°55'56"	502.00'	169.42'
2	N12°16'28"W	--	71.93'
3	N89°16'28"W	--	111.87'
4	Δ=13°00'00"	1000.00'	226.89'
5	N77°43'32"E	--	287.96'
6	N77°43'32"E	--	85.27'

* PORTION SHOWN

NO	DELTA/BRG	RADIUS	LENGTH
7	Δ=23°21'58"	650.00'	265.08'
8	N78°54'30"W	--	148.25'
9	N07°05'30"E	--	159.91'
10	Δ=14°28'47"	1000.00'	252.72'
11	*Δ=14°23'54"	1000.00'	75.54'
12	N12°16'28"W	--	268.00'
13	N77°43'32"E	--	361.37'

* PORTION SHOWN

NO	DELTA/BRG	RADIUS	LENGTH
14	*N00°43'32"E	--	293.24'
15	*N00°43'55"E	--	4.14'
16	N89°16'05"W	--	163.33'
17	N00°43'55"E	--	60.00'
18	*N13°39'28"E	--	39.31'

* PORTION SHOWN

BASIS OF BEARINGS

NORTH LINE OF SECTION 1 AS SHOWN ON TRACT MAP 30422-1, RECORDED OCTOBER 23, 2006, IN BOOK 411 OF MAPS, PAGES 69-99 AS DOCUMENT NO. 2006-0777728. IE N89°28'44"W

SCALE: 1"=40'

0 40 80 120 160

PUBLIC UTILITIES NOTE:

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DATE	BY	MARK	REVISIONS	APPVD	DATE
		1			
ENGINEER				COUNTY	

DESIGNED BY: DRAWN BY: CHECKED BY:

RECOMMENDED FOR APPROVAL

DATE:

CHECKED BY:

DATE:

DEVELOPER:

EXCEL ENGINEERING
LAND PLANNING • ENGINEERING • SURVEYING
440 STATE PLACE, ESCONDIDO, CA 92029
PH (760)745-8118 FX (760)745-1890

TENTATIVE TRACT MAP
ROCKPORT RANCH
SOUTH CENTRAL MAP SHEET

TR3
OF 21 SHTS

FOR: W.O. DATE: 02/25/2019

CENTERLINE DATA			
NO	DELTA/BRG	RADIUS	LENGTH
1	*Δ=14°23'54"	1000.00'	175.76'
2	Δ=06°16'42"	1000.00'	109.58'
3	N00°43'55"E	--	143.16'
4	N00°43'55"E	--	214.04'
5	N89°41'58"W	--	153.85'
6	Δ=05°43'55"	2000.00'	200.08'
7	Δ=11°27'50"	1000.00'	200.08'
8	Δ=05°43'55"	2000.00'	200.08'
9	N89°41'58"W	--	167.33'
10	*N00°43'32"E	--	432.71'

* PORTION SHOWN

SCALE: 1"=40'

0 40 80 120 160

BASIS OF BEARINGS

NORTH LINE OF SECTION 1 AS SHOWN ON TRACT MAP 30422-1, RECORDED OCTOBER 23, 2006, IN BOOK 411 OF MAPS, PAGES 69-99 AS DOCUMENT NO. 2006-0777728. IE N89°28'44"W

PUBLIC UTILITIES NOTE:

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0 40 80 120 160

DATE	BY	MARK	REVISIONS	APPVD	DATE
		1			
ENGINEER				COUNTY	

DESIGNED BY: DRAWN BY: CHECKED BY:

RECOMMENDED FOR APPROVAL

DATE:

CHECKED BY:

DATE:

DEVELOPER:

EXCEL ENGINEERING
LAND PLANNING • ENGINEERING • SURVEYING
440 STATE PLACE, ESCONDIDO, CA 92029
PH (760)745-8118 FX (760)745-1890

TENTATIVE TRACT MAP
ROCKPORT RANCH
SOUTH MAP SHEET

FOR:

W.O.

DATE: 02/25/2019

TR4

OF 21 SHTS

Appendix 3: Soils Information

Geotechnical Study and Other Infiltration Testing Data

GeoTek, Inc.
1548 North Maple Street, Corona, California 92880
(951) 710-1160 Office (951) 710-1167 Fax www.geotekusa.com

January 10, 2018
Project No. 1414-CR

Excel Engineering
440 State Place
Escondido, California 92029

Attention: Mr. Eric Harrington

Subject: Response to Plan Check Comments
Proposed Single-Family Residential Development
29875 Newport Road
Menifee, Riverside County, California

Reference: *GeoTek, 2016, "Geotechnical Evaluation, Proposed Single-Family Residential Development, 29875 Newport Road, Menifee, Riverside County, California", Project No. 1414-CR, dated March 3.*

Dear Mr. Harrington:

As requested, GeoTek, Inc. (GeoTek) is providing this letter to respond to a plan check comment relative to the Catch Basin and bioretention details provided on the Tentative DMA Map, prepared by Excel Engineering (undated) for the Rockport Ranch project in Menifee. Noted below is the plan check comment followed by our response.

Plan Check Comment: *An impermeable liner is proposed around the entire basin, but there does not appear to be geotechnically based recommendation to prevent all infiltration. The detail also states that the liner sizing and* thickness *will be based on the soil engineer's recommendations. Please note that unless supported by the soil engineer* recommendations the impermeable liner should be removed from the bottom of the basins to allow for incidental infiltration.

GeoTek Response: Due to the low infiltration rates of the site soils as previously documented by GeoTek, infiltration into the underlying soils is not deemed feasible. Therefore, use of an impervious liner (such as HDPE-high density polyethylene, or similar) beneath the catch basin and bioretention facilities is recommended. The liner should possess appropriate engineering properties to limit infiltration into the underlying soils. As a guide, we would suggest a maximum coefficient of permeability of 1×10^{-7} cm/sec for the impervious liner. A specific minimum thickness of the liner is not deemed necessary provided the maximum coefficient of permeability can be documented by the liner manufacturer. Once a specific liner is proposed/selected, the product specification sheet for the material should be provided to GeoTek for review. The liner should be installed as recommended by the liner manufacturer.

The opportunity to be of service is sincerely appreciated. If you should have any questions, please do not hesitate to call our office.

Respectfully submitted,

GeoTek, Inc.

REGISTERED PROFESSIONAL ENGINEER ROBERT R. RUSSELL No. 2042 GEOTECHNICAL STATE OF CALIFORNIA

REGISTERED GEOLOGIST EDWARD H. LaMONT No. 1892 Exp. Certified Engineering Geologist STATE OF CALIFORNIA

Robert R. Russell, PE, GE
GE 2042, Exp. 12/31/18
Sr. Project Engineer

Edward H. LaMont
CEG 1892, Exp. 07/31/18
Principal Geologist

Distribution: (1) Addressee via email

G:\Projects\1401 to 1450\1414CR Excel Engineering 29875 Newport Road Menifee\1414-CR Response to Review comment, basin liner.doc

GeoTek, Inc.
1548 North Maple Street, Corona, California 92880
(951) 710-1160 Office (951) 710-1167 Fax www.geotekusa.com

September 8, 2017
Project No. 1414-CR

Excel Engineering
440 State Place
Escondido, California 92029

Attention: Mr. Andrew Van Loy

Subject: Revised Rock Placement Recommendations
Proposed Single-Family Residential Development
29875 Newport Road
Menifee, Riverside County, California

Reference: "Geotechnical Evaluation, Proposed Single-Family Residential Development, 29875 Newport Road, Menifee, Riverside County, California," by GeoTek, Inc., Project No. 1414-CR, dated March 3, 2016.

Dear Mr. Van Loy:

As requested, GeoTek, Inc. is presenting revised recommendations for maximum size of rock/particles that can be placed during earthwork operations for the subject project site. It's our understanding that existing site improvements will soon be razed. As part of this process, existing concrete and asphalt is planned to be broken down and incorporated into engineered fill in existing low-lying site areas. The intent of this letter is to provide guidelines for this material placement from a geotechnical perspective.

Currently, the locations of the ultimately proposed residential structures are in a conceptual design status. However, proposed site finish grade elevations are not expected to change significantly from those currently anticipated by the project civil engineer (Excel Engineering). As such, the currently anticipated finish grade elevations should be considered the ultimate finish design elevations with respect to these recommendations. Existing site elevations should be provided by the project civil engineer prior to any fill placement at the subject site. In addition, a suitable removal bottom should be approved by a representative of GeoTek prior to any fill placement. The area approved for fill placement should be accurately identified by the project civil engineer after GeoTek has marked the limits in the field.

Given the nature of the materials to be incorporated into site engineered fill (concrete free of reinforcement and asphaltic concrete), these materials should be kept a minimum of eight feet from proposed finish grade elevations, or lower than the deepest proposed underground improvements, whichever is deepest. Rock fragments with a maximum dimension of 12 inches may be placed beneath a depth of eight feet from finish grade. Alternatively, the concrete (that is free of reinforcement) and asphalt may be broken down to three inches in diameter or smaller, and be incorporated into the engineered fill if kept a minimum of three feet beneath finish grade elevations. Since the County of Riverside is understood to consider asphalt to be "unsubstantiated fill," any asphalt should not be placed in structural fill areas. The asphalt may be placed outside of building pads, streets, parking and driveway areas, provided that no structural improvements (including walls, pools, etc.) are proposed.

The oversize rock materials should be placed in accordance with recommendations provided in the referenced report with respect to methodology, compaction standard and with an adequate amount of fine material. There should be a suitable percentage of sand and/or fines in the material to be used as engineered fill so that the proper compaction can be attained. It is recommended that engineered fill have at least 50 percent of the soil passing the No. 4 sieve.

All voids between large particles should be filled with granular soil that is flooded into place. The soil matrix between the particles should attain a relative compaction of at least 90 percent (ASTM D 1557). A representative of this firm should observe and approve this process. In addition, earthwork and grading should be performed in accordance with the applicable grading ordinances of the City of Menifee, County of Riverside, and the 2016 CBC.

The opportunity to be of service is sincerely appreciated. If you should have any questions, please do not hesitate to call our office.

Respectfully submitted,
GeoTek, Inc.

Edward H. LaMont
CEG 1892, Exp. 07/31/18
Principal Geologist

Noelle C. Toney
PE 84700, Exp. 03/31/18
Project Engineer

Distribution: (1) Addressee via email
G:\Projects\1401 to 1450\1414CR Excel Engineering 29875 Newport Road Menifee\1414CR3 Revised Rock Placement Recommendations.doc

GeoTek, Inc.
710 E. Parkridge Avenue, Suite 105, Corona, California, 92879-1097
(951) 710-1160 Office (951) 710-1167 Fax www.geotekusa.com

April 10, 2017
Project No. 1414-CR

Excel Engineering
440 State Place
Escondido, California 92029

Attention: Mr. Eric Sampson

Subject: Infiltration Rates
Proposed Single-Family Residential Development
29875 Newport Road
Menifee, Riverside County, California

Reference: *GeoTek, 2016, "Geotechnical Evaluation Proposed Single-Family Residential Development 29875 Newport Road, Menifee, Riverside County, California" Project No. 1414-CR, dated March 3.*

Dear Mr. Sampson:

As requested, GeoTek performed four (4) percolation (infiltration) tests within the subject site in February, 2016. The results are included in the referenced report. Very low infiltration rates (0.01 to 0.06 inches/hour) were attained. Based on these results, it appears that infiltration for the subject property is not feasible or practical.

The opportunity to be of service is sincerely appreciated. If you should have any questions, please do not hesitate to call our office.

Respectfully submitted,
GeoTek, Inc.

Edward H. LaMont
CEG 1892, Exp. 07/31/18
Principal Geologist

Distribution: (1) Addressee via email

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GEOTECHNICAL EVALUATION

FOR

PROPOSED SINGLE-FAMILY RESIDENTIAL DEVELOPMENT
29875 NEWPORT ROAD
MENIFEE, RIVERSIDE COUNTY, CALIFORNIA

PREPARED FOR

EXCEL ENGINEERING
440 STATE PLACE
ESCONDIDO, CALIFORNIA 92029

PREPARED BY

GEOTEK, INC.
710 EAST PARKRIDGE AVENUE, SUITE 105
CORONA, CALIFORNIA 92879

PROJECT NO. 1414-CR **MARCH 3, 2016**

GEOTEK

GeoTek, Inc.
710 E. Parkridge Avenue, Suite 105, Corona, California 92879-1097
(951) 710-1160 Office (951) 710-1167 Fax www.geotekusa.com

March 3, 2016
Project No. 1414-CR

Excel Engineering
440 State Place
Escondido, California 92029

Attention: Mr. Rod Jones

Subject: Geotechnical Evaluation
Proposed Single-Family Residential Development
29875 Newport Road
Menifee, Riverside County, California

Dear Mr. Jones:

We are pleased to provide the results of our geotechnical evaluation for the proposed project located at the 29875 Newport Road, in the city of Menifee, Riverside County, California. This report presents the results of our evaluation, discussion of our findings, and provides geotechnical recommendations for foundation design and construction. In our opinion, site development appears feasible from a geotechnical viewpoint provided that the recommendations included in this report are incorporated into the design and construction phases of the project.

The opportunity to be of service is sincerely appreciated. If you should have any questions, please do not hesitate to contact our office.

Respectfully submitted,
GeoTek, Inc.

REGISTERED GEOLOGIST
EDWARD H. LaMONT
No. 1892
Exp.
Certified Engineering Geologist
STATE OF CALIFORNIA

REGISTERED PROFESSIONAL ENGINEER
HYUN JIN KIM
C 77214
EXP. 06/30/17
CIVIL
STATE OF CALIFORNIA

Edward H. LaMont
CEG 1892, Exp. 07/31/16
Principal Geologist

Paul Hyun Jin Kim
PE 77214, Exp. 06/30/17
Project Engineer

Distribution: (1) Addressee via email (one PDF file)
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TABLE OF CONTENTS

TABLE OF CONTENTS

1. PURPOSE AND SCOPE OF SERVICES

The purpose of this study was to evaluate the geotechnical conditions across the project site with respect to the proposed development. Services provided for this study included the following:

- Research and review of available geologic data and general information pertinent to the site,
- Site exploration consisting of the excavation, logging, and sampling of 14 exploratory borings,
- Perform 4 percolation tests;
- Laboratory testing of soil samples collected during the field investigation,
- Review and evaluation of site seismicity, and
- Compilation of this geotechnical report which presents our findings, conclusions, and recommendations for this site.

2. SITE DESCRIPTION AND PROPOSED DEVELOPMENT

2.1 SITE DESCRIPTION

The subject property is located at the southwest corner of Newport Road and Briggs Road in the city of Menifee, Riverside County, California (see Figure 1). The 78.8 acre site is the location of the former Abacherli Dairy. The site is occupied with several structures in the northeast portion including four residences, a milking building and a work shop building. The cow pens have generally been recently demolished and removed from the site and the dairy facility is no longer active. Concrete and asphalt parking/drive areas and landscaping also occupy the northeast portion of the property. The remaining portions of the site are undeveloped. The site can be accessed from Newport Road and Briggs Road.

The subject property is in an area largely characterized by mixed-use development. The site is bounded by Newport Road, followed by a residential development to the north; Briggs Road, followed by Ramona Egg Ranch and agricultural property to the east; Wilderness Lakes Recreational Vehicle Resort to the south; and a residential tract development to the west.

Natural drainage at the site is generally interpreted to be toward the southwest, conforming to the natural topography in the area. Standing water was observed on the site in several locations on the dates of our exploration due to the recent inclement weather. Additionally, several basins, approximately 5 feet to 20 feet in depth, are located in the western and southwestern portions of the site and collect storm water.

2.2 PROPOSED DEVELOPMENT

Based on the preliminary plan entitled "Abacherli Dairy Concept Site Plan" prepared by Excel Engineering (undated), the subject project will consist of the construction of:

- 319 single-family residential building pads;
- 4 tot lots;
- 3 playfield areas;
- A water quality basin at the west-central side of the site;
- A pond in the south-central portion of the site;
- A community building and swimming pool;
- 2 parking lots;
- Local streets, labeled "A" through "E"; and,
- A continuation of Tres Lagos Drive along the south side of the site.

A specific grading plan was not provided at the time of this report. This report is based on planned cuts and fills of approximately 3 feet with the exception of the existing basin areas where fills up to 20 feet is anticipated to bring the site up to project grades.

If site development differs from the project information presented in this report, the recommendations should be subject to further review and evaluation.

3. FIELD EXPLORATION AND LABORATORY TESTING

3.1 FIELD EXPLORATION

The field exploration for this investigation was conducted on February 9 and 10, 2016 and consisted of excavating 14 exploratory borings with the aid of a hollow stem tract drill rig to depths of 10 feet to 51.5 feet. The borings were drilled within the proposed development as shown on the attached Boring Location Map (Figure 2). Four of the borings were used for percolation tests. An engineer and geologist from our firm logged the excavations and collected soil samples for use in subsequent laboratory testing. The logs of the exploratory borings are included in Appendix A.

3.2 LABORATORY TESTING

Laboratory testing was performed on selected bulk and relatively undisturbed samples collected during the field exploration. The purpose of the laboratory testing was to confirm the field classification of the materials encountered and to evaluate their physical properties for use in the engineering design and analysis. Results of the laboratory testing program along with a brief description and relevant information regarding testing procedures are included in Appendix B.

3.3 PERCOLATION TEST INFORMATION

As requested, GeoTek performed four (4) percolation (infiltration) tests within the subject site at the approximate locations indicated in Figure 2. Percolation testing was conducted at a depth of 10 feet below existing grade.

Each boring diameter was approximately 8 inches. Approximately 2 inches of gravel was placed on the bottom of each of the percolation boring excavations. A 3-inch diameter perforated PVC pipe, wrapped in filter sock was placed in the percolation boring excavations and the annular space was filled with gravel to prevent caving within the boring. The test borings were then filled with water between the depths of 5 and 10 feet to pre-soak the hole. The hole was allowed to pre-soak overnight and the percolation test was performed the next day.

The results were converted to an infiltration rate via the Porchet Method as per Riverside County guidelines and a factor of safety of 3 was applied. Based on the results of our testing, the test locations have the following infiltration rates:

Test Hole	Infiltration Rate (in/hr)
P-1	0.02
P-2	0.01
P-3	0.06
P-4	0.04

Note that variations may occur within the site and with depth.

4. GEOLOGIC AND SOILS CONDITIONS

4.1 REGIONAL SETTING

The site is situated in the Peninsular Ranges province, which is one of the largest geomorphic units in western North America. Basically, it extends from the Transverse Ranges geomorphic province and the Los Angeles Basin, approximately 900 miles south to the tip of Baja California. This province varies in width from about 30 to 100 miles. It is bounded on the west by the Pacific Ocean, on the south by the Gulf of California and on the east by the Colorado Desert Province.

The Peninsular Ranges are essentially a series of northwest-southeast oriented fault blocks. Three major fault zones are found in this province. The Elsinore Fault zone and the San Jacinto Fault zone trend northwest-southeast and are found near the middle of the province. The San Andreas Fault zone borders the northeasterly margin of the province.

More specific to the property, the site is located in an area geologically mapped (see Figure 3) to be underlain by older alluvial fan deposits (Mortan, 2003).

4.2 GENERAL SOIL CONDITIONS

A brief description of the earth materials encountered is presented in this section. Based on our site reconnaissance, our exploratory excavations and review of published geologic maps, the area investigated is locally underlain by undocumented artificial fill, older alluvial materials and granitic bedrock at depth.

4.2.1 Undocumented Artificial Fill

Undocumented artificial fill (Afu) was encountered in borings B-1, B-8 and B-9 between approximate depths of 2 and 3 feet. Undocumented fill is associated with past grading to create berms/access roads. Based on a conversation with the current owner of the property, thicker zones of undocumented fill are known to exist on the site, including an area along the northwest portion of the site (north of one of the detention basins), where a zone approximately 9 feet wide by 100 feet long and 8 feet deep contains buried debris. The fill encountered consists of brown, orange brown and dark brown, slightly moist to moist, medium dense to dense silty fine to coarse sand with local cobbles.

4.2.2 Older Alluvium

Older alluvium (Qoal) was observed in all the borings. The older alluvium generally consists of red brown to orange brown and brown, slightly moist to moist, dense to very dense silty fine to coarse sand with occasional clay and, less common, stiff to hard clayey silt, silty clay, sandy clay and silt.

According to the results of the laboratory testing performed, the older alluvium tested exhibit a "low" expansion potential when tested in accordance with ASTM D 4829.

4.2.3 Bedrock

Granitic bedrock, likely consisting of granodiorite or tonalite as mapped by Mortan (2003) northeast of the subject property, was encountered underlying the older alluvium at depths of 20.5 and 15.5 feet in borings B-9 and B-10, respectively. The granitic bedrock is hard to very hard and consists of medium to coarse crystals which are tan, light orange brown and black.

4.3 SURFACE WATER AND GROUNDWATER

4.3.1 Surface Water

Surface water was locally observed on the site at the time of our subsurface exploration. The surface water encountered was the result of recent heavy rains. Overall surface drainage in the area is generally to the southwest. Provisions for surface drainage will need to be accounted for by the project civil engineer.

4.3.2 Groundwater

Water was not encountered in our exploratory excavations to a maximum depth of 51.5 feet below existing grade. According to a review of historical groundwater data (California

Department of Water Resources and California State Water Resources Control Board groundwater well data [http://wdl.water.ca.gov and http://geotracker.waterboards.ca.gov]) and in-house information, depth to groundwater is currently roughly 100 feet below ground surface in the general site area. Data obtained from the California Department of Water Resources for two wells located in the southern portion of the site indicate groundwater greater than 90 feet below ground surface.

It is possible that seasonal variations (temperature, rainfall, etc.) will cause fluctuations in the groundwater level. Additionally, perched water may be encountered in discontinuous zones within the overburden.

4.4 FAULTING AND SEISMICITY

4.4.1 Faulting

The geologic structure of the entire California area is dominated mainly by northwest-trending faults associated with the San Andreas system. The site is in a seismically active region. No active or potentially active fault is known to exist at this site nor is the site situated within a State of California designated *"Alquist-Priolo"* Earthquake Fault Zone or County of Riverside fault zone. The nearest zoned fault is the San Jacinto Fault, located approximately 6 miles to the east.

4.4.2 Seismic Design Parameters

The site is located at approximately latitude: 33.682797°N and longitude: -117.140393°W. Site spectral accelerations (S_S and S_1), for 0.2 and 1.0 second periods for a Class "D" site, were determined from the USGS Website, Earthquake Hazards Program, U.S. Seismic Design Maps for Risk-Targeted Maximum Considered Earthquake (MCE_R) Ground Motion Response Accelerations for the Conterminous 48 States by Latitude/Longitude. The results are presented in the following table:

SITE SEISMIC PARAMETERS	
Mapped 0.2 sec Period Spectral Acceleration, S_S	1.5g
Mapped 1.0 sec Period Spectral Acceleration, S_1	0.6g
Site Coefficient for Site Class "C", F_a	1.0
Site Coefficient for Site Class "C", F_v	1.5
Maximum Considered Earthquake Spectral Response Acceleration for 0.2 Second, S_{MS}	1.5g
Maximum Considered Earthquake Spectral Response Acceleration for 1.0 Second, S_{M1}	0.9g
5% Damped Design Spectral Response Acceleration Parameter at 0.2 Second, S_{DS}	1.0g
5% Damped Design Spectral Response Acceleration Parameter at 1 second, S_{D1}	0.6g

Final selection of the appropriate seismic design coefficients should be made by the project structural engineer based upon the local practices and ordinances, expected building response and desired level of conservatism.

4.5 LIQUEFACTION

Liquefaction describes a phenomenon in which cyclic stresses, produced by earthquake-induced ground motion, create excess pore pressures in relatively cohesionless soils. These soils may thereby acquire a high degree of mobility, which can lead to lateral movement, sliding, consolidation and settlement of loose sediments, sand boils and other damaging deformations. This phenomenon occurs only below the water table, but, after liquefaction has developed, the effects can propagate upward into overlying non-saturated soil as excess pore water dissipates.

The factors known to influence liquefaction potential include soil type and grain size, relative density, groundwater level, confining pressures, and both intensity and duration of ground shaking. In general, materials that are susceptible to liquefaction are loose, saturated granular soils having low fines content under low confining pressures.

The subject site is mapped within a "low" zone of potentially liquefiable soils by the Riverside County "Map My County" website http://mmc.rivcoit.org/MMC_Public/Custom/disclaimer/Default.htm. Liquefaction is not considered a hazard at the site due to great depth to groundwater (greater than 90 feet) and the underlying dense nature of the subsurface soils.

4.6 OTHER SEISMIC HAZARDS

Evidence of ancient landslides or slope instabilities at this site was not observed during our investigation. Thus, the potential for landslides is considered negligible.

The potential for secondary seismic hazards such as a seiche and tsunami are considered to be negligible due to site elevation and distance from an open body of water.

5. CONCLUSIONS AND RECOMMENDATIONS

5.1 GENERAL

The anticipated site development appears feasible from a geotechnical viewpoint provided that the following recommendations, and those provided by this firm at a later date, are properly incorporated into the design and construction phases of development. Site development and grading plans should be reviewed by GeoTek when they become available.

Undocumented fill was observed in portions of the site with an approximate thickness of 2 to 3 feet, with thicker zones likely. The undocumented fill is not a suitable bearing material and should be removed and replaced with engineered fill. In areas where thin zones or no undocumented fill exists, GeoTek recommends that the upper 3 feet of earth materials be removed prior to placement of engineered fill. At a minimum, 3 feet of engineered fill should be provided below proposed improvements or 2 feet below beneath foundation, whichever is greater.

In the existing retention basin areas, the loose surficial materials should be removed until competent native materials are exposed prior to placement of additional engineered fill.

A methane report was prepared by Carlin Environmental Consulting, Inc. (CEC). The report is included in Appendix C. CEC should be consulted on the appropriate remedial measures necessary for methane mitigation.

5.2 EARTHWORK CONSIDERATIONS

5.2.1 General

Earthwork and grading should be performed in accordance with the applicable grading ordinances of the city of Menifee, County of Riverside, the 2013 California Building Code (CBC), and recommendations contained in this report. The Grading Guidelines included in Appendix D outline general procedures and do not anticipate all site specific situations. In the event of conflict, the recommendations presented in the text of this report should supersede those contained in Appendix D.

5.2.2 Site Clearing and Preparation

Site preparation should commence with removal of existing structures, deleterious materials and vegetation. Existing underground utilities should either be properly capped off at the property boundaries and removed or be re-routed around the new development. All soils disturbed by the clearing operations should be removed and stockpiled on-site for future use as engineered fill. All debris and deleterious materials generated by the site stripping operations should be legally disposed off-site. Voids resulting from site clearing should be replaced with engineered fill materials with expansion characteristics similar to the on-site soils.

5.2.3 Removals

All undocumented fill should be removed. In areas where thin zones or no undocumented fill exists, the upper 3 feet of the existing earth materials should be removed and replaced with engineered fill. A minimum of 3 feet of engineered fill should be provided in areas of the proposed residential buildings and improvements or 2 feet beneath foundations, whichever is greater. A minimum of 2 feet of fill should be provided beneath the pavement subgrade. The lateral extent of removals should extend at least 5 feet outside the footings and floor-slabs, or a distance equal to the depth of overexcavation below the bottom of the structural elements, whichever is greater.

A representative of this firm should observe the bottom of all excavations. Upon approval, the exposed subgrade should be scarified to a depth of approximately 8 inches, moistened to at least the optimum moisture content and compacted to a minimum relative compaction of 90 percent (ASTM D1557).

The removals in the areas of the existing basins should extend down to competent native materials. Competent native materials are defined as natural soils that are uniform in appearance, not relatively visibly porous and with an in-place relative compaction of at least 85 percent.

5.2.4 Engineered Fill

On-site materials are generally considered suitable for reuse as engineered fill provided they are free from vegetation, roots, and other deleterious material. Rock fragments greater than 6 inches in maximum dimension should not be incorporated into engineered fill.

Engineered fill materials should be placed in horizontal lifts not exceeding 8 inches in loose thickness, moisture conditioned to at least the optimum moisture content and compacted to a minimum relative compaction of 90% (ASTM D 1557). The upper 12 inches of pavement subgrade should be compacted to 95%.

5.2.5 Excavation Characteristics

Excavation in the on-site soils is expected to be feasible utilizing heavy-duty grading equipment in good operating condition. All temporary excavations for grading purposes and installation of underground utilities should be constructed in accordance with local and Cal-OSHA guidelines. Temporary vertical excavations within the on-site materials should be stable at five (5) feet with a 1:1 (horizontal: vertical) cut above.

5.2.6 Slopes

Fill and cut slopes constructed at gradients of 2:1 or flatter, in accordance with industry standards, are anticipated to be both grossly and surficially stable. Fill placed on slopes should be properly benched into competent soils per the soils engineer.

5.2.7 Shrinkage and Bulking

Several factors will impact earthwork balancing on the site, including shrinkage, subsidence, trench spoil from utilities and footing excavations, as well as the accuracy of topography.

Shrinkage and subsidence are primarily dependent upon the degree of compactive effort achieved during construction, depth of fill and underlying site conditions. For planning purposes, a shrinkage factor from 5 to 15 percent may be considered for the materials requiring removal and recompaction. Site balance areas should be available in order to adjust project grades, depending on actual field conditions at the conclusion of site earthwork construction. Subsidence on the order of up to 0.10 foot may be anticipated for the underlying soils.

5.2.8 Trench Excavations and Backfill

Trench excavations should conform to Cal-OSHA regulations. The contractor should have a competent person, per OSHA requirements, on site during construction to observe conditions and to make the appropriate recommendations.

Utility trench backfill should consist of sandy soil with a "very low" expansion potential and compacted to at least 90% relative compaction (as determined per ASTM D 1557). Where applicable, based on jurisdictional requirements, the top 12 inches of backfill below subgrade for road pavements should be compacted to at least 95 percent relative compaction.

Compaction should be achieved with a mechanical compaction device. Jetting of trench backfill is not recommended. If soils to be used as backfill have dried out, they should be thoroughly moisture conditioned prior to placement in trenches.

5.3 DESIGN RECOMMENDATIONS

5.3.1 Foundation Design Criteria

Foundation design criteria for a conventional foundation system, in general conformance with the 2013 CBC, are presented herein. Based on the results of our laboratory testing, it is anticipated that the soils near subgrade will classify as having a "very low" to "low" expansion potential (20≤EI≤50) in accordance with ASTM D 4829. Typical design criteria for the site based upon a "very low" and "low" expansion potential are tabulated below. These are minimal recommendations and are not intended to supersede the design by the project structural engineer.

The foundation elements for the proposed structures and other improvements should be founded entirely in engineered fill soils. Foundations should be designed in accordance with the *2013 California Building Code* (CBC).

Additional expansion index and soluble sulfate testing of the soils should be performed during construction to evaluate the as-graded conditions. Final recommendations should be based upon the as-graded soils conditions.

A summary of our foundation design recommendations is presented in the following table:

GEOTECHNICAL RECOMMENDATIONS FOR FOUNDATION DESIGN

DESIGN PARAMETER	$0 \le EI \le 20$	$21 \le EI \le 50$
Foundation Depth or Minimum Perimeter Beam Depth (inches below lowest adjacent grade)	One- and Two-Story - 12 Three-Story - 18	One- and Two-Story - 12 Three-Story - 18
Minimum Foundation Width (inches)*	12	12
Minimum Slab Thickness (inches)	4 (actual)	4 (actual)
Sand Blanket and Moisture Retardant Membrane Below On-Grade Building Slabs	2 inches of sand ** overlying moisture vapor retardant membrane overlying 2 inches of sand **	2 inches of sand ** overlying moisture vapor retardant membrane overlying 2 inches of sand **
Minimum Slab Reinforcing	6"x6"- W1.4/1.4 welded wire fabric placed in middle of slab	6"x6"- W2.9/2.9 welded wire fabric placed in middle of slab
Minimum Reinforcement for Continuous Footings, Grade Beams and Retaining Wall Footings	Two No. 4 reinforcing Bars, one placed near the top and one near the bottom	Two No. 4 reinforcing Bars, one placed near the top and one near the bottom
Effective Plasticity Index	N/A	15
Presaturation of Subgrade Soil (Percent of Optimum/Depth in Inches)	Minimum of 100% of the optimum moisture content to a depth of at least 12 inches prior to placing concrete	Minimum of 110% of the optimum moisture content to a depth of at least 12 inches prior to placing concrete

* Code minimums per Table 1809.7 of the 2013 CBC

** Sand should have a Sand Equivalent of at least 30

It should be noted that the above recommendations are based on soil support characteristics only. The structural engineer should design the slab and beam reinforcement based on actual loading conditions.

The following criteria for design of foundations should be implemented:

5.3.1.1 An allowable bearing capacity of 1,800 pounds per square foot (psf) may be used for design of continuous footings 12 inches deep and 12 inches wide, and pad footings 24 inches square and 12 inches deep. This value may be increased by 250 pounds per square foot for each additional 12 inches in depth and 150 pounds per square foot for each additional 12 inches in width to a maximum value of 2,500 psf. Additionally, an increase of one-third may be applied when considering short-term live loads (e.g. seismic and wind loads).

5.3.1.2 The recommended allowable bearing capacity is based on a total post-construction settlement of one (1) inch. Differential settlement of up to one-half of the total settlement over a horizontal distance of 40 feet could result.

5.3.1.3 Spread footings for an individual structure should be tied together in two orthogonal directions with either reinforced grade-beams and/or continuous footings to provide a more rigid and monolithic shallow foundation system.

5.3.1.4 The passive earth pressure may be computed as an equivalent fluid having a density of 250 psf per foot of depth, to a maximum earth pressure of 2,500 psf for footings founded in engineered fill. A coefficient of friction between engineered fill and concrete of 0.35 may be used with dead load forces. When combining passive pressure and frictional resistance, the passive pressure component should be reduced by one-third.

5.3.1.5 A grade beam, 12 inches wide by 12 inches deep (minimum), should be utilized across large openings. The base of the grade beam should be at the same elevation as the bottom of the adjoining footings.

5.3.1.6 A moisture and vapor retarding system should be placed below slabs-on-grade where moisture migration through the slab is undesirable. Guidelines for these systems are provided in the 2013 California Green Building Standards Code (CALGreen) Section 4.505.2 and the 2013 CBC Section 1907.1 and ACI 360R-10. The vapor retarder design and construction should also meet the requirements of ASTM E1643. A portion of the vapor retarder design should be the implementation of a moisture vapor retardant membrane.

It should be realized that the effectiveness of the vapor retarding membrane can be adversely impacted as a result of construction related punctures (e.g. stake penetrations, tears, punctures from walking on the aggregate layer, etc.). These occurrences should be limited as much as possible during construction. Thicker membranes are generally more resistant to accidental puncture than thinner ones. Products specifically designed for use as moisture/vapor retarders may also be more puncture resistant. Although the CBC specifies a 6 mil vapor retarder membrane, it is GeoTek's opinion that a minimum 10 mil thick membrane with joints properly overlapped and sealed should be considered, unless otherwise specified by the slab design professional. The membrane should consist of Stego wrap or the equivalent.

Moisture and vapor retarding systems are intended to provide a certain level of resistance to vapor and moisture transmission through the concrete, but do not eliminate it. The acceptable level of moisture transmission through the slab is to a large extent based on the type of flooring used and environmental conditions. Ultimately, the vapor retarding system should be comprised of suitable elements to limit migration of water and reduce transmission of water vapor through the slab to acceptable levels. The selected elements should have suitable properties (i.e., thickness, composition, strength, and permeability) to achieve the desired performance level. Consideration should be given to consulting with an individual possessing specific expertise in this area for additional evaluation.

Moisture retarders can reduce, but not eliminate, moisture vapor rise from the underlying soils up through the slab. Moisture retarders should be designed and constructed in accordance with applicable American Concrete Institute, Portland Cement Association, Post-Tensioning Concrete Institute, ASTM and California Building Code requirements and guidelines.

GeoTek recommends that a qualified person, such as the flooring contractor, structural engineer, and/or architect be consulted to evaluate the general and specific moisture vapor transmission paths and any impact on the proposed construction. That person (or persons) should provide recommendations for mitigation of potential adverse impact of moisture vapor transmission on various components of the structures as deemed appropriate.

In addition, the recommendations in this report and our services in general are not intended to address mold prevention, since we along with geotechnical consultants in general, do not practice in areas of mold prevention. If specific recommendations are desired, a professional mold prevention consultant should be contacted.

5.3.1.7 We recommend that control joints be placed in two orthogonal directions spaced approximately 24 to 36 times the thickness of the slab in inches. These joints are a widely accepted means to control cracks and should be reviewed by the project structural engineer.

5.3.2 Miscellaneous Foundation Recommendations

5.3.2.1 Isolated exterior footings should be tied back to the main foundation system in two orthogonal directions.

5.3.2.2 To reduce moisture penetration beneath the slab on grade areas, utility trenches should be backfilled with engineered fill, lean concrete or concrete slurry where they intercept the perimeter footing or thickened slab edge.

5.3.2.3 Soils from the footing excavations should not be placed in the slab-on-grade areas unless properly compacted and tested. The excavations should be free of loose/sloughed materials and be neatly trimmed at the time of concrete placement.

5.3.3 Retaining Wall Design and Construction

5.3.3.1 General Design Criteria

Recommendations presented in this report apply to typical masonry or concrete retaining walls to a maximum height of up to 6 feet. Additional review and recommendations should be requested for higher walls. These are typical design criteria and are not intended to supersede the design by the structural engineer.

Retaining wall foundations should be embedded a minimum of 18 inches into engineered fill and should be designed in accordance with Section 5.3.1 of this report. Structural needs may govern and should be evaluated by the project structural engineer.

All earth retention structure plans, as applicable, should be reviewed by this office prior to finalization.

Earthwork considerations, site clearing and remedial earthwork for all earth retention structures should meet the requirements of this report, unless specifically provided otherwise, or more stringent requirements or recommendations are made by the designer. The backfill material placement for all earth retention structures should meet the requirement of Section 5.3.3.4 in this report.

In general, cantilever earth retention structures, which are designed to yield at least 0.001H, where H is equal to the height of the earth retention structure to the base of its footing, may be designed using the active condition. Rigid earth retention structures (including but not limited to rigid walls, and walls braced at top, such as typical basement walls) should be designed using the at-rest condition.

In addition to the design lateral forces due to retained earth, surcharges due to improvements, such as an adjacent building or traffic loading, should be considered in the design of the earth retention structures. Loads applied within a 1:1 (h:v) projection from the surcharge on the stem and footing of the earth retention structure should be considered in the design.

Final selection of the appropriate design parameters should be made by the designer of the earth retention structures.

5.3.3.2 Cantilevered Walls

The recommendations presented below are for cantilevered retaining walls up to 6 feet high. Active earth pressure may be used for retaining wall design, provided the top of the wall is not restrained from minor deflections. An equivalent fluid pressure approach may be used to compute the horizontal pressure against the wall. Appropriate fluid unit weights are given below for specific slope gradients of the retained material. These do not include other superimposed loading conditions such as traffic, structures, seismic events, or adverse geologic conditions.

ACTIVE EARTH PRESSURES	
Surface Slope of Retained Materials (h:v)	Equivalent Fluid Pressure (pcf) Select Backfill*
Level	30
2:1	45

* The design pressures assume the backfill material has an expansion index less than or equal to 20. Backfill zone includes area between back of the wall to a plane (1:1 h:v) up from bottom of the wall foundation (on the backside of the wall) to the (sloped) ground surface.

5.3.3.3 Restrained Retaining Walls

Retaining walls that will be restrained at the top that support level backfill or that have reentrant or male corners, should be designed for an equivalent at-rest fluid pressure of 55 pcf, plus any applicable surcharge loading. For areas of male or reentrant corners, the restrained wall design should extend a minimum distance of twice the height of the wall laterally from the corner, or a distance otherwise determined by the project structural engineer.

5.3.3.4 Retaining Wall Backfill and Drainage

Retaining walls should be provided with an adequate pipe and gravel back drain system to help prevent buildup of hydrostatic pressures. Backdrains should consist of a 4-inch diameter perforated collector pipe (Schedule 40, SDR 35, or approved equivalent) embedded in a minimum of one (1) cubic foot per linear foot of ¾- to 1-inch clean crushed rock or an approved equivalent, wrapped in filter fabric (Mirafi 140N or an approved equivalent). The drain system should be connected to a suitable outlet. Waterproofing of site walls should be performed where moisture migration through the wall is undesirable.

Retaining wall backfill should be placed in lifts no greater than eight (8) inches in thickness and compacted to a minimum of 90% relative compaction in accordance with ASTM Test Method D 1557. The wall backfill should also include a minimum one (1) foot wide section of ¾- to 1-inch clean crushed rock (or an approved equivalent). The rock should be placed immediately adjacent to the back of the wall and extend up from a back drain to within approximately 24 inches of the finish grade. The rock should be separated from the earth with filter fabric. The upper 24 inches should consist of compacted on-site soil.

As an alternative to the drain rock and fabric, Miradrain 2000, or approved equivalent, may be used behind the retaining wall. The Miradrain 2000 should extend from the base of the wall to within 2 feet of the ground surface. The subdrain should be placed at the base of the wall in direct contact with the Miradrain 2000.

The presence of other materials might necessitate revision to the parameters provided and modification of the wall designs. Proper surface drainage needs to be provided and maintained.

5.3.4 Pavement Design

The recommended thicknesses presented below are considered typical and minimum for the utilized parameters. In designing the proposed paved areas, the existing subgrade conditions must be considered together with the expected traffic use and loading conditions. The conditions that will influence the pavement design can be summarized as follows:

1) Subgrade support characteristics of the subgrade. This is typically represented by a R-Value for the design of flexible pavements in this region.
2) Vehicular traffic, in terms of the number and frequency of vehicles and their range of axle loads.
3) Probable increase in vehicular use over the life of the pavement.

We recommend that the exposed subgrade be prepared in accordance with the site preparation requirements specified previously in this report. The upper one foot of pavement subgrade should be compacted to at least 95% of the maximum dry density as determined by the modified Proctor (ASTM D1557).

The appropriate pavement section depends primarily upon the type of subgrade soil, shear strength, traffic load, and planned pavement life. For preliminary purposes, we have provided traffic indices of TI=5.0 (typically for parking areas) through TI=7.0 (typically for those driveway and truck lanes subject to relatively heavy traffic). The provided traffic indices should be verified by the project civil engineer prior to construction. Based on the results of our subsurface exploration, we have utilized an R-value of 25 for the near-surface soils within pavement areas. Since an evaluation of the characteristics of the actual soils at pavement subgrade can only be provided at the completion of grading, the following pavement sections should be used for planning purposes only. Final pavement designs should be evaluated after R-value tests have been performed on the actual subgrade material.

It should be noted that additional earthwork and/or ground improvement efforts may be required during grading on the actual subgrade material, in order to achieve the aforementioned design parameters and assumptions. These design thicknesses assume that a properly prepared subgrade has been achieved.

Flexible Pavement Recommendations

Traffic Index	Recommended Pavement Section
5.0	3 inches AC over 6½ inches Class II Aggregate Base
6.0	4 inches AC over 6½ inches Class II Aggregate Base
7.0	4½ inches AC over 8 inches Class II Aggregate Base

Concrete pavement is recommended in areas that receive continuous repetitive traffic such as loading areas and parking lot entrances. Due to heavy wheel loads and impact loads, concrete approach aprons and dumpster pads, should have a minimum thickness of 6 inches, with an underlying 4-inch thick section of Class II Aggregate Base (AB). Portland Cement Concrete pavement sections should incorporate appropriate steel reinforcement and crack control joints as designed by the project structural engineer. We recommend that sections be as nearly squared as possible and no more than 15 feet on a side. A minimum 3,500 psi mix is recommended. The actual design should also be in accordance with design criteria specified by the governing jurisdiction.

Asphalt Concrete (AC), Portland Cement Concrete, and Class II aggregate base should conform to and be placed in accordance with the latest revision of the California Department of Transportation Standard Specifications and American Concrete Institute (ACI) codes. Aggregate base should be compacted to a minimum of 95 percent of the maximum dry density as determined by the modified Proctor (ASTM D1557) prior to placement of AC. Subgrade preparation for pavement areas is included in the Site Preparation section of this report.

5.3.4.1 Other Design Considerations

- Wall design should consider the additional surcharge loads from superjacent slopes and/or footings, where appropriate.
- No backfill should be placed against concrete until minimum design strengths are evident by compression tests of cylinders.
- The retaining wall footing excavations, backcuts, and backfill materials should be approved the project geotechnical engineer or their authorized representative.

5.3.5 Soil Corrosivity

The soil resistivity at this site was tested in the laboratory on two samples collected during the field investigation. The results of the testing (Resistivity = 270 and 1,100 ohm-cm) indicate that the on-site soils are considered "extremely corrosive" to "highly corrosive" to buried ferrous metal in accordance with current standards used by corrosion engineers. We recommend that a corrosion engineer be consulted to provide recommendations for the protection of buried ferrous metal at this site.

5.3.6 Soil Sulfate Content

The sulfate content was determined in the laboratory for two on-site soil samples. The results indicate that the water soluble sulfate result is less than 0.1 percent by weight, which is considered "not applicable" (negligible) as per Table 4.2.1 of ACI 318.

5.4 CONCRETE CONSTRUCTION

5.4.1 General

Concrete construction should follow the 2013 CBC and ACI guidelines regarding design, mix placement and curing of the concrete. If desired, we could provide quality control testing of the concrete during construction.

5.4.2 Concrete Mix Design

As indicated in Section 5.3.5, no special concrete mix design is required by Code to resist sulfate attack based on the existing test results. However, additional testing should be performed during grading so that specific recommendations can be formulated based on the as-graded conditions.

5.4.3 Concrete Flatwork

Exterior concrete flatwork is often one of the most visible aspects of site development. They are typically given the least level of quality control, being considered "non-structural" components. Cracking of these features is fairly common due to various factors. While cracking is not usually detrimental, it is unsightly. We suggest that the same standards of care be applied to these features as to the structure itself.

Flatwork may consist of 4-inch thick concrete and the use of reinforcement is suggested. The project structural engineer should provide final design recommendations.

5.4.4 Concrete Performance

Concrete cracks should be expected. These cracks can vary from sizes that are essentially unnoticeable to more than 1/8 inch in width. Most cracks in concrete while unsightly do not significantly impact long-term performance. While it is possible to take measures (proper concrete mix, placement, curing, control joints, etc.) to reduce the extent and size of cracks that occur, some cracking will occur despite the best efforts to minimize it. Concrete undergoes chemical processes that are dependent on a wide range of variables, which are difficult, at best, to control. Concrete, while seemingly a stable material, is subject to internal expansion and contraction due to external changes over time.

One of the simplest means to control cracking is to provide weakened control joints for cracking to occur along. These do not prevent cracks from developing; they simply provide a relief point for the stresses that develop. These joints are a widely accepted means to control cracks but are not always effective. Control joints are more effective the more closely spaced they are. GeoTek suggests that control joints be placed in two directions and located a distance apart approximately equal to 24 to 36 times the slab thickness.

5.5 POST CONSTRUCTION CONSIDERATION

5.5.1 Irrigation

Control of irrigation water is a necessary part of site maintenance. Soggy ground, near-surface perched water, or seeps may result if irrigation water is excessively or improperly applied. All irrigation systems should be adjusted to provide the minimum water needed to sustain landscaping and prevent excessive drying of the soils. Generally significant runoff during an irrigation cycle indicates excessive irrigation, while soils which dry to a depth of more than several inches between irrigation cycles indicate inadequate irrigation. Adjustments should be made for changes in the climate and rainfall. Irrigation should stop when sufficient water is provided by precipitation.

It is important to avoid repeated wetting and drying of the slope surface, which may cause the soil to crack, loosen and/or slowly move laterally (creep) downslope. Landscaping and irrigation will reduce repeated wetting and drying of the slopes.

It is important to maintain uniform soil moisture conditions adjacent to the structure to reduce soil expansion and shrinkage that can cause cracking to the structure. Irrigation should be utilized to prevent the soils from drying to a depth more than several inches.

Broken, leaking or plugged sprinklers or irrigation lines should be repaired immediately. Frequent inspections of the irrigation systems should be performed.

It is common for planting to be placed adjacent to structures in planter or lawn areas. This will result in the introduction of water into the ground adjacent to the foundation. This type of landscaping should be avoided. If used, then extreme care should be exercised with regard to the irrigation and drainage in these areas. Waterproofing of the foundation and/or subdrains may be necessary and advisable.

5.5.2 Drainage

The need to maintain proper surface drainage and subsurface systems cannot be overly emphasized. Positive site drainage should be maintained at all times. Drainage should not flow uncontrolled down any descending slope. Water should be directed away from foundations and not allowed to pond or seep into the ground adjacent to the footings. Soil areas within 10 feet of the proposed structure should slope at a minimum of 5 percent away from the building, if possible unless the area is paved. Paved areas are to be sloped at 2 percent away from the structure. Roof gutters and downspouts should discharge onto paved surfaces sloping away from the structure or into a closed pipe system which outfalls to the street gutter pan or directly to the storm drain system. Pad drainage should be directed toward approved areas and not be blocked by other improvements.

It is the owner's responsibility to maintain and clean drainage devices on or contiguous to their lot. In order to be effective, maintenance should be conducted on a regular and routine schedule and necessary corrections made prior to each rainy season.

5.6 PLAN REVIEW AND CONSTRUCTION OBSERVATIONS

We recommend that site grading, specifications, and foundation plans be reviewed by this office prior to construction to check for conformance with the recommendations of this report. We also recommend that GeoTek representatives be present during site grading and foundation construction to observe and document for proper implementation of the geotechnical recommendations. The owner/developer should have GeoTek perform at least the following duties:

- Observe site clearing and grubbing operations for proper removal of all unsuitable materials.
- Observe and test bottom of removals prior to fill placement.
- Evaluate the suitability of on-site and import materials for fill placement, and collect soil samples for laboratory testing where necessary.
- Observe the fill for uniformity during placement including utility trenches. Also, test the fill for field density, relative compaction and moisture content.
- Observe and probe foundation excavations to confirm suitability of bearing materials.
- Observed retaining wall subdrain.

If requested, a construction observation and compaction report can be provided by GeoTek which can comply with the requirements of the governmental agencies having jurisdiction over the project. We recommend that these agencies be notified prior to commencement of construction so that necessary grading permits can be obtained

6. INTENT

It is the intent of this report to aid in the design and construction of the proposed development. Implementation of the advice presented in this report is intended to reduce risk associated with construction projects. The professional opinions and geotechnical advice contained in this report are not intended to imply total performance of the project or guarantee that unusual or variable conditions will not be discovered during or after construction.

The scope of our evaluation is limited to the area explored that is shown on the Boring Location Map (Figure 2). This evaluation does not and should in no way be construed to encompass any areas beyond the specific area of the proposed construction as indicated to us by the client. Further, no evaluation of any existing site improvements is included. The scope is based on our understanding of the project and the client's needs, our proposal (Proposal No. P-1104215) dated December 1, 2015 and geotechnical engineering standards normally used on similar projects in this region.

7. LIMITATIONS

Our findings are based on site conditions observed and the stated sources. Thus, our comments are professional opinions that are limited to the extent of the available data.

GeoTek has prepared this report in a manner consistent with that level of care and skill ordinarily exercised by members of the engineering and science professions currently practicing under similar conditions in the jurisdiction in which the services are provided, subject to the time limits and physical constraints applicable to this report.

Since our recommendations are based on the site conditions observed and encountered, and laboratory testing, our conclusions and recommendations are professional opinions that are limited to the extent of the available data. Observations during construction are important to allow for any change in recommendations found to be warranted. These opinions have been derived in accordance with current standards of practice and no warranty of any kind is expressed or implied. Standards of care/practice are subject to change with time.

8. SELECTED REFERENCES

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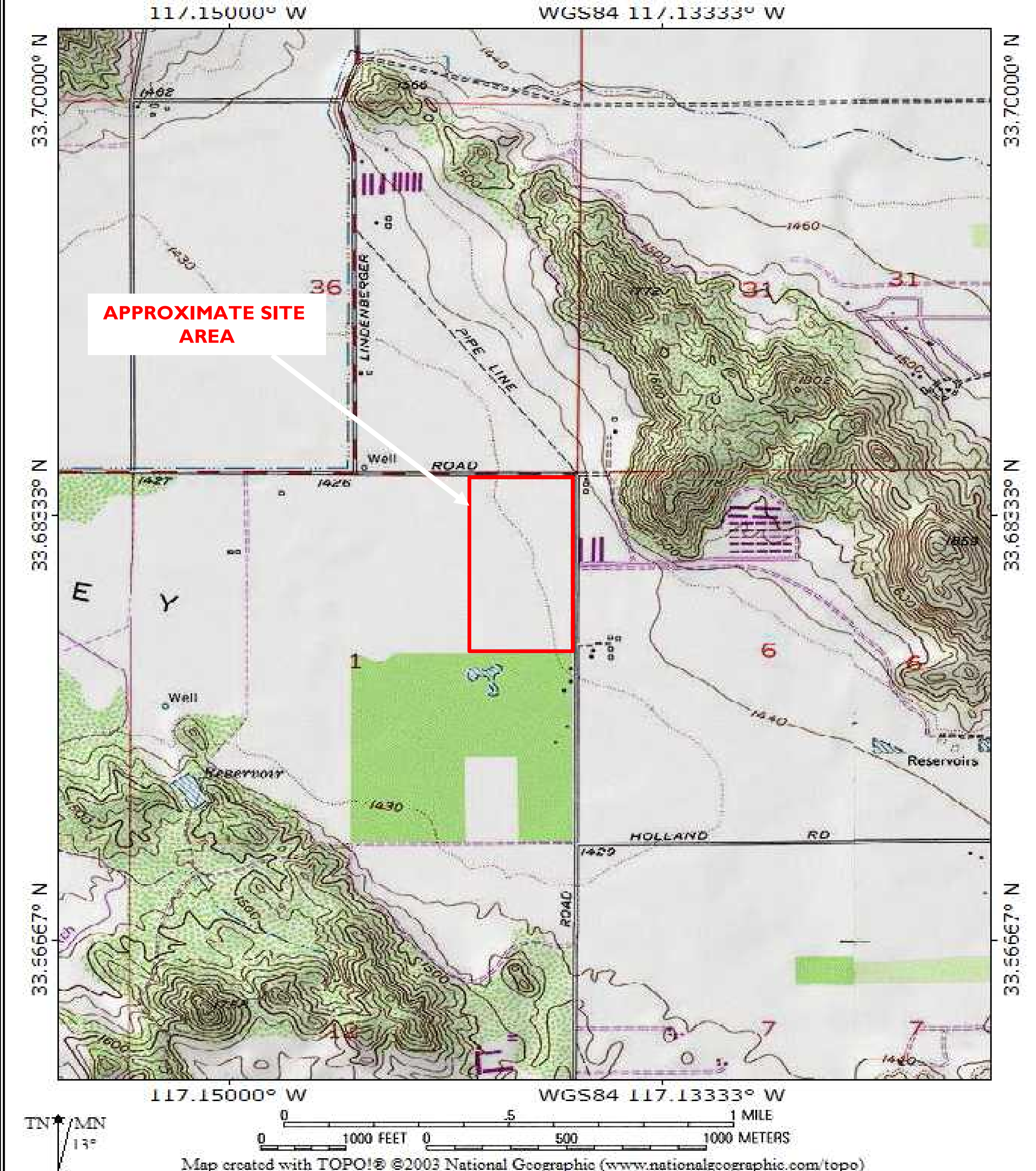


Excel Engineering
APN 364-190-004
29875 Newport Road
Menifee, Riverside County, California

GeoTek Project No. 1414-CR

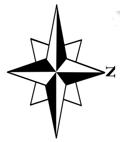
N

Modified from USGS 7.5 Topographic Map

Figure 1

Site Location Map

GEOTEK



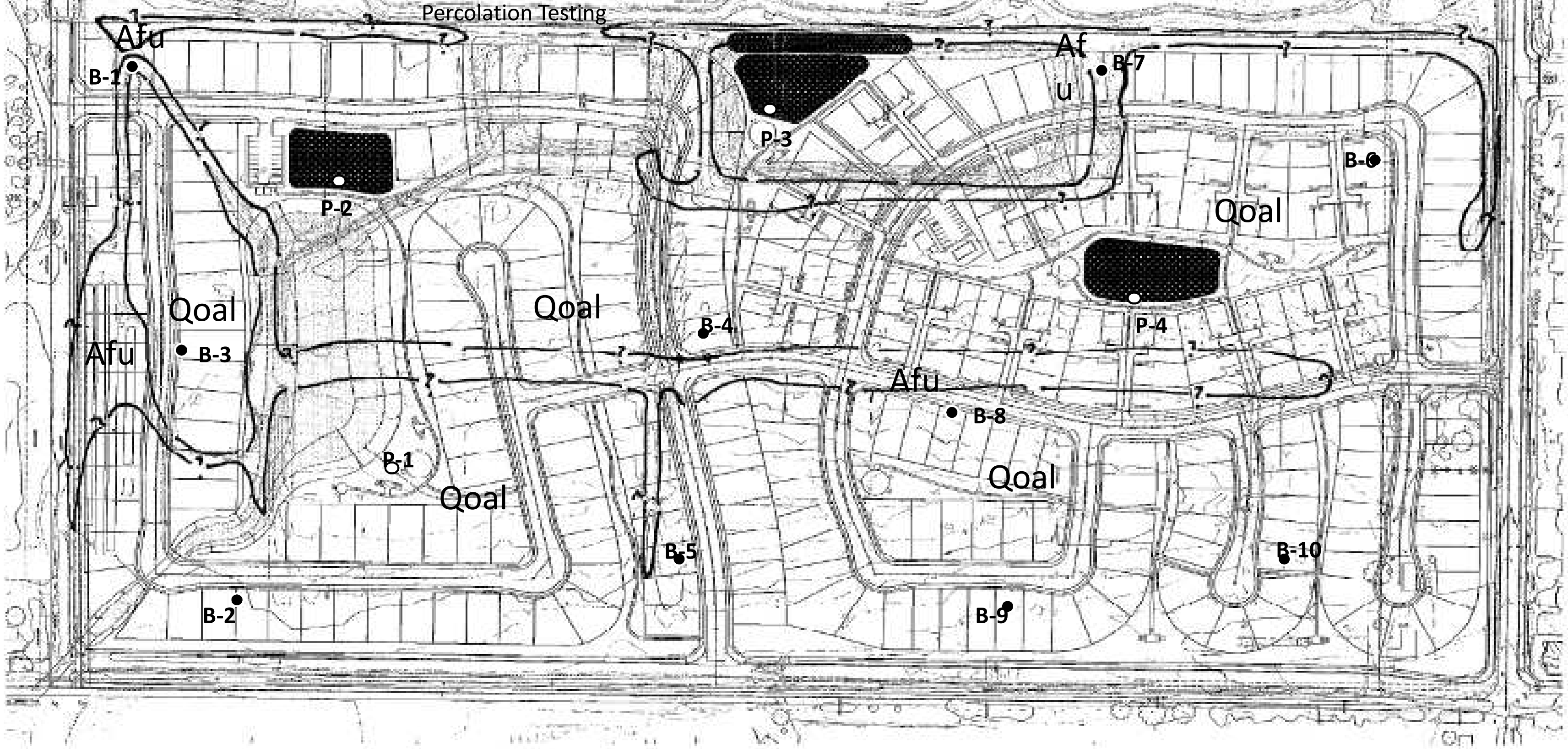
0 100
Scale
(feet)

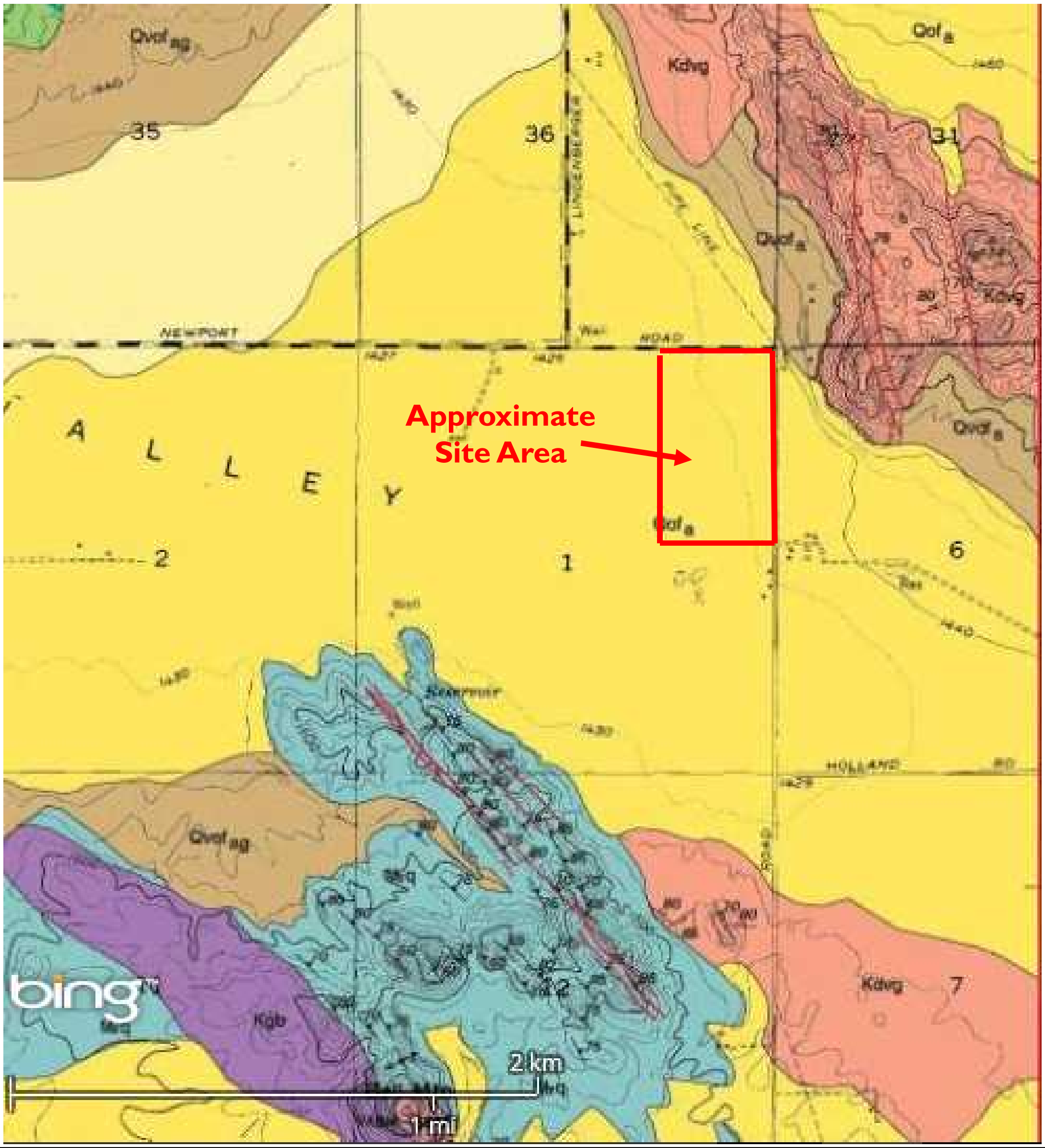
GEOTECHNICAL MAP

GEOTEK	Geotechnical Map
Figure 2 GEOTEK Project No. 1414-CR	Excel Engineering Newport Ranch Menifee, Riverside, CA

LEGEND

- ? — Approximate Contact
- B-10 ● Number and Approximate Location of Exploratory Boring
- P-4 ○ Number and Approximate Location of Boring for Percolation Testing
- Afu Undocumented Artificial Fill
- Qoal Older Alluvium





LEGEND

Qofa - Quaternary Old Alluvial Fan Deposits

Qvofa - Quaternary Very Old Alluvial Fan Deposits

Kdvg – Grandiorite to Tonalite

Mzq - Quartz rich rocks

Reference Map: Geologic Map of the Romoland 7.5' Quadarangle, Riverside County, CA, Mortan, et.al., USGS Survey OF-2003-102.

Excel Engineering
29875 Newport Road
Menifee, Riverside County, California

GeoTek Project No. 1428-CR

N

Figure 3

Regional Geologic Map

GEOTEK

APPENDIX A

LOGS OF EXPLORATORY BORINGS

Excel Engineering

29875 Newport Road, Menifee, Riverside County, California

Project No. 1414-CR

A - FIELD TESTING AND SAMPLING PROCEDURES

The Modified Split-Barrel Sampler (Ring)
The Ring sampler is driven into the ground in accordance with ASTM Test Method D 3550. The sampler, with an external diameter of 3.0 inches, is lined with 1-inch high, thin brass rings with an inside diameter of approximately 2.4 inches. The sampler is typically driven into the ground 12 or 18 inches with a 140-pound hammer free falling from a height of 30 inches. Blow counts are recorded for every 6 inches of penetration as indicated on the log of boring. The samples are removed from the sample barrel in the brass rings, sealed, and transported to the laboratory for testing.

The Split-Spoon Sampler (SPT)
During the sampling procedure, Standard Penetration Tests (SPT) were performed in accordance with ASTM D1586. The SPT for soil borings is performed by driving a split-spoon sampler with an outside diameter of 2 inches into the undisturbed formation located at the bottom of the advanced borehole with repeated blows of a 140-pound hammer falling a vertical distance of 30 inches. The number of blows required to drive the sampler for three consecutive 6-inch intervals were recorded, and the sum of the blow counts for the last 12 inches of penetration is a measure of the soil consistency. Samples were identified in the field, placed in sealed containers and transported to the laboratory for further classification and testing.

Bulk Samples (Large)
These samples are normally large bags of earth materials over 20 pounds in weight collected from the field by means of hand digging or exploratory cuttings.

B - BORING LOG LEGEND

The following abbreviations and symbols often appear in the classification and description of soil and rock on the log of boring:

SOILS

USCS	Unified Soil Classification System
f-c	Fine to coarse
f-m	Fine to medium

GEOLOGIC

B: Attitudes	Bedding: strike/dip
J: Attitudes	Joint: strike/dip
C: Contact line	
………..	Dashed line denotes USCS material change
———	Solid Line denotes unit / formational change
━━━	Thick solid line denotes end of boring

(Additional denotations and symbols are provided on the log of boring)

GeoTek, Inc.
LOG OF EXPLORATORY BORING

CLIENT:	Excel Enginering	**DRILLER:**	2R Drilling	**LOGGED BY:**	R. Hankes
PROJECT NAME:	29875 Newport Rd.	**DRILL METHOD:**	Hollow Stem	**OPERATOR:**	Jeff/George
PROJECT NO.:	1414-CR	**HAMMER:**	140#/30"	**RIG TYPE:**	CME 75
LOCATION:	Menifee, CA			**DATE:**	2/9/2016

Boring No.: B-1

Depth (ft)	SAMPLES: Sample Type	SAMPLES: Blows/ 6 in	SAMPLES: Sample Number	USCS Symbol	MATERIAL DESCRIPTION AND COMMENTS	Laboratory Testing: Water Content (%)	Laboratory Testing: Dry Density (pcf)	Laboratory Testing: Others
0	Large Bulk			SM	**UNDOCUMENTED ARTIFICIAL FILL** Silty f SAND, dark brown, slightly moist, medium dense, some cobble size rock			
	Ring	12 16 18		SM	**OLDER ALLUVIUM** Silty f SAND, brown to dark brown, moist, medium dense	9.9	127.0	
5								
	Ring	15 28 33		ML	f Sandy SILT, brown, moist, hard	14.7	120.1	
	Ring	11 21 29		SC	Clayey m-c SAND, brown with white specs, sligthly moist to moist, dense	8.8	132.1	LL=24, PL=14, PI=10 Fines=39%
10								
15	SPT	4 8 5		CL	m Sandy CLAY, brown, moist, stiff	22.1		LL=40, PL=19, PI=21
20	SPT	7 12 18		SM	Silty m-f SAND, brown, moist, dense	14.3		
25	SPT	5 12 21		ML	f Sandy SILT, brown to dark brown, moist, hard, with mica	15.7		
30	SPT	7 11 18			f Sandy SILT, brown to dark brown, moist, very stiff, with mica	15.2		

LEGEND

Sample type: ---Ring ---SPT ---Small Bulk ---Large Bulk ---No Recovery ---Water Table

Lab testing:
AL = Atterberg Limits | EI = Expansion Index | SA = Sieve Analysis | RV = R-Value Test
SR = Sulfate/Resisitivity Test | SH = Shear Test | HC= Consolidation | MD = Maximum Density

GeoTek, Inc.
LOG OF EXPLORATORY BORING

CLIENT:	Excel Engineering	**DRILLER:**	2R Drilling	**LOGGED BY:**	R. Hankes
PROJECT NAME:	29875 Newport Rd.	**DRILL METHOD:**	Hollow Stem	**OPERATOR:**	Jeff/George
PROJECT NO.:	1414-CR	**HAMMER:**	140#/30"	**RIG TYPE:**	CME 75
LOCATION:	Menifee, CA			**DATE:**	2/9/2016

Boring No.: B-1(Cont.)

Depth (ft)	SAMPLES: Sample Type	SAMPLES: Blows/ 6 in	SAMPLES: Sample Number	USCS Symbol	MATERIAL DESCRIPTION AND COMMENTS	Laboratory Testing: Water Content (%)	Laboratory Testing: Dry Density (pcf)	Laboratory Testing: Others
30					(see previous page)			
35	SPT	7 16 20		ML	f-m Sandy SILT, brown, miost, hard, with mica	15.7		
40	SPT	8 13 23			same	14.0		
45	SPT	8 18 29		SP	f-m SAND, tan, slighlty moist, dense	4.2		
50	SPT	8 14 28		ML	f sandy SILT, brown, moist, hard, with mica	15.0		
					Boring Terminated at 51.5 feet Boring backfilled with excavated soils. No groundwater encountered. Fill to 3.5 feet			
55								
60								

LEGEND

Sample type: ---Ring ---SPT ---Small Bulk ---Large Bulk ---No Recovery ---Water Table

Lab testing:

AL = Atterberg Limits | EI = Expansion Index | SA = Sieve Analysis | RV = R-Value Test
SR = Sulfate/Resisitivity Test | SH = Shear Test | HC= Consolidation | MD = Maximum Density

GeoTek, Inc.

LOG OF EXPLORATORY BORING

CLIENT:	Methane Related Services	**DRILLER:**	2R Drilling	**LOGGED BY:**	R. Hankes
PROJECT NAME:	29875 Newport Rd.	**DRILL METHOD:**	Hollow Stem	**OPERATOR:**	Jeff/George
PROJECT NO.:	1414-CR	**HAMMER:**	140#/30"	**RIG TYPE:**	CME 75
LOCATION:	Menifee, CA			**DATE:**	2/9/2016

Boring No.: B-2

Depth (ft)	SAMPLES: Sample Type	Blows/ 6 in	Sample Number	USCS Symbol	MATERIAL DESCRIPTION AND COMMENTS	Laboratory Testing: Water Content (%)	Dry Density (pcf)	Others
0					**OLDER ALLUVIUM**			
	Ring	33 50/6"		ML	f Sandy SILT, brown, slightly moist, hard, with some gravel	6.3	128.5	
5	Ring	50/6"				6.7	122.4	
	Ring	30 50/3"			with caliche	9.3	126.9	
10	SPT	25 35 42		ML	SILT, brown, slightly moist, hard, with some m sand grains	9.0		
15	SPT	9 23 21		SM	SILT, brown, moist, hard, with caliche and some f sand grains	14.8		
20	SPT	10 18 30		ML	f Sandy SILT, brown, moist, hard	12.0		
					Boring Terminated at 21.5 feet Boring backfilled with excavated soils. No groundwater encountered. No fill.			
25								
30								

LEGEND

Sample type: ---Ring ---SPT ---Small Bulk ---Large Bulk ---No Recovery ---Water Table

Lab testing:
AL = Atterberg Limits | EI = Expansion Index | SA = Sieve Analysis | RV = R-Value Test
SR = Sulfate/Resisitivity Test | SH = Shear Test | HC= Consolidation | MD = Maximum Density

GeoTek, Inc.
LOG OF EXPLORATORY BORING

CLIENT:	Excel Engineering	**DRILLER:**	2R Drilling	**LOGGED BY:**	R. Hankes
PROJECT NAME:	29875 Newport Rd.	**DRILL METHOD:**	Hollow Stem	**OPERATOR:**	Jeff/George
PROJECT NO.:	1414-CR	**HAMMER:**	140#/30"	**RIG TYPE:**	CME 75
LOCATION:	Menifee, CA			**DATE:**	2/9/2016

Boring No.: B-3

Depth (ft)	SAMPLES: Sample Type	Blows/ 6 in	Sample Number	USCS Symbol	MATERIAL DESCRIPTION AND COMMENTS	Laboratory Testing: Water Content (%)	Dry Density (pcf)	Others
0					**OLDER ALLUVIUM**			
	Ring	17 34 40		SM	Silty f SAND, brown, moist, dense	12.3	125.7	
5	Ring	16 30 36			with trace clay	11.5	126.6	
	Ring	16 25 26				12.8	123.0	
10								
15	SPT	11 18 16		ML	SILT, brown, moist, hard, with mica and some f-m sand grains	13.6		
20	SPT	10 16 22		SP	f-m SAND, tan and light brown, slightly miost to moist, dense	7.3		
					Boring Terminated at 21.5 feet Boring backfilled with excavated soils. No groundwater encountered. No fill.			
25								
30								

LEGEND

Sample type: ---Ring ---SPT ---Small Bulk ---Large Bulk ---No Recovery ---Water Table

Lab testing: AL = Atterberg Limits EI = Expansion Index SA = Sieve Analysis RV = R-Value Test SR = Sulfate/Resisitivity Test SH = Shear Test HC= Consolidation MD = Maximum Density

GeoTek, Inc.

LOG OF EXPLORATORY BORING

CLIENT:	Excel Engineering	**DRILLER:**	2R Drilling	**LOGGED BY:**	R. Hankes
PROJECT NAME:	29875 Newport Rd.	**DRILL METHOD:**	Hollow Stem	**OPERATOR:**	Jeff/George
PROJECT NO.:	1414-CR	**HAMMER:**	140#/30"	**RIG TYPE:**	CME 75
LOCATION:	Menifee, CA			**DATE:**	2/9/2016

Boring No.: B-4

Depth (ft)	SAMPLES: Sample Type	SAMPLES: Blows/ 6 in	SAMPLES: Sample Number	USCS Symbol	MATERIAL DESCRIPTION AND COMMENTS	Laboratory Testing: Water Content (%)	Laboratory Testing: Dry Density (pcf)	Laboratory Testing: Others
0					**OLDER ALLUVIUM**			
	Ring	14 20 15		SM	Silty f SAND, brown, slightly moist, medium dense, trace gravel	7.3	116.8	
5								
	Ring	37 50/5"		ML	m-f Sandy SILT, brown, slightly moist, hard, with caliche	7.3	126.8	
10	Ring	11 13 15		ML	Clayey SILT, brown and light brown, moist, very stiff	16.3	111.5	
15	SPT	4 10 15		CL	m Sandy CLAY, brown, moist, very stiff	14.8		
20	SPT	6 10 17		ML	f Sandy SILT, brown to dark brown, moist, very stiff, with mica	16.9		
					Boring Terminated at 21.5 feet Boring backfilled with excavated soils. No groundwater encountered. No fill.			
25								
30								

LEGEND

Sample type: ---Ring ---SPT ---Small Bulk ---Large Bulk ---No Recovery ---Water Table

Lab testing:
AL = Atterberg Limits
EI = Expansion Index
SA = Sieve Analysis
RV = R-Value Test
SR = Sulfate/Resisitivity Test
SH = Shear Test
HC= Consolidation
MD = Maximum Density

GeoTek, Inc.
LOG OF EXPLORATORY BORING

CLIENT:	Excel Engineering	**DRILLER:**	2R Drilling	**LOGGED BY:**	R. Hankes
PROJECT NAME:	29875 Newport Rd.	**DRILL METHOD:**	Hollow Stem	**OPERATOR:**	Jeff/George
PROJECT NO.:	1414-CR	**HAMMER:**	140#/30"	**RIG TYPE:**	CME 75
LOCATION:	Menifee, CA			**DATE:**	2/9/2016

Boring No.: B-5

Depth (ft)	SAMPLES: Sample Type	SAMPLES: Blows/ 6 in	SAMPLES: Sample Number	USCS Symbol	MATERIAL DESCRIPTION AND COMMENTS	Laboratory Testing: Water Content (%)	Laboratory Testing: Dry Density (pcf)	Laboratory Testing: Others
0					**OLDER ALLUVIUM**			
	Ring	18 50/5"		SM	Silty f SAND, brown to dark brown, slightly moist, very dense, with some gravel	5.8	112.0	
5								
	Ring	50/6"			slightly moist to moist	7.9	125.1	
	Ring	50/6"				7.5	121.4	
10								
15	SPT	11 31 50/4"		SM	Silty m-c SAND, reddish brown, slightly moist to moist, very dense	10.5		
20	SPT	14 21 33		SM	Silty f-m sand, reddish brown, slightly moist to moist, very dense, with mica	10.1		
					Boring Terminated at 21.5 feet Boring backfilled with excavated soils. No groundwater encountered.			
25								
30								

LEGEND

Sample type: ---Ring ---SPT ---Small Bulk ---Large Bulk ---No Recovery ---Water Table

Lab testing:
AL = Atterberg Limits EI = Expansion Index SA = Sieve Analysis RV = R-Value Test
SR = Sulfate/Resisitivity Test SH = Shear Test HC= Consolidation MD = Maximum Density

GeoTek, Inc.
LOG OF EXPLORATORY BORING

CLIENT:	Excel Engineering	**DRILLER:**	2R Drilling	**LOGGED BY:**	DRB
PROJECT NAME:	29875 Newport Rd.	**DRILL METHOD:**	Hollow Stem	**OPERATOR:**	Jeff/George
PROJECT NO.:	1414-CR	**HAMMER:**	140#/30"	**RIG TYPE:**	CME 75
LOCATION:	Menifee, CA			**DATE:**	2/10/2016

Boring No.: B-6

Depth (ft)	SAMPLES: Sample Type	Blows/ 6 in	Sample Number	USCS Symbol	MATERIAL DESCRIPTION AND COMMENTS	Laboratory Testing: Water Content (%)	Dry Density (pcf)	Others
0					**OLDER ALLUVIUM**			
				SM	Silty f-c SAND, orange-brown, moderately moist, very dense			
	Ring	30 50/3"				12.5	123.4	
5								
	Ring	8 15 19		ML/CL	Silty CLAY to Clayey SILT, medium brown, moist, very stiff, some sand micaceous	15.8	114.9	
10	Ring	14 24 50		SM	Silty m-c SAND, brown, moderately moist to moist, dense, trace clay	9.0	127.5	
15	SPT	9 18 35		ML	f Sandy SILT to SILT, orange brown, medium brown, tan, moist, hard	20.2		
20	SPT	12 21 25		SM	Silty f SAND to Sandy SILT, brown to orange brown, moist, dense, hard, micaceous	10.1		
25	SPT	14 30 50/5"		SM	Silty f-c SAND, orange brown, moderately moist, very dense	7.3		
30	SPT	12 20 28		SP/SM	m-c SAND, Silty SAND, some small gravel, light to medium brown, slightly moist, dense	4.8		

LEGEND

Sample type: ---Ring ---SPT ---Small Bulk ---Large Bulk ---No Recovery ---Water Table

Lab testing:
AL = Atterberg Limits EI = Expansion Index SA = Sieve Analysis RV = R-Value Test
SR = Sulfate/Resisitivity Test SH = Shear Test HC= Consolidation MD = Maximum Density

GeoTek, Inc.

LOG OF EXPLORATORY BORING

CLIENT:	Excel Engineering	**DRILLER:**	2R Drilling	**LOGGED BY:**	DRB
PROJECT NAME:	29875 Newport Rd.	**DRILL METHOD:**	Hollow Stem	**OPERATOR:**	Jeff/George
PROJECT NO.:	1414-CR	**HAMMER:**	140#/30"	**RIG TYPE:**	CME 75
LOCATION:	Menifee, CA			**DATE:**	2/10/2016

Boring No.: B-6 (Cont.)

Depth (ft)	SAMPLES: Sample Type	Blows/ 6 in	Sample Number	USCS Symbol	MATERIAL DESCRIPTION AND COMMENTS	Laboratory Testing: Water Content (%)	Dry Density (pcf)	Others
30					(see previous page)			
35	SPT	12 16 20		SM	Silty f-c SAND, brown, orange brown, moist, dense	15.6		
40	SPT	10 23 38		SM	Silty f-c SAND, brown, gold brown, moist, very dense, micaceous	8.3		
45	SPT	14 27 34		SM/ML	Silty f-c SAND to Sandy SILT, brown, moist, very dense, hard	11.0		
50	SPT	14 24 31		SM	Silty f-c SAND, brown, orange brown, moist, very dense	9.2		
					Boring Terminated at 51.5 feet Boring backfilled with excavated soils. No ground water encountered. No fill.			
55								
60								

LEGEND

Sample type: ---Ring ---SPT ---Small Bulk ---Large Bulk ---No Recovery ---Water Table

Lab testing:
AL = Atterberg Limits; EI = Expansion Index; SA = Sieve Analysis; RV = R-Value Test
SR = Sulfate/Resisitivity Test; SH = Shear Test; HC= Consolidation; MD = Maximum Density

GeoTek, Inc.

LOG OF EXPLORATORY BORING

CLIENT:	Excel Engineering	**DRILLER:**	2R Drilling	**LOGGED BY:**	DRB
PROJECT NAME:	29875 Newport Rd.	**DRILL METHOD:**	Hollow Stem	**OPERATOR:**	Jeff/George
PROJECT NO.:	1414-CR	**HAMMER:**	140#/30"	**RIG TYPE:**	CME 75
LOCATION:	Menifee, CA			**DATE:**	2/10/2016

Boring No.: B-7

Depth (ft)	SAMPLES: Sample Type	Blows/ 6 in	Sample Number	USCS Symbol	MATERIAL DESCRIPTION AND COMMENTS	Laboratory Testing: Water Content (%)	Dry Density (pcf)	Others
0					**OLDER ALLUVIUM**			
				ML	Clayey SILT, brown, moist, hard			
	Ring	40 50/4"			same	17.2	107.6	LL=32, PL=29, PI=3
5								
	Ring	3 4 5		CL	Silty CLAY, brown, very moist, medium stiff	32.8	88.1	
10	Ring	6 11 14		CL/ML	Silty CLAY to Clayey SILT, brown, moist, stiff	17.3	115.8	
15	SPT	4 7 11		SM	Silty f-c SAND, some clay, brown, moist, medium dense	24.4		
					Boring Terminated at 16.5 feet Boring backfilled with excavated soils. No ground water encountered. No fill.			
20								
25								
30								

LEGEND

Sample type: ---Ring ---SPT ---Small Bulk ---Large Bulk ---No Recovery ---Water Table

Lab testing:
AL = Atterberg Limits EI = Expansion Index SA = Sieve Analysis RV = R-Value Test
SR = Sulfate/Resisitivity Test SH = Shear Test HC= Consolidation MD = Maximum Density

GeoTek, Inc.
LOG OF EXPLORATORY BORING

CLIENT:	Excel Engineering	**DRILLER:**	2R Drilling	**LOGGED BY:**	DRB
PROJECT NAME:	29875 Newport Rd.	**DRILL METHOD:**	Hollow Stem	**OPERATOR:**	Jeff/George
PROJECT NO.:	1414-CR	**HAMMER:**	140#/30"	**RIG TYPE:**	CME 75
LOCATION:	Menifee, CA			**DATE:**	2/10/2016

Boring No.: B-8

Depth (ft)	Sample Type	Blows/ 6 in	Sample Number	USCS Symbol	MATERIAL DESCRIPTION AND COMMENTS	Water Content (%)	Dry Density (pcf)	Others
0					**UNDOCUMENTED ARTIFICIAL FILL**			
				SM	Silty f-c SAND, brown, orange brown, moist dense			
	Ring	7 19 22		SM	**ALLUVIUM** Silty f-c SAND, orange brown, moist, medium dense	13.1	121.3	
5								
	Ring	11 27 49		SM	Silty f-c SAND, brown and orange brown, moderately moist to moist, very dense	8.2	127.2	
	Ring	26 50/5"		SM/SC	Silty and Clayey f-c SAND, brown, orange brown, moderately moist to moist, very dense	11.2	123.8	
10								
15	SPT	9 14 30		SM	Silty m-c SAND, red brown, brown, moderately moist, dense	11.5		
20	SPT	9 17 24		SM	Silty m-c SAND, medium red and orange brown, moderately moist, dense	11.5		
					Boring Terminated at 21.5 feet Boring backfilled with excavated soils. No ground water encountered. Fill to approximatly 3 feet.			
25								
30								

LEGEND

Sample type: ---Ring ---SPT ---Small Bulk ---Large Bulk ---No Recovery ---Water Table

Lab testing:
AL = Atterberg Limits | EI = Expansion Index | SA = Sieve Analysis | RV = R-Value Test
SR = Sulfate/Resisitivity Test | SH = Shear Test | HC= Consolidation | MD = Maximum Density

GeoTek, Inc.

LOG OF EXPLORATORY BORING

CLIENT:	Excel Engineering	**DRILLER:**	2R Drilling	**LOGGED BY:**	DRB
PROJECT NAME:	29875 Newport Rd.	**DRILL METHOD:**	Hollow Stem	**OPERATOR:**	Jeff/George
PROJECT NO.:	1414-CR	**HAMMER:**	140#/30"	**RIG TYPE:**	CME 75
LOCATION:	Menifee, CA			**DATE:**	2/10/2016

Boring No.: B-9

Depth (ft)	SAMPLES: Sample Type	SAMPLES: Blows/ 6 in	SAMPLES: Sample Number	USCS Symbol	MATERIAL DESCRIPTION AND COMMENTS	Laboratory Testing: Water Content (%)	Laboratory Testing: Dry Density (pcf)	Laboratory Testing: Others
0					**ALLUVIUM**			
				SM	Silty f-m SAND, brown, orange brown, moderately moist, dense			
	Ring	15 26 27		SM/ML	Silty f SAND to Sandy SILT, medium brown, moderately moist, dense/ very stiff	6.7	109.1	
5								
	Ring	50/6"		SM	Silty f-c SAND, orange brown, moderately moist, very dense, some mica very dense	8.0	119.6	
	Ring	50/6"		SM	Silty f-c SAND, red brown, orange brown, moderately moist, very dense, some mica	8.0	117.7	
10								
15	SPT	12 14 22		SM/ML	Silty f-m SAND to Sandy SILT, orange brown, brown, moderately moist to moist, dense/hard	11.0		
20	SPT	8				5.5		
		31 50			**BEDROCK** Granite, tan, light orange brown and black crystals, hard to very hard			
					Boring Terminated at 21.5 feet Boring backfilled with excavated soils. No ground water encountered. No fill.			
25								
30								

LEGEND

Sample type: ---Ring ---SPT ---Small Bulk ---Large Bulk ---No Recovery ---Water Table

Lab testing:

AL = Atterberg Limits	EI = Expansion Index	SA = Sieve Analysis	RV = R-Value Test
SR = Sulfate/Resisitivity Test	SH = Shear Test	HC= Consolidation	MD = Maximum Density

GeoTek, Inc.
LOG OF EXPLORATORY BORING

CLIENT:	Excel Engineering	**DRILLER:**	2R Drilling	**LOGGED BY:**	DRB
PROJECT NAME:	29875 Newport Rd.	**DRILL METHOD:**	Hollow Stem	**OPERATOR:**	Jeff/George
PROJECT NO.:	1414-CR	**HAMMER:**	140#/30"	**RIG TYPE:**	CME 75
LOCATION:	Menifee, CA			**DATE:**	2/10/2016

Boring No.: B-10

Depth (ft)	SAMPLES: Sample Type	SAMPLES: Blows/ 6 in	SAMPLES: Sample Number	USCS Symbol	MATERIAL DESCRIPTION AND COMMENTS	Laboratory Testing: Water Content (%)	Laboratory Testing: Dry Density (pcf)	Laboratory Testing: Others
0					**UNDOCUMENTED ARTIFICIAL FILL** Silty f-m SAND, brown, orange brown, moderately moist, dense			
	Ring	13 20 44		SM	**ALLUVIUM** Silty f-m SAND, orange brown, brown, moderately moist to moist, dense, local small gravel	6.6	125.6	
5								
	Ring	40 50/3"		SM	Silty f-c SAND, red to orange brown, moderately moist to moist, very dense	8.3	115.3	
	Ring	23 50/2"		SM	Silty f-c SAND, red brown, moderately moist to moist, very dense	9.0	126.6	
10								
15	SPT	17 50/2"				5.7		
					BEDROCK Granite, tan, light orange brown and black crystals, hard to very hard, weathered			
20	SPT	50/2"						
					Boring Terminated at 20.5 feet Boring backfilled with excavated soils. No ground water encountered. Approximately 2 feet of fill.			
25								
30								

LEGEND

Sample type: ---Ring ---SPT ---Small Bulk ---Large Bulk ---No Recovery ---Water Table

Lab testing: AL = Atterberg Limits; EI = Expansion Index; SA = Sieve Analysis; RV = R-Value Test; SR = Sulfate/Resisitivity Test; SH = Shear Test; HC= Consolidation; MD = Maximum Density

GeoTek, Inc.
LOG OF EXPLORATORY BORING

CLIENT:	Excel Engineering	**DRILLER:**	2R Drilling	**LOGGED BY:**	R. Hankes
PROJECT NAME:	29875 Newport Rd.	**DRILL METHOD:**	Hollow Stem	**OPERATOR:**	Jeff/George
PROJECT NO.:	1414-CR	**HAMMER:**	140#/30"	**RIG TYPE:**	CME 75
LOCATION:	Menifee, CA			**DATE:**	2/9/2016

Boring No.: P-1

Depth (ft)	SAMPLES: Sample Type	Blows/ 6 in	Sample Number	USCS Symbol	MATERIAL DESCRIPTION AND COMMENTS	Laboratory Testing: Water Content (%)	Dry Density (pcf)	Others
0					**OLDER ALLUVIUM**			
5	Ring	35 50/5"		SM	Silty f-m SAND, brown, slightly moist to moist, very dense	9.5	127.7	
	Ring	12 24 44		ML	Clayey SILT, brown, moist, hard, with some coarse sand	16.4	117.4	
10					**Boring Terminated at 10 feet** No groundwater encountered. No fill. Pipe and gravel set for percolation testing.			
15								
20								
25								
30								

LEGEND

Sample type: ---Ring ---SPT ---Small Bulk ---Large Bulk ---No Recovery ---Water Table

Lab testing: AL = Atterberg Limits EI = Expansion Index SA = Sieve Analysis RV = R-Value Test SR = Sulfate/Resisitivity Test SH = Shear Test HC= Consolidation MD = Maximum Density

GeoTek, Inc.
LOG OF EXPLORATORY BORING

CLIENT:	Excel Engineering	**DRILLER:**	2R Drilling	**LOGGED BY:**	R. Hankes
PROJECT NAME:	29875 Newport Rd.	**DRILL METHOD:**	Hollow Stem	**OPERATOR:**	Jeff/George
PROJECT NO.:	1414-CR	**HAMMER:**	140#/30"	**RIG TYPE:**	CME 75
LOCATION:	Menifee, CA			**DATE:**	2/9/2016

Boring No.: P-2

Depth (ft)	SAMPLES: Sample Type	SAMPLES: Blows/ 6 in	SAMPLES: Sample Number	USCS Symbol	MATERIAL DESCRIPTION AND COMMENTS	Laboratory Testing: Water Content (%)	Laboratory Testing: Dry Density (pcf)	Laboratory Testing: Others
0					**OLDER ALLUVIUM**			
5	Ring	18 22 25		ML	SILT, brown, moist, hard, with some m sand and rock fragments	15.1	119.0	
	Ring	12 24 23		ML	f-m Sandy SILT, brown, slightly moist to moist, hard	11.8	124.8	
10					**Boring Terminated at 10 feet** No groundwater encountered. No fill. Pipe and gravel set for percolation testing.			
15								
20								
25								
30								

LEGEND

Sample type: ---Ring ---SPT ---Small Bulk ---Large Bulk ---No Recovery ---Water Table

Lab testing:
AL = Atterberg Limits, EI = Expansion Index, SA = Sieve Analysis, RV = R-Value Test
SR = Sulfate/Resisitivity Test, SH = Shear Test, HC= Consolidation, MD = Maximum Density

GeoTek, Inc.
LOG OF EXPLORATORY BORING

CLIENT:	Excel Engineering	**DRILLER:**	2R Drilling	**LOGGED BY:**	R. Hankes
PROJECT NAME:	29875 Newport Rd.	**DRILL METHOD:**	Hollow Stem	**OPERATOR:**	Jeff/George
PROJECT NO.:	1414-CR	**HAMMER:**	140#/30"	**RIG TYPE:**	CME 75
LOCATION:	Menifee, CA			**DATE:**	2/9/2016

Boring No.: P-3

Depth (ft)	SAMPLES: Sample Type	Blows/ 6 in	Sample Number	USCS Symbol	MATERIAL DESCRIPTION AND COMMENTS	Laboratory Testing: Water Content (%)	Dry Density (pcf)	Others
0					**OLDER ALLUVIUM**			
5	Ring	20 33 46		ML	f Sandy SILT, light brown and dark greenish brown, moist, hard, with mica	16.6	116.6	
	Ring	28 33 44				14.7	120.1	
10					**Boring Terminated at 10 feet** No groundwater encountered. No fill. Pipe and gravel set for percolation testing.			
15								
20								
25								
30								

LEGEND

Sample type: ---Ring ---SPT ---Small Bulk ---Large Bulk ---No Recovery ---Water Table

Lab testing:
AL = Atterberg Limits; EI = Expansion Index; SA = Sieve Analysis; RV = R-Value Test
SR = Sulfate/Resisitivity Test; SH = Shear Test; HC= Consolidation; MD = Maximum Density

GeoTek, Inc.

LOG OF EXPLORATORY BORING

CLIENT:	Excel Engineering	**DRILLER:**	2R Drilling	**LOGGED BY:**	DRB
PROJECT NAME:	29875 Newport Rd.	**DRILL METHOD:**	Hollow Stem	**OPERATOR:**	Jeff/George
PROJECT NO.:	1414-CR	**HAMMER:**	140#/30"	**RIG TYPE:**	CME 75
LOCATION:	Menifee, CA			**DATE:**	2/10/2016

Boring No.: P-4

Depth (ft)	SAMPLES: Sample Type	Blows/ 6 in	Sample Number	USCS Symbol	MATERIAL DESCRIPTION AND COMMENTS	Laboratory Testing: Water Content (%)	Dry Density (pcf)	Others
0					**ALLUVIUM**			
				SM/ML	Silty f SAND to Sandy SILT, medium orange brown, moderately moist, dense, stiff			
5	Ring	38 40 43		ML	SILT with Clay and Sand, brown, moderately moist, hard	10.4	123.5	
	Ring	18 24 24		ML	Clayey SILT, some sand, brown, orange brown, moist, hard	10.9	125.1	
10					**Boring Terminated at 10 feet**			
					No ground water encountered. No fill. Pipe and gravel set for percolation testing.			
15								
20								
25								
30								

LEGEND

Sample type: ---Ring ---SPT ---Small Bulk ---Large Bulk ---No Recovery ---Water Table

Lab testing:
AL = Atterberg Limits; EI = Expansion Index; SA = Sieve Analysis; RV = R-Value Test
SR = Sulfate/Resisitivity Test; SH = Shear Test; HC= Consolidation; MD = Maximum Density

APPENDIX B

RESULTS OF LABORATORY TESTING

Excel Engineering

29875 Newport Road, Menifee, Riverside County, California

Project No. 1414-CR

SUMMARY OF LABORATORY TESTING

Classification
Soils were classified visually in general accordance to the Unified Soil Classification System (ASTM Test Method D 2487). The soil classifications are shown on the logs of borings in Appendix A.

Gradation Analysis
Gradation analysis was performed on selected samples of the site soils according to ASTM 422. The results of this testing is presented in the boring logs in Appendix A.

Atterberg Limits
Liquid Limit, Plastic Limit and Plasticity Index testing was completed on bulk soil samples collected from the site. Results are included on the boring logs in Appendix A.

Expansion Index
Expansion index testing was performed on two soil samples. Testing was performed in general accordance with ASTM Test Method D 4829. The result indicates that the tested soil is considered to be in the "very low" expansion range.

Location	Depth	Soil Type	Expansion Index	Classification
B-1	0-5'	Silty Sand	14	Very Low
B-7	0-2.5'	Clayey Silt	22	Low

In-Situ Moisture and Density
The natural water content was determined (ASTM D 2216) on samples of the materials recovered from the subsurface exploration. In addition, in-place dry density determination (ASTM D 2937) were performed on relatively undisturbed samples to measure the unity weight of the subsurface soils. Results of these tests are shown on the boring logs at the appropriate sample depths in Appendix A.

Moisture-Density Relationship
Laboratory testing was performed on two samples collected during the subsurface exploration. The laboratory maximum dry density and optimum moisture content for the soil type was determined in general accordance with test method ASTM Test Procedure D 1557. The results are included herein in Appendix B.

Direct Shear
Shear testing was performed in a direct shear machine of the strain-control type in general accordance with ASTM Test Method D 3080. The rate of deformation is approximately 0.01 inches per minute. The samples were sheared under varying confining loads in order to determine the coulomb shear strength parameters, angle of internal friction and cohesion. One test was performed on a bulk sample that was remolded to 90 percent relative compaction. The shear test results are presented herein in Appendix B.

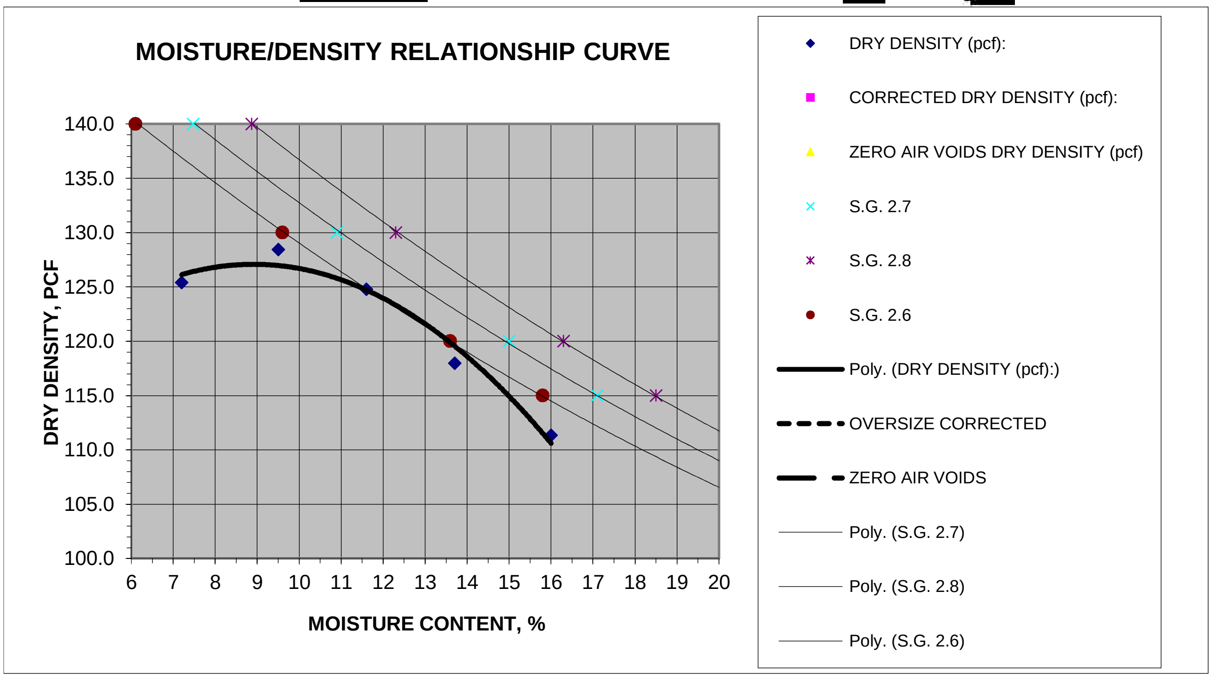
Sulfate Content, Resistivity and Chloride Content
Testing to determine the water-soluble sulfate content was performed by others in general accordance with California Test No. 417. Resistivity testing was completed by others in general accordance with California Test No. 643. Testing to determine the chloride content was performed by others in general accordance with California Test No. 422. The results are included herein in Appendix B.

MOISTURE/DENSITY RELATIONSHIP

Client: Excel Engineering
Job No.: 1414-CR
Project: 29875 Newport Rd.
Lab No.: Corona
Location: Menifee
Material Type: Brown F - M Silty Sand
Material Supplier:
Material Source:
Sample Location: B-1 @ 0 - 5

Sampled By: RH
Date Sampled: 9-Feb-16
Received By: DI
Date Received: 10-Feb-16
Tested By: AH
Date Tested: 12-Feb-16
Reviewed By:
Date Reviewed:

Test Procedure: ASTM 1557
Method: A
Oversized Material (%): 1.1
Correction Required: yes x no



MOISTURE DENSITY RELATIONSHIP VALUES

Maximum Dry Density, pcf	128.5	**@ Optimum Moisture, %**	9.5
Corrected Maximum Dry Density, pcf		**@ Optimum Moisture, %**	

MATERIAL DESCRIPTION

Grain Size Distribution:

	% Gravel (retained on No. 4)
	% Sand (Passing No. 4, Retained on No. 200)
	% Silt and Clay (Passing No. 200)

Atterberg Limits:

	Liquid Limit, %
	Plastic Limit, %
	Plasticity Index, %

Classification:

Unified Soils Classification:
AASHTO Soils Classification:

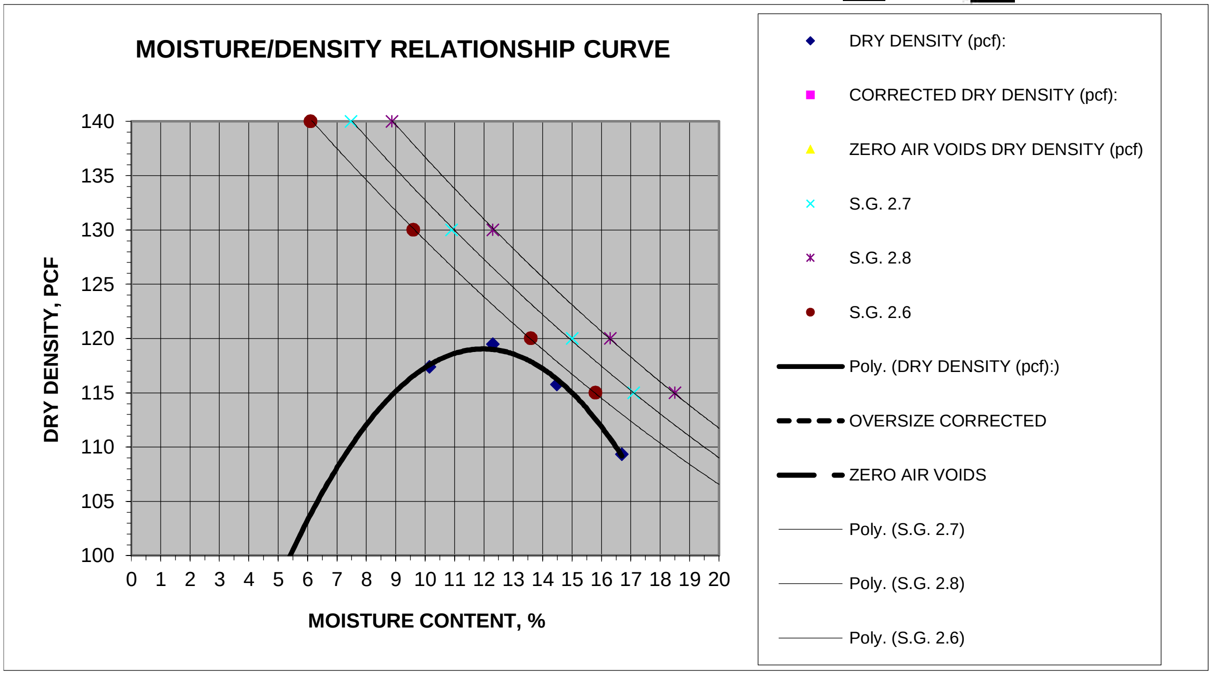
MD-1

GEOTEK

MOISTURE/DENSITY RELATIONSHIP

Client:	Excel Engineering	**Job No.:**	1414-CR
Project:	29875 Newport Rd.	**Lab No.:**	Corona
Location:	Menifee		
Material Type:	Brown F - M Silty Sand		
Material Supplier:			
Material Source:			
Sample Location:	B-7 @ 0 - 2.5		
Sampled By:	RH	**Date Sampled:**	9-Feb-16
Received By:	DI	**Date Received:**	10-Feb-16
Tested By:	AH	**Date Tested:**	15-Feb-16
Reviewed By:		**Date Reviewed:**	

Test Procedure: ASTM 1557 **Method:** A
Oversized Material (%): 1.1 **Correction Required:** ☐ yes ☒ no



MOISTURE DENSITY RELATIONSHIP VALUES

Maximum Dry Density, pcf	119.5	**@ Optimum Moisture, %**	12.0
Corrected Maximum Dry Density, pcf		**@ Optimum Moisture, %**	

MATERIAL DESCRIPTION

Grain Size Distribution:

	% Gravel (retained on No. 4)
	% Sand (Passing No. 4, Retained on No. 200)
	% Silt and Clay (Passing No. 200)

Atterberg Limits:

	Liquid Limit, %
	Plastic Limit, %
	Plasticity Index, %

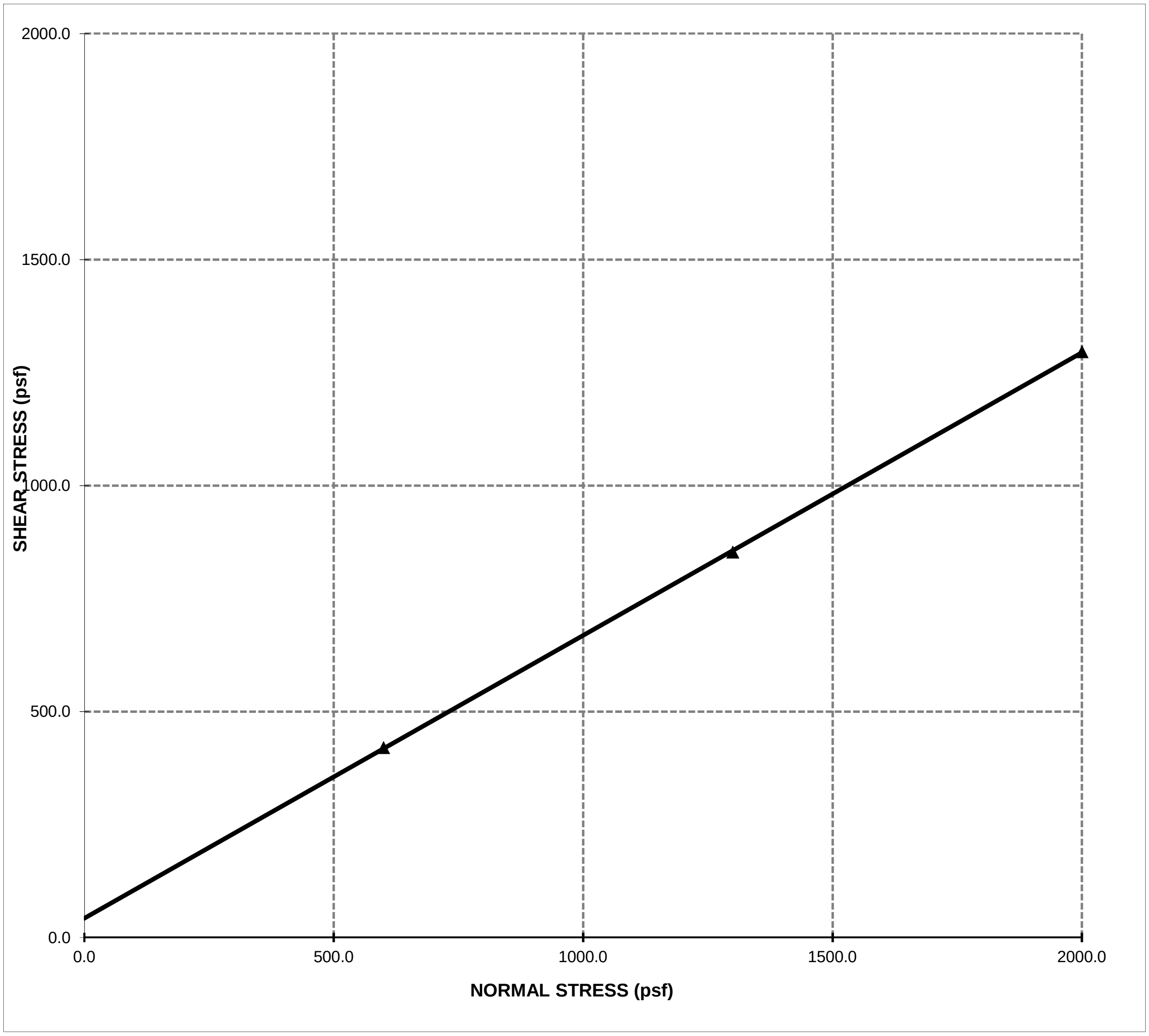
Classification:

Unified Soils Classification:
AASHTO Soils Classification:

MD-2

DIRECT SHEAR TEST

Project Name:	29875 Newport Rd., Menifee	***Sample Location:***	B-1 @ 0 - 5
Project Number:	1414-CR	***Date Tested:***	2/22/2016



Shear Strength: Φ = **32.0 °** , **C = 42.57 psf**

Notes: 1 - The soil specimen used in the shear box was a ring sample remolded to approximately 90% relative compaction from a bulk sample collected during the field investigation.
2 - The above reflect residual shear strength at saturated conditions.
3 - The tests were run at a shear rate of 0.035 in/min.

GeoTek, Inc.
710 East Parkridge Avenue, Suite 105
Corona, California 92879

Client: Excel Engineering
W.O.: 1414-CR
Project: 29875 Newport Rd, Menifee

Date: February 22, 2016
QCI Project No.: 16-167-002h
Summarized by: KA

Corrosivity Test Results

Sample ID	Sample Depth (Feet)	pH CT-532 (643)	Chloride CT-422 (ppm)	Sulfate CT-417 (% By Weight)	Resistivity CT-532 (643) (ohm-cm)
B-1	0.5’	7.21	20	0.0890	270
B-7	0-2.5’	8.52	45	0.0070	1100

APPENDIX C

METHANE REPORT BY CEC

Excel Engineering

29875 Newport Road, Menifee, Riverside County, California

Project No. 1414-CR

Carlin Environmental Consulting, Inc.
AssessmentXRemediationXMitigation Design
2522 Chambers Road, # 100
Tustin, California 92780
714-508-1111

GeoTek, Inc.
710 E. Parkridge Ave. Suite 105
Corona, CA 92879

February 24, 2016

Attention: Ed LaMont

Subject: Methane Related Services For the Former Abacherli Dairy Site, City of Menifee, Riverside County, California.

In accordance with your request, it is Carlin Environmental Consulting, Inc's. (CEC) pleasure to provide environmental consulting services related to methane issues at the Abacherli Site in the City of Menifee, California (Figure 1). The subject investigation was conducted for the purpose of providing preliminary information regarding methane beneath the site with the goal of providing guidance during grading and/or development of the site. However, the investigation conducted cannot replace the Requirements of the County of Riverside, which requires testing on a lot-by-lot basis after rough grading has been completed.

The County of Riverside protocols require that minimum methane mitigation measures be incorporated into the construction plans for approval by the County's Building and Safety Staff where previous dairy, livestock or related activities have occurred. The actual mitigation measures are dependent on testing that can only be conducted 30-days after the site has been graded. The County has minimum standards for methane mitigation depending on the level of methane encountered. Methane mitigation must be provided on the foundation plans and approved by the appropriate agency. During construction the methane design engineer is required to certify and approve the installation of the mitigation measures on each lot or cluster of lots.

Methane production beneath the ground surface is controlled by several factors. It is produced in an anaerobic (oxygen depleted) environment where there is sufficient organic material present. Near the ground surface (upper three feet) there is little

Modified from Google Earth

Site Location Map

Carlin Environmental Consulting

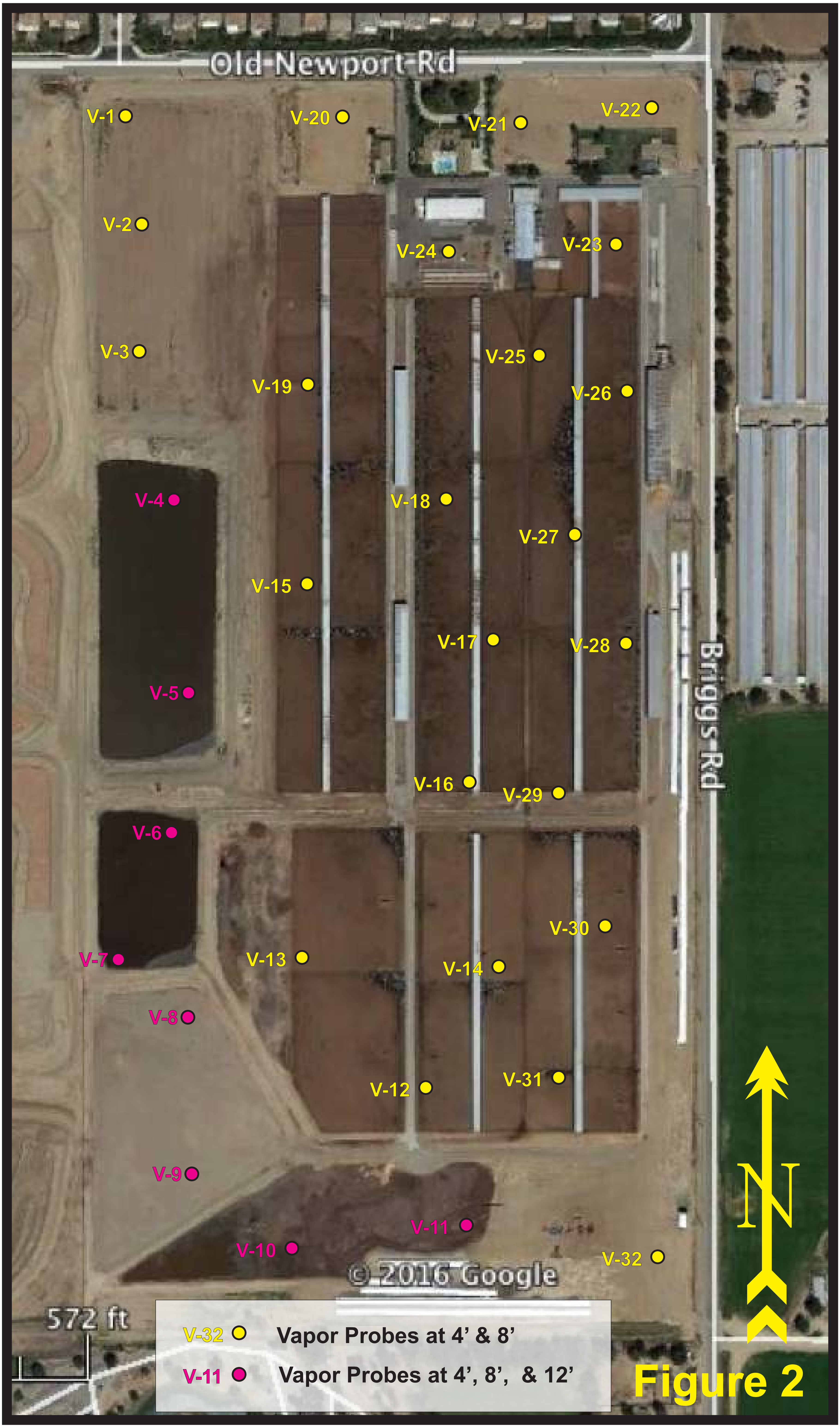
Figure 1

methane production because the oxygen content is too high. This is especially true in sandier soils. With depth, the oxygen content decreases and therefore, the potential for methane production increases. Generally the organic content of soils decreases with depth as the amount of roots and other natural organic material decreases. For a typical dairy operation there is variable organic material beneath the surface due to the significant quantities of manure and urine produced by the livestock. The organics are flushed into the subsurface soils through rain and/or with the urine. The area where the waste products are either stockpiled and/or in the stock ponds have increased flushing of organics into the soils and therefore, the methane production is typically greatest in these areas.

Preliminary Methane Investigation

A preliminary Methane study is required by the County of Riverside, which identifies whether or not the project site, or portions of the site, were previously occupied by dairy operations and within a County of Riverside zone that requires special methane protocols. The subject site is rectangular shaped and approximately 75 acres in size. It is our understanding that the proposed development will consist of single-family homes sites along with associated improvements. CEC reviewed aerial photographs available from Google Earth dating 1994 to present and from Historicaerials.com, which has photographs available from 1967 to present. In addition regional and historical topographic maps were also observed.

Based on a preliminary review of readily available information it appears that approximately 85% of the site was utilized for previous livestock activities and will require evaluation and/or mitigation for methane. Figure 3 indicates those areas that have been identified to have been utilized for livestock related activities and those areas that did not have related activities (highlighted in green). The non-related activities areas include the residential structure areas, areas that were used primarily related to crops, and the site perimeter areas.



Old Newport Rd
Briggs Rd
V-1
V-2
V-3
V-4
V-5
V-6
V-7
V-8
V-9
V-10
V-11
V-12
V-13
V-14
V-15
V-16
V-17
V-18
V-19
V-20
V-21
V-22
V-23
V-24
V-25
V-26
V-27
V-28
V-29
V-30
V-31
V-32
© 2016 Google
572 ft
N
V-32 Vapor Probes at 4' & 8'
V-11 Vapor Probes at 4', 8', & 12'

Figure 2

Field Testing for Methane

As requested, preliminary testing for methane was conducted at the site for the purpose of guiding future grading operations. Thirty-two probe sets were installed in a two-day period (Figure 2). This is approximately 1/2 probe per acre of land that was utilized for former dairy related activities. In the areas of former stock pens and other uses, the probes were set at depths of 4 and 8 feet below existing grade. In former pond areas a third probe was placed at a depth of approximately 12 feet below existing grades. The soil-gas probes were installed with a direct push rig that punches a hole in the ground. The tubing and gas probes are then placed in the hole and backfilled with sand surrounding the probes and bentonite plugs between the probe depths. The probe tubes are extended above the surface where they can be connected to a device that monitors/reads the amount of methane gas within the soil column. Each probe was monitored twice after the probes were installed in order to verify consistent results. The results of the methane monitoring are presented on Table 1.

Findings

Review of the site history and past uses at the site indicates three general areas present at the site. These are 1) Areas where there was not significant use for domestic animal /dairy related uses; 2) Areas where domestic animals were present and kept in pens and/or manure stored and spread; 3) Areas of stock ponds or desilting basins that collected the urine and other liquid waste from the animals at the site. The methane concentrations from the vapor probes were compared to these three use areas. Figure 3 indicates the maximum concentration measured (for either of the two readings) for the probes installed at each location. Analysis of the data in comparison to the past site usage indicates that for those areas that did not have domestic animal use (Area 1) had the lowest methane readings. In theses areas (highlighted in green on Figure 3) the maximum concentration of methane detected was less than 200 parts per million (ppm). In Area 2, where the stock pens were located, the concentrations of methane were generally above 100 ppm and below 1,200 ppm. In the stock pond areas (Area 3 highlighted in red on Figure 3) methane concentrations were generally above 200 ppm and were as high as 50,000 ppm.

Conclusions and Recommendations

It is CEC's conclusion that the concentrations of methane measured in the subsurface probes match well with the previous site uses. Therefore, CEC's recommendations are specific to each of the three areas as discussed below.

Area 1 - Aerial photographs and methane readings both indicate that these areas were not used for significant domestic animal related uses, therefore these areas are considered exempt from methane mitigation and/or testing after grading has been completed. Care should be taken not to import fill from other portions of the site that has significant manure or organic content into this area. Prior to site development the proposed grading plan, which indicates the layout of individual lots, should be reviewed to determine specific lots that are exempt from methane investigation and/or mitigation.

Area 2 – This area (un-highlighted on Figure 3) has moderate methane concentrations beneath the surface. Due to the presence of domesticated animals, County regulations indicate that these areas must be tested on a lot-by-lot basis a minimum 30 days after grading has been conducted. In addition manure remnants were observed in the near surface within these former stock pen areas. CEC recommends that this near surface highly organic material be skimmed from these areas and removed offsite. Any former manure stockpiles should also be removed from the site.

Area 3 – The stock pond and desilting basin areas have collected urine and other waste products from the former daily operations and the subsurface soils have significant concentrations of organic material that have resulted in the production of methane. The production of significant methane was measured at depths of up to 12 feet. It is likely that that methane is being produced at depths greater than 12 feet. Remedial removals in former stock pond areas should be carefully observed during grading. Because the organics have been flushed deep into the native soils it may not be economically feasible


Old Newport Rd
Briggs Rd
V-1 120 160
V-20 95 150
V-21 100
V-22 95 160
V-2 110 180
V-24 250 45
V-23 280 350
V-3 75 190
V-25 160 270
V-19 300 290
V-26 220 430
V-4 2450 50000 3800
V-18 130 230
V-27 260 1160
V-15 200 330
V-17 180 320
V-28 260 640
V-5 360 7050 1250
V-16 150 320
V-29 290 410
V-6 400 800 3800
V-7 1250 7800 15750
V-13 110 160
V-14 270 450
V-30 160 540
V-8 800 5780 5250
V-12 180 330
V-31 160 420
V-9 1600 3500
V-10 130 14000 15000
V-11 210 590 1200
V-32 180 570
© 2016 Google
572 ft
130 - 4' -Probe reading
14000 - 8' -Probe reading
15000 - 12' -Probe reading
- Areas exempt from further methane testing
- Former/existing Stock Pond Areas
N
Figure 3

to remove all the organics that are producing significant methane. The near surface soils may not currently be producing the greatest quantities of methane, however this may be due to increased oxygen content, which is less favorable for methane production.

To develop the site into single-family residences will require significant grading to create level pads and associated improvements. A preliminary plan for the site also indicates the potential for a lake and/or deep drainage/desilting basin. To reduce the potential for methane production any highly organic manure stockpiles or the near surface remaining manure should be skimmed from the surface and removed offsite. Remedial removals in the stock pond areas should be based on visual observations to determine if highly organic rich layers are present. The methane testing conducted during this investigation suggests that remedial removals as deep as 10 feet below the former stock ponds would be prudent. However, ultimately the geotechnical consultant must also determine the appropriate remedial removal depths to provide a suitable foundation material.

As indicated previously, organic rich soils should not be placed within those areas that are designated as exempt from methane testing protocols (highlighted in green on Figure 3). County protocols also indicate that the organic content of fill materials beneath residential structures should be less than 1%.

Prior to site development the proposed grading plan which indicates the layout of individual lots should be reviewed to determine specific lots that are exempt from methane investigation and/or mitigation.

If you have any questions, comments, or addendums to this proposal, please feel free to contact Gary Carlin at any time at 714-508-1111.

Sincerely,
Carlin Environmental Services, Inc.

Don Terres	Gary T. Carlin
Project Geologist	President/Environmental Scientist
P.G. 4349, CEG 1362	

Table 1 - Menifee Project

Probe #	1st Reading - 2-2-16			2nd Reading - 2-3-16		
	4'	8'	12'	4'	8'	12'
1	120	100	x	95	160	x
2	110	180	x	110	140	x
3	75	190	x	50	190	x
4	2,450	50,000	3,800	2,350	49,000	2,700
5	360	7,050	1,250	160	4,400	900
6	35	800	3,800	400	290	1,200
7	1,250	7,800	15,750	590	3,600	4,900
8	800	5,780	5,250	Fail*	Fail*	Fail*
9	1,600	3,500	Fail*	Fail	4,500-Fail	Fail*
10	130	12,500	25,000	120	14,000-Fail	15,000-Fail
11	200	590	1,200	210	580	750
12	160	320	x	180	330	x
13	110	160	x	60	150	x
14	270	450	x	210	220	x
15	not read**	not read**	x	200	330	x
16	150	310	x	130	320	x
17	180	320	x	170	240	x
18	130	120	x	65	230	x
19	300	290	x	not read**	not read**	x
20	95	150	x	25	85	x
21	100	Fail*	x	85	Fail*	x
22	95	160	x	75	150	x
23	280	350	x	150	200	x
24	250	-	x	190	45	x
25	160	250	x	120	270	x
26	220	430	x	150	260	x
27	250	1,150	x	260	850-Fail	x
28	260	640	x	250	340	x
29	290	410	x	280	390	x
30	160	510	x	160	540-Fail	x
31	140	420	x	160	420	x
32	160	15	x	180	570	x

* Fail = Lack of Air in vapor Probe for Instrument to read

** Probe could not be located

APPENDIX D

GENERAL GRADING GUIDELINES

Excel Engineering
29875 Newport Road, Menifee, Riverside County, California
Project No. 1414-CR

GEOTEK

GENERAL GRADING GUIDELINES

Guidelines presented herein are intended to address general construction procedures for earthwork construction. Specific situations and conditions often arise which cannot reasonably be discussed in general guidelines, when anticipated these are discussed in the text of the report. Often unanticipated conditions are encountered which may necessitate modification or changes to these guidelines. It is our hope that these will assist the contractor to more efficiently complete the project by providing a reasonable understanding of the procedures that would be expected during earthwork and the testing and observation used to evaluate those procedures.

General

Grading should be performed to at least the minimum requirements of governing agencies, Chapters 18 and 33 of the Uniform Building Code, CBC (2013) and the guidelines presented below.

Preconstruction Meeting

A preconstruction meeting should be held prior to site earthwork. Any questions the contractor has regarding our recommendations, general site conditions, apparent discrepancies between reported and actual conditions and/or differences in procedures the contractor intends to use should be brought up at that meeting. The contractor (including the main onsite representative) should review our report and these guidelines in advance of the meeting. Any comments the contractor may have regarding these guidelines should be brought up at that meeting.

Grading Observation and Testing

1. Observation of the fill placement should be provided by our representative during grading. Verbal communication during the course of each day will be used to inform the contractor of test results. The contractor should receive a copy of the "Daily Field Report" indicating results of field density tests that day. If our representative does not provide the contractor with these reports, our office should be notified.
2. Testing and observation procedures are, by their nature, specific to the work or area observed and location of the tests taken, variability may occur in other locations. The contractor is responsible for the uniformity of the grading operations; our observations and test results are intended to evaluate the contractor's overall level of efforts during grading. The contractor's personnel are the only individuals participating in all aspect of site work. Compaction testing and observation should not be considered as relieving the contractor's responsibility to properly compact the fill.
3. Cleanouts, processed ground to receive fill, key excavations, and subdrains should be observed by our representative prior to placing any fill. It will be the contractor's responsibility to notify our representative or office when such areas are ready for observation.
4. Density tests may be made on the surface material to receive fill, as considered warranted by this firm.

5. In general, density tests would be made at maximum intervals of two feet of fill height or every 1,000 cubic yards of fill placed. Criteria will vary depending on soil conditions and size of the fill. More frequent testing may be performed. In any case, an adequate number of field density tests should be made to evaluate the required compaction and moisture content is generally being obtained.
6. Laboratory testing to support field test procedures will be performed, as considered warranted, based on conditions encountered (e.g. change of material sources, types, etc.) Every effort will be made to process samples in the laboratory as quickly as possible and in progress construction projects are our first priority. However, laboratory workloads may cause in delays and some soils may require a **minimum of 48 to 72 hours to complete test procedures**. Whenever possible, our representative(s) should be informed in advance of operational changes that might result in different source areas for materials.
7. Procedures for testing of fill slopes are as follows:
   a) Density tests should be taken periodically during grading on the flat surface of the fill, three to five feet horizontally from the face of the slope.
   b) If a method other than over building and cutting back to the compacted core is to be employed, slope compaction testing during construction should include testing the outer six inches to three feet in the slope face to determine if the required compaction is being achieved.
8. Finish grade testing of slopes and pad surfaces should be performed after construction is complete.

Site Clearing

1. All vegetation, and other deleterious materials, should be removed from the site. If material is not immediately removed from the site it should be stockpiled in a designated area(s) well outside of all current work areas and delineated with flagging or other means. Site clearing should be performed in advance of any grading in a specific area.
2. Efforts should be made by the contractor to remove all organic or other deleterious material from the fill, as even the most diligent efforts may result in the incorporation of some materials. This is especially important when grading is occurring near the natural grade. All equipment operators should be aware of these efforts. Laborers may be required as root pickers.
3. Nonorganic debris or concrete may be placed in deeper fill areas provided the procedures used are observed and found acceptable by our representative.

Treatment of Existing Ground

1. Following site clearing, all surficial deposits of alluvium and colluvium as well as weathered or creep effected bedrock, should be removed unless otherwise specifically indicated in the text of this report.

2. In some cases, removal may be recommended to a specified depth (e.g. flat sites where partial alluvial removals may be sufficient). The contractor should not exceed these depths unless directed otherwise by our representative.
3. Groundwater existing in alluvial areas may make excavation difficult. Deeper removals than indicated in the text of the report may be necessary due to saturation during winter months.
4. Subsequent to removals, the natural ground should be processed to a depth of six inches, moistened to near optimum moisture conditions and compacted to fill standards.
5. Exploratory back hoe or dozer trenches still remaining after site removal should be excavated and filled with compacted fill if they can be located.

Fill Placement

1. Unless otherwise indicated, all site soil and bedrock may be reused for compacted fill; however, some special processing or handling may be required (see text of report).
2. Material used in the compacting process should be evenly spread, moisture conditioned, processed, and compacted in thin lifts six (6) to eight (8) inches in compacted thickness to obtain a uniformly dense layer. The fill should be placed and compacted on a nearly horizontal plane, unless otherwise found acceptable by our representative.
3. If the moisture content or relative density varies from that recommended by this firm, the contractor should rework the fill until it is in accordance with the following:
   a) Moisture content of the fill should be at or above optimum moisture. Moisture should be evenly distributed without wet and dry pockets. Pre-watering of cut or removal areas should be considered in addition to watering during fill placement, particularly in clay or dry surficial soils. The ability of the contractor to obtain the proper moisture content will control production rates.
   b) Each six-inch layer should be compacted to at least 90 percent of the maximum dry density in compliance with the testing method specified by the controlling governmental agency. In most cases, the testing method is ASTM Test Designation D 1557.
4. Rock fragments less than eight inches in diameter may be utilized in the fill, provided:
   a) They are not placed in concentrated pockets;
   b) There is a sufficient percentage of fine-grained material to surround the rocks;
   c) The distribution of the rocks is observed by, and acceptable to, our representative.
5. Rocks exceeding eight (8) inches in diameter should be taken off site, broken into smaller fragments, or placed in accordance with recommendations of this firm in areas designated suitable for rock disposal. On projects where significant large quantities of oversized materials are anticipated, alternate guidelines for placement may be included. If significant oversize materials are encountered during construction, these guidelines should be requested.
6. In clay soil, dry or large chunks or blocks are common. If in excess of eight (8) inches minimum dimension, then they are considered as oversized. Sheepsfoot compactors or other suitable

methods should be used to break up blocks. When dry, they should be moisture conditioned to provide a uniform condition with the surrounding fill.

Slope Construction

1. The contractor should obtain a minimum relative compaction of 90 percent out to the finished slope face of fill slopes. This may be achieved by either overbuilding the slope and cutting back to the compacted core, or by direct compaction of the slope face with suitable equipment.
2. Slopes trimmed to the compacted core should be overbuilt by at least three (3) feet with compaction efforts out to the edge of the false slope. Failure to properly compact the outer edge results in trimming not exposing the compacted core and additional compaction after trimming may be necessary.
3. If fill slopes are built "at grade" using direct compaction methods, then the slope construction should be performed so that a constant gradient is maintained throughout construction. Soil should not be "spilled" over the slope face nor should slopes be "pushed out" to obtain grades. Compaction equipment should compact each lift along the immediate top of slope. Slopes should be back rolled or otherwise compacted at approximately every 4 feet vertically as the slope is built.
4. Corners and bends in slopes should have special attention during construction as these are the most difficult areas to obtain proper compaction.
5. Cut slopes should be cut to the finished surface. Excessive undercutting and smoothing of the face with fill may necessitate stabilization.

UTILITY TRENCH CONSTRUCTION AND BACKFILL

Utility trench excavation and backfill is the contractors responsibility. The geotechnical consultant typically provides periodic observation and testing of these operations. While efforts are made to make sufficient observations and tests to verify that the contractors' methods and procedures are adequate to achieve proper compaction, it is typically impractical to observe all backfill procedures. As such, it is critical that the contractor use consistent backfill procedures.

Compaction methods vary for trench compaction and experience indicates many methods can be successful. However, procedures that "worked" on previous projects may or may not prove effective on a given site. The contractor(s) should outline the procedures proposed, so that we may discuss them **prior** to construction. We will offer comments based on our knowledge of site conditions and experience.

1. Utility trench backfill in slopes, structural areas, in streets and beneath flat work or hardscape should be brought to at least optimum moisture and compacted to at least 90 percent of the laboratory standard. Soil should be moisture conditioned prior to placing in the trench.

2. Flooding and jetting are not typically recommended or acceptable for native soils. Flooding or jetting may be used with select sand having a Sand Equivalent (SE) of 30 or higher. This is typically limited to the following uses:
   a) shallow (12 + inches) under slab interior trenches and,
   b) as bedding in pipe zone.

   The water should be allowed to dissipate prior to pouring slabs or completing trench compaction.
3. Care should be taken not to place soils at high moisture content within the upper three feet of the trench backfill in street areas, as overly wet soils may impact subgrade preparation. Moisture may be reduced to 2% below optimum moisture in areas to be paved within the upper three feet below sub grade.
4. Sand backfill should not be allowed in exterior trenches adjacent to and within an area extending below a 1:1 projection from the outside bottom edge of a footing, unless it is similar to the surrounding soil.
5. Trench compaction testing is generally at the discretion of the geotechnical consultant. Testing frequency will be based on trench depth and the contractors procedures. A probing rod would be used to assess the consistency of compaction between tested areas and untested areas. If zones are found that are considered less compact than other areas, this would be brought to the contractors attention.

JOB SAFETY

General

Personnel safety is a primary concern on all job sites. The following summaries are safety considerations for use by all our employees on multi-employer construction sites. On ground personnel are at highest risk of injury and possible fatality on grading construction projects. The company recognizes that construction activities will vary on each site and that job site safety is the contractor's responsibility. However, it is, imperative that all personnel be safety conscious to avoid accidents and potential injury.

In an effort to minimize risks associated with geotechnical testing and observation, the following precautions are to be implemented for the safety of our field personnel on grading and construction projects.

1. Safety Meetings: Our field personnel are directed to attend the contractor's regularly scheduled safety meetings.
2. Safety Vests: Safety vests are provided for and are to be worn by our personnel while on the job site.
3. Safety Flags: Safety flags are provided to our field technicians; one is to be affixed to the vehicle when on site, the other is to be placed atop the spoil pile on all test pits.

In the event that the contractor's representative observes any of our personnel not following the above, we request that it be brought to the attention of our office.

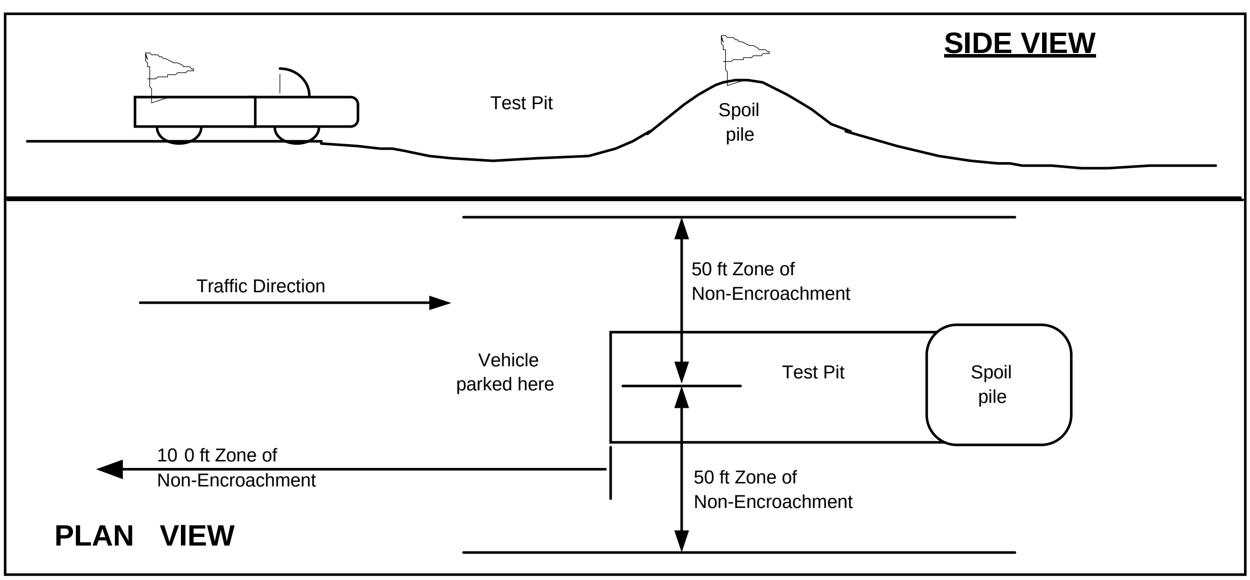
Test Pits Location, Orientation and Clearance

The technician is responsible for selecting test pit locations. The primary concern is the technician's safety. However, it is necessary to take sufficient tests at various locations to obtain a representative sampling of the fill. As such, efforts will be made to coordinate locations with the grading contractors authorized representatives (e.g. dump man, operator, supervisor, grade checker, etc.), and to select locations following or behind the established traffic pattern, preferably outside of current traffic. The contractors authorized representative should direct excavation of the pit and safety during the test period. Again, safety is the paramount concern.

Test pits should be excavated so that the spoil pile is placed away from oncoming traffic. The technician's vehicle is to be placed next to the test pit, opposite the spoil pile. This necessitates that the fill be maintained in a drivable condition. Alternatively, the contractor may opt to park a piece of equipment in front of test pits, particularly in small fill areas or those with limited access.

A zone of non-encroachment should be established for all test pits (see diagram below). No grading equipment should enter this zone during the test procedure. The zone should extend outward to the sides approximately 50 feet from the center of the test pit and 100 feet in the direction of traffic flow. This zone is established both for safety and to avoid excessive ground vibration, which typically decreases test results.

TEST PIT SAFETY PLAN



Slope Tests

When taking slope tests, the technician should park their vehicle directly above or below the test location on the slope. The contractor's representative should effectively keep all equipment at a safe operation distance (e.g. 50 feet) away from the slope during testing.

The technician is directed to withdraw from the active portion of the fill as soon as possible following testing. The technician's vehicle should be parked at the perimeter of the fill in a highly visible location.

Trench Safety

It is the contractor's responsibility to provide safe access into trenches where compaction testing is needed. Trenches for all utilities should be excavated in accordance with CAL-OSHA and any other applicable safety standards. Safe conditions will be required to enable compaction testing of the trench backfill.

All utility trench excavations in excess of 5 feet deep, which a person enters, are to be shored or laid back. Trench access should be provided in accordance with OSHA standards. Our personnel are directed not to enter any trench by being lowered or "riding down" on the equipment.

Our personnel are directed not to enter any excavation which;

1. is 5 feet or deeper unless shored or laid back,
2. exit points or ladders are not provided,
3. displays any evidence of instability, has any loose rock or other debris which could fall into the trench, or
4. displays any other evidence of any unsafe conditions regardless of depth.

If the contractor fails to provide safe access to trenches for compaction testing, our company policy requires that the soil technician withdraws and notifies their supervisor. The contractors representative will then be contacted in an effort to effect a solution. All backfill not tested due to safety concerns or other reasons is subject to reprocessing and/or removal.

Procedures

In the event that the technician's safety is jeopardized or compromised as a result of the contractor's failure to comply with any of the above, the technician is directed to inform both the developer's and contractor's representatives. If the condition is not rectified, the technician is required, by company policy, to immediately withdraw and notify their supervisor. The contractor's representative will then be contacted in an effort to effect a solution. No further testing will be performed until the situation is rectified. Any fill placed in the interim can be considered unacceptable and subject to reprocessing, recompaction or removal.

In the event that the soil technician does not comply with the above or other established safety guidelines, we request that the contractor bring this to technicians attention and notify our project manager or office. Effective communication and coordination between the contractors' representative and the field technician(s) is strongly encouraged in order to implement the above safety program and safety in general.

The safety procedures outlined above should be discussed at the contractor's safety meetings. This will serve to inform and remind equipment operators of these safety procedures particularly the zone of non-encroachment.

The safety procedures outlined above should be discussed at the contractor's safety meetings. This will serve to inform and remind equipment operators of these safety procedures particularly the zone of non-encroachment.

Anaheim office
Lab No: 16-043-0021
February 24, 2016

GeoTek Inc.
710 E. Parkridge Ave.
Corona, CA 92879

Attn: David Benson

NEWPORT RANCH JOB #1414-CR

Attached are the results of the analyses performed on three soil samples that were collected from the above mentioned project site by the client and received by our laboratory on February 12, 2016. These samples were analyzed in preparation for a new landscape installation.

Analytical Results:

Salinity (ECe) is elevated in the 'B-1' sample at 4.4 dS/m and in the 'B-2' sample at 2.9 dS/m. This could cause some plants to show burning of foliage, beginning on the oldest growth. In the 'B-1' sample, elevated soluble calcium is the greatest contributor to salinity while magnesium and sodium contribute to a lesser extent. In the 'B-2' sample, soluble sodium is the greatest contributor to the salinity level while high nitrogen also contributes. In both samples, sodium is properly balanced by calcium and magnesium in regards to its effect on soil structure and water infiltration, as indicated by the favorably low sodium adsorption ratio (SAR) values.

In order to reduce salinity in the root zone in both areas, thorough leaching irrigations should be applied. In the 'B-1' area, we estimate that approximately 1 ½ inches of water should move through the soil profile. In the 'B-2' area, two or three irrigations should be sufficient. Drainage must be sufficient for leaching to be effective. The soil should be allowed to dry slightly between irrigations to avoid creating anaerobic soil conditions.

Salinity and SAR values are safely low in the 'B-7' sample. Boron is safely low, yet sufficient for plant nutrition, in all three samples.

Nitrogen is low in the 'B-1' sample. In the 'B-2' sample, nitrogen is high and will likely remain sufficient for plant nutrition, even after leaching. Nitrogen is optimum in the 'B-7' sample. Phosphorous is sufficient for plant nutrition throughout and, in fact, will not require addition in the 'B-1' and 'B-7' areas for at least a year and probably longer. Potassium is ample throughout and will not require addition in any of these areas for at least a year. Calcium is sufficient in the 'B-1' sample and low in the 'B-2' and 'B-7' samples. Magnesium is well supplied throughout. Copper and zinc, though not problematically high, will not require addition for at least a year in any of these areas. Manganese and iron are at good levels for plant nutrition. The organic content of the soil at this site is low, ranging from 0.4% to 1.5% of the soil by total dry weight.

The texture of the soil at the site ranges from 'sandy loam' to 'loam' with an average estimated water infiltration rate of 0.30 inches per hour. The actual rate of water infiltration may vary with the degree of soil compaction.

Page 2
GeoTek Inc.
February 24, 2016

Analytical Results Continued

The 'B-1' sample is slightly alkaline at 7.2 on the pH scale, which is suitable for a broad range of plants and no pH adjustment is recommended for that area.

The other two samples are moderately alkaline, each with a pH value of 7.7. This could cause some plants to show yellowing of younger foliage. Qualitative lime is low to absent, indicating that the soil is weakly buffered against downward pH changes. Incorporating soil sulfur at the provided rate and depth in those areas will adjust the soil pH downward. However, that change will happen slowly and only as deeply as sulfur is incorporated. Plants that are chosen for those areas should have some tolerance for alkaline soil conditions.

Recommendations

Surface Soil Preparation for Turf, Groundcover and Mass Planting

If feasible, prior to amending the areas where severe compaction exists, the surface soil should be ripped or tilled to a 9-inch depth. Uniformly broadcast and blend the following with existing soil to a 6-inch depth.

Materials	Amount per 1000 sq.ft.	Sample Location(s)
Nitrogen fortified organic amendment (compost* or redwood or fir sawdust)	4 cu. yards	All sample locations
Soil sulfur	10 lbs.	'B-2' and 'B-7'
Gypsum	50 lbs.	'B-2' and 'B-7'
Ammonium sulfate (21-0-0)	7 lbs.	'B-1'

*Rates and fertilizers may have to be adjusted depending on analysis of selected compost.

Tree and Shrub Planting Guidelines

1. Excavate planting pits at least twice the diameter of the rootball.
2. The top of the rootball should be at or slightly above final grade.
3. To improve soil chemistry, uniformly blend 1 lb. of iron sulfate per cubic yard of backfill soil in the 'B-2' and 'B-7' areas. Handle iron sulfate with caution since it will severely stain moist concrete.
4. Uniformly blend 2 lbs. of gypsum per cu. yd. of backfill soil in the 'B-2' and 'B-7' areas.
5. Organic material is not required in the backfill; however if you wish, the amended surface soil or a soil blend consisting of no more than 20% by volume organic matter can be placed in the upper 12 inches of backfill only. Soil below this depth should not contain any added organic matter because of the threat of plant disease and/or anaerobic soil conditions developing.

Tree and Shrub Planting Guidelines Continued

6. Place slow release fertilizer tablets in the upper 12 inches of backfill at manufacturer's recommended rates. If fertilizer amended soil is used as a backfill the addition of slow release fertilizer tablets is not necessary.
7. Do not cover the original rootball with other soil. Ideally, a temporary soil berm is often constructed around the outer edge of the rootball to help channel water into the rootball and then into surrounding soil until roots are established in the backfill and the rootball is no longer the sole source of water for the plant.
8. Ideally, a weed and turf free zone, preferably 2-3 ft. in diameter, should be maintained just beyond the diameter of the planting hole. A 2-4 inch deep layer of coarse mulch can be placed around the tree or shrub; mulch should be kept a minimum 4-6 inches from the trunk.

Maintenance Fertilization

For turf, groundcover and mass planting areas, uniformly broadcast sulfur coated urea at the rate of 5 lbs. per 1000 sq. ft. The first application should occur approximately 45 days after planting, with repeat applications every 60-90 days or as growth and color dictate. In early fall and spring, make an application of triple superphosphate (0-45-0) in the 'B-2' area at the rate of 3 lbs. per 1000 sq. ft. to ensure a continuing supply of phosphorus in that area. Tree and shrub plantings can be maintained with the above fertilizers; however, the frequency between applications should be every 120 days, with the first application 90 days after planting. Follow each fertilization with a thorough irrigation. When plants have become well established, fertilizer applications can be less frequent.

If we can be of any further assistance, please feel free to contact us.

Jason Gihring

Emailed: dbenson@geotekusa.com

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Project : Newport Ranch
Job: #1414-CR

Report No : **16-043-0021**
Purchase Order :
Date Recd : 02/12/2016
Date Printed : 02/22/2016
Page : 1 of 1

COMPREHENSIVE SOIL ANALYSIS

Sample Description - Sample ID	Half Sat % / TEC	pH / Qual Lime	ECe dS/m	NO_3-N ppm	NH_4-N ppm	PO_4-P ppm	K ppm	Ca ppm	Mg ppm	Cu ppm	Zn ppm	Mn ppm	Fe ppm	Organic % dry wt.	Lab No.
				Sufficiency Factors											
B-1 @ 0-5'	15	7.2	4.4	2	5	96	492	819	199	4.8	8.4	12	54	1.5	30454
	59	Low		0.2		5.3	5.0	0.8	1.5	6.3	2.8	1.8	1.9		
B-2 @ 2.5'	13	7.7	2.9	61	294	12	338	385	142	10.8	14.3	12	14	0.4	30455
	58	None		14.1		0.8	4.1	0.4	1.2	15.2	5.2	2.0	0.5		
B-7 @ 0-2.5'	18	7.7	2.1	18	32	62	965	622	214	6.0	6.7	8	34	1.1	30456
	73	Low		1.4		2.9	8.3	0.5	1.3	6.3	1.8	1.0	0.9		

Saturation Extract Values						SAR	Gravel %		Percent of Sample Passing 2 mm Screen					USDA Soil Classification	Lab No.
									Sand						
Ca meq/L	Mg meq/L	Na meq/L	K meq/L	B ppm	SO_4 meq/L		Coarse 5 - 12	Fine 2 - 5	Very Coarse 1 - 2	Coarse 0.5 - 1	Med. to Very Fine 0.05 - 0.5	Silt .002-.05	Clay 0-.002		
31.6	15.5	19.1	2.2	0.59	21.2	3.9	0.3	2.0	8.6	11.2	30.2	28.8	21.0	Loam	30454
13.4	8.2	16.2	2.5	0.55	7.8	4.9	0	5.3	9.0	11.6	37.4	28.8	13.0	Sandy Loam	30455
5.3	3.9	7.4	5.7	0.65	7.5	3.4	1.4	5.6	6.0	9.4	28.6	34.8	21.0	Loam	30456

Sufficiency factor (1.0=sufficient for average crop) below each nutrient value. N factor based on 200 ppm constant feed. SAR = Sodium adsorption ratio. Half Saturation %=approx field moisture capacity. Nitrogen(N), Potassium(K), Calcium(Ca) and Magnesium(Mg) by sodium chloride extraction. Phosphorus(P) by sodium bicarbonate extraction. Copper(Cu), Zinc(Zn), Manganese(Mn) & Iron(Fe) by DTPA extraction. Sat. ext. method for salinity (ECe as dS/m),Boron (B), Sulfate(SO_4), Sodium(Na). Gravel fraction expressed as percent by weight of oven-dried sample passing a 12mm(1/2 inch) sieve. Particle sizes in millimeters. Organic percentage determined by Walkley-Black or Loss on Ignition.

* LOW , SUFFICIENT , HIGH

Appendix 4: Historical Site Conditions

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

Carlin Environmental Consulting, Inc.

AssessmentXRemediationXMitigation Design

2522 Chambers Road, # 100
Tustin, California 92780
714-508-1111

GeoTek, Inc. February 24, 2016
710 E. Parkridge Ave. Suite 105
Corona, CA 92879

Attention: Ed LaMont

Subject: Methane Related Services For the Former Abacherli Dairy Site, City of Menifee, Riverside County, California.

In accordance with your request, it is Carlin Environmental Consulting, Inc's. (CEC) pleasure to provide environmental consulting services related to methane issues at the Abacherli Site in the City of Menifee, California (Figure 1). The subject investigation was conducted for the purpose of providing preliminary information regarding methane beneath the site with the goal of providing guidance during grading and/or development of the site. However, the investigation conducted cannot replace the Requirements of the County of Riverside, which requires testing on a lot-by-lot basis after rough grading has been completed.

The County of Riverside protocols require that minimum methane mitigation measures be incorporated into the construction plans for approval by the County's Building and Safety Staff where previous dairy, livestock or related activities have occurred. The actual mitigation measures are dependent on testing that can only be conducted 30-days after the site has been graded. The County has minimum standards for methane mitigation depending on the level of methane encountered. Methane mitigation must be provided on the foundation plans and approved by the appropriate agency. During construction the methane design engineer is required to certify and approve the installation of the mitigation measures on each lot or cluster of lots.

Methane production beneath the ground surface is controlled by several factors. It is produced in an anaerobic (oxygen depleted) environment where there is sufficient organic material present. Near the ground surface (upper three feet) there is little

Modified from Google Earth

Site Location Map

Carlin Environmental Consulting

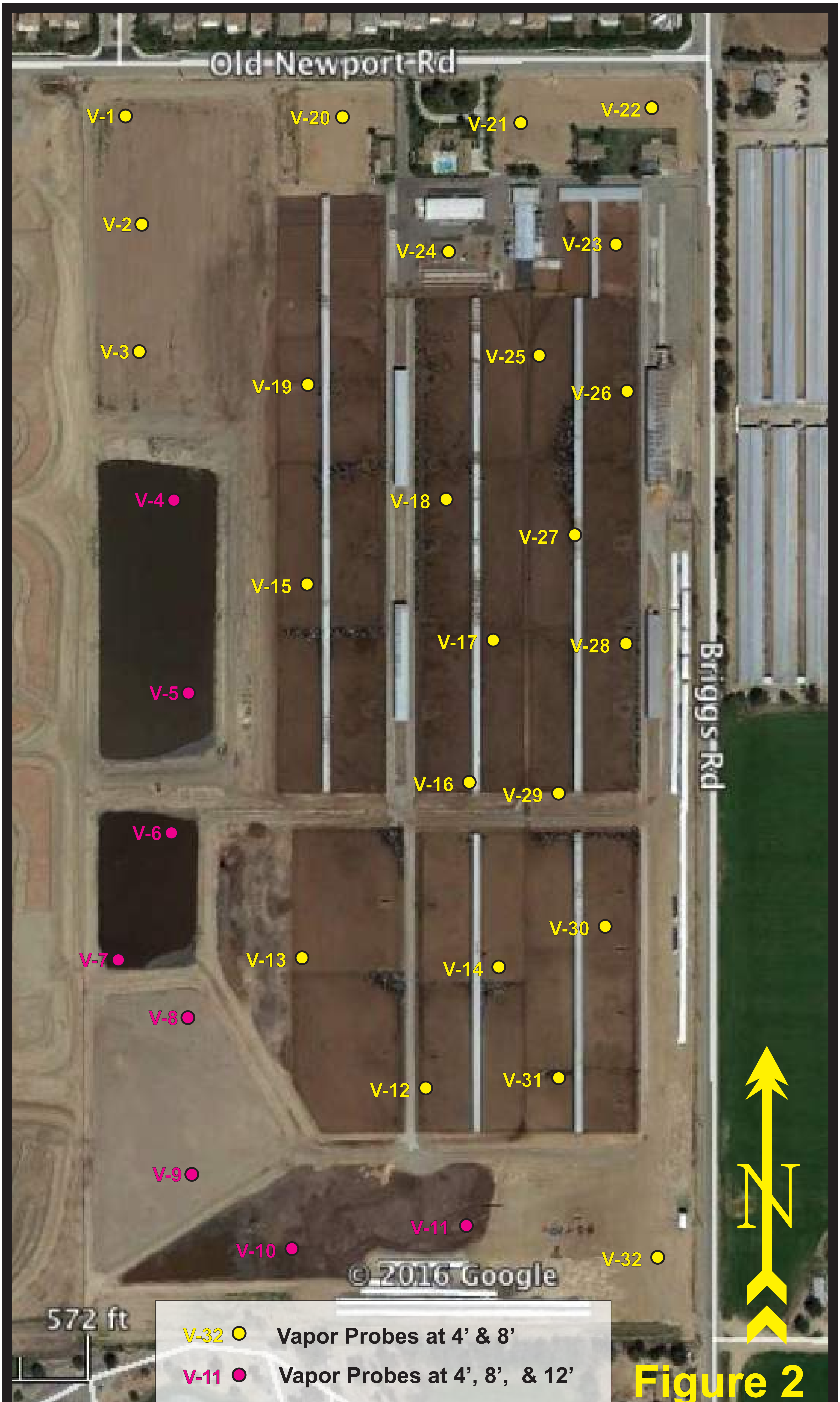
Figure 1

methane production because the oxygen content is too high. This is especially true in sandier soils. With depth, the oxygen content decreases and therefore, the potential for methane production increases. Generally the organic content of soils decreases with depth as the amount of roots and other natural organic material decreases. For a typical dairy operation there is variable organic material beneath the surface due to the significant quantities of manure and urine produced by the livestock. The organics are flushed into the subsurface soils through rain and/or with the urine. The area where the waste products are either stockpiled and/or in the stock ponds have increased flushing of organics into the soils and therefore, the methane production is typically greatest in these areas.

<u>Preliminary Methane Investigation</u>

A preliminary Methane study is required by the County of Riverside, which identifies whether or not the project site, or portions of the site, were previously occupied by dairy operations and within a County of Riverside zone that requires special methane protocols. The subject site is rectangular shaped and approximately 75 acres in size. It is our understanding that the proposed development will consist of single-family homes sites along with associated improvements. CEC reviewed aerial photographs available from Google Earth dating 1994 to present and from Historicaerials.com, which has photographs available from 1967 to present. In addition regional and historical topographic maps were also observed.

Based on a preliminary review of readily available information it appears that approximately 85% of the site was utilized for previous livestock activities and will require evaluation and/or mitigation for methane. Figure 3 indicates those areas that have been identified to have been utilized for livestock related activities and those areas that did not have related activities (highlighted in green). The non-related activities areas include the residential structure areas, areas that were used primarily related to crops, and the site perimeter areas.



Old Newport Rd
Briggs Rd
V-1
V-2
V-3
V-4
V-5
V-6
V-7
V-8
V-9
V-10
V-11
V-12
V-13
V-14
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© 2016 Google
572 ft
N
V-32 Vapor Probes at 4' & 8'
V-11 Vapor Probes at 4', 8', & 12'

Figure 2

Field Testing for Methane

As requested, preliminary testing for methane was conducted at the site for the purpose of guiding future grading operations. Thirty-two probe sets were installed in a two-day period (Figure 2). This is approximately 1/2 probe per acre of land that was utilized for former dairy related activities. In the areas of former stock pens and other uses, the probes were set at depths of 4 and 8 feet below existing grade. In former pond areas a third probe was placed at a depth of approximately 12 feet below existing grades. The soil-gas probes were installed with a direct push rig that punches a hole in the ground. The tubing and gas probes are then placed in the hole and backfilled with sand surrounding the probes and bentonite plugs between the probe depths. The probe tubes are extended above the surface where they can be connected to a device that monitors/reads the amount of methane gas within the soil column. Each probe was monitored twice after the probes were installed in order to verify consistent results. The results of the methane monitoring are presented on Table 1.

Findings

Review of the site history and past uses at the site indicates three general areas present at the site. These are 1) Areas where there was not significant use for domestic animal /dairy related uses; 2) Areas where domestic animals were present and kept in pens and/or manure stored and spread; 3) Areas of stock ponds or desilting basins that collected the urine and other liquid waste from the animals at the site. The methane concentrations from the vapor probes were compared to these three use areas. Figure 3 indicates the maximum concentration measured (for either of the two readings) for the probes installed at each location. Analysis of the data in comparison to the past site usage indicates that for those areas that did not have domestic animal use (Area 1) had the lowest methane readings. In theses areas (highlighted in green on Figure 3) the maximum concentration of methane detected was less than 200 parts per million (ppm). In Area 2, where the stock pens were located, the concentrations of methane were generally above 100 ppm and below 1,200 ppm. In the stock pond areas (Area 3 highlighted in red on Figure 3) methane concentrations were generally above 200 ppm and were as high as 50,000 ppm.

<u>Conclusions and Recommendations</u>

It is CEC's conclusion that the concentrations of methane measured in the subsurface probes match well with the previous site uses. Therefore, CEC's recommendations are specific to each of the three areas as discussed below.

Area 1 - Aerial photographs and methane readings both indicate that these areas were not used for significant domestic animal related uses, therefore these areas are considered exempt from methane mitigation and/or testing after grading has been completed. Care should be taken not to import fill from other portions of the site that has significant manure or organic content into this area. Prior to site development the proposed grading plan, which indicates the layout of individual lots, should be reviewed to determine specific lots that are exempt from methane investigation and/or mitigation.

Area 2 – This area (un-highlighted on Figure 3) has moderate methane concentrations beneath the surface. Due to the presence of domesticated animals, County regulations indicate that these areas must be tested on a lot-by-lot basis a minimum 30 days after grading has been conducted. In addition manure remnants were observed in the near surface within these former stock pen areas. CEC recommends that this near surface highly organic material be skimmed from these areas and removed offsite. Any former manure stockpiles should also be removed from the site.

Area 3 – The stock pond and desilting basin areas have collected urine and other waste products from the former daily operations and the subsurface soils have significant concentrations of organic material that have resulted in the production of methane. The production of significant methane was measured at depths of up to 12 feet. It is likely that that methane is being produced at depths greater than 12 feet. Remedial removals in former stock pond areas should be carefully observed during grading. Because the organics have been flushed deep into the native soils it may not be economically feasible

Old Newport Rd
Briggs Rd
V-1 120 160
V-2 110 180
V-3 75 190
V-4 2450 50000 3800
V-5 360 7050 1250
V-6 400 800 3800
V-7 1250 7800 15750
V-8 800 5780 5250
V-9 1600 3500
V-10 130 14000 15000
V-11 210 590 1200
V-12 180 330
V-13 110 160
V-14 270 450
V-15 200 330
V-16 150 320
V-17 180 320
V-18 130 230
V-19 300 290
V-20 95 150
V-21 100
V-22 95 160
V-23 280 350
V-24 250 45
V-25 160 270
V-26 220 430
V-27 260 1160
V-28 260 640
V-29 290 410
V-30 160 540
V-31 160 420
V-32 180 570
© 2016 Google
572 ft
130 - 4' -Probe reading
14000 - 8' -Probe reading
15000 - 12' -Probe reading
- Areas exempt from further methane testing
- Former/existing Stock Pond Areas
N
Figure 3

to remove all the organics that are producing significant methane. The near surface soils may not currently be producing the greatest quantities of methane, however this may be due to increased oxygen content, which is less favorable for methane production.

To develop the site into single-family residences will require significant grading to create level pads and associated improvements. A preliminary plan for the site also indicates the potential for a lake and/or deep drainage/desilting basin. To reduce the potential for methane production any highly organic manure stockpiles or the near surface remaining manure should be skimmed from the surface and removed offsite. Remedial removals in the stock pond areas should be based on visual observations to determine if highly organic rich layers are present. The methane testing conducted during this investigation suggests that remedial removals as deep as 10 feet below the former stock ponds would be prudent. However, ultimately the geotechnical consultant must also determine the appropriate remedial removal depths to provide a suitable foundation material.

As indicated previously, organic rich soils should not be placed within those areas that are designated as exempt from methane testing protocols (highlighted in green on Figure 3). County protocols also indicate that the organic content of fill materials beneath residential structures should be less than 1%.

Prior to site development the proposed grading plan which indicates the layout of individual lots should be reviewed to determine specific lots that are exempt from methane investigation and/or mitigation.

If you have any questions, comments, or addendums to this proposal, please feel free to contact Gary Carlin at any time at 714-508-1111.

Sincerely,
Carlin Environmental Services, Inc.

Don Terres
Project Geologist
P.G. 4349, CEG 1362

Gary T. Carlin
President/Environmental Scientist

Table 1 - Menifee Project

Probe #	1st Reading - 2-2-16			2nd Reading - 2-3-16		
	4'	8'	12'	4'	8'	12'
1	120	100	x	95	160	x
2	110	180	x	110	140	x
3	75	190	x	50	190	x
4	2,450	50,000	3,800	2,350	49,000	2,700
5	360	7,050	1,250	160	4,400	900
6	35	800	3,800	400	290	1,200
7	1,250	7,800	15,750	590	3,600	4,900
8	800	5,780	5,250	Fail*	Fail*	Fail*
9	1,600	3,500	Fail*	Fail	4,500-Fail	Fail*
10	130	12,500	25,000	120	14,000-Fail	15,000-Fail
11	200	590	1,200	210	580	750
12	160	320	x	180	330	x
13	110	160	x	60	150	x
14	270	450	x	210	220	x
15	not read**	not read**	x	200	330	x
16	150	310	x	130	320	x
17	180	320	x	170	240	x
18	130	120	x	65	230	x
19	300	290	x	not read**	not read**	x
20	95	150	x	25	85	x
21	100	Fail*	x	85	Fail*	x
22	95	160	x	75	150	x
23	280	350	x	150	200	x
24	250	-	x	190	45	x
25	160	250	x	120	270	x
26	220	430	x	150	260	x
27	250	1,150	x	260	850-Fail	x
28	260	640	x	250	340	x
29	290	410	x	280	390	x
30	160	510	x	160	540-Fail	x
31	140	420	x	160	420	x
32	160	15	x	180	570	x

* Fail = Lack of Air in vapor Probe for Instrument to read

** Probe could not be located

PHASE I ENVIRONMENTAL SITE ASSESSMENT
29875 NEWPORT ROAD
MENIFEE, RIVERSIDE COUNTY, CALIFORNIA 92584

February 8, 2016

Project No. 1414-CR

Prepared For:

Excel Engineering
440 State Place
Escondido, California 92029

GEOTEK

GeoTek, Inc.
1548 North Maple Street, Corona, California 92880
(951) 710-1160 Office (951) 710-1167 Fax www.geotekusa.com

January 10, 2018
Project No. 1414-CR

Excel Engineering
440 State Place
Escondido, California 92029

Attention: Mr. Eric Harrington

Subject: Response to Plan Check Comments
Proposed Single-Family Residential Development
29875 Newport Road
Menifee, Riverside County, California

Reference: *GeoTek, 2016, "Geotechnical Evaluation, Proposed Single-Family Residential Development, 29875 Newport Road, Menifee, Riverside County, California", Project No. 1414-CR, dated March 3.*

Dear Mr. Harrington:

As requested, GeoTek, Inc. (GeoTek) is providing this letter to respond to a plan check comment relative to the Catch Basin and bioretention details provided on the Tentative DMA Map, prepared by Excel Engineering (undated) for the Rockport Ranch project in Menifee. Noted below is the plan check comment followed by our response.

Plan Check Comment: *An impermeable liner is proposed around the entire basin, but there does not appear to be geotechnically based recommendation to prevent all infiltration. The detail also states that the liner sizing and* thickness *will be based on the soil engineer's recommendations. Please note that unless supported by the soil engineer* recommendations the impermeable liner should be removed from the bottom of the basins to allow for incidental infiltration.

GeoTek Response: Due to the low infiltration rates of the site soils as previously documented by GeoTek, infiltration into the underlying soils is not deemed feasible. Therefore, use of an impervious liner (such as HDPE-high density polyethylene, or similar) beneath the catch basin and bioretention facilities is recommended. The liner should possess appropriate engineering properties to limit infiltration into the underlying soils. As a guide, we would suggest a maximum coefficient of permeability of 1×10^{-7} cm/sec for the impervious liner. A specific minimum thickness of the liner is not deemed necessary provided the maximum coefficient of permeability can be documented by the liner manufacturer. Once a specific liner is proposed/selected, the product specification sheet for the material should be provided to GeoTek for review. The liner should be installed as recommended by the liner manufacturer.

The opportunity to be of service is sincerely appreciated. If you should have any questions, please do not hesitate to call our office.

Respectfully submitted,

GeoTek, Inc.

Robert R. Russell, PE, GE
GE 2042, Exp. 12/31/18
Sr. Project Engineer

Edward H. LaMont
CEG 1892, Exp. 07/31/18
Principal Geologist

Distribution: (1) Addressee via email

G:\Projects\1401 to 1450\1414CR Excel Engineering 29875 Newport Road Menifee\1414-CR Response to Review comment, basin liner.doc

GeoTek, Inc.
710 E. Parkridge Avenue, Suite 105, Corona, California 92879-1097
(951) 710-1160 Office (951) 710-1167 Fax www.geotekusa.com

February 8, 2016
Project No. 1414-CR

Excel Engineering
440 State Place
Escondido, California 92029

Attention: Mr. Rod Jones

Subject: Phase I Environmental Site Assessment
29875 Newport Road
Menifee, Riverside County, California 92584

Dear Mr. Jones:

GEOTEK, INC. (GEOTEK) is pleased to present this Phase I Environmental Site Assessment for the above-referenced subject Site. Services were conducted in substantial conformance with the scope and limitations of the American Society of Testing and Materials E 1527-13, "*Standard Practice for Environmental Site Assessments: Phase I Environmental Site Assessment Process,*" which is approved to meet the requirements of the federal All Appropriate Inquiries (AAI) standards as set forth in the Code of Federal Regulations, Title 40, Section 312 (40 CFR 312), and GEOTEK'S Proposal No. P-1104115, dated November 25, 2015.

This Phase I Environmental Site Assessment has not revealed evidence of a recognized environmental condition or concern in connection with the subject Site. No additional investigation is necessary at this time.

Due to the apparent age of the Site structures, federal regulations require an asbestos containing materials (ACM) and lead based paint (LBP) survey must be performed on the existing Site structures when the structures are not occupied and prior to demolition.

We appreciate this opportunity to be of service. If you have any questions, or if we can be of further service, please contact us at (951) 710-1160.

Sincerely,
GEOTEK, INC.

REGISTERED GEOLOGIST
EDWARD H. LaMONT
No. 1892
Exp.
Certified Engineering Geologist
STATE OF CALIFORNIA

Edward H. LaMont
Principal Geologist, CEG 1892
Expires 07/31/2016

J. Michael Batten, CEM, REPA
Environmental Services Manager
Registered Environmental Property
Assessor No. 113162
Expires 06/15/2016

Anna M. Scott
Project Geologist

TABLE OF CONTENTS

TABLE OF CONTENTS

TABLE OF CONTENTS

LIST OF APPENDICES

1.0 EXECUTIVE SUMMARY

GEOTEK, INC. (GEOTEK) has performed a Phase I Environmental Site Assessment (ESA) for the subject property: 29875 Newport Road (the "Site"), located in the City of Menifee, Riverside County, California. Our services were conducted in substantial conformance with the scope and limitations of the American Society of Testing and Materials (ASTM) E 1527-13, "*Standard Practice for Environmental Site Assessments: Phase I Environmental Site Assessment Process*", which is approved to meet the requirements of the federal All Appropriate Inquiries (AAI) standards as set forth in the Code of Federal Regulations, Title 40, Section 312 (40 CFR 312), and GEOTEK Proposal No. P-1104115, dated November 25, 2015. Any additions or deletions from our scope of services are discussed in the appropriate sections of this assessment.

A representative of GEOTEK conducted a Site reconnaissance on January 11, 2016. The weather was cool and the sky was clear. The irregular shaped Site is comprised of one parcel of land [Assessor Parcel Number (APN) 364-190-004] and encompasses a total of approximately 78.8 acres of land. The Site can generally be accessed from Newport Road and Briggs Road.

The Site is the location of the former Abacherli Dairy. The Site is occupied with several structures including four residences, a milking building and a work shop building. The cow pens have generally been demolished and removed from the Site and the dairy is no longer active. Two water wells are located in the southern portion of the Site. Concrete and asphalt parking/drive areas and landscaping also occupy the Site. An above ground storage tank (AST) containing diesel fuel is located to the west of the shop building. Several other empty ASTs were observed on the Site associated with the previous dairy activities. Several 50-gallon barrels were observed in the shop building along with some paint buckets. All of the Site residences utilize a leach field waste water disposal system. Other visual evidence of hazardous substances or wastes was not observed. No pungent or acrid odors were observed emanating from the Site.

The Site is in an area largely characterized by mixed-use development. The site is bounded by Newport Road, followed by a residential development to the north; Briggs Road, followed by Ramona Egg Ranch and agricultural property to the east; Wilderness Lakes Recreational Vehicle Resort to the south; and a residential development to the west. The site can be accessed from Newport Road and Briggs Road.

Based on readily available historic information, the Site appears to have been vacant land from approximately 1938 until 1985, when the existing Site structures and Site improvements can be observed. The surrounding properties appear to historically have been vacant land or occupied with structures since at least 1938.

The Site appears on the database report obtained for this assessment. The Site is listed with FINDS, EMI and WDS. FINDS is a facility index system/facility registry system. EMI (Emissions Inventory Data) is a list of toxics and pollutants emissions data. WDS (Waste Discharge System) is a list of sites which have been issued waste discharge requirements. All of these listings are associated with the dairy operations, which are no longer occurring. There are no records of violations associated with the dairy. Therefore, the listings with FINDS, EMI and WDS do not represent a recognized environmental condition.

In addition, there is one facility listed on the database report within the various search distances specified by ASTM E 1527-13. This listing is the result of a mandatory Preliminary Endangerment Assessment conducted for all school sites in California. The facility status is listed as "no further action." It is our opinion that this facility does not represent a recognized environmental condition to the Site.

This Phase I Environmental Site Assessment has not revealed evidence of a recognized environmental condition or concern in connection with the subject Site.

Due to the apparent age of the Site structures, federal regulations require an asbestos containing materials (ACM) and lead based paint (LBP) survey must be performed on the existing Site structures when the structures are not occupied and prior to demolition.

This executive summary does not contain all the information that is found in the full report. The report should be read in its entirety to obtain a more complete understanding of the information provided and to aid in any decisions made or actions taken based on this information.

2.0 INTRODUCTION

GEOTEK, INC. (GEOTEK) has performed a Phase I Environmental Site Assessment (ESA) for 29875 Newport Road (the "Site"), located in the City of Menifee, Riverside County, California.

2.1 PURPOSE

The purpose of this Phase I ESA was to identify and evaluate actual and potential environmental conditions involving the subject Site. It was not the purpose of this assessment to determine the degree or extent of contamination, if any, but rather the potential for contamination.

2.2 SCOPE OF WORK

The Phase I ESA is a general characterization of environmental concerns based on reasonably ascertainable information and observations. GEOTEK performed the Phase I ESA in substantial accordance with ASTM E 1527-13. The following services were provided for the assessment:

- A reconnaissance of the Site and surrounding properties to visually assess current utilization and indications of potential surface contamination. This was accomplished by driving the Site boundaries, and then traversing the Site until the entire Site had been surveyed.

- A reconnaissance of the surrounding area for approximately one-half mile was conducted, without entering the properties, making observations concerning property uses, conditions, and housekeeping.

- A review of the geologic and hydro-geologic settings was conducted using reasonably ascertainable public records and documents.

- An environmental database report was obtained from a data service provider. This database report compiles and locates documented "hazardous waste" facilities within specific minimum search distances as defined by ASTM E 1527-13. If necessary, additional information on identified facilities was gathered by a file review at the appropriate federal, state, local, and/or tribal regulatory agency.

- A review of reasonably ascertainable historical records (including aerial photographs, topographic maps, building records, and city directories) was conducted to assess the historical land utilization and indications of potential contamination or sources of contamination for the Site.

- This report was prepared, which relates the findings of this study and presents our conclusions and recommendations.

Specific items not included in this Scope of Services are soil analysis, water analysis, asbestos containing materials analysis, radon analysis, lead-based paint analysis, lead in drinking water, wetlands, regulatory compliance, cultural and historic resources, industrial hygiene, health and safety, ecological resources, endangered species, indoor air quality, vapor intrusion testing, high voltage power lines, and other items not within the scope of ASTM E 1527-13.

2.3 SIGNIFICANT ASSUMPTIONS

Specific assumptions by GEOTEK for this assessment include:

- GEOTEK had permission to access the Site grounds;
- The client has provided GEOTEK with available geotechnical or environmental reports for the Site;
- The client has provided GEOTEK with known current or historic uses of hazardous materials at the Site, or with other specialized knowledge of the environmental history of the Site and surrounding area;
- The client is not the sole and absolute source of information;
- Seller has provided proper and complete access to their knowledge, both written and verbal, and GEOTEK can rely on the information.

2.4 LIMITATIONS AND EXCEPTIONS

GEOTEK conducted a Phase I Environmental Site Assessment in substantial accordance with ASTM E 1527-13 and as authorized by Excel Engineering. This study does not include sampling of soil, groundwater and/or the debris on-site for environmental testing. This report is intended for the use of Excel Engineering. The contents should not be relied upon by any party other than the aforementioned without the express written consent of GEOTEK.

The findings, conclusions, and recommendations made in this report are based on the information that was made available to GEOTEK, in most instances from public records. The information is relevant to the date of our site work and should not be relied on to represent conditions at any later date. The opinions and conclusions expressed herein are based on information obtained during our assessment and on our experience and current standards of technical practice. GEOTEK makes no other warranties, either express or implied, concerning the completeness of the data furnished to us. GEOTEK cannot be responsible for conditions or consequences arising from relevant facts that were concealed, withheld, or not fully disclosed at the time our assessment was undertaken. GEOTEK is not responsible, nor liable for work, testing or recommendations performed or provided by others. This Phase I Environmental Site Assessment is not and should not be construed as a warranty or guarantee about the presence or absence of environmental hazards or contaminants, which may affect the subject site. Facts, conditions, and acceptable risk factors change with time; accordingly, this report should be viewed within this context.

Specific limitations to the scope of ASTM E 1527-13 due to contract limitations, availability of resources, and/or encountered Site conditions are discussed in the appropriate section(s) of this report.

2.5 SPECIAL TERMS AND CONDITIONS

This assessment report is presented as fulfilling the standard requirements of most financial institutions, governmental regulatory agencies, ASTM, and generally accepted industry standards and practices. Please refer to GEOTEK Proposal No. P-1104115 for complete terms and conditions for this assessment.

2.6 RELIANCE

This assessment has been prepared for the exclusive use, and may be relied upon by Excel Engineering and its successors and assignees. Third party reliance letters may be issued upon request and upon the payment of the, then current, fee for such letters. All third parties relying on this report, by such reliance, agree to be bound by the General Conditions and Limitations agreed to Excel Engineering. No reliance by any party is permitted without such agreement, regardless of the content of the reliance letter itself.

3.0 DESCRIPTION OF SITE AND SURROUNDING AREA

The objective of describing the Site and surrounding area is to document current conditions as observed and to obtain information which would indicate the likelihood of a recognized environmental condition in connection with the Site. A representative of GEOTEK conducted a Site reconnaissance on January 11, 2016. The weather was cool and the sky was clear. The Site can generally be accessed from Newport Road and Briggs Road.

3.1 SITE LOCATION AND LEGAL DESCRIPTION

The Site is located at, and addressed as, 29875 Newport Road in the City of Menifee, Riverside County, California. According to the U.S. Geological Survey (USGS) Romoland and Winchester Quadrangle topographic maps (7.5-minute series), the Site is located in Section 1, Township 6 South, Range 3 West, San Bernardino Baseline and Meridian (see Figure 1 in Appendix A and documents in Appendix B). The Riverside County Assessor Parcel Number (APN) is 364-190-004. A Property Tax Map Report, as obtained from Environmental Data Resources, Inc. (EDR), is included herein in Appendix B.

3.2 SITE AND VICINITY GENERAL CHARACTERISTICS

The Site is the location of the Abacherli Dairy and is in an area largely characterized by mixed-use development.

3.3 CURRENT PROPERTY USE

The Site is the location of the Abacherli Dairy, which is no longer operating.

3.4 SITE IMPROVEMENTS

The Site is the location of the former Abacherli Dairy. The Site is occupied with several structures including four residences, a milking building and a work shop building. The cow pens have generally been demolished and removed from the Site and the dairy is no longer active. Two water wells are located in the southern portion of the Site. Concrete and asphalt parking/drive areas and landscaping also occupy the Site. An above ground storage tank (AST) containing diesel fuel is located to the west of the shop building. Several other empty ASTs were observed on the Site associated with the previous dairy activities. Several 50-gallon barrels were observed in the shop building along with some paint buckets. All of the Site residences are on a leach field waste water disposal system. Photographs of the Site are included in Appendix C.

3.4.1 HAZARDOUS SUBSTANCES

Several 50-gallon barrels were observed in the shop building along with some paint buckets. No visual evidence of spills or leaks was observed near the barrels. Other visual evidence of hazardous substances or wastes was not observed. No pungent or acrid odors were observed emanating from the Site.

3.4.2 STORAGE TANKS

GEOTEK observed several empty ASTs on the Site. Their former use is unknown. An above ground storage tank (AST) containing diesel fuel is located to the west of the shop building.

GEOTEK did not observe any other evidence of underground or above ground storage tanks (such as vent pipes, fill pipes, regular-shaped depressions, etc.) on the Site.

3.4.3 POLY-CHLORINATED BIPHENYLS (PCBS)

GEOTEK observed slab mounted transformers at the Site which may contain PCBs. It is our understanding that these transformers are owned by Southern California Edison and said entity is responsible for these transformers. No stained soils were observed on the ground in associated with these transformers.

GEOTEK did not observe other suspect equipment (elevators, hydraulic lift mechanisms, trash compactors, etc.), which may contain PCBs on the Site.

3.4.4 CONTROLLED SUBSTANCES

GEOTEK consulted the U.S. Drug Enforcement Agency (DEA) website to cross-check the Site address against published facilities subject to DEA enforcement. The Site did not appear on the list of published facilities. A copy of the DEA printout is included in Appendix B.

GEOTEK did not observe evidence of illegal or controlled substances being used or manufactured at the Site.

3.4.5 INDICATIONS OF SOLID WASTE DISPOSAL

Waste disposal for the Site area is provided by Waste Management.

3.4.6 UTILITY SUPPLY

The Site utilizes water wells and septic systems for water and sewer services. Sewer and water services for the area are provided by Eastern Municipal District. Electric services are provided for the Site area by Southern California Edison. Natural gas is provided for the Site area by Southern California Gas Company.

3.4.7 DRAINAGE

Natural drainage at the Site is generally interpreted to be toward the southwest, conforming to the natural topography in the area. Standing water was observed on the Site in several locations on the date of our reconnaissance due to the recent inclement weather. Additionally, several ponds are located in the southwestern portion of the Site to contain storm water.

3.4.8 OTHER CONDITIONS OF CONCERN

Two active wells are located on the Site. If these wells are not to be utilized, they should be demolished in accordance with the local jurisdictional agency.

The residences on Site utilize a leach field for waste water disposal system. In our experience, leach fields for residential use are not an environmental concern. If the leach field and associated septic tanks are not to be utilized, they should be demolished in accordance with the local jurisdictional agency and disposed of properly offsite.

No other visual indication of other conditions of concern that would indicate a recognized environmental condition was observed during the Site reconnaissance.

3.4.9 INTERVIEWS

GEOTEK interviewed the following individual while performing this assessment, in the form of completing a *User Questionnaire*:

- Mr. Ron Abacherli (a representative of the current Site owner) completed a User Questionnaire.

Information from this interview is incorporated into the appropriate sections of this report.

3.5 CURRENT ADJOINING PROPERTY USE

The Site is in an area largely characterized by mixed-use development. The site is bounded by Newport Road, followed by a residential development to the north; Briggs Road, followed by Ramona Egg Ranch and agricultural property to the east; Wilderness Lakes Recreational Vehicle Resort to the south; and a residential development to the west. The site can be accessed from Newport Road and Briggs Road.

4.0 CLIENT PROVIDED INFORMATION

As a form of interview, a representative of the current Site owner completed a "User Questionnaire" for the Site in accordance with ASTM E 1527-13. A copy of the completed questionnaire is included in Appendix B.

4.1 ENVIRONMENTAL CLEAN UP LIENS

Mr. Ron Abacherli is not aware of any environmental clean-up liens at the Site.

4.2 ACTIVITY AND USE LIMITATIONS

Mr. Ron Abacherli is not aware of an activity use limitations at the Site.

4.3 SPECIALIZED KNOWLEDGE

Mr. Ron Abacherli is aware of specialized knowledge of the Site or nearby properties. Mr. Ron Abacherli stated that "the Site has been a dairy which sole business was that of milk production for 34 years. Prior use of the property was dry farm wheat production."

4.4 PURCHASE PRICE

Mr. Ron Abacherli has indicated that the purchase price being paid for the Site has not yet been established. Mr. Ron Abacherli stated that the property has no contamination to his knowledge.

4.5 COMMONLY KNOWN INFORMATION

Mr. Ron Abacherli is aware of past uses of the Site and is aware of specific chemicals that are present or once present at the Site. Mr. Ron Abacherli is not aware of any chemical spills or releases at the Site and is not aware of any environmental cleanups at the Site.

4.6 OBVIOUS INDICATORS OF CONTAMINATION

Mr. Ron Abacherli is not aware of obvious indicators of a likely environmental impact at the Site.

4.7 OWNER, PROPERTY MANAGER AND OCCUPANT INFORMATION

The Site is currently owned and managed by Frederick A & Lindi S Abacherli Trustees. The Site is occupied by the Abacherli Dairy. Four residences are located on the Site and are all occupied.

4.8 REASON FOR PERFORMING PHASE I ESA

This Phase I ESA was performed at the request of Excel Engineering as part of their due diligence for future improvements on the Site.

4.9 OTHER USER PROVIDED INFORMATION

GEOTEK was not provided with any other information by Excel Engineering.

5.0 PROPERTY PHYSICAL SETTING

Surface and subsurface environments are of interest because they control the movement of water-born contaminants, which could be transported to and from the subject Site. GEOTEK reviewed information regarding the physical setting of the subject Site and immediately surrounding area.

5.1 REGIONAL GEOLOGY

The property is situated in the Peninsular Ranges geomorphic province. The Peninsular Ranges province is one of the largest geomorphic units in western North America. Basically, it extends from the point of contact with the Transverse Ranges geomorphic province, southerly to the tip of Baja California. This province varies in width from about 30 to 100 miles. It is bounded on the west by the Pacific Ocean, on the south by the Gulf of California and on the east by the Colorado Desert Province.

The Peninsular Ranges are essentially a series of northwest-southeast oriented fault blocks. Several major fault zones are found in this province. The Elsinore Fault zone and the San Jacinto Fault zone trend northwest-southeast and are found near the middle of the province. The San Andreas Fault zone borders the northeasterly margin of the province.

5.2 LOCAL GEOLOGIC SETTING AND TOPOGRAPHY

The Site and Site area are understood to be underlain by alluvium. Additional data regarding soil survey information for the Site and Site area is also included in Appendix B.

The Site can be considered as having relatively flat terrain. Based on the USGS topographic map for the area and other documents reviewed for this report, the elevation of the subject Site ranges from approximately 1,430 to 1,440 feet above mean sea level (see Figure 1, Appendix A).

5.3 VICINITY SURFACE DRAINAGE

Natural drainage at the Site is interpreted to be dominantly directed toward the southwest, conforming to the natural topography in the area. Storm water runoff will most likely not drain towards the Site from the adjacent properties due to the presence of existing streets and/or improvements.

According to the Federal Emergency Management Agency (FEMA), a portion of the Site is located within a 100-year flood zone (see Appendix D).

5.4 HYDROGEOLOGY

According to a review of historical groundwater data (California Department of Water Resources and California State Water Resources Control Board groundwater well data [http://wdl.water.ca.gov and http://geotracker.waterboards.ca.gov]) and in-house information, depth to groundwater is currently roughly 100 feet bgs in the general site area, with a flow direction to the southwest. Data obtained from the California Department of Water Resources for the two wells located on Site is included in Appendix B.

6.0 ENVIRONMENTAL REGULATORY RECORDS REVIEW

The records review is conducted to help identify known recognized environmental conditions at the Site and/or on adjacent or nearby properties which may have impacted the subject Site.

6.1 ENVIRONMENTAL DATABASE RECORDS SEARCH

GEOTEK obtained and reviewed an environmental database report of the federal and state environmental records specified by ASTM E 1527-13. The database report was provided by Environmental Data Resources, Inc. (EDR) of Shelton, Connecticut. Additionally, orphan or un-mappable sites listed by EDR were reviewed for the approximate minimum search distances noted and included in our discussion, if applicable. Refer to Appendix D for a copy of the database report.

ENVIRONMENTAL DATABASE	MINIMUM SEARCH DISTANCE	SITE	ADJACENT	TOTAL LISTED
U.S. Environmental Protection Agency (USEPA) - National Priorities List (NPL), including delisted NPL	1.0 Mile	No	0	0
USEPA - Comprehensive Environmental Response, Compensation and Liability Information System (CERCLIS), including NFRAP[i] sites	0.5 Mile	No	0	0
USEPA – Resource Conservation and Recovery Act (RCRA), Corrective Action Facilities (CORRACTS)	1.0 Mile	No	0	0
USEPA – RCRA, Transportation, Storage, and Disposal facilities (TSD)	0.5 Mile	No	0	0
USEPA - RCRA Generators	Site and Adjacent	No	0	0
USEPA – Emergency Response Notification System (ERNS)	Site	No	N/A	0
Federal institutional control/engineering control registries	0.5 Mile	No	0	0
California Environmental Protection Agency (CEPA) – State Response Sites (Response, formerly Annual Work Plan and Bond Expenditure Plan)	1.0 Mile	No	0	0

[i] NFRAP = "No Further Remedial Action Planned"

ENVIRONMENTAL DATABASE	MINIMUM SEARCH DISTANCE	SITE	ADJACENT	TOTAL LISTED
CEPA – EnviroStor Database (formerly CALSITES)	0.5 Mile	No	0	1
CEPA – CHMIRS - California Hazardous Materials Information Reporting System	Site	No	No	0
CEPA - Solid Waste Fill/Landfill (SWF/LF), Solid Waste Assessment Test (SWAT)/Waste Management Unit Database System (WMUDS)	0.5 Mile	No	0	0
CEPA – Leaking Underground Storage Tanks (LUST)	0.5 Mile	No	0	0
CEPA – Underground Storage Tanks (UST), including historic USTs	Site and Adjacent	No	0	0
CEPA – Spills, Leaks, Investigations & Cleanup Cost Recovery Listing (SLIC)	0.5 Mile	No	0	0
State institutional control/engineering control registries	Site	No	N/A	0
Local and/or Tribal databases	Up To 1.0 Mile	No	0	0
Drycleaners	0.25 Mile	No	0	0
Other databases	Up to 1.0 Mile	**Yes**	0	0
Unmappable facilities	Up to 1.0 Mile	No	0	0

N/A – Not Applicable

6.2 Discussion of Regulatory Records

6.2.1 National Priority List

The National Priority List (NPL) is the USEPA's list of confirmed or proposed Superfund sites. Our review of this data includes sites which have been delisted from the NPL. The NPL is searched for a 1.0 mile distance.

The Site does not appear on the NPL. There are no facilities on the NPL within 1.0 mile of the Site.

6.2.2 Comprehensive Environmental Response, Compensation, and Liability Information System List

The Comprehensive Environmental Response, Compensation and Liability Information System (CERCLIS) is a compilation of sites that the EPA has investigated or is currently investigating for a release or threatened release of hazardous substances. Our review of CERCLIS sites includes No Further Remedial Action Planed (NFRAP) facilities. The CERCLIS list is searched for a 0.5 mile distance.

The Site does not appear on the CERCLIS or the CERCLIS-NFRAP list. There are no facilities on the CERCLIS or the CERCLIS-NFRAP list within 0.5 mile of the Site.

6.2.3 Resource Conservation and Recovery Act

The Resource Conservation and Recovery Act compile selective information on facilities which generate, transport, store, treat and or dispose of hazardous waste. RCRA facilities can be listed on one of three databases:

- *Corrective Action Facilities (CORRACTS)* are facilities undergoing corrective action. A corrective action order is issued pursuant to RCRA Section 3008(h) when there has been a release of hazardous waste or constituents into the environment from a RCRA facility. The CORRACTS list is searched for a 1.0 mile distance.

  The Site does not appear on the CORRACTS list. There are no facilities on the CORRACTS list within 1.0 mile of the Site.

- *Transportation, Storage, and Disposal Facilities (TSD)* includes facilities that transport, store or dispose of hazardous waste and are not listed on the RCRA Generators list. The TSD is searched for a 0.5 mile distance.

  The Site does not appear on the RCRA TSD list. There are no facilities on the RCRA TSD list within 0.5 mile of the Site.

- *Generators List* identifies and tracks hazardous waste from the point of generation to the point of disposal. The RCRA Generators database is a compilation by the EPA of reporting facilities that generate hazardous waste. The RCRA generators list is searched for the Site and adjacent properties.

The Site does not appear on the RCRA Generators list. There are no facilities listed as a RCRA Generator within 0.25 mile of the Site.

6.2.4 EMERGENCY RESPONSE NOTIFICATION SYSTEM

The Emergency Response Notification System (ERNS) is a national database used to collect information on reported releases of oil or hazardous substances. The ERNS list is searched for the Site. The Site does not appear on the ERNS list.

6.2.5 FEDERAL INSTITUTIONAL CONTROL/ENGINEERING CONTROL REGISTRIES

The USEPA maintains two databases which list sites that have institutional and/or engineering controls in place as part of their operations. These databases are searched for a 0.5 mile distance.

The Site does not appear on either of these databases. There are no facilities on either of these databases within 0.5 mile of the Site.

6.2.6 STATE RESPONSE SITES

The State Response Sites (RESPONSE) records are the state equivalent to the federal National Priorities List (NPL) database. The RESPONSE is searched for a 1.0-mile distance.

The Site does not appear on the on the RESPONSE. There are no RESPONSE facilities listed within a 1.0-mile distance of the Site.

6.2.7 ENVIROSTOR DATABASE

The EnviroStor Database (EnviroStor, formerly CALSITES) records are the state equivalent to the federal CERCLIS database. EnviroStor is searched for a 0.5 mile distance.

The Site does not appear on the EnviroStor database.

There is one (1) EnviroStor facility listed within a 0.5 mile distance of the Site. The facility is listed as New Elementary School No. 6, located at La Ventana Road/Newport Road. The facility is listed as being located 0.5 to 1.0 (0.908) mile north-northeast of the Site. This listing is the result of a mandatory Preliminary Endangerment Assessment conducted for all school sites in California. The facility status is listed as "no further action."

It is our opinion that this facility does not represent a recognized environmental condition to the Site.

6.2.8 CALIFORNIA HAZARDOUS MATERIAL INCIDENT REPORT SYSTEM

The California Hazardous Material Incident Report Systems (CHMIRS) is a state database used to collect information on reported hazardous materials incidents (accidental leaks and spills). The CHMIRS list is searched for a 0.25-mile distance.

The Site does not appear on the CHMIRS list. There are no CHMIRS facilities located within 0.25 mile of the Site.

6.2.9 SOLID WASTE FACILITIES LIST

The Solid Waste Fill/Landfill (SWF/LF) and Waste Management Unit Database System (WMUDS)/Solid Waste Assessment Test (SWAT) databases includes information pertaining to closed and open solid waste facilities operating in the state of California. The SWF/LF and WMUDS/SWAT databases are searched for a 0.5-mile distance.

The Site does not appear on the SWF/LF or WMUDS/SWAT lists. There are no facilities on the SWF/LF or WMUDS/SWAT list within 0.5 mile of the subject Site.

6.2.10 LEAKING UNDERGROUND STORAGE TANKS LIST

The California Leaking Underground Storage Tanks (LUST) list is a compilation of petroleum storage tank sites that have reported a release. The LUST list is searched for a 0.5 mile distance.

The Site did not appear on the LUST list. There are no facilities listed as being on the LUST list within 0.5 mile of the Site.

6.2.11 UNDERGROUND STORAGE TANKS LIST

The California Underground Storage Tank (UST) list is a compilation of petroleum storage tank sites that are registered with the state of California. The UST list is searched for the Site and adjacent properties.

The Site did not appear on the UST list. There are no nearby facilities listed on the UST list.

6.2.12 SPILLS, LEAKS, INVESTIGATION AND CLEANUP COST RECOVERY LISTING (SLIC)

The SLIC database is compiled by the CEPA California Regional Water Quality Control Board, San Ana Region. It is designed to protect and restore water quality from spills, leaks, and similar discharges. The SLIC is searched for a 0.5 mile distance.

The Site does not appear on the SLIC. There are no SLIC facilities listed within a 0.5-mile distance of the Site.

6.2.13 STATE INSTITUTIONAL CONTROL/ENGINEERING CONTROL REGISTRIES

The State of California maintains institutional and engineering control databases or registries. This lists sites with engineering or institutional controls in place. Institutional controls include administrative measures intended to prevent exposure to contaminants remaining on site. Engineering controls include various forms of caps, building foundations, liners, and treatment methods. The State Institutional Control/Engineering Control Registries is searched for the Site.

The subject Site does not appear on the State Institutional Control/Engineering Control Registries.

6.2.14 TRIBAL DATABASES

Tribal governments are under the jurisdiction of the USEPA for environmental concerns. Currently, the USEPA Region 9 publishes LUST and UST information for tribes in Arizona, California, Hawaii, Nevada, and the Pacific Territories. The LUST database is searched for 0.5 mile, and the UST database is searched for 0.25 mile.

The Site does not appear on the Tribal LUST or UST databases. No facilities were identified on the Tribal LUST or UST databases within 0.5 mile of the Site.

6.2.15 Other Databases

Occasionally, EDR reports on local or internal databases they maintain or compile.

The Site appears on the database report obtained for this assessment. The Site is listed with FINDS, EMI and WDS. FINDS is a facility index system/facility registry system. EMI (Emissions Inventory Data) is a list of toxics and pollutants emissions data. WDS (Waste Discharge System) is a list of sites which have been issued waste discharge requirements. All of these listings are associated with the dairy operations, which are no longer occurring. There are no records of violations associated with the dairy. Therefore, the listings with FINDS, EMI and WDS do not represent a recognized environmental condition.

6.2.16 Dry Cleaners

The DRYCLEANERS list is compiled and provided by EDR. The DRYCLEANER database is searched for a 0.25 mile distance.

The Site does not appear on the DRYCLEANER list. There are no DRYCLEANER facilities listed within 0.25 mile of the Site.

6.2.17 Vapor Encroachment Screen

The purpose of a Vapor Encroachment Screen (VES) is to identify, to the extent feasible, if a vapor encroachment conditions exists at the Site.

A Vapor Encroachment Screen Report was generated for the Site and Site area utilizing EDR's Vapor Encroachment Worksheet (see Appendix B). It was determined that there are no historical dry cleaners or historical auto stations within 600 feet and/or up gradient from the Site.

The Vapor Encroachment Screen report is included in Appendix B.

6.2.18 Unmappable Facilities

GeoTek reviewed the listing of "orphan" or unmappable facilities in the database report. There are no unmapped sites in the report.

6.3 Local Regulatory Agency Records

GeoTek contacted the County of Riverside Sheriff and Fire Departments regarding underground or above ground storage tanks, hazardous materials permits or business plans, emergency responses, spills, inspections, or other information of an environmental or hazardous nature.

Neither department had any information for the Site.

6.4 Environmental Lien and AUL Search

GeoTek obtained an Environmental Lien and Activity Use Limitation (AUL) Search Report from EDR. No environmental liens or AUL's were found. The report is included herein Appendix B.

7.0 SITE AND SURROUNDING AREA HISTORY

In order to construct the history of the Site and the surrounding area, GEOTEK reviewed reasonably ascertainable public documents, including aerial photographs, topographic maps, building records, city directories, fire insurance maps, and county assessor history records.

7.1 HISTORICAL SITE USAGE

7.1.1 AERIAL PHOTOGRAPH REVIEW

GEOTEK reviewed aerial photographs dated 1938, 1953, 1961, 1967, 1978, 1985, 1989, 1996, 2002, 2005, 2006, 2009, 2010 and 2012 (see Appendix B).

The Site appears to be vacant land in the 1938, 1953, 1961, 1967 and 1978 aerial photographs. The Site appears to be dry farmed in the 1953 aerial photograph.

The northern portion of the dairy can be observed in the 1985 aerial photograph.

Additional cow pens can be observed in the southern portion of the dairy in the 1989 aerial photograph.

Additional cow pens can be observed in the southern portion of the dairy in the 1996 aerial photograph.

The dairy appears similar in the 2002, 2005, 2006, 2009, 2010 and 2012 aerial photographs.

7.1.2 TOPOGRAPHIC MAP REVIEW

GEOTEK reviewed the Elsinore Quadrangle (30-minute series), dated 1901; the Murrieta Quadrangle (15-minute series), dated 1942; the Murrieta Quadrangle (15-minute series), dated 1943; the Romoland and Winchester Quadrangles (7.5-minute series), dated 1953; the Romoland and Winchester Quadrangles (7.5-minute series), dated 1973; the Romoland and Winchester Quadrangles (7.5-minute series), dated 1979; and the Romoland and Winchester Quadrangles (7.5-minute series), dated 2012 (see Appendix B).

A structure can be observed in the eastern portion of the Site on the topographic map sheet dated 1901.

The Site appears to be vacant land on the topographic map sheets dates 1942, 1943, 1953, 1973 and 1979. The 2012 maps show little detail other than streets in the vicinity.

7.1.3 BUILDING DEPARTMENT RECORDS

GEOTEK contacted the County of Riverside Building and Safety Records Department. Numerous permits were found for the subject Site which entail various improvements to the Site including the residences, a pool, electrical, etc. A copy of the provided information from the County of Riverside is included herein in Appendix B.

7.1.4 CITY DIRECTORY REVIEW

GEOTEK reviewed The EDR – City Directory Image Report, as obtained from and provided by EDR, and included herein in Appendix B.

YEAR	SOURCE	ADDRESS	LISTING(S)
2013	Cole Information Services	29875 Newport Road	Abacherli Dairy
2008	Cole Information Services	29875 Newport Road	Abacherli Dairy Frank Abacherli
2003	Cole Information Services	29875 Newport Road	Frank Abacherli
1999	Cole Information Services	29875 Newport Road	Abacherli Dairy Frank Abacherli
1995	Cole Information Services	29875 Newport Road	Abacherli, Frank
1992	Cole Information Services	29875 Newport Road	Abacherli Dairy Abacherli, Frank Graham, Leona
1990	Haines Criss-Cross Directory	29875 Newport Road	Abacherli Dairy Abacherli Frank Abacherli Jim Graham Leona
1985	Haines Criss-Cross Directory	29875 Newport Road	Abacherli Dairy Abacherli Frank Abacherli Jim Graham Leona

No listings which would indicate an historic recognized environmental condition were found.

7.1.5 Sanborn Map Review

Sanborn Fire Insurance Maps for the parcel were requested from EDR-Sanborn, which owns and maintains the largest and most complete collection of the maps. Source sheets were not available for the Site. The Sanborn Map Report is included in Appendix B.

7.1.6 Chain of Title

GeoTek has not received, nor was authorized to obtain, Chain-of-Title documents as part of this assessment.

7.2 Historical Immediately Surrounding Property Usage

7.2.1 Aerial Photograph Review

GeoTek reviewed aerial photographs dated 1938, 1953, 1961, 1967, 1978, 1985, 1989, 1996, 2002, 2005, 2006, 2009, 2010 and 2012 (see Appendix B).

Newport Road and Briggs Road can be observed in the 1938 aerial photograph. The surrounding properties to the north, west and south appear to be vacant land. Structures can be observed on the property to the east.

The property to the north appears to be dry farmed in the 1953 aerial photograph. The properties to the west and south appear to be vacant land. Structures can be observed on the property to the east.

The properties to the north and west appear to be vacant land in the 1961, 1967, 1978, 1985, 1989, 1996 and 2002 aerial photographs. Structures can be observed on the properties to the east and south.

Residential development can be observed on the property to the north in the 2005 aerial photograph. The property to the west is vacant land. Structures can be observed on the properties to the east and south.

Residential development can be observed on the property to the north in the 2006, 2009, 2010 and 2012 aerial photographs. The property to the west is graded for residential development. Structures can be observed on the properties to the east and south.

7.2.2 TOPOGRAPHIC MAP REVIEW

GEOTEK reviewed the Elsinore Quadrangle (30-minute series), dated 1901; the Murrieta Quadrangle (15-minute series), dated 1942; the Murrieta Quadrangle (15-minute series), dated 1943; the Romoland and Winchester Quadrangles (7.5-minute series), dated 1953; the Romoland and Winchester Quadrangles (7.5-minute series), dated 1973; the Romoland and Winchester Quadrangles (7.5-minute series), dated 1979; and the Romoland and Winchester Quadrangles (7.5-minute series), dated 2012 (see Appendix B).

Structures can be observed on the property to the east on the 1901 topographic map sheet. The remaining surrounding properties appear to be vacant land.

Structures can be observed on the properties to the east and south on the 1942, 1943, 1953, 1973 and 1979 topographic map sheets. The remaining surrounding properties appear to be vacant land.

The 2012 maps show little detail other than streets in the vicinity.

7.2.3 CITY DIRECTORIES

GEOTEK has reviewed a City Directory Image report obtained from and provided by EDR for the Site and surrounding property addresses. The City Directory Image report provides information on multiple nearby property addresses. The listings do not appear to present an obvious environmental concern to the subject Site.

7.2.4 SANBORN MAP REVIEW

Sanborn Fire Insurance Maps for the Site were requested from EDR-Sanborn, which owns and maintains the largest and most complete collection of the maps. According to EDR, no coverage was available for the property; therefore it is not likely that coverage would be available for the adjoining properties. The Sanborn Map Report is included in Appendix B.

7.3 HISTORICAL USE SUMMARY

Based on readily available historic information, the Site appears to have been vacant land from approximately 1938 until 1985, when the existing Site structures and Site improvements can be observed. The surrounding properties appear to historically have been vacant land or occupied with structures since at least 1938.

Data gaps exist from 1901 to 1938, 1943 to 1953, 1953 to 1961, 1989 to 1996 and 1996 to 2002 due to the limited records which are reasonably ascertainable in the local area. However, it is our opinion that additional historic information, if it were to become available, is not likely to change the conclusions or recommendations of this assessment.

8.0 SIGNIFICANT DATA GAPS

No significant data gaps were discovered while performing this Phase I Environmental Site Assessment. Therefore, it is our opinion that sufficient information was obtained to identify current Site conditions and past Site usage.

Minor data gaps include:

- Gaps in the historic records from 1901 to 1938, 1943 to 1953, 1953 to 1961, 1989 to 1996 and 1996 to 2002.
- GEOTEK was not provided with, nor authorized to obtain, a chain-of-title report for this assessment. However, it is our opinion that a review of chain-of-title documents will not change the conclusions or recommendations of this assessment.

It is our opinion that additional information, if it were to become available, is not likely to change the conclusions or recommendations of this assessment.

9.0 CONCLUSIONS AND RECOMMENDATIONS

GEOTEK has performed a Phase I Environmental Site Assessment (ESA) for the subject Site in substantial conformance with the scope and limitations of ASTM E 1527-13 and GEOTEK Proposal No. P-1104115, dated November 25, 2015. Any exceptions to, or deletions from, this practice are described in the appropriate section(s) of this report.

This Phase I Environmental Site Assessment has not revealed evidence of a recognized environmental condition or concern in connection with the subject Site. No additional environmental investigation is necessary.

Due to the apparent age of the Site structures, federal regulations require an asbestos containing materials (ACM) and lead based paint (LBP) survey must be performed on the existing Site structures when the structures are not occupied and prior to demolition.

10.0 CERTIFICATIONS

I declare that, to the best of my professional knowledge and belief, I meet the definition of Environmental Professional as defined in 40 CFR 312. I have the specific qualifications based on education, training, and experience to assess a property of the nature, history, and setting of the subject Site. I have developed and performed the all appropriate inquiries in conformance with the standards and practices set forth in 40 CFR 312.

The qualifications of the Project Team are included in Appendix E.

We appreciate this opportunity to be of service. If you have any questions, or if we can be of further service, please contact us at (951) 710-1160.

Sincerely,
GEOTEK, INC.

REGISTERED GEOLOGIST
EDWARD H. LaMONT
No. 1892
Exp.____
Certified Engineering Geologist
STATE OF CALIFORNIA

Edward H. LaMont
Principal Geologist
Exp. 07/31/2016

J. Michael Batten, CEM, REPA
Environmental Services Manager
Registered Environmental Property
Assessor No. 113162
Expires 06/15/2016

Anna M. Scott
Project Geologist

G:\Projects\1401 to 1450\1414CR Excel Engineering 29875 Newport Road Menifee\ESA\1414CR Phase I Environmental Site Assessment 29875 Newport Road.DOC

11.0 REFERENCES

CALIFORNIA, STATE OF

- Geologic Map and Digital Database of the Romoland 7.5' Quadrangle, Riverside County, California, 2003, Morton, D.M., Bovard, K.R., and Morton, Gregory, U.S. Geological Survey OF-2003-102, scale 1:24,000.
- Water Resources, Department of Hydrologic Data

ENVIRONMENTAL DATA RESOURCES, INC.

- Aerial Photo Decade Package, Inquiry No. 4490591.12, dated December 15, 2015.
- Certified Sanborn Map Report, Inquiry No. 4490591.3, dated December 11, 2015.
- City Directory Image Report, Inquiry No. 4490591.5, dated December 14, 2015.
- Environmental Lien and AUL Search, Inquiry No. 4490591.7S, dated December 15, 2015.
- Historical Topo Map Report, Inquiry No. 4490591.4, dated December 11, 2015.
- Property Tax Map Report, Inquiry No. 4490591.6, dated December 11, 2015.
- Radius Map Report, Inquiry No. 4490591.2s, dated December 11, 2015.
- Vapor Encroachment Screen Report, Inquiry No. 4490591.9s, dated December 14, 2015.

RIVERSIDE, COUNTY OF

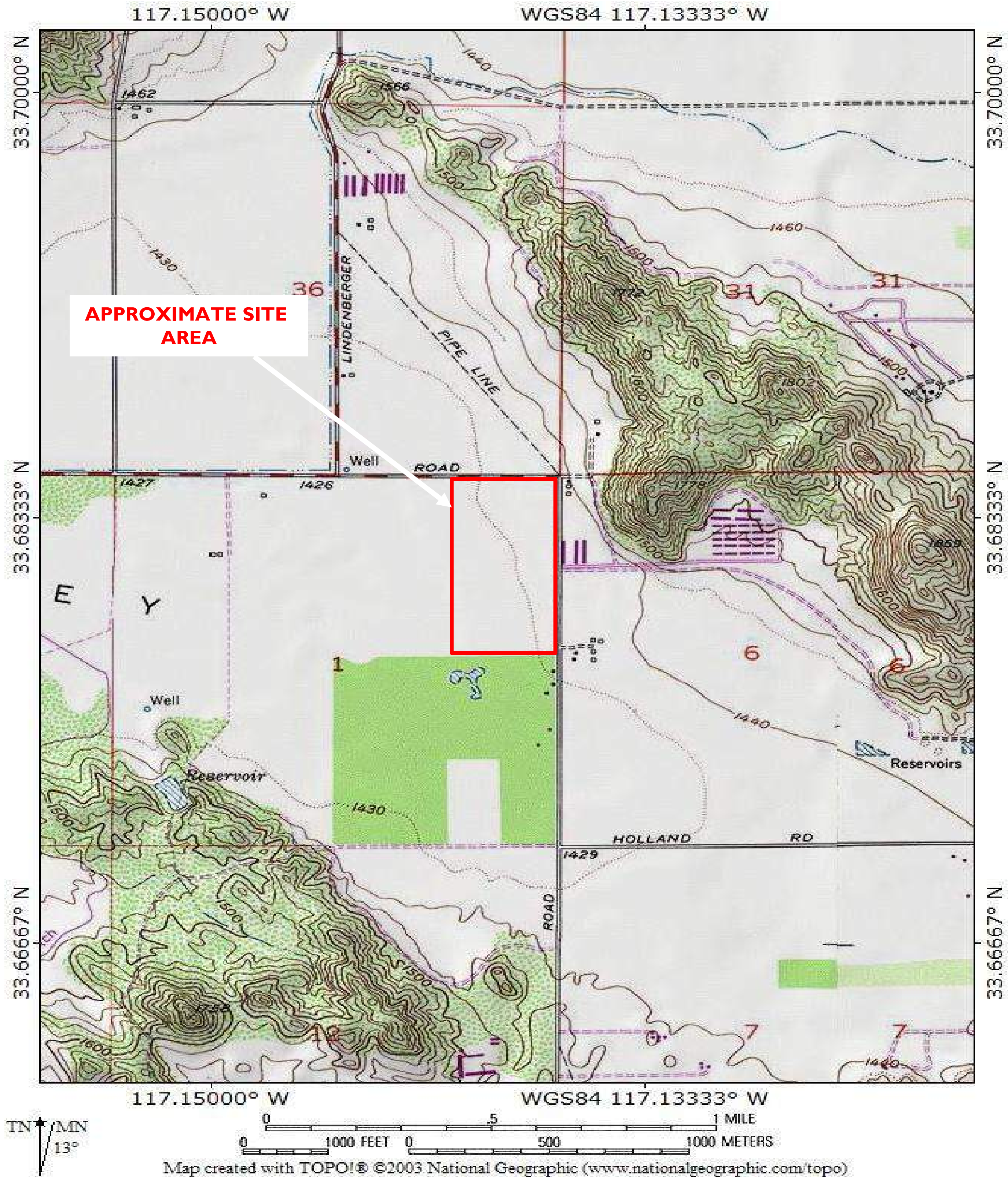
- Assessor's Department
- Building Department, Records Inquiry
- Fire Department, Records Inquiry
- Sherriff's Department, Records Inquiry

U.S. GOVERNMENT

- Drug Enforcement Agency
- Records inquiry, http://www.dea.gov/seizures
- Federal Emergency Management Agency (FEMA)

APPENDIX A

FIGURES



Excel Engineering
APN 364-190-004
29875 Newport Road
Menifee, Riverside County, California

GeoTek Project No. 1414-CR

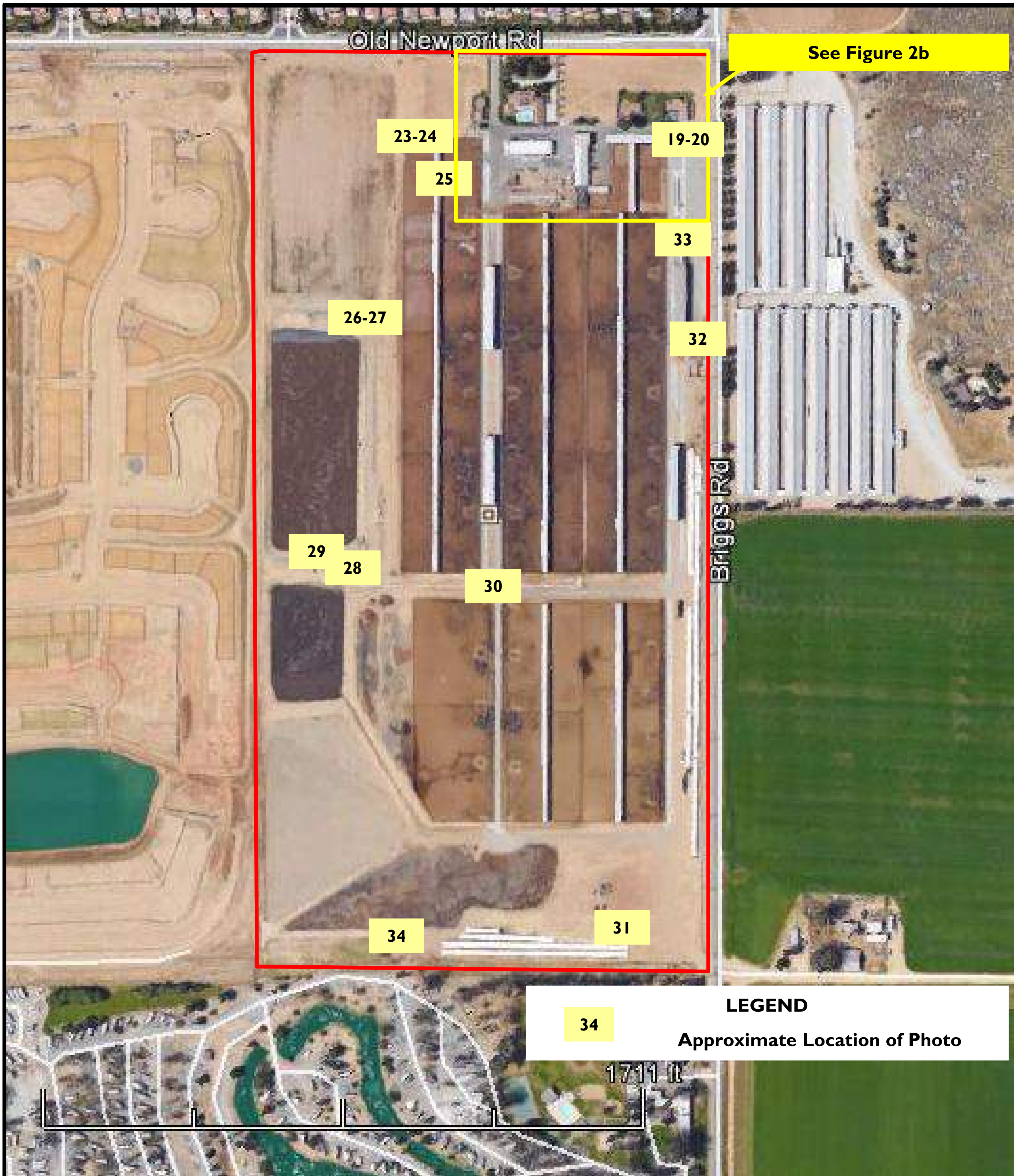
N

Modified from USGS
7.5 Topographic Map

Figure 1

Site Location Map

GEOTEK



Excel Engineering
APN 364-190-004
29875 Newport Road
Menifee, Riverside County, California

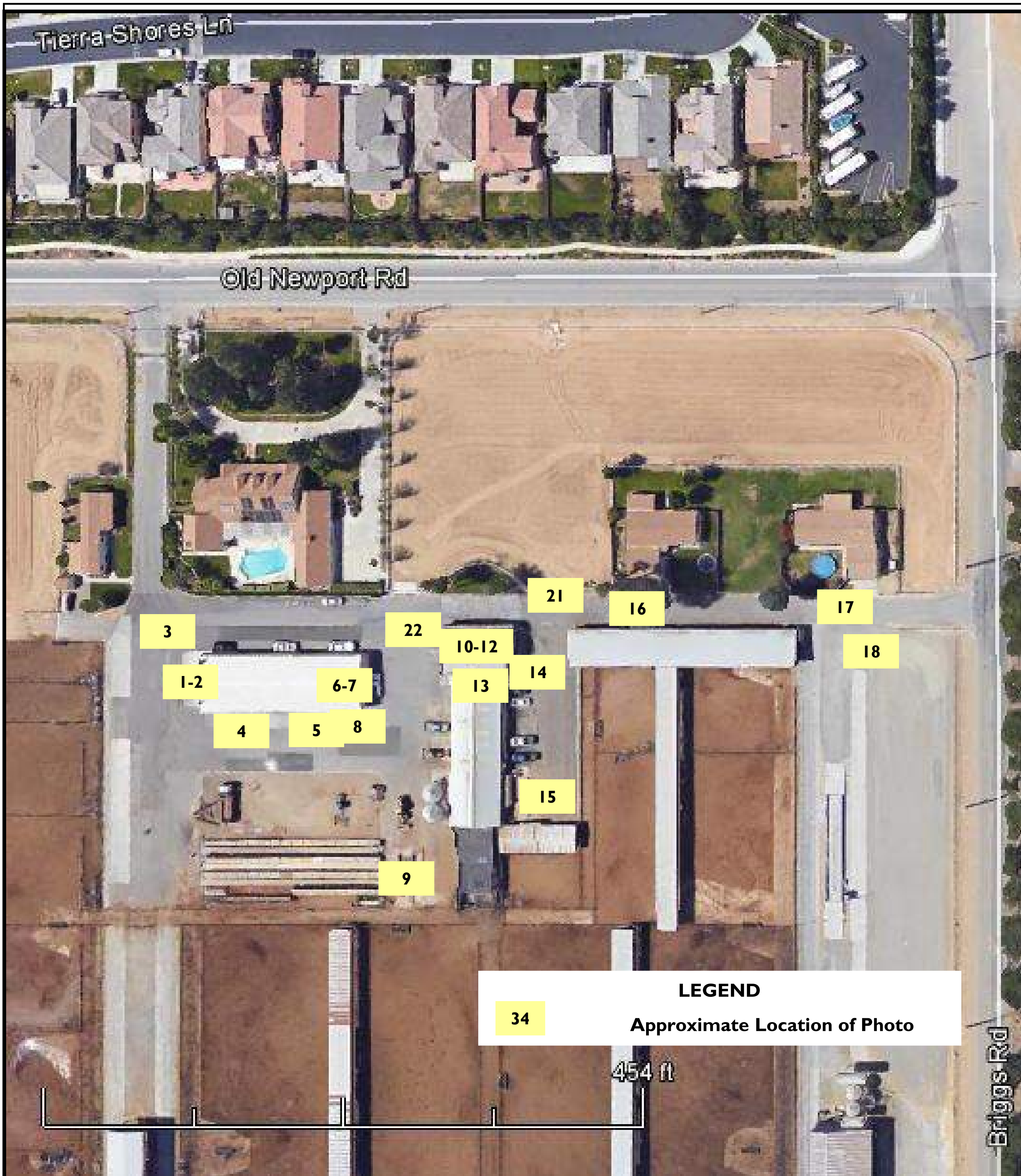
GeoTek Project No. 1414-CR

N

Figure 2a

General Site Layout Map

GEOTEK



Excel Engineering
APN 364-190-004
29875 Newport Road
Menifee, Riverside County, California

GeoTek Project No. 1414-CR

N

Figure 2b

General Site Layout Map

GEOTEK

APPENDIX B

SUPPORTING DOCUMENTS

Abacherli Dairy
29875 Newport Road
Menifee, CA 92584

Inquiry Number: 4490591.12
December 15, 2015

The EDR Aerial Photo Decade Package

6 Armstrong Road, 4th Floor
Shelton, Connecticut 06484
Toll Free: 800.352.0050
www.edrnet.com

EDR Aerial Photo Decade Package

Environmental Data Resources, Inc. (EDR) Aerial Photo Decade Package is a screening tool designed to assist environmental professionals in evaluating potential liability on a target property resulting from past activities. EDR's professional researchers provide digitally reproduced historical aerial photographs, and when available, provide one photo per decade.

When delivered electronically by EDR, the aerial photo images included with this report are for ONE TIME USE ONLY. Further reproduction of these aerial photo images is prohibited without permission from EDR. For more information contact your EDR Account Executive.

Thank you for your business.
Please contact EDR at 1-800-352-0050
with any questions or comments.

Date EDR Searched Historical Sources:

Aerial Photography December 15, 2015

Target Property:

29875 Newport Road

Menifee, CA 92584

Year	***Scale***	***Details***	***Source***
1938	Aerial Photograph. Scale: 1"=500'	Flight Year: 1938	USGS
1953	Aerial Photograph. Scale: 1"=500'	Flight Year: 1953	USGS
1961	Aerial Photograph. Scale: 1"=500'	Flight Year: 1961	USGS
1967	Aerial Photograph. Scale: 1"=500'	Flight Year: 1967	USGS
1978	Aerial Photograph. Scale: 1"=500'	Flight Year: 1978	USGS
1985	Aerial Photograph. Scale: 1"=500'	Flight Year: 1985	USGS
1989	Aerial Photograph. Scale: 1"=500'	Flight Year: 1989	USGS
1996	Aerial Photograph. Scale: 1"=500'	Flight Year: 1996	USGS
2002	Aerial Photograph. Scale: 1"=500'	/DOQQ - acquisition dates: 2002	USGS/DOQQ
2005	Aerial Photograph. Scale: 1"=500'	Flight Year: 2005	USDA/NAIP
2006	Aerial Photograph. Scale: 1"=500'	Flight Year: 2006	USDA/NAIP
2009	Aerial Photograph. Scale: 1"=500'	Flight Year: 2009	USDA/NAIP
2010	Aerial Photograph. Scale: 1"=500'	Flight Year: 2010	USDA/NAIP
2012	Aerial Photograph. Scale: 1"=500'	Flight Year: 2012	USDA/NAIP


INQUIRY #: 4490591.12
YEAR: 1938
= 500'
N
EDR


INQUIRY #: 4490591.12
YEAR: 1953
= 500'
N
EDR


INQUIRY #: 4490591.12
YEAR: 1961
= 500'
N
EDR


INQUIRY #: 4490591.12
YEAR: 1967
= 500'
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EDR


INQUIRY #: 4490591.12
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= 500'
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EDR
189


INQUIRY #: 4490591.12
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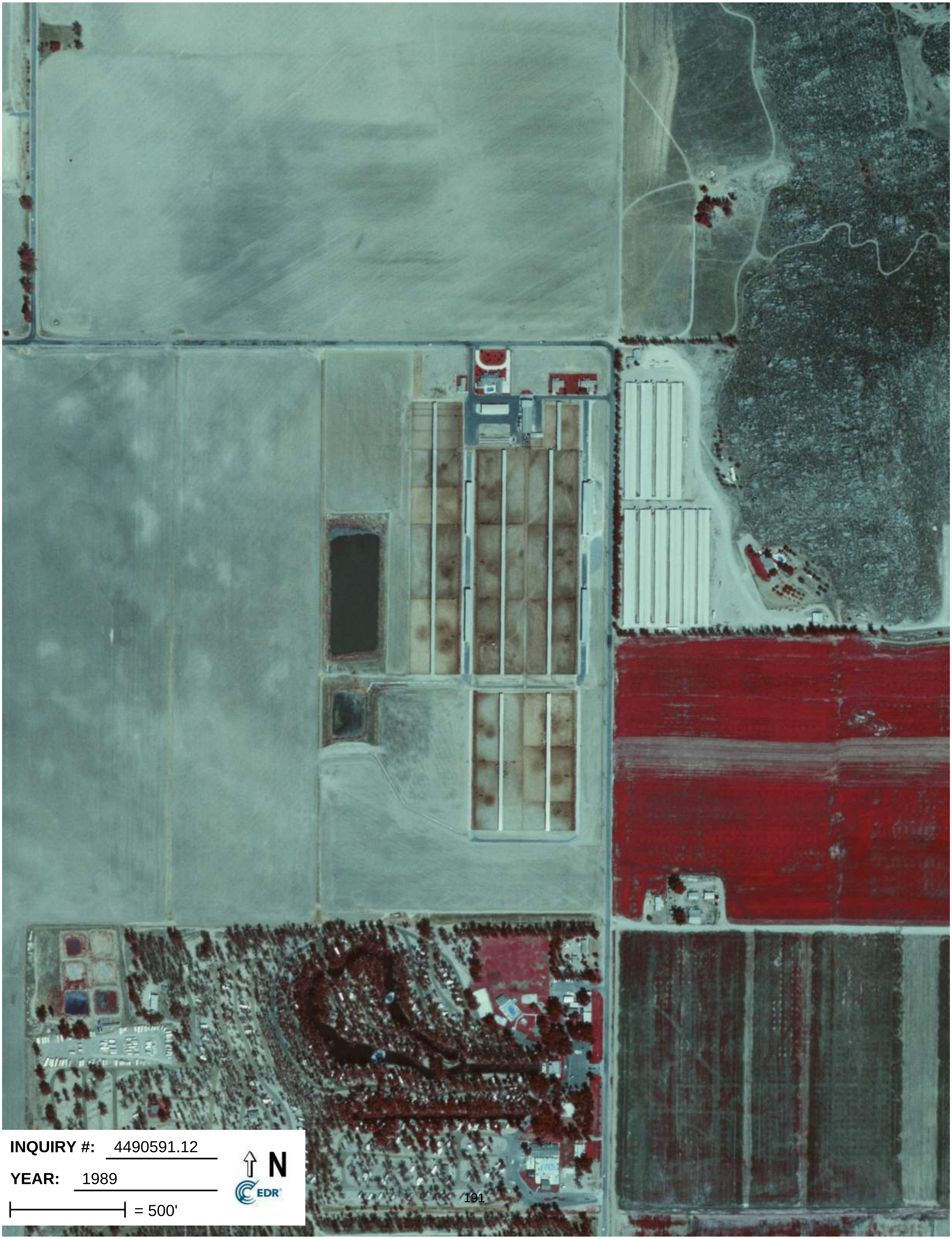
EDR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EDR

INQUIRY #: 4490591.12

YEAR: 1996

= 500'

N

EDR


INQUIRY #: 4490591.12
YEAR: 2002
= 500'
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EDR


INQUIRY #: 4490591.12
YEAR: 2005
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INQUIRY #: 4490591.12
YEAR: 2006
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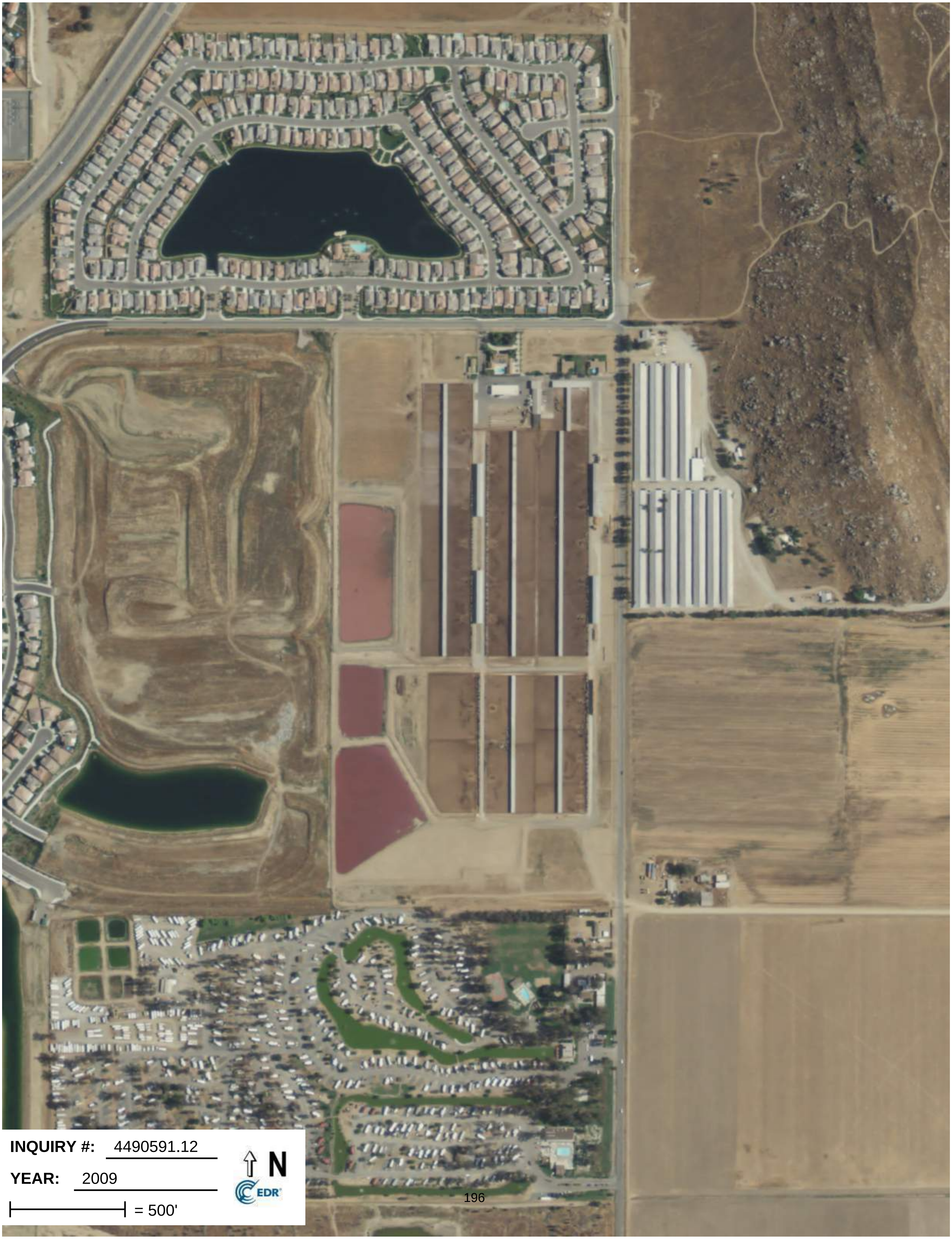
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INQUIRY #: 4490591.12
YEAR: 2010
= 500'
N
EDR


INQUIRY #: 4490591.12
YEAR: 2012
= 500'
N
EDR

Abacherli Dairy
29875 Newport Road
Menifee, CA 92584

Inquiry Number: 4490591.3
December 11, 2015

Certified Sanborn® Map Report

EDR®

6 Armstrong Road, 4th Floor
Shelton, Connecticut 06484
Toll Free: 800.352.0050
www.edrnet.com

Certified Sanborn® Map Report

12/11/15

Site Name:	**Client Name:**
Abacherli Dairy	Geotek Inc
29875 Newport Road	710 East Parkridge Ave, Suite
Menifee, CA 92584	Corona, CA 92879-0000
EDR Inquiry # 4490591.3	Contact: Anna M. Scott

The Sanborn Library has been searched by EDR and maps covering the target property location as provided by Geotek Inc were identified for the years listed below. The Sanborn Library is the largest, most complete collection of fire insurance maps. The collection includes maps from Sanborn, Bromley, Perris & Browne, Hopkins, Barlow, and others. Only Environmental Data Resources Inc. (EDR) is authorized to grant rights for commercial reproduction of maps by the Sanborn Library LLC, the copyright holder for the collection. Results can be authenticated by visiting www.edrnet.com/sanborn.

The Sanborn Library is continually enhanced with newly identified map archives. This report accesses all maps in the collection as of the day this report was generated.

Certified Sanborn Results:

Site Name: Abacherli Dairy
Address: 29875 Newport Road
City, State, Zip: Menifee, CA 92584
Cross Street:
P.O. # NA
Project: 1414-CR
Certification # 3D7F-4B1F-B3E3

UNMAPPED PROPERTY

This report certifies that the complete holdings of the Sanborn Library, LLC collection have been searched based on client supplied target property information, and fire insurance maps covering the target property were not found.

Sanborn® Library search results
Certification # 3D7F-4B1F-B3E3

The Sanborn Library includes more than 1.2 million fire insurance maps from Sanborn, Bromley, Perris & Browne, Hopkins, Barlow and others which track historical property usage in approximately 12,000 American cities and towns. Collections searched:

- ✔ Library of Congress
- ✔ University Publications of America
- ✔ EDR Private Collection

The Sanborn Library LLC Since 1866™

Limited Permission To Make Copies

Geotek Inc (the client) is permitted to make up to FIVE photocopies of this Sanborn Map transmittal and each fire insurance map accompanying this report solely for the limited use of its customer. No one other than the client is authorized to make copies. Upon request made directly to an EDR Account Executive, the client may be permitted to make a limited number of additional photocopies. This permission is conditioned upon compliance by the client, its customer and their agents with EDR's copyright policy; a copy of which is available upon request.

Abacherli Dairy
29875 Newport Road
Menifee, CA 92584

Inquiry Number: 4490591.5
December 14, 2015

The EDR-City Directory Image Report

Environmental Data Resources Inc

6 Armstrong Road
Shelton, CT 06484
800.352.0050
www.edrnet.com

TABLE OF CONTENTS

SECTION

Thank you for your business.
Please contact EDR at 1-800-352-0050
with any questions or comments.

EXECUTIVE SUMMARY

DESCRIPTION

Environmental Data Resources, Inc.'s (EDR) City Directory Report is a screening tool designed to assist environmental professionals in evaluating potential liability on a target property resulting from past activities. EDR's City Directory Report includes a search of available city directory data at 5 year intervals.

RESEARCH SUMMARY

The following research sources were consulted in the preparation of this report. A check mark indicates where information was identified in the source and provided in this report.

Year	***Target Street***	***Cross Street***	***Source***
2013	☑	☐	Cole Information Services
2008	☑	☐	Cole Information Services
2003	☑	☐	Cole Information Services
1999	☑	☐	Cole Information Services
1995	☑	☐	Cole Information Services
1992	☑	☐	Cole Information Services
1990	☑	☐	Haines Criss-Cross Directory
1985	☑	☐	Haines Criss-Cross Directory
1980	☐	☐	Haines Criss-Cross Directory
1975	☑	☐	Haines Criss-Cross Directory

RECORD SOURCES

EDR is licensed to reproduce certain City Directory works by the copyright holders of those works. The purchaser of this EDR City Directory Report may include it in report(s) delivered to a customer. Reproduction of City Directories without permission of the publisher or licensed vendor may be a violation of copyright.

FINDINGS

TARGET PROPERTY STREET

29875 Newport Road
Menifee, CA 92584

Year	*CD Image*	*Source*	
NEWPORT RD			
2013	pg A1	Cole Information Services	
2008	pg A2	Cole Information Services	
2003	pg A3	Cole Information Services	
1999	pg A4	Cole Information Services	
1995	pg A5	Cole Information Services	
1992	pg A6	Cole Information Services	
1990	pg A7	Haines Criss-Cross Directory	
1985	pg A8	Haines Criss-Cross Directory	
1980	-	Haines Criss-Cross Directory	Target and Adjoining not listed in Source
1975	pg A9	Haines Criss-Cross Directory	

FINDINGS

CROSS STREETS

No Cross Streets Identified

City Directory Images

NEWPORT RD 2013

28307	BASIC EDUC SERVICES TEAM
29865	CLAUDIA MARQUEZ
29875	ABACHERLI DAIRY
29905	SAUL YANEZ
29907	VANESSA SIGWING

NEWPORT RD 2008

28307	EMMONS CO
	MENIFEE LAKES MASTER ASSOCIATION
	PALMILLA HOMEOWNERS ASSOCIATION INC
29865	CLAUDIA MARQUEZ
29875	ABACHERLI DAIRY
	FRANK ABACHERLI
29905	SAUL YANEZ
29907	VANESSA SIGWING

NEWPORT RD 2003

29865	VANESSA SIGWING
29875	FRANK ABACHERLI
29905	JOSE CAMACHO
29907	OCCUPANT UNKNOWN

NEWPORT RD 1999

28307	ALTERNATIVE REAL ESTATE CONCEPTS
29875	ABACHERLI DAIRY
	FRANK ABACHERLI
29905	JOSE CAMACHO
29907	VANESSA SIGWING

Target Street	Cross Street	Source
✓	-	Cole Information Services

NEWPORT RD 1995

29865	OCCUPANT UNKNOWNN
29875	ABACHERLI, FRANK
29905	OCCUPANT UNKNOWNN
29907	EDWARDS, STEVEN

NEWPORT RD 1992

28250	LUSK COMPANY
28307	LUSK CO THE
29875	ABACHERLI DAIRY
	ABACHERLI, FRANK
	GRAHAM, LEONA
29907	ABACHERLI, RON

Target Street	Cross Street	Source
✓	-	Haines Criss-Cross Directory

NEWPORT RD 1990

NEWPORT RD (85) 92355 SUN CITY

25355	★HUNTINGTON BEACH CO	679-5156	7
	PEREZ Adolfo	679-0320	5
25601	SMITH Harold W	679-4427	
27090	NESS Lyle	672-2668	+0
	NESS Patricia	672-2668	+0
27160	DEITRICK Brent A	679-3310	
28250	★LAKE CONSLTNT&CONST	672-1268	+0
	★LUSK COMPANY	672-4951	9
	★MENIFEE LKS CLUB	672-4976	+0
	★MENIFEE LKS PRO SHP	679-8851	+0
	★MENIFEE P P CONSTR	679-9986	+0
	★PALOMAR GRDNG&PAVN	672-4978	+0
28307	★LUSK CO THE	672-1995	+0
29010	★L S I ENGINEERING	679-8871	9
29875	★ABACHERLI DAIRY	679-0747	3
	ABACHERLI Frank	672-2401	5
	ABACHERLI Jim	672-1714	5
	GRAHAM Leona	672-1617	5
29905	XXXX	00	
30050	XXXX	00	

★ 10 BUS 10 RES 8 NEW

Target Street	Cross Street	Source
✓	-	Haines Criss-Cross Directory

NEWPORT RD 1985

NEWPORT RD 92381
SUN CITY

25355	PEREZ DOLFO	679-0320	+5
25601	SMITH HAROLD W	679-4427	6
27090	REISMAN MILTON	672-1362	+5
27160	DEITRICK BRENT A	679-3310	
29875	ABACHERLI DAIRY	679-0747	3
	ABACHERLI FRANK	672-2401	+5
	ABACHERLI JIM	672-1714	+5
	GRAHAM LEONA	672-1617	+5
29907	ABACHERLI RON	679-6043	+5
30050	ACOSTA TERI	679-4655	+5

* 1 BUS 9 RES 7 NEW

Target Street	Cross Street	Source
✓	-	Haines Criss-Cross Directory

NEWPORT RD 1975

NEWPORT RD 92380 ROMOLAND

27160	DEITRICK BRENT A	679-3310
27980	ETCHEGARAY SAM	679-5658+5
29251	ORTIZ JUAN	679-1450
29980	HERNANDEZ PETRA	679-3424
30050	HOLMES RALPH	679-3332
NO #	SMITH HAROLD W	679-4427

* 0 BUS 6 RES 1 NEW

Abacherli Dairy
29875 Newport Road
Menifee, CA 92584

Inquiry Number: 4490591.7
December 15, 2015

EDR Environmental Lien and AUL Search

6 Armstrong Road
Shelton, CT 06484
800.352.0050
www.edrnet.com

Environmental Data Resources Inc

EDR Environmental Lien and AUL Search

The EDR Environmental Lien and AUL Search Report provides results from a search of available current land title records for environmental cleanup liens and other activity and use limitations, such as engineering controls and institutional controls.

A network of professional, trained researchers, following established procedures, uses client supplied address information to:

- search for parcel information and/or legal description;
- search for ownership information;
- research official land title documents recorded at jurisdictional agencies such as recorders' offices, registries of deeds, county clerks' offices, etc.;
- access a copy of the deed;
- search for environmental encumbering instrument(s) associated with the deed;
- provide a copy of any environmental encumbrance(s) based upon a review of key words in the instrument(s) (title, parties involved, and description); and
- provide a copy of the deed or cite documents reviewed.

Thank you for your business.
Please contact EDR at 1-800-352-0050
with any questions or comments.

EDR Environmental Lien and AUL Search

TARGET PROPERTY INFORMATION

ADDRESS

29875 Newport Road
Abacherli Dairy
Menifee, CA 92584

RESEARCH SOURCE

Source 1:

Riverside Recorder
Riverside, CA

PROPERTY INFORMATION

Deed 1:

Type of Deed:	deed
Title is vested in:	Frederick A & Lindi S Abacherli Trustees
Title received from:	Frederick A & Lindi S Abacherli
Deed Dated	3/9/2015
Deed Recorded:	3/10/2015
Book:	NA
Page:	na
Volume:	na
Instrument:	na
Docket:	NA
Land Record Comments:	
Miscellaneous Comments:	
Legal Description:	See Exhibit
Legal Current Owner:	Frederick A & Lindi S Abacherli Trustees
Parcel # / Property Identifier:	364-190-004
Comments:	See Exhibit

ENVIRONMENTAL LIEN

Environmental Lien: Found ☐ Not Found ☒

OTHER ACTIVITY AND USE LIMITATIONS (AULs)

AULs: Found ☐ Not Found ☒

Deed Exhibit 1

DOC # 2015-0094623
03/10/2015 12:23P Fee:28.00
Page 1 of 2
Recorded in Official Records
County of Riverside
Peter Aldana
Assessor, County Clerk & Recorder

C
606

2950

RECORDING REQUESTED BY:

Attorney Anita Cheek Milner

AND WHEN RECORDED MAIL TO,
AND MAIL TAX STATEMENT TO:

Abacherli Family Trust
45004 Chaplan Way
Temecula, CA 92590

S	R	U	PAGE	SIZE	DA	MISC	LONG	RFD	COPY
1			2		1				150
M	A	L	465	426	PCOR	NCOR	SMF	NCHG	EXAM
					T:		CTY	UNI	606

APN 364-190-004

QUITCLAIM DEED

THE UNDERSIGNED GRANTORS DECLARE:
Exempt transaction - no documentary transfer tax due. This conveyance transfers the grantors' interest into the grantors' revocable living trust. R&T §11930.

☐ Unincorporated area ☒ City of Menifee , and

FOR A VALUABLE CONSIDERATION, receipt of which is hereby acknowledged,

FREDERICK A. ABACHERLI and LINDI ABACHERLI, husband and wife as community property with right of survivorship, as to an undivided 7.45% interest,

hereby remise, release and forever quitclaim to

FREDERICK A. ABACHERLI and LINDI S. ABACHERLI, as Co-Trustees of the ABACHERLI FAMILY TRUST, UDT dtd 3/4/2015,

the following described real property in the City of Menifee, County of Riverside, State of California:

property in the County of Riverside, State of California, described as:

The East half of the Northeast quarter of Section 1, Township 6 South, Range 3 West, San Bernardino Base and Meridian, in the County of Riverside, State of California, according to the official Plat thereof. (APN: 364-190-004)

By their signatures hereto the undersigned, FREDERICK A. ABACHERLI and LINDI ABACHERLI, hereby expressly declare that this transmutation of separate property to community property of husband and wife is made, joined in, consented to, and accepted by FREDERICK A. ABACHERLI and LINDI S. ABACHERLI in accordance with Sections 850, *et seq.*, of the Family Code, and Section 682.1(a) of the Civil Code, of the State of California.

Dated: March 9, 2015

Frederick A. Abacherli
FREDERICK A. ABACHERLI

Lindi S. Abacherli
LINDI S. ABACHERLI

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

ACKNOWLEDGMENTS

STATE OF CALIFORNIA

COUNTY OF RIVERSIDE

On March 9, 2015, before me, APRIL MAURINE PROFFITT, Notary Public, personally appeared FREDERICK A. ABACHERLI and LINDI S. ABACHERLI, who proved to me on the basis of satisfactory evidence to be the persons whose names are subscribed to the within instrument, and personally acknowledged to me that they executed the same in their authorized capacities, and that by their signatures on the instrument the persons, or the entity upon behalf of which the persons acted, executed the instrument.

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

WITNESS my hand and official seal.

APRIL MAURINE PROFFITT
COMM. #2019023
Notary Public - California
Riverside County
My Comm. Expires Apr. 11, 2017

April Maurine Proffitt
Notary Public in and for said County and State

MISCELLANEOUS EXHIBITS

RECORDING REQUESTED BY
Taylor, Simonson & Winter LLP

AND WHEN RECORDED MAIL THIS DEED
AND, UNLESS OTHERWISE SHOWN BELOW,
MAIL TAX STATEMENTS TO:

NAME: Shirley M. Abacherli,
Jeanette M. Sutherlin, &
Ronald F. Abacherli, Trustees

ADDRESS: 29875 Newport Road
Menifee, CA 92584

APN: 364-190-004

DOC # 2014-0104158
03/21/2014 08:00A Fee:28.00
Page 1 of 2
Recorded in Official Records
County of Riverside
Larry W. Ward
Assessor, County Clerk & Recorder

S	R	U	PAGE	SIZE	DA	MISC	LONG	RFD	COPY
1			2						150
M	A	L	465	426	PCOR	NCOR	SMF	NCHG	EXAM
					T:		CTY	UNI	034

The undersigned grantor(s) declare(s):
DOCUMENTARY TRANSFER TAX IS $0.00 (*)

29.50

GRANT DEED

[ ] Computed on Full Value of property conveyed, or
[ ] Computed on Full Value less liens and encumbrances remaining at the time of sale.

M
034

SHIRLEY M. ABACHERLI, JEANETTE M. SUTHERLIN, and RONALD F. ABACHERLI, Trustees of the Abacherli Family Trust created by instrument dated October 6, 1989, the undersigned grantors, for a valuable consideration, receipt of which is hereby acknowledged, do hereby grant to SHIRLEY M. ABACHERLI, JEANETTE M. SUTHERLIN, and RONALD F. ABACHERLI, Trustees of the Exemption Trust established under the Abacherli Family Trust, dated October 6, 1989, as to an undivided sixty-two and 75/100 percent (62.75%) interest, and to SHIRLEY M. ABACHERLI, JEANETTE M. SUTHERLIN, and RONALD F. ABACHERLI, Trustees of the Marital Trust established under the Abacherli Family Trust, dated October 6, 1989, as to an undivided thirty-seven and 25/100 percent (37.25%) interest in and to the following described real property situated in the County of Riverside, State of California:

The East half of the Northeast quarter of Section 1, Township 6 South, Range 3 West, San Bernardino Base and Meridian, in the County of Riverside, State of California, according to the official Plat thereof.

* "This is a bona fide gift and the grantor received nothing in return, R & T 11911."

Executed on March 4, 2014, at Claremont, California.

Shirley M. Abacherli
SHIRLEY M. ABACHERLI, Trustee of the Abacherli Family Trust created by instrument dated October 6, 1989

Jeanette M. Sutherlin
JEANETTE M. SUTHERLIN, Trustee of the Abacherli Family Trust created by instrument dated October 6, 1989

Ronald F. Abacherli
RONALD F. ABACHERLI, Trustee of the Abacherli Family Trust created by instrument dated October 6, 1989

MAIL TAX STATEMENTS AS DIRECTED ABOVE

STATE OF CALIFORNIA }
} ss.
COUNTY OF LOS ANGELES }

On March 4, 2014, before me, Jamie Watkins, Notary Public, personally appeared Shirley M. Abacherli, Jeanette M. Sutherlin, and Ronald F. Abacherli, who proved to me on the basis of satisfactory evidence to be the person(s) whose name(s) ~~is~~/are subscribed to the within instrument, and acknowledged to me that ~~he/she~~/they executed the same in ~~his/her~~/their authorized capacity(ies), and that by ~~his/her~~/their signature(s) on this instrument the person(s), or the entity upon behalf of which the person(s) acted, executed the instrument.

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

WITNESS my hand and official seal.

Notary Public

JAMIE WATKINS
COMM. #19906
Notary Public - California
Los Angeles County
My Comm. Expires Sep. 6.

JAMIE WATKINS
COMM. #1990616
Notary Public - California
Los Angeles County
My Comm. Expires Sep. 6, 2016

2 of 2

Abacherli Dairy
29875 Newport Road
Menifee, CA 92584

Inquiry Number: 4490591.4
December 11, 2015

EDR Historical Topo Map Report

with QuadMatch™

6 Armstrong Road, 4th floor
Shelton, CT 06484
Toll Free: 800.352.0050
www.edrnet.com

EDR Historical Topo Map Report

12/11/15

Site Name:	Client Name:
Abacherli Dairy	Geotek Inc
29875 Newport Road	710 East Parkridge Ave, Suite 1(
Menifee, CA 92584	Corona, CA 92879-0000
EDR Inquiry # 4490591.4	Contact: Anna M. Scott

EDR Topographic Map Library has been searched by EDR and maps covering the target property location as provided by Geotek Inc were identified for the years listed below. EDR's Historical Topo Map Report is designed to assist professionals in evaluating potential liability on a target property resulting from past activities. EDRs Historical Topo Map Report includes a search of a collection of public and private color historical topographic maps, dating back to the late 1800s.

Search Results: ***Coordinates:***

Site Name:	Abacherli Dairy	**Latitude:**	33.6814 33° 40' 53" North
Address:	29875 Newport Road	**Longitude:**	-117.1388 -117° 8' 20" West
City,State,Zip:	Menifee, CA 92584	**UTM Zone:**	Zone 11 North
P.O.#	NA	**UTM X Meters:**	487134.46
Project:	1414-CR	**UTM Y Meters:**	3726839.80
		Elevation:	1432.12' above sea level

Maps Provided:

2012
1979
1973
1953
1943
1942
1901

Topo Sheet Thumbnails

This EDR Topo Map Report is based upon the following USGS topographic map sheets.

2012 Source Sheets

Romoland
2012
7.5-minute, 24000

Winchester
2012
7.5-minute, 24000

1979 Source Sheets

Romoland
1979
7.5-minute, 24000
Photo Revised 1979
Aerial Photo Revised 1976

Winchester
1979
7.5-minute, 24000
Photo Revised 1979
Aerial Photo Revised 1976

1973 Source Sheets

Romoland
1973
7.5-minute, 24000
Photo Revised 1973
Aerial Photo Revised 1973

Winchester
1973
7.5-minute, 24000
Photo Revised 1973
Aerial Photo Revised 1973

1953 Source Sheets

Romoland
1953
7.5-minute, 24000
Aerial Photo Revised 1951

Winchester
1953
7.5-minute, 24000
Aerial Photo Revised 1951

Topo Sheet Thumbnails

This EDR Topo Map Report is based upon the following USGS topographic map sheets.

1943 Source Sheets

Murrieta
1943
15-minute, 62500
Aerial Photo Revised 1939

1942 Source Sheets

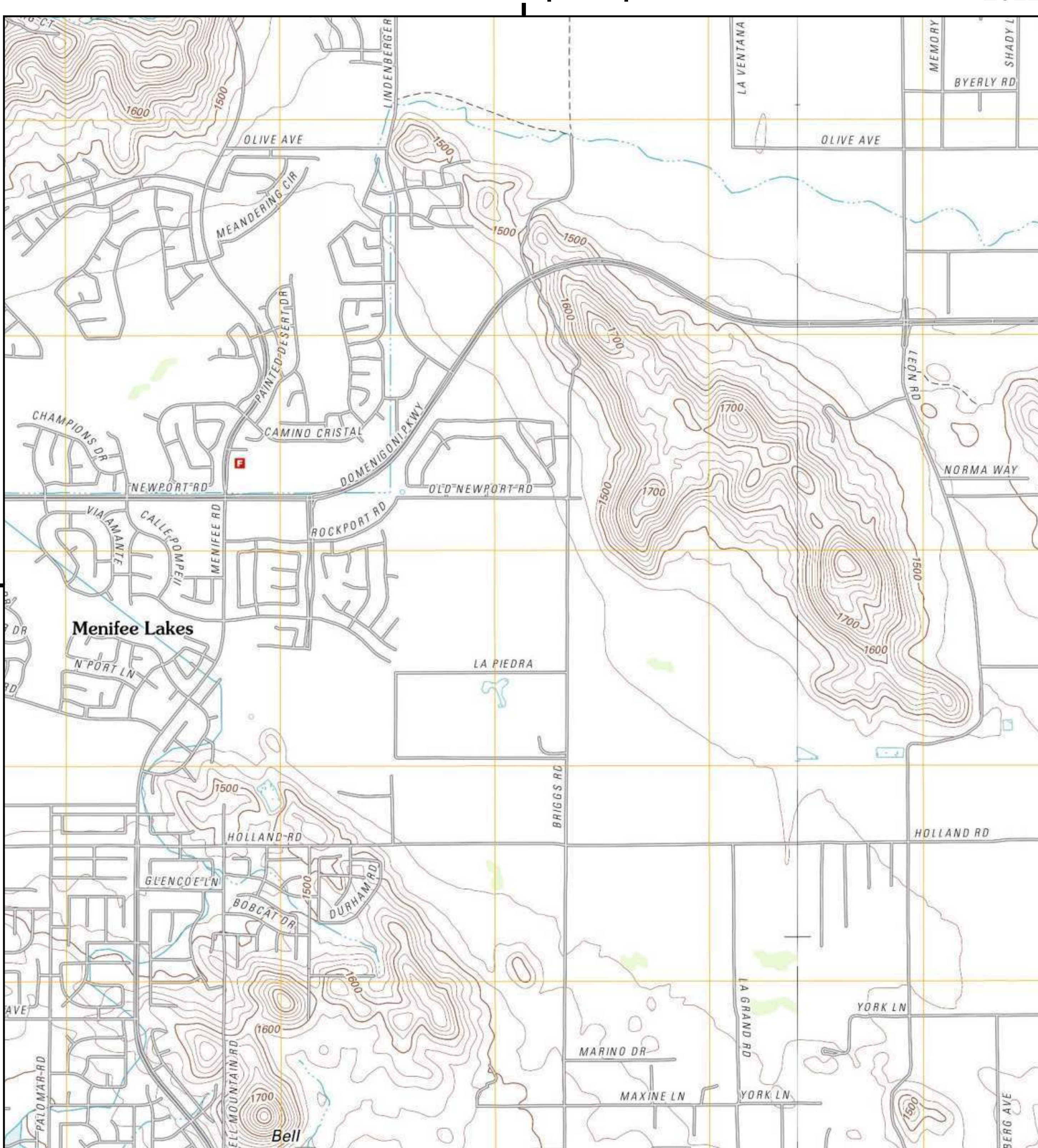
Murrieta
1942
15-minute, 62500
Aerial Photo Revised 1939

1901 Source Sheets

Elsinore
1901
30-minute, 125000

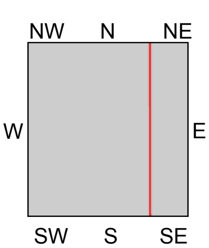
Historical Topo Map

2012



This report includes information from the following map sheet(s).

Miles 0.25 0.5 1 1.5



TP, Romoland, 2012, 7.5-minute

E, Winchester, 2012, 7.5-minute

SITE NAME: Abacherli Dairy
ADDRESS: 29875 Newport Road
Menifee, CA 92584
CLIENT: Geotek Inc

Historical Topo Map

1979

This report includes information from the following map sheet(s).

Miles 0.25 0.5 1 1.5

NW N NE W E SW S SE

TP, Romoland, 1979, 7.5-minute

E, Winchester, 1979, 7.5-minute

SITE NAME: Abacherli Dairy

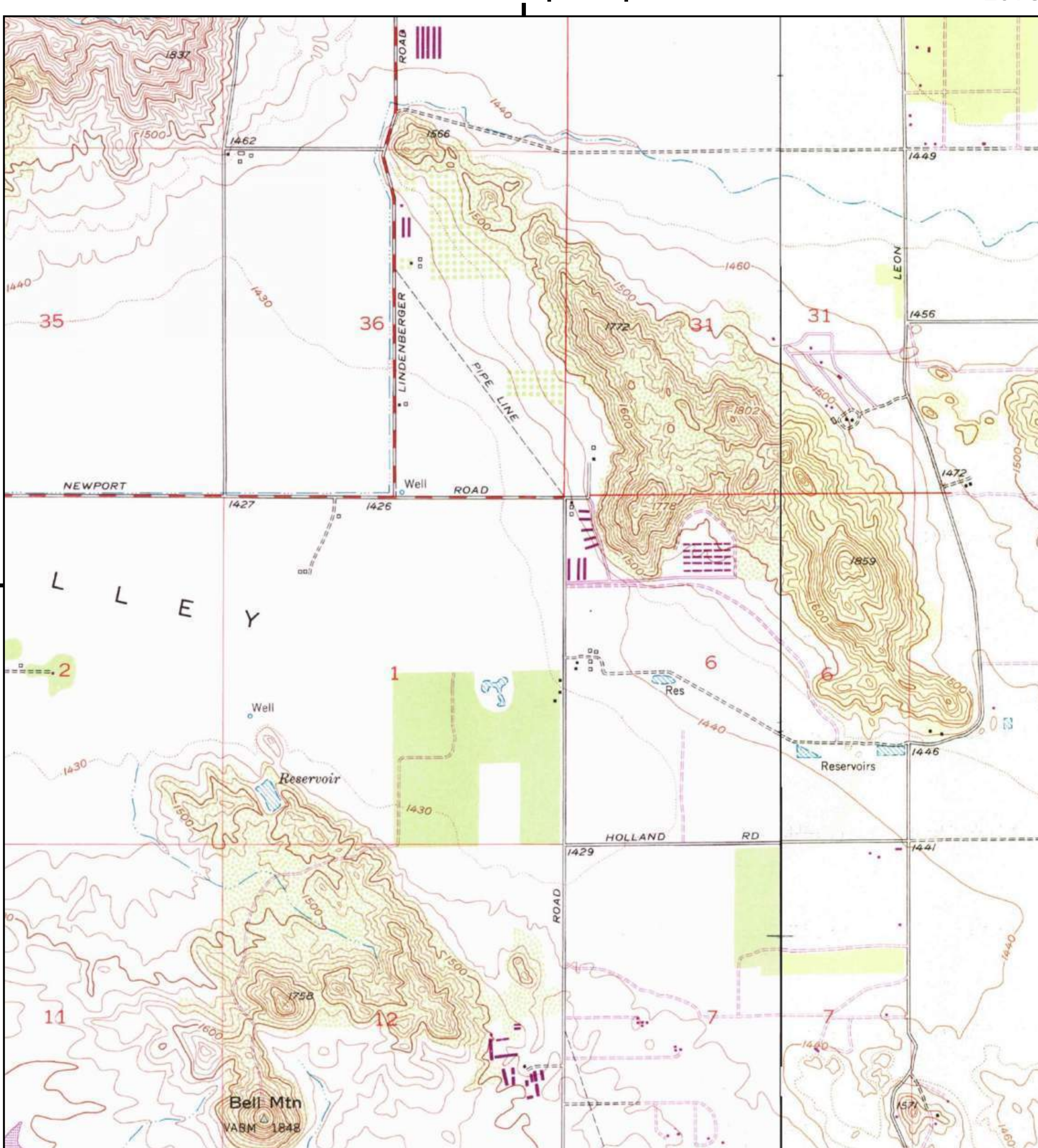
ADDRESS: 29875 Newport Road
Menifee, CA 92584

CLIENT: Geotek Inc

N

Historical Topo Map

1973



This report includes information from the following map sheet(s).

Miles 0.25 0.5 1 1.5

NW N NE

W E

SW S SE

TP, Romoland, 1973, 7.5-minute

E, Winchester, 1973, 7.5-minute

SITE NAME: Abacherli Dairy

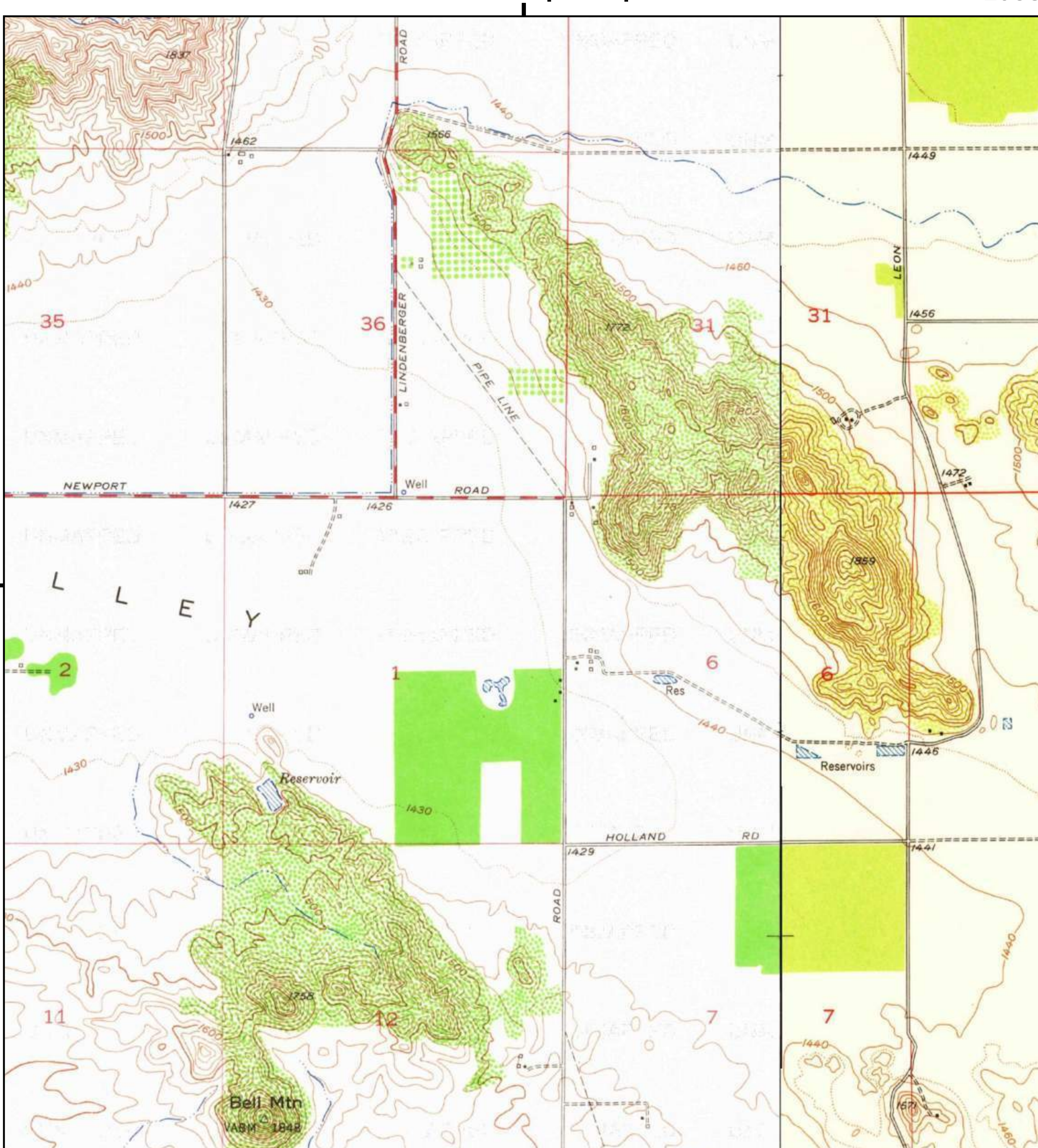
ADDRESS: 29875 Newport Road
Menifee, CA 92584

CLIENT: Geotek Inc

N

Historical Topo Map

1953



This report includes information from the following map sheet(s).

Miles 0.25 0.5 1 1.5

NW N NE
W E
SW S SE

TP, Romoland, 1953, 7.5-minute

E, Winchester, 1953, 7.5-minute

SITE NAME: Abacherli Dairy

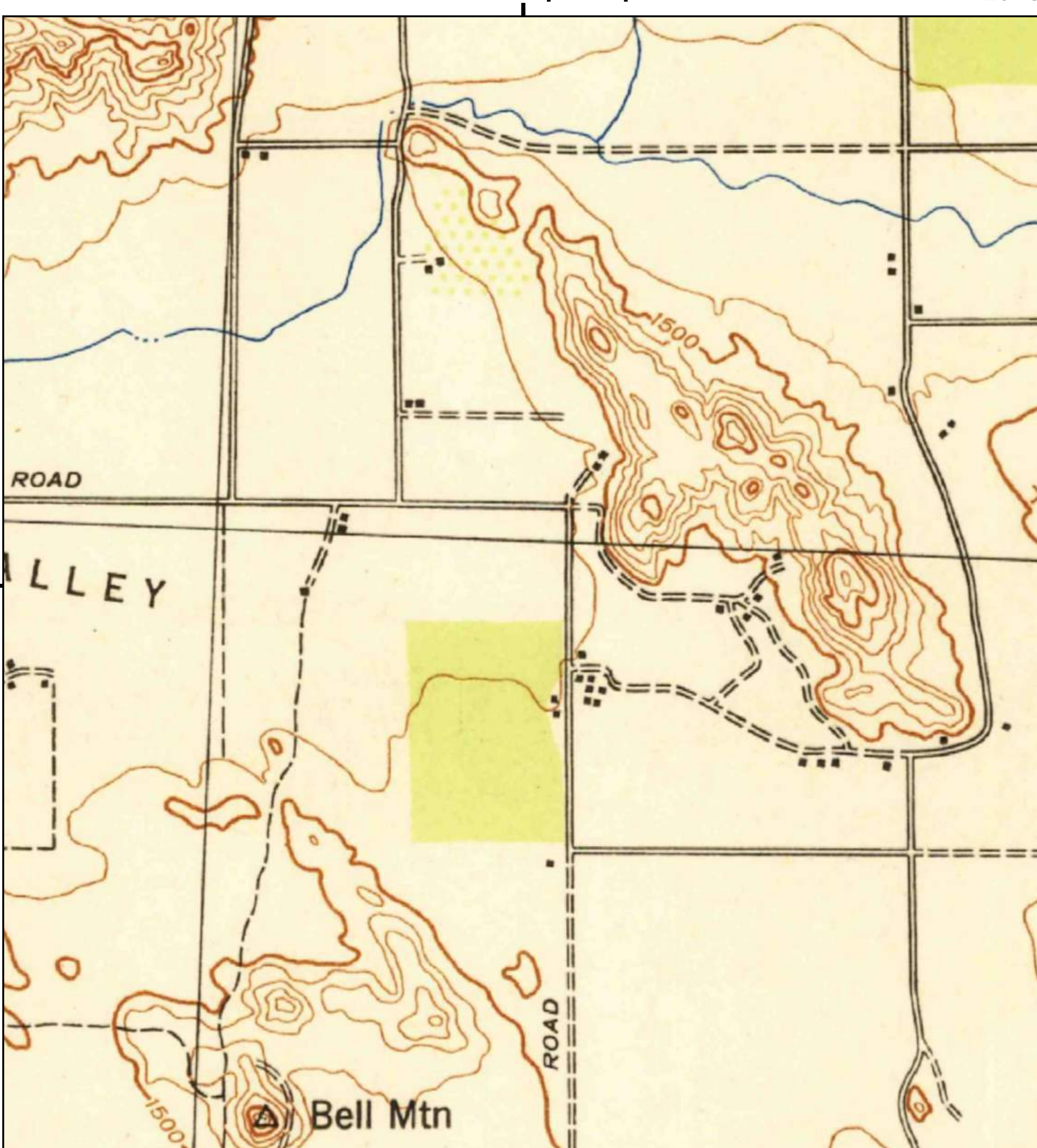
ADDRESS: 29875 Newport Road
Menifee, CA 92584

CLIENT: Geotek Inc

N

Historical Topo Map

1943



This report includes information from the following map sheet(s).

Miles 0.25 0.5 1 1.5

NW N NE
W E
SW S SE

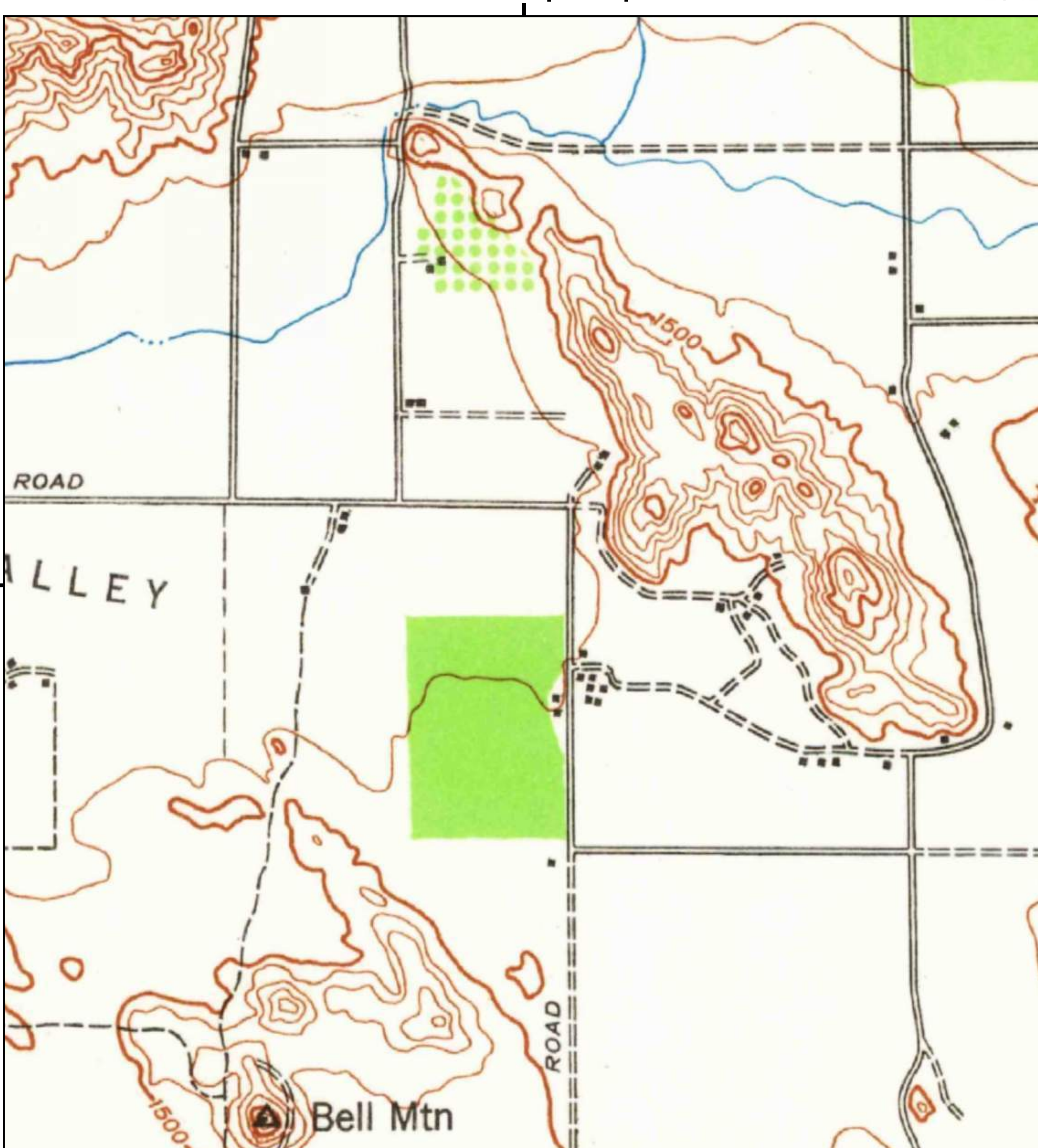
TP, Murrieta, 1943, 15-minute

SITE NAME: Abacherli Dairy
ADDRESS: 29875 Newport Road
Menifee, CA 92584
CLIENT: Geotek Inc

N

Historical Topo Map

1942



Miles 0.25 0.5 1 1.5

This report includes information from the following map sheet(s).

NW N NE
W E
SW S SE

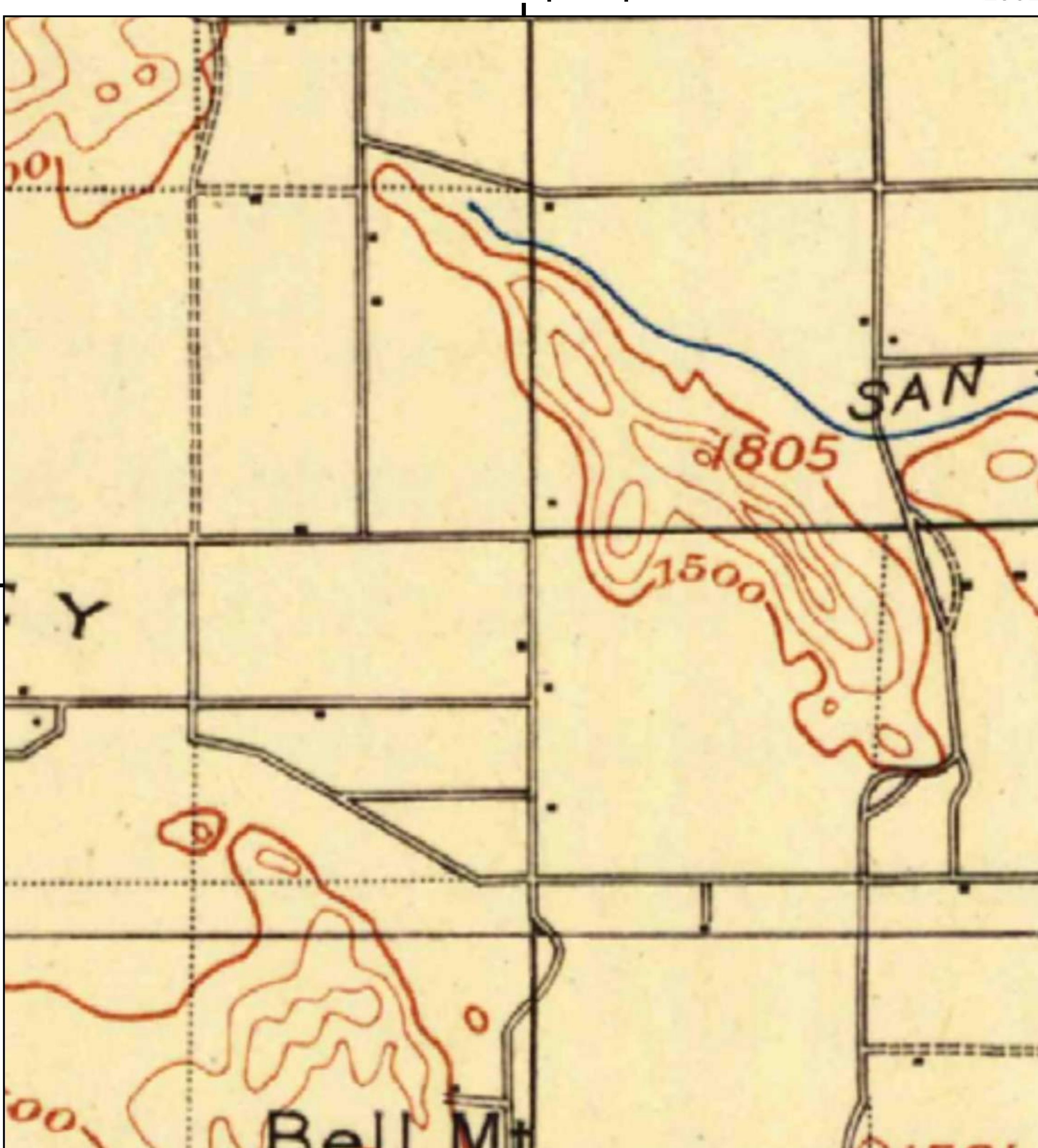
TP, Murrieta, 1942, 15-minute

SITE NAME: Abacherli Dairy
ADDRESS: 29875 Newport Road
Menifee, CA 92584
CLIENT: Geotek Inc

N

Historical Topo Map

1901



Miles	0.25	0.5	1	1.5

This report includes information from the following map sheet(s).

NW N NE
W E
SW S SE

TP, Elsinore, 1901, 30-minute

SITE NAME: Abacherli Dairy
ADDRESS: 29875 Newport Road
Menifee, CA 92584
CLIENT: Geotek Inc

N

Abacherli Dairy
29875 Newport Road
Menifee, CA 92584

Inquiry Number: 4490591.6
December 11, 2015

The EDR Property Tax Map Report

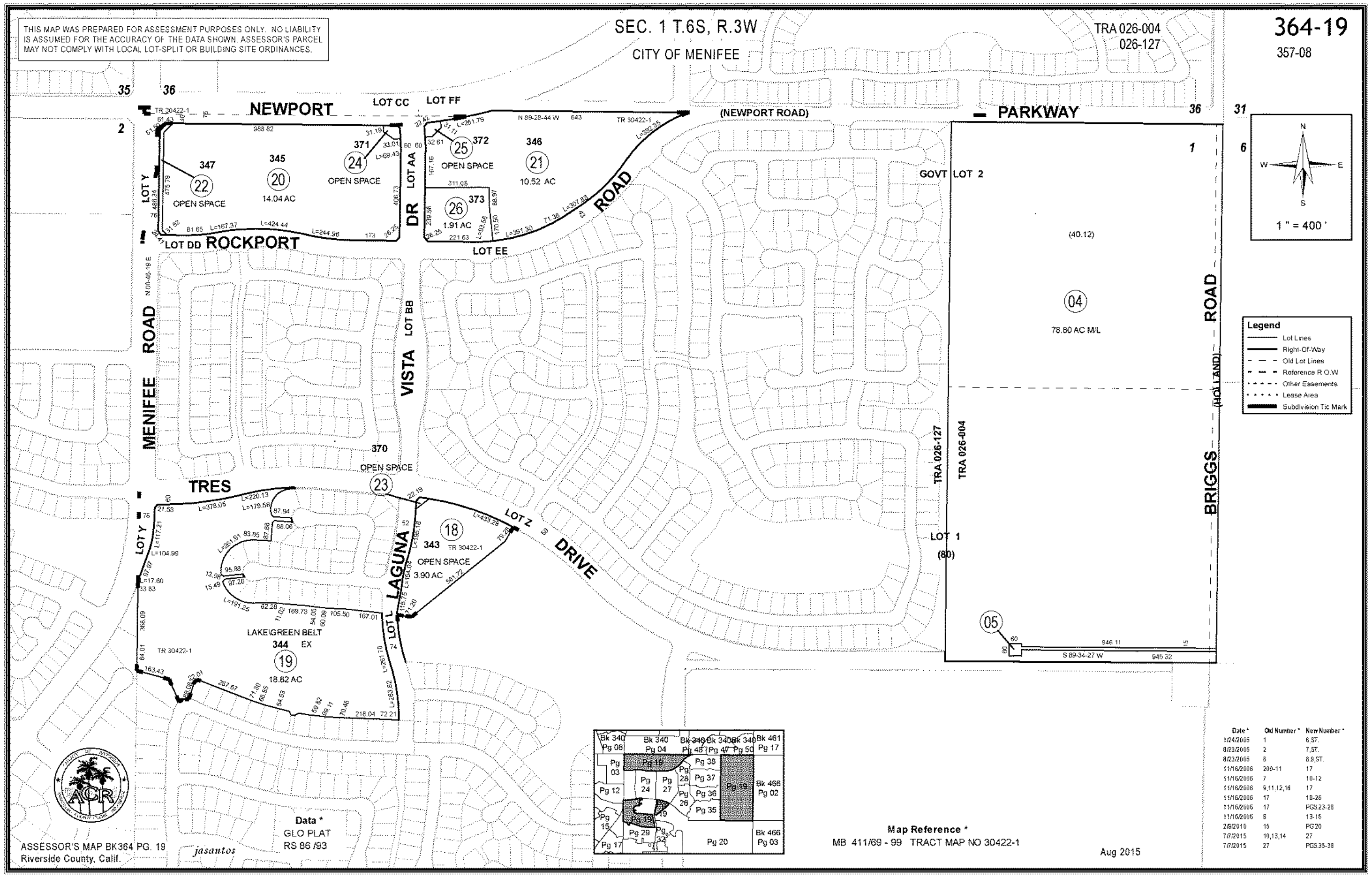
Environmental Data Resources Inc

6 Armstrong Road
Shelton, CT 06484
800.352.0050
www.edrnet.com

EDR Property Tax Map Report

Environmental Data Resources, Inc.'s EDR Property Tax Map Report is designed to assist environmental professionals in evaluating potential environmental conditions on a target property by understanding property boundaries and other characteristics. The report includes a search of available property tax maps, which include information on boundaries for the target property and neighboring properties, addresses, parcel identification numbers, as well as other data typically used in property location and identification.

Thank you for your business.
Please contact EDR at 1-800-352-0050
with any questions or comments.


THIS MAP WAS PREPARED FOR ASSESSMENT PURPOSES ONLY. NO LIABILITY IS ASSUMED FOR THE ACCURACY OF THE DATA SHOWN. ASSESSOR'S PARCEL MAY NOT COMPLY WITH LOCAL LOT-SPLIT OR BUILDING SITE ORDINANCES.
SEC. 1 T.6S, R.3W
CITY OF MENIFEE
TRA 026-004
026-127
364-19
357-08
NEWPORT
(NEWPORT ROAD)
PARKWAY
ROCKPORT
DR
VISTA
ROAD
MENIFEE ROAD
TRES
LAGUNA
DRIVE
BRIGGS ROAD
(HOLLAND)
LOT CC
LOT FF
LOT AA
LOT BB
LOT DD
LOT EE
LOT Y
LOT Z
LOT L
GOVT LOT 2
LOT 1
(80)
OPEN SPACE
14.04 AC
10.52 AC
1.91 AC
3.90 AC
LAKE/GREEN BELT
18.82 AC
(40.12)
78.80 AC M/L
Legend
Lot Lines
Right-Of-Way
Old Lot Lines
Reference R.O.W
Other Easements
Lease Area
Subdivision Tic Mark
1 " = 400 '
Data *
GLO PLAT
RS 86 /93
Map Reference *
MB 411/69 - 99 TRACT MAP NO 30422-1
Aug 2015
ASSESSOR'S MAP BK364 PG. 19
Riverside County, Calif.

Abacherli Dairy
29875 Newport Road
Menifee, CA 92584

Inquiry Number: 4490591.9s
December 14, 2015

EDR Vapor Encroachment Screen

Prepared using EDR's Vapor Encroachment Worksheet

EDR® Environmental Data Resources Inc

6 Armstrong Road, 4th floor
Shelton, CT 06484
Toll Free: 800.352.0050
www.edrnet.com

TABLE OF CONTENTS

Thank you for your business.
Please contact EDR at 1-800-352-0050
with any questions or comments.

EXECUTIVE SUMMARY

A search of available environmental records was conducted by Environmental Data Resources, Inc (EDR). The report was designed to assist parties seeking to meet the search requirements of the ASTM Standard Practice for Assessment of Vapor Encroachment into Structures on Property Involved in Real Estate Transactions (E 2600-10).

STANDARD ENVIRONMENTAL RECORDS	Maximum Search Distance*	Summary property	1/10	1/10 - 1/3
Federal NPL	0.333	0	0	0
Federal CERCLIS	0.333	0	0	0
Federal RCRA CORRACTS facilities list	0.333	0	0	0
Federal RCRA TSD facilities list	0.333	0	0	0
Federal RCRA generators list	property	0	-	-
Federal institutional controls / engineering controls registries	0.333	0	0	0
Federal ERNS list	property	0	-	-
State and tribal - equivalent NPL	0.333	0	0	0
State and tribal - equivalent CERCLIS	0.333	0	0	0
State and tribal landfill / solid waste disposal	0.333	0	0	0
State and tribal leaking storage tank lists	0.333	0	0	0
State and tribal registered storage tank lists	property	0	-	-
State and tribal institutional control / engineering control registries	not searched	-	-	-
State and tribal voluntary cleanup sites	0.333	0	0	0
State and tribal Brownfields sites	0.333	0	0	0
Other Standard Environmental Records	0.333	2	0	0

HISTORICAL USE RECORDS				
Former manufactured Gas Plants	0.333	0	0	0
Historical Gas Stations	0.25	0	0	0
Historical Dry Cleaners	0.25	0	0	0
Exclusive Recovered Govt. Archives	property	0	-	-

*Each category may include several separate databases, each having a different search distance. For each category, the table reports the maximum search distance applied. See the section 'Record Sources and Currency' for information on individual databases.

EXECUTIVE SUMMARY

TARGET PROPERTY INFORMATION

ADDRESS

ABACHERLI DAIRY
29875 NEWPORT ROAD
MENIFEE, CA 92584

COORDINATES

Latitude (North):	33.6814 - 33° 40′ 53.041077″
Longitude (West):	117.1388 - 117° 8′ 19.685669″
Elevation:	1433 ft. above sea level

TARGET PROPERTY SEARCH RESULTS

The target property was identified in the following records.

Site	Database(s)
ABACHERLI DAIRY, RONALD ABACHERLI 29875 NEWPORT RD MENIFEE, CA 92584	FINDS Registry ID:: 110041406207
ABACHERLI DAIRY, RONALD ABACHERLI 29875 NEWPORT RD MENIFEE, CA 92584	EMI Facility Id: 143870 WDS Facility Id: 8 335476001 Facility Status: A

EXECUTIVE SUMMARY

PHYSICAL SETTING INFORMATION

Flood Zone:	Available
NWI Wetlands:	Available

AQUIFLOW®

Search Radius: 0.333 Mile.

No Aquiflow sites reported.

DOMINANT SOIL COMPOSITION IN GENERAL AREA OF TARGET PROPERTY

The U.S. Department of Agriculture's (USDA) Soil Conservation Service (SCS) leads the National Cooperative Soil Survey (NCSS) and is responsible for collecting, storing, maintaining and distributing soil survey information for privately owned lands in the United States. A soil map in a soil survey is a representation of soil patterns in a landscape. The following information is based on Soil Conservation Service SSURGO data.

Soil Map ID: 1

Soil Component Name:	DOMINO
Soil Surface Texture:	fine sandy loam
Hydrologic Group:	Class C - Slow infiltration rates. Soils with layers impeding downward movement of water, or soils with moderately fine or fine textures.
Soil Drainage Class:	Moderately well drained
Hydric Status:	Not hydric
Corrosion Potential - Uncoated Steel:	High
Depth to Bedrock Min:	> 0 inches
Depth to Watertable Min:	> 0 inches

Soil Layer Information

	Boundary			Classification		Saturated hydraulic conductivity micro m/sec	
Layer	**Upper**	**Lower**	**Soil Texture Class**	**AASHTO Group**	**Unified Soil**		**Soil Reaction (pH)**
1	0 inches	14 inches	fine sandy loam	Silt-Clay Materials (more than 35 pct. passing No. 200), Silty Soils.	COARSE-GRAINED SOILS, Sands, Sands with fines, Silty Sand.	Max: 14 Min: 4	Max: 9 Min: 7.9

EXECUTIVE SUMMARY

Soil Layer Information							
	Boundary			Classification		Saturated hydraulic conductivity micro m/sec	Soil Reaction (pH)
Layer	Upper	Lower	Soil Texture Class	AASHTO Group	Unified Soil		
2	14 inches	27 inches	silt loam	Silt-Clay Materials (more than 35 pct. passing No. 200), Clayey Soils.	FINE-GRAINED SOILS, Silts and Clays (liquid limit less than 50%), Lean Clay	Max: 1.4 Min: 0.42	Max: 9 Min: 7.9
3	27 inches	35 inches	cemented	Not reported	Not reported	Max: 0.01 Min: 0	Max: Min:
4	35 inches	62 inches	loam	Silt-Clay Materials (more than 35 pct. passing No. 200), Silty Soils.	FINE-GRAINED SOILS, Silts and Clays (liquid limit less than 50%), silt.	Max: 4 Min: 1.4	Max: 9 Min: 7.9

Soil Map ID: 2

Soil Component Name: WAUKENA

Soil Surface Texture: loam

Hydrologic Group: Class C - Slow infiltration rates. Soils with layers impeding downward movement of water, or soils with moderately fine or fine textures.

Soil Drainage Class: Moderately well drained

Hydric Status: Not hydric

Corrosion Potential - Uncoated Steel: High

Depth to Bedrock Min: > 0 inches

Depth to Watertable Min: > 0 inches

Soil Layer Information							
	Boundary			Classification		Saturated hydraulic conductivity micro m/sec	Soil Reaction (pH)
Layer	Upper	Lower	Soil Texture Class	AASHTO Group	Unified Soil		
1	0 inches	11 inches	loam	Silt-Clay Materials (more than 35 pct. passing No. 200), Silty Soils.	FINE-GRAINED SOILS, Silts and Clays (liquid limit less than 50%), silt.	Max: 14 Min: 4	Max: 9.6 Min: 7.8

EXECUTIVE SUMMARY

Soil Layer Information							
	Boundary			Classification		Saturated hydraulic conductivity micro m/sec	Soil Reaction (pH)
Layer	Upper	Lower	Soil Texture Class	AASHTO Group	Unified Soil		
2	11 inches	35 inches	sandy clay loam	Silt-Clay Materials (more than 35 pct. passing No. 200), Clayey Soils.	FINE-GRAINED SOILS, Silts and Clays (liquid limit less than 50%), Lean Clay	Max: 1.4 Min: 0.42	Max: 9.6 Min: 7.8
3	35 inches	59 inches	stratified loamy fine sand to clay loam	Granular materials (35 pct. or less passing No. 200), Silty, or Clayey Gravel and Sand.	COARSE-GRAINED SOILS, Sands, Sands with fines, Silty Sand.	Max: 4 Min: 1.4	Max: 9.6 Min: 7.8

Soil Map ID: 3

Soil Component Name: EXETER

Soil Surface Texture: sandy loam

Hydrologic Group: Class C - Slow infiltration rates. Soils with layers impeding downward movement of water, or soils with moderately fine or fine textures.

Soil Drainage Class: Well drained

Hydric Status: Not hydric

Corrosion Potential - Uncoated Steel: High

Depth to Bedrock Min: > 0 inches

Depth to Watertable Min: > 0 inches

Soil Layer Information							
	Boundary			Classification		Saturated hydraulic conductivity micro m/sec	Soil Reaction (pH)
Layer	Upper	Lower	Soil Texture Class	AASHTO Group	Unified Soil		
1	0 inches	16 inches	sandy loam	Silt-Clay Materials (more than 35 pct. passing No. 200), Silty Soils.	COARSE-GRAINED SOILS, Sands, Sands with fines, Clayey sand. COARSE-GRAINED SOILS, Sands, Sands with fines, Silty Sand.	Max: 14 Min: 4	Max: 7.3 Min: 6.6

Soil Layer Information							
	Boundary			Classification		Saturated hydraulic conductivity micro m/sec	Soil Reaction (pH)
Layer	Upper	Lower	Soil Texture Class	AASHTO Group	Unified Soil		
2	16 inches	37 inches	sandy clay loam	Silt-Clay Materials (more than 35 pct. passing No. 200), Clayey Soils.	FINE-GRAINED SOILS, Silts and Clays (liquid limit less than 50%), Lean Clay	Max: 14 Min: 4	Max: 7.8 Min: 6.6
3	37 inches	50 inches	indurated	Not reported	Not reported	Max: 0.01 Min: 0	Max: Min:
4	50 inches	59 inches	stratified sandy loam to silt loam	Silt-Clay Materials (more than 35 pct. passing No. 200), Silty Soils.	FINE-GRAINED SOILS, Silts and Clays (liquid limit less than 50%), silt.	Max: 4 Min: 1.4	Max: 8.4 Min: 7.4

Soil Map ID: 4

Soil Component Name: EXETER

Soil Surface Texture: sandy loam

Hydrologic Group: Class C - Slow infiltration rates. Soils with layers impeding downward movement of water, or soils with moderately fine or fine textures.

Soil Drainage Class: Well drained

Hydric Status: Not hydric

Corrosion Potential - Uncoated Steel: High

Depth to Bedrock Min: > 0 inches

Depth to Watertable Min: > 0 inches

Soil Layer Information							
	Boundary			Classification		Saturated hydraulic conductivity micro m/sec	Soil Reaction (pH)
Layer	Upper	Lower	Soil Texture Class	AASHTO Group	Unified Soil		
1	0 inches	16 inches	sandy loam	Silt-Clay Materials (more than 35 pct. passing No. 200), Silty Soils.	COARSE-GRAINED SOILS, Sands, Sands with fines, Clayey sand. COARSE-GRAINED SOILS, Sands, Sands with fines, Silty Sand.	Max: 14 Min: 4	Max: 9 Min: 7.9

EXECUTIVE SUMMARY

Soil Layer Information							
	Boundary			Classification		Saturated hydraulic conductivity micro m/sec	
Layer	Upper	Lower	Soil Texture Class	AASHTO Group	Unified Soil		Soil Reaction (pH)
2	16 inches	37 inches	sandy clay loam	Silt-Clay Materials (more than 35 pct. passing No. 200), Clayey Soils.	FINE-GRAINED SOILS, Silts and Clays (liquid limit less than 50%), Lean Clay	Max: 14 Min: 4	Max: 9 Min: 7.9
3	37 inches	50 inches	indurated	Not reported	Not reported	Max: 0.01 Min: 0	Max: Min:
4	50 inches	59 inches	stratified sandy loam to silt loam	Silt-Clay Materials (more than 35 pct. passing No. 200), Silty Soils.	FINE-GRAINED SOILS, Silts and Clays (liquid limit less than 50%), silt.	Max: 4 Min: 1.4	Max: 8.4 Min: 7.9

Soil Map ID: 5

Soil Component Name: EXETER

Soil Surface Texture: very fine sandy loam

Hydrologic Group: Class C - Slow infiltration rates. Soils with layers impeding downward movement of water, or soils with moderately fine or fine textures.

Soil Drainage Class: Well drained

Hydric Status: Not hydric

Corrosion Potential - Uncoated Steel: High

Depth to Bedrock Min: > 0 inches

Depth to Watertable Min: > 0 inches

Soil Layer Information							
	Boundary			Classification		Saturated hydraulic conductivity micro m/sec	
Layer	Upper	Lower	Soil Texture Class	AASHTO Group	Unified Soil		Soil Reaction (pH)
1	0 inches	16 inches	very fine sandy loam	Silt-Clay Materials (more than 35 pct. passing No. 200), Silty Soils.	FINE-GRAINED SOILS, Silts and Clays (liquid limit less than 50%), Lean Clay. FINE-GRAINED SOILS, Silts and Clays (liquid limit less than 50%), silt.	Max: 14 Min: 4	Max: 7.3 Min: 6.6

EXECUTIVE SUMMARY

Soil Layer Information							
	Boundary			Classification		Saturated hydraulic conductivity micro m/sec	
Layer	Upper	Lower	Soil Texture Class	AASHTO Group	Unified Soil		Soil Reaction (pH)
2	16 inches	37 inches	sandy clay loam	Silt-Clay Materials (more than 35 pct. passing No. 200), Clayey Soils.	FINE-GRAINED SOILS, Silts and Clays (liquid limit less than 50%), Lean Clay	Max: 14 Min: 4	Max: 7.8 Min: 6.6
3	37 inches	50 inches	indurated	Not reported	Not reported	Max: 0.01 Min: 0	Max: Min:
4	50 inches	59 inches	stratified sandy loam to silt loam	Silt-Clay Materials (more than 35 pct. passing No. 200), Silty Soils.	FINE-GRAINED SOILS, Silts and Clays (liquid limit less than 50%), silt.	Max: 4 Min: 1.4	Max: 8.4 Min: 7.4

Soil Map ID: 6

Soil Component Name: DOMINO

Soil Surface Texture: silt loam

Hydrologic Group: Class C - Slow infiltration rates. Soils with layers impeding downward movement of water, or soils with moderately fine or fine textures.

Soil Drainage Class: Moderately well drained

Hydric Status: Partially hydric

Corrosion Potential - Uncoated Steel: High

Depth to Bedrock Min: > 0 inches

Depth to Watertable Min: > 0 inches

Soil Layer Information							
	Boundary			Classification		Saturated hydraulic conductivity micro m/sec	
Layer	Upper	Lower	Soil Texture Class	AASHTO Group	Unified Soil		Soil Reaction (pH)
1	0 inches	14 inches	silt loam	Silt-Clay Materials (more than 35 pct. passing No. 200), Silty Soils.	FINE-GRAINED SOILS, Silts and Clays (liquid limit less than 50%), silt.	Max: 14 Min: 4	Max: 9 Min: 7.9

EXECUTIVE SUMMARY

Soil Layer Information							
	Boundary			Classification		Saturated hydraulic conductivity micro m/sec	
Layer	Upper	Lower	Soil Texture Class	AASHTO Group	Unified Soil		Soil Reaction (pH)
2	14 inches	27 inches	silt loam	Silt-Clay Materials (more than 35 pct. passing No. 200), Clayey Soils.	FINE-GRAINED SOILS, Silts and Clays (liquid limit less than 50%), Lean Clay	Max: 1.4 Min: 0.42	Max: 9 Min: 7.9
3	27 inches	35 inches	cemented	Not reported	Not reported	Max: 0.01 Min: 0	Max: Min:
4	35 inches	62 inches	loam	Silt-Clay Materials (more than 35 pct. passing No. 200), Silty Soils.	COARSE-GRAINED SOILS, Sands, Sands with fines, Silty Sand.	Max: 4 Min: 1.4	Max: 9 Min: 7.9

Soil Map ID: 7

Soil Component Name: EXETER

Soil Surface Texture: fine sandy loam

Hydrologic Group: Class B - Moderate infiltration rates. Deep and moderately deep, moderately well and well drained soils with moderately coarse textures.

Soil Drainage Class: Well drained

Hydric Status: Not hydric

Corrosion Potential - Uncoated Steel: High

Depth to Bedrock Min: > 0 inches

Depth to Watertable Min: > 0 inches

Soil Layer Information							
	Boundary			Classification		Saturated hydraulic conductivity micro m/sec	
Layer	Upper	Lower	Soil Texture Class	AASHTO Group	Unified Soil		Soil Reaction (pH)
1	0 inches	16 inches	fine sandy loam	Silt-Clay Materials (more than 35 pct. passing No. 200), Silty Soils.	COARSE-GRAINED SOILS, Sands, Sands with fines, Silty Sand.	Max: 14 Min: 4	Max: 7.3 Min: 6.6

EXECUTIVE SUMMARY

Soil Layer Information							
	Boundary			Classification		Saturated hydraulic conductivity micro m/sec	Soil Reaction (pH)
Layer	Upper	Lower	Soil Texture Class	AASHTO Group	Unified Soil		
2	16 inches	37 inches	sandy clay loam	Silt-Clay Materials (more than 35 pct. passing No. 200), Clayey Soils.	FINE-GRAINED SOILS, Silts and Clays (liquid limit less than 50%), Lean Clay	Max: 4 Min: 1.4	Max: 7.8 Min: 6.6
3	37 inches	50 inches	indurated	Not reported	Not reported	Max: 0.01 Min: 0	Max: Min:
4	50 inches	59 inches	stratified sandy loam to silt loam	Silt-Clay Materials (more than 35 pct. passing No. 200), Silty Soils.	COARSE-GRAINED SOILS, Sands, Sands with fines, Silty Sand.	Max: 4 Min: 1.4	Max: 8.4 Min: 7.4

Soil Map ID: 8

Soil Component Name: EXETER

Soil Surface Texture: sandy loam

Hydrologic Group: Class B - Moderate infiltration rates. Deep and moderately deep, moderately well and well drained soils with moderately coarse textures.

Soil Drainage Class: Well drained

Hydric Status: Not hydric

Corrosion Potential - Uncoated Steel: High

Depth to Bedrock Min: > 0 inches

Depth to Watertable Min: > 0 inches

Soil Layer Information							
	Boundary			Classification		Saturated hydraulic conductivity micro m/sec	Soil Reaction (pH)
Layer	Upper	Lower	Soil Texture Class	AASHTO Group	Unified Soil		
1	0 inches	16 inches	sandy loam	Silt-Clay Materials (more than 35 pct. passing No. 200), Silty Soils.	COARSE-GRAINED SOILS, Sands, Sands with fines, Silty Sand.	Max: 14 Min: 4	Max: 7.3 Min: 6.6

EXECUTIVE SUMMARY

Soil Layer Information							
	Boundary			Classification		Saturated hydraulic conductivity micro m/sec	Soil Reaction (pH)
Layer	Upper	Lower	Soil Texture Class	AASHTO Group	Unified Soil		
2	16 inches	37 inches	sandy clay loam	Silt-Clay Materials (more than 35 pct. passing No. 200), Clayey Soils.	FINE-GRAINED SOILS, Silts and Clays (liquid limit less than 50%), Lean Clay	Max: 4 Min: 1.4	Max: 7.8 Min: 6.6
3	37 inches	50 inches	indurated	Not reported	Not reported	Max: 0.01 Min: 0	Max: Min:
4	50 inches	59 inches	stratified sandy loam to silt loam	Silt-Clay Materials (more than 35 pct. passing No. 200), Silty Soils.	FINE-GRAINED SOILS, Silts and Clays (liquid limit less than 50%), silt.	Max: 4 Min: 1.4	Max: 8.4 Min: 7.4

Soil Map ID: 9

Soil Component Name: EXETER

Soil Surface Texture: sandy loam

Hydrologic Group: Class C - Slow infiltration rates. Soils with layers impeding downward movement of water, or soils with moderately fine or fine textures.

Soil Drainage Class: Well drained

Hydric Status: Not hydric

Corrosion Potential - Uncoated Steel: High

Depth to Bedrock Min: > 0 inches

Depth to Watertable Min: > 0 inches

Soil Layer Information							
	Boundary			Classification		Saturated hydraulic conductivity micro m/sec	Soil Reaction (pH)
Layer	Upper	Lower	Soil Texture Class	AASHTO Group	Unified Soil		
1	0 inches	16 inches	sandy loam	Silt-Clay Materials (more than 35 pct. passing No. 200), Silty Soils.	COARSE-GRAINED SOILS, Sands, Sands with fines, Clayey sand. COARSE-GRAINED SOILS, Sands, Sands with fines, Silty Sand.	Max: 14 Min: 4	Max: 7.3 Min: 6.6

Soil Layer Information							
	Boundary			Classification		Saturated hydraulic conductivity micro m/sec	Soil Reaction (pH)
Layer	Upper	Lower	Soil Texture Class	AASHTO Group	Unified Soil		
2	16 inches	37 inches	sandy clay loam	Silt-Clay Materials (more than 35 pct. passing No. 200), Clayey Soils.	FINE-GRAINED SOILS, Silts and Clays (liquid limit less than 50%), Lean Clay	Max: 14 Min: 4	Max: 7.8 Min: 6.6
3	37 inches	50 inches	indurated	Not reported	Not reported	Max: 0.01 Min: 0	Max: Min:
4	50 inches	59 inches	stratified sandy loam to silt loam	Silt-Clay Materials (more than 35 pct. passing No. 200), Silty Soils.	COARSE-GRAINED SOILS, Sands, Sands with fines, Silty Sand.	Max: 4 Min: 1.4	Max: 8.4 Min: 7.4

Soil Map ID: 10

Soil Component Name: WILLOWS

Soil Surface Texture: silty clay

Hydrologic Group: Class D - Very slow infiltration rates. Soils are clayey, have a high water table, or are shallow to an impervious layer.

Soil Drainage Class: Poorly drained

Hydric Status: Not hydric

Corrosion Potential - Uncoated Steel: High

Depth to Bedrock Min: > 0 inches

Depth to Watertable Min: > 0 inches

Soil Layer Information							
	Boundary			Classification		Saturated hydraulic conductivity micro m/sec	Soil Reaction (pH)
Layer	Upper	Lower	Soil Texture Class	AASHTO Group	Unified Soil		
1	0 inches	9 inches	silty clay	Silt-Clay Materials (more than 35 pct. passing No. 200), Clayey Soils.	FINE-GRAINED SOILS, Silts and Clays (liquid limit 50% or more), Fat Clay.	Max: 0.42 Min: 0.01	Max: 9 Min: 7.4

Soil Layer Information							
	Boundary			Classification		Saturated hydraulic conductivity micro m/sec	Soil Reaction (pH)
Layer	Upper	Lower	Soil Texture Class	AASHTO Group	Unified Soil		
2	9 inches	42 inches	clay	Silt-Clay Materials (more than 35 pct. passing No. 200), Clayey Soils.	FINE-GRAINED SOILS, Silts and Clays (liquid limit 50% or more), Fat Clay.	Max: 0.42 Min: 0.01	Max: 9 Min: 8.5

Soil Map ID: 11

Soil Component Name: HANFORD

Soil Surface Texture: coarse sandy loam

Hydrologic Group: Class B - Moderate infiltration rates. Deep and moderately deep, moderately well and well drained soils with moderately coarse textures.

Soil Drainage Class: Somewhat excessively drained

Hydric Status: Not hydric

Corrosion Potential - Uncoated Steel: Low

Depth to Bedrock Min: > 0 inches

Depth to Watertable Min: > 0 inches

Soil Layer Information							
	Boundary			Classification		Saturated hydraulic conductivity micro m/sec	Soil Reaction (pH)
Layer	Upper	Lower	Soil Texture Class	AASHTO Group	Unified Soil		
1	0 inches	7 inches	coarse sandy loam	Silt-Clay Materials (more than 35 pct. passing No. 200), Silty Soils.	COARSE-GRAINED SOILS, Sands, Sands with fines, Silty Sand.	Max: 42 Min: 14	Max: 7.8 Min: 5.6
2	7 inches	40 inches	fine sandy loam	Silt-Clay Materials (more than 35 pct. passing No. 200), Silty Soils.	COARSE-GRAINED SOILS, Sands, Sands with fines, Silty Sand.	Max: 42 Min: 14	Max: 7.8 Min: 5.6

EXECUTIVE SUMMARY

Soil Layer Information							
	Boundary			Classification		Saturated hydraulic conductivity micro m/sec	Soil Reaction (pH)
Layer	Upper	Lower	Soil Texture Class	AASHTO Group	Unified Soil		
3	40 inches	59 inches	stratified loamy sand to coarse sandy loam	Granular materials (35 pct. or less passing No. 200), Stone Fragments, Gravel and Sand.	COARSE-GRAINED SOILS, Sands, Sands with fines, Silty Sand.	Max: 141 Min: 42	Max: 7.8 Min: 5.6

Soil Map ID: 12

Soil Component Name: Cieneba

Soil Surface Texture: sandy loam

Hydrologic Group: Class C - Slow infiltration rates. Soils with layers impeding downward movement of water, or soils with moderately fine or fine textures.

Soil Drainage Class: Somewhat excessively drained

Hydric Status: Not hydric

Corrosion Potential - Uncoated Steel: Low

Depth to Bedrock Min: > 0 inches

Depth to Watertable Min: > 0 inches

Soil Layer Information							
	Boundary			Classification		Saturated hydraulic conductivity micro m/sec	Soil Reaction (pH)
Layer	Upper	Lower	Soil Texture Class	AASHTO Group	Unified Soil		
1	0 inches	14 inches	sandy loam	Granular materials (35 pct. or less passing No. 200), Silty, or Clayey Gravel and Sand.	COARSE-GRAINED SOILS, Sands, Sands with fines, Silty Sand.	Max: 42 Min: 14	Max: 7.3 Min: 5.1
2	14 inches	22 inches	weathered bedrock	Not reported	Not reported	Max: 0.42 Min: 0	Max: Min:

EXECUTIVE SUMMARY

Soil Map ID: 13

Soil Component Name: DOMINO

Soil Surface Texture: silt loam

Hydrologic Group: Class C - Slow infiltration rates. Soils with layers impeding downward movement of water, or soils with moderately fine or fine textures.

Soil Drainage Class: Moderately well drained

Hydric Status: Not hydric

Corrosion Potential - Uncoated Steel: High

Depth to Bedrock Min: > 0 inches

Depth to Watertable Min: > 0 inches

Soil Layer Information							
	Boundary			Classification		Saturated hydraulic conductivity micro m/sec	
Layer	Upper	Lower	Soil Texture Class	AASHTO Group	Unified Soil		Soil Reaction (pH)
1	0 inches	14 inches	silt loam	Silt-Clay Materials (more than 35 pct. passing No. 200), Silty Soils.	FINE-GRAINED SOILS, Silts and Clays (liquid limit less than 50%), silt.	Max: 14 Min: 4	Max: 8.4 Min: 7.9
2	14 inches	27 inches	silt loam	Silt-Clay Materials (more than 35 pct. passing No. 200), Clayey Soils.	FINE-GRAINED SOILS, Silts and Clays (liquid limit less than 50%), Lean Clay	Max: 1.4 Min: 0.42	Max: 8.4 Min: 7.9
3	27 inches	35 inches	cemented	Not reported	Not reported	Max: 0.01 Min: 0	Max: Min:
4	35 inches	62 inches	loam	Silt-Clay Materials (more than 35 pct. passing No. 200), Silty Soils.	FINE-GRAINED SOILS, Silts and Clays (liquid limit less than 50%), silt.	Max: 4 Min: 1.4	Max: 8.4 Min: 7.9

Soil Map ID: 14

Soil Component Name: GREENFIELD

Soil Surface Texture: sandy loam

Hydrologic Group: Class B - Moderate infiltration rates. Deep and moderately deep, moderately well and well drained soils with moderately coarse textures.

Soil Drainage Class: Well drained

EXECUTIVE SUMMARY

Hydric Status: Not hydric

Corrosion Potential - Uncoated Steel: Low

Depth to Bedrock Min: > 0 inches

Depth to Watertable Min: > 0 inches

Soil Layer Information							
	Boundary			Classification		Saturated hydraulic conductivity micro m/sec	
Layer	Upper	Lower	Soil Texture Class	AASHTO Group	Unified Soil		Soil Reaction (pH)
1	0 inches	25 inches	sandy loam	Granular materials (35 pct. or less passing No. 200), Silty, or Clayey Gravel and Sand.	COARSE-GRAINED SOILS, Sands, Sands with fines, Silty Sand.	Max: 42 Min: 14	Max: 7.8 Min: 6.1
2	25 inches	42 inches	fine sandy loam	Granular materials (35 pct. or less passing No. 200), Silty, or Clayey Gravel and Sand.	COARSE-GRAINED SOILS, Sands, Sands with fines, Silty Sand.	Max: 42 Min: 14	Max: 7.8 Min: 6.1
3	42 inches	59 inches	loam	Silt-Clay Materials (more than 35 pct. passing No. 200), Silty Soils.	FINE-GRAINED SOILS, Silts and Clays (liquid limit less than 50%), silt.	Max: 14 Min: 4	Max: 7.8 Min: 6.1
4	59 inches	72 inches	stratified loamy sand to sandy loam	Granular materials (35 pct. or less passing No. 200), Silty, or Clayey Gravel and Sand.	COARSE-GRAINED SOILS, Sands, Sands with fines, Silty Sand.	Max: 42 Min: 14	Max: 8.4 Min: 6.6

Soil Map ID: 15

Soil Component Name: HANFORD

Soil Surface Texture: coarse sandy loam

Hydrologic Group: Class B - Moderate infiltration rates. Deep and moderately deep, moderately well and well drained soils with moderately coarse textures.

Soil Drainage Class: Well drained

Hydric Status: Not hydric

Corrosion Potential - Uncoated Steel: Low

Depth to Bedrock Min: > 0 inches

Depth to Watertable Min: > 0 inches

Soil Layer Information							
	Boundary			Classification		Saturated hydraulic conductivity micro m/sec	Soil Reaction (pH)
Layer	Upper	Lower	Soil Texture Class	AASHTO Group	Unified Soil		
1	0 inches	7 inches	coarse sandy loam	Silt-Clay Materials (more than 35 pct. passing No. 200), Silty Soils.	COARSE-GRAINED SOILS, Sands, Sands with fines, Silty Sand.	Max: 42 Min: 14	Max: 7.8 Min: 5.6
2	7 inches	40 inches	fine sandy loam	Silt-Clay Materials (more than 35 pct. passing No. 200), Silty Soils.	COARSE-GRAINED SOILS, Sands, Sands with fines, Silty Sand.	Max: 42 Min: 14	Max: 7.8 Min: 5.6
3	40 inches	59 inches	stratified loamy sand to coarse sandy loam	Granular materials (35 pct. or less passing No. 200), Stone Fragments, Gravel and Sand.	COARSE-GRAINED SOILS, Sands, Sands with fines, Silty Sand.	Max: 141 Min: 42	Max: 7.8 Min: 5.6

Soil Map ID: 16

Soil Component Name: FALLBROOK

Soil Surface Texture: sandy loam

Hydrologic Group: Class C - Slow infiltration rates. Soils with layers impeding downward movement of water, or soils with moderately fine or fine textures.

Soil Drainage Class: Well drained

Hydric Status: Not hydric

Corrosion Potential - Uncoated Steel: Low

Depth to Bedrock Min: > 0 inches

Depth to Watertable Min: > 0 inches

EXECUTIVE SUMMARY

Soil Layer Information							
	Boundary			Classification		Saturated hydraulic conductivity micro m/sec	Soil Reaction (pH)
Layer	Upper	Lower	Soil Texture Class	AASHTO Group	Unified Soil		
1	0 inches	14 inches	sandy loam	Silt-Clay Materials (more than 35 pct. passing No. 200), Silty Soils.	COARSE-GRAINED SOILS, Sands, Sands with fines, Silty Sand.	Max: 42 Min: 14	Max: 7.3 Min: 5.6
2	14 inches	24 inches	sandy clay loam	Silt-Clay Materials (more than 35 pct. passing No. 200), Clayey Soils.	FINE-GRAINED SOILS, Silts and Clays (liquid limit less than 50%), Lean Clay	Max: 14 Min: 4	Max: 7.3 Min: 6.1
3	24 inches	27 inches	weathered bedrock	Not reported	Not reported	Max: 0.42 Min: 0	Max: Min:

Soil Map ID: 17

Soil Component Name: PACHAPPA

Soil Surface Texture: fine sandy loam

Hydrologic Group: Class B - Moderate infiltration rates. Deep and moderately deep, moderately well and well drained soils with moderately coarse textures.

Soil Drainage Class: Well drained

Hydric Status: Not hydric

Corrosion Potential - Uncoated Steel: Low

Depth to Bedrock Min: > 0 inches

Depth to Watertable Min: > 0 inches

Soil Layer Information							
	Boundary			Classification		Saturated hydraulic conductivity micro m/sec	Soil Reaction (pH)
Layer	Upper	Lower	Soil Texture Class	AASHTO Group	Unified Soil		
1	0 inches	20 inches	fine sandy loam	Silt-Clay Materials (more than 35 pct. passing No. 200), Silty Soils.	COARSE-GRAINED SOILS, Sands, Sands with fines, Silty Sand.	Max: 14 Min: 4	Max: 7.8 Min: 6.1

EXECUTIVE SUMMARY

Soil Layer Information							
	Boundary			Classification		Saturated hydraulic conductivity micro m/sec	Soil Reaction (pH)
Layer	Upper	Lower	Soil Texture Class	AASHTO Group	Unified Soil		
2	20 inches	62 inches	loam	Silt-Clay Materials (more than 35 pct. passing No. 200), Silty Soils.	FINE-GRAINED SOILS, Silts and Clays (liquid limit less than 50%), Lean Clay	Max: 14 Min: 4	Max: 7.8 Min: 6.6

Soil Map ID: 18

Soil Component Name: TRAVER

Soil Surface Texture: loamy fine sand

Hydrologic Group: Class B - Moderate infiltration rates. Deep and moderately deep, moderately well and well drained soils with moderately coarse textures.

Soil Drainage Class: Moderately well drained

Hydric Status: Not hydric

Corrosion Potential - Uncoated Steel: High

Depth to Bedrock Min: > 0 inches

Depth to Watertable Min: > 0 inches

Soil Layer Information							
	Boundary			Classification		Saturated hydraulic conductivity micro m/sec	Soil Reaction (pH)
Layer	Upper	Lower	Soil Texture Class	AASHTO Group	Unified Soil		
1	0 inches	12 inches	loamy fine sand	Granular materials (35 pct. or less passing No. 200), Silty, or Clayey Gravel and Sand.	COARSE-GRAINED SOILS, Sands, Sands with fines, Silty Sand.	Max: 42 Min: 14	Max: 9 Min: 7.4
2	12 inches	38 inches	fine sandy loam	Silt-Clay Materials (more than 35 pct. passing No. 200), Silty Soils.	FINE-GRAINED SOILS, Silts and Clays (liquid limit less than 50%), silt.	Max: 14 Min: 4	Max: 9.6 Min: 8.4

EXECUTIVE SUMMARY

Soil Layer Information							
	Boundary			Classification		Saturated hydraulic conductivity micro m/sec	Soil Reaction (pH)
Layer	Upper	Lower	Soil Texture Class	AASHTO Group	Unified Soil		
3	38 inches	59 inches	stratified fine sandy loam to silty clay loam	Silt-Clay Materials (more than 35 pct. passing No. 200), Silty Soils.	FINE-GRAINED SOILS, Silts and Clays (liquid limit less than 50%), silt.	Max: 14 Min: 4	Max: 9.6 Min: 8.4

Soil Map ID: 19

Soil Component Name: WILLOWS

Soil Surface Texture: silty clay

Hydrologic Group: Class D - Very slow infiltration rates. Soils are clayey, have a high water table, or are shallow to an impervious layer.

Soil Drainage Class: Poorly drained

Hydric Status: Not hydric

Corrosion Potential - Uncoated Steel: High

Depth to Bedrock Min: > 0 inches

Depth to Watertable Min: > 0 inches

Soil Layer Information							
	Boundary			Classification		Saturated hydraulic conductivity micro m/sec	Soil Reaction (pH)
Layer	Upper	Lower	Soil Texture Class	AASHTO Group	Unified Soil		
1	0 inches	9 inches	silty clay	Silt-Clay Materials (more than 35 pct. passing No. 200), Clayey Soils.	FINE-GRAINED SOILS, Silts and Clays (liquid limit 50% or more), Fat Clay.	Max: 0.42 Min: 0.01	Max: 9 Min: 7.4
2	9 inches	59 inches	clay	Silt-Clay Materials (more than 35 pct. passing No. 200), Clayey Soils.	FINE-GRAINED SOILS, Silts and Clays (liquid limit 50% or more), Fat Clay.	Max: 0.42 Min: 0.01	Max: 9 Min: 8.5

EXECUTIVE SUMMARY

SEARCH RESULTS

Unmappable (orphan) sites are not considered in the foregoing analysis.

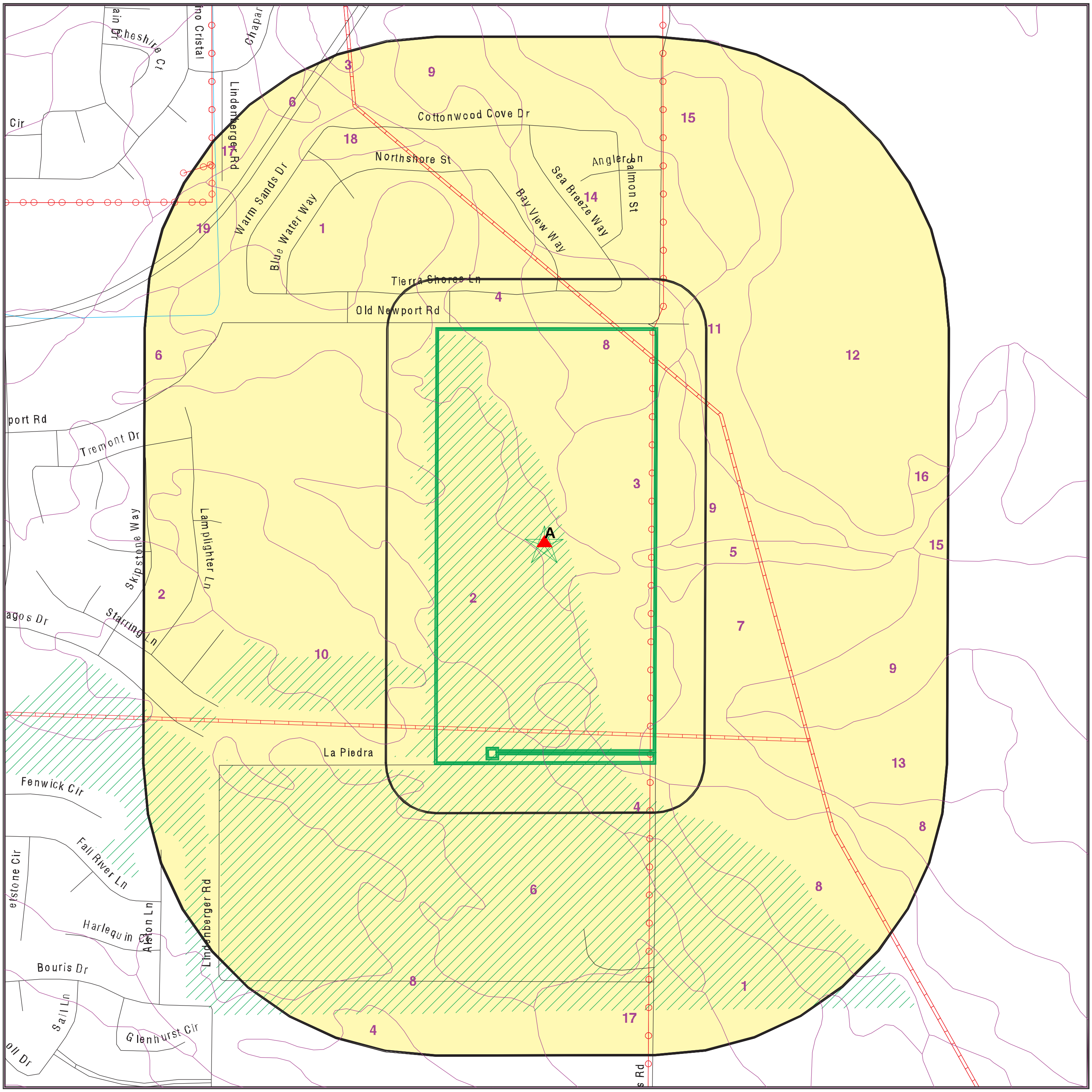
STANDARD ENVIRONMENTAL RECORDS

Name	Address	Dist/Dir	Map ID	Page
ABACHERLI DAIRY, RONALD ABACHERLI FINDS: Other Standard Environmental Records	29875 NEWPORT RD	Property	▲ A1	26
ABACHERLI DAIRY, RONALD ABACHERLI EMI: Other Standard Environmental Records WDS: Other Standard Environmental Records	29875 NEWPORT RD	Property	▲ A2	27

HISTORICAL USE RECORDS

Name	Address	Dist/Dir	Map ID	Page
Not Reported				

PRIMARY MAP - 4490591.9S

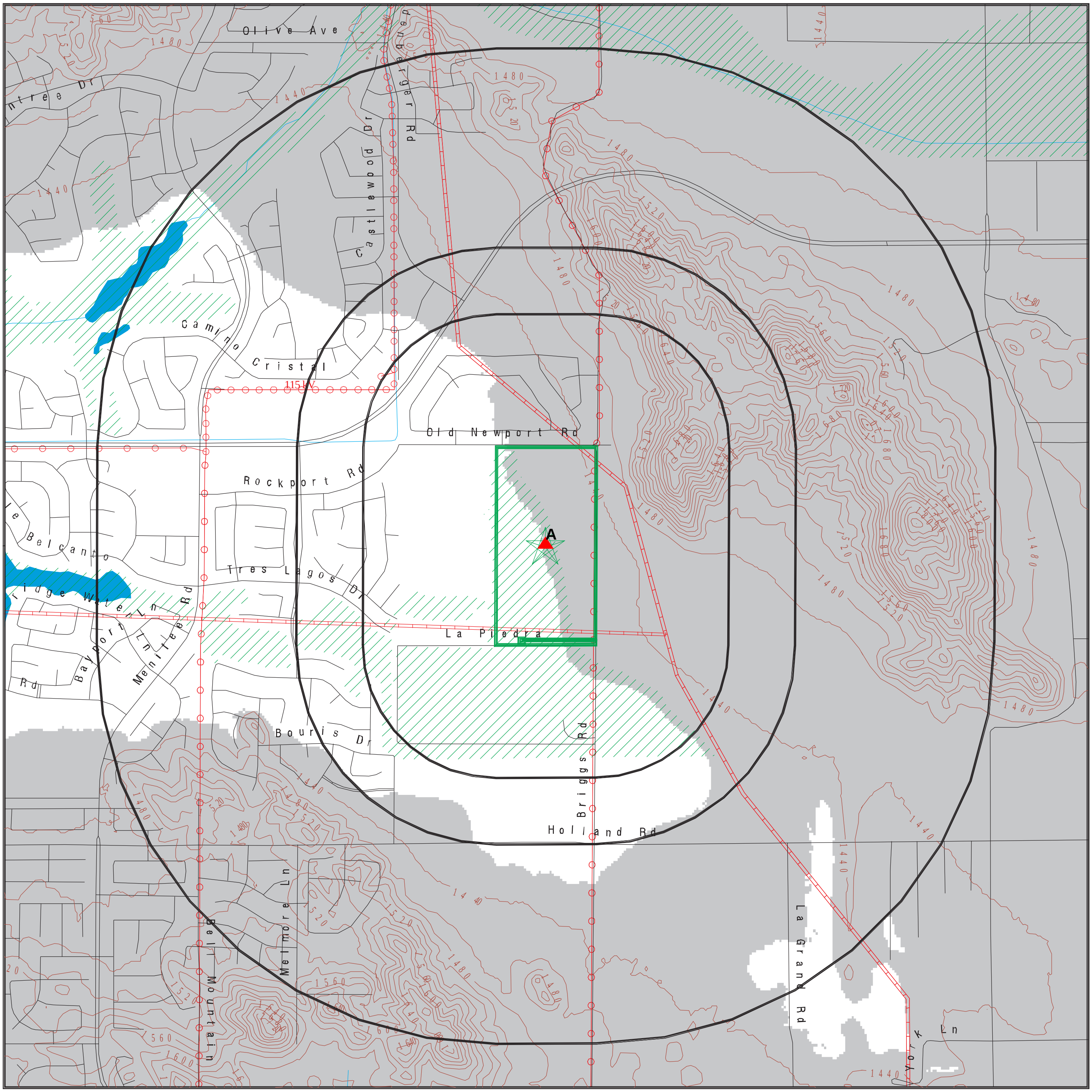


0 300 1/3 1/2 Miles

- Target Property
- Sites at elevations higher than or equal to the target property
- Sites at elevations lower than the target property
- Manufactured Gas Plants
- Sensitive Receptors
- National Priority List Sites
- Dept. Defense Sites
- Indian Reservations BIA
- Power transmission lines
- Pipelines
- 100-year flood zone
- 500-year flood zone
- Groundwater Flow Direction
- (G I) Indeterminate Groundwater Flow at Location
- (G V) Groundwater Flow Varies at Location
- SSURGO Soil
- Areas of Concern

SITE NAME:	Abacherli Dairy	CLIENT:	Geotek Inc
ADDRESS:	29875 Newport Road	CONTACT:	Anna M. Scott
	Menifee CA 92584	INQUIRY #:	4490591.9s
LAT/LONG:	33.6814 / 117.1388	DATE:	December 11, 2015 8:54 pm

SECONDARY MAP - 4490591.9S

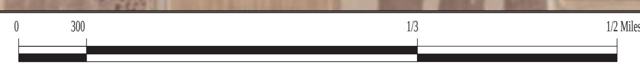


0 1/3 1/2 1 Miles

- Target Property
- Sites at elevations higher than or equal to the target property
- Sites at elevations lower than the target property
- Manufactured Gas Plants
- National Priority List Sites
- Dept. Defense Sites
- Indian Reservations BIA
- Contour Lines
- Power transmission lines
- Pipelines
- 100-year flood zone
- 500-year flood zone
- Upgradient Area
- Areas of Concern

SITE NAME:	Abacherli Dairy	CLIENT:	Geotek Inc
ADDRESS:	29875 Newport Road	CONTACT:	Anna M. Scott
	Menifee CA 92584	INQUIRY #:	4490591.9s
LAT/LONG:	33.6814 / 117.1388	DATE:	December 11, 2015 8:53 pm

AERIAL PHOTOGRAPHY - 4490591.9s



SITE NAME:	Abacherli Dairy
ADDRESS:	29875 Newport Road Menifee CA 92584
LAT/LONG:	33.6814 / 117.1388

CLIENT:	Geotek Inc
CONTACT:	Anna M. Scott
INQUIRY #:	4490591.9s
DATE:	December 11, 2015 8:54 pm

LEGEND

FACILITY NAME **FACILITY ADDRESS, CITY, ST, ZIP**			EDR SITE ID NUMBER
▼ **MAP ID#**	Direction Distance Range Relative Elevation	(Distance feet / miles) Feet Above Sea Level	ASTM 2600 Record Sources found in this report. Each database searched has been assigned to one or more categories. For detailed information about categorization, see the section of the report Records Searched and Currency.

Worksheet:

Comments:

Comments may be added on the online Vapor Encroachment Worksheet.

DATABASE ACRONYM: Applicable categories (A hoverbox with database description).

ABACHERLI DAIRY, RONALD ABACHERLI 29875 NEWPORT RD, MENIFEE, CA, 92584		1014678367
▲ A1	Target Property 1433 ft. Above Sea Level	Other Standard Environmental Records

Worksheet:

Groundwater Flow Gradient:

Upgradient or Indeterminate: YES

ABACHERLI DAIRY, RONALD ABACHERLI 29875 NEWPORT RD, MENIFEE, CA, 92584		S102005466
▲ A2	Target Property 1433 ft. Above Sea Level	Other Standard Environmental Records

Worksheet:

Groundwater Flow Gradient:

Upgradient or Indeterminate: YES

RECORD SOURCES AND CURRENCY

To maintain currency of the following databases, EDR contacts the appropriate agency on a monthly or quarterly basis, as required.

Number of Days to Update: Provides confirmation that EDR is reporting records that have been updated within 90 days from the date the government agency made the information available to the public.

STANDARD ENVIRONMENTAL RECORDS

PRP: Potentially Responsible Parties

Standard Environmental Record Source: Other Standard Environmental Records
Search Distance: Property

A listing of verified Potentially Responsible Parties

Date of Government Version: 10/25/2013
Number of Days to Update: 3
Last EDR Contact :11/13/2015
Source: EPA
Telephone: 202-564-6023

RMP: Risk Management Plans

Standard Environmental Record Source: Other Standard Environmental Records
Search Distance: Property

When Congress passed the Clean Air Act Amendments of 1990, it required EPA to publish regulations and guidance for chemical accident prevention at facilities using extremely hazardous substances. The Risk Management Program Rule (RMP Rule) was written to implement Section 112(r) of these amendments. The rule, which built upon existing industry codes and standards, requires companies of all sizes that use certain flammable and toxic substances to develop a Risk Management Program, which includes a(n): Hazard assessment that details the potential effects of an accidental release, an accident history of the last five years, and an evaluation of worst-case and alternative accidental releases; Prevention program that includes safety precautions and maintenance, monitoring, and employee training measures; and Emergency response program that spells out emergency health care, employee training measures and procedures for informing the public and response agencies (e.g the fire department) should an accident occur.

Date of Government Version: 08/01/2015
Number of Days to Update: 69
Last EDR Contact :10/26/2015
Source: Environmental Protection Agency
Telephone: 202-564-8600

ALAMEDA CO. UST: Underground Tanks

Standard Environmental Record Source: State and tribal registered storage tank lists
Underground storage tank sites located in Alameda county.

Date of Government Version: 10/09/2015
Number of Days to Update: 37
Last EDR Contact :10/09/2015
Source: Alameda County Environmental Health Services
Telephone: 510-567-6700

AST: Aboveground Petroleum Storage Tank Facilities

Standard Environmental Record Source: State and tribal registered storage tank lists
Search Distance: Property

A listing of aboveground storage tank petroleum storage tank locations.

Date of Government Version: 08/01/2009
Number of Days to Update: 21
Last EDR Contact :09/28/2015
Source: California Environmental Protection Agency
Telephone: 916-327-5092

Alameda County CS: Contaminated Sites

Standard Environmental Record Source: State and tribal leaking storage tank lists
Search Distance: 0.333 Mile

A listing of contaminated sites overseen by the Toxic Release Program (oil and groundwater contamination from chemical releases and spills) and the Leaking Underground Storage Tank Program (soil and ground water contamination from leaking petroleum USTs).

Date of Government Version: 10/09/2015
Number of Days to Update: 34
Last EDR Contact :10/09/2015

Source: Alameda County Environmental Health Services
Telephone: 510-567-6700

BROWNFIELDS: Considered Brownfieds Sites Listing
Standard Environmental Record Source: State and tribal Brownfields sites
Search Distance: 0.333 Mile

A listing of sites the SWRCB considers to be Brownfields since these are sites have come to them through the MOA Process.

Date of Government Version: 06/25/2015
Number of Days to Update: 34
Last EDR Contact :12/04/2015

Source: State Water Resources Control Board
Telephone: 916-323-7905

CA BOND EXP. PLAN: Bond Expenditure Plan
Standard Environmental Record Source: Other Standard Environmental Records
Search Distance: 0.333 Mile

Department of Health Services developed a site-specific expenditure plan as the basis for an appropriation of Hazardous Substance Cleanup Bond Act funds. It is not updated.

Date of Government Version: 01/01/1989
Number of Days to Update: 6
Last EDR Contact :05/31/1994

Source: Department of Health Services
Telephone: 916-255-2118

CA FID UST: Facility Inventory Database
Standard Environmental Record Source: State and tribal registered storage tank lists
Search Distance: Property

The Facility Inventory Database (FID) contains a historical listing of active and inactive underground storage tank locations from the State Water Resource Control Board. Refer to local/county source for current data.

Date of Government Version: 10/31/1994
Number of Days to Update: 24
Last EDR Contact :12/28/1998

Source: California Environmental Protection Agency
Telephone: 916-341-5851

CA LA LF: City of Los Angeles Landfills
Standard Environmental Record Source: State and tribal landfill / solid waste disposal
Landfills owned and maintained by the City of Los Angeles.

Date of Government Version: 01/01/2015
Number of Days to Update: 14
Last EDR Contact :10/19/2015

Source: Engineering & Construction Division
Telephone: 213-473-7869

CDL: Clandestine Drug Labs
Standard Environmental Record Source: Other Standard Environmental Records
Search Distance: Property

A listing of drug lab locations. Listing of a location in this database does not indicate that any illegal drug lab materials were or were not present there, and does not constitute a determination that the location either requires or does not require additional cleanup work.

Date of Government Version: 12/31/2014

Source: Department of Toxic Substances Control

Number of Days to Update: 8
Telephone: 916-255-6504
Last EDR Contact :10/26/2015

CHMIRS: California Hazardous Material Incident Report System

Standard Environmental Record Source: Other Standard Environmental Records

Search Distance: Property

California Hazardous Material Incident Reporting System. CHMIRS contains information on reported hazardous material incidents (accidental releases or spills).

Date of Government Version: 09/25/2015
Source: Office of Emergency Services
Number of Days to Update: 20
Telephone: 916-845-8400
Last EDR Contact :10/27/2015

CONTRA COSTA CO. SITE LIST: Site List

Standard Environmental Record Source: Other Standard Environmental Records

Search Distance: 0.25 Mile

List includes sites from the underground tank, hazardous waste generator and business plan/2185 programs.

Date of Government Version: 08/24/2015
Source: Contra Costa Health Services Department
Number of Days to Update: 37
Telephone: 925-646-2286
Last EDR Contact :11/07/2015

CORTESE: "Cortese" Hazardous Waste & Substances Sites List

Standard Environmental Record Source: Other Standard Environmental Records

Search Distance: 0.333 Mile

The sites for the list are designated by the State Water Resource Control Board (LUST), the Integrated Waste Board (SWF/LS), and the Department of Toxic Substances Control (Cal-Sites).

Date of Government Version: 09/28/2015
Source: CAL EPA/Office of Emergency Information
Number of Days to Update: 37
Telephone: 916-323-3400
Last EDR Contact :09/29/2015

CUPA AMADOR: CUPA Facility List

Standard Environmental Record Source: Other Standard Environmental Records

Cupa Facility List

Date of Government Version: 08/24/2015
Source: Amador County Environmental Health
Number of Days to Update: 35
Telephone: 209-223-6439
Last EDR Contact :12/04/2015

CUPA BUTTE: CUPA Facility Listing

Standard Environmental Record Source: Other Standard Environmental Records

Cupa facility list.

Date of Government Version: 11/20/2014
Source: Public Health Department
Number of Days to Update: 44
Telephone: 530-538-7149
Last EDR Contact :11/23/2015

CUPA CALVERAS: CUPA Facility Listing

Standard Environmental Record Source: Other Standard Environmental Records

Cupa Facility Listing

Date of Government Version: 10/22/2015
Source: Calveras County Environmental Health

Number of Days to Update: 24
Last EDR Contact :09/28/2015

Telephone: 209-754-6399

CUPA COLUSA: CUPA Facility List
Standard Environmental Record Source: Other Standard Environmental Records
Cupa facility list.

Date of Government Version: 06/08/2015
Number of Days to Update: 22
Last EDR Contact :11/09/2015

Source: Health & Human Services
Telephone: 530-458-0396

CUPA DEL NORTE: CUPA Facility List
Standard Environmental Record Source: Other Standard Environmental Records
Cupa Facility list

Date of Government Version: 05/20/2015
Number of Days to Update: 31
Last EDR Contact :11/13/2015

Source: Del Norte County Environmental Health Division
Telephone: 707-465-0426

CUPA EL DORADO: CUPA Facility List
Standard Environmental Record Source: Other Standard Environmental Records
CUPA facility list.

Date of Government Version: 09/23/2015
Number of Days to Update: 20
Last EDR Contact :11/07/2015

Source: El Dorado County Environmental Management Department
Telephone: 530-621-6623

CUPA FRESNO: CUPA Resources List
Standard Environmental Record Source: Other Standard Environmental Records
Certified Unified Program Agency. CUPA's are responsible for implementing a unified hazardous materials and hazardous waste management regulatory program. The agency provides oversight of businesses that deal with hazardous materials, operate underground storage tanks or aboveground storage tanks.

Date of Government Version: 10/15/2015
Number of Days to Update: 32
Last EDR Contact :10/05/2015

Source: Dept. of Community Health
Telephone: 559-445-3271

CUPA HUMBOLDT: CUPA Facility List
Standard Environmental Record Source: Other Standard Environmental Records
CUPA facility list.

Date of Government Version: 08/04/2015
Number of Days to Update: 27
Last EDR Contact :11/12/2015

Source: Humboldt County Environmental Health
Telephone: Not Reported

CUPA IMPERIAL: CUPA Facility List
Standard Environmental Record Source: Other Standard Environmental Records
Cupa facility list.

Date of Government Version: 08/11/2015
Number of Days to Update: 20
Last EDR Contact :10/26/2015

Source: San Diego Border Field Office
Telephone: 760-339-2777

CUPA INYO: CUPA Facility List

Standard Environmental Record Source: Other Standard Environmental Records

Cupa facility list.

Date of Government Version: 09/10/2013
Number of Days to Update: 33
Last EDR Contact :11/18/2015

Source: Inyo County Environmental Health Services
Telephone: 760-878-0238

CUPA KINGS: CUPA Facility List

Standard Environmental Record Source: Other Standard Environmental Records

A listing of sites included in the county's Certified Unified Program Agency database. California's Secretary for Environmental Protection established the unified hazardous materials and hazardous waste regulatory program as required by chapter 6.11 of the California Health and Safety Code. The Unified Program consolidates the administration, permits, inspections, and enforcement activities.

Date of Government Version: 08/25/2015
Number of Days to Update: 34
Last EDR Contact :11/18/2015

Source: Kings County Department of Public Health
Telephone: 559-584-1411

CUPA LAKE: CUPA Facility List

Standard Environmental Record Source: Other Standard Environmental Records

Cupa facility list

Date of Government Version: 08/11/2015
Number of Days to Update: 20
Last EDR Contact :10/19/2015

Source: Lake County Environmental Health
Telephone: 707-263-1164

CUPA MADERA: CUPA Facility List

Standard Environmental Record Source: Other Standard Environmental Records

A listing of sites included in the county's Certified Unified Program Agency database. California's Secretary for Environmental Protection established the unified hazardous materials and hazardous waste regulatory program as required by chapter 6.11 of the California Health and Safety Code. The Unified Program consolidates the administration, permits, inspections, and enforcement activities.

Date of Government Version: 09/15/2015
Number of Days to Update: 27
Last EDR Contact :11/18/2015

Source: Madera County Environmental Health
Telephone: 559-675-7823

CUPA MERCED: CUPA Facility List

Standard Environmental Record Source: Other Standard Environmental Records

CUPA facility list.

Date of Government Version: 09/21/2015
Number of Days to Update: 42
Last EDR Contact :12/10/2015

Source: Merced County Environmental Health
Telephone: 209-381-1094

CUPA MONO: CUPA Facility List

Standard Environmental Record Source: Other Standard Environmental Records

CUPA Facility List

Date of Government Version: 09/02/2015
Number of Days to Update: 39
Last EDR Contact :11/23/2015

Source: Mono County Health Department
Telephone: 760-932-5580

CUPA MONTEREY: CUPA Facility Listing

Standard Environmental Record Source: Other Standard Environmental Records

CUPA Program listing from the Environmental Health Division.

Date of Government Version: 06/30/2015
Number of Days to Update: 9
Last EDR Contact :11/18/2015

Source: Monterey County Health Department
Telephone: 831-796-1297

CUPA NEVADA: CUPA Facility List
Standard Environmental Record Source: Other Standard Environmental Records
CUPA facility list.

Date of Government Version: 06/03/2015
Number of Days to Update: 48
Last EDR Contact :11/06/2015

Source: Community Development Agency
Telephone: 530-265-1467

CUPA SAN LUIS OBISPO: CUPA Facility List
Standard Environmental Record Source: Other Standard Environmental Records
Cupa Facility List.

Date of Government Version: 08/25/2015
Number of Days to Update: 34
Last EDR Contact :12/04/2015

Source: San Luis Obispo County Public Health Department
Telephone: 805-781-5596

CUPA SANTA BARBARA: CUPA Facility Listing
Standard Environmental Record Source: Other Standard Environmental Records
CUPA Program Listing from the Environmental Health Services division.

Date of Government Version: 09/08/2011
Number of Days to Update: 28
Last EDR Contact :11/18/2015

Source: Santa Barbara County Public Health Department
Telephone: 805-686-8167

CUPA SANTA CLARA: Cupa Facility List
Standard Environmental Record Source: Other Standard Environmental Records
Cupa facility list

Date of Government Version: 08/24/2015
Number of Days to Update: 67
Last EDR Contact :11/18/2015

Source: Department of Environmental Health
Telephone: 408-918-1973

CUPA SANTA CRUZ: CUPA Facility List
Standard Environmental Record Source: Other Standard Environmental Records
CUPA facility listing.

Date of Government Version: 08/25/2015
Number of Days to Update: 36
Last EDR Contact :11/18/2015

Source: Santa Cruz County Environmental Health
Telephone: 831-464-2761

CUPA SHASTA: CUPA Facility List
Standard Environmental Record Source: Other Standard Environmental Records
Cupa Facility List.

Date of Government Version: 09/15/2015
Number of Days to Update: 49
Last EDR Contact :11/18/2015

Source: Shasta County Department of Resource Management
Telephone: 530-225-5789

CUPA SONOMA: Cupa Facility List

Standard Environmental Record Source: Other Standard Environmental Records

Cupa Facility list

Date of Government Version: 09/28/2015
Number of Days to Update: 36
Last EDR Contact :09/28/2015

Source: County of Sonoma Fire & Emergency Services Department
Telephone: 707-565-1174

CUPA TUOLUMNE: CUPA Facility List

Standard Environmental Record Source: Other Standard Environmental Records

Cupa facility list

Date of Government Version: 07/13/2015
Number of Days to Update: 6
Last EDR Contact :10/26/2015

Source: Divison of Environmental Health
Telephone: 209-533-5633

CUPA YUBA: CUPA Facility List

Standard Environmental Record Source: Other Standard Environmental Records

CUPA facility listing for Yuba County.

Date of Government Version: 08/04/2015
Number of Days to Update: 27
Last EDR Contact :11/13/2015

Source: Yuba County Environmental Health Department
Telephone: 530-749-7523

DEED: Deed Restriction Listing

Standard Environmental Record Source: Other Standard Environmental Records

Search Distance: 0.333 Mile

Site Mitigation and Brownfields Reuse Program Facility Sites with Deed Restrictions & Hazardous Waste Management Program Facility Sites with Deed / Land Use Restriction. The DTSC Site Mitigation and Brownfields Reuse Program (SMBRP) list includes sites cleaned up under the program's oversight and generally does not include current or former hazardous waste facilities that required a hazardous waste facility permit. The list represents deed restrictions that are active. Some sites have multiple deed restrictions. The DTSC Hazardous Waste Management Program (HWMP) has developed a list of current or former hazardous waste facilities that have a recorded land use restriction at the local county recorder's office. The land use restrictions on this list were required by the DTSC HWMP as a result of the presence of hazardous substances that remain on site after the facility (or part of the facility) has been closed or cleaned up. The types of land use restriction include deed notice, deed restriction, or a land use restriction that binds current and future owners.

Date of Government Version: 09/08/2015
Number of Days to Update: 34
Last EDR Contact :12/08/2015

Source: DTSC and SWRCB
Telephone: 916-323-3400

DRYCLEANERS: Cleaner Facilities

Standard Environmental Record Source: Other Standard Environmental Records

Search Distance: 0.25 Mile

A list of drycleaner related facilities that have EPA ID numbers. These are facilities with certain SIC codes: power laundries, family and commercial; garment pressing and cleaner's agents; linen supply; coin-operated laundries and cleaning; drycleaning plants, except rugs; carpet and upholster cleaning; industrial launderers; laundry and garment services.

Date of Government Version: 08/10/2015
Number of Days to Update: 35
Last EDR Contact :12/04/2015

Source: Department of Toxic Substance Control
Telephone: 916-327-4498

EL SEGUNDO UST: City of El Segundo Underground Storage Tank

Standard Environmental Record Source: State and tribal registered storage tank lists

Underground storage tank sites located in El Segundo city.

Date of Government Version: 03/30/2015
Number of Days to Update: 11
Last EDR Contact :10/19/2015

Source: City of El Segundo Fire Department
Telephone: 310-524-2236

EMI: Emissions Inventory Data

Standard Environmental Record Source: Other Standard Environmental Records
Search Distance: Property

Toxics and criteria pollutant emissions data collected by the ARB and local air pollution agencies.

Date of Government Version: 12/31/2013
Number of Days to Update: 41
Last EDR Contact :09/25/2015

Source: California Air Resources Board
Telephone: 916-322-2990

ENF: Enforcement Action Listing

Standard Environmental Record Source: Other Standard Environmental Records
Search Distance: Property

A listing of Water Board Enforcement Actions. Formal is everything except Oral/Verbal Communication, Notice of Violation, Expedited Payment Letter, and Staff Enforcement Letter.

Date of Government Version: 08/24/2015
Number of Days to Update: 36
Last EDR Contact :11/18/2015

Source: State Water Resoruces Control Board
Telephone: 916-445-9379

ENVIROSTOR: EnviroStor Database

Standard Environmental Record Source: State and tribal - equivalent CERCLIS
Search Distance: 0.333 Mile

The Department of Toxic Substances Control's (DTSC's) Site Mitigation and Brownfields Reuse Program's (SMBRP's) EnviroStor database identifes sites that have known contamination or sites for which there may be reasons to investigate further. The database includes the following site types: Federal Superfund sites (National Priorities List (NPL)); State Response, including Military Facilities and State Superfund; Voluntary Cleanup; and School sites. EnviroStor provides similar information to the information that was available in CalSites, and provides additional site information, including, but not limited to, identification of formerly-contaminated properties that have been released for reuse, properties where environmental deed restrictions have been recorded to prevent inappropriate land uses, and risk characterization information that is used to assess potential impacts to public health and the environment at contaminated sites.

Date of Government Version: 08/03/2015
Number of Days to Update: 30
Last EDR Contact :11/07/2015

Source: Department of Toxic Substances Control
Telephone: 916-323-3400

HAULERS: Registered Waste Tire Haulers Listing

Standard Environmental Record Source: Other Standard Environmental Records
Search Distance: Property

A listing of registered waste tire haulers.

Date of Government Version: 09/21/2015
Number of Days to Update: 44
Last EDR Contact :11/13/2015

Source: Integrated Waste Management Board
Telephone: 916-341-6422

HAZNET: Facility and Manifest Data

Standard Environmental Record Source: Other Standard Environmental Records
Search Distance: Property

Facility and Manifest Data. The data is extracted from the copies of hazardous waste manifests received each year by the DTSC. The annual volume of manifests is typically 700,000 - 1,000,000 annually, representing approximately 350,000 - 500,000 shipments. Data are from the manifests submitted without correction, and therefore many contain some invalid values for data elements such as generator ID, TSD ID, waste category, and disposal method. This database begins with calendar year 1993.

Date of Government Version: 12/31/2013
Number of Days to Update: 35
Last EDR Contact :10/14/2015

Source: California Environmental Protection Agency
Telephone: 916-255-1136

HIST CAL-SITES: Calsites Database

Standard Environmental Record Source: State and tribal - equivalent CERCLIS
Search Distance: 0.333 Mile

The Calsites database contains potential or confirmed hazardous substance release properties. In 1996, California EPA reevaluated and significantly reduced the number of sites in the Calsites database. No longer updated by the state agency. It has been replaced by ENVIROSTOR.

Date of Government Version: 08/08/2005
Number of Days to Update: 21
Last EDR Contact :02/23/2009

Source: Department of Toxic Substance Control
Telephone: 916-323-3400

HIST CORTESE: Hazardous Waste & Substance Site List

Standard Environmental Record Source: Other Standard Environmental Records
Search Distance: 0.333 Mile

The sites for the list are designated by the State Water Resource Control Board [LUST], the Integrated Waste Board [SWF/LS], and the Department of Toxic Substances Control [CALSITES]. This listing is no longer updated by the state agency.

Date of Government Version: 04/01/2001
Number of Days to Update: 76
Last EDR Contact :01/22/2009

Source: Department of Toxic Substances Control
Telephone: 916-323-3400

HIST LUST SANTA CLARA: HIST LUST - Fuel Leak Site Activity Report

Standard Environmental Record Source: State and tribal leaking storage tank lists
Search Distance: 0.333 Mile

A listing of open and closed leaking underground storage tanks. This listing is no longer updated by the county. Leaking underground storage tanks are now handled by the Department of Environmental Health.

Date of Government Version: 03/29/2005
Number of Days to Update: 22
Last EDR Contact :03/23/2009

Source: Santa Clara Valley Water District
Telephone: 408-265-2600

HIST UST: Hazardous Substance Storage Container Database

Standard Environmental Record Source: State and tribal registered storage tank lists
Search Distance: Property

The Hazardous Substance Storage Container Database is a historical listing of UST sites. Refer to local/county source for current data.

Date of Government Version: 10/15/1990
Number of Days to Update: 18
Last EDR Contact :07/26/2001

Source: State Water Resources Control Board
Telephone: 916-341-5851

HWP: EnviroStor Permitted Facilities Listing

Standard Environmental Record Source: Other Standard Environmental Records
Search Distance: 0.333 Mile

Detailed information on permitted hazardous waste facilities and corrective action ("cleanups") tracked in EnviroStor.

Date of Government Version: 08/24/2015
Number of Days to Update: 36
Last EDR Contact :11/24/2015

Source: Department of Toxic Substances Control
Telephone: 916-323-3400

HWT: Registered Hazardous Waste Transporter Database
Standard Environmental Record Source: Other Standard Environmental Records
Search Distance: Property

A listing of hazardous waste transporters. In California, unless specifically exempted, it is unlawful for any person to transport hazardous wastes unless the person holds a valid registration issued by DTSC. A hazardous waste transporter registration is valid for one year and is assigned a unique registration number.

Date of Government Version: 07/27/2015
Number of Days to Update: 36
Last EDR Contact :10/14/2015

Source: Department of Toxic Substances Control
Telephone: 916-440-7145

KERN CO. UST: Underground Storage Tank Sites & Tank Listing
Standard Environmental Record Source: State and tribal registered storage tank lists
Kern County Sites and Tanks Listing.

Date of Government Version: 05/19/2015
Number of Days to Update: 34
Last EDR Contact :11/18/2015

Source: Kern County Environment Health Services Department
Telephone: 661-862-8700

LA Co. Site Mitigation: Site Mitigation List
Standard Environmental Record Source: Other Standard Environmental Records
Search Distance: Property

Industrial sites that have had some sort of spill or complaint.

Date of Government Version: 01/15/2015
Number of Days to Update: 40
Last EDR Contact :10/19/2015

Source: Community Health Services
Telephone: 323-890-7806

LDS: Land Disposal Sites Listing
Standard Environmental Record Source: Other Standard Environmental Records
Search Distance: Property

The Land Disposal program regulates of waste discharge to land for treatment, storage and disposal in waste management units.

Date of Government Version: 10/21/2015
Number of Days to Update: 14
Last EDR Contact :10/22/2015

Source: State Water Qualilty Control Board
Telephone: 866-480-1028

LIENS: Environmental Liens Listing
Standard Environmental Record Source: Other Standard Environmental Records
Search Distance: Property

A listing of property locations with environmental liens for California where DTSC is a lien holder.

Date of Government Version: 09/08/2015
Number of Days to Update: 32

Source: Department of Toxic Substances Control
Telephone: 916-323-3400

Last EDR Contact :12/04/2015

LONG BEACH UST: City of Long Beach Underground Storage Tank

Standard Environmental Record Source: State and tribal registered storage tank lists

Underground storage tank sites located in the city of Long Beach.

Date of Government Version: 03/03/2015
Number of Days to Update: 16
Last EDR Contact :10/26/2015

Source: City of Long Beach Fire Department
Telephone: 562-570-2563

LOS ANGELES CO. HMS: HMS: Street Number List

Standard Environmental Record Source: Other Standard Environmental Records

Search Distance: Property

Industrial Waste and Underground Storage Tank Sites.

Date of Government Version: 11/24/2014
Number of Days to Update: 33
Last EDR Contact :10/09/2015

Source: Department of Public Works
Telephone: 626-458-3517

LOS ANGELES CO. LF: List of Solid Waste Facilities

Standard Environmental Record Source: State and tribal landfill / solid waste disposal

Solid Waste Facilities in Los Angeles County.

Date of Government Version: 10/19/2015
Number of Days to Update: 30
Last EDR Contact :10/20/2015

Source: La County Department of Public Works
Telephone: 818-458-5185

LUST: Geotracker's Leaking Underground Fuel Tank Report

Standard Environmental Record Source: State and tribal leaking storage tank lists

Search Distance: 0.333 Mile

Leaking Underground Storage Tank Incident Reports. LUST records contain an inventory of reported leaking underground storage tank incidents. Not all states maintain these records, and the information stored varies by state. For more information on a particular leaking underground storage tank sites, please contact the appropriate regulatory agency.

Date of Government Version: 10/21/2015
Number of Days to Update: 14
Last EDR Contact :10/22/2015

Source: State Water Resources Control Board
Telephone: see region list

LUST REG 1: Active Toxic Site Investigation

Standard Environmental Record Source: State and tribal leaking storage tank lists

Del Norte, Humboldt, Lake, Mendocino, Modoc, Siskiyou, Sonoma, Trinity counties. For more current information, please refer to the State Water Resources Control Board's LUST database.

Date of Government Version: 02/01/2001
Number of Days to Update: 29
Last EDR Contact :08/01/2011

Source: California Regional Water Quality Control Board North Coast (1)
Telephone: 707-570-3769

LUST REG 2: Fuel Leak List

Standard Environmental Record Source: State and tribal leaking storage tank lists

Leaking Underground Storage Tank locations. Alameda, Contra Costa, Marin, Napa, San Francisco, San Mateo, Santa Clara, Solano, Sonoma counties.

Date of Government Version: 09/30/2004
Number of Days to Update: 30
Last EDR Contact :09/19/2011

Source: California Regional Water Quality Control Board San Francisco Bay Region (2)
Telephone: 510-622-2433

LUST REG 3: Leaking Underground Storage Tank Database

Standard Environmental Record Source: State and tribal leaking storage tank lists

Leaking Underground Storage Tank locations. Monterey, San Benito, San Luis Obispo, Santa Barbara, Santa Cruz counties.

Date of Government Version: 05/19/2003
Number of Days to Update: 14
Last EDR Contact :07/18/2011

Source: California Regional Water Quality Control Board Central Coast Region (3)
Telephone: 805-542-4786

LUST REG 4: Underground Storage Tank Leak List

Standard Environmental Record Source: State and tribal leaking storage tank lists

Los Angeles, Ventura counties. For more current information, please refer to the State Water Resources Control Board's LUST database.

Date of Government Version: 09/07/2004
Number of Days to Update: 35
Last EDR Contact :09/06/2011

Source: California Regional Water Quality Control Board Los Angeles Region (4)
Telephone: 213-576-6710

LUST REG 5: Leaking Underground Storage Tank Database

Standard Environmental Record Source: State and tribal leaking storage tank lists

Leaking Underground Storage Tank locations. Alameda, Alpine, Amador, Butte, Colusa, Contra Costa, Calveras, El Dorado, Fresno, Glenn, Kern, Kings, Lake, Lassen, Madera, Mariposa, Merced, Modoc, Napa, Nevada, Placer, Plumas, Sacramento, San Joaquin, Shasta, Solano, Stanislaus, Sutter, Tehama, Tulare, Tuolumne, Yolo, Yuba counties.

Date of Government Version: 07/01/2008
Number of Days to Update: 9
Last EDR Contact :07/01/2011

Source: California Regional Water Quality Control Board Central Valley Region (5)
Telephone: 916-464-4834

LUST REG 6L: Leaking Underground Storage Tank Case Listing

Standard Environmental Record Source: State and tribal leaking storage tank lists

For more current information, please refer to the State Water Resources Control Board's LUST database.

Date of Government Version: 09/09/2003
Number of Days to Update: 27
Last EDR Contact :09/12/2011

Source: California Regional Water Quality Control Board Lahontan Region (6)
Telephone: 530-542-5572

LUST REG 6V: Leaking Underground Storage Tank Case Listing

Standard Environmental Record Source: State and tribal leaking storage tank lists

Leaking Underground Storage Tank locations. Inyo, Kern, Los Angeles, Mono, San Bernardino counties.

Date of Government Version: 06/07/2005
Number of Days to Update: 22
Last EDR Contact :09/12/2011

Source: California Regional Water Quality Control Board Victorville Branch Office (6)
Telephone: 760-241-7365

LUST REG 7: Leaking Underground Storage Tank Case Listing

Standard Environmental Record Source: State and tribal leaking storage tank lists

Leaking Underground Storage Tank locations. Imperial, Riverside, San Diego, Santa Barbara counties.

Date of Government Version: 02/26/2004
Number of Days to Update: 27
Last EDR Contact :08/01/2011

Source: California Regional Water Quality Control Board Colorado River Basin Region (7)
Telephone: 760-776-8943

LUST REG 8: Leaking Underground Storage Tanks

Standard Environmental Record Source: State and tribal leaking storage tank lists

California Regional Water Quality Control Board Santa Ana Region (8). For more current information, please refer to the State Water Resources Control Board's LUST database.

Date of Government Version: 02/14/2005
Number of Days to Update: 41
Last EDR Contact :08/15/2011

Source: California Regional Water Quality Control Board Santa Ana Region (8)
Telephone: 909-782-4496

LUST REG 9: Leaking Underground Storage Tank Report

Standard Environmental Record Source: State and tribal leaking storage tank lists

Orange, Riverside, San Diego counties. For more current information, please refer to the State Water Resources Control Board's LUST database.

Date of Government Version: 03/01/2001
Number of Days to Update: 28
Last EDR Contact :09/26/2011

Source: California Regional Water Quality Control Board San Diego Region (9)
Telephone: 858-637-5595

LUST SANTA CLARA: LOP Listing

Standard Environmental Record Source: State and tribal leaking storage tank lists

A listing of leaking underground storage tanks located in Santa Clara county.

Date of Government Version: 03/03/2014
Number of Days to Update: 13
Last EDR Contact :11/23/2015

Source: Department of Environmental Health
Telephone: 408-918-3417

MARIN CO. UST: Underground Storage Tank Sites

Standard Environmental Record Source: State and tribal registered storage tank lists

Currently permitted USTs in Marin County.

Date of Government Version: 10/05/2015
Number of Days to Update: 7
Last EDR Contact :10/05/2015

Source: Public Works Department Waste Management
Telephone: 415-499-6647

MCS: Military Cleanup Sites Listing

Standard Environmental Record Source: Other Standard Environmental Records

Search Distance: Property

The State Water Resources Control Board and nine Regional Water Quality Control Boards partner with the Department of Defense (DoD) through the Defense and State Memorandum of Agreement (DSMOA) to oversee the investigation and remediation of water quality issues at military facilities.

Date of Government Version: 10/21/2015
Number of Days to Update: 14
Last EDR Contact :10/22/2015

Source: State Water Resources Control Board
Telephone: 866-480-1028

MED WASTE VENTURA: Medical Waste Program List

Standard Environmental Record Source: Other Standard Environmental Records

Search Distance: Property

To protect public health and safety and the environment from potential exposure to disease causing agents, the Environmental Health Division Medical Waste Program regulates the generation, handling, storage, treatment and disposal of medical waste throughout the County.

Date of Government Version: 09/28/2015
Number of Days to Update: 22
Last EDR Contact :10/26/2015

Source: Ventura County Resource Management Agency
Telephone: 805-654-2813

MINES: Mines Site Location Listing

Standard Environmental Record Source: Other Standard Environmental Records

Search Distance: 0.333 Mile

A listing of mine site locations from the Office of Mine Reclamation.

Date of Government Version: 09/14/2015
Number of Days to Update: 29
Last EDR Contact :09/15/2015

Source: Department of Conservation
Telephone: 916-322-1080

MWMP: Medical Waste Management Program Listing

Standard Environmental Record Source: Other Standard Environmental Records

Search Distance: Property

The Medical Waste Management Program (MWMP) ensures the proper handling and disposal of medical waste by permitting and inspecting medical waste Offsite Treatment Facilities (PDF) and Transfer Stations (PDF) throughout the state. MWMP also oversees all Medical Waste Transporters.

Date of Government Version: 09/03/2015
Number of Days to Update: 33
Last EDR Contact :12/08/2015

Source: Department of Public Health
Telephone: 916-558-1784

NAPA CO. LUST: Sites With Reported Contamination

Standard Environmental Record Source: State and tribal leaking storage tank lists

A listing of leaking underground storage tank sites located in Napa county.

Date of Government Version: 12/05/2011
Number of Days to Update: 63
Last EDR Contact :11/23/2015

Source: Napa County Department of Environmental Management
Telephone: 707-253-4269

NAPA CO. UST: Closed and Operating Underground Storage Tank Sites

Standard Environmental Record Source: State and tribal registered storage tank lists

Underground storage tank sites located in Napa county.

Date of Government Version: 01/15/2008
Number of Days to Update: 23
Last EDR Contact :11/23/2015

Source: Napa County Department of Environmental Management
Telephone: 707-253-4269

NOTIFY 65: Proposition 65 Records

Standard Environmental Record Source: Other Standard Environmental Records

Search Distance: Property

Listings of all Proposition 65 incidents reported to counties by the State Water Resources Control Board and the Regional Water Quality Control Board. This database is no longer updated by the reporting agency.

Date of Government Version: 08/04/2015

Source: State Water Resources Control Board

Number of Days to Update: 41
Telephone: 916-445-3846
Last EDR Contact :11/16/2015

NPDES: NPDES Permits Listing
Standard Environmental Record Source: Other Standard Environmental Records
Search Distance: Property

A listing of NPDES permits, including stormwater.

Date of Government Version: 08/17/2015
Source: State Water Resources Control Board
Number of Days to Update: 24
Telephone: 916-445-9379
Last EDR Contact :11/18/2015

ORANGE CO. LUST: List of Underground Storage Tank Cleanups
Standard Environmental Record Source: State and tribal leaking storage tank lists
Orange County Underground Storage Tank Cleanups (LUST).

Date of Government Version: 08/03/2015
Source: Health Care Agency
Number of Days to Update: 32
Telephone: 714-834-3446
Last EDR Contact :11/10/2015

ORANGE CO. UST: List of Underground Storage Tank Facilities
Standard Environmental Record Source: State and tribal registered storage tank lists
Orange County Underground Storage Tank Facilities (UST).

Date of Government Version: 08/01/2015
Source: Health Care Agency
Number of Days to Update: 23
Telephone: 714-834-3446
Last EDR Contact :11/11/2015

Orange Co. Industrial Site: List of Industrial Site Cleanups
Standard Environmental Record Source: Other Standard Environmental Records
Search Distance: Property

Petroleum and non-petroleum spills.

Date of Government Version: 08/01/2015
Source: Health Care Agency
Number of Days to Update: 24
Telephone: 714-834-3446
Last EDR Contact :11/10/2015

PEST LIC: Pesticide Regulation Licenses Listing
Standard Environmental Record Source: Other Standard Environmental Records
Search Distance: 0.333 Mile

A listing of licenses and certificates issued by the Department of Pesticide Regulation. The DPR issues licenses and/or certificates to: Persons and businesses that apply or sell pesticides; Pest control dealers and brokers; Persons who advise on agricultural pesticide applications.

Date of Government Version: 09/08/2015
Source: Department of Pesticide Regulation
Number of Days to Update: 33
Telephone: 916-445-4038
Last EDR Contact :12/08/2015

PLACER CO. MS: Master List of Facilities
Standard Environmental Record Source: Other Standard Environmental Records
Search Distance: 0.25 Mile

List includes aboveground tanks, underground tanks and cleanup sites.

Date of Government Version: 09/08/2015
Number of Days to Update: 36
Last EDR Contact :12/04/2015

Source: Placer County Health and Human Services
Telephone: 530-745-2363

PROC: Certified Processors Database
Standard Environmental Record Source: Other Standard Environmental Records
Search Distance: 0.333 Mile

A listing of certified processors.

Date of Government Version: 09/14/2015
Number of Days to Update: 29
Last EDR Contact :09/15/2015

Source: Department of Conservation
Telephone: 916-323-3836

RESPONSE: State Response Sites
Standard Environmental Record Source: State and tribal - equivalent NPL
Search Distance: 0.333 Mile

Identifies confirmed release sites where DTSC is involved in remediation, either in a lead or oversight capacity. These confirmed release sites are generally high-priority and high potential risk.

Date of Government Version: 08/03/2015
Number of Days to Update: 30
Last EDR Contact :11/07/2015

Source: Department of Toxic Substances Control
Telephone: 916-323-3400

RIVERSIDE CO. LUST: Listing of Underground Tank Cleanup Sites
Standard Environmental Record Source: State and tribal leaking storage tank lists
Riverside County Underground Storage Tank Cleanup Sites (LUST).

Date of Government Version: 10/26/2015
Number of Days to Update: 22
Last EDR Contact :09/21/2015

Source: Department of Environmental Health
Telephone: 951-358-5055

RIVERSIDE CO. UST: Underground Storage Tank Tank List
Standard Environmental Record Source: State and tribal registered storage tank lists
Underground storage tank sites located in Riverside county.

Date of Government Version: 10/26/2015
Number of Days to Update: 22
Last EDR Contact :09/21/2015

Source: Department of Environmental Health
Telephone: 951-358-5055

SAN DIEGO CO. HMMD: Hazardous Materials Management Division Database
Standard Environmental Record Source: Other Standard Environmental Records
Search Distance: Property

The database includes: HE58 - This report contains the business name, site address, business phone number, establishment 'H' permit number, type of permit, and the business status. HE17 - In addition to providing the same information provided in the HE58 listing, HE17 provides inspection dates, violations received by the establishment, hazardous waste generated, the quantity, method of storage, treatment/disposal of waste and the hauler, and information on underground storage tanks. Unauthorized Release List - Includes a summary of environmental contamination cases in San Diego County (underground tank cases, non-tank cases, groundwater contamination, and soil contamination are included.)

Date of Government Version: 09/23/2013
Number of Days to Update: 23

Source: Hazardous Materials Management Division
Telephone: 619-338-2268

Last EDR Contact :12/04/2015

SAN DIEGO CO. LF: Solid Waste Facilities

Standard Environmental Record Source: State and tribal landfill / solid waste disposal

San Diego County Solid Waste Facilities.

Date of Government Version: 10/31/2014
Number of Days to Update: 38
Last EDR Contact :10/26/2015

Source: Department of Health Services
Telephone: 619-338-2209

SAN DIEGO CO. SAM: Environmental Case Listing

Standard Environmental Record Source: State and tribal leaking storage tank lists

Search Distance: 0.333 Mile

The listing contains all underground tank release cases and projects pertaining to properties contaminated with hazardous substances that are actively under review by the Site Assessment and Mitigation Program.

Date of Government Version: 03/23/2010
Number of Days to Update: 24
Last EDR Contact :12/04/2015

Source: San Diego County Department of Environmental Health
Telephone: 619-338-2371

SAN FRANCISCO CO. LUST: Local Oversite Facilities

Standard Environmental Record Source: State and tribal leaking storage tank lists

A listing of leaking underground storage tank sites located in San Francisco county.

Date of Government Version: 09/19/2008
Number of Days to Update: 10
Last EDR Contact :11/09/2015

Source: Department Of Public Health San Francisco County
Telephone: 415-252-3920

SAN FRANCISCO CO. UST: Underground Storage Tank Information

Standard Environmental Record Source: State and tribal registered storage tank lists

Underground storage tank sites located in San Francisco county.

Date of Government Version: 11/29/2010
Number of Days to Update: 5
Last EDR Contact :11/09/2015

Source: Department of Public Health
Telephone: 415-252-3920

SAN JOSE HAZMAT: Hazardous Material Facilities

Standard Environmental Record Source: Other Standard Environmental Records

Search Distance: Property

Hazardous material facilities, including underground storage tank sites.

Date of Government Version: 08/10/2015
Number of Days to Update: 20
Last EDR Contact :11/18/2015

Source: City of San Jose Fire Department
Telephone: 408-535-7694

SAN MATEO CO. LUST: Fuel Leak List

Standard Environmental Record Source: State and tribal leaking storage tank lists

A listing of leaking underground storage tank sites located in San Mateo county.

Date of Government Version: 09/16/2015
Number of Days to Update: 49
Last EDR Contact :12/10/2015

Source: San Mateo County Environmental Health Services Division
Telephone: 650-363-1921

RECORD SOURCES AND CURRENCY

SCH: School Property Evaluation Program

Standard Environmental Record Source: Other Standard Environmental Records

Search Distance: Property

This category contains proposed and existing school sites that are being evaluated by DTSC for possible hazardous materials contamination. In some cases, these properties may be listed in the CalSites category depending on the level of threat to public health and safety or the environment they pose.

Date of Government Version: 08/03/2015
Number of Days to Update: 30
Last EDR Contact :11/07/2015

Source: Department of Toxic Substances Control
Telephone: 916-323-3400

SLIC: Statewide SLIC Cases

Standard Environmental Record Source: State and tribal leaking storage tank lists

Search Distance: 0.333 Mile

The SLIC (Spills, Leaks, Investigations and Cleanup) program is designed to protect and restore water quality from spills, leaks, and similar discharges.

Date of Government Version: 10/21/2015
Number of Days to Update: 15
Last EDR Contact :10/22/2015

Source: State Water Resources Control Board
Telephone: 866-480-1028

SLIC REG 1: Active Toxic Site Investigations

Standard Environmental Record Source: State and tribal leaking storage tank lists

The SLIC (Spills, Leaks, Investigations and Cleanup) program is designed to protect and restore water quality from spills, leaks, and similar discharges.

Date of Government Version: 04/03/2003
Number of Days to Update: 18
Last EDR Contact :08/01/2011

Source: California Regional Water Quality Control Board, North Coast Region (1)
Telephone: 707-576-2220

SLIC REG 2: Spills, Leaks, Investigation & Cleanup Cost Recovery Listing

Standard Environmental Record Source: State and tribal leaking storage tank lists

The SLIC (Spills, Leaks, Investigations and Cleanup) program is designed to protect and restore water quality from spills, leaks, and similar discharges.

Date of Government Version: 09/30/2004
Number of Days to Update: 30
Last EDR Contact :09/19/2011

Source: Regional Water Quality Control Board San Francisco Bay Region (2)
Telephone: 510-286-0457

SLIC REG 3: Spills, Leaks, Investigation & Cleanup Cost Recovery Listing

Standard Environmental Record Source: State and tribal leaking storage tank lists

The SLIC (Spills, Leaks, Investigations and Cleanup) program is designed to protect and restore water quality from spills, leaks, and similar discharges.

Date of Government Version: 05/18/2006
Number of Days to Update: 28
Last EDR Contact :07/18/2011

Source: California Regional Water Quality Control Board Central Coast Region (3)
Telephone: 805-549-3147

SLIC REG 4: Spills, Leaks, Investigation & Cleanup Cost Recovery Listing

Standard Environmental Record Source: State and tribal leaking storage tank lists

The SLIC (Spills, Leaks, Investigations and Cleanup) program is designed to protect and restore water quality from spills, leaks, and similar discharges.

Date of Government Version: 11/17/2004
Number of Days to Update: 47
Last EDR Contact :07/01/2011

Source: Region Water Quality Control Board Los Angeles Region (4)
Telephone: 213-576-6600

SLIC REG 5: Spills, Leaks, Investigation & Cleanup Cost Recovery Listing

Standard Environmental Record Source: State and tribal leaking storage tank lists

The SLIC (Spills, Leaks, Investigations and Cleanup) program is designed to protect and restore water quality from spills, leaks, and similar discharges.

Date of Government Version: 04/01/2005
Number of Days to Update: 16
Last EDR Contact :09/12/2011

Source: Regional Water Quality Control Board Central Valley Region (5)
Telephone: 916-464-3291

SLIC REG 6L: SLIC Sites

Standard Environmental Record Source: State and tribal leaking storage tank lists

The SLIC (Spills, Leaks, Investigations and Cleanup) program is designed to protect and restore water quality from spills, leaks, and similar discharges.

Date of Government Version: 09/07/2004
Number of Days to Update: 35
Last EDR Contact :08/15/2011

Source: California Regional Water Quality Control Board, Lahontan Region
Telephone: 530-542-5574

SLIC REG 6V: Spills, Leaks, Investigation & Cleanup Cost Recovery Listing

Standard Environmental Record Source: State and tribal leaking storage tank lists

The SLIC (Spills, Leaks, Investigations and Cleanup) program is designed to protect and restore water quality from spills, leaks, and similar discharges.

Date of Government Version: 05/24/2005
Number of Days to Update: 22
Last EDR Contact :08/15/2011

Source: Regional Water Quality Control Board, Victorville Branch
Telephone: 619-241-6583

SLIC REG 7: SLIC List

Standard Environmental Record Source: State and tribal leaking storage tank lists

The SLIC (Spills, Leaks, Investigations and Cleanup) program is designed to protect and restore water quality from spills, leaks, and similar discharges.

Date of Government Version: 11/24/2004
Number of Days to Update: 36
Last EDR Contact :08/01/2011

Source: California Regional Quality Control Board, Colorado River Basin Region
Telephone: 760-346-7491

SLIC REG 8: Spills, Leaks, Investigation & Cleanup Cost Recovery Listing

Standard Environmental Record Source: State and tribal leaking storage tank lists

The SLIC (Spills, Leaks, Investigations and Cleanup) program is designed to protect and restore water quality from spills, leaks, and similar discharges.

Date of Government Version: 04/03/2008
Number of Days to Update: 11
Last EDR Contact :09/12/2011

Source: California Region Water Quality Control Board Santa Ana Region (8)
Telephone: 951-782-3298

SLIC REG 9: Spills, Leaks, Investigation & Cleanup Cost Recovery Listing

Standard Environmental Record Source: State and tribal leaking storage tank lists

The SLIC (Spills, Leaks, Investigations and Cleanup) program is designed to protect and restore water quality from spills, leaks, and similar discharges.

Date of Government Version: 09/10/2007
Source: California Regional Water Quality Control Board San Diego Region (9)
Number of Days to Update: 17
Telephone: 858-467-2980
Last EDR Contact :08/08/2011

SOLANO CO. LUST: Leaking Underground Storage Tanks

Standard Environmental Record Source: State and tribal leaking storage tank lists

A listing of leaking underground storage tank sites located in Solano county.

Date of Government Version: 09/02/2015
Source: Solano County Department of Environmental Management
Number of Days to Update: 49
Telephone: 707-784-6770
Last EDR Contact :09/10/2015

SOLANO CO. UST: Underground Storage Tanks

Standard Environmental Record Source: State and tribal registered storage tank lists

Underground storage tank sites located in Solano county.

Date of Government Version: 09/02/2015
Source: Solano County Department of Environmental Management
Number of Days to Update: 27
Telephone: 707-784-6770
Last EDR Contact :12/10/2015

SONOMA CO. LUST: Leaking Underground Storage Tank Sites

Standard Environmental Record Source: State and tribal leaking storage tank lists

A listing of leaking underground storage tank sites located in Sonoma county.

Date of Government Version: 10/01/2015
Source: Department of Health Services
Number of Days to Update: 34
Telephone: 707-565-6565
Last EDR Contact :09/28/2015

SUTTER CO. UST: Underground Storage Tanks

Standard Environmental Record Source: State and tribal registered storage tank lists

Underground storage tank sites located in Sutter county.

Date of Government Version: 06/05/2015
Source: Sutter County Department of Agriculture
Number of Days to Update: 27
Telephone: 530-822-7500
Last EDR Contact :12/04/2015

SWEEPS UST: SWEEPS UST Listing

Standard Environmental Record Source: State and tribal registered storage tank lists

Search Distance: Property

Statewide Environmental Evaluation and Planning System. This underground storage tank listing was updated and maintained by a company contacted by the SWRCB in the early 1990's. The listing is no longer updated or maintained. The local agency is the contact for more information on a site on the SWEEPS list.

Date of Government Version: 06/01/1994
Source: State Water Resources Control Board
Number of Days to Update: 35
Telephone: Not Reported
Last EDR Contact :06/03/2005

SWF/LF (SWIS): Solid Waste Information System

Standard Environmental Record Source: State and tribal landfill / solid waste disposal

Search Distance: 0.333 Mile

Active, Closed and Inactive Landfills.SWF/LF records typically contain an inventory of solid waste disposal facilities or landfills.These may be active or inactive facilities or open dumps that failed to meet RCRA Section 4004 criteriafor solid waste landfills or disposal sites.

Date of Government Version: 08/17/2015
Number of Days to Update: 16
Last EDR Contact :11/18/2015

Source: Department of Resources Recycling and Recovery
Telephone: 916-341-6320

SWRCY: Recycler Database

Standard Environmental Record Source: State and tribal landfill / solid waste disposal

Search Distance: 0.333 Mile

A listing of recycling facilities in California.

Date of Government Version: 09/14/2015
Number of Days to Update: 29
Last EDR Contact :09/15/2015

Source: Department of Conservation
Telephone: 916-323-3836

Sacramento Co. CS: Toxic Site Clean-Up List

Standard Environmental Record Source: State and tribal leaking storage tank lists

Search Distance: 0.333 Mile

List of sites where unauthorized releases of potentially hazardous materials have occurred.

Date of Government Version: 08/03/2015
Number of Days to Update: 41
Last EDR Contact :10/06/2015

Source: Sacramento County Environmental Management
Telephone: 916-875-8406

Sacramento Co. ML: Master Hazardous Materials Facility List

Standard Environmental Record Source: Other Standard Environmental Records

Search Distance: 0.25 Mile

Any business that has hazardous materials on site - hazardous material storage sites, underground storage tanks, waste generators.

Date of Government Version: 08/03/2015
Number of Days to Update: 31
Last EDR Contact :10/06/2015

Source: Sacramento County Environmental Management
Telephone: 916-875-8406

San Bern. Co. Permit: Hazardous Material Permits

Standard Environmental Record Source: Other Standard Environmental Records

Search Distance: 0.25 Mile

This listing includes underground storage tanks, medical waste handlers/generators, hazardous materials handlers, hazardous waste generators, and waste oil generators/handlers.

Date of Government Version: 06/30/2015
Number of Days to Update: 7
Last EDR Contact :11/09/2015

Source: San Bernardino County Fire Department Hazardous Materials Division
Telephone: 909-387-3041

San Mateo Co. BI: Business Inventory

Standard Environmental Record Source: Other Standard Environmental Records

Search Distance: 0.25 Mile

List includes Hazardous Materials Business Plan, hazardous waste generators, and underground storage tanks.

Date of Government Version: 10/14/2015
Number of Days to Update: 32
Last EDR Contact :09/14/2015

Source: San Mateo County Environmental Health Services Division
Telephone: 650-363-1921

TORRANCE UST: City of Torrance Underground Storage Tank

Standard Environmental Record Source: State and tribal registered storage tank lists

Underground storage tank sites located in the city of Torrance.

Date of Government Version: 10/13/2015
Number of Days to Update: 48
Last EDR Contact :10/09/2015

Source: City of Torrance Fire Department
Telephone: 310-618-2973

TOXIC PITS: Toxic Pits Cleanup Act Sites

Standard Environmental Record Source: Other Standard Environmental Records

Search Distance: 0.333 Mile

Toxic PITS Cleanup Act Sites. TOXIC PITS identifies sites suspected of containing hazardous substances where cleanup has not yet been completed.

Date of Government Version: 07/01/1995
Number of Days to Update: 27
Last EDR Contact :01/26/2009

Source: State Water Resources Control Board
Telephone: 916-227-4364

UIC: UIC Listing

Standard Environmental Record Source: Other Standard Environmental Records

Search Distance: Property

A listing of wells identified as underground injection wells, in the California Oil and Gas Wells database.

Date of Government Version: 07/23/2015
Number of Days to Update: 28
Last EDR Contact :09/15/2015

Source: Deaprtment of Conservation
Telephone: 916-445-2408

UST: Active UST Facilities

Standard Environmental Record Source: State and tribal registered storage tank lists

Search Distance: Property

Active UST facilities gathered from the local regulatory agencies

Date of Government Version: 10/21/2015
Number of Days to Update: 28
Last EDR Contact :10/22/2015

Source: SWRCB
Telephone: 916-341-5851

UST MENDOCINO: Mendocino County UST Database

Standard Environmental Record Source: State and tribal registered storage tank lists

A listing of underground storage tank locations in Mendocino County.

Date of Government Version: 09/23/2009
Number of Days to Update: 8
Last EDR Contact :11/23/2015

Source: Department of Public Health
Telephone: 707-463-4466

UST SAN JOAQUIN: San Joaquin Co. UST

Standard Environmental Record Source: State and tribal registered storage tank lists

A listing of underground storage tank locations in San Joaquin county.

Date of Government Version: 09/23/2015
Number of Days to Update: 20
Last EDR Contact :09/21/2015

Source: Environmental Health Department
Telephone: Not Reported

VCP: Voluntary Cleanup Program Properties

Standard Environmental Record Source: State and tribal voluntary cleanup sites
Search Distance: 0.333 Mile

Contains low threat level properties with either confirmed or unconfirmed releases and the project proponents have request that DTSC oversee investigation and/or cleanup activities and have agreed to provide coverage for DTSC's costs.

Date of Government Version: 08/03/2015
Number of Days to Update: 30
Last EDR Contact :11/07/2015

Source: Department of Toxic Substances Control
Telephone: 916-323-3400

VENTURA CO. BWT: Business Plan, Hazardous Waste Producers, and Operating Underground Tanks

Standard Environmental Record Source: Other Standard Environmental Records
Search Distance: Property

The BWT list indicates by site address whether the Environmental Health Division has Business Plan (B), Waste Producer (W), and/or Underground Tank (T) information.

Date of Government Version: 07/27/2015
Number of Days to Update: 17
Last EDR Contact :08/12/2015

Source: Ventura County Environmental Health Division
Telephone: 805-654-2813

VENTURA CO. LF: Inventory of Illegal Abandoned and Inactive Sites

Standard Environmental Record Source: State and tribal landfill / solid waste disposal
Ventura County Inventory of Closed, Illegal Abandoned, and Inactive Sites.

Date of Government Version: 12/01/2011
Number of Days to Update: 49
Last EDR Contact :10/02/2015

Source: Environmental Health Division
Telephone: 805-654-2813

VENTURA CO. LUST: Listing of Underground Tank Cleanup Sites

Standard Environmental Record Source: State and tribal leaking storage tank lists
Ventura County Underground Storage Tank Cleanup Sites (LUST).

Date of Government Version: 05/29/2008
Number of Days to Update: 37
Last EDR Contact :11/13/2015

Source: Environmental Health Division
Telephone: 805-654-2813

VENTURA CO. UST: Underground Tank Closed Sites List

Standard Environmental Record Source: State and tribal registered storage tank lists
Ventura County Operating Underground Storage Tank Sites (UST)/Underground Tank Closed Sites List.

Date of Government Version: 08/26/2015
Number of Days to Update: 30
Last EDR Contact :09/15/2015

Source: Environmental Health Division
Telephone: 805-654-2813

WDS: Waste Discharge System

Standard Environmental Record Source: Other Standard Environmental Records
Search Distance: Property

Sites which have been issued waste discharge requirements.

Date of Government Version: 06/19/2007
Number of Days to Update: 9
Last EDR Contact :11/18/2015

Source: State Water Resources Control Board
Telephone: 916-341-5227

WIP: Well Investigation Program Case List

Standard Environmental Record Source: Other Standard Environmental Records
Search Distance: 0.25 Mile

Well Investigation Program case in the San Gabriel and San Fernando Valley area.

Date of Government Version: 07/03/2009
Number of Days to Update: 13
Last EDR Contact :09/28/2015

Source: Los Angeles Water Quality Control Board
Telephone: 213-576-6726

WMUDS/SWAT: Waste Management Unit Database

Standard Environmental Record Source: Other Standard Environmental Records
Search Distance: 0.333 Mile

Waste Management Unit Database System. WMUDS is used by the State Water Resources Control Board staff and the Regional Water Quality Control Boards for program tracking and inventory of waste management units. WMUDS is composed of the following databases: Facility Information, Scheduled Inspections Information, Waste Management Unit Information, SWAT Program Information, SWAT Report Summary Information, SWAT Report Summary Data, Chapter 15 (formerly Subchapter 15) Information, Chapter 15 Monitoring Parameters, TPCA Program Information, RCRA Program Information, Closure Information, and Interested Parties Information.

Date of Government Version: 04/01/2000
Number of Days to Update: 30
Last EDR Contact :11/09/2015

Source: State Water Resources Control Board
Telephone: 916-227-4448

YOLO CO. UST: Underground Storage Tank Comprehensive Facility Report

Standard Environmental Record Source: State and tribal registered storage tank lists
Underground storage tank sites located in Yolo county.

Date of Government Version: 10/19/2015
Number of Days to Update: 23
Last EDR Contact :10/19/2015

Source: Yolo County Department of Health
Telephone: 530-666-8646

2020 COR ACTION: 2020 Corrective Action Program List

Standard Environmental Record Source: Other Standard Environmental Records
Search Distance: 0.25 Mile

The EPA has set ambitious goals for the RCRA Corrective Action program by creating the 2020 Corrective Action Universe. This RCRA cleanup baseline includes facilities expected to need corrective action. The 2020 universe contains a wide variety of sites. Some properties are heavily contaminated while others were contaminated but have since been cleaned up. Still others have not been fully investigated yet, and may require little or no remediation. Inclusion in the 2020 Universe does not necessarily imply failure on the part of a facility to meet its RCRA obligations.

Date of Government Version: 04/22/2013
Number of Days to Update: 6
Last EDR Contact :11/13/2015

Source: Environmental Protection Agency
Telephone: 703-308-4044

CERCLIS: Comprehensive Environmental Response, Compensation, and Liability Information System

Standard Environmental Record Source: Federal CERCLIS
Search Distance: 0.333 Mile

CERCLIS contains data on potentially hazardous waste sites that have been reported to the USEPA by states, municipalities, private companies and private persons, pursuant to Section 103 of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). CERCLIS contains sites which are either proposed to or on the National Priorities List (NPL) and sites which are in the screening and assessment phase for possible inclusion on the NPL.

Date of Government Version: 10/25/2013
Number of Days to Update: 94
Last EDR Contact :11/23/2015

Source: EPA
Telephone: 703-412-9810

CERCLIS-NFRAP: CERCLIS No Further Remedial Action Planned

Standard Environmental Record Source: Other Standard Environmental Records
Search Distance: 0.333 Mile

Archived sites are sites that have been removed and archived from the inventory of CERCLIS sites. Archived status indicates that, to the best of EPA's knowledge, assessment at a site has been completed and that EPA has determined no further steps will be taken to list this site on the National Priorities List (NPL), unless information indicates this decision was not appropriate or other considerations require a recommendation for listing at a later time. This decision does not necessarily mean that there is no hazard associated with a given site; it only means that, based upon available information, the location is not judged to be a potential NPL site.

Date of Government Version: 10/25/2013
Number of Days to Update: 94
Last EDR Contact :11/23/2015

Source: EPA
Telephone: 703-412-9810

COAL ASH DOE: Steam-Electric Plant Operation Data

Standard Environmental Record Source: Other Standard Environmental Records
Search Distance: Property

A listing of power plants that store ash in surface ponds.

Date of Government Version: 12/31/2005
Number of Days to Update: 76
Last EDR Contact :07/13/2015

Source: Department of Energy
Telephone: 202-586-8719

COAL ASH EPA: Coal Combustion Residues Surface Impoundments List

Standard Environmental Record Source: Other Standard Environmental Records
Search Distance: 0.333 Mile

A listing of coal combustion residues surface impoundments with high hazard potential ratings.

Date of Government Version: 07/01/2014
Number of Days to Update: 40
Last EDR Contact :09/11/2015

Source: Environmental Protection Agency
Telephone: Not Reported

CONSENT: Superfund (CERCLA) Consent Decrees

Standard Environmental Record Source: Federal NPL
Search Distance: 0.333 Mile

Major legal settlements that establish responsibility and standards for cleanup at NPL (Superfund) sites. Released periodically by United States District Courts after settlement by parties to litigation matters.

Date of Government Version: 12/31/2014
Number of Days to Update: 46
Last EDR Contact :09/28/2015

Source: Department of Justice, Consent Decree Library
Telephone: Varies

CORRACTS: Corrective Action Report

Standard Environmental Record Source: Federal RCRA CORRACTS facilities list
Search Distance: 0.333 Mile

CORRACTS identifies hazardous waste handlers with RCRA corrective action activity.

Date of Government Version: 06/09/2015
Number of Days to Update: 82
Last EDR Contact :09/29/2015

Source: EPA
Telephone: 800-424-9346

DEBRIS REGION 9: Torres Martinez Reservation Illegal Dump Site Locations
Standard Environmental Record Source: State and tribal landfill / solid waste disposal
Search Distance: 0.333 Mile

A listing of illegal dump sites location on the Torres Martinez Indian Reservation located in eastern Riverside County and northern Imperial County, California.

Date of Government Version: 01/12/2009
Number of Days to Update: 137
Last EDR Contact :10/26/2015

Source: EPA, Region 9
Telephone: 415-947-4219

DOT OPS: Incident and Accident Data
Standard Environmental Record Source: Other Standard Environmental Records
Search Distance: Property

Department of Transporation, Office of Pipeline Safety Incident and Accident data.

Date of Government Version: 07/31/2012
Number of Days to Update: 42
Last EDR Contact :11/07/2015

Source: Department of Transporation, Office of Pipeline Safety
Telephone: 202-366-4595

Delisted NPL: National Priority List Deletions
Standard Environmental Record Source: Other Standard Environmental Records
Search Distance: 0.333 Mile

The National Oil and Hazardous Substances Pollution Contingency Plan (NCP) establishes the criteria that the EPA uses to delete sites from the NPL. In accordance with 40 CFR 300.425.(e), sites may be deleted from the NPL where no further response is appropriate.

Date of Government Version: 03/26/2015
Number of Days to Update: 75
Last EDR Contact :11/07/2015

Source: EPA
Telephone: Not Reported

EPA WATCH LIST: EPA WATCH LIST
Standard Environmental Record Source: Other Standard Environmental Records
Search Distance: Property

EPA maintains a "Watch List" to facilitate dialogue between EPA, state and local environmental agencies on enforcement matters relating to facilities with alleged violations identified as either significant or high priority. Being on the Watch List does not mean that the facility has actually violated the law only that an investigation by EPA or a state or local environmental agency has led those organizations to allege that an unproven violation has in fact occurred. Being on the Watch List does not represent a higher level of concern regarding the alleged violations that were detected, but instead indicates cases requiring additional dialogue between EPA, state and local agencies - primarily because of the length of time the alleged violation has gone unaddressed or unresolved.

Date of Government Version: 08/30/2013
Number of Days to Update: 88
Last EDR Contact :11/10/2015

Source: Environmental Protection Agency
Telephone: 617-520-3000

ERNS: Emergency Response Notification System
Standard Environmental Record Source: Federal ERNS list
Search Distance: Property

Emergency Response Notification System. ERNS records and stores information on reported releases of oil and hazardous substances.

Date of Government Version: 06/22/2015
Number of Days to Update: 82
Last EDR Contact :09/29/2015

Source: National Response Center, United States Coast Guard
Telephone: 202-267-2180

FEMA UST: Underground Storage Tank Listing

Standard Environmental Record Source: State and tribal registered storage tank lists
Search Distance: Property

A listing of all FEMA owned underground storage tanks.

Date of Government Version: 01/01/2010
Number of Days to Update: 55
Last EDR Contact :10/08/2015

Source: FEMA
Telephone: 202-646-5797

FINDS: Facility Index System/Facility Registry System

Standard Environmental Record Source: Other Standard Environmental Records
Search Distance: Property

Facility Index System. FINDS contains both facility information and 'pointers' to other sources that contain more detail. EDR includes the following FINDS databases in this report: PCS (Permit Compliance System), AIRS (Aerometric Information Retrieval System), DOCKET (Enforcement Docket used to manage and track information on civil judicial enforcement cases for all environmental statutes), FURS (Federal Underground Injection Control), C-DOCKET (Criminal Docket System used to track criminal enforcement actions for all environmental statutes), FFIS (Federal Facilities Information System), STATE (State Environmental Laws and Statutes), and PADS (PCB Activity Data System).

Date of Government Version: 07/20/2015
Number of Days to Update: 55
Last EDR Contact :12/10/2015

Source: EPA
Telephone: Not Reported

FTTS: FIFRA/ TSCA Tracking System - FIFRA (Federal Insecticide, Fungicide, & Rodenticide Act)/TSCA (Toxic Substances Control Act)

Standard Environmental Record Source: Other Standard Environmental Records
Search Distance: Property

FTTS tracks administrative cases and pesticide enforcement actions and compliance activities related to FIFRA, TSCA and EPCRA (Emergency Planning and Community Right-to-Know Act). To maintain currency, EDR contacts the Agency on a quarterly basis.

Date of Government Version: 04/09/2009
Number of Days to Update: 25
Last EDR Contact :11/18/2015

Source: EPA/Office of Prevention, Pesticides and Toxic Substances
Telephone: 202-566-1667

FTTS INSP: FIFRA/ TSCA Tracking System - FIFRA (Federal Insecticide, Fungicide, & Rodenticide Act)/TSCA (Toxic Substances Control Act)

Standard Environmental Record Source: Other Standard Environmental Records
A listing of FIFRA/TSCA Tracking System (FTTS) inspections and enforcements.

Date of Government Version: 04/09/2009
Number of Days to Update: 25
Last EDR Contact :11/18/2015

Source: EPA
Telephone: 202-566-1667

FUDS: Formerly Used Defense Sites

Standard Environmental Record Source: Other Standard Environmental Records
Search Distance: 0.333 Mile

The listing includes locations of Formerly Used Defense Sites properties where the US Army Corps of Engineers is actively working or will take necessary cleanup actions.

Date of Government Version: 01/31/2015
Number of Days to Update: 97
Last EDR Contact :09/11/2015

Source: U.S. Army Corps of Engineers
Telephone: 202-528-4285

HIST FTTS: FIFRA/TSCA Tracking System Administrative Case Listing
Standard Environmental Record Source: Other Standard Environmental Records
Search Distance: Property

A complete administrative case listing from the FIFRA/TSCA Tracking System (FTTS) for all ten EPA regions. The information was obtained from the National Compliance Database (NCDB). NCDB supports the implementation of FIFRA (Federal Insecticide, Fungicide, and Rodenticide Act) and TSCA (Toxic Substances Control Act). Some EPA regions are now closing out records. Because of that, and the fact that some EPA regions are not providing EPA Headquarters with updated records, it was decided to create a HIST FTTS database. It included records that may not be included in the newer FTTS database updates. This database is no longer updated.

Date of Government Version: 10/19/2006
Number of Days to Update: 40
Last EDR Contact :12/17/2007

Source: Environmental Protection Agency
Telephone: 202-564-2501

HMIRS: Hazardous Materials Information Reporting System
Standard Environmental Record Source: Other Standard Environmental Records
Search Distance: Property

Hazardous Materials Incident Report System. HMIRS contains hazardous material spill incidents reported to DOT.

Date of Government Version: 06/24/2015
Number of Days to Update: 68
Last EDR Contact :09/29/2015

Source: U.S. Department of Transportation
Telephone: 202-366-4555

ICIS: Integrated Compliance Information System
Standard Environmental Record Source: Other Standard Environmental Records
Search Distance: Property

The Integrated Compliance Information System (ICIS) supports the information needs of the national enforcement and compliance program as well as the unique needs of the National Pollutant Discharge Elimination System (NPDES) program.

Date of Government Version: 01/23/2015
Number of Days to Update: 31
Last EDR Contact :10/08/2015

Source: Environmental Protection Agency
Telephone: 202-564-5088

INDIAN LUST R1: Leaking Underground Storage Tanks on Indian Land
Standard Environmental Record Source: State and tribal leaking storage tank lists
Search Distance: 0.333 Mile

A listing of leaking underground storage tank locations on Indian Land.

Date of Government Version: 02/03/2015
Number of Days to Update: 53
Last EDR Contact :10/27/2015

Source: EPA Region 1
Telephone: 617-918-1313

INDIAN LUST R10: Leaking Underground Storage Tanks on Indian Land
Standard Environmental Record Source: State and tribal leaking storage tank lists
LUSTs on Indian land in Alaska, Idaho, Oregon and Washington.

Date of Government Version: 07/21/2015
Number of Days to Update: 76
Last EDR Contact :10/26/2015

Source: EPA Region 10
Telephone: 206-553-2857

INDIAN LUST R4: Leaking Underground Storage Tanks on Indian Land
Standard Environmental Record Source: State and tribal leaking storage tank lists
LUSTs on Indian land in Florida, Mississippi and North Carolina.

Date of Government Version: 07/30/2015
Number of Days to Update: 67
Last EDR Contact :10/26/2015

Source: EPA Region 4
Telephone: 404-562-8677

INDIAN LUST R5: Leaking Underground Storage Tanks on Indian Land
Standard Environmental Record Source: State and tribal leaking storage tank lists
Leaking underground storage tanks located on Indian Land in Michigan, Minnesota and Wisconsin.

Date of Government Version: 07/28/2015
Number of Days to Update: 67
Last EDR Contact :10/26/2015

Source: EPA, Region 5
Telephone: 312-886-7439

INDIAN LUST R6: Leaking Underground Storage Tanks on Indian Land
Standard Environmental Record Source: State and tribal leaking storage tank lists
LUSTs on Indian land in New Mexico and Oklahoma.

Date of Government Version: 05/13/2015
Number of Days to Update: 71
Last EDR Contact :10/26/2015

Source: EPA Region 6
Telephone: 214-665-6597

INDIAN LUST R7: Leaking Underground Storage Tanks on Indian Land
Standard Environmental Record Source: State and tribal leaking storage tank lists
LUSTs on Indian land in Iowa, Kansas, and Nebraska

Date of Government Version: 03/30/2015
Number of Days to Update: 55
Last EDR Contact :10/08/2015

Source: EPA Region 7
Telephone: 913-551-7003

INDIAN LUST R8: Leaking Underground Storage Tanks on Indian Land
Standard Environmental Record Source: State and tribal leaking storage tank lists
LUSTs on Indian land in Colorado, Montana, North Dakota, South Dakota, Utah and Wyoming.

Date of Government Version: 04/30/2015
Number of Days to Update: 48
Last EDR Contact :10/08/2015

Source: EPA Region 8
Telephone: 303-312-6271

INDIAN LUST R9: Leaking Underground Storage Tanks on Indian Land
Standard Environmental Record Source: State and tribal leaking storage tank lists
LUSTs on Indian land in Arizona, California, New Mexico and Nevada

Date of Government Version: 01/08/2015
Number of Days to Update: 32
Last EDR Contact :10/30/2015

Source: Environmental Protection Agency
Telephone: 415-972-3372

INDIAN ODI: Report on the Status of Open Dumps on Indian Lands
Standard Environmental Record Source: Other Standard Environmental Records

Search Distance: 0.333 Mile

Location of open dumps on Indian land.

Date of Government Version: 12/31/1998
Number of Days to Update: 52
Last EDR Contact :11/06/2015

Source: Environmental Protection Agency
Telephone: 703-308-8245

INDIAN UST R1: Underground Storage Tanks on Indian Land

Standard Environmental Record Source: State and tribal registered storage tank lists

Search Distance: Property

The Indian Underground Storage Tank (UST) database provides information about underground storage tanks on Indian land in EPA Region 1 (Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, Vermont and ten Tribal Nations).

Date of Government Version: 02/03/2015
Number of Days to Update: 53
Last EDR Contact :10/27/2015

Source: EPA, Region 1
Telephone: 617-918-1313

INDIAN UST R10: Underground Storage Tanks on Indian Land

Standard Environmental Record Source: State and tribal registered storage tank lists

The Indian Underground Storage Tank (UST) database provides information about underground storage tanks on Indian land in EPA Region 10 (Alaska, Idaho, Oregon, Washington, and Tribal Nations).

Date of Government Version: 07/21/2015
Number of Days to Update: 76
Last EDR Contact :10/26/2015

Source: EPA Region 10
Telephone: 206-553-2857

INDIAN UST R4: Underground Storage Tanks on Indian Land

Standard Environmental Record Source: State and tribal registered storage tank lists

The Indian Underground Storage Tank (UST) database provides information about underground storage tanks on Indian land in EPA Region 4 (Alabama, Florida, Georgia, Kentucky, Mississippi, North Carolina, South Carolina, Tennessee and Tribal Nations)

Date of Government Version: 07/30/2015
Number of Days to Update: 67
Last EDR Contact :10/26/2015

Source: EPA Region 4
Telephone: 404-562-9424

INDIAN UST R5: Underground Storage Tanks on Indian Land

Standard Environmental Record Source: State and tribal registered storage tank lists

The Indian Underground Storage Tank (UST) database provides information about underground storage tanks on Indian land in EPA Region 5 (Michigan, Minnesota and Wisconsin and Tribal Nations).

Date of Government Version: 07/28/2015
Number of Days to Update: 67
Last EDR Contact :10/26/2015

Source: EPA Region 5
Telephone: 312-886-6136

INDIAN UST R6: Underground Storage Tanks on Indian Land

Standard Environmental Record Source: State and tribal registered storage tank lists

The Indian Underground Storage Tank (UST) database provides information about underground storage tanks on Indian land in EPA Region 6 (Louisiana, Arkansas, Oklahoma, New Mexico, Texas and 65 Tribes).

Date of Government Version: 05/13/2015
Number of Days to Update: 71
Last EDR Contact :10/26/2015

Source: EPA Region 6
Telephone: 214-665-7591

RECORD SOURCES AND CURRENCY

INDIAN UST R7: Underground Storage Tanks on Indian Land

Standard Environmental Record Source: State and tribal registered storage tank lists

The Indian Underground Storage Tank (UST) database provides information about underground storage tanks on Indian land in EPA Region 7 (Iowa, Kansas, Missouri, Nebraska, and 9 Tribal Nations).

Date of Government Version: 09/23/2014
Number of Days to Update: 65
Last EDR Contact :10/26/2015

Source: EPA Region 7
Telephone: 913-551-7003

INDIAN UST R8: Underground Storage Tanks on Indian Land

Standard Environmental Record Source: State and tribal registered storage tank lists

The Indian Underground Storage Tank (UST) database provides information about underground storage tanks on Indian land in EPA Region 8 (Colorado, Montana, North Dakota, South Dakota, Utah, Wyoming and 27 Tribal Nations).

Date of Government Version: 07/28/2015
Number of Days to Update: 60
Last EDR Contact :07/22/2015

Source: EPA Region 8
Telephone: 303-312-6137

INDIAN UST R9: Underground Storage Tanks on Indian Land

Standard Environmental Record Source: State and tribal registered storage tank lists

The Indian Underground Storage Tank (UST) database provides information about underground storage tanks on Indian land in EPA Region 9 (Arizona, California, Hawaii, Nevada, the Pacific Islands, and Tribal Nations).

Date of Government Version: 12/14/2014
Number of Days to Update: 28
Last EDR Contact :10/30/2015

Source: EPA Region 9
Telephone: 415-972-3368

INDIAN VCP R1: Voluntary Cleanup Priority Listing

Standard Environmental Record Source: State and tribal voluntary cleanup sites

Search Distance: 0.333 Mile

A listing of voluntary cleanup priority sites located on Indian Land located in Region 1.

Date of Government Version: 09/29/2014
Number of Days to Update: 36
Last EDR Contact :09/29/2015

Source: EPA, Region 1
Telephone: 617-918-1102

INDIAN VCP R7: Voluntary Cleanup Priority Lisitng

Standard Environmental Record Source: State and tribal voluntary cleanup sites

A listing of voluntary cleanup priority sites located on Indian Land located in Region 7.

Date of Government Version: 03/20/2008
Number of Days to Update: 27
Last EDR Contact :04/20/2009

Source: EPA, Region 7
Telephone: 913-551-7365

LEAD SMELTER 1: Lead Smelter Sites

Standard Environmental Record Source: Other Standard Environmental Records

Search Distance: Property

A listing of former lead smelter site locations.

Date of Government Version: 11/25/2014
Number of Days to Update: 64
Last EDR Contact :10/05/2015

Source: Environmental Protection Agency
Telephone: 703-603-8787

LEAD SMELTER 2: Lead Smelter Sites

Standard Environmental Record Source: Other Standard Environmental Records

A list of several hundred sites in the U.S. where secondary lead smelting was done from 1931and 1964. These sites may pose a threat to public health through ingestion or inhalation of contaminated soil or dust

Date of Government Version: 04/05/2001
Number of Days to Update: 36
Last EDR Contact :12/02/2009

Source: American Journal of Public Health
Telephone: 703-305-6451

LIENS 2: CERCLA Lien Information

Standard Environmental Record Source: Federal CERCLIS

Search Distance: Property

A Federal CERCLA ('Superfund') lien can exist by operation of law at any site or property at which EPA has spent Superfund monies. These monies are spent to investigate and address releases and threatened releases of contamination. CERCLIS provides information as to the identity of these sites and properties.

Date of Government Version: 02/18/2014
Number of Days to Update: 37
Last EDR Contact :10/30/2015

Source: Environmental Protection Agency
Telephone: 202-564-6023

LUCIS: Land Use Control Information System

Standard Environmental Record Source: Federal institutional controls / engineering controls registries

Search Distance: 0.333 Mile

LUCIS contains records of land use control information pertaining to the former Navy Base Realignment and Closure properties.

Date of Government Version: 05/28/2015
Number of Days to Update: 13
Last EDR Contact :11/13/2015

Source: Department of the Navy
Telephone: 843-820-7326

MLTS: Material Licensing Tracking System

Standard Environmental Record Source: Other Standard Environmental Records

Search Distance: Property

MLTS is maintained by the Nuclear Regulatory Commission and contains a list of approximately 8,100 sites which possess or use radioactive materials and which are subject to NRC licensing requirements. To maintain currency, EDR contacts the Agency on a quarterly basis.

Date of Government Version: 06/26/2015
Number of Days to Update: 95
Last EDR Contact :12/07/2015

Source: Nuclear Regulatory Commission
Telephone: 301-415-7169

NPL: National Priority List

Standard Environmental Record Source: Federal NPL

Search Distance: 0.333 Mile

National Priorities List (Superfund). The NPL is a subset of CERCLIS and identifies over 1,200 sites for priority cleanup under the Superfund Program. NPL sites may encompass relatively large areas. As such, EDR provides polygon coverage for over 1,000 NPL site boundaries produced by EPA's Environmental Photographic Interpretation Center (EPIC) and regional EPA offices.

Date of Government Version: 03/26/2015
Number of Days to Update: 75
Last EDR Contact :11/07/2015

Source: EPA
Telephone: Not Reported

NPL Site Boundaries

RECORD SOURCES AND CURRENCY

Sources:

EPA''s Environmental Photographic Interpretation Center (EPIC)
Telephone: 202-566-0690

EPA Region 1
Telephone: 617-918-1102

EPA Region 2
Telephone: 212-637-4293

EPA Region 3
Telephone: 215-814-5418

EPA Region 4
Telephone: 404-562-8681

EPA Region 5
Telephone: 312-353-1063

EPA Region 6
Telephone: 214-655-6659

EPA Region 7
Telephone: 913-551-7247

EPA Region 8
Telephone: 303-312-6118

EPA Region 9
Telephone: 415-947-4579

EPA Region 10
Telephone: 206-553-4479

NPL LIENS: Federal Superfund Liens

Standard Environmental Record Source: Federal NPL

Search Distance: Property

Federal Superfund Liens. Under the authority granted the USEPA by CERCLA of 1980, the USEPA has the authority to file liens against real property in order to recover remedial action expenditures or when the property owner received notification of potential liability. USEPA compiles a listing of filed notices of Superfund Liens.

Date of Government Version: 10/15/1991
Number of Days to Update: 56
Last EDR Contact :08/15/2011

Source: EPA
Telephone: 202-564-4267

ODI: Open Dump Inventory

Standard Environmental Record Source: Other Standard Environmental Records

Search Distance: 0.333 Mile

An open dump is defined as a disposal facility that does not comply with one or more of the Part 257 or Part 258 Subtitle D Criteria.

Date of Government Version: 06/30/1985
Number of Days to Update: 39
Last EDR Contact :06/09/2004

Source: Environmental Protection Agency
Telephone: 800-424-9346

PADS: PCB Activity Database System

Standard Environmental Record Source: Other Standard Environmental Records

Search Distance: Property

PCB Activity Database. PADS Identifies generators, transporters, commercial storers and/or brokers and disposers of PCB's who are required to notify the EPA of such activities.

Date of Government Version: 07/01/2014
Number of Days to Update: 33

Source: EPA
Telephone: 202-566-0500

Last EDR Contact :10/29/2015

PCB TRANSFORMER: PCB Transformer Registration Database

Standard Environmental Record Source: Other Standard Environmental Records

Search Distance: Property

The database of PCB transformer registrations that includes all PCB registration submittals.

Date of Government Version: 02/01/2011
Number of Days to Update: 83
Last EDR Contact :10/29/2015

Source: Environmental Protection Agency
Telephone: 202-566-0517

Proposed NPL: Proposed National Priority List Sites

Standard Environmental Record Source: Federal NPL

Search Distance: 0.333 Mile

A site that has been proposed for listing on the NationalPriorities List through the issuance of a proposed rule in the Federal Register.EPA then accepts public comments on the site, responds to the comments,and places on the NPL those sites that continue to meet therequirements for listing.

Date of Government Version: 03/26/2015
Number of Days to Update: 75
Last EDR Contact :11/07/2015

Source: EPA
Telephone: Not Reported

RAATS: RCRA Administrative Action Tracking System

Standard Environmental Record Source: Other Standard Environmental Records

Search Distance: Property

RCRA Administration Action Tracking System. RAATS contains records based on enforcement actions issued under RCRA pertaining to major violators and includes administrative and civil actions brought by the EPA. For administration actions after September 30, 1995, data entry in the RAATS database was discontinued. EPA will retain a copy of the database for historical records. It was necessary to terminate RAATS because a decrease in agency resources made it impossible to continue to update the information contained in the database.

Date of Government Version: 04/17/1995
Number of Days to Update: 35
Last EDR Contact :06/02/2008

Source: EPA
Telephone: 202-564-4104

RADINFO: Radiation Information Database

Standard Environmental Record Source: Other Standard Environmental Records

Search Distance: Property

The Radiation Information Database (RADINFO) contains information about facilities that are regulated by U.S. Environmental Protection Agency (EPA) regulations for radiation and radioactivity.

Date of Government Version: 07/07/2015
Number of Days to Update: 69
Last EDR Contact :10/07/2015

Source: Environmental Protection Agency
Telephone: 202-343-9775

RCRA NonGen / NLR: RCRA - Non Generators / No Longer Regulated

Standard Environmental Record Source: Other Standard Environmental Records

Search Distance: Property

RCRAInfo is EPA's comprehensive information system, providing access to data supporting the Resource Conservation and Recovery Act (RCRA) of 1976 and the Hazardous and Solid Waste Amendments (HSWA) of 1984. The database includes selective information on sites which generate, transport, store, treat and/or dispose of hazardous waste as defined by the Resource Conservation and Recovery Act (RCRA). Non-Generators do not presently generate hazardous waste.

Date of Government Version: 06/09/2015

Source: Environmental Protection Agency

Number of Days to Update: 82 | Telephone: 703-308-8895
Last EDR Contact :09/29/2015

RCRA-CESQG: RCRA - Conditionally Exempt Small Quantity Generators

Standard Environmental Record Source: Federal RCRA generators list

Search Distance: Property

RCRAInfo is EPA's comprehensive information system, providing access to data supporting the Resource Conservation and Recovery Act (RCRA) of 1976 and the Hazardous and Solid Waste Amendments (HSWA) of 1984. The database includes selective information on sites which generate, transport, store, treat and/or dispose of hazardous waste as defined by the Resource Conservation and Recovery Act (RCRA). Conditionally exempt small quantity generators (CESQGs) generate less than 100 kg of hazardous waste, or less than 1 kg of acutely hazardous waste per month.

Date of Government Version: 06/09/2015
Source: Environmental Protection Agency
Number of Days to Update: 82
Telephone: 703-308-8895
Last EDR Contact :09/29/2015

RCRA-LQG: RCRA - Large Quantity Generators

Standard Environmental Record Source: Federal RCRA generators list

Search Distance: Property

RCRAInfo is EPA's comprehensive information system, providing access to data supporting the Resource Conservation and Recovery Act (RCRA) of 1976 and the Hazardous and Solid Waste Amendments (HSWA) of 1984. The database includes selective information on sites which generate, transport, store, treat and/or dispose of hazardous waste as defined by the Resource Conservation and Recovery Act (RCRA). Large quantity generators (LQGs) generate over 1,000 kilograms (kg) of hazardous waste, or over 1 kg of acutely hazardous waste per month.

Date of Government Version: 06/09/2015
Source: Environmental Protection Agency
Number of Days to Update: 82
Telephone: 703-308-8895
Last EDR Contact :09/29/2015

RCRA-SQG: RCRA - Small Quantity Generators

Standard Environmental Record Source: Federal RCRA generators list

Search Distance: Property

RCRAInfo is EPA's comprehensive information system, providing access to data supporting the Resource Conservation and Recovery Act (RCRA) of 1976 and the Hazardous and Solid Waste Amendments (HSWA) of 1984. The database includes selective information on sites which generate, transport, store, treat and/or dispose of hazardous waste as defined by the Resource Conservation and Recovery Act (RCRA). Small quantity generators (SQGs) generate between 100 kg and 1,000 kg of hazardous waste per month.

Date of Government Version: 06/09/2015
Source: Environmental Protection Agency
Number of Days to Update: 82
Telephone: 703-308-8895
Last EDR Contact :09/29/2015

RCRA-TSDF: RCRA - Treatment, Storage and Disposal

Standard Environmental Record Source: Federal RCRA TSD facilities list

Search Distance: 0.333 Mile

RCRAInfo is EPA's comprehensive information system, providing access to data supporting the Resource Conservation and Recovery Act (RCRA) of 1976 and the Hazardous and Solid Waste Amendments (HSWA) of 1984. The database includes selective information on sites which generate, transport, store, treat and/or dispose of hazardous waste as defined by the Resource Conservation and Recovery Act (RCRA). Transporters are individuals or entities that move hazardous waste from the generator offsite to a facility that can recycle, treat, store, or dispose of the waste. TSDFs treat, store, or dispose of the waste.

Date of Government Version: 06/09/2015
Source: Environmental Protection Agency
Number of Days to Update: 82
Telephone: 703-308-8895
Last EDR Contact :09/29/2015

ROD: Records Of Decision

Standard Environmental Record Source: Federal NPL

Search Distance: 0.333 Mile

Record of Decision. ROD documents mandate a permanent remedy at an NPL (Superfund) site containing technical and health information to aid in the cleanup.

Date of Government Version: 11/25/2013 | Source: EPA
Number of Days to Update: 74 | Telephone: 703-416-0223
Last EDR Contact :09/11/2015

SCRD DRYCLEANERS: State Coalition for Remediation of Drycleaners Listing

Standard Environmental Record Source: Other Standard Environmental Records

Search Distance: 0.333 Mile

The State Coalition for Remediation of Drycleaners was established in 1998, with support from the U.S. EPA Office of Superfund Remediation and Technology Innovation. It is comprised of representatives of states with established drycleaner remediation programs. Currently the member states are Alabama, Connecticut, Florida, Illinois, Kansas, Minnesota, Missouri, North Carolina, Oregon, South Carolina, Tennessee, Texas, and Wisconsin.

Date of Government Version: 03/07/2011 | Source: Environmental Protection Agency
Number of Days to Update: 54 | Telephone: 615-532-8599
Last EDR Contact :11/19/2015

SSTS: Section 7 Tracking Systems

Standard Environmental Record Source: Other Standard Environmental Records

Search Distance: Property

Section 7 of the Federal Insecticide, Fungicide and Rodenticide Act, as amended (92 Stat. 829) requires all registered pesticide-producing establishments to submit a report to the Environmental Protection Agency by March 1st each year. Each establishment must report the types and amounts of pesticides, active ingredients and devices being produced, and those having been produced and sold or distributed in the past year.

Date of Government Version: 12/31/2009 | Source: EPA
Number of Days to Update: 77 | Telephone: 202-564-4203
Last EDR Contact :10/26/2015

TRIS: Toxic Chemical Release Inventory System

Standard Environmental Record Source: Other Standard Environmental Records

Search Distance: Property

Toxic Release Inventory System. TRIS identifies facilities which release toxic chemicals to the air, water and land in reportable quantities under SARA Title III Section 313.

Date of Government Version: 12/31/2013 | Source: EPA
Number of Days to Update: 110 | Telephone: 202-566-0250
Last EDR Contact :11/24/2015

TSCA: Toxic Substances Control Act

Standard Environmental Record Source: Other Standard Environmental Records

Search Distance: Property

Toxic Substances Control Act. TSCA identifies manufacturers and importers of chemical substances included on the TSCA Chemical Substance Inventory list. It includes data on the production volume of these substances by plant site.

Date of Government Version: 12/31/2012 | Source: EPA
Number of Days to Update: 14 | Telephone: 202-260-5521
Last EDR Contact :09/25/2015

UMTRA: Uranium Mill Tailings Sites

Standard Environmental Record Source: Other Standard Environmental Records

Search Distance: 0.333 Mile

Uranium ore was mined by private companies for federal government use in national defense programs. When the mills shut down, large piles of the sand-like material (mill tailings) remain after uranium has been extracted from the ore. Levels of human exposure to radioactive materials from the piles are low; however, in some cases tailings were used as construction materials before the potential health hazards of the tailings were recognized.

Date of Government Version: 09/14/2010
Number of Days to Update: 146
Last EDR Contact :11/19/2015

Source: Department of Energy
Telephone: 505-845-0011

US AIRS (AFS): Aerometric Information Retrieval System Facility Subsystem (AFS)

Standard Environmental Record Source: Other Standard Environmental Records

Search Distance: Property

The database is a sub-system of Aerometric Information Retrieval System (AIRS). AFS contains compliance data on air pollution point sources regulated by the U.S. EPA and/or state and local air regulatory agencies. This information comes from source reports by various stationary sources of air pollution, such as electric power plants, steel mills, factories, and universities, and provides information about the air pollutants they produce. Action, air program, air program pollutant, and general level plant data. It is used to track emissions and compliance data from industrial plants.

Date of Government Version: 07/22/2015
Number of Days to Update: 40
Last EDR Contact :09/28/2015

Source: EPA
Telephone: 202-564-2496

US AIRS MINOR: Air Facility System Data

Standard Environmental Record Source: Other Standard Environmental Records

A listing of minor source facilities.

Date of Government Version: 07/22/2015
Number of Days to Update: 40
Last EDR Contact :09/28/2015

Source: EPA
Telephone: 202-564-2496

US BROWNFIELDS: A Listing of Brownfields Sites

Standard Environmental Record Source: Other Standard Environmental Records

Search Distance: 0.333 Mile

Brownfields are real property, the expansion, redevelopment, or reuse of which may be complicated by the presence or potential presence of a hazardous substance, pollutant, or contaminant. Cleaning up and reinvesting in these properties takes development pressures off of undeveloped, open land, and both improves and protects the environment. Assessment, Cleanup and Redevelopment Exchange System (ACRES) stores information reported by EPA Brownfields grant recipients on brownfields properties assessed or cleaned up with grant funding as well as information on Targeted Brownfields Assessments performed by EPA Regions. A listing of ACRES Brownfield sites is obtained from Cleanups in My Community. Cleanups in My Community provides information on Brownfields properties for which information is reported back to EPA, as well as areas served by Brownfields grant programs.

Date of Government Version: 06/22/2015
Number of Days to Update: 70
Last EDR Contact :09/23/2015

Source: Environmental Protection Agency
Telephone: 202-566-2777

US CDL: Clandestine Drug Labs

Standard Environmental Record Source: Other Standard Environmental Records

Search Distance: Property

A listing of clandestine drug lab locations. The U.S. Department of Justice ("the Department") provides this web site as a public service. It contains addresses of some locations where law enforcement agencies reported they found chemicals or other items that indicated the presence of either clandestine drug laboratories or dumpsites. In most cases, the source of the entries is not the Department, and the Department has not verified the entry and does not guarantee its accuracy. Members of the public must verify the accuracy of all entries by, for example, contacting local law enforcement and local health departments.

Date of Government Version: 08/12/2015
Number of Days to Update: 60
Last EDR Contact :11/25/2015

Source: Drug Enforcement Administration
Telephone: 202-307-1000

US ENG CONTROLS: Engineering Controls Sites List

Standard Environmental Record Source: Federal institutional controls / engineering controls registries

Search Distance: Property

A listing of sites with engineering controls in place. Engineering controls include various forms of caps, building foundations, liners, and treatment methods to create pathway elimination for regulated substances to enter environmental media or effect human health.

Date of Government Version: 09/10/2015
Number of Days to Update: 53
Last EDR Contact :11/24/2015

Source: Environmental Protection Agency
Telephone: 703-603-0695

US FIN ASSUR: Financial Assurance Information

Standard Environmental Record Source: Other Standard Environmental Records

Search Distance: Property

All owners and operators of facilities that treat, store, or dispose of hazardous waste are required to provide proof that they will have sufficient funds to pay for the clean up, closure, and post-closure care of their facilities.

Date of Government Version: 09/01/2015
Number of Days to Update: 61
Last EDR Contact :11/13/2015

Source: Environmental Protection Agency
Telephone: 202-566-1917

US HIST CDL: National Clandestine Laboratory Register

Standard Environmental Record Source: Other Standard Environmental Records

Search Distance: Property

A listing of clandestine drug lab locations. The U.S. Department of Justice ("the Department") provides this web site as a public service. It contains addresses of some locations where law enforcement agencies reported they found chemicals or other items that indicated the presence of either clandestine drug laboratories or dumpsites. In most cases, the source of the entries is not the Department, and the Department has not verified the entry and does not guarantee its accuracy. Members of the public must verify the accuracy of all entries by, for example, contacting local law enforcement and local health departments.

Date of Government Version: 08/12/2015
Number of Days to Update: 60
Last EDR Contact :08/31/2015

Source: Drug Enforcement Administration
Telephone: 202-307-1000

US INST CONTROL: Sites with Institutional Controls

Standard Environmental Record Source: Federal institutional controls / engineering controls registries

Search Distance: Property

A listing of sites with institutional controls in place. Institutional controls include administrative measures, such as groundwater use restrictions, construction restrictions, property use restrictions, and post remediation care requirements intended to prevent exposure to contaminants remaining on site. Deed restrictions are generally required as part of the institutional controls.

Date of Government Version: 09/10/2015
Number of Days to Update: 53
Last EDR Contact :11/24/2015

Source: Environmental Protection Agency
Telephone: 703-603-0695

US MINES: Mines Master Index File

Standard Environmental Record Source: Other Standard Environmental Records

Search Distance: Property

Contains all mine identification numbers issued for mines active or opened since 1971. The data also includes violation information.

Date of Government Version: 05/14/2015
Number of Days to Update: 91
Last EDR Contact :12/03/2015

Source: Department of Labor, Mine Safety and Health Administration
Telephone: 303-231-5959

AOCONCERN: San Gabriel Valley Areas of Concern

Standard Environmental Record Source: State and tribal - equivalent CERCLIS
Search Distance: 0.333 Mile

San Gabriel Valley areas where VOC contamination is at or above the MCL as designated by region 9 EPA office.

Date of Government Version: 03/30/2009
Number of Days to Update: 206
Last EDR Contact :09/21/2015

Source: EPA Region 9
Telephone: 415-972-3178

DOD: Department of Defense Sites

Standard Environmental Record Source: Other Standard Environmental Records
Search Distance: 0.333 Mile

This data set consists of federally owned or administered lands, administered by the Department of Defense, that have any area equal to or greater than 640 acres of the United States, Puerto Rico, and the U.S. Virgin Islands.

Date of Government Version: 12/31/2005
Number of Days to Update: 62
Last EDR Contact :10/16/2015

Source: USGS
Telephone: 888-275-8747

INDIAN RESERV: Indian Reservations

Standard Environmental Record Source: Other Standard Environmental Records
Search Distance: Property

This map layer portrays Indian administered lands of the United States that have any area equal to or greater than 640 acres.

Date of Government Version: 12/31/2005
Number of Days to Update: 34
Last EDR Contact :10/16/2015

Source: USGS
Telephone: 202-208-3710

PWS: Public Water System Data

Standard Environmental Record Source: Other Standard Environmental Records
Search Distance: Property

This Safe Drinking Water Information System (SDWIS) file contains public water systems name and address, population served and the primary source of water

Date of Government Version: 12/17/2013
Number of Days to Update: 279
Last EDR Contact :12/09/2015

Source: EPA
Telephone: Not Reported

RECORD SOURCES AND CURRENCY

HISTORICAL USE RECORDS

RGA LF: Recovered Government Archive Solid Waste Facilities List

Standard Environmental Record Source: Exclusive Recovered Govt. Archives

Search Distance: Property

The EDR Recovered Government Archive Landfill database provides a list of landfills derived from historical databases and includes many records that no longer appear in current government lists. Compiled from Records formerly available from the Department of Resources Recycling and Recovery in California.

Date of Government Version: Not Reported
Source: Department of Resources Recycling and Recovery
Number of Days to Update: 196
Telephone: Not Reported
Last EDR Contact :06/01/2012

RGA LUST: Recovered Government Archive Leaking Underground Storage Tank

Standard Environmental Record Source: Exclusive Recovered Govt. Archives

Search Distance: Property

The EDR Recovered Government Archive Leaking Underground Storage Tank database provides a list of LUST incidents derived from historical databases and includes many records that no longer appear in current government lists. Compiled from Records formerly available from the State Water Resources Control Board in California.

Date of Government Version: Not Reported
Source: State Water Resources Control Board
Number of Days to Update: 182
Telephone: Not Reported
Last EDR Contact :06/01/2012

EDR Hist Auto: EDR Exclusive Historic Gas Stations

Standard Environmental Record Source: Historical Gas Stations

Search Distance: 0.25 Mile

EDR has searched selected national collections of business directories and has collected listings of potential gas station/filling station/service station sites that were available to EDR researchers. EDR's review was limited to those categories of sources that might, in EDR's opinion, include gas station/filling station/service station establishments. The categories reviewed included, but were not limited to gas, gas station, gasoline station, filling station, auto, automobile repair, auto service station, service station, etc. This database falls within a category of information EDR classifies as "High Risk Historical Records", or HRHR. EDR's HRHR effort presents unique and sometimes proprietary data about past sites and operations that typically create environmental concerns, but may not show up in current government records searches.

Date of Government Version: 02/20/2007
Source: EDR, Inc.
Number of Days to Update: 42
Telephone: Not Reported
Last EDR Contact :02/21/2007

EDR Hist Cleaner: EDR Exclusive Historic Dry Cleaners

Standard Environmental Record Source: Historical Dry Cleaners

Search Distance: 0.25 Mile

EDR has searched selected national collections of business directories and has collected listings of potential dry cleaner sites that were available to EDR researchers. EDR's review was limited to those categories of sources that might, in EDR's opinion, include dry cleaning establishments. The categories reviewed included, but were not limited to dry cleaners, cleaners, laundry, laundromat, cleaning/laundry, wash & dry etc. This database falls within a category of information EDR classifies as "High Risk Historical Records", or HRHR. EDR's HRHR effort presents unique and sometimes proprietary data about past sites and operations that typically create environmental concerns, but may not show up in current government records searches.

Date of Government Version: 02/20/2007
Source: EDR, Inc.
Number of Days to Update: 42
Telephone: Not Reported
Last EDR Contact :02/21/2007

EDR MGP: EDR Proprietary Manufactured Gas Plants

Standard Environmental Record Source: Former manufactured Gas Plants

Search Distance: 0.333 Mile

RECORD SOURCES AND CURRENCY

The EDR Proprietary Manufactured Gas Plant Database includes records of coal gas plants (manufactured gas plants) compiled by EDR's researchers. Manufactured gas sites were used in the United States from the 1800's to 1950's to produce a gas that could be distributed and used as fuel. These plants used whale oil, rosin, coal, or a mixture of coal, oil, and water that also produced a significant amount of waste. Many of the byproducts of the gas production, such as coal tar (oily waste containing volatile and non-volatile chemicals), sludges, oils and other compounds are potentially hazardous to human health and the environment. The byproduct from this process was frequently disposed of directly at the plant site and can remain or spread slowly, serving as a continuous source of soil and groundwater contamination.

Date of Government Version: 08/28/2009
Number of Days to Update: 55
Last EDR Contact :11/30/2012

Source: EDR, Inc.
Telephone: Not Reported

RECORD SOURCES AND CURRENCY

TOPOGRAPHIC INFORMATION

USGS 7.5' Digital Elevation Model (DEM)

Source: United States Geologic Survey
EDR acquired the USGS 7.5' Digital Elevation Model in 2002 and updated it in 2006. The 7.5' minute DEM corresponds to the USGS 1:24,000- and 1:25,000-scale topographic quadrangle maps. The DEM provides elevation data with consistent elevation units and projection.

HYDROLOGIC INFORMATION

Flood Zone Data: This data, available in select counties across the country, was obtained by EDR in 1999 from the Federal Emergency Management Agency (FEMA). Data depicts 100-year and 500-year flood zones as defined by FEMA.

NWI: National Wetlands Inventory. This data, available in select counties across the country, was obtained by EDR in 2002 and 2005 from the U.S. Fish and Wildlife Service.

HYDROGEOLOGIC INFORMATION

AQUIFLOW® Information System

Source: EDR proprietary database of groundwater flow information
EDR has developed the AQUIFLOW® Information System (AIS) to provide data on the general direction of groundwater flow at specific points. EDR has reviewed reports submitted to regulatory authorities at select sites and has extracted the date of the report, hydrogeologically determined groundwater flow direction and depth to water table information.

GEOLOGIC INFORMATION

STATSGO: State Soil Geographic Database

Source: Department of Agriculture, Natural Resources Conservation Services. The U.S. Department of Agriculture's (USDA) Natural Resources Conservation Service (NRCS) leads the national Conservation Soil Survey (NCSS) and is responsible for collecting, storing, maintaining and distributing soil survey information for privately owned lands in the United States. A soil map in a soil survey is a representation of soil patterns in a landscape. Soil maps for STATSGO are compiled by generalizing more detailed (SSURGO) soil survey maps.

SSURGO: Soil Survey Geographic Database

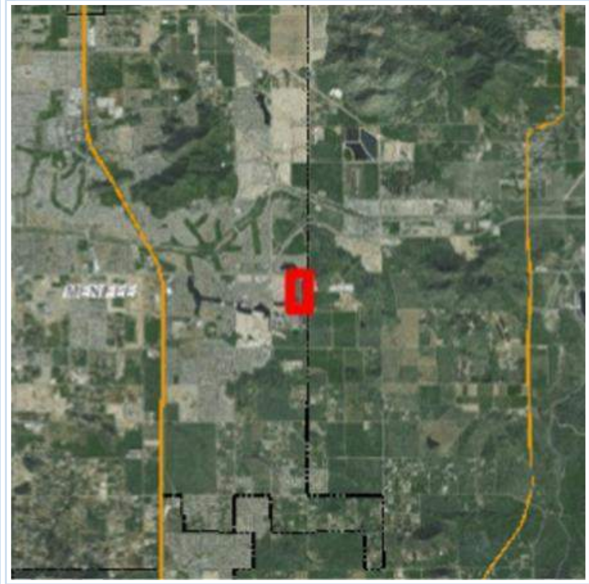
Source: Department of Agriculture, Natural Resources Conservation Services (NRCS)
Telephone: 800-672-5559
SSURGO is the most detailed level of mapping done by the Natural Resources Conservation Services, mapping scales generally range from 1:12,000 to 1:63,360. Field mapping methods using national standards are used to construct the soil maps in the Soil Survey Geographic (SSURGO) database. SSURGO digitizing duplicates the original soil survey maps. This level of mapping is designed for use by landowners, townships and county natural resource planning and management.

STREET AND ADDRESS INFORMATION

Riverside County Parcel Report
APN 364-190-004
Disclaimer

Report Date: Wednesday, January 13, 2016

MAPS/IMAGES



PARCEL

APN	364-190-004-1	Supervisorial District 2011 Supervisorial District 2001	MARION ASHLEY, DISTRICT 5 JEFF STONE, DISTRICT 3
Previous APN	357080004	Township/Range	T6SR3W SEC 1
Address	29875 NEWPORT RD MENIFEE, CA 92584	Elevation Range	1,428 - 1,436
Mailing Address	See situs address	Thomas Bros. Map Page/Grid	PAGE: 868 GRID: J2 PAGE: 868 GRID: J3
Legal Description	Recorded Page: Not Available Subdivision Name: Lot/Parcel: Not Available Block: Not Available Tract Number: Not Available	Indian Tribal Land	Not in Tribal Land
Lot Size	Recorded lot size is 78.80 acres	City Boundary/Sphere	City Boundary: MENIFEE Not within a City Sphere Annexation Date: Not Applicable LAFCO Case #: 2007-40-3&5 Proposals: Not Applicable

PARCEL

Property Characteristcs	Constructed: 1982 Baths: 3.25 Bedrooms: 3 Central Cool: Y Central Heat: Y Const. Type: WOOD FRAME Garage Type: A Prop Area: 3191 SqFt Roof Type: SHAKE Stories: 1	March Joint Powers Authority	NOT WITHIN THE JURISDICTION OF THE MARCH JOINT POWERS AUTHORITY
		County Service Area	Not in a County Service Area

PLANNING

Specific Plans	Not within a Specific Plan	Historic Preservation Districts	Not in an Historic Preservation District
Land Use Designations	CITY	Agricultural Preserve	Not in an agricultural preserve
General Plan Policy Overlays	Not in a General Plan Policy Overlay Area	Redevelopment Areas	Not in a Redevelopment Area
Area Plan (RCIP)	Sun City / Menifee Valley	Airport Influence Areas	MARCH AIR RESERVE BASE
General Plan Policy Areas	None	Airport Compatibility Zones	MARCH AIR RESERVE BASE, zone E
Zoning Classifications (ORD. 348)	See the city for more information	Zoning Districts and Zoning Areas	Not in a Zoning District/Area
Zoning Overlays	Not in a Zoning Overlay	Community Advisory Councils	Not in a Community Advisory Council Area

ENVIRONMENTAL

CVMSHCP (Coachella Valley Multi-Species Habitat Conservation Plan) Plan Area	NOT WITHIN THE COACHELLA VALLEY MSHCP FEE AREA MSHCP Plan Area	WRMSHCP (Western Riverside County Multi-Species Habitat Conservation Plan) Cell Group	Not in a Cell Group
CVMSHCP (Coachella Valley Multi-Species Habitat Conservation Plan) Conservation Area	Not in a Conservation Area	WRMSHCP Cell Number	None
CVMSHCP Fluvial Sand Transport Special Provision Areas	Not in a Fluvial Sand Transport Special Provision Area	HANS/ERP (Habitat Acquisition and Negotiation Strategy/Expedited Review Process)	None
WRMSHCP (Western Riverside County Multi-Species Habitat	None	Vegetation (2005)	Agricultural Land

ENVIRONMENTAL

Conservation Plan) Plan Area			

FIRE

Fire Hazard Classification (Ord. 787)	Not in a High Fire Area	Fire Responsibility Area	Not in a Fire Responsibility Area

DEVELOPMENT FEES

CVMSHCP (Coachella Valley Multi-Species Habitat Conservation Plan) Fee Area (Ord 875)	NOT WITHIN THE COACHELLA VALLEY MSHCP FEE AREA MSHCP Fee Area	RBBD (Road & Bridge Benefit District)	MENIFEE VALLEY , E1
WRMSHCP (Western Riverside County Multi-Species Habitat Conservation Plan) Fee Area (Ord. 810)	IN OR PARTIALLY WITHIN THE WESTERN RIVERSIDE MSHCP FEE AREA. SEE MAP FOR MORE INFORMATION	DIF (Development Impact Fee Area Ord. 659)	SUN CITY/MENIFEE
Western TUMF (Transportation Uniform Mitigation Fee Ord. 824)	IN OR PARTIALLY WITHIN A TUMF FEE AREA. SEE MAP FOR MORE INFORMATION. SOUTHWEST	SKR Fee Area (Stephen's Kagaroo Rat Ord. 663.10)	In or partially within an SKR Fee Area
Eastern TUMF (Transportation Uniform Mitigation Fee Ord. 673)	NOT WITHIN THE EASTERN TUMF FEE AREA	DA (Development Agreements)	Not in a Development Agreement Area

TRANSPORTATION

Circulation Element Ultimate Right-of-Way	IN OR PARTIALLY WITHIN A CIRCULATION ELEMENT RIGHT-OF-WAY. SEE MAP FOR MORE INFORMATION. CONTACT THE TRANSPORTATION DEPT. PERMITS SECTION AT (951) 955-6790 FOR INFORMATION REGARDING THIS PARCEL IF IT IS IN AN UNINCORPORATED AREA.	Road Book Page	117
		Transportation Agreements	Not in a Transportation Agreement
		CETAP (Community and Environmental Transportation Acceptability Process) Corridors	Not in a CETAP Corridor

HYDROLOGY

Flood Plan Review	RCFC	Watershed	SAN JACINTO VALLEY
Water District	EMWD	California Water Board	None
Flood Control District			

HYDROLOGY

	RIVERSIDE COUNTY FLOOD CONTROL DISTRICT		

GEOLOGIC

Fault Zone	Not in a Fault Zone	Paleontological Sensitivity	High Sensitivity (High B): SENSITIVITY EQUIVALENT TO HIGH A, BUT IS BASED ON THE OCCURRENCE OF FOSSILS AT A SPECIFIED DEPTH BELOW THE SURFACE. THE CATEGORY HIGH B INDICATES THAT FOSSILS ARE LIKELY TO BE ENCOUNTERED AT OR BELOW FOUR FEET OF DEPTH, AND MAY BE IMPACTED DURING EXCAVATION BY CONSTRUCTION ACTIVITIES.
Faults	Not within a 1/2 mile of a Fault		
Liquefaction Potential	Low		
Subsidence	Susceptible		

MISCELLANEOUS

School District	MENIFEE UNION &PERRIS UNION HIGH	Tax Rate Areas	026004 CITY OF MENIFEE CITY OF MENIFEE FIRE PROTECTION CO FREE LIBRARY CSA 145 MENIFEE CSA 152 CSA 33 MENIFEE CSA 86 MENIFEE EMWD EMWD IMP DIST 13 EMWD IMP DIST A FLOOD CONTROL ADMIN FLOOD CONTROL ZN 4 GENERAL GENERAL PURPOSE MENIFEE SCHOOL MT SAN JACINTO JR COLLEGE MWD EAST 1301999 PERRIS AREA ELEM SCHOOL FUND PERRIS JR HIGH AREA FUND PERRIS UNION HS PERRIS VALLEY CEMETERY RIV CO REGIONAL PARK & OPEN SP RIVERSIDE CO OFC OF EDUCATION SAN JACINTO BASIN RESOURCE CONS SO. CALIF,JT (19,30,33,36,37,56) VALLEY HEALTH SYSTEM HOSP DIST
Communities	Menifee		
Lighting (Ord. 655)	Zone B, 27.15 Miles From Mt. Palomar Observatory		
2010 Census Tract	042738		
Farmland	LOCAL IMPORTANCE PRIME FARMLAND STATEWIDE IMPORTANCE URBAN-BUILT UP LAND		
Special Notes	No Special Notes		

PERMITS / CASES / ADDITIONAL

Building Permits

Case #	Description	Status
006228	DWLG & ATT GAR	FINALED
280069	FAMILY ROOM ADD TO EXIST DWELL 653SF	ISSUED
BXX981961	VINYL SIDING ON SFD	EXPIRED
BZ412326	PLAN CHECK (DAIRY MILK HOUSE)	FINAL
BZ416882	PLAN CHECK (DWELLING AND ATTACHED GARAGE)	FINAL
BZ423015	DAIRY MILK HOUSE	FINAL
BZ423016	REGIST EQUIPMENT SHED	FINAL
BZ423017	REGIST WASHPEN & MILK BARN	ISSUED
BZ423018	REGIST HOSPITAL PENS	FINAL

Environmental Health Permits

Case #	Description	Status
No Environmental Health Permits	Not Applicable	Not Applicable

Planning Cases

Case #	Description	Status
EA38129	EA FOR SO CAL GAS CO NATURAL GAS PIPELINE PROJECT	APPROVED

Code Cases

Case #	Description	Status
No Code Cases	Not Applicable	Not Applicable

APN		Street #	Street Name	Suffix	Space	City
364-190-004	1	29875	NEWPORT			MENIFEE

Enter Permit Information Here

Permit Number	Log Number	Requested Permits	Scanned	Comments
BZ423018		☐	0	REG HOSPITAL PENS
BZ423017		☐	0	REG WASHHPEN & MILK BARN
BZ423016		☐	0	REG EQUIPMENT SHED
BZ423015		☐	0	DAIRY MILK HOUSE
BZ416882		☐	0	P/C DWLG & ATT GAR
BZ412326		☐	0	P/C DAIRY MILK HOUSE
BXX981961		☐	0	VINYL SIDING ON DWLG
BGR050365		☐	0	ROUGH GRADING FOR TR 30505
653339	320842	☐	0	ELEC TO WELL
589811	280069	☐	0	PC FAMILY ROOM ADD TO EXIST DWLG
082095	197866	☐	0	GARAGE WITH FIRE WALL & PATIO COVER
037929	020438	☐	0	BLOCK WALL
025185	017296	☐	0	POOL
022223	014457	☐	0	2 DECKS AND 2 AWNINGS TO MH
013676	011643	☐	0	DECK AND ATTACHED GARAGE TO MH
003075	006228	☐	0	DWLG & ATT GAR

USER QUESTIONNAIRE

INTRODUCTION

In order to qualify for one of the *Landowner Liability Protections* offered by the Small Business Liability Relief and Brownfields Revitalization Act of 2002, the *user* must provide the following information (if available) to the *environmental professional*. Failure to provide this information could result in a determination that "*all appropriate inquiry*" is not complete.

(1) Are you aware of any environmental cleanup liens against the property that are filed or recorded under federal, tribal, state or local law?

CIRCLE YES *or* NO

If yes, please explain in detail.

(2) Are you aware of any Act Use Limitations (AUL), such as *engineering controls*, land use restrictions or *institutional controls* that are in place at the site and/or have been filed or recorded in a registry under federal, tribal, state or local law?

YES *or* NO

If yes, please explain.

(3) As the *user* of this Environmental Site Assessment (ESA) do you have any specialized knowledge or familiarity related to the *property* or nearby properties? For example, are you involved in the same line of business as the current or former *occupants* of the *property* or its neighboring *property*, so that you may have specific knowledge of the chemicals and processes used by this type of business?

YES *or* NO

If yes, please explain. THE SITE HAS BEEN A DAIRY WHICH SOLE BUSINESS WAS THAT OF MILK PRODUCTION FOR 34 YEARS. PRIOR USE OF THE PROPERTY WAS DRY FARM WHEAT PRODUCTION.

(4) Does the purchase price being paid for this *property* reasonably reflect the fair market value of the *property*?

YES *or* NO NO SALE PRICE HAS BEEN ESTABLISHED

If you believe that there is a difference, have you considered whether the lower purchase price is because contamination is known or believed to be present at the property?

YES or NO PROPERTY HAS NO CONTAMINATION TO MY KNOWLEDGE

If yes, please explain.

(5) Are you aware of commonly known or *reasonably* ascertainable information that would help the *environment professional* to identify conditions pinpointing releases or threaten releases of hazardous materials and/ or chemicals? For example, as user,

(a.) Do you know of any past uses of the *property*? YES or NO

(b.) Do you know of specific chemicals that are present or once were present at the *property*? YES or NO

(c.) Do you know of any chemical spills or any other chemical releases that have taken place at the *property*? YES or NO

(d.) Do you know of any environmental cleanups that have taken place at the *property*? YES *or* NO

If any yes, please explain.

(6) As the user of this Environmental Site Assessment (ESA), based on your knowledge and experience related to the *property* are there any *obvious* indicators that point to the presence or likely presence of a contamination at the *property*?

YES *or* NO

If yes, please explain.

Completed By RON ABACHERLI
Print Name

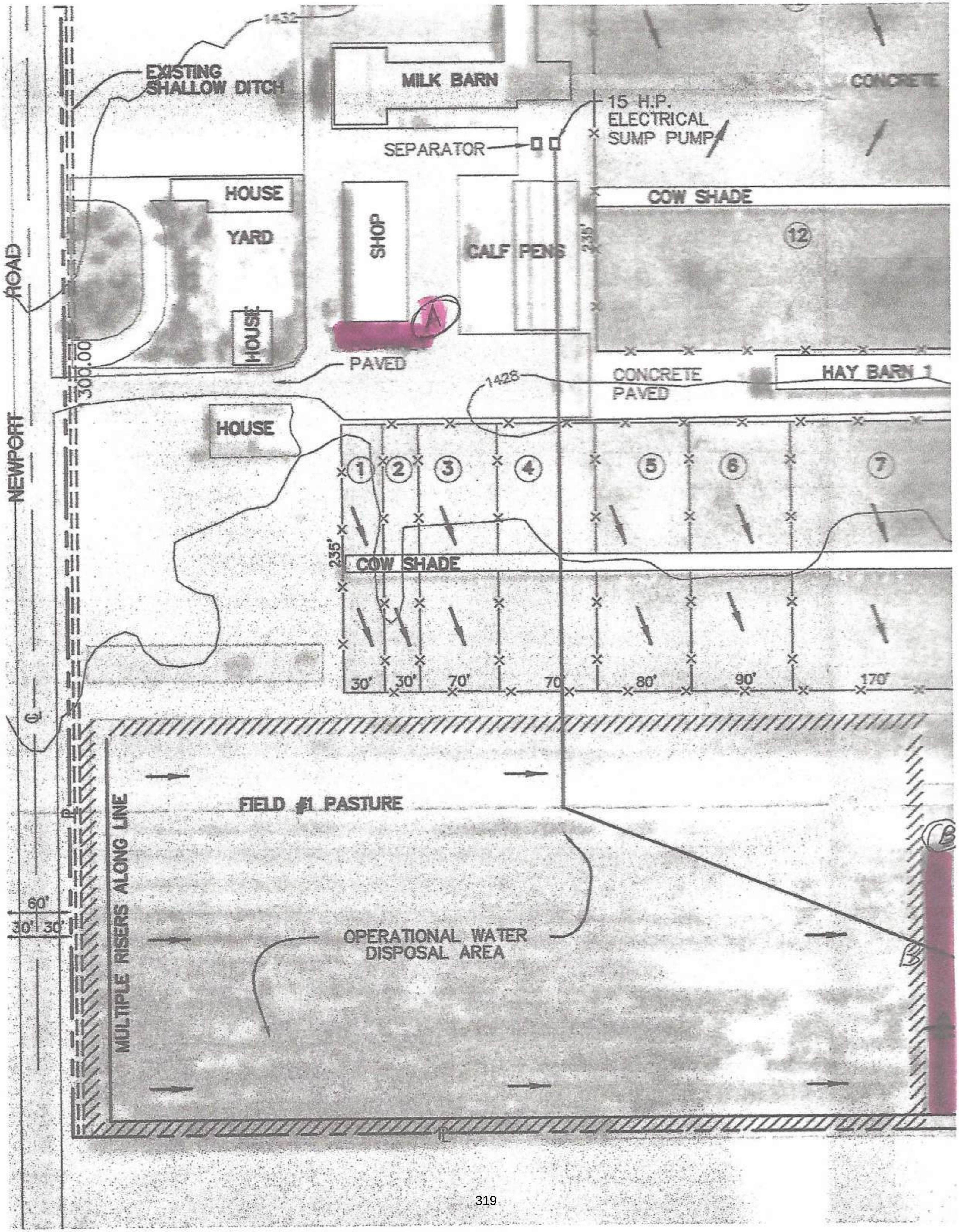
ABACHERLI DAIRY
RON ABACHERLI
29875 OLD NEWPORT RD
MENIFEE CA 92584
CELL:951-970-4662
FAX:951-679-7623
E-MAIL:RONABACHERLI@VERIZON.NET

Area "A" on map is the location of an above ground 2000 gallon diesel tank. It is a Con Vault tank encased in concrete. To my knowledge there has never been a spill however the tank has been at this location for 34 years and I feel that it is important to document the location.

Area "B" is the location of buried debris. On the north end of the lagoon, an area of approximately 9 feet wide by 100 feet long and 8 feet deep, was filled with asphalt and concrete debris and covered by 4 feet of dirt.

RON ABACHERLI 12/14/15

Ron Abacherli 12/14/15


1432
EXISTING SHALLOW DITCH
MILK BARN
CONCRETE
15 H.P. ELECTRICAL SUMP PUMP
SEPARATOR
HOUSE
YARD
SHOP
CALF PENS
COW SHADE
12
235'
ROAD
NEWPORT
HOUSE
300.00'
A
PAVED
CONCRETE PAVED
HAY BARN 1
1428
HOUSE
1
2
3
4
5
6
7
235'
COW SHADE
30'
30'
70'
70'
80'
90'
170'
FIELD #1 PASTURE
MULTIPLE RISERS ALONG LINE
OPERATIONAL WATER DISPOSAL AREA
60'
30'
30'
B
B

National Clandestine Laboratory Register - California

COUNTY	CITY	ADDRESS	DATE
ALAMEDA	BERKELEY	2240 9TH STREET	7/19/2008
ALAMEDA	CASTRO VALLEY	19127 SANTA MARIA AVENUE	3/24/2010
ALAMEDA	FREMONT	35856 TOLEDO COURT	7/28/2006
ALAMEDA	HAYWARD	333 JACKSON ST 219	3/12/2004
ALAMEDA	HAYWARD	1032 CENTRAL BLVD	6/9/2004
ALAMEDA	HAYWARD	231 CULP AVE	8/29/2004
ALAMEDA	HAYWARD	27948 PUEBLO SERENA WAY	1/9/2006
ALAMEDA	HAYWARD	698 OVERHILL DRIVE	5/16/2008
ALAMEDA	NEWARK	37120 SPRUCE ST G	2/29/2004
ALAMEDA	OAKLAND	923 39TH STREET	11/25/2008
ALAMEDA	PLEASANTON	6443 ALISAL ST	1/19/2005
ALAMEDA	PLEASANTON	818 ANGELA STREET	3/10/2010
ALAMEDA	SAN LEANDRO	1735 138TH AVE	2/18/2004
ALAMEDA	SAN LEANDRO	872 DONOVAN DR	5/4/2005
ALAMEDA	SAN LEANDRO	14446 ELM ST	5/31/2005
ALAMEDA	SAN LEANDRO	1553 SANTA MARIA ROAD	11/28/2007
ALAMEDA	SAN LORENZO	17283 VIA ANNETTE DR	2/6/2004
ALAMEDA	SAN LORENZO	1302 VIA SAN JUAN STREET	10/25/2007
ALAMEDA	SAN LORENZO	16150 ARRIBA VIADUCT	4/8/2009
ALAMEDA	UNION CITY	32673 BRENDA WAY 3	9/28/2004
ALAMEDA	UNION CITY	2351 HARTFORD DRIVE	4/7/2006
BUTTE	BIGGS	2164 LARKIN	4/9/2004
BUTTE	BIGGS	488 G ST	10/26/2004
BUTTE	CHICO	939 W EAST AVE 4	4/19/2004
BUTTE	CHICO	853 E 7TH ST	7/14/2004
BUTTE	CHICO	453 POSADA WAY 12	8/4/2004
BUTTE	CHICO	1056 E 8TH ST	3/18/2005
BUTTE	CHICO	696 7TH E ST	10/19/2005
BUTTE	CHICO	1402 POMONA LN	11/17/2005
BUTTE	CHICO	997 E 16TH ST	12/15/2005
BUTTE	CHICO	1735 MAGNOLIA AVENUE	2/26/2007
BUTTE	CHICO	1024 NEAL DOW AVENUE	6/7/2008
BUTTE	CHICO	729 NORD AVENUE	9/30/2008
BUTTE	DURHAM	9606 FIMPLE RD	7/15/2005
BUTTE	DURHAM	8200 DURNEL DRIVE	5/22/2010
BUTTE	GRIDLEY	233 KENTUCKY STREET	2/21/2006
BUTTE	GRIDLEY	275 KENTUCKY ST	2/21/2006
BUTTE	GRIDLEY	124 EAST GRIDLEY ROAD	5/14/2010
BUTTE	HONCUT	16 TRUXTON COURT	9/2/2008
BUTTE	MAGALIA	3 JORDAN HILL RD	3/31/2004
BUTTE	MAGALIA	14723 GOLD CONE DR	9/21/2004
BUTTE	OROVILLE	1940 HELMAN ST	2/4/2004
BUTTE	OROVILLE	110 GREENBACK DR	2/5/2004
BUTTE	OROVILLE	2437 ORO QUINCY HWY	3/17/2004
BUTTE	OROVILLE	126 CANYON HIGHLANDS DR	5/5/2004
BUTTE	OROVILLE	208 MISTY VIEW LN	5/10/2004
BUTTE	OROVILLE	2750 DE BANGAR HWY	7/21/2004
BUTTE	OROVILLE	2720 ORO DAM BLVD 6A	8/3/2004
BUTTE	OROVILLE	1130 TEHAMA ST	1/12/2005
BUTTE	OROVILLE	1915 PLUMAS ST	6/9/2005
BUTTE	OROVILLE	2794 OAK KNOLL WAY	11/30/2005

National Clandestine Laboratory Register - California

COUNTY	CITY	ADDRESS	DATE
BUTTE	OROVILLE	91 TOYON HILLS DRIVE	2/23/2007
BUTTE	OROVILLE	165 HURLES CIRCLE	3/18/2007
BUTTE	OROVILLE	4210 ORO BANGOR HIGHWAY	6/1/2007
BUTTE	OROVILLE	2349 VIA MADERO	9/11/2007
BUTTE	OROVILLE	1616 ORO DAM BOULEVARD	10/29/2007
BUTTE	OROVILLE	1660 20TH STREET	1/31/2008
BUTTE	OROVILLE	3 ALVERDA DRIVE	5/13/2008
BUTTE	OROVILLE	1840 7TH STREET	9/17/2008
BUTTE	OROVILLE	1960 ROSE STREET	4/7/2009
BUTTE	OROVILLE	5075 LOWER WYANDOTTE AVENUE	4/7/2009
BUTTE	PALERMO	2398 LOUIS AVENUE	8/27/2007
BUTTE	PARADISE	6441 MOSS LN	3/31/2004
BUTTE	PARADISE	538 CASTLE	7/23/2004
BUTTE	PARADISE	5955 HAZEL WAY	5/25/2006
CALAVERAS	MOUNTAIN RANCH	5645 DOSTER RD	12/20/2004
CONTRA COSTA	ANTIOCH	1927 BIRCH AVE	12/12/2004
CONTRA COSTA	BAY POINT	71 MOUNTAIN VIEW AVENUE	3/22/2011
CONTRA COSTA	BRENTWOOD	1880 EAST EDEN PLAINS STREET	10/2/2014
CONTRA COSTA	BRENTWOOD	638 SUMMERWOOD DRIVE	2/11/2010
CONTRA COSTA	CROCKETT	815 1ST AVENUE	12/9/2010
CONTRA COSTA	EL SOBRANTE	2211 RANCHO ROAD	9/20/2007
CONTRA COSTA	MARTINEZ	625 MARINA VISTA ST	3/22/2005
CONTRA COSTA	RICHMOND	2420 ESMOND AVENUE	12/5/2006
CONTRA COSTA	RICHMOND	712 BRADFORD DRIVE	7/29/2008
CONTRA COSTA	RODEO	1120 4TH ST	7/8/2004
DEL NORTE	CRESCENT CITY	1733 WILDWOOD LN	4/14/2004
EL DORADO	EL DORADO	6841 UNION MINE RD	4/29/2004
FRESNO	CARUTHERS	14594 SOUTH ELM AVENUE	11/28/2006
FRESNO	CLOVIS	287 WEST BARSTOW AVENUE 125B	10/26/2012
FRESNO	COALINGA	47932 LOST HILLS RD	8/30/2004
FRESNO	DOS PALOS	43186 MERRILL AVENUE	4/15/2010
FRESNO	DOS PALOS	43186 MERRILL AVENUE	4/15/2010
FRESNO	FOWLER	6424 SOUTH FOWLER AVENUE	8/21/2007
FRESNO	FRESNO	12884 S ELM AVE	7/15/2004
FRESNO	FRESNO	1315 E CORNELL	7/15/2004
FRESNO	FRESNO	7090 N FRUIT AVE 140	7/29/2004
FRESNO	FRESNO	4822 E MONO ST	6/9/2005
FRESNO	FRESNO	2540 NORTH FLOYD AVENUE	11/24/2006
FRESNO	FRESNO	8971 MOUNTAIN VIEW	12/13/2006
FRESNO	FRESNO	4409 EAST HEDGES AVENUE A	12/16/2008
FRESNO	FRESNO	3001 WEST SWIFT AVE AVENUE 104	8/6/2013
FRESNO	FRESNO	4851 NORTH N CEDAR AVE AVENUE 117	1/6/2014
FRESNO	FRESNO	3852 EAST E OLIVE AVE AVENUE 201	1/14/2014
FRESNO	FRESNO	3025 EAST E GETTYSBURG AVE AVENUE 102	1/21/2014
FRESNO	FRESNO	7675 N FIRST STREET BOX 203	9/6/2015
FRESNO	REEDLEY	22134 E HOGAN AVE	1/15/2004
FRESNO	REEDLEY	20069 CLAYTON AVENUE	12/8/2007

National Clandestine Laboratory Register - California

COUNTY	CITY	ADDRESS	DATE
FRESNO	SAN JOAQUIN	2243 ELDORADO S B	3/10/2006
FRESNO	SQUAW VALLEY	46992 CREEKSIDE ROAD	11/18/2013
GLENN	WILLOWS	5627 COUNTY ROAD 69	5/12/2004
HUMBOLDT	ARCATA	258 LUPIN AVENUE	8/30/2006
HUMBOLDT	BLUE LAKE	113 RAYMAR AVE	5/9/2005
HUMBOLDT	EUREKA	1984 GAGE LN	4/27/2004
HUMBOLDT	EUREKA	1034 14TH ST	6/6/2005
HUMBOLDT	EUREKA	1323 SUMMER STREET	6/15/2006
HUMBOLDT	FORTUNA	1788 PENN AVE	3/2/2004
HUMBOLDT	MCKINLEYVILLE	2331 CENTRAL AVE 4	3/25/2004
IMPERIAL	HOLTVILLE	819 1/2 FERN ST	1/28/2004
IMPERIAL	HOLTVILLE	2300 SLAYTON RD	2/5/2004
IMPERIAL	HOLTVILLE	819 1/2 FERN AVE	3/20/2006
IMPERIAL	SEELEY	2205 HASKELL RD	7/20/2004
KERN	BAKERSFIELD	8614 FULLER	2/22/2004
KERN	BAKERSFIELD	2600 NORMAN AVE	5/26/2004
KERN	BAKERSFIELD	8614 FULLER	6/18/2004
KERN	BAKERSFIELD	321 OAKDALE DR	3/15/2005
KERN	BAKERSFIELD	2714 ALLEN RD	3/22/2005
KERN	BAKERSFIELD	2314 CENTER ST	10/19/2005
KERN	BAKERSFIELD	200 MIRAFLORES	2/28/2006
KERN	BAKERSFIELD	101 AGARNSEY LN	3/20/2006
KERN	BAKERSFIELD	109 CLYDE STREET	4/26/2006
KERN	BAKERSFIELD	200 MIRAFLORES AVENUE	3/18/2007
KERN	BAKERSFIELD	8TH STREET	6/22/2009
KERN	BAKERSFIELD	3801 NEWCOMBE COURT	3/3/2011
KERN	BAKERSFIELD	3804 LA TONIA COURT	3/3/2011
KERN	BAKERSFIELD	218 EL TEJON AVENUE	7/8/2011
KERN	BAKERSFIELD	7601 REDBANK	12/13/2011
KERN	DELANO	1305 20TH AVE	2/4/2004
KERN	JOHANNESBURG	405 BROADWAY AVENUE	10/9/2008
KERN	LAKE ISABELLA	3105 WENYOR	9/21/2004
KERN	LAMONT	10224 SAN EMIDIO STREET	7/11/2007
KERN	LAMONT	8008 MIDDLETON LANE	5/19/2008
KERN	RIDGECREST	709 W ATKINS AVE	12/9/2004
KERN	RIDGECREST	345 WEST MOYER AVENUE	6/4/2007
KERN	SHAFTER	18478 S SHAFTER AVE	1/23/2004
KERN	SHAFTER	31396 BURBANK AVE	6/12/2004
KERN	TAFT	412 KERN ST	8/26/2004
KERN	TAFT	217 LIERLY ST	6/20/2005
KINGS	HANFORD	11111 9 3/4 AVENUE	4/16/2007
KINGS	UNINCORPORATED CITY	6260 BARSTOW AVE	5/21/2004
LAKE	CLEARLAKE	13660 EAST LAKE DR	4/19/2004
LAKE	CLEARLAKE	15888 19TH ST	4/28/2004
LAKE	CLEARLAKE	16537 35TH AVE	6/18/2005
LAKE	CLEARLAKE	13820 MANAKEE DRIVE	1/20/2010
LAKE	FINLEY	3424 STONE DR	9/15/2004
LAKE	LAKEPORT	525 ESPLANADE ST	1/27/2004
LAKE	LOWER LAKE	10243 SIEGLER CANYON RD	11/17/2004
LAKE	NICE	6643 COLLIER	2/15/2006
LOS ANGELES	ARTESIA	11635 ARTESIA BOULEVARD	5/1/2013

National Clandestine Laboratory Register - California

COUNTY	CITY	ADDRESS	DATE
LOS ANGELES	BALDWIN PARK	3109 ROBINETTE AVE	9/28/2004
LOS ANGELES	BALDWIN PARK	4442 EDRA AVENUE	6/16/2008
LOS ANGELES	BELL	3717 BELL AVENUE	6/6/2009
LOS ANGELES	BELL GARDENS	7534 PURDY STREET	5/1/2010
LOS ANGELES	BELLFLOWER	17122 DOWNEY AVENUE	11/2/2008
LOS ANGELES	BEVERLY HILLS	712 NORTH REXFORD DRIVE	6/1/2013
LOS ANGELES	CERRITOS	12513 SANDY CREEK LANE	3/9/2007
LOS ANGELES	CITY OF COMMERCE	5820 RAMON CT	4/14/2005
LOS ANGELES	COMPTON	1016 POINSETTIA S AVE	3/10/2004
LOS ANGELES	COVINA	444 CITRUS N AVE	1/13/2004
LOS ANGELES	COVINA	19850 ARROW HIGHWAY	8/6/2006
LOS ANGELES	DIAMOND BAR	2620 CASTLEROCK ROAD	8/1/2006
LOS ANGELES	DIAMOND BAR	749 FEATHERWOOD DRIVE	11/1/2007
LOS ANGELES	DOWNEY	9322 STAMPS AVE	2/18/2005
LOS ANGELES	DOWNEY	10350 HALEDON AVENUE	5/21/2008
LOS ANGELES	EAST LOS ANGELES	4135 FLORAL AVE	3/5/2004
LOS ANGELES	EL MONTE	11828 EMERY ST	11/18/2004
LOS ANGELES	EL MONTE	4350 RANGER AVE	11/29/2004
LOS ANGELES	ENCINO	17448 VENTURA BOULEVARD	8/11/2008
LOS ANGELES	GARDENA	14903 CHADRON AVE 1	3/1/2006
LOS ANGELES	GLENDORA	19104 MANUA LOA	7/21/2004
LOS ANGELES	HAWTHORNE	12600 PRAIRIE AVENUE	7/19/2010
LOS ANGELES	HAWTHORNE	2851 WEST 120TH STREET	7/22/2010
LOS ANGELES	HAWTHORNE	13611 DOTY AVENUE	2/3/2011
LOS ANGELES	HAWTHORNE	13611 DOTY AVENUE	2/3/2011
LOS ANGELES	HUNTINGTON PARK	2505 OLIVE STREET	5/15/2007
LOS ANGELES	HUNTINGTON PARK	6418 SEVILLE	9/18/2007
LOS ANGELES	HUNTINGTON PARK	2409 OLIVE STREET	11/18/2008
LOS ANGELES	INGLEWOOD	8815 SOUTH VAN NESS AVENUE	5/4/2010
LOS ANGELES	LA CANADA FLINTRIDGE	5016 ANGELES CREST HWY	5/25/2004
LOS ANGELES	LA PUENTE	410 EVANWOOD AVE	9/22/2004
LOS ANGELES	LA PUENTE	18631 ALTARIO ST	1/13/2005
LOS ANGELES	LANCASTER	3995 AVENUE H W	3/3/2004
LOS ANGELES	LANCASTER	42705 6TH E ST	2/3/2005
LOS ANGELES	LANCASTER	44634 DATE AVENUE	6/2/2006
LOS ANGELES	LANCASTER	45448 ELM	7/14/2007
LOS ANGELES	LITTLEROCK	8632 AVENUE U E	1/21/2004
LOS ANGELES	LLANO	25757 V E AVE	3/24/2004
LOS ANGELES	LONG BEACH	2520 PACIFIC COAST E HWY 221	1/27/2004
LOS ANGELES	LONG BEACH	1401 11 E ST	7/1/2004
LOS ANGELES	LONG BEACH	2124 MC KENZIE AVENUE	4/25/2006
LOS ANGELES	LONG BEACH	1624 JUNIPERO AVENUE	4/4/2007
LOS ANGELES	LONG BEACH	3613 LA JARA STREET	11/14/2007
LOS ANGELES	LONG BEACH	1875 LIME AVENUE	12/22/2008
LOS ANGELES	LONG BEACH	2345 EAST HARDING STREET	2/4/2010
LOS ANGELES	LONG BEACH	2454 EASY AVENUE	2/10/2010
LOS ANGELES	LOS ANGELES	2742 LANFRANCO ST 7	1/7/2004
LOS ANGELES	LOS ANGELES	560 KEENAN AVE	5/12/2004
LOS ANGELES	LOS ANGELES	5320 1/2 ITHACA AVE	6/22/2004
LOS ANGELES	LOS ANGELES	21150 HOBART	8/18/2004
LOS ANGELES	LOS ANGELES	1406 GORDON STREET	3/26/2006

National Clandestine Laboratory Register - California

COUNTY	CITY	ADDRESS	DATE
LOS ANGELES	LOS ANGELES	123 S LAKE STREET	7/14/2006
LOS ANGELES	LOS ANGELES	3015 SUNNYNOOK DRIVE	8/11/2006
LOS ANGELES	LOS ANGELES	244 47TH PLACE	10/12/2006
LOS ANGELES	LOS ANGELES	244 WEST 47TH PLACE	10/12/2006
LOS ANGELES	LOS ANGELES	11630 WEST 207TH STREET	12/7/2006
LOS ANGELES	LOS ANGELES	321 WESTMINSTER AVENUE	8/9/2007
LOS ANGELES	LOS ANGELES	1216 HANOVER AVENUE	8/12/2007
LOS ANGELES	LOS ANGELES	359 71ST STREET	10/10/2007
LOS ANGELES	LOS ANGELES	3744 59TH STREET	12/20/2007
LOS ANGELES	LOS ANGELES	218 1/2 54TH STREET	3/14/2008
LOS ANGELES	LOS ANGELES	4154 COMPTON AVENUE	4/17/2008
LOS ANGELES	LOS ANGELES	6118 HOOPER STREET	4/24/2009
LOS ANGELES	LOS ANGELES	5170 SOUTH NORMANDIE AVENUE	1/3/2010
LOS ANGELES	LOS ANGELES	2109 ESTRELLA AVENUE	2/2/2010
LOS ANGELES	LOS ANGELES	6516 SOUTH MAIN STREET	6/2/2010
LOS ANGELES	LOS ANGELES	213 1/2 WEST 66 STREET	9/21/2010
LOS ANGELES	LOS ANGELES	1564 EAST 117TH STREET	4/4/2013
LOS ANGELES	LYNWOOD	10868 DRURY LN	10/29/2004
LOS ANGELES	NORWALK	11026 IMPERIAL E HWY 10	4/21/2004
LOS ANGELES	NORWALK	12618 STUDEBAKER ROAD	6/14/2010
LOS ANGELES	PALMDALE	38233 HENDON DR	4/3/2004
LOS ANGELES	PALMDALE	38566 EAST 35TH STREET	10/3/2006
LOS ANGELES	PANORAMA CITY	8154 ALLOTT	1/19/2006
LOS ANGELES	POMONA	320 JEFFERSON W AVE	10/19/2004
LOS ANGELES	POMONA	1347 CAMBRIN ROAD	12/7/2006
LOS ANGELES	POMONA	260 LA VERNE AVENUE	7/12/2007
LOS ANGELES	REDONDO BEACH	208 B AVE	1/4/2004
LOS ANGELES	SAN DIMAS	1717 MONTE VISTA DR	10/7/2004
LOS ANGELES	SAN PEDRO	975 5TH W ST	8/3/2005
LOS ANGELES	SANTA FE SPRINGS	11462 TELEGRAPH RD	1/14/2004
LOS ANGELES	SANTA FE SPRINGS	13310 TELEGRAPH ROAD	4/14/2010
LOS ANGELES	SHADOW HILLS	10339 JOHANNA AVENUE	6/22/2006
LOS ANGELES	SIGNAL HILL	2210 GAVIOTA N AVE C	7/6/2004
LOS ANGELES	SOUTH GATE	2634 PALM PLACE	5/29/2007
LOS ANGELES	SYLMAR	12600 BRADLEY STREET	7/19/2006
LOS ANGELES	TORRANCE	4111 PACIFIC COAST HIGHWAY 308	4/11/2004
LOS ANGELES	VAN NUYS	15149 DOMINO ST	11/8/2005
LOS ANGELES	VAN NUYS	7400 SEPULVEDA BOULEVARD	2/12/2008
LOS ANGELES	WHITTIER	8171 WASHINGTON AVE	6/24/2004
LOS ANGELES	WHITTIER	6133 MCNEES AVE	1/14/2006
LOS ANGELES	WHITTIER	10816 TOWNLEY DRIVE	5/11/2007
LOS ANGELES	WILMINGTON	1724 FRIES AVE	2/17/2006
LOS ANGELES	WILMINGTON	1630 SANDISON STREET	7/20/2007
LOS ANGELES	WINNETKA	8474 QUARTZ AVE	9/28/2005
MADERA	CHOWCHILLA	18899 ROAD 16	4/28/2004
MADERA	CHOWCHILLA	1304 COLUSA AVE A	1/25/2005
MADERA	MADERA	21442 AVENUE 19 AVE	2/10/2005
MADERA	MADERA	815 EAST CLINTON AVENUE	8/29/2006
MADERA	MADERA	18697 AVENUE PASS	8/21/2007
MADERA	MADERA	512 FEIN STREET	8/25/2007
MADERA	MADERA	35626 14 1/2 AVENUE	2/1/2008

National Clandestine Laboratory Register - California

COUNTY	CITY	ADDRESS	DATE
MADERA	MADERA	13577 20TH AVENUE	9/4/2008
MADERA	MADERA	19184 AVE 18	5/15/2014
MENDOCINO	FORT BRAGG	16900 FRANKLIN ROAD	5/9/2006
MENDOCINO	PHILO	3500 LITTLE MILL CREEK ROAD	5/6/2010
MENDOCINO	REDWOOD VALLEY	9800 WEST ROAD	4/9/2009
MENDOCINO	WILLITS	65000 SHERWOOD RIDGE ROAD	2/20/2008
MERCED	ATWATER	9000 MORAN AVE	5/11/2005
MERCED	ATWATER	1236 HULL RD	9/23/2005
MERCED	ATWATER	1001 SANDPIPER WAY	11/15/2006
MERCED	ATWATER	4146 SOUTH ELLIOTT ROAD	8/11/2008
MERCED	BALLICO	11368 NORTH SANTA FE AVENUE	1/10/2010
MERCED	CRESSEY	9835 CRESSEY	6/3/2004
MERCED	DELHI	16235 REDBUD CT	6/29/2004
MERCED	DELHI	8620 HINTON	11/15/2006
MERCED	DELHI	15575 AUGUST AVENUE	9/8/2008
MERCED	DELHI	9640 SANDS ROAD	6/6/2010
MERCED	GUSTINE	8450 HIGHWAY 33 S HWY	3/2/2005
MERCED	HILMAR	20295 AUGUST RD	4/15/2004
MERCED	HILMAR	19511 WILLIAMS AVE	10/13/2004
MERCED	HILMAR	250 N UNION	10/12/2007
MERCED	HILMAR	19542 EAST FIRST STREET	4/1/2010
MERCED	LIVINGSTON	5679 ARENA WAY	4/6/2004
MERCED	LIVINGSTON	15290 SUNSET DRIVE	5/22/2010
MERCED	LOS BANOS	313 J STREET	8/11/2006
MERCED	MERCED	2536 LOBO	2/4/2004
MERCED	MERCED	3613 N GARNER RD	2/27/2004
MERCED	MERCED	321 S 59 S HWY	1/3/2005
MERCED	MERCED	824 S FREYA	1/25/2007
MERCED	MERCED	2499 EAST GERARD AVENUE	3/21/2007
MERCED	MERCED	14717 EAST 272ND	9/6/2007
MERCED	MERCED	5 WEST 25TH STREET 2	1/16/2008
MERCED	SOUTH DOS PALOS	8827 W K ST	7/23/2004
MERCED	STEVINSON	18910 W 6TH ST	2/10/2004
MERCED	STEVINSON	23875 SECOND AVENUE	3/27/2006
MERCED	STEVINSON	2917 CEMETERY ROAD	2/20/2008
MERCED	STEVINSON	2991 CEMETERY	2/20/2008
MERCED	STEVINSON	2228 NELANDER AVENUE	4/27/2010
MERCED	WINTON	6280 CENTRAL AVE	8/8/2004
MERCED	WINTON	9605 EUCALYPTUS AVE	8/8/2004
MERCED	WINTON	7409 AMANDA DRIVE	3/13/2007
MERCED	WINTON	6814 ARLENE WAY	3/12/2008
MERCED	WINTON	7125 NORTH VINE AVENUE	4/21/2010
MONTEREY	GREENFIELD	424 7TH AVENUE	9/19/2010
MONTEREY	PACIFIC GROVE	316 PRESCOTT LN	7/16/2004
MONTEREY	SALINAS	1769 YOSEMITE CIR	5/21/2004
MONTEREY	SALINAS	1233 EAST POLK STREET	6/20/2007
MONTEREY	SALINAS	18840 NORTHEAST EISENHOWERE D	6/20/2007
NEVADA	GRASS VALLEY	439 NEAL ST 1	7/30/2004
ORANGE	ANAHEIM	131 MAGNOLIA AVENUE	3/21/2008
ORANGE	ANAHEIM	3554 WEST CORNELIA CIRCLE	3/24/2008
ORANGE	ANAHEIM	1819 CRIS	3/27/2008

National Clandestine Laboratory Register - California

COUNTY	CITY	ADDRESS	DATE
ORANGE	ANAHEIM	1261 PLACENTIA STREET	3/29/2008
ORANGE	ANAHEIM	2500 EAST TERRACE STREET	4/8/2008
ORANGE	ANAHEIM	622 VELARE AVENUE	9/16/2008
ORANGE	ANAHEIM	1303 WEST MARLBORO AVENUE	2/22/2010
ORANGE	BREA	2595 IMPERIAL HIGHWAY	5/20/2010
ORANGE	BUENA PARK	7555 BEACH BLVD 128	2/10/2004
ORANGE	BUENA PARK	7111 BEACH BOULEVARD	2/10/2010
ORANGE	COSTA MESA	929 JOANN STREET	5/13/2008
ORANGE	CYPRESS	4812 GRACE AVENUE	4/10/2006
ORANGE	FULLERTON	641 COMMONWEALTH AVENUE	12/7/2007
ORANGE	GARDEN GROVE	8062 GARDEN GROVE BLVD 241	9/21/2004
ORANGE	GARDEN GROVE	9755 BIXBY AVENUE	4/11/2008
ORANGE	GARDEN GROVE	10042 LAMPSON AVENUE	5/13/2009
ORANGE	GARDEN GROVE	13691 BARNETT WAY	2/13/2010
ORANGE	HUNTINGTON BEACH	8230 TALBERT	4/7/2010
ORANGE	IRVINE	173 TOPEKA	2/11/2004
ORANGE	IRVINE	87 PINESTONE	3/23/2010
ORANGE	LA HABRA	2320 STORY AVE	7/16/2004
ORANGE	LA PALMA	4761 SHARON DRIVE A	7/17/2006
ORANGE	LAGUNA BEACH	985 PACIFIC COAST N HWY	2/1/2004
ORANGE	ORANGE	2135 ALMOND W ST	10/15/2004
ORANGE	ORANGE	207 ESPLANDE STREET	5/30/2008
ORANGE	ORANGE	2300 NORTH TUSTIN AVENUE	3/29/2010
ORANGE	PLACENTIA	745 DUNN	3/16/2010
ORANGE	SANTA ANA	1137 MCFADDEN W	7/7/2004
ORANGE	SANTA ANA	1233 GENOA S DR	11/30/2004
ORANGE	SANTA ANA	1314 HARBOR BOULEVARD	4/9/2008
ORANGE	SANTA ANA	3012 HALLADAY	5/19/2008
ORANGE	SANTA ANA	412 BAKER STREET	5/21/2008
ORANGE	SANTA ANA	702 SANTA ANA BOULEVARD	7/14/2008
ORANGE	SANTA ANA	1450 AUTO DRIVE	5/11/2009
ORANGE	SANTA ANA	4417 MORNINGSIDE	4/28/2010
ORANGE	SANTA ANA	800 SOUTH SULLIVAN STREET D3	12/23/2011
ORANGE	STANTON	10698 COURT STREET	9/15/2006
ORANGE	STANTON	7701 WESTBROOK WAY	4/19/2007
ORANGE	TUSTIN	13624 ESTERO CIR	4/24/2004
ORANGE	WESTMINSTER	7681 BAYLOR DR	7/15/2004
ORANGE	WESTMINSTER	9851 BOLSA AVENUE	5/5/2006
ORANGE	WESTMINSTER	5051 PRINCETON AVENUE	5/17/2006
ORANGE	WESTMINSTER	13100 GOLDENWEST STREET	4/28/2009
ORANGE	WESTMINSTER	6942 GARDEN GROVE BOULEVARD	5/21/2009
ORANGE	YORBA LINDA	5471 JEFFERSON STREET	11/13/2007
PLUMAS	CHESTER	460 MELISSA AVENUE	10/11/2007
PLUMAS	PORTOLA	5630 CASEY JONES ROAD	4/14/2006
PLUMAS	PORTOLA	324 BELLA VISTA	3/9/2010
PLUMAS	QUINCY JUNCTION	1426 BUTTERFLY VALLEY ROAD	2/17/2010
RIVERSIDE	ANZA	57310 VALLEY VISTA	6/11/2004
RIVERSIDE	BANNING	1007 LINDA VISTA RD	10/26/2004
RIVERSIDE	BANNING	514 EAST VICTORY AVENUE	3/21/2010
RIVERSIDE	BEAUMONT	34250 SAN TIMITEO CANYON RD	4/15/2004

National Clandestine Laboratory Register - California

COUNTY	CITY	ADDRESS	DATE
RIVERSIDE	BEAUMONT	1016 PALM AVE	4/19/2004
RIVERSIDE	CALIMESA	9453 SHARONDALE ROAD	6/8/2006
RIVERSIDE	CATHEDRAL CITY	68557 C STREET	2/16/2004
RIVERSIDE	CORONA	734 VIEWTOP LN	3/12/2004
RIVERSIDE	CORONA	995 POMONA RD 17	4/2/2004
RIVERSIDE	CORONA	1330 W 8TH ST 18	7/21/2004
RIVERSIDE	CORONA	446 FRANCIS E ST	2/2/2006
RIVERSIDE	CORONA	379 EAST RANCHO ROAD	1/2/2008
RIVERSIDE	DESERT HOT SPRINGS	66366 6TH ST	1/20/2004
RIVERSIDE	DESERT HOT SPRINGS	13255 MEXQUITE AVENUE	3/23/2006
RIVERSIDE	DESERT HOT SPRINGS	12155 OCOTILLO ROAD	4/29/2009
RIVERSIDE	EL CERRITO	19078 RISING SUN RD	3/12/2004
RIVERSIDE	GLEN AVON HEIGHTS	4080 CONNING	2/29/2004
RIVERSIDE	HEMET	531 CEDAR LN 2	2/7/2004
RIVERSIDE	HEMET	1675 COBBLE LN	2/11/2004
RIVERSIDE	HEMET	1097 N STATE ST 2	2/18/2004
RIVERSIDE	HEMET	772 N STATE	3/24/2004
RIVERSIDE	HEMET	225 S ELK ST 36	3/30/2004
RIVERSIDE	HEMET	43939 FLORIDA AVE	5/4/2004
RIVERSIDE	HEMET	585 S SANTA FE	5/15/2004
RIVERSIDE	HEMET	2688 E FLORIDA AVE 18	6/4/2004
RIVERSIDE	HEMET	4400 FLORIDA W AVE 117	12/8/2004
RIVERSIDE	HEMET	41251 ROPE RD	1/29/2005
RIVERSIDE	HEMET	525 GILBERT N 49	1/20/2006
RIVERSIDE	HEMET	25873 RIVERVIEW LANE	3/15/2006
RIVERSIDE	HEMET	32809 RED MOUNTAIN ROAD	2/18/2008
RIVERSIDE	HEMET	871 SAN MATEO CIRCLE	5/21/2009
RIVERSIDE	INDIO	46540 PADUA CIR	6/9/2004
RIVERSIDE	INDIO	47800 MADISON ST 169	9/21/2004
RIVERSIDE	LAKE ELSINORE	17911 THORESON	4/29/2004
RIVERSIDE	LAKE ELSINORE	34323 SUNRISE DRIVE	1/27/2006
RIVERSIDE	LAKE MATTHEWS	17224 CAJON DR	9/28/2004
RIVERSIDE	MENIFEE	26814 MADERA CT	12/6/2004
RIVERSIDE	MIRA LOMA	10351 OAK BARK LANE	11/12/2008
RIVERSIDE	MORENO VALLEY	25204 BRIDLE TRAIL	8/29/2004
RIVERSIDE	MORENO VALLEY	16329 SADDLEBACK LANE	2/3/2015
RIVERSIDE	MORENO VALLEY	25399 TODD DRIVE	8/15/2015
RIVERSIDE	MOUNTAIN CENTER	63137 JERABOA ROAD	4/12/2007
RIVERSIDE	NORCO	2574 RIDGECREST	3/16/2004
RIVERSIDE	NORCO	3117 SHADOW CANYON CIRCLE	1/31/2008
RIVERSIDE	NUEVO	22788 VIA SANTANA	4/21/2006
RIVERSIDE	PALM SPRINGS	383 VEREDA NORTE	6/20/2008
RIVERSIDE	PERRIS	332 W 11TH ST	2/8/2004
RIVERSIDE	PERRIS	143 PEROU ST	6/27/2004
RIVERSIDE	PERRIS	618 BOND DR	7/29/2004
RIVERSIDE	PERRIS	4715 WADE AVE	3/3/2005
RIVERSIDE	PERRIS	19881 GUSTIN RD	12/12/2005
RIVERSIDE	PERRIS	21747 WEBSTER AVENUE	8/7/2008
RIVERSIDE	PERRIS	21881 OLEANDER AVENUE	8/29/2008
RIVERSIDE	PERRIS	644 PRIMROSE PLACE	4/8/2011
RIVERSIDE	PERRIS	2520 SPECTACULAR BID STREET	7/29/2014

National Clandestine Laboratory Register - California

COUNTY	CITY	ADDRESS	DATE
RIVERSIDE	RIVERSIDE	344 N STATE 148	1/28/2004
RIVERSIDE	RIVERSIDE	5861 MITCHELL	3/31/2004
RIVERSIDE	RIVERSIDE	11235 CYPRESS	6/27/2006
RIVERSIDE	RIVERSIDE	4080 PEDLEY ROAD	2/5/2010
RIVERSIDE	RIVERSIDE	11744 HAZELDELL DRIVE	4/2/2010
RIVERSIDE	RIVERSIDE	12172 SEVERN WAY	4/2/2010
RIVERSIDE	RIVERSIDE	12172 SEVERN WAY	4/2/2010
RIVERSIDE	SAN JACINTO	437 MEAD	8/2/2004
RIVERSIDE	SAN JACINTO	344 N STATE ST SP 196	6/15/2005
RIVERSIDE	SAN JACINTO	610 WASHINGTON E AVE	2/22/2006
RIVERSIDE	SAN JACINTO	182 DE ANZA	4/20/2006
RIVERSIDE	TEMECULA	29774 CALLE PANTANO	2/2/2010
RIVERSIDE	VICTORVILLE	20197 NANDINA AVE	7/9/2004
RIVERSIDE	VICTORVILLE	22875 RIOS	11/16/2004
RIVERSIDE	WINCHESTER	33091 WILLARD	5/20/2004
SACRAMENTO	CITRUS HEIGHTS	7401 LOVATO	6/23/2007
SACRAMENTO	ELK GROVE	5354 JADE CREEK	2/23/2005
SACRAMENTO	ELVERTA	2495 RHINE WAY	8/5/2004
SACRAMENTO	ELVERTA	2110 QUAIL RANCH COURT	2/28/2006
SACRAMENTO	GALT	132 4TH	4/20/2010
SACRAMENTO	RANCHO CORDOVA	10892 WALNUTWOOD WAY	4/4/2004
SACRAMENTO	SACRAMENTO	4405 23RD ST	2/4/2004
SACRAMENTO	SACRAMENTO	4719 HAYFORD WAY	2/24/2004
SACRAMENTO	SACRAMENTO	7624 BIRDIE CT	3/23/2004
SACRAMENTO	SACRAMENTO	1536 STRADER AVE	3/26/2004
SACRAMENTO	SACRAMENTO	5867 AUBURN BLVD 30	3/30/2004
SACRAMENTO	SACRAMENTO	2530 STREET S 8	4/1/2004
SACRAMENTO	SACRAMENTO	3534 SUMMER PARK DR 354	10/8/2004
SACRAMENTO	SACRAMENTO	4144 CABINET CIRCLE	3/6/2006
SACRAMENTO	SACRAMENTO	7662 COUNTRY PARK DRIVE	6/6/2006
SACRAMENTO	SACRAMENTO	5230 PALM	1/30/2007
SACRAMENTO	SACRAMENTO	2681 FAIRFIELD STREET	2/13/2007
SACRAMENTO	SACRAMENTO	6316 WELTY WAY	12/3/2008
SACRAMENTO		5140 W SHERMAN ISLAND ROAD	5/13/2006
SAN BERNARDINO	ADELANTO	17526 KEATS ROAD	11/29/2007
SAN BERNARDINO	APPLE VALLEY	21845 ARAPAHOE ST 1	2/17/2004
SAN BERNARDINO	APPLE VALLEY	10620 MATILIJA	5/21/2004
SAN BERNARDINO	APPLE VALLEY	10808 MILLS RD	6/2/2004
SAN BERNARDINO	APPLE VALLEY	12618 POCONO ROAD	10/15/2006
SAN BERNARDINO	APPLE VALLEY	20024 HAPPY TRAILS HIGHWAY	1/4/2007
SAN BERNARDINO	APPLE VALLEY	9611 NAVAJO ROAD	5/5/2009
SAN BERNARDINO	BAKER	71759 BAKER BLVD	4/16/2004
SAN BERNARDINO	BARSTOW	24966 CAMINO DEL SOL ST	6/7/2004
SAN BERNARDINO	BARSTOW	2577 COMMUNITY BLVD	9/18/2004
SAN BERNARDINO	BARSTOW	29779 N 1ST	11/18/2004
SAN BERNARDINO	BARSTOW	434 S SECOND ST 1	1/1/2005
SAN BERNARDINO	BLOOMINGTON	16742 14TH ST	11/17/2004
SAN BERNARDINO	CHINO	11838 CENTRAL AVE 93	2/11/2004
SAN BERNARDINO	CHINO	12018 CENTRAL AVE	5/13/2004
SAN BERNARDINO	CHINO HILLS	15553 ESTHER ST	12/13/2004
SAN BERNARDINO	COLTON	1822 ADMIRALTY STREET	6/15/2007

National Clandestine Laboratory Register - California

COUNTY	CITY	ADDRESS	DATE
SAN BERNARDINO	FONTANA	14430 SANTA ANA	1/15/2004
SAN BERNARDINO	FONTANA	13519 ARROW RT	3/30/2004
SAN BERNARDINO	FONTANA	7642 KEMPSTER AVE	9/7/2004
SAN BERNARDINO	FONTANA	17265 LURELANE STREET	3/20/2006
SAN BERNARDINO	FONTANA	13449 IVY	6/15/2006
SAN BERNARDINO	FONTANA	14349 FIGWOOD DRIVE	12/13/2006
SAN BERNARDINO	FONTANA	16411 ATHOL STREET	4/17/2008
SAN BERNARDINO	HESPERIA	14926 FIR ST	2/25/2004
SAN BERNARDINO	HESPERIA	15356 PENDLETON	6/16/2004
SAN BERNARDINO	HESPERIA	11976 MARIPOSA RD	7/3/2004
SAN BERNARDINO	HESPERIA	7892 ALSTON	10/1/2004
SAN BERNARDINO	HESPERIA	10721 MAPLE ST	7/29/2005
SAN BERNARDINO	HESPERIA	9553 LOS BANOS AVE	1/12/2006
SAN BERNARDINO	HESPERIA	11516 HAWTHORNE	3/25/2006
SAN BERNARDINO	HESPERIA	9393 HICKORY	6/8/2006
SAN BERNARDINO	HESPERIA	10983 4TH AVENUE	6/9/2006
SAN BERNARDINO	HESPERIA	13010 PRAIRIE TRAIL	2/22/2007
SAN BERNARDINO	HESPERIA	9519 MAPLE AVENUE	10/18/2008
SAN BERNARDINO	HIGHLAND	7409 LOS FELIZ DR	4/23/2004
SAN BERNARDINO	HIGHLAND	25715 LIME ST	5/18/2004
SAN BERNARDINO	HIGHLAND	28457 MERRION AVE	5/21/2004
SAN BERNARDINO	HINKLEY	23572 STATE HIGHWAY 58	4/5/2009
SAN BERNARDINO	JOSHUA TREE	62475 COVE LN	5/27/2004
SAN BERNARDINO	JOSHUA TREE	3255 SUNSET RD	9/26/2004
SAN BERNARDINO	JOSHUA TREE	8997 TORTUGA ROAD	1/14/2008
SAN BERNARDINO	LANDERS	57646 LINN ROAD	10/14/2008
SAN BERNARDINO	LOMA LINDA	26232 NEWPORT AVENUE	8/1/2006
SAN BERNARDINO	MUSCOY	2544 3RD ST	6/23/2004
SAN BERNARDINO	NEWBERRY SPRINGS	52875 BEDFORD RD	3/25/2004
SAN BERNARDINO	NEWBERRY SPRINGS	47962 HORNER RD	6/24/2004
SAN BERNARDINO	NEWBERRY SPRINGS	35377 NEWBERRY RD	10/11/2004
SAN BERNARDINO	NEWBERRY SPRINGS	42378 SILVER VALLEY ROAD	4/21/2006
SAN BERNARDINO	ONTARIO	844 WYSTERIA E CT	1/21/2004
SAN BERNARDINO	ONTARIO	1506 E HIGHLAND CT	7/26/2004
SAN BERNARDINO	ONTARIO	956 PRINCETON W ST	2/10/2006
SAN BERNARDINO	ONTARIO	740 CAMALOT	9/10/2007
SAN BERNARDINO	ORO GRANDE	21451 NATIONAL TRAILS HIGHWAY	6/13/2006
SAN BERNARDINO	PHELAN	8135 JOSHUA ST	4/27/2004
SAN BERNARDINO	PHELAN	6721 NIELSON RD	9/17/2004
SAN BERNARDINO	PHELAN	11480 MACRON	10/19/2004
SAN BERNARDINO	PINON HILLS	11475 PRADO ROAD	3/27/2007
SAN BERNARDINO	RANCHO CUCAMONGA	7651 EFFEN	10/1/2004
SAN BERNARDINO	REDLANDS	1034 ALTA ST	1/28/2004
SAN BERNARDINO	REDLANDS	28565 SAN TIMOTEO CANYON	10/25/2004
SAN BERNARDINO	REDLANDS	2155 CITRUS AVE 112	2/14/2005
SAN BERNARDINO	REDLANDS	828 6TH STREET	3/23/2006
SAN BERNARDINO	REDLANDS	511 REDLANDS BOULEVARD	5/16/2007
SAN BERNARDINO	RIALTO	349 N LILAC	2/17/2004
SAN BERNARDINO	RIALTO	624 ETIWANDA AVENUE	12/22/2007
SAN BERNARDINO	SAN BERNARDINO	1443 CEDAR 23	3/9/2004
SAN BERNARDINO	SAN BERNARDINO	1443 CEDAR ST 1	4/9/2004

COUNTY	CITY	ADDRESS	DATE
SAN BERNARDINO	SAN BERNARDINO	3160 N STATE ST	4/23/2004
SAN BERNARDINO	SAN BERNARDINO	2176 AMANDA ST	5/21/2004
SAN BERNARDINO	SAN BERNARDINO	1162 E 2ND	11/16/2004
SAN BERNARDINO	SAN BERNARDINO	2547 3RD AVE	12/28/2004
SAN BERNARDINO	SAN BERNARDINO	123 E 11TH ST	1/19/2005
SAN BERNARDINO	SAN BERNARDINO	1318 E GOULD ST	1/22/2005
SAN BERNARDINO	SAN BERNARDINO	11571 5TH ST	8/29/2005
SAN BERNARDINO	SAN BERNARDINO	2131 GENEVIEVE STREET	3/10/2006
SAN BERNARDINO	SAN BERNARDINO	756 W 19 ST	3/16/2006
SAN BERNARDINO	SAN BERNARDINO	19829 KENDALL DRIVE	9/12/2006
SAN BERNARDINO	SAN BERNARDINO	2292 PORTOLA STREET	10/13/2006
SAN BERNARDINO	SAN BERNARDINO	243 MERIDIAN AVENUE	7/18/2007
SAN BERNARDINO	SAN BERNARDINO	223 49TH	11/7/2007
SAN BERNARDINO	SAN BERNARDINO	1431 7TH STREET	11/26/2007
SAN BERNARDINO	SAN BERNARDINO	6317 BONNIE STREET	4/3/2008
SAN BERNARDINO	SAN BERNARDINO	7234 DWIGHT WAY	7/1/2008
SAN BERNARDINO	SAN BERNARDINO	205 WEST BENEDICT ROAD	4/2/2010
SAN BERNARDINO	TRONA	13860 FREMONT ST 2	12/30/2004
SAN BERNARDINO	TWENTYNINE PALMS	4828 LEAR AVE	2/22/2004
SAN BERNARDINO	TWENTYNINE PALMS	7580 MAC RD	3/31/2004
SAN BERNARDINO	TWENTYNINE PALMS	5665 AERONIA	4/15/2004
SAN BERNARDINO	TWENTYNINE PALMS	68077 INDIAN TRAIL	6/16/2004
SAN BERNARDINO	UPLAND	359 SEVENTH ST	1/5/2005
SAN BERNARDINO	VICTORVILLE	16717 C ST	1/30/2004
SAN BERNARDINO	VICTORVILLE	16868 STODDARD WELLS RD	2/19/2004
SAN BERNARDINO	VICTORVILLE	15330 CONDOR RD	3/9/2004
SAN BERNARDINO	VICTORVILLE	17053 B ST	10/19/2004
SAN BERNARDINO	VICTORVILLE	16688 HUGHES	10/21/2004
SAN BERNARDINO	VICTORVILLE	16262 YUCCA AVE	8/1/2005
SAN BERNARDINO	VICTORVILLE	11550 WHITE RD	10/17/2005
SAN BERNARDINO	VICTORVILLE	13126 MESA	2/7/2006
SAN BERNARDINO	VICTORVILLE	16755 UNION ST B	2/24/2006
SAN BERNARDINO	VICTORVILLE	15618 TOPANGO ROAD	3/2/2006
SAN BERNARDINO	VICTORVILLE	13602 NASSAU DRIVE	3/15/2006
SAN BERNARDINO	VICTORVILLE	14349 HESPERIA ROAD	12/21/2006
SAN BERNARDINO	VICTORVILLE	13852 BURNING TREE LANE	5/3/2007
SAN BERNARDINO	VICTORVILLE	16753 ZENDA STREET	8/6/2007
SAN BERNARDINO	VICTORVILLE	13143 SLEEPY RIDGE LANE	3/5/2010
SAN BERNARDINO	YERMO	37933 GRANDVIEW AVENUE	8/10/2006
SAN BERNARDINO	YUCAIPA	12470 15TH ST	5/25/2005
SAN BERNARDINO	YUCCA VALLEY	58620 SAN MARINO DRIVE	9/6/2006
SAN DIEGO	ALPINE	404 SUMMERHILL TERRACE	12/2/2013
SAN DIEGO	BOULEVARD	2605 PASEO ALTA CT	1/7/2004
SAN DIEGO	CARLSBAD	382 ACACIA	8/8/2010
SAN DIEGO	CARLSBAD	847 LAGUNA	8/8/2010
SAN DIEGO	ESCONDIDO	1306 RONDA AVE	3/23/2004
SAN DIEGO	ESCONDIDO	431 4TH E AVE 1B	8/31/2004
SAN DIEGO	ESCONDIDO	16975 GUEJITO RD	3/3/2005
SAN DIEGO	ESCONDIDO	1825 EAST VALLEY WAY	6/6/2006
SAN DIEGO	ESCONDIDO JUNCTION	1531 MONTIEL	1/20/2010
SAN DIEGO	FALLBROOK	422 CATALPA LN	5/19/2004

National Clandestine Laboratory Register - California

COUNTY	CITY	ADDRESS	DATE
SAN DIEGO	LA PUENTE	1254 BANNON	5/10/2007
SAN DIEGO	LAKESIDE	11441 EL NOPAL	8/12/2004
SAN DIEGO	OCEANSIDE	3965 BROWN STREET	9/20/2006
SAN DIEGO	SAN DIEGO	875 HOTEL S CIR	1/30/2004
SAN DIEGO	SAN DIEGO	6173 FAUNA DRIVE	5/21/2004
SAN DIEGO	SAN DIEGO	4242 34TH ST D	9/16/2004
SAN DIEGO	SAN DIEGO	3835 MIDWAY #203 DRIVE	6/20/2007
SAN DIEGO	SAN DIEGO	9777 DE LA AMISTAD VIADUCT	6/12/2009
SAN DIEGO	SAN YSIDRO	905 HWY CALIENTE RD	1/16/2004
SAN DIEGO	SANTEE	8593 MAGNOLIA AVE	1/30/2004
SAN DIEGO	VALLEY CENTER	30118 MILLER ROAD	11/7/2008
SAN DIEGO	VISTA	1280 HACIENDA DR G6	11/24/2004
SAN DIEGO	VISTA	1710 AVOCADO DRIVE	9/14/2006
SAN DIEGO	VISTA	663 EUCALYPTUS	4/3/2007
SAN DIEGO	VISTA	526 MAR VISTA DRIVE	11/29/2007
SAN DIEGO	VISTA	1610 N SANTA FE	4/9/2008
SAN FRANCISCO	SAN FRANCISCO	35 BELVEDERE ST 5	3/29/2006
SAN JOAQUIN	LATHROP	15523 SIXTH STREET	10/11/2007
SAN JOAQUIN	MANTECA	481 SOUTH UNION ROAD	4/20/2007
SAN JOAQUIN	MANTECA	250 N UNION	10/12/2007
SAN JOAQUIN	STOCKTON	7790 N ASHLEY LN	1/20/2004
SAN JOAQUIN	STOCKTON	9800 E EIGHT MILE RD	4/16/2004
SAN JOAQUIN	STOCKTON	5708 N HIGHWAY 99	4/18/2004
SAN JOAQUIN	STOCKTON	1560 SILVER CREEK	4/22/2004
SAN JOAQUIN	STOCKTON	10285 HILDRETH LN	6/30/2004
SAN JOAQUIN	STOCKTON	2717 W MARCH LN	7/31/2004
SAN JOAQUIN	STOCKTON	2654 W MARCH LN 304	8/4/2004
SAN JOAQUIN	STOCKTON	3416 FARMINGTON E RD 2	8/26/2004
SAN JOAQUIN	STOCKTON	2274 E FREMONT	9/25/2004
SAN JOAQUIN	STOCKTON	2071 LA JOLLA DR	4/25/2005
SAN JOAQUIN	STOCKTON	2553 MICHAELANGELO DRIVE	6/1/2006
SAN JOAQUIN	STOCKTON	301 MORADA	4/19/2007
SAN JOAQUIN	TRACY	14703 FINCK ROAD	8/3/2006
SAN JOAQUIN	TRACY	11422 WEST LARCH ROAD	3/14/2008
SAN LUIS OBISPO	ATASCADERO	1400 SAN RAMON	1/5/2004
SAN LUIS OBISPO	ATASCADERO	4080 DOLORES AVENUE	3/14/2006
SAN LUIS OBISPO	GROVER BEACH	448 NORTH 9TH STREET	3/30/2006
SAN LUIS OBISPO	MORRO BAY	525 ATASCADERO ROAD	7/12/2006
SAN LUIS OBISPO	NIPOMO	155 EAST PRICE STREET	4/29/2008
SAN LUIS OBISPO	PASO ROBLES	749 ORCHARD	9/5/2006
SAN LUIS OBISPO	PASO ROBLES	512 FEIN STREET	8/25/2007
SAN LUIS OBISPO	SAN LUIS OBISPO	3500 BULLOCK	8/29/2006
SAN LUIS OBISPO	SAN LUIS OBISPO	1771 CORDOVA	12/7/2011
SAN LUIS OBISPO	TEMPLETON	30 DANELION ROAD	1/15/2007
SAN MATEO	BELMONT	926 SOUTH ROAD	6/21/2006
SAN MATEO	DALY CITY	439 BONNIE STREET	1/14/2010
SAN MATEO	EAST PALO ALTO	1894 BAY ROAD	6/4/2006
SANTA CLARA	CAMPBELL	768 NEVINS STREET	7/11/2007
SANTA CLARA	GILROY	7860 DRIFTWOOD TER A	4/3/2004
SANTA CLARA	GILROY	2250 ROOP RD ROAD	8/19/2010
SANTA CLARA	LOS ALTOS	25562 FERNHILL DR	10/26/2004

National Clandestine Laboratory Register - California

COUNTY	CITY	ADDRESS	DATE
SANTA CLARA	MORGAN HILL	6760 CROY RD	9/29/2004
SANTA CLARA	SAN JOSE	3570 COLUMBINE DR	1/15/2004
SANTA CLARA	SAN JOSE	110 ROUNDTABLE DR 1	2/8/2004
SANTA CLARA	SAN JOSE	1374 RANDOL AVE	5/5/2004
SANTA CLARA	SAN JOSE	90 SADDLEBROOK DR	6/22/2004
SANTA CLARA	SAN JOSE	935 FOXCHASE DR 413	9/21/2004
SANTA CLARA	SAN JOSE	2251 LANSFORD AVE	11/15/2004
SANTA CLARA	SAN JOSE	1425 STAHL ST	10/16/2005
SANTA CLARA	SAN JOSE	1560 DARLENE AVE	1/24/2006
SANTA CLARA	SAN JOSE	1919 FRUITDALE AVENUE	5/11/2006
SANTA CLARA	SAN JOSE	4075 HOBART AVENUE	4/27/2007
SANTA CLARA	SAN JOSE	2475 GLEN ANGUS WAY	2/21/2008
SANTA CLARA	SAN JOSE	843 SPINDRIFT WAY	3/18/2008
SANTA CLARA	SAN JOSE	1480 DOUGLAS STREET	3/20/2008
SANTA CLARA	SAN JOSE	71 AVENIDA ESPANA	5/29/2008
SANTA CLARA	SAN JOSE	973 IDLEWOOD DRIVE	8/31/2008
SANTA CLARA	SAN JOSE	800 SARATOGA AVENUE A308	6/10/2010
SANTA CLARA	SAN JOSE	5674 SAN FELIPE ROAD	8/26/2010
SANTA CLARA	SAN JOSE	315 N 21ST STREET	9/18/2015
SANTA CLARA	SANTA CLARA	1232 WARBURTON AVE	6/8/2004
SANTA CLARA	SANTA CLARA	2597 BORAX DRIVE	2/22/2008
SANTA CLARA	SANTA CLARA	2147 NEWHALL STREET	3/9/2011
SANTA CRUZ	CAPITOLA	1066 41ST AVENUE	9/12/2010
SANTA CRUZ	SANTA CRUZ	911 SOQUEL AVE	3/18/2005
SANTA CRUZ	SANTA CRUZ	231 FELIX STREET	5/2/2006
SANTA CRUZ	SANTA CRUZ	870 17TH AVENUE	9/29/2006
SANTA CRUZ	SANTA CRUZ	15769 COMSTOCK MILL ROAD	3/13/2008
SANTA CRUZ	SOQUEL	2600 41ST ST	8/12/2004
SANTA CRUZ	WATSONVILLE	216 SILVERLEAF DRIVE	10/17/2007
SHASTA	ANDERSON	6465 SADDLE TRAIL RD	7/29/2004
SHASTA	IGO	14463 WINDWALKER LN	3/27/2006
SHASTA	REDDING	1420 ARIZONA STREET	2/2/2004
SHASTA	REDDING	781 S STREET	3/21/2004
SHASTA	REDDING	12691 WILLIAMSON RD	3/30/2004
SHASTA	REDDING	80 CHURN CREEK RD	7/18/2005
SHASTA	REDDING	3115 STRATFORD AVENUE	9/19/2006
SHASTA	REDDING	1571 COLLEGE VIEW DRIVE	8/29/2007
SHASTA	REDDING	13922A SUNDUST ROAD	3/11/2010
SHASTA	SHINGLETOWN	7498 HILDA RD	4/13/2006
SISKIYOU	DORRIS	2100 SHEEPY ISLAND RD 437	3/3/2004
SISKIYOU	WEED	208 JACKSON ST	2/21/2004
SISKIYOU	WEED	208 JACKSON ST	3/16/2004
SISKIYOU	WEED	208 JACKSON ST	7/21/2005
SOLANO	DIXON	805 N ADAMS ST 110	3/23/2004
SOLANO	DIXON	9155 OLMO RD	3/3/2006
SOLANO	SUISUN CITY	515 CRESTED DR	3/9/2005
SOLANO	VACAVILLE	7234 SHELTON LN	9/29/2005
SOLANO	VACAVILLE	148 LOMITA AVENUE	3/5/2008
SOLANO	VALLEJO	1130 MONTEREY ST	2/12/2004
SOLANO	VALLEJO	1163 LEWIS AVE	3/30/2004
SOLANO	VALLEJO	618 MAIN ST	4/20/2004

National Clandestine Laboratory Register - California

COUNTY	CITY	ADDRESS	DATE
SOLANO	VALLEJO	136 HOGAN ST	5/14/2004
SOLANO	VALLEJO	318 TAPER AVENUE	1/31/2008
SOLANO	VALLEJO	264 FLYINGCLOUD COURT	4/30/2010
STANISLAUS	CERES	4837 FAITH HOME RD 119	1/1/2004
STANISLAUS	CERES	4022 ESMAIL KEYES	7/2/2004
STANISLAUS	CERES	2033 HACKETT RD	1/18/2005
STANISLAUS	CERES	527 MITCHELL RD	3/22/2006
STANISLAUS	CERES	3707 MONTE VISTA E AVE	3/24/2006
STANISLAUS	CERES	1743 CENTRAL	10/20/2006
STANISLAUS	CERES	112 TAYLOR ROAD	8/25/2008
STANISLAUS	CERES	1948 EVANS ROAD	11/16/2008
STANISLAUS	CERES	1528 EVANS ROAD	11/18/2008
STANISLAUS	CERES	3107 TAYLOR ROAD	5/19/2009
STANISLAUS	CERES	3107 EAST TAYLOR ROAD	5/19/2009
STANISLAUS	CERES	2329 6TH STREET	2/5/2010
STANISLAUS	DENAIR	5319 BERKELEY AVE	9/19/2004
STANISLAUS	DENAIR	4540 ARNOLD RD	2/2/2005
STANISLAUS	DENAIR	18000 KEYES ROAD	4/14/2009
STANISLAUS	GRAYSON	1705 HITO DR	4/7/2005
STANISLAUS	HICKMAN	948 HICKMAN RD	1/20/2004
STANISLAUS	HICKMAN	861 MEIER ROAD	6/19/2008
STANISLAUS	HUGHSON	1828 WHITE BIRTCH DRIVE	8/28/2011
STANISLAUS	MODESTO	3356 MAZE W BLVD	1/17/2004
STANISLAUS	MODESTO	1520 PROSPECT LN	1/24/2004
STANISLAUS	MODESTO	1312 MCHENRY 111	7/13/2004
STANISLAUS	MODESTO	2009 MONTICELLO AVE	7/13/2004
STANISLAUS	MODESTO	1516 BOLLINGER CT	9/1/2004
STANISLAUS	MODESTO	1240 N 9TH ST 10	9/5/2004
STANISLAUS	MODESTO	8100 YOSEMITE BLVD	10/3/2004
STANISLAUS	MODESTO	3708 ALMERIA DR	12/11/2004
STANISLAUS	MODESTO	400 ALGEN AVE	2/2/2005
STANISLAUS	MODESTO	1022 CALDER CT	3/26/2005
STANISLAUS	MODESTO	205 GLACIER AVE	1/18/2006
STANISLAUS	MODESTO	3500 PLAIN VIEW ROAD	3/7/2006
STANISLAUS	MODESTO	1411 SCENIC DRIVE	4/24/2006
STANISLAUS	MODESTO	110 WISENOR	5/18/2006
STANISLAUS	MODESTO	2008 STRACKER WAY	6/8/2006
STANISLAUS	MODESTO	620 PARADISE ROAD	9/13/2006
STANISLAUS	MODESTO	306 LOCUST STREET	9/14/2006
STANISLAUS	MODESTO	665 7TH STREET	12/4/2006
STANISLAUS	MODESTO	1331 PARADISE ROAD	6/3/2007
STANISLAUS	MODESTO	1016 EAST MARLOW	6/19/2008
STANISLAUS	MODESTO	1016 MARLOW	6/19/2008
STANISLAUS	MODESTO	1898 SKYLANE WAY	5/21/2009
STANISLAUS	MODESTO	1600 FRENCH	8/11/2011
STANISLAUS	MODESTO	1749 POLAND	2/9/2012
STANISLAUS	NEWMAN	531 LADY SLIPPER	1/15/2008
STANISLAUS	NEWMAN	1200 MAIN STREET	7/26/2010
STANISLAUS	OAKDALE	143 N 6TH ST	1/5/2004
STANISLAUS	OAKDALE	13537 ORANGE BLOSSOM RD	10/22/2004
STANISLAUS	OAKDALE	410 ARBOLES WAY	10/26/2004

National Clandestine Laboratory Register - California

COUNTY	CITY	ADDRESS	DATE
STANISLAUS	OAKDALE	755 RIVER AVE	11/29/2004
STANISLAUS	OAKDALE	445 N FIFTH	12/6/2004
STANISLAUS	OAKDALE	20601 WARNERVILLE ROAD	5/28/2009
STANISLAUS	OAKDALE	10742 PIONEER AVENUE	6/30/2009
STANISLAUS	PATTERSON	1830 ORANGE AVENUE	5/3/2009
STANISLAUS	RIVERBANK	3939 MINNIEAR AVE	1/31/2006
STANISLAUS	RIVERBANK	2924 STANISLAUS STREET	6/18/2009
STANISLAUS	RIVERBANK	3238 POCKET AVENUE	5/22/2010
STANISLAUS	STANISLAUS	13660 CARPENTER RD	2/7/2004
STANISLAUS	TURLOCK	6407 MITCHELL RD	4/12/2004
STANISLAUS	TURLOCK	1625 LARKSPUR ST	6/29/2004
STANISLAUS	TURLOCK	265 IRONWOOD	10/30/2004
STANISLAUS	TURLOCK	357 E OLIVE AVE	11/4/2004
STANISLAUS	TURLOCK	201 G STREET	6/26/2007
STANISLAUS	TURLOCK	1105 BEREA	9/15/2007
STANISLAUS	TURLOCK	1090 DENAIR AVENUE	1/6/2008
STANISLAUS	TURLOCK	1125 SOUTH TEGNER ROAD A	2/16/2008
STANISLAUS	TURLOCK	3800 CROWELL ROAD	4/18/2008
STANISLAUS	TURLOCK	590 MINARET AVENUE	8/5/2008
STANISLAUS	TURLOCK	677 NORTH SODERQUIST ROAD	12/15/2008
STANISLAUS	TURLOCK	4519 MOFFETT ROAD	4/22/2009
STANISLAUS	TURLOCK	6107 MOUNTAIN VIEW ROAD	5/19/2009
STANISLAUS	TURLOCK	460 MOFFET ROAD	5/29/2009
STANISLAUS	TURLOCK	1180 WEST LINWOOD AVENUE	2/9/2010
STANISLAUS	WATERFORD	575 E ST	3/5/2004
SUTTER	LIVE OAK	2691 STAFFORD DR	11/10/2004
SUTTER	LIVE OAK	9755 O ST	4/7/2005
SUTTER	SUTTER	2235 MADRONE ST	5/17/2004
SUTTER	YUBA CITY	2898 MCKENLY RD	1/11/2004
SUTTER	YUBA CITY	1400 LYTLE RD	2/17/2004
SUTTER	YUBA CITY	1718 ELMER RD	3/10/2004
SUTTER	YUBA CITY	1292 HARTER RD	5/11/2004
SUTTER	YUBA CITY	1619 FRANKLIN RD K	6/7/2004
SUTTER	YUBA CITY	1081 NORTHRIDGE DR	9/1/2004
SUTTER	YUBA CITY	400 WALTON N AVE 3	9/2/2004
SUTTER	YUBA CITY	761 CHESTNUT ST	10/18/2004
SUTTER	YUBA CITY	413 PINE ST	10/30/2004
SUTTER	YUBA CITY	1368 HUTCHINSON A	11/5/2004
SUTTER	YUBA CITY	24 CENTRAL AVE	12/11/2004
SUTTER	YUBA CITY	132 S WALTON AVE A	12/22/2004
SUTTER	YUBA CITY	1587 GRAY AVE	2/15/2005
SUTTER	YUBA CITY	1341 DUSTIN DR 39	9/1/2005
SUTTER	YUBA CITY	4098 MARLETTE RD	1/23/2006
SUTTER	YUBA CITY	1115 MARCIA AVENUE	2/18/2006
SUTTER	YUBA CITY	1250 KENNY DRIVE	5/19/2006
SUTTER	YUBA CITY	617 FORBES AVENUE	1/2/2007
TEHAMA	CORNING	6330 PIEDMONT RD	9/27/2004
TEHAMA	CORNING	323 RIO DEL REY COURT	7/31/2006
TEHAMA	LOS MOLINOS	24881 68TH	4/28/2010
TEHAMA	RED BLUFF	19932 SAWTOOTH DRIVE	8/1/2006
TRINITY	TRINITY CENTER	360 MAUDE AVENUE	3/11/2007

National Clandestine Laboratory Register - California

COUNTY	CITY	ADDRESS	DATE
TULARE	CUTLER	39500 ROAD 136	4/28/2006
TULARE	DINUBA	39780 ROAD 56	3/31/2004
TULARE	DINUBA	38929 ROAD 84	8/17/2006
TULARE	LINDSAY	1445 E HONOLULU	3/24/2004
TULARE	PORTERVILLE	27003 AVENUE 120	2/7/2004
TULARE	PORTERVILLE	1611 E SUCCESS DRIVE	1/7/2006
TULARE	PORTERVILLE	670 E POPLAR	1/7/2006
TULARE	TIPTON	14144 ROAD 152	8/9/2006
TULARE	TULARE	26442 99 HWY 210	5/26/2004
TULARE	VISALIA	3347 WEST HILLSDALE STREET G	11/3/2008
TULARE	WOODVILLE	16477 HUDSON AVE	1/29/2004
VENTURA	FILLMORE	2989 WEST W TELEGRAPH ROAD HIC	6/14/2006
VENTURA	N/A	5892 SANTA CLARA RD	2/22/2006
VENTURA	OXNARD	765 KOHALA STREET	11/9/2006
VENTURA	THOUSAND OAKS	982 EAST JANAS ROAD	3/20/2007
VENTURA	VENTURA	1300 SARATOGA STREET	5/4/2006
YOLO	WEST SACRAMENTO	1155 LINDEN RD	1/13/2004
YOLO	WEST SACRAMENTO	1900 EVERGREEN AVENUE	3/30/2007
YOLO	WOODLAND	1730 DONNER WAY	3/10/2004
YUBA	ARBOGA	13814 CHARLIES LN	5/27/2004
YUBA	LOMA RICA	5124 WOLF TRAIL	1/25/2006
YUBA	MARYSVILLE	1118 I ST	4/6/2004
YUBA	MARYSVILLE	1205 E 22ND ST	4/12/2004
YUBA	MARYSVILLE	222 H ST	4/14/2004
YUBA	MARYSVILLE	1804 HILE AVE C	5/12/2004
YUBA	MARYSVILLE	1505 RAMIREZ RD	5/20/2004
YUBA	MARYSVILLE	5956 PARK AVE O	7/18/2004
YUBA	MARYSVILLE	5818 PARK AVE	8/3/2004
YUBA	MARYSVILLE	5931 REDBURN AVE	8/8/2004
YUBA	MARYSVILLE	1735 N BEALE RD	9/10/2004
YUBA	MARYSVILLE	2209 BOULTON WAY	10/18/2004
YUBA	MARYSVILLE	976 KAY ST	10/25/2004
YUBA	MARYSVILLE	5395 FEATHER RIVER BLVD	12/21/2004
YUBA	MARYSVILLE	5528 ALICIA AVE	2/22/2005
YUBA	MARYSVILLE	5696 ARBOGA RD	3/9/2005
YUBA	MARYSVILLE	1100 E 17TH ST 36	5/18/2005
YUBA	MARYSVILLE	885 GRAND AVE	5/24/2005
YUBA	MARYSVILLE	209 E ST	12/13/2005
YUBA	MARYSVILLE	1097 VINE AVE	1/12/2006
YUBA	MARYSVILLE	647 RAMIREZ RD B	2/16/2006
YUBA	MARYSVILLE	714 BOYER ROAD	3/30/2006
YUBA	MARYSVILLE	5514 FEATHER RIVER BOULEVARD	7/13/2006
YUBA	MARYSVILLE	8369 HWY 70	10/3/2006
YUBA	MARYSVILLE	7340 DOC ADAMS ROAD	10/9/2006
YUBA	MARYSVILLE	1164 REDWOOD AVENUE	6/11/2007
YUBA	MARYSVILLE	4499 EAST ERLE ROAD	7/7/2007
YUBA	OLIVEHURST	3735 ARBOGA RD	9/27/2004
YUBA	OLIVEHURST	4456 COLLEGE	9/28/2004
YUBA	OLIVEHURST	1941 14TH ST	11/3/2004
YUBA	OLIVEHURST	4461 COLLEGE WAY	11/17/2004
YUBA	OLIVEHURST	1696 10TH AVE	1/27/2005

National Clandestine Laboratory Register - California

COUNTY	CITY	ADDRESS	DATE
YUBA	OLIVEHURST	1440 BROADWAY RD	1/17/2006
YUBA	OLIVEHURST	3948 SHIMER RD	1/31/2006
YUBA	OLIVEHURST	4605 SUMMERS LN	1/31/2006

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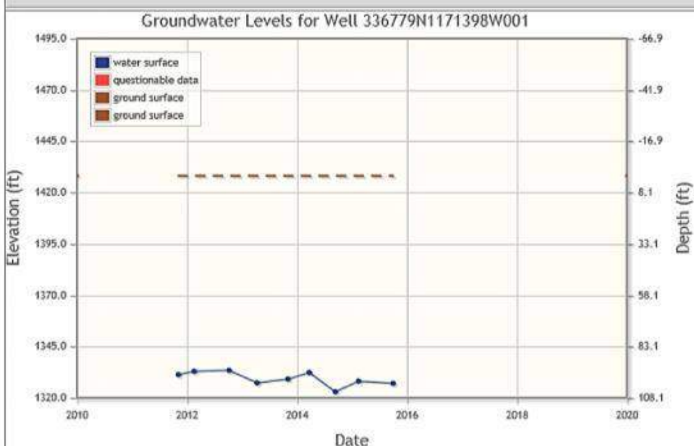
- Water Data Library Home
- Groundwater Level Data
- Water Quality Data
- Continuous Data
- Historical Information
- Contact Information

Groundwater Levels for Station 336779N1171398W001

Data for your selected well is shown in the tabbed interface below. To view data managed in the updated WDL tables, including data collected under the CASGEM program, click the "Recent Groundwater Level Data" tab. To view data stored in the former WDL tables, click the "Historical Groundwater Level Data" tab. To download the data in CSV format, click the "Download CSV File" button on the respective tab. Please note that the vertical datum for "recent" measurements is NAVD88, while the vertical datum for "historical" measurements is NGVD29. To change your well selection criteria, click the "Perform a New Well Search" button.

Station Data | **Recent Groundwater Level Data** | Historical Groundwater Level Data



Download CSV File

Date	RPE	GSE	RPWS	WSE	GS to...	Msmt Code	CASGEM Msmt	Agency	Comments
11/03/2011 00:00	1428.000	1428.143	96.7	1331.3	96.843		N	5035	
02/16/2012 00:00	1428.000	1428.143	95.1	1332.9	95.243		N	5035	
10/04/2012 00:00	1428.000	1428.143	94.6	1333.4	94.743		N	5035	
04/08/2013 00:00	1428.000	1428.140	100.7	1327.3	100.84		N	5035	
10/30/2013 00:00	1428.000	1428.140	98.9	1329.1	99.04		N	5035	
03/20/2014 00:00	1428.000	1428.140	95.7	1332.3	95.84		N	5035	
09/10/2014 00:00	1429.240	1428.140	106.3	1322.94	105.2		N	5035	
02/12/2015 00:00	1429.240	1428.140	101.1	1328.14	100		N	5035	
09/29/2015 00:00	1429.240	1428.140	102.2	1327.04	101.1		N	5035	

All elevation and depth measurements are in feet. The vertical datum for recent measurements is NAVD88.

Perform a New Well Search

8:03 AM 2/4/2016

File Edit View Favorites Tools Help

CDEC | CIMIS | WDL | IEP | IWRIS | All Data Topics...

- Water Data Library Home
- Groundwater Level Data
- Water Quality Data
- Continuous Data
- Historical Information
- Contact Information

Groundwater Levels for Station 336783N1171377W001

Data for your selected well is shown in the tabbed interface below. To view data managed in the updated WDL tables, including data collected under the CASGEM program, click the "Recent Groundwater Level Data" tab. To view data stored in the former WDL tables, click the "Historical Groundwater Level Data" tab. To download the data in CSV format, click the "Download CSV File" button on the respective tab. Please note that the vertical datum for "recent" measurements is NAVD88, while the vertical datum for "historical" measurements is NGVD29. To change your well selection criteria, click the "Perform a New Well Search" button.

Station Data | Recent Groundwater Level Data | Historical Groundwater Level Data

Download CSV File

Date	RPE	GSE	RPWS	WSE	GS to...	Msmt Code	CASGEM Msmt	Agency	Comments
11/03/2011 00:00	1431.000	1431.248	97.1	1333.9	97.348		N	5035	
02/16/2012 00:00	1431.000	1431.248	96.2	1334.8	96.448		N	5035	
11/01/2012 00:00	1431.000	1431.248				N-9	N	5035	
05/01/2013 00:00	1431.000	1431.250				N-9	N	5035	
11/01/2013 00:00	1431.000	1431.250				N-9	N	5035	
05/01/2014 00:00	1431.000	1431.250				N-0	N	5035	
10/24/2014 00:00	1431.000	1431.250				N-0	N	5035	
04/23/2015 00:00	1431.000	1431.250				N-0	N	5035	
11/01/2015 00:00	1431.000	1431.250				N-9	N	5035	

All elevation and depth measurements are in feet. The vertical datum for recent measurements is NAVD88.

8:01 AM 2/4/2016

APPENDIX C

PHOTOGRAPHS

PHOTOGRAPHS
29875 Newport Road
Menifee, Riverside County, California

1. View of above ground concrete tank for storage of fuel.

2. View of above ground concrete tank for storage of fuel.

GEOTEK

PHOTOGRAPHS
29875 Newport Road
Menifee, Riverside County, California

3. View of residential structure at Site.

4. View of inside of work shop.

GEOTEK

PHOTOGRAPHS
29875 Newport Road
Menifee, Riverside County, California

5. View of inside of work shop with drums.

6. View of block lined service pit in work shop.

GEOTEK

PHOTOGRAPHS
29875 Newport Road
Menifee, Riverside County, California

7. View of service pit in work shop area.

8. View of storage area in work shop area.

GEOTEK

PHOTOGRAPHS
29875 Newport Road
Menifee, Riverside County, California

9. View of waste water collection sump.

10. View of interior of milk building.

GEOTEK

PHOTOGRAPHS
29875 Newport Road
Menifee, Riverside County, California

11. **View of interior of milk building.**

12. **View of interior of milk building.**

GEOTEK

PHOTOGRAPHS
29875 Newport Road
Menifee, Riverside County, California

13. View of inside of milking area.

14. View of stained soils outside milk building.

GEOTEK

PHOTOGRAPHS
29875 Newport Road
Menifee, Riverside County, California

15. View of AST and filled in block lined water tank.

16. View of one residence on site.

GEOTEK

PHOTOGRAPHS
29875 Newport Road
Menifee, Riverside County, California

17. View of another residence on the Site.

18. View of Site.

GEOTEK

PHOTOGRAPHS
29875 Newport Road
Menifee, Riverside County, California

19. View of Site.

20. View of Site.

GEOTEK

PHOTOGRAPHS
29875 Newport Road
Menifee, Riverside County, California

21. View of transformers on Site.

22. View of milking building.

GEOTEK

PHOTOGRAPHS
29875 Newport Road
Menifee, Riverside County, California

23. View of leach field area in northwest corner of Site.

24. View of Site.

GEOTEK

PHOTOGRAPHS
29875 Newport Road
Menifee, Riverside County, California

25. View of Site.

26. View of Site.

GEOTEK

PHOTOGRAPHS
29875 Newport Road
Menifee, Riverside County, California

27. View of Site.

28. View of Site.

GEOTEK

PHOTOGRAPHS
29875 Newport Road
Menifee, Riverside County, California

29. View of pump on Site.

30. View of Site.

GEOTEK

PHOTOGRAPHS
29875 Newport Road
Menifee, Riverside County, California

31. View of one of the two wells on Site.

32. View of concrete structures on Site.

GEOTEK

PHOTOGRAPHS
29875 Newport Road
Menifee, Riverside County, California

33. View of Site.

34. View of one of two wells on Site.

GEOTEK

APPENDIX D

ENVIRONMENTAL DATABASE REPORT

Abacherli Dairy
29875 Newport Road
Menifee, CA 92584

Inquiry Number: 4490591.2s
December 11, 2015

The EDR Radius Map™ Report with GeoCheck®

EDR® Environmental Data Resources Inc

6 Armstrong Road, 4th floor
Shelton, CT 06484
Toll Free: 800.352.0050
www.edrnet.com

TABLE OF CONTENTS

GEOCHECK ADDENDUM

Thank you for your business.
Please contact EDR at 1-800-352-0050
with any questions or comments.

EXECUTIVE SUMMARY

A search of available environmental records was conducted by Environmental Data Resources, Inc (EDR). The report was designed to assist parties seeking to meet the search requirements of EPA's Standards and Practices for All Appropriate Inquiries (40 CFR Part 312), the ASTM Standard Practice for Environmental Site Assessments (E 1527-13) or custom requirements developed for the evaluation of environmental risk associated with a parcel of real estate.

TARGET PROPERTY INFORMATION

ADDRESS

29875 NEWPORT ROAD
MENIFEE, CA 92584

COORDINATES

Latitude (North):	33.6814000 - 33˚ 40' 53.04''
Longitude (West):	117.1388000 - 117˚ 8' 19.68''
Universal Tranverse Mercator:	Zone 11
UTM X (Meters):	487134.2
UTM Y (Meters):	3726646.5
Elevation:	1433 ft. above sea level

USGS TOPOGRAPHIC MAP ASSOCIATED WITH TARGET PROPERTY

Target Property Map:	5641314 ROMOLAND, CA
Version Date:	2012
East Map:	5640944 WINCHESTER, CA
Version Date:	2012

AERIAL PHOTOGRAPHY IN THIS REPORT

Portions of Photo from:	20120519
Source:	USDA

MAPPED SITES SUMMARY

Target Property Address:
29875 NEWPORT ROAD
MENIFEE, CA 92584

Click on Map ID to see full detail.

MAP ID	SITE NAME	ADDRESS	DATABASE ACRONYMS	RELATIVE ELEVATION	DIST (ft. & mi.) DIRECTION
A1	ABACHERLI DAIRY, RON	29875 NEWPORT RD	FINDS		TP
A2	ABACHERLI DAIRY, RON	29875 NEWPORT RD	EMI, WDS		TP
3	NEW ELEMENTARY SCHOO	LA VENTANA ROAD/NEWP	ENVIROSTOR, SCH	Higher	4794, 0.908, NNE

EXECUTIVE SUMMARY

TARGET PROPERTY SEARCH RESULTS

The target property was identified in the following records. For more information on this property see page 8 of the attached EDR Radius Map report:

Site	Database(s)	EPA ID
ABACHERLI DAIRY, RON 29875 NEWPORT RD MENIFEE, CA 92584	FINDS Registry ID:: 110041406207	N/A
ABACHERLI DAIRY, RON 29875 NEWPORT RD MENIFEE, CA 92584	EMI Facility Id: 143870 WDS Facility Status: A Facility Id: 8 335476001	N/A

DATABASES WITH NO MAPPED SITES

No mapped sites were found in EDR's search of available ("reasonably ascertainable ") government records either on the target property or within the search radius around the target property for the following databases:

STANDARD ENVIRONMENTAL RECORDS

Federal NPL site list

NPL........................... National Priority List
Proposed NPL.................. Proposed National Priority List Sites
NPL LIENS..................... Federal Superfund Liens

Federal Delisted NPL site list

Delisted NPL.................. National Priority List Deletions

Federal CERCLIS list

FEDERAL FACILITY.............. Federal Facility Site Information listing
CERCLIS....................... Comprehensive Environmental Response, Compensation, and Liability Information System

Federal CERCLIS NFRAP site List

CERCLIS-NFRAP................. CERCLIS No Further Remedial Action Planned

Federal RCRA CORRACTS facilities list

CORRACTS...................... Corrective Action Report

Federal RCRA non-CORRACTS TSD facilities list

RCRA-TSDF..................... RCRA - Treatment, Storage and Disposal

EXECUTIVE SUMMARY

Federal RCRA generators list

RCRA-LQG .... RCRA - Large Quantity Generators
RCRA-SQG .... RCRA - Small Quantity Generators
RCRA-CESQG .... RCRA - Conditionally Exempt Small Quantity Generator

Federal institutional controls / engineering controls registries

LUCIS .... Land Use Control Information System
US ENG CONTROLS .... Engineering Controls Sites List
US INST CONTROL .... Sites with Institutional Controls

Federal ERNS list

ERNS .... Emergency Response Notification System

State- and tribal - equivalent NPL

RESPONSE .... State Response Sites

State and tribal landfill and/or solid waste disposal site lists

SWF/LF .... Solid Waste Information System

State and tribal leaking storage tank lists

LUST .... Geotracker's Leaking Underground Fuel Tank Report
INDIAN LUST .... Leaking Underground Storage Tanks on Indian Land
SLIC .... Statewide SLIC Cases

State and tribal registered storage tank lists

FEMA UST .... Underground Storage Tank Listing
UST .... Active UST Facilities
AST .... Aboveground Petroleum Storage Tank Facilities
INDIAN UST .... Underground Storage Tanks on Indian Land

State and tribal voluntary cleanup sites

VCP .... Voluntary Cleanup Program Properties
INDIAN VCP .... Voluntary Cleanup Priority Listing

State and tribal Brownfields sites

BROWNFIELDS .... Considered Brownfieds Sites Listing

ADDITIONAL ENVIRONMENTAL RECORDS

Local Brownfield lists

US BROWNFIELDS .... A Listing of Brownfields Sites

Local Lists of Landfill / Solid Waste Disposal Sites

WMUDS/SWAT .... Waste Management Unit Database

EXECUTIVE SUMMARY

SWRCY - Recycler Database
HAULERS - Registered Waste Tire Haulers Listing
INDIAN ODI - Report on the Status of Open Dumps on Indian Lands
ODI - Open Dump Inventory
DEBRIS REGION 9 - Torres Martinez Reservation Illegal Dump Site Locations

Local Lists of Hazardous waste / Contaminated Sites

US HIST CDL - National Clandestine Laboratory Register
HIST Cal-Sites - Historical Calsites Database
SCH - School Property Evaluation Program
CDL - Clandestine Drug Labs
Toxic Pits - Toxic Pits Cleanup Act Sites
US CDL - Clandestine Drug Labs

Local Lists of Registered Storage Tanks

SWEEPS UST - SWEEPS UST Listing
HIST UST - Hazardous Substance Storage Container Database
CA FID UST - Facility Inventory Database

Local Land Records

LIENS - Environmental Liens Listing
LIENS 2 - CERCLA Lien Information
DEED - Deed Restriction Listing

Records of Emergency Release Reports

HMIRS - Hazardous Materials Information Reporting System
CHMIRS - California Hazardous Material Incident Report System
LDS - Land Disposal Sites Listing
MCS - Military Cleanup Sites Listing
SPILLS 90 - SPILLS 90 data from FirstSearch

Other Ascertainable Records

RCRA NonGen / NLR - RCRA - Non Generators / No Longer Regulated
FUDS - Formerly Used Defense Sites
DOD - Department of Defense Sites
SCRD DRYCLEANERS - State Coalition for Remediation of Drycleaners Listing
US FIN ASSUR - Financial Assurance Information
EPA WATCH LIST - EPA WATCH LIST
2020 COR ACTION - 2020 Corrective Action Program List
TSCA - Toxic Substances Control Act
TRIS - Toxic Chemical Release Inventory System
SSTS - Section 7 Tracking Systems
ROD - Records Of Decision
RMP - Risk Management Plans
RAATS - RCRA Administrative Action Tracking System
PRP - Potentially Responsible Parties
PADS - PCB Activity Database System
ICIS - Integrated Compliance Information System
FTTS - FIFRA/ TSCA Tracking System - FIFRA (Federal Insecticide, Fungicide, & Rodenticide Act)/TSCA (Toxic Substances Control Act)

EXECUTIVE SUMMARY

MLTS	Material Licensing Tracking System
COAL ASH DOE	Steam-Electric Plant Operation Data
COAL ASH EPA	Coal Combustion Residues Surface Impoundments List
PCB TRANSFORMER	PCB Transformer Registration Database
RADINFO	Radiation Information Database
HIST FTTS	FIFRA/TSCA Tracking System Administrative Case Listing
DOT OPS	Incident and Accident Data
CONSENT	Superfund (CERCLA) Consent Decrees
INDIAN RESERV	Indian Reservations
UMTRA	Uranium Mill Tailings Sites
LEAD SMELTERS	Lead Smelter Sites
US AIRS	Aerometric Information Retrieval System Facility Subsystem
US MINES	Mines Master Index File
CA BOND EXP. PLAN	Bond Expenditure Plan
Cortese	"Cortese" Hazardous Waste & Substances Sites List
CUPA Listings	CUPA Resources List
DRYCLEANERS	Cleaner Facilities
ENF	Enforcement Action Listing
Financial Assurance	Financial Assurance Information Listing
HAZNET	Facility and Manifest Data
HIST CORTESE	Hazardous Waste & Substance Site List
HWP	EnviroStor Permitted Facilities Listing
HWT	Registered Hazardous Waste Transporter Database
MINES	Mines Site Location Listing
MWMP	Medical Waste Management Program Listing
NPDES	NPDES Permits Listing
PEST LIC	Pesticide Regulation Licenses Listing
PROC	Certified Processors Database
Notify 65	Proposition 65 Records
UIC	UIC Listing
WASTEWATER PITS	Oil Wastewater Pits Listing
WIP	Well Investigation Program Case List

EDR HIGH RISK HISTORICAL RECORDS

EDR Exclusive Records

EDR MGP	EDR Proprietary Manufactured Gas Plants
EDR Hist Auto	EDR Exclusive Historic Gas Stations
EDR Hist Cleaner	EDR Exclusive Historic Dry Cleaners

EDR RECOVERED GOVERNMENT ARCHIVES

Exclusive Recovered Govt. Archives

RGA LF	Recovered Government Archive Solid Waste Facilities List
RGA LUST	Recovered Government Archive Leaking Underground Storage Tank

SURROUNDING SITES: SEARCH RESULTS

Surrounding sites were identified in the following databases.

EXECUTIVE SUMMARY

Elevations have been determined from the USGS Digital Elevation Model and should be evaluated on a relative (not an absolute) basis. Relative elevation information between sites of close proximity should be field verified. Sites with an elevation equal to or higher than the target property have been differentiated below from sites with an elevation lower than the target property.
Page numbers and map identification numbers refer to the EDR Radius Map report where detailed data on individual sites can be reviewed.

Sites listed in ***bold italics*** are in multiple databases.

Unmappable (orphan) sites are not considered in the foregoing analysis.

STANDARD ENVIRONMENTAL RECORDS

State- and tribal - equivalent CERCLIS

ENVIROSTOR: The Department of Toxic Substances Control's (DTSC's) Site Mitigation and Brownfields Reuse Program's (SMBRP's) EnviroStor database identifes sites that have known contamination or sites for which there may be reasons to investigate further. The database includes the following site types: Federal Superfund sites (National Priorities List (NPL)); State Response, including Military Facilities and State Superfund; Voluntary Cleanup; and School sites. EnviroStor provides similar information to the information that was available in CalSites, and provides additional site information, including, but not limited to, identification of formerly-contaminated properties that have been released for reuse, properties where environmental deed restrictions have been recorded to prevent inappropriate land uses, and risk characterization information that is used to assess potential impacts to public health and the environment at contaminated sites.

A review of the ENVIROSTOR list, as provided by EDR, and dated 08/03/2015 has revealed that there is 1 ENVIROSTOR site within approximately 1 mile of the target property.

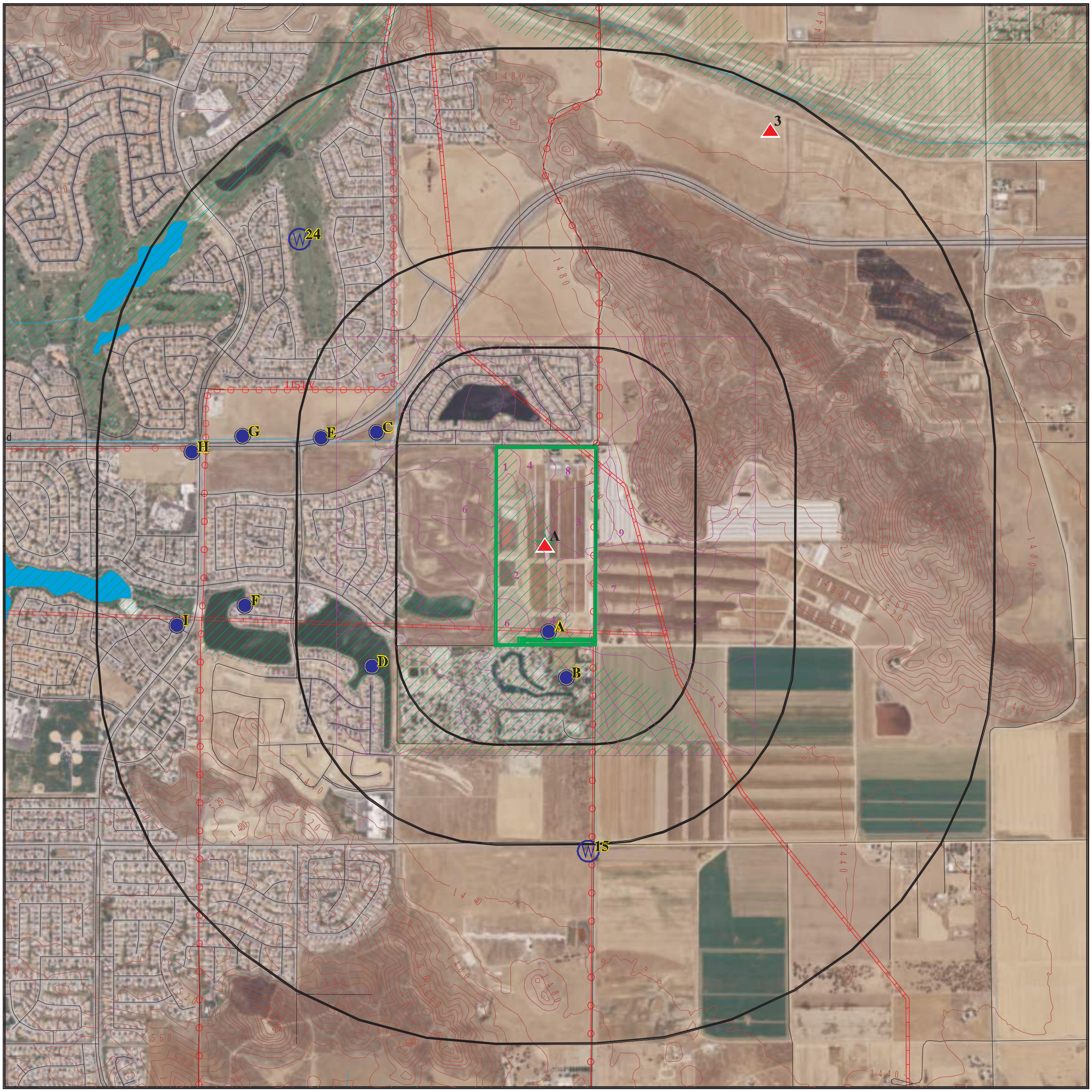
Equal/Higher Elevation	Address	Direction / Distance	Map ID	Page
NEW ELEMENTARY SCHOO Facility Id: 60000762 Status: No Further Action	***LA VENTANA ROAD/NEWP***	***NNE 1/2 - 1 (0.908 mi.)***	***3***	***11***

EXECUTIVE SUMMARY

Due to poor or inadequate address information, the following sites were not mapped. Count: 1 records.

Site Name	Database(s)
	CDL

OVERVIEW MAP - 4490591.2S



Target Property
Sites at elevations higher than or equal to the target property
Sites at elevations lower than the target property
Manufactured Gas Plants
National Priority List Sites
Dept. Defense Sites

0 | 1/4 | 1/2 | 1 Miles

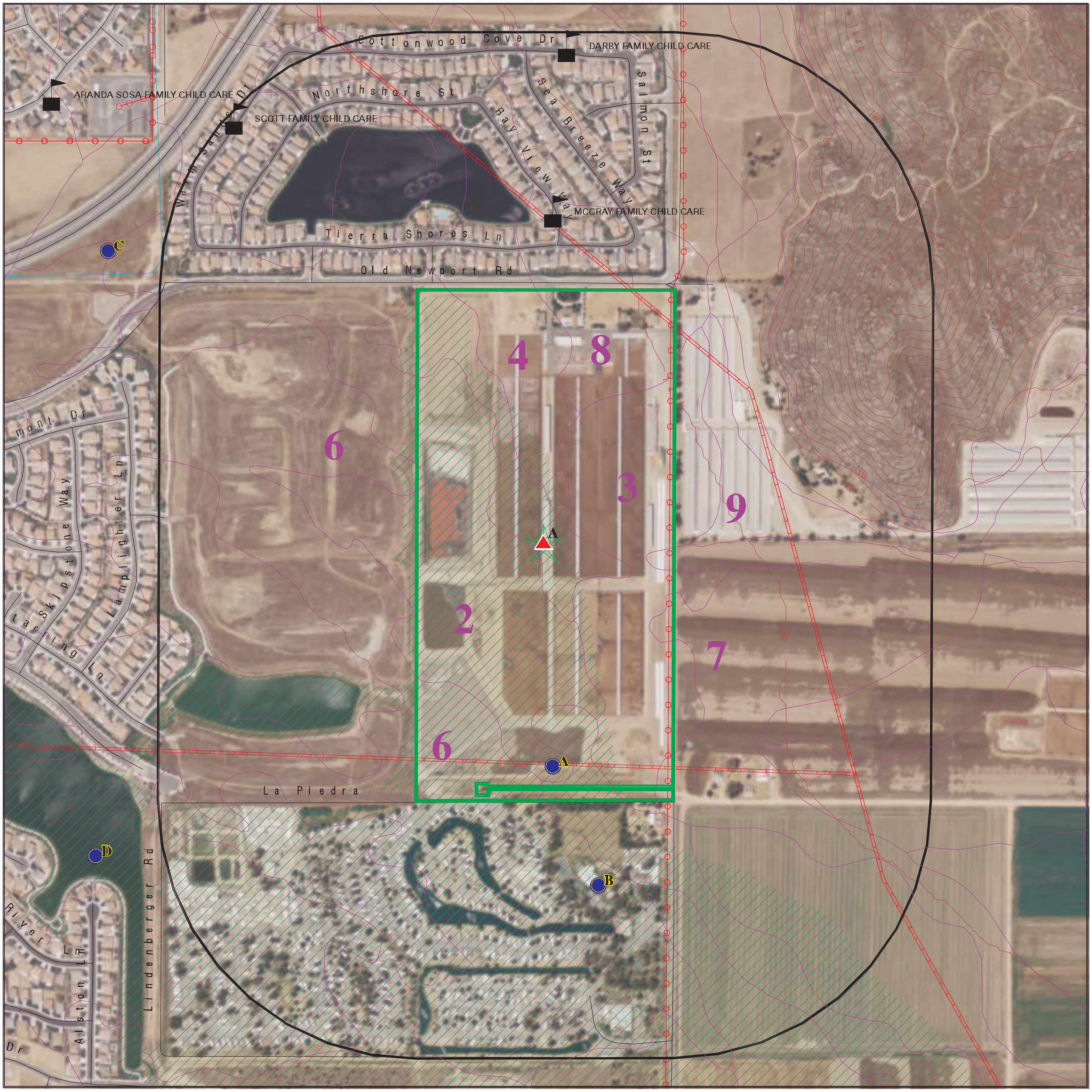
Indian Reservations BIA
Power transmission lines
Pipelines
100-year flood zone
500-year flood zone

Areas of Concern

This report includes Interactive Map Layers to display and/or hide map information. The legend includes only those icons for the default map view.

SITE NAME: Abacherli Dairy	CLIENT: Geotek Inc
ADDRESS: 29875 Newport Road	CONTACT: Anna M. Scott
Menifee CA 92584	INQUIRY #: 4490591.2s
LAT/LONG: 33.6814 / 117.1388	DATE: December 11, 2015 7:26 pm

DETAIL MAP - 4490591.2S



Target Property

Sites at elevations higher than or equal to the target property

Sites at elevations lower than the target property

Manufactured Gas Plants

Sensitive Receptors

National Priority List Sites

Dept. Defense Sites

0 1/8 1/4 1/2 Miles

Indian Reservations BIA

Power transmission lines

Pipelines

100-year flood zone

500-year flood zone

Areas of Concern

This report includes Interactive Map Layers to display and/or hide map information. The legend includes only those icons for the default map view.

SITE NAME: Abacherli Dairy ADDRESS: 29875 Newport Road Menifee CA 92584 LAT/LONG: 33.6814 / 117.1388	CLIENT: Geotek Inc CONTACT: Anna M. Scott INQUIRY #: 4490591.2s DATE: December 11, 2015 7:26 pm

MAP FINDINGS SUMMARY

Database	Search Distance (Miles)	Target Property	< 1/8	1/8 - 1/4	1/4 - 1/2	1/2 - 1	> 1	Total Plotted
STANDARD ENVIRONMENTAL RECORDS								
Federal NPL site list								
NPL	1.000		0	0	0	0	NR	0
Proposed NPL	1.000		0	0	0	0	NR	0
NPL LIENS	TP		NR	NR	NR	NR	NR	0
Federal Delisted NPL site list								
Delisted NPL	1.000		0	0	0	0	NR	0
Federal CERCLIS list								
FEDERAL FACILITY	0.500		0	0	0	NR	NR	0
CERCLIS	0.500		0	0	0	NR	NR	0
Federal CERCLIS NFRAP site List								
CERCLIS-NFRAP	0.500		0	0	0	NR	NR	0
Federal RCRA CORRACTS facilities list								
CORRACTS	1.000		0	0	0	0	NR	0
Federal RCRA non-CORRACTS TSD facilities list								
RCRA-TSDF	0.500		0	0	0	NR	NR	0
Federal RCRA generators list								
RCRA-LQG	0.250		0	0	NR	NR	NR	0
RCRA-SQG	0.250		0	0	NR	NR	NR	0
RCRA-CESQG	0.250		0	0	NR	NR	NR	0
Federal institutional controls / engineering controls registries								
LUCIS	0.500		0	0	0	NR	NR	0
US ENG CONTROLS	0.500		0	0	0	NR	NR	0
US INST CONTROL	0.500		0	0	0	NR	NR	0
Federal ERNS list								
ERNS	TP		NR	NR	NR	NR	NR	0
State- and tribal - equivalent NPL								
RESPONSE	1.000		0	0	0	0	NR	0
State- and tribal - equivalent CERCLIS								
ENVIROSTOR	1.000		0	0	0	1	NR	1
State and tribal landfill and/or solid waste disposal site lists								
SWF/LF	0.500		0	0	0	NR	NR	0
State and tribal leaking storage tank lists								
LUST	0.500		0	0	0	NR	NR	0

MAP FINDINGS SUMMARY

Database	Search Distance (Miles)	Target Property	< 1/8	1/8 - 1/4	1/4 - 1/2	1/2 - 1	> 1	Total Plotted
INDIAN LUST	0.500		0	0	0	NR	NR	0
SLIC	0.500		0	0	0	NR	NR	0
State and tribal registered storage tank lists								
FEMA UST	0.250		0	0	NR	NR	NR	0
UST	0.250		0	0	NR	NR	NR	0
AST	0.250		0	0	NR	NR	NR	0
INDIAN UST	0.250		0	0	NR	NR	NR	0
State and tribal voluntary cleanup sites								
VCP	0.500		0	0	0	NR	NR	0
INDIAN VCP	0.500		0	0	0	NR	NR	0
State and tribal Brownfields sites								
BROWNFIELDS	0.500		0	0	0	NR	NR	0
ADDITIONAL ENVIRONMENTAL RECORDS								
Local Brownfield lists								
US BROWNFIELDS	0.500		0	0	0	NR	NR	0
Local Lists of Landfill / Solid Waste Disposal Sites								
WMUDS/SWAT	0.500		0	0	0	NR	NR	0
SWRCY	0.500		0	0	0	NR	NR	0
HAULERS	TP		NR	NR	NR	NR	NR	0
INDIAN ODI	0.500		0	0	0	NR	NR	0
ODI	0.500		0	0	0	NR	NR	0
DEBRIS REGION 9	0.500		0	0	0	NR	NR	0
Local Lists of Hazardous waste / Contaminated Sites								
US HIST CDL	TP		NR	NR	NR	NR	NR	0
HIST Cal-Sites	1.000		0	0	0	0	NR	0
SCH	0.250		0	0	NR	NR	NR	0
CDL	TP		NR	NR	NR	NR	NR	0
Toxic Pits	1.000		0	0	0	0	NR	0
US CDL	TP		NR	NR	NR	NR	NR	0
Local Lists of Registered Storage Tanks								
SWEEPS UST	0.250		0	0	NR	NR	NR	0
HIST UST	0.250		0	0	NR	NR	NR	0
CA FID UST	0.250		0	0	NR	NR	NR	0
Local Land Records								
LIENS	TP		NR	NR	NR	NR	NR	0
LIENS 2	TP		NR	NR	NR	NR	NR	0
DEED	0.500		0	0	0	NR	NR	0
Records of Emergency Release Reports								
HMIRS	TP		NR	NR	NR	NR	NR	0

MAP FINDINGS SUMMARY

Database	Search Distance (Miles)	Target Property	< 1/8	1/8 - 1/4	1/4 - 1/2	1/2 - 1	> 1	Total Plotted
CHMIRS	TP		NR	NR	NR	NR	NR	0
LDS	TP		NR	NR	NR	NR	NR	0
MCS	TP		NR	NR	NR	NR	NR	0
SPILLS 90	TP		NR	NR	NR	NR	NR	0
Other Ascertainable Records								
RCRA NonGen / NLR	0.250		0	0	NR	NR	NR	0
FUDS	1.000		0	0	0	0	NR	0
DOD	1.000		0	0	0	0	NR	0
SCRD DRYCLEANERS	0.500		0	0	0	NR	NR	0
US FIN ASSUR	TP		NR	NR	NR	NR	NR	0
EPA WATCH LIST	TP		NR	NR	NR	NR	NR	0
2020 COR ACTION	0.250		0	0	NR	NR	NR	0
TSCA	TP		NR	NR	NR	NR	NR	0
TRIS	TP		NR	NR	NR	NR	NR	0
SSTS	TP		NR	NR	NR	NR	NR	0
ROD	1.000		0	0	0	0	NR	0
RMP	TP		NR	NR	NR	NR	NR	0
RAATS	TP		NR	NR	NR	NR	NR	0
PRP	TP		NR	NR	NR	NR	NR	0
PADS	TP		NR	NR	NR	NR	NR	0
ICIS	TP		NR	NR	NR	NR	NR	0
FTTS	TP		NR	NR	NR	NR	NR	0
MLTS	TP		NR	NR	NR	NR	NR	0
COAL ASH DOE	TP		NR	NR	NR	NR	NR	0
COAL ASH EPA	0.500		0	0	0	NR	NR	0
PCB TRANSFORMER	TP		NR	NR	NR	NR	NR	0
RADINFO	TP		NR	NR	NR	NR	NR	0
HIST FTTS	TP		NR	NR	NR	NR	NR	0
DOT OPS	TP		NR	NR	NR	NR	NR	0
CONSENT	1.000		0	0	0	0	NR	0
INDIAN RESERV	1.000		0	0	0	0	NR	0
UMTRA	0.500		0	0	0	NR	NR	0
LEAD SMELTERS	TP		NR	NR	NR	NR	NR	0
US AIRS	TP		NR	NR	NR	NR	NR	0
US MINES	0.250		0	0	NR	NR	NR	0
FINDS	TP	1	NR	NR	NR	NR	NR	1
CA BOND EXP. PLAN	1.000		0	0	0	0	NR	0
Cortese	0.500		0	0	0	NR	NR	0
CUPA Listings	0.250		0	0	NR	NR	NR	0
DRYCLEANERS	0.250		0	0	NR	NR	NR	0
EMI	TP	1	NR	NR	NR	NR	NR	1
ENF	TP		NR	NR	NR	NR	NR	0
Financial Assurance	TP		NR	NR	NR	NR	NR	0
HAZNET	TP		NR	NR	NR	NR	NR	0
HIST CORTESE	0.500		0	0	0	NR	NR	0
HWP	1.000		0	0	0	0	NR	0
HWT	0.250		0	0	NR	NR	NR	0
MINES	TP		NR	NR	NR	NR	NR	0
MWMP	0.250		0	0	NR	NR	NR	0
NPDES	TP		NR	NR	NR	NR	NR	0

MAP FINDINGS SUMMARY

Database	Search Distance (Miles)	Target Property	< 1/8	1/8 - 1/4	1/4 - 1/2	1/2 - 1	> 1	Total Plotted
PEST LIC	TP		NR	NR	NR	NR	NR	0
PROC	0.500		0	0	0	NR	NR	0
Notify 65	1.000		0	0	0	0	NR	0
UIC	TP		NR	NR	NR	NR	NR	0
WASTEWATER PITS	0.500		0	0	0	NR	NR	0
WDS	TP	1	NR	NR	NR	NR	NR	1
WIP	0.250		0	0	NR	NR	NR	0
EDR HIGH RISK HISTORICAL RECORDS								
EDR Exclusive Records								
EDR MGP	1.000		0	0	0	0	NR	0
EDR Hist Auto	0.125		0	NR	NR	NR	NR	0
EDR Hist Cleaner	0.125		0	NR	NR	NR	NR	0
EDR RECOVERED GOVERNMENT ARCHIVES								
Exclusive Recovered Govt. Archives								
RGA LF	TP		NR	NR	NR	NR	NR	0
RGA LUST	TP		NR	NR	NR	NR	NR	0
- Totals --		3	0	0	0	1	0	4

NOTES:

TP = Target Property

NR = Not Requested at this Search Distance

Sites may be listed in more than one database

A1 Target Property	**ABACHERLI DAIRY, RONALD ABACHERLI** **29875 NEWPORT RD** **MENIFEE, CA 92584**	**FINDS**	**1014678367** **N/A**

Site 1 of 2 in cluster A

Actual:
1433 ft.

FINDS:

Registry ID: 110041406207

Environmental Interest/Information System
AIR EMISSIONS CLASSIFICATION UNKNOWN

A2 Target Property	**ABACHERLI DAIRY, RONALD ABACHERLI** **29875 NEWPORT RD** **MENIFEE, CA 92584**	**EMI** **WDS**	**S102005466** **N/A**

Site 2 of 2 in cluster A

Actual:
1433 ft.

EMI:

Year:	2006
County Code:	33
Air Basin:	SC
Facility ID:	143870
Air District Name:	SC
SIC Code:	241
Air District Name:	SOUTH COAST AQMD
Community Health Air Pollution Info System:	Not reported
Consolidated Emission Reporting Rule:	Not reported
Total Organic Hydrocarbon Gases Tons/Yr:	14.63784712281706269
Reactive Organic Gases Tons/Yr:	10.226
Carbon Monoxide Emissions Tons/Yr:	.001
NOX - Oxides of Nitrogen Tons/Yr:	.002
SOX - Oxides of Sulphur Tons/Yr:	0
Particulate Matter Tons/Yr:	4.361
Part. Matter 10 Micrometers & Smllr Tons/Yr:	2.1338373

Year:	2007
County Code:	33
Air Basin:	SC
Facility ID:	143870
Air District Name:	SC
SIC Code:	241
Air District Name:	SOUTH COAST AQMD
Community Health Air Pollution Info System:	Not reported
Consolidated Emission Reporting Rule:	Not reported
Total Organic Hydrocarbon Gases Tons/Yr:	14.63784712281706269
Reactive Organic Gases Tons/Yr:	10.226
Carbon Monoxide Emissions Tons/Yr:	.001
NOX - Oxides of Nitrogen Tons/Yr:	.002
SOX - Oxides of Sulphur Tons/Yr:	0
Particulate Matter Tons/Yr:	4.361
Part. Matter 10 Micrometers & Smllr Tons/Yr:	2.1338373

Year:	2008
County Code:	33
Air Basin:	SC
Facility ID:	143870
Air District Name:	SC

ABACHERLI DAIRY, RONALD ABACHERLI (Continued) **S102005466**

SIC Code:	241
Air District Name:	SOUTH COAST AQMD
Community Health Air Pollution Info System:	Not reported
Consolidated Emission Reporting Rule:	Not reported
Total Organic Hydrocarbon Gases Tons/Yr:	14.61505622139120221
Reactive Organic Gases Tons/Yr:	10.21009375
Carbon Monoxide Emissions Tons/Yr:	.000255
NOX - Oxides of Nitrogen Tons/Yr:	.0011725
SOX - Oxides of Sulphur Tons/Yr:	.00001775
Particulate Matter Tons/Yr:	4.34008375
Part. Matter 10 Micrometers & Smllr Tons/Yr:	2.12364575

Year:	2009
County Code:	33
Air Basin:	SC
Facility ID:	143870
Air District Name:	SC
SIC Code:	241
Air District Name:	SOUTH COAST AQMD
Community Health Air Pollution Info System:	Not reported
Consolidated Emission Reporting Rule:	Not reported
Total Organic Hydrocarbon Gases Tons/Yr:	14.6150562811497
Reactive Organic Gases Tons/Yr:	10.210093799999999
Carbon Monoxide Emissions Tons/Yr:	2.5500000000000002E-4
NOX - Oxides of Nitrogen Tons/Yr:	0.00117
SOX - Oxides of Sulphur Tons/Yr:	1.7799999999999999E-5
Particulate Matter Tons/Yr:	4.3400838000000004
Part. Matter 10 Micrometers & Smllr Tons/Yr:	2.1236437887999999

Year:	2010
County Code:	33
Air Basin:	SC
Facility ID:	143870
Air District Name:	SC
SIC Code:	241
Air District Name:	SOUTH COAST AQMD
Community Health Air Pollution Info System:	Not reported
Consolidated Emission Reporting Rule:	Not reported
Total Organic Hydrocarbon Gases Tons/Yr:	15.430183940077001
Reactive Organic Gases Tons/Yr:	10.779680000000001
Carbon Monoxide Emissions Tons/Yr:	2.5500000000000002E-3
NOX - Oxides of Nitrogen Tons/Yr:	0.01172
SOX - Oxides of Sulphur Tons/Yr:	1.7000000000000001E-4
Particulate Matter Tons/Yr:	4.6288299999999998
Part. Matter 10 Micrometers & Smllr Tons/Yr:	2.26529048

Year:	2011
County Code:	33
Air Basin:	SC
Facility ID:	143870
Air District Name:	SC
SIC Code:	241
Air District Name:	SOUTH COAST AQMD
Community Health Air Pollution Info System:	Not reported
Consolidated Emission Reporting Rule:	Not reported
Total Organic Hydrocarbon Gases Tons/Yr:	15.042692736
Reactive Organic Gases Tons/Yr:	10.50884

ABACHERLI DAIRY, RONALD ABACHERLI (Continued) **S102005466**

Carbon Monoxide Emissions Tons/Yr:	0.00025
NOX - Oxides of Nitrogen Tons/Yr:	0.00117
SOX - Oxides of Sulphur Tons/Yr:	1e-005
Particulate Matter Tons/Yr:	4.45008
Part. Matter 10 Micrometers & Smllr Tons/Yr:	2.17746308

Year:	2012
County Code:	33
Air Basin:	SC
Facility ID:	143870
Air District Name:	SC
SIC Code:	241
Air District Name:	SOUTH COAST AQMD
Community Health Air Pollution Info System:	Not reported
Consolidated Emission Reporting Rule:	Not reported
Total Organic Hydrocarbon Gases Tons/Yr:	15.042800301
Reactive Organic Gases Tons/Yr:	10.50893
Carbon Monoxide Emissions Tons/Yr:	0.00051
NOX - Oxides of Nitrogen Tons/Yr:	0.00234
SOX - Oxides of Sulphur Tons/Yr:	1.05e-006
Particulate Matter Tons/Yr:	4.45016
Part. Matter 10 Micrometers & Smllr Tons/Yr:	2.17754116

Year:	2013
County Code:	33
Air Basin:	SC
Facility ID:	143870
Air District Name:	SC
SIC Code:	241
Air District Name:	SOUTH COAST AQMD
Community Health Air Pollution Info System:	Not reported
Consolidated Emission Reporting Rule:	Not reported
Total Organic Hydrocarbon Gases Tons/Yr:	14.671093255
Reactive Organic Gases Tons/Yr:	10.50893
Carbon Monoxide Emissions Tons/Yr:	0.00051
NOX - Oxides of Nitrogen Tons/Yr:	0.00234
SOX - Oxides of Sulphur Tons/Yr:	1.05e-006
Particulate Matter Tons/Yr:	4.45016
Part. Matter 10 Micrometers & Smllr Tons/Yr:	2.17754116

WDS:

Facility ID:	Santa Ana River 335476001
Facility Type:	Agricultural - Facility that treats and/or disposes of the wastes associated with confined and concentrated animal feeding, confined animal feeding, confined animal holding, confined and concentrated aquatic animal production facilities, and aquaculture. the treatment and/or disposal of agricultural return water is included in this category.
Facility Status:	Active - Any facility with a continuous or seasonal discharge that is under Waste Discharge Requirements.
NPDES Number:	CAG018001 The 1st 2 characters designate the state. The remaining 7 are assigned by the Regional Board
Subregion:	8
Facility Telephone:	Not reported
Facility Contact:	Not reported
Agency Name:	ABACHERLI FRANK
Agency Address:	29875 NEWPORT RD

ABACHERLI DAIRY, RONALD ABACHERLI (Continued) **S102005466**

Agency City,St,Zip:	MENIFEE 92584
Agency Contact:	Not reported
Agency Telephone:	Not reported
Agency Type:	Private
SIC Code:	241
SIC Code 2:	Not reported
Primary Waste Type:	Nonhazardous Solid Wastes/Influent or Solid Wastes that contain nonhazardous putrescible and non putrescible solid, semisolid, and liquid wastes (E.G., garbage, trash, refuse, paper, demolition and construction wastes, manure, vegetable or animal solid and semisolid waste).
Primary Waste:	STORMS
Waste Type2:	N
Waste2:	Stormwater Runoff
Primary Waste Type:	Nonhazardous Solid Wastes/Influent or Solid Wastes that contain nonhazardous putrescible and non putrescible solid, semisolid, and liquid wastes (E.G., garbage, trash, refuse, paper, demolition and construction wastes, manure, vegetable or animal solid and semisolid waste).
Secondary Waste:	Solid Wastes
Secondary Waste Type:	Nonhazardous Solid Wastes/Influent or Solid Wastes that contain nonhazardous putrescible and non putrescible solid, semisolid, and liquid wastes (E.G., garbage, trash, refuse, paper, demolition and construction wastes, manure, vegetable or animal solid and semisolid waste).
Design Flow:	0
Baseline Flow:	0
Reclamation:	No reclamation requirements associated with this facility.
POTW:	The facility is not a POTW.
Treat To Water:	Moderate Threat to Water Quality. A violation could have a major adverse impact on receiving biota, can cause aesthetic impairment to a significant human population, or render unusable a potential domestic or municipal water supply. Awsthetic impairment would include nuisance from a waste treatment facility.
Complexity:	Category C - Facilities having no waste treatment systems, such as cooling water dischargers or thosewho must comply through best management practices, facilities with passive waste treatment and disposal systems, such as septic systems with subsurface disposal, or dischargers having waste storage systems with land disposal such as dairy waste ponds.

3
NNE
1/2-1
0.908 mi.
4794 ft.

NEW ELEMENTARY SCHOOL NO. 6
LA VENTANA ROAD/NEWPORT ROAD
WINCHESTER (UNINCORPORATED), CA 92544

ENVIROSTOR **S108936086**
SCH **N/A**

Relative:
Higher

Actual:
1449 ft.

ENVIROSTOR:

Facility ID:	60000762
Status:	No Further Action
Status Date:	09/03/2008
Site Code:	404761
Site Type:	School Investigation
Site Type Detailed:	School
Acres:	12
NPL:	NO
Regulatory Agencies:	SMBRP
Lead Agency:	SMBRP

NEW ELEMENTARY SCHOOL NO. 6 (Continued) **S108936086**

Program Manager:	Not reported
Supervisor:	Shahir Haddad
Division Branch:	Southern California Schools & Brownfields Outreach
Assembly:	67
Senate:	28
Special Program:	Not reported
Restricted Use:	NO
Site Mgmt Req:	NONE SPECIFIED
Funding:	School District
Latitude:	33.6965
Longitude:	-117.129
APN:	NONE SPECIFIED
Past Use:	UNKNOWN
Potential COC:	Under Investigation
Confirmed COC:	NONE SPECIFIED
Potential Description:	SOIL
Alias Name:	404761
Alias Type:	Project Code (Site Code)
Alias Name:	60000762
Alias Type:	Envirostor ID Number

Completed Info:

Completed Area Name:	PROJECT WIDE
Completed Sub Area Name:	Not reported
Completed Document Type:	Environmental Oversight Agreement
Completed Date:	12/03/2007
Comments:	Sent fully executed agreement to district

Completed Area Name:	PROJECT WIDE
Completed Sub Area Name:	Not reported
Completed Document Type:	Other Report
Completed Date:	04/03/2008
Comments:	DTSC concurred with the proposed sampling.

Completed Area Name:	PROJECT WIDE
Completed Sub Area Name:	Not reported
Completed Document Type:	Preliminary Endangerment Assessment Report
Completed Date:	09/03/2008
Comments:	Not reported

Completed Area Name:	PROJECT WIDE
Completed Sub Area Name:	Not reported
Completed Document Type:	Cost Recovery Closeout Memo
Completed Date:	09/11/2008
Comments:	DTSC prepared project close out Cost Recovery Unit Memorandum

Future Area Name:	Not reported
Future Sub Area Name:	Not reported
Future Document Type:	Not reported
Future Due Date:	Not reported
Schedule Area Name:	Not reported
Schedule Sub Area Name:	Not reported
Schedule Document Type:	Not reported
Schedule Due Date:	Not reported
Schedule Revised Date:	Not reported

SCH:

NEW ELEMENTARY SCHOOL NO. 6 (Continued) **S108936086**

Facility ID:	60000762
Site Type:	School Investigation
Site Type Detail:	School
Site Mgmt. Req.:	NONE SPECIFIED
Acres:	12
National Priorities List:	NO
Cleanup Oversight Agencies:	SMBRP
Lead Agency:	SMBRP
Lead Agency Description:	DTSC - Site Cleanup Program
Project Manager:	Not reported
Supervisor:	Shahir Haddad
Division Branch:	Southern California Schools & Brownfields Outreach
Site Code:	404761
Assembly:	67
Senate:	28
Special Program Status:	Not reported
Status:	No Further Action
Status Date:	09/03/2008
Restricted Use:	NO
Funding:	School District
Latitude:	33.6965
Longitude:	-117.129
APN:	NONE SPECIFIED
Past Use:	UNKNOWN
Potential COC:	Under Investigation
Confirmed COC:	NONE SPECIFIED
Potential Description:	SOIL
Alias Name:	404761
Alias Type:	Project Code (Site Code)
Alias Name:	60000762
Alias Type:	Envirostor ID Number

Completed Info:

Completed Area Name:	PROJECT WIDE
Completed Sub Area Name:	Not reported
Completed Document Type:	Environmental Oversight Agreement
Completed Date:	12/03/2007
Comments:	Sent fully executed agreement to district
Completed Area Name:	PROJECT WIDE
Completed Sub Area Name:	Not reported
Completed Document Type:	Other Report
Completed Date:	04/03/2008
Comments:	DTSC concurred with the proposed sampling.
Completed Area Name:	PROJECT WIDE
Completed Sub Area Name:	Not reported
Completed Document Type:	Preliminary Endangerment Assessment Report
Completed Date:	09/03/2008
Comments:	Not reported
Completed Area Name:	PROJECT WIDE
Completed Sub Area Name:	Not reported
Completed Document Type:	Cost Recovery Closeout Memo
Completed Date:	09/11/2008
Comments:	DTSC prepared project close out Cost Recovery Unit Memorandum
Future Area Name:	Not reported

NEW ELEMENTARY SCHOOL NO. 6 (Continued) **S108936086**

Future Sub Area Name:	Not reported
Future Document Type:	Not reported
Future Due Date:	Not reported
Schedule Area Name:	Not reported
Schedule Sub Area Name:	Not reported
Schedule Document Type:	Not reported
Schedule Due Date:	Not reported
Schedule Revised Date:	Not reported

Count: 1 records.

ORPHAN SUMMARY

City	EDR ID	Site Name	Site Address	Zip	Database(s)
RIVERSIDE COUNTY	S107537916		BRIGGS ROAD/300' FROM POWERLIN		CDL

GOVERNMENT RECORDS SEARCHED / DATA CURRENCY TRACKING

To maintain currency of the following federal and state databases, EDR contacts the appropriate governmental agency on a monthly or quarterly basis, as required.

Number of Days to Update: Provides confirmation that EDR is reporting records that have been updated within 90 days from the date the government agency made the information available to the public.

STANDARD ENVIRONMENTAL RECORDS

Federal NPL site list

NPL: National Priority List

National Priorities List (Superfund). The NPL is a subset of CERCLIS and identifies over 1,200 sites for priority cleanup under the Superfund Program. NPL sites may encompass relatively large areas. As such, EDR provides polygon coverage for over 1,000 NPL site boundaries produced by EPA's Environmental Photographic Interpretation Center (EPIC) and regional EPA offices.

Date of Government Version: 03/26/2015
Date Data Arrived at EDR: 04/08/2015
Date Made Active in Reports: 06/22/2015
Number of Days to Update: 75

Source: EPA
Telephone: N/A
Last EDR Contact: 11/07/2015
Next Scheduled EDR Contact: 01/18/2016
Data Release Frequency: Quarterly

NPL Site Boundaries

Sources:

EPA's Environmental Photographic Interpretation Center (EPIC)
Telephone: 202-564-7333

EPA Region 1
Telephone 617-918-1143

EPA Region 3
Telephone 215-814-5418

EPA Region 4
Telephone 404-562-8033

EPA Region 5
Telephone 312-886-6686

EPA Region 10
Telephone 206-553-8665

EPA Region 6
Telephone: 214-655-6659

EPA Region 7
Telephone: 913-551-7247

EPA Region 8
Telephone: 303-312-6774

EPA Region 9
Telephone: 415-947-4246

Proposed NPL: Proposed National Priority List Sites

A site that has been proposed for listing on the National Priorities List through the issuance of a proposed rule in the Federal Register. EPA then accepts public comments on the site, responds to the comments, and places on the NPL those sites that continue to meet the requirements for listing.

Date of Government Version: 03/26/2015
Date Data Arrived at EDR: 04/08/2015
Date Made Active in Reports: 06/22/2015
Number of Days to Update: 75

Source: EPA
Telephone: N/A
Last EDR Contact: 11/07/2015
Next Scheduled EDR Contact: 01/18/2016
Data Release Frequency: Quarterly

NPL LIENS: Federal Superfund Liens

Federal Superfund Liens. Under the authority granted the USEPA by CERCLA of 1980, the USEPA has the authority to file liens against real property in order to recover remedial action expenditures or when the property owner received notification of potential liability. USEPA compiles a listing of filed notices of Superfund Liens.

Date of Government Version: 10/15/1991
Date Data Arrived at EDR: 02/02/1994
Date Made Active in Reports: 03/30/1994
Number of Days to Update: 56

Source: EPA
Telephone: 202-564-4267
Last EDR Contact: 08/15/2011
Next Scheduled EDR Contact: 11/28/2011
Data Release Frequency: No Update Planned

Federal Delisted NPL site list

Delisted NPL: National Priority List Deletions

The National Oil and Hazardous Substances Pollution Contingency Plan (NCP) establishes the criteria that the EPA uses to delete sites from the NPL. In accordance with 40 CFR 300.425.(e), sites may be deleted from the NPL where no further response is appropriate.

Date of Government Version: 03/26/2015
Date Data Arrived at EDR: 04/08/2015
Date Made Active in Reports: 06/22/2015
Number of Days to Update: 75

Source: EPA
Telephone: N/A
Last EDR Contact: 11/07/2015
Next Scheduled EDR Contact: 01/18/2016
Data Release Frequency: Quarterly

Federal CERCLIS list

FEDERAL FACILITY: Federal Facility Site Information listing

A listing of National Priority List (NPL) and Base Realignment and Closure (BRAC) sites found in the Comprehensive Environmental Response, Compensation and Liability Information System (CERCLIS) Database where EPA Federal Facilities Restoration and Reuse Office is involved in cleanup activities.

Date of Government Version: 03/26/2015
Date Data Arrived at EDR: 04/08/2015
Date Made Active in Reports: 06/11/2015
Number of Days to Update: 64

Source: Environmental Protection Agency
Telephone: 703-603-8704
Last EDR Contact: 10/09/2015
Next Scheduled EDR Contact: 01/18/2016
Data Release Frequency: Varies

CERCLIS: Comprehensive Environmental Response, Compensation, and Liability Information System

CERCLIS contains data on potentially hazardous waste sites that have been reported to the USEPA by states, municipalities, private companies and private persons, pursuant to Section 103 of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). CERCLIS contains sites which are either proposed to or on the National Priorities List (NPL) and sites which are in the screening and assessment phase for possible inclusion on the NPL.

Date of Government Version: 10/25/2013
Date Data Arrived at EDR: 11/11/2013
Date Made Active in Reports: 02/13/2014
Number of Days to Update: 94

Source: EPA
Telephone: 703-412-9810
Last EDR Contact: 11/23/2015
Next Scheduled EDR Contact: 03/07/2016
Data Release Frequency: Quarterly

Federal CERCLIS NFRAP site List

CERCLIS-NFRAP: CERCLIS No Further Remedial Action Planned

Archived sites are sites that have been removed and archived from the inventory of CERCLIS sites. Archived status indicates that, to the best of EPA's knowledge, assessment at a site has been completed and that EPA has determined no further steps will be taken to list this site on the National Priorities List (NPL), unless information indicates this decision was not appropriate or other considerations require a recommendation for listing at a later time. This decision does not necessarily mean that there is no hazard associated with a given site; it only means that, based upon available information, the location is not judged to be a potential NPL site.

Date of Government Version: 10/25/2013
Date Data Arrived at EDR: 11/11/2013
Date Made Active in Reports: 02/13/2014
Number of Days to Update: 94

Source: EPA
Telephone: 703-412-9810
Last EDR Contact: 11/23/2015
Next Scheduled EDR Contact: 03/07/2016
Data Release Frequency: Quarterly

Federal RCRA CORRACTS facilities list

CORRACTS: Corrective Action Report

CORRACTS identifies hazardous waste handlers with RCRA corrective action activity.

Date of Government Version: 06/09/2015	Source: EPA
Date Data Arrived at EDR: 06/26/2015	Telephone: 800-424-9346
Date Made Active in Reports: 09/16/2015	Last EDR Contact: 09/29/2015
Number of Days to Update: 82	Next Scheduled EDR Contact: 01/11/2016
	Data Release Frequency: Quarterly

Federal RCRA non-CORRACTS TSD facilities list

RCRA-TSDF: RCRA - Treatment, Storage and Disposal

RCRAInfo is EPA's comprehensive information system, providing access to data supporting the Resource Conservation and Recovery Act (RCRA) of 1976 and the Hazardous and Solid Waste Amendments (HSWA) of 1984. The database includes selective information on sites which generate, transport, store, treat and/or dispose of hazardous waste as defined by the Resource Conservation and Recovery Act (RCRA). Transporters are individuals or entities that move hazardous waste from the generator offsite to a facility that can recycle, treat, store, or dispose of the waste. TSDFs treat, store, or dispose of the waste.

Date of Government Version: 06/09/2015	Source: Environmental Protection Agency
Date Data Arrived at EDR: 06/26/2015	Telephone: (415) 495-8895
Date Made Active in Reports: 09/16/2015	Last EDR Contact: 09/29/2015
Number of Days to Update: 82	Next Scheduled EDR Contact: 01/11/2016
	Data Release Frequency: Quarterly

Federal RCRA generators list

RCRA-LQG: RCRA - Large Quantity Generators

RCRAInfo is EPA's comprehensive information system, providing access to data supporting the Resource Conservation and Recovery Act (RCRA) of 1976 and the Hazardous and Solid Waste Amendments (HSWA) of 1984. The database includes selective information on sites which generate, transport, store, treat and/or dispose of hazardous waste as defined by the Resource Conservation and Recovery Act (RCRA). Large quantity generators (LQGs) generate over 1,000 kilograms (kg) of hazardous waste, or over 1 kg of acutely hazardous waste per month.

Date of Government Version: 06/09/2015	Source: Environmental Protection Agency
Date Data Arrived at EDR: 06/26/2015	Telephone: (415) 495-8895
Date Made Active in Reports: 09/16/2015	Last EDR Contact: 09/29/2015
Number of Days to Update: 82	Next Scheduled EDR Contact: 01/11/2016
	Data Release Frequency: Quarterly

RCRA-SQG: RCRA - Small Quantity Generators

RCRAInfo is EPA's comprehensive information system, providing access to data supporting the Resource Conservation and Recovery Act (RCRA) of 1976 and the Hazardous and Solid Waste Amendments (HSWA) of 1984. The database includes selective information on sites which generate, transport, store, treat and/or dispose of hazardous waste as defined by the Resource Conservation and Recovery Act (RCRA). Small quantity generators (SQGs) generate between 100 kg and 1,000 kg of hazardous waste per month.

Date of Government Version: 06/09/2015	Source: Environmental Protection Agency
Date Data Arrived at EDR: 06/26/2015	Telephone: (415) 495-8895
Date Made Active in Reports: 09/16/2015	Last EDR Contact: 09/29/2015
Number of Days to Update: 82	Next Scheduled EDR Contact: 01/11/2016
	Data Release Frequency: Quarterly

RCRA-CESQG: RCRA - Conditionally Exempt Small Quantity Generators

RCRAInfo is EPA's comprehensive information system, providing access to data supporting the Resource Conservation and Recovery Act (RCRA) of 1976 and the Hazardous and Solid Waste Amendments (HSWA) of 1984. The database includes selective information on sites which generate, transport, store, treat and/or dispose of hazardous waste as defined by the Resource Conservation and Recovery Act (RCRA). Conditionally exempt small quantity generators (CESQGs) generate less than 100 kg of hazardous waste, or less than 1 kg of acutely hazardous waste per month.

Date of Government Version: 06/09/2015	Source: Environmental Protection Agency
Date Data Arrived at EDR: 06/26/2015	Telephone: (415) 495-8895
Date Made Active in Reports: 09/16/2015	Last EDR Contact: 09/29/2015
Number of Days to Update: 82	Next Scheduled EDR Contact: 01/11/2016
	Data Release Frequency: Varies

GOVERNMENT RECORDS SEARCHED / DATA CURRENCY TRACKING

Federal institutional controls / engineering controls registries

LUCIS: Land Use Control Information System

LUCIS contains records of land use control information pertaining to the former Navy Base Realignment and Closure properties.

Date of Government Version: 05/28/2015
Date Data Arrived at EDR: 05/29/2015
Date Made Active in Reports: 06/11/2015
Number of Days to Update: 13

Source: Department of the Navy
Telephone: 843-820-7326
Last EDR Contact: 11/13/2015
Next Scheduled EDR Contact: 02/29/2016
Data Release Frequency: Varies

US ENG CONTROLS: Engineering Controls Sites List

A listing of sites with engineering controls in place. Engineering controls include various forms of caps, building foundations, liners, and treatment methods to create pathway elimination for regulated substances to enter environmental media or effect human health.

Date of Government Version: 09/10/2015
Date Data Arrived at EDR: 09/11/2015
Date Made Active in Reports: 11/03/2015
Number of Days to Update: 53

Source: Environmental Protection Agency
Telephone: 703-603-0695
Last EDR Contact: 11/24/2015
Next Scheduled EDR Contact: 03/14/2016
Data Release Frequency: Varies

US INST CONTROL: Sites with Institutional Controls

A listing of sites with institutional controls in place. Institutional controls include administrative measures, such as groundwater use restrictions, construction restrictions, property use restrictions, and post remediation care requirements intended to prevent exposure to contaminants remaining on site. Deed restrictions are generally required as part of the institutional controls.

Date of Government Version: 09/10/2015
Date Data Arrived at EDR: 09/11/2015
Date Made Active in Reports: 11/03/2015
Number of Days to Update: 53

Source: Environmental Protection Agency
Telephone: 703-603-0695
Last EDR Contact: 11/24/2015
Next Scheduled EDR Contact: 03/14/2016
Data Release Frequency: Varies

Federal ERNS list

ERNS: Emergency Response Notification System

Emergency Response Notification System. ERNS records and stores information on reported releases of oil and hazardous substances.

Date of Government Version: 06/22/2015
Date Data Arrived at EDR: 06/26/2015
Date Made Active in Reports: 09/16/2015
Number of Days to Update: 82

Source: National Response Center, United States Coast Guard
Telephone: 202-267-2180
Last EDR Contact: 09/29/2015
Next Scheduled EDR Contact: 01/11/2016
Data Release Frequency: Annually

State- and tribal - equivalent NPL

RESPONSE: State Response Sites

Identifies confirmed release sites where DTSC is involved in remediation, either in a lead or oversight capacity. These confirmed release sites are generally high-priority and high potential risk.

Date of Government Version: 08/03/2015
Date Data Arrived at EDR: 08/04/2015
Date Made Active in Reports: 09/03/2015
Number of Days to Update: 30

Source: Department of Toxic Substances Control
Telephone: 916-323-3400
Last EDR Contact: 11/07/2015
Next Scheduled EDR Contact: 02/15/2016
Data Release Frequency: Quarterly

State- and tribal - equivalent CERCLIS

ENVIROSTOR: EnviroStor Database

The Department of Toxic Substances Control's (DTSC's) Site Mitigation and Brownfields Reuse Program's (SMBRP's) EnviroStor database identifes sites that have known contamination or sites for which there may be reasons to investigate further. The database includes the following site types: Federal Superfund sites (National Priorities List (NPL)); State Response, including Military Facilities and State Superfund; Voluntary Cleanup; and School sites. EnviroStor provides similar information to the information that was available in CalSites, and provides additional site information, including, but not limited to, identification of formerly-contaminated properties that have been released for reuse, properties where environmental deed restrictions have been recorded to prevent inappropriate land uses, and risk characterization information that is used to assess potential impacts to public health and the environment at contaminated sites.

Date of Government Version: 08/03/2015
Date Data Arrived at EDR: 08/04/2015
Date Made Active in Reports: 09/03/2015
Number of Days to Update: 30

Source: Department of Toxic Substances Control
Telephone: 916-323-3400
Last EDR Contact: 11/07/2015
Next Scheduled EDR Contact: 02/15/2016
Data Release Frequency: Quarterly

State and tribal landfill and/or solid waste disposal site lists

SWF/LF (SWIS): Solid Waste Information System

Active, Closed and Inactive Landfills. SWF/LF records typically contain an inve ntory of solid waste disposal facilities or landfills. These may be active or i nactive facilities or open dumps that failed to meet RCRA Section 4004 criteria for solid waste landfills or disposal sites.

Date of Government Version: 08/17/2015
Date Data Arrived at EDR: 08/18/2015
Date Made Active in Reports: 09/03/2015
Number of Days to Update: 16

Source: Department of Resources Recycling and Recovery
Telephone: 916-341-6320
Last EDR Contact: 11/18/2015
Next Scheduled EDR Contact: 02/29/2016
Data Release Frequency: Quarterly

State and tribal leaking storage tank lists

LUST REG 1: Active Toxic Site Investigation

Del Norte, Humboldt, Lake, Mendocino, Modoc, Siskiyou, Sonoma, Trinity counties. For more current information, please refer to the State Water Resources Control Board's LUST database.

Date of Government Version: 02/01/2001
Date Data Arrived at EDR: 02/28/2001
Date Made Active in Reports: 03/29/2001
Number of Days to Update: 29

Source: California Regional Water Quality Control Board North Coast (1)
Telephone: 707-570-3769
Last EDR Contact: 08/01/2011
Next Scheduled EDR Contact: 11/14/2011
Data Release Frequency: No Update Planned

LUST REG 9: Leaking Underground Storage Tank Report

Orange, Riverside, San Diego counties. For more current information, please refer to the State Water Resources Control Board's LUST database.

Date of Government Version: 03/01/2001
Date Data Arrived at EDR: 04/23/2001
Date Made Active in Reports: 05/21/2001
Number of Days to Update: 28

Source: California Regional Water Quality Control Board San Diego Region (9)
Telephone: 858-637-5595
Last EDR Contact: 09/26/2011
Next Scheduled EDR Contact: 01/09/2012
Data Release Frequency: No Update Planned

LUST: Geotracker's Leaking Underground Fuel Tank Report

Leaking Underground Storage Tank Incident Reports. LUST records contain an inventory of reported leaking underground storage tank incidents. Not all states maintain these records, and the information stored varies by state. For more information on a particular leaking underground storage tank sites, please contact the appropriate regulatory agency.

Date of Government Version: 10/21/2015
Date Data Arrived at EDR: 10/22/2015
Date Made Active in Reports: 11/05/2015
Number of Days to Update: 14

Source: State Water Resources Control Board
Telephone: see region list
Last EDR Contact: 10/22/2015
Next Scheduled EDR Contact: 12/28/2015
Data Release Frequency: Quarterly

LUST REG 7: Leaking Underground Storage Tank Case Listing
Leaking Underground Storage Tank locations. Imperial, Riverside, San Diego, Santa Barbara counties.

Date of Government Version: 02/26/2004
Date Data Arrived at EDR: 02/26/2004
Date Made Active in Reports: 03/24/2004
Number of Days to Update: 27

Source: California Regional Water Quality Control Board Colorado River Basin Region (7)
Telephone: 760-776-8943
Last EDR Contact: 08/01/2011
Next Scheduled EDR Contact: 11/14/2011
Data Release Frequency: No Update Planned

LUST REG 6V: Leaking Underground Storage Tank Case Listing
Leaking Underground Storage Tank locations. Inyo, Kern, Los Angeles, Mono, San Bernardino counties.

Date of Government Version: 06/07/2005
Date Data Arrived at EDR: 06/07/2005
Date Made Active in Reports: 06/29/2005
Number of Days to Update: 22

Source: California Regional Water Quality Control Board Victorville Branch Office (6)
Telephone: 760-241-7365
Last EDR Contact: 09/12/2011
Next Scheduled EDR Contact: 12/26/2011
Data Release Frequency: No Update Planned

LUST REG 6L: Leaking Underground Storage Tank Case Listing
For more current information, please refer to the State Water Resources Control Board's LUST database.

Date of Government Version: 09/09/2003
Date Data Arrived at EDR: 09/10/2003
Date Made Active in Reports: 10/07/2003
Number of Days to Update: 27

Source: California Regional Water Quality Control Board Lahontan Region (6)
Telephone: 530-542-5572
Last EDR Contact: 09/12/2011
Next Scheduled EDR Contact: 12/26/2011
Data Release Frequency: No Update Planned

LUST REG 5: Leaking Underground Storage Tank Database
Leaking Underground Storage Tank locations. Alameda, Alpine, Amador, Butte, Colusa, Contra Costa, Calveras, El Dorado, Fresno, Glenn, Kern, Kings, Lake, Lassen, Madera, Mariposa, Merced, Modoc, Napa, Nevada, Placer, Plumas, Sacramento, San Joaquin, Shasta, Solano, Stanislaus, Sutter, Tehama, Tulare, Tuolumne, Yolo, Yuba counties.

Date of Government Version: 07/01/2008
Date Data Arrived at EDR: 07/22/2008
Date Made Active in Reports: 07/31/2008
Number of Days to Update: 9

Source: California Regional Water Quality Control Board Central Valley Region (5)
Telephone: 916-464-4834
Last EDR Contact: 07/01/2011
Next Scheduled EDR Contact: 10/17/2011
Data Release Frequency: No Update Planned

LUST REG 4: Underground Storage Tank Leak List
Los Angeles, Ventura counties. For more current information, please refer to the State Water Resources Control Board's LUST database.

Date of Government Version: 09/07/2004
Date Data Arrived at EDR: 09/07/2004
Date Made Active in Reports: 10/12/2004
Number of Days to Update: 35

Source: California Regional Water Quality Control Board Los Angeles Region (4)
Telephone: 213-576-6710
Last EDR Contact: 09/06/2011
Next Scheduled EDR Contact: 12/19/2011
Data Release Frequency: No Update Planned

LUST REG 3: Leaking Underground Storage Tank Database
Leaking Underground Storage Tank locations. Monterey, San Benito, San Luis Obispo, Santa Barbara, Santa Cruz counties.

Date of Government Version: 05/19/2003
Date Data Arrived at EDR: 05/19/2003
Date Made Active in Reports: 06/02/2003
Number of Days to Update: 14

Source: California Regional Water Quality Control Board Central Coast Region (3)
Telephone: 805-542-4786
Last EDR Contact: 07/18/2011
Next Scheduled EDR Contact: 10/31/2011
Data Release Frequency: No Update Planned

LUST REG 2: Fuel Leak List
Leaking Underground Storage Tank locations. Alameda, Contra Costa, Marin, Napa, San Francisco, San Mateo, Santa Clara, Solano, Sonoma counties.

Date of Government Version: 09/30/2004
Date Data Arrived at EDR: 10/20/2004
Date Made Active in Reports: 11/19/2004
Number of Days to Update: 30

Source: California Regional Water Quality Control Board San Francisco Bay Region (2)
Telephone: 510-622-2433
Last EDR Contact: 09/19/2011
Next Scheduled EDR Contact: 01/02/2012
Data Release Frequency: Quarterly

LUST REG 8: Leaking Underground Storage Tanks

California Regional Water Quality Control Board Santa Ana Region (8). For more current information, please refer to the State Water Resources Control Board's LUST database.

Date of Government Version: 02/14/2005
Date Data Arrived at EDR: 02/15/2005
Date Made Active in Reports: 03/28/2005
Number of Days to Update: 41

Source: California Regional Water Quality Control Board Santa Ana Region (8)
Telephone: 909-782-4496
Last EDR Contact: 08/15/2011
Next Scheduled EDR Contact: 11/28/2011
Data Release Frequency: Varies

INDIAN LUST R7: Leaking Underground Storage Tanks on Indian Land

LUSTs on Indian land in Iowa, Kansas, and Nebraska

Date of Government Version: 03/30/2015
Date Data Arrived at EDR: 04/28/2015
Date Made Active in Reports: 06/22/2015
Number of Days to Update: 55

Source: EPA Region 7
Telephone: 913-551-7003
Last EDR Contact: 10/08/2015
Next Scheduled EDR Contact: 02/08/2016
Data Release Frequency: Varies

INDIAN LUST R10: Leaking Underground Storage Tanks on Indian Land

LUSTs on Indian land in Alaska, Idaho, Oregon and Washington.

Date of Government Version: 07/21/2015
Date Data Arrived at EDR: 07/29/2015
Date Made Active in Reports: 10/13/2015
Number of Days to Update: 76

Source: EPA Region 10
Telephone: 206-553-2857
Last EDR Contact: 10/26/2015
Next Scheduled EDR Contact: 02/08/2016
Data Release Frequency: Quarterly

INDIAN LUST R6: Leaking Underground Storage Tanks on Indian Land

LUSTs on Indian land in New Mexico and Oklahoma.

Date of Government Version: 05/13/2015
Date Data Arrived at EDR: 08/03/2015
Date Made Active in Reports: 10/13/2015
Number of Days to Update: 71

Source: EPA Region 6
Telephone: 214-665-6597
Last EDR Contact: 10/26/2015
Next Scheduled EDR Contact: 02/08/2016
Data Release Frequency: Varies

INDIAN LUST R5: Leaking Underground Storage Tanks on Indian Land

Leaking underground storage tanks located on Indian Land in Michigan, Minnesota and Wisconsin.

Date of Government Version: 07/28/2015
Date Data Arrived at EDR: 08/07/2015
Date Made Active in Reports: 10/13/2015
Number of Days to Update: 67

Source: EPA, Region 5
Telephone: 312-886-7439
Last EDR Contact: 10/26/2015
Next Scheduled EDR Contact: 02/08/2016
Data Release Frequency: Varies

INDIAN LUST R9: Leaking Underground Storage Tanks on Indian Land

LUSTs on Indian land in Arizona, California, New Mexico and Nevada

Date of Government Version: 01/08/2015
Date Data Arrived at EDR: 01/08/2015
Date Made Active in Reports: 02/09/2015
Number of Days to Update: 32

Source: Environmental Protection Agency
Telephone: 415-972-3372
Last EDR Contact: 10/30/2015
Next Scheduled EDR Contact: 02/08/2016
Data Release Frequency: Quarterly

INDIAN LUST R8: Leaking Underground Storage Tanks on Indian Land
LUSTs on Indian land in Colorado, Montana, North Dakota, South Dakota, Utah and Wyoming.

Date of Government Version: 04/30/2015
Date Data Arrived at EDR: 05/05/2015
Date Made Active in Reports: 06/22/2015
Number of Days to Update: 48

Source: EPA Region 8
Telephone: 303-312-6271
Last EDR Contact: 10/08/2015
Next Scheduled EDR Contact: 02/08/2016
Data Release Frequency: Quarterly

INDIAN LUST R4: Leaking Underground Storage Tanks on Indian Land
LUSTs on Indian land in Florida, Mississippi and North Carolina.

Date of Government Version: 07/30/2015
Date Data Arrived at EDR: 08/07/2015
Date Made Active in Reports: 10/13/2015
Number of Days to Update: 67

Source: EPA Region 4
Telephone: 404-562-8677
Last EDR Contact: 10/26/2015
Next Scheduled EDR Contact: 02/08/2016
Data Release Frequency: Semi-Annually

INDIAN LUST R1: Leaking Underground Storage Tanks on Indian Land
A listing of leaking underground storage tank locations on Indian Land.

Date of Government Version: 02/03/2015
Date Data Arrived at EDR: 04/30/2015
Date Made Active in Reports: 06/22/2015
Number of Days to Update: 53

Source: EPA Region 1
Telephone: 617-918-1313
Last EDR Contact: 10/27/2015
Next Scheduled EDR Contact: 02/08/2016
Data Release Frequency: Varies

SLIC: Statewide SLIC Cases
The SLIC (Spills, Leaks, Investigations and Cleanup) program is designed to protect and restore water quality from spills, leaks, and similar discharges.

Date of Government Version: 10/21/2015
Date Data Arrived at EDR: 10/22/2015
Date Made Active in Reports: 11/06/2015
Number of Days to Update: 15

Source: State Water Resources Control Board
Telephone: 866-480-1028
Last EDR Contact: 10/22/2015
Next Scheduled EDR Contact: 12/28/2015
Data Release Frequency: Varies

SLIC REG 1: Active Toxic Site Investigations
The SLIC (Spills, Leaks, Investigations and Cleanup) program is designed to protect and restore water quality from spills, leaks, and similar discharges.

Date of Government Version: 04/03/2003
Date Data Arrived at EDR: 04/07/2003
Date Made Active in Reports: 04/25/2003
Number of Days to Update: 18

Source: California Regional Water Quality Control Board, North Coast Region (1)
Telephone: 707-576-2220
Last EDR Contact: 08/01/2011
Next Scheduled EDR Contact: 11/14/2011
Data Release Frequency: No Update Planned

SLIC REG 2: Spills, Leaks, Investigation & Cleanup Cost Recovery Listing
The SLIC (Spills, Leaks, Investigations and Cleanup) program is designed to protect and restore water quality from spills, leaks, and similar discharges.

Date of Government Version: 09/30/2004
Date Data Arrived at EDR: 10/20/2004
Date Made Active in Reports: 11/19/2004
Number of Days to Update: 30

Source: Regional Water Quality Control Board San Francisco Bay Region (2)
Telephone: 510-286-0457
Last EDR Contact: 09/19/2011
Next Scheduled EDR Contact: 01/02/2012
Data Release Frequency: Quarterly

SLIC REG 3: Spills, Leaks, Investigation & Cleanup Cost Recovery Listing
The SLIC (Spills, Leaks, Investigations and Cleanup) program is designed to protect and restore water quality from spills, leaks, and similar discharges.

Date of Government Version: 05/18/2006
Date Data Arrived at EDR: 05/18/2006
Date Made Active in Reports: 06/15/2006
Number of Days to Update: 28

Source: California Regional Water Quality Control Board Central Coast Region (3)
Telephone: 805-549-3147
Last EDR Contact: 07/18/2011
Next Scheduled EDR Contact: 10/31/2011
Data Release Frequency: Semi-Annually

SLIC REG 4: Spills, Leaks, Investigation & Cleanup Cost Recovery Listing
The SLIC (Spills, Leaks, Investigations and Cleanup) program is designed to protect and restore water quality from spills, leaks, and similar discharges.

Date of Government Version: 11/17/2004
Date Data Arrived at EDR: 11/18/2004
Date Made Active in Reports: 01/04/2005
Number of Days to Update: 47

Source: Region Water Quality Control Board Los Angeles Region (4)
Telephone: 213-576-6600
Last EDR Contact: 07/01/2011
Next Scheduled EDR Contact: 10/17/2011
Data Release Frequency: Varies

SLIC REG 5: Spills, Leaks, Investigation & Cleanup Cost Recovery Listing
The SLIC (Spills, Leaks, Investigations and Cleanup) program is designed to protect and restore water quality from spills, leaks, and similar discharges.

Date of Government Version: 04/01/2005
Date Data Arrived at EDR: 04/05/2005
Date Made Active in Reports: 04/21/2005
Number of Days to Update: 16

Source: Regional Water Quality Control Board Central Valley Region (5)
Telephone: 916-464-3291
Last EDR Contact: 09/12/2011
Next Scheduled EDR Contact: 12/26/2011
Data Release Frequency: Semi-Annually

SLIC REG 6V: Spills, Leaks, Investigation & Cleanup Cost Recovery Listing
The SLIC (Spills, Leaks, Investigations and Cleanup) program is designed to protect and restore water quality from spills, leaks, and similar discharges.

Date of Government Version: 05/24/2005
Date Data Arrived at EDR: 05/25/2005
Date Made Active in Reports: 06/16/2005
Number of Days to Update: 22

Source: Regional Water Quality Control Board, Victorville Branch
Telephone: 619-241-6583
Last EDR Contact: 08/15/2011
Next Scheduled EDR Contact: 11/28/2011
Data Release Frequency: Semi-Annually

SLIC REG 6L: SLIC Sites
The SLIC (Spills, Leaks, Investigations and Cleanup) program is designed to protect and restore water quality from spills, leaks, and similar discharges.

Date of Government Version: 09/07/2004
Date Data Arrived at EDR: 09/07/2004
Date Made Active in Reports: 10/12/2004
Number of Days to Update: 35

Source: California Regional Water Quality Control Board, Lahontan Region
Telephone: 530-542-5574
Last EDR Contact: 08/15/2011
Next Scheduled EDR Contact: 11/28/2011
Data Release Frequency: No Update Planned

SLIC REG 7: SLIC List
The SLIC (Spills, Leaks, Investigations and Cleanup) program is designed to protect and restore water quality from spills, leaks, and similar discharges.

Date of Government Version: 11/24/2004
Date Data Arrived at EDR: 11/29/2004
Date Made Active in Reports: 01/04/2005
Number of Days to Update: 36

Source: California Regional Quality Control Board, Colorado River Basin Region
Telephone: 760-346-7491
Last EDR Contact: 08/01/2011
Next Scheduled EDR Contact: 11/14/2011
Data Release Frequency: No Update Planned

SLIC REG 8: Spills, Leaks, Investigation & Cleanup Cost Recovery Listing
The SLIC (Spills, Leaks, Investigations and Cleanup) program is designed to protect and restore water quality from spills, leaks, and similar discharges.

Date of Government Version: 04/03/2008
Date Data Arrived at EDR: 04/03/2008
Date Made Active in Reports: 04/14/2008
Number of Days to Update: 11

Source: California Region Water Quality Control Board Santa Ana Region (8)
Telephone: 951-782-3298
Last EDR Contact: 09/12/2011
Next Scheduled EDR Contact: 12/26/2011
Data Release Frequency: Semi-Annually

SLIC REG 9: Spills, Leaks, Investigation & Cleanup Cost Recovery Listing
The SLIC (Spills, Leaks, Investigations and Cleanup) program is designed to protect and restore water quality from spills, leaks, and similar discharges.

Date of Government Version: 09/10/2007
Date Data Arrived at EDR: 09/11/2007
Date Made Active in Reports: 09/28/2007
Number of Days to Update: 17

Source: California Regional Water Quality Control Board San Diego Region (9)
Telephone: 858-467-2980
Last EDR Contact: 08/08/2011
Next Scheduled EDR Contact: 11/21/2011
Data Release Frequency: Annually

State and tribal registered storage tank lists

FEMA UST: Underground Storage Tank Listing
A listing of all FEMA owned underground storage tanks.

Date of Government Version: 01/01/2010
Date Data Arrived at EDR: 02/16/2010
Date Made Active in Reports: 04/12/2010
Number of Days to Update: 55

Source: FEMA
Telephone: 202-646-5797
Last EDR Contact: 10/08/2015
Next Scheduled EDR Contact: 01/25/2016
Data Release Frequency: Varies

UST: Active UST Facilities
Active UST facilities gathered from the local regulatory agencies

Date of Government Version: 10/21/2015
Date Data Arrived at EDR: 10/22/2015
Date Made Active in Reports: 11/19/2015
Number of Days to Update: 28

Source: SWRCB
Telephone: 916-341-5851
Last EDR Contact: 10/22/2015
Next Scheduled EDR Contact: 12/28/2015
Data Release Frequency: Semi-Annually

AST: Aboveground Petroleum Storage Tank Facilities
A listing of aboveground storage tank petroleum storage tank locations.

Date of Government Version: 08/01/2009
Date Data Arrived at EDR: 09/10/2009
Date Made Active in Reports: 10/01/2009
Number of Days to Update: 21

Source: California Environmental Protection Agency
Telephone: 916-327-5092
Last EDR Contact: 09/28/2015
Next Scheduled EDR Contact: 01/11/2016
Data Release Frequency: Quarterly

INDIAN UST R8: Underground Storage Tanks on Indian Land
The Indian Underground Storage Tank (UST) database provides information about underground storage tanks on Indian land in EPA Region 8 (Colorado, Montana, North Dakota, South Dakota, Utah, Wyoming and 27 Tribal Nations).

Date of Government Version: 07/28/2015
Date Data Arrived at EDR: 08/14/2015
Date Made Active in Reports: 10/13/2015
Number of Days to Update: 60

Source: EPA Region 8
Telephone: 303-312-6137
Last EDR Contact: 07/22/2015
Next Scheduled EDR Contact: 02/08/2016
Data Release Frequency: Quarterly

INDIAN UST R6: Underground Storage Tanks on Indian Land
The Indian Underground Storage Tank (UST) database provides information about underground storage tanks on Indian land in EPA Region 6 (Louisiana, Arkansas, Oklahoma, New Mexico, Texas and 65 Tribes).

Date of Government Version: 05/13/2015
Date Data Arrived at EDR: 08/03/2015
Date Made Active in Reports: 10/13/2015
Number of Days to Update: 71

Source: EPA Region 6
Telephone: 214-665-7591
Last EDR Contact: 10/26/2015
Next Scheduled EDR Contact: 02/08/2016
Data Release Frequency: Semi-Annually

INDIAN UST R4: Underground Storage Tanks on Indian Land

The Indian Underground Storage Tank (UST) database provides information about underground storage tanks on Indian land in EPA Region 4 (Alabama, Florida, Georgia, Kentucky, Mississippi, North Carolina, South Carolina, Tennessee and Tribal Nations)

Date of Government Version: 07/30/2015
Date Data Arrived at EDR: 08/07/2015
Date Made Active in Reports: 10/13/2015
Number of Days to Update: 67

Source: EPA Region 4
Telephone: 404-562-9424
Last EDR Contact: 10/26/2015
Next Scheduled EDR Contact: 02/08/2016
Data Release Frequency: Semi-Annually

INDIAN UST R7: Underground Storage Tanks on Indian Land

The Indian Underground Storage Tank (UST) database provides information about underground storage tanks on Indian land in EPA Region 7 (Iowa, Kansas, Missouri, Nebraska, and 9 Tribal Nations).

Date of Government Version: 09/23/2014
Date Data Arrived at EDR: 11/25/2014
Date Made Active in Reports: 01/29/2015
Number of Days to Update: 65

Source: EPA Region 7
Telephone: 913-551-7003
Last EDR Contact: 10/26/2015
Next Scheduled EDR Contact: 02/08/2016
Data Release Frequency: Varies

INDIAN UST R5: Underground Storage Tanks on Indian Land

The Indian Underground Storage Tank (UST) database provides information about underground storage tanks on Indian land in EPA Region 5 (Michigan, Minnesota and Wisconsin and Tribal Nations).

Date of Government Version: 07/28/2015
Date Data Arrived at EDR: 08/07/2015
Date Made Active in Reports: 10/13/2015
Number of Days to Update: 67

Source: EPA Region 5
Telephone: 312-886-6136
Last EDR Contact: 10/26/2015
Next Scheduled EDR Contact: 02/08/2016
Data Release Frequency: Varies

INDIAN UST R1: Underground Storage Tanks on Indian Land

The Indian Underground Storage Tank (UST) database provides information about underground storage tanks on Indian land in EPA Region 1 (Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, Vermont and ten Tribal Nations).

Date of Government Version: 02/03/2015
Date Data Arrived at EDR: 04/30/2015
Date Made Active in Reports: 06/22/2015
Number of Days to Update: 53

Source: EPA, Region 1
Telephone: 617-918-1313
Last EDR Contact: 10/27/2015
Next Scheduled EDR Contact: 02/08/2016
Data Release Frequency: Varies

INDIAN UST R10: Underground Storage Tanks on Indian Land

The Indian Underground Storage Tank (UST) database provides information about underground storage tanks on Indian land in EPA Region 10 (Alaska, Idaho, Oregon, Washington, and Tribal Nations).

Date of Government Version: 07/21/2015
Date Data Arrived at EDR: 07/29/2015
Date Made Active in Reports: 10/13/2015
Number of Days to Update: 76

Source: EPA Region 10
Telephone: 206-553-2857
Last EDR Contact: 10/26/2015
Next Scheduled EDR Contact: 02/08/2016
Data Release Frequency: Quarterly

INDIAN UST R9: Underground Storage Tanks on Indian Land

The Indian Underground Storage Tank (UST) database provides information about underground storage tanks on Indian land in EPA Region 9 (Arizona, California, Hawaii, Nevada, the Pacific Islands, and Tribal Nations).

Date of Government Version: 12/14/2014
Date Data Arrived at EDR: 02/13/2015
Date Made Active in Reports: 03/13/2015
Number of Days to Update: 28

Source: EPA Region 9
Telephone: 415-972-3368
Last EDR Contact: 10/30/2015
Next Scheduled EDR Contact: 02/09/2016
Data Release Frequency: Quarterly

State and tribal voluntary cleanup sites

VCP: Voluntary Cleanup Program Properties

Contains low threat level properties with either confirmed or unconfirmed releases and the project proponents have request that DTSC oversee investigation and/or cleanup activities and have agreed to provide coverage for DTSC's costs.

Date of Government Version: 08/03/2015
Date Data Arrived at EDR: 08/04/2015
Date Made Active in Reports: 09/03/2015
Number of Days to Update: 30

Source: Department of Toxic Substances Control
Telephone: 916-323-3400
Last EDR Contact: 11/07/2015
Next Scheduled EDR Contact: 02/15/2016
Data Release Frequency: Quarterly

INDIAN VCP R1: Voluntary Cleanup Priority Listing

A listing of voluntary cleanup priority sites located on Indian Land located in Region 1.

Date of Government Version: 09/29/2014
Date Data Arrived at EDR: 10/01/2014
Date Made Active in Reports: 11/06/2014
Number of Days to Update: 36

Source: EPA, Region 1
Telephone: 617-918-1102
Last EDR Contact: 09/29/2015
Next Scheduled EDR Contact: 01/11/2016
Data Release Frequency: Varies

INDIAN VCP R7: Voluntary Cleanup Priority Lisitng

A listing of voluntary cleanup priority sites located on Indian Land located in Region 7.

Date of Government Version: 03/20/2008
Date Data Arrived at EDR: 04/22/2008
Date Made Active in Reports: 05/19/2008
Number of Days to Update: 27

Source: EPA, Region 7
Telephone: 913-551-7365
Last EDR Contact: 04/20/2009
Next Scheduled EDR Contact: 07/20/2009
Data Release Frequency: Varies

State and tribal Brownfields sites

BROWNFIELDS: Considered Brownfieds Sites Listing

A listing of sites the SWRCB considers to be Brownfields since these are sites have come to them through the MOA Process.

Date of Government Version: 06/25/2015
Date Data Arrived at EDR: 09/08/2015
Date Made Active in Reports: 10/12/2015
Number of Days to Update: 34

Source: State Water Resources Control Board
Telephone: 916-323-7905
Last EDR Contact: 12/04/2015
Next Scheduled EDR Contact: 03/21/2016
Data Release Frequency: Varies

ADDITIONAL ENVIRONMENTAL RECORDS

Local Brownfield lists

US BROWNFIELDS: A Listing of Brownfields Sites

Brownfields are real property, the expansion, redevelopment, or reuse of which may be complicated by the presence or potential presence of a hazardous substance, pollutant, or contaminant. Cleaning up and reinvesting in these properties takes development pressures off of undeveloped, open land, and both improves and protects the environment. Assessment, Cleanup and Redevelopment Exchange System (ACRES) stores information reported by EPA Brownfields grant recipients on brownfields properties assessed or cleaned up with grant funding as well as information on Targeted Brownfields Assessments performed by EPA Regions. A listing of ACRES Brownfield sites is obtained from Cleanups in My Community. Cleanups in My Community provides information on Brownfields properties for which information is reported back to EPA, as well as areas served by Brownfields grant programs.

Date of Government Version: 06/22/2015
Date Data Arrived at EDR: 06/24/2015
Date Made Active in Reports: 09/02/2015
Number of Days to Update: 70

Source: Environmental Protection Agency
Telephone: 202-566-2777
Last EDR Contact: 09/23/2015
Next Scheduled EDR Contact: 01/04/2016
Data Release Frequency: Semi-Annually

Local Lists of Landfill / Solid Waste Disposal Sites

WMUDS/SWAT: Waste Management Unit Database

Waste Management Unit Database System. WMUDS is used by the State Water Resources Control Board staff and the Regional Water Quality Control Boards for program tracking and inventory of waste management units. WMUDS is composed of the following databases: Facility Information, Scheduled Inspections Information, Waste Management Unit Information, SWAT Program Information, SWAT Report Summary Information, SWAT Report Summary Data, Chapter 15 (formerly Subchapter 15) Information, Chapter 15 Monitoring Parameters, TPCA Program Information, RCRA Program Information, Closure Information, and Interested Parties Information.

Date of Government Version: 04/01/2000
Date Data Arrived at EDR: 04/10/2000
Date Made Active in Reports: 05/10/2000
Number of Days to Update: 30

Source: State Water Resources Control Board
Telephone: 916-227-4448
Last EDR Contact: 11/09/2015
Next Scheduled EDR Contact: 02/22/2016
Data Release Frequency: No Update Planned

SWRCY: Recycler Database

A listing of recycling facilities in California.

Date of Government Version: 09/14/2015
Date Data Arrived at EDR: 09/15/2015
Date Made Active in Reports: 10/14/2015
Number of Days to Update: 29

Source: Department of Conservation
Telephone: 916-323-3836
Last EDR Contact: 09/15/2015
Next Scheduled EDR Contact: 12/28/2015
Data Release Frequency: Quarterly

HAULERS: Registered Waste Tire Haulers Listing

A listing of registered waste tire haulers.

Date of Government Version: 09/21/2015
Date Data Arrived at EDR: 09/22/2015
Date Made Active in Reports: 11/05/2015
Number of Days to Update: 44

Source: Integrated Waste Management Board
Telephone: 916-341-6422
Last EDR Contact: 11/13/2015
Next Scheduled EDR Contact: 02/29/2016
Data Release Frequency: Varies

INDIAN ODI: Report on the Status of Open Dumps on Indian Lands

Location of open dumps on Indian land.

Date of Government Version: 12/31/1998
Date Data Arrived at EDR: 12/03/2007
Date Made Active in Reports: 01/24/2008
Number of Days to Update: 52

Source: Environmental Protection Agency
Telephone: 703-308-8245
Last EDR Contact: 11/06/2015
Next Scheduled EDR Contact: 02/15/2016
Data Release Frequency: Varies

ODI: Open Dump Inventory

An open dump is defined as a disposal facility that does not comply with one or more of the Part 257 or Part 258 Subtitle D Criteria.

Date of Government Version: 06/30/1985
Date Data Arrived at EDR: 08/09/2004
Date Made Active in Reports: 09/17/2004
Number of Days to Update: 39

Source: Environmental Protection Agency
Telephone: 800-424-9346
Last EDR Contact: 06/09/2004
Next Scheduled EDR Contact: N/A
Data Release Frequency: No Update Planned

DEBRIS REGION 9: Torres Martinez Reservation Illegal Dump Site Locations

A listing of illegal dump sites location on the Torres Martinez Indian Reservation located in eastern Riverside County and northern Imperial County, California.

Date of Government Version: 01/12/2009
Date Data Arrived at EDR: 05/07/2009
Date Made Active in Reports: 09/21/2009
Number of Days to Update: 137

Source: EPA, Region 9
Telephone: 415-947-4219
Last EDR Contact: 10/26/2015
Next Scheduled EDR Contact: 02/08/2016
Data Release Frequency: No Update Planned

Local Lists of Hazardous waste / Contaminated Sites

US HIST CDL: National Clandestine Laboratory Register

A listing of clandestine drug lab locations. The U.S. Department of Justice ("the Department") provides this web site as a public service. It contains addresses of some locations where law enforcement agencies reported they found chemicals or other items that indicated the presence of either clandestine drug laboratories or dumpsites. In most cases, the source of the entries is not the Department, and the Department has not verified the entry and does not guarantee its accuracy. Members of the public must verify the accuracy of all entries by, for example, contacting local law enforcement and local health departments.

Date of Government Version: 08/12/2015
Date Data Arrived at EDR: 09/04/2015
Date Made Active in Reports: 11/03/2015
Number of Days to Update: 60

Source: Drug Enforcement Administration
Telephone: 202-307-1000
Last EDR Contact: 08/31/2015
Next Scheduled EDR Contact: 12/14/2015
Data Release Frequency: No Update Planned

HIST CAL-SITES: Calsites Database

The Calsites database contains potential or confirmed hazardous substance release properties. In 1996, California EPA reevaluated and significantly reduced the number of sites in the Calsites database. No longer updated by the state agency. It has been replaced by ENVIROSTOR.

Date of Government Version: 08/08/2005
Date Data Arrived at EDR: 08/03/2006
Date Made Active in Reports: 08/24/2006
Number of Days to Update: 21

Source: Department of Toxic Substance Control
Telephone: 916-323-3400
Last EDR Contact: 02/23/2009
Next Scheduled EDR Contact: 05/25/2009
Data Release Frequency: No Update Planned

SCH: School Property Evaluation Program

This category contains proposed and existing school sites that are being evaluated by DTSC for possible hazardous materials contamination. In some cases, these properties may be listed in the CalSites category depending on the level of threat to public health and safety or the environment they pose.

Date of Government Version: 08/03/2015
Date Data Arrived at EDR: 08/04/2015
Date Made Active in Reports: 09/03/2015
Number of Days to Update: 30

Source: Department of Toxic Substances Control
Telephone: 916-323-3400
Last EDR Contact: 11/07/2015
Next Scheduled EDR Contact: 02/15/2016
Data Release Frequency: Quarterly

CDL: Clandestine Drug Labs

A listing of drug lab locations. Listing of a location in this database does not indicate that any illegal drug lab materials were or were not present there, and does not constitute a determination that the location either requires or does not require additional cleanup work.

Date of Government Version: 12/31/2014
Date Data Arrived at EDR: 03/10/2015
Date Made Active in Reports: 03/18/2015
Number of Days to Update: 8

Source: Department of Toxic Substances Control
Telephone: 916-255-6504
Last EDR Contact: 10/26/2015
Next Scheduled EDR Contact: 01/25/2016
Data Release Frequency: Varies

TOXIC PITS: Toxic Pits Cleanup Act Sites

Toxic PITS Cleanup Act Sites. TOXIC PITS identifies sites suspected of containing hazardous substances where cleanup has not yet been completed.

Date of Government Version: 07/01/1995
Date Data Arrived at EDR: 08/30/1995
Date Made Active in Reports: 09/26/1995
Number of Days to Update: 27

Source: State Water Resources Control Board
Telephone: 916-227-4364
Last EDR Contact: 01/26/2009
Next Scheduled EDR Contact: 04/27/2009
Data Release Frequency: No Update Planned

US CDL: Clandestine Drug Labs

A listing of clandestine drug lab locations. The U.S. Department of Justice ("the Department") provides this web site as a public service. It contains addresses of some locations where law enforcement agencies reported they found chemicals or other items that indicated the presence of either clandestine drug laboratories or dumpsites. In most cases, the source of the entries is not the Department, and the Department has not verified the entry and does not guarantee its accuracy. Members of the public must verify the accuracy of all entries by, for example, contacting local law enforcement and local health departments.

Date of Government Version: 08/12/2015
Date Data Arrived at EDR: 09/04/2015
Date Made Active in Reports: 11/03/2015
Number of Days to Update: 60

Source: Drug Enforcement Administration
Telephone: 202-307-1000
Last EDR Contact: 11/25/2015
Next Scheduled EDR Contact: 03/14/2016
Data Release Frequency: Quarterly

Local Lists of Registered Storage Tanks

SWEEPS UST: SWEEPS UST Listing

Statewide Environmental Evaluation and Planning System. This underground storage tank listing was updated and maintained by a company contacted by the SWRCB in the early 1990's. The listing is no longer updated or maintained. The local agency is the contact for more information on a site on the SWEEPS list.

Date of Government Version: 06/01/1994
Date Data Arrived at EDR: 07/07/2005
Date Made Active in Reports: 08/11/2005
Number of Days to Update: 35

Source: State Water Resources Control Board
Telephone: N/A
Last EDR Contact: 06/03/2005
Next Scheduled EDR Contact: N/A
Data Release Frequency: No Update Planned

UST MENDOCINO: Mendocino County UST Database

A listing of underground storage tank locations in Mendocino County.

Date of Government Version: 09/23/2009
Date Data Arrived at EDR: 09/23/2009
Date Made Active in Reports: 10/01/2009
Number of Days to Update: 8

Source: Department of Public Health
Telephone: 707-463-4466
Last EDR Contact: 11/23/2015
Next Scheduled EDR Contact: 03/14/2016
Data Release Frequency: Annually

HIST UST: Hazardous Substance Storage Container Database

The Hazardous Substance Storage Container Database is a historical listing of UST sites. Refer to local/county source for current data.

Date of Government Version: 10/15/1990
Date Data Arrived at EDR: 01/25/1991
Date Made Active in Reports: 02/12/1991
Number of Days to Update: 18

Source: State Water Resources Control Board
Telephone: 916-341-5851
Last EDR Contact: 07/26/2001
Next Scheduled EDR Contact: N/A
Data Release Frequency: No Update Planned

CA FID UST: Facility Inventory Database

The Facility Inventory Database (FID) contains a historical listing of active and inactive underground storage tank locations from the State Water Resource Control Board. Refer to local/county source for current data.

Date of Government Version: 10/31/1994
Date Data Arrived at EDR: 09/05/1995
Date Made Active in Reports: 09/29/1995
Number of Days to Update: 24

Source: California Environmental Protection Agency
Telephone: 916-341-5851
Last EDR Contact: 12/28/1998
Next Scheduled EDR Contact: N/A
Data Release Frequency: No Update Planned

Local Land Records

LIENS: Environmental Liens Listing
A listing of property locations with environmental liens for California where DTSC is a lien holder.

Date of Government Version: 09/08/2015
Date Data Arrived at EDR: 09/10/2015
Date Made Active in Reports: 10/12/2015
Number of Days to Update: 32

Source: Department of Toxic Substances Control
Telephone: 916-323-3400
Last EDR Contact: 12/04/2015
Next Scheduled EDR Contact: 03/21/2016
Data Release Frequency: Varies

LIENS 2: CERCLA Lien Information
A Federal CERCLA ('Superfund') lien can exist by operation of law at any site or property at which EPA has spent Superfund monies. These monies are spent to investigate and address releases and threatened releases of contamination. CERCLIS provides information as to the identity of these sites and properties.

Date of Government Version: 02/18/2014
Date Data Arrived at EDR: 03/18/2014
Date Made Active in Reports: 04/24/2014
Number of Days to Update: 37

Source: Environmental Protection Agency
Telephone: 202-564-6023
Last EDR Contact: 10/30/2015
Next Scheduled EDR Contact: 02/08/2016
Data Release Frequency: Varies

DEED: Deed Restriction Listing
Site Mitigation and Brownfields Reuse Program Facility Sites with Deed Restrictions & Hazardous Waste Management Program Facility Sites with Deed / Land Use Restriction. The DTSC Site Mitigation and Brownfields Reuse Program (SMBRP) list includes sites cleaned up under the program's oversight and generally does not include current or former hazardous waste facilities that required a hazardous waste facility permit. The list represents deed restrictions that are active. Some sites have multiple deed restrictions. The DTSC Hazardous Waste Management Program (HWMP) has developed a list of current or former hazardous waste facilities that have a recorded land use restriction at the local county recorder's office. The land use restrictions on this list were required by the DTSC HWMP as a result of the presence of hazardous substances that remain on site after the facility (or part of the facility) has been closed or cleaned up. The types of land use restriction include deed notice, deed restriction, or a land use restriction that binds current and future owners.

Date of Government Version: 09/08/2015
Date Data Arrived at EDR: 09/09/2015
Date Made Active in Reports: 10/13/2015
Number of Days to Update: 34

Source: DTSC and SWRCB
Telephone: 916-323-3400
Last EDR Contact: 12/08/2015
Next Scheduled EDR Contact: 12/21/2015
Data Release Frequency: Semi-Annually

Records of Emergency Release Reports

HMIRS: Hazardous Materials Information Reporting System
Hazardous Materials Incident Report System. HMIRS contains hazardous material spill incidents reported to DOT.

Date of Government Version: 06/24/2015
Date Data Arrived at EDR: 06/26/2015
Date Made Active in Reports: 09/02/2015
Number of Days to Update: 68

Source: U.S. Department of Transportation
Telephone: 202-366-4555
Last EDR Contact: 09/29/2015
Next Scheduled EDR Contact: 01/11/2016
Data Release Frequency: Annually

CHMIRS: California Hazardous Material Incident Report System
California Hazardous Material Incident Reporting System. CHMIRS contains information on reported hazardous material incidents (accidental releases or spills).

Date of Government Version: 09/25/2015
Date Data Arrived at EDR: 10/27/2015
Date Made Active in Reports: 11/16/2015
Number of Days to Update: 20

Source: Office of Emergency Services
Telephone: 916-845-8400
Last EDR Contact: 10/27/2015
Next Scheduled EDR Contact: 11/09/2015
Data Release Frequency: Varies

LDS: Land Disposal Sites Listing

The Land Disposal program regulates of waste discharge to land for treatment, storage and disposal in waste management units.

Date of Government Version: 10/21/2015
Date Data Arrived at EDR: 10/22/2015
Date Made Active in Reports: 11/05/2015
Number of Days to Update: 14

Source: State Water Qualilty Control Board
Telephone: 866-480-1028
Last EDR Contact: 10/22/2015
Next Scheduled EDR Contact: 12/28/2015
Data Release Frequency: Quarterly

MCS: Military Cleanup Sites Listing

The State Water Resources Control Board and nine Regional Water Quality Control Boards partner with the Department of Defense (DoD) through the Defense and State Memorandum of Agreement (DSMOA) to oversee the investigation and remediation of water quality issues at military facilities.

Date of Government Version: 10/21/2015
Date Data Arrived at EDR: 10/22/2015
Date Made Active in Reports: 11/05/2015
Number of Days to Update: 14

Source: State Water Resources Control Board
Telephone: 866-480-1028
Last EDR Contact: 10/22/2015
Next Scheduled EDR Contact: 12/28/2015
Data Release Frequency: Quarterly

SPILLS 90: SPILLS90 data from FirstSearch

Spills 90 includes those spill and release records available exclusively from FirstSearch databases. Typically, they may include chemical, oil and/or hazardous substance spills recorded after 1990. Duplicate records that are already included in EDR incident and release records are not included in Spills 90.

Date of Government Version: 06/06/2012
Date Data Arrived at EDR: 01/03/2013
Date Made Active in Reports: 02/22/2013
Number of Days to Update: 50

Source: FirstSearch
Telephone: N/A
Last EDR Contact: 01/03/2013
Next Scheduled EDR Contact: N/A
Data Release Frequency: No Update Planned

Other Ascertainable Records

RCRA NonGen / NLR: RCRA - Non Generators / No Longer Regulated

RCRAInfo is EPA's comprehensive information system, providing access to data supporting the Resource Conservation and Recovery Act (RCRA) of 1976 and the Hazardous and Solid Waste Amendments (HSWA) of 1984. The database includes selective information on sites which generate, transport, store, treat and/or dispose of hazardous waste as defined by the Resource Conservation and Recovery Act (RCRA). Non-Generators do not presently generate hazardous waste.

Date of Government Version: 06/09/2015
Date Data Arrived at EDR: 06/26/2015
Date Made Active in Reports: 09/16/2015
Number of Days to Update: 82

Source: Environmental Protection Agency
Telephone: (415) 495-8895
Last EDR Contact: 09/29/2015
Next Scheduled EDR Contact: 01/11/2016
Data Release Frequency: Varies

FUDS: Formerly Used Defense Sites

The listing includes locations of Formerly Used Defense Sites properties where the US Army Corps of Engineers is actively working or will take necessary cleanup actions.

Date of Government Version: 01/31/2015
Date Data Arrived at EDR: 07/08/2015
Date Made Active in Reports: 10/13/2015
Number of Days to Update: 97

Source: U.S. Army Corps of Engineers
Telephone: 202-528-4285
Last EDR Contact: 09/11/2015
Next Scheduled EDR Contact: 12/21/2015
Data Release Frequency: Varies

DOD: Department of Defense Sites

This data set consists of federally owned or administered lands, administered by the Department of Defense, that have any area equal to or greater than 640 acres of the United States, Puerto Rico, and the U.S. Virgin Islands.

Date of Government Version: 12/31/2005
Date Data Arrived at EDR: 11/10/2006
Date Made Active in Reports: 01/11/2007
Number of Days to Update: 62

Source: USGS
Telephone: 888-275-8747
Last EDR Contact: 10/16/2015
Next Scheduled EDR Contact: 01/25/2016
Data Release Frequency: Semi-Annually

FEDLAND: Federal and Indian Lands

Federally and Indian administrated lands of the United States. Lands included are administrated by: Army Corps of Engineers, Bureau of Reclamation, National Wild and Scenic River, National Wildlife Refuge, Public Domain Land, Wilderness, Wilderness Study Area, Wildlife Management Area, Bureau of Indian Affairs, Bureau of Land Management, Department of Justice, Forest Service, Fish and Wildlife Service, National Park Service.

Date of Government Version: 12/31/2005
Date Data Arrived at EDR: 02/06/2006
Date Made Active in Reports: 01/11/2007
Number of Days to Update: 339

Source: U.S. Geological Survey
Telephone: 888-275-8747
Last EDR Contact: 10/16/2015
Next Scheduled EDR Contact: 01/25/2016
Data Release Frequency: N/A

SCRD DRYCLEANERS: State Coalition for Remediation of Drycleaners Listing

The State Coalition for Remediation of Drycleaners was established in 1998, with support from the U.S. EPA Office of Superfund Remediation and Technology Innovation. It is comprised of representatives of states with established drycleaner remediation programs. Currently the member states are Alabama, Connecticut, Florida, Illinois, Kansas, Minnesota, Missouri, North Carolina, Oregon, South Carolina, Tennessee, Texas, and Wisconsin.

Date of Government Version: 03/07/2011
Date Data Arrived at EDR: 03/09/2011
Date Made Active in Reports: 05/02/2011
Number of Days to Update: 54

Source: Environmental Protection Agency
Telephone: 615-532-8599
Last EDR Contact: 11/19/2015
Next Scheduled EDR Contact: 02/29/2016
Data Release Frequency: Varies

US FIN ASSUR: Financial Assurance Information

All owners and operators of facilities that treat, store, or dispose of hazardous waste are required to provide proof that they will have sufficient funds to pay for the clean up, closure, and post-closure care of their facilities.

Date of Government Version: 09/01/2015
Date Data Arrived at EDR: 09/03/2015
Date Made Active in Reports: 11/03/2015
Number of Days to Update: 61

Source: Environmental Protection Agency
Telephone: 202-566-1917
Last EDR Contact: 11/13/2015
Next Scheduled EDR Contact: 02/29/2016
Data Release Frequency: Quarterly

EPA WATCH LIST: EPA WATCH LIST

EPA maintains a "Watch List" to facilitate dialogue between EPA, state and local environmental agencies on enforcement matters relating to facilities with alleged violations identified as either significant or high priority. Being on the Watch List does not mean that the facility has actually violated the law only that an investigation by EPA or a state or local environmental agency has led those organizations to allege that an unproven violation has in fact occurred. Being on the Watch List does not represent a higher level of concern regarding the alleged violations that were detected, but instead indicates cases requiring additional dialogue between EPA, state and local agencies - primarily because of the length of time the alleged violation has gone unaddressed or unresolved.

Date of Government Version: 08/30/2013
Date Data Arrived at EDR: 03/21/2014
Date Made Active in Reports: 06/17/2014
Number of Days to Update: 88

Source: Environmental Protection Agency
Telephone: 617-520-3000
Last EDR Contact: 11/10/2015
Next Scheduled EDR Contact: 02/22/2016
Data Release Frequency: Quarterly

2020 COR ACTION: 2020 Corrective Action Program List

The EPA has set ambitious goals for the RCRA Corrective Action program by creating the 2020 Corrective Action Universe. This RCRA cleanup baseline includes facilities expected to need corrective action. The 2020 universe contains a wide variety of sites. Some properties are heavily contaminated while others were contaminated but have since been cleaned up. Still others have not been fully investigated yet, and may require little or no remediation. Inclusion in the 2020 Universe does not necessarily imply failure on the part of a facility to meet its RCRA obligations.

Date of Government Version: 04/22/2013	Source: Environmental Protection Agency
Date Data Arrived at EDR: 03/03/2015	Telephone: 703-308-4044
Date Made Active in Reports: 03/09/2015	Last EDR Contact: 11/13/2015
Number of Days to Update: 6	Next Scheduled EDR Contact: 02/22/2016
	Data Release Frequency: Varies

TSCA: Toxic Substances Control Act

Toxic Substances Control Act. TSCA identifies manufacturers and importers of chemical substances included on the TSCA Chemical Substance Inventory list. It includes data on the production volume of these substances by plant site.

Date of Government Version: 12/31/2012	Source: EPA
Date Data Arrived at EDR: 01/15/2015	Telephone: 202-260-5521
Date Made Active in Reports: 01/29/2015	Last EDR Contact: 09/25/2015
Number of Days to Update: 14	Next Scheduled EDR Contact: 01/04/2016
	Data Release Frequency: Every 4 Years

TRIS: Toxic Chemical Release Inventory System

Toxic Release Inventory System. TRIS identifies facilities which release toxic chemicals to the air, water and land in reportable quantities under SARA Title III Section 313.

Date of Government Version: 12/31/2013	Source: EPA
Date Data Arrived at EDR: 02/12/2015	Telephone: 202-566-0250
Date Made Active in Reports: 06/02/2015	Last EDR Contact: 11/24/2015
Number of Days to Update: 110	Next Scheduled EDR Contact: 03/07/2016
	Data Release Frequency: Annually

SSTS: Section 7 Tracking Systems

Section 7 of the Federal Insecticide, Fungicide and Rodenticide Act, as amended (92 Stat. 829) requires all registered pesticide-producing establishments to submit a report to the Environmental Protection Agency by March 1st each year. Each establishment must report the types and amounts of pesticides, active ingredients and devices being produced, and those having been produced and sold or distributed in the past year.

Date of Government Version: 12/31/2009	Source: EPA
Date Data Arrived at EDR: 12/10/2010	Telephone: 202-564-4203
Date Made Active in Reports: 02/25/2011	Last EDR Contact: 10/26/2015
Number of Days to Update: 77	Next Scheduled EDR Contact: 02/08/2016
	Data Release Frequency: Annually

ROD: Records Of Decision

Record of Decision. ROD documents mandate a permanent remedy at an NPL (Superfund) site containing technical and health information to aid in the cleanup.

Date of Government Version: 11/25/2013	Source: EPA
Date Data Arrived at EDR: 12/12/2013	Telephone: 703-416-0223
Date Made Active in Reports: 02/24/2014	Last EDR Contact: 09/11/2015
Number of Days to Update: 74	Next Scheduled EDR Contact: 12/21/2015
	Data Release Frequency: Annually

RMP: Risk Management Plans

When Congress passed the Clean Air Act Amendments of 1990, it required EPA to publish regulations and guidance for chemical accident prevention at facilities using extremely hazardous substances. The Risk Management Program Rule (RMP Rule) was written to implement Section 112(r) of these amendments. The rule, which built upon existing industry codes and standards, requires companies of all sizes that use certain flammable and toxic substances to develop a Risk Management Program, which includes a(n): Hazard assessment that details the potential effects of an accidental release, an accident history of the last five years, and an evaluation of worst-case and alternative accidental releases; Prevention program that includes safety precautions and maintenance, monitoring, and employee training measures; and Emergency response program that spells out emergency health care, employee training measures and procedures for informing the public and response agencies (e.g the fire department) should an accident occur.

Date of Government Version: 08/01/2015
Date Data Arrived at EDR: 08/26/2015
Date Made Active in Reports: 11/03/2015
Number of Days to Update: 69

Source: Environmental Protection Agency
Telephone: 202-564-8600
Last EDR Contact: 10/26/2015
Next Scheduled EDR Contact: 02/08/2016
Data Release Frequency: Varies

RAATS: RCRA Administrative Action Tracking System

RCRA Administration Action Tracking System. RAATS contains records based on enforcement actions issued under RCRA pertaining to major violators and includes administrative and civil actions brought by the EPA. For administration actions after September 30, 1995, data entry in the RAATS database was discontinued. EPA will retain a copy of the database for historical records. It was necessary to terminate RAATS because a decrease in agency resources made it impossible to continue to update the information contained in the database.

Date of Government Version: 04/17/1995
Date Data Arrived at EDR: 07/03/1995
Date Made Active in Reports: 08/07/1995
Number of Days to Update: 35

Source: EPA
Telephone: 202-564-4104
Last EDR Contact: 06/02/2008
Next Scheduled EDR Contact: 09/01/2008
Data Release Frequency: No Update Planned

PRP: Potentially Responsible Parties

A listing of verified Potentially Responsible Parties

Date of Government Version: 10/25/2013
Date Data Arrived at EDR: 10/17/2014
Date Made Active in Reports: 10/20/2014
Number of Days to Update: 3

Source: EPA
Telephone: 202-564-6023
Last EDR Contact: 11/13/2015
Next Scheduled EDR Contact: 02/22/2016
Data Release Frequency: Quarterly

PADS: PCB Activity Database System

PCB Activity Database. PADS Identifies generators, transporters, commercial storers and/or brokers and disposers of PCB's who are required to notify the EPA of such activities.

Date of Government Version: 07/01/2014
Date Data Arrived at EDR: 10/15/2014
Date Made Active in Reports: 11/17/2014
Number of Days to Update: 33

Source: EPA
Telephone: 202-566-0500
Last EDR Contact: 10/29/2015
Next Scheduled EDR Contact: 01/25/2016
Data Release Frequency: Annually

ICIS: Integrated Compliance Information System

The Integrated Compliance Information System (ICIS) supports the information needs of the national enforcement and compliance program as well as the unique needs of the National Pollutant Discharge Elimination System (NPDES) program.

Date of Government Version: 01/23/2015
Date Data Arrived at EDR: 02/06/2015
Date Made Active in Reports: 03/09/2015
Number of Days to Update: 31

Source: Environmental Protection Agency
Telephone: 202-564-5088
Last EDR Contact: 10/08/2015
Next Scheduled EDR Contact: 01/25/2016
Data Release Frequency: Quarterly

FTTS: FIFRA/ TSCA Tracking System - FIFRA (Federal Insecticide, Fungicide, & Rodenticide Act)/TSCA (Toxic Substances Control Act)

FTTS tracks administrative cases and pesticide enforcement actions and compliance activities related to FIFRA, TSCA and EPCRA (Emergency Planning and Community Right-to-Know Act). To maintain currency, EDR contacts the Agency on a quarterly basis.

Date of Government Version: 04/09/2009	Source: EPA/Office of Prevention, Pesticides and Toxic Substances
Date Data Arrived at EDR: 04/16/2009	Telephone: 202-566-1667
Date Made Active in Reports: 05/11/2009	Last EDR Contact: 11/18/2015
Number of Days to Update: 25	Next Scheduled EDR Contact: 03/07/2016
	Data Release Frequency: Quarterly

FTTS INSP: FIFRA/ TSCA Tracking System - FIFRA (Federal Insecticide, Fungicide, & Rodenticide Act)/TSCA (Toxic Substances Control Act)

A listing of FIFRA/TSCA Tracking System (FTTS) inspections and enforcements.

Date of Government Version: 04/09/2009	Source: EPA
Date Data Arrived at EDR: 04/16/2009	Telephone: 202-566-1667
Date Made Active in Reports: 05/11/2009	Last EDR Contact: 11/18/2015
Number of Days to Update: 25	Next Scheduled EDR Contact: 03/07/2016
	Data Release Frequency: Quarterly

MLTS: Material Licensing Tracking System

MLTS is maintained by the Nuclear Regulatory Commission and contains a list of approximately 8,100 sites which possess or use radioactive materials and which are subject to NRC licensing requirements. To maintain currency, EDR contacts the Agency on a quarterly basis.

Date of Government Version: 06/26/2015	Source: Nuclear Regulatory Commission
Date Data Arrived at EDR: 07/10/2015	Telephone: 301-415-7169
Date Made Active in Reports: 10/13/2015	Last EDR Contact: 12/07/2015
Number of Days to Update: 95	Next Scheduled EDR Contact: 03/21/2016
	Data Release Frequency: Quarterly

COAL ASH DOE: Steam-Electric Plant Operation Data

A listing of power plants that store ash in surface ponds.

Date of Government Version: 12/31/2005	Source: Department of Energy
Date Data Arrived at EDR: 08/07/2009	Telephone: 202-586-8719
Date Made Active in Reports: 10/22/2009	Last EDR Contact: 07/13/2015
Number of Days to Update: 76	Next Scheduled EDR Contact: 10/28/2015
	Data Release Frequency: Varies

COAL ASH EPA: Coal Combustion Residues Surface Impoundments List

A listing of coal combustion residues surface impoundments with high hazard potential ratings.

Date of Government Version: 07/01/2014	Source: Environmental Protection Agency
Date Data Arrived at EDR: 09/10/2014	Telephone: N/A
Date Made Active in Reports: 10/20/2014	Last EDR Contact: 09/11/2015
Number of Days to Update: 40	Next Scheduled EDR Contact: 12/21/2015
	Data Release Frequency: Varies

PCB TRANSFORMER: PCB Transformer Registration Database

The database of PCB transformer registrations that includes all PCB registration submittals.

Date of Government Version: 02/01/2011	Source: Environmental Protection Agency
Date Data Arrived at EDR: 10/19/2011	Telephone: 202-566-0517
Date Made Active in Reports: 01/10/2012	Last EDR Contact: 10/29/2015
Number of Days to Update: 83	Next Scheduled EDR Contact: 02/08/2016
	Data Release Frequency: Varies

RADINFO: Radiation Information Database

The Radiation Information Database (RADINFO) contains information about facilities that are regulated by U.S. Environmental Protection Agency (EPA) regulations for radiation and radioactivity.

Date of Government Version: 07/07/2015
Date Data Arrived at EDR: 07/09/2015
Date Made Active in Reports: 09/16/2015
Number of Days to Update: 69

Source: Environmental Protection Agency
Telephone: 202-343-9775
Last EDR Contact: 10/07/2015
Next Scheduled EDR Contact: 01/18/2016
Data Release Frequency: Quarterly

HIST FTTS: FIFRA/TSCA Tracking System Administrative Case Listing

A complete administrative case listing from the FIFRA/TSCA Tracking System (FTTS) for all ten EPA regions. The information was obtained from the National Compliance Database (NCDB). NCDB supports the implementation of FIFRA (Federal Insecticide, Fungicide, and Rodenticide Act) and TSCA (Toxic Substances Control Act). Some EPA regions are now closing out records. Because of that, and the fact that some EPA regions are not providing EPA Headquarters with updated records, it was decided to create a HIST FTTS database. It included records that may not be included in the newer FTTS database updates. This database is no longer updated.

Date of Government Version: 10/19/2006
Date Data Arrived at EDR: 03/01/2007
Date Made Active in Reports: 04/10/2007
Number of Days to Update: 40

Source: Environmental Protection Agency
Telephone: 202-564-2501
Last EDR Contact: 12/17/2007
Next Scheduled EDR Contact: 03/17/2008
Data Release Frequency: No Update Planned

HIST FTTS INSP: FIFRA/TSCA Tracking System Inspection & Enforcement Case Listing

A complete inspection and enforcement case listing from the FIFRA/TSCA Tracking System (FTTS) for all ten EPA regions. The information was obtained from the National Compliance Database (NCDB). NCDB supports the implementation of FIFRA (Federal Insecticide, Fungicide, and Rodenticide Act) and TSCA (Toxic Substances Control Act). Some EPA regions are now closing out records. Because of that, and the fact that some EPA regions are not providing EPA Headquarters with updated records, it was decided to create a HIST FTTS database. It included records that may not be included in the newer FTTS database updates. This database is no longer updated.

Date of Government Version: 10/19/2006
Date Data Arrived at EDR: 03/01/2007
Date Made Active in Reports: 04/10/2007
Number of Days to Update: 40

Source: Environmental Protection Agency
Telephone: 202-564-2501
Last EDR Contact: 12/17/2008
Next Scheduled EDR Contact: 03/17/2008
Data Release Frequency: No Update Planned

DOT OPS: Incident and Accident Data

Department of Transporation, Office of Pipeline Safety Incident and Accident data.

Date of Government Version: 07/31/2012
Date Data Arrived at EDR: 08/07/2012
Date Made Active in Reports: 09/18/2012
Number of Days to Update: 42

Source: Department of Transporation, Office of Pipeline Safety
Telephone: 202-366-4595
Last EDR Contact: 11/07/2015
Next Scheduled EDR Contact: 02/15/2016
Data Release Frequency: Varies

CONSENT: Superfund (CERCLA) Consent Decrees

Major legal settlements that establish responsibility and standards for cleanup at NPL (Superfund) sites. Released periodically by United States District Courts after settlement by parties to litigation matters.

Date of Government Version: 12/31/2014
Date Data Arrived at EDR: 04/17/2015
Date Made Active in Reports: 06/02/2015
Number of Days to Update: 46

Source: Department of Justice, Consent Decree Library
Telephone: Varies
Last EDR Contact: 09/28/2015
Next Scheduled EDR Contact: 01/11/2016
Data Release Frequency: Varies

BRS: Biennial Reporting System

The Biennial Reporting System is a national system administered by the EPA that collects data on the generation and management of hazardous waste. BRS captures detailed data from two groups: Large Quantity Generators (LQG) and Treatment, Storage, and Disposal Facilities.

Date of Government Version: 12/31/2013
Date Data Arrived at EDR: 02/24/2015
Date Made Active in Reports: 09/30/2015
Number of Days to Update: 218

Source: EPA/NTIS
Telephone: 800-424-9346
Last EDR Contact: 11/24/2015
Next Scheduled EDR Contact: 03/07/2016
Data Release Frequency: Biennially

INDIAN RESERV: Indian Reservations

This map layer portrays Indian administered lands of the United States that have any area equal to or greater than 640 acres.

Date of Government Version: 12/31/2005
Date Data Arrived at EDR: 12/08/2006
Date Made Active in Reports: 01/11/2007
Number of Days to Update: 34

Source: USGS
Telephone: 202-208-3710
Last EDR Contact: 10/16/2015
Next Scheduled EDR Contact: 01/25/2016
Data Release Frequency: Semi-Annually

UMTRA: Uranium Mill Tailings Sites

Uranium ore was mined by private companies for federal government use in national defense programs. When the mills shut down, large piles of the sand-like material (mill tailings) remain after uranium has been extracted from the ore. Levels of human exposure to radioactive materials from the piles are low; however, in some cases tailings were used as construction materials before the potential health hazards of the tailings were recognized.

Date of Government Version: 09/14/2010
Date Data Arrived at EDR: 10/07/2011
Date Made Active in Reports: 03/01/2012
Number of Days to Update: 146

Source: Department of Energy
Telephone: 505-845-0011
Last EDR Contact: 11/19/2015
Next Scheduled EDR Contact: 03/07/2016
Data Release Frequency: Varies

LEAD SMELTER 1: Lead Smelter Sites

A listing of former lead smelter site locations.

Date of Government Version: 11/25/2014
Date Data Arrived at EDR: 11/26/2014
Date Made Active in Reports: 01/29/2015
Number of Days to Update: 64

Source: Environmental Protection Agency
Telephone: 703-603-8787
Last EDR Contact: 10/05/2015
Next Scheduled EDR Contact: 01/18/2016
Data Release Frequency: Varies

LEAD SMELTER 2: Lead Smelter Sites

A list of several hundred sites in the U.S. where secondary lead smelting was done from 1931and 1964. These sites may pose a threat to public health through ingestion or inhalation of contaminated soil or dust

Date of Government Version: 04/05/2001
Date Data Arrived at EDR: 10/27/2010
Date Made Active in Reports: 12/02/2010
Number of Days to Update: 36

Source: American Journal of Public Health
Telephone: 703-305-6451
Last EDR Contact: 12/02/2009
Next Scheduled EDR Contact: N/A
Data Release Frequency: No Update Planned

US AIRS (AFS): Aerometric Information Retrieval System Facility Subsystem (AFS)

The database is a sub-system of Aerometric Information Retrieval System (AIRS). AFS contains compliance data on air pollution point sources regulated by the U.S. EPA and/or state and local air regulatory agencies. This information comes from source reports by various stationary sources of air pollution, such as electric power plants, steel mills, factories, and universities, and provides information about the air pollutants they produce. Action, air program, air program pollutant, and general level plant data. It is used to track emissions and compliance data from industrial plants.

Date of Government Version: 07/22/2015
Date Data Arrived at EDR: 07/24/2015
Date Made Active in Reports: 09/02/2015
Number of Days to Update: 40

Source: EPA
Telephone: 202-564-2496
Last EDR Contact: 09/28/2015
Next Scheduled EDR Contact: 01/11/2016
Data Release Frequency: Annually

US AIRS MINOR: Air Facility System Data

A listing of minor source facilities.

Date of Government Version: 07/22/2015
Date Data Arrived at EDR: 07/24/2015
Date Made Active in Reports: 09/02/2015
Number of Days to Update: 40

Source: EPA
Telephone: 202-564-2496
Last EDR Contact: 09/28/2015
Next Scheduled EDR Contact: 01/11/2016
Data Release Frequency: Annually

US MINES: Mines Master Index File

Contains all mine identification numbers issued for mines active or opened since 1971. The data also includes violation information.

Date of Government Version: 05/14/2015
Date Data Arrived at EDR: 06/03/2015
Date Made Active in Reports: 09/02/2015
Number of Days to Update: 91

Source: Department of Labor, Mine Safety and Health Administration
Telephone: 303-231-5959
Last EDR Contact: 12/03/2015
Next Scheduled EDR Contact: 03/14/2016
Data Release Frequency: Semi-Annually

US MINES 2: Ferrous and Nonferrous Metal Mines Database Listing

This map layer includes ferrous (ferrous metal mines are facilities that extract ferrous metals, such as iron ore or molybdenum) and nonferrous (Nonferrous metal mines are facilities that extract nonferrous metals, such as gold, silver, copper, zinc, and lead) metal mines in the United States.

Date of Government Version: 12/05/2005
Date Data Arrived at EDR: 02/29/2008
Date Made Active in Reports: 04/18/2008
Number of Days to Update: 49

Source: USGS
Telephone: 703-648-7709
Last EDR Contact: 12/04/2015
Next Scheduled EDR Contact: 03/14/2016
Data Release Frequency: Varies

US MINES 3: Active Mines & Mineral Plants Database Listing

Active Mines and Mineral Processing Plant operations for commodities monitored by the Minerals Information Team of the USGS.

Date of Government Version: 04/14/2011
Date Data Arrived at EDR: 06/08/2011
Date Made Active in Reports: 09/13/2011
Number of Days to Update: 97

Source: USGS
Telephone: 703-648-7709
Last EDR Contact: 12/04/2015
Next Scheduled EDR Contact: 03/14/2016
Data Release Frequency: Varies

FINDS: Facility Index System/Facility Registry System

Facility Index System. FINDS contains both facility information and 'pointers' to other sources that contain more detail. EDR includes the following FINDS databases in this report: PCS (Permit Compliance System), AIRS (Aerometric Information Retrieval System), DOCKET (Enforcement Docket used to manage and track information on civil judicial enforcement cases for all environmental statutes), FURS (Federal Underground Injection Control), C-DOCKET (Criminal Docket System used to track criminal enforcement actions for all environmental statutes), FFIS (Federal Facilities Information System), STATE (State Environmental Laws and Statutes), and PADS (PCB Activity Data System).

Date of Government Version: 07/20/2015
Date Data Arrived at EDR: 09/09/2015
Date Made Active in Reports: 11/03/2015
Number of Days to Update: 55

Source: EPA
Telephone: (415) 947-8000
Last EDR Contact: 12/10/2015
Next Scheduled EDR Contact: 03/21/2016
Data Release Frequency: Quarterly

CA BOND EXP. PLAN: Bond Expenditure Plan

Department of Health Services developed a site-specific expenditure plan as the basis for an appropriation of Hazardous Substance Cleanup Bond Act funds. It is not updated.

Date of Government Version: 01/01/1989
Date Data Arrived at EDR: 07/27/1994
Date Made Active in Reports: 08/02/1994
Number of Days to Update: 6

Source: Department of Health Services
Telephone: 916-255-2118
Last EDR Contact: 05/31/1994
Next Scheduled EDR Contact: N/A
Data Release Frequency: No Update Planned

CORTESE: "Cortese" Hazardous Waste & Substances Sites List

The sites for the list are designated by the State Water Resource Control Board (LUST), the Integrated Waste Board (SWF/LS), and the Department of Toxic Substances Control (Cal-Sites).

Date of Government Version: 09/28/2015
Date Data Arrived at EDR: 09/29/2015
Date Made Active in Reports: 11/05/2015
Number of Days to Update: 37

Source: CAL EPA/Office of Emergency Information
Telephone: 916-323-3400
Last EDR Contact: 09/29/2015
Next Scheduled EDR Contact: 01/11/2016
Data Release Frequency: Quarterly

DRYCLEANERS: Cleaner Facilities

A list of drycleaner related facilities that have EPA ID numbers. These are facilities with certain SIC codes: power laundries, family and commercial; garment pressing and cleaner's agents; linen supply; coin-operated laundries and cleaning; drycleaning plants, except rugs; carpet and upholster cleaning; industrial launderers; laundry and garment services.

Date of Government Version: 08/10/2015
Date Data Arrived at EDR: 08/27/2015
Date Made Active in Reports: 10/01/2015
Number of Days to Update: 35

Source: Department of Toxic Substance Control
Telephone: 916-327-4498
Last EDR Contact: 12/04/2015
Next Scheduled EDR Contact: 03/21/2016
Data Release Frequency: Annually

EMI: Emissions Inventory Data

Toxics and criteria pollutant emissions data collected by the ARB and local air pollution agencies.

Date of Government Version: 12/31/2013
Date Data Arrived at EDR: 09/25/2015
Date Made Active in Reports: 11/05/2015
Number of Days to Update: 41

Source: California Air Resources Board
Telephone: 916-322-2990
Last EDR Contact: 09/25/2015
Next Scheduled EDR Contact: 01/04/2016
Data Release Frequency: Varies

ENF: Enforcement Action Listing

A listing of Water Board Enforcement Actions. Formal is everything except Oral/Verbal Communication, Notice of Violation, Expedited Payment Letter, and Staff Enforcement Letter.

Date of Government Version: 08/24/2015
Date Data Arrived at EDR: 08/26/2015
Date Made Active in Reports: 10/01/2015
Number of Days to Update: 36

Source: State Water Resoruces Control Board
Telephone: 916-445-9379
Last EDR Contact: 11/18/2015
Next Scheduled EDR Contact: 02/08/2016
Data Release Frequency: Varies

Financial Assurance 1: Financial Assurance Information Listing

Financial Assurance information

Date of Government Version: 08/03/2015
Date Data Arrived at EDR: 08/06/2015
Date Made Active in Reports: 09/03/2015
Number of Days to Update: 28

Source: Department of Toxic Substances Control
Telephone: 916-255-3628
Last EDR Contact: 10/26/2015
Next Scheduled EDR Contact: 02/08/2016
Data Release Frequency: Varies

Financial Assurance 2: Financial Assurance Information Listing

A listing of financial assurance information for solid waste facilities. Financial assurance is intended to ensure that resources are available to pay for the cost of closure, post-closure care, and corrective measures if the owner or operator of a regulated facility is unable or unwilling to pay.

Date of Government Version: 08/17/2015
Date Data Arrived at EDR: 08/18/2015
Date Made Active in Reports: 09/03/2015
Number of Days to Update: 16

Source: California Integrated Waste Management Board
Telephone: 916-341-6066
Last EDR Contact: 11/13/2015
Next Scheduled EDR Contact: 02/29/2016
Data Release Frequency: Varies

HAZNET: Facility and Manifest Data

Facility and Manifest Data. The data is extracted from the copies of hazardous waste manifests received each year by the DTSC. The annual volume of manifests is typically 700,000 - 1,000,000 annually, representing approximately 350,000 - 500,000 shipments. Data are from the manifests submitted without correction, and therefore many contain some invalid values for data elements such as generator ID, TSD ID, waste category, and disposal method. This database begins with calendar year 1993.

Date of Government Version: 12/31/2013
Date Data Arrived at EDR: 10/15/2014
Date Made Active in Reports: 11/19/2014
Number of Days to Update: 35

Source: California Environmental Protection Agency
Telephone: 916-255-1136
Last EDR Contact: 10/14/2015
Next Scheduled EDR Contact: 01/25/2016
Data Release Frequency: Annually

HIST CORTESE: Hazardous Waste & Substance Site List

The sites for the list are designated by the State Water Resource Control Board [LUST], the Integrated Waste Board [SWF/LS], and the Department of Toxic Substances Control [CALSITES]. This listing is no longer updated by the state agency.

Date of Government Version: 04/01/2001
Date Data Arrived at EDR: 01/22/2009
Date Made Active in Reports: 04/08/2009
Number of Days to Update: 76

Source: Department of Toxic Substances Control
Telephone: 916-323-3400
Last EDR Contact: 01/22/2009
Next Scheduled EDR Contact: N/A
Data Release Frequency: No Update Planned

HWP: EnviroStor Permitted Facilities Listing

Detailed information on permitted hazardous waste facilities and corrective action ("cleanups") tracked in EnviroStor.

Date of Government Version: 08/24/2015
Date Data Arrived at EDR: 08/26/2015
Date Made Active in Reports: 10/01/2015
Number of Days to Update: 36

Source: Department of Toxic Substances Control
Telephone: 916-323-3400
Last EDR Contact: 11/24/2015
Next Scheduled EDR Contact: 03/07/2016
Data Release Frequency: Quarterly

HWT: Registered Hazardous Waste Transporter Database

A listing of hazardous waste transporters. In California, unless specifically exempted, it is unlawful for any person to transport hazardous wastes unless the person holds a valid registration issued by DTSC. A hazardous waste transporter registration is valid for one year and is assigned a unique registration number.

Date of Government Version: 07/27/2015
Date Data Arrived at EDR: 10/14/2015
Date Made Active in Reports: 11/19/2015
Number of Days to Update: 36

Source: Department of Toxic Substances Control
Telephone: 916-440-7145
Last EDR Contact: 10/14/2015
Next Scheduled EDR Contact: 01/25/2016
Data Release Frequency: Quarterly

MINES: Mines Site Location Listing

A listing of mine site locations from the Office of Mine Reclamation.

Date of Government Version: 09/14/2015
Date Data Arrived at EDR: 09/15/2015
Date Made Active in Reports: 10/14/2015
Number of Days to Update: 29

Source: Department of Conservation
Telephone: 916-322-1080
Last EDR Contact: 09/15/2015
Next Scheduled EDR Contact: 12/28/2015
Data Release Frequency: Varies

MWMP: Medical Waste Management Program Listing

The Medical Waste Management Program (MWMP) ensures the proper handling and disposal of medical waste by permitting and inspecting medical waste Offsite Treatment Facilities (PDF) and Transfer Stations (PDF) throughout the state. MWMP also oversees all Medical Waste Transporters.

Date of Government Version: 09/03/2015
Date Data Arrived at EDR: 09/09/2015
Date Made Active in Reports: 10/12/2015
Number of Days to Update: 33

Source: Department of Public Health
Telephone: 916-558-1784
Last EDR Contact: 12/08/2015
Next Scheduled EDR Contact: 03/21/2016
Data Release Frequency: Varies

NPDES: NPDES Permits Listing

A listing of NPDES permits, including stormwater.

Date of Government Version: 08/17/2015
Date Data Arrived at EDR: 08/18/2015
Date Made Active in Reports: 09/11/2015
Number of Days to Update: 24

Source: State Water Resources Control Board
Telephone: 916-445-9379
Last EDR Contact: 11/18/2015
Next Scheduled EDR Contact: 02/29/2016
Data Release Frequency: Quarterly

PEST LIC: Pesticide Regulation Licenses Listing

A listing of licenses and certificates issued by the Department of Pesticide Regulation. The DPR issues licenses and/or certificates to: Persons and businesses that apply or sell pesticides; Pest control dealers and brokers; Persons who advise on agricultural pesticide applications.

Date of Government Version: 09/08/2015
Date Data Arrived at EDR: 09/09/2015
Date Made Active in Reports: 10/12/2015
Number of Days to Update: 33

Source: Department of Pesticide Regulation
Telephone: 916-445-4038
Last EDR Contact: 12/08/2015
Next Scheduled EDR Contact: 03/21/2016
Data Release Frequency: Quarterly

PROC: Certified Processors Database

A listing of certified processors.

Date of Government Version: 09/14/2015
Date Data Arrived at EDR: 09/15/2015
Date Made Active in Reports: 10/14/2015
Number of Days to Update: 29

Source: Department of Conservation
Telephone: 916-323-3836
Last EDR Contact: 09/15/2015
Next Scheduled EDR Contact: 12/28/2015
Data Release Frequency: Quarterly

NOTIFY 65: Proposition 65 Records

Listings of all Proposition 65 incidents reported to counties by the State Water Resources Control Board and the Regional Water Quality Control Board. This database is no longer updated by the reporting agency.

Date of Government Version: 08/04/2015
Date Data Arrived at EDR: 08/25/2015
Date Made Active in Reports: 10/05/2015
Number of Days to Update: 41

Source: State Water Resources Control Board
Telephone: 916-445-3846
Last EDR Contact: 11/16/2015
Next Scheduled EDR Contact: 01/04/2016
Data Release Frequency: No Update Planned

UIC: UIC Listing

A listing of wells identified as underground injection wells, in the California Oil and Gas Wells database.

Date of Government Version: 07/23/2015
Date Data Arrived at EDR: 09/15/2015
Date Made Active in Reports: 10/13/2015
Number of Days to Update: 28

Source: Deaprtment of Conservation
Telephone: 916-445-2408
Last EDR Contact: 09/15/2015
Next Scheduled EDR Contact: 12/28/2015
Data Release Frequency: Varies

WASTEWATER PITS: Oil Wastewater Pits Listing

Water officials discovered that oil producers have been dumping chemical-laden wastewater into hundreds of unlined pits that are operating without proper permits. Inspections completed by the Central Valley Regional Water Quality Control Board revealed the existence of previously unidentified waste sites. The water board?s review found that more than one-third of the region?s active disposal pits are operating without permission.

Date of Government Version: 04/15/2015
Date Data Arrived at EDR: 04/17/2015
Date Made Active in Reports: 06/23/2015
Number of Days to Update: 67

Source: RWQCB, Central Valley Region
Telephone: 559-445-5577
Last EDR Contact: 10/16/2015
Next Scheduled EDR Contact: 01/25/2016
Data Release Frequency: Varies

WDS: Waste Discharge System

Sites which have been issued waste discharge requirements.

Date of Government Version: 06/19/2007
Date Data Arrived at EDR: 06/20/2007
Date Made Active in Reports: 06/29/2007
Number of Days to Update: 9

Source: State Water Resources Control Board
Telephone: 916-341-5227
Last EDR Contact: 11/18/2015
Next Scheduled EDR Contact: 03/07/2016
Data Release Frequency: Quarterly

WIP: Well Investigation Program Case List
Well Investigation Program case in the San Gabriel and San Fernando Valley area.

Date of Government Version: 07/03/2009
Date Data Arrived at EDR: 07/21/2009
Date Made Active in Reports: 08/03/2009
Number of Days to Update: 13

Source: Los Angeles Water Quality Control Board
Telephone: 213-576-6726
Last EDR Contact: 09/28/2015
Next Scheduled EDR Contact: 01/11/2016
Data Release Frequency: Varies

EDR HIGH RISK HISTORICAL RECORDS

EDR Exclusive Records

EDR MGP: EDR Proprietary Manufactured Gas Plants
The EDR Proprietary Manufactured Gas Plant Database includes records of coal gas plants (manufactured gas plants) compiled by EDR's researchers. Manufactured gas sites were used in the United States from the 1800's to 1950's to produce a gas that could be distributed and used as fuel. These plants used whale oil, rosin, coal, or a mixture of coal, oil, and water that also produced a significant amount of waste. Many of the byproducts of the gas production, such as coal tar (oily waste containing volatile and non-volatile chemicals), sludges, oils and other compounds are potentially hazardous to human health and the environment. The byproduct from this process was frequently disposed of directly at the plant site and can remain or spread slowly, serving as a continuous source of soil and groundwater contamination.

Date of Government Version: N/A
Date Data Arrived at EDR: N/A
Date Made Active in Reports: N/A
Number of Days to Update: N/A

Source: EDR, Inc.
Telephone: N/A
Last EDR Contact: N/A
Next Scheduled EDR Contact: N/A
Data Release Frequency: No Update Planned

EDR Hist Auto: EDR Exclusive Historic Gas Stations
EDR has searched selected national collections of business directories and has collected listings of potential gas station/filling station/service station sites that were available to EDR researchers. EDR's review was limited to those categories of sources that might, in EDR's opinion, include gas station/filling station/service station establishments. The categories reviewed included, but were not limited to gas, gas station, gasoline station, filling station, auto, automobile repair, auto service station, service station, etc. This database falls within a category of information EDR classifies as "High Risk Historical Records", or HRHR. EDR's HRHR effort presents unique and sometimes proprietary data about past sites and operations that typically create environmental concerns, but may not show up in current government records searches.

Date of Government Version: N/A
Date Data Arrived at EDR: N/A
Date Made Active in Reports: N/A
Number of Days to Update: N/A

Source: EDR, Inc.
Telephone: N/A
Last EDR Contact: N/A
Next Scheduled EDR Contact: N/A
Data Release Frequency: Varies

EDR Hist Cleaner: EDR Exclusive Historic Dry Cleaners
EDR has searched selected national collections of business directories and has collected listings of potential dry cleaner sites that were available to EDR researchers. EDR's review was limited to those categories of sources that might, in EDR's opinion, include dry cleaning establishments. The categories reviewed included, but were not limited to dry cleaners, cleaners, laundry, laundromat, cleaning/laundry, wash & dry etc. This database falls within a category of information EDR classifies as "High Risk Historical Records", or HRHR. EDR's HRHR effort presents unique and sometimes proprietary data about past sites and operations that typically create environmental concerns, but may not show up in current government records searches.

Date of Government Version: N/A
Date Data Arrived at EDR: N/A
Date Made Active in Reports: N/A
Number of Days to Update: N/A

Source: EDR, Inc.
Telephone: N/A
Last EDR Contact: N/A
Next Scheduled EDR Contact: N/A
Data Release Frequency: Varies

EDR RECOVERED GOVERNMENT ARCHIVES

Exclusive Recovered Govt. Archives

RGA LF: Recovered Government Archive Solid Waste Facilities List

The EDR Recovered Government Archive Landfill database provides a list of landfills derived from historical databases and includes many records that no longer appear in current government lists. Compiled from Records formerly available from the Department of Resources Recycling and Recovery in California.

Date of Government Version: N/A
Date Data Arrived at EDR: 07/01/2013
Date Made Active in Reports: 01/13/2014
Number of Days to Update: 196

Source: Department of Resources Recycling and Recovery
Telephone: N/A
Last EDR Contact: 06/01/2012
Next Scheduled EDR Contact: N/A
Data Release Frequency: Varies

RGA LUST: Recovered Government Archive Leaking Underground Storage Tank

The EDR Recovered Government Archive Leaking Underground Storage Tank database provides a list of LUST incidents derived from historical databases and includes many records that no longer appear in current government lists. Compiled from Records formerly available from the State Water Resources Control Board in California.

Date of Government Version: N/A
Date Data Arrived at EDR: 07/01/2013
Date Made Active in Reports: 12/30/2013
Number of Days to Update: 182

Source: State Water Resources Control Board
Telephone: N/A
Last EDR Contact: 06/01/2012
Next Scheduled EDR Contact: N/A
Data Release Frequency: Varies

COUNTY RECORDS

ALAMEDA COUNTY:

Contaminated Sites

A listing of contaminated sites overseen by the Toxic Release Program (oil and groundwater contamination from chemical releases and spills) and the Leaking Underground Storage Tank Program (soil and ground water contamination from leaking petroleum USTs).

Date of Government Version: 10/09/2015
Date Data Arrived at EDR: 10/13/2015
Date Made Active in Reports: 11/16/2015
Number of Days to Update: 34

Source: Alameda County Environmental Health Services
Telephone: 510-567-6700
Last EDR Contact: 10/09/2015
Next Scheduled EDR Contact: 01/25/2016
Data Release Frequency: Semi-Annually

Underground Tanks

Underground storage tank sites located in Alameda county.

Date of Government Version: 10/09/2015
Date Data Arrived at EDR: 10/13/2015
Date Made Active in Reports: 11/19/2015
Number of Days to Update: 37

Source: Alameda County Environmental Health Services
Telephone: 510-567-6700
Last EDR Contact: 10/09/2015
Next Scheduled EDR Contact: 01/25/2016
Data Release Frequency: Semi-Annually

AMADOR COUNTY:

CUPA Facility List
Cupa Facility List

Date of Government Version: 08/24/2015
Date Data Arrived at EDR: 09/08/2015
Date Made Active in Reports: 10/13/2015
Number of Days to Update: 35

Source: Amador County Environmental Health
Telephone: 209-223-6439
Last EDR Contact: 12/04/2015
Next Scheduled EDR Contact: 03/21/2016
Data Release Frequency: Varies

BUTTE COUNTY:

CUPA Facility Listing
Cupa facility list.

Date of Government Version: 11/20/2014
Date Data Arrived at EDR: 11/24/2014
Date Made Active in Reports: 01/07/2015
Number of Days to Update: 44

Source: Public Health Department
Telephone: 530-538-7149
Last EDR Contact: 11/23/2015
Next Scheduled EDR Contact: 01/25/2016
Data Release Frequency: No Update Planned

CALVERAS COUNTY:

CUPA Facility Listing
Cupa Facility Listing

Date of Government Version: 10/22/2015
Date Data Arrived at EDR: 10/23/2015
Date Made Active in Reports: 11/16/2015
Number of Days to Update: 24

Source: Calveras County Environmental Health
Telephone: 209-754-6399
Last EDR Contact: 09/28/2015
Next Scheduled EDR Contact: 01/11/2016
Data Release Frequency: Quarterly

COLUSA COUNTY:

CUPA Facility List
Cupa facility list.

Date of Government Version: 06/08/2015
Date Data Arrived at EDR: 09/22/2015
Date Made Active in Reports: 10/14/2015
Number of Days to Update: 22

Source: Health & Human Services
Telephone: 530-458-0396
Last EDR Contact: 11/09/2015
Next Scheduled EDR Contact: 02/22/2016
Data Release Frequency: Varies

CONTRA COSTA COUNTY:

Site List
List includes sites from the underground tank, hazardous waste generator and business plan/2185 programs.

Date of Government Version: 08/24/2015
Date Data Arrived at EDR: 08/25/2015
Date Made Active in Reports: 10/01/2015
Number of Days to Update: 37

Source: Contra Costa Health Services Department
Telephone: 925-646-2286
Last EDR Contact: 11/07/2015
Next Scheduled EDR Contact: 02/15/2016
Data Release Frequency: Semi-Annually

DEL NORTE COUNTY:

CUPA Facility List
Cupa Facility list

Date of Government Version: 05/20/2015
Date Data Arrived at EDR: 08/03/2015
Date Made Active in Reports: 09/03/2015
Number of Days to Update: 31

Source: Del Norte County Environmental Health Division
Telephone: 707-465-0426
Last EDR Contact: 11/13/2015
Next Scheduled EDR Contact: 02/15/2016
Data Release Frequency: Varies

EL DORADO COUNTY:

CUPA Facility List
CUPA facility list.

Date of Government Version: 09/23/2015
Date Data Arrived at EDR: 09/25/2015
Date Made Active in Reports: 10/15/2015
Number of Days to Update: 20

Source: El Dorado County Environmental Management Department
Telephone: 530-621-6623
Last EDR Contact: 11/07/2015
Next Scheduled EDR Contact: 02/15/2016
Data Release Frequency: Varies

FRESNO COUNTY:

CUPA Resources List
Certified Unified Program Agency. CUPA's are responsible for implementing a unified hazardous materials and hazardous waste management regulatory program. The agency provides oversight of businesses that deal with hazardous materials, operate underground storage tanks or aboveground storage tanks.

Date of Government Version: 10/15/2015
Date Data Arrived at EDR: 10/15/2015
Date Made Active in Reports: 11/16/2015
Number of Days to Update: 32

Source: Dept. of Community Health
Telephone: 559-445-3271
Last EDR Contact: 10/05/2015
Next Scheduled EDR Contact: 01/18/2016
Data Release Frequency: Semi-Annually

HUMBOLDT COUNTY:

CUPA Facility List
CUPA facility list.

Date of Government Version: 08/04/2015
Date Data Arrived at EDR: 08/07/2015
Date Made Active in Reports: 09/03/2015
Number of Days to Update: 27

Source: Humboldt County Environmental Health
Telephone: N/A
Last EDR Contact: 11/12/2015
Next Scheduled EDR Contact: 12/07/2015
Data Release Frequency: Varies

IMPERIAL COUNTY:

CUPA Facility List
Cupa facility list.

Date of Government Version: 08/11/2015
Date Data Arrived at EDR: 08/14/2015
Date Made Active in Reports: 09/03/2015
Number of Days to Update: 20

Source: San Diego Border Field Office
Telephone: 760-339-2777
Last EDR Contact: 10/26/2015
Next Scheduled EDR Contact: 02/08/2016
Data Release Frequency: Varies

INYO COUNTY:

CUPA Facility List
Cupa facility list.

Date of Government Version: 09/10/2013
Date Data Arrived at EDR: 09/11/2013
Date Made Active in Reports: 10/14/2013
Number of Days to Update: 33

Source: Inyo County Environmental Health Services
Telephone: 760-878-0238
Last EDR Contact: 11/18/2015
Next Scheduled EDR Contact: 03/07/2016
Data Release Frequency: Varies

KERN COUNTY:

Underground Storage Tank Sites & Tank Listing
Kern County Sites and Tanks Listing.

Date of Government Version: 05/19/2015
Date Data Arrived at EDR: 06/18/2015
Date Made Active in Reports: 07/22/2015
Number of Days to Update: 34

Source: Kern County Environment Health Services Department
Telephone: 661-862-8700
Last EDR Contact: 11/18/2015
Next Scheduled EDR Contact: 02/22/2016
Data Release Frequency: Quarterly

KINGS COUNTY:

CUPA Facility List
A listing of sites included in the county's Certified Unified Program Agency database. California's Secretary for Environmental Protection established the unified hazardous materials and hazardous waste regulatory program as required by chapter 6.11 of the California Health and Safety Code. The Unified Program consolidates the administration, permits, inspections, and enforcement activities.

Date of Government Version: 08/25/2015
Date Data Arrived at EDR: 08/27/2015
Date Made Active in Reports: 09/30/2015
Number of Days to Update: 34

Source: Kings County Department of Public Health
Telephone: 559-584-1411
Last EDR Contact: 11/18/2015
Next Scheduled EDR Contact: 03/07/2016
Data Release Frequency: Varies

LAKE COUNTY:

CUPA Facility List
Cupa facility list

Date of Government Version: 08/11/2015
Date Data Arrived at EDR: 08/14/2015
Date Made Active in Reports: 09/03/2015
Number of Days to Update: 20

Source: Lake County Environmental Health
Telephone: 707-263-1164
Last EDR Contact: 10/19/2015
Next Scheduled EDR Contact: 02/01/2016
Data Release Frequency: Varies

LOS ANGELES COUNTY:

San Gabriel Valley Areas of Concern
San Gabriel Valley areas where VOC contamination is at or above the MCL as designated by region 9 EPA office.

Date of Government Version: 03/30/2009
Date Data Arrived at EDR: 03/31/2009
Date Made Active in Reports: 10/23/2009
Number of Days to Update: 206

Source: EPA Region 9
Telephone: 415-972-3178
Last EDR Contact: 09/21/2015
Next Scheduled EDR Contact: 01/04/2016
Data Release Frequency: No Update Planned

HMS: Street Number List
Industrial Waste and Underground Storage Tank Sites.

Date of Government Version: 11/24/2014
Date Data Arrived at EDR: 01/30/2015
Date Made Active in Reports: 03/04/2015
Number of Days to Update: 33

Source: Department of Public Works
Telephone: 626-458-3517
Last EDR Contact: 10/09/2015
Next Scheduled EDR Contact: 01/25/2016
Data Release Frequency: Semi-Annually

List of Solid Waste Facilities
Solid Waste Facilities in Los Angeles County.

Date of Government Version: 10/19/2015
Date Data Arrived at EDR: 10/20/2015
Date Made Active in Reports: 11/19/2015
Number of Days to Update: 30

Source: La County Department of Public Works
Telephone: 818-458-5185
Last EDR Contact: 10/20/2015
Next Scheduled EDR Contact: 02/01/2016
Data Release Frequency: Varies

City of Los Angeles Landfills
Landfills owned and maintained by the City of Los Angeles.

Date of Government Version: 01/01/2015
Date Data Arrived at EDR: 07/27/2015
Date Made Active in Reports: 08/10/2015
Number of Days to Update: 14

Source: Engineering & Construction Division
Telephone: 213-473-7869
Last EDR Contact: 10/19/2015
Next Scheduled EDR Contact: 02/01/2016
Data Release Frequency: Varies

Site Mitigation List
Industrial sites that have had some sort of spill or complaint.

Date of Government Version: 01/15/2015
Date Data Arrived at EDR: 01/29/2015
Date Made Active in Reports: 03/10/2015
Number of Days to Update: 40

Source: Community Health Services
Telephone: 323-890-7806
Last EDR Contact: 10/19/2015
Next Scheduled EDR Contact: 02/01/2016
Data Release Frequency: Annually

City of El Segundo Underground Storage Tank
Underground storage tank sites located in El Segundo city.

Date of Government Version: 03/30/2015
Date Data Arrived at EDR: 04/02/2015
Date Made Active in Reports: 04/13/2015
Number of Days to Update: 11

Source: City of El Segundo Fire Department
Telephone: 310-524-2236
Last EDR Contact: 10/19/2015
Next Scheduled EDR Contact: 02/01/2016
Data Release Frequency: Semi-Annually

City of Long Beach Underground Storage Tank
Underground storage tank sites located in the city of Long Beach.

Date of Government Version: 03/03/2015
Date Data Arrived at EDR: 05/26/2015
Date Made Active in Reports: 06/11/2015
Number of Days to Update: 16

Source: City of Long Beach Fire Department
Telephone: 562-570-2563
Last EDR Contact: 10/26/2015
Next Scheduled EDR Contact: 02/08/2016
Data Release Frequency: Annually

City of Torrance Underground Storage Tank
Underground storage tank sites located in the city of Torrance.

Date of Government Version: 10/13/2015
Date Data Arrived at EDR: 10/14/2015
Date Made Active in Reports: 12/01/2015
Number of Days to Update: 48

Source: City of Torrance Fire Department
Telephone: 310-618-2973
Last EDR Contact: 10/09/2015
Next Scheduled EDR Contact: 01/25/2016
Data Release Frequency: Semi-Annually

MADERA COUNTY:

CUPA Facility List

A listing of sites included in the county's Certified Unified Program Agency database. California's Secretary for Environmental Protection established the unified hazardous materials and hazardous waste regulatory program as required by chapter 6.11 of the California Health and Safety Code. The Unified Program consolidates the administration, permits, inspections, and enforcement activities.

Date of Government Version: 09/15/2015
Date Data Arrived at EDR: 09/17/2015
Date Made Active in Reports: 10/14/2015
Number of Days to Update: 27

Source: Madera County Environmental Health
Telephone: 559-675-7823
Last EDR Contact: 11/18/2015
Next Scheduled EDR Contact: 03/07/2016
Data Release Frequency: Varies

MARIN COUNTY:

Underground Storage Tank Sites

Currently permitted USTs in Marin County.

Date of Government Version: 10/05/2015
Date Data Arrived at EDR: 10/08/2015
Date Made Active in Reports: 10/15/2015
Number of Days to Update: 7

Source: Public Works Department Waste Management
Telephone: 415-499-6647
Last EDR Contact: 10/05/2015
Next Scheduled EDR Contact: 01/18/2016
Data Release Frequency: Semi-Annually

MERCED COUNTY:

CUPA Facility List

CUPA facility list.

Date of Government Version: 09/21/2015
Date Data Arrived at EDR: 09/22/2015
Date Made Active in Reports: 11/03/2015
Number of Days to Update: 42

Source: Merced County Environmental Health
Telephone: 209-381-1094
Last EDR Contact: 12/10/2015
Next Scheduled EDR Contact: 03/07/2016
Data Release Frequency: Varies

MONO COUNTY:

CUPA Facility List

CUPA Facility List

Date of Government Version: 09/02/2015
Date Data Arrived at EDR: 09/04/2015
Date Made Active in Reports: 10/13/2015
Number of Days to Update: 39

Source: Mono County Health Department
Telephone: 760-932-5580
Last EDR Contact: 11/23/2015
Next Scheduled EDR Contact: 03/14/2016
Data Release Frequency: Varies

MONTEREY COUNTY:

CUPA Facility Listing

CUPA Program listing from the Environmental Health Division.

Date of Government Version: 06/30/2015
Date Data Arrived at EDR: 07/07/2015
Date Made Active in Reports: 07/16/2015
Number of Days to Update: 9

Source: Monterey County Health Department
Telephone: 831-796-1297
Last EDR Contact: 11/18/2015
Next Scheduled EDR Contact: 03/07/2016
Data Release Frequency: Varies

NAPA COUNTY:

Sites With Reported Contamination

A listing of leaking underground storage tank sites located in Napa county.

Date of Government Version: 12/05/2011
Date Data Arrived at EDR: 12/06/2011
Date Made Active in Reports: 02/07/2012
Number of Days to Update: 63

Source: Napa County Department of Environmental Management
Telephone: 707-253-4269
Last EDR Contact: 11/23/2015
Next Scheduled EDR Contact: 03/14/2016
Data Release Frequency: No Update Planned

Closed and Operating Underground Storage Tank Sites

Underground storage tank sites located in Napa county.

Date of Government Version: 01/15/2008
Date Data Arrived at EDR: 01/16/2008
Date Made Active in Reports: 02/08/2008
Number of Days to Update: 23

Source: Napa County Department of Environmental Management
Telephone: 707-253-4269
Last EDR Contact: 11/23/2015
Next Scheduled EDR Contact: 03/14/2016
Data Release Frequency: No Update Planned

NEVADA COUNTY:

CUPA Facility List

CUPA facility list.

Date of Government Version: 06/03/2015
Date Data Arrived at EDR: 06/04/2015
Date Made Active in Reports: 07/22/2015
Number of Days to Update: 48

Source: Community Development Agency
Telephone: 530-265-1467
Last EDR Contact: 11/06/2015
Next Scheduled EDR Contact: 02/15/2016
Data Release Frequency: Varies

ORANGE COUNTY:

List of Industrial Site Cleanups

Petroleum and non-petroleum spills.

Date of Government Version: 08/01/2015
Date Data Arrived at EDR: 08/10/2015
Date Made Active in Reports: 09/03/2015
Number of Days to Update: 24

Source: Health Care Agency
Telephone: 714-834-3446
Last EDR Contact: 11/10/2015
Next Scheduled EDR Contact: 02/22/2016
Data Release Frequency: Annually

List of Underground Storage Tank Cleanups

Orange County Underground Storage Tank Cleanups (LUST).

Date of Government Version: 08/03/2015
Date Data Arrived at EDR: 08/10/2015
Date Made Active in Reports: 09/11/2015
Number of Days to Update: 32

Source: Health Care Agency
Telephone: 714-834-3446
Last EDR Contact: 11/10/2015
Next Scheduled EDR Contact: 02/22/2016
Data Release Frequency: Quarterly

List of Underground Storage Tank Facilities

Orange County Underground Storage Tank Facilities (UST).

Date of Government Version: 08/01/2015
Date Data Arrived at EDR: 08/11/2015
Date Made Active in Reports: 09/03/2015
Number of Days to Update: 23

Source: Health Care Agency
Telephone: 714-834-3446
Last EDR Contact: 11/11/2015
Next Scheduled EDR Contact: 02/22/2016
Data Release Frequency: Quarterly

PLACER COUNTY:

Master List of Facilities

List includes aboveground tanks, underground tanks and cleanup sites.

Date of Government Version: 09/08/2015
Date Data Arrived at EDR: 09/08/2015
Date Made Active in Reports: 10/14/2015
Number of Days to Update: 36

Source: Placer County Health and Human Services
Telephone: 530-745-2363
Last EDR Contact: 12/04/2015
Next Scheduled EDR Contact: 03/21/2016
Data Release Frequency: Semi-Annually

RIVERSIDE COUNTY:

Listing of Underground Tank Cleanup Sites

Riverside County Underground Storage Tank Cleanup Sites (LUST).

Date of Government Version: 10/26/2015
Date Data Arrived at EDR: 10/28/2015
Date Made Active in Reports: 11/19/2015
Number of Days to Update: 22

Source: Department of Environmental Health
Telephone: 951-358-5055
Last EDR Contact: 09/21/2015
Next Scheduled EDR Contact: 01/04/2016
Data Release Frequency: Quarterly

Underground Storage Tank Tank List

Underground storage tank sites located in Riverside county.

Date of Government Version: 10/26/2015
Date Data Arrived at EDR: 10/28/2015
Date Made Active in Reports: 11/19/2015
Number of Days to Update: 22

Source: Department of Environmental Health
Telephone: 951-358-5055
Last EDR Contact: 09/21/2015
Next Scheduled EDR Contact: 01/04/2016
Data Release Frequency: Quarterly

SACRAMENTO COUNTY:

Toxic Site Clean-Up List

List of sites where unauthorized releases of potentially hazardous materials have occurred.

Date of Government Version: 08/03/2015
Date Data Arrived at EDR: 10/06/2015
Date Made Active in Reports: 11/16/2015
Number of Days to Update: 41

Source: Sacramento County Environmental Management
Telephone: 916-875-8406
Last EDR Contact: 10/06/2015
Next Scheduled EDR Contact: 01/18/2016
Data Release Frequency: Quarterly

Master Hazardous Materials Facility List

Any business that has hazardous materials on site - hazardous material storage sites, underground storage tanks, waste generators.

Date of Government Version: 08/03/2015
Date Data Arrived at EDR: 10/06/2015
Date Made Active in Reports: 11/06/2015
Number of Days to Update: 31

Source: Sacramento County Environmental Management
Telephone: 916-875-8406
Last EDR Contact: 10/06/2015
Next Scheduled EDR Contact: 01/18/2016
Data Release Frequency: Quarterly

SAN BERNARDINO COUNTY:

Hazardous Material Permits

This listing includes underground storage tanks, medical waste handlers/generators, hazardous materials handlers, hazardous waste generators, and waste oil generators/handlers.

Date of Government Version: 06/30/2015
Date Data Arrived at EDR: 07/07/2015
Date Made Active in Reports: 07/14/2015
Number of Days to Update: 7

Source: San Bernardino County Fire Department Hazardous Materials Division
Telephone: 909-387-3041
Last EDR Contact: 11/09/2015
Next Scheduled EDR Contact: 02/22/2016
Data Release Frequency: Quarterly

SAN DIEGO COUNTY:

Hazardous Materials Management Division Database

The database includes: HE58 - This report contains the business name, site address, business phone number, establishment 'H' permit number, type of permit, and the business status. HE17 - In addition to providing the same information provided in the HE58 listing, HE17 provides inspection dates, violations received by the establishment, hazardous waste generated, the quantity, method of storage, treatment/disposal of waste and the hauler, and information on underground storage tanks. Unauthorized Release List - Includes a summary of environmental contamination cases in San Diego County (underground tank cases, non-tank cases, groundwater contamination, and soil contamination are included.)

Date of Government Version: 09/23/2013
Date Data Arrived at EDR: 09/24/2013
Date Made Active in Reports: 10/17/2013
Number of Days to Update: 23

Source: Hazardous Materials Management Division
Telephone: 619-338-2268
Last EDR Contact: 12/04/2015
Next Scheduled EDR Contact: 03/21/2016
Data Release Frequency: Quarterly

Solid Waste Facilities

San Diego County Solid Waste Facilities.

Date of Government Version: 10/31/2014
Date Data Arrived at EDR: 11/21/2014
Date Made Active in Reports: 12/29/2014
Number of Days to Update: 38

Source: Department of Health Services
Telephone: 619-338-2209
Last EDR Contact: 10/26/2015
Next Scheduled EDR Contact: 02/08/2016
Data Release Frequency: Varies

Environmental Case Listing

The listing contains all underground tank release cases and projects pertaining to properties contaminated with hazardous substances that are actively under review by the Site Assessment and Mitigation Program.

Date of Government Version: 03/23/2010
Date Data Arrived at EDR: 06/15/2010
Date Made Active in Reports: 07/09/2010
Number of Days to Update: 24

Source: San Diego County Department of Environmental Health
Telephone: 619-338-2371
Last EDR Contact: 12/04/2015
Next Scheduled EDR Contact: 03/21/2016
Data Release Frequency: No Update Planned

SAN FRANCISCO COUNTY:

Local Oversite Facilities

A listing of leaking underground storage tank sites located in San Francisco county.

Date of Government Version: 09/19/2008
Date Data Arrived at EDR: 09/19/2008
Date Made Active in Reports: 09/29/2008
Number of Days to Update: 10

Source: Department Of Public Health San Francisco County
Telephone: 415-252-3920
Last EDR Contact: 11/09/2015
Next Scheduled EDR Contact: 02/22/2016
Data Release Frequency: Quarterly

Underground Storage Tank Information

Underground storage tank sites located in San Francisco county.

Date of Government Version: 11/29/2010
Date Data Arrived at EDR: 03/10/2011
Date Made Active in Reports: 03/15/2011
Number of Days to Update: 5

Source: Department of Public Health
Telephone: 415-252-3920
Last EDR Contact: 11/09/2015
Next Scheduled EDR Contact: 02/22/2016
Data Release Frequency: Quarterly

SAN JOAQUIN COUNTY:

San Joaquin Co. UST

A listing of underground storage tank locations in San Joaquin county.

Date of Government Version: 09/23/2015
Date Data Arrived at EDR: 09/25/2015
Date Made Active in Reports: 10/15/2015
Number of Days to Update: 20

Source: Environmental Health Department
Telephone: N/A
Last EDR Contact: 09/21/2015
Next Scheduled EDR Contact: 01/04/2016
Data Release Frequency: Semi-Annually

SAN LUIS OBISPO COUNTY:

CUPA Facility List

Cupa Facility List.

Date of Government Version: 08/25/2015
Date Data Arrived at EDR: 08/27/2015
Date Made Active in Reports: 09/30/2015
Number of Days to Update: 34

Source: San Luis Obispo County Public Health Department
Telephone: 805-781-5596
Last EDR Contact: 12/04/2015
Next Scheduled EDR Contact: 03/07/2016
Data Release Frequency: Varies

SAN MATEO COUNTY:

Business Inventory

List includes Hazardous Materials Business Plan, hazardous waste generators, and underground storage tanks.

Date of Government Version: 10/14/2015
Date Data Arrived at EDR: 10/15/2015
Date Made Active in Reports: 11/16/2015
Number of Days to Update: 32

Source: San Mateo County Environmental Health Services Division
Telephone: 650-363-1921
Last EDR Contact: 09/14/2015
Next Scheduled EDR Contact: 12/28/2015
Data Release Frequency: Annually

Fuel Leak List

A listing of leaking underground storage tank sites located in San Mateo county.

Date of Government Version: 09/16/2015
Date Data Arrived at EDR: 09/17/2015
Date Made Active in Reports: 11/05/2015
Number of Days to Update: 49

Source: San Mateo County Environmental Health Services Division
Telephone: 650-363-1921
Last EDR Contact: 12/10/2015
Next Scheduled EDR Contact: 03/28/2016
Data Release Frequency: Semi-Annually

SANTA BARBARA COUNTY:

CUPA Facility Listing

CUPA Program Listing from the Environmental Health Services division.

Date of Government Version: 09/08/2011
Date Data Arrived at EDR: 09/09/2011
Date Made Active in Reports: 10/07/2011
Number of Days to Update: 28

Source: Santa Barbara County Public Health Department
Telephone: 805-686-8167
Last EDR Contact: 11/18/2015
Next Scheduled EDR Contact: 03/07/2016
Data Release Frequency: Varies

SANTA CLARA COUNTY:

Cupa Facility List

Cupa facility list

Date of Government Version: 08/24/2015
Date Data Arrived at EDR: 08/28/2015
Date Made Active in Reports: 11/03/2015
Number of Days to Update: 67

Source: Department of Environmental Health
Telephone: 408-918-1973
Last EDR Contact: 11/18/2015
Next Scheduled EDR Contact: 03/07/2016
Data Release Frequency: Varies

HIST LUST - Fuel Leak Site Activity Report

A listing of open and closed leaking underground storage tanks. This listing is no longer updated by the county. Leaking underground storage tanks are now handled by the Department of Environmental Health.

Date of Government Version: 03/29/2005
Date Data Arrived at EDR: 03/30/2005
Date Made Active in Reports: 04/21/2005
Number of Days to Update: 22

Source: Santa Clara Valley Water District
Telephone: 408-265-2600
Last EDR Contact: 03/23/2009
Next Scheduled EDR Contact: 06/22/2009
Data Release Frequency: No Update Planned

LOP Listing

A listing of leaking underground storage tanks located in Santa Clara county.

Date of Government Version: 03/03/2014
Date Data Arrived at EDR: 03/05/2014
Date Made Active in Reports: 03/18/2014
Number of Days to Update: 13

Source: Department of Environmental Health
Telephone: 408-918-3417
Last EDR Contact: 11/23/2015
Next Scheduled EDR Contact: 03/14/2016
Data Release Frequency: Annually

Hazardous Material Facilities

Hazardous material facilities, including underground storage tank sites.

Date of Government Version: 08/10/2015
Date Data Arrived at EDR: 08/14/2015
Date Made Active in Reports: 09/03/2015
Number of Days to Update: 20

Source: City of San Jose Fire Department
Telephone: 408-535-7694
Last EDR Contact: 11/18/2015
Next Scheduled EDR Contact: 02/22/2016
Data Release Frequency: Annually

SANTA CRUZ COUNTY:

CUPA Facility List

CUPA facility listing.

Date of Government Version: 08/25/2015
Date Data Arrived at EDR: 08/26/2015
Date Made Active in Reports: 10/01/2015
Number of Days to Update: 36

Source: Santa Cruz County Environmental Health
Telephone: 831-464-2761
Last EDR Contact: 11/18/2015
Next Scheduled EDR Contact: 03/07/2016
Data Release Frequency: Varies

SHASTA COUNTY:

CUPA Facility List

Cupa Facility List.

Date of Government Version: 09/15/2015
Date Data Arrived at EDR: 09/17/2015
Date Made Active in Reports: 11/05/2015
Number of Days to Update: 49

Source: Shasta County Department of Resource Management
Telephone: 530-225-5789
Last EDR Contact: 11/18/2015
Next Scheduled EDR Contact: 03/07/2016
Data Release Frequency: Varies

SOLANO COUNTY:

Leaking Underground Storage Tanks
A listing of leaking underground storage tank sites located in Solano county.

Date of Government Version: 09/02/2015
Date Data Arrived at EDR: 09/17/2015
Date Made Active in Reports: 11/05/2015
Number of Days to Update: 49

Source: Solano County Department of Environmental Management
Telephone: 707-784-6770
Last EDR Contact: 09/10/2015
Next Scheduled EDR Contact: 12/28/2015
Data Release Frequency: Quarterly

Underground Storage Tanks
Underground storage tank sites located in Solano county.

Date of Government Version: 09/02/2015
Date Data Arrived at EDR: 09/18/2015
Date Made Active in Reports: 10/15/2015
Number of Days to Update: 27

Source: Solano County Department of Environmental Management
Telephone: 707-784-6770
Last EDR Contact: 12/10/2015
Next Scheduled EDR Contact: 03/28/2016
Data Release Frequency: Quarterly

SONOMA COUNTY:

Cupa Facility List
Cupa Facility list

Date of Government Version: 09/28/2015
Date Data Arrived at EDR: 09/30/2015
Date Made Active in Reports: 11/05/2015
Number of Days to Update: 36

Source: County of Sonoma Fire & Emergency Services Department
Telephone: 707-565-1174
Last EDR Contact: 09/28/2015
Next Scheduled EDR Contact: 01/11/2016
Data Release Frequency: Varies

Leaking Underground Storage Tank Sites
A listing of leaking underground storage tank sites located in Sonoma county.

Date of Government Version: 10/01/2015
Date Data Arrived at EDR: 10/02/2015
Date Made Active in Reports: 11/05/2015
Number of Days to Update: 34

Source: Department of Health Services
Telephone: 707-565-6565
Last EDR Contact: 09/28/2015
Next Scheduled EDR Contact: 01/11/2016
Data Release Frequency: Quarterly

SUTTER COUNTY:

Underground Storage Tanks
Underground storage tank sites located in Sutter county.

Date of Government Version: 06/05/2015
Date Data Arrived at EDR: 06/09/2015
Date Made Active in Reports: 07/06/2015
Number of Days to Update: 27

Source: Sutter County Department of Agriculture
Telephone: 530-822-7500
Last EDR Contact: 12/04/2015
Next Scheduled EDR Contact: 03/21/2016
Data Release Frequency: Semi-Annually

TUOLUMNE COUNTY:

CUPA Facility List
Cupa facility list

Date of Government Version: 07/13/2015
Date Data Arrived at EDR: 07/28/2015
Date Made Active in Reports: 08/03/2015
Number of Days to Update: 6

Source: Divison of Environmental Health
Telephone: 209-533-5633
Last EDR Contact: 10/26/2015
Next Scheduled EDR Contact: 02/08/2016
Data Release Frequency: Varies

VENTURA COUNTY:

Business Plan, Hazardous Waste Producers, and Operating Underground Tanks

The BWT list indicates by site address whether the Environmental Health Division has Business Plan (B), Waste Producer (W), and/or Underground Tank (T) information.

Date of Government Version: 07/27/2015
Date Data Arrived at EDR: 08/17/2015
Date Made Active in Reports: 09/03/2015
Number of Days to Update: 17

Source: Ventura County Environmental Health Division
Telephone: 805-654-2813
Last EDR Contact: 08/12/2015
Next Scheduled EDR Contact: 11/30/2015
Data Release Frequency: Quarterly

Inventory of Illegal Abandoned and Inactive Sites

Ventura County Inventory of Closed, Illegal Abandoned, and Inactive Sites.

Date of Government Version: 12/01/2011
Date Data Arrived at EDR: 12/01/2011
Date Made Active in Reports: 01/19/2012
Number of Days to Update: 49

Source: Environmental Health Division
Telephone: 805-654-2813
Last EDR Contact: 10/02/2015
Next Scheduled EDR Contact: 01/18/2016
Data Release Frequency: Annually

Listing of Underground Tank Cleanup Sites

Ventura County Underground Storage Tank Cleanup Sites (LUST).

Date of Government Version: 05/29/2008
Date Data Arrived at EDR: 06/24/2008
Date Made Active in Reports: 07/31/2008
Number of Days to Update: 37

Source: Environmental Health Division
Telephone: 805-654-2813
Last EDR Contact: 11/13/2015
Next Scheduled EDR Contact: 02/29/2016
Data Release Frequency: Quarterly

Medical Waste Program List

To protect public health and safety and the environment from potential exposure to disease causing agents, the Environmental Health Division Medical Waste Program regulates the generation, handling, storage, treatment and disposal of medical waste throughout the County.

Date of Government Version: 09/28/2015
Date Data Arrived at EDR: 10/28/2015
Date Made Active in Reports: 11/19/2015
Number of Days to Update: 22

Source: Ventura County Resource Management Agency
Telephone: 805-654-2813
Last EDR Contact: 10/26/2015
Next Scheduled EDR Contact: 02/08/2016
Data Release Frequency: Quarterly

Underground Tank Closed Sites List

Ventura County Operating Underground Storage Tank Sites (UST)/Underground Tank Closed Sites List.

Date of Government Version: 08/26/2015
Date Data Arrived at EDR: 09/15/2015
Date Made Active in Reports: 10/15/2015
Number of Days to Update: 30

Source: Environmental Health Division
Telephone: 805-654-2813
Last EDR Contact: 09/15/2015
Next Scheduled EDR Contact: 12/28/2015
Data Release Frequency: Quarterly

YOLO COUNTY:

Underground Storage Tank Comprehensive Facility Report

Underground storage tank sites located in Yolo county.

Date of Government Version: 10/19/2015
Date Data Arrived at EDR: 10/27/2015
Date Made Active in Reports: 11/19/2015
Number of Days to Update: 23

Source: Yolo County Department of Health
Telephone: 530-666-8646
Last EDR Contact: 10/19/2015
Next Scheduled EDR Contact: 01/18/2016
Data Release Frequency: Annually

YUBA COUNTY:

CUPA Facility List

CUPA facility listing for Yuba County.

Date of Government Version: 08/04/2015
Date Data Arrived at EDR: 08/07/2015
Date Made Active in Reports: 09/03/2015
Number of Days to Update: 27

Source: Yuba County Environmental Health Department
Telephone: 530-749-7523
Last EDR Contact: 11/13/2015
Next Scheduled EDR Contact: 02/15/2016
Data Release Frequency: Varies

OTHER DATABASE(S)

Depending on the geographic area covered by this report, the data provided in these specialty databases may or may not be complete. For example, the existence of wetlands information data in a specific report does not mean that all wetlands in the area covered by the report are included. Moreover, the absence of any reported wetlands information does not necessarily mean that wetlands do not exist in the area covered by the report.

CT MANIFEST: Hazardous Waste Manifest Data

Facility and manifest data. Manifest is a document that lists and tracks hazardous waste from the generator through transporters to a tsd facility.

Date of Government Version: 07/30/2013
Date Data Arrived at EDR: 08/19/2013
Date Made Active in Reports: 10/03/2013
Number of Days to Update: 45

Source: Department of Energy & Environmental Protection
Telephone: 860-424-3375
Last EDR Contact: 11/16/2015
Next Scheduled EDR Contact: 02/29/2016
Data Release Frequency: No Update Planned

NJ MANIFEST: Manifest Information

Hazardous waste manifest information.

Date of Government Version: 12/31/2013
Date Data Arrived at EDR: 07/17/2015
Date Made Active in Reports: 08/12/2015
Number of Days to Update: 26

Source: Department of Environmental Protection
Telephone: N/A
Last EDR Contact: 10/13/2015
Next Scheduled EDR Contact: 01/25/2016
Data Release Frequency: Annually

NY MANIFEST: Facility and Manifest Data

Manifest is a document that lists and tracks hazardous waste from the generator through transporters to a TSD facility.

Date of Government Version: 11/02/2015
Date Data Arrived at EDR: 11/08/2015
Date Made Active in Reports: 12/09/2015
Number of Days to Update: 31

Source: Department of Environmental Conservation
Telephone: 518-402-8651
Last EDR Contact: 11/08/2015
Next Scheduled EDR Contact: 02/15/2016
Data Release Frequency: Annually

PA MANIFEST: Manifest Information

Hazardous waste manifest information.

Date of Government Version: 12/31/2014
Date Data Arrived at EDR: 07/24/2015
Date Made Active in Reports: 08/18/2015
Number of Days to Update: 25

Source: Department of Environmental Protection
Telephone: 717-783-8990
Last EDR Contact: 10/19/2015
Next Scheduled EDR Contact: 02/01/2016
Data Release Frequency: Annually

RI MANIFEST: Manifest information

Hazardous waste manifest information

Date of Government Version: 12/31/2013
Date Data Arrived at EDR: 06/19/2015
Date Made Active in Reports: 07/15/2015
Number of Days to Update: 26

Source: Department of Environmental Management
Telephone: 401-222-2797
Last EDR Contact: 11/19/2015
Next Scheduled EDR Contact: 03/07/2016
Data Release Frequency: Annually

WI MANIFEST: Manifest Information
Hazardous waste manifest information.

Date of Government Version: 12/31/2014	Source: Department of Natural Resources
Date Data Arrived at EDR: 03/19/2015	Telephone: N/A
Date Made Active in Reports: 04/07/2015	Last EDR Contact: 12/09/2015
Number of Days to Update: 19	Next Scheduled EDR Contact: 03/28/2016
	Data Release Frequency: Annually

Oil/Gas Pipelines
Source: PennWell Corporation
Petroleum Bundle (Crude Oil, Refined Products, Petrochemicals, Gas Liquids (LPG/NGL), and Specialty Gases (Miscellaneous)) N = Natural Gas Bundle (Natural Gas, Gas Liquids (LPG/NGL), and Specialty Gases (Miscellaneous)). This map includes information copyrighted by PennWell Corporation. This information is provided on a best effort basis and PennWell Corporation does not guarantee its accuracy nor warrant its fitness for any particular purpose. Such information has been reprinted with the permission of PennWell.

Electric Power Transmission Line Data
Source: PennWell Corporation
This map includes information copyrighted by PennWell Corporation. This information is provided on a best effort basis and PennWell Corporation does not guarantee its accuracy nor warrant its fitness for any particular purpose. Such information has been reprinted with the permission of PennWell.

Sensitive Receptors: There are individuals deemed sensitive receptors due to their fragile immune systems and special sensitivity to environmental discharges. These sensitive receptors typically include the elderly, the sick, and children. While the location of all sensitive receptors cannot be determined, EDR indicates those buildings and facilities - schools, daycares, hospitals, medical centers, and nursing homes - where individuals who are sensitive receptors are likely to be located.

AHA Hospitals:
Source: American Hospital Association, Inc.
Telephone: 312-280-5991
The database includes a listing of hospitals based on the American Hospital Association’s annual survey of hospitals.

Medical Centers: Provider of Services Listing
Source: Centers for Medicare & Medicaid Services
Telephone: 410-786-3000
A listing of hospitals with Medicare provider number, produced by Centers of Medicare & Medicaid Services, a federal agency within the U.S. Department of Health and Human Services.

Nursing Homes
Source: National Institutes of Health
Telephone: 301-594-6248
Information on Medicare and Medicaid certified nursing homes in the United States.

Public Schools
Source: National Center for Education Statistics
Telephone: 202-502-7300
The National Center for Education Statistics’ primary database on elementary and secondary public education in the United States. It is a comprehensive, annual, national statistical database of all public elementary and secondary schools and school districts, which contains data that are comparable across all states.

Private Schools
Source: National Center for Education Statistics
Telephone: 202-502-7300
The National Center for Education Statistics’ primary database on private school locations in the United States.

Daycare Centers: Licensed Facilities
Source: Department of Social Services
Telephone: 916-657-4041

Flood Zone Data: This data, available in select counties across the country, was obtained by EDR in 2003 & 2011 from the Federal Emergency Management Agency (FEMA). Data depicts 100-year and 500-year flood zones as defined by FEMA.

NWI: National Wetlands Inventory. This data, available in select counties across the country, was obtained by EDR in 2002, 2005 and 2010 from the U.S. Fish and Wildlife Service.

State Wetlands Data: Wetland Inventory
Source: Department of Fish & Game
Telephone: 916-445-0411

Current USGS 7.5 Minute Topographic Map
Source: U.S. Geological Survey

STREET AND ADDRESS INFORMATION

GEOCHECK ®- PHYSICAL SETTING SOURCE ADDENDUM

TARGET PROPERTY ADDRESS

ABACHERLI DAIRY
29875 NEWPORT ROAD
MENIFEE, CA 92584

TARGET PROPERTY COORDINATES

Latitude (North):	33.6814 - 33˚ 40’ 53.04’’
Longitude (West):	117.1388 - 117˚ 8’ 19.68’’
Universal Tranverse Mercator:	Zone 11
UTM X (Meters):	487134.2
UTM Y (Meters):	3726646.5
Elevation:	1433 ft. above sea level

USGS TOPOGRAPHIC MAP

Target Property Map:	5641314 ROMOLAND, CA
Version Date:	2012
East Map:	5640944 WINCHESTER, CA
Version Date:	2012

EDR’s GeoCheck Physical Setting Source Addendum is provided to assist the environmental professional in forming an opinion about the impact of potential contaminant migration.

Assessment of the impact of contaminant migration generally has two principal investigative components:

1. Groundwater flow direction, and
2. Groundwater flow velocity.

Groundwater flow direction may be impacted by surface topography, hydrology, hydrogeology, characteristics of the soil, and nearby wells. Groundwater flow velocity is generally impacted by the nature of the geologic strata.

GEOCHECK® - PHYSICAL SETTING SOURCE SUMMARY

GROUNDWATER FLOW DIRECTION INFORMATION

Groundwater flow direction for a particular site is best determined by a qualified environmental professional using site-specific well data. If such data is not reasonably ascertainable, it may be necessary to rely on other sources of information, such as surface topographic information, hydrologic information, hydrogeologic data collected on nearby properties, and regional groundwater flow information (from deep aquifers).

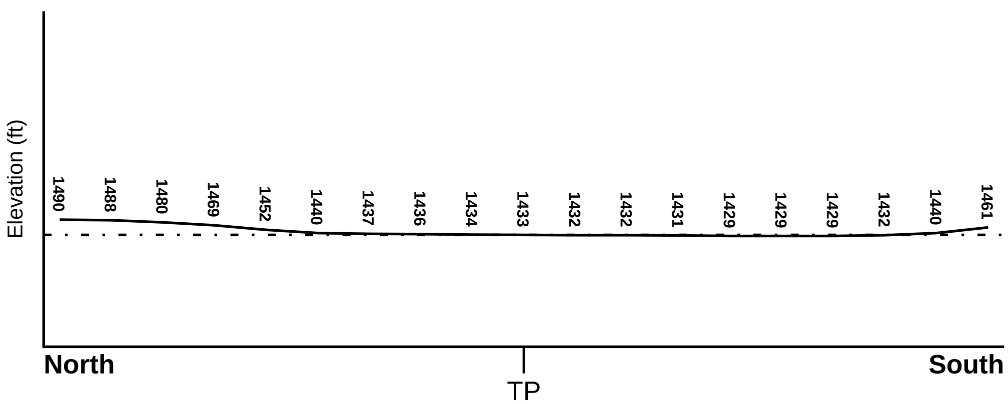
TOPOGRAPHIC INFORMATION

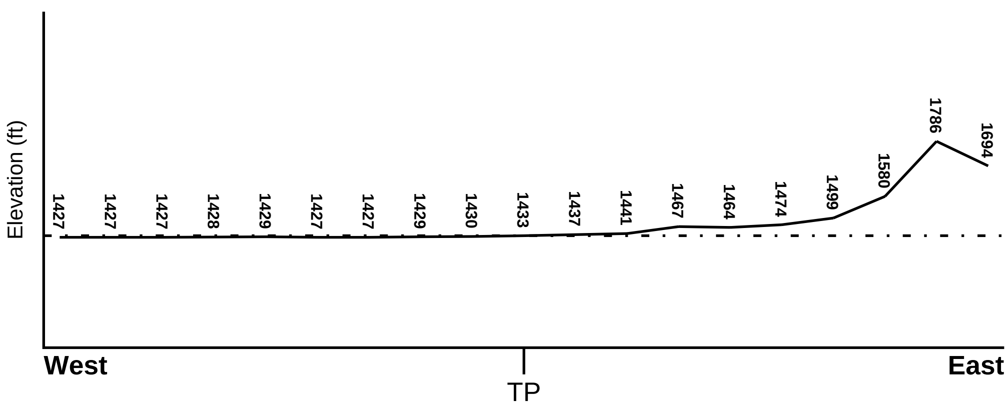
Surface topography may be indicative of the direction of surficial groundwater flow. This information can be used to assist the environmental professional in forming an opinion about the impact of nearby contaminated properties or, should contamination exist on the target property, what downgradient sites might be impacted.

TARGET PROPERTY TOPOGRAPHY

General Topographic Gradient: General WSW

SURROUNDING TOPOGRAPHY: ELEVATION PROFILES





Target Property Elevation: 1433 ft.

Source: Topography has been determined from the USGS 7.5' Digital Elevation Model and should be evaluated on a relative (not an absolute) basis. Relative elevation information between sites of close proximity should be field verified.

GEOCHECK® - PHYSICAL SETTING SOURCE SUMMARY

HYDROLOGIC INFORMATION

Surface water can act as a hydrologic barrier to groundwater flow. Such hydrologic information can be used to assist the environmental professional in forming an opinion about the impact of nearby contaminated properties or, should contamination exist on the target property, what downgradient sites might be impacted.

Refer to the Physical Setting Source Map following this summary for hydrologic information (major waterways and bodies of water).

FEMA FLOOD ZONE

Target Property County	FEMA Flood Electronic Data
RIVERSIDE, CA	YES - refer to the Overview Map and Detail Map

Flood Plain Panel at Target Property: 06065C - FEMA DFIRM Flood data

Additional Panels in search area: Not Reported

NATIONAL WETLAND INVENTORY

NWI Quad at Target Property	NWI Electronic Data Coverage
NOT AVAILABLE	YES - refer to the Overview Map and Detail Map

HYDROGEOLOGIC INFORMATION

Hydrogeologic information obtained by installation of wells on a specific site can often be an indicator of groundwater flow direction in the immediate area. Such hydrogeologic information can be used to assist the environmental professional in forming an opinion about the impact of nearby contaminated properties or, should contamination exist on the target property, what downgradient sites might be impacted.

Site-Specific Hydrogeological Data*:

Search Radius: 1.25 miles
Status: Not found

AQUIFLOW®

Search Radius: 1.000 Mile.

EDR has developed the AQUIFLOW Information System to provide data on the general direction of groundwater flow at specific points. EDR has reviewed reports submitted by environmental professionals to regulatory authorities at select sites and has extracted the date of the report, groundwater flow direction as determined hydrogeologically, and the depth to water table.

MAP ID	LOCATION FROM TP	GENERAL DIRECTION GROUNDWATER FLOW
Not Reported		

* ©1996 Site−specific hydrogeological data gathered by CERCLIS Alerts, Inc., Bainbridge Island, WA. All rights reserved. All of the information and opinions presented are those of the cited EPA report(s), which were completed under a Comprehensive Environmental Response Compensation and Liability Information System (CERCLIS) investigation.

GROUNDWATER FLOW VELOCITY INFORMATION

Groundwater flow velocity information for a particular site is best determined by a qualified environmental professional using site specific geologic and soil strata data. If such data are not reasonably ascertainable, it may be necessary to rely on other sources of information, including geologic age identification, rock stratigraphic unit and soil characteristics data collected on nearby properties and regional soil information. In general, contaminant plumes move more quickly through sandy-gravelly types of soils than silty-clayey types of soils.

GEOLOGIC INFORMATION IN GENERAL AREA OF TARGET PROPERTY

Geologic information can be used by the environmental professional in forming an opinion about the relative speed at which contaminant migration may be occurring.

ROCK STRATIGRAPHIC UNIT

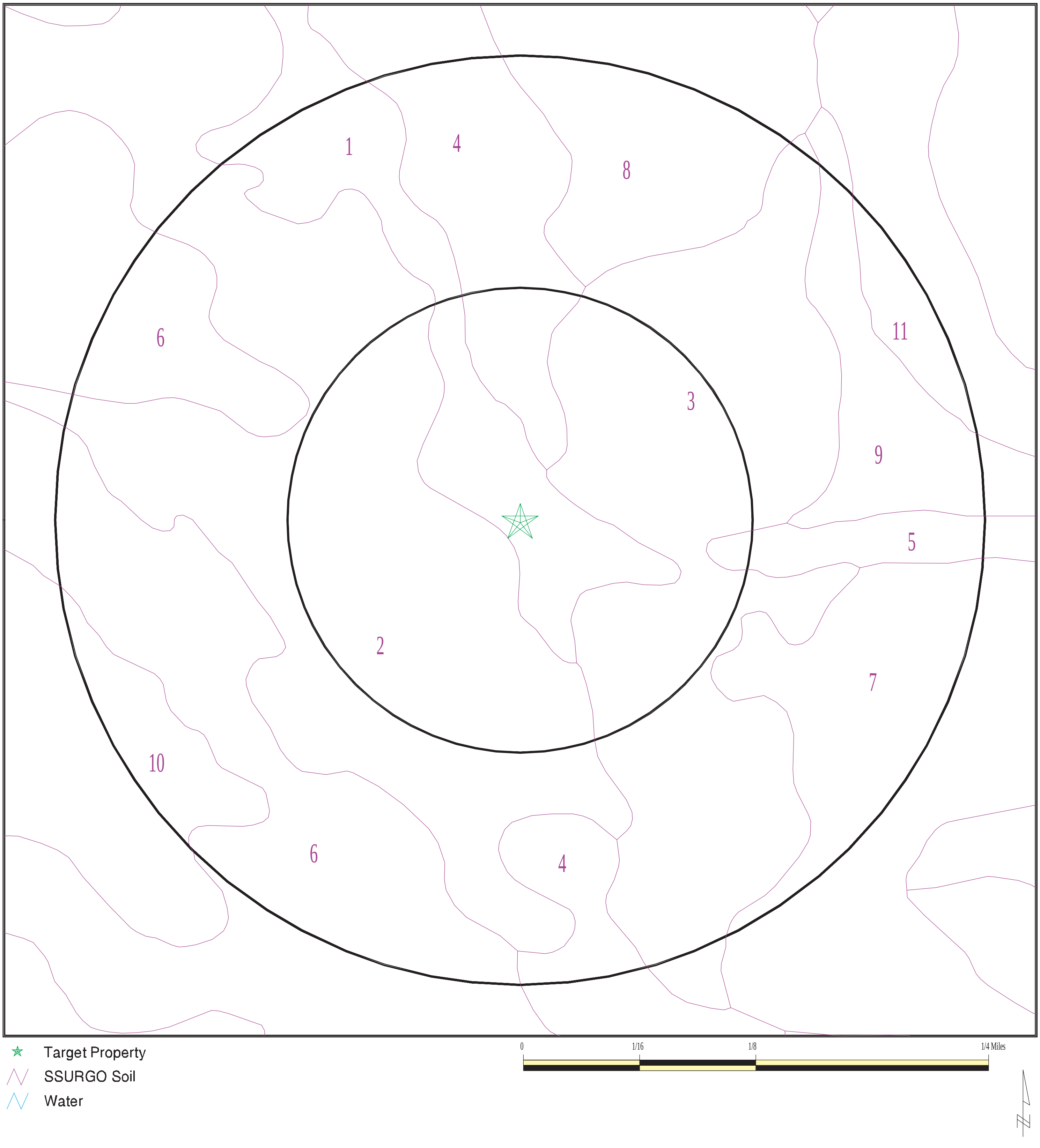
Era:	Mesozoic
System:	Cretaceous
Series:	Cretaceous granitic rocks
Code:	Kg *(decoded above as Era, System & Series)*

GEOLOGIC AGE IDENTIFICATION

Category: Plutonic and Intrusive Rocks

Geologic Age and Rock Stratigraphic Unit Source: P.G. Schruben, R.E. Arndt and W.J. Bawiec, Geology of the Conterminous U.S. at 1:2,500,000 Scale - a digital representation of the 1974 P.B. King and H.M. Beikman Map, USGS Digital Data Series DDS - 11 (1994).

SSURGO SOIL MAP - 4490591.2s



SITE NAME: Abacherli Dairy ADDRESS: 29875 Newport Road Menifee CA 92584 LAT/LONG: 33.6814 / 117.1388	CLIENT: Geotek Inc CONTACT: Anna M. Scott INQUIRY #: 4490591.2s DATE: December 11, 2015 7:27 pm

DOMINANT SOIL COMPOSITION IN GENERAL AREA OF TARGET PROPERTY

The U.S. Department of Agriculture's (USDA) Soil Conservation Service (SCS) leads the National Cooperative Soil Survey (NCSS) and is responsible for collecting, storing, maintaining and distributing soil survey information for privately owned lands in the United States. A soil map in a soil survey is a representation of soil patterns in a landscape. The following information is based on Soil Conservation Service SSURGO data.

Soil Map ID: 1

Soil Component Name: DOMINO

Soil Surface Texture: fine sandy loam

Hydrologic Group: Class C - Slow infiltration rates. Soils with layers impeding downward movement of water, or soils with moderately fine or fine textures.

Soil Drainage Class: Moderately well drained

Hydric Status: Not hydric

Corrosion Potential - Uncoated Steel: High

Depth to Bedrock Min: > 0 inches

Depth to Watertable Min: > 0 inches

Soil Layer Information

	Boundary			Classification		Saturated hydraulic conductivity micro m/sec	
Layer	**Upper**	**Lower**	**Soil Texture Class**	**AASHTO Group**	**Unified Soil**		**Soil Reaction (pH)**
1	0 inches	14 inches	fine sandy loam	Silt-Clay Materials (more than 35 pct. passing No. 200), Silty Soils.	COARSE-GRAINED SOILS, Sands, Sands with fines, Silty Sand.	Max: 14 Min: 4	Max: 9 Min: 7.9
2	14 inches	27 inches	silt loam	Silt-Clay Materials (more than 35 pct. passing No. 200), Clayey Soils.	FINE-GRAINED SOILS, Silts and Clays (liquid limit less than 50%), Lean Clay	Max: 1.4 Min: 0.42	Max: 9 Min: 7.9
3	27 inches	35 inches	cemented	Not reported	Not reported	Max: 0.01 Min: 0	Max: Min:
4	35 inches	62 inches	loam	Silt-Clay Materials (more than 35 pct. passing No. 200), Silty Soils.	FINE-GRAINED SOILS, Silts and Clays (liquid limit less than 50%), silt.	Max: 4 Min: 1.4	Max: 9 Min: 7.9

Soil Map ID: 2

Soil Component Name: WAUKENA

Soil Surface Texture: loam

Hydrologic Group: Class C - Slow infiltration rates. Soils with layers impeding downward movement of water, or soils with moderately fine or fine textures.

Soil Drainage Class: Moderately well drained

Hydric Status: Not hydric

Corrosion Potential - Uncoated Steel: High

Depth to Bedrock Min: > 0 inches

Depth to Watertable Min: > 0 inches

Soil Layer Information							
	Boundary			Classification		Saturated hydraulic conductivity micro m/sec	Soil Reaction (pH)
Layer	Upper	Lower	Soil Texture Class	AASHTO Group	Unified Soil		
1	0 inches	11 inches	loam	Silt-Clay Materials (more than 35 pct. passing No. 200), Silty Soils.	FINE-GRAINED SOILS, Silts and Clays (liquid limit less than 50%), silt.	Max: 14 Min: 4	Max: 9.6 Min: 7.8
2	11 inches	35 inches	sandy clay loam	Silt-Clay Materials (more than 35 pct. passing No. 200), Clayey Soils.	FINE-GRAINED SOILS, Silts and Clays (liquid limit less than 50%), Lean Clay	Max: 1.4 Min: 0.42	Max: 9.6 Min: 7.8
3	35 inches	59 inches	stratified loamy fine sand to clay loam	Granular materials (35 pct. or less passing No. 200), Silty, or Clayey Gravel and Sand.	COARSE-GRAINED SOILS, Sands, Sands with fines, Silty Sand.	Max: 4 Min: 1.4	Max: 9.6 Min: 7.8

Soil Map ID: 3

Soil Component Name: EXETER

Soil Surface Texture: sandy loam

Hydrologic Group: Class C - Slow infiltration rates. Soils with layers impeding downward movement of water, or soils with moderately fine or fine textures.

Soil Drainage Class: Well drained

Hydric Status: Not hydric

Corrosion Potential - Uncoated Steel: High

Depth to Bedrock Min: > 0 inches

Depth to Watertable Min: > 0 inches

Soil Layer Information							
	Boundary			Classification		Saturated hydraulic conductivity micro m/sec	Soil Reaction (pH)
Layer	Upper	Lower	Soil Texture Class	AASHTO Group	Unified Soil		
1	0 inches	16 inches	sandy loam	Silt-Clay Materials (more than 35 pct. passing No. 200), Silty Soils.	COARSE-GRAINED SOILS, Sands, Sands with fines, Clayey sand. COARSE-GRAINED SOILS, Sands, Sands with fines, Silty Sand.	Max: 14 Min: 4	Max: 7.3 Min: 6.6
2	16 inches	37 inches	sandy clay loam	Silt-Clay Materials (more than 35 pct. passing No. 200), Clayey Soils.	FINE-GRAINED SOILS, Silts and Clays (liquid limit less than 50%), Lean Clay	Max: 14 Min: 4	Max: 7.8 Min: 6.6
3	37 inches	50 inches	indurated	Not reported	Not reported	Max: 0.01 Min: 0	Max: Min:
4	50 inches	59 inches	stratified sandy loam to silt loam	Silt-Clay Materials (more than 35 pct. passing No. 200), Silty Soils.	FINE-GRAINED SOILS, Silts and Clays (liquid limit less than 50%), silt.	Max: 4 Min: 1.4	Max: 8.4 Min: 7.4

Soil Map ID: 4

Soil Component Name: EXETER

Soil Surface Texture: sandy loam

Hydrologic Group: Class C - Slow infiltration rates. Soils with layers impeding downward movement of water, or soils with moderately fine or fine textures.

Soil Drainage Class: Well drained

Hydric Status: Not hydric

Corrosion Potential - Uncoated Steel: High

Depth to Bedrock Min: > 0 inches

Depth to Watertable Min: > 0 inches

Soil Layer Information							
	Boundary			Classification		Saturated hydraulic conductivity micro m/sec	
Layer	Upper	Lower	Soil Texture Class	AASHTO Group	Unified Soil		Soil Reaction (pH)
1	0 inches	16 inches	sandy loam	Silt-Clay Materials (more than 35 pct. passing No. 200), Silty Soils.	COARSE-GRAINED SOILS, Sands, Sands with fines, Clayey sand. COARSE-GRAINED SOILS, Sands, Sands with fines, Silty Sand.	Max: 14 Min: 4	Max: 9 Min: 7.9
2	16 inches	37 inches	sandy clay loam	Silt-Clay Materials (more than 35 pct. passing No. 200), Clayey Soils.	FINE-GRAINED SOILS, Silts and Clays (liquid limit less than 50%), Lean Clay	Max: 14 Min: 4	Max: 9 Min: 7.9
3	37 inches	50 inches	indurated	Not reported	Not reported	Max: 0.01 Min: 0	Max: Min:
4	50 inches	59 inches	stratified sandy loam to silt loam	Silt-Clay Materials (more than 35 pct. passing No. 200), Silty Soils.	FINE-GRAINED SOILS, Silts and Clays (liquid limit less than 50%), silt.	Max: 4 Min: 1.4	Max: 8.4 Min: 7.9

Soil Map ID: 5

Soil Component Name: EXETER

Soil Surface Texture: very fine sandy loam

Hydrologic Group: Class C - Slow infiltration rates. Soils with layers impeding downward movement of water, or soils with moderately fine or fine textures.

Soil Drainage Class: Well drained

Hydric Status: Not hydric

Corrosion Potential - Uncoated Steel: High

Depth to Bedrock Min: > 0 inches

Depth to Watertable Min: > 0 inches

Soil Layer Information							
	Boundary			Classification		Saturated hydraulic conductivity micro m/sec	Soil Reaction (pH)
Layer	Upper	Lower	Soil Texture Class	AASHTO Group	Unified Soil		
1	0 inches	16 inches	very fine sandy loam	Silt-Clay Materials (more than 35 pct. passing No. 200), Silty Soils.	FINE-GRAINED SOILS, Silts and Clays (liquid limit less than 50%), Lean Clay. FINE-GRAINED SOILS, Silts and Clays (liquid limit less than 50%), silt.	Max: 14 Min: 4	Max: 7.3 Min: 6.6
2	16 inches	37 inches	sandy clay loam	Silt-Clay Materials (more than 35 pct. passing No. 200), Clayey Soils.	FINE-GRAINED SOILS, Silts and Clays (liquid limit less than 50%), Lean Clay	Max: 14 Min: 4	Max: 7.8 Min: 6.6
3	37 inches	50 inches	indurated	Not reported	Not reported	Max: 0.01 Min: 0	Max: Min:
4	50 inches	59 inches	stratified sandy loam to silt loam	Silt-Clay Materials (more than 35 pct. passing No. 200), Silty Soils.	FINE-GRAINED SOILS, Silts and Clays (liquid limit less than 50%), silt.	Max: 4 Min: 1.4	Max: 8.4 Min: 7.4

Soil Map ID: 6

Soil Component Name: DOMINO

Soil Surface Texture: silt loam

Hydrologic Group: Class C - Slow infiltration rates. Soils with layers impeding downward movement of water, or soils with moderately fine or fine textures.

Soil Drainage Class: Moderately well drained

Hydric Status: Partially hydric

Corrosion Potential - Uncoated Steel: High

Depth to Bedrock Min: > 0 inches

Depth to Watertable Min: > 0 inches

Soil Layer Information							
	Boundary			Classification		Saturated hydraulic conductivity micro m/sec	
Layer	Upper	Lower	Soil Texture Class	AASHTO Group	Unified Soil		Soil Reaction (pH)
1	0 inches	14 inches	silt loam	Silt-Clay Materials (more than 35 pct. passing No. 200), Silty Soils.	FINE-GRAINED SOILS, Silts and Clays (liquid limit less than 50%), silt.	Max: 14 Min: 4	Max: 9 Min: 7.9
2	14 inches	27 inches	silt loam	Silt-Clay Materials (more than 35 pct. passing No. 200), Clayey Soils.	FINE-GRAINED SOILS, Silts and Clays (liquid limit less than 50%), Lean Clay	Max: 1.4 Min: 0.42	Max: 9 Min: 7.9
3	27 inches	35 inches	cemented	Not reported	Not reported	Max: 0.01 Min: 0	Max: Min:
4	35 inches	62 inches	loam	Silt-Clay Materials (more than 35 pct. passing No. 200), Silty Soils.	COARSE-GRAINED SOILS, Sands, Sands with fines, Silty Sand.	Max: 4 Min: 1.4	Max: 9 Min: 7.9

Soil Map ID: 7

Soil Component Name: EXETER

Soil Surface Texture: fine sandy loam

Hydrologic Group: Class B - Moderate infiltration rates. Deep and moderately deep, moderately well and well drained soils with moderately coarse textures.

Soil Drainage Class: Well drained

Hydric Status: Not hydric

Corrosion Potential - Uncoated Steel: High

Depth to Bedrock Min: > 0 inches

Depth to Watertable Min: > 0 inches

Soil Layer Information							
	Boundary			Classification		Saturated hydraulic conductivity micro m/sec	Soil Reaction (pH)
Layer	Upper	Lower	Soil Texture Class	AASHTO Group	Unified Soil		
1	0 inches	16 inches	fine sandy loam	Silt-Clay Materials (more than 35 pct. passing No. 200), Silty Soils.	COARSE-GRAINED SOILS, Sands, Sands with fines, Silty Sand.	Max: 14 Min: 4	Max: 7.3 Min: 6.6
2	16 inches	37 inches	sandy clay loam	Silt-Clay Materials (more than 35 pct. passing No. 200), Clayey Soils.	FINE-GRAINED SOILS, Silts and Clays (liquid limit less than 50%), Lean Clay	Max: 4 Min: 1.4	Max: 7.8 Min: 6.6
3	37 inches	50 inches	indurated	Not reported	Not reported	Max: 0.01 Min: 0	Max: Min:
4	50 inches	59 inches	stratified sandy loam to silt loam	Silt-Clay Materials (more than 35 pct. passing No. 200), Silty Soils.	COARSE-GRAINED SOILS, Sands, Sands with fines, Silty Sand.	Max: 4 Min: 1.4	Max: 8.4 Min: 7.4

Soil Map ID: 8

Soil Component Name: EXETER

Soil Surface Texture: sandy loam

Hydrologic Group: Class B - Moderate infiltration rates. Deep and moderately deep, moderately well and well drained soils with moderately coarse textures.

Soil Drainage Class: Well drained

Hydric Status: Not hydric

Corrosion Potential - Uncoated Steel: High

Depth to Bedrock Min: > 0 inches

Depth to Watertable Min: > 0 inches

Soil Layer Information							
	Boundary			Classification		Saturated hydraulic conductivity micro m/sec	
Layer	Upper	Lower	Soil Texture Class	AASHTO Group	Unified Soil		Soil Reaction (pH)
1	0 inches	16 inches	sandy loam	Silt-Clay Materials (more than 35 pct. passing No. 200), Silty Soils.	COARSE-GRAINED SOILS, Sands, Sands with fines, Silty Sand.	Max: 14 Min: 4	Max: 7.3 Min: 6.6
2	16 inches	37 inches	sandy clay loam	Silt-Clay Materials (more than 35 pct. passing No. 200), Clayey Soils.	FINE-GRAINED SOILS, Silts and Clays (liquid limit less than 50%), Lean Clay	Max: 4 Min: 1.4	Max: 7.8 Min: 6.6
3	37 inches	50 inches	indurated	Not reported	Not reported	Max: 0.01 Min: 0	Max: Min:
4	50 inches	59 inches	stratified sandy loam to silt loam	Silt-Clay Materials (more than 35 pct. passing No. 200), Silty Soils.	FINE-GRAINED SOILS, Silts and Clays (liquid limit less than 50%), silt.	Max: 4 Min: 1.4	Max: 8.4 Min: 7.4

Soil Map ID: 9

Soil Component Name: EXETER

Soil Surface Texture: sandy loam

Hydrologic Group: Class C - Slow infiltration rates. Soils with layers impeding downward movement of water, or soils with moderately fine or fine textures.

Soil Drainage Class: Well drained

Hydric Status: Not hydric

Corrosion Potential - Uncoated Steel: High

Depth to Bedrock Min: > 0 inches

Depth to Watertable Min: > 0 inches

Soil Layer Information							
	Boundary			Classification		Saturated hydraulic conductivity micro m/sec	Soil Reaction (pH)
Layer	Upper	Lower	Soil Texture Class	AASHTO Group	Unified Soil		
1	0 inches	16 inches	sandy loam	Silt-Clay Materials (more than 35 pct. passing No. 200), Silty Soils.	COARSE-GRAINED SOILS, Sands, Sands with fines, Clayey sand. COARSE-GRAINED SOILS, Sands, Sands with fines, Silty Sand.	Max: 14 Min: 4	Max: 7.3 Min: 6.6
2	16 inches	37 inches	sandy clay loam	Silt-Clay Materials (more than 35 pct. passing No. 200), Clayey Soils.	FINE-GRAINED SOILS, Silts and Clays (liquid limit less than 50%), Lean Clay	Max: 14 Min: 4	Max: 7.8 Min: 6.6
3	37 inches	50 inches	indurated	Not reported	Not reported	Max: 0.01 Min: 0	Max: Min:
4	50 inches	59 inches	stratified sandy loam to silt loam	Silt-Clay Materials (more than 35 pct. passing No. 200), Silty Soils.	COARSE-GRAINED SOILS, Sands, Sands with fines, Silty Sand.	Max: 4 Min: 1.4	Max: 8.4 Min: 7.4

Soil Map ID: 10

Soil Component Name: WILLOWS

Soil Surface Texture: silty clay

Hydrologic Group: Class D - Very slow infiltration rates. Soils are clayey, have a high water table, or are shallow to an impervious layer.

Soil Drainage Class: Poorly drained

Hydric Status: Not hydric

Corrosion Potential - Uncoated Steel: High

Depth to Bedrock Min: > 0 inches

Depth to Watertable Min: > 0 inches

Soil Layer Information							
	Boundary			Classification		Saturated hydraulic conductivity micro m/sec	Soil Reaction (pH)
Layer	Upper	Lower	Soil Texture Class	AASHTO Group	Unified Soil		
1	0 inches	9 inches	silty clay	Silt-Clay Materials (more than 35 pct. passing No. 200), Clayey Soils.	FINE-GRAINED SOILS, Silts and Clays (liquid limit 50% or more), Fat Clay.	Max: 0.42 Min: 0.01	Max: 9 Min: 7.4
2	9 inches	42 inches	clay	Silt-Clay Materials (more than 35 pct. passing No. 200), Clayey Soils.	FINE-GRAINED SOILS, Silts and Clays (liquid limit 50% or more), Fat Clay.	Max: 0.42 Min: 0.01	Max: 9 Min: 8.5

Soil Map ID: 11

Soil Component Name: HANFORD

Soil Surface Texture: coarse sandy loam

Hydrologic Group: Class B - Moderate infiltration rates. Deep and moderately deep, moderately well and well drained soils with moderately coarse textures.

Soil Drainage Class: Somewhat excessively drained

Hydric Status: Not hydric

Corrosion Potential - Uncoated Steel: Low

Depth to Bedrock Min: > 0 inches

Depth to Watertable Min: > 0 inches

Soil Layer Information							
	Boundary			Classification		Saturated hydraulic conductivity micro m/sec	Soil Reaction (pH)
Layer	Upper	Lower	Soil Texture Class	AASHTO Group	Unified Soil		
1	0 inches	7 inches	coarse sandy loam	Silt-Clay Materials (more than 35 pct. passing No. 200), Silty Soils.	COARSE-GRAINED SOILS, Sands, Sands with fines, Silty Sand.	Max: 42 Min: 14	Max: 7.8 Min: 5.6

Soil Layer Information							
	Boundary			Classification		Saturated hydraulic conductivity micro m/sec	
Layer	Upper	Lower	Soil Texture Class	AASHTO Group	Unified Soil		Soil Reaction (pH)
2	7 inches	40 inches	fine sandy loam	Silt-Clay Materials (more than 35 pct. passing No. 200), Silty Soils.	COARSE-GRAINED SOILS, Sands, Sands with fines, Silty Sand.	Max: 42 Min: 14	Max: 7.8 Min: 5.6
3	40 inches	59 inches	stratified loamy sand to coarse sandy loam	Granular materials (35 pct. or less passing No. 200), Stone Fragments, Gravel and Sand.	COARSE-GRAINED SOILS, Sands, Sands with fines, Silty Sand.	Max: 141 Min: 42	Max: 7.8 Min: 5.6

LOCAL / REGIONAL WATER AGENCY RECORDS

EDR Local/Regional Water Agency records provide water well information to assist the environmental professional in assessing sources that may impact ground water flow direction, and in forming an opinion about the impact of contaminant migration on nearby drinking water wells.

WELL SEARCH DISTANCE INFORMATION

DATABASE	SEARCH DISTANCE (miles)
Federal USGS	1.000
Federal FRDS PWS	Nearest PWS within 1 mile
State Database	1.000

FEDERAL USGS WELL INFORMATION

MAP ID	WELL ID	LOCATION FROM TP
A2	USGS40000136643	1/8 - 1/4 Mile South
B6	USGS40000136616	1/4 - 1/2 Mile South
C7	USGS40000136723	1/4 - 1/2 Mile WNW
D9	USGS40000136625	1/2 - 1 Mile SW
E12	USGS40000136724	1/2 - 1 Mile WNW
F14	USGS40000136657	1/2 - 1 Mile WSW
G17	USGS40000136725	1/2 - 1 Mile WNW
H21	USGS40000136718	1/2 - 1 Mile WNW
I23	USGS40000136644	1/2 - 1 Mile WSW

GEOCHECK® - PHYSICAL SETTING SOURCE SUMMARY

FEDERAL USGS WELL INFORMATION

MAP ID	WELL ID	LOCATION FROM TP
24	USGS40000136812	1/2 - 1 Mile NW

FEDERAL FRDS PUBLIC WATER SUPPLY SYSTEM INFORMATION

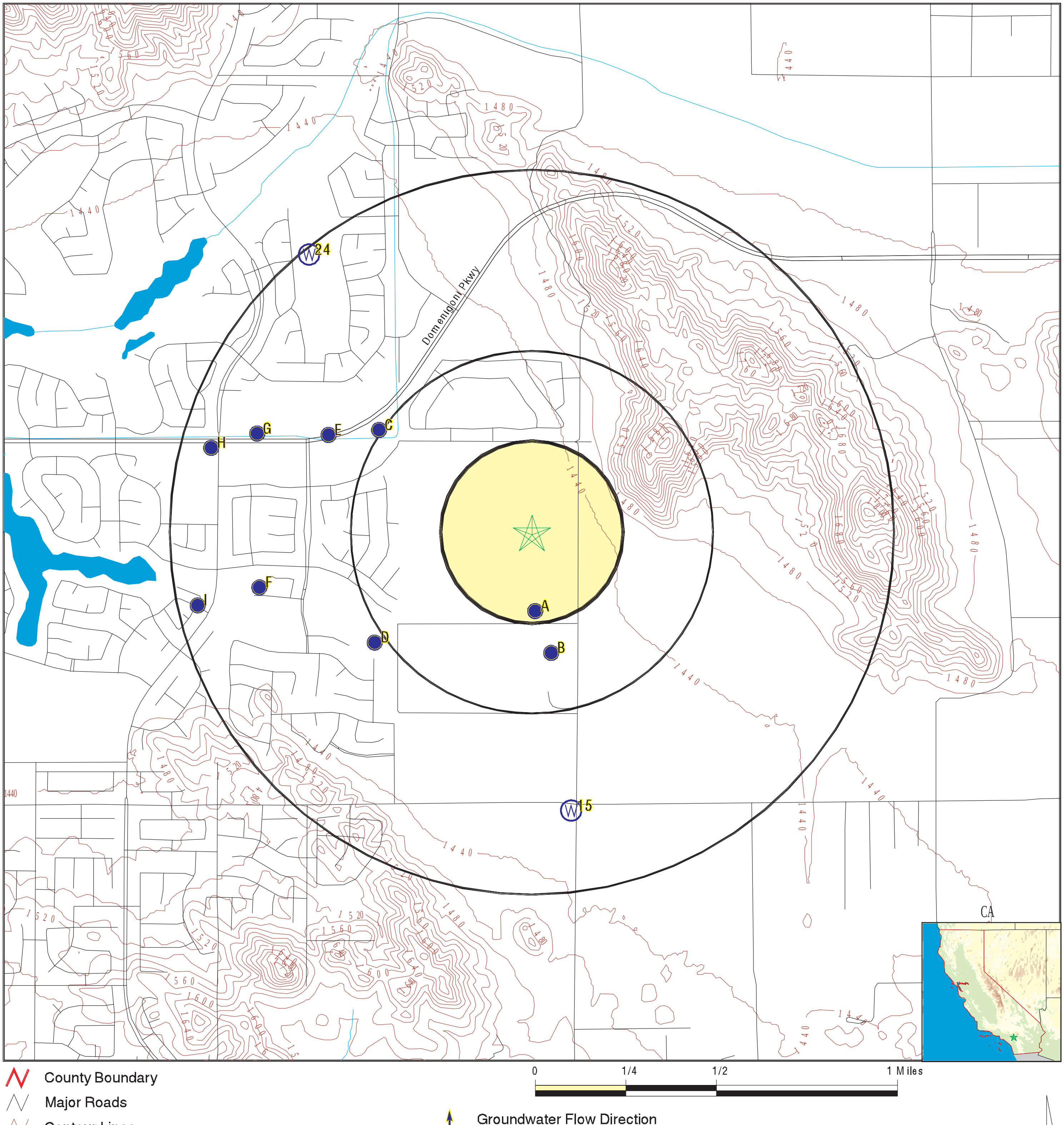
MAP ID	WELL ID	LOCATION FROM TP
No PWS System Found		

Note: PWS System location is not always the same as well location.

STATE DATABASE WELL INFORMATION

MAP ID	WELL ID	LOCATION FROM TP
A1	CADW60000034417	1/8 - 1/4 Mile South
A3	CADW60000006175	1/8 - 1/4 Mile SSE
A4	CADW60000006176	1/8 - 1/4 Mile SSW
B5	CADW60000006212	1/4 - 1/2 Mile South
C8	CADW60000006172	1/2 - 1 Mile NW
C10	CADW60000035673	1/2 - 1 Mile WNW
D11	CADW60000021502	1/2 - 1 Mile WSW
E13	CADW60000022709	1/2 - 1 Mile WNW
15	CADW60000006217	1/2 - 1 Mile South
G16	CADW60000006171	1/2 - 1 Mile WNW
F18	CADW60000021501	1/2 - 1 Mile West
G19	CADW60000035672	1/2 - 1 Mile WNW
H20	CADW60000021503	1/2 - 1 Mile WNW
I22	CADW60000006215	1/2 - 1 Mile WSW

PHYSICAL SETTING SOURCE MAP - 4490591.2s



County Boundary
Major Roads
Contour Lines
Earthquake Fault Lines
Earthquake epicenter, Richter 5 or greater
Water Wells
Public Water Supply Wells
Cluster of Multiple Icons

Groundwater Flow Direction
Indeterminate Groundwater Flow at Location
Groundwater Flow Varies at Location
Closest Hydrogeological Data
Oil, gas or related wells

SITE NAME:	Abacherli Dairy	CLIENT:	Geotek Inc
ADDRESS:	29875 Newport Road	CONTACT:	Anna M. Scott
	Menifee CA 92584	INQUIRY #:	4490591.2s
LAT/LONG:	33.6814 / 117.1388	DATE:	December 11, 2015 7:27 pm

443

GEOCHECK® - PHYSICAL SETTING SOURCE MAP FINDINGS

Map ID Direction Distance Elevation	Database	EDR ID Number
A1 **South** **1/8 - 1/4 Mile** **Higher**	**CA WELLS**	**CADW60000034417**

Objectid:	34417
Latitude:	33.6784
Longitude:	-117.139
Site code:	336784N1171390W001
State well numbe:	06S03W01H001S
Local well name:	’’
Well use id:	6
Well use descrip:	Unknown
County id:	33
County name:	Riverside
Basin code:	’8-5’
Basin desc:	San Jacinto
Dwr region id:	80238
Dwr region:	Southern Region Office
Site id:	CADW60000034417

A2 **South** **1/8 - 1/4 Mile** **Higher**	**FED USGS**	**USGS40000136643**

Org. Identifier:	USGS-CA		
Formal name:	USGS California Water Science Center		
Monloc Identifier:	USGS-334042117081401		
Monloc name:	006S003W01H001S		
Monloc type:	Well		
Monloc desc:	DEPTH SOUNDED 6/2/95		
Huc code:	18070202	Drainagearea value:	Not Reported
Drainagearea Units:	Not Reported	Contrib drainagearea:	Not Reported
Contrib drainagearea units:	Not Reported	Latitude:	33.6783556
Longitude:	-117.138087	Sourcemap scale:	24000
Horiz Acc measure:	5	Horiz Acc measure units:	seconds
Horiz Collection method:	Interpolated from map		
Horiz coord refsys:	NAD83	Vert measure val:	1430
Vert measure units:	feet	Vertacc measure val:	5
Vert accmeasure units:	feet		
Vertcollection method:	Interpolated from topographic map		
Vert coord refsys:	NGVD29	Countrycode:	US
Aquifername:	California Coastal Basin aquifers		
Formation type:	Not Reported		
Aquifer type:	Not Reported		
Construction date:	Not Reported	Welldepth:	369.5
Welldepth units:	ft	Wellholedepth:	Not Reported
Wellholedepth units:	Not Reported		

Ground-water levels, Number of Measurements: 1

Date	Feet below Surface	Feet to Sealevel
1995-06-02	109.59	

Map ID Direction Distance Elevation		Database	EDR ID Number
A3 **SSE** **1/8 - 1/4 Mile** **Higher**		**CA WELLS**	**CADW60000006175**

Objectid:	6175
Latitude:	33.67829
Longitude:	-117.137668
Site code:	336783N1171377W001
State well numbe:	Not Reported
Local well name:	'EMWD11191'
Well use id:	3
Well use descrip:	Irrigation
County id:	33
County name:	Riverside
Basin code:	'8-5'
Basin desc:	San Jacinto
Dwr region id:	80238
Dwr region:	Southern Region Office
Site id:	CADW60000006175

A4 **SSW** **1/8 - 1/4 Mile** **Lower**		**CA WELLS**	**CADW60000006176**

Objectid:	6176
Latitude:	33.677937
Longitude:	-117.139801
Site code:	336779N1171398W001
State well numbe:	Not Reported
Local well name:	'EMWD12836'
Well use id:	3
Well use descrip:	Irrigation
County id:	33
County name:	Riverside
Basin code:	'8-5'
Basin desc:	San Jacinto
Dwr region id:	80238
Dwr region:	Southern Region Office
Site id:	CADW60000006176

B5 **South** **1/4 - 1/2 Mile** **Higher**		**CA WELLS**	**CADW60000006212**

Objectid:	6212
Latitude:	33.676612
Longitude:	-117.137852
Site code:	336766N1171379W001
State well numbe:	Not Reported
Local well name:	'EMWD12837'
Well use id:	3
Well use descrip:	Irrigation
County id:	33
County name:	Riverside

Basin code:	'8-5'
Basin desc:	San Jacinto
Dwr region id:	80238
Dwr region:	Southern Region Office
Site id:	CADW60000006212

B6
South
1/4 - 1/2 Mile
Higher

FED USGS **USGS40000136616**

Org. Identifier:	USGS-CA		
Formal name:	USGS California Water Science Center		
Monloc Identifier:	USGS-334036117081101		
Monloc name:	006S003W01J002S		
Monloc type:	Well		
Monloc desc:	Not Reported		
Huc code:	18070202	Drainagearea value:	Not Reported
Drainagearea Units:	Not Reported	Contrib drainagearea:	Not Reported
Contrib drainagearea units:	Not Reported	Latitude:	33.6765278
Longitude:	-117.1378889	Sourcemap scale:	24000
Horiz Acc measure:	.5	Horiz Acc measure units:	seconds
Horiz Collection method:	Global positioning system (GPS), uncorrected		
Horiz coord refsys:	NAD83	Vert measure val:	1430.00
Vert measure units:	feet	Vertacc measure val:	10
Vert accmeasure units:	feet		
Vertcollection method:	Interpolated from topographic map		
Vert coord refsys:	NGVD29	Countrycode:	US
Aquifername:	California Coastal Basin aquifers		
Formation type:	Not Reported		
Aquifer type:	Not Reported		
Construction date:	Not Reported	Welldepth:	300
Welldepth units:	ft	Wellholedepth:	Not Reported
Wellholedepth units:	Not Reported		

Ground-water levels, Number of Measurements: 0

C7
WNW
1/4 - 1/2 Mile
Lower

FED USGS **USGS40000136723**

Org. Identifier:	USGS-CA		
Formal name:	USGS California Water Science Center		
Monloc Identifier:	USGS-334107117084201		
Monloc name:	005S003W36P002S		
Monloc type:	Well		
Monloc desc:	EMWD WELL		
Huc code:	18070202	Drainagearea value:	Not Reported
Drainagearea Units:	Not Reported	Contrib drainagearea:	Not Reported
Contrib drainagearea units:	Not Reported	Latitude:	33.6852998
Longitude:	-117.1458651	Sourcemap scale:	24000
Horiz Acc measure:	5	Horiz Acc measure units:	seconds
Horiz Collection method:	Interpolated from map		
Horiz coord refsys:	NAD83	Vert measure val:	1430
Vert measure units:	feet	Vertacc measure val:	10
Vert accmeasure units:	feet		
Vertcollection method:	Interpolated from topographic map		
Vert coord refsys:	NGVD29	Countrycode:	US
Aquifername:	California Coastal Basin aquifers		
Formation type:	Not Reported		

Aquifer type:	Not Reported		
Construction date:	19920603	Welldepth:	680
Welldepth units:	ft	Wellholedepth:	750
Wellholedepth units:	ft		

Ground-water levels, Number of Measurements: 2

Date	Feet below Surface	Feet to Sealevel	Date	Feet below Surface	Feet to Sealevel
1995-09-28	96.73		1994-07-12	104.71	

C8
NW
1/2 - 1 Mile
Lower

CA WELLS CADW60000006172

Objectid:	6172
Latitude:	33.685903
Longitude:	-117.145705
Site code:	336859N1171457W001
State well numbe:	Not Reported
Local well name:	'EMWD12816'
Well use id:	1
Well use descrip:	Observation
County id:	33
County name:	Riverside
Basin code:	'8-5'
Basin desc:	San Jacinto
Dwr region id:	80238
Dwr region:	Southern Region Office
Site id:	CADW60000006172

D9
SW
1/2 - 1 Mile
Lower

FED USGS USGS40000136625

Org. Identifier:	USGS-CA		
Formal name:	USGS California Water Science Center		
Monloc Identifier:	USGS-334037117084201		
Monloc name:	006S003W01L001S		
Monloc type:	Well		
Monloc desc:	Not Reported		
Huc code:	18070202	Drainagearea value:	Not Reported
Drainagearea Units:	Not Reported	Contrib drainagearea:	Not Reported
Contrib drainagearea units:	Not Reported	Latitude:	33.6769668
Longitude:	-117.1458651	Sourcemap scale:	24000
Horiz Acc measure:	5	Horiz Acc measure units:	seconds
Horiz Collection method:	Interpolated from map		
Horiz coord refsys:	NAD83	Vert measure val:	1427
Vert measure units:	feet	Vertacc measure val:	5
Vert accmeasure units:	feet		
Vertcollection method:	Interpolated from topographic map		
Vert coord refsys:	NGVD29	Countrycode:	US
Aquifername:	California Coastal Basin aquifers		
Formation type:	Not Reported		

Aquifer type:	Not Reported		
Construction date:	Not Reported	Welldepth:	109.4
Welldepth units:	ft	Wellholedepth:	Not Reported
Wellholedepth units:	Not Reported		

Ground-water levels, Number of Measurements: 2

Date	Feet below Surface	Feet to Sealevel	Date	Feet below Surface	Feet to Sealevel
1995-09-28					
Note: The site was dry (no water level recorded).					
1995-05-10	99.87				

C10
WNW
1/2 - 1 Mile
Lower

CA WELLS CADW60000035673

Objectid:	35673
Latitude:	33.6853
Longitude:	-117.1468
Site code:	336853N1171468W001
State well numbe:	05S03W36P002S
Local well name:	’’
Well use id:	6
Well use descrip:	Unknown
County id:	33
County name:	Riverside
Basin code:	’8-5’
Basin desc:	San Jacinto
Dwr region id:	80238
Dwr region:	Southern Region Office
Site id:	CADW60000035673

D11
WSW
1/2 - 1 Mile
Lower

CA WELLS CADW60000021502

Objectid:	21502
Latitude:	33.677
Longitude:	-117.1468
Site code:	336770N1171468W001
State well numbe:	06S03W01L001S
Local well name:	’’
Well use id:	6
Well use descrip:	Unknown
County id:	33
County name:	Riverside
Basin code:	’8-5’
Basin desc:	San Jacinto
Dwr region id:	80238
Dwr region:	Southern Region Office
Site id:	CADW60000021502

Map ID Direction Distance Elevation	Database	EDR ID Number
E12 **WNW** **1/2 - 1 Mile** **Lower**	**FED USGS**	**USGS40000136724**

Org. Identifier:	USGS-CA		
Formal name:	USGS California Water Science Center		
Monloc Identifier:	USGS-334107117085001		
Monloc name:	005S003W36P001S		
Monloc type:	Well		
Monloc desc:	ORIG DEPTH 705 FT, SOUNDED DEPTH 128.7 FT APR 95		
Huc code:	18070202	Drainagearea value:	Not Reported
Drainagearea Units:	Not Reported	Contrib drainagearea:	Not Reported
Contrib drainagearea units:	Not Reported	Latitude:	33.6852998
Longitude:	-117.1480875	Sourcemap scale:	24000
Horiz Acc measure:	5	Horiz Acc measure units:	seconds
Horiz Collection method:	Interpolated from map		
Horiz coord refsys:	NAD83	Vert measure val:	1425
Vert measure units:	feet	Vertacc measure val:	5
Vert accmeasure units:	feet		
Vertcollection method:	Interpolated from topographic map		
Vert coord refsys:	NGVD29	Countrycode:	US
Aquifername:	California Coastal Basin aquifers		
Formation type:	Not Reported		
Aquifer type:	Not Reported		
Construction date:	195012	Welldepth:	128.7
Welldepth units:	ft	Wellholedepth:	705
Wellholedepth units:	ft		

Ground-water levels, Number of Measurements: 2

Date	Feet below Surface	Feet to Sealevel	Date	Feet below Surface	Feet to Sealevel
1995-09-28	95.22		1995-04-26	96.41	

E13 **WNW** **1/2 - 1 Mile** **Lower**	**CA WELLS**	**CADW60000022709**

Objectid:	22709
Latitude:	33.6853
Longitude:	-117.149
Site code:	336853N1171490W001
State well numbe:	05S03W36P001S
Local well name:	’’
Well use id:	6
Well use descrip:	Unknown
County id:	33
County name:	Riverside
Basin code:	’8-5’
Basin desc:	San Jacinto
Dwr region id:	80238
Dwr region:	Southern Region Office
Site id:	CADW60000022709

Map ID Direction Distance Elevation	Database	EDR ID Number
F14 **WSW** **1/2 - 1 Mile** **Lower**	**FED USGS**	**USGS40000136657**

Org. Identifier:	USGS-CA		
Formal name:	USGS California Water Science Center		
Monloc Identifier:	USGS-334045117090201		
Monloc name:	006S003W01E001S		
Monloc type:	Well		
Monloc desc:	DEPTH MEASURED 5/10/95		
Huc code:	18070202	Drainagearea value:	Not Reported
Drainagearea Units:	Not Reported	Contrib drainagearea:	Not Reported
Contrib drainagearea units:	Not Reported	Latitude:	33.6791889
Longitude:	-117.151421	Sourcemap scale:	24000
Horiz Acc measure:	5	Horiz Acc measure units:	seconds
Horiz Collection method:	Interpolated from map		
Horiz coord refsys:	NAD83	Vert measure val:	1428
Vert measure units:	feet	Vertacc measure val:	5
Vert accmeasure units:	feet		
Vertcollection method:	Interpolated from topographic map		
Vert coord refsys:	NGVD29	Countrycode:	US
Aquifername:	California Coastal Basin aquifers		
Formation type:	Not Reported		
Aquifer type:	Not Reported		
Construction date:	Not Reported	Welldepth:	272.7
Welldepth units:	ft	Wellholedepth:	Not Reported
Wellholedepth units:	Not Reported		

Ground-water levels, Number of Measurements: 2

Date	Feet below Surface	Feet to Sealevel	Date	Feet below Surface	Feet to Sealevel
1995-09-28	96.83		1995-05-10	93.43	

15 **South** **1/2 - 1 Mile** **Lower**	**CA WELLS**	**CADW60000006217**

Objectid:	6217
Latitude:	33.670251
Longitude:	-117.136916
Site code:	336703N1171369W001
State well numbe:	Not Reported
Local well name:	'EMWD14358'
Well use id:	1
Well use descrip:	Observation
County id:	33
County name:	Riverside
Basin code:	'8-5'
Basin desc:	San Jacinto
Dwr region id:	80238
Dwr region:	Southern Region Office
Site id:	CADW60000006217

Map ID Direction Distance Elevation	Database	EDR ID Number
G16 **WNW** **1/2 - 1 Mile** **Lower**	**CA WELLS**	**CADW60000006171**

Objectid:	6171
Latitude:	33.68547
Longitude:	-117.151591
Site code:	336855N1171516W001
State well numbe:	Not Reported
Local well name:	'EMWD14432'
Well use id:	1
Well use descrip:	Observation
County id:	33
County name:	Riverside
Basin code:	'8-5'
Basin desc:	San Jacinto
Dwr region id:	80238
Dwr region:	Southern Region Office
Site id:	CADW60000006171

	Database	EDR ID Number
G17 **WNW** **1/2 - 1 Mile** **Lower**	**FED USGS**	**USGS40000136725**

Org. Identifier:	USGS-CA		
Formal name:	USGS California Water Science Center		
Monloc Identifier:	USGS-334107117090301		
Monloc name:	005S003W36N002S		
Monloc type:	Well		
Monloc desc:	ORIG DEPTH 700 FT, SOUNDED DEPTH 338.6 FT 4/26/95		
Huc code:	18070202	Drainagearea value:	Not Reported
Drainagearea Units:	Not Reported	Contrib drainagearea:	Not Reported
Contrib drainagearea units:	Not Reported	Latitude:	33.6852998
Longitude:	-117.1516988	Sourcemap scale:	24000
Horiz Acc measure:	5	Horiz Acc measure units:	seconds
Horiz Collection method:	Interpolated from map		
Horiz coord refsys:	NAD83	Vert measure val:	1425
Vert measure units:	feet	Vertacc measure val:	5
Vert accmeasure units:	feet		
Vertcollection method:	Interpolated from topographic map		
Vert coord refsys:	NGVD29	Countrycode:	US
Aquifername:	California Coastal Basin aquifers		
Formation type:	Not Reported		
Aquifer type:	Not Reported		
Construction date:	19770524	Welldepth:	338.6
Welldepth units:	ft	Wellholedepth:	700
Wellholedepth units:	ft		

Ground-water levels, Number of Measurements: 2

Date	Feet below Surface	Feet to Sealevel	Date	Feet below Surface	Feet to Sealevel
1995-09-28	95.07		1995-04-26	91.98	

Map ID Direction Distance Elevation	Database	EDR ID Number
F18 **West** **1/2 - 1 Mile** **Lower**	**CA WELLS**	**CADW60000021501**

Objectid:	21501
Latitude:	33.6792
Longitude:	-117.1523
Site code:	336792N1171523W001
State well numbe:	06S03W01E001S
Local well name:	’’
Well use id:	6
Well use descrip:	Unknown
County id:	33
County name:	Riverside
Basin code:	’8-5’
Basin desc:	San Jacinto
Dwr region id:	80238
Dwr region:	Southern Region Office
Site id:	CADW60000021501

Map ID Direction Distance Elevation	Database	EDR ID Number
G19 **WNW** **1/2 - 1 Mile** **Lower**	**CA WELLS**	**CADW60000035672**

Objectid:	35672
Latitude:	33.6853
Longitude:	-117.1526
Site code:	336853N1171526W001
State well numbe:	05S03W36N002S
Local well name:	’’
Well use id:	6
Well use descrip:	Unknown
County id:	33
County name:	Riverside
Basin code:	’8-5’
Basin desc:	San Jacinto
Dwr region id:	80238
Dwr region:	Southern Region Office
Site id:	CADW60000035672

Map ID Direction Distance Elevation	Database	EDR ID Number
H20 **WNW** **1/2 - 1 Mile** **Lower**	**CA WELLS**	**CADW60000021503**

Objectid:	21503
Latitude:	33.684827
Longitude:	-117.154138
Site code:	336847N1171551W001
State well numbe:	06S03W02A001S
Local well name:	’EMWD12840’
Well use id:	1
Well use descrip:	Observation
County id:	33
County name:	Riverside

Basin code:	'8-5'
Basin desc:	San Jacinto
Dwr region id:	80238
Dwr region:	Southern Region Office
Site id:	CADW60000021503

H21
WNW
1/2 - 1 Mile
Lower

FED USGS **USGS40000136718**

Org. Identifier:	USGS-CA		
Formal name:	USGS California Water Science Center		
Monloc Identifier:	USGS-334105117091201		
Monloc name:	006S003W02A001S		
Monloc type:	Well		
Monloc desc:	ORIG DEPTH 580 FT SOUNDED DEPTH 577 FT		
Huc code:	18070202	Drainagearea value:	Not Reported
Drainagearea Units:	Not Reported	Contrib drainagearea:	Not Reported
Contrib drainagearea units:	Not Reported	Latitude:	33.6847443
Longitude:	-117.1541989	Sourcemap scale:	24000
Horiz Acc measure:	5	Horiz Acc measure units:	seconds
Horiz Collection method:	Interpolated from map		
Horiz coord refsys:	NAD83	Vert measure val:	1425
Vert measure units:	feet	Vertacc measure val:	5
Vert accmeasure units:	feet		
Vertcollection method:	Interpolated from topographic map		
Vert coord refsys:	NGVD29	Countrycode:	US
Aquifername:	California Coastal Basin aquifers		
Formation type:	Not Reported		
Aquifer type:	Not Reported		
Construction date:	19930811	Welldepth:	577
Welldepth units:	ft	Wellholedepth:	600
Wellholedepth units:	ft		

Ground-water levels, Number of Measurements: 2

Date	Feet below Surface	Feet to Sealevel	Date	Feet below Surface	Feet to Sealevel
1995-09-28	98.27		1995-04-26	93.97	

I22
WSW
1/2 - 1 Mile
Lower

CA WELLS **CADW60000006215**

Objectid:	6215
Latitude:	33.678589
Longitude:	-117.1546
Site code:	336786N1171546W001
State well numbe:	Not Reported
Local well name:	'EMWD12847'
Well use id:	3
Well use descrip:	Irrigation
County id:	33
County name:	Riverside

Basin code:	'8-5'
Basin desc:	San Jacinto
Dwr region id:	80238
Dwr region:	Southern Region Office
Site id:	CADW60000006215

I23
WSW
1/2 - 1 Mile
Lower

FED USGS **USGS40000136644**

Org. Identifier:	USGS-CA		
Formal name:	USGS California Water Science Center		
Monloc Identifier:	USGS-334042117091501		
Monloc name:	006S003W02H002S		
Monloc type:	Well		
Monloc desc:	Not Reported		
Huc code:	18070202	Drainagearea value:	Not Reported
Drainagearea Units:	Not Reported	Contrib drainagearea:	Not Reported
Contrib drainagearea units:	Not Reported	Latitude:	33.6783556
Longitude:	-117.1550322	Sourcemap scale:	24000
Horiz Acc measure:	5	Horiz Acc measure units:	seconds
Horiz Collection method:	Interpolated from map		
Horiz coord refsys:	NAD83	Vert measure val:	1428
Vert measure units:	feet	Vertacc measure val:	10
Vert accmeasure units:	feet		
Vertcollection method:	Interpolated from topographic map		
Vert coord refsys:	NGVD29	Countrycode:	US
Aquifername:	California Coastal Basin aquifers		
Formation type:	Not Reported		
Aquifer type:	Not Reported		
Construction date:	19871009	Welldepth:	565
Welldepth units:	ft	Wellholedepth:	565
Wellholedepth units:	ft		

Ground-water levels, Number of Measurements: 1

Date	Feet below Surface	Feet to Sealevel
1995-06-02	95.26	

24
NW
1/2 - 1 Mile
Higher

FED USGS **USGS40000136812**

Org. Identifier:	USGS-CA		
Formal name:	USGS California Water Science Center		
Monloc Identifier:	USGS-334133117085501		
Monloc name:	005S003W36E001S		
Monloc type:	Well		
Monloc desc:	ORIG DEPTH 270 SOUNDED DEPTH 51.2 FT ON 6/2/95		
Huc code:	18070202	Drainagearea value:	Not Reported
Drainagearea Units:	Not Reported	Contrib drainagearea:	Not Reported
Contrib drainagearea units:	Not Reported	Latitude:	33.6925218
Longitude:	-117.1494765	Sourcemap scale:	24000

Horiz Acc measure:	5	Horiz Acc measure units:	seconds
Horiz Collection method:	Interpolated from map		
Horiz coord refsys:	NAD83	Vert measure val:	1431
Vert measure units:	feet	Vertacc measure val:	5
Vert accmeasure units:	feet		
Vertcollection method:	Interpolated from topographic map		
Vert coord refsys:	NGVD29	Countrycode:	US
Aquifername:	California Coastal Basin aquifers		
Formation type:	Not Reported		
Aquifer type:	Not Reported		
Construction date:	Not Reported	Welldepth:	51.2
Welldepth units:	ft	Wellholedepth:	270
Wellholedepth units:	ft		

Ground-water levels, Number of Measurements: 2

Date	Feet below Surface	Feet to Sealevel	Date	Feet below Surface	Feet to Sealevel
1995-09-28	46.63		1995-06-02	47.93	

AREA RADON INFORMATION

State Database: CA Radon

Radon Test Results

Zipcode	Num Tests	> 4 pCi/L
92584	3	0

Federal EPA Radon Zone for RIVERSIDE County: 2

Note: Zone 1 indoor average level > 4 pCi/L.
: Zone 2 indoor average level >= 2 pCi/L and <= 4 pCi/L.
: Zone 3 indoor average level < 2 pCi/L.

Federal Area Radon Information for RIVERSIDE COUNTY, CA

Number of sites tested: 12

Area	Average Activity	% <4 pCi/L	% 4-20 pCi/L	% >20 pCi/L
Living Area - 1st Floor	0.117 pCi/L	100%	0%	0%
Living Area - 2nd Floor	0.450 pCi/L	100%	0%	0%
Basement	1.700 pCi/L	100%	0%	0%

PHYSICAL SETTING SOURCE RECORDS SEARCHED

TOPOGRAPHIC INFORMATION

USGS 7.5' Digital Elevation Model (DEM)
Source: United States Geologic Survey
EDR acquired the USGS 7.5' Digital Elevation Model in 2002 and updated it in 2006. The 7.5 minute DEM corresponds to the USGS 1:24,000- and 1:25,000-scale topographic quadrangle maps. The DEM provides elevation data with consistent elevation units and projection.

Current USGS 7.5 Minute Topographic Map
Source: U.S. Geological Survey

HYDROLOGIC INFORMATION

Flood Zone Data: This data, available in select counties across the country, was obtained by EDR in 2003 & 2011 from the Federal Emergency Management Agency (FEMA). Data depicts 100-year and 500-year flood zones as defined by FEMA.

NWI: National Wetlands Inventory. This data, available in select counties across the country, was obtained by EDR in 2002, 2005 and 2010 from the U.S. Fish and Wildlife Service.

State Wetlands Data: Wetland Inventory
Source: Department of Fish & Game
Telephone: 916-445-0411

HYDROGEOLOGIC INFORMATION

AQUIFLOW[R] Information System
Source: EDR proprietary database of groundwater flow information
EDR has developed the AQUIFLOW Information System (AIS) to provide data on the general direction of groundwater flow at specific points. EDR has reviewed reports submitted to regulatory authorities at select sites and has extracted the date of the report, hydrogeologically determined groundwater flow direction and depth to water table information.

GEOLOGIC INFORMATION

Geologic Age and Rock Stratigraphic Unit
Source: P.G. Schruben, R.E. Arndt and W.J. Bawiec, Geology of the Conterminous U.S. at 1:2,500,000 Scale - A digital representation of the 1974 P.B. King and H.M. Beikman Map, USGS Digital Data Series DDS - 11 (1994).

STATSGO: State Soil Geographic Database
Source: Department of Agriculture, Natural Resources Conservation Service (NRCS)
The U.S. Department of Agriculture's (USDA) Natural Resources Conservation Service (NRCS) leads the national Conservation Soil Survey (NCSS) and is responsible for collecting, storing, maintaining and distributing soil survey information for privately owned lands in the United States. A soil map in a soil survey is a representation of soil patterns in a landscape. Soil maps for STATSGO are compiled by generalizing more detailed (SSURGO) soil survey maps.

SSURGO: Soil Survey Geographic Database
Source: Department of Agriculture, Natural Resources Conservation Service (NRCS)
Telephone: 800-672-5559
SSURGO is the most detailed level of mapping done by the Natural Resources Conservation Service, mapping scales generally range from 1:12,000 to 1:63,360. Field mapping methods using national standards are used to construct the soil maps in the Soil Survey Geographic (SSURGO) database. SSURGO digitizing duplicates the original soil survey maps. This level of mapping is designed for use by landowners, townships and county natural resource planning and management.

PHYSICAL SETTING SOURCE RECORDS SEARCHED

LOCAL / REGIONAL WATER AGENCY RECORDS

FEDERAL WATER WELLS

PWS: Public Water Systems
Source: EPA/Office of Drinking Water
Telephone: 202-564-3750
Public Water System data from the Federal Reporting Data System. A PWS is any water system which provides water to at least 25 people for at least 60 days annually. PWSs provide water from wells, rivers and other sources.

PWS ENF: Public Water Systems Violation and Enforcement Data
Source: EPA/Office of Drinking Water
Telephone: 202-564-3750
Violation and Enforcement data for Public Water Systems from the Safe Drinking Water Information System (SDWIS) after August 1995. Prior to August 1995, the data came from the Federal Reporting Data System (FRDS).

USGS Water Wells: USGS National Water Inventory System (NWIS)
This database contains descriptive information on sites where the USGS collects or has collected data on surface water and/or groundwater. The groundwater data includes information on wells, springs, and other sources of groundwater.

STATE RECORDS

Water Well Database
Source: Department of Water Resources
Telephone: 916-651-9648

California Drinking Water Quality Database
Source: Department of Public Health
Telephone: 916-324-2319
The database includes all drinking water compliance and special studies monitoring for the state of California since 1984. It consists of over 3,200,000 individual analyses along with well and water system information.

OTHER STATE DATABASE INFORMATION

California Oil and Gas Well Locations
Source: Department of Conservation
Telephone: 916-323-1779
Oil and Gas well locations in the state.

RADON

State Database: CA Radon
Source: Department of Health Services
Telephone: 916-324-2208
Radon Database for California

Area Radon Information
Source: USGS
Telephone: 703-356-4020
The National Radon Database has been developed by the U.S. Environmental Protection Agency (USEPA) and is a compilation of the EPA/State Residential Radon Survey and the National Residential Radon Survey. The study covers the years 1986 - 1992. Where necessary data has been supplemented by information collected at private sources such as universities and research institutions.

EPA Radon Zones
Source: EPA
Telephone: 703-356-4020
Sections 307 & 309 of IRAA directed EPA to list and identify areas of U.S. with the potential for elevated indoor radon levels.

OTHER

Airport Landing Facilities: Private and public use landing facilities
Source: Federal Aviation Administration, 800-457-6656

Epicenters: World earthquake epicenters, Richter 5 or greater
Source: Department of Commerce, National Oceanic and Atmospheric Administration

California Earthquake Fault Lines: The fault lines displayed on EDR's Topographic map are digitized quaternary fault lines, prepared in 1975 by the United State Geological Survey. Additional information (also from 1975) regarding activity at specific fault lines comes from California's Preliminary Fault Activity Map prepared by the California Division of Mines and Geology.

STREET AND ADDRESS INFORMATION

APPENDIX E

PROJECT TEAM QUALIFICATIONS

Anna M. Scott

Project Geologist

Education

B.S., Geology, University of California, Riverside

Certifications

ICC Soils Special Inspector No. 8160149 (issued 05/23/12 and expires 05/23/18)

Professional Experience

Ms. Anna Scott has over 25 years of geotechnical experience and has worked on or managed a wide range of geotechnical projects throughout Southern California, including the High Desert, Inland Empire, Antelope Valley, Coachella Valley, Orange County and Bakersfield area. Her geotechnical experience has ranged from field and laboratory technician to field, staff and project geologist. Ms. Scott's responsibilities include preparation of proposals, preliminary geotechnical investigations, seismic studies, settlement monitor installation and studies, and field studies as a technician and geologist for large grading projects. Ms. Scott has performed Phase I and II ESAs for various property acquisitions and transfers in Orange, Riverside and San Bernardino Counties.

Representative Project Experience-

Ms. Scott has worked on numerous projects throughout Southern California. Her experience includes working with various entities including the public and private sectors. Her vast knowledge includes geotechnical, environmental and materials services. This experience has been attained through small and large projects over the numerous years of her career.

Employment History

GeoTek, Inc., Project Geologist February 2005 to Present

GeoSoils, Inc. (Santa Ana) September 1987 to February 2005

Edward H. LaMont, CEG, PG, REA

Branch Manager

Areas of Expertise

Grading and Earthwork Construction
Industry Standard of Care
Hillside, Liquefaction, Seismic Hazard, Fault Analyses and Forensic Studies.

Education

Bachelor of Science in Geology, Cal State University, Northridge

Registrations

Registered Geologist, PG 6025
Certified Engineering Geologist, CEG 1892
Registered Environmental Assessor, REA I 04620

Certifications

OSHA 40-Hr HAZWOPER Training
OSHA 8-Hour Refresher
First Aid/CPR

Professional Affiliations

Association of Engineering Geologist
South Coast Geological Society
San Diego Association of Geologist
Inland Geological Society
BIA Riverside

Professional Experience

Mr. LaMont has been involved with numerous large residential and commercial earthwork projects within the southern California area. Numerous residential and public works projects have been successfully completed in the High Desert area, including in the cities of Victorville, Hesperia, Adelanto, Palmdale and Lancaster. Multi-million cubic yard projects in Riverside County include Eagle Glen in Corona and The Retreat in south Corona/Riverside County; Projects in the Temecula area include commercial Developments for The Garrett Group, a Temecula Valley Winery, Ranch Development (Old Town Temecula) and single-family residential projects. These projects have generally included preliminary geotechnical investigations, slope stability evaluations, review and design recommendations, fault evaluations, street improvements construction and testing services, and project management.

In addition to the experience on large hillside residential developments, Mr. LaMont has performed numerous fault and landslide investigations, and performed governmental review of geotechnical reports for the County of Orange. Mr. LaMont has also completed geotechnical studies for the Riverside County Flood Control, City of Lancaster and City of Victorville.

Representative Project Experience

Project experience has included residential tracts, for various land developers including The Garrett Group, The Focus Group, Frontier Homes; Empire Homes; D.R. Horton; Beazer Homes; Tandis Homes; Kaylind Communities; Ion Communities; Empire Land, Royal Investors Group and Heller Development. Mr. LaMont has also completed geotechnical investigations and performed project management for several residential tracts and commercial facilities within the Mountain Gate Development – Corona; Norco; Moreno Valley; Beaumont; Winchester; Murrieta; City of Riverside; Fontana; Rancho Cucamonga; Banning; San Jacinto, Temecula (PHS Building Site for The Garrett Group, Old Town for Ranch Development, etc.)

Professional History

Branch Manager - Riverside GeoTek, Inc., 2004 to present

Vice President, Principal Geologist --GeoSoils, Inc., Santa Ana, 2003 to 2004

Geotechnical Reviewer, Geologist. County of Orange, 2001 to 2003.

Project Geologist. GeoSoils, Inc., Santa Ana, California, 1994 to 2001.

Staff/Project Geologist GeoSoils, Inc., Carlsbad, California, 1988-1994.

J. MICHAEL BATTEN, CAC, CEM, REPA

Environmental Services Manager

Education

BS in Geology, California State University, Fresno 1988

Registrations

- Certified Asbestos Consultant (CA #95-1721)
- Licensed Asbestos Abatement Consultant (NV #IJPM0655)
- Certified Environmental Manager (NV #1782)
- Asbestos Professional Inspector (IL #100-11092)
- Registered Environmental Property Assessor (#113162))
- Certified Lead Inspector Assessor (CA #4358)

Certifications

- AHERA Certified Asbestos Building Inspector, Management Planner, Project Designer, & Contractor/Supervisor
- EPA Accredited Lead-based Paint Inspector & Risk Assessor
- OSHA HAZWOPER certified worker & supervisor
- OSHA Construction Safety & Health (10-Hour)

Affiliations

- American Society of Testing and Materials
- National Registry of Environmental Professionals

Professional Experience

Mr. Batten has over 25 years of environmental experience, throughout which he has conducted and managed numerous environmental investigations, assessments, and remediations. He has prepared several NEPA assessments, USEPA EIS, and CEQA EIR reports. In addition, Mr. Batten has extensive experience in conducting asbestos and lead-based paint surveys and preparing management plans, including remediation design, for asbestos and lead present in buildings.

Project Experience

- **Phase I Environmental Site Assessments:** Mr. Batten has conducted more than 2,000 Phase I Environmental Site Assessments in 21 states, including Brownfield studies under USEPA grants.
- **Phase II Environmental Site Assessments:** Mr. Batten has conducted more than 150 Phase II Environmental Assessments, including Brownfield studies under USEPA grants.
- **Site Characterizations and Remediations:** Mr. Batten has experience conducting numerous site characterizations and remediations, including obtaining regulatory closure.
- **NEPA Studies:** Mr. Batten has conducted more than 200 NEPA studies, including Environmental Assessments, Environmental Impact Reports/Environmental Impact Studies, in eight states. The agencies involved include USEPA, FCC, BLM, National Park Service, and California EPA.
- **Asbestos Services:** Mr. Batten has conducted over 600 asbestos surveys in several states. He has also prepared numerous Asbestos Management Plans, prepared design plans, and monitored numerous abatement projects.
- **Lead-Based Paint Services:** Mr. Batten has conducted numerous Lead-Based Paint surveys.
- **Landfills**: Mr. Batten has conducted investigations and overseen remediations on landfills in Fresno, California and Henderson, Nevada.
- **Other Services:** Mr. Batten has been called upon to conduct less usual services on occasion, including mold consultation and investigation, radon studies, vapor intrusion studies, and indoor air quality studies.

GEOTEK

Professional History

Environmental Services Manager. GeoTek, Inc., 2001 to present.

Director of Environmental Services. ATC Associates, Inc., 1999 to 2001.

Director of Operations. Hygienetics Environmental Services, Inc., 1997 to 1999.

Project Manager. AllWest Environmental, Inc., 1996 to 1997.

Project Manager. Citadel Environmental Services, Inc., 2/1996 to 9/1996.

Project Manager. Boelter Environmental consultants, 3/1995 to 9/1995.

Senior Staff Geologist. Converse Consultants, 1992 to 1995.

Staff Geologist. Converse Environmental West, 1991 to 1992.

Project Geologist. Krazan and Associates, 1990 to 1991.

Environmental Technician. Krazan and Associates, 1989 to 1990.

STATE OF CALIFORNIA Edmund G. Brown, Jr. *Governor*

DEPARTMENT OF INDUSTRIAL RELATIONS
Division of Occupational Safety and Health
Asbestos Unit
2424 Arden Way, Suite 495
Sacramento, CA 95825-2417
(916) 574-2993 Office (916) 483-0572 Fax
http://www.dir.ca.gov/dirdatabases.html actu@dir.ca.gov

505011721C **109** **115**

September 04, 2015

J. Michael Batten
8240 Edmond Street
Las Vegas ' NV 89139

Dear Certified Asbestos Consultant or Technician:

Enclosed is your certification card. **To maintain your certification, you must abide by the rules printed on the back of the certification card.**

Your certification is valid for a period of one year. If you wish to renew your certification, you must apply for renewal at least 60 days before the expiration date shown on your card. [8 CCR 341.15(h)(1)].

Please hold and do not send copies of your required AHERA refresher renewal certificates to our office until you apply for renewal of your certification.

Certificates must be kept current if you are actively working as a CAC or CSST. The grace period is only for those who are not actively working as an asbestos consultant or site surveillance technician.

Please contact our office at the above address, fax number or email; of any changes in your contact/mailing information within 15 days of the change.

Sincerely,

Jeff Ferrell
Senior Safety Engineer

Attachment: Certification Card

cc: File

Renewal – Card Attached (Revised 10/24/2012)

State of California
Division of Occupational Safety and Health
Certified Asbestos Consultant

J. Michael Batten
Name
Certification No. **95-1721**
Expires on **10/27/16**
This certification was issued by the Division of Occupational Safety and Health as authorized by Sections 7180 et seq. of the Business and Professions Code.

California Department of
Public Health CDPH

Mr. J. Michael Batten
Geotek, Inc
6835 South Escondido Street
Las Vegas, Nevada 891189

Conditions of Certification

This individual meets the requirements of the State of California, Department of Public Health (CDPH), to perform lead-related construction. CDPH may suspend or revoke certification for:

1. any false statement in the application (for certification);
2. violations of relevant local, state or federal statutes or regulations;
3. misrepresentation, failure to disclose relevant facts, fraud, or issuance by mistake; or
4. failure to comply with any relevant regulation or order of the Department.

This certificate was issued by the Department of Public Health as authorized by 17 CCR 35001 et seq., and is non-transferable.

To verify authenticity call
(800) 597-LEAD or
510-620-5600

03203118

IDPH
ILLINOIS DEPARTMENT OF PUBLIC HEALTH

525-535 West Jefferson Street • Springfield, Illinois 62761-0001 • www.dph.illinois.gov

4/22/2015

MICHAEL BATTEN
8240 EDMOND STREET
LAS VEGAS, NV 89139

ASBESTOS PROFESSIONAL LICENSE ID NUMBER: 11092

Enclosed is your Asbestos Professional License that expires 05/15/2016

CERTIFICATE EXPIRATION DATE

INSPECTOR	4/7/2016

If you have any questions or need further assistance, contact the Asbestos Program at (217)782-3517 or fax (217)785-5897.
Our WEB address is http://www.idph.state.il.us/envhealth/ehhome.htm

IDPH ASBESTOS PROFESSIONAL LICENSE

ID NUMBER	ISSUED	EXPIRES
100 - 11092	4/22/2015	05/15/2016

MICHAEL BATTEN
8240 EDMOND STREET
LAS VEGAS, NV 89139
Environmental Health

State of Nevada

Department of Conservation and Natural Resources

Division of Environmental Protection

This is to certify that

Michael J. Batten

having given satisfactory evidence of the necessary qualifications as required by the Nevada Revised Statute 459.400 to 459.600, inclusive, and Nevada Administrative Code 459.970 to 459.9729, inclusive, has been granted certification as a

Environmental Manager

in the State of Nevada

In testimony whereof, witness the signature of the Administrator and the Seal of the State of Nevada.

1782

Certification Number

David Emme, Administrator

August 31, 2017

Expiration Date

National Registry of Environmental Professionals

Be it known to all persons that the following individual pursuant to the requirements for education, experience and examination established by the National Registry of Environmental Professionals is entitled to all of the rights and privileges by the body and to be duly registered by it.

This is to certify that

Michael J Batten

is a

Registered Environmental Property Assessor

This certificate will remain valid only if it bears the seal of the current year, unless revoked, suspended or invalidated by order of the Board of Directors of the National Registry of Environmental Professionals.

Witness our hand

This Day **06/15/2013**

Executive Director

Registration Number: **REPA 113162**

This certificate is the property of the National Registry of Environmental Professionals and must upon demand be returned.

WESTERN REGIONAL LEAD TRAINING CENTER
AT THE UNIVERSITY OF CALIFORNIA, SAN DIEGO
15090 AVENUE OF SCIENCE • SAN DIEGO, CA 92128 • 1-800/572-LEAD

This is to verify that

J. BATTEN

has successfully completed 24 hours of instruction in

LEAD INSPECTOR TRAINING

05/09/94 - 05/11/94
Date

David Carey, Director
Western Regional Lead Training Center

EPA
Certificate No.
I 0240

UCSD Extension
University of California, San Diego

This is to verify that

J. Michael Batten

has completed 8 hours in the course

Risk Assessment Protocol for Lead Contamination

with the Environmental Training Center

OCTOBER 31, 1994
Date

David W. Carey, Director
Department of Environmental Management

STATE OF NEVADA
DEPARTMENT OF BUSINESS AND INDUSTRY
DIVISION OF INDUSTRIAL RELATIONS
Occupational Safety and Health Administration
Asbestos Control Program

Certifies That J. Michael Batten
Geotek Insite Inc.
is Licensed As Asbestos Abatement Consultant

License No. IJPM-655 Expiration Date 03/25/2016

Signature Of Licensee J M Batten

National Registry of Environmental Professionals.
CERTIFIED

Michael Batten REPA 113162
Registered Environmental Property Assessor

The Person Named Above is Qualified as Defined by the NREP

Richard A. Young
Executive Director

First Certified: 06/15/2013

06/15/2016
Expiration Date

M&C Environmental Training

Asbestos Contractor/Supervisor
Refresher Training Course

J. Michael Batten

[illegible]

Course Approval Number: [illegible]

Location: Oakland, California Expiration: September [illegible], 2015
Date: September [illegible], 2014
Director of Training: John McGinnis

Certificate Number [illegible]

M&C Environmental Training

Asbestos Project Designer
Refresher Training Course

J. Michael Batten

[illegible]

Course Approval Number: [illegible]

Location: Oakland, California Expiration: September [illegible], 2015
Date: September [illegible], 2014
Director of Training: John McGinnis

Certificate Number [illegible]

This is to Certify that
Michael Batten
Has Satisfactorily Completed Training in Accordance with Applicable Rules and Regulations
Asbestos Building Inspector Refresher

Completed: 4/7/2015 *Expires: 4/7/2016*
Certificate: BIR1504071883

2015 Occupational Training & Supply, Inc.
7233 Adams Street • Willowbrook, IL 60527 • (630) 655-3900

OSHA 002340551

U.S. Department of Labor
Occupational Safety and Health Administration

Michael Batten

has successfully completed a 10-hour Occupational Safety and Health Training Course in

Construction Safety & Health

Kenner Costen 12/12/09
(Trainer) (Date)

M&C Environmental Training

Asbestos Project Designer
Refresher Training Course

J. Michael Batten

has successfully completed the Asbestos Project Designer Refresher course approved by the California Division of Occupational Safety and Health for purposes of certification required by Title 8, Article 2.7 Chapter 3.2, Section 341.16 and the accreditation required under the Toxic Substances Control Act, Title II. Conducted by M&C Environmental Training, Inc., 1619 Beverly Place, Berkeley, California 94707. Tel. #(510) 525 - 1388

Course Approval Number: CA-003-10

Location: **Oakland, California** Expiration: **September 16, 2016**

Dates: **September 16, 2015**

Director of Training: **John McGinnis**

John McGinnis

Certificate Number **38632 DR**

M&C Environmental Training

Asbestos Contractor/Supervisor
Refresher Training Course

J. Michael Batten

has successfully completed the Asbestos Contractor/Supervisor Refresher course approved by the California Division of Occupational Safety and Health for purposes of certification required by Title 8, Article 2.7 Chapter 3.2, Section 341.16 and the accreditation required under the Toxic Substances Control Act, Title II. Conducted by M&C Environmental Training, Inc., 1619 Beverly Place, Berkeley, California 94707. Tel. #(510) 525 - 1388

Course Approval Number: CA-003-04

Location: **Oakland, California** Expiration: **September 18, 2016**

Dates: **September 18, 2015**

Director of Training: **John McGinnis**

John McGinnis

Certificate Number **38675 SR**

Appendix 5: LID Infeasibility

LID Technical Infeasibility Analysis

Rockport Ranch DMA In feasibility list

I.2 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.

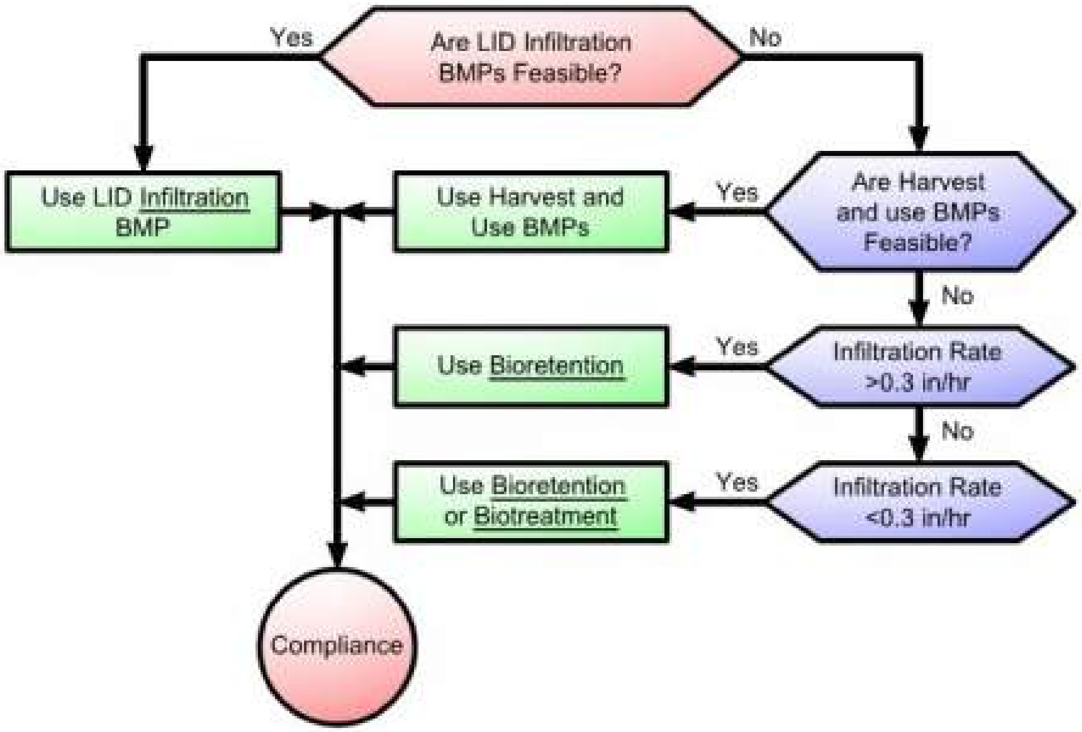


FIGURE 3-6. LID BMP Feasibility Flow Chart

The BMP feasibility analysis must be performed on a DMA by DMA basis.

DMA List (DMA by DMA) determination of feasibility

DMA – 1: This DMA is located to the North West end of the proposed site. It is a Self-Treating area that will include only landscaping and will be allowed to run naturally to the POC as do the existing conditions.

DMA – 2: This DMA is located at the North West corner of the site. It features a portion of the existing Old Newport Road as well as pervious area in the right of way. This area was deemed not feasible to allow infiltration since rates are 0.01 to 0.06 in/hr. Harvest and use was also not feasible (see section D.2), and with an infiltration rate less than 0.3in/hr the flow chart leaves Bioretention or Biotreatment; a lined Bioretention facility is proposed; BMP-A.

DMA – 3: This DMA is located at the North end of the site. It features a portion of the Old Newport Road as well as pervious area in the right of way. This area was deemed not feasible to allow infiltration since rates are 0.01 to 0.06 in/hr. Harvest and use was also not feasible (see section D.2), and with an infiltration rate less than 0.3in/hr the flow chart leaves Bioretention or Biotreatment; a lined Bioretention facility is proposed; BMP-B.

DMA – 4: This DMA is located at the North West end of the site. It is about the second quadrant (on a Cartesian Plane) of a residential development proposed for the site. Infiltration BMPs are not feasible due to the low infiltration rate of 0.01 to 0.06 in/hr. Harvest and use was also not feasible (see section D.2), and with an infiltration rate less than 0.3in/hr the flow chart leaves Bioretention or Biotreatment; a wet pond, BMP H, was chosen as the proposed Structural BMP. Please see Wet Pond documents at end of Appendix 6.

DMA – 5: This DMA is located at the North East end of the site. It is about the first quadrant (on a Cartesian Plane) of a residential development proposed for the site. Infiltration BMPs are not feasible due to the low infiltration rate of 0.01 to 0.06 in/hr. Harvest and use was also not feasible (see section D.2), and with an infiltration rate less than 0.3in/hr the flow chart leaves Bioretention or Biotreatment; a wet pond, BMP H, was chosen as the proposed Structural BMP. Please see Wet Pond documents at end of Appendix 6.

DMA – 6: This DMA is located approximately half way down the site from the North end and towards the West property line. Infiltration BMPs are not feasible due to the low infiltration rate of 0.01 to 0.06 in/hr. Harvest and use was also not feasible (see section D.2), and with an infiltration rate less than 0.3in/hr flow chart leaves Bioretention or Biotreatment; a wet pond, BMP H, was chosen as the proposed Structural BMP. Please see Wet Pond documents at end of Appendix 6.

DMA – 7: This DMA was removed and is now just BMP-H. Please see Wet Pond documents at end of Appendix 6.

DMA – 8: This DMA is located at the Mid-West end of the site. It is the top of the third quadrant (on a Cartesian Plane) of residential development proposed for the site. Infiltration BMPs are not feasible due to the low infiltration rate of 0.01 to 0.06 in/hr. Harvest and use was also not feasible (see section D.2), and with an infiltration less than 0.3in/hr the flow chart leaves Bioretention or Biotreatment; a wet pond, BMP H, was chosen as the proposed Structural BMP. Please see Wet Pond documents at end of Appendix 6.

DMA – 9: This DMA is located at the South West end of the site and is in the third quadrant (on a Cartesian Plane) of residential development proposed for the site. Infiltration BMPs are not feasible due to the low infiltration rate of 0.01 to 0.06 in/hr. Harvest and use was also not feasible (see section D.2), and with an infiltration rate less than 0.3in/hr the flow chart leaves

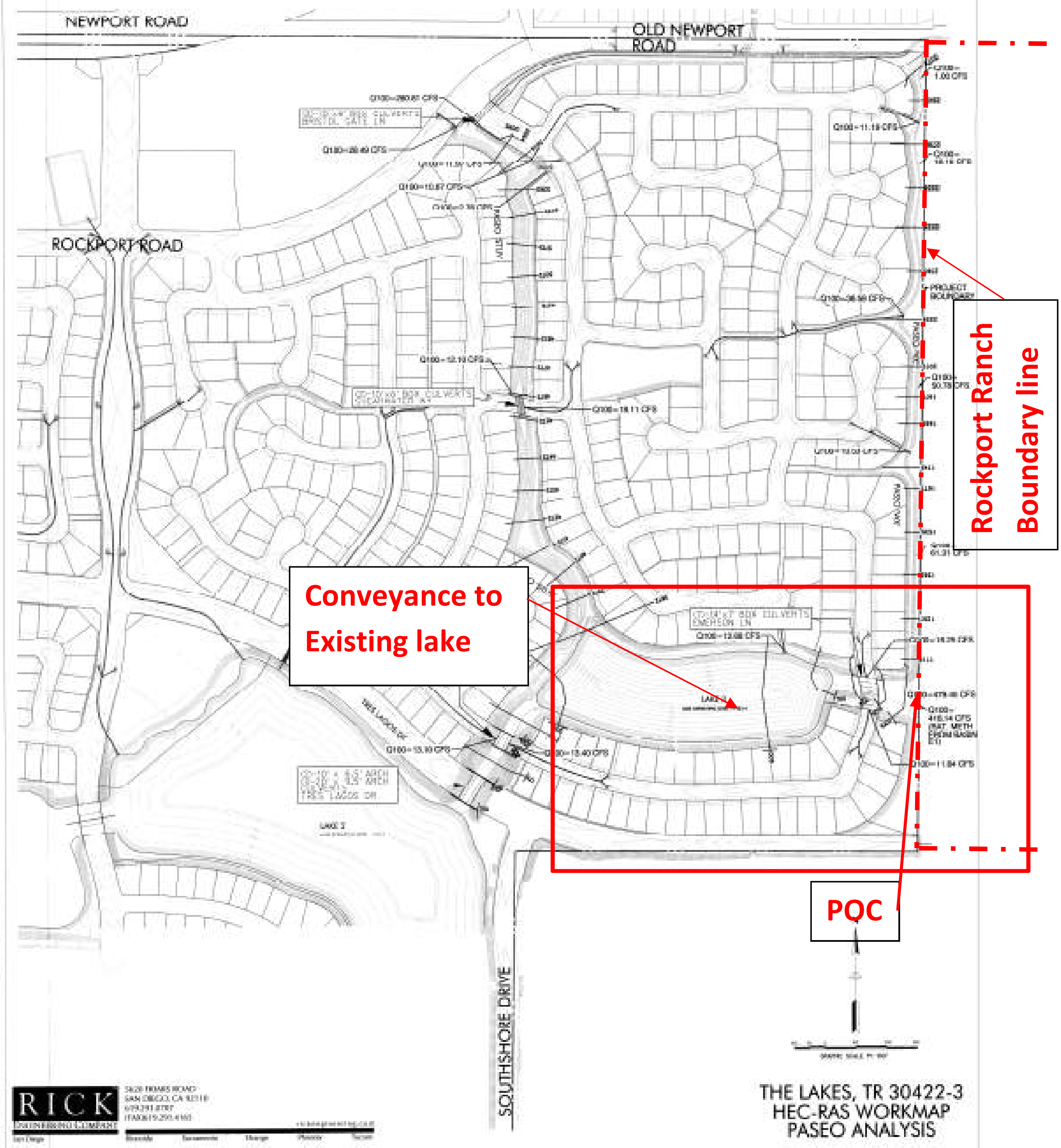
Bioretention or Biotreatment; a wet pond, BMP H, was Chosen as the proposed Structural BMP. Please see Wet Pond documents at end of Appendix 6.

DMA – 10: This DMA was removed and is now just BMP-H. Please see Wet Pond documents at end of Appendix 6.

DMA – 11: This DMA is located at the South East end of the site and is in the fourth quadrant (on a Cartesian Plane) of residential development proposed for the site. Infiltration BMPs are not feasible due to the low infiltration rate of 0.01 to 0.06 in/hr. Harvest and use was also not feasible (see section D.2), and with an infiltration rate less than 0.3in/hr the flow chart leaves Bioretention or Biotreatment; a wet pond, BMP H, was chosen as the proposed Structural BMP. Please see Wet Pond documents at end of Appendix 6.

DMA – 12: This DMA is a self-retaining area that is conveying water directly off site to the lake next door for treatment. A closed conduit (box culvert) is to convey treated water from DMAs 14-18, as well as the water designed in Q100 flood conditions from offsite. This water is conveyed from the east end of the site to the west to meet the POC; then travel to the next site downstream for treatment in the existing wet pond according to the master drainage map. See map below.

THE LAKES, TR 30422-3
HEC-RAS WORKMAP
PASEO ANALYSIS



DMA – 13: This DMA was incorporated into DMA-14 and DMA-15 and allows the water to be captured in the bioretention treatment facility that will be located in the respected DMAs.

DMA – 14: This DMA is located at the South West corner of the site, it features a portion of Tres Lagos that is a proposed road south of the site. This area was deemed not feasible to allow infiltration since rates are 0.01 to 0.06 in/hr. Harvest and use was also not feasible (see section D.2), and with an infiltration rate less than 0.3in/hr the flow chart leaves Bioretention or Biotreatment; a lined Bioretention facility, BMP C, was chosen as the proposed Structural BMP.

DMA – 15: This DMA is located at the South West corner of the site, it features a portion of Tres Lagos that is a proposed road south of the site. This area was deemed not feasible to allow infiltration since rates are 0.01 to 0.06 in/hr. Harvest and use was also not feasible (see section D.2), and with an infiltration rate less than 0.3in/hr the flow chart leaves Bioretention or Biotreatment; a lined Bioretention facility, BMP D, was chosen as the proposed Structural BMP.

DMA – 16: This DMA is located on the East side of site. Infiltration BMPs are not feasible due to the low infiltration rate of 0.01 to 0.06 in/hr. Harvest and use was also not feasible (see section D.2), and with an infiltration rate less than 0.3in/hr the flow chart leaves Bioretention or Biotreatment; a lined Bioretention, BMP E, was chosen as the proposed Structural BMP.

DMA – 17: This DMA is located on the East side of site. Infiltration BMPs are not feasible due to the low infiltration rate of 0.01 to 0.06 in/hr. Harvest and use was also not feasible (see section D.2), and with an infiltration rate less than 0.3in/hr the flow chart leaves Bioretention or Biotreatment; a lined Bioretention, BMP F, was chosen as the proposed Structural BMP.

DMA – 18: This DMA is located on the East side of site. Infiltration BMPs are not feasible due to the low infiltration rate of 0.01 to 0.06 in/hr. Harvest and use was also not feasible (see section D.2), and with an infiltration rate less than 0.3in/hr the flow chart leaves Bioretention or Biotreatment; a lined Bioretention, BMP G, was chosen as the proposed Structural BMP.

Wet Pond

Basis for Design

The Rockport Ranch project is proposing to construct a Wet Pond Basin. A wet pond is not specifically detailed in the Riverside County WQMP so supporting documents on how research was implemented in order to insure compliance with the WQMP is established herein.

(As an additional look at the Basis of Design for the use of Wet Ponds, please see the Flow Chart on the next page)

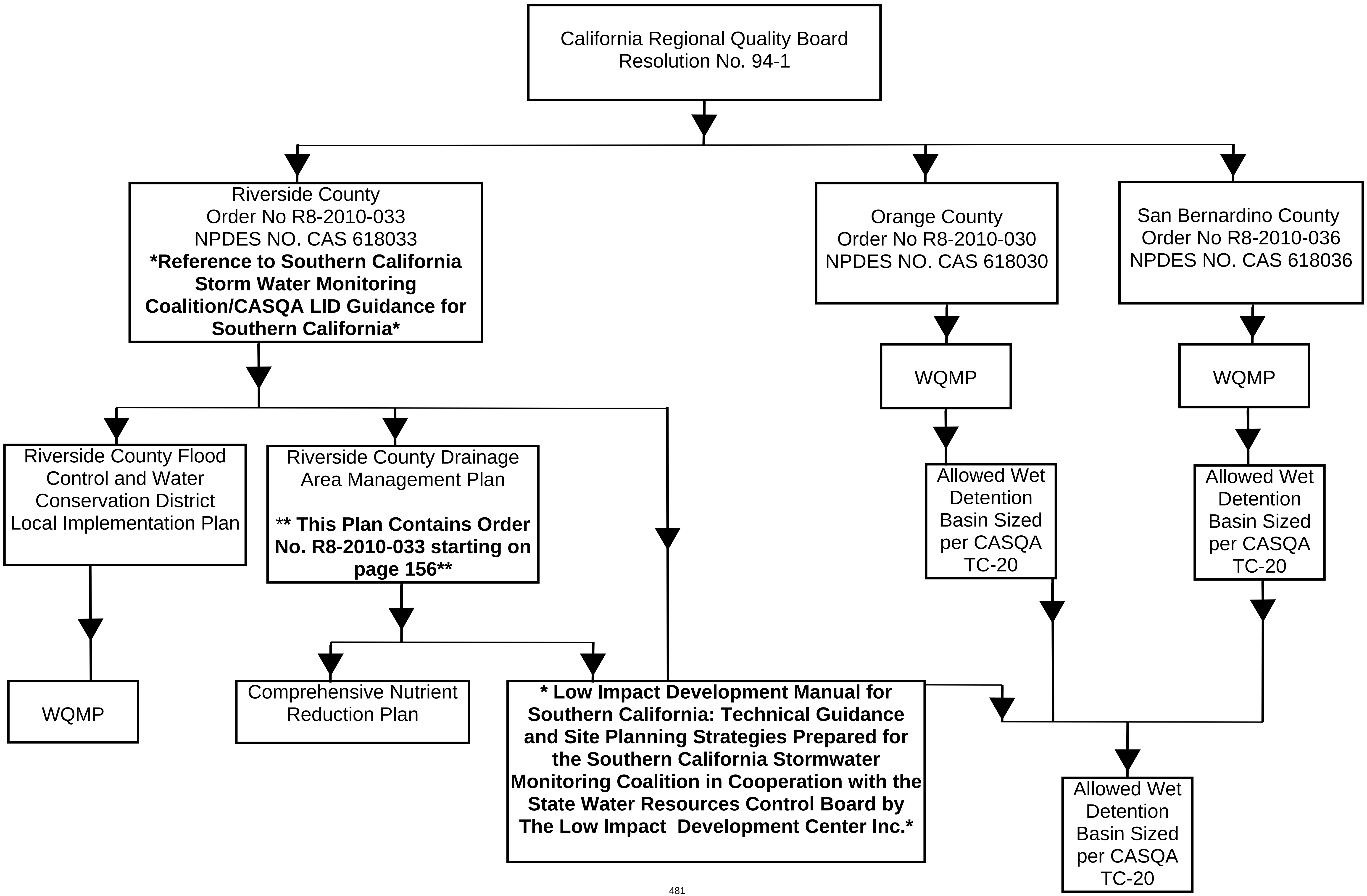
The originating Order dictating the need for each specific jurisdiction within Region 8 of the State of California to implement water quality standards to their storm drainage discharges is Resolution No. 94-1. Under this Resolution, the Counties of Orange, San Bernardino, and Riverside developed their own MS4 Permits to further implement water quality controls specific to each jurisdiction's watershed's needs (Order Nos. R8-2010-030, R8-2010-036, and R8-2010-033, respectively). Each of these Orders developed Water Quality Management Plans (WQMPs) with Low Impact Design (LID) guidelines for site design, source control, and treatment control BMPs. The WQMPs for Orange and San Bernardino Counties specifically allow for Wet Ponds, per CASQA TC-20, throughout all watersheds within those two Counties. Further still, the Santa Ana Watershed, of which the City of Menifee is a part (in the County of Riverside), originates in San Bernardino County and terminates at the Pacific Ocean in Orange County. However, the WQMP document created by the Riverside County MS4 Permit does not specifically address the use of Wet Ponds to be utilized in treatment control.

The Riverside County MS4 permit references three documents in setting the foundation for the development of the WQMP: the *Riverside County Flood Control and Water Conservation District Local Implementation Plan (LIP)*, the *Riverside County Drainage Area Management Plan (DAMP)*, and the *Low Impact Development Manual for Southern California; Technical Guidance and Site Planning Strategies Prepared for the Southern California Storm Water Monitoring Coalition in Cooperation with the State Water Resources Control Board by The Low Impact Development Center, Inc.* The last document, the Low Impact Development Manual, specifically identifies Wet Ponds per CASQA TC-20 being a suitable form of treatment control. In a sort of circular reference, the second document, the Riverside County DAMP, actually includes the MS4 permit within its text starting on page 156. By including that text, the Low Impact Development Manual is directly referenced within the DAMP and therefore the use of Wet Ponds is identified as being suitable within Riverside County in two of the three foundational documents of the County's WQMP.

In the chain of references, the developed Riverside County WQMP directly stems from the LIP and then the MS4 Permit and then the Regional Order. We can find no logic as to why the use of Wet Ponds were omitted from the LIP and the developed WQMP, especially since the basis of the actual design guidelines throughout the rest of the documentation (the DAMP, the Low Impact Development Manual, the WQMPs for the Santa Ana Watershed in the Counties of Orange and San Bernardino) all specifically include Wet Ponds as a suitable BMP. In order to verify whether the use of Wet Ponds are indeed allowed within Riverside County, and that perhaps they were omitted without fully being vetted as to why, we contacted the California Water Resources Control Board asking about the construction of a Wet Pond within Riverside's Santa Ana Watershed. We were informed that, so long as the source water is not deemed to be "wasted water" (being that we are in an arid climate) and is also of appropriate quality itself, they see no reason why a Wet Pond can't but utilized – being that they are allowed within the same region by so many other documents. With this affirmation from the State Board, we propose to incorporate a comprehensive Site Design and Source Control BMP program along with a Wet Pond design to serve as the main Treatment Control BMP for the project (bioretention will also be used in localized areas where feasible).

Conclusion:

As stated above the proposed Rockport Ranch Site is proposing a Wet Pond to be used as an LID as shown in the Low Impact Development Manual for Southern California which is referenced in the Riverside County MS4 permit, as well as the Orange County and San Bernardino County WQMPs (BIO-4). Also was a positive response from the California Water resource Board for the Santa Ana Region. A copy of the BIO-4 Wet Detention Basin is included below from the Orange County WQMP. Here the Wet detention basin is defined as a TC-20 per CASQA standards and is provided below in the supporting documents. The permit and documents regarding the order, LIP and, DAMP are all located at: https://www.waterboards.ca.gov/santaana/water_issues/programs/stormwater/riverside_permit.html


California Regional Quality Board
Resolution No. 94-1
Riverside County
Order No R8-2010-033
NPDES NO. CAS 618033
Reference to Southern California Storm Water Monitoring Coalition/CASQA LID Guidance for Southern California
Orange County
Order No R8-2010-030
NPDES NO. CAS 618030
San Bernardino County
Order No R8-2010-036
NPDES NO. CAS 618036
WQMP
WQMP
Allowed Wet Detention Basin Sized per CASQA TC-20
Allowed Wet Detention Basin Sized per CASQA TC-20
Riverside County Flood Control and Water Conservation District Local Implementation Plan
Riverside County Drainage Area Management Plan
** This Plan Contains Order No. R8-2010-033 starting on page 156**
WQMP
Comprehensive Nutrient Reduction Plan
* Low Impact Development Manual for Southern California: Technical Guidance and Site Planning Strategies Prepared for the Southern California Stormwater Monitoring Coalition in Cooperation with the State Water Resources Control Board by The Low Impact Development Center Inc.*
Allowed Wet Detention Basin Sized per CASQA TC-20

Eric Harrington

From:	Fischer, Adam@Waterboards <Adam.Fischer@waterboards.ca.gov>
Sent:	Monday, June 12, 2017 3:26 PM
To:	Eric Harrington
Cc:	Willis, Lauma@Waterboards; Smythe, Hope@Waterboards; Sturdivant, Ann@Waterboards; Heinemann, Kevin@Waterboards
Subject:	RE: Requesting information regarding the Santa Ana MS4 Permit

Hi Eric: Over the phone today you explained that the lake would be newly-constructed and the project would not be using an existing lake. I presume that you need fill dirt to raise structures above the flood plain and thus the hole you're looking to use as a lake/wet detention basin.

Although there are valid reasons for not using a wet detention basin in an arid environment, such as finding a reliable and sustainable supply, the quality of the source water, and if the water quality will degrade simply as a matter of being retained (similar to Lake Elsinore), it is within the city's discretion to accept a wet detention basin.

Wet detention basins are a widely recognized structural treatment control but they have some risks, some summarized above. We recommend those risks be considered as part of the environmental review if possible.

Regional Board staff has no preference for using one design manual over another so long as the manual is generally-accepted. --Adam

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From: Eric Harrington [mailto:eharrington@excelengineering.net]
Sent: Monday, June 12, 2017 2:57 PM
To: Fischer, Adam@Waterboards <Adam.Fischer@waterboards.ca.gov>
Subject: FW: Requesting information regarding the Santa Ana MS4 Permit

---

From: Eric Harrington
Sent: Monday, June 12, 2017 2:30 PM
To: 'info8@waterboards.ca.gov' <info8@waterboards.ca.gov>
Subject: Requesting information regarding the Santa Ana MS4 Permit

Good afternoon,

I appreciate your time, I am currently seeking information about the MS4 Permit. The project I am working on in Menifee, (Riverside County) would like to use a small lake, approximately about 10 acres for retention of the DCV that will be produced on site; Infiltration is extremely low, and harvest and use is not feasible. The current WQMP for Riverside County does not include it, but does not exclude the possibility of designing for one. Currently the Orange County and San Bernardino County WQMP allow for a Wet Detention Basin to allow for storage of the DCV on a volume of "dead storage".

I have talked to Riverside Flood Control (RFC) and they have said that if the water is retained so water is not let into a receiving body of water then the design should be ok, following guidelines set forth according to the California Water Control Board.

Can I use the designs and sizing set forth in the Orange County and San Bernardino County, if the City of Menifee is willing to accept these conditions? The said designs and sizing are based on the CASQA TC-20, along with any other requirements set forth will be followed.

Please let me know if there is any information I can provide, so that as I put my proposal before the city, they can be aware everyone knows of and is ok with using a lake for bio retention following the conditions set forward.

Thank you for your time

Eric Harrington
Excel Engineering
440 State Place
Escondido, CA 92029
o: (760) 745-8118 ext 216
c: (951) 760-8609

Low Impact Development Manual for Southern California:

Technical Guidance and Site Planning Strategies

Prepared for

the Southern California Stormwater Monitoring Coalition

in cooperation with the State Water Resources Control Board

By

The Low Impact Development Center Inc

April 2010

Prepared for the Southern California Stormwater Monitoring Coalition, in cooperation with the State Water Resources Control Board, by the Low Impact Development Center, Inc.

The Low Impact Development Center, Inc.

Funding for this project has been provided in full or in part through an agreement with the State Water Resources Control Board. The contents of this document do not necessarily reflect the views and policies of the State Water Resources Control Board, nor does mention of trade names or commercial products constitute endorsement or recommendation for use. (Gov. Code 7550, 40 CFR 31.20)

Table of Contents

List of Figures

List of Tables

Table 14. BMP Functions of the LID BMPs Discussed in this Manual.

BMP	Capture and Reuse	Infiltration	Filtration
Bioretention (infiltration design)		✓	✓
Bioretention (filtration design)			✓
Porous Pavement (infiltration design)		✓	✓
Porous Pavement (filtration design)			✓
Capture/Reuse	✓		✓*
Vegetated Roofs			✓
Soil Amendments		✓	✓
Downspout Disconnection		✓	✓
Filter Strips			✓
Vegetated Swales			✓
Infiltration (Retention) Basins		✓	✓
Infiltration Trenches		✓	✓
Dry Wells		✓	✓
Dry Ponds (Extended Detention Basins)			✓
Constructed Wetlands			✓
Wet Ponds			✓
Media Filters / Filter Basins			✓
Proprietary Devices			✓
* depends on design			
Many filtration BMPs can result in substantial runoff reduction via infiltration or evapotranspiration.			

Source: The Low Impact Development Center, Inc.

The selection of an appropriate set of BMPs for a given site should be based on the project goals and site capabilities and constraints. Several factors must be taken into account:

- LID goals (peak flow reduction, storage volume needed, pollutant removal)
- Site configuration (e.g. space available)
- Site constraints (e.g. slopes, depth to groundwater)
- Operation and maintenance requirements
- Cost

The following tables can be used to compare BMPs.

Table 15. BMP Performance – Hydrologic Impacts.

BMP	Volume Reduction	Peak Flow Reduction	Groundwater Recharge
Bioretention (infiltration design)	●	●	●
Bioretention (filtration design)	○	●	○
Porous Pavement (infiltration design)	●	●	●
Porous Pavement (filtration design)	○	●	○
Capture/Reuse	◉	○	○
Vegetated Roofs	○	●	○
Soil Amendments	◉	◉	◉
Downspout Disconnection	◉	◉	◉
Filter Strips	◉	○	◉
Vegetated Swales	◉	○	◉
Infiltration (Retention) Basins	●	●	●
Infiltration Trenches	◉	○	◉
Dry Wells	◉	○	◉
Dry Ponds (Extended Detention Basins)	○	●	○
Constructed Wetlands	◉*	●	○
Wet Ponds	◉*	●	○
Media Filters / Filter Basins	○	◉	○
Proprietary Devices	○	○	○

Key: ● High effectiveness ◉ Medium effectiveness ○Low effectiveness

Rankings are qualitative.

- "High effectiveness" means that one of the BMP's primary functions is to meet the objective.
- "Medium effectiveness" means that a BMP can partially meet the objective but should be used in conjunction with other source controls.
- "Low effectiveness" means that the BMP provides minimal benefit to the objective and another BMP should be used if that objective is important.

* Wetlands and wet ponds constructed on soils with high permeability are difficult to keep saturated during Southern California's extended dry season. For this reason, they are rarely used, and only on highly impermeable soils.

Source: Adapted from WERF, 2006.

Table 16. Environmental Benefits of BMPs.

BMP	Runoff Quality Enhancement	Water Conservation (Recharge/Reuse)	Heat Island Reduction	Energy Conservation	Air Pollution Reduction	Habitat
Bioretention	✓	✓	✓		✓	✓
Permeable Pavement	✓	✓				
Capture/Reuse	✓	✓				
Vegetated Roofs	✓		✓	✓	✓	✓
Soil Amendments	✓	✓				✓
Downspout Disconnection		✓				
Filter Strips	✓	✓	✓			
Vegetated Swales	✓	✓	✓		✓	
Infiltration (Retention) Basins	✓	✓				
Infiltration Trenches	✓	✓				
Dry Wells	✓	✓				
Dry Ponds (Detention Basins)	✓					
Constructed Wetlands	✓		✓		✓	✓
Wet Ponds	✓					✓
Media Filters/Filter Basins	✓					
Proprietary Devices	✓					

Source: Adapted from WERF, 2006.

Table 17 (Cont.): BMP Performance – Influent/Effluent Water Quality.

BMP	Sediment (mg/L)	Nitrogen (mg/L)	Phosphorus (mg/L)	Metals – Zn (µg/L)	Oil and Grease (mg/L)	Bacteria (#/100mL)	Temp	Notes
Dry Wells	0	0	0	0	0	0	Excellent	Infiltration practices are assumed to have zero discharge
Dry Ponds	114/46.6[§§]	0.96/0.98[‡‡]	0.38/0.28[§§]	355/136[§§]	2.72/2.54[‡‡]	2,218/1,741[§]	Poor	
Constructed Wetlands	37.8/17.8[††]	2.12/1.15[††]	0.27/0.14[††]	47/31[††]	No data	2,097/257[§]	Poor[**]	
Wet Ponds	114/11.8[§§]	2.29/1.46[‡‡]	0.38/0.54[§§]	355/37[§§]	0.82/0.88[‡‡]	2,693/446.4[§]	Poor[**]	
Media Filters / Filter Basins	114/11.3[§§]	No data	0.38/0.25[§§]	355/36[§§]	No data	1,820/541.3[§]	Poor	Includes Austin sand filter, Delaware sand filter, Multi-chambered treatment trains
Proprietary Devices	varies	varies	varies	varies	varies	varies	Poor	Performance is device-specific

Key: [*]Davis, 2007 [§]Clary et al, 2008 [†]Hunt et al, 2008 [‡]Hong et al, 2006 [***]Teemusk and Mander, 2007
[**]Jones and Hunt, 2008 [§§]Caltrans, 2004 [††]Geosyntec, 2008 [‡‡]International Stormwater BMP Database, 2009

Source: Data assembled by the Low Impact Development Center, Inc.

Table 18. BMP Site Suitability Criteria.

BMP	Soil HSG				Depth to groundwater		Depth to impermeable layer/bedrock		Slope			High Landslide Risk	Soil Contamination
	A	B	C	D	< 10'	> 10'	<5'	>5'	0-5%	5-15%	> 15%		
Bioretention	✓	✓				✓		✓	✓	✓if terraced			
Bioretention with underdrain			✓	✓	✓	✓	✓	✓	✓	✓ if terraced		✓	✓ with liner
Permeable Pavement	✓	✓				✓		✓	✓				
Permeable Pavement with underdrain			✓	✓	✓	✓	✓	✓	✓			✓	✓with liner
Capture/Reuse	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Vegetated Roofs	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Soil Amendments	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		
Downspout Disconnection	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓			
Filter Strips	✓	✓	✓	✓		✓		✓	✓				
Vegetated Swales	✓	✓	✓	✓		✓		✓	✓	✓			
Infiltration (Retention) Basins	✓	✓	✓			✓		✓	✓				
Infiltration trenches	✓	✓	✓			✓		✓	✓				
Dry wells	✓	✓	✓			✓		✓	✓				
Dry ponds (detention basins)	✓	✓	✓			✓		✓	✓				✓ with liner
Constructed Wetlands		✓	✓	✓	✓	✓	✓	✓	✓				✓ with liner
Wet ponds		✓	✓	✓	✓	✓	✓	✓	✓	✓			✓ with liner
Media filters / Filter Basins	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Proprietary Devices	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

Source: The Low Impact Development Center, Inc.

Table 18 (Cont.): BMP Site Suitability Criteria.

BMP	Available space			Maintenance		
	Low	Med	High	Low	Med	High
Bioretention		✓		✓	✓	
Bioretention with underdrain		✓		✓	✓	
Permeable Pavement	✓				✓	✓
Permeable Pavement with underdrain	✓				✓	✓
Capture/Reuse	✓			✓		
Vegetated Roofs	✓				✓	
Soil Amendments	✓	✓	✓	✓		
Downspout Disconnection		✓	✓	✓		
Filter Strips		✓			✓	
Vegetated Swales		✓		✓	✓	
Infiltration (Retention) Basins		✓			✓	✓
Infiltration trenches	✓			✓		
Dry wells	✓			✓		
Dry ponds (detention basins)			✓		✓	
Constructed Wetlands			✓		✓	✓
Wet ponds			✓		✓	
Media filters / Filter Basins	✓				✓	
Proprietary Devices	✓					✓

Source: The Low Impact Development Center, Inc.

Table 19. Maintenance Considerations for LID BMPs.

Source Control	Level of Effort	Frequency
Bioretention	**Minimal to Moderate:** Vegetation management required; occasional removal of captured debris	Semi-annual vegetation management, inspection
Permeable Pavement	**Moderate:** Rejuvenation may be needed (vacuum sweeper/power washing); vegetation management; pavement may have to be completely changed	Semi-annual vacuuming, inspection
Capture/Reuse	**Low:** No vegetation management; no removal of captured pollutants	Weekly emptying between storm events Semi-annual inspection
Vegetated Roofs	**Moderate:** Vegetation management	Semi-annual inspection Vegetation management
Soil Amendments	**Minimal:** No vegetation management; no removal of captured pollutants	Annual inspection
Downspout Disconnection	**Minimal:** No vegetation management; no removal of captured pollutants	Annual inspection
Filter Strips	**Low to Moderate:** Management of vegetation; occasional removal of captured pollutants	Weekly mowing Semi-annual inspection
Vegetated Swales	**Low to Moderate:** Minimal removal of captured pollutants; vegetation management	Weekly mowing Semi-annual inspection
Infiltration Basins	**Moderate to High:** Rejuvenation may be needed (scarifying surface/raking); possible removal of vegetation; removal of captured materials	Semi-annual inspection
Infiltration Trenches	**Low:** Removal of captured debris; periodic inspection	Semi-annual inspection
Dry Wells	**Low:** Removal of captured debris; periodic inspection	Semi-annual inspection
Dry Ponds	**Moderate:** Removal of captured debris; vegetation management; periodic inspection	Weekly mowing Semi-annual inspection Sediment removal every 5-25 years
Constructed Wetlands	**High:** Management of vegetation; removal of floating debris and trash; sediment and vegetation removal; maintain water level during dry periods	Semi-annual inspection Vegetation management
Wet Ponds	**Moderate:** Removal of captured debris; vegetation management; mosquito control	Semi-annual inspection, debris removal, Annual vegetation harvesting
Media Filters	**Moderate:** Inspection and removal of captured debris; sediment removal.	Quarterly inspection, debris removal
Proprietary Devices	**Moderate:** Inspection and removal of captured debris; sediment removal.	Quarterly inspection, debris removal

Source: Adapted from WERF, 2006

BIO-4: Wet Detention Basin

Also known as:

- *Wet Ponds*
- *Retention Ponds*

Wet Detention Basin
Source: Geosyntec Consultants

Wet detention basins are constructed, naturalistic ponds with a permanent or seasonal pool of water (also called a "wet pool" or "dead storage"). Aquascape facilities, such as artificial lakes, are a special form of wet pool facility that can incorporate innovative design elements to allow them to function as a stormwater treatment facility in addition to an aesthetic water feature. Wet ponds require base flows to exceed or match losses through evaporation and/or infiltration, and they must be designed with the outlet positioned and/or operated in such a way as to maintain a permanent pool. Wet ponds can be designed to provide extended detention of incoming flows using the volume above the permanent pool surface.

Feasibility Screening Considerations

- Feasibility screening is not applicable to wet ponds; however the potential risk of groundwater contamination should be considered in selection and design.

Opportunity Criteria

- Can provide aesthetic/recreational value for a project.
- Requires relatively large open space area at outlet of drainage area.
- Generally most applicable for drainage areas larger than 10 acres; however may be applied to smaller drainage areas.
- Applicable in drainage areas with source of base flow to maintain water level.

OC-Specific Design Criteria and Considerations

- ☐ Minimum set-backs from foundations and slopes should be observed.
- ☐ Retention of permanent pool volume should not cause geotechnical concerns related to slope stability. Proposed basins in areas with slopes greater than 15 percent or within 200 feet from the top of a hazardous slope or landslide area require geotechnical investigation.
- ☐ Design should include a sediment forebay to remove coarse solids.
- ☐ Flow path length to width ratio is 2:1 (minimum) and 3:1 or greater (preferred).
- ☐ Maximum side slope (H:V) should be 4:1 interior and 3:1 exterior, unless protected from public access by fencing and approved for stability by a geotechnical professional.
- ☐ Wetland vegetation must not occupy more than 25% of surface area.
- ☐ A buffer zone with a minimum width of 25 feet should be provided around the top perimeter of the wet detention basin.

☐ Inlets and outlets should be positioned to maximize flowpaths through the facility. All inlets should enter the first cell of the wet detention basin.

☐ The inlet to wet detention basin should be submerged to dissipate the energy of incoming flow. Energy dissipation should also be used at the outlet of the basin.

☐ Minimum freeboard should be 1 foot (2 feet preferred) above the maximum water surface elevation for on-line basins and 1 foot maximum for off-line basins.

☐ Maximum basin residence time for dry weather flows is 7 days.

Computing Sizing Criteria for Wet Detention Basins

- This document does not provide specific sizing guidance for wet detention basins. Wet basins should be designed by a team of specialists that understand wetland ecology and biology and are familiar with methods to avoid stagnation, odors, and vector issues associated with maintaining a permanent pool. The BMP designer(s) must demonstrate that the facility is sized to capture and treat the volume of runoff not being addressed by upstream BMPs such that 80 percent of average annual stormwater runoff volume from the site is retained or biotreated.
- The retention volume within a wet detention basin is the equal to the permanent pool volume. The drawdown time criteria, or the rate at which the retention volume becomes available, does not apply to wet detention basins. All runoff in excess of the retention volume that flows through the basin is considered biotreated.
- The permanent pool volume should be at least 50 percent of the volume of active (extended detention) storage.

Configuration for Use in a Treatment Train

- Wet detention basins would generally be designed to serve as the final BMP before discharging runoff off-site.
- Wet detention basins may be preceeded in a treatment train by HSCs and LID BMPs in the drainage area, which would reduce the pollutant load and volume of runoff entering the basin, thereby reducing the sizing requirments of the wet detention basin.
- Wet detention basins can be designed to precede other LID or treatment control BMPs, providing equalization and pretreatment.

Additional References for Design Guidance

- CASQA BMP Handbook for New and Redevelopment: http://www.cabmphandbooks.com/Documents/Development/TC-20.pdf
- Los Angeles County Stormwater BMP Design and Maintenance Manual: http://dpw.lacounty.gov/DES/design_manuals/StormwaterBMPDesignandMaintenance.pdf
- LA County LID Manual, Chapter 5: http://dpw.lacounty.gov/wmd/LA_County_LID_Manual.pdf
- Portland Stormwater Management Manual: http://www.portlandonline.com/bes/index.cfm?c=47953&
- Western Washington Stormwater Management Manual, Volume V, Chapter 10: http://www.ecy.wa.gov/pubs/0510033.pdf

Maintenance Concerns, Objectives, and Goals

- Vegetation/Landscape Maintenance
- Endangered Species Habitat Creation
- Pollutant Removal Efficiency
- Clogging of the Outlet
- Invasive/exotic Plant Species
- Vector Control

Targeted Constituents

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

Legend ***(Removal Effectiveness)***

● Low ■ High

▲ Medium

General Description

Wet ponds (a.k.a. stormwater ponds, retention ponds, wet extended detention ponds) are constructed basins that have a permanent pool of water throughout the year (or at least throughout the wet season) and differ from constructed wetlands primarily in having a greater average depth. Ponds treat incoming stormwater runoff by settling and biological uptake. The primary removal mechanism is settling as stormwater runoff resides in this pool, but pollutant uptake, particularly of nutrients, also occurs to some degree through biological activity in the pond. Wet ponds are among the most widely used stormwater practices. While there are several different versions of the wet pond design, the most common modification is the extended detention wet pond, where storage is provided above the permanent pool in order to detain stormwater runoff and promote settling. The schematic diagram is of an on-line pond that includes detention for larger events, but this is not required in all areas of the state.

Inspection/Maintenance Considerations

In order to maintain the pond's design capacity, sediment must be removed occasionally and adequate resources must be committed to properly maintain peripheral aquatic vegetation, control vector production, and to maintain effective pool volume. Wet ponds can become a nuisance due to mosquito and midge breeding unless carefully designed and maintained. A proactive and routine preventative maintenance plan (which can vary according to location) is crucial to minimizing vector habitat. A vegetated buffer should be preserved around the pond to protect the banks from erosion and provide some pollutant removal before runoff enters the pond by overland flow.

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Inspection Activities	Suggested Frequency
■ Inspect after several storm events to confirm that the drainage system functions, and bank stability and vegetation growth are sufficient.	Post construction
■ Inspect for invasive vegetation, trash and debris, clogging of inlet/outlet structures, excessive erosion, sediment buildup in basin or outlet, cracking or settling of the dam, bank stability, tree growth on dam or embankment, vigor and density of the grass turf on the basin side slopes and floor, differential settlement, leakage, subsidence, damage to the emergency spillway, mechanical component condition, and graffiti.	Semi-annual, after significant storms, or more frequent as needed
■ Inspect condition of inlet and outlet structures, pipes, sediment forebays, basin, and upstream and downstream channel conditions. Monitor drain times, and check for algal growth, signs of pollution such as oil sheens, discolored water, or unpleasant odors, and signs of flooding.	Annual inspection
■ During inspections, note changes to the wet pond or the contributing watershed as these may affect basin performance.	
Maintenance Activities	**Suggested Frequency**
■ Introduce mosquito fish, *Gambusia* spp., (where permitted by the Department of Fish and Game or other agency regulations) to enhance natural mosquito and midge control and regularly maintain emergent and shoreline vegetation to provide access for vector inspectors and facilitate vector control if needed.	Post construction
■ Perform vector control, if necessary. ■ Remove sediment from outlet structure. Dispose of properly. ■ Remove accumulated trash and debris in the basin, inlet/outlet structures, side slopes, and collection system as required. ■ Repair undercut areas and erosion to banks and basin.	Semi annual, after significant storm events
■ Maintain protected vegetated buffer around pond. Mow side slopes and maintain vegetation in and around basin to prevent any erosion or aesthetic problems. Minimize use of fertilizers and pesticides. Reseed if necessary. ■ Manage and harvest wetland plants. ■ Structural repair or replacement, as needed.	Annual maintenance (if needed)
■ Remove sediment from the forebay and regrade when the accumulated sediment volume exceeds 10-20% of the forebay volume. Clean in early spring so vegetation damaged during cleaning has time to re-establish.	5- to 7-year maintenance
■ Remove sediment when the permanent pool volume has become reduced significantly (sediment accumulation exceeds 25% of design depth), resuspension is observed, or the pond becomes eutrophic.	>5 year maintenance

Additional Information

In most cases, sediment from wet ponds do not contain toxins at levels posing a hazardous concern. Studies to date indicate that pond sediments are generally below toxicity limits and can be safely landfilled or disposed onsite. Onsite sediment disposal is always preferable (if local authorities permit) as long as the sediments are deposited away from the shoreline to prevent their reentry into the pond and away from recreation areas, where they could possibly be ingested by young children.

Sediments should be tested for toxicants in compliance with current disposal requirements if land uses in the catchment include commercial or industrial zones, or if visual or olfactory indications of pollution are noticed. Sediments containing high levels of pollutants should be disposed of properly.

For the best water quality benefit, the pond should hold water for at least 24 hours. It should drain down to the permanent water level within 72 hours of a storm event to avoid conditions which might increase water temperatures, deplete oxygen, promote vector growth, and/or cause odors.

References

King County, Stormwater Pollution Control Manual – Best Management Practices for Businesses. July, 1995 Available at: ftp://dnr.metrokc.gov/wlr/dss/spcm/SPCM.HTM

Metropolitan Council, Urban Small Sites Best Management Practices Manual. Available at: http://www.metrocouncil.org/environment/Watershed/BMP/manual.htm

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

Montgomery County Department of Environmental Protection. Maintaining Urban Stormwater Facilities - A Guidebook for Common Ownership Communities. Available at: http://www.montgomerycountymd.gov/mc/services/dep/Stormwater/maintain.htm

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Oregon Association of Clean Water Agencies, Oregon Municipal Stormwater Toolbox for Maintenance Practices, June 1998. Available at: http://www.oracwa.org/Pages/toolbox.htm

Stormwater Managers Resource Center. On-line: http://www.stormwatercenter.net

U.S. Environmental Protection Agency, Post-Construction Stormwater Management in New Development & Redevelopment BMP Factsheets. Available at: cfpub.epa.gov/npdes/stormwater/menuofbmps/bmp_files.cfm

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

Design Considerations

- Area Required
- Slope
- Water Availability
- Aesthetics
- Environmental Side-effects

Targeted Constituents

☑	Sediment	■
☑	Nutrients	▲
☑	Trash	■
☑	Metals	■
☑	Bacteria	■
☑	Oil and Grease	■
☑	Organics	■

Legend *(Removal Effectiveness)*

● Low ■ High

▲ Medium

Description

Wet ponds (a.k.a. stormwater ponds, retention ponds, wet extended detention ponds) are constructed basins that have a permanent pool of water throughout the year (or at least throughout the wet season) and differ from constructed wetlands primarily in having a greater average depth. Ponds treat incoming stormwater runoff by settling and biological uptake. The primary removal mechanism is settling as stormwater runoff resides in this pool, but pollutant uptake, particularly of nutrients, also occurs to some degree through biological activity in the pond. Wet ponds are among the most widely used stormwater practices. While there are several different versions of the wet pond design, the most common modification is the extended detention wet pond, where storage is provided above the permanent pool in order to detain stormwater runoff and promote settling. The schematic diagram is of an on-line pond that includes detention for larger events, but this is not required in all areas of the state.

California Experience

Caltrans constructed a wet pond in northern San Diego County (I-5 and La Costa Blvd.). Largest issues at this site were related to vector control, vegetation management, and concern that endangered species would become resident and hinder maintenance activities.

Advantages

- If properly designed, constructed and maintained, wet basins can provide substantial aesthetic/recreational value and wildlife and wetlands habitat.

- Ponds are often viewed as a public amenity when integrated into a park setting.

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- Due to the presence of the permanent wet pool, properly designed and maintained wet basins can provide significant water quality improvement across a relatively broad spectrum of constituents including dissolved nutrients.

- Widespread application with sufficient capture volume can provide significant control of channel erosion and enlargement caused by changes to flow frequency relationships resulting from the increase of impervious cover in a watershed.

Limitations

- Some concern about safety when constructed where there is public access.

- Mosquito and midge breeding is likely to occur in ponds.

- Cannot be placed on steep unstable slopes.

- Need for base flow or supplemental water if water level is to be maintained.

- Require a relatively large footprint

- Depending on volume and depth, pond designs may require approval from the State Division of Safety of Dams

Design and Sizing Guidelines

- Capture volume determined by local requirements or sized to treat 85% of the annual runoff volume.

- Use a draw down time of 48 hours in most areas of California. Draw down times in excess of 48 hours may result in vector breeding, and should be used only after coordination with local vector control authorities. Draw down times of less than 48 hours should be limited to BMP drainage areas with coarse soils that readily settle and to watersheds where warming may be detrimental to downstream fisheries.

- Permanent pool volume equal to twice the water quality volume.

- Water depth not to exceed about 8 feet.

- Wetland vegetation occupying no more than 25% of surface area.

- Include energy dissipation in the inlet design and a sediment forebay to reduce resuspension of accumulated sediment and facilitate maintenance.

- A maintenance ramp should be included in the design to facilitate access to the forebay for maintenance activities and for vector surveillance and control.

- To facilitate vector surveillance and control activities, road access should be provided along at least one side of BMPs that are seven meters or less in width. Those BMPs that have shoreline-to-shoreline distances in excess of seven meters should have perimeter road access on both sides or be designed such that no parcel of water is greater than seven meters from the road.

Construction/Inspection Considerations

- In areas with porous soils an impermeable liner may be required to maintain an adequate permanent pool level.

- Outlet structures and piping should be installed with collars to prevent water from seeping through the fill and causing structural failure.

- Inspect facility after first large storm to determine whether the desired residence time has been achieved.

Performance

The observed pollutant removal of a wet pond is highly dependent on two factors: the volume of the permanent pool relative to the amount of runoff from the typical event in the area and the quality of the base flow that sustains the permanent pool. A recent study (Caltrans, 2002) has documented that if the permanent pool is much larger than the volume of runoff from an average event, then displacement of the permanent pool by the wet weather flow is the primary process. A statistical comparison of the wet pond discharge quality during dry and wet weather shows that they are not significantly different. Consequently, there is a relatively constant discharge quality during storms that is the same as the concentrations observed in the pond during ambient (dry weather) conditions. Consequently, for most constituents the performance of the pond is better characterized by the average effluent concentration, rather than the "percent reduction," which has been the conventional measure of performance. Since the effluent quality is essentially constant, the percent reduction observed is mainly a function of the influent concentrations observed at a particular site.

The dry and wet weather discharge quality is, therefore, related to the quality of the base flow that sustains the permanent pool and of the transformations that occur to those constituents during their residence in the basin. One could potentially expect a wide range of effluent concentrations at different locations even if the wet ponds were designed according to the same guidelines, if the quality of the base flow differed significantly. This may explain the wide range of concentration reductions reported in various studies.

Concentrations of nutrients in base flow may be substantially higher than in urban stormwater runoff. Even though these concentrations may be substantially reduced during the residence time of the base flow in the pond, when this water is displaced by wet weather flows, concentrations may still be quite elevated compared to the levels that promote eutrophication in surface water systems. Consequently comparing influent and effluent nutrient concentrations during wet weather can make the performance seem highly variable.

Relatively small perennial flows may often substantially exceed the wet weather flow treated. Consequently, one should also consider the load reduction observed under ambient conditions when assessing the potential benefit to the receiving water.

Siting Criteria

Wet ponds are a widely applicable stormwater management practice and can be used over a broad range of storm frequencies and sizes, drainage areas and land use types. Although they have limited applicability in highly urbanized settings and in arid climates, they have few other restrictions. Wet basins may be constructed on- or off-line and can be sited at feasible locations along established drainage ways with consistent base flow. An off-line design is preferred. Wet basins are often utilized in smaller sub-watersheds and are particularly appropriate in areas with residential land

uses or other areas where high nutrient loads are considered to be potential problems (e.g., golf courses).

Ponds do not consume a large area (typically 2–3 percent of the contributing drainage area); however, these facilities are generally large. Other practices, such as filters or swales, may be "squeezed" into relatively unusable land, but ponds need a relatively large continuous area. Wet basins are typically used in drainage basins of more than ten acres and less than one square mile (Schueler et al., 1992). Emphasis can be placed in siting wet basins in areas where the pond can also function as an aesthetic amenity or in conjunction with other stormwater management functions.

Wet basin application is appropriate in the following settings: (1) where there is a need to achieve a reasonably high level of dissolved contaminant removal and/or sediment capture; (2) in small to medium-sized regional tributary areas with available open space and drainage areas greater than about 10 ha (25 ac.); (3) where base flow rates or other channel flow sources are relatively consistent year-round; (4) in residential settings where aesthetic and wildlife habitat benefits can be appreciated and maintenance activities are likely to be consistently undertaken.

Traditional wet extended detention ponds can be applied in most regions of the United States, with the exception of arid climates. In arid regions, it is difficult to justify the supplemental water needed to maintain a permanent pool because of the scarcity of water. Even in semi-arid Austin, Texas, one study found that 2.6 acre-feet per year of supplemental water was needed to maintain a permanent pool of only 0.29 acre-feet (Saunders and Gilroy, 1997). Seasonal wet ponds (i.e., ponds that maintain a permanent pool only during the wet season) may prove effective in areas with distinct wet and dry seasons; however, this configuration has not been extensively evaluated.

Wet ponds may pose a risk to cold water systems because of their potential for stream warming. When water remains in the permanent pool, it is heated by the sun. A study in Prince George's County, Maryland, found that stormwater wet ponds heat stormwater by about 9°F from the inlet to the outlet (Galli, 1990).

Additional Design Guidelines

Specific designs may vary considerably, depending on site constraints or preferences of the designer or community. There are several variations of the wet pond design, including constructed wetlands, and wet extended detention ponds. Some of these design alternatives are intended to make the practice adaptable to various sites and to account for regional constraints and opportunities. In conventional wet ponds, the open water area comprises 50% or more of the total surface area of the pond. The permanent pool should be no deeper than 2.5 m (8 feet) and should average 1.2 – 2 m (4-6 feet) deep. The greater depth of this configuration helps limit the extent of the vegetation to an aquatic bench around the perimeter of the pond with a nominal depth of about 1 foot and variable width. This shallow bench also protects the banks from erosion, enhances habitat and aesthetic values, and reduces the drowning hazard.

The wet extended detention pond combines the treatment concepts of the dry extended detention pond and the wet pond. In this design, the water quality volume is detained above the permanent pool and released over 24 hours. In addition to increasing the residence time, which improves pollutant removal, this design also attenuates peak runoff rates. Consequently, this design alternative is recommended.

Pretreatment incorporates design features that help to settle out coarse sediment particles. By removing these particles from runoff before they reach the large permanent pool, the maintenance burden of the pond is reduced. In ponds, pretreatment is achieved with a sediment forebay. A sediment forebay is a small pool (typically about 10 percent of the volume of the permanent pool). Coarse particles remain trapped in the forebay, and maintenance is performed on this smaller pool, eliminating the need to dredge the entire pond.

There are a variety of sizing criteria for determining the volume of the permanent pool, mostly related to the water quality volume (i.e., the volume of water treated for pollutant removal) or the average storm size in a particular area. In addition, several theoretical approaches to determination of permanent pool volume have been developed. However, there is little empirical evidence to support these designs. Consequently, a simplified method (i.e., permanent pool volume equal to twice the water quality volume) is recommended.

Other design features do not increase the volume of a pond, but can increase the amount of time stormwater remains in the device and eliminate short-circuiting. Ponds should always be designed with a length-to-width ratio of at least 1.5:1, where feasible. In addition, the design should incorporate features to lengthen the flow path through the pond, such as underwater berms designed to create a longer route through the pond. Combining these two measures helps ensure that the entire pond volume is used to treat stormwater. Wet ponds with greater amounts of vegetation often have channels through the vegetated areas and contain dead areas where stormwater is restricted from mixing with the entire permanent pool, which can lead to less pollutant removal. Consequently, a pond with open water comprising about 75% of the surface area is preferred.

Design features are also incorporated to ease maintenance of both the forebay and the main pool of ponds. Ponds should be designed with a maintenance access to the forebay to ease this relatively routine (every 5–7 year) maintenance activity. In addition, ponds should generally have a drain to draw down the pond for vegetation harvesting or the more infrequent dredging of the main cell of the pond.

Cold climates present many challenges to designers of wet ponds. The spring snowmelt may have a high pollutant load and a large volume to be treated. In addition, cold winters may cause freezing of the permanent pool or freezing at inlets and outlets. Finally, high salt concentrations in runoff resulting from road salting, and sediment loads from road sanding, may impact pond vegetation as well as reduce the storage and treatment capacity of the pond.

One option to deal with high pollutant loads and runoff volumes during the spring snowmelt is the use of a seasonally operated pond to capture snowmelt during the winter and retain the permanent pool during warmer seasons. In this option, proposed by Oberts (1994), the pond has two water quality outlets, both equipped with gate valves. In the summer, the lower outlet is closed. During the fall and throughout the winter, the lower outlet is opened to draw down the permanent pool. As the spring melt begins, the lower outlet is closed to provide detention for the melt event. The manipulation of this system requires some labor and vigilance; a careful maintenance agreement should be confirmed.

Several other modifications may help to improve the performance of ponds in cold climates. Designers should consider planting the pond with salt-tolerant vegetation if the facility receives road runoff. In order to counteract the effects of freezing on inlet and outlet structures, the use of inlet and outlet structures that are resistant to frost, including weirs and larger diameter pipes, may be

useful. Designing structures on-line, with a continuous flow of water through the pond, will also help prevent freezing of these structures. Finally, since freezing of the permanent pool can reduce the effectiveness of pond systems, it is important to incorporate extended detention into the design to retain usable treatment area above the permanent pool when it is frozen.

Summary of Design Recommendations

(1) Facility Sizing – The basin should be sized to hold the permanent pool as well as the required water quality volume. The volume of the permanent pool should equal twice the water quality volume.

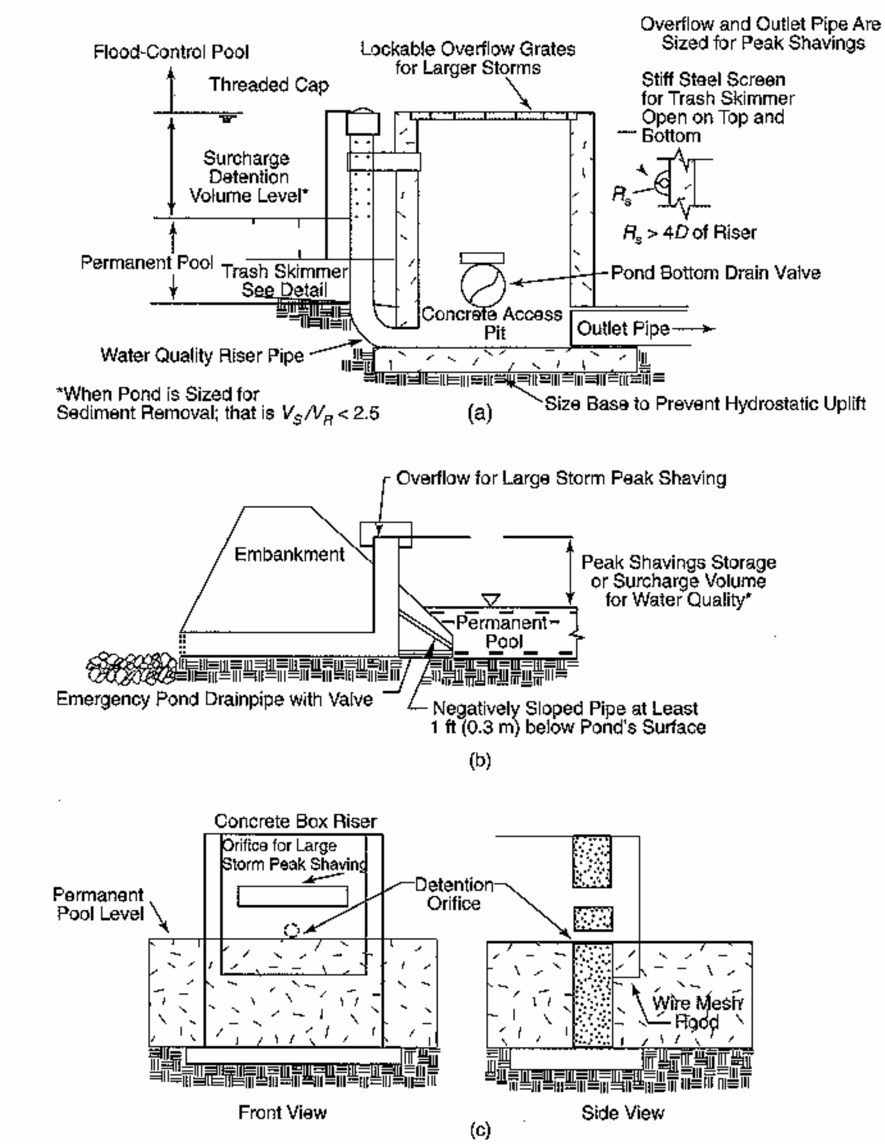
(2) Pond Configuration - The wet basin should be configured as a two stage facility with a sediment forebay and a main pool. The basins should be wedge-shaped, narrowest at the inlet and widest at the outlet. The minimum length to width ratio should be 1.5 where feasible. The perimeter of all permanent pool areas with depths of 4.0 feet or greater should be surrounded by an aquatic bench. This bench should extend inward 5-10 feet from the perimeter of the permanent pool and should be no more than 18 inches below normal depth. The area of the bench should not exceed about 25% of pond surface. The depth in the center of the basin should be 4 – 8 feet deep to prevent vegetation from encroaching on the pond open water surface.

(3) Pond Side Slopes - Side slopes of the basin should be 3:1 (H:V) or flatter for grass stabilized slopes. Slopes steeper than 3:1 should be stabilized with an appropriate slope stabilization practice.

(4) Sediment Forebay - A sediment forebay should be used to isolate gross sediments as they enter the facility and to simplify sediment removal. The sediment forebay should consist of a separate cell formed by an earthen berm, gabion, or loose riprap wall. The forebay should be sized to contain 15 to 25% of the permanent pool volume and should be at least 3 feet deep. Exit velocities from the forebay should not be erosive. Direct maintenance access should be provided to the forebay. The bottom of the forebay may be hardened (concrete) to make sediment removal easier. A fixed vertical sediment depth marker should be installed in the forebay to measure sediment accumulation.

(5) Outflow Structure - Figure 2 presents a schematic representation of suggested outflow structures. The outlet structure should be designed to drain the water quality volume over 24 hours with the orifice sized according to the equation presented in the Extended Detention Basin fact sheet. The facility should have a separate drain pipe with a manual valve that can completely or partially drain the pond for maintenance purposes. To allow for possible sediment accumulation, the submerged end of the pipe should be protected, and the drain pipe should be sized to drain the pond within 24 hours. The valve should be located at a point where it can be operated in a safe and convenient manner.

For on-line facilities, the principal and emergency spillways must be sized to provide 1.0 foot of freeboard during the 25-year event and to safely pass the 100-year flood. The embankment should be designed in accordance with all relevant specifications for small dams.



(6) Splitter Box - When the pond is designed as an off-line facility, a splitter structure is used to isolate the water quality volume. The splitter box, or other flow diverting approach, should be designed to convey the 25-year event while providing at least 1.0 foot of freeboard along pond side slopes.

(7) Vegetation - A plan should be prepared that indicates how aquatic and terrestrial areas will be vegetatively stabilized. Wetland vegetation elements should be placed along the aquatic bench or in the shallow portions of the permanent pool. The optimal elevation for planting of wetland vegetation is within 6 inches vertically of the normal pool elevation. A list of some wetland vegetation native to California is presented in Table 1.

Table 1 California Wetland Vegetation	
Botanical Name	**Common Name**
BACCHARIS SALICIFOLIA	MULE FAT
FRANKENIA GRANDIFOLIA	HEATH
SALIX GOODINGII	BLACK WILLOW
SALIX LASIOLEPIS	ARROYO WILLOW
SAMUCUS MEXICANUS	MEXICAN ELDERBERRY
HAPLOPAPPUS VENETUS	COAST GOLDENBRUSH
DISTICHIS SPICATA	SALT GRASS
LIMONIUM CALIFORNICUM	COASTAL STATICE
ATRIPLEX LENTIFORMIS	COASTAL QUAIL BUSH
BACCHARIS PILULARIS	CHAPARRAL BROOM
MIMULUS LONGIFLORUS	MONKEY FLOWER
SCIRPUS CALIFORNICUS	BULRUSH
SCIRPUS ROBUSTUS	BULRUSH
TYPHA LATIFOLIA	BROADLEAF CATTAIL
JUNCUS ACUTUS	RUSH

Maintenance

The amount of maintenance required for a wet pond is highly dependent on local regulatory agencies, particular health and vector control agencies. These agencies are often extremely concerned about the potential for mosquito breeding that may occur in the permanent pool. Even though mosquito fish (*Gambusia affinis*) were introduced into a wet pond constructed by Caltrans in the San Diego area, mosquito breeding was routinely observed during inspections. In addition, the vegetation at this site became sufficiently dense on the bench around the edge of the pool that mosquito fish were unable to enter this area to feed upon the mosquito larvae. The vegetation at this site was particularly vigorous because of the high nutrient concentrations in the perennial base flow (15.5 mg/L NO3-N) and the mild climate, which permitted growth year round. Consequently, the vector control agency required an annual harvest of vegetation to address this situation. This harvest can be very expensive.

On the other hand, routine harvesting may increase nutrient removal and prevent the export of these constituents from dead and dying plants falling in the water. A previous study (Faulkner and Richardson, 1991) documented dramatic reductions in nutrient removal after the first several years of operation and related it to the vegetation achieving a maximum density. That content then decreases through the growth season, as the total biomass increases. In effect, the total amount of

nutrients/m2 of wetland remains essentially the same from June through September, when the plants start to put the P back into the rhizomes. Therefore harvesting should occur between June and September. Research also suggests that harvesting only the foliage is less effective, since a very small percentage of the removed nutrients is taken out with harvesting.

Since wet ponds are often selected for their aesthetic considerations as well as pollutant removal, they are often sited in areas of high visibility. Consequently, floating litter and debris are removed more frequently than would be required simply to support proper functioning of the pond and outlet. This is one of the primary maintenance activities performed at the Central Market Pond located in Austin, Texas. In this type of setting, vegetation management in the area surrounding the pond can also contribute substantially to the overall maintenance requirements.

One normally thinks of sediment removal as one of the typical activities performed at stormwater BMPs. This activity does not normally constitute one of the major activities on an annual basis. At the concentrations of TSS observed in urban runoff from stable watersheds, sediment removal may only be required every 20 years or so. Because this activity is performed so infrequently, accurate costs for this activity are lacking.

In addition to regular maintenance activities needed to maintain the function of wet ponds, some design features can be incorporated to ease the maintenance burden. In wet ponds, maintenance reduction features include techniques to reduce the amount of maintenance needed, as well as techniques to make regular maintenance activities easier.

One potential maintenance concern in wet ponds is clogging of the outlet. Ponds should be designed with a non-clogging outlet such as a reverse-slope pipe, or a weir outlet with a trash rack. A reverse-slope pipe draws from below the permanent pool extending in a reverse angle up to the riser and establishes the water elevation of the permanent pool. Because these outlets draw water from below the level of the permanent pool, they are less likely to be clogged by floating debris.

Typical maintenance activities and frequencies include:

- Schedule semiannual inspections for burrows, sediment accumulation, structural integrity of the outlet, and litter accumulation.

- Remove accumulated trash and debris in the basin at the middle and end of the wet season. The frequency of this activity may be altered to meet specific site conditions and aesthetic considerations.

- Where permitted by the Department of Fish and Game or other agency regulations, stock wet ponds/constructed wetlands regularly with mosquito fish (*Gambusia spp.*) to enhance natural mosquito and midge control.

- Introduce mosquito fish and maintain vegetation to assist their movements to control mosquitoes, as well as to provide access for vector inspectors. An annual vegetation harvest in summer appears to be optimum, in that it is after the bird breeding season, mosquito fish can provide the needed control until vegetation reaches late summer density, and there is time for re-growth for runoff treatment purposes before the wet season. In certain cases, more frequent plant harvesting may be required by local vector control agencies.

- Maintain emergent and perimeter shoreline vegetation as well as site and road access to facilitate vector surveillance and control activities.

- Remove accumulated sediment in the forebay and regrade about every 5-7 years or when the accumulated sediment volume exceeds 10 percent of the basin volume. Sediment removal may not be required in the main pool area for as long as 20 years.

Cost

Construction Cost

Wet ponds can be relatively inexpensive stormwater practices; however, the construction costs associated with these facilities vary considerably. Much of this variability can be attributed to the degree to which the existing topography will support a wet pond, the complexity and amount of concrete required for the outlet structure, and whether it is installed as part of new construction or implemented as a retrofit of existing storm drain system.

A recent study (Brown and Schueler, 1997) estimated the cost of a variety of stormwater management practices. The study resulted in the following cost equation, adjusting for inflation:

$$C = 24.5^{V0.705}$$

where:

C = Construction, design and permitting cost;

V = Volume in the pond to include the 10-year storm (ft^3).

Using this equation, typical construction costs are:

$45,700 for a 1 acre-foot facility

$232,000 for a 10 acre-foot facility

$1,170,000 for a 100 acre-foot facility

In contrast, Caltrans (2002) reported spending over $448,000 for a pond with a total permanent pool plus water quality volume of only 1036 m^3 (0.8 ac.-ft.), while the City of Austin spent $584,000 (including design) for a pond with a permanent pool volume of 3,100 m^3 (2.5 ac.-ft.). The large discrepancies between the costs of these actual facilities and the model developed by Brown and Schueler indicate that construction costs are highly site specific, depending on topography, soils, subsurface conditions, the local labor, rate and other considerations.

Maintenance Cost

For ponds, the annual cost of routine maintenance has typically been estimated at about 3 to 5 percent of the construction cost; however, the published literature is almost totally devoid of actual maintenance costs. Since ponds are long-lived facilities (typically longer than 20 years), major maintenance activities are unlikely to occur during a relatively short study.

Caltrans (2002) estimated annual maintenance costs of $17,000 based on three years of monitoring of a pond treating runoff from 1.7 ha. Almost all the activities are associated with the annual vegetation harvest for vector control. Total cost at this site falls within the 3-5% range reported

above; however, the construction costs were much higher than those estimated by Brown and Schueler (1997). The City of Austin has been reimbursing a developer about $25,000/yr for wet pond maintenance at a site located at a very visible location. Maintenance costs are mainly the result of vegetation management and litter removal. On the other hand, King County estimates annual maintenance costs at about $3,000 per pond; however, this cost likely does not include annual extensive vegetation removal. Consequently, maintenance costs may vary considerably at sites in California depending on the aggressiveness of the vegetation management in that area and the frequency of litter removal.

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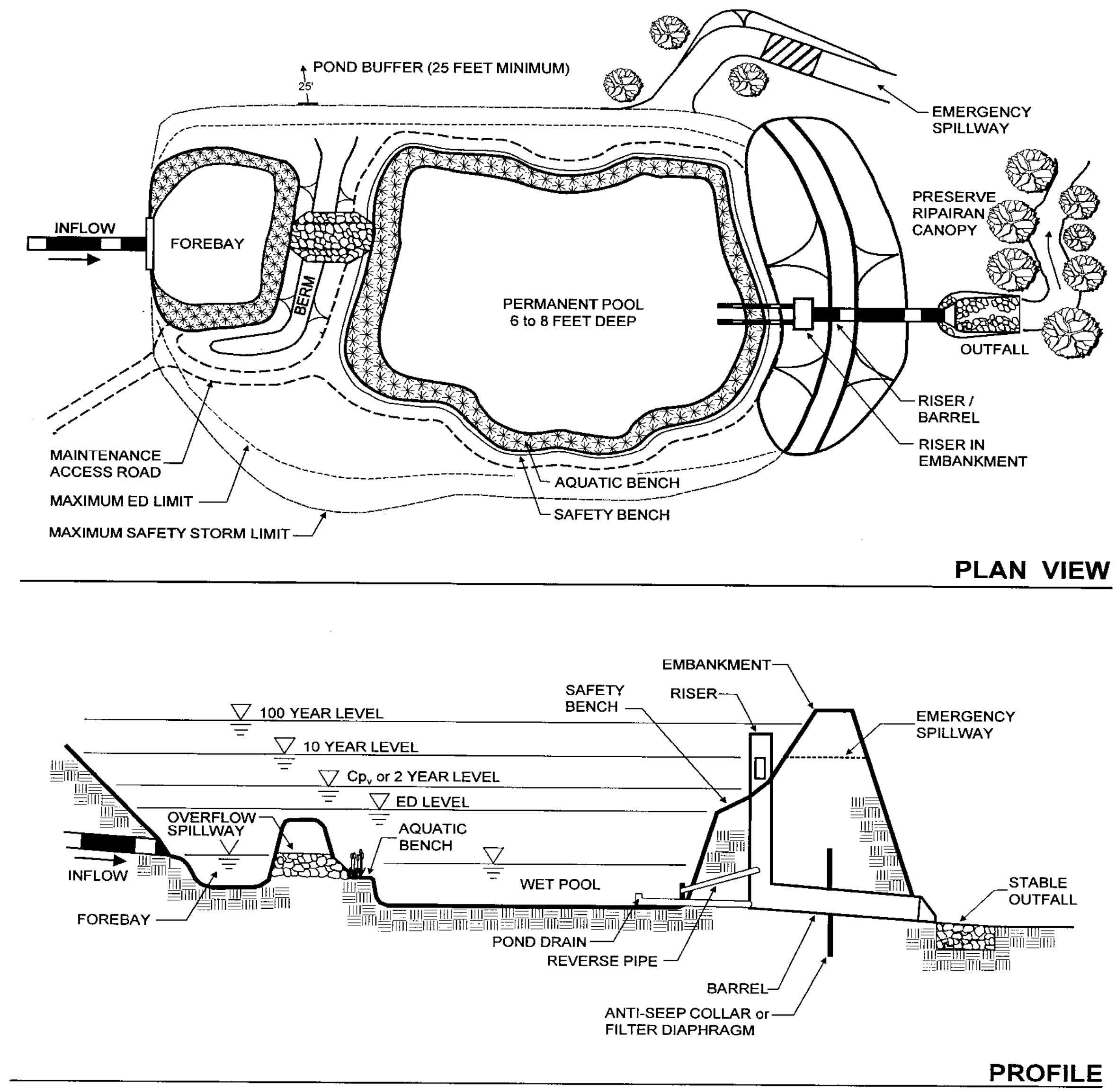

POND BUFFER (25 FEET MINIMUM)
25'
EMERGENCY SPILLWAY
INFLOW
FOREBAY
BERM
PRESERVE RIPAIRAN CANOPY
PERMANENT POOL 6 to 8 FEET DEEP
OUTFALL
RISER / BARREL
RISER IN EMBANKMENT
MAINTENANCE ACCESS ROAD
MAXIMUM ED LIMIT
AQUATIC BENCH
SAFETY BENCH
MAXIMUM SAFETY STORM LIMIT
PLAN VIEW
EMBANKMENT
SAFETY BENCH
RISER
100 YEAR LEVEL
EMERGENCY SPILLWAY
10 YEAR LEVEL
Cp$_v$ or 2 YEAR LEVEL
ED LEVEL
OVERFLOW SPILLWAY
AQUATIC BENCH
INFLOW
WET POOL
STABLE OUTFALL
FOREBAY
POND DRAIN
REVERSE PIPE
BARREL
ANTI-SEEP COLLAR or FILTER DIAPHRAGM
PROFILE

Appendix 6: BMP Design Details

BMP Sizing/ Design Details and other Supporting Documentation

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

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 EXCEL ENGINEERING — Date 6/11/2019
Designed by Eric Harrington — Case No
Company Project Number/Name 14047- Rockport Development

BMP Identification

BMP NAME / ID BMP-A

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}= 0.58 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)*
DMA-2	*11,713.00*	*Concrete or Asphalt*	*1*	*0.89*	*10448*			
	7,233.47	*Natural (D Soil)*	*0.4*	*0.279712*	*2023.3*			
	18946.472	***Total***			12471.3	0.58	*602.8*	*638.4*

Notes:

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

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 EXCEL ENGINEERING Date 6/11/2019
Designed by Eric Harrington Case No 2016-285
Company Project Number/Name 14047- Rockport Development

BMP Identification

BMP NAME / ID BMP-B

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}= 0.58 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)*
DMA-3	*25,072.00*	*Concrete or Asphalt*	*1*	*0.89*	*22364.2*			
	16,347.21	*Natural (D Soil)*	*0.4*	*0.279712*	*4572.5*			
	41419.21	***Total***			**26936.7**	**0.58**	***1301.9***	***1318.68***

Notes:

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

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 EXCEL ENGINEERING | Date 6/11/2019

Designed by Eric Harrington | Case No 2016-285

Company Project Number/Name 14047- Rockport Development

BMP Identification

BMP NAME / ID BMP-H

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}= 0.58 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)*
DMA-4	*841,023.38*	*Mixed Surface Types*	*0.82*	*0.62*	*524194.5*			
DMA-5	*926,149.47*	*Mixed Surface Types*	*0.82*	*0.62328*	*577252.1*			
DMA-6	*86,228.98*	*Mixed Surface Types*	*0.82*	*0.62328*	*53744.9*			
DMA-8	*158,409.72*	*Mixed Surface Types*	*0.82*	*0.62328*	*98733.9*			
DMA-9	*272,649.13*	*Mixed Surface Types*	*0.82*	*0.62328*	*169937.2*			
DMA-11	*315,604.81*	*Mixed Surface Types*	*0.82*	*0.62328*	*196710.7*			
	2,600,065	***Total***			**1,620,573**	**0.58**	***78,328***	***182,354***

Notes:

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

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 EXCEL ENGINEERING — Date 6/11/2019

Designed by Eric Harrington — Case No

Company Project Number/Name 14047- Rockport Development

BMP Identification

BMP NAME / ID BMP-C

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}= 0.58 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)*
DMA-14	*28,638.01*	*Concrete or Asphalt*	*1*	*0.89*	*25545.1*			
	20988.681	*Natural (D Soil)*	*0.4*	*0.279712*	*5870.8*			
	49626.69	***Total***			**31415.9**	**0.58**	***1518.4***	***1573***

Notes:

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

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 EXCEL ENGINEERING   Date 10/31/2016
Designed by Sophie L   Case No
Company Project Number/Name 14047- Rockport Development

BMP Identification

BMP NAME / ID BMP-D

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}= 0.58 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)*
DMA-15	*27351.72*	*Concrete or Asphalt*	*1*	*0.89*	*24397.7*			
	26180.26	*Natural (D Soil)*	*0.4*	*0.279712*	*7322.9*			
	53531.98	***Total***			**31720.6**	**0.58**	***1533.2***	***1561.6***

Notes:

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

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 EXCEL ENGINEERING
Date 10/31/2016
Designed by Sophie L
Case No
Company Project Number/Name 14047- Rockport Development

BMP Identification

BMP NAME / ID BMP-E

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}= 0.58 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)*
DMA-16	*65,180.38*	*Concrete or Asphalt*	*1*	*0.89*	*58140.9*			
	51,029.91	*Natural (D Soil)*	*0.4*	*0.279712*	*14273.7*			
	116210.29	***Total***			**72414.6**	**0.58**	**3500**	**4269.3**

Notes:

Santa Ana Watershed - BMP Design Volume, V_{BMP}	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	EXCEL ENGINEERING	Date	10/31/2016
Designed by	Sophie L	Case No	
Company Project Number/Name	14047- Rockport Development		

BMP Identification

BMP NAME / ID BMP-F

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}= 0.58 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)*
DMA-17	*30534.44*	*Concrete or Asphalt*	*1*	*0.89*	*27236.7*			
	22525.29	*Natural (D Soil)*	*0.4*	*0.279712*	*6300.6*			
	53059.73	***Total***			**33537.3**	**0.58**	***1621***	***1723.68***

Notes:

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

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	EXCEL ENGINEERING	Date	10/31/2016
Designed by	Sophie L	Case No	
Company Project Number/Name	14047- Rockport Development		

BMP Identification

BMP NAME / ID BMP-G

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}= 0.58 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)*
DMA-18	*24,002.84*	*Concrete or Asphalt*	*1*	*0.89*	*21410.5*			
	23,152.37	*Natural (D Soil)*	*0.4*	*0.279712*	*6476*			
	47155.21	***Total***			**27886.5**	**0.58**	***1347.8***	***1685.1***

Notes:

Effective Impervious Fraction

Developed Cover Types	Effective Impervious Fraction
Roofs	1.00
Concrete or Asphalt	1.00
Grouted or Gapless Paving Blocks	1.00
Compacted Soil (e.g. unpaved parking)	0.40
Decomposed Granite	0.40
Permeable Paving Blocks w/ Sand Filled Gap	0.25
Class 2 Base	0.30
Gravel or Class 2 Permeable Base	0.10
Pervious Concrete / Porous Asphalt	0.10
Open and Porous Pavers	0.10
Turf block	0.10
Ornamental Landscaping	0.10
Natural (A Soil)	0.03
Natural (B Soil)	0.15
Natural (C Soil)	0.30
Natural (D Soil)	0.40

Mixed Surface Types

Use this table to determine the effective impervious fraction for the V_{BMP} and Q_{BMP} calculation sheets

Bioretention Facility - Design Procedure	BMP ID	Legend:	Required Entries
	BMP-A		Calculated Cells

Company Name: EXCEL ENGINEERING — Date: 6/11/2019

Designed by: Eric Harrington — County/City Case No.: 2016-285

Design Volume

Enter the area tributary to this feature — A_T= 0.4349511 acres

Enter V_{BMP} determined from Section 2.1 of this Handbook — V_{BMP}= 603 ft^3

Type of Bioretention Facility Design

◉ Side slopes required (parallel to parking spaces or adjacent to walkways)

○ No side slopes required (perpendicular to parking space or Planter Boxes)

Bioretention Facility Surface Area

Depth of Soil Filter Media Layer — d_S = 3.0 ft

Top Width of Bioretention Facility, excluding curb — w_T = 6.0 ft

Total Effective Depth, d_E

$d_E = (0.3) \times d_S + (0.4) \times 1 - (0.7/w_T) + 0.5$ — d_E = 1.68 ft

Minimum Surface Area, A_m

$$A_M (ft^2) = \frac{V_{BMP} (ft^3)}{d_E (ft)}$$

A_M = 359 ft^2

Proposed Surface Area — A= 380 ft^2

Bioretention Facility Properties

Side Slopes in Bioretention Facility — z = 4 :1

Diameter of Underdrain — 6 inches

Longitudinal Slope of Site (3% maximum) — 0 %

6" Check Dam Spacing — 0 feet

Describe Vegetation: Other

Notes: BASIN A

BMP IS TO CONTAIN SHRUBS AND NATURAL GRASS

Bioretention Facility - Design Procedure	BMP ID	Legend:	Required Entries
	BMP-B		Calculated Cells

Company Name: EXCEL ENGINEERING — Date: 6/11/2019

Designed by: Eric Harrington — County/City Case No.: 2016-285

Design Volume

Enter the area tributary to this feature	A_T=	0.9508542	acres
Enter V_{BMP} determined from Section 2.1 of this Handbook	V_{BMP}=	1,302	ft^3

Type of Bioretention Facility Design

- ◉ Side slopes required (parallel to parking spaces or adjacent to walkways)
- ○ No side slopes required (perpendicular to parking space or Planter Boxes)

Bioretention Facility Surface Area

Depth of Soil Filter Media Layer	d_S =	1.8	ft
Top Width of Bioretention Facility, excluding curb	w_T =	6.0	ft
Total Effective Depth, d_E $d_E = (0.3) \times d_S + (0.4) \times 1 - (0.7/w_T) + 0.5$	d_E =	1.32	ft
Minimum Surface Area, A_m $A_M\ (ft^2) = \dfrac{V_{BMP}\ (ft^3)}{d_E\ (ft)}$	A_M =	984	ft^2
Proposed Surface Area	A=	999	ft^2

Bioretention Facility Properties

Side Slopes in Bioretention Facility	z =	4	:1
Diameter of Underdrain		6	inches
Longitudinal Slope of Site (3% maximum)		0	%
6" Check Dam Spacing		0	feet

Describe Vegetation: Other

Notes: BASIN B

BMP IS TO CONTAIN SHRUBS AND NATURAL GRASS

Bioretention Facility - Design Procedure	BMP ID	Legend:	Required Entries
	BMP-C		Calculated Cells

Company Name: EXCEL ENGINEERING — Date: 11/1/2016

Designed by: Eric Harrington — County/City Case No.: 2016-285

Design Volume

Enter the area tributary to this feature — A_T= 1.139272 acres

Enter V_{BMP} determined from Section 2.1 of this Handbook — V_{BMP}= 1,518 ft^3

Type of Bioretention Facility Design

- (●) Side slopes required (parallel to parking spaces or adjacent to walkways)
- ( ) No side slopes required (perpendicular to parking space or Planter Boxes)

Bioretention Facility Surface Area

Depth of Soil Filter Media Layer — d_S = 2.0 ft

Top Width of Bioretention Facility, excluding curb — w_T = 10.0 ft

Total Effective Depth, d_E

$$d_E = (0.3) \times d_S + (0.4) \times 1 - (0.7/w_T) + 0.5$$

d_E = 1.43 ft

Minimum Surface Area, A_m

$$A_M\ (ft^2) = \frac{V_{BMP}\ (ft^3)}{d_E\ (ft)}$$

A_M = 1,062 ft^2

Proposed Surface Area — A= 1,100 ft^2

Bioretention Facility Properties

Side Slopes in Bioretention Facility — z = 4 :1

Diameter of Underdrain — 6 inches

Longitudinal Slope of Site (3% maximum) — 0 %

6" Check Dam Spacing — 0 feet

Describe Vegetation: Other

Notes: BASIN C

BMP IS TO CONTAIN SHRUBS AND NATURAL GRASS

Bioretention Facility - Design Procedure	BMP ID	Legend:	Required Entries
	BMP-D		Calculated Cells

Company Name: EXCEL ENGINEERING — Date: 11/1/2016

Designed by: Eric Harrington — County/City Case No.: 2016-285

Design Volume

Enter the area tributary to this feature	A_T=	1.2289252	acres
Enter V_{BMP} determined from Section 2.1 of this Handbook	V_{BMP}=	1,533	ft^3

Type of Bioretention Facility Design

◉ Side slopes required (parallel to parking spaces or adjacent to walkways)

○ No side slopes required (perpendicular to parking space or Planter Boxes)

Bioretention Facility Surface Area

Depth of Soil Filter Media Layer	d_S =	1.5	ft
Top Width of Bioretention Facility, excluding curb	w_T =	10.0	ft
Total Effective Depth, d_E $d_E = (0.3) \times d_S + (0.4) \times 1 - (0.7/w_T) + 0.5$	d_E =	1.28	ft
Minimum Surface Area, A_m $A_M\ (ft^2) = \frac{V_{BMP}\ (ft^3)}{d_E\ (ft)}$	A_M =	1,198	ft^2
Proposed Surface Area	A=	1,220	ft^2

Bioretention Facility Properties

Side Slopes in Bioretention Facility	z =	4	:1
Diameter of Underdrain		6	inches
Longitudinal Slope of Site (3% maximum)		0	%
6" Check Dam Spacing		0	feet

Describe Vegetation: Other

Notes: BASIN D

BMP IS TO CONTAIN SHRUBS AND NATURAL GRASS

Bioretention Facility - Design Procedure	BMP ID	Legend:	Required Entries
	BMP-E		Calculated Cells

Company Name: EXCEL ENGINEERING — Date: 6/11/2019

Designed by: Eric Harrington — County/City Case No.: 2016-285

Design Volume

Enter the area tributary to this feature	A_T=	2.6678212	acres
Enter V_{BMP} determined from Section 2.1 of this Handbook	V_{BMP}=	3,500	ft^3

Type of Bioretention Facility Design

◉ Side slopes required (parallel to parking spaces or adjacent to walkways)

○ No side slopes required (perpendicular to parking space or Planter Boxes)

Bioretention Facility Surface Area

Depth of Soil Filter Media Layer	d_S =	1.5	ft
Top Width of Bioretention Facility, excluding curb	w_T =	28.0	ft
Total Effective Depth, d_E $d_E = (0.3) \times d_S + (0.4) \times 1 - (0.7/w_T) + 0.5$	d_E =	1.33	ft
Minimum Surface Area, A_m $A_M\ (ft^2) = \frac{V_{BMP}\ (ft^3)}{d_E\ (ft)}$	A_M =	2,642	ft^2
Proposed Surface Area	A=	3,210	ft^2

Bioretention Facility Properties

Side Slopes in Bioretention Facility	z =	4	:1
Diameter of Underdrain		6	inches
Longitudinal Slope of Site (3% maximum)		0	%
6" Check Dam Spacing		0	feet

Describe Vegetation: Other

Notes: BASIN E

BMP IS TO CONTAIN SHRUBS AND NATURAL GRASS

Bioretention Facility - Design Procedure	BMP ID	Legend:	Required Entries
	BMP-F		Calculated Cells

Company Name: EXCEL ENGINEERING — Date: 11/1/2016

Designed by: Eric Harrington — County/City Case No.: 2016-285

Design Volume

Enter the area tributary to this feature — A_T= 1.2180838 acres

Enter V_{BMP} determined from Section 2.1 of this Handbook — V_{BMP}= 1,621 ft^3

Type of Bioretention Facility Design

◉ Side slopes required (parallel to parking spaces or adjacent to walkways)

○ No side slopes required (perpendicular to parking space or Planter Boxes)

Bioretention Facility Surface Area

Depth of Soil Filter Media Layer — d_S = 1.5 ft

Top Width of Bioretention Facility, excluding curb — w_T = 8.0 ft

Total Effective Depth, d_E

$$d_E = (0.3) \times d_S + (0.4) \times 1 - (0.7/w_T) + 0.5$$

d_E = 1.26 ft

Minimum Surface Area, A_m

$$A_M\ (ft^2) = \frac{V_{BMP}\ (ft^3)}{d_E\ (ft)}$$

A_M = 1,284 ft^2

Proposed Surface Area — A= 1,368 ft^2

Bioretention Facility Properties

Side Slopes in Bioretention Facility — z = 4 :1

Diameter of Underdrain — 6 inches

Longitudinal Slope of Site (3% maximum) — 0 %

6" Check Dam Spacing — 0 feet

Describe Vegetation: Other

Notes: BASIN F

BMP IS TO CONTAIN SHRUBS AND NATURAL GRASS

Bioretention Facility - Design Procedure	BMP ID	Legend:	Required Entries
	BMP-G		Calculated Cells

Company Name:	EXCEL ENGINEERING	Date:	11/1/2016
Designed by:	Eric Harrington	County/City Case No.:	2016-285

Design Volume

Enter the area tributary to this feature — A_T= 1.0825347 acres

Enter V_{BMP} determined from Section 2.1 of this Handbook — V_{BMP}= 1,142 ft^3

Type of Bioretention Facility Design

- (●) Side slopes required (parallel to parking spaces or adjacent to walkways)
- ( ) No side slopes required (perpendicular to parking space or Planter Boxes)

Bioretention Facility Surface Area

Depth of Soil Filter Media Layer — d_S = 1.5 ft

Top Width of Bioretention Facility, excluding curb — w_T = 6.0 ft

Total Effective Depth, d_E

$d_E = (0.3) \times d_S + (0.4) \times 1 - (0.7/w_T) + 0.5$ — d_E = 1.23 ft

Minimum Surface Area, A_m

$$A_M\ (ft^2) = \frac{V_{BMP}\ (ft^3)}{d_E\ (ft)}$$

A_M = 926 ft^2

Proposed Surface Area — A= 1,449 ft^2

Bioretention Facility Properties

Side Slopes in Bioretention Facility — z = 4 :1

Diameter of Underdrain — 6 inches

Longitudinal Slope of Site (3% maximum) — 0 %

6" Check Dam Spacing — 0 feet

Describe Vegetation: Other

Notes: BASIN G

BMP IS TO CONTAIN SHRUBS AND NATURAL GRASS

Appendix 6: BMP Design Details

Documents for Wet Pond

The proposed project is using a Wet Pond for a portion of the site's stormwater treatment. The live storage of this BMP will also be used for detention for compliance on the hydrology study. The CASQA Wet Pond TC-20 will be used for design purposes utilizing requirements set forth in Riverside County such as DCV Calculations. Compliance regarding stormwater will be to detain the entire DCV as calculated using Santa Ana Watershed – BMP Design Volume (V_{BMP}).

The calculated BMP was done using the following table (also attached to this section)

DMA Type/ID	DMA Area (square feet)	Post-Project Surface Type	Effective Impervious 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)*
DMA-4	*841,023.38*	*Mixed Surface Types*	*0.82*	*0.62*	*524194.5*			
DMA-5	*926,149.47*	*Mixed Surface Types*	*0.82*	*0.623282*	*577252.1*			
DMA-6	*86,228.98*	*Mixed Surface Types*	*0.82*	*0.623282*	*53744.9*			
DMA-8	*158,409.72*	*Mixed Surface Types*	*0.82*	*0.623282*	*98733.9*			
DMA-9	*272,649.13*	*Mixed Surface Types*	*0.82*	*0.623282*	*169937.2*			
DMA-11	*315,604.81*	*Mixed Surface Types*	*0.82*	*0.623282*	*196710.7*			
	2,600,065	***Total***			**1,620,573**	**0.58**	*78,328*	182,354

Table 6.1 – Wetpond V_{BMP}

The results give a value of 78,328 cubic feet of required treatment volume. From the proposed site plan the main lake (BMP-H Major) is proposed to be used as treatment BMP (for the simplicity of this report the small attached lake to the north (BMP-H Minor) will be neglected since the large lake meets requirements).

Using Autocad Stage Storage from Autocad Civil 3d 2015 Stage Storage Program and solving for both average end and conical volume area the results of the active storage volume are:

Detention Storage
Project: 14047 - Rockport Ranch
Basin Description: Wet Pond

Contour Elevation	Contour Area (sq. ft)	Depth (ft)	Incremental Volume Avg. End (cu. ft)	Cumulative Volume Avg. End (cu. ft)	Incremental Volume Conic (cu. ft)	Cumulative Volume Conic (cu. ft)
1,423.350	205,598.77	N/A	N/A	0.00	N/A	0.00
1,424.270	211,621.10	0.920	191921.14	191921.14	191914.47	191914.47

Using the more conservative volume calculation the overall active treatment volume is 191,914 cubic feet. The volume is so large to account for detention that will be needed on site, as well as providing cut-to-fill soil needed for grading purposes. The depth of the active volume is at 0.92 feet to allow as much room as possible for hydrological demands during the Q100 storm event however not to exceed the 8 foot depth requirement permitting a proper drawdown time across the lake to trap sediment in the dead storage.

The dead storage below the active storage must be at least twice the determined DCV. The following is from calculations done on Stage Storage in Autocad Civil 3d 2015:

Project: 14047 Rockport Ranch
Basin Description: Wet Pond - Dead Storage volume

Contour Elevation	Contour Area (sq. ft)	Depth (ft)	Incremental Volume Avg. End (cu. ft)	Cumulative Volume Avg. End (cu. ft)	Incremental Volume Conic (cu. ft)	Cumulative Volume Conic (cu. ft)
1,390.000	28,251.68	N/A	N/A	0.00	N/A	0.00
1,391.000	31,869.02	1.000	30060.35	30060.35	30042.20	30042.20
1,392.000	35,592.73	1.000	33730.87	63791.22	33713.73	63755.93
1,393.000	39,422.83	1.000	37507.78	101299.00	37491.47	101247.40
1,394.000	43,359.30	1.000	41391.06	142690.06	41375.45	142622.85
1,395.000	47,402.15	1.000	45380.72	188070.79	45365.71	187988.56
1,396.000	51,552.33	1.000	49477.24	237548.02	49462.73	237451.29
1,397.000	55,810.33	1.000	53681.33	291229.35	53667.25	291118.54
1,398.000	60,174.56	1.000	57992.44	349221.79	57978.75	349097.29
1,399.000	64,645.02	1.000	62409.79	411631.58	62396.44	411493.73
1,400.000	69,221.72	1.000	66933.37	478564.95	66920.33	478414.06
1,401.000	73,904.65	1.000	71563.18	550128.13	71550.41	549964.47
1,402.000	78,693.81	1.000	76299.23	626427.36	76286.70	626251.17
1,403.000	83,589.20	1.000	81141.50	707568.86	81129.20	707380.36
1,404.000	88,590.83	1.000	86090.01	793658.88	86077.90	793458.27
1,405.000	93,698.69	1.000	91144.76	884803.63	91132.83	884591.09
1,406.000	98,912.78	1.000	96305.73	981109.37	96293.97	980885.06
1,407.000	104,231.47	1.000	101572.13	1082681.49	101560.52	1082445.58
1,408.000	109,648.73	1.000	106940.10	1189621.60	106928.67	1189374.25
1,409.000	115,163.88	1.000	112406.30	1302027.90	112395.03	1301769.27
1,410.000	120,776.90	1.000	117970.39	1419998.29	117959.26	1419728.53
1,411.000	126,487.39	1.000	123632.14	1543630.43	123621.15	1543349.69
1,412.000	132,294.90	1.000	129391.14	1673021.58	129380.28	1672729.97
1,413.000	138,199.45	1.000	135247.18	1808268.76	135236.44	1807966.40
1,414.000	144,201.03	1.000	141200.24	1949469.00	141189.61	1949156.02
1,415.000	150,299.64	1.000	147250.34	2096719.33	147239.81	2096395.83
1,416.000	156,495.29	1.000	153397.47	2250116.80	153387.04	2249782.87
1,417.000	162,787.96	1.000	159641.63	2409758.43	159631.29	2409414.16
1,418.000	169,177.67	1.000	165982.82	2575741.24	165972.57	2575386.72
1,419.000	175,664.41	1.000	172421.04	2748162.29	172410.87	2747797.60
1,420.000	182,248.29	1.000	178956.35	2927118.64	178946.26	2926743.86
1,421.000	189,093.34	1.000	185670.81	3112789.45	185660.30	3112404.15
1,422.000	196,672.15	1.000	192882.74	3305672.20	192870.33	3305274.49
1,423.000	203,546.19	1.000	200109.17	3505781.36	200099.33	3505373.82
1,423.350	205,598.77	0.350	71600.37	3577381.73	71600.07	3576973.88

Again using the most conservative volume of 3,576,973 cubic feet the volume is approximately 45 times greater than the DCV and will meet the treatment of minimum 2x larger than DCV conditions permitted under CASQA and Riverside Flood Control.

A detail showing the proposed pond is included in this section to show cross sections of the proposed pond as well as a copy of CASQA TC-20 as basis for the proposed design.

BIO-4: Wet Detention Basin

Wet detention basins are constructed, naturalistic ponds with a permanent or seasonal pool of water (also called a "wet pool" or "dead storage"). Aquascape facilities, such as artificial lakes, are a special form of wet pool facility that can incorporate innovative design elements to allow them to function as a stormwater treatment facility in addition to an aesthetic water feature. Wet ponds require base flows to exceed or match losses through evaporation and/or infiltration, and they must be designed with the outlet positioned and/or operated in such a way as to maintain a permanent pool. Wet ponds can be designed to provide extended detention of incoming flows using the volume above the permanent pool surface.

Also known as:

- *Wet Ponds*
- *Retention Ponds*

Wet Detention Basin
Source: Geosyntec Consultants

Feasibility Screening Considerations

- Feasibility screening is not applicable to wet ponds; however the potential risk of groundwater contamination should be considered in selection and design.

Opportunity Criteria

- Can provide aesthetic/recreational value for a project.
- Requires relatively large open space area at outlet of drainage area.
- Generally most applicable for drainage areas larger than 10 acres; however may be applied to smaller drainage areas.
- Applicable in drainage areas with source of base flow to maintain water level.

OC-Specific Design Criteria and Considerations

- ☐ Minimum set-backs from foundations and slopes should be observed.
- ☐ Retention of permanent pool volume should not cause geotechnical concerns related to slope stability. Proposed basins in areas with slopes greater than 15 percent or within 200 feet from the top of a hazardous slope or landslide area require geotechnical investigation.
- ☐ Design should include a sediment forebay to remove coarse solids.
- ☐ Flow path length to width ratio is 2:1 (minimum) and 3:1 or greater (preferred).
- ☐ Maximum side slope (H:V) should be 4:1 interior and 3:1 exterior, unless protected from public access by fencing and approved for stability by a geotechnical professional.
- ☐ Wetland vegetation must not occupy more than 25% of surface area.
- ☐ A buffer zone with a minimum width of 25 feet should be provided around the top perimeter of the wet detention basin.

☐ Inlets and outlets should be positioned to maximize flowpaths through the facility. All inlets should enter the first cell of the wet detention basin.

☐ The inlet to wet detention basin should be submerged to dissipate the energy of incoming flow. Energy dissipation should also be used at the outlet of the basin.

☐ Minimum freeboard should be 1 foot (2 feet preferred) above the maximum water surface elevation for on-line basins and 1 foot maximum for off-line basins.

☐ Maximum basin residence time for dry weather flows is 7 days.

Computing Sizing Criteria for Wet Detention Basins

- This document does not provide specific sizing guidance for wet detention basins. Wet basins should be designed by a team of specialists that understand wetland ecology and biology and are familiar with methods to avoid stagnation, odors, and vector issues associated with maintaining a permanent pool. The BMP designer(s) must demonstrate that the facility is sized to capture and treat the volume of runoff not being addressed by upstream BMPs such that 80 percent of average annual stormwater runoff volume from the site is retained or biotreated.
- The retention volume within a wet detention basin is the equal to the permanent pool volume. The drawdown time criteria, or the rate at which the retention volume becomes available, does not apply to wet detention basins. All runoff in excess of the retention volume that flows through the basin is considered biotreated.
- The permanent pool volume should be at least 50 percent of the volume of active (extended detention) storage.

Configuration for Use in a Treatment Train

- Wet detention basins would generally be designed to serve as the final BMP before discharging runoff off-site.
- Wet detention basins may be preceeded in a treatment train by HSCs and LID BMPs in the drainage area, which would reduce the pollutant load and volume of runoff entering the basin, thereby reducing the sizing requirments of the wet detention basin.
- Wet detention basins can be designed to precede other LID or treatment control BMPs, providing equalization and pretreatment.

Additional References for Design Guidance

- CASQA BMP Handbook for New and Redevelopment: http://www.cabmphandbooks.com/Documents/Development/TC-20.pdf
- Los Angeles County Stormwater BMP Design and Maintenance Manual: http://dpw.lacounty.gov/DES/design_manuals/StormwaterBMPDesignandMaintenance.pdf
- LA County LID Manual, Chapter 5: http://dpw.lacounty.gov/wmd/LA_County_LID_Manual.pdf
- Portland Stormwater Management Manual: http://www.portlandonline.com/bes/index.cfm?c=47953&
- Western Washington Stormwater Management Manual, Volume V, Chapter 10: http://www.ecy.wa.gov/pubs/0510033.pdf

Wet Ponds TC-20

Design Considerations

- Area Required
- Slope
- Water Availability
- Aesthetics
- Environmental Side-effects

Targeted Constituents

☑	Sediment	■
☑	Nutrients	▲
☑	Trash	■
☑	Metals	■
☑	Bacteria	■
☑	Oil and Grease	■
☑	Organics	■

Legend *(Removal Effectiveness)*

● Low ■ High

▲ Medium

Description

Wet ponds (a.k.a. stormwater ponds, retention ponds, wet extended detention ponds) are constructed basins that have a permanent pool of water throughout the year (or at least throughout the wet season) and differ from constructed wetlands primarily in having a greater average depth. Ponds treat incoming stormwater runoff by settling and biological uptake. The primary removal mechanism is settling as stormwater runoff resides in this pool, but pollutant uptake, particularly of nutrients, also occurs to some degree through biological activity in the pond. Wet ponds are among the most widely used stormwater practices. While there are several different versions of the wet pond design, the most common modification is the extended detention wet pond, where storage is provided above the permanent pool in order to detain stormwater runoff and promote settling. The schematic diagram is of an on-line pond that includes detention for larger events, but this is not required in all areas of the state.

California Experience

Caltrans constructed a wet pond in northern San Diego County (I-5 and La Costa Blvd.). Largest issues at this site were related to vector control, vegetation management, and concern that endangered species would become resident and hinder maintenance activities.

Advantages

- If properly designed, constructed and maintained, wet basins can provide substantial aesthetic/recreational value and wildlife and wetlands habitat.

- Ponds are often viewed as a public amenity when integrated into a park setting.

- Due to the presence of the permanent wet pool, properly designed and maintained wet basins can provide significant water quality improvement across a relatively broad spectrum of constituents including dissolved nutrients.

- Widespread application with sufficient capture volume can provide significant control of channel erosion and enlargement caused by changes to flow frequency relationships resulting from the increase of impervious cover in a watershed.

Limitations

- Some concern about safety when constructed where there is public access.

- Mosquito and midge breeding is likely to occur in ponds.

- Cannot be placed on steep unstable slopes.

- Need for base flow or supplemental water if water level is to be maintained.

- Require a relatively large footprint

- Depending on volume and depth, pond designs may require approval from the State Division of Safety of Dams

Design and Sizing Guidelines

- Capture volume determined by local requirements or sized to treat 85% of the annual runoff volume.

- Use a draw down time of 48 hours in most areas of California. Draw down times in excess of 48 hours may result in vector breeding, and should be used only after coordination with local vector control authorities. Draw down times of less than 48 hours should be limited to BMP drainage areas with coarse soils that readily settle and to watersheds where warming may be detrimental to downstream fisheries.

- Permanent pool volume equal to twice the water quality volume.

- Water depth not to exceed about 8 feet.

- Wetland vegetation occupying no more than 25% of surface area.

- Include energy dissipation in the inlet design and a sediment forebay to reduce resuspension of accumulated sediment and facilitate maintenance.

- A maintenance ramp should be included in the design to facilitate access to the forebay for maintenance activities and for vector surveillance and control.

- To facilitate vector surveillance and control activities, road access should be provided along at least one side of BMPs that are seven meters or less in width. Those BMPs that have shoreline-to-shoreline distances in excess of seven meters should have perimeter road access on both sides or be designed such that no parcel of water is greater than seven meters from the road.

Construction/Inspection Considerations

- In areas with porous soils an impermeable liner may be required to maintain an adequate permanent pool level.
- Outlet structures and piping should be installed with collars to prevent water from seeping through the fill and causing structural failure.
- Inspect facility after first large storm to determine whether the desired residence time has been achieved.

Performance

The observed pollutant removal of a wet pond is highly dependent on two factors: the volume of the permanent pool relative to the amount of runoff from the typical event in the area and the quality of the base flow that sustains the permanent pool. A recent study (Caltrans, 2002) has documented that if the permanent pool is much larger than the volume of runoff from an average event, then displacement of the permanent pool by the wet weather flow is the primary process. A statistical comparison of the wet pond discharge quality during dry and wet weather shows that they are not significantly different. Consequently, there is a relatively constant discharge quality during storms that is the same as the concentrations observed in the pond during ambient (dry weather) conditions. Consequently, for most constituents the performance of the pond is better characterized by the average effluent concentration, rather than the “percent reduction,” which has been the conventional measure of performance. Since the effluent quality is essentially constant, the percent reduction observed is mainly a function of the influent concentrations observed at a particular site.

The dry and wet weather discharge quality is, therefore, related to the quality of the base flow that sustains the permanent pool and of the transformations that occur to those constituents during their residence in the basin. One could potentially expect a wide range of effluent concentrations at different locations even if the wet ponds were designed according to the same guidelines, if the quality of the base flow differed significantly. This may explain the wide range of concentration reductions reported in various studies.

Concentrations of nutrients in base flow may be substantially higher than in urban stormwater runoff. Even though these concentrations may be substantially reduced during the residence time of the base flow in the pond, when this water is displaced by wet weather flows, concentrations may still be quite elevated compared to the levels that promote eutrophication in surface water systems. Consequently comparing influent and effluent nutrient concentrations during wet weather can make the performance seem highly variable.

Relatively small perennial flows may often substantially exceed the wet weather flow treated. Consequently, one should also consider the load reduction observed under ambient conditions when assessing the potential benefit to the receiving water.

Siting Criteria

Wet ponds are a widely applicable stormwater management practice and can be used over a broad range of storm frequencies and sizes, drainage areas and land use types. Although they have limited applicability in highly urbanized settings and in arid climates, they have few other restrictions. Wet basins may be constructed on- or off-line and can be sited at feasible locations along established drainage ways with consistent base flow. An off-line design is preferred. Wet basins are often utilized in smaller sub-watersheds and are particularly appropriate in areas with residential land

uses or other areas where high nutrient loads are considered to be potential problems (e.g., golf courses).

Ponds do not consume a large area (typically 2–3 percent of the contributing drainage area); however, these facilities are generally large. Other practices, such as filters or swales, may be "squeezed" into relatively unusable land, but ponds need a relatively large continuous area. Wet basins are typically used in drainage basins of more than ten acres and less than one square mile (Schueler et al., 1992). Emphasis can be placed in siting wet basins in areas where the pond can also function as an aesthetic amenity or in conjunction with other stormwater management functions.

Wet basin application is appropriate in the following settings: (1) where there is a need to achieve a reasonably high level of dissolved contaminant removal and/or sediment capture; (2) in small to medium-sized regional tributary areas with available open space and drainage areas greater than about 10 ha (25 ac.); (3) where base flow rates or other channel flow sources are relatively consistent year-round; (4) in residential settings where aesthetic and wildlife habitat benefits can be appreciated and maintenance activities are likely to be consistently undertaken.

Traditional wet extended detention ponds can be applied in most regions of the United States, with the exception of arid climates. In arid regions, it is difficult to justify the supplemental water needed to maintain a permanent pool because of the scarcity of water. Even in semi-arid Austin, Texas, one study found that 2.6 acre-feet per year of supplemental water was needed to maintain a permanent pool of only 0.29 acre-feet (Saunders and Gilroy, 1997). Seasonal wet ponds (i.e., ponds that maintain a permanent pool only during the wet season) may prove effective in areas with distinct wet and dry seasons; however, this configuration has not been extensively evaluated.

Wet ponds may pose a risk to cold water systems because of their potential for stream warming. When water remains in the permanent pool, it is heated by the sun. A study in Prince George's County, Maryland, found that stormwater wet ponds heat stormwater by about 9°F from the inlet to the outlet (Galli, 1990).

Additional Design Guidelines

Specific designs may vary considerably, depending on site constraints or preferences of the designer or community. There are several variations of the wet pond design, including constructed wetlands, and wet extended detention ponds. Some of these design alternatives are intended to make the practice adaptable to various sites and to account for regional constraints and opportunities. In conventional wet ponds, the open water area comprises 50% or more of the total surface area of the pond. The permanent pool should be no deeper than 2.5 m (8 feet) and should average 1.2 – 2 m (4-6 feet) deep. The greater depth of this configuration helps limit the extent of the vegetation to an aquatic bench around the perimeter of the pond with a nominal depth of about 1 foot and variable width. This shallow bench also protects the banks from erosion, enhances habitat and aesthetic values, and reduces the drowning hazard.

The wet extended detention pond combines the treatment concepts of the dry extended detention pond and the wet pond. In this design, the water quality volume is detained above the permanent pool and released over 24 hours. In addition to increasing the residence time, which improves pollutant removal, this design also attenuates peak runoff rates. Consequently, this design alternative is recommended.

Pretreatment incorporates design features that help to settle out coarse sediment particles. By removing these particles from runoff before they reach the large permanent pool, the maintenance burden of the pond is reduced. In ponds, pretreatment is achieved with a sediment forebay. A sediment forebay is a small pool (typically about 10 percent of the volume of the permanent pool). Coarse particles remain trapped in the forebay, and maintenance is performed on this smaller pool, eliminating the need to dredge the entire pond.

There are a variety of sizing criteria for determining the volume of the permanent pool, mostly related to the water quality volume (i.e., the volume of water treated for pollutant removal) or the average storm size in a particular area. In addition, several theoretical approaches to determination of permanent pool volume have been developed. However, there is little empirical evidence to support these designs. Consequently, a simplified method (i.e., permanent pool volume equal to twice the water quality volume) is recommended.

Other design features do not increase the volume of a pond, but can increase the amount of time stormwater remains in the device and eliminate short-circuiting. Ponds should always be designed with a length-to-width ratio of at least 1.5:1, where feasible. In addition, the design should incorporate features to lengthen the flow path through the pond, such as underwater berms designed to create a longer route through the pond. Combining these two measures helps ensure that the entire pond volume is used to treat stormwater. Wet ponds with greater amounts of vegetation often have channels through the vegetated areas and contain dead areas where stormwater is restricted from mixing with the entire permanent pool, which can lead to less pollutant removal. Consequently, a pond with open water comprising about 75% of the surface area is preferred.

Design features are also incorporated to ease maintenance of both the forebay and the main pool of ponds. Ponds should be designed with a maintenance access to the forebay to ease this relatively routine (every 5–7 year) maintenance activity. In addition, ponds should generally have a drain to draw down the pond for vegetation harvesting or the more infrequent dredging of the main cell of the pond.

Cold climates present many challenges to designers of wet ponds. The spring snowmelt may have a high pollutant load and a large volume to be treated. In addition, cold winters may cause freezing of the permanent pool or freezing at inlets and outlets. Finally, high salt concentrations in runoff resulting from road salting, and sediment loads from road sanding, may impact pond vegetation as well as reduce the storage and treatment capacity of the pond.

One option to deal with high pollutant loads and runoff volumes during the spring snowmelt is the use of a seasonally operated pond to capture snowmelt during the winter and retain the permanent pool during warmer seasons. In this option, proposed by Oberts (1994), the pond has two water quality outlets, both equipped with gate valves. In the summer, the lower outlet is closed. During the fall and throughout the winter, the lower outlet is opened to draw down the permanent pool. As the spring melt begins, the lower outlet is closed to provide detention for the melt event. The manipulation of this system requires some labor and vigilance; a careful maintenance agreement should be confirmed.

Several other modifications may help to improve the performance of ponds in cold climates. Designers should consider planting the pond with salt-tolerant vegetation if the facility receives road runoff. In order to counteract the effects of freezing on inlet and outlet structures, the use of inlet and outlet structures that are resistant to frost, including weirs and larger diameter pipes, may be

useful. Designing structures on-line, with a continuous flow of water through the pond, will also help prevent freezing of these structures. Finally, since freezing of the permanent pool can reduce the effectiveness of pond systems, it is important to incorporate extended detention into the design to retain usable treatment area above the permanent pool when it is frozen.

Summary of Design Recommendations

(1) Facility Sizing – The basin should be sized to hold the permanent pool as well as the required water quality volume. The volume of the permanent pool should equal twice the water quality volume.

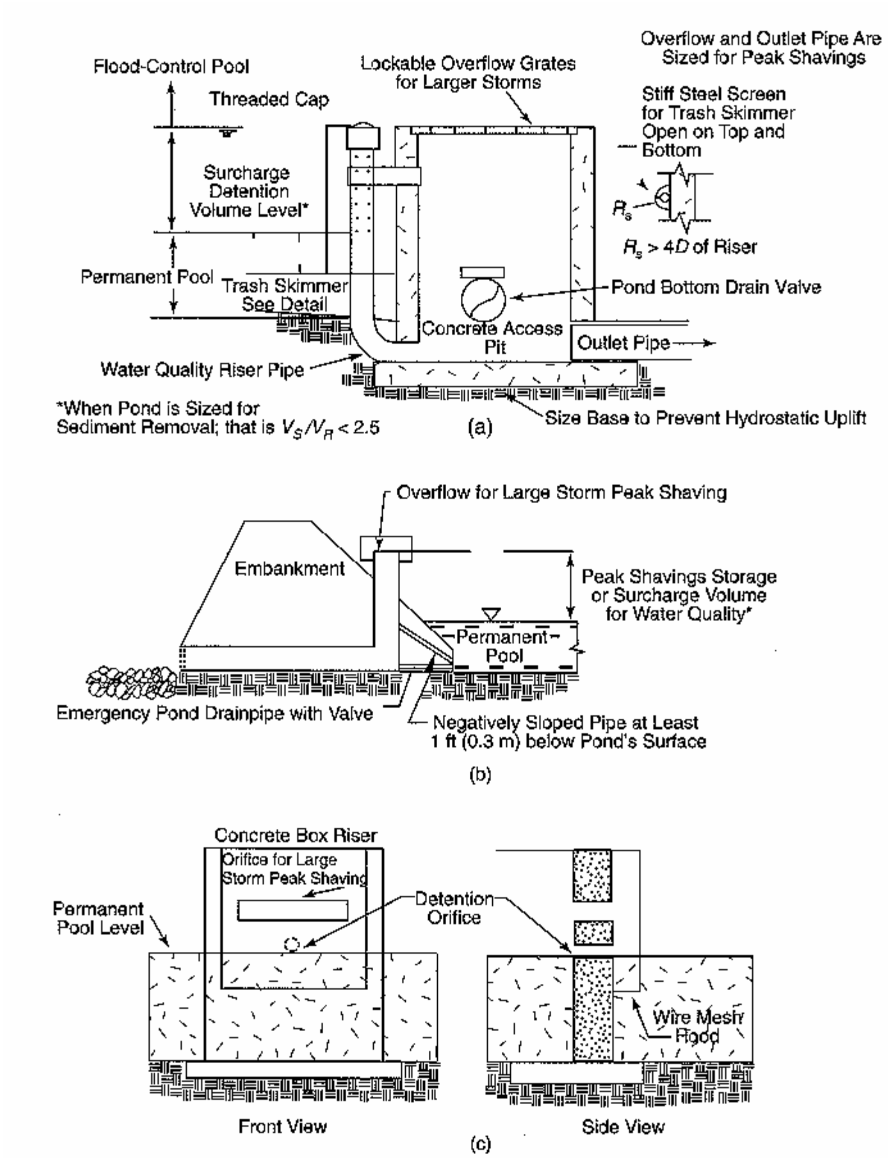
(2) Pond Configuration - The wet basin should be configured as a two stage facility with a sediment forebay and a main pool. The basins should be wedge-shaped, narrowest at the inlet and widest at the outlet. The minimum length to width ratio should be 1.5 where feasible. The perimeter of all permanent pool areas with depths of 4.0 feet or greater should be surrounded by an aquatic bench. This bench should extend inward 5-10 feet from the perimeter of the permanent pool and should be no more than 18 inches below normal depth. The area of the bench should not exceed about 25% of pond surface. The depth in the center of the basin should be 4 – 8 feet deep to prevent vegetation from encroaching on the pond open water surface.

(3) Pond Side Slopes - Side slopes of the basin should be 3:1 (H:V) or flatter for grass stabilized slopes. Slopes steeper than 3:1 should be stabilized with an appropriate slope stabilization practice.

(4) Sediment Forebay - A sediment forebay should be used to isolate gross sediments as they enter the facility and to simplify sediment removal. The sediment forebay should consist of a separate cell formed by an earthen berm, gabion, or loose riprap wall. The forebay should be sized to contain 15 to 25% of the permanent pool volume and should be at least 3 feet deep. Exit velocities from the forebay should not be erosive. Direct maintenance access should be provided to the forebay. The bottom of the forebay may be hardened (concrete) to make sediment removal easier. A fixed vertical sediment depth marker should be installed in the forebay to measure sediment accumulation.

(5) Outflow Structure - Figure 2 presents a schematic representation of suggested outflow structures. The outlet structure should be designed to drain the water quality volume over 24 hours with the orifice sized according to the equation presented in the Extended Detention Basin fact sheet. The facility should have a separate drain pipe with a manual valve that can completely or partially drain the pond for maintenance purposes. To allow for possible sediment accumulation, the submerged end of the pipe should be protected, and the drain pipe should be sized to drain the pond within 24 hours. The valve should be located at a point where it can be operated in a safe and convenient manner.

For on-line facilities, the principal and emergency spillways must be sized to provide 1.0 foot of freeboard during the 25-year event and to safely pass the 100-year flood. The embankment should be designed in accordance with all relevant specifications for small dams.



(6) Splitter Box - When the pond is designed as an off-line facility, a splitter structure is used to isolate the water quality volume. The splitter box, or other flow diverting approach, should be designed to convey the 25-year event while providing at least 1.0 foot of freeboard along pond side slopes.

(7) Vegetation - A plan should be prepared that indicates how aquatic and terrestrial areas will be vegetatively stabilized. Wetland vegetation elements should be placed along the aquatic bench or in the shallow portions of the permanent pool. The optimal elevation for planting of wetland vegetation is within 6 inches vertically of the normal pool elevation. A list of some wetland vegetation native to California is presented in Table 1.

Table 1 California Wetland Vegetation	
Botanical Name	**Common Name**
BACCHARIS SALICIFOLIA	MULE FAT
FRANKENIA GRANDIFOLIA	HEATH
SALIX GOODINGII	BLACK WILLOW
SALIX LASIOLEPIS	ARROYO WILLOW
SAMUCUS MEXICANUS	MEXICAN ELDERBERRY
HAPLOPAPPUS VENETUS	COAST GOLDENBRUSH
DISTICHIS SPICATA	SALT GRASS
LIMONIUM CALIFORNICUM	COASTAL STATICE
ATRIPLEX LENTIFORMIS	COASTAL QUAIL BUSH
BACCHARIS PILULARIS	CHAPARRAL BROOM
MIMULUS LONGIFLORUS	MONKEY FLOWER
SCIRPUS CALIFORNICUS	BULRUSH
SCIRPUS ROBUSTUS	BULRUSH
TYPHA LATIFOLIA	BROADLEAF CATTAIL
JUNCUS ACUTUS	RUSH

Maintenance

The amount of maintenance required for a wet pond is highly dependent on local regulatory agencies, particular health and vector control agencies. These agencies are often extremely concerned about the potential for mosquito breeding that may occur in the permanent pool. Even though mosquito fish (*Gambusia affinis*) were introduced into a wet pond constructed by Caltrans in the San Diego area, mosquito breeding was routinely observed during inspections. In addition, the vegetation at this site became sufficiently dense on the bench around the edge of the pool that mosquito fish were unable to enter this area to feed upon the mosquito larvae. The vegetation at this site was particularly vigorous because of the high nutrient concentrations in the perennial base flow (15.5 mg/L NO3-N) and the mild climate, which permitted growth year round. Consequently, the vector control agency required an annual harvest of vegetation to address this situation. This harvest can be very expensive.

On the other hand, routine harvesting may increase nutrient removal and prevent the export of these constituents from dead and dying plants falling in the water. A previous study (Faulkner and Richardson, 1991) documented dramatic reductions in nutrient removal after the first several years of operation and related it to the vegetation achieving a maximum density. That content then decreases through the growth season, as the total biomass increases. In effect, the total amount of

nutrients/m2 of wetland remains essentially the same from June through September, when the plants start to put the P back into the rhizomes. Therefore harvesting should occur between June and September. Research also suggests that harvesting only the foliage is less effective, since a very small percentage of the removed nutrients is taken out with harvesting.

Since wet ponds are often selected for their aesthetic considerations as well as pollutant removal, they are often sited in areas of high visibility. Consequently, floating litter and debris are removed more frequently than would be required simply to support proper functioning of the pond and outlet. This is one of the primary maintenance activities performed at the Central Market Pond located in Austin, Texas. In this type of setting, vegetation management in the area surrounding the pond can also contribute substantially to the overall maintenance requirements.

One normally thinks of sediment removal as one of the typical activities performed at stormwater BMPs. This activity does not normally constitute one of the major activities on an annual basis. At the concentrations of TSS observed in urban runoff from stable watersheds, sediment removal may only be required every 20 years or so. Because this activity is performed so infrequently, accurate costs for this activity are lacking.

In addition to regular maintenance activities needed to maintain the function of wet ponds, some design features can be incorporated to ease the maintenance burden. In wet ponds, maintenance reduction features include techniques to reduce the amount of maintenance needed, as well as techniques to make regular maintenance activities easier.

One potential maintenance concern in wet ponds is clogging of the outlet. Ponds should be designed with a non-clogging outlet such as a reverse-slope pipe, or a weir outlet with a trash rack. A reverse-slope pipe draws from below the permanent pool extending in a reverse angle up to the riser and establishes the water elevation of the permanent pool. Because these outlets draw water from below the level of the permanent pool, they are less likely to be clogged by floating debris.

Typical maintenance activities and frequencies include:

- Schedule semiannual inspections for burrows, sediment accumulation, structural integrity of the outlet, and litter accumulation.
- Remove accumulated trash and debris in the basin at the middle and end of the wet season. The frequency of this activity may be altered to meet specific site conditions and aesthetic considerations.
- Where permitted by the Department of Fish and Game or other agency regulations, stock wet ponds/constructed wetlands regularly with mosquito fish (*Gambusia spp.*) to enhance natural mosquito and midge control.
- Introduce mosquito fish and maintain vegetation to assist their movements to control mosquitoes, as well as to provide access for vector inspectors. An annual vegetation harvest in summer appears to be optimum, in that it is after the bird breeding season, mosquito fish can provide the needed control until vegetation reaches late summer density, and there is time for re-growth for runoff treatment purposes before the wet season. In certain cases, more frequent plant harvesting may be required by local vector control agencies.

- Maintain emergent and perimeter shoreline vegetation as well as site and road access to facilitate vector surveillance and control activities.

- Remove accumulated sediment in the forebay and regrade about every 5-7 years or when the accumulated sediment volume exceeds 10 percent of the basin volume. Sediment removal may not be required in the main pool area for as long as 20 years.

Cost

Construction Cost

Wet ponds can be relatively inexpensive stormwater practices; however, the construction costs associated with these facilities vary considerably. Much of this variability can be attributed to the degree to which the existing topography will support a wet pond, the complexity and amount of concrete required for the outlet structure, and whether it is installed as part of new construction or implemented as a retrofit of existing storm drain system.

A recent study (Brown and Schueler, 1997) estimated the cost of a variety of stormwater management practices. The study resulted in the following cost equation, adjusting for inflation:

$$C = 24.5^{V0.705}$$

where:

C = Construction, design and permitting cost;

V = Volume in the pond to include the 10-year storm (ft^3).

Using this equation, typical construction costs are:

$45,700 for a 1 acre-foot facility

$232,000 for a 10 acre-foot facility

$1,170,000 for a 100 acre-foot facility

In contrast, Caltrans (2002) reported spending over $448,000 for a pond with a total permanent pool plus water quality volume of only 1036 m^3 (0.8 ac.-ft.), while the City of Austin spent $584,000 (including design) for a pond with a permanent pool volume of 3,100 m^3 (2.5 ac.-ft.). The large discrepancies between the costs of these actual facilities and the model developed by Brown and Schueler indicate that construction costs are highly site specific, depending on topography, soils, subsurface conditions, the local labor, rate and other considerations.

Maintenance Cost

For ponds, the annual cost of routine maintenance has typically been estimated at about 3 to 5 percent of the construction cost; however, the published literature is almost totally devoid of actual maintenance costs. Since ponds are long-lived facilities (typically longer than 20 years), major maintenance activities are unlikely to occur during a relatively short study.

Caltrans (2002) estimated annual maintenance costs of $17,000 based on three years of monitoring of a pond treating runoff from 1.7 ha. Almost all the activities are associated with the annual vegetation harvest for vector control. Total cost at this site falls within the 3-5% range reported

above; however, the construction costs were much higher than those estimated by Brown and Schueler (1997). The City of Austin has been reimbursing a developer about $25,000/yr for wet pond maintenance at a site located at a very visible location. Maintenance costs are mainly the result of vegetation management and litter removal. On the other hand, King County estimates annual maintenance costs at about $3,000 per pond; however, this cost likely does not include annual extensive vegetation removal. Consequently, maintenance costs may vary considerably at sites in California depending on the aggressiveness of the vegetation management in that area and the frequency of litter removal.

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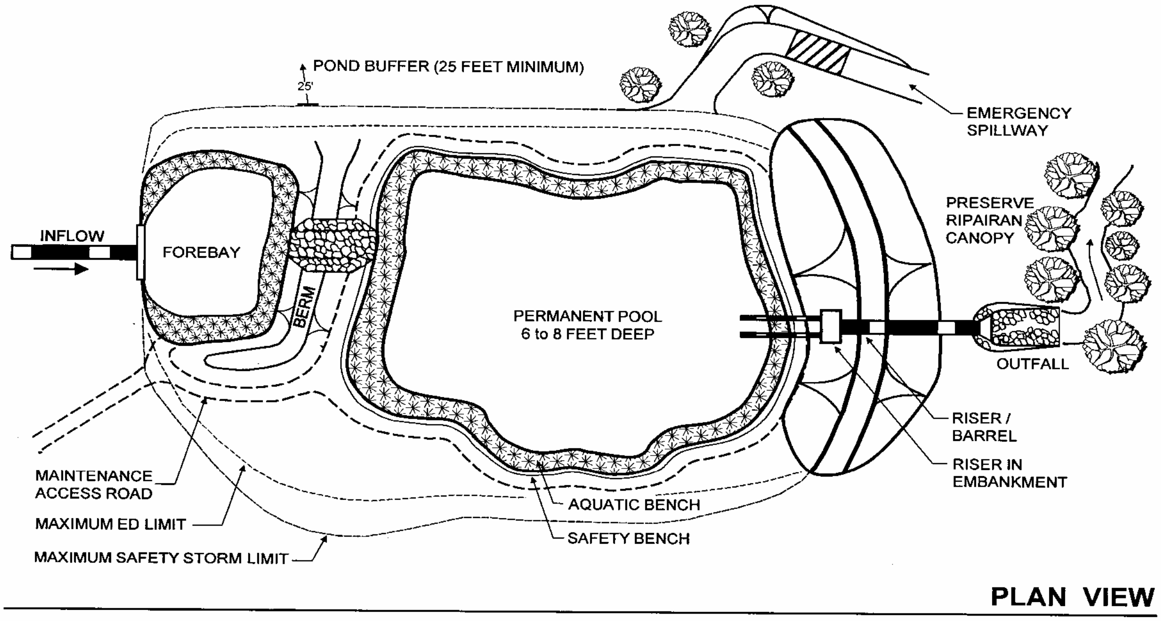
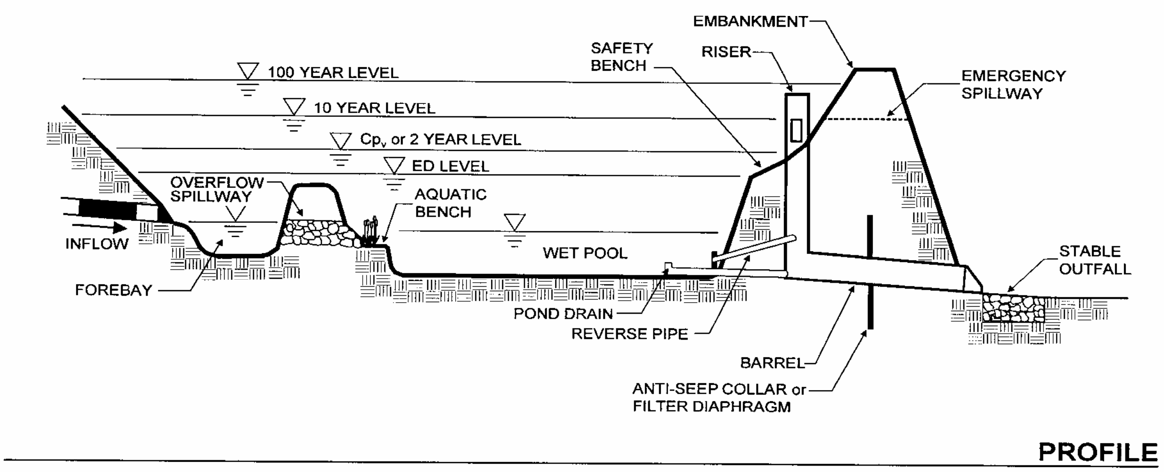
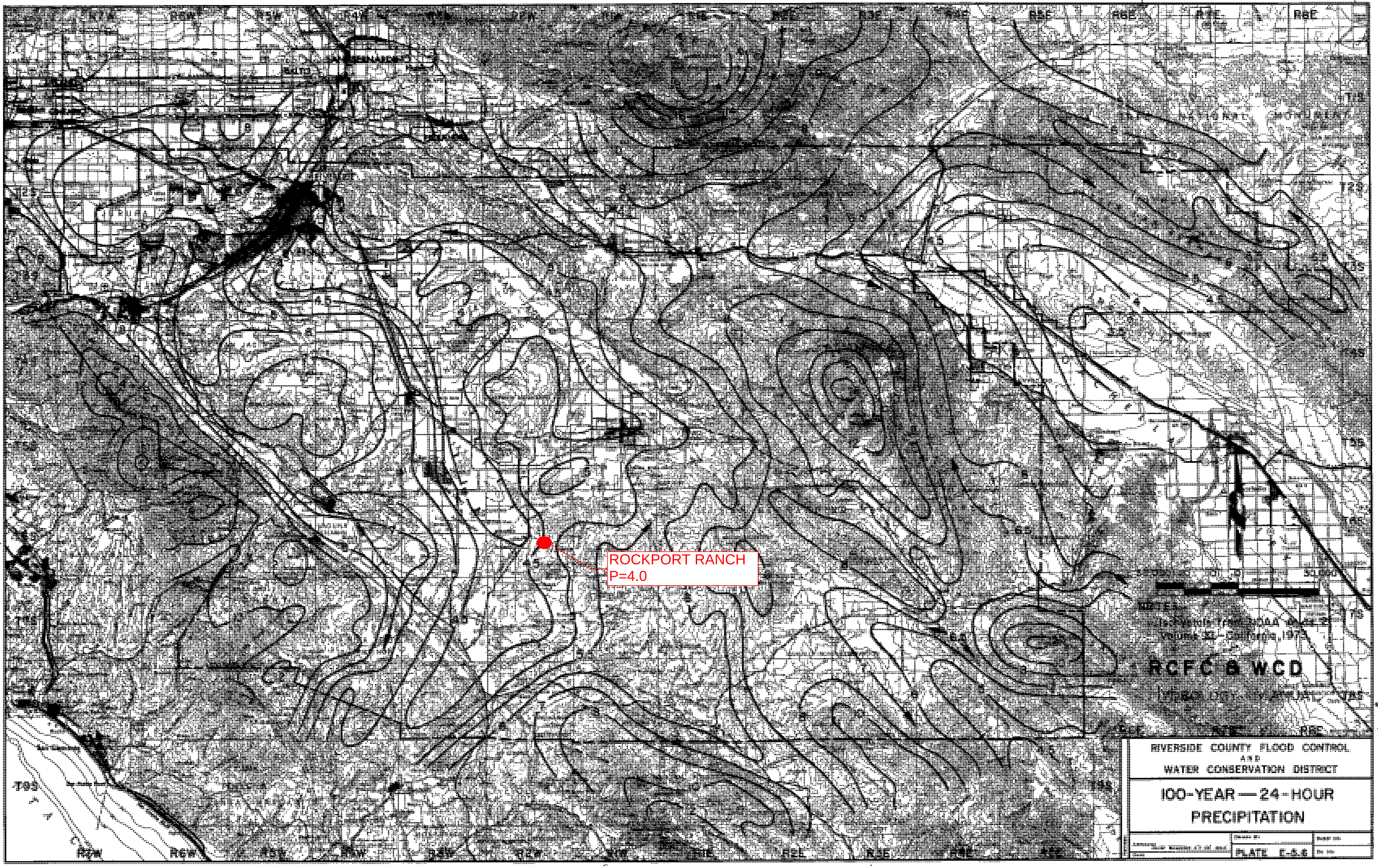
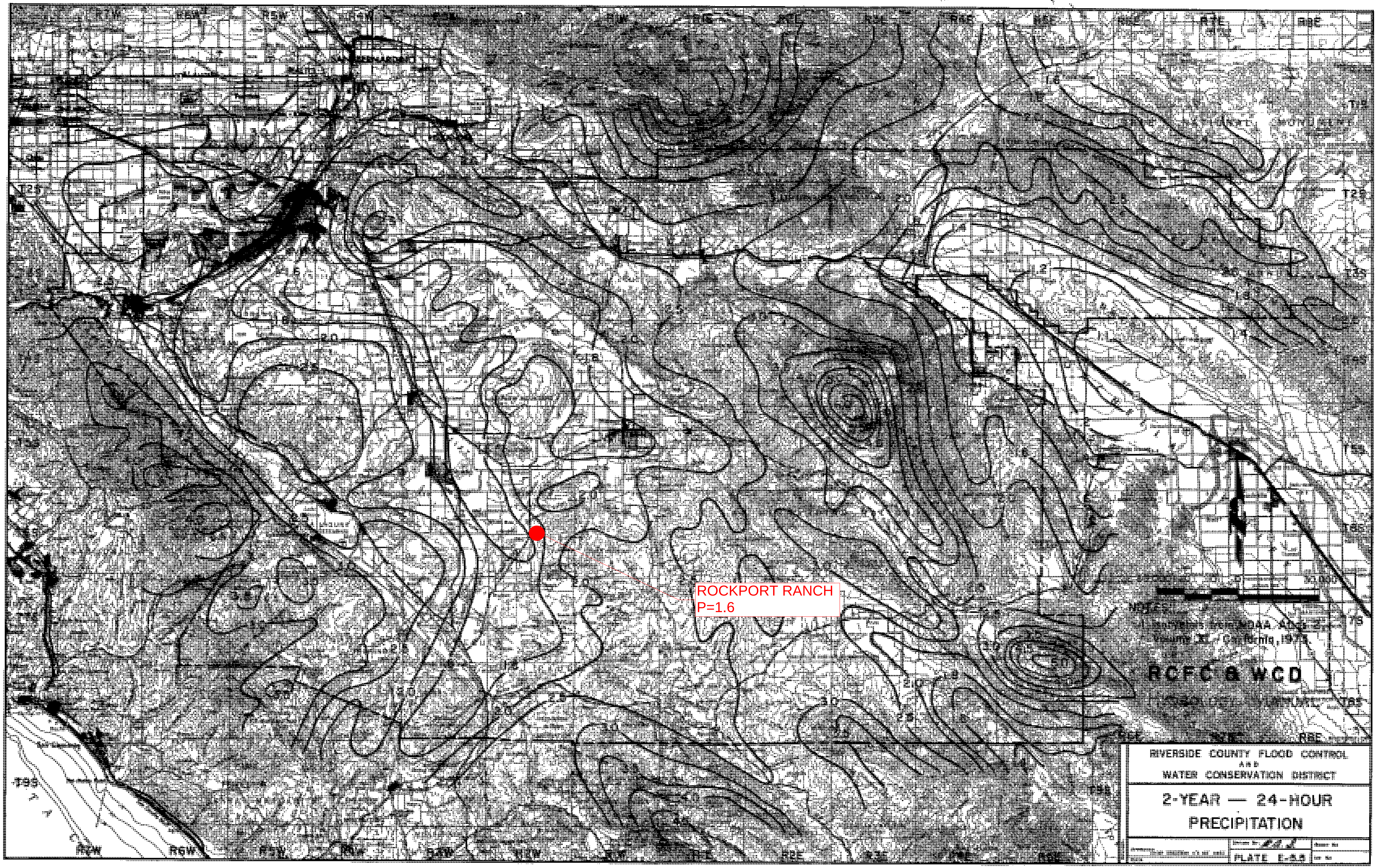

POND BUFFER (25 FEET MINIMUM)
25'
EMERGENCY SPILLWAY
INFLOW
FOREBAY
BERM
PRESERVE RIPAIRAN CANOPY
PERMANENT POOL 6 to 8 FEET DEEP
OUTFALL
RISER / BARREL
RISER IN EMBANKMENT
MAINTENANCE ACCESS ROAD
MAXIMUM ED LIMIT
AQUATIC BENCH
SAFETY BENCH
MAXIMUM SAFETY STORM LIMIT
PLAN VIEW

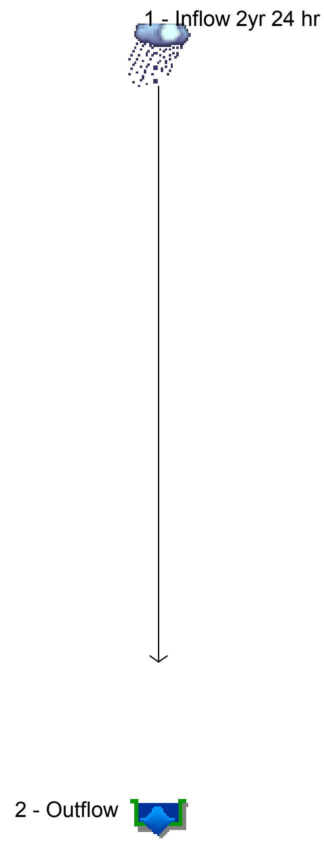

EMBANKMENT
SAFETY BENCH
RISER
100 YEAR LEVEL
EMERGENCY SPILLWAY
10 YEAR LEVEL
Cpv or 2 YEAR LEVEL
ED LEVEL
OVERFLOW SPILLWAY
AQUATIC BENCH
INFLOW
WET POOL
STABLE OUTFALL
FOREBAY
POND DRAIN
REVERSE PIPE
BARREL
ANTI-SEEP COLLAR or FILTER DIAPHRAGM
PROFILE


ROCKPORT RANCH
P=4.0
RCFC & WCD
RIVERSIDE COUNTY FLOOD CONTROL
AND
WATER CONSERVATION DISTRICT
100-YEAR — 24-HOUR
PRECIPITATION
PLATE E-5.6


ROCKPORT RANCH
P=1.6
NOTES:
RCFC & WCD
RIVERSIDE COUNTY FLOOD CONTROL
AND
WATER CONSERVATION DISTRICT
2-YEAR — 24-HOUR
PRECIPITATION
PLATE E-5.5

Watershed Model Schematic

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4



Legend

Hyd.	**Origin**	**Description**
1	Manual	Inflow 2yr 24 hr
2	Reservoir	Outflow

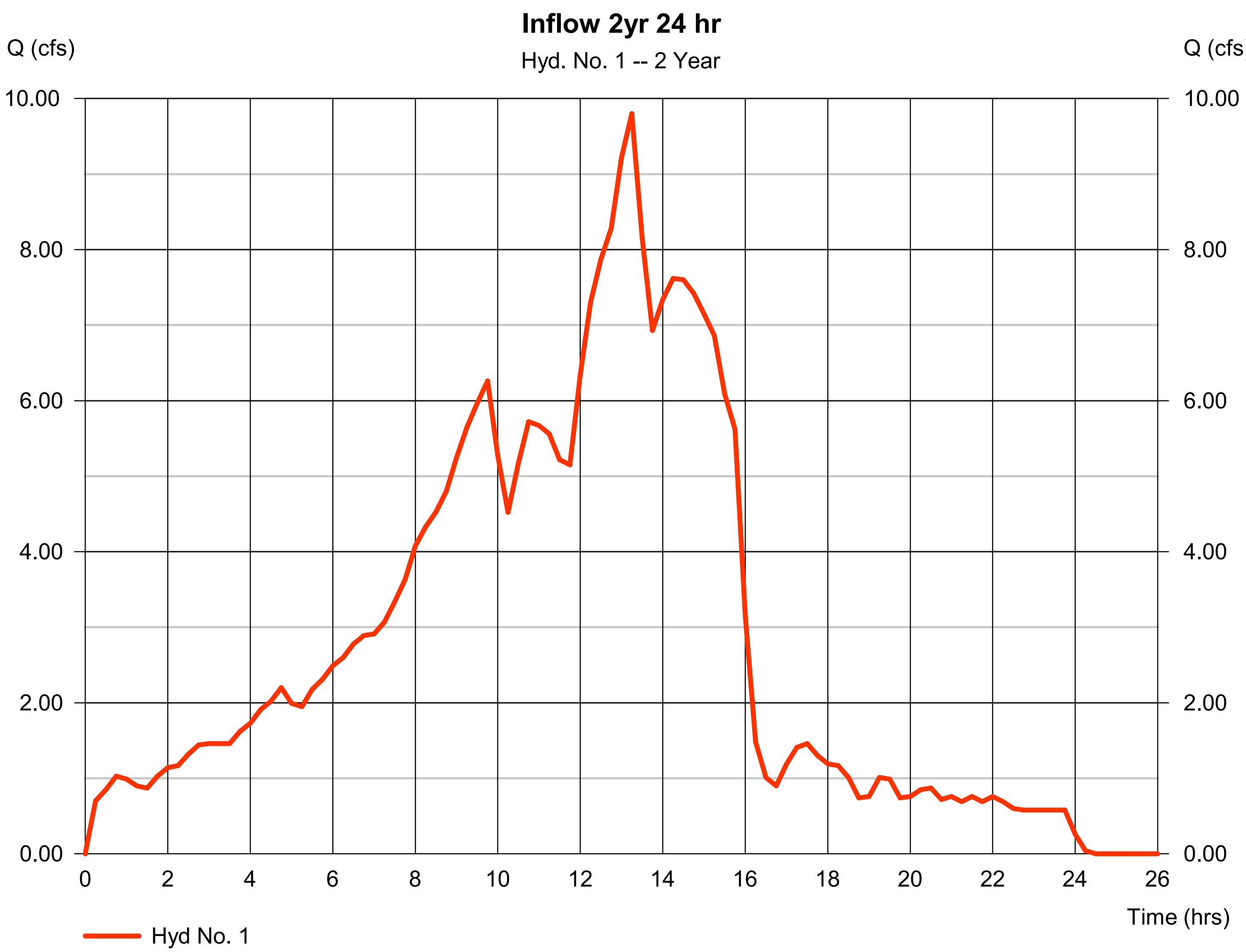
Hydrograph Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2015 by Autodesk, Inc. v10.4 Monday, 08 / 14 / 2017

Hyd. No. 1

Inflow 2yr 24 hr

Hydrograph type	= Manual	Peak discharge	= 9.800 cfs
Storm frequency	= 2 yrs	Time to peak	= 13.25 hrs
Time interval	= 15 min	Hyd. volume	= 262,242 cuft



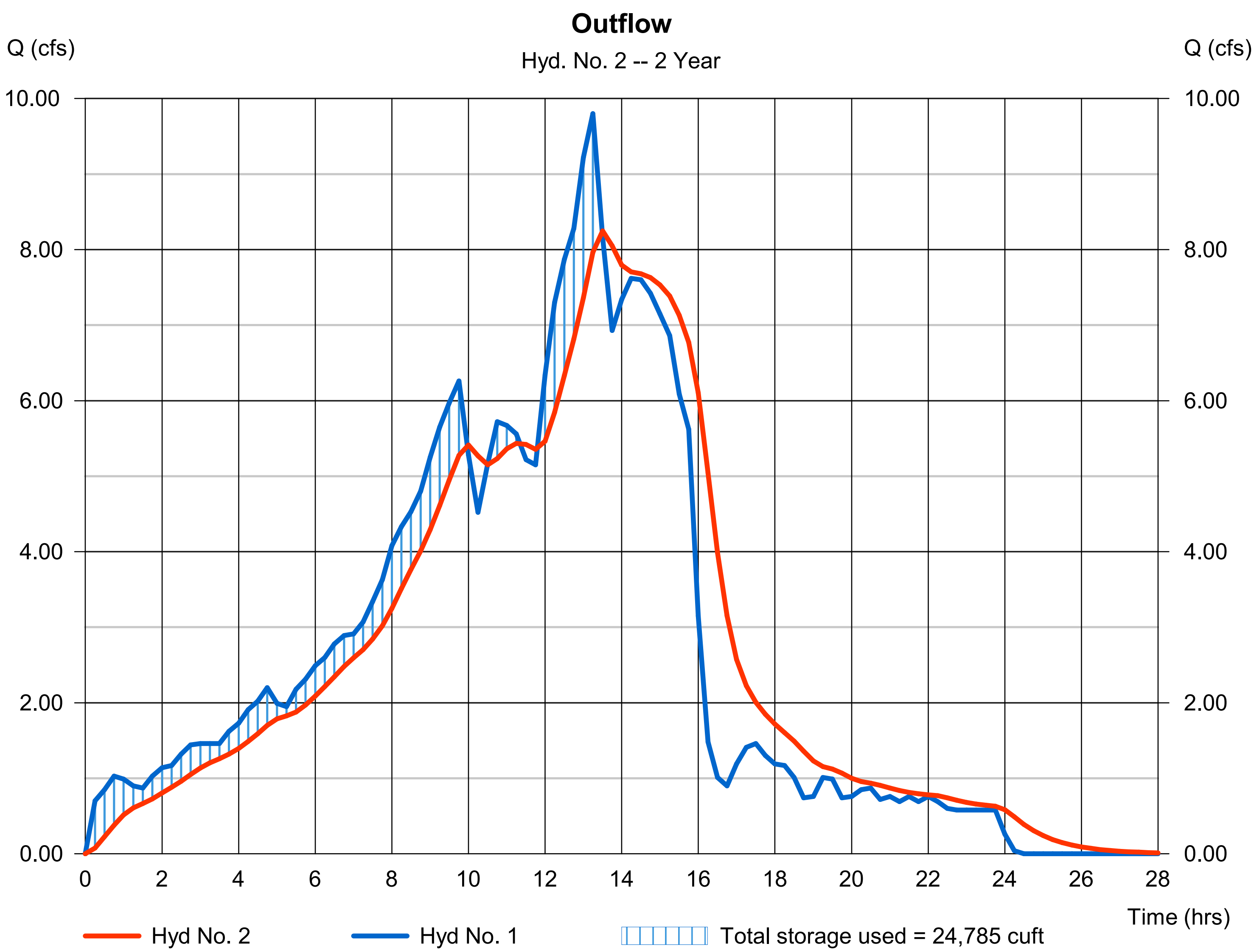
Hydrograph Report

Hyd. No. 2

Outflow

Hydrograph type	= Reservoir	Peak discharge	= 8.250 cfs
Storm frequency	= 2 yrs	Time to peak	= 13.50 hrs
Time interval	= 15 min	Hyd. volume	= 261,950 cuft
Inflow hyd. No.	= 1 - Inflow 2yr 24 hr	Max. Elevation	= 1424.95 ft
Reservoir name	= Pond	Max. Storage	= 24,785 cuft

Storage Indication method used.



Stage Storage
Project: Rockport Ranch
Basin Description: Basin E-7 Stage Storage

Contour Elevation	Contour Area (sq. ft)	Depth (ft)	Incremental Volume Avg. End (cu. ft)	Cumulative Volume Avg. End (cu. ft)	Incremental Volume Conic (cu. ft)	Cumulative Volume Conic (cu. ft)
1,424.000	212,035.58		N/A	N/A	0.00	N/A
0.00						
1,425.000	219,948.65		1.000	215992.12	215992.12	
215980.03	215980.03					
1,426.000	230,663.21		1.000	225305.93	441298.04	
225284.69	441264.73					

Appendix 6: BMP Design Details

Forebay Sizing Calculations

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

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: EXCEL ENGINEERING — Date: 10/31/2016
Designed by: Eric Harrington — Case No:
Company Project Number/Name: 14047- Rockport Development

BMP Identification

BMP NAME / ID: BMP-H

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}= 0.58 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)*
DMA-4	*841,023.38*	*Mixed Surface Types*	*0.82*	*0.62*	*524194.5*			
DMA-6	*86,228.98*	*Mixed Surface Types*	*0.82*	*0.623282*	*53744.9*			
	927,252	***Total***			**577,939**	**0.58**	***27,934***	***182,354***

3%min	**Forebay volume**	**838.011**
Provided	1' deep rectangle for square footage	838.011

Notes:

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

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: EXCEL ENGINEERING
Date: 10/31/2016
Designed by: Eric Harrington
Case No:
Company Project Number/Name: 14047- Rockport Development

BMP Identification

BMP NAME / ID: BMP-H

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}= 0.58 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)*
DMA-5	*926,149.47*	*Mixed Surface Types*	*0.82*	*0.623282*	*577252.1*			
	926,149	***Total***			**577,252**	**0.58**	***27,901***	***182,354***

	3%min	**Forebay volume**	**837.015**
Provided	1' deep rectangle for square footage		1513.16

Notes:

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

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: EXCEL ENGINEERING
Date: 10/31/2016
Designed by: Eric Harrington
Case No:
Company Project Number/Name: 14047- Rockport Development

BMP Identification

BMP NAME / ID: BMP-H

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}= 0.58 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)*
DMA-11	*315,604.81*	*Mixed Surface Types*	*0.82*	*0.62*	*196710.7*			
	315,605	***Total***			**196,711**	**0.58**	***9,508***	***182,354***

3%min Forebay volume 285.231

Provided 1' deep rectangle for square footage 285.231

Notes:

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

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 EXCEL ENGINEERING | Date 10/31/2016
Designed by Eric Harrington | Case No
Company Project Number/Name 14047- Rockport Development

BMP Identification

BMP NAME / ID BMP-H

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}= 0.58 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)*
DMA-9	*272,649.13*	*Mixed Surface Types*	*0.82*	*0.62*	*169937.2*			
	272,649	**Total**			**169,937**	**0.58**	**8,214**	**182,354**

3%min Forebay volume 246.408

Provided 1' deep rectangle for square footage 246.408

Notes:

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

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: EXCEL ENGINEERING — Date: 10/31/2016
Designed by: Eric Harrington — Case No:
Company Project Number/Name: 14047- Rockport Development

BMP Identification

BMP NAME / ID: BMP-H

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}= 0.58 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 Imperious 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)*
DMA-8	*158,409.72*	*Mixed Surface Types*	*0.82*	*0.62*	*98733.9*			
	158,410	***Total***			**98,734**	**0.58**	***4,772***	***182,354***

3%min **Forebay volume** **143.163**

Provided 1' deep rectangle for square footage 143.163

Notes:

Appendix 7: Hydromodification

Supporting Detail Relating to Hydrologic Conditions of Concern

HCOC EXEMPT OPTION #3
THIS SECTION NOT APPLICAPLE

Appendix 8: Source Control

Pollutant Sources/Source Control Checklist

SOURCE CONTROL

POTENTIAL SOURCES OF RUNOFF POLLUTANS	PERMANENT CONTROLS	OPERATIONAL BMPs	LOCATION
STORM DRAIN INLETS 1	MARK ALL INLETS WITH THE WORDS "ONLY RAIN DOWN THE STORM DRAIN" SEE APPENDIX 8 IN WQMP REPORT FOR LABEL DETAILS.	• MAINTAIN AND PERIODICALLY REPAINT OR REPLACE INLET MARKINGS. • PROVIDE STORMWATER POLLUTION PREVENTION INFORMATION TO NEW SITE OWNERS, LESSEES, OR OPERATOR. • SEE APPLICABLE OPERATIONAL BMPs IN FACT SHEET SC-44, "DRAINAGE SYSTEM MAINTENANCE" IN THE CASQA STORM WATER QUALITY HANDBOOKS AT: WWW.CABMPHANDBOOKS.COM. • INCLUDE THE FOLLOWING IN LEASE AGREEMENTS: "TENANTS SHALL NOT ALLOW ANYONE TO DISCHARGE ANYTHING TO STORM DRAINS OR TO STORE OR DEPOSIT MATERIALS SO AS TO CREATE A POTENTIAL DISCHARGE TO STORM DRAINS."	AT ALL INLETS
PUBLIC PLAZAS, SIDEWALKS, AND PARKING LOTS 2	• SIGN WITH THE WORDS "NO LITTERING". • "TRASH BINS" SIGNS NEARBY TRASH BINS. • COVERED TRASH BINS WITH PLASTIC BAG INSIDE LOCATED STRATEGICALLY. • STREET SWEEPING.	• PLAZA, SIDEWALKS, AND PARKING LOTS SHALL BE SWEPT REGULARLY TO PREVENT THE ACCUMULATION OF LITTER AND DEBRIS. DEBRIS FROM PRESSURE WASHING SHALL BE COLLECTED TO PREVENT ENTRY INTO THE STORM DRAIN SYSTEM. WASH WATER CONTAINING ANY CLEANING AGENT OR DEGREASER SHALL NOT BE DISCHARGED TO A STORM DRAIN.	ON-SITE
LANDSCAPE/ OUTDOOR PESTICIDE USE 3	• EXISTING NATIVE TREES, SHRUBS, AND GROUND COVER ARE PRESERVED TO THE MAXIMUM EXTENT POSSIBLE. • LANDSCAPING IS DESIGNED TO MINIMIZE IRRIGATION AND RUNOFF, AND TO MINIMIZE THE USE OF FERTILIZERS AND PESTICIDES THAT CAN CONTRIBUTE TO STORM WATER POLLUTION. • FOR THE LANDSCAPING IN THE BIO-RETENTION AREAS USE CALIFORNIAN DROUGHT TOLERANT NATIVE GRASSES SUCH AS: HUMMING BIRD SAGE, COMMON YARROW, POLYPODY FERN AND/OR FUSCHIA.	• LANDSCAPING WILL BE USING THE MINIMUM OR NO PESTICIDES • PLEASE REFER TO CASQA BMP FACT SHEET SC-41, "BUILDING AND GROUND MAINTENANCE" AT www..cabmphandbooks.com • PROVIDE INFORMATION BROCHURES TO NEW OWNERS, LESSEES AND OPERATORS.	ON-SITE AND THE BIO-RETENTION AREA

Appendix 9: O&M

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

Operation/ Maintenance

The purpose of the Operation and Maintenance section is to give responsibility regarding maintenance, replacement and funds for such BMPS. As stated in section I this section will be the area for designating the following. Currently this project is in the preliminary stages and should be expanded upon in final engineering; as the operation and maintenance section as is the entire WQMP a “Living Document”.

1. A means to finance and implement facility maintenance in perpetuity/ including replacement cost.

   Financial responsibility shall fall upon a Future HOA for Private BMPS and the City of Menifee through the Community Facilities Department for the Public BMPs.

   The following table breaks down the individual BMPS.

BMP NAME	TYPE	PUBLIC/PRIVATE	RESPONSIBLE PARTY	Funded By
BMP-A	BIORETENTION	PUBLIC	CITY OF MENIFEE	Community Facilities District
BMP-B	BIORETENTION	PUBLIC	CITY OF MENIFEE	Community Facilities District
BMP-C	BIORETENTION	PUBLIC	CITY OF MENIFEE	Community Facilities District
BMP-D	BIORETENTION	PUBLIC	CITY OF MENIFEE	Community Facilities District
BMP-E	BIORETENTION	PUBLIC	CITY OF MENIFEE	Community Facilities District
BMP-F	BIORETENTION	PUBLIC	CITY OF MENIFEE	Community Facilities District
BMP-G	BIORETENTION	PUBLIC	CITY OF MENIFEE	Community Facilities District
BMP-H	BIORETENTION	PRIVATE	FUTURE HOA	Future HOA

   These BMPS can be located on the DMA Map or by their longitude and latitude locations. A preliminary cost sheet is also included to be used at the preliminary stages.

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.

   Acceptance of responsibility for maintenance shall be drawn up during final engineering prior to construction of the BMPS to accommodate any final adjustments in final engineering.

3. An outline of general maintenance requirements for the Stormwater BMPs you have selected.

   A generalized table has been provided and shall be expanded upon in final engineering to incorporate specific maintenance activities for each BMP.

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.

   Appendix 6: BMP Design Details specifies the different areas draining to each BMP

Table H.1 Construction Plan Cross-reference

BMP No. or ID	BMP Identifier and Description	Corresponding Plan Sheet(s)	BMP Location (Lat/Long)
BMP - A	*BMP A (BIORETENTION)*	TBD	33°41'5.90"/ -117°08'25.02"
BMP - B	*BMP B (BIORETENTION)*	TBD	33°41'5.90"/ -117°08'15.45"
BMP - C	*BMP C (BIOTREATMENT)*	TBD	33°40'40.38"/ -117°08'24.80"
BMP - D	*BMP D (BIOTREATMENT)*	TBD	33°40'40.29"/ -117°08'15.55"
BMP - E	*BMP E (BIORETENTION)*	TBD	33°40'44.8413"/ -117°08'24.9953"
BMP - F	*BMP F (BIORETENTION)*	TBD	33°40'51.0307"/ -117°08'23.3922"
BMP - G	*BMP G (BIORENTION)*	TBD	33°40'50.6276"/ -117°08'23.4294"
BMP - H	*BMP H (BIOTREATMENT)*	TBD	33°40'45.73"/ -117°08'20.18"

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.

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.

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

DMA Name or ID	Area (Sq. Ft.)	Stabilization Type	Irrigation Type (if any)
DMA - 1	*75,664*		
DMA - 12	*16,864*		

ROCKPORT DEVELOPMENT
Inspection and Maintenance Checklist
Private BMP's

Today's Date: _______________
Signature of Person Performing Inspection: ______________
Print Name of Person: ________________

BMP ID:_____________________________
BMP type: BioRetention - Wet Pond

Frequency: ____________

Comments:

Observed Items:

BMP Name	Frequency	Comments	Observed
Educate Occoupants	Every September		
Irrigation System	Every other Month		
Landscape Maintenance	Monthly		
Litter Control	As needed		
Parking Lot Sweeping	As needed		
Dumpster	Weekly		
Catch basin Insert	Every 2 months until end of rainy season		
Roof drain			
CB stenciling			

List actions taken and comments below:

ROCKPORT DEVELOPMENT
Inspection and Maintenance Checklist
Public BMP's

Today's Date: _______________
Signature of Person Performing Inspection: ______________
Print Name of Person: ________________

BMP ID:______________________________
BMP type: Bioretention
Frequency: ____________

Comments:

Observed Items:

BMP Name	Frequency	Comments	Observed
Educate Occoupants	Every September		
Irrigation System	Every other Month		
Landscape Maintenance	Monthly		
Litter Control	As needed		
Parking Lot Sweeping	As needed		
Dumpster	Weekly		
Catch basin Insert	Every 2 months until end of rainy season		
Roof drain			
CB stenciling			

List actions taken and comments below:

PREVENTATIVE MAINTENANCE AND ROUTINE INSPECTION					
TYPE BMP	Routine Action	Maintenance Indicator	Maintenance Frequency	MAINTENANCE ACTIVITY	SITE-SPECIFIC REQUIREMENTS
Landscaping & irrigation	Proper irrigation & Fertilizer.	Less than 80% coverage	30 days prior to October 1st each year and Monthly	Re-seed or Re- plant. Repair Irrigation system with-in 5-days.	All slopes and landscaped areas are to have a minimum coverage of 80%
Trash storage areas	Trash free and removal of silt	Visual Inspection	Daily inspection	Remove trash and silt Daily.	All trash storage areas to be free from trash and silt at all times
Roof drain	Trash free and removal of silt, sedimentation & Debris	Silt build up of more than 1" no trash	30 days prior to October 1st each year and weekly during rain season.	Remove all trash and silt and repair any damage to roof drains,	All Roof to be free from trash and silt and in good repair
Bioretention	Trash free and removal of silt. Clear Clogged outlets and Standing Water.	Silt build up of more than 2" no trash, Exposed soils, dead vegetation, ponded water, and excessive vegetation (see TC-32)	30 days prior to October 1st each year, monthly during rainy season, and after Storm Event	Remove trash and silt – repair and reseed exposed areas, maintain grass height so as not be shorter than 2" or higher than 5" remove all ponded water weekly inspections, (See TC-32)	All bio-filters to be free from trash and silt at all times, grass area to be free from exposed soil and maintained to proper height, ponding of water for more than 72 hours maintenance will be required
Storm Water Conveyance system Stenciling & Signing	Must be legible at all times and have a clear view.	Fading of paint or illegible letters or	Semi-annually, 30 days prior to October 1st each year & monthly during rainy season	Repaint stenciling and/or replace signs 30 days prior to October 1st.	Applicable to all stenciling and signs
Outlet Structures	Must be kept functional at all times. Clear Clogged outlets and Standing Water.	Silt, debris, trash accumulation, Ponding Water	30 days prior to October 1st each year and weekly during rainy season or within 24 hours prior to rain forecasts.	Silt, debris, trash accumulation and repair any structural damage to the outlet structures.	All outlet structures shall be kept functional at all times.

BMP: Bioretention Area
MAINTENANCE ACTIVITIES

ROUTINE ACTION	MAINTENANCE INDICATOR	FIELD MEASUREMENT	MEASUREMENT FREQUENCY	MAINTENANCE ACTIVITY	Frequency (# of times per year)	Hours per Event	# of Units Requiring Maintenence	Total Hours of Action	Average Labor Crew Size	Total Hours For Year	Avg. (Pro-Rated) Labor Rate/Hr. ($)	Equipment	Equipment Cost/Hour ($)	Materials & Incidentals Cost or Disposal Cost/Event ($)	Total cost per visit ($)	Total cost per year ($)
Vegetation Management for Aesthetics (optional)	Average vegetation height greater than 12-inches, emergence of trees or woody vegetation,	Visual observation and random measurements through out the side slope area	Annually, prior to start of wet season	Cut vegetation to an average height of 6-inches and remove trimmings. Remove any trees, or woody vegetation.	1.0	0.375	7.0	2.6	1	3	$74.97/hr	Utility Truck	$ 14.39	$ 50.00	$ 285	$ 285
Soil Repair	Evidence of erosion	Visual observation	Annually, prior to start of wet season	Reseed/revegetate barren spots prior to wet season.	0.3	1.000	7.0	7.0	1	2	$74.97/hr	Utility Truck	$ 14.39	$ 150.00	$ 306	$ 77
Standing Water	Standing water for more than 96 hrs	Visual observation	Annually, 96 hours after a target storm (0.60 in) event	Drain facility. Corrective action prior to wet season. Consult engineers if immediate solution is not evident.	1.0	0.125	7.0	0.9	1	1	$74.97/hr	Utility Truck	$ 14.39		$ 78	$ 78
Trash and Debris	Trash and Debris present	Visual observation	Annually, prior to start of wet season	Remove and dispose of trash and debris	1.0	0.125	7.0	0.9	1	1	$74.97/hr	Utility Truck	$ 14.39		$ 78	$ 78
Sediment Management	Sediment depth exceeds 10% of the facility design	Measure depth at apparent maximum and minimum accumulation of sediment. Calculate average depth	Annually, prior to start of wet season	Remove and properly dispose of sediment. Regrade if necessary. (expected every 2 years)	1.0	0.250	7.0	1.8	2	4	$74.97/hr	Utility Truck, 10-15 yd Truck, Backhoe	$ 56.02	$ 400.00	$ 858	$ 858
Underdrains	Evidence of Clogging	Visual Observation	Annually, prior to start of wet season	Corrective action prior to wet season. Consult engineers if immediate solution is not evident.	1.0	0.250	7.0	1.8	1	2	$74.97/hr	Utility Truck	$ 14.39		$ 156	$ 156
General Maintenance Inspection	Inlet structures, outlet structures, side slopes or other features damaged, significant erosion, burrows, emergence of trees or woody vegetation, graffiti or vandalism, fence damage, etc.	Visual observation	Annually, prior to start of wet season	Corrective action prior to wet season. Consult engineers if immediate solution is not evident.	1.0	0.250	7.0	1.8	2	4	$74.97/hr	Utility Truck	$ 14.39		$ 313	$ 313
Reporting					1.0	3.0	1.0	3.0	1	3	$74.97/hr				$ 225	$ 225

Average Annual Total Hours	17.88
Average Annual Total Cost	$ 2,070.06
Average Two Year Cost	$ 4,140.12

Labor Rate	$74.97/hr

Equipment	Equipment Cost
Utility Truck	$14.39/hr
10-15 yd truck	$28.27/hr
Backhoe	$13.36/hr
Vactor	$62.70/hr
Sweeper	$123.26/hr

BMP: Wet Pond / Basin (Permanent Pool) MAINTENANCE ACTIVITIES													
ROUTINE ACTION	MAINTENANCE INDICATOR	FIELD MEASUREMENT	MEASUREMENT FREQUENCY	MAINTENANCE ACTIVITY	Frequency (# of times per year)	Hours per Event	Average Labor Crew Size	Avg. (Pro-Rated) Labor Rate/Hr. ($)	Equipment	Equipment Cost/Hour ($)	Materials & Incidentals Cost or Disposal Cost/Event ($)	Total cost per visit ($)	Total cost per year ($)
Vegetation Management	Vegetation coverage / density impeding flow	Visual, visible vegetation growth or emergent vegetation growth	Annually, prior to start of wet season	1. Have a biologist survey the wet pond to determine if any birds are nesting or other sensitive animals are present. If birds are nesting, with advice from the biologist, proceed with the maintenance. 2.Lower and maintain the water level to expose the area to be maintained, do not completely drain basin. 3. Mechanically remove all plants vegetation. 4. Dispose of the vegetation material in a landfill or other appropriate disposal area. 5. Restock mosquito fish as recommended by vector control agency.	1.0	24.0	4.0	75.0	Utility Truck, 10-15 yd Truck	42.7	200.0	$ 8,421	$ 8,421
24-hour draw down measured between the rim of the outlet structure and invert of the WQ orifice in the outlet structure.	Drawdown greater than 24 hours or water is flowing over weir.	Evaluate drain time from inlet and outlet flow data loggers or observe 24 hours after design storm (0.60 in) Observation of water flowing over spillway.	Once during wet season and after completion or modification of the facility,	If greater than 24 hours then discharge water to permanent pool elevation, clear outlet of debris. Notify engineer if needed.	1.0	2.0	2.0	75.0	Utility Truck	14.4		$ 329	$ 329
Trash and Debris	Trash and Debris present	Visual observation	Annually, prior to start of wet season	Remove and dispose of trash and debris	1.0	2.0	2.0	75.0	Utility Truck	14.4		$ 329	$ 329
Sediment Management	Sediment depth exceeds 10% of the facility design	Measure depth of sediment.	Annually, prior to start of wet season	Remove and properly dispose of sediment. Prior to start of wet season, restore vegetation to the plan shown on the as-built drawings. (expected every 5 years)	0.2	8.0	3.0	75.0	Utility Truck, 10-15 yd Truck, Backhoe	56.0	600.0	$ 2,847	$ 569
General Maintenance Inspection	Inlet structures, outlet structures, side slopes or other features damaged, significant erosion, burrows, emergence of trees or woody vegetation, graffiti or vandalism, fence damage, etc.	Visual observation	Annually, prior to start of wet season	Corrective action prior to wet season. Consult engineers if immediate solution is not evident.	1.0	1.0	2.0	75.0	Utility Truck	14.4		$ 164	$ 164
Reporting					1.0	3.0	1.0	75.0				$ 225	$ 225
				Average Annual Total		113.8							$ 10,037

Small Wet Pond (1500 sf)		113.8	$ 10,037
Medium Wet Pond (3750 sf)		214.6	$ 17,081
Large Wet Pond (7500 sf)		517.0	$ 39,752

Labor Rate	$74.97/hr

Equipment	Equipment Cost
Utility Truck	$14.39/hr
10-15 yd truck	$28.27/hr
Backhoe	$13.36/hr
Vactor	$62.70/hr
Sweeper	$123.26/hr

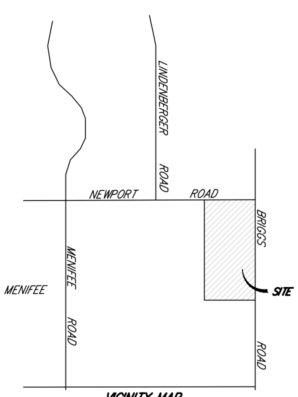
TENTATIVE DMA MAP
ROCKPORT RANCH

EXCEL ENGINEERING
LAND PLANNING • ENGINEERING • SURVEYING
440 STATE PLACE, ESCONDIDO, CA 92029
PH (760)745-8118 FX (760)745-1890

W.O. | DATE: | FOR: | DEVELOPER: | RECOMMENDED FOR APPROVAL | DATE: | CHECKED BY: | DATE:

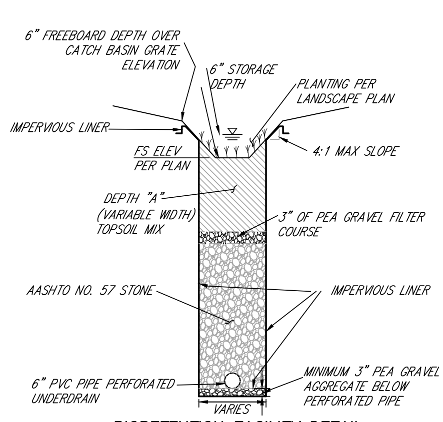
SOURCE CONTROL

POTENTIAL SOURCES OF RUNOFF POLLUTANS	PERMANENT CONTROLS
STORM DRAIN INLETS (1)	MARK ALL INLETS WITH THE WORDS "ONLY RAIN DOWN THE STORM DRAIN" SEE APPENDIX 8 IN WQMP REPORT FOR LABEL DETAILS.
PUBLIC PLAZAS, SIDEWALKS, AND PARKING LOTS (2)	• SIGN WITH THE WORDS "NO LITTERING". • "TRASH BINS" SIGNS NEARBY TRASH BINS. • COVERED TRASH BINS WITH PLASTIC BAG INSIDE LOCATED STRATEGICALLY. • STREET SWEEPING.
LANDSCAPE/ OUTDOOR PESTICIDE USE (3)	• EXISTING NATIVE TREES, SHRUBS, AND GROUND COVER ARE PRESERVED TO THE MAXIMUM EXTENT POSSIBLE. • LANDSCAPING IS DESIGNED TO MINIMIZE IRRIGATION AND RUNOFF, AND TO MINIMIZE THE USE OF FERTILIZERS AND PESTICIDES THAT CAN CONTRIBUTE TO STORM WATER POLLUTION. • FOR THE LANDSCAPING IN THE BIO-RETENTION AREAS USE CALIFORNIAN DROUGHT TOLERANT NATIVE GRASSES SUCH AS: HUMMING BIRD SAGE, COMMON YARROW, POLYPODY FERN AND/OR FUSCHIA.



VICINITY MAP
NOT TO SCALE
THOMAS GUIDE PG. 868 C-3

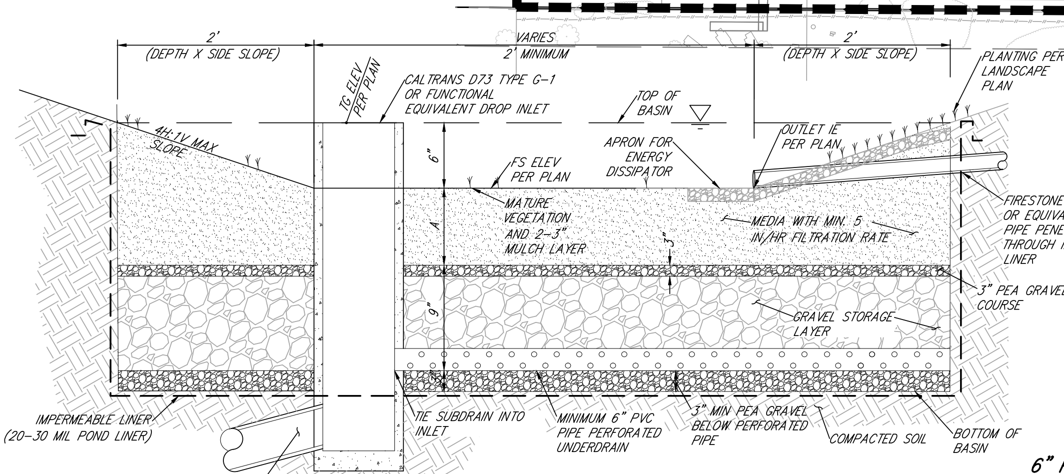
BIORETENTION
WET POND
CONCRETE
A/C SURFACE
DMA BOUNDARY



BIORETENTION FACILITY DETAIL
TYPICAL SECTION
NOT TO SCALE

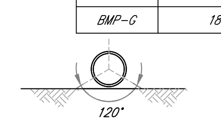
NOTE: ENGINEERED SOIL MEDIA REQUIREMENTS
85% MINERAL COMPONENT, 15% ORGANIC COMPONENT.
MINERAL COMPONENT SHALL BE CLASS A SANDY LOAM TOPSOIL THAT CONTAINS 70-80% SAND, 15-20% SILT, 5-10% CLAY. THE ORGANIC COMPONENT SHALL BE NITROGEN STABILIZED COMPOST, SUCH THAT THE NITROGEN DOES NOT LEACH FROM THE MEDIA

PEA GRAVEL REQUIREMENTS ASTM C-C33 3/8" CRUSHED AGGREGATE (OR EQUIVALENT)



BIORETENTION FACILITY DETAIL
NOT TO SCALE

BIORETENTION FACILITY SOIL MEDIA DEPTH	
BMP ID	DIMENSION "A" MEDIA (INCH)
BMP-A	36
BMP-B	21
BMP-C	24
BMP-D	18
BMP-E	18
BMP-F	18
BMP-G	18



6" PVC PIPE PERFORATION UNDERDRAIN LAYOUT DETAIL
NOT TO SCALE

BMP NAME	TYPE	PUBLIC/PRIVATE	RESPONSIBLE PARTY	FUNDED BY
BMP-A	BIORETENTION	PUBLIC	CITY OF MENIFEE	COMMUNITY FACILITIES DISTRICT
BMP-B	BIORETENTION	PUBLIC	CITY OF MENIFEE	COMMUNITY FACILITIES DISTRICT
BMP-C	BIORETENTION	PUBLIC	CITY OF MENIFEE	COMMUNITY FACILITIES DISTRICT
BMP-D	BIORETENTION	PUBLIC	CITY OF MENIFEE	COMMUNITY FACILITIES DISTRICT
BMP-E	BIORETENTION	PUBLIC	CITY OF MENIFEE	COMMUNITY FACILITIES DISTRICT
BMP-F	BIORETENTION	PUBLIC	CITY OF MENIFEE	COMMUNITY FACILITIES DISTRICT
BMP-G	BIORETENTION	PUBLIC	CITY OF MENIFEE	COMMUNITY FACILITIES DISTRICT
BMP-H	BIORETENTION	PRIVATE	FUTURE HOA	FUTURE HOA

SCALE: 1"=100'
0 100 200 300 400

Comprehensive Nutrient Reduction Plan for Lake Elsinore and Canyon Lake

January 28, 2013

Riverside County Flood Control & Water Conservation District on behalf of:

County of Riverside and the Cities of Beaumont, Canyon Lake, Hemet, Lake Elsinore, Menifee, Moreno Valley, Murrieta, Perris, Riverside, San Jacinto, and Wildomar

CDM Smith

Table of Contents

List of Attachments

Tables

Figures

List of Acronyms

Al	Aluminum
BMPs	Best Management Practices
CAFO	Concentrated Animal Feeding Operations
CAP	Compliance Assistance Program
CEQA	California Environmental Quality Act
cfs	cubic feet per second
CL	Canyon Lake
CNRP	Comprehensive Nutrient Reduction Plan
CWA	Clean Water Act
CWP	Center for Watershed Protection
DAMP	Drainage Area Management Plan
EPA	Environmental Protection Agency
LE	Lake Elsinore
LID	Low Impact Development
mL	Milliliters
MS4	Municipal Separate Storm Sewer System
NPDES	National Pollutant Discharge Elimination System
PTP	Pollutant Trading Plan
RCFC&WCD	Riverside County Flood Control and Water Conservation District
ROWD	Report of Waste Discharge
RWQCB	Regional Water Quality Control Board
SAWPA	Santa Ana Watershed Protection Authority
SCAG	Southern California Association of Governments
SJR	San Jacinto River
TMDL	Total Maximum Daily Load
USGS	United States Geological Study
WQMP	Water Quality Management Plan
WQO	Water Quality Objective

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Section 1
Background and Purpose

The Santa Ana Regional Water Quality Control Board ("Regional Board") adopted a Municipal Separate Storm Sewer System (MS4) permit for Riverside County on January 29, 2010 that requires the development of a Comprehensive Nutrient Reduction Plan (CNRP). The CNRP is a long term plan designed to achieve compliance with wasteload allocations (WLAs)[1] established in the Lake Elsinore and Canyon Lake Nutrient Total Maximum Daily Loads ("Nutrient TMDLs"). This document fulfills this MS4 permit requirement. The following sections provide the regulatory background, purpose, and framework of the CNRP.

1.1 Regulatory Background

The 1972 Federal Water Pollution Control Act and its amendments comprise what is commonly known as the Clean Water Act (CWA). The CWA provides the basis for the protection of all inland surface waters, estuaries, and coastal waters. The federal Environmental Protection Agency (EPA) is responsible for ensuring the implementation of the CWA and its governing regulations (primarily Title 40 of the Code of Federal Regulations) at the state level.

California's Porter-Cologne Water Quality Control Act of 1970 and its implementing regulations establish the Santa Ana Regional Board as the agency responsible for implementing CWA requirements in the Santa Ana River Watershed. These requirements include adoption of a Water Quality Control Plan ("Basin Plan") to protect inland freshwaters and estuaries. The Basin Plan identifies the beneficial uses for waterbodies in the Santa Ana River watershed, establishes the water quality objectives required to protect those uses, and provides an implementation plan to protect water quality in the region (RWQCB 1995, as amended).

The CWA requires the Regional Board to routinely monitor and assess water quality in the Santa Ana River watershed. If this assessment indicates that beneficial uses are not met in a particular waterbody, then the waterbody is found to be impaired and placed on the state's impaired waters list (or 303(d) list2). This list is subject to EPA approval; the most recent EPA-approved 303(d) list for California is the 2010 list3.

Waterbodies on the 303(d) list require development of a Total Maximum Daily Load (TMDL). A TMDL establishes the maximum amount of a pollutant that a waterbody can receive (from both point and nonpoint sources) and still meet water quality objectives.

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[1] As set forth in Tables 9 and 10 in the MS4 permit (Order No. R8-2010-0033), the CNRP is addressing both urban WLAs and loads from septic systems.
[2] 303(d) is a reference to the CWA section that requires the development of an impaired waters list.
[3] On November 12, 2010, EPA approved California's 2008-2010 Section 303(d) list of impaired waters and disapproved the omission of several water bodies and associated pollutants that meet federal listing requirements. EPA identified additional water bodies and pollutants for inclusion on the State's 303(d) list. On October 11, 2011, EPA issued its final decision regarding the waters EPA added to the State's 303(d) list.

1.2 Lake Elsinore and Canyon Lake Nutrient TMDLs

Through its bi-annual water quality assessment process, the Regional Board determined that Lake Elsinore was not attaining its water quality standards due to excessive nitrogen and phosphorus. This finding led to the Regional Board placing Lake Elsinore on the 303(d) list in 1994 as a result of the impairment of the following uses: warm water aquatic habitat (WARM), and water contact and non-water contact recreation (REC1 and REC2).

Similarly, a Regional Board water quality assessment of Canyon Lake identified excessive nutrients causing impairment of the lake. Accordingly, Canyon Lake was listed on the 303(d) list in 1998. The following uses were identified as impaired by nutrients: municipal water supply (MUN), warm water aquatic habitat (WARM), and water contact and non-water contact recreation (REC1 and REC2).

Regional Board staff prepared the Lake Elsinore Nutrient TMDL Problem Statement and the Canyon Lake Nutrient TMDL Problem Statement in October 2000 and October 2001, respectively. These reports documented the impairment caused by excessive nutrients and provided preliminary recommendations for numeric targets to ensure beneficial uses of both lakes would be protected.

Following completion of the Lake Elsinore and Canyon Lake Problem Statements, a number of studies were conducted:

- UC Riverside conducted studies to quantify the internal nutrient loading from Lake Elsinore and Canyon Lake sediments, as well as the response of the lakes to these internal nutrient loadings.
- Regional Board staff and watershed stakeholders conducted in-lake monitoring to evaluate the current nutrient cycling processes and to determine the in-lake response to nutrient loads from the watershed and characterize spatial and temporal trends of nutrients, algal biomass, dissolved oxygen, and other water quality parameters.
- Regional Board staff and watershed stakeholders implemented a watershed-wide monitoring program that assessed nutrient loadings from various land uses in the watershed.
- Lake Elsinore San Jacinto Watershed Authority (LESJWA), a joint powers authority, implemented watershed modeling to simulate nutrient loads under different hydrologic conditions and assess the impact of various implementation plans on the water quality of each lake.
- LESJWA conducted a survey of lake users from April through September 2002 to link lake users' opinions of Lake Elsinore to water quality parameters monitored on the same day as surveys were conducted.

The Regional Board used the data developed from the above studies to develop the Nutrient TMDLs. This information was reported in the Regional Board's Staff Report, released for public review May 21, 2004. The purpose of the Staff Report was to provide the technical basis for the proposed TMDLs. Table 1-1 summarizes the nutrient numeric targets applicable to Lake Elsinore and Canyon Lake.

Public workshops were held on June 4, and September 17, 2004 to gather public comment on the proposed Nutrient TMDLs. Based on the comments received, the Regional Board prepared final Nutrient TMDLs that were adopted on December 20, 2004 (Order No. R8-2005-0037). The subsequent TMDL approval process included: State Water Resources Control Board (State Board) approval on May 19, 2005, Office of Administrative Law approval on July 26, 2005, and EPA approval on September 30, 2005.

Table 1-1. TMDL Compliance Requirements

Indicator	Lake Elsinore	Canyon Lake
Total Phosphorus Concentration (Final)	Annual average no greater than 0.1 mg/L to be attained no later than 2020	Annual average no greater than 0.1 mg/L to be attained no later than 2020
Total Nitrogen Concentration (Final)	Annual average no greater than 0.75 mg/L to be attained no later than 2020	Annual average no greater than 0.75 mg/L to be attained no later than 2020
Ammonia Nitrogen Concentration (Final)	Calculated concentrations to be attained no later than 2020 Acute: 1 hour average concentration of total ammonia nitrogen (mg/L) not to exceed, more than once every three years on the average, the Criterion Maximum Concentration (CMC) (acute criteria), where CMC = $0.411/(1+10^{7.204-pH}) + 58.4/(1+10^{pH-7.204})$ Chronic: 30-day average concentration of total ammonia nitrogen (mg/L) not to exceed, more than once every three years on the average, the Criterion Continuous Concentration (CCC) (chronic criteria), where CCC = $(0.0577/(1+10^{7.688-pH}) + 2.487/(1+10^{pH-7.688})) * \min(2.85, 1.45*10^{0.028(25-T)}$	Calculated concentrations to be attained no later than 2020 Acute: 1 hour average concentration of total ammonia nitrogen (mg/L) not to exceed, more than once every three years on the average, the Criterion Maximum Concentration (CMC) (acute criteria), where CMC = $0.411/(1+10^{7.204-pH}) + 58.4/(1+10^{pH-7.204})$ Chronic: 30-day average concentration of total ammonia nitrogen (mg/L) not to exceed, more than once every three years on the average, the Criterion Continuous Concentration (CCC) (chronic criteria), where CCC = $(0.0577/(1+10^{7.688-pH}) + 2.487/(1+10^{pH-7.688})) * \min(2.85, 1.45*10^{0.028(25-T)}$
Chlorophyll a concentration (Interim)	Summer average no greater than 40 µg/L; to be attained no later than 2015	Annual average no greater than 40 µg/L; to be attained no later than 2015
Chlorophyll a Concentration (Final)	Summer average no greater than 25 µg/L; to be attained no later than 2020	Annual average no greater than 25 µg/L; to be attained no later than 2020
Dissolved Oxygen Concentration (Interim)	Depth average no less than 5 mg/L; to be attained no later than 2015	Minimum of 5 mg/L above thermocline; to be attained no later than 2015
Dissolved Oxygen Concentration (Final)	No less than 5 mg/L 1 meter above lake bottom to be attained no later than 2015	Daily average in hypolimnion no less than 5 mg/L; to be attained no later than 2015

TMDL coordination efforts have been underway since August 2000, well before adoption of the Nutrient TMDLs. These activities were coordinated and administered through the LESJWA. Following TMDL adoption, the existing TMDL stakeholders formally organized into a funded TMDL Task Force ("Task Force") in 2006. This Task Force in coordination with LESJWA has been actively involved in the implementation of the TMDL requirements, which include 14 tasks. Attachment A summarizes the status of the implementation of these tasks, in particular those that are relevant to the MS4 Permittees in Riverside County subject to the Nutrient TMDLs.

1.3 Riverside County MS4 Permit

In large metropolitan areas with interconnected MS4s, MS4 permits are often issued to multiple Permittees that work cooperatively to implement the requirements. This is the case for the Riverside County area where the MS4 facilities within the Santa Ana Region of Riverside County are permitted under a single area-wide MS4 permit. The Riverside County Flood Control and Water Conservation District (RCFC&WCD) is the Principal Permittee and the County of Riverside and the Cities of Beaumont, Calimesa, Canyon Lake, Corona, Eastvale, Hemet, Jurupa Valley, Lake Elsinore, Menifee, Moreno Valley, Murrieta, Norco, Perris, Riverside, San Jacinto, and Wildomar are the Co-Permittees.

The first MS4 permit was issued by the Regional Board to the MS4 Permittees in 1990. The 1990 MS4 permit was followed by MS4 permits issued in 1996, 2002 and 2010. The 2002 MS4 permit included a general requirement to update MS4 program documents, as appropriate, to support TMDL implementation requirements. As a result, the Permittees amended their Drainage Area Management Plan (DAMP) and Water Quality Management Plan (WQMP) on July 29, 2006 to incorporate Chapter 13 – TMDL Implementation. This Chapter included specific initial actions taken to address the Lake Elsinore/Canyon Lake Nutrient TMDLs (See Sections 13.1 – 13.4)

The Regional Board adopted a new MS4 permit for the Santa Ana Region of Riverside County on January 29, 2010 (Order No. 2010-0033, NPDES No. CAS618033). This permit is the first to incorporate requirements directly addressing the WLAs for Lake Elsinore and Canyon Lake. Specifically, this permit explicitly requires implementation of tasks contained within the TMDLs and compliance with the WLAs. The permit also requires preparation of a CNRP; which describes the specific actions that have been taken or will be taken to achieve compliance with the TMDL's WLA by December 31, 2020.

1.4 Comprehensive Nutrient Reduction Plan

This section provides information on the requirements for CNRP development and the applicability of the plan to urban discharges in the watershed that drains to Canyon Lake and Lake Elsinore. In addition, information is provided on the general framework of this plan and the process associated with its development.

1.4.1 Purpose and Requirements

The need for the development of the CNRP is described in the findings section of the MS4 permit, e.g.:

- *Section II.F.23* – Interim compliance (compliance determination prior to the final WLA compliance dates) determination with the WLAs in the TMDLs will be based on the Lake Elsinore and Canyon Lake (LE/CL) Permittees progress towards implementing the various TMDL Implementation Plan tasks as per the resultant studies and plans approved by the Regional Board. The LE/CL Permittees [MS4 Permittees] are required to develop a CNRP designed to achieve compliance with the WLAs by the final compliance date for approval of the Regional Board. In the absence of an approved CNRP, the WLAs specified in the approved Canyon Lake/Lake Elsinore Nutrient TMDL will constitute the final numeric WQBELs [Water Quality Based Effluent Limits].

- *Section II.K.4.b.v* – The Regional Board recognizes that additional research is needed to determine the most appropriate control mechanism to attain water quality standards for nutrients in these two lakes. This Order provides the LE/CL Permittees the flexibility to meet the WLAs through a variety of techniques. Even though the WLAs for the Canyon Lake and Lake Elsinore Nutrient TMDLs are expressed as WQBELs, if water quality standards in the Lakes are met through biological or other in-Lake control mechanisms, the LE]/CL Permittees' obligation to meet the WLAs is satisfied as the impairment for which the TMDLs were developed would not exist anymore. The Permittees in the affected watersheds are required to develop a CNRP designed to achieve the WLAs by the compliance dates specified in the TMDL. In the absence of an approved CNRP, the WLAs become the final numeric WQBELs for nutrients.

Based on these findings, the Regional Board established specific requirements for the CNRP's content. These requirements, found in Section VI.D.2.d in the MS4 permit, are intended to achieve compliance with TMDL WLAs as per the TMDL Implementation Plans. The LE/CL Permittees shall submit a CNRP by December 31, 2011, describing, in detail, the specific actions that have been taken or will be taken to achieve compliance with the urban WLA by December 31, 2020. The CNRP must include the following:

- Evaluation of the effectiveness of BMPs [Best Management Practices] and other control actions implemented. This evaluation shall include the following:
  - The specific ordinance(s) adopted or proposed for adoption to reduce the concentration of nutrients in urban sources.
  - The specific BMPs implemented to reduce the concentration of urban nutrient sources and the water quality improvements expected to result from these BMPs.
  - The specific inspection criteria used to identify and manage the urban sources most likely causing exceedences of water quality objectives for nutrients.
  - The specific regional treatment facilities and the locations where such facilities will be built to reduce the concentration of nutrient discharged from urban sources and the expected water quality improvements to result when the facilities are complete.
- Proposed method for evaluating progress towards compliance with the nutrient WLA for Urban Runoff. The progress evaluation shall include:
  - The scientific and technical documentation used to conclude that the CNRP, once fully implemented, is expected to achieve compliance with the urban waste load allocation for nutrient by December 31, 2020.
  - A detailed schedule for implementing the CNRP. The schedule must identify discrete milestones decision points and alternative analyses necessary to assess satisfactory progress toward meeting the urban waste load allocations for nutrient by December 31, 2020. The schedule must also indicate which agency or agencies are responsible for meeting each milestone.
  - The specific metric(s) that will be established to demonstrate the effectiveness of the CNRP and acceptable progress toward meeting the urban waste load allocations for nutrient by December 31, 2020.
  - The DAMP, WQMP and LIPs [Local Implementation Plans] shall be revised consistent with the CNRP no more than 180 days after the CNRP is approved by the Regional Board.
  - Detailed description of any additional BMPs planned, and the time that is required to implement them. In the event that data from the watershed-wide water quality monitoring program indicate that water quality objectives for nutrients are still being exceeded after the CNRP is fully implemented.

1.4.2 Applicability

The applicability of this CNRP is limited to the MS4 Permittees in the following jurisdictions: County of Riverside and the Cities of Beaumont, Canyon Lake, Hemet, Menifee, Moreno Valley, Murrieta, Perris, Riverside, San Jacinto, Lake Elsinore and Wildomar[4].

1.4.3 Compliance with Urban Wasteload Allocation

The Riverside County MS4 Permittees have developed a CNRP that is designed to achieve compliance with the urban WLAs by the compliance date of December 31, 2020. Per MS4 permit Section VI.D.2.k, compliance with the urban WLAs can be measured using one of the two following methods:

- Directly, using relevant monitoring data and/or approved modeling procedures to estimate actual nitrogen and phosphorus loads being discharged to the lakes, or,

- Indirectly, using water quality monitoring data and other biological metrics approved by the Regional Board, to show water quality standards are being consistently attained (as measured by the response targets identified in the Nutrient TMDLs).

Compliance with the urban WLAs may also be accomplished through the trading of pollutant allocations among sources to the extent that such allocation tradeoffs optimize point and non-point source control strategies to achieve the compliance in an efficient manner.

1.4.4 CNRP Conceptual Framework

Based on the analysis contained herein, compliance with the urban WLAs will require implementation of nutrient mitigation activities in both the watershed and the lakes. Accordingly, the CNRP is built around a framework that includes both watershed-based BMPs and in-lake remediation activities. Coupled with this framework is a monitoring program to evaluate progress towards compliance with urban WLAs and an adaptive implementation program to provide opportunity to make adjustments to the CNRP, where deemed necessary to achieve the urban WLAs.

- *Watershed-based BMPs* – The CNRP identifies the specific ordinance(s) and BMPs that will be implemented by the MS4 Permittees in the watersheds that drain to Lake Elsinore or Canyon Lake. These activities focus on targeting and mitigating nutrients at their source, prior to discharge during wet weather events.

- *In-lake Remediation Projects* – A significant source of nutrients to Lake Elsinore and Canyon Lake are nutrient releases from in-lake sediments. Practical remediation projects for reducing or managing sediment releases of nutrients have been identified and incorporated into the CNRP. In some cases these projects are already ongoing; in others, new project activities will be initiated. The CNRP identifies the MS4 Permittee commitments to the implementation of these projects, in terms of the commitment to initiate the project through capital expenditures and the long-term commitment to the operation and maintenance of the project.

- *Monitoring Program* – The original monitoring program (Lake Elsinore, Canyon Lake and San Jacinto watershed) established in 2006 was modified in 2010 to allow resources dedicated to

[4] An agreement with the San Diego Regional Water Quality Control Board ("San Diego Regional Board") allows the cities of Wildomar and Murrieta to be wholly regulated by the Santa Margarita Region MS4 permit issued by the San Diego Regional Board; however, these cities continue to be subject to the TMDL requirements of the Santa Ana Region MS4 permit (RWQCB, San Diego Region, 2010).

monitoring activities to be used to support implementation of in-lake remediation projects. Further reductions in monitoring were discussed with Regional Board staff and documented in correspondence from Regional Board staff to the TMDL Task Force dated September 2, 2011. Under the CNRP, monitoring will continue to be implemented at a reduced level through FY 2014-2015 to facilitate dedicating resources to necessary in-lake projects. In FY 2015-2016, monitoring will be increased to provide sufficient data to evaluate progress towards achieving the urban and septic WLAs and LAs or lake water quality response targets. Section 2.2.3 describes the monitoring program that will be implemented as part of the CNRP.

- *Special Studies* – The CNRP describes several special studies that may be undertaken by the MS4 Permittees to support changes to the CNRP and/or the TMDL. Execution of these studies is optional and at the discretion of the MS4 Permittees. If the Permittees decide to implement any of these studies, efforts will be coordinated with the Regional Board and Task Force.
- *Adaptive Implementation* – Implementation of the CNRP will be an iterative process that involves implementation of watershed BMPs and in-lake remediation projects followed by monitoring to assess compliance with urban and septic WLAs and LAs or lake water quality response targets. As additional data become available, the CNRP may need to be revised as part of an adaptive implementation process.

1.4.5 CNRP Development Process

The CNRP was developed by the MS4 Permittees subject to the TMDL requirements. In parallel with and prior to CNRP development, the Permittees have actively participated in TMDL related implementation activities (e.g., see Attachment A). Coordination activities since January 2010 have included:

Management Steering Committee Meetings

- May 20, 2010
- August 19, 2010
- October 21, 2010
- May 19, 2011

LE/CL TMDL Task Force Meetings

- January 25, 2010
- February 22, 2010
- April 12, 2010
- June 28, 2010
- August 23, 2010
- February 22, 2011
- April 19, 2011
- May 31, 2011
- July 12, 2011
- January 23, 2012
- February 14, 2012
- March 27, 2012
- April 23, 2012
- May 21, 2012
- June 18, 2012
- August 21, 2012
- September 19, 2012
- January 23, 2013

LE/CL TMDL Task Force Technical Advisory Committee Meetings

- August 4, 2010
- September 27, 2010
- October 25, 2010
- November 18,2010

- December 15, 2010
- March 22, 2011
- April 6, 2011
- May 18, 2011
- June 14, 2011
- August 15, 2011
- September 13, 2011
- October 19, 2011
- November 15, 2011
- December 12, 2012

Other TMDL-related Meetings

- October 5, 2011 – LESJWA TMDL Workshop
- November 17, 2011 – Western Riverside Council of Governments Technical Advisory Committee Meeting - Presentation to Riverside County City Managers
- December 7, 2011 – Presentation to Canyon Lake City Council

1.4.6 CNRP Roadmap

The CNRP is presented in two parts: (1) primary sections that provide an executive level summary of the components, schedule, strategy, and technical basis for the CNRP; and (2) supporting attachments that provide additional information to support the primary sections. Following is a summary of the purpose and content of each part of the CNRP:

- ***Section 2*** – Describes the CNRP program elements, the CNRP implementation schedule and the incorporation of an adaptive implementation strategy into the plan.
- ***Section 3*** – Provides the technical basis for the conclusion that full implementation of the CNRP will achieve compliance with the urban and septic WLAs and LAs or lake water quality response targets applicable to each lake.

The above sections are supported by the following attachments:

- ***Attachment A, TMDL Implementation*** – Documents TMDL implementation activities completed to date by the Task Force and MS4 Permittees.
- ***Attachment B, Watershed Characterization*** – Provides background information regarding the general characteristics of the watersheds draining to Canyon Lake and Lake Elsinore and existing water quality in each lake.
- ***Attachment C, Canyon Lake Nutrient TMDL In-Lake Strategies Evaluation*** – Provides additional information to support the selection and prioritization of in-lake remediation projects for Canyon Lake.
- ***Attachment D, Existing Nutrient Source Control Programs*** - Documents existing MS4 permit activities that have been implemented by the MS4 permit program that reduce the runoff of nutrients to Canyon Lake and Lake Elsinore.
- ***Attachment E, Implementation Schedule*** – Provides additional information regarding the implementation schedule summarized in Section 2.3.
- ***Attachment F, References***

Section 2
CNRP Implementation Program

2.1 Introduction

The MS4 Permittees have been actively participating in the implementation of the Nutrient TMDLs through the activities of the Task Force since 2006. Substantial effort, e.g., data collection, in-lake and watershed modeling, program development and BMP implementation, have been completed to date. This compilation of work provides the foundation for this CNRP, which establishes the additional actions that will be carried out by MS4 Permittees to achieve compliance with the urban and septic WLAs and LAs or lake water quality response targets.

The MS4 Permittees will achieve compliance with the urban and septic WLAs and LAs or lake water quality response targets applicable to the Lake Elsinore and Canyon Lake through a combination of watershed-based BMPs and in-lake remediation projects. For the most part, the watershed-based BMPs implemented under the CNRP will be an extension or continuation of ongoing BMP implementation carried out by the MS4 program and individual Permittee jurisdictions. For example, an extension may be the revision of ordinances to provide tighter controls on nutrient sources in the watershed or the implementation of newly required low impact development (LID)-based BMPs in all new development or significant redevelopment projects. A continuation of a BMP would include existing public education and outreach (PEO) activities that already target nutrient sources.

While some watershed-based BMP implementation activities are expected to be generally uniform across the area, e.g., through implementation of area-wide MS4 programs, others may vary by jurisdiction, i.e., implementation is dependent on each Permittee's current local program, available resources and opportunities, and local sub-watershed needs. Each Permittee's LIP will describe in more detail the specific actions that will be taken by the Permittees to address CNRP implementation requirements.

In addition to the watershed-based BMPs implemented through the area-wide MS4 program or by local Permittee jurisdictions, the CNRP identifies specific in-lake remediation projects and monitoring activities planned for implementation under the CNRP. These CNRP elements will be implemented collectively by all MS4 Permittees subject to the requirements of the TMDLs.

This CNRP supersedes all other plans for the CL/LE Nutrient TMDL, including previous version of the CNRP and monitoring plans. The following sections describe the key elements contained in this CNRP and provide an implementation schedule to achieve compliance by December 31, 2020. Where necessary, CNRP attachments provide supplemental information.

2.2 CNRP Program Elements

CNRP implementation consists of the following key implementation activities:

- Watershed-based BMPs to reduce nutrient loading in urban runoff, primarily wet weather flows.
- In-lake remediation projects to mitigate nutrient impacts from in-lake sediments or external loads in suspension. Separate remediation projects are included for Lake Elsinore and Canyon Lake.
- Monitoring activities to assess compliance with TMDL.
- Optional special studies to develop data to support BMP implementation or provide the basis for revisions to the TMDL.

Each of these implementation activities is described in more detail below. In addition to these activities, the CNRP program includes an adaptive implementation element to provide opportunity to make changes to the CNRP or TMDL as more information is developed over time.

2.2.1 Watershed-based BMPs

The level of implementation of watershed-based BMPs will vary by MS4 Permittee. As will be discussed in Section 3, the estimated number of acres requiring implementation of watershed-based BMPs varies considerably from one Permittee to another. Given the range of watershed-based BMPs available for implementation and the specific exposure of individual Permittees to the TMDL (due to geographic location, portion of jurisdiction subject to TMDL, etc.), each Permittee will determine the degree to which it will incorporate a particular BMP into its TMDL compliance activities. For example, one Permittee may determine that increased emphasis on street sweeping/debris removal BMPs provides the needed nutrient source reduction that it needs to comply with its WLA. Another Permittee may find that other programs such as pet waste management or better management of fertilizer use provides the necessary load reductions.

Watershed-based BMPs include both non-structural programmatic BMPs and post-construction BMPs associated with the implementation of WQMP requirements for new development and significant redevelopment activities. The CNRP accounts for water quality improvements that have already occurred since TMDL adoption (January 1, 2005, see Attachment D) and anticipated improvements expected from implementation of specific non-structural program elements in the future (see Section 2.2). Watershed-based BMPs include the following activities:

- Ordinance Development and/or Implementation where necessary
- Street Sweeping/Debris Removal
- Low Impact Development and Land Use Conversion (WQMP Implementation)
- Septic System Management
- Public Education and Outreach
- Inspections and Enforcement

The CNRP quantifies the expected water quality benefits associated with implementation of street sweeping/debris removal, septic system management and WQMP implementation. The remaining BMPs, ordinance development, public education and outreach, and inspections and enforcement, provide water quality benefits, but these benefits were not quantified as part of the compliance analysis. Instead, implementation of these BMPs provides a planned additional margin of safety with regards to the compliance analyses completed as part of this CNRP.

Post-construction LID-based BMPs required for new development and significant re-development projects are the only structural watershed-based BMPs currently included in the CNRP. The newly developed WQMP requirements ensure that a portion of the wet weather runoff will be contained onsite for all future development projects subject to WQMP requirements[5]. Implementation of WQMP requirements over time coupled with the in-lake remediation projects (described below) are expected to provide sufficient mitigation of nutrients. However, if over time it is determined that additional watershed-based structural BMPs are necessary (as would be determined through the adaptive implementation process, as described in Section 2.4), then specific structural BMP projects could be identified. The Permittees are currently conducting retrofit studies of their MS4 systems that will help develop a list of additional structural watershed controls that can be considered in the future if needed.

If additional structural watershed-based BMPs are needed, then the project would be implemented according to the Capital Improvement Project (CIP) Process, as described in Figure 2-1. Because the completion of the CIP process, from project identification through construction, requires adequate funding, completion of the California Environmental Quality Act (CEQA) process, and obtaining all appropriate permits and approvals, the timeline associated with implementation of a watershed-based structural BMP may be lengthy.

The following sections provide additional information regarding each of the watershed-based BMPs incorporated into the CNRP.

2.2.1.1 Ordinances

The CNRP requires the identification of specific ordinances that when implemented will reduce nutrient loads from various urban sources in the watershed (MS4 permit *Section VI.D.2.d.i.(a)*) Implementation of this CNRP element will occur either through the adoption of a new ordinance or modification of an existing ordinance. Decisions regarding the use of ordinances to reduce nutrients will be made at the individual Permittee level. Some MS4 Permittees may choose to make no changes to their ordinances.

Three types of ordinances are included in the CNRP for evaluation by the individual MS4 Permittee jurisdictions: Pet waste, Fertilizer Application Management, and Yard Waste Management (leaf litter). The following sections provide additional information regarding potential use of each ordinance type as a tool to manage nutrients at the local level.

Pet Waste Ordinance

Purpose – Evaluate existing ordinances to determine need to improve management of animal wastes to reduce nutrients in urban runoff from entering MS4 storm drains.

[5] The MS4's revised WQMP guidance and template are currently under review by the Regional Board; however, Regional Board approval and full-scale implementation are expected to coincide with the implementation of this CNRP.

Figure 2-1 Typical MS4 Permittee's Capital Improvement Project (CIP) Process

Project Identification - Identification of a CIP project occurs through one of two mechanisms:

- Public agency assessment of a particular site's current conditions to evaluate the need for structural improvements. These needs may be identified from observations of agency staff, routine maintenance / replacement schedules, or other sources internal to the agency.
- Receipt of public complaints (presented directly to agency staff or a governing body) regarding an infrastructure concern (e.g., potholes, street flooding), which may result in a site investigation. Based on the outcome of the investigation, an agency may decide that a project needs to be constructed.

Budgeting / Planning - After a project need has been established, staff implement a process to have the proposed project included in the CIP. Agency staff begins preliminary planning steps to verify the viability of the project and prepares a cost estimate, which along with other new or ongoing infrastructure needs, is used to prioritize the project based on public need, necessity and available funds. This phase typically involves both project planning and preparation of a preliminary design to support development of the cost estimate. With a project budget prepared, staff seeks approval to incorporate the project in the CIP. In some cases preliminary planning efforts may determine that a proposed project is not viable due to environmental constraints, community opposition, engineering limitations or other factors. In such cases a project is typically abandoned and alternative solutions are considered.

Design - Once a project is in the CIP, design work to prepare construction drawings and project specifications can begin. Based on project complexity, the time required to complete the design varies from less than a year to several years. During the design phase, and sometimes beginning in the budgeting / planning phase, staff initiates the CEQA process. Depending on the nature of the project or the need for special permits, obtaining CEQA approval can significantly affect the timeline to construct a project. Projects may also be abandoned in the design phase as the project is further refined. Factors such as changes to the project's preliminary design parameters, soils, groundwater and utility investigations, and regulatory issues can impact the viability of a project during its refinement in the design stage.

Permitting– During this phase, all required permits and approvals for construction are obtained. The process for obtaining permits and approvals typically begins during the design phase and sometimes begins as early as the budgeting / planning phase. Depending on the nature of the project or the need for special permits, obtaining all required permits and approvals can significantly affect the timeline to construct a project and in some cases result in cancellation of the project. If this occurs, then alternative solutions are considered.

Construction– Construction can begin upon design completion, receipt of all required permits and approvals, completion of all administrative requirements and availability of funds. Depending on the complexity and size of the project, right of way acquisition timelines, CEQA documentation and approvals, and involvement of other agencies, e.g., utilities, the construction phase can take anywhere from a few months to several years.

Implementation Approach - Apart from the City of Canyon Lake's recently adopted pet waste disposal ordinance (Ordinance No. 138U), existing ordinances do not establish specific requirements to properly dispose of pet waste with accompanying penalties for failure to comply. As part of CNRP implementation, the Permittees will evaluate existing ordinances that address any type of animal waste and examine ways to enhance waste management requirements, compliance, and enforcement. For example, a control ordinance could specifically require owners/keepers of pets to properly dispose of pet waste that is deposited on any property, whether public or private. Proper disposal would be defined as placement of pet waste in waste receptacles or containers that are regularly emptied or to a sanitary sewage system for proper treatment. Penalties or fines could be also included.

The evaluation of the need for pet waste ordinance would be coordinated with the Riverside County MS4 permit requirement for MS4 Permittees to evaluate the need for modifications to existing ordinances or establishment of a new ordinance to manage pathogens or bacterial indicators:

- *Riverside County MS4 Permit Section VIII.C* – "Within three (3) years of adoption of this Order, the Co-Permittees shall promulgate and implement ordinances that would control known pathogen or Bacterial Indicator sources such as animal wastes, if necessary."

With a permit adoption date of January 29, 2010, this MS4 permit requirement must be addressed by January 29, 2013. While the emphasis of the permit language is on pathogens or bacterial indicators, adoption of an ordinance to manage animal wastes can also reduce a potentially important source of nutrients in the watershed.

Expected Benefits – Establishing requirements to manage animal wastes in a manner that reduces opportunity for nutrients contained in these wastes to be mobilized in urban runoff reduces nutrients potentially discharged to receiving waters through the MS4. Given variable levels of implementation by jurisdiction, the expected water quality benefits of this BMP have not been quantified; instead the benefits are included in the margin of safety.

Fertilizer Management Ordinance

Purpose – Evaluate existing ordinances regarding the appropriate use and management of fertilizers within the local jurisdiction.

Implementation Approach – Currently, existing ordinances do not regulate the content of manufactured fertilizers as applied within the jurisdictions. Under this element, the MS4 Permittees will evaluate and consider adoption of new ordinances to include lawn application control, specifically, the content of phosphorus in commercial fertilizers[6].

Expected Benefit – Establishment of fertilizer application ordinances reduces the source of phosphorus available to runoff from lawn or turf areas in the watershed. Given variable levels of implementation by jurisdiction, the expected water quality benefits of this BMP have not been quantified; instead the benefits are included in the margin of safety.

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[6] Examples of this type of fertilizer ordinance are codified in the Cities of Ann Arbor, Michigan (Ord. No. 1-06) and Plymouth, Minnesota (City Code 1170.05). In the City of Ann Arbor, the fertilizer ordinance regulates the use and application of manufactured fertilizer containing phosphorus. The ordinance also requires commercial applicators or institutional applicators (e.g., those applying fertilizer to parks, schools, etc.) to sign a sworn statement abiding by the ordinance and to submit fertilizer samples upon request. The ordinance does allow for exemptions in cases where soil testing shows phosphorus levels to be insufficient for turf growth or for applications on newly established or developed turf areas in the first growing season. For a three year period following the implementation of the Ann Arbor ordinance limiting application of lawn fertilizers containing phosphorus, Lehman at al. (2011) reported statistically significant reductions in total phosphorus (TP) to the Huron River. TP showed an average reduction from 11 to 23 percent at monitored study sites.

Yard Waste Management Ordinance

Purpose – Evaluate existing ordinances which regulate the depositing of yard waste debris into the MS4.

Implementation Approach - The Permittees have existing legal authority within each jurisdiction establishing stormwater ordinances to prohibit the depositing of yard waste into the MS4. Permittees will review these existing ordinances to evaluate ways to enhance public education or inspection/enforcement activities to provide additional reductions in nutrients from these sources. For example, approaches to better manage these potential nutrient sources include establishing yard waste/leaf blowing requirements for commercial yard businesses, sweeping and returning yard clippings to lawn areas, collecting and disposing yard wastes for green recycling, or recycling yard waste by composting.

Expected Benefit - Reducing the volume of yard waste blown into or washed into the MS4 decreases the nutrient load to downstream waters. Given variable levels of implementation by jurisdiction, the expected water quality benefits of this BMP have not been quantified; instead the benefits are included in the margin of safety.

2.2.1.2 Specific Watershed-based BMPs

The MS4 permit requires that the CNRP identify the specific BMPs that, when implemented, will reduce the concentration of urban nutrient sources in the watershed (MS4 permit Section VI.D.2.d.i.(b)). The following sections describe each of the specific watershed-based BMPs included in the CNRP. Section 3 describes the expected water quality benefits, where such benefits may be quantified. As noted above, the level of implementation of each of these BMPs will be determined by the local jurisdiction.

Under this BMP, the MS4 Permittees will evaluate existing street sweeping and MS4 facility cleaning programs to determine if ongoing programs can be enhanced to further reduce presence of nutrient sources on street surfaces and MS4 facilities.

Street Sweeping and Debris Removal

Purpose – Street sweeping and MS4 facility debris removal activities reduce a significant source of nutrients in urban environments.

Implementation Approach – The MS4 Permittees will continue to perform street sweeping, MS4 facility inspections and cleaning programs for storm drain pipes, catch basins and storm channels. Under this BMP element, each Permittee will review their existing programs (e.g., methods, frequency of implementation, and equipment use) to evaluate the potential to modify these programs to further reduce nutrient loads from streets and MS4 facilities. Where opportunities exist, Permittees will evaluate the feasibility of implementing changes to their programs. If it is determined that a change in equipment will provide water quality benefits, the Permittees will work with their respective governing bodies to request funding to upgrade/replace equipment.

Expected Benefits – Existing street sweeping/debris removal practices have already provided important reductions from these nutrient sources in the watershed. Given the important benefits of these types of BMPs, a review of these programs could identify additional opportunities to further reduce nutrients from these sources. Quantification of the water quality benefits is provided in Section 3.

Septic System Management

Purpose – Continue ongoing efforts to reduce nutrients associated with the use of septic systems in the watershed.

Implementation Approach – Task 6 of the TMDL Implementation Plan required the County of Riverside and Cities of Perris, Moreno Valley, and Murrieta to collectively or individually develop and submit to the Regional Board a Septic System Management Plan (SSMP) to identify and address nutrient discharges from septic systems within the San Jacinto watershed. This plan, *San Jacinto Onsite Wastewater Management Program report*, was submitted to the Regional Board on November 17, 2007. The County and Cities are currently implementing the plan in their respective jurisdictions. In addition, the City of Perris is currently implementing a project to convert septic to sewer in the Enchanted Heights area of the City. There are also plans for septic conversions in other areas of the San Jacinto Watershed, including Quail Valley. However, these other plans are not finalized yet and therefore are not credited for load reduction in the CNRP. Should additional septic systems be converted to sewer, these activities would be reported and credited in future annual reports on CNRP implementation.

The SSMP was also intended to incorporate pending regulations from the State Water Resource Control Board (State Board). The State Board is developing a Water Quality Control Policy for Siting, Design, Operation, and Management of Onsite Wastewater Treatment Systems (OWTS or "septic systems") ("OWTS Policy"). The OWTS Policy is being developed pursuant to California Assembly Bill 885 (AB 885). The State Board released a draft OWTS Policy for public comment on September 30, 2011. The draft policy establishes a multi-tiered regulatory system for the management of septic systems. For example, Tier 3 (Impaired Areas) includes specific performance requirements for new or replacement OWTS in areas near waterbodies impaired for pathogens or nitrogen (unless it is determined that the OWTS is not contributing to a local water quality problem). Tier 4 (OWTS Requiring Corrective Action) establishes requirements for septic systems that are failing. When finalized, implementation of the State Board's OWTS Policy will support efforts to reduce impacts from OWTS in the area covered by the CNRP.

Expected Benefits – Implementation of this BMP (as required currently or as will be required following State Board adoption of the OTWS Policy) reduces the potential for leakage from septic systems to contribute nutrients to the MS4 during wet weather conditions. The Section 3 Compliance Analysis quantifies the expected benefits from septic to sewer conversions as well as improved management of septic systems at risk of failure.

Low Impact Development (LID) and Land Use Conversion

Purpose – The MS4 Permit requires the implementation of LID practices to reduce runoff from new development and significant redevelopment activities. Implementation of these practices over time will reduce the nutrient load during wet weather runoff events.

Implementation Approach – Each of the MS4 Permittee jurisdictions include areas of open space , agricultural lands and other non-urban land uses that are expected to be converted to urban land use over the next ten years. This land use conversion can result in significant positive or negative effects to nutrient loading to the lakes. BMPs, including LID BMPs, that are required of new development and significant redevelopment projects (as defined in Board Order R8-2010-0033) help to offset the negative loading impacts of urbanization. The MS4 program recently revised its WQMP to incorporate the new LID requirements for development activities. The WQMP was submitted to the Regional Board July 29, 2011 and was approved on October 22, 2012. The WQMP takes full effect on April 22, 2013.

Expected Benefits – WQMP implementation has already provided water quality benefits throughout the watershed since TMDL adoption in December 2004. The compliance analysis incorporates these benefits by taking into account where BMPs have been implemented for removal of nutrients. As each MS4 Permittee jurisdiction develops, i.e., approves projects that convert non-urban areas to urban land uses or projects that redevelop existing urban areas, implementation of the new LID-based BMP requirements will provide additional water quality benefits. Section 3, Compliance Analysis, describes how these benefits were incorporated into the CNRP.

Public Education and Outreach

Purpose –Continue implementation of PEO activities that target nutrients as a pollutant of concern

Implementation Approach – The MS4 program has developed an extensive PEO program that targets nutrient sources that impact wet weather water quality, specifically – sediment management, fertilizer management and pet waste (see Attachment D). These PEO programs will be regularly evaluated and updated as needed to continue efforts to communicate the need to manage nutrients at the source, especially on commercial and residential properties. This BMP will be coordinated with the ordinance BMP, described above. If cities decide to modify existing or establish new ordinances to improve management of nutrient sources, PEO materials will be updated to communicate the new requirements to city or county residents and businesses.

Expected Benefits – Increased awareness of pollutant sources reduces nutrients at the source, thus minimizing the opportunity for nutrients to be mobilized during wet weather events. Given the difficulty of equating PEO impressions to specific reductions in nutrient loads, the expected water quality benefits of this BMP have not been quantified; instead the benefits are included in the margin of safety.

Inspections and Enforcement

*Purpose –*Continue implementation of inspection and enforcement programs that target activities that can contribute pollutants, in particular nutrients, to storm drains.

Implementation Approach – Each MS4 Permittee has an active inspection and enforcement program to comply with MS4 permit requirements applicable to their jurisdictions. These programs will continue to be implemented (see Attachment D). This BMP will be coordinated with the ordinance BMP, described above. If cities decide to modify existing or establish new ordinances to improve management of nutrient sources, inspection and enforcement programs will be reviewed, and if necessary modified, to implement new ordinance requirements.

Expected Benefits – Inspection and enforcement activities help ensure compliance with local stormwater management requirements, which maximizes the potential benefits of BMP implementation. Given the year-to-year variability in inspection activities and potential follow-up enforcement actions, the expected water quality benefits of this BMP have not been quantified; instead the benefits are included in the margin of safety.

2.2.2 In-Lake Remediation Activities

The MS4 permit requires that the CNRP identify the specific regional treatment facilities and the locations where such facilities will be built to reduce the concentration of nutrients discharged from urban sources and the expected water quality improvements to result when the facilities are complete (MS4 Permit Section VI.D.2.d.i.(d)). The CNRP includes implementation of in-lake remediation activities that serve as regional treatment facilities for Canyon Lake and Lake Elsinore. The following sections describe the remediation activities planned for each lake; information regarding the expected water quality improvements to result from implementation of these activities is provided in Section 3.

Canyon Lake

Numerous studies have been conducted by the Task Force to evaluate potential in-lake nutrient management BMPs for Canyon Lake, including addition of chemicals; alum, Phoslock, and zeolite, and construction of aeration or hypolimnetic oxygenation. The most recent studies are summarized in Attachment C. They provide the basis for the selected in-lake BMPs. Table 2-1 provides a matrix showing how two selected in-lake BMPs for inclusion in the CNRP perform in meeting either WLAs or LAs for urban and septic sources or TMDL numeric targets for causal and response variables. The basis for these determinations is provided by modeling studies conducted in 2012 (Attachment C).

Table 2-1. Matrix Comparing Effectiveness of HOS and Alum In-Lake Nutrient Management BMPs for Compliance with the TMDL, per the MS4 Permit

Criteria	Constituent	HOS	Alum
WLA/LA	TP	■	■
	TN	■	□
TMDL Numeric Targets	TP (causal)	□	■
	TN (causal)	□	□
	Chlorophyll-a (response)	□	■
	Dissolved Oxygen (response)	■	◩

Key: Filled in square denotes an expectation that the target will be achieved, partially filled square denote an expectation of signifcant improvement, but not enough to achieve target as currently described in TMDL, and blank boxes indicate targets that are not effectively managed

To comply with the TMDL, the MS4 Permittees must either demonstrate that 1) WLAs and LAs for urban and septic sources can be achieved with implementation of a project or 2) that the project will improve lake water quality to protect water quality standards, as measured by TMDL response targets for chlorophyll-a and DO. Incubation studies and subsequent models specific to Canyon Lake suggest that the HOS would suppress sediment nutrient flux to offset enough watershed loads to bring the MS4 Permittees into compliance with the WLA for urban and LA for septic sources. However, Anderson 2012b determined that exceedences of the chlorophyll-a response target would continue to occur if only HOS were to be implemented in the lake. In its March 31, 2012 comment letter, the Regional Board states that if allocations are met by all dischargers, but in-lake water quality response targets are not achieved, then the TMDL will be reconsidered and allocated loads may be further reduced. Thus, the Permittees opted to prioritize in-lake BMPs based on their effectiveness in meeting the TMDL response targets for chlorophyll-a, and DO.

Adding alum to Canyon Lake was estimated to be highly effective in achieving the interim and final chlorophyll-a response target; therefore to control algae in the lake, the Permittees plan first conduct five alum applications over a two-year period (see Section 3.4.2). By binding phosphorus and reducing algae growth, the continued use of alum will reduce the cycling of nutrients and associated sediment oxygen demand in the lake bottom. Accordingly, the changes in biogeochemical processes will indirectly increase DO in the hypolimnion, and may be sufficient to achieve the interim and final DO response target.

The effectiveness of in-lake remediation using alum addition will be evaluated as part of the adaptive management process incorporated into this CNRP (see Section 2.4). If it is found that a combination of watershed BMPs and alum additions are not sufficient to meet the final DO response target, then the Permittees plan to implement additional in-lake solutions which can include aeration and/or HOS, if necessary. These additional in-lake BMPs would be constructed to provide the additional oxygen needed to meet the DO final response target. This is expected to be a much smaller scale than if the HOS was used for suppression of sediment nutrient flux.

Lake Elsinore

Work completed through the Task Force identified several recommended Phase 1 in-lake remediation activities, as well as potential supplemental BMPs, for deployment in Lake Elsinore (*In-Lake Sediment Nutrient Reduction Plan for Lake Elsinore*, October 22, 2007). Of these remediation activities, the CNRP includes participation in the operation of the in-lake aeration system. This in-lake aeration/mixing system was installed in Lake Elsinore in two phases. The first phase, implemented by LESJWA in 2005, involved the construction of axial flow water pumps to improve lake circulation. A second phase, implemented in 2007, involved construction of an in-lake aeration project designed to pump air through a system of twelve perforated pipelines submerged along the bottom of lake. The intent of the aeration system is to improve circulation so that oxygen levels are better distributed throughout the water column. The bubble diffuser "lifts" oxygen-deficient bottom waters to the surface where it can be re-saturated through direct contact with the atmosphere.

Through agreements established with other stakeholders and as part of CNRP implementation, the MS4 Permittees will participate in the operation of the in-lake aeration system. At this time, based on lake modeling and compliance analyses, the MS4 Permittees believe the aeration system will provide the necessary nutrient load reductions to comply with urban WLAs. In the event that additional BMPs are necessary, the *In-Lake Sediment Nutrient Reduction Plan for Lake Elsinore* (October 22, 2007) identified a number of other in-lake control strategies. Of these strategies, participation in fishery management activities or the application of metal salts, are the preferred next steps if additional BMPs are necessary.

Similar to Canyon Lake, the Permittees are continuing to evaluate alternative compliance options should the Permittees determine that an alternative compliance approach is needed to achieve in-lake response targets for Lake Elsinore. If the Permittees determine that an alternative compliance approach is necessary, the Permittees may propose revisions to this CNRP to incorporate the alternative compliance approach.

2.2.3 Monitoring Program

The MS4 permit requires that the CNRP include inspection criteria that will be used to identify and manage the urban sources most likely causing exceedences of urban WLAs for nutrients (MS4 permit Section VI.D.2.d.i.(c)). This requirement will be fulfilled through (a) implementation of watershed and in-lake monitoring programs (MS4 permit Section VI.D.2.g); and (b) the requirement to provide a summary in the MS4 program's Annual Report of all relevant data from water quality monitoring programs and an evaluation of compliance with the Nutrient TMDLs by reporting the effectiveness of the BMPs implemented in the watershed to control nutrient inputs into the lake from urban runoff (MS4 Permit Section VI.D.2.h).

Monitoring activities have been implemented in a phased manner since adoption of the TMDL. The following sections provide a brief history of the monitoring program and expectations for continued monitoring under the CNRP.

Phase 1 Monitoring

The MS4 Permittees, as participants in the Task Force, have conducted water quality monitoring on Lake Elsinore and Canyon Lake since 2006. The Task Force prepared the *Lake Elsinore and Canyon Lake*

Nutrient TMDL Monitoring Plan ("Monitoring Plan") in February 2006. Monitoring began after the Regional Board approved the Monitoring Plan in March 2006. This plan included three components:

- Lake Elsinore – Provide data to evaluate compliance with interim and final nitrogen, phosphorus, chlorophyll *a*, and dissolved oxygen numeric targets.
- Canyon Lake - Provide data to evaluate compliance with interim and final nitrogen, phosphorus, chlorophyll *a*, and dissolved oxygen numeric targets.
- San Jacinto River watershed – Provide data to evaluate compliance with interim and/or final nitrogen and phosphorus TMDL WLAs and load allocations.

The original monitoring program included a multi-phase approach:

- *Phase 1 (Intensive Lake Elsinore and Canyon Lake Study)* - Phase 1 focused on collecting data to evaluate in-lake processes and develop a linkage analysis to relate external pollutant loading to the in-lake response, e.g., with regards to nutrient concentrations. Phase 1 was scheduled to occur over a two to three-year period.
- *Phase 2 (Intensive Watershed Study)* - Phase 2 is an intensive watershed study that provides data to support compliance analyses and provide data to understand external nutrient source contributions from the watershed.
- *Phase 3 (Compliance Monitoring)* – Upon completion of Phases 1 and 2, a compliance monitoring phase would begin. Phase 3 monitoring would consist of an agreed upon base level of in-lake and watershed compliance monitoring based on the findings from the previous phases.

Revision to Phase 1 Monitoring

In December 2010, the Task Force, in consultation with the Regional Board, revised the Phase 1 monitoring program for Lake Elsinore and Canyon Lake. The revised Phase 1 program decreases the number of sample locations in these waterbodies. The watershed monitoring program was not revised. Table 2-2 summarizes the currently approved Phase 1 monitoring program elements.

Table 2-2. Phase 1 Monitoring Summary

Monitoring Program	Sample Stations	Sampling Frequency	Field Parameters	Laboratory Parameters
Lake Elsinore	Station E2 (lake center)	16 events/year: Monthly (Oct to May); Bi-weekly (June to September)	Temperature, dissolved oxygen, conductivity, pH, turbidity, and redux potential	Chlorophyll *a*, hardness, total phosphorus, soluble reactive phosphorus, total organic phosphorus, nitrogen (total N, nitrite + nitrate, Ammonia N, total inorganic nitrogen, total organic nitrogen, iron, and total dissolved solids
Canyon Lake	Station C7 (deep lake)	16 events/year: Monthly (Oct to May); Bi-weekly (June to September)		
	Station C8 (mid-lake)			
	Station C10 (east bay)			
San Jacinto River Watershed	Site 3 - Salt Creek at Murrieta Rd	Three storm events per wet season	Temperature, turbidity, pH	Total organic nitrogen, nitrite nitrogen, nitrate N, ammonia, total phosphorus, soluble reactive phosphorus, total suspended solids, chemical oxygen demand, biological oxygen demand
	Site 4 –San Jacinto River at Goetz Road			
	Site 6 – San Jacinto River at Ramona Expressway			
	Site 30 – Canyon Lake Spillway			
	Site 1 – San Jacinto River, Cranston Guard Station			

CNRP Monitoring Program

Through fiscal year 2014-2015 the Permittees propose to continue the existing Phase I watershed monitoring program (see Table 2-2). The Permittees also propose to eliminate existing in-lake monitoring programs through the same period to ensure that resources are dedicated to facilitating and constructing in-lake BMPs. The Permittees will propose a revised comprehensive watershed and in-lake monitoring program by December 31, 2014 for implementation in fiscal year 2015-2016.

2.2.4 Special Studies

As resources allow, the MS4 Permittees may implement a number of studies during CNRP implementation to provide additional data to support TMDL implementation efforts. These studies are optional; MS4 Permittees implementation of or participation in these studies (if initiated by other TMDL stakeholders) is solely at their discretion. Where implemented, the outcome from various analyses or studies would be used to support the adaptive implementation process (see Section 2.3). The purpose of such studies is to provide data to refine TMDL parameters, e.g., development of more accurate land use data, revisions to the TMDL watershed and lake models based on updated water quality and land use data, and technical data to support use of supplemental BMPs should the effectiveness of planned in-lake remediation strategies be lower than anticipated. The implementation and timing of such studies is solely at the discretion of the MS4 Permittees; however, implementation would consider regular triennial reviews of the TMDL and TMDL compliance milestones.

2.3 Adaptive Implementation

The MS4 permit requires that the CNRP be updated as needed based on BMP effectiveness analyses completed as part of annual reporting activities (MS4 permit Section VI.D.2.f). In addition, the MS4 permit requires that the CNRP provide descriptions of any additional BMPs planned, and the time required to implement those BMPs, in the event that monitoring data indicate that water quality objectives for nutrient are still being exceeded after the CNRP is fully implemented (MS4 permit Section VI.D.2.d.ii.(e)). These requirements will be addressed through the adaptive implementation process that has been incorporated into this CNRP.

This CNRP establishes a program to reduce urban sources of nutrients through the implementation of watershed-based BMPs and to reduce nutrients already entrained in Canyon Lake and Lake Elsinore through the application of in-lake remediation strategies. With regards to the in-lake remediation projects proposed for Lake Elsinore, the following has been stated previously:

> "It is unlikely that the stakeholders will implement the perfect solution on the first try. Rather, success will depend on an iterative process of developing mitigation projects, measuring results, updating the predictive models and refine the follow-on strategy. This process of "adaptive implementation" makes best use of scarce public resources and reduces the risk of unforeseen consequences by emphasizing incremental changes. Using the lake as a laboratory, successful projects can be repeated or expanded. Unsuccessful projects can be terminated and resources shifted to alternative approaches. Moreover, as additional data becomes available, the ability to accurately assess the lake's true potential, and the steps necessary to achieve that potential, will also improve." (*In-Lake Sediment Nutrient Reduction Plan for Lake Elsinore*, October 22, 2007, page 28).

This statement applies to any of the proposed watershed-based BMPs and in-lake remediation projects in either Canyon Lake or Lake Elsinore. For example, the Permittees may determine prior to 2014 that Zeolite or other remediation tool will provide a more cost effective method to address urban nutrient loads and and/or attain in-lake response targets. If such a finding is made, the Permittees may propose a revision to the CNRP based on this new information.

The compliance analysis (Section 3) quantifies the expected water quality benefits from implementation of this comprehensive nutrient management program. Based on this analysis, the CNRP, when fully implemented, is expected to result in compliance with the TMDL. This finding is based on the quantified compliance analysis results coupled with the margin of safety associated with the implementation of watershed-based BMPs that could not be quantified. All analyses are based on currently available data, including what is known regarding the effectiveness of the various BMPs included in the CNRP.

Over time, through the monitoring program and information collected through the MS4 Permit Annual Report, additional data will be developed to evaluate the effectiveness of various CNRP elements. These data may be supplemented by additional information developed through the optional special studies described above. In total, new data and information will be used to annually report and assess the effectiveness of CNRP implementation. As part of this effort, the Permittees will prepare a trend analysis for the response targets and nutrient levels in Lake Elsinore and Canyon Lake by November 30, 2018. This analysis will be included in the fiscal year 2018-2019 MS4 Annual Report. Based on the outcome of this analysis, the Permittees will make recommendations for additional BMPs and a schedule for deployment of those BMPs for incorporation into a revised CNRP by June 30, 2019. Upon Regional Board approval, the Permittees will implement the revised CNRP.

If it is determined that additional BMP implementation will be necessary to comply with the TMDL requirements as stated in the MS4 Permit, it is anticipated that the focus will be on additional in-lake remediation strategies, rather than additional watershed-based BMPs. This expectation is based on what is most likely to be most cost effective in terms of implementation. Specifically, other than implementation of large regional structural projects in the watershed, which would be very costly and potentially not practical given the potential size of storm flows, additional watershed-based BMPs are not expected to provide needed water quality benefits in a cost effective manner. As noted earlier in this chapter, there are several additional in-lake options that may be considered for both Lake Elsinore and Canyon Lake.

2.4 Implementation Schedule

The MS4 permit requires that the CNRP include a detailed schedule that provides the following information:

- Identifies the discrete milestones, decision points and alternative analyses necessary to assess satisfactory progress toward complying with the MS4 Permit requirements for the CL/LE Nutrient TMDL by December 31, 2020.
- Indicates which agency or agencies are responsible for meeting each milestone.
- Establishes the specific metric(s) that demonstrate the effectiveness of the CNRP and acceptable progress toward complying with the MS4 Permit requirements for the CL/LE Nutrient TMDL by December 31, 2020

Figure 2-2 shows the overall tasks and schedule for CNRP implementation. Presented as a timeline, this figure illustrates the relationship among tasks over the period from 2012 through the December 31, 2020 compliance date. Attachment E provides the detailed information required above for each CNRP task.

The implementation schedule includes tasks associated with each of the following elements:'

- *Watershed-based BMPs* – This element includes six BMPs. Three of these BMPs (ordinance development, street sweeping & debris removal, and inspection & enforcement) include time for the evaluation and, if appropriate, revision to the program element (shown as a "Development Activity"). For example, the Permittees will evaluate the need to revise existing ordinances to provide better tools to target nutrient sources. If needed changes are identified, then the Permittees will need to work through the process to revise the ordinance per local requirements. Once development is complete, then the schedule shows the element as an "implementation activity". Two BMPs (PEO and septic system management) will continue to be implemented as currently prescribed, i.e., the BMP can be implemented now. The final watershed-based BMP (LID-based WQMP implementation) will be fully implemented on or before April 22, 2013.

- *In-Lake Remediation Activities*

  - *Lake Elsinore* – The in-lake aeration system is already being implemented in Lake Elsinore. As shown in the schedule, the MS4 Permittees propose to support continuation of aeration and mixing activities in the lakes through participation in cost-sharing agreements.

  - *Canyon Lake* – The MS4 Permittees propose to implement a series of five alum additions in Canyon Lake. The schedule establishes a development period (planning, operation agreements, toxicity testing, CEQA, and mobilization) that is expected be completed by September 2013 in time for the first alum application. This schedule is dependent on obtaining all required regulatory approvals for addition of alum to Canyon Lake in a timely manner.

- *Monitoring Program* –Watershed-based monitoring will continue as approved under the Phase I watershed monitoring program through fiscal year 2014-2015. By the end of 2014, the Permittees will propose a revised comprehensive watershed and in-lake monitoring program. If approved, this revised program will be implemented in fiscal year 2015-2016.

- Special Studies – The CNRP identifies special studies that may be implemented by the MS4 Permittees. The schedule for implementation of various studies is related to the need for new information that may be used to support the 2015 compliance assessment, need for any revisions to the CNRP, and anticipated TMDL triennial reviews, including evaluation of the appropriateness of the existing DO Target for Canyon Lake.

- Adaptive Implementation – This element includes TMDL implementation activities that could affect other stakeholders (e.g., TMDL revision, Task Force activities) and the potential need to revise the CNRP based on the findings from monitoring activities. The TMDL triennial review dates are based on the assumption that a triennial review will occur in 2015 and then every three years beyond 2015.

Figure 2-2. CNRP Implementation Schedule

Year of CNRP Implementation: 2012 (Q3–Q4), 2013–2020 (Q1–Q4); Post 2020 - Continuous improvement through Adaptive Implementation

Legend: - Development Activity; - Implementation Activity

CNRP Activity	CNRP Program Elements		Description/Purpose
Watershed-based BMPs	Ordinances Development		Review and revise existing ordinances as needed to increase legal authority, e.g., pet and yard waste management, fertilizer use
	Street Sweeping & Debris Removal		Evaluate existing programs; enhance where needed to increase debris removal/decrease potential nutrient loads
	Inspection & Enforcement		Implementation of inspection and enforcement programs to target nutrient sources; enhance activity as needed based on revisions or new ordinances
	Septic System Management		Implement guidance (either existing or as required by State OTWS Policy); convert areas with septic systems to sewer
	Public Education & Outreach		Continue to implement public education and outreach programs that target nutrient sources, e.g., pet waste, fertilizer application, sediment deposition
	WQMP Implementation		Implement LID requirements in revised WQMP (within 6 months of Regional Board approval of revised WQMP)
In-Lake Remediation	Lake Elsinore	Aeration System	Establish agreements; participate in the operation and maintenance of the existing Lake Elsinore aeration system
	Canyon Lake	Alternatives Analyses	Complete alternatives analysis, which will include further evaluation of use of chemical additives as an in-lake remediation alternative
		HOS System	Prepare preliminary design of HOS
			Complete CEQA process; obtain all necessary permits and approvals to construct (if implemented as an in-lake remediation alternative)
			Complete final design of HOS (if implemeted as an in-lake remediation alternative)
			Construct HOS (includes bid and award process, if implemented as an in-lake remediation alternative)
			Implement operation and maintenance activities (if implemented as an in-lake remediation alternative)
Monitoring Program	In-Lake Monitoring		Prepare revised comprehensive monitoring program
			Implement revised comprehensive monitoring program
	Watershed Monitoring		Continue implementation of Phase I watershed monitoring program
			Prepare revised comprehensive monitoring program
			Implement revised comprehensive monitoring program
	Annual Reports		Complete annual reports by November 30 each year; reports assess effectiveness of in-lake and watershed-based BMPs, coincide with MS4 Annual Report submittal
	Interim ComplianceAssessment		Demonstrate compliance with interim TMDL requirements
	Final Compliance Assessment		Demonstrate compliance with final TMDL requirements
Special Studies (Optional)	Use of Chemical Additives		Evaluate potential to use chemical additives, e.g., alum, as an in-lake remediation alternative
	Land Use Updates		Update watershed urban land use based on 2010 data to support potential revisions to TMDL WLAs
	TMDL Model Update		Revise/update the TMDL model for Canyon Lake and Lake Elsinore based on new data (e.g., land use, water quality)
Adaptive Implementation	Task Force		Continue participation in Task Force to coordinate Nutrient TMDL implementation activities, as needed
	Pollutant Trading Plan		Participate in the development/establishment of the PTP; implement PTP as appropriate
	CNRP Revisions		Review progress towards achieving interim TMDL requirements based on compliance assessments; modify CNRP as needed
			Review progress towards achieving final TMDL requirements based on compliance assessments; modify CNRP as needed
	TMDL Revision		Based on degree of Regional Board support, prepare materials to support revision to the TMDL as part of the Triennial Review process, if revision is appropriate

Section 3
Compliance Analysis

3.1 Introduction

The MS4 permit requires that the Permittees provide the scientific and technical documentation used to conclude that the CNRP, once fully implemented, is expected to achieve compliance with the urban WLA and septic LA for total nitrogen (TN) and total phosphorus (TP) by December 31, 2020 (MS4 permit Section VI.D.1.d.ii.(a)). The TMDL sets 10-year average WLAs for urban and LAs for septic sources of nutrients (Table 3-1) that will result in reductions needed to achieve numeric targets for response variables in Lake Elsinore and Canyon Lake (see Table 1-1). In the Nutrient TMDLs, sources with WLAs include urban, septic, reclaimed water, agriculture, and Concentrated Animal Feeding Operation (CAFO) sources. This compliance analysis only addresses the urban and septic WLAs associated with the MS4 Permittees and presumes other TMDL Stakeholders will reduce loads to their respective WLAs to achieve numeric targets in the lakes.

Table 3-1. Wasteload Allocations for Urban and Load Allocations for Septic Nutrient Sources in Canyon Lake and Lake Elsinore Watersheds

Nutrient Source	Canyon Lake		Lake Elsinore	
	TP (kg/yr)	TN (kg/yr)	TP (kg/yr)	TN (kg/yr)
Urban	306	3,974	124	349
Septic	139	4,850	69	608

Per MS4 permit Section VI.D.2.k, compliance with the urban WLAs can be measured using one of the following methods:

- Directly, using relevant monitoring data and approved modeling procedures to estimate 10-year average nitrogen and phosphorus loads being discharged to the lakes, or,

- Indirectly, using water quality monitoring data and other biological metrics approved by the Regional Board, to show water quality standards are being consistently attained (as measured by the response targets identified in the Nutrient TMDLs).

For the Lake Elsinore TMDL, this compliance analysis uses the direct method, with BMPs designed to reduce long-term average (running 10-year) annual nutrient load for urban and septic sources to allowable levels, set as WLAs and LAs in the TMDL. Conversely, the indirect method is used to demonstrate compliance with the Canyon Lake TMDL, with BMPs designed to achieve lake water quality response variables for annual average chlorophyll-a and daily average DO. By using the shorter term (annual for chlorophyll-a and daily for DO) response variables to demonstrate compliance in Canyon Lake, BMP implementation must account for wet years when watershed loads are much greater than the 10-year average.

3.1.1 Compliance Analysis Approach

The following sections provide detailed description of the methodology employed to demonstrate compliance with the WLAs for urban and septic sources. The analysis involved several key questions, including:

- What is the average load of nutrients from urban and septic sources in the Canyon Lake and Lake Elsinore watersheds?
  Development of the TMDL involved application of lake and watershed models to characterize nutrient sources for setting WLAs and LAs. In addition, the TMDL watershed model was updated in 2010 to incorporate a more recent land use distribution. Section 3.2.1 describes the results from these models.

- To what extent does watershed loads (referred to as "washoff") translate to reductions in loads delivered to Lake Elsinore and Canyon Lake?
  Section 3.2.2 describes the estimation of loading factors to account for loss of nutrients between washoff areas and inputs to Lake Elsinore and Canyon Lake.

- What is the nutrient load reduction necessary to reduce existing loads down to the WLA for urban and to the LA for septic sources for each MS4 Permittee?
  See Section 3.2.3.

- How much nutrient load reduction has occurred or is expected to occur from external urban and septic sources in the watershed?
  MS4 Permittees have implemented watershed-based BMPs since the adoption of the TMDL in Lake Elsinore and Canyon Lake (see Section 3.3) watersheds. In addition, projected changes in watershed nutrient loads resulting from land use change and application of new WQMP requirements are summarized for Lake Elsinore and Canyon Lake.

- For Lake Elsinore, what in-lake nutrient control strategy is recommended to address remaining load reduction requirements for each MS4 Permittee after accounting for watershed load reduction?
  Section 3.4.1 summarizes in-lake nutrient control recommendations and demonstrates how the selected strategy will provide the necessary load reduction to achieve compliance with the Lake Elsinore WLAs for urban and LAs for septic sources.

- For Canyon Lake, what in-lake management action(s) is recommended to manage lake water quality so that numeric targets for response variables chlorophyll-a and DO can be achieved?
  Section 3.4.2 summarizes proposed in-lake management actions and demonstrates that the selected strategy will provide the necessary reductions in annual average chlorophyll-a and increase in daily average DO to achieve the interim and final chlorophyll-a targets and the interim TMDL numeric target for DO (except for a short period of time during lake turnover), and possibly the final DO target.

- What is the certainty that the CNRP, once implemented, will result in compliance with TMDLs for Lake Elsinore and Canyon Lake?
  Section 3.5 characterizes several important sources of uncertainty, including the role of spatial and temporal variability in nutrient loading as a result of hydrology and modeling assumptions for land use change, watershed and Lake BMP effectiveness, and lake water quality response to both reduced watershed loads and in lake management actions.

The analysis contained herein is based on the TMDL staff report, 2003 TMDL watershed model, 2010 watershed model, and other studies and analyses conducted by various individuals, task forces and agencies. These documents and studies represent the best available data regarding the lakes, their impairments, and potential remediation strategies. However, they are limited by the quality and amount of data that was available at the time of publication. This compliance analysis relies on this older information but also incorporates new data where available. However, this analysis is still an approximation based on best available data. Although this analysis presents existing load data down to the individual Permittee level, the data should be considered order of magnitude estimates of individual responsibility. The CNRP compliance analysis should ultimately be evaluated at the higher level of combined loading and load reductions due to inherent uncertainties in the underlying data sets.

3.2 Watershed Load Assessment

3.2.1 Nutrient Washoff from Urban and Septic Sources

The linkage analysis used to develop the nutrient TMDLs and the subsequent 2010 watershed model update evaluated the role of land cover and failing septic systems in contributing to the wash off of nutrients to receiving waterbodies, such as Salt Creek, San Jacinto River, Perris Valley Channel, and other major tributaries to the lakes. The method used to simulate loads from the watershed involved a continuous simulation of pollutant buildup during dry periods and pollutant washoff as a function of hydrologic response to historical (1990-2009) rainfall records. The Loading Simulation Program C++ (LSPC) tool was used to simulate hydrology and pollutant buildup and washoff using exponential functions. Variables used to simulate hydrology and pollutant buildup and washoff for different land cover types were adjusted within expected ranges to generate results that approximate observed data at six U.S. Geological Survey streamflow gauges and six water quality monitoring sites (Tetra Tech, 2010).

The TMDL was developed based on a frequency-weighted average loading simulated from three hydrologic year types: Wet at 16 percent weight (Water Year [WY] 1997-1998); Dry at 43 percent weight (WY 1999-2000), and Moderate at 41 percent weight (WY 1993-1994). Table 3-2 summarizes, for each MS4 Permittee, the frequency weighted average washoff of nutrients from urban and septic sources based on the 2010 watershed model update.

3.2.2 Estimation of Washoff Loading Factors

Nutrients washed off from source areas are transported to Canyon Lake and Lake Elsinore by a variety of drainage courses. Characteristics of these drainage courses control how much of the washed off pollutant reaches the downstream lakes. Reduction of nutrient loads within conveyance systems, referred to as natural decay in the CNRP, is generally the result of settling of suspended solids and stormwater infiltration within channels and upstream lakes, most notably Mystic Lake. The LSPC model accounted for this decay in the runoff routing simulation. Based on these results loading factors (ratios of lake loading to watershed washoff) were computed for three aggregated analysis zones: Local Lake Elsinore (Figure 3-1, Zone 1); Canyon Lake below Mystic Lake (Figure 3-1, Zones 2-6); and Above Mystic Lake (Figure 3-1, Zones 7-9) (Table 3-3)

Table 3-2. 2010 LSPC Update Simulated Nutrient Washoff from Urban and Septic Sources for each MS4 Permittee in the Local Lake Elsinore, Canyon Lake below Mystic Lake, and Above Mystic Lake Watersheds

MS4 Permittee[1]	TP Washoff (kg/yr)			TN Washoff (kg/yr)		
	Local Lake Elsinore	Canyon Lake below Mystic Lake	Above Mystic Lake	Local Lake Elsinore	Canyon Lake below Mystic Lake	Above Mystic Lake
Beaumont			69			362
Canyon Lake	14	130		78	765	
Hemet		235	187		1,660	1,246
Lake Elsinore	284	44		1,489	222	
Menifee	6	467		17	2,881	
Moreno Valley		1,160	1		7,255	2
Murrieta		1			5	
Perris		388			2,222	
Riverside		37			268	
Riverside County	116	485	697	585	2,374	2,632
San Jacinto		0	201		1	1,294
Wildomar	127	0		639	0	
Septic	13	83	63	176	1109	841
Other Jurisdictions	50	355	103	248	1,877	403
Total	610	3,386	1,339	3,232	20,640	6,902

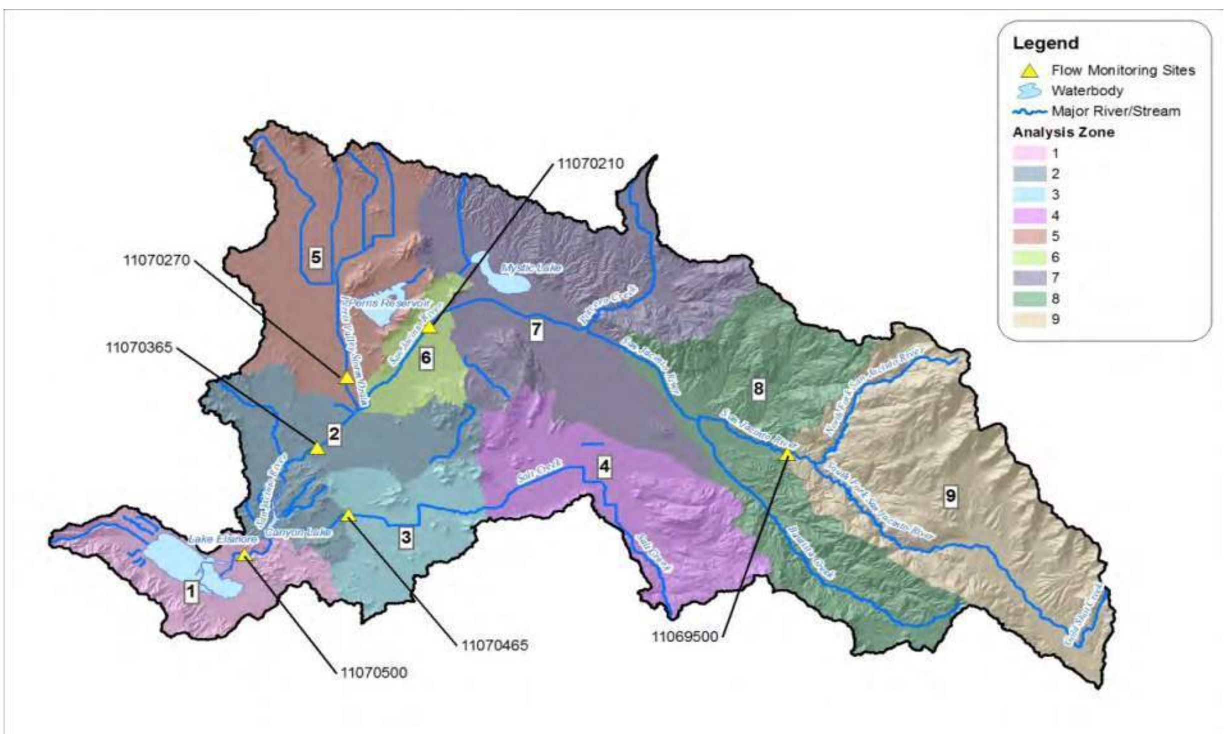


Figure 3-1
San Jacinto River Watershed Analysis Zones

Table 3-3. Estimation of Loading Factors for the Portion of Urban and Septic Watershed Nutrient Washoff that Reaches Lake Elsinore or Canyon Lake

Watershed Analysis Zone	Watershed Washoff[1]		Loads to Lakes[1]		Loading Factor	
	TP (kg/yr)	TN (kg/yr)	TP (kg/yr)	TN (kg/yr)	TP	TN
Local Lake Elsinore (Zone 1)	610	3,232	610	3,232	100%	100%
Canyon Lake below Mystic Lake (Zones 2-6)	3,386	20,640	1,765	12,515	52%	61%
Above Mystic Lake (Zones 7-9)	1,339	6,902	<1	<1	<0.01%	<0.01%

1) Watershed washoff and loads to lakes from urban sources are inclusive of state, federal, and tribal jurisdiction lands

The computed loading factors for the three aggregated zones show that all urban and septic nutrient washoff in the local Lake Elsinore watershed reaches Lake Elsinore. For the Canyon Lake watershed, roughly half of nutrient washoff from urban land areas from the portion of the drainage area that is downstream of Mystic Lake reaches Canyon Lake. For MS4 drainages upstream of Mystic Lake, any loading to Canyon Lake is extremely rare (11 of 240 months) and of small magnitude relative to flow in the Upper San Jacinto River, as has been shown with extensive analysis of flow gauge data and simulation models (http://www.sawpa.org/documents/2010-9-27SanJacintoWatershedModelUpdate.pdf). Thus, it is assumed that nutrients conveyed to Canyon Lake are from drainage areas downstream of Mystic Lake.

These loading factors must be included in any estimate of reduced loading to Lake Elsinore or Canyon Lake from implementing watershed BMPs to avoid double counting reductions that would have been achieved through natural in-stream decay. Therefore, in the Canyon Lake watershed, washoff reductions in MS4 drainage areas do not achieve an equivalent benefit in load reduction to the lakes. For example, watershed BMPs in MS4 drainages in the Canyon Lake watershed below Mystic Lake have to reduce washoff by 1.9 kg TP and 1.6 kg TN to achieve a 1 kg TP or TN reduction in loads to Canyon Lake. This compliance analysis does not evaluate washoff reduction from urban and septic sources above Mystic Lake, where the loading factor is negligible, making washoff reduction ineffective.

3.2.3 Gap Analysis for Urban WLAs and Septic LAs

The load reduction into Lake Elsinore and Canyon Lake necessary to reduce existing load to the urban WLA and septic LA is equal to the difference between existing loads and the allocated loads. For Lake Elsinore, the compliance analysis will show how watershed and in-lake BMPs will achieve the necessary reduction to meet allocation. This gap analysis is completed for Canyon Lake but is not the method used to demonstrate compliance. Instead, the gap analysis for Canyon Lake is used to estimate relative participation in the Canyon Lake in-lake solution that is designed to achieve TMDL numeric response targets for chlorophyll-a and DO.

The relative contribution from each MS4 Permittee drainage area to existing loads into Lake Elsinore and Canyon Lake is used to allocate urban WLAs and septic LAs and determine each Permittees' responsibility for reducing nutrient loads from urban and septic sources. Different approaches are necessary to estimate nutrient loads to the lakes from urban and septic sources, as follows:

- Urban Sources - Washoff from the watershed is modeled for each Permittee. Nutrient washoff from MS4 drainage areas is then translated to an existing load in Lake Elsinore or Canyon Lake by applying the appropriate loading factors depending upon acreage within each aggregated zone.

- Septic Sources - The watershed model simulated total septic loads from each of the three aggregated zones. No assessment of the distribution of septic systems among individual MS4 Permittees was made. The County's GIS shapefile of septic systems at risk provided a means to develop a distribution of existing septic loads for each MS4 Permittee within each aggregated zone.

The urban WLA was divided between the MS4 Permittees based on the relative contribution by each MS4 Permittee to the total urban load (as estimated from the 2010 watershed model). The total septic load to Lake Elsinore and Canyon Lake, as estimated in the 2010 watershed model, is less than the septic LA in the TMDL, hence, there is allowable load in excess of what is attributed to existing septic systems. The reason for this is that analysis to support the development of the 2007 SSMP significantly reduced the estimate of potentially failing septic systems in the San Jacinto River watershed from levels assumed during the TMDL development (Tetra Tech, 2007). The Regional Board required the MS4 Permittees to take the full responsibility of the septic LA. Therefore, it is appropriate to shift the allocation, including credits, to urban MS4 sources.

Tables 3-4 and 3-5 show how the septic LA and excess credits are shifted to MS4 Permittees. For Permittees with septic systems within their jurisdiction, the existing septic load was added to the urban WLA, based on the number of septic systems within 500 feet of a drainage facility within the watershed (see Section 3.3.3 for detailed breakout by jurisdiction). The load allocation in excess of the existing septic load (i.e. credits) was divided between all MS4 Permittees based on relative portion of existing urban load, estimated in the 2010 watershed model update. The final columns of Tables 3-4 and 3-5 compute the gap or load reduction that must be achieved by each MS4 Permittee for both urban and septic sources

For Lake Elsinore, the majority of existing urban and septic load comes from stormwater that flows through Canyon Lake in moderate rainfall years. For purposes of the CNRP compliance analysis, compliance with the Canyon Lake TMDL is assumed to translate to a sufficient reduction in Canyon Lake outflow load to meet the WLA for flows from Canyon Lake to Lake Elsinore. If future data demonstrates that exceedances of WLA for flows from Canyon Lake to Lake Elsinore are still occurring despite compliance with the Canyon Lake TMDL (by achieving response variables chlorophyll-a and DO), then these issues will be addressed through the adaptive implementation process that has been incorporated into this CNRP.

Table 3-4. Gap Analysis for Existing Urban and Septic Total Phosphorus Loading to Lake Elsinore and Canyon Lake for MS4 Permittees (all values in kg/yr)

MS4 Permittee	Existing Load	Urban WLA Septic LA	Load Reduction (Needed) / Credit	Reallocation of Existing Septic Load	Reallocation of Septic Credits	WLA (Urban + Septic)	Remaining Load Reduction (Needed)
Local Lake Elsinore Watershed[1]							
Canyon Lake	14	3	(11)	0	+1	4	(10)
Lake Elsinore	310	65	(246)	+11	+29	104	(206)
Menifee	6	1	(5)	0	+1	2	(4)
Riverside County	119	25	(94)	0	+11	36	(83)
Wildomar	147	31	(116)	+2	+14	47	(100)
Urban Subtotal	597	124	(473)	+13	+56	193	(404)
Septic Total	13	69	56	(13)	(56)	n/a	n/a
Canyon Lake Watershed							
Beaumont	0.0	0	(0)	0	0	0	(0)
Canyon Lake	67	12	(55)	0	+3	15	(52)
Hemet	125	22	(102)	+1	+6	29	(96)
Lake Elsinore	24	4	(20)	0	+1	5	(18)
Menifee	257	46	(211)	+16	+12	74	(183)
Moreno Valley	659	118	(541)	+7	+32	157	(502)
Murrieta	1	0	(1)	0	0	0	(1)
Perris	218	39	(179)	0	+11	50	(169)
Riverside	20	4	(17)	0	+1	5	(16)
Riverside County	337	60	(277)	+32	+16	109	(228)
San Jacinto	0	0	(0)	0	0	0	(0)
Wildomar	0	0	(0)	0	0	0	(0)
Urban Total	1,709	306	(1,403)	+56	+83	445	(1,264)
Septic Total	56	139	83	(56)	(83)		

1) Assumes pass through TP load from Canyon Lake to Lake Elsinore is reduced to the pass through WLA of 2,770 kg if all entities upstream of Canyon Lake reduce loads to their respective WLAs or LAs for the Canyon Lake nutrient TMDL.

Table 3-5. Gap Analysis for Existing Urban and Septic Total Nitrogen Loading to Lake Elsinore and Canyon Lake for MS4 Permittees (all values in kg/yr)

MS4 Permittee	Existing Load	Urban WLA Septic LA	Load Reduction (Needed) / Credit	Reallocation of Existing Septic Load	Reallocation of Septic Credits	WLA (Urban + Septic)	Remaining Load Reduction (Needed)
Local Lake Elsinore Watershed							
Canyon Lake	78	9	(69)	0	+11	20	(58)
Lake Elsinore	1,615	184	(1,430)	+143	+228	555	(1,059)
Menifee	17	2	(15)	0	+2	4	(13)
Riverside County	600	68	(531)	0	+85	153	(446)
Wildomar	747	85	(662)	+33	+106	224	(523)
Urban Subtotal	3,056	349	(2,707)	+176	+432	957	(2,099)
Septic Total	176	608	432	(176)	(432)		
Canyon Lake Watershed							
Beaumont	0.0	0	(0)	0	0	0	(0)
Canyon Lake	459	156	(302)	0	+157	313	(145)
Hemet	1,011	344	(666)	+9	+346	700	(311)
Lake Elsinore	139	47	(91)	0	+48	95	(44)
Menifee	1,825	622	(1,203)	+241	+625	1,488	(337)
Moreno Valley	4,694	1,600	(3,094)	+112	+1,608	3,320	(1,374)
Murrieta	7	2	(4)	0	+2	5	(2)
Perris	1,437	490	(947)	+1	+492	983	(453)
Riverside	165	56	(109)	0	+57	113	(52)
Riverside County	1,925	656	(1,269)	+491	+660	1,807	(119)
San Jacinto	1	0	(1)	0	0	1	(0)
Wildomar	0	0	(0)	0	0	0	(0)
Urban Total	11,661	3,974	(7,687)	+854	+3,996	8,824	(2,837)
Septic Total	854	4,850	3,996	(854)	(3,996)		

1) Assumes pass through TN load from Canyon Lake to Lake Elsinore is reduced to the pass through WLA of 20,774 kg if all entities upstream of Canyon Lake reduce loads to their respective WLAs or LAs for the Canyon Lake nutrient TMDL.

3.3 Load Reduction from Watershed BMPs

Since TMDL adoption, MS4 program implementation has resulted in reductions in nutrient washoff from MS4 drainage areas. For stormwater program activities involving changes to human behavior, the nutrient washoff reduction benefit was not incorporated into the assessment of expected load reduction due to uncertainty in effectiveness (see Section 2.2.1); however, rough estimates were developed and used to quantify a margin of safety (MOS) for TMDL compliance (see Section 3.5.3). Watershed BMPs that provide a quantifiable reduction of nutrient washoff loads are detailed in the following sections.

CDM Smith

3.3.1 Street Sweeping and MS4 Debris Removal

Street sweeping and MS4 facility debris removal activities reduce a significant source of nutrients in urban environments. Quantifying these reductions required assessment of sediment and debris mass removal data and development of an analysis to convert tonnage of sediment and debris collected to reductions in washoff loads. The MS4 Permittees provided street sweeping and MS4 debris removal data for the reporting period from 2005 to 2010 (see Table D-2, Annual Street Sweeping Summary). This data was the basis for quantifying nutrient washoff reduction for the CNRP compliance analysis.

A continuous simulation analysis was developed to compute sediment and debris accumulation prior to each storm event(buildup) and transport to downstream waterbodies during each storm event(washoff) (Wolosoff et. al., 2010). The consecutive sequence of storm events provided a basis to perform a simulation of pollutant buildup during inter-event periods and washoff as a function of event runoff. Historical daily rainfall data for the Lake Elsinore NCDC meteorological station was used to estimate average runoff depth from a typical urban street, assuming a runoff coefficient of 0.9 for the impervious drainage area (i.e. runoff depth is 90 percent of rainfall depth to allow for depression storage and other initial abstractions).

The buildup/washoff model determined a long-term average washoff ratio (W_r) of roughly 50 percent. This is the portion of collected sediment and debris that would have otherwise been washed off to MS4s and receiving waterbodies. Translating avoided sediment and debris washoff into a potential reduction in nutrient loads requires an estimate of expected concentrations in typical street sediment and debris (C_s), measured as kg/metric ton, within MS4s for TP and TN. The City of San Diego Targeted Aggressive Street Sweeping Pilot Program, completed in 2011 measured concentrations of nutrients in sediment and debris on streets and found approximately 0.3 kg/metric ton for TP and 1.0 kg/metric ton for TN (City of San Diego, 2011). These values are comparable to nutrient concentration data reported by Pitt et al. (1973) from sites in Wisconsin (0.07-0.6 kg/metric ton TP and 0.5-1.9 kg/metric ton TN), Walch, 2006 from sites in Delaware (0.3 kg/metric ton TP and 0.7 kg/metric ton TN), and Breault et. al., 2005 from sites in Massachusetts (0.3-0.16 kg/metric ton TP). Therefore, for every metric ton of sediment and debris removed (M_{swept}), 0.15 kg of TP and 0.5 kg of TN is reduced from washoff, as;

$$\mathbf{W_{BMP} = M_{swept} * W_r * C_s}$$

Table 3-6 presents the baseline mean quantity of debris removed from street sweeping activities and MS4 facilities cleaning, between the 2005 and 2010 reporting years, within the San Jacinto River watershed and the estimated nutrient washoff reduction based on the method described above.

Table 3-6. Estimated Total Phosphorus and Total Nitrogen Annual Load Reduction (kg/yr) from Street Sweeping and MS4 Debris Removal

Jurisdiction	Debris Removal Average [1] (metric tons/yr)	Street Sweeping Average Removal [1] (metric tons/yr)	Baseline Metric Tons/yr (2005-2010)	TP Removed (kg/yr)	TN Removed (kg/yr)
Local Lake Elsinore					
Canyon Lake	1	8	8	0	0
Lake Elsinore	0	350	350	47	157
Menifee	24	5	29	0	0
Riverside County	182	538	720	6	20
Wildomar	0	25	25	4	13
Total				57	189
Canyon Lake					
Beaumont	23	23	45	0	0
Canyon Lake	1	8	8	1	4
Hemet	2	1,080	1,082	114	380
Lake Elsinore	0	350	350	6	19
Menifee	36	0	36	5	18
Moreno Valley[2]	18	893	911	132	442
Murrieta[2]	24	5	29	4	14
Perris	66	506	573	86	286
Riverside	0	29	29	4	14
Riverside County	182	538	720	52	175
San Jacinto	6	128	134	0	0
Wildomar	0	25	25	0	0
Total	359	3,584	3,942	406	1,352

1) Tonnage data is based on an extrapolation for catch basins cleaned, sweepers filled, and other metrics. Permittees are evaluating alternatives to more directly measure the mass removed from streets and MS4 facilities. Values are less than total reported debris removal for some Permittees (shown in Table D-2) due to discounting sweeping performed upstream of Mystic Lake according to proportion of road miles upstream of Mystic Lake.
2) Permittees reported MS4 debris data as volumetric measurements. Conversion to tonnage assumed debris density of 1.5 g/cm^3.

3.3.2 Structural Post Construction BMPs

MS4 Permittees within the San Jacinto River Watershed first required new development projects to establish post-construction stormwater BMPs that provide nutrient load reduction benefits as part of the San Jacinto Watershed Construction Permit requirements (Regional Board Permit No. CAG 618005, Order 01-34). These Permit requirements were effective from 2002 until the adoption of the Water Quality Management Plan for New Developments and Redevelopments pursuant to the third-term Riverside County MS4 Permit in 2005. Structural post-construction BMPs completed as a result of these requirements were not accounted for in the 2010 watershed model update. The MS4 Permittees have researched historic development and provided data for structural post-construction BMPs constructed within the San Jacinto River watershed and they are now accounted for in this compliance analysis (see Attachment D, Table D-6).

The 2010 watershed model update provides estimated pollutant loading rates or export coefficients (L_{EC}) for TP and TN of 0.08 kg/acre/yr and 0.42 kg/acre/yr, respectively. These loading rates do not account for inclusion of structural BMPs in WQMP projects. Reduction in washoff due to implementation of WQMP

CDM Smith

projects is estimated by reducing the modeled loading rate for new urban development since adoption of the TMDL. Two factors are applied, including:

- Average annual percent of runoff capture ($V_{capture}$) - Since BMPs in Riverside County are designed to meet MS4 Permit water quality volume criteria (Section VII.D.4(a)), constructed BMPs were assumed to treat approximately 80 percent of the volume of long-term average annual storm water runoff.

- Pollutant removal efficiency (R_{eff}) - BMP removal efficiency for infiltration is assumed to be 100 percent. For BMPs that treat and release runoff, average stormwater BMP effluent concentrations reported in the international BMPs database were compared with MS4 outfall concentrations at NPDES monitoring locations in the San Jacinto River watershed to approximate pollutant removal efficiency (ASCE, 2010). Results are summarized below:

  - Infiltration – 100 percent removal for the Vcapture
  - Extended detention – TP 75 percent; TN 24 percent
  - Hydrodynamic separators – TP 33 percent; TN 13 percent
  - Vegetated swale - TP 47 percent; TN 0 percent
  - Media filter – TP 69 percent; TN 0 percent

For each jurisdiction in this analysis, the area of new development draining to structural stormwater BMPs in acres (DA_{WQMP}), provided by the MS4 Permittees, was used to determine the TP and TN washoff reduction as follows:

$$\mathbf{W_{reduction} = DA_{WQMP} * L_{EC} * V_{capture\%} * R_{eff\%}}$$

Table 3-7 shows the estimated annual nutrient washoff reduction for each MS4 Permittee associated with implementation of structural BMPs in WQMP projects. It should be noted that not all Permittees were able to track deployment of BMPs constructed under the San Jacinto construction permit. Only those BMPs that could be verified were included in Table 3-7.

3.3.3 Septic System Management

Each Permittee with septic systems within their jurisdiction will implement the System Management Plan (SSMP) aimed to reduce nutrient washoff from failing septic systems to MS4s in the San Jacinto River watershed. The SSMP includes proposed activities such as enhancing performance requirements for new systems, examining existing systems near impaired waters to determine potential impacts, and repairing or replacing existing systems that may threaten valuable water resources.

Table 3-7. WQMP Project BMPs and Nutrients Load Reduction (kg/yr)

Jurisdiction[1]	BMP Treatment Area (acres)					TP Washoff Reduction (kg/yr)	TN Washoff Reduction (kg/yr)
	Infiltration	Extended Detention	Hydrodynamic Separator	Vegetated Swale	Media Filter		
Local Lake Elsinore Watershed							
Lake Elsinore	707	1995		9		145	395
Canyon Lake Watershed							
Hemet	54	44		10		6	22
Menifee		75				4	6
Moreno Valley	159	1,032	8	21		61	136
Murrieta	8.5					1	3
Perris	513	768	819	114	18	92	267
City of Riverside[2]		511				25	41
County of Riverside		25				1	2
Subtotal	735	2,455	827	145	18	450	476

1) Recent WQMPs assumed to be entirely within the local Lake Elsinore watershed portion of the City of Lake Elsinore's jurisdictional area. For Cities of Canyon Lake, Menifee, and Wildomar, and County of Riverside, recent WQMPs are assumed to be entirely within the Canyon Lake watershed portion of their respective jurisdictional areas
2) Extended detention basins located in March Joint Powers Authority treats all runoff from city of Riverside

The SSMP development employed a GIS screening approach to approximate properties with potentially failing septic systems based on distance from sewer lines and proximity to watercourses, assuming that 10 percent of properties are uninhabited and a 30 percent failure rate for properties with operating septic systems. The current condition washoff of nutrients attributed to septic sources was simulated in the 2010 watershed model update, and is used herein to estimate the load reduction benefits from correcting failing septic systems or improving sewering projects. Modeled loads from septic systems divided into the number of potentially failing septic systems, provides an approximate nutrient load reduction that could be achieved for each septic system corrected by the Permittees (Table 3-8).

Table 3-8. Estimation of Failing Septic System Washoff Rates in Local Lake Elsinore and Canyon Lake Watersheds based on 2010 Watershed Model Update

Variable	Local Lake Elsinore	Canyon Lake below Mystic Lake
Properties w/ septic systems at risk	106	2,204
Properties w/ potentially failing septic[1]	29	595
Modeled TN washoff (kg/yr)	176	854
Modeled TP washoff (kg/yr)	13	56
TN Washoff Rate (kg/failing septic/yr)	6.1	1.4
TP Washoff Rate (kg/failing septic/yr)	0.5	0.1

1) Potentially failing systems assumes 10 percent of properties with septic system at risk are uninhabited and 30 percent of inhabited properties with a septic system at risk are failing

The estimated washoff rates in Table 3-8 are used to approximate the washoff reduction that could be achieved from implementation of the SSMP and sewering projects, assuming either septic system repair for 25 percent of potentially failing septic systems or complete reduction of all septic washoff in areas planned for sewering projects (Table 3-9).

Table 3-9. Estimated Washoff Reduction from SSMP Implementation and Sewering Projects in San Jacinto River Watershed

Jurisdiction	Number of Septic Systems	Failing Septic Systems Managed	TP Washoff Reduction (kg/yr)	TN Washoff Reduction (kg/yr)
Local Lake Elsinore Watershed				
Lake Elsinore	86	6	2.7	36.9
Wildomar	20	2	0.9	12.3
Total	106	8	3.6	49.2
Canyon Lake Watershed				
Canyon Lake	54	4	0.4	5.7
Hemet	20	2	0.2	2.9
Menifee	544	37	3.5	53.1
Moreno Valley	253	18	1.7	25.8
Murrieta	1	0	0.1	1.4
Perris (Enchanted	223	61	5.7	87.5
Riverside County	1,109	75	7.1	107.6
Total	2,204	198	18.6	284.2

In the City of Perris, the Enchanted Heights neighborhood has approximately 223 dwelling units on septic systems. Using the 2010 Model's 10 percent vacancy consideration and a 30 percent septic system failing rate, the number of potentially failing septic systems that would benefit from sewering is 61. In 2011, construction began on a three-year sewer system project to replace the existing septic systems. Converting the Enchanted Heights neighborhood to a wastewater treatment system would provide a conservative nutrient reduction of approximately 6 kg/year of TP and 88 kg/year of TN.

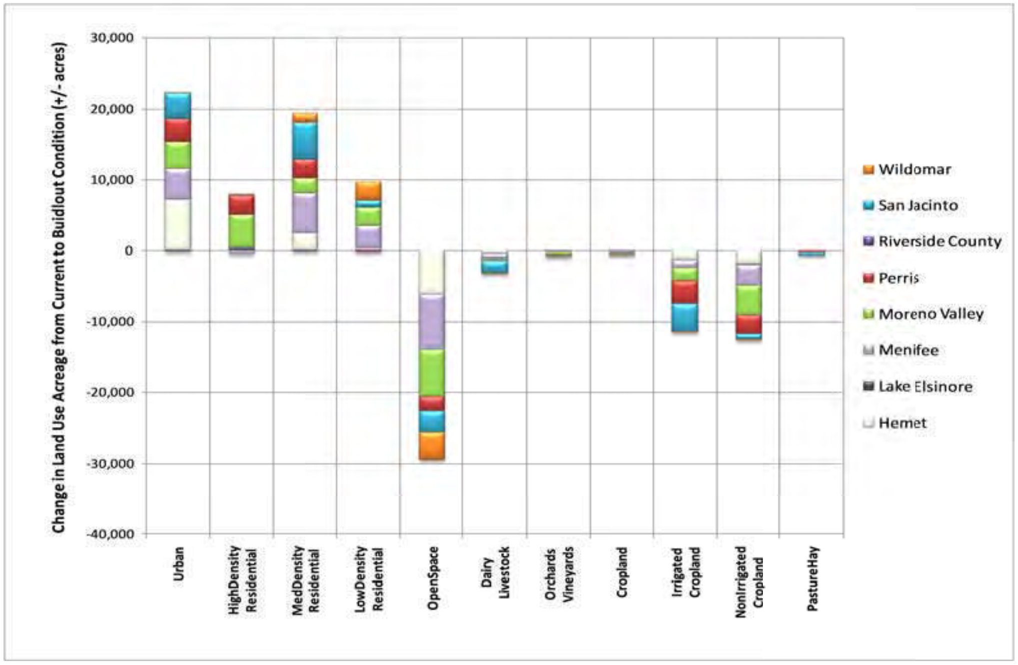
In 2008, the Quail Valley development was incorporated into the City of Menifee. The majority of homes in the development are served by septic systems. There are 1,390 existing dwelling units in Quail Valley of which 1,057 are located in areas scripted to be converted from septic to the regional sewer treatment facility. This potential project would increase the CNRP estimate of septic load reduction from the Quail Valley area if it is implemented in the future; however, it is not included in the load reductions shown in Table 3-9.

3.3.4 Future Low Impact Urban Development

The San Jacinto watershed has significant urban growth potential, which over the long-term will alter the distribution of land use. Since nutrient loading rates or export coefficients vary for different land uses, loading to Lake Elsinore and Canyon Lake will change. Depending upon the pre-developed land use, loads could increase (e.g. converting from open space land use) or decrease (e.g. converting from CAFO land use). Land use types have an associated nutrient loading rate or export coefficient, which contributes to non-point source loading within a watershed. For example, in the Canyon Lake below Mystic Lake watershed, the modeled TP export coefficient from urban land use is 0.08 kg/acre/year, while the forested land use TP export coefficient is 0.02 kg/acre/year.

Current land use was compared to long-term general plan land use projections provided by each Permittee. Figure 3-2 shows the change in land use projected for each Permittee from current to buildout conditions. Only jurisdiction areas in the local Lake Elsinore and Canyon Lake below Mystic Lake watersheds are included in this assessment since the majority of washoff from above Mystic Lake is retained within Mystic Lake. Urban growth potential in the San Jacinto River watershed is an approximate even split between conversion of agricultural lands and development of open spaces (Figure

3-2). For Permittees that are largely built out, washoff reductions may be achieved through re-development of existing land uses with implementation of new LID requirements in WQMPs. However this was not included in the quantification for the CNRP compliance analysis. Tables 3-10 and 3-11 provide current and buildout land use distributions for each of the MS4 Permittees within the local Lake Elsinore and Canyon Lake below Mystic Lake watersheds.



igure 3-2

: General

Table 3-10. Current Land Use for MS4 Permittees in the Local Lake Elsinore and Canyon Lake below Mystic Lake Watersheds

Jurisdiction	Acres	Urban	High Density Residential	Med Density Residential	Low Density Residential	Open Space	Forested	Water	Dairy / Livestock	Orchards / Vineyards	Cropland	Irrigated Cropland	Non Irrigated Cropland	Pasture / Hay
Local Lake Elsinore														
Canyon Lake	316	29		102	3	81	102							
Lake Elsinore	13,376	1,525	145	1,910	327	259	6,026	3,095		18	3	0	69	
Menifee	414				125		273				13	3		
Riverside County	10,574	155	8	787	1,000	57	8,334	110	42	14	24	31	12	
Wildomar	5,074	480		531	1,345	31	2,532		7	32	2	32	84	
Subtotal	29,754	2,188	153	3,330	2,799	428	17,267	3,205	48	63	43	66	164	0
Canyon Lake Watershed (below Mystic Lake)														
Canyon Lake	2,653	46	17	1,128	63	61	853	470	9				6	
Hemet	13,020	1,916	414	2,973	105	930	3,537	191	181	3	20	867	1,883	
Lake Elsinore	1,573	124		254	11	13	1,171							
Menifee	28,580	3,194	292	4,675	3,413	1,594	6,412	640	746	210	199	1,232	5,971	
Moreno Valley	27,009	3,316	339	8,512	2,224	1,004	6,605	331	125	236	56	1,814	2,447	
Murrieta	375	75	18	235	9	26								12
Perris	20,277	2,925	154	2,056	1,055	2,151	4,917	470	50	144	49	3,269	2,710	327
Riverside	511	39		459		13								
Riverside County	105,128	4,655	174	1,571	10,591	6,600	61,047	3,215	2,636	705	337	7,960	5,637	
San Jacinto	223	30			7	14	60	27	15			34	35	
Wildomar	7	0					7							
Subtotal	199,496	16,396	1,404	21,833	17,487	12,387	84,656	5,356	3,771	1,298	661	15,178	18,742	327

Table 3-11. General Plan Buildout Land Use for MS4 Permittees in the Local Lake Elsinore and Canyon Lake below Mystic Lake Watersheds

Jurisdiction	Acres	Urban	High Density Residential	Med Density Residential	Low Density Residential	Open Space	Forested	Water	Dairy / Livestock	Orchards / Vineyards	Cropland	Irrigated Cropland	Non Irrigated Cropland	Pasture / Hay
Local Lake Elsinore														
Canyon Lake	316	29		102	3	81	102							
Lake Elsinore	13,376	1409	511	1823	215	2226	4423	2770	0	0	0	0	0	0
Menifee	414	110	2	150	99	46	7	0	1	0	0	0	0	0
Riverside County	10,574	196	9	1,003	1,203	31	7,900	110	42	14	24	31	12	0
Wildomar	5,074	376	80	1402	3048	168	0	0	0	0	0	0	0	0
Subtotal	29,754	2,119	602	4,480	4,567	2,551	12,432	2,879	43	14	24	31	12	0
Canyon Lake Watershed (below Mystic Lake)														
Canyon Lake	2,653	46	17	1,128	63	61	853	470	9				6	
Hemet	13,020	7,014	414	4,763	638	0	0	191						
Lake Elsinore	1,573	209	76	270	32	330	656	0						
Menifee	28,580	7,503	292	10,104	6,750		70	640	79			79	3,062	
Moreno Valley	27,009	5,966	4,180	8,823	4,009	3,701	0	331						
Murrieta	375	75	18	235	9	26								12
Perris	20,277	6,213	2,791	4,729	1,051	3,643	1,380	470						
Riverside	511	39		459		13								
Riverside County	105,128	9,007	255	12,145	32,786	5,552	37,309	3,215	1,272	705	337	1,272	1,272	0
San Jacinto	223	30			7	14	60	27	15			34	35	
Wildomar	7	0					7	0						
Subtotal	199,496	36,180	8,038	42,625	45,353	13,321	40,381	5,356	1,384	705	338	1,385	4,428	0

For each Permittee in each watershed analysis zone, area-weighted averages of land use specific TP and TN loading rates were computed for current landuse and projections at buildout as well as estimates of urban growth by the year 2020. The Riverside County economic forecast developed by Caltrans provided a means to project the portion of urban growth that will occur by 2020, when compliance with the LE/CL nutrient TMDL must be achieved (http://www.dot.ca.gov/hq/tpp/offices/eab/socio_economic_files/2011/Riverside.pdf). Figure 3-3 shows the projected rate of growth over time from 2010 until the projected buildout date of 2035. This growth rate was used to compute dynamic land use based loading between 2010 and 2020 for TP and TN in Canyon Lake below Mystic Lake (Figures 3-4 and 3-5) and local Lake Elsinore (Figures 3-6 and 3-7) watersheds. The impact of urbanization is not as significant in the Lake Elsinore watershed.

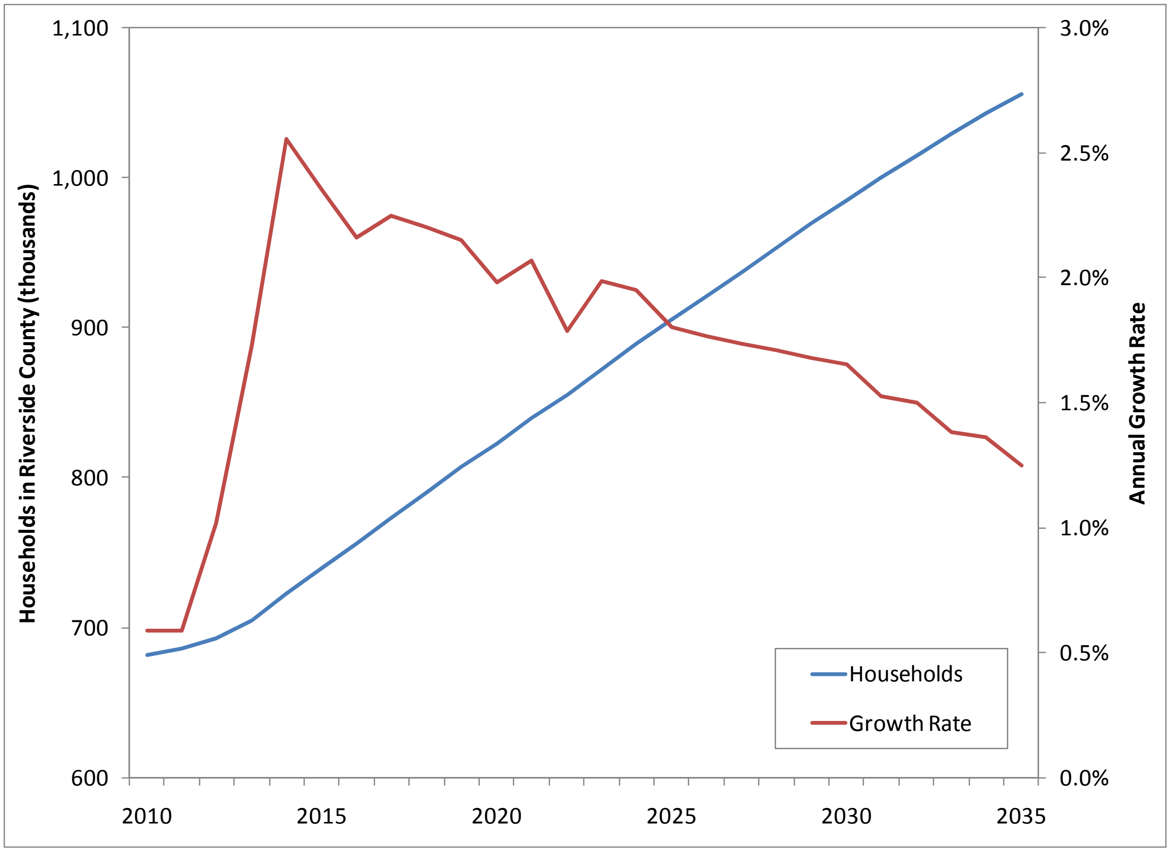


Figure 3-3
Projected Growth Rate for Urban Development in Riverside County (from Caltrans, 2011)

Also accounted for in these estimates of loading rate change are assumed reductions to account for LID requirements in WQMPs. LID BMPs will reduce nutrient washoff rate below those currently assumed for urban land uses in the watershed model. For planning purposes, 40 percent of future WQMPs are assumed to provide complete on-site retention of the water quality volume. For the remaining 60 percent of future WQMPs, it was assumed that biotreatment of the water quality volume would be 75 and 24 percent effective in removing TP and TN, respectively.

The expected change in nutrient washoff from urban growth and future LID is summarized for each Permittee in Table 3-12. Figure 3-8 shows the difference between current and 2020 weighted average loading rates for TP and TN for jurisdictions with significant growth potential (positive = net increasing load; negative = net load reduction).

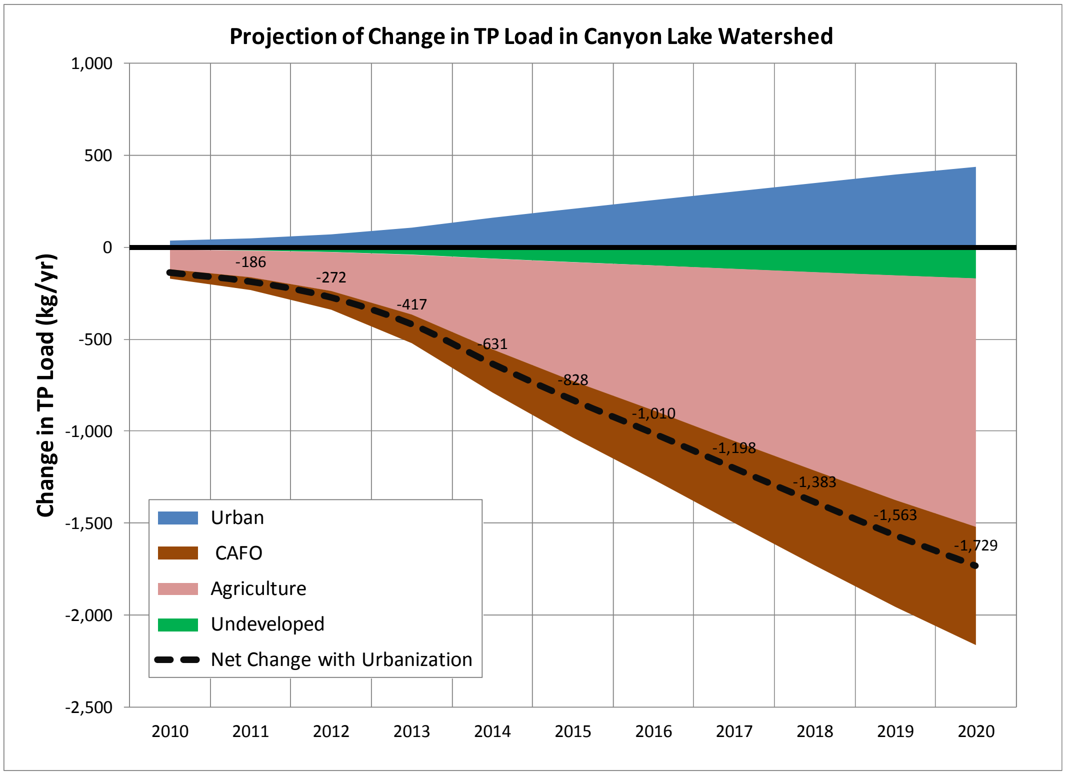


Figure 3-4
Projected TP Load from Urban, Agriculture, CAFO, and Undeveloped Lands in Canyon Lake Watershed

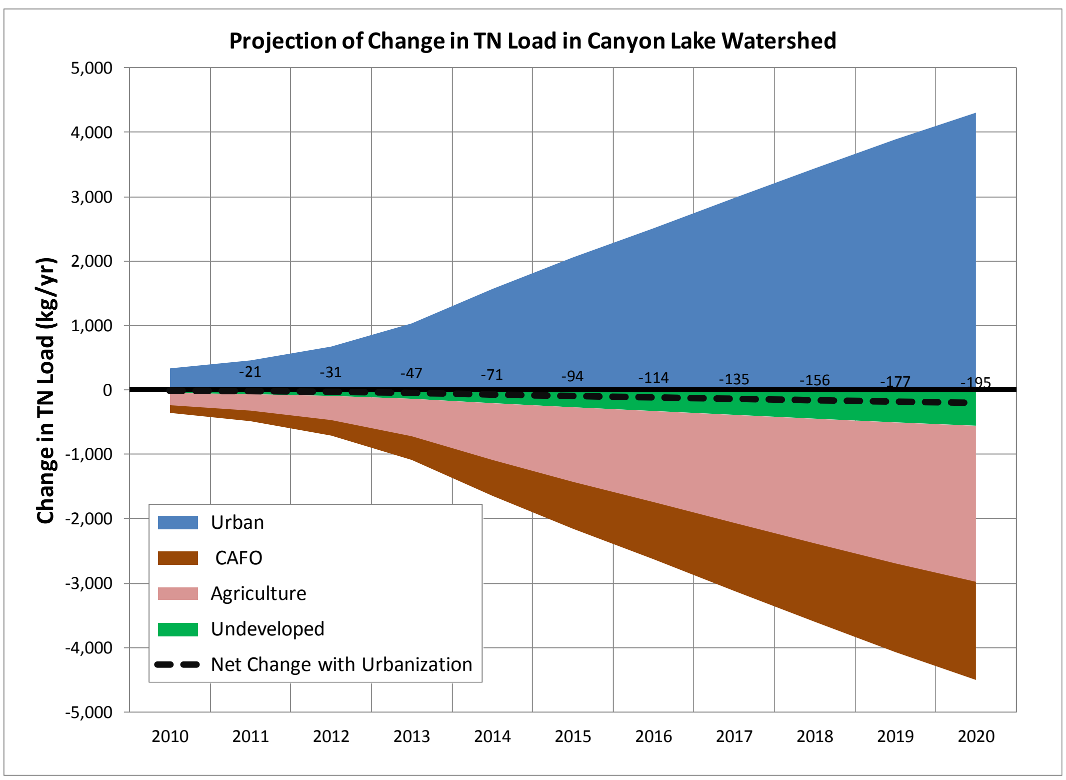


Figure 3-5
Projected TN Load from Urban, Agriculture, CAFO, and Undeveloped Lands in Canyon Lake Watershed

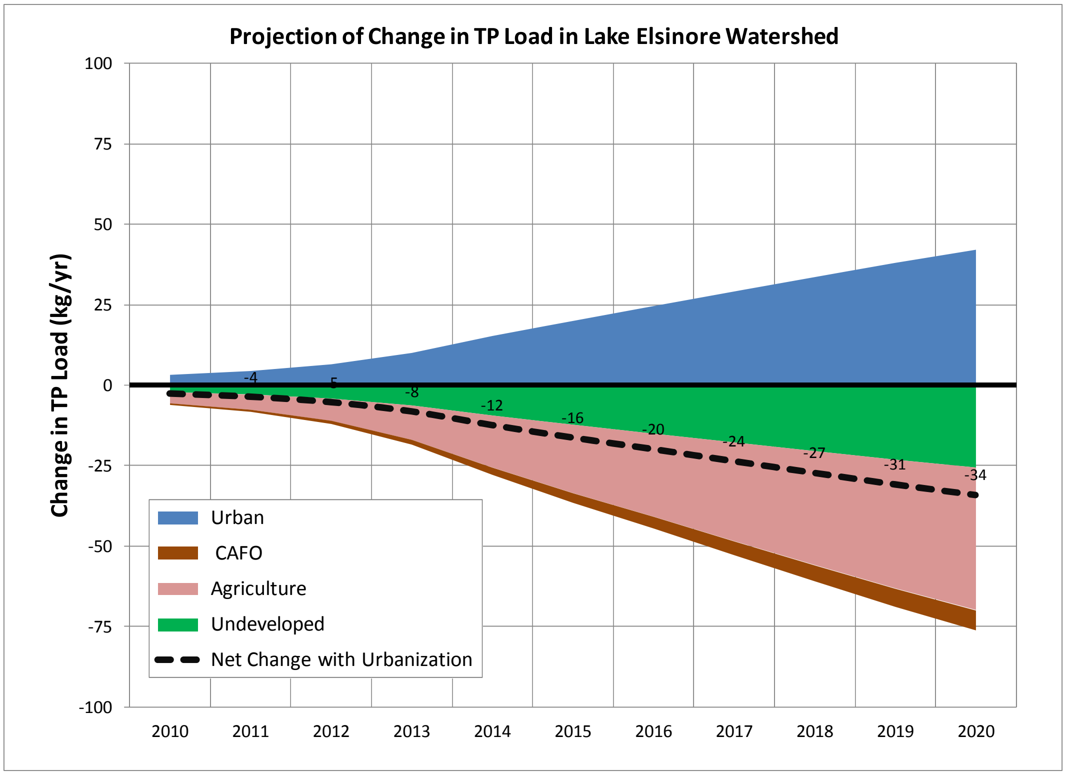


Figure 3-6
Projected TP Load from Urban, Agriculture, CAFO, and Undeveloped Lands in Lake Elsinore Watershed

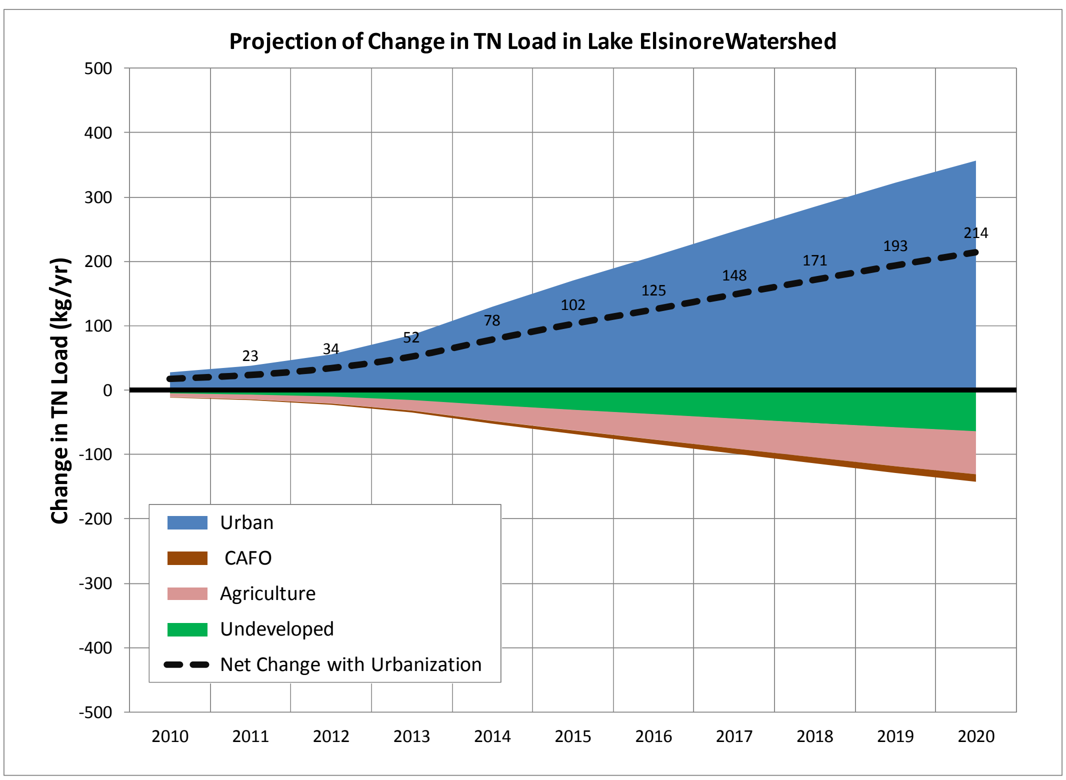


Figure 3-7
Projected TN Load from Urban, Agriculture, CAFO, and Undeveloped Lands in Lake Elsinore Watershed

Table 3-12. Change in Washoff as a Result of Urban Development for MS4 Permittees based on Projections of Buildout Land Use Distribution

MS4 Permittee	Jurisdictional Area (acres)	Current Loading Rate (kg/ac/yr)		Projected Buildout Loading Rate (kg/ac/yr)		Washoff Reduction / (Increase) (kg/yr)	
		TP	TN	TP	TN	TP	TN
Local Lake Elsinore Watershed							
Canyon Lake	316	0.06	0.25	0.06	0.25	0	(0)
Lake Elsinore	13,376	0.04	0.17	0.04	0.18	16	(63)
Menifee	414	0.06	0.16	0.05	0.27	2	(46)
Riverside County	10,574	0.05	0.15	0.05	0.16	(2)	(78)
Wildomar	5,074	0.07	0.23	0.05	0.29	60	(287)
Total	29,754					75	(474)
Canyon Lake Watershed [1]							
Canyon Lake	2,653	0.05	0.28	0.05	0.28	0	0
Hemet	13,020	0.10	0.31	0.05	0.32	652	(90)
Lake Elsinore	1,573	0.03	0.15	0.04	0.18	(3)	(42)
Menifee	28,580	0.12	0.32	0.07	0.31	1450	369
Moreno Valley	27,010	0.09	0.32	0.06	0.33	881	(154)
Murrieta	375	0.08	0.46	0.08	0.46	0	0
Perris	20,277	0.09	0.24	0.04	0.25	1083	(152)
Riverside	511	0.09	0.53	0.09	0.53	0	0
Riverside County	105,127	0.08	0.18	0.05	0.17	3317	792
San Jacinto	223	0.16	0.32	0.16	0.32	0	0
Wildomar	7	0.02	0.05	0.02	0.05	0	0
Total	199,496					7380	722

1) Only areas below Mystic Lake were evaluated for change in watershed washoff as a result of future urban development incorporating LID requirements in WQMPS

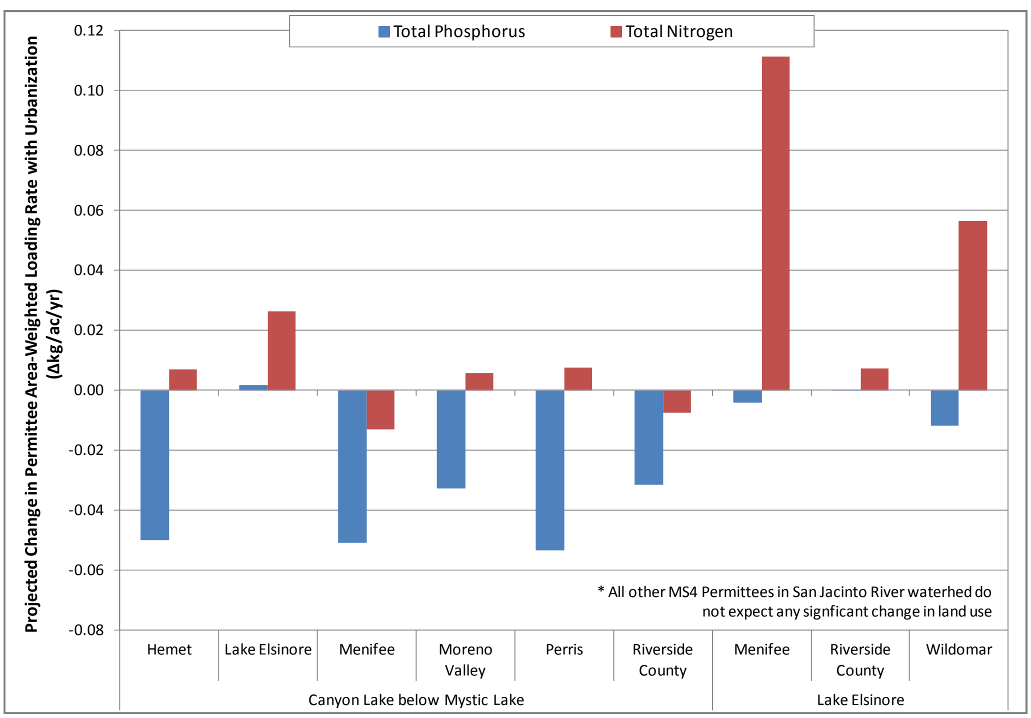


Figure 3-8

Change in Land Use Area Weighted Loading Rates from 2010 to 2020 for Permittees with Urban Growth Potential in the San Jacinto River Watershed

3.3.5 Watershed BMP Summary

Table 3-13 provides a summary of the estimated reduction of TP and TN washoff from MS4 drainage areas in the local Lake Elsinore and Canyon Lake watersheds. Washoff reductions include accrued benefits from MS4 program implementation since the adoption of the TMDL as well as future projections of program implementation. Future development in the watershed generates the greatest reduction in TP loading for the Canyon Lake watershed, due to the combined benefit of lower TP washoff rates for urban land uses (as compared to agricultural land uses) and the additional reduction in urban washoff from new WQMP requirements. Conversely, future development is expected to result in a net *increase* in loading for TN in Canyon Lake and TN and TP in the Lake Elsinore watershed. Increased washoff of nutrients occurs when expected benefits of new LID requirements for new development do not offset higher washoff rates for urban land use relative to pre-developed condition. For example, open space/forest have lower TP and TN washoff rates and some agricultural land uses have lower TN washoff rates relative to some urban land use categories.

Table 3-13. Summary of Expected Watershed Nutrient Washoff Reduction from Implementation of MS4 Stormwater Programs for Lake Elsinore and Canyon Lake Watersheds

MS4 Permittee	Street Sweeping and Debris Removal (kg/yr)		Existing WQMP BMPs (kg/yr)		Septic System Management / Sewering (kg/yr)[1]		2010-2020 Average Future Urban LID (kg/yr)[2]		Total Watershed Washoff Reduction (kg/yr)	
	TP	TN	TP	TN	TP	TN	TP	TN	TP	TN
Local Lake Elsinore Watershed										
Canyon Lake	0	0					0	(0)	0	0
Lake Elsinore	47	157	145	395	3	37	4	(14)	198	575
Menifee	0	0					0	(10)	0	-10
Riverside County	6	20					(0)	(17)	5	3
Wildomar	4	13			1	12	13	(63)	18	-38
Total	57	189	145	395	4	49	17	(104)	222	529
Canyon Lake Watershed below Mystic Lake										
Canyon Lake	1	4			0.4	6	0	0	2	10
Hemet	114	380	9	22	0.2	3	143	(20)	267	385
Lake Elsinore	6	19					(1)	(9)	5	9
Menifee	5	18	4	6	3.5	53	319	81	331	158
Moreno Valley	132	442	70	136	1.7	26	194	(34)	398	570
Murrieta	4	14	1	3	0.1	1	0	0	5	18
Perris	86	286	341	267	5.7	88	238	(33)	671	607
Riverside	4	14	25	41			0	0	29	56
Riverside County	52	175	1	2	7.1	108	730	174	790	458
Total	406	1352	450	476	19	284	1,624	159	2,500	2,271

1) Loading factor not required in accounting for failing septic system reductions in lake loads. For all other watershed BMPs, loading factor must be included in determining resulting reduction in loads to lakes

2) Negative values indicate an increase of watershed nutrient washoff. Change in loads as a result of urbanization is representative of roughly 22 percent of buildout growth forecasted to occur by 2015.

Reductions of watershed nutrient washoff translate to reductions in nutrient load to Canyon Lake and Lake Elsinore based on the appropriate loading factors in Table 3-3. Table 3-14 shows the remaining load reduction requirement after accounting for watershed washoff reductions. For the Lake Elsinore TMDL, the MS4 Permittees will meet these load reductions through implementation of in-lake remediation projects. For the Canyon Lake TMDL, the remaining load reductions are used for allocating responsibility between the upstream MS4 Permittees. The values reported in Table 3-14 are based on a projection of 22 percent of urban growth occurring by 2015 in the San Jacinto River watershed. This closely approximates the 2010-2020 average and is therefore consistent with the averaging period for WLAs included in the TMDL. Figure 3-9 shows the projected trend in load reduction needs from in-lake remediation strategies in both Canyon Lake and Lake Elsinore. The changes in load reduction requirements over time show an increasing need to reduce TN and a decreasing need to reduce TP. This is largely due to higher TN loading rates for residential land uses in the 2010 watershed model.

Table 3-14. Calculated Load Reduction Requirements to be Achieved with In-Lake Remediation Projects

MS4 Permittee	Total Load Reduction Requirement (kg/yr)		Watershed Load Reduction / (Debit) [1] kg/yr)		In-Lake BMP Load Reduction Requirement (kg/yr) [2]	
	TP	TN	TP	TN	TP	TN
Local Lake Elsinore Watershed [2]						
Canyon Lake	10	58	0	0	10	58
Lake Elsinore[3]	217	1,202	198	575	19	627
Menifee	4	13	0	(10)	4	23
Riverside County	83	446	5	3	78	443
Wildomar	103	556	18	(38)	85	594
Total	417	2,275	222	529	195	1745
Canyon Lake Watershed						
Canyon Lake	52	145	1	8	51	137
Hemet	96	320	139	232	(43)	88
Lake Elsinore	18	44	3	6	15	38
Menifee	199	578	174	116	25	462
Moreno Valley	509	1,486	208	352	301	1,134
Murrieta	1	2	3	17	(2)	(15)
Perris	169	455	352	399	(183)	56
Riverside	16	52	15	33	1	19
Riverside County	261	609	414	318	(153)	291
Total	1,320	3,691	1308	1477	11	2,209

1) Load reduction from watershed takes into account a washoff loading factor, whereby only a portion of the expected washoff reduction in Table 3-13 is translated to a reduction in loading to Lake Elsinore and Canyon Lake. Load reductions for septic system management and sewering projects are not subject to this loading factor because the watershed model simulated failing septic systems as direct points sources to Lake Elsinore and Canyon Lake.

2) Does not include baseline sediment nutrient flux reduction necessary to create assimilative capacity for phosphorus in Lake Elsinore, allowing for TMDL WLAs above zero.

3) The City of Lake Elsinore currently participates in, or operates, several in-lake watershed programs that exceed their current load reduction obligations shown above. These programs include aeration, fishery management and lake-water addition

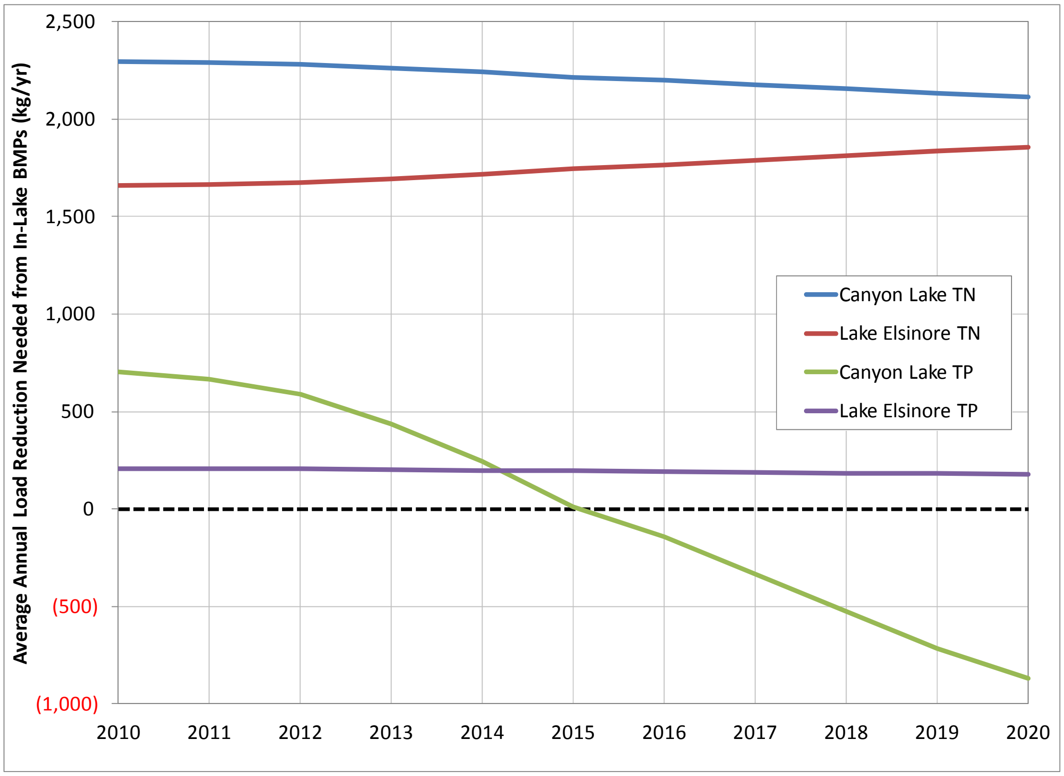


Figure 3-9
Projection of Remaining Load Reduction Needed, After Accounting for Watershed BMPs, to Reduce Existing Urban + Septic Loads to Respective WLAs and LAs

3.4 Load Reduction from In-Lake Remediation Projects

Reducing loads down to the WLA via watershed-based BMPs alone would be nearly impossible and extremely costly. Watershed-based BMPs would need to be designed to treat extreme storm events; whereas they are typically designed to treat smaller storm events (e.g. 1" or less of rainfall). Additionally, watershed controls would require significant rights-of-way to store and treat rainfall runoff from the 740 sq. mi. watershed. For example, using unit costs of $20,000-$80,000 per impervious acre treated (CWP, 2007) and an estimate of total watershed imperviousness of ~25,000 acres (30percent of urbanized land use), estimated total cost for the Lake Elsinore and Canyon Lake watersheds could range from $500 million to $2 billion if watershed BMPs were solely deployed.

Alternatively, for lake-nutrient TMDLs, water quality objectives can be achieved through the implementation of in-lake remediation projects in Lake Elsinore and Canyon Lake. Reduction of internal nutrient loads can offset reductions required from urban and septic sources that cannot be achieved with existing and planned watershed BMPs. Additionally, in-lake BMPs can be designed to achieve numeric targets for response variables in the TMDL, which include annual average chlorophyll-a and daily average DO. The following sections describe existing in-lake remediation activities ongoing in Lake Elsinore that provide sufficient nutrient reduction to offset the remaining load reduction needed to achieve WLAs and LAs for urban and septic sources. Also included is a new in-lake remediation project planned for Canyon Lake that will demonstrate compliance with the TMDL by achieving numeric targets for response variables chlorophyll-a and DO.

3.4.1 Lake Elsinore

Three in-lake remediation projects (or BMPs) are being implemented currently in Lake Elsinore: operation of aeration/mixing system, fishery management, and lake stabilization through the addition of reclaimed water. Various parties subject to the TMDL have implemented each of these projects through the Task Force. The Permittees have determined that support of aeration/mixing is sufficient to achieve in-lake nutrient load reduction needed to offset remainder of urban and septic load in excess of WLAs and LAs, as demonstrated in this section.

An average annual estimate of internal TP loading from sediments of 33,160 kg/yr for Lake Elsinore was found to exceed the TMDL allocation of 28,634 kg/yr, leaving no assimilative capacity for external loading (Regional Board, 2004). However, since the Lake Elsinore aeration/mixing system was planned for implementation at the time of TMDL adoption, a 35 percent TP reduction was assumed to create assimilative capacity and allow for development of LAs and WLAs for external sources, including open space. This assumed reduction in TP requires that all sources with WLA or LAs in the San Jacinto River watershed continue to operate the aeration system to achieve the presumed 35 percent TP reduction, referred to as the baseline sediment nutrient reduction requirement. For the MS4 Permittees, the baseline sediment nutrient reduction requirement is approximately 875 kg/yr, 7.5 percent of the total presumed load reduction of 11,606 kg/yr (35 percent of 33,160 kg/yr internal TP load). Table 3-15 provides the basis for determining the MS4 Permittee portion of the baseline sediment nutrient reduction requirement.

Table 3-15. Baseline Sediment Nutrient Reduction Requirement for MS4 Permittees

Nutrient Source	Watershed	WLA/LA Relative to Total Lake Elsinore WLA[1]	Baseline Sediment Nutrient Reduction Requirement (kg/yr)
Urban	Local Lake Elsinore	1.8%	208
	Canyon Lake [2]	3.2%	370
Septic	Local Lake Elsinore	1.0%	116
	Canyon Lake [2]	1.4%	168
Total		7.4%	861

1) For the local Lake Elsinore watershed, the urban WLA of 124 kg/yr is 1.8% and the septic LA of 69 kg/yr is 1.0% of total external load allocation of 6,922 kg/yr for reclaimed water, urban, septic, agriculture, and transfer from Canyon Lake

2) Transfer WLA from Canyon Lake watershed of 2,770 kg/yr is 40% of total external load allocation of 6,922 kg/yr. The urban and septic portion of the transfer from Canyon Lake to Lake Elsinore was assumed to be equal to the relative allocation of allowable loads in the Canyon Lake TMDL; urban WLA of 306 kg/yr is 8.0% and septic LA of 139 kg/yr is 3.6% of the total external load allocation of 3,845 kg/yr. Therefore the portion of baseline sediment nutrient reduction requirement assigned to urban and septic nutrient sources in Canyon Lake watershed is 3.2% (0.40 * 0.08) and 1.4% (0.40 * 0.036), respectively.

In addition to the baseline sediment nutrient reduction requirement, the MS4 Permittees in the local Lake Elsinore watershed must demonstrate ~200 kg/yr TP reduction and ~1,800 kg/yr TN reduction. Table 3-16 summarizes the water quality benefits of existing Lake Elsinore in-lake BMPs. As shown, the aeration system has more than enough capacity to meet baseline sediment nutrient reductions and additional needs to meet urban WLAs and septic LAs.

Table 3-16. Summary of Water Quality Benefits of Existing and Potential Supplemental Lake Elsinore In-Lake BMPs

In-Lake BMP	Nutrient / Response Variable	Benefit	Process
Aeration system	Phosphorus	11,606 kg/yr [1]	Suppression of sediment nutrient flux
	Nitrogen	11,600 kg/yr [3]	Nitrification / denitrification
		17,500 kg/yr [3]	Sequestration in benthic felt
	Dissolved Oxygen	~2 mg/L at bottom	Mixing of water column
Fishery management	Phosphorus	1,670 kg/yr [4]	Reduction of bioturbation by Carp
	Chlorophyll	Unknown	Reduction of zooplankton predation by Shad
Reclaimed water addition / lake level stabilization	Chlorophyll	10.2 ug/L	Increased depth increases light limitation needed for algal growth; increased habitat for zooplankton that predate algae; decreased salinity allows for zooplankton survival
	Nitrogen	1.5 kg/yr per AF of reclaimed water addition[5]	Increased bank vegetation density provides sink for nutrient
	Phosphorus	0.15 kg/yr per AF of reclaimed water addition[5]	Increased bank vegetation density provides sink for nutrient and stabilizes bottom sediment; Prevention of wind-driven re-suspension; dilution of Soluble Reactive Phosphorus (SRP) released from sediment

1) Assumed reduction in TMDL
2) Based on estimate of study of Lake Elsinore following aeration (Horne, 2009)
3) Based on study of bioturbation role in internal nutrient flux (Anderson, March 2006). Bioturbation by Carp are estimated to cause 6.9% of internal loading. Reduction of carp by 75% would reduce total TP internal load by 1,570 kg/yr (33,160*0.069*0.75)
5) Horne, 2011 developed a relationship between nutrient load reduction and reduced chlorophyll concentration of 10.2 ug/L per foot of water level rise observed in the summer season following the 2004-05 wet season. For an average annual water level increase of 1.7 ft achieved by addition of 6,000 AFY of reclaimed water, an estimated 0.9 tons TP and 9.0 tons TN would offset nutrients associated with reclaimed water addition The City of Lake Elsinore has a 50/50 cost share with EVMWD for current reclaimed water additions to stabilize lake levels.

Table 3-17 shows the portion of TP and TN load reduction required for each MS4 Permittee, including the baseline sediment nutrient reduction. If monitoring data show that the existing BMPs are not sufficient to achieve the WLA or in-lake response variable numeric targets, supplemental nutrient control strategies may be a part of an adaptive implementation strategy.

Since the 10 year running average in 2020 includes lake water quality data beginning in 2010, some portion of the compliance period will not reflect conditions with CNRP implementation underway. There are numerous elements of the CNRP intended to provide a margin of safety that could help alleviate the higher internal loading rates in the beginning years of the 2010-2020 compliance averaging period. The CNRP implementation schedule provides a roadmap to assist the MS4 Permittees in implementing key elements of the plan as efficiently as possible to increase the number of years when water quality benefits from internal loading offset are able to accrue.

Table 3-17. Lake Elsinore In-Lake BMP Load Reduction Requirements for MS4 Permittees

Jurisdiction	Baseline Sediment Nutrient Reduction (kg TP/yr)	Load Reduction Needed to Meet WLA (kg TP/yr)	Total TP Load Reduction Needed (kg/yr)	Total TN Load Reduction Needed (kg/yr)
Beaumont [1]	0.01		0.01	
Canyon Lake	20	10	30	57
Hemet [1]	29		29	
Lake Elsinore[2]	207	19	226	627
Menifee	108	4	112	23
Moreno Valley [1]	169		169	
Murrieta [1]	0.4		0	
Perris [1]	49		49	
Riverside [1]	4		4	
Riverside County	215	77	293	444
San Jacinto [1]	0.04		0.04	
Wildomar	73	85	158	594
Total	875	195	1,070	1,745

1) MS4 Permittees in Canyon Lake watershed responsibility is only to meet the baseline sediment nutrient reduction requirement only

2) The City of Lake Elsinore currently operates several in-lake treatment systems that result in load reductions exceeding their regulatory requirements including aeration, fishery management and lake water addition.

3.4.2 Canyon Lake

This compliance analysis for Canyon Lake uses response targets of nutrient related impairments, chlorophyll-a and DO, to demonstrate compliance using a lake water quality model, in lieu of achieving load reductions needed to meet WLAs and LAs for nutrients TP and TN. The Riverside County MS4 Permit allows the Permittees to use the response targets exclusively to demonstrate compliance with the TMDL (Order R8-2010-0033, Section VI.D.2.k.ii). The following sections describe how the use of alum additions will achieve compliance with the response targets for chlorophyll-a and DO.

A one dimensional lake water quality model, DYRESM-CAEDYM, was developed by the Task Force for use in evaluating nutrient management strategies for Canyon Lake and Lake Elsinore. The analysis of in-lake nutrient management alternatives to achieve response targets does account for estimated load reductions from watershed BMPs included in this CNRP by reducing daily inflow loads to DYRESM-CAEDYM. Since watershed load reductions are estimated on an annual basis, an assumption was made that percent load reductions are roughly equivalent for different seasons and storm event sizes, allowing for daily inflow loads reductions at the same percentage as annual reductions (Table 3-18). Table 3-18 includes additional watershed load reductions projected from implementation of Western Riverside County Agricultural Coalition's (WRCAC) agriculture nutrient management plan (AgNMP) for the CL/LE Nutrient TMDL and from expectation of continued improvement to vehicle emissions as a result of more stringent federal and state air quality standards (State Implementation Plan, South Coast Air Quality Management District).

The Task Force has completed detailed evaluations of aeration, oxygenation, and chemical addition (Anderson, 2008; CDM, 2011; Anderson, 2012b; Anderson, 2012c). Based on these evaluations, the Task Force has determined that chemical addition, using aluminum sulfate (alum), is the most effective in-lake nutrient control strategy to achieve interim numeric targets for the response variables, chlorophyll-a and DO. Appendix C provides the basis for this determination.

Table 3-18. Projected External Nutrient Load Reduction to Canyon Lake from all Jurisdictions with Allocated Loads

Nutrient Reduction Source	TN Load Reduction (kg/yr)	TP Load Reduction (kg /yr)
Land use change (2003 to 2010)	2828	818
Stormwater program implementation	955	182
Future urbanization w/ LID (2010 to 2020)	-217	649
Atmospheric Deposition [1]	384	0
AgNMP Projects	835	208
Estimated Load Reduction	4,785	1,857
External Load to Lake from 2010 Model Update	32,209	8,932
% of TMDL External Load	15%	21%

1) Reduced emissions of NOx from new air quality standards are expected to reduce atmospheric NOx concentrations in southern California by 60% (State Implementation Plan, South Coast Air Quality Management District). Based on recent TMDL implementation planning in the Chesapeake Bay, it was assumed this reduced NOx concentration could translate into 20% less TN load from direct atmospheric deposition over Canyon Lake. This reduction does not account for reduced deposition and subsequent washoff from watersheds.

3.4.2.1 Chlorophyll-a Response Target

When alum is added to a waterbody, an aluminum hydroxide precipitate known as floc is formed. The floc binds with phosphorus in the water column to form an aluminum phosphate compound which will settle to the bottom of the lake or reservoir. Once precipitated to the bottom of the reservoir, the floc will also act as a phosphorus barrier. It binds any phosphorus released from the sediments during normal nutrient cycling processes that occur primarily under anoxic conditions such as those found in much of the hypolimnion at Canyon Lake. The aluminum phosphate compounds are insoluble in water under most conditions, including those in Canyon Lake, and will render all bound phosphorus unavailable for nutrient uptake by aquatic organisms. It is through the reduction of bioavailable phosphorus that alum additions reduce the growth of algae in Canyon Lake, as measured by chlorophyll-a concentration in water samples.

Algae need both nitrogen and phosphorus for growth. The limiting nutrient is the one that is completely used for algal growth while some of the other still remains in its bioavailable form. Thus, only reductions of the limiting nutrient would be expected to generate reductions in algal growth. A Redfield ratio of TN to TP of greater than 7 suggests the waterbody in phosphorus limited, while a ratio less than 7 suggests the waterbody in nitrogen limited. Historical water quality data for Canyon Lake shows that the system is weakly nitrogen limited (Figure B-18). However, alum additions are only effective for addressing phosphorus. Thus, Canyon Lake alum additions are designed to reduce phosphorus sufficiently to create a condition of phosphorus limitation before generating any positive results toward compliance with the chlorophyll-a response target.

Seasonality

Generally, algal blooms in Canyon Lake occur at similar times of year (Figure 3-10) and are primarily a function of nutrient loading trends. For this reason, the Alum applications described in this CNRP were developed to reduce seasonal chlorophyll-a concentrations crested by these algal blooms, despite the numeric target being an annual average basis. This approach provides an additional MOS for compliance. In addition, this approach is more likely to gain support from the public as it addresses the impairment as it occurs. I.e. clears up the lake water.

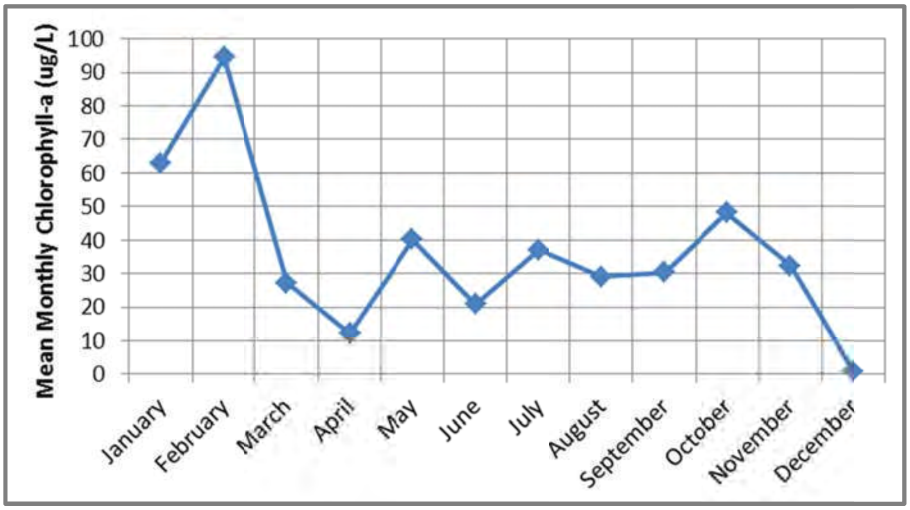


Figure 3-10
Mean Monthly Chlorophyll-a in Main Body of Canyon Lake

The first algal bloom occurs around February and is caused by the presence of nutrient rich external loads in dissolved or suspended particulate form that remain in Canyon Lake at the end of the wet season, coincident with increasing daylight hours and water temperatures. The second algal bloom occurs around October and is caused by turnover of the lake, which brings nutrient enriched water from the hypolimnion to the photic zone where it serves as a food source for algae. This source of nutrients comes from internal loads released from bottom sediments into the hypolimnion during the period of thermal stratification (roughly March through October). The presence of anoxic conditions in the hypolimnion increases the rate of nutrient flux from bottom sediments and subsequent loading of nutrients to photic zone at turnover. To address both periods of enhanced algal growth, alum applications to Canyon Lake are proposed twice per year, once around February 15th, and again around September 15th.

Analysis for Main Body

The DYRESM-CAEDYM model was used to estimate the reduction of bioavailable phosphorus that would be needed to limit algae growth, and maintain average annual chlorophyll-a concentration at less than 25 ug/L in all hydrologic years. Adsorption isotherms were then used to estimate the required dose of alum needed to reduce phosphorus from current levels to the target concentration. Results showed that a dose of 10 mg/L of alum (~1 mg/L as Al) would effectively reduce 10-year averages of chlorophyll-a from ~35 ug/L to less than ~5 ug/L by reducing TP from ~0.31 mg/L to ~0.15 mg/L (Anderson, 2012e). The model predicted a significant reduction in chlorophyll-a despite average TP concentrations being above the TMDL numeric target of 0.1 mg/L. The reason for this is that the reduction accounts for most of the bioavailable pool of phosphorus (i.e. dissolved orthophosphate form). At a relatively low dose of 10 mg/L, alum forms a less than typical floc size or "microfloc", which has a longer residence time as it settles through the water column. The longer residence time allows for chemical processes needed to bind dissolved forms of phosphorus relative to heavier doses (50-100 mg/L) that largely only provide physical entrainment of particulates as a larger floc settles through the water column (Moore et al., 2009). EVMWD conducted jar tests to determine the reduction of TP that could be achieved at varying doses of alum (see Attachment C). Jar test results from the two Main Body monitoring locations (CL07 and CL08) showed that a dose of 10 mg/L alum would result in a TP reduction of ~0.15 mg/L, which presumably is mostly in the form of dissolved orthophosphate.

Analysis for East Bay

The one dimensional DYRESM-CAEDYM model simulates a lake wide average vertical profile of water quality, therefore areas of relatively greater concern for chlorophyll-a are averaged with areas of typically better water quality. of a particular interest to the MS4 Permittees is the East Bay of Canyon Lake. The East Bay is shallower than the Main Body, receives runoff from a different subwatershed, has higher nutrient concentrations, more dense and persistent algal blooms, and experiences minimal lateral mixing with the Main Body of the lake. A separate analysis using CDM Smith's Small Lake Assessment Model (SLAM) was completed for this zone of Canyon Lake to assess whether alum can be effective for reducing chlorophyll-a (CDM Smith, 2012). Once calibrated using historical nutrient and chlorophyll-a data (2007 – 2010), SLAM was used to test the effect of reduced water column TP on chlorophyll-a. SLAM results suggest that TP would need to be reduced to ~0.05 mg/L to reduce seasonal chlorophyll-a concentrations to below the numeric target of 25 ug/L (Figure 3-11). This differs from the DYESM-CAEDYM results, because SLAM does not partition dissolved and particulate forms of phosphorus. The alum application in the East Bay is heavier than in the Main Body and will therefore not act as a microfloc targeting primarily dissolved orthophosphate as is planned for the Main Body. Thus, simulation of total phosphorus is appropriate for the East Bay as additional removal of particulate phosphorus will occur.

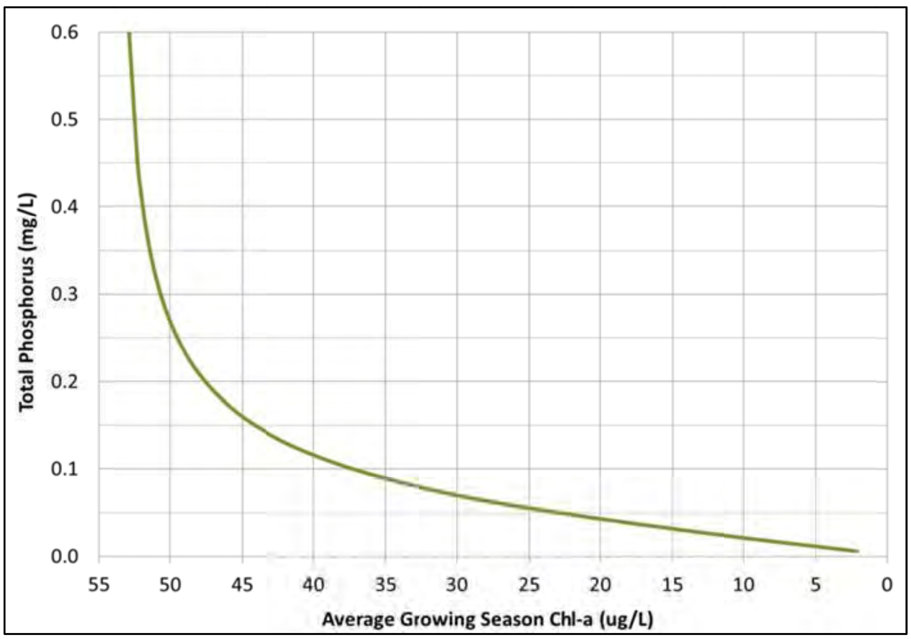


Figure 3-11
SLAM Results Showing Chlorophyll-a for Varying Reductions in Total Phosphorus during Growing Seasons

EVMWD jar test results from the two East Bay monitoring locations (CL09 and CL10) showed that a dose of 20-40 mg/L alum would result in a TP of ~0.05 mg/L, therefore a heavier dose of 30 mg/L alum (~3 mg/L as Al) was selected for East Bay alum applications (Attachment C).

3.4.2.2 Dissolved Oxygen Response Target

The numeric target for DO in the CL/LE Nutrient TMDL is not limited to conditions that exist "as a result of controllable water quality factors", which is contained in the Basin Plan WQO for DO. The TMDL Staff Report recognizes uncertainty and comes to the resolution that "as the relationship between nutrient input and dissolved oxygen levels in the lakes is better understood, the TMDL targets for dissolved oxygen can be revised appropriately to ensure protection of aquatic life beneficial uses". Accordingly, the Task Force developed a DYRESM-CAEDYM model scenario to assess DO conditions above and below the thermocline if the watershed were completely undeveloped (Anderson 2012d). The cumulative frequency plots in Figure 3-12 show the full range of daily results. For the hypolimnion, exceedences of the DO WQO of at least 5 mg/L occur roughly 50 percent of the time in the predevelopment scenario, which is intended to represent the uncontrollable portion of low DO conditions.

For the epilimnion (model output average for top 3 meters of water column), there are no exceedences of the DO WQO in the predevelopment or watershed BMP + alum condition. However, DO monitoring data shows that exceedences of the DO target do occur in the epilimnion, but are limited to the period when the lake is turning over. Turnover occurs around October and involves destratification, which allows for low DO water from bottom of the lake to mix with surface waters. This problem is also expected to occur under pre-development conditions; however, the degree to which the current rate of non-compliance may differ from pre-development conditions has not yet been modeled. Thus, it can be concluded that Canyon Lake is currently meeting interim numeric targets (see Table 1-1) except for a temporary period when the lake is turning over.

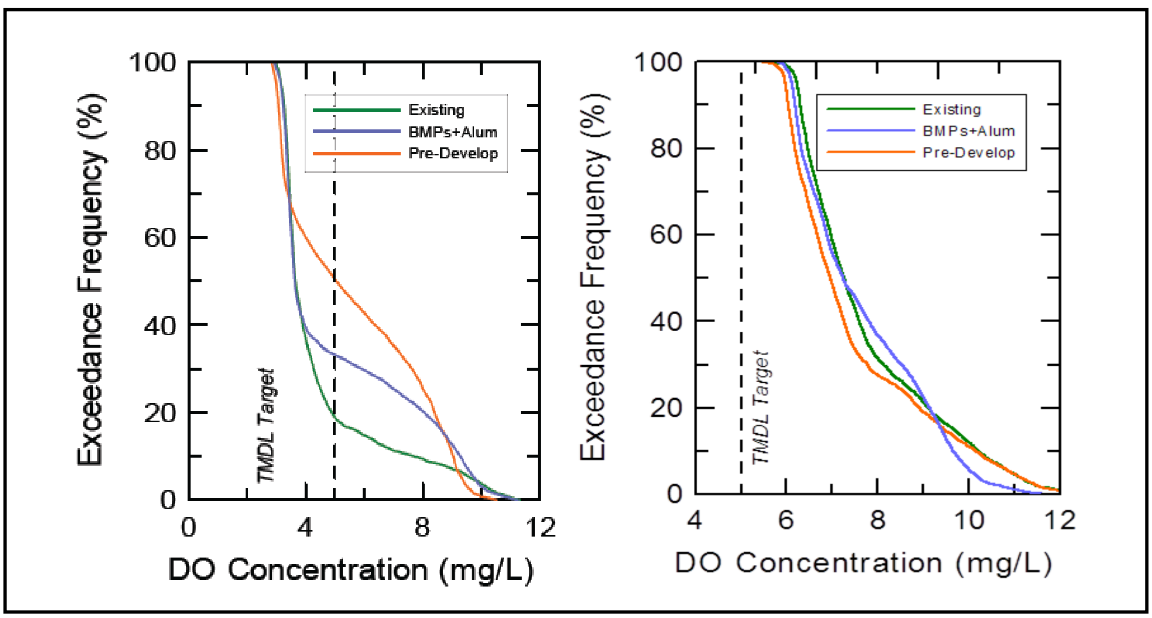


Figure 3-12
Cumulative Frequency of Daily Average DO in hypolimnion (left) and epilimnion (right) for DYRESM-CAEDYM Simulations of Existing, Pre-development, and with CNRP Implementation Scenarios

The combination of watershed BMPs and alum additions will not directly increase dissolved oxygen within Canyon Lake; however, over time, the indirect benefit of reduced algal growth and die-off/settling will reduce sediment oxygen demand, and therefore reduce anoxic conditions at sediment-water interface. In turn, more oxic conditions at the sediment-water interface will reduce the flux of nutrient from bottom sediments to the water column, which would provide additional reductions in algal growth and die-off/settling. Figure 3-12 shows that implementation of watershed BMPs and alum additions over a 10-year period would be expected to provide significant progress toward returning exceedence frequency of WQOs to pre-development levels. However, these indirect benefits will not be realized immediately, given that the half-life of settled nutrients in Canyon Lake is estimated to be approximately 10 years (Anderson, 2012a). Attachment C includes a slideshow presentation, given by Michael Anderson on February 14, 2012, describing kinetic modeling completed to assess the length of time settled nutrients are rendered no longer bioavailable, or inert, in Canyon Lake bottom sediments.

3.4.2.3 Canyon Lake In-Lake BMP Implementation

Table 3-19 shows the plan for alum additions to Canyon Lake for both the wet and dry season applications. These applications are based on the evaluation of an effective dose for the Main Body and East Bay as well as an assessment of seasonality in algal growth to determine the appropriate times of year to conduct the alum additions. The estimate of treated TP with the proposed alum applications is roughly twice the combined TP load from urban (1709 kg/yr) and septic (56 kg/yr) sources to Canyon Lake based on the 2010 update to the watershed model used for the TMDL linkage analysis (Tetra Tech, 2010). Thus, the proposed alum addition plan would provide more than enough TP removal to offset the load reduction needed to meet the WLA for urban and LA for septic sources, as well as providing excess credits for other potential project proponents.

Table 3-19. Alum Addition Plan for Canyon Lake (2013-2015)

Zone	Application Date	Description	Alum Dosage (mg/L)	Alum Application (kg dry alum)	Treated TP (kg)
Main Body	February	Water column stripping following wet season storms prior to spring algal bloom	10	70,000	685
	September	Water column stripping prior to turnover/fall algal bloom and suppression of internal sediment nutrient flux	20	140,000	1,309
East Bay	February	Water column stripping following wet season storms prior to date of historic algal bloom occurrence	30	50,000	808
	September	Water column stripping prior to turnover in deeper sections and fall algal bloom	30	50,000	808
			Annual Total	310,000	3,609

One concern with the use of alum in lakes is the possible effects on aquatic life. There is potential for acute or chronic aluminum toxicity to aquatic life in surface waters (e.g. zooplankton) that receive the initial dose of alum. Studies of aluminum toxicity from similar source waters show that this is not a likely condition, especially considering the low dose proposed for Canyon Lake. Jar tests performed at each of the Canyon Lake compliance monitoring stations provided an approximation of the dissolved aluminum that may be present in the water column immediately following the alum application. With dissolved aluminum concentration ranging from 200-600 ug/L, acute or chronic toxicity is not expected. However, to ensure that the alum additions in Canyon Lake are safe for aquatic life, the Permittees first step to implement the CNRP will involve conducting toxicity tests using ambient water from different parts of Canyon Lake prior to alum addition. If these tests find there is no impact to aquatic life from the proposed alum additions, such data will be used to develop a case for a negative declaration in the CEQA analysis.

Beginning in September 2013, assuming CEQA compliance is complete, alum application will be performed according to the schedule shown in Table 3-19. After the fifth alum application in September of 2015, the MS4 Permittees will evaluate water quality data in the lake, and determine whether response targets are achieved or if modification to the alum application plan or potential supplemental BMPs may be needed to achieve response targets in Canyon Lake for chlorophyll-a and DO (see Table E-1 in Attachment E for detailed implementation schedule).

In 2016, the TMDL will be reopened to revise the final numeric target for DO to incorporate controllability by means of an allowable exceedance frequency representative of a pre-development condition in the watershed. The 2012 DYRESM-CAEDYM simulations of a lake water quality for a pre-development level of watershed nutrient loads will be used to represent an uncontrollable frequency of exceeding the final DO target of at least 5 mg/L in the hypolimnion. A cumulative frequency plot of average daily DO data from the two year period of alum applications (Sep 2013 through Sep 2015) will be compared to the pre-development cumulative frequency to determine whether sufficient improvement to DO was achieved with the alum applications.

3.5 Uncertainty

WLAs and LAs for TP and TN in Lake Elsinore are expected to be achieved following implementation of watershed and in-lake BMPs included in the CNRP. For Canyon Lake, the proposed watershed BMPs and in-lake treatment will significantly exceed the TP load reduction needed to meet the WLA and LA for urban and septic sources; however, the CNRP will not provide sufficient load reduction to meet the WLAs and LAs for TN in the Canyon Lake watershed. Instead, the CNRP is tailored to achieve the response targets for chlorophyll-a, and DO in Canyon Lake.

For both lakes, the development of the CNRP involved a conservative approach to account for uncertainty in the expected benefits of watershed and in-lake nutrient management BMPs proposed. The following sections characterize some of these sources of uncertainty that could cause the CNRP to be more or less effective than expected.

3.5.1 Use of 2010 Watershed Model Update

Load reduction requirements for this CNRP compliance analysis were based on existing load estimates from the 2010 watershed model update. Since the adoption of the TMDL, urban land use has increased while agricultural land use has declined and this trend is expected to continue as the watershed approaches a buildout condition. Accordingly, the 2010 watershed model update generally showed an increased nutrient load from urban sources and a decreased nutrient load from agricultural sources. Septic loads also decreased based on the more accurate accounting of septics resulting from the 2007 SSMP. CAFO loads increased. The TMDL did not account for future changes in land use distribution in the watershed. To assess the impact of these changes on the feasibility of meeting the TMDL, WLAs were converted to allowable per acre loading rates using land use acreage used to develop the TMDL and the 2010 watershed model update (Figure 3-13). Figure 3-13 shows that maintaining the same mass based WLAs, as set in the TMDL, would reduce the allowable per acre loading rate for urban and septic sources, and increase the allowable per acre loading rate for agricultural and CAFO sources. Ultimately, this issue should be addressed in a supplemental Basin Plan Amendment as per acre loading rates should be based on achievable wash-off rates for each land use and not subject to change due to land use conversion.

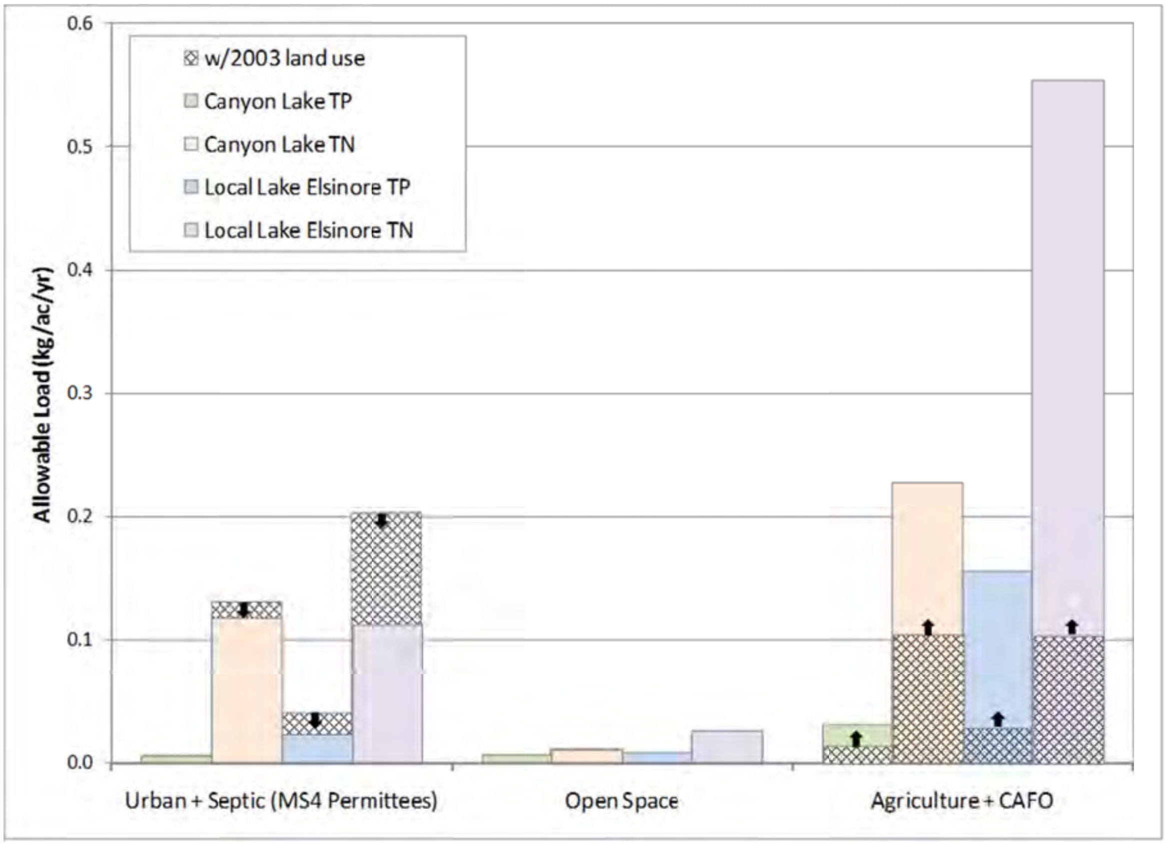


Figure 3-13
WLAs Converted to Allowable per acre Loading Rates

3.5.2 Potential Benefit of Margin of Safety BMPs

Studies have shown that education and outreach programs and/or ordinance enforcement actions may result in a measureable change in human behavior, thereby providing a reduction in a specific source of nutrients available for washoff into MS4s in the watershed. However, quantification of potential washoff reductions entails estimations with a high level of uncertainty. This compliance analysis estimates the potential washoff reduction for education, outreach and enforcement programs, but then uses these estimations as a "margin of safety" for MS4 compliance with the TMDL. Therefore, the load reduction values of these BMPs are not included to attain TMDL WLA..

To approximate the additional MOS provided by such BMPs for this CNRP, it was assumed that 15 percent of pollutant sources in the watershed could be reduced from current conditions with enhanced and targeted education and outreach programs or by enforcement of existing ordinances. Rough estimates were developed to approximate the additional MOS provided by improvements to how residents manage potential sources of nutrients in the watershed.

The basis for these estimates involves an assessment of the relative role of targeted nutrient sources in the downstream load of nutrients. Estimates of reductions in loads to Canyon Lake also incorporated a loading factor to account for nutrients that would be retained in-stream between the source area and lake inflow without BMP implementation (see Table 3-3).

In the case of the CNRP, education and outreach programs and ordinance enforcement actions are focused on three main sources of nutrient in urban watersheds; fertilizer, pet waste, and green waste. A nitrogen budget for an urban watershed developed for the Central Arizona-Phoenix long term ecological research (LTER) site found that fertilizer and pet waste may account for as much as 60 percent and 14 percent of total nitrogen inputs (Baker et. al., 2001). Also, the study estimated green waste to account for 28 percent of outputs in the total nitrogen budget. Consequently, there is significant opportunity for reducing downstream nitrogen loads with improved management of these sources in the urban watershed. Load reductions for MOS BMPS targeting each of these sources are described below:

- To quantify reductions in mobilization of fertilizer from application sites to MS4 drainage facilities, several factors were applied to an estimate of the total nutrient load applied to fertilized lawns (assumed to cover 20 percent of the total urban acreage) in the local Lake Elsinore and Canyon Lake watersheds. According to a UCR Agricultural and Natural Resources Publication (Pub No. 8065), typical fertilizer application rates for grass lawns in southern California are 20 kg/ac/yr nitrogen and 7 kg/ac/yr phosphorus. Several studies have found nutrient loss in surface runoff as a result of fertilizer application to be about 2-5 percent for nitrogen (Groffman et al., 2004; Baker et al., 2001) and less than 10 percent for phosphorus (Soldat and Petrovich, 2008). Thus, a conservative factor of 2 percent was used to estimate the mass of nutrients that could be reduced through fertilizer management that is 15 percent more effective than current conditions (Table 3-20).

- For MOS BMP implementation addressing pet waste, the method used to estimate nutrient washoff involved several factors to convert dog population to nutrient accumulation, and loss from lawns during a rain event. The population of dogs in the Canyon Lake and Lake Elsinore watersheds was approximated by applying a US average dog ownership ratio of 1 dog per four persons to the approximate population within the watershed (see Table B-1). An average dog generates about 125 kg/yr of feces which has a composition of roughly 1 percent nitrogen and 1 percent phosphorus. If 50 percent of dog feces is available for washoff (i.e. not picked up), then the annual accumulation would be about 0.6 kg/dog/yr for both TP and TN. For pet waste it was assumed that loss of nutrients in surface runoff is 1 percent, which is half of the abovementioned value used for fertilizer, a more readily soluble material. Assuming 15 percent effectiveness in the MOS BMPs, the reduction in nutrient washoff related to pet waste management is estimated, as shown in Table 3-20.

- The method used to estimate nutrient washoff reduction from improved green waste management on impervious surfaces, such as roads and driveways, involved application of the same model developed to simulate benefits of street sweeping (see Section 3.3.1). The buildup/washoff model determined a washoff reduction benefit of improved green waste management of approximately 0.07 kg/mi/yr for TP and 0.45 kg/mi/yr for TN. The basis for the buildup model was a study of green waste in Plymouth and Maple Grove, MN, which found a grass clipping accumulation rate on average to be 3 kg/curb mi/day and a composition of TP and TN in grass clippings of 0.3 and 2.0 percent, respectively (Minnesota Pollution Control Agency, 2008). Assuming 15 percent effectiveness in the MOS BMPs, the buildup of green waste on impervious areas was reduced for the buildup/washoff simulation. The estimated reductions from MOS BMPs targeting green waste left on impervious surfaces, such as roads and driveways, are shown in Table 3-20.

The Permittees believe these MOS BMPs offset the other sources of uncertainty in the determination that estimated watershed loads reductions assumed in the lake water quality model, will be achieved. Specifically, estimates of reduction in nutrient washoff from MS4 drainage areas involved many assumptions on effectiveness, urban growth rates, and stormwater program implementation..

Table 3-20. Estimate of Potential Load Reduction provided by Margin of Safety BMPs which Target Human Behaviors

Targeted Source	Variable	Local Lake Elsinore	Canyon Lake below Mystic Lake[1]
Fertilizer Management	Urban Acreage	8,469	57,609
	TP Reduction (kg/yr)	34	120
	TN Reduction (kg/yr)	102	415
Pet Waste Management	Dog Population	22,259	129,043
	TP Reduction (kg/yr)	17	50
	TN Reduction (kg/yr)	17	58
Green Waste Management	Residential Road Miles	137	959
	TP Reduction (kg/yr)	9	34
	TN Reduction (kg/yr)	62	261
Total MOS BMPs	TP Reduction (kg/yr)	60	204
	TN Reduction (kg/yr)	180	733
% of Required Load Reduction[2]	TP	14%	15%
	TN	8%	20%

1) Incorporates loading factors of 52 percent for TP and 60 percent for TN to account for nutrients that may have been retained in-stream between the source areas and Canyon Lake without BMP implementation
2) Load reduction required in TMDL, used for developing the CNRP already includes a 10 percent MOS, thus these BMPs provide additional MOS

3.5.3 Controllability of TMDL Allocations and Response Targets

3.5.3.1 TMDL Allocations for Lake Elsinore

This CNRP uses WLAs and LAs to demonstrate compliance with the TMDL in Lake Elsinore. These allocations are evaluated by assessing 10-year running averages of modeled TP and TN loading to Lake Elsinore. The 2010 watershed model was modified to also evaluate watershed loads to Canyon Lake and Lake Elsinore[1] for a pre-development or natural condition in the San Jacinto River watershed. Figure 3-14 compares existing and pre-development scenarios annual loading and 10-year running averages for TP and TN in the local Lake Elsinore and Canyon Lake watersheds.

These charts show that even in a predevelopment scenario, it is common for wetter hydrologic years to result in 10-year average watershed loads in excess of the WLA, which suggests that numeric response targets in Lake Elsinore and Canyon Lake may not be attained even under natural conditions. Thus, it may be appropriate to propose a revision of numeric targets from use of daily, seasonal, or annual averages, to incorporate a provision to allow for a natural background standard. The Permittees reserve the right to request such amendments should effectiveness data indicates that the current TMDL is unattainable. The MS4 Permittees plan to implement a CNRP that will achieve the WLAs, as set in the TMDL. However, if implementation demonstrates that load reduction targets cannot feasibly be met,

[1] The 2010 watershed model did not explicitly simulate loading to Lake Elsinore for the pre-development scenario. Instead, nutrient loading rates for open space from the calibrated model, were extrapolated over the entire local Lake Elsinore watershed to approximate loading. This approach neglects decay that may have occurred as nutrients are transported from sources areas to Lake Elsinore.

then the MS4 Permittees may recommend that the TMDL be revised to consider naturally attainable water quality standards and/or achievable wash-off rates.

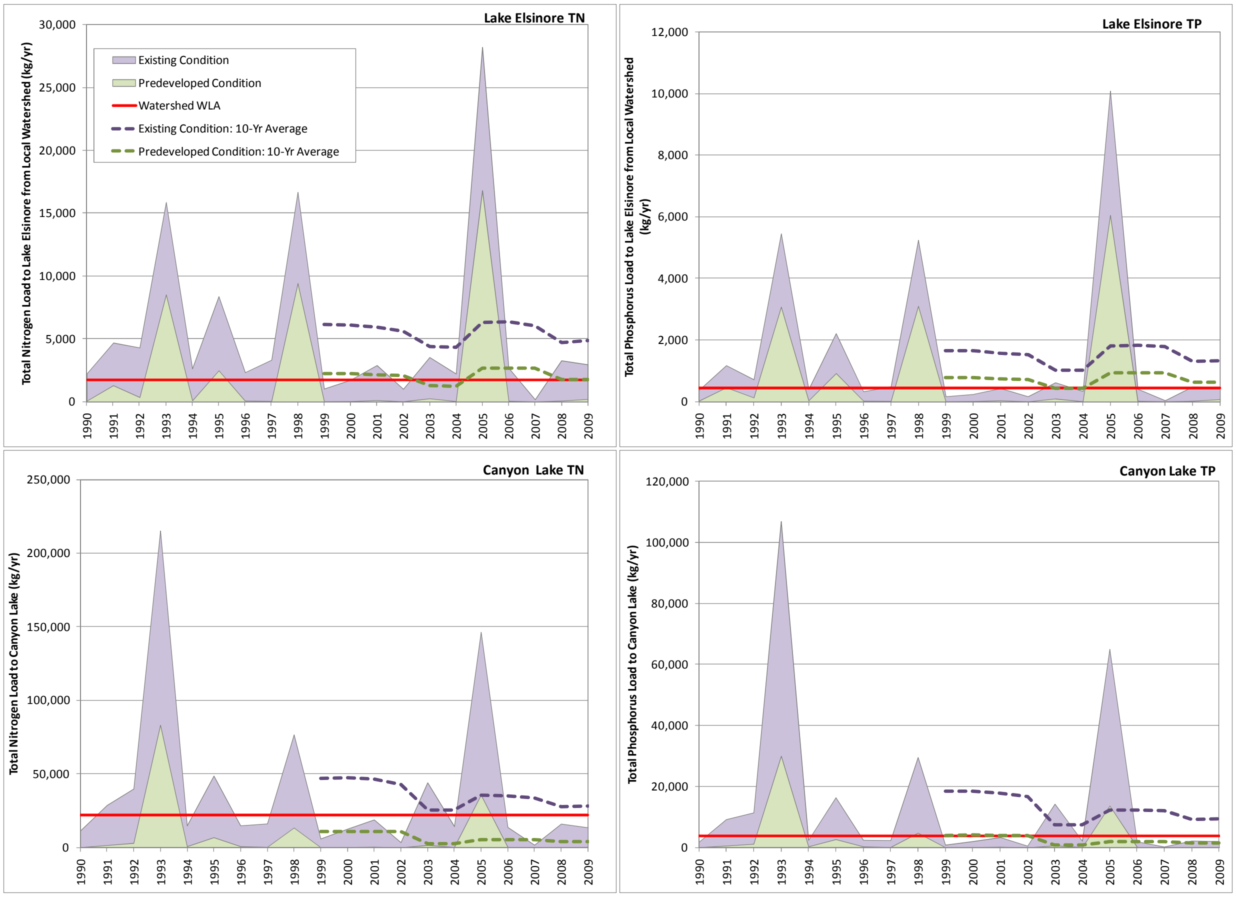


Figure 3-14
Comparison of Modeled Existing Load with Natural Conditions Assessment Scenario

3.5.3.2 Lake Water Quality Response Targets for Canyon Lake

The DYRESM-CAEDYM simulation projected that with implementation of the CNRP and AgNMP, annual average chlorophyll-a for the entire lake would be 5 ug/L with wetter years reaching 10 ug/L. Therefore, the model projects that the CNRP will achieve compliance with the final chlorophyll-a response target of an annual average of 25 ug/L, irrespective of hydrologic fluctuation. This model estimates a lake-wide average chlorophyll-a, which is the same metric used to determine compliance with the response target per the TMDL. Even if the lake-wide average chlorophyll-a meets the response target, specific areas of Canyon Lake during critical seasons may still experience more algal growth than others, such as East Bay. For this reason, a heavier dose of alum is planned for shallower areas to drop TP below 0.1 mg/L, furthering limiting the available phosphorus needed for algae to grow, based on East Bay specific simulations using SLAM.

These models rely on a relationship between the dose of alum addition and resultant phosphorus reduction, which was based on one set of jar tests from each of the four compliance monitoring stations, collected in dry season of 2012 (see Attachment C). These jar tests may not be representative of potential ambient water quality when alum additions are implemented in 2013-2015, and thus the expected benefits may vary from the DYRESM-CADYM simulation. For example, if pH is higher than it was in the jar test samples, then a portion of the applied alum would be spent acidifying the water before forming an effective aluminum hydroxide floc that is able to bind with phosphorus. The Permittees will continually evaluate water quality data to assess whether the alum applications are performing as expected or if the plan should be modified.

Uncertainty is greatest when it comes to the ability for alum to achieve the final DO response target for the hypolimnion, even after accounting for the potentially uncontrollable exceedences associated with a predevelopment condition in the watershed. The DYRESM-CAEDYM results showed a reduction in exceedence frequency from 80 to 65 percent of the time, attributable to the indirect benefits of reduced nutrient cycling and associated sediment oxygen demands. Anderson 2012a suggests that such benefits may continue to accrue over several decades, but there is much uncertainty as to the ultimate potential for DO conditions in the hypolimnion. Consequently, the Permittees have developed adaptive management into this CNRP. In 2016, the Permittees will evaluate the effectiveness of alum applications for DO in the hypolimnion and determine whether a supplemental in-lake project for DO, such as aeration or oxygenation, would be needed.

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Attchment A
Table of Contents

Tables

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Attachment A
TMDL Implementation

A.1 Introduction

TMDL coordination efforts have been underway since August 2000, well before adoption of the Lake Elsinore and Canyon Lake Nutrient TMDLs ("Nutrient TMDLs"). These activities were coordinated and administered through the Lake Elsinore San Jacinto Watersheds Authority (LESJWA), a joint powers authority. The Santa Ana Regional Water Quality Control Board (Regional Board) adopted the Nutrient TMDLs on December 20, 2004; the Nutrient TMDLs became effective on September 30, 2005, after EPA approval. The existing TMDL stakeholders formally organized into a funded TMDL Task Force in 2006. This Task Force in coordination with LESJWA has been actively involved in the implementation of the TMDL requirements. The following sections describe the organizational structure and responsibilities of LESJWA and the Task Force and status of TMDL implementation activities, as applicable to the MS4 Permittees.

A.2 Lake Elsinore San Jacinto Watersheds Authority

LESJWA is made up of representatives from the Santa Ana Watershed Project Authority, Elsinore Valley Municipal Water District, City of Lake Elsinore, City of Canyon Lake and County of Riverside. LESJWA was formed in April of 2000 after California voters passed Proposition 13, a bond measure to fund water projects throughout the State. Proposition 13 earmarked $15 million for LESJWA to implement projects to address the impairments in Lake Elsinore and Canyon Lake. LESJWA is charged with improving water quality and protecting wildlife habitats, primarily in Lake Elsinore, but also in Canyon Lake and the surrounding watershed. Several LESJWA projects are central to the stakeholder TMDL compliance strategies, including:

- Lake Elsinore Aeration System
- Lake Elsinore Wetland Enhancement
- Lake Elsinore Carp Removal
- Lake Elsinore Axial Flow Pumps
- Lake Elsinore Island Wells
- Lake Elsinore Dredging Project

LESJWA has conducted several studies to evaluate lake conditions, alternative management measures and potential funding mechanisms.

These efforts provide the basis for ongoing compliance work of the TMDL Task Force. In addition, the TMDL Task Force continues to rely on the LESJWA Technical Advisory Committee for technical guidance.

A.3 Lake Elsinore and Canyon Lake TMDL Task Force

In December 2004, all responsible parties named in the TMDL began the process of creating a formal cost-sharing body, or Task Force, to collaboratively implement various requirements defined in the implementation plan for the nutrient TMDLs. A Task Force Agreement was signed March 5, 2007. The purpose of the Task Force is to conduct studies necessary to collect data to analyze the appropriateness of the TMDL, identify in-lake and regional watershed solutions, pursue grants, coordinate activities among all of the various stakeholders, and recommend appropriate revision to the Basin Plan language regarding Lake Elsinore and Canyon Lake based on data collection and analysis. The Task Force includes the following participants:

- County of Riverside
- Riverside County Flood Control & Water Conservation District
- City of Beaumont
- City of Canyon Lake
- City of Hemet
- City of Lake Elsinore
- City of Menifee
- City of Moreno Valley
- City of Murrieta
- City of Riverside
- City of San Jacinto
- City of Wildomar
- Elsinore Valley Municipal Water District
- Eastern Municipal Water District
- California Transportation Department
- California Department of Fish & Game
- March Air Reserve Joint Powers Authority
- US Air Force (March Air Reserve Base)
- Western Riverside County Agriculture Coalition on behalf of Agricultural & Dairy Operators in the San Jacinto River Basin

SAWPA serves as the administrator for the Task Force. In this role, SAWPA provides all Task Force meeting organization/facilitation, secretarial, clerical and administrative services, management of Task Force funds, annual reports of Task Force assets and expenditures and hiring of Task Force authorized consultants. SAWPA maintains a website with all information developed to date through the Task Force: www.sawpa.org/roundtable-LECLTF.html.

A.4 TMDL Tasks Applicable to MS4 Permittees

The Nutrient TMDLs include 14 tasks in the TMDL implementation Plan (Resolution No. R8-2004-0037). Not all tasks are applicable to the MS4 Permittees. Table A-1 briefly describes each TMDL task, its relevance to the MS4 Permittees, and general status. Further discussion on the status and work performed for each task for which the MS4 Permittees have responsibilities is detailed in the subsections that follow.

A.4.1 Task 2.1 – Review and/or Revise Existing Waste Discharge Requirements, Riverside County MS4

When the TMDL was adopted, the Riverside County MS4 permit (Waste Discharge Requirements for the Riverside County Flood Control and Water Conservation District, the County of Riverside and the

Incorporated Cities of Riverside County within the Santa Ana Region, Area-wide Urban Runoff, NPDES No. CAS 618033; Regional Board Order No. R8-2002-0011) did not include requirements directly related to the TMDL Implementation Plan or require the Permittees to address the TMDL WLAs.

Since the adoption of the TMDL, a new MS4 permit has been adopted (NPDES No. CAS 618033; Regional Board Order No. R8-2010-0033). This permit not only requires completion of the tasks identified by the TMDL, but it also requires the preparation of this CNRP to address the Nutrient TMDL WLAs for urban runoff and LAs for septic sources.

A.4.2 Task 2.2 – Review and/or Revise Existing Waste Discharge Requirements, New Development, San Jacinto Watershed

In 2001 the Regional Board adopted Order No. 01-34 (NPDES No. CAG 618005) that established requirements for discharges of stormwater runoff associated with new developments in the San Jacinto Watershed. The TMDL stated that this Order would be rescinded once the Regional Board approves a WQMP under Order R8-2002-0011 (existing MS4 permit at time of TMDL permit adoption).

The Regional Board approved the MS4 program's revised WQMP (Order R8-2004-0080), which became effective September 17, 2004. Subsequent to the approval of this Order, the Regional Board approved Order R8-2005-0038 that amended Order 01-34 to state that projects that implement an approved WQMP are exempt from Order 01-34.

The Riverside County MS4 program is currently revising its WQMP again to incorporate LID-based BMP requirements contained in the most recently adopted MS4 permit (January 29, 2010). A draft WQMP was submitted to the Regional Board on July 29, 2011; a final WQMP was submitted June 28, 2012 and was approved by the Regional Board on October 22, 2012.

Table A-1. TMDL Implementation Plan Tasks Applicable to MS4 Permittees

Task No.	Task Name	Task Description	Compliance Date (per TMDL)	Relevance to Riverside County MS4 Permit and Status
Task 1	Establish new Waste Discharge Requirements (WDR)	Issue new WDR to Elsinore Valley Municipal Water District for supplemental discharges to Canyon Lake	March 31, 2006	Not applicable to MS4 dischargers; per Regional Board status is ongoing
Task 2	2.1 – WDR for Riverside County MS4 Permittees	Revise existing MS4 permit (Order R8-2002-0011) as needed to incorporate TMDL requirements	March 31, 2006	2002 MS4 permit was not revised; new MS4 permit issued on January 29, 2010 includes both TMDL requirements and requirement to complete CNRP.
	2.2 – Watershed-wide WDRs for Discharges of Storm Water Runoff associated with new developments in the San Jacinto Watershed	Rescind Order 01-34 when revised Water Quality Management Plan (WQMP) approved under Order R8-2002-0011	March 31, 2006	Revised WQMP approved by Order R8-2004-0080; Order R8-2005-0038 amends Order 01-34 to state that projects that implement an approved WQMP are exempt from Order 01-34
	2.3 – General WDR for Concentrated Animal Feeding Operations (CAFOs)	Revise existing General WDR (Order 99-11) as needed to incorporate TMDL requirements	March 31, 2006	Not applicable to MS4 dischargers; CAFP WDR adopted per Regional Board Order R8-2007-001
	2.4 – Waste Discharge and Producer/User Reclamation Requirements for the EVMWD, Regional Water Reclamation Facility	Revise Order No. 00-1 to take into consideration Lake Elsinore Recycled Water Pilot Project findings	March 31, 2006	Not applicable to MS4 dischargers; per Regional Board status is complete/ongoing-as needed
	2.5 – WDR for Eastern Municipal Water District (EMWD), Regional Water Reclamation System	If needed, revise order No. 99-5 to address EMWD discharge of recycled water to Lake Elsinore and to take into consideration Lake Elsinore Recycled Water Pilot Project findings	March 31, 2006	Not applicable to MS4 dischargers; per Regional Board status is complete/ongoing-as needed
	2.6 – WDR for US Air Force, March Air Reserve Base	Revise Order R8-2004-0033 to incorporate TMDL requirements	March 31, 2006	Not applicable to MS4 dischargers; per Regional Board status is complete/ongoing-as needed
Task 3	Identify Agricultural Operators	Regional Board will develop a list of all known agricultural operators in the San Jacinto watershed responsible for TMDL implementation	October 31, 2005	Complete

Table A-1. TMDL Implementation Plan Tasks Applicable to MS4 Permittees (Continued)

Task No.	Task Name	Task Description	Compliance Date (per TMDL)	Relevance to Riverside County MS4 Permit and Status
Task 4	4.1 – Watershed-wide Nutrient Monitoring Plan(s)	TMDL responsible parties to submit collectively or individually a watershed-wide nutrient water quality monitoring program for Regional Board approval; submit modified program as needed	Initial plan due December 31, 2005; Revised plan due December 31, 2006 Annual report due by August 15 each year	Monitoring Program approved by Regional Board in March 2006 (Order R8-2006-0031); Amended monitoring program approved in March 2011 (Order R8-2011-0023; Annual reports submitted through August 25, 2011
	4.2 – Lake Elsinore Nutrient Monitoring Plan(s)	TMDL responsible parties to submit collectively or individually a Lake Elsinore in-lake nutrient water quality monitoring program for Regional Board approval; submit modified program as needed		
	4.3 – Canyon Lake Nutrient Monitoring Plan(s)	TMDL responsible parties to submit collectively or individually a Canyon Lake in-lake nutrient water quality monitoring program for Regional Board approval; submit modified program as		
Task 5	Agricultural Discharges – Nutrient Management Plan	Agricultural operators collectively or individually shall submit an NMP that addresses a range of agricultural-related activities	Plan/Schedule due September 30, 2007	Not applicable to MS4 dischargers; draft submitted; final plan due by December 31, 2011
Task 6	On-site Disposal System (Septic Systems) Management Plan	County of Riverside and Cities of Perris, Moreno Valley, and Murrieta shall submit collectively or individually a Septic System Management Plan	Dependent on State Board approval of relevant regulations	Relevant to the following MS4 Permittees; County of Riverside and the Cities of Perris, Moreno Valley and Murrieta; San Jacinto Onsite Wastewater Management Program report was submitted on November 17, 2007; implementation ongoing

Table A-1. TMDL Implementation Plan Tasks Applicable to MS4 Permittees (Continued)

Task No.	Task Name	Task Description	Compliance Date (per TMDL)	Relevance to Riverside County MS4 Permit and Status
Task 7	7.1 – Revision of Drainage Area Management Plan (DAMP)	Revise DAMP to include TMDL requirements	August 1, 2006, ff.	Revised DAMP July 24, 2006, as required by existing permit and TMDL. Entire DAMP revised again July 29, 2011.
	7.2 – Revision of the Water Quality Management Plan (WQMP)	Review WQMP to include TMDL requirements	August 1, 2006,ff.	Revised WQMP submitted July 24, 2006 approved by Order R8-2004-0080; Order R8-2005-0038 amended Order 01-34; additional revision to WQMP to comply with new MS4 permit (Order R8-2010-0033) submitted July 29, 2011; revised WQMP under Regional Board review
	7.3 – Update of the Caltrans Stormwater Management Plan (SWMP) and Regional Workplan	Revise SWMP annually as required; submit a Regional Workplan that includes plans and schedules for meeting TMDL requirements	August 1, 2006	Not applicable to MS4 dischargers; revisions to occur as part of permit renewal process
	7.4 – Update of US Air Force, March Air Reserve Base SWPPP	Revise facility SWPPP as needed to incorporate TMDL requirements	Dependent on nutrient monitoring program results	Not applicable to MS4 dischargers; revisions to occur as part of permit renewal process
Task 8	Forest Area – Review/Revision of Forest Service Management Plans	Submit for approval a plan with a schedule for the identification and implementation of Management Practices to reduce nutrients from Cleveland and San Bernardino National Forests	Plan/schedule due September 30, 2007	Not applicable to MS4 dischargers; considered complete – draft submitted to the Regional Board on September 27, 2007 that stated the existing Forest Plans are sufficient to meet TMDL requirements. Regional Board found the proposed plan and schedule for BMP implementation satisfies TMDL requirements
Task 9	Lake Elsinore In-Lake Sediment Nutrient Reduction Plan	TMDL responsible parties (including MS4 Permittees) to submit collectively or individually a proposed plan and schedule for in-lake sediment nutrient reduction that includes a monitoring program	Plan/schedule due March 31, 2007	Complete; implementation ongoing
Task 10	Canyon Lake In-Lake Sediment Treatment Evaluation	TMDL responsible parties (including MS4 Permittees) to submit collectively or individually a proposed plan and schedule for in-lake sediment nutrient reduction that includes a monitoring program	Plan/schedule due March 31, 2007	Complete

Table A-1. TMDL Implementation Plan Tasks Applicable to MS4 Permittees (Continued)

Task No.	Task Name	Task Description	Compliance Date (per TMDL)	Relevance to Riverside County MS4 Permit and Status
Task 11	Watershed and Canyon Lake and Lake Elsinore In-Lake Model Updates	TMDL responsible parties (including MS4 Permittees) to submit collectively or individually a proposed plan and schedule to update the existing Lake Elsinore/San Jacinto River Nutrient Watershed Model and the Canyon Lake and Lake Elsinore in-Lake models	Plan/schedule due March 31, 2007	Modeling efforts completed December 23, 2010 per June 30, 2011 RCFC&WCD letter to the Regional Board
Task 12	Pollutant Trading Plan or functional equivalent	TMDL responsible parties (including MS4 Permittees) to submit collectively or individually a proposed plan, schedule and funding strategy for project implementation, an approach for tracking pollutant credits and a schedule for reporting status of implementation	Plan/schedule due September 30, 2007	Initial plan/schedule for developing Pollutant Trading Plan has been submitted and approved; implementation on-going
Task 13	Review and Revise Nutrient Water Quality Objectives (WQOs)	For Canyon Lake and Lake Elsinore, the Regional Board will (a) review and revise as necessary the total inorganic nitrogen WQOs; and (b) evaluate the appropriateness of establishing total phosphorus and un-ionized ammonia WQOs	December 31, 2009	Regional Board action pending collection of additional data
Task 14	Review of TMDL/WLA/LA	Regional Board will re-evaluate basis for the TMDLs and implementation at least once every three years, and revise TMDL as needed	Once every 3 years	To date, TMDL has not been revised; the next triennial review is scheduled for 2015

A.4.3 Task 4 - Nutrient Water Quality Monitoring Program

Task 4 of the TMDL implementation plan requires the responsible jurisdictions to submit to the Regional Board for approval a proposed watershed-wide compliance monitoring program (Task 4.1) and in-lake compliance monitoring plans for Lake Elsinore (Task 4.2) and Canyon Lake (Task 4.3). The required Monitoring Program should include:

- A watershed-wide monitoring program to determine compliance with interim and/or final nitrogen and phosphorus allocations, and compliance with the nitrogen and phosphorus TMDL, including the waste load allocations (WLAs) and load allocations (LAs).
- A Lake Elsinore in-lake nutrient monitoring program to determine compliance with interim and final nitrogen, phosphorus, chlorophyll a, and dissolved oxygen numeric targets. In addition, this program will evaluate and determine the relationship between ammonia toxicity and the total nitrogen allocation to ensure that the total nitrogen allocation will prevent ammonia toxicity in Lake Elsinore.
- A Canyon Lake nutrient monitoring program to determine compliance with interim and final nitrogen, phosphorus, chlorophyll a, and dissolved oxygen numeric targets. In addition, the monitoring program will evaluate and determine the relationship between ammonia toxicity and the total nitrogen allocation to ensure that the total nitrogen allocation will prevent ammonia toxicity in Canyon Lake.

The Lake Elsinore & Canyon Lake Nutrient TMDL Monitoring Program was approved by the Regional Board March 3, 2006 (Order No. R8-2006-0031). The Task Force submitted a Quality Assurance Project Plan (QAPP), which was also approved by the Regional Board. All required activities have been carried out and Annual Reports prepared and submitted to the Regional Board by August 15th of each year.

The Lake Elsinore and San Jacinto Watershed Authority (LESJWA) on behalf of the Task Force submitted a revised in-lake monitoring program for Lake Elsinore and Canyon Lakes to the Regional Board on December 23, 2010. This proposal also provided a rationale for the deferral of a watershed-wide monitoring program pending development of the CNRP. The Regional Board approved the revised in-lake monitoring program and the request for deferral of the watershed-wide monitoring program to the CNRP (Order No. R8-2011-0023, March 4, 2011).

In a letter dated June 7, 2011 the Task Force requested that monitoring be reduced further to allow resources to be re-focused on project implementation in Canyon Lake. However, monitoring efforts would be restored in time to assess compliance with the 2015-16 interim targets. The Regional Board indicated by letter (September 2, 2011) that it may be supportive of further reductions in the monitoring program as long as the reductions are justified and that there are firm and certain commitments by the Task Force to move forward with specific in-lake and/or watershed projects. The Regional Board also stated that reductions in in-lake monitoring may be appropriate given the existing volume of lake data; however, reducing watershed monitoring is a concern given the need to assess compliance with the TMDL, WLAs and LAs. Regardless, the Regional Board agreed to work with the Task Force on the development of a revised monitoring program.

A.4.4 Task 6 - On-site Disposal Systems (Septic Systems) Management Plan

The TMDL implementation plan includes the following requirement, with regards to septic systems:

> "No later than 6 months after the effective date of an agreement between the County of Riverside and the Regional Board to implement regulations adopted pursuant to Water Code Sections 13290-13291.7, or if no such agreement is required or completed, within 12 months of the effective date of these regulations, the County of Riverside and the Cities of Perris, Moreno Valley and Murrieta shall, as a group, submit a Septic System Management Plan to identify and address nutrient discharges from septic systems within the San Jacinto watershed."

The latter approach, implementation of a Septic System Management Plan *(San Jacinto Onsite Wastewater Management Program)* was completed on November 17, 2007. This document establishes a general framework for an onsite wastewater management program, with the assumption that the various agencies involved will further refine their individual programs. Completion of this document satisfied the requirements of the TMDL Task; implementation of the plan is ongoing. The State Board is drafting new OWTS regulations that will enhance regulation of OWTS owners and require additional actions of local government agencies (including MS4 Permittees) with permitting powers over OWTS. Upon adoption of the policy, the MS4 Permittees will revise their programs as required.

A.4.5 Task 7.1 - Revision of Drainage Area Management Plan (DAMP)

The TMDL implementation plan required the MS4 Permittees to revise their DAMP to incorporate TMDL requirements by August 1, 2006. The MS4 program adopted a revised DAMP on July 24, 2006.

On January 29, 2010, the Regional Board adopted a new MS4 permit to authorize the discharge of urban runoff from MS4 facilities in Riverside County within the Santa Ana Region MS4 Permit area. This new permit requires additional updates to the DAMP as appropriate to incorporate interim water quality based effluent-limits established in the permit (Section VI.2.D.a, b). A revised DAMP was submitted to the Regional Board for approval on July 29, 2011 and is pending approval.

DAMP Section 13.4 (July 29, 2011 version) addresses the requirements of the Lake Elsinore/Canyon Lake TMDL. The DAMP includes the following TMDL-specific elements:

- Section 13.4.4.2 summarizes the Permittees' strategy for complying with the TMDL WLA assigned to the specified Permittees.
- Section 13.3 describes programmatic BMPs implemented by the Permittees to address TMDLs in the permitted area, including public education and outreach, inspection and enforcement actions taken by the Permittees. Section 13.4.4.2 and 13.4.4.3 describes the Permittees' participation in the TMDL Task Force and LESJWA, and their roles in assisting the Permittees in implementing TMDL implementation tasks.
- Section 13.4.4.5 describes how the Permittees propose to address BMP Effectiveness evaluations.
- Section 13.4.4.6 describes how the Permittees propose to conduct monitoring to determine compliance with Lake Elsinore and Canyon Lake Nutrient TMDL WLAs assigned to the Permittees.
- In addition to the compliance programs specified above, the Permittees also implement numerous compliance programs that manage nutrient discharges to Canyon Lake and Lake Elsinore. Section

13.4.4.3.2 of the DAMP summarizes these programs, which range from management of sanitary sewer overflows to ensuring appropriate BMP implementation for new development and redevelopment projects. Details regarding each of the summarized programs are provided in other sections of the DAMP.

The DAMP may require additional revision based on the outcome of the CNRP development and approval process. Specifically, the MS4 permit requires incorporation of relevant CNRP elements within 180 days after Regional Board approval of the CNRP.

A.4.6 Task 7.2 - Revision of the Water Quality Management Plan (WQMP)

The TMDL implementation plan required the MS4 Permittees to revise their WQMP (Appendix O of the DAMP) to incorporate TMDL requirements by August 1, 2006. The MS4 program adopted a revised WQMP on July 24, 2006.

On January 29, 2010, the Regional Board adopted a new MS4 permit to authorize the discharge of urban runoff from MS4 facilities in Riverside County within the Santa Ana Region MS4 Permit area. This new permit requires revision to the WQMP to not only incorporate LID-based BMP practices, but also, as appropriate, incorporate interim water quality based effluent-limits established in the permit (Section VI.2.D.a, b) and relevant CNRP elements.

The Riverside County MS4 program submitted a revised WQMP to the Regional Board on July 29, 2011; a final WQMP was submitted June 28, 2012 and was approved by the Regional Board on October 22, 2012. Additional revision of the WQMP may be required following approval of this CNRP. Specifically, the MS4 permit requires incorporation of relevant CNRP elements into the WQMP within 180 days after Regional Board approval of the CNRP.

A.4.7 Task 9 - Lake Elsinore In-Lake Sediment Nutrient Reduction Plan

The In-Lake Sediment Nutrient Reduction Plan, dated October 31, 2007, relies on existing projects that have been or are being implemented to improve the water quality in Lake Elsinore. These Phase 1 remediation projects include (a) stabilizing Lake Elsinore depth with recycled water; (2) reducing the carp population in Lake Elsinore through a fishery management program; and (3) installing and operating an aeration/mixing system in Lake Elsinore. The Regional Board approved this plan (Order No. R8-2007-0083) on November 30, 2007).

The October 31, 2007 plan included a preliminary list of other mitigation strategies (Phase 2 Alternatives) for potential implementation in the event that the three remediation strategies described above are not sufficient to achieve the in-lake numeric targets for Lake Elsinore. However, in a letter dated June 30, 2011 the Task Force indicated that the Phase 1 projects are performing as expected, and if continued, are likely to achieve the nutrient reductions required to comply with the WLAs and LAs in Lake Elsinore. In its response (September 2, 2011), the Regional stated that while it appears that the Phase 1 projects may be sufficient to reduce phosphorus levels in Lake Elsinore, that nitrogen and chlorophyll-a may not be controlled by the Phase 1 projects and further consideration of Phase 2 projects may be necessary.

A.4.8 Task 10 - Canyon Lake In-Lake Sediment Treatment Evaluation

Task 10 of the TMDL required completion of an in-lake sediment treatment evaluation plan for Canyon Lake. The Task Force submitted this plan to the Regional Board on June 25, 2007. The plan included an evaluation of alum treatment, aeration and hypolimnetic oxygenation system (HOS) as alternatives for in-lake sediment treatment in Canyon Lake, and a proposed plan for additional modeling and preparation of an implementation schedule. Regional Board Order No. R8-2007-0083 approved the plan and schedule for additional implementation activities.

In LESJWA's December 31, 2010 letter to the Regional Board, the Canyon Lake stakeholders indicated that it was considering two alternatives for nutrient control in Canyon Lake: (1) HOS; and (2) application of Phoslock. However, of these two alternatives, the letter indicated that the stakeholders believed that it would only be necessary to implement the HOS in order to achieve the response targets specified in the TMDL. In a May 17, 2011 meeting with the Regional Board, the Task Force discussed the proposed alternatives further in the context of implementation strategies: (a) Strategy A - use of alum, Phoslock or zeolite; and (b) Strategy B -implementation of HOS. The Task Force preferred Strategy B.

The Task Force completed a study titled *Canyon Lake Hypolimnetic Oxygenation System Preliminary Design Phase I Report i*n April 2011. The report evaluated multiple scenarios and identified a recommended design scenario. To facilitate continued planning for implementation of HOS, LESJWA submitted a letter to the Regional Board on June 7, 2011 requesting a formal response from Regional Board regarding the proposed strategies. In a letter dated September 2, 2011, the Regional Board indicated its support, as long as watershed improvements and nutrient reduction actions are also undertaken consistent with existing permit requirements and BMPs.

The December 31, 2011 draft of the CNRP contained an evaluation of different strategies for in-lake reduction of nutrient levels in Canyon Lake, and determined that HOS would be the most effective means of complying with the nutrient TMDL. The basis for this determination were studies showing that suppression of nutrient flux from lake bottom sediments by creating an oxic condition at the sediment water interface would more than offset the load reduction needed to reduce existing urban and septic loads to the allowable WLA/LAs, after accounting for estimated watershed loads reduction.

In January of 2012, the Task Force sought Michael Anderson to conduct additional studies to determine the potential impact of HOS on in-lake TMDL response targets for chlorophyll-a and DO and to evaluate chemical addition alternatives. The studies were intended to provide additional confirmation on the selection of a HOS by assessing whether it can be a whole-lake solution, or to revise the proposed in-lake nutrient management strategy to use chemical addition or regulatory approaches to achieve the response targets. Anderson 2012b determined that exceedences of the chlorophyll-a response target would continue to occur if only HOS were to be implemented in the lake. In its Mar 31, 2012 CNRP comment letter, the Regional Board states that if allocations are met by all dischargers, but in lake water quality response targets are not achieved, then the TMDL will be reconsidered and allocated loads may be further reduced.

Thus, the Permittees opted to prioritize in-lake BMPs based on their effectiveness in meeting the TMDL response targets for chlorophyll-a and DO. Adding alum to Canyon Lake was estimated to be highly effective in achieving the interim and final chlorophyll-a response target, therefore to control algae in the lake, the Permittees plan is to first conduct 5 alum applications over a 2-year period beginning in September 2013.

A.4.9 Task 11 - Watershed and Canyon Lake and Lake Elsinore In-Lake Model Updates

The Lake Elsinore and Canyon Lake TMDLs are based on watershed and in-lake water quality models (Lake Elsinore and Canyon Lake Nutrient Source Assessment –Final Report, January 2003). Task 11 requires an update of these models to consider additional data and information gathered from TMDL monitoring programs. The Task Force submitted a plan and schedule for updating these models to the Regional Board by letter dated October 31, 2007. The Regional Board subsequently issued its approval (Order No. R8-2007-0083, November 30, 2007).

The Task Force submitted the updated model *(San Jacinto Watershed Model update (2010) – Final,* October 7, 2010) and a spreadsheet tool for calculating the nutrient loads contributed by each TMDL responsible party to the Regional Board on December 23, 2010. Additional modeling needs were identified in the 2010 update. However, in its December 23, 2010 letter to the Regional Board, the Task Force stated rather than updating the model, resources would be more wisely spent on implementing in-lake projects to achieve the numeric response targets. This recommendation was reiterated in a June 30, 2011 letter to the Regional Board. The June 30, 2011 letter also indicated that the Task Force considers Task 11 to be complete.

The Regional Board's September 2, 2011 letter stated that in principle staff agreed that at this time resources should be expended on implementation activities rather than modeling. However, for the Regional Board to consider Task 11 complete, the following conditions should be met:

Funds earmarked or considered necessary for model update work are used to implement new remediation projects; these new projects do not include the Phase 1 projects already implemented in Lake Elsinore, though enhancements to those projects may be considered;

- The Task Force should explicitly acknowledge that it is its responsibility to conduct updates to the watershed model should (a) the spreadsheet tool proves insufficient to develop the CNRP; and/or (b) the Regional Board independently determines that updates to the model are necessary;
- The Task Force submits a proposed plan for update and use of the in-lake models; and
- If monitoring does not demonstrate TMDL compliance by December 31, 2015, then implementation efforts, including possible model updates, will need to be increased.

A.4.10 Task 12 - Pollutant Trading Plan (PTP)

Task 12 of the TMDL requires that a PTP be developed. On October 31, 2007 the Task Force submitted a plan and schedule outlining the steps for developing a pollutant trading plan. The Regional Board issued its approval in Order No. R8-2007-0083 (November 30, 2007). The Task Force plans to submit a PTP or its functional equivalent for Regional Board consideration, on an as needed basis, to support implementation of individual in-lake nutrient management projects.

Attachment B
Watershed Characterization

B.1 Introduction

Lake Elsinore and Canyon Lake lie within the San Jacinto Watershed, an area encompassing approximately 780 square miles in the San Jacinto River Basin. Located approximately 60 miles southeast of Los Angeles and 22 miles southwest of the City of Riverside, the San Jacinto Watershed lies primarily in Riverside County with a small portion located within Orange County.

The primary municipalities located in the San Jacinto River Basin include Lake Elsinore, Canyon Lake, Wildomar, Menifee, Perris, Moreno Valley, Hemet, San Jacinto, and Beaumont. Other jurisdictions include unincorporated Riverside County, March Air Force Base, U.S. National Forest lands, Wildlife Reserves, and Native American lands (Figure B-1,). Table B-1 summarizes the area covered by each jurisdiction.

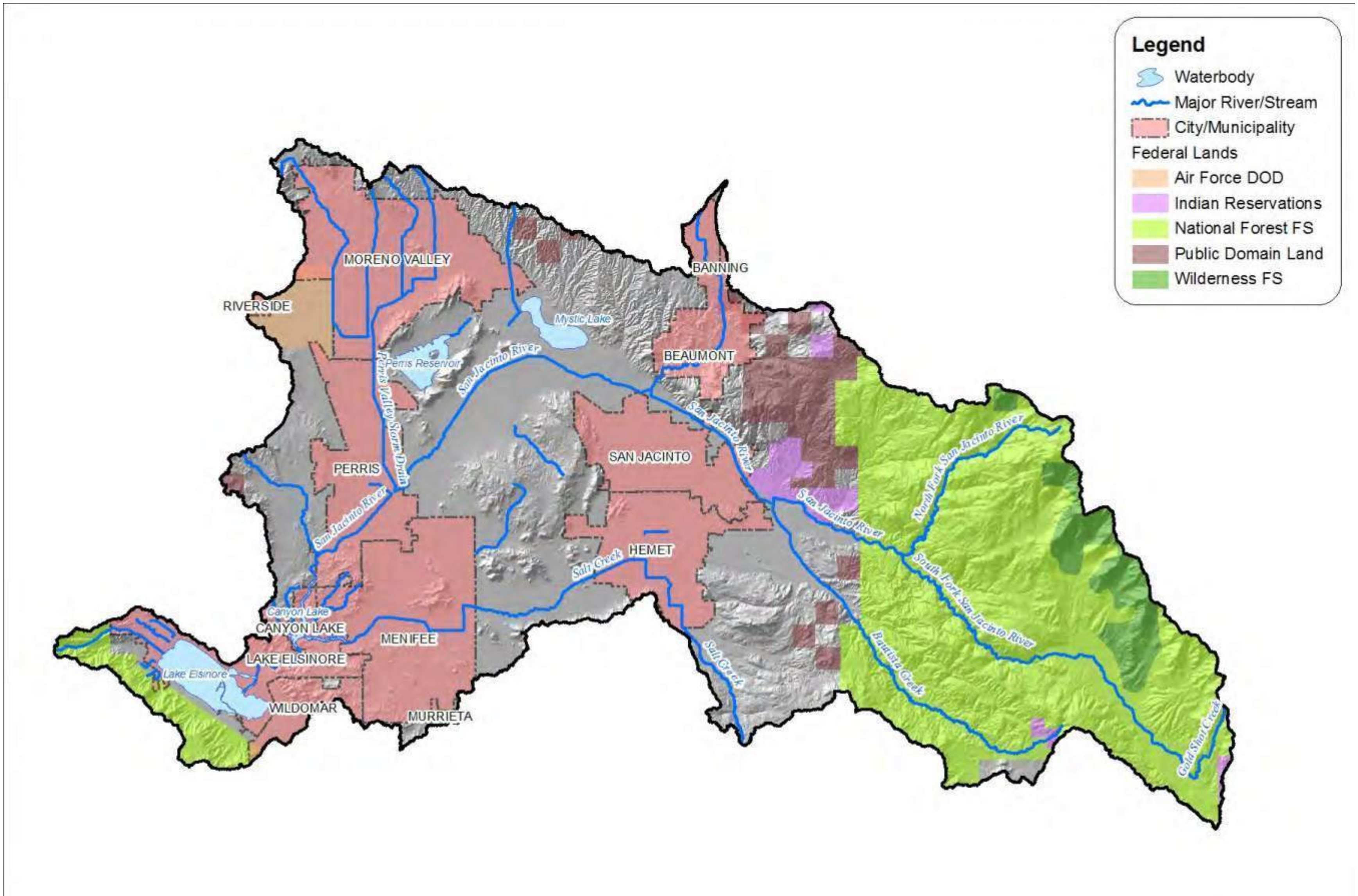
B.2 Land Use

The 2005 Southern California Association of Governments (SCAG) and the 2009 Western Riverside County Agriculture Coalition (WRCAC) land use data were used to characterize land use within the watershed. Where appropriate, land use data were consolidated into broader categories to help accurately support nutrient loading analyses (Table B-2, Figure B-2,). Tetra Tech (2010) provides additional information regarding land classification in the watershed.

Historically, land use development in the San Jacinto watershed has been associated with agricultural activities. However, over the past ten years land use has shifted markedly from agricultural-related to urban. This shift has influenced to a large degree the expected nutrient loading from various portions of the watershed. Although in the last few years the pace of urbanization has declined due to an economic downturn, continued shift from agriculture to urban land is expected to continue.

B.3 Climate

Area climate is characterized as semi-arid with dry warm to hot summers and mild winters. Average annual precipitation in Lake Elsinore/Canyon Lake area is approximately 11 inches occurring primarily as rain during winter and spring seasons (Table B-3). Precipitation in the upper watershed averages 18.7 inches annually. RCFC&WCD monitors precipitation at six rain gauges within the San Jacinto River Basin. Table B-4 lists the monitoring stations and average annual precipitation. Figure B-3 illustrates the location of these gauges.



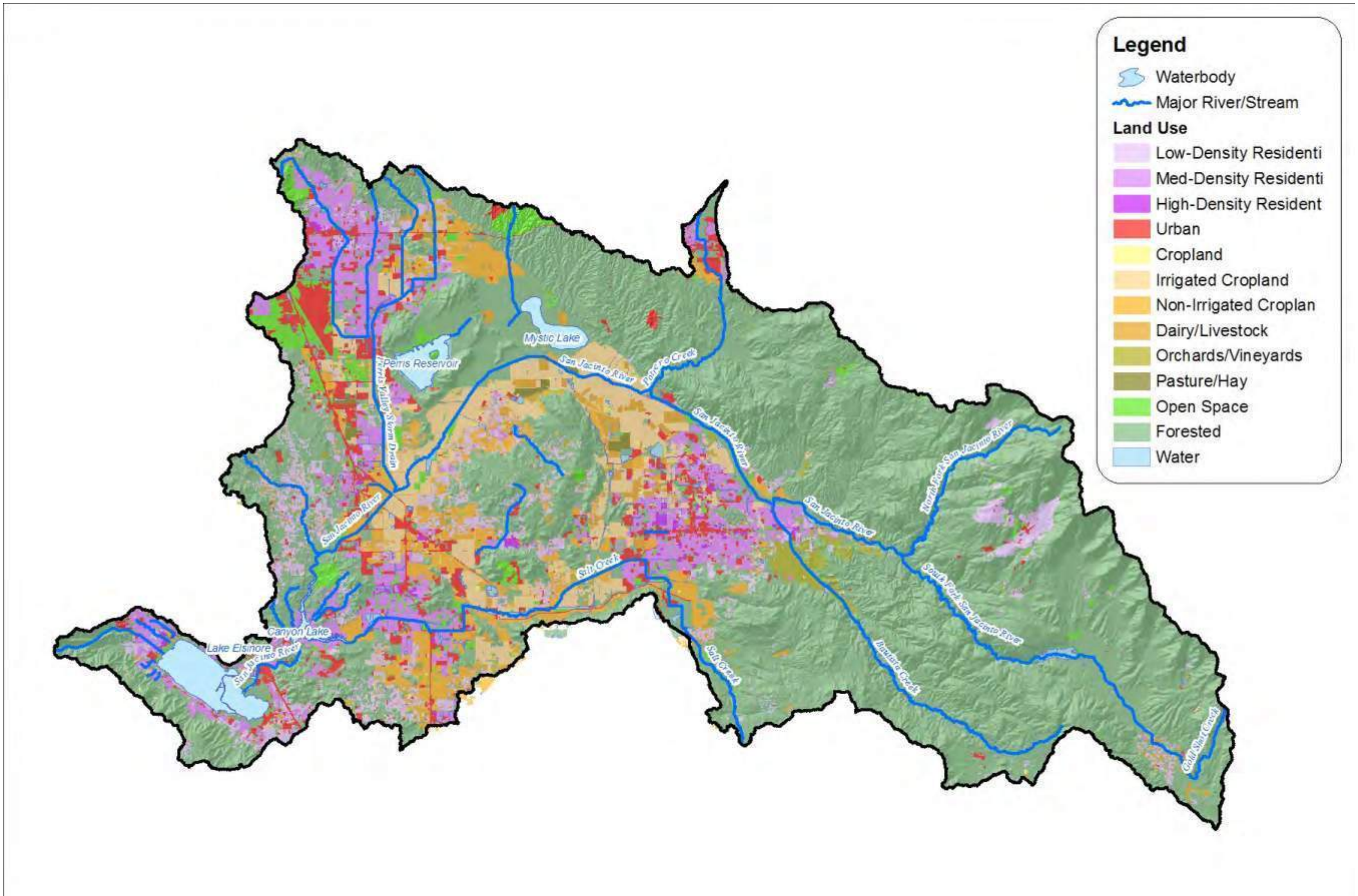
Comprehensive Nutrient Reduction Plan For MS4 Permittees in Canyon Lake and Lake Elsinore Watershed	Dec. 1, 2011	0 2 4 8 Miles		**Figure B-1**	CDM
	Cities, Districts, and Federal Lands in San Jacinto River Watershed				

Table B-1. Area and Population for Jurisdictions Within the San Jacinto Watershed

Jurisdictions	Number of Acres	Percent of San Jacinto Watershed Area (%)	Approximate Population in SJR Watershed
Cities/County			
Riverside County	165,925	8.5	105,299
Moreno Valley	30,861	6.3%	188,636
Menifee	28,994	5.9%	71,012
Perris	20,277	4.1%	57,483
Hemet	17,306	3.5%	78,053
San Jacinto	16,132	3.3%	37,679
Lake Elsinore	14,949	3.0%	53,471
Beaumont	11,759	2.4%	9,639
Wildomar	5,080	1.0%	
Canyon Lake	2,969	0.6%	11,152
Murrieta	516	0.1%	
Riverside	511	0.1%	6,360
Banning	351	0.1%	
Other Jurisdictions			
U.S. National Forest	130,502	26.6%	
Public Domain Land BLM	18,716	3.8%	
Wilderness Lands	12,501	2.5%	
Indian Reservations BIA	7,130	1.5%	
Air Force DOD	5,875	1.2%	
Grand Total	490,354	100%	

Table B-2 Land Use Acreage Among San Jacinto River Basin Jurisdictions (source: 2010 Watershed Model Report)

Jurisdiction	Urban	Low-Density Residential	Med-Density Residential	High-Density Resident	Cropland	Irrigated Cropland	Non-Irrigated Cropland	Dairy/ Livestock	Orchards/ Vineyards	Pasture/Hay	Open Space	Forested	Water	Grand Total
Cities/County														
Banning	58	4	144	17			0				50	78		351
Beaumont	738	39	504	35			444	0	18		29	9,954		11,759
Canyon Lake	75	66	1,230	17			6	9			142	955	470	2,969
Hemet	2,666	560	4,371	632	36	1,299	2,117	511	21		674	4,114	304	17,306
Lake Elsinore	1,649	339	2,166	145	3	0	69		18		273	7,198	3,096	14,954
Menifee	3,304	3,512	4,825	294	199	1,232	5,971	746	210		1,640	6,419	640	28,994
Moreno Valley	3,341	2,245	8,520	340	56	1,862	4,388	200	261		953	8,297	398	30,861
Murrieta	152	16	203	14	1		54	10			7	47	11	516
Perris	2,925	1,055	2,056	154	49	3,269	2,710	50	144	327	2,151	4,917	470	20,277
Riverside	39		459								13			511
San Jacinto	1,617	489	1,951	169	83	4,266	757	1,737	99	339	466	3,647	513	16,132
Wildomar	480	1,346	532		2	32	84	7	32		31	2,539		5,083
Riverside County	3,406	12,891	3,640	328	580	14,926	7,488	4,360	3,898	459	4,811	104,903	4,235	165,925
Other Jurisdictions														
Air Force DOD	2,685		426				0				2,590	117	56	5,875
Indian Reservations BIA	77	222				35	325	3	102		42	6,239	83	7,130
U.S. National Forest	418	4,152	327		46	10	3	633	252		861	123,327	475	130,502
Public Domain Land BLM	26	62	66		5	36	18	2	44		590	17,868		18,716
Wilderness Lands	2	16						0			24	12,459		12,501
Grand Total	23,537	27,043	31,243	2,142	1,077	27,254	25,145	8,343	5,100	1,130	14,226	313,357	10,751	490,346
Land Use Percentage	4.8	5.5	6.4	0.4	0.2	5.6	5.1	1.7	1.0	0.2	2.9	63.9	2.2	



Comprehensive Nutrient Reduction Plan For MS4 Permittees in Canyon Lake and Lake Elsinore Watershed	Dec. 1, 2011		**Figure B-2**	CDM
	Map of Watershed Categorized Land Uses			

Table B-3 Average Monthly Temperatures and Precipitation

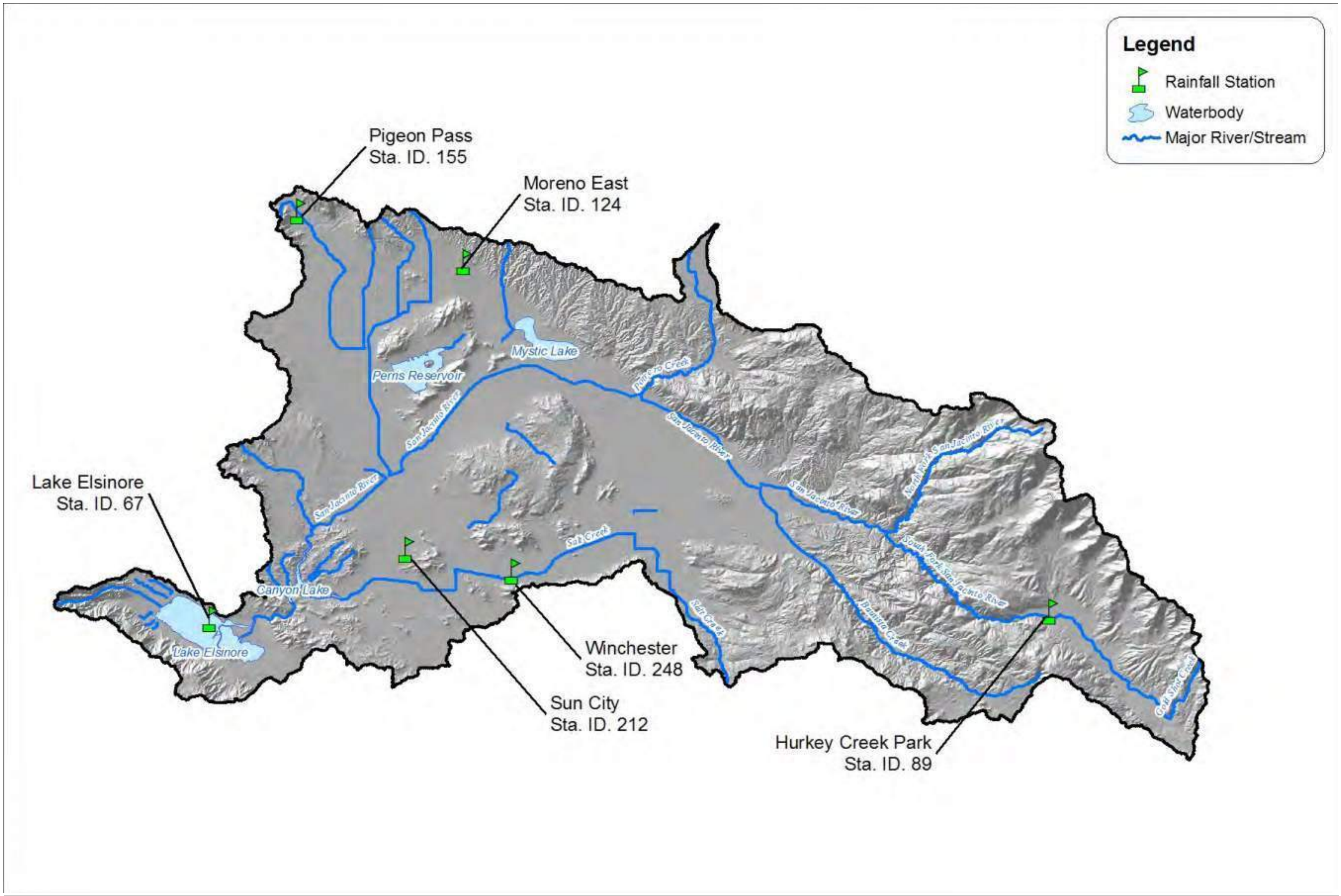
Month	Average Monthly Precipitation (in)	Average Monthly High Temperature (°F)	Average Monthly Low Temperature (°F)	Average Monthly Temperature (°F)
January	2.8	66	38	52
February	2.96	68	40	54
March	2.29	71	43	57
April	0.56	77	46	62
May	0.22	83	51	67
June	0.02	91	56	74
July	0.1	98	61	80
August	0.12	98	62	80
September	0.3	93	58	76
October	0.36	84	51	67
November	0.78	73	42	58
December	1.58	67	37	52
Annual	12.09	81	49	65

Source: Monthly Average for Lake Elsinore, CA - weather.com
http://www.weather.com/weather/wxclimatology/monthly/USCA0580

Table B-4 Precipitation Monitoring Stations in San Jacinto Watershed

Station code	Agency	Station Name	Period of Record Collected	Annual Rainfall (inches)
67	RCFC&WCD	Elsinore	7/1/1990 –7/31/2009	10.6
212	RCFC&WCD	Sun City	7/1/1990 –7/31/2009	11.2
155	RCFC&WCD	Pigeon Pass	7/1/1990 –7/31/2009	12.8
124	RCFC&WCD	Moreno East	7/1/1990 –7/31/2009	12.1
248	RCFC&WCD	Winchester	7/1/1990 –7/31/2009	10.8
89	RCFC&WCD	Hurkey Creek Park	7/1/1990 –7/31/2009	18.7

Source: Tetra Tech Inc., San Jacinto Watershed Model Update, October, 2010



Comprehensive Nutrient Reduction Plan For MS4 Permittees in Canyon Lake and Lake Elsinore Watershed	Dec. 1, 2011	0 2 4 8 Miles	**Figure B-3**	CDM
	Map of Precipitation Gauges			

B.4 Hydrology

This section presents the hydrologic characteristics for the watershed draining to Canyon Lake and Lake Elsinore. The north fork and south fork San Jacinto River are located in the upper portions of the watershed where they converge and collectively become the San Jacinto River upstream of Mystic Lake (Figure B-4). Overflow from Mystic Lake is conveyed by the San Jacinto River to Canyon Lake. Canyon Lake is formed by Canyon Lake Dam; water releases from Canyon Lake ultimately drain to the downstream Lake Elsinore.

All streams in the San Jacinto River watershed are ephemeral. Under normal dry periods, the mainstream of the San Jacinto River is dry, contributing no flow to Canyon Lake, and upstream pollutants do not reach the lakes. External sources contribute nutrients to the lakes via storm flows only during the wet season (October, through April). Further information regarding the hydrologic scenario evaluation is discussed in the Lake Elsinore and Canyon Lake TMDL.

Due to the ephemeral nature of the San Jacinto River system, the location of the various land use sources within the watershed is a major factor affecting the ultimate delivery of nutrients to Canyon Lake and Lake Elsinore. A natural sump, formed by the confluence of two faults, known as Mystic Lake, serves as a hydrologic barrier between the upper and lower San Jacinto Watershed. Mystic Lake is located north of Ramona Expressway and east of the City of Moreno Valley in the San Jacinto Wildlife Preserve. This sump is gradually subsiding providing more runoff storage capacity over time.

During dry hydrologic seasons, Lake Elsinore and Canyon Lake only receive runoff from the subwatersheds directly tributary to them. For example, Lake Elsinore would only receive runoff from the local watershed downstream of Canyon Lake. Similarly, Canyon Lake would only receive runoff from the watershed areas downstream of Mystic Lake. Under moderate hydrologic years, Canyon Lake would be expected to spill, resulting in urban development and agricultural land practices in the central portion of the San Jacinto River watershed below Mystic Lake (including Perris Valley and the Salt Creek sub-watershed) additionally impacting water quality of Lake Elsinore. Lastly, during wet hydrologic years, heavy rain and/or extended periods of rainfall may exceed the storage capacity of Mystic Lake, causing surface flow from open space areas in the headwaters, stormwater runoff from portions of the cities of Hemet and San Jacinto draining to Zones 7-9, and agricultural runoff upstream of Mystic Lake, to reach Canyon Lake. Further, if the rainfall is significant, Canyon Lake may overflow into Lake Elsinore.

Major tributaries to the San Jacinto River include the Perris Valley storm drain and Salt Creek. Perris Valley storm drain conveys flows from the northern portion of the watershed to the San Jacinto River, between Mystic Lake and Canyon Lake. Salt Creek drains to Canyon Lake from the southeast. The U.S. Geological Survey (USGS) operates several flow gauges in the watershed (Table B-5, Figure B-4,), which provide the hydrologic data that were used in the development of the TMDL. The following subsections provide more detailed information regarding the hydrology of the watershed.

Table B-5 USGS Flow Gauge Stations in the San Jacinto Watershed

Station Number	Station Name	Historical Record
11070500	San Jacinto River near Elsinore, CA	1/1/1916–present
11070365	San Jacinto River near Sun City, CA	8/25/2000–present
11070270	Perris Valley Storm Drain at Nuevo Rd. near Perris,	10/1/1969–9/30/1997; 10/1/1998–present
11070210	San Jacinto River at Ramona Expressway near	8/23/2000–9/30/2010
11069500	San Jacinto River near San Jacinto, CA	10/1/1920–9/30/1991; 10/1/1996–present
11070465	Salt Creek at Murrieta Rd. near Sun City, CA	10/1/1983–9/30/1985; 10/1/2000–present

Representative Hydrologic Flow Scenarios

Hydrologic flow scenarios were developed in the Lake Elsinore and Canyon Lake Nutrient Total Maximum Daily Loads (TMDL) (California Regional Water Quality Control Board, 2004) to classify hydrologic conditions within the San Jacinto Watershed. Three scenarios (wet, moderate, and dry) were developed in the Lake Elsinore and Canyon Lake TMDL to evaluate the variability of nutrient loading to the lake due to the various hydrologic conditions that occur in the San Jacinto watershed. Representative years from 1991 – 2000 were initially chosen to represent various hydrologic conditions, and are described in Table B-6. Under wet conditions, the main stem of the San Jacinto River flows into and fills Mystic Lake, which then spills to Canyon Lake. Canyon Lake also spills to Lake Elsinore, and depending on the existing elevation, Lake Elsinore could fill and spill to Temescal Wash. The moderate condition is when the main stem of the San Jacinto River doesn't flow all the way to Canyon Lake, with flows from Salt Creek and the Perris Valley Storm Drain making up the water to Canyon Lake. However, Canyon Lake may have moderate spills to Lake Elsinore. Under dry conditions, the flow from the San Jacinto River watershed never reaches Lake Elsinore, with external nutrient loads to the lake coming from the runoff from the local watershed surrounding the lake.

Table B-6. Three hydrologic conditions defined in the TMDL

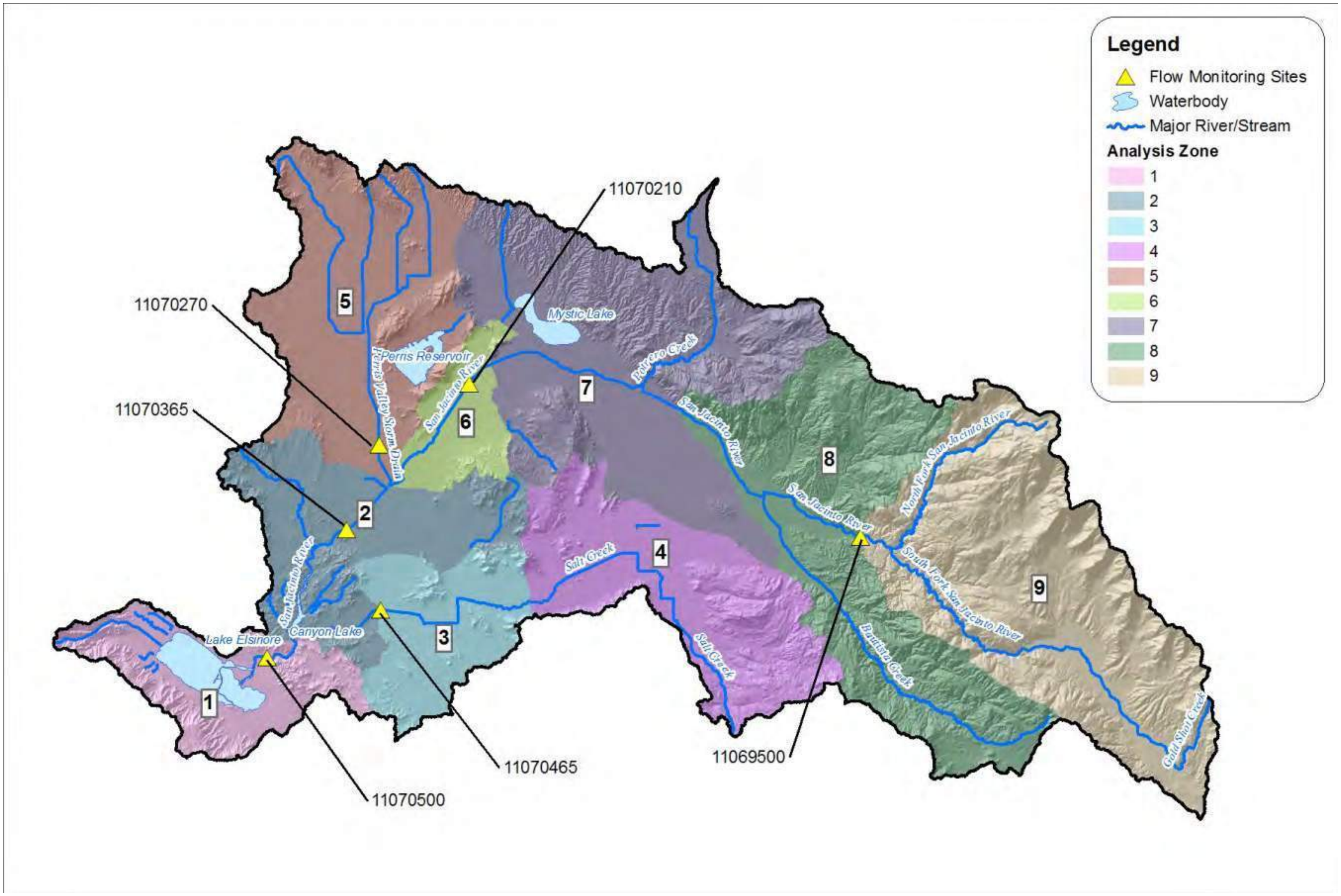
Scenario	Hydrologic Condition	Representative Water Year	Description
I	Wet	1998	Both Canyon Lake and Mystic Lake overflow; flow at the USGS gauging station 11070500 was 17,000 acre-feet
II	Moderate	1994	No Mystic Lake overflow; Canyon Lake overflowed, flow at the USGS gauging station 11070500 was 2,485 acre-feet
III	Dry	2000	No overflows from Mystic Lake or Canyon Lake, flow at the USGS gauging station 11070500 was 371 acre-feet

The relative flow frequency of each of the scenarios was determined using the annual total flow data (for each water year) at the USGS gauging station #1170500. Table B-7 lists the relative flow frequency of the wet, moderate and dry seasons.

Table B-7. Relative flow frequency at the USGS gauging station #1170500 during 1917 – 2011 period

Hydrologic Scenario (Category)	Years in Each Category	Relative Frequency (%) [1]
Wet	15	16%
Moderate	43	45%
Dry	37	39%

1) Frequency weighting in TMDL is based on 1917-2003 period of record and therefore results are slightly different than shown above



Comprehensive Nutrient Reduction Plan For MS4 Permittees in Canyon Lake and Lake Elsinore Watershed	Dec. 1, 2011	0 2 4 8 Miles		**Figure B-4**	CDM
	Watershed Analysis Zones and Flow Monitoring Stations				

B.4.1 Watershed Analysis Zones

As part of the development the TMDL model, the San Jacinto River Basin was divided into nine watershed analysis zones (Figure B-4). The delineation of these zones was based upon hydrologic features such as significant water retention features or major tributaries:

- Zones 7, 8, and 9, which drain to Mystic Lake, represent the most upstream portion of the watershed;
- Zone 6 represents the area downstream of Mystic Lake that drains directly to the San Jacinto River;
- Zone 5 drains to the Perris Valley Storm Drain which confluences with the San Jacinto River between Mystic Lake and Canyon Lake;
- Zones 3 and 4 drain to Salt Creek, which drains to Canyon Lake;
- Zone 2 drains the area downstream of the Perris Valley Storm Drain drainage area and drains to Canyon Lake; and
- Zone 1 represents that area that drains directly to Lake Elsinore.

B.4.2 Major Waterbodies

Lake Elsinore

Lake Elsinore is located in the southwest portion of the San Jacinto River Basin at the terminus of the San Jacinto River watershed. Lake Elsinore is a natural lake, which has been in existence for thousands of years. Prior to development in the area, the lake naturally experienced significant variations in lake level from being a dry lake bed to filling temporarily following extreme rain events. Today, the lake receives surface flows from local tributaries (Zone 1), which make up less than 10 percent of the overall San Jacinto River watershed and water releases from Canyon Lake. During rare overflow events, at approximately 1,255 feet water surface elevation, Lake Elsinore overflows into Temescal Creek and ultimately to the Santa Ana River.

Canyon Lake

Canyon Lake Reservoir was created in 1928 with the construction of the Railroad Canyon Dam. Over 90 percent of the San Jacinto watershed drains to Canyon Lake. Flows typically enter the reservoir from both the upper San Jacinto River watershed (Zones 5 and 6) and the Salt Creek watershed (Zones 3 and 4). Flows may also reach Canyon Lake from Zones 7-9 during rare periods when Mystic Lake overflows. The elevation of Canyon Lake Dam spillway is approximately 1,382 feet; when the lake level reaches this point flows continue downstream to Lake Elsinore. USGS flow gauge 11070500, located on the San Jacinto River downstream of Canyon Lake, has been in operation since 1916. During its operational period, it is estimated that flows from Canyon Lake have occurred 38 of the 94 years or a frequency of 40 percent.

Mystic Lake

Flows entering the San Jacinto River from upstream portions of the watershed (Zones 7-9) drain into Mystic Lake. Mystic Lake is typically a dry lake and serves as a water sink because flows entering the lake are generally lost from the system due to soil infiltration and evaporation. Mystic Lake is formed by the confluence of two faults and is located north of Ramona Expressway and east of the City of Moreno Valley in the San Jacinto Wildlife Preserve. This sump is gradually subsiding providing more runoff storage capacity over time. During high or long duration flow events, the storage capacity of Mystic Lake may be exceeded and overflow back to the San Jacinto River and downstream to Canyon Lake. Overflow at Mystic Lake occurs when the water surface elevation is approximately 1,425 feet. USGS flow gauge 11070210 is located on the San Jacinto River roughly 3.5 miles downstream of Mystic Lake. This gauge was in operation between 8/23/2000–9/30/2010 and records local runoff as well as overflows from Mystic Lake. Flow was recorded at Ramona Expressway in 2005, however field investigations determined the flow was from the local watershed area and not Mystic Lake. Given the low flow rates during the other years, it is assumed that since 2000, Mystic Lake has not overflowed.

Lake Hemet

Lake Hemet was created when Hemet Dam was constructed in 1895. The dam is owned and operated by the Lake Hemet Municipal Water District (LHMWD) and is a water source for the cities of Hemet and San Jacinto, and the San Jacinto Mountain community of Garner Valley. The lake is approximately 4,340 ft above sea level and located in the San Jacinto Mountains. The lake volume is roughly 8,100 acre-ft and the outlet flows to the south fork of the San Jacinto River. Flow data at USGS flow gage 11069500, located downstream of Lake Hemet, indicates that this area generally sustains baseflow after a rain event throughout the year. This is in contrast to flow data recorded at other gauges in the San Jacinto River Basin.

San Jacinto River

The headwaters of the San Jacinto River begin in the San Bernardino National Forest where the north and south forks converge east of Valle Vista. The San Jacinto River drains the upper portions of the San Jacinto River Basin to Mystic Lake. The river continues downstream of Mystic Lake to Canyon Lake and again downstream of the Canyon Lake Dam to Lake Elsinore where it terminates. The San Jacinto River Basin is a complex hydraulic system which includes hydraulic sinks, little or no sustained baseflow in most areas especially during dry periods, deep groundwater losses, and reduction in groundwater levels due to excessive groundwater pumping and limited recharge. Generally, the San Jacinto River is not sustained by groundwater flows during dry years and remains waterless. With limited surface water recharge from groundwater, water that infiltrates into the ground is considered to be lost from the system.

Perris Valley Storm Drain

The northwest area of the San Jacinto River watershed is drained by Perris Valley Storm Drain. The drain has its confluences with the San Jacinto River upstream of Canyon Lake. USGS gauge 11070270 is located on the Perris Valley Storm Drain near Perris, CA. Flows recorded at this gauge display high peak flow rates of short durations, a pattern commonly seen with stormwater runoff from developed areas with little or no associated groundwater flow.

Salt Creek

Salt Creek is an intermittent creek that drains southern portions of the San Jacinto River watershed. The drainage enters Canyon Lake from the southeast. USGS gauge 11070465 measures flow in Salt Creek near Sun City and displays a lower unit-area flow than other gauges in the watershed. However, the USGS rates the data recorded at this station as poor quality.

B.4.3 Flow

Wet weather runoff is the primary influence on flow rates observed in the San Jacinto watershed. Figure B-5 presents a flow duration curve for daily mean discharges at the USGS gauges (See Table B-5). The figure shows the cumulative-frequency curves, which represent the likelihood that a particular flow discharge is equaled or exceeded at the site. Figure B-5 indicates that the upstream portion of the San Jacinto River has a more stable flow rate, which suggests that this area receives groundwater inflow and snowmelt runoff that tends to infiltrate prior to reaching the Ramona Expressway gauge.

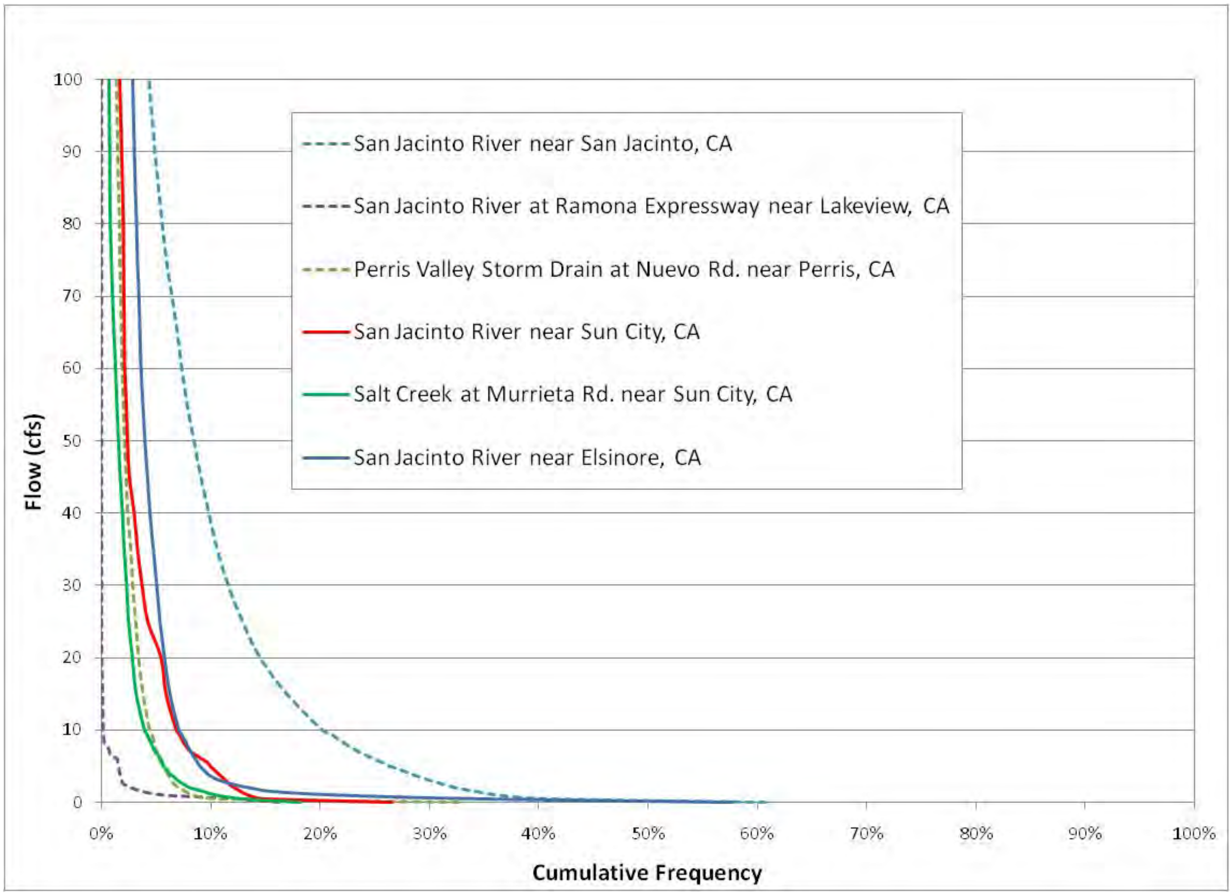
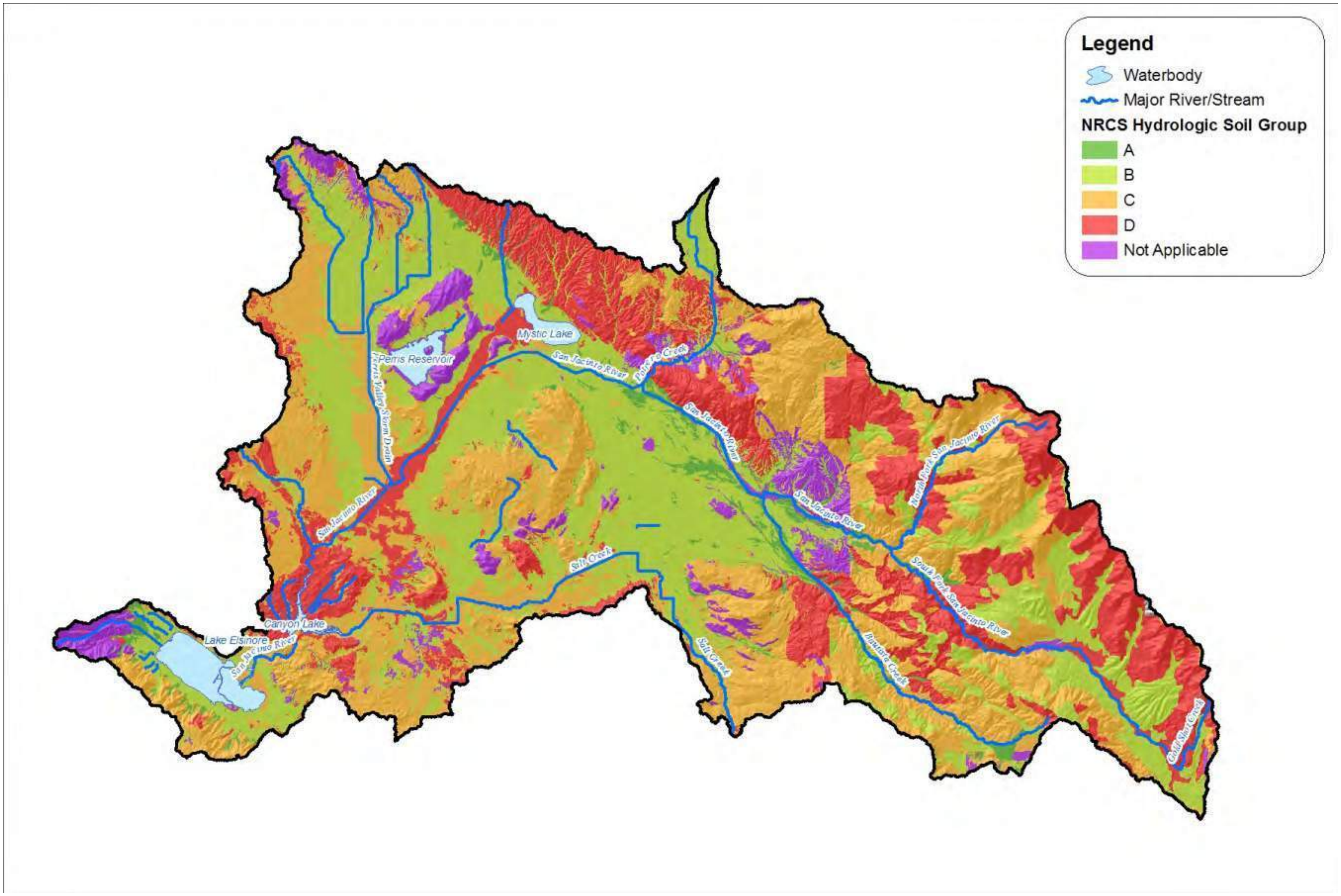


Figure B-5
Flow Duration Curves for Daily Mean Discharges at USGS Gauges in the San Jacinto River Watershed

B.4.4 Soils

The U.S. Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS) categorizes soils into four distinct hydrologic soil groups, based on infiltration and transmission rates after prolonged wetting (Table B-8). Generally, soils in group A are well-drained and have a high infiltration while soils in group D have a slow infiltration rate. Soil data for the San Jacinto River Basin was obtained from STATSGO2 (USDA 2006) and summarized by hydrologic soil groups (Figure B-6). Areas draining to the north and south fork San Jacinto River are dominated by soil group C. Forest land is the most common land use in these areas. Areas draining to Salt Creek are also mainly represented by soil group C but differ from the north and south fork San Jacinto River drainage areas mainly because the unit-area flow for this area is lower. Potential causes for this difference may be poor quality of flow records, flows captured by the Paloma Valley Reservoir, or occasional diversions for irrigation and domestic use. The majority of the area draining to Perris Valley Storm Drain is classified as soil group B meaning the soil has moderate infiltration rates and a moderate rate of water transmission. This is a mixed land use area of the watershed and representative hydrographs show large stormwater runoff peaks with little or no associated groundwater flow. Local watersheds draining into Canyon Lake are classified as soil group D representing areas of low permeability.



Comprehensive Nutrient Reduction Plan For MS4 Permittees in Canyon Lake and Lake Elsinore Watershed	Dec. 1, 2011	0 2 4 8 Miles		**Figure B-6**	CDM
	NRCS Hydrologic Soil Type				

Table B-8. Hydrologic Soil Group Descriptions (USDA 2006)

Hydrologic Soils Group	Description
A	Soils with high infiltration rates. Usually deep, well drained sands or gravels. Little runoff.
B	Soils with moderate infiltration rates. Usually moderately deep, moderately well drained soils.
C	Soils with slow infiltration rates. Soils with finer textures and slow water movement.
D	Soils with very slow infiltration rates. Soils with high clay content and poor drainage. High amounts of runoff.
Not Applicable	Limited soil, exposed bedrock, or water body.

B.4.5 Water Quality

The following sections characterize water quality in Lake Elsinore, Canyon Lake, and runoff from the San Jacinto watershed. This analysis focuses on the primary indicators of nutrient impacts to water quality: total phosphorus, total nitrogen, dissolved oxygen, and chlorophyll *a*. This section is a summary of detailed information, which can be obtained Lake Elsinore & Canyon Lake Nutrient TMDL Annual Water Quality Reports, (http://www.sawpa.org/AnnualWQReports.htm).

Lake Elsinore

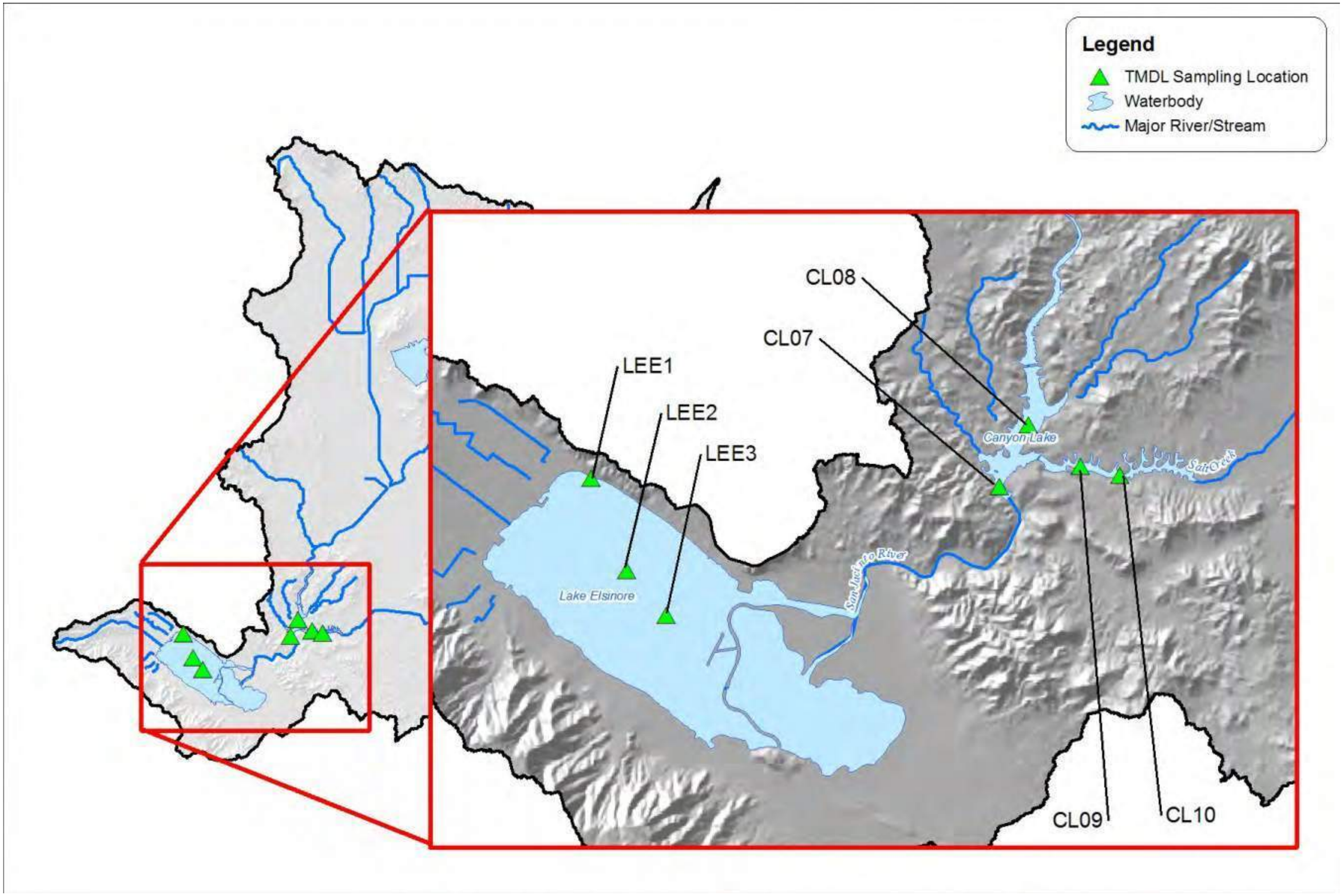
Elsinore Valley Municipal Water District's (EVMWD) initiated its NPDES compliance monitoring program for Lake Elsinore in April 2006. Initially, monitoring for nutrients occurred at three water quality sampling stations. Figure B-7 shows the sampling stations where surface, bottom, and integrated samples were collected. EMVWD collects samples monthly from October through May and biweekly from June through September.

Table B-9 summarizes monitoring results for the period July 1, 2006 through June 30, 2011 for the LEE2 sample location. Results are compared to basin plan objectives and TMDL targets.

Figure B-8 shows lake surface, integrated, and lake bottom dissolved oxygen concentrations observed at station LEE2. Summer months exhibit stratified dissolved oxygen, with the lake bottom samples declining to 0 mg/L. The winter months exhibit greater uniformity in dissolved oxygen concentrations, due to turnover and mixing of the epilimnion and hypolimnion.

Figure B-9 shows depth integrated total nitrogen and phosphorus results locations, averaged from all three sites. Nitrogen and phosphorus concentrations were generally uniform and did not exhibit seasonal fluctuations or significant changes as a result of depth. A spike in phosphorus concentrations was observed on April 11, 2011.

Figure B-10 shows depth integrated chlorophyll *a*, averaged from all three sites. There has been a gradual increase in chlorophyll *a* after October 2009, although further study is required to determine if this is a significant trend. Table B-10 provides the average chlorophyll *a* concentrations consolidated by season; concentrations decrease during the spring sample period compared to the other seasons, possibly due to an increase in precipitation which may dilute the algae.



Comprehensive Nutrient Reduction Plan For MS4 Permittees in Canyon Lake and Lake Elsinore Watershed	Dec. 1, 2011	0 2 4 8 Miles		**Figure B-7**	CDM
	Lake Water Quality Monitoring Sites				

Table B-9 Summary - Lake Elsinore Water Quality Data

Parameter	TMDL Compliance Date	Basin Plan Objectives or TMDL Targets	2006 - 2011 Results				
			No. of Sampling Events	Range of Daily Averages	Annual Mean	Annual Median	Standard Deviation
Dissolved Oxygen (mg/L) (Station LEE2, depth profile)	2015	Not less than 5 mg/L as a depth average	91	0.3 - 11.65	6.35	6.20	2.02
	2020	Not less than 5 mg/L 1 meter above lake bottom	91	0.00 - 11.50	4.24	3.65	2.56
pH (3 stations, depth profile)	---	6-5 - 8.5	101	6.72 - 9.76	8.92	8.95	0.35
Ammonia N (NH4-N) (mg/L) (3 stations, integrated samples)	2020	Data Results	100	ND - 0.77	0.14	0.09	0.15
		Acute Criteria Compliance	No observed exceedances of the acute criterion at the range of pH conditions measured.				
		Chronic Criteria Compliance	Exceedance of the chronic criteria observed 7.2% of the time (80 out of 1040 ammonia readings).on the following dates: 8/29/06, 12/19/06, 1/10/07, 10/12/07, 11/28/07, 1/16/08, 5/16/08, 6/27/08, 9/18/08, 7/29/09, 8/19/09 , 8/26/09, 9/11/09, 9/25/09, 10/21/09, 12/4/09, 6/9/10, 7/23/2010, 8/18/2010, 9/30/2010, 10/12/2010, and 6/29/2011.				
Total Nitrogen (TN) (mg/L) (3 stations, integrated samples)	2020	Annual average 0.75 mg/L	90	0.50 - 8.56	3.57	3.29	1.42
Total Phosphorus (TP) (mg/L) (3 stations, integrated samples)	2020	Annual average 0.1 mg/L	81	0.09 - 0.89	0.23	0.20	0.12
Chlorophyll *a* (µg/L) (3 stations, surface samples 0-2 m, April to September)	2015	Summer average no greater than 40 µg/L	95	15.2 - 247.5	93.27	88.37	55.08
Chlorophyll *a* (µg/L) (3 stations, integrated samples, April to September)	2020	Summer average no greater than 25 µg/L	96	16.1 - 271.3	89.41	90.19	52.51
Secchi Depth (cm) (3 stations)	---	---	100	28 - 102	57.56	52.19	19.64
Total Dissolved Solids (mg/L) (3 stations, integrated samples)	---	2000 mg/L	101	1082 - 1967	1449	1437	205

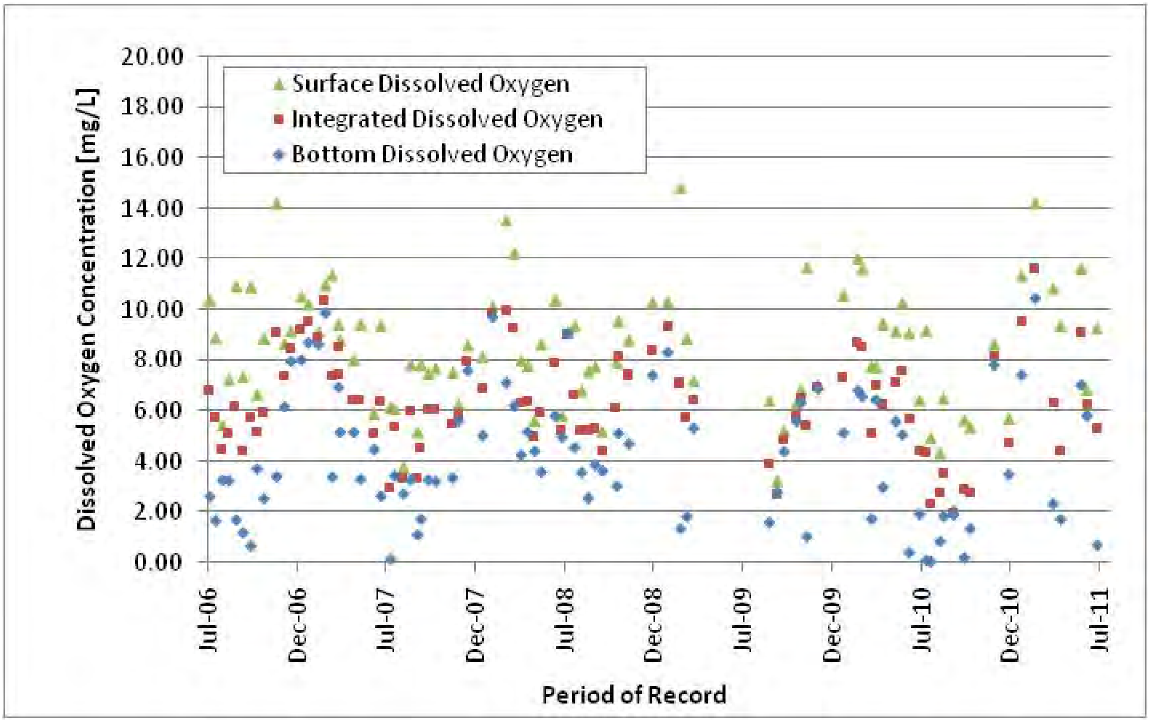


Figure B-8
Lake Elsinore Dissolved Oxygen Concentrations Observed at Station LEE2

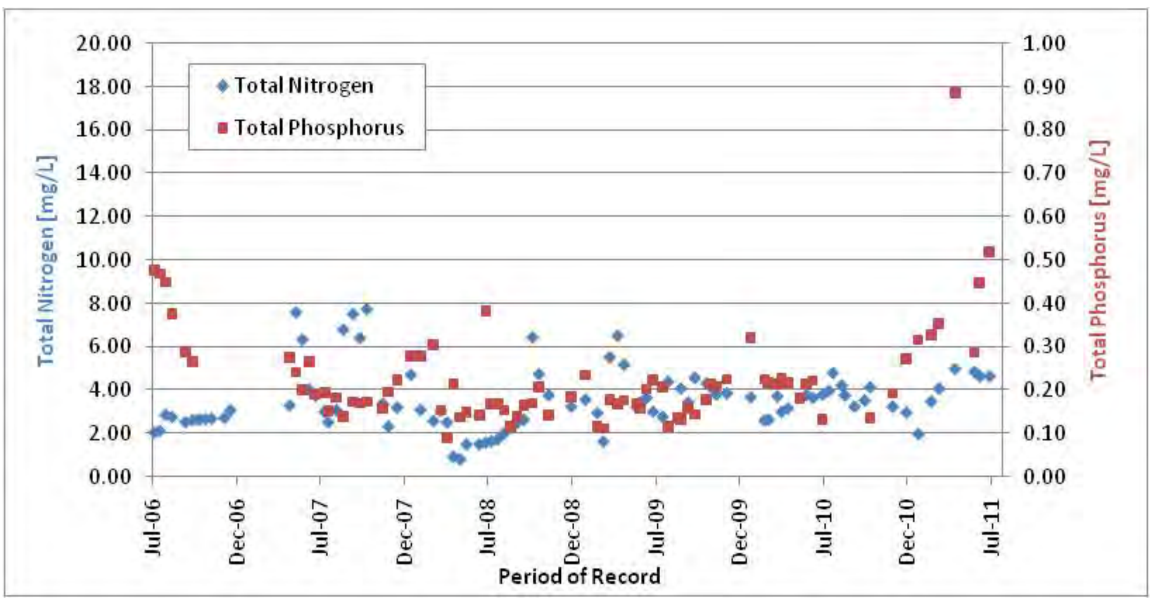


Figure B-9
Lake Elsinore Total Nitrogen and Total Phosphorus Concentrations

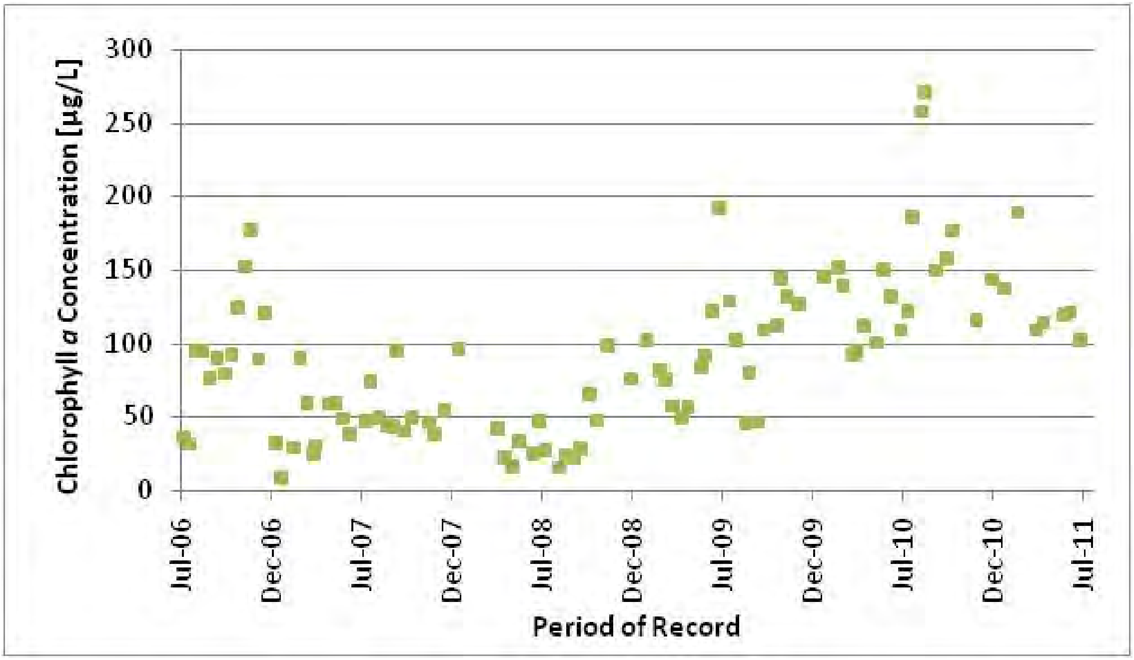


Figure B-10
Lake Elsinore Chlorophyll *a* Concentrations

Table B-10 Lake Elsinore average chlorophyll *a* concentrations consolidated by season

Season	Concentration [µg/L]
Winter	98.9
Spring	74.1
Summer	93.4
Fall	94.1

The Redfield ratio has been used to determine the limiting nutrient for algal growth in the lake. The nutrient that is below the ratio likely limits the growth of phytoplankton (Schindler et al. 2008). For this analysis, a 7:1 ratio for nitrogen to phosphorus (N:P) was used. Figure B-11 shows the N:P ratios observed in Lake Elsinore. For most of the period of record, the observed N:P ratio is greater than 7:1, indicating that phosphorus is the limiting nutrient.

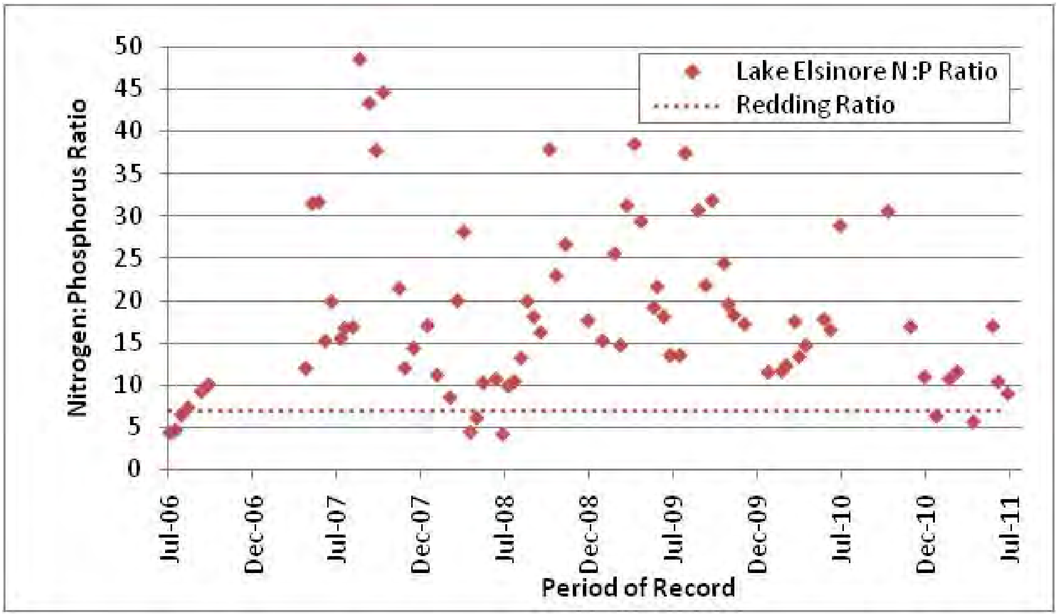


Figure B-11
Observed Lake Elsinore Nitrogen to Phosphorus Ratios

Canyon Lake

EVMWD's NPDES compliance monitoring program for Canyon Lake, which began June 2007, consists of four sampling locations (Figure B-7). Samples from Station CL07 and CL08 are located within the Main Basin and Stations CL09 and CL10 are located in the East Basin.

- Station CL07 – Located at the deepest part of the lake near the dam. The site is generally strongly stratified during the summer.
- Station CL08 – Located mid-lake in the main body of Canyon Lake.
- Station CL09 and CL10 – Two relatively shallow sample locations within the East Basin of the lake that receive local nuisance runoff and discharges from Salt Creek during wet weather events.

Unless stated otherwise, in subsequent tables and figures the Main Basin sampling results are averaged samples from Stations CL07 and CL08, and East Basin sampling results are averaged samples from Stations CL09 and CL10. Samples are collected monthly from October through May, and biweekly from June through September. Table B-11 summarizes Canyon Lake monitoring results for the period July 1, 2007 through June 30, 2011.

Table B-11 Summary - Lake Elsinore Water Quality Data

Parameter	TMDL Compliance Date	Basin Plan Objectives or TMDL Targets	Main Basin 2007- 2011 Results					East Basin 2006 - 2011 Results				
			No. of Sampling Events	Range of Daily Averages	Annual Mean	Annual Median	Standard Deviation	No. of Sampling Events	Range of Daily Averages	Annual Mean	Annual Median	Standard Deviation
Dissolved Oxygen (mg/L) (Station 07 for Main Basin; Stations 09 and 10 for East Basin)	2015	Not less than 5 mg/L above the thermocline	61	0.94 - 13.75	7.01	7.27	2.85	60.00	0.33 - 11.17	6.24	6.01	1.56
	2020	Not less than 5 mg/L daily average in hypolimnion	61	0 - 5.7	0.89	0.21	1.53					
pH (Station 07 for Main Basin; Stations 09 and 10 for East Basin)	---	6-5 - 8.5	68	7.43 - 8.94	8.02	7.98	0.34	68	7.30 - 9.70	8.31	8.22	0.47
Ammonia N (NH4-N) (mg/L) (Station 07 for Main Basin; Stations 09 and 10 for East Basin)	2020	Data Results	70	0.011 - 1.800	0.49	0.44	0.31	70	ND - 1.290	0.40	0.37	0.28
		Acute Criteria Compliance	Exceedances of the acute criterion on: 5/30/08; observed 0.16% of the time (1 out of 644 samples)					Exceedances of the acute criterion on: 5/30/08; observed 0.18% of the time (1 out of 551 samples)				
		Chronic Criteria Compliance	Exceedances of the chronic criterion: 6/18/08, 7/2/08, 7/1/09, 7/24/09, 5/10/10, 6/28/10, 6/12/10, 7/30/10, 8/9/10, 8/30/10, 9/17/10, 10/26/10; Exceedances observed 2.95% of the time (19 out of 644 samples)					Exceedances of the chronic criterion: 5/30/08, 6/6/08, 6/18/08, 7/2/08, 7/24/09, 11/30/09, 6/11/10, 6/28/10; Exceedances observed 4.54% of the time (25 out of 551 samples)				
Total Nitrogen (TN) (mg/L)	2020	Annual average 0.75 mg/L	68	0.33 - 4.37	2.06	2.00	0.93	69	0.35 - 5.49	2.04	1.92	0.92
Total Phosphorus (TP) (mg/L)	2020	Annual average 0.1 mg/L	70	0.33 - 1.74	0.68	0.64	0.25	70	0.09 - 2.27	0.61	0.53	0.36
Chlorophyll *a* (µg/L) (surface samples 0-2 m)	2015	Summer average no greater than 40 µg/L	40	1.5 - 138.3	34.33[1]	29.30	27.49	45	2.5 - 266.1	61.00	38.85	71.62
Chlorophyll *a* (µg/L) (integrated samples)	2020	Summer average no greater than 25 µg/L	60	1.0 - 171.8	37.56[1]	33.49	28.77	60	2.5 - 266.1	56.19	50.92	46.22
Secchi Depth (cm)	---	---	68	18 - 301	119.32	113.25	44.67	69	21 - 231	90.50	86.36	34.26
Total Dissolved Solids (mg/L) (integrated samples)	---	700 mg/L	69	152 - 901	616.63	684.00	215.96	68	336 - 1206	703.82	658.11	223.28

[1] Data presented as annual mean

Figure B-12 shows observed dissolved oxygen concentrations at Station CL07 (closest to the lake spillway). Highly stratified conditions exist throughout most of the year, with the lake bottom concentrations at 0 mg/L for most months. The winter months exhibit greater uniformity in dissolved oxygen concentrations, due to turnover and mixing of the epilimnion and hypolimnion.

Figure B-13 shows observed dissolved oxygen concentrations at Station CL08 (most representative of Main Basin). Dissolved oxygen concentrations are similar to the values found in CL07, with peaks and troughs occurring on the same sample dates as CL07. Highly stratified conditions exist throughout most of the year, with the lake bottom concentrations at 0 mg/L for most months. The winter months exhibit greater uniformity in dissolved oxygen concentrations, due to turnover and mixing of the epilimnion and hypolimnion.

Figure B-14 characterizes observed dissolved oxygen concentrations at Stations CL09 and CL10. Due to the low water depth and inflow from Salt Creek, stratification does not occur in this portion of the lake. Dissolved oxygen concentrations in the East Basin have remained relatively constant throughout the period of record.

Figures B-15 and B-16 show depth integrated total nitrogen and phosphorus observations within the Main Basin and East Basin, respectively. Similar observations occurred at both sample locations. Nitrogen and phosphorus concentrations were generally uniform and did not exhibit seasonal fluctuations or significant changes by depth. Peaks and troughs in nutrient concentrations occurred generally during the same periods. However, the spike in phosphorus concentrations, observed on April 11, 2011 and continuing to the end of the sampling season, was not observed for nitrogen.

Figure B-17 illustrates depth integrated chlorophyll *a* concentrations for the Main Basin and East Basin sample locations. Peaks and troughs of chlorophyll *a* concentrations occurred at the same time at both sites; however, concentrations in the East Basin have been typically higher than the Main Basin. Table B-12 summarizes the average seasonal chlorophyll *a* concentrations at both sample locations. The lowest concentrations have been observed in the spring.

Figure B-18 characterizes the average N:P ratio for both lake basins. For the majority of the period of record, the N:P ratio of N:P is less than 7:1, indicating that nitrogen is the limiting nutrient.

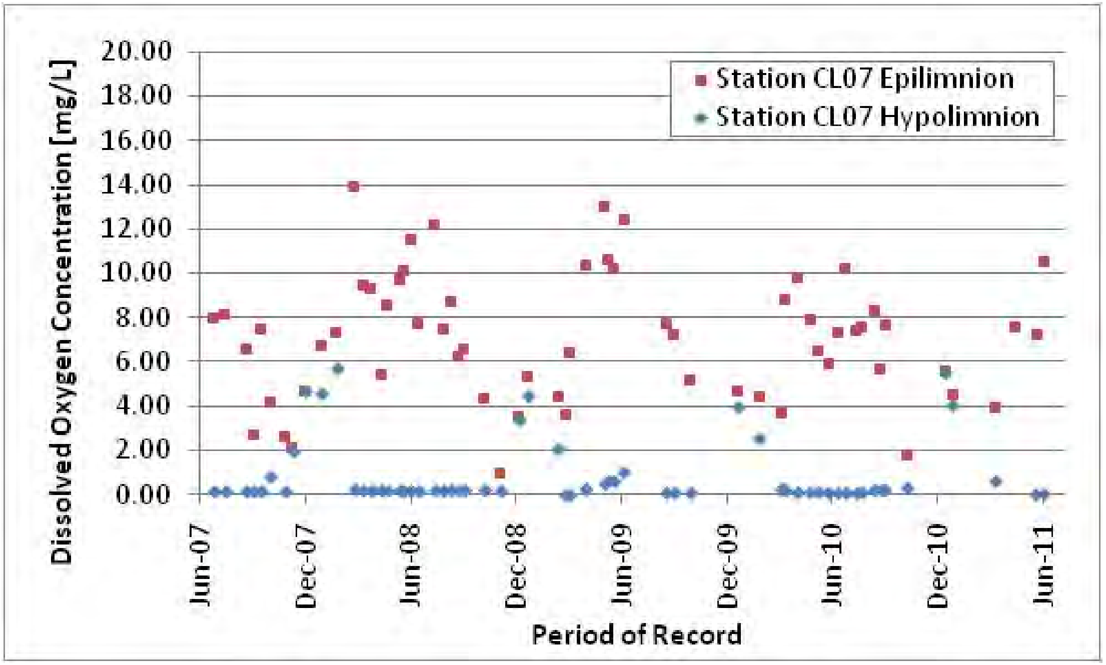


Figure B-12
Canyon Lake Dissolved Oxygen Concentrations at Station CL07

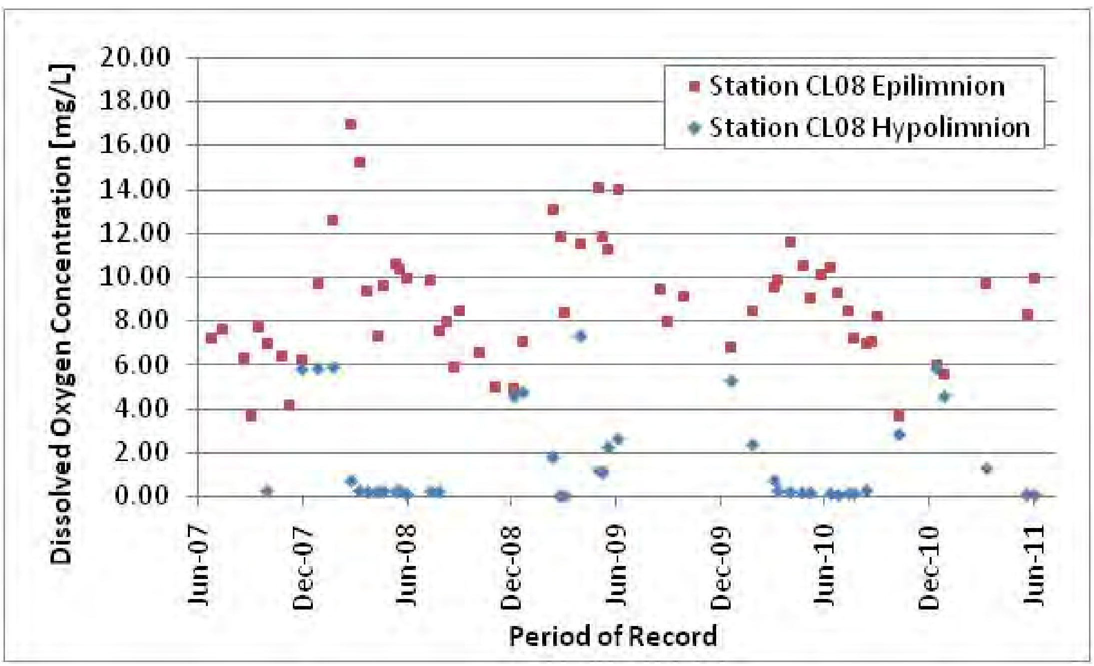


Figure B-13
Canyon Lake Dissolved Oxygen Concentrations at Station CL08

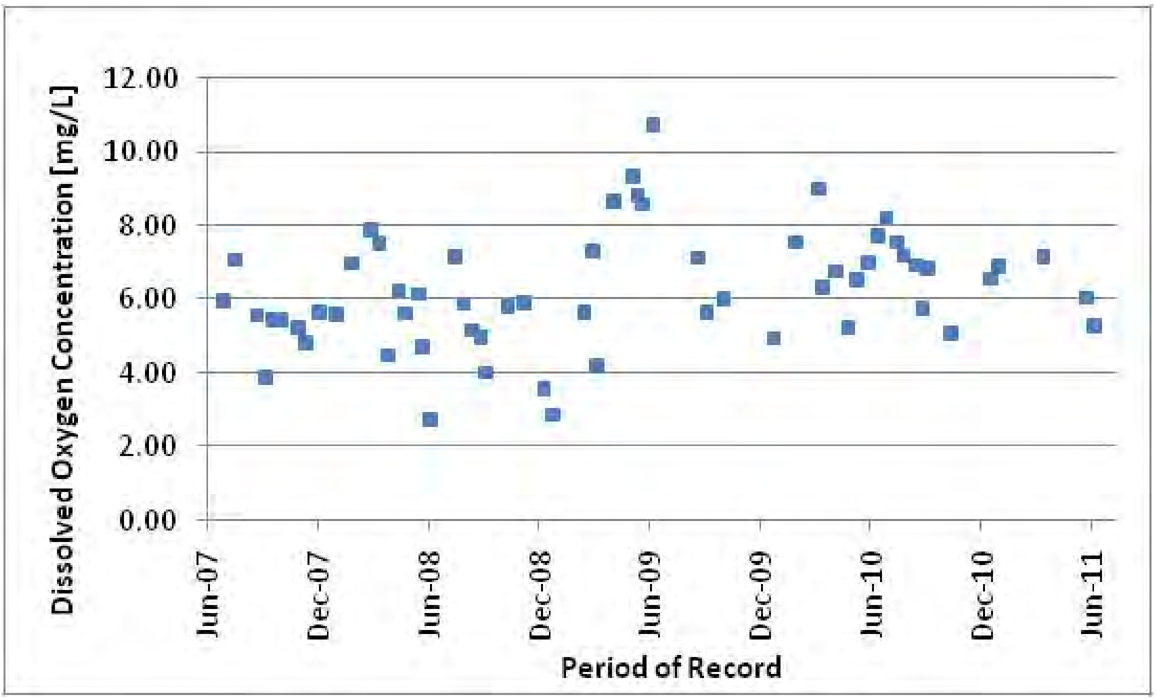


Figure B-14

Canyon Lake Dissolved Oxygen Concentrations at East Basin Sample Locations (CL09 and CL10)

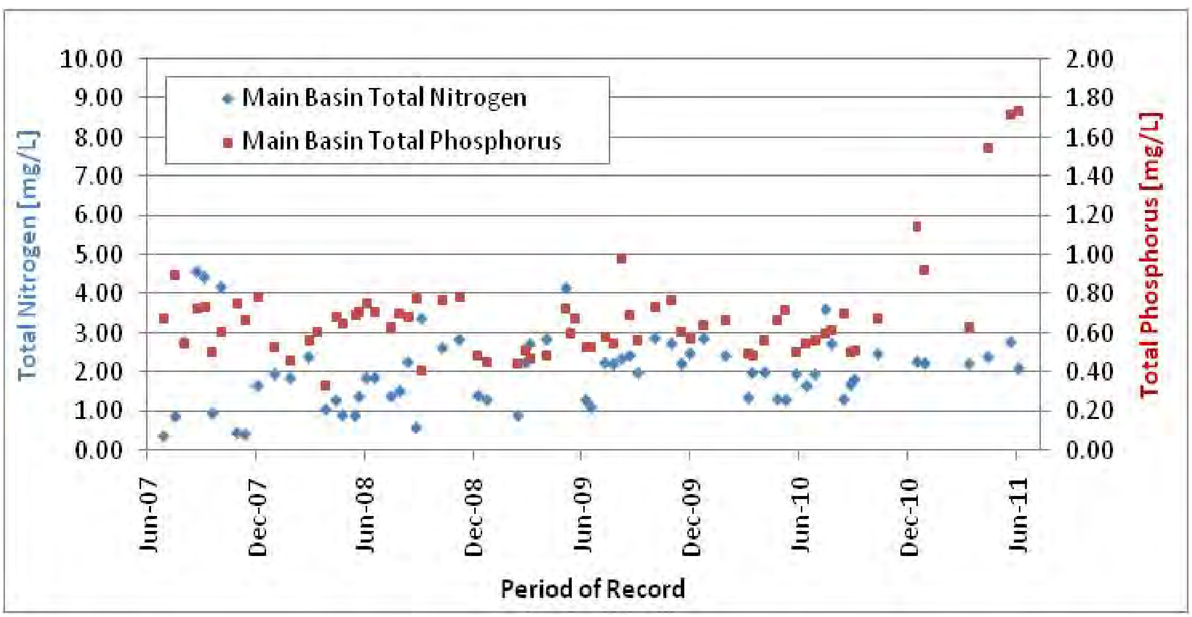


Figure B-15

Canyon Lake Total Nitrogen and Total Phosphorus Concentrations in the Main Basin

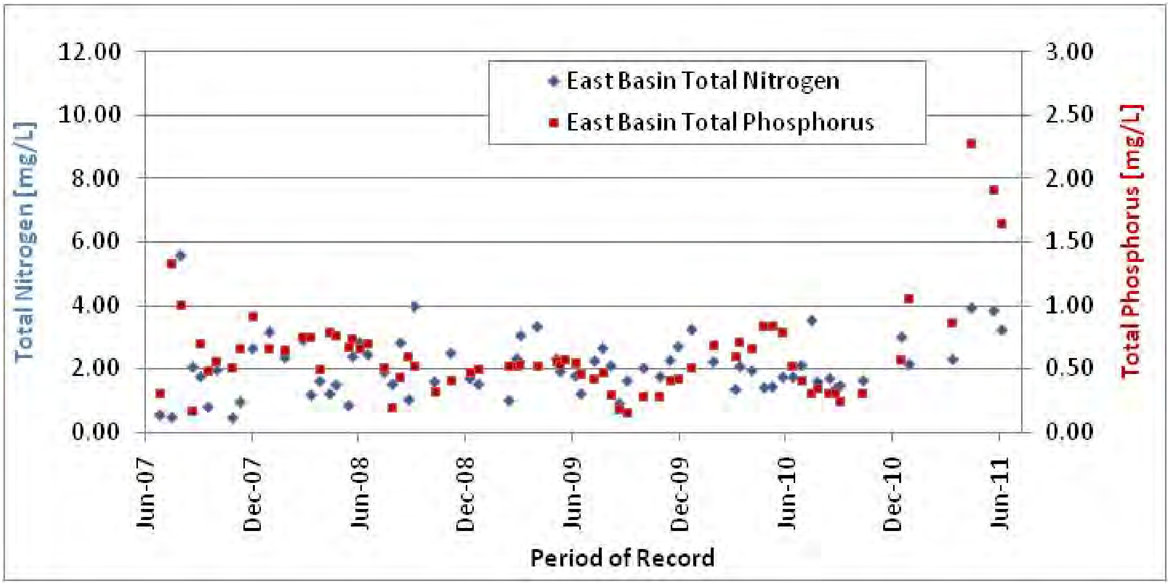


Figure B-16
Canyon Lake Total Nitrogen and Total Phosphorus Concentrations in the East Basin

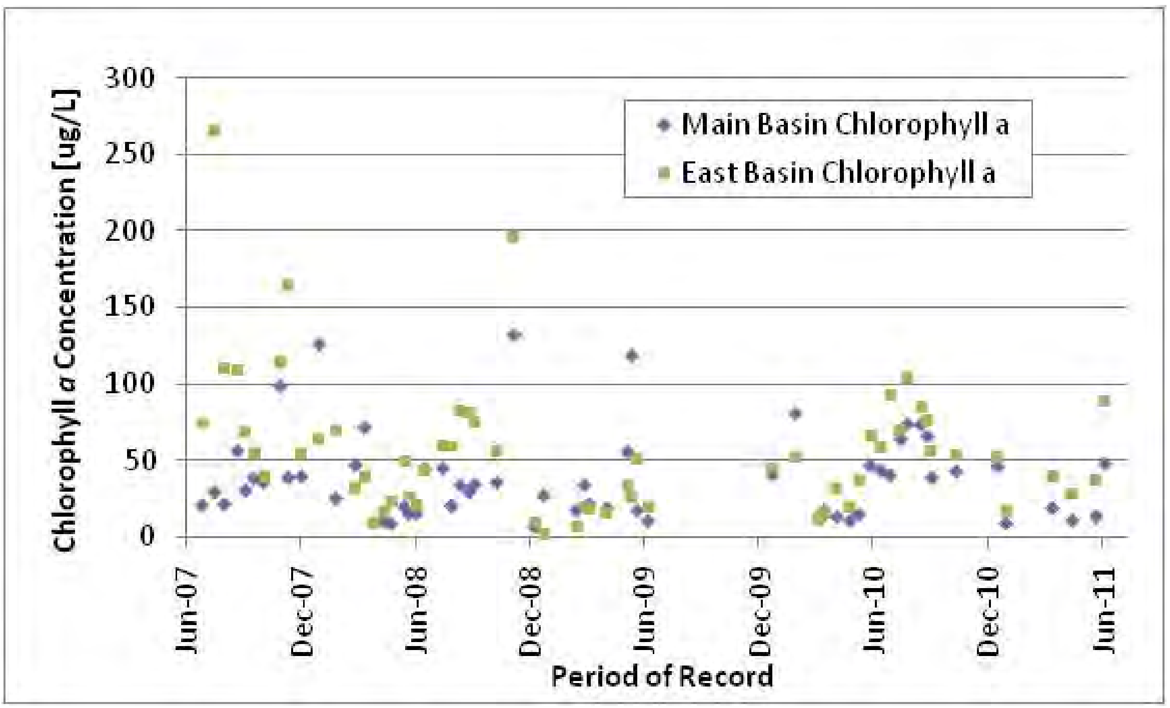


Figure B-17
Canyon Lake Chlorophyll *a* Concentrations

Table B-12 Canyon Lake average Chlorophyll *a* Concentrations (µg/L) by Season

Season	Main Basin	East Basin
Winter	41.4	36.7
Spring	27.9	25.4
Summer	35.1	74.0
Fall	51.6	87.8

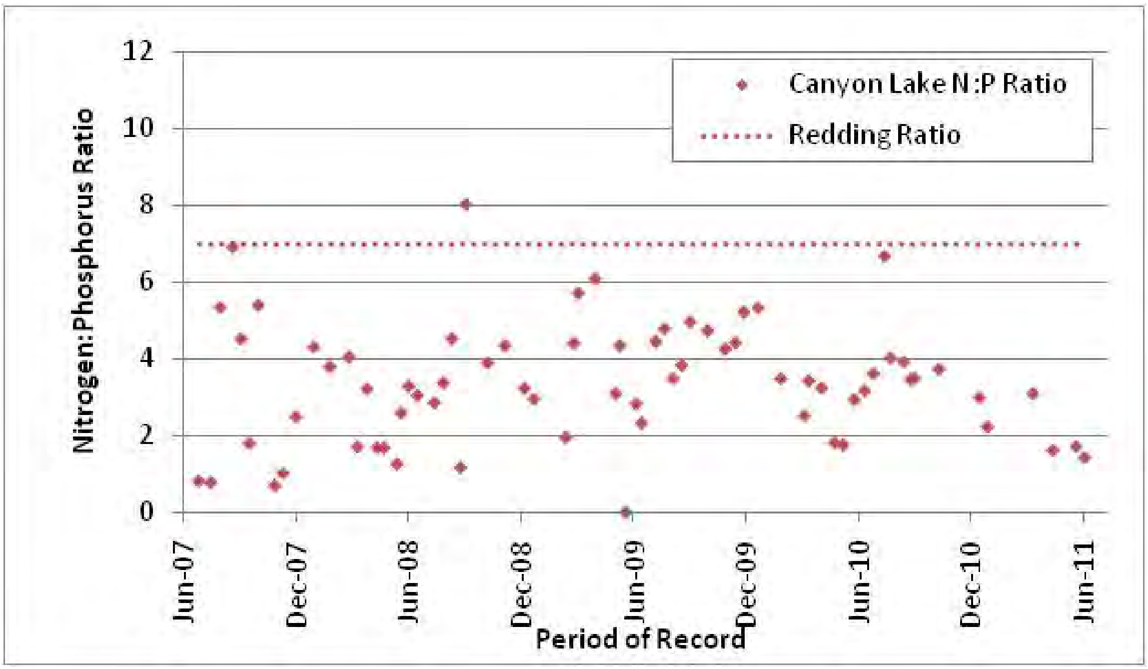


Figure B-18
Observed Canyon Lake Nitrogen to Phosphorus Ratios

San Jacinto Watershed

As part of the Phase I San Jacinto River Watershed Monitoring Program, water quality samples were collected from four sample locations during wet weather events (Figure B-19):

- Salt Creek at Murrieta Rd – Area tributary to this sample location includes the southern portion of the San Jacinto watershed, with land uses consisting of irrigated croplands and residential.
- Goetz Road – Tributary area includes the northern half of the San Jacinto watershed; land use includes urban, irrigated croplands, residential, and open space. This monitoring location has the largest tributary area, but much of the water is captured by nearby Mystic Lake.

- Canyon Lake Spillway – Only during high storm events is water released from Canyon Lake to Lake Elsinore. Samples are gathered from this site only when water is released.

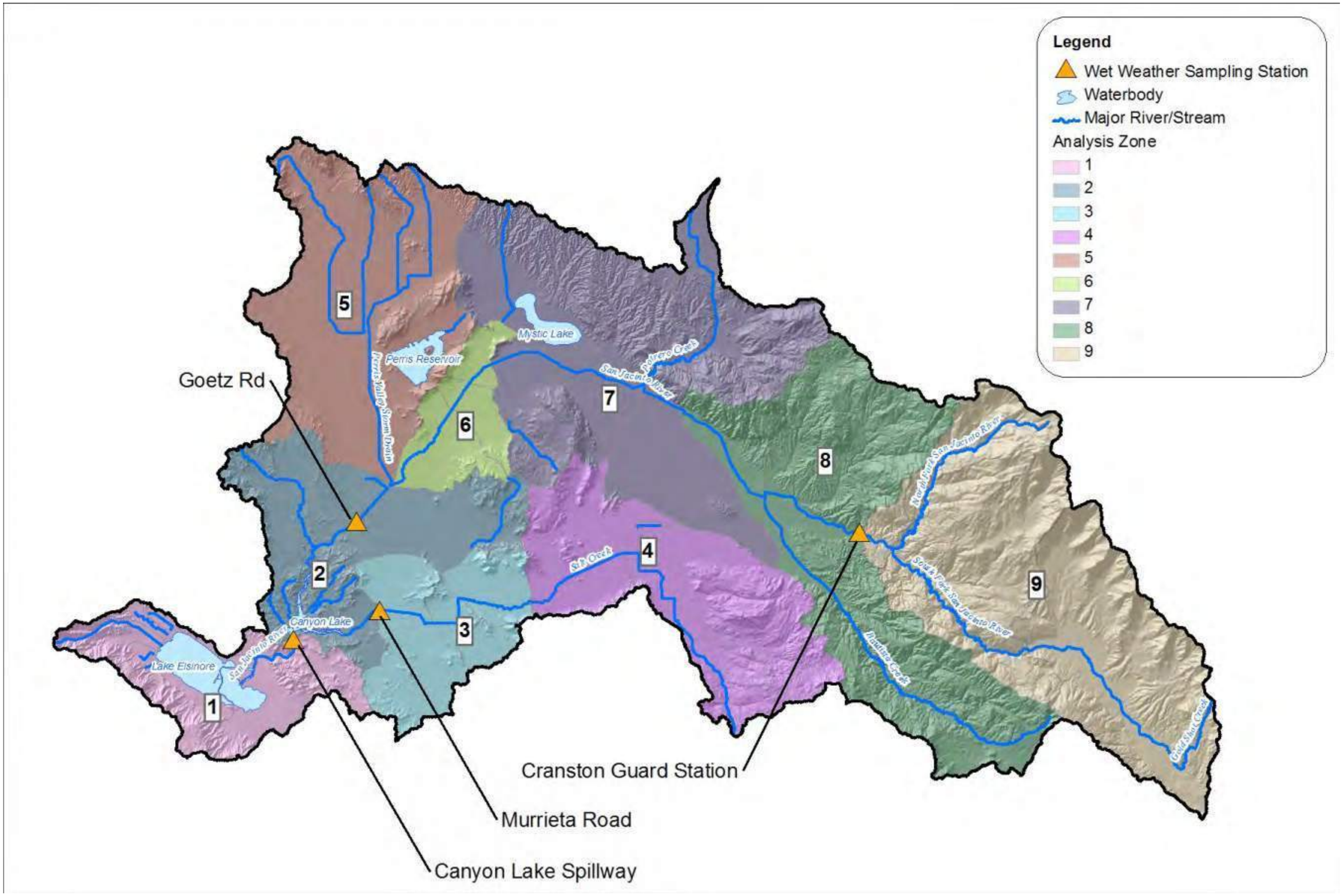
- Cranston Guard Station – This station is located at the eastern portion of the watershed. This station experiences the highest annual flows compared to the other stations. Sampling at this station is conducted by the United States Forest Service, and is dependent on whether adequate funding is allocated through Congress. Land use upstream of this site is forested area.

- A fifth station, San Jacinto River at Ramona Expressway, would be sampled if Mystic Lake overflows; however, since the implementation of this monitoring program no such overflows have occurred.

Samples are collected throughout observed storms at different points of the hydrograph to obtain a range of concentrations across the storm event. Sampling methodology is described in detail in the Lake Elsinore & Canyon Lake Nutrient TMDL Annual Water Quality Monitoring Reports. Figures B-20 and B-21 illustrate the observed water quality concentrations for total phosphorus and total nitrogen, respectively; Table B-13 summarizes the water quality data. Sample results indicate that nutrient concentrations tend to be higher during the beginning of the storm (first flush) and then decrease during later portions of the storm event. San Jacinto River at Goetz Road and Salt Creek at Murrieta Road have the highest concentrations of total nitrogen based on observed median concentrations, while the Goetz Road site has the highest total phosphorus. The average N:P ratio was calculated for each watershed water quality sample site; all ratios were less than 7.1, indicating that nitrogen is the limiting nutrient in wet weather runoff.

Table B-13. Summary of Nutrient Water Quality Data for San Jacinto Watershed (mg/L)

Waterbody	Nutrient	N	Average Concentration	Median Concentration	Standard Deviation	Average N:P Ratio
Salt Creek at Murrieta Road	Total Phosphorus	108	0.75	0.66	0.47	4.2
	Total Nitrogen	108	2.47	2.32	0.91	
San Jacinto River at Goetz Road	Total Phosphorus	90	1.44	0.95	1.84	2.7
	Total Nitrogen	90	2.73	2.26	1.70	
Canyon Lake Spillway	Total Phosphorus	59	0.57	0.50	0.21	3.2
	Total Nitrogen	59	1.78	1.76	0.55	
Cranston Guard Station	Total Phosphorus	29	0.65	0.49	0.44	2.4
	Total Nitrogen	29	1.22	1.10	0.57	



Comprehensive Nutrient Reduction Plan For MS4 Permittees in Canyon Lake and Lake Elsinore Watershed	Dec. 1, 2011	0 2 4 8 Miles		**Figure B-19**	CDM
	Watershed Water Quality Monitoring Sites and Watershed Analysis Zones				

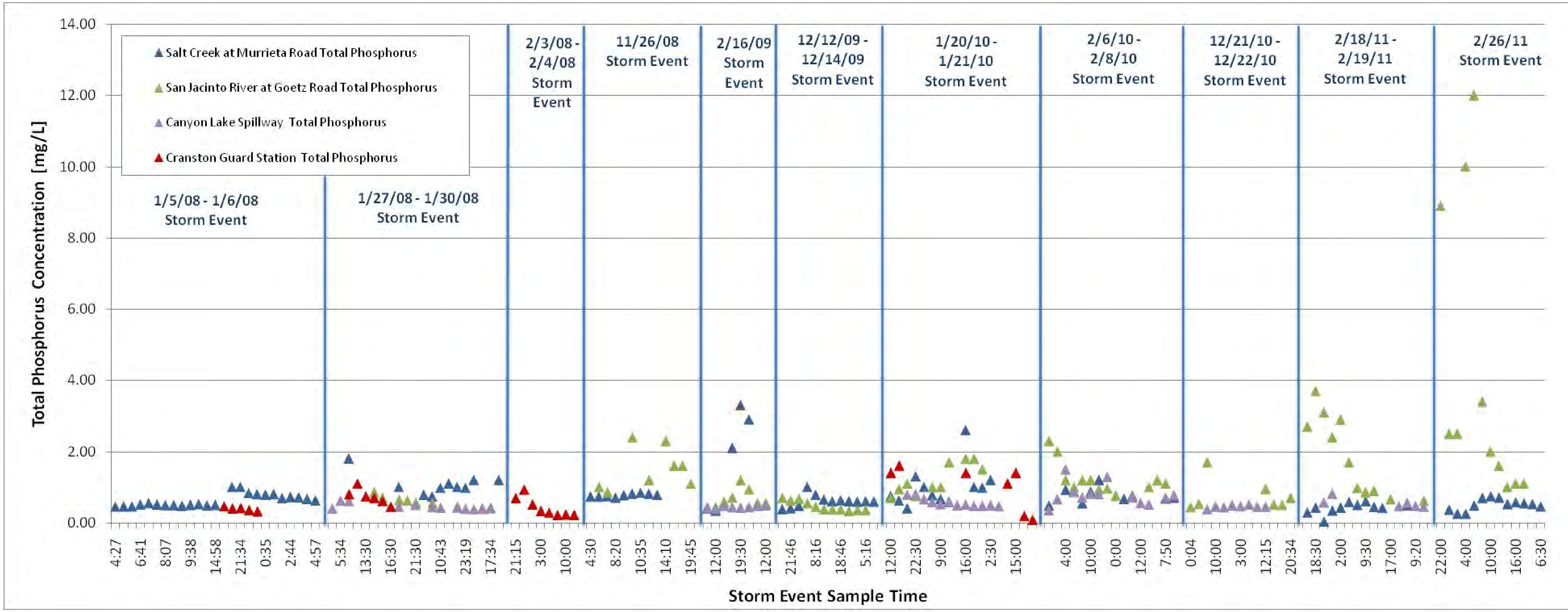


Figure B-20
Wet-Weather Sampling Total Phosphorus Concentrations

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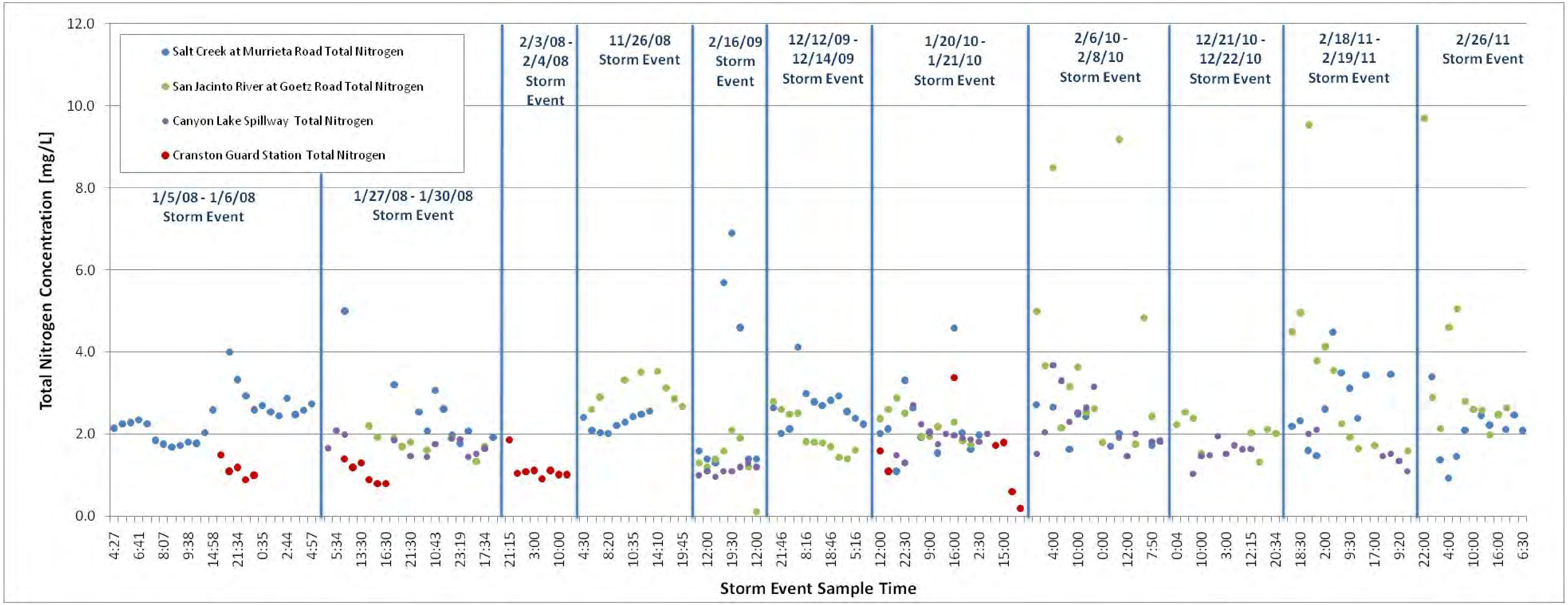

Figure B-21
Wet-Weather Sampling Total Nitrogen Concentrations

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MS4 System Monitoring

Wet weather monitoring during February 2011 was conducted by RCFCD&WCD at six outfalls to receiving waterbodies in the San Jacinto River watershed. The data collected at the Meadowbrook site consistently have significantly higher nutrient concentrations than would be expected from urban stormwater and would be candidates for follow up investigation (Table B-14). Other monitored outfalls have average nutrient concentrations that are generally lower than concentrations in CORE receiving waterbody monitoring sites for the two primary inputs to Canyon Lake from the San Jacinto River and Salt Creek.

Table B-14. Summary of Nutrient Water Quality Data for Phase 2 TMDL MS4 Outfall Monitoring during February 2011

Waterbody	Nutrient	N	Average Concentration	Coefficient of Variation
Hemet Channel at Sanderson Avenue	Total Phosphorus	9	0.28	0.28
	Total Nitrogen	9	1.19	0.25
San Jacinto River Upstream of Lake Elsinore	Total Phosphorus	7	0.59	0.26
	Total Nitrogen	7	1.59	0.22
Kitching St. Channel at Iris Avenue	Total Phosphorus	9	0.43	0.26
	Total Nitrogen	9	2.05	0.32
Meadowbrook at Highway 74	Total Phosphorus	10	1.21	0.41
	Total Nitrogen	10	11.83	0.21
Perris Valley Storm Drain at Nuevo Road	Total Phosphorus	11	0.82	0.32
	Total Nitrogen	11	2.71	0.49
Sierra Park Drain in Canyon Lake	Total Phosphorus	10	0.33	0.33
	Total Nitrogen	10	2.55	0.22

In addition to summary statistics, correlations were evaluated between nutrients and suspended sediment for samples collected during February 2011. TP showed a greater correlation strength with sediment than TN. The results showed statistically significant correlations, as follows:

- TN and TP: Pearson's r 0.78, $df = 54$, $p < 0.001$
- TN and TSS: Pearson's r 0.37, $df = 54$, $p = 0.004$
- TP and TSS: Pearson's r 0.76, $df = 54$, $p < 0.001$

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Attachment C
Table of Contents

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C-1 Executive Summary

In order to achieve compliance with the Lake Elsinore and Canyon Lake nutrient TMDLs, the responsible parties, which include the MS4 Permittees discharging urban runoff, considered: (1) implementing watershed-based activities and projects that reduce the discharge of nutrients into the lake; (2) implementing projects in the lakes that reduce in-lake loads and concentrations projects; or (3) some combination of watershed and in-lake BMPs. The December 31, 2011 draft of the CNRP contained an evaluation of different strategies for in-lake reduction of nutrient levels in Canyon Lake, and determined that HOS would be the most effective means of complying with the nutrient TMDL. The basis for this determination were studies showing that suppression of nutrient flux from lake bottom sediments by creating an oxic condition at the sediment water interface would more than offset the load reduction needed to reduce existing urban and septic loads to the allowable WLA/LAs, after accounting for estimated watershed loads reduction.

In January of 2012, the Task Force sought Michael Anderson to conduct additional studies to evaluate chemical addition alternatives and to determine the potential impact of HOS on in-lake TMDL response targets for chlorophyll-a and DO. The studies were intended to provide additional confirmation on the selection of a HOS by assessing whether it can be a whole-lake solution, or to revise the proposed in-lake nutrient management strategy to use chemical addition or regulatory approaches to achieve the response targets. Section C.2 of this attachment provides the results of these studies. The key findings from each study that led to a revision to the Canyon Lake in-lake nutrient management strategy are summarized below:

- Task 1: Estimate Rate at Which Phosphorus is Rendered No Longer Bioavailable in Sediments. This task showed that settled nutrients in lake-bottom sediments continue to release nutrients to the water column for several decades. Thus a reduction in external loads from CNRP implementation may not result in a significant change to internal nutrient cycling prior to 2020.

- Task 2. Evaluation of Long-Term Reduction of Phosphorus Loads from Internal Recycling as a Result of Hypolimnetic Oxygenation in Canyon Lake: This study showed that HOS will not provide sufficient nutrient reduction in years with above average rainfall to achieve response target for chlorophyll-a. In its March 31, 2012 comment letter, the Regional Board states that if the WLAs and LAs are effectively offset with in-lake BMPs, but response targets are still not achieved, then the TMDL would be reopened to reduce WLAs and LAs. Thus, HOS alone is not sufficient to achieve compliance with the TMDL.

- Task 3. Evaluation of Alum Phoslock, and Modified Zeolite to Sequester Nutrients in Inflow and Improve Water Quality in Canyon Lake. This study evaluated the potential water quality benefit that could be achieved with chemical additional alternatives. The DYRESM-CAEDYM results showed that a reduction in dissolved orthophosphate at the lake inflows from ~0.35 mg/L to 0.20 mg/L would shift the lake to P-limitation and reduce average annual chlorophyll-a to below the final numeric target of 25 ug/L. The study also evaluated potential doses and associated costs for alum, Phoslock, or zeolite.

- Task 4. Predevelopment Condition Assessments for Canyon Lake (Task 4a) and Lake Elsinore (Task 4b). To estimate the controllability of water quality in Canyon Lake and Lake Elsinore, the DYRESM-CAEDYM model was run for a scenario with external loads reflective of a completely undeveloped watershed. This scenario showed chlorophyll-a consistently below the water quality objectives. For DO, exceedences of the water quality objectives were estimated to occur as much as 50 percent of the time in Canyon Lake. Thus, a completely undeveloped watershed would not comply with the DO numeric target, as stated in the TMDL. The MS4 Permittees plan to modify the TMDL numeric target at the next reopener of the TMDL, to allow for exceedences of the DO water quality objective within the hypolimnion as would be expected if the watershed were completely undeveloped.

- Task 5a. Simulations Using Refined Model Parameter Set Under Steady State Conditions for Lake Elsinore. This analysis updated previous evaluations of management alternatives. The analysis quantifies the improvement to lake TP and chlorophyll-a that may be achieved with reclaimed water addition, carp fishery management, and aeration. Results suggest that, at a minimum, all three management strategies will be needed to comply with the TMDL

- Task 5b. Evaluate Effects of Management Alternatives for Canyon Lake on External Nutrient Loading to Lake Elsinore. This study updated the DYRESM-CAEDYM model to create a linkage between Canyon Lake and Lake Elsinore, for testing whether improved lake water quality in Canyon Lake would reduce pass-through loads to Lake Elsinore. Results showed limited pass-through load reductions as a result of in-lake BMPs in Canyon Lake.

- Task 6. Predicted Water Quality in Canyon Lake with In-Lake Alum Treatments and Watershed BMPs. This task involved simulation of the water quality response to proposed watershed BMPs and in-lake alum additions included in the CNRP. Results showed that the final numeric target for chlorophyll-a is expected to be achieved with the proposed project (Scenario 12 in the TM). For DO, the results show that the interim (epilimnion) DO target is expected to be achieved and significant progress toward the final (hypolimnion) target. These results are the primary basis for the Canyon Lake compliance demonstration presented in Section 3 of the CNRP

When alum is added to a waterbody, an aluminum hydroxide precipitate known as floc is formed. The floc binds with phosphorus in the water column to form an aluminum phosphate compound which will settle to the bottom of the lake or reservoir. EVMWD conducted jar tests to determine the reduction of TP that could be achieved at varying doses of alum. Samples collected at all four TMDL monitoring stations were collected and varying amounts of alum were added to each. Jar test results are summarized in Section C.3 of this Attachment

Technical Memorandum

Task 4b: Evaluate Water Quality in Lake Elsinore Under Pre-Development Conditions

Objective

The objective of this task was to evaluate water quality conditions in Lake Elsinore assuming no development in the watershed.

Approach

A DYRESM-CAEDYM model for Lake Elsinore was developed to predict water quality in Lake Elsinore assuming no development in the watershed. As in previous simulations, the 2002-2011 time period was evaluated, with the same meteorological conditions as used in the Canyon Lake simulations, with overflow from Canyon Lake and runoff from the local watershed serving as the primary water and external nutrient inputs to the lake. Direct precipitation on the lake surface was included in the water budget calculations, while atmospheric deposition also provided a limited amount of direct nutrient additions (somewhat arbitrarily set at 10% of current levels). Local runoff volumes were estimated based upon precipitation rates and the area of the local watershed (54 km^2) assuming a runoff coefficient of 0.3 (Anderson, 2006). Area-volume-depth relationships were taken from the analytical model previously developed as well (Anderson, 2006). Nutrient concentrations in the local runoff were estimated from pre-development watershed values from TetraTech, while outflow nutrient concentrations were taken from predicted values of the pre-development simulation for Canyon Lake (Anderson, 2012c).

Note that aspects of this pre-development scenario are quite different than the true pre-development condition at the lake, since (i) we are using the deeper, smaller reconfigured lake basin developed as part of the Lake Elsinore Management Plan, and (ii) Canyon Lake is retained as an upstream impoundment on the San Jacinto River despite its relatively new role in the watershed. For these and several other reasons, the results presented herein should be viewed as a semi-quantitative estimate of a hypothetical pre-development condition here, and could thus be expected to differ from conditions that might be inferred from paleolimnological investigations.

Results

Lake Elsinore, prior to development in the watershed, was predicted to be relatively well-mixed vertically throughout most years (Fig. 1a). This is a result of the low nutrient levels and low corresponding chlorophyll a concentrations (described below) that yield high predicted water clarity. Based upon the predicted chlorophyll a concentrations, the Secchi depth of the lake is estimated to be 2-4 m or more much of the time, which allows for penetration of shortwave radiation to considerable depths in the lake. Combined with the long fetch and strong afternoon winds, the lake is predicted to be mixed to the bottom at lower lake elevations and during intervals of particularly clear water (Fig. 1a). This differs markedly from existing conditions in the lake, where low transparency limits heat penetration, restricts vertical mixing and maintains a relatively thin epilimnion when present.

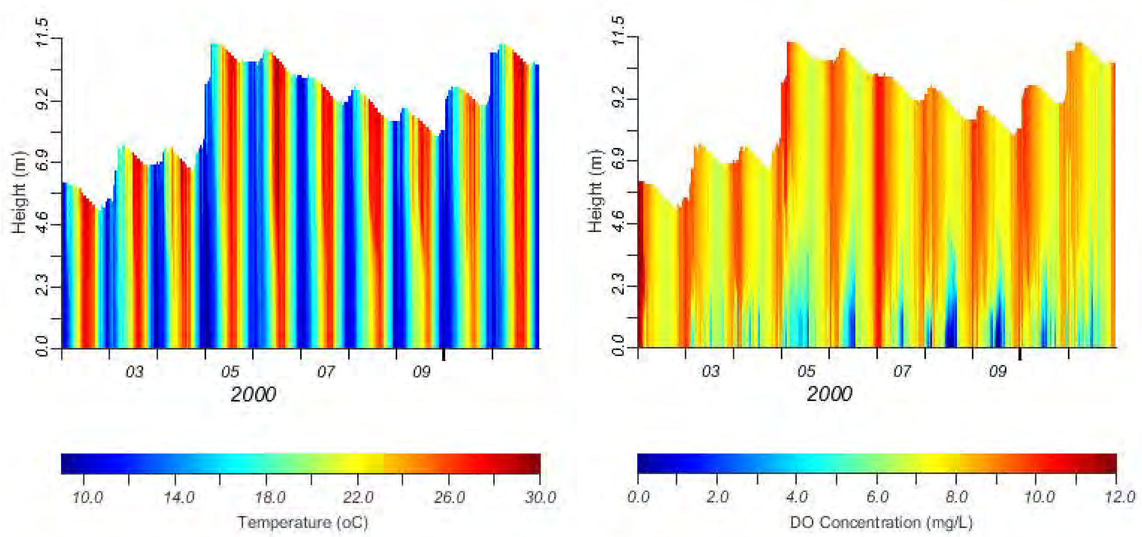

Fig. 1. Simulation results for Lake Elsinore under the pre-development scenario (using meteorological conditions for the 2002-2011 period): a) temperature and b) dissolved oxygen concentration.

The improved mixing in the lake was also predicted to maintain higher concentrations of dissolved oxygen (DO) in the water column, including concentrations near the bottom sediments much of the time (Fig. 1b). While markedly improved relative to existing conditions, where up to 75% of the bottom sediments are often anoxic (<1 mg/L) for most of the summer (Lawson and Anderson, 2007), some intervals of reduced DO concentrations were predicted near the sediments at higher lake levels *e.g.*, in the summers of 2006-2009. Nonetheless, anoxia at 1 m above the deepest point on the lake was found only 1.7% of the days in this 10 yr simulation period.

As alluded to above, predicted concentrations of nutrients were generally quite low relative to existing conditions, with concentrations generally 0.02 - 0.06 mg/L, although higher concentrations were found above the bottom sediments in the summer of 2008 and 2009 (Fig. 2a) when DO levels were low (Fig. 1b). Predicted total N concentrations within the water column were below existing concentrations as well, ranging from 0.40 to 1.2 mg/L (Fig. 2b). As with total P, some increase in total N was observed near the sediments in the summer of 2008 and 2009. The predicted TN:TP ratios typically near 20 suggest that the lake will likely be weakly P-limited under pre-development conditions.

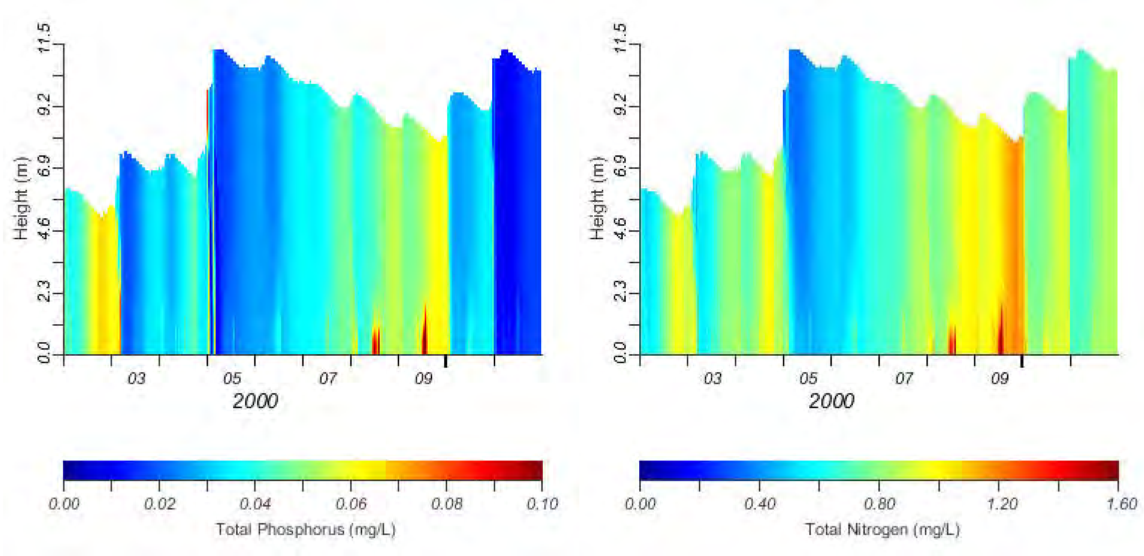

Fig. 2. Simulation results for Lake Elsinore under the pre-development scenario (using meteorological conditions for the 2002-2011 period): a) total P and b) total N concentration.

The low nutrient concentrations were predicted to support chlorophyll a levels generally 12-25 μg/L (Fig. 3a), values that stand in sharp contrast to some of the concentrations seen, e.g., in the summer of 2002 and 2004 that exceeded 300 μg/L (Veiga-Nascimento and Anderson, 2004). Simulations suggest that blue-green algae (cyanobacteria) will comprise the dominant algal species in the lake even with reduced nutrient levels, although diatoms and green algae were predicted to be present as well (Fig. 3b).

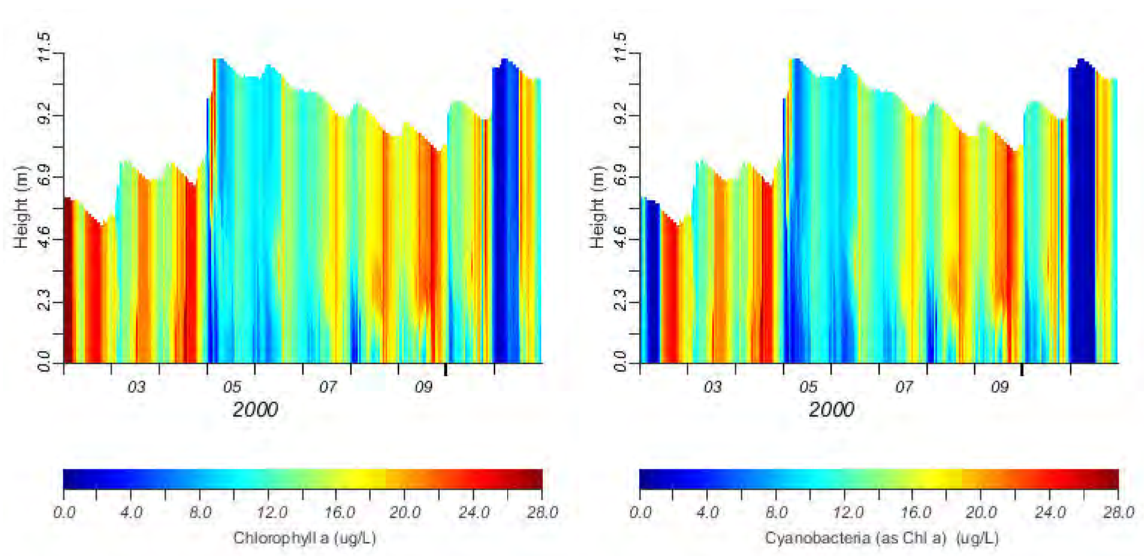

Fig. 3. Simulation results for Lake Elsinore under the pre-development scenario (using meteorological conditions for the 2002-2011 period): a) chlorophyll a and b) cyanobacteria.

Dissolved nutrient concentrations in the water column were generally predicted to be low, although some dissolved PO_4-P was predicted in the fall of 2003 and in 2008-2009 (Fig. 4a). Dissolved PO_4-P comprised essentially all of the phosphorus just above the deepest bottom sediments in the summer of 2008 and 2009, reflecting internal loading during periods of stratification (Fig. 1a) and low DO conditions (Fig 1b). Ammonium-N concentrations were uniformly low in the upper water column, with limited accumulation near sediments during intervals of stratification and anoxia (Fig. 4b). Little NO_3-N was also predicted, consistent with phytoplankton and bacteria utilizing the available inorganic forms (not shown).

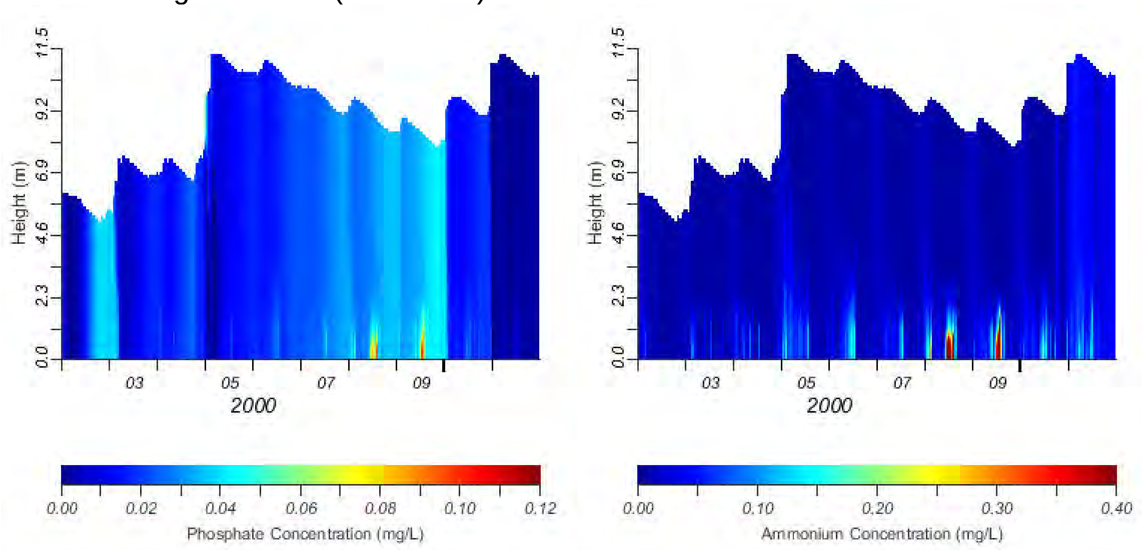

Fig. 4. Simulation results for Lake Elsinore under the pre-development scenario (using meteorological conditions for the 2002-2011 period): a) PO_4-P and b) NH_4-N concentrations.

For comparison with the nutrient TMDL numeric targets for Lake Elsinore, data from the simulations used to calculate annual average total P, total N and summer average chlorophyll a concentrations, as well as the number of days each year when DO concentrations above bottom sediments were <5 mg/L (Table 1). As expected from Fig. 2a, annual average total P levels were low (mean value of 0.036 mg/L), although they did exhibit some interannual variation (0.024 - 0.056 mg/L) related to hydraulic and external nutrient loading, lake surface elevation and related factors (Table 1). Notwithstanding, these simulations suggest that the water quality in the lake prior to development in the watershed would come in well-below the TMDL numeric target for total P of 0.1 mg/L.

In contrast, the model predicted annual average concentrations of total N in Lake Elsinore that would be near or frequently exceed the numeric target of 0.75 mg/L (Table 1). For this 10-year period of time, the predicted annual total N ranged from a low of 0.44 mg/L in 2005 to a high of 1.06 mg/Lin 2009, and averaged 0.76 mg/L, just exceeding by the narrowest of margins the numeric target.

Predicted chlorophyll a concentrations were less variable than found under existing conditions, and annual summer-averaged values ranged only from 9.6 - 21.7 μg/L. Over the 10-year simulation period, the summer chlorophyll a concentration was predicted to averaged 15.7 μg/L, a value significantly below the TMDL numeric target of 25 μg/L (Table 1).

Table 1. Predicted mean annual concentrations of total P, total N, and summer chlorophyll a, and number of days each year DO <5 mg/L 1m above bottom sediments.

Year	**Total P (mg/L)**	**Total N (mg/L)**	**Chlorophyll a (μg/L)**	**# days DO < 5 mg/L**
Target	*0.10*	*0.75*	*25*	*≥5*
2002	0.052	0.74	20.6	0
2003	0.033	0.70	17.5	13
2004	0.035	0.84	21.7	2
2005	0.024	0.44	9.6	111
2006	0.029	0.56	12.2	78
2007	0.040	0.75	14.9	43
2008	0.048	0.89	16.2	121
2009	0.056	1.06	18.8	99
2010	0.032	0.83	15.5	68
2011	0.013	0.76	10.4	58
Average	*0.036*	*0.76*	*15.7*	*59*

The concentration of DO 1 m above the bottom sediments at the deepest part of the lake was strongly dependent upon lake level and duration and strength of thermal stratification (Fig. 1a). The shallow depth and well-mixed conditions in 2002 resulted in concentrations above 5 mg/L throughout the year, while higher lake levels in 2005 and beyond, combined with evapoconcentration of nutrients and other factors, increased the frequency and duration of bottom water DO concentrations below the 5 mg/L target (Table 1). As noted previously, however, anoxic conditions when the DO concentrations declined below 1 mg/L, a threshold where significant biogeochemical transformations such as Fe reduction and hydrogen sulfide production often commence, were predicted to be rare, occurring only 1.7 % of the days from 2002-2011.

Conclusions

Results from these simulations suggest that:

(i) Conditions in Lake Elsinore prior to development in the watershed would be mesotrophic to weakly eutrophic, as opposed to the eutrophic-hypereutrophic conditions presently.

(ii) Greater water clarity would allow heat to penetrate to greater depths, resulting in better mixing and improved DO conditions throughout much of the water column, especially at low to moderate lake levels.

(iii) Development of some thermal stratification and reductions in DO were predicted especially at higher lake levels, although intense and prolonged anoxia, fish kills and so on, are not generally expected.

(iv) Annual average concentrations of total P and summer average concentrations of chlorophyll a were predicted to below their respective TMDL numeric targets.

(v) The average total N concentration for the 10-year simulation period was at the numeric target of 0.75 mg/L, while DO concentrations were predicted to drop below the target of 5 mg/L above the bottom sediments an average of 59 days in a given year.

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Anderson, M.A. 2012b. *Evaluation of Alum, Phoslock and Modified Zeolite to Sequester Nutrients in Inflow and Improve Water Quality in Canyon Lake.* Draft Technical Memorandum, Task 3, to LESJWA. 12 pp.

Anderson, M.A. 2012c. *Evaluate Water Quality in Canyon Lake Under Pre-Development Conditions and TMDL-Prescribed External Load Reductions.* Draft Technical Memorandum, Task 4a, to LESJWA. 8pp.

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Technical Memorandum

Task 5b: Evaluate Effects of Management Alternatives for Canyon Lake on External Nutrient Loading to Lake Elsinore

Objective

The objective of this sub-task was to evaluate the effects of various previously considered management alternatives for Canyon Lake (e.g., HOS, watershed BMPs, microfloc alum injection) on the external loading of nutrients downstream to Lake Elsinore.

Approach

The nutrient loading to Lake Elsinore from Canyon Lake for the 2002-11 simulation period was evaluated for the different management options considered for Canyon Lake. Four specific scenarios were evaluated: (i) reference conditions (existing conditions for 2002-2011), (ii) implementation of TMDL-prescribed reductions in nutrient loading from the watershed, (iii) operation of the hypolimnetic oxygenation system (HOS), and (iv) treatment of inflow with alum to a PO_4-P concentration of 0.20 mg/L.

Results

Annual flows from Canyon Lake to Lake Elsinore varied over the past decade, with very high flows in 2005 and no or negligible flows in 2002, 2006 and 2007 (Fig. 1). Note that these flows are presented on a calendar year basis, and so differ somewhat from earlier representations of flows that were based upon the water year.

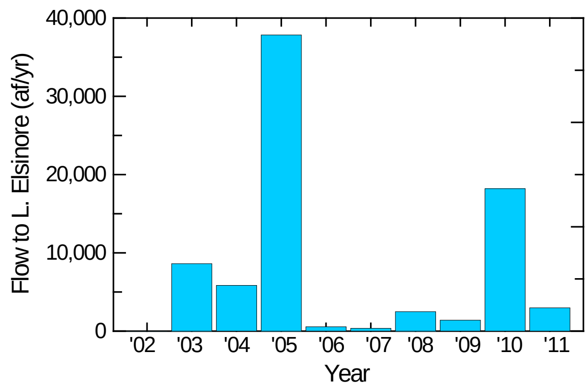


Fig.1. Predicted annual flow (calendar year basis) from Canyon Lake to Lake Elsinore for the period 2002-2011.

The concentrations of nutrients in these flows were used to calculate the predicted annual loading of nitrogen (Fig. 2) and phosphorus (Fig. 3) to Lake Elsinore.

The very high flows in 2005 yielded correspondingly high loads of P to Lake Elsinore, with generally markedly lower loads during the other years (Fig. 2a). Concentrations were predicted to be approximately evenly distribution between readily bioavailable ortho-phosphate phosphorus (PO_4-P) and other forms generally associated with particulate phases (although dissolved organic P would also be included in the particulate fraction represented in these figures). Particulate inorganic P generally comprised only a small part of the P in the overflow from Canyon Lake (data not shown).

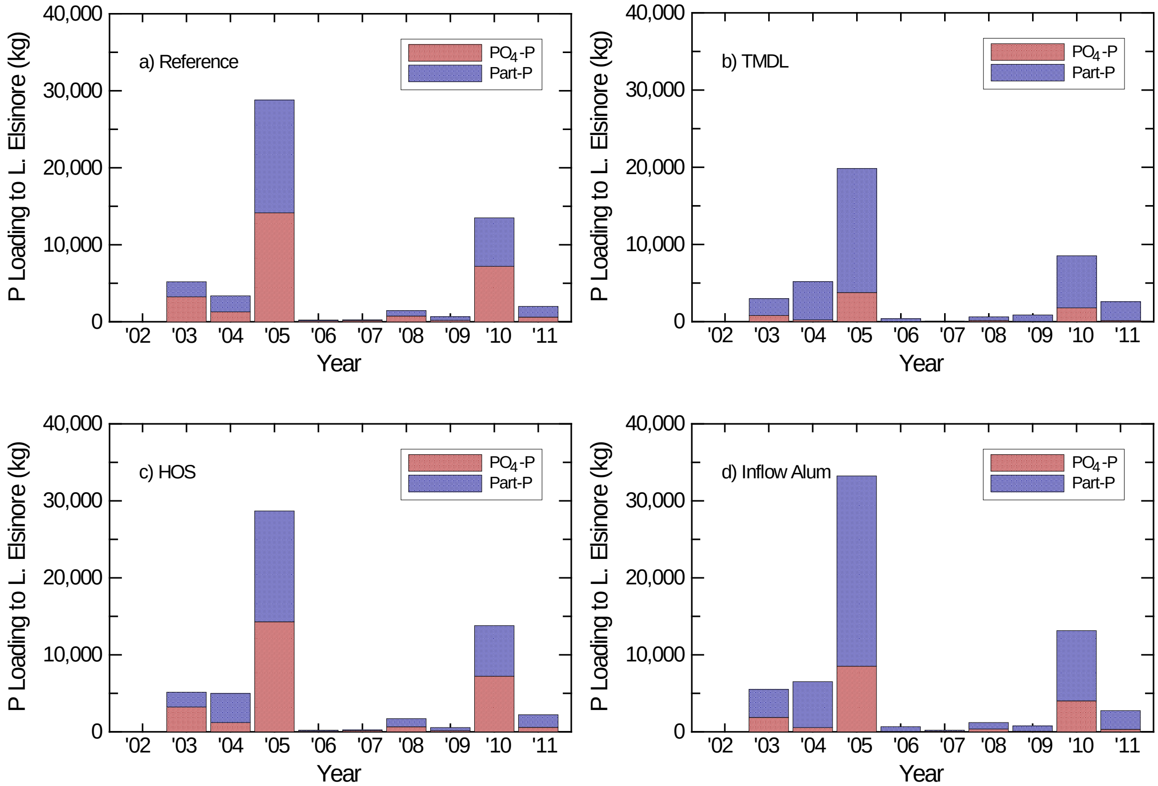


Fig. 2. Predicted loading of P from Canyon Lake to Lake Elsinore for the period 2002-2011: a) reference (existing) condition; b) TMDL-prescribed reductions in external loading; c) operation of HOS; and d) alum treatment of inflows lowering PO_4-P concentrations to 0.2 mg/L.

Implementation of the TMDL-prescribed reductions in total P loading from the watershed not only lowered levels delivered to Canyon Lake (Anderson, 2012c) but also reduced loading to Lake Elsinore (Fig. 2b). Significant reductions in PO_4-P loads exported to Lake Elsinore were predicted that appears to be due to repartitioning of P between dissolved and particulate forms when routed through Canyon Lake relative to the reference (existing) condition. In contrast, operation of the HOS was not predicted to substantively alter the mass or form of P delivered to Lake Elsinore (Fig. 2c). The treatment of inflows with low doses of alum sufficient to modestly lower PO_4-P concentrations in influent to 0.20 mg/L (Anderson, 2012b) was not predicted to greatly alter the mass delivered to Lake Elsinore (and was, surprisingly, predicted to increase it slightly), but was predicted to decrease the amount of PO_4-P delivered to Lake Elsinore. Higher alum doses would presumably further reduce PO_4-P loading and would also promote greater flocculation and settling of particulate P. Irrespective of the particular scenario, these figures support the notion of highly asynchronous loading from the upstream watershed to Lake Elsinore. It is important to note that external loading from the local watershed, which can comprise a significant part of the total external loading during dry years, is not included in these figures and so the total loading would potentially be quite a bit higher for those conditions.

The loading of N exhibited strong interannual variation broadly similar to P, with much of the N delivered in just a few years. A significant fraction of that N was predicted to be delivered as NO_3-N and as a particulate (or dissolved organic) form, while smaller amounts were delivered as NH_4-N (Fig. 3a). TMDL-mandated reductions in external N loading were reflected in loads delivered to Lake Elsinore, with slightly greater predicted removal of particulate-N (Fig. 3b). Other restoration actions that target phosphorus were not predicted to differ substantively from the reference condition (Fig. 3c,d)

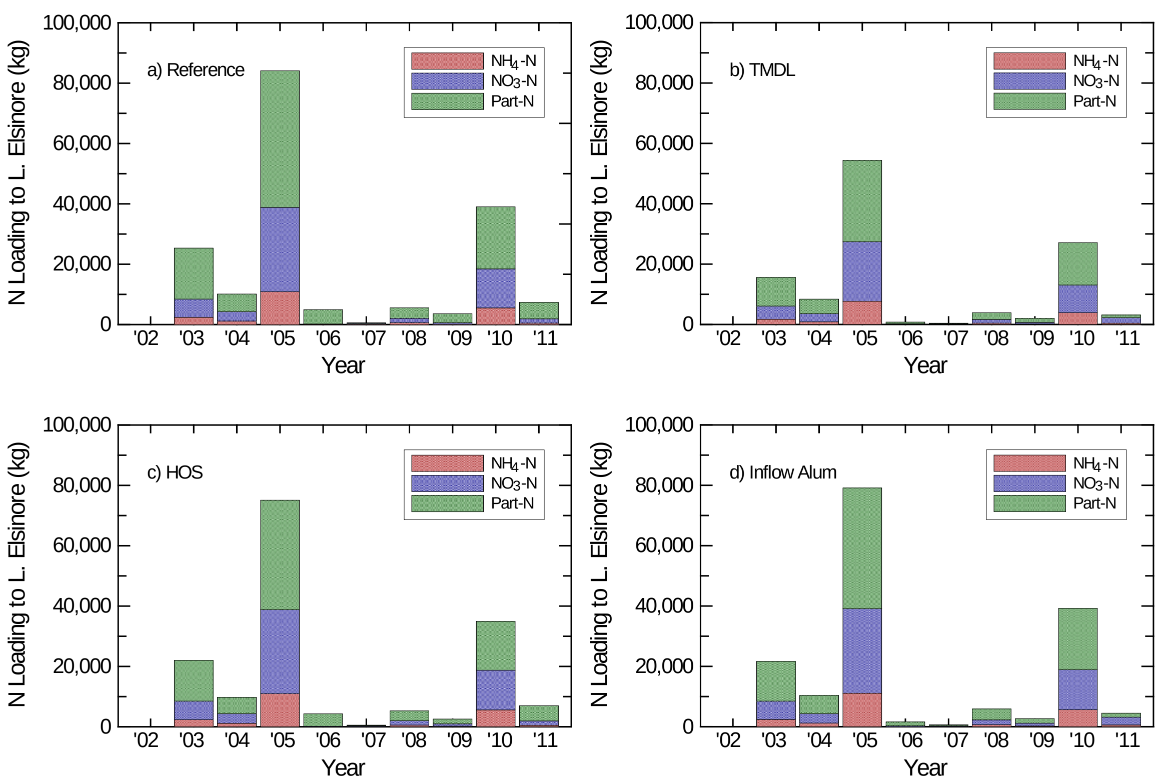


Fig. 3. Predicted loading of N from Canyon Lake to Lake Elsinore for the period 2002-2011: a) reference (existing) condition; b) TMDL-prescribed reductions in external loading; c) operation of HOS; and d) alum treatment of inflows lowering PO_4-P concentrations to 0.2 mg/L.

Conclusions

Results from these analyses indicate:

(i) Strong asymmetric loading of nutrients routed through Canyon Lake to Lake Elsinore during periods of large runoff events.

(ii) TMDL-prescribed external load reductions were predicted to have a greater effect on N and P loading to Lake Elsinore than operation of a hypolimnetic oxygenation system or low levels of alum addition to inflow.

References

Anderson, M.A. 2012a. *Evaluation of Long-Term Reduction of Phosphorus Loads from Internal Recycling as a Result of Hypolimnetic Oxygenation in Canyon Lake.* Draft Technical Memorandum, Task 2, to LESJWA. 21 pp.

Anderson, M.A. 2012b. *Evaluation of Alum, Phoslock and Modified Zeolite to Sequester Nutrients in Inflow and Improve Water Quality in Canyon Lake.* Draft Technical Memorandum, Task 3, to LESJWA. 12 pp.

Anderson, M.A. 2012c. *Evaluate Water Quality in Canyon Lake Under Pre-Development conditions and TMDL-Prescribed External Load Reductions.* Draft Technical Memorandum, Task 4a, to LESJWA. 8 pp.

Task 1: Estimate Rate at Which Phosphorus is Rendered No Longer Bioavailable in Sediments

- Data from Anderson (2001), Anderson and Oza (2003), Anderson et al. (2007) and Anderson (2010) were used to improve understanding of sediment diagenesis in Canyon Lake and Lake Elsinore
- Kinetic modeling conducted to define reactivity and persistence of sediment-bound nutrients available for release from sediments

Table 1. Median water column, particulate and sediment properties in lakes.

	Property	Canyon L.	L. Elsinore
Water Column	Total N	1.50	3.82
(mg L^{-1})	Total P	0.18	0.22
	N:P Ratio	8.3	17.4
Particulates(Sediment Trap)	Total N	11.1	8.5
(mg g^{-1})	Total P	2.73	1.29
	Organic C	46.5	64.8
	Inorganic C	17.8	14.0
	C:N Ratio	4.2	7.7
	N:P Ratio	4.1	6.6
Sediment (0-10 cm)	Total N	4.4	5.0
(mg g^{-1})	Total P	0.74	0.85
	Organic C	32.6	43.0
	Inorganic C	5.3	9.0
	C:N Ratio	7.4	8.6
	N:P Ratio	5.9	5.9
Loss from Particulates	Total N	6.7 (60%)	3.5 (41%)
(mg g^{-1})	Total P	1.99 (73%)	0.44 (34%)
	Organic C	13.9 (30%)	21.8 (34%)
	Inorganic C	12.5 (70%)	5.0 (36%)

- Median TN:TP values indicate weak N-limitation in Canyon Lake and co-limitation or weak P-limitation in Lake Elsinore when light not limiting
- Particles recovered in sediment traps in Canyon Lake had higher median N and P contents and lower organic C contents and TN:TP ratio than Lake Elsinore
- Lower N:P ratios in particles suggest preferential removal of N during settling and/or resuspension
- Sediments (0-10 cm) had much lower N and P contents that particles recovered in sediment traps, indicating significant loss through recycling and diagenesis
- Greater relative loss in surficial sediments of Canyon L. (60-70%) compared with L. Elsinore (~35-40%)

Table 2. Median particulate flux, internal recycling rate and difference in flux rates.			
	Property	**Canyon L.**	**L. Elsinore**
Particulate Flux In	Total Mass	8,220	16,300
(mg m^{-2} d^{-1})	Total N	91	138
	Total P	22.4	21.0
	Organic C	382	1056
	Inorganic C	146	228
	N:P Ratio	4.1	6.6
Nutrient Flux Out	NH_4-N	29.1	86.0
(mg m^{-2} d^{-1})	SRP	9.1	10.2
	N:P Ratio	3.1	8.4
Difference	Total N	62	52
(mg m^{-2} d^{-1})	Total P	13.3	10.8
= storage	N:P Ratio	4.7	4.8

- Assuming sediments are ~80% water with a bulk density of 1.1 g cm^{-3}, these total particle flux rates correspond to sediment rates of 1.4 – 2.7 cm yr^{-1}

- Sediment trap data were used to calculate median particle-borne nutrient deposition rates to sediments
- Very similar particulate-P flux to sediments (~21 mg m^{-2} d^{-1}) in both lakes
- Higher particulate-N, organic C and inorganic C flux to bottom sediments in L. Elsinore
- Similar median rates of SRP flux out of bottom sediments in both lakes (9-10 mg m^{-2} d), but lower NH4-N flux from Canyon L.
- N:P ratio of median recycling/flux rates lower in Canyon L. than L. Elsinore (3.1 vs. 8.4, respectively).

- Differences between particle-borne nutrient flux <u>to</u> sediments and recycling/release <u>from</u> sediments reflect possible storage
- Based upon rates of nutrient flux, similar total N and total P concentrations and N:P ratios would be expected (and are seen) in the two lakes
- Results of all this indicate pronounced biogeochemical transformation occuring within water column and bottom sediments of these lakes
- Kinetic analyses were conducted using available sediment core data to determine rates of these transformations

- Mineralization of organic matter in sediments proceeds through a very complex set of physical, microbiological and chemical reactions

- The rate of mineralization can, in some cases, be represented as a simple 1st-order process:

$$dC/dt = -kC$$

  where *C* is the concentration, *k* is the decomposition rate constant and *t* is time

- This differential equation can be integrated to:

$$C=C_0e^{-kt}$$

- Organic matter in sediments is being both mineralized through bacterial processes *and* buried at some sedimentation rate ω

- With information about the sedimentation rate, we can transform from time domain to depth and rewrite as:

$$C_z = C_0 e^{-\frac{k_r}{\omega} z}$$

where k_r is the rate constant for mineralization, and calculated from fit to sediment core nutrient concentrations with depth (k) and sedimentation rate

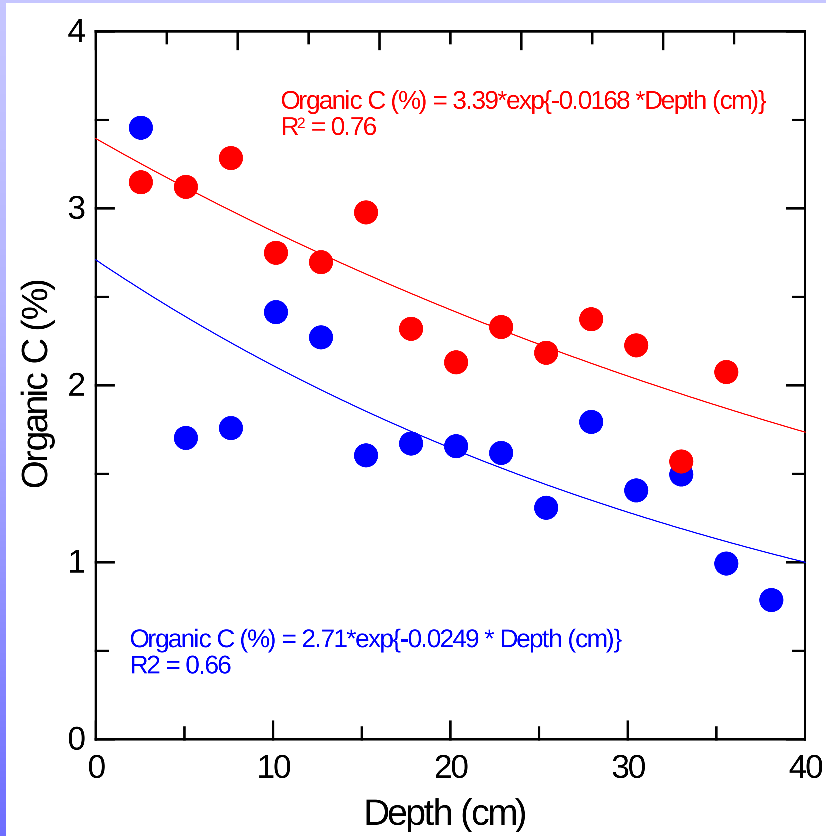
$$k_r = k\ \omega$$

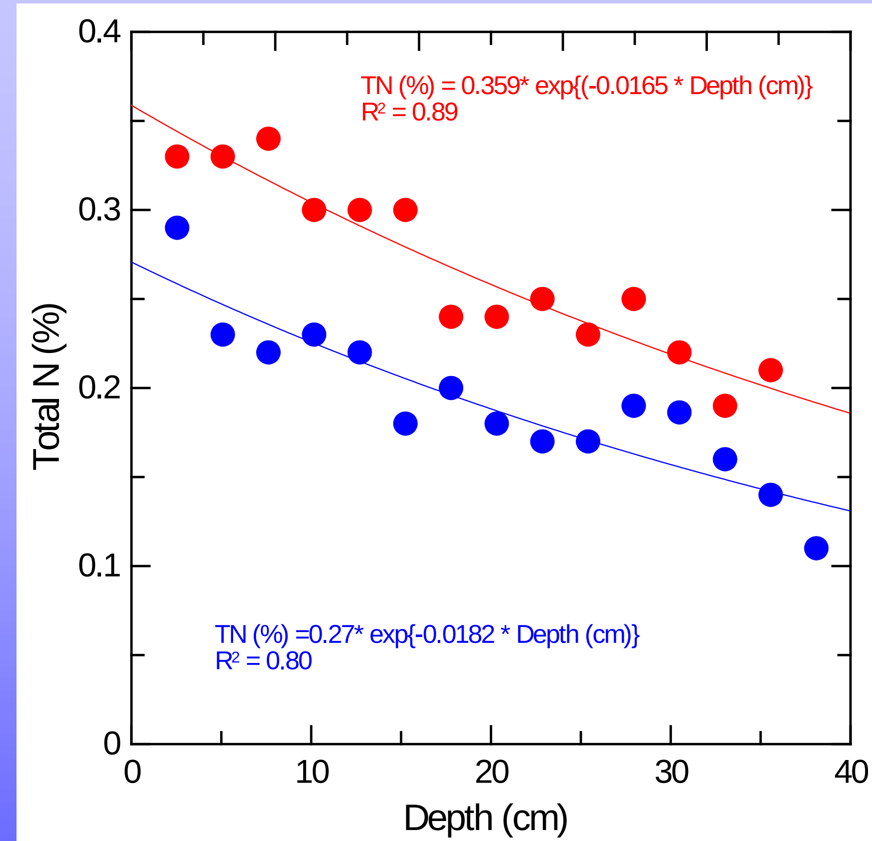
- The half-life for nutrients in the sediment can then be calculated for kr via:

$$t_{1/2} = 0.693/k_r$$

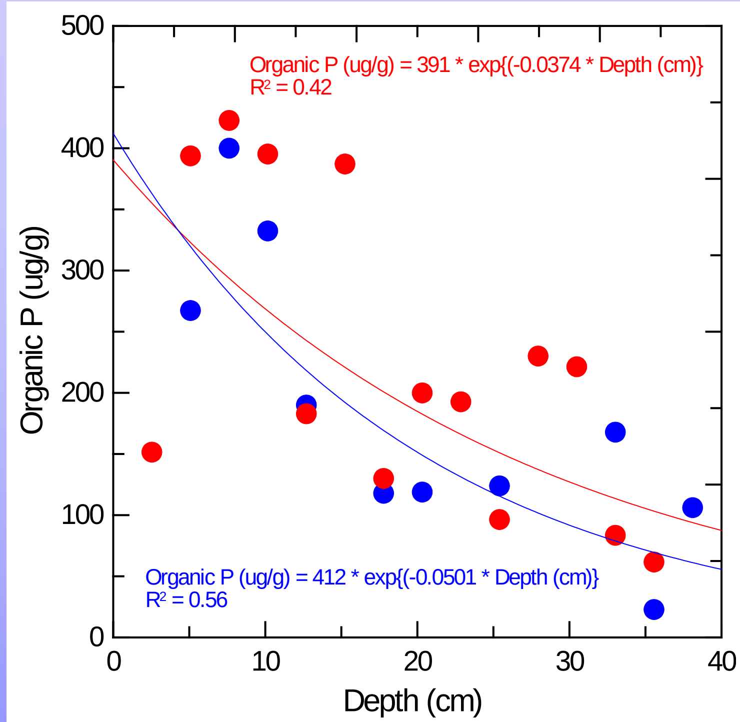
- Sedimentation rates of 2.4 cm yr^{-1} reported by USGS for Canyon L. and 1.35 cm yr^{-1} reported by Kirby et al.

Canyon Lake (East Bay cores, 2002)





- Organic C and total N contents decrease with depth in sediments
- Statistically significant (at p=0.05) for exponential model



- Organic P concentrations exhibited greater scatter and fits not statistically significant
- Half-lives were similar for organic C and N (~14-16 yrs), but lower for organic P (6.7 yrs)

Table 3. Mineralization rate and half-life for organic C, total N and organic P in East Bay, Canyon L.

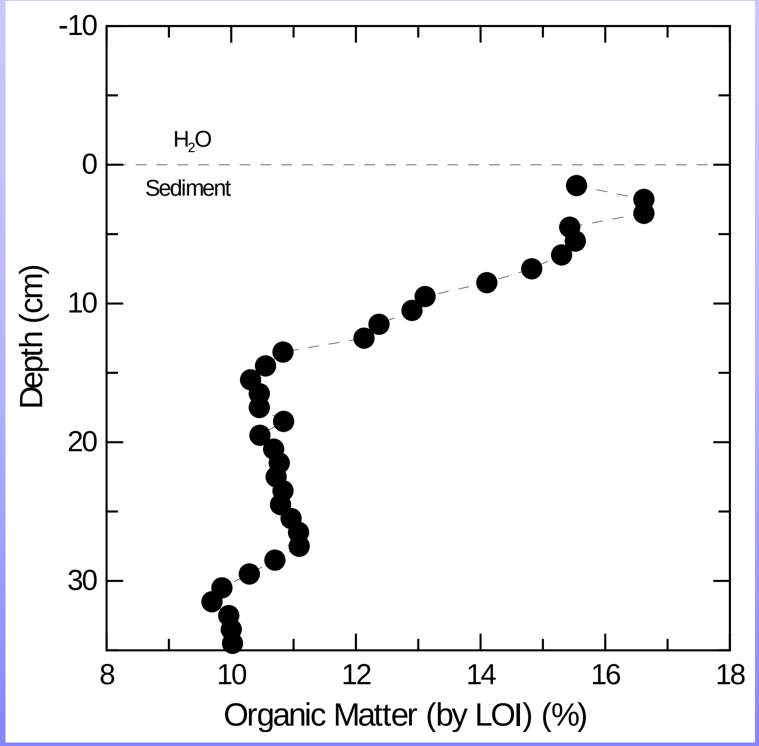
	k (cm^{-1})	R^2 (n=15)	k_r (yr^{-1})	$t_{1/2}$
Organic C	0.0205 0.0040	0.71 0.05	0.050 0.010	13.9 2.9
Total N	0.0174 0.0008	0.85 0.05	0.042 0.002	16.5 0.8
Organic P	0.0438 0.0064	0.49 0.07	0.105 0.015	6.7 1.0

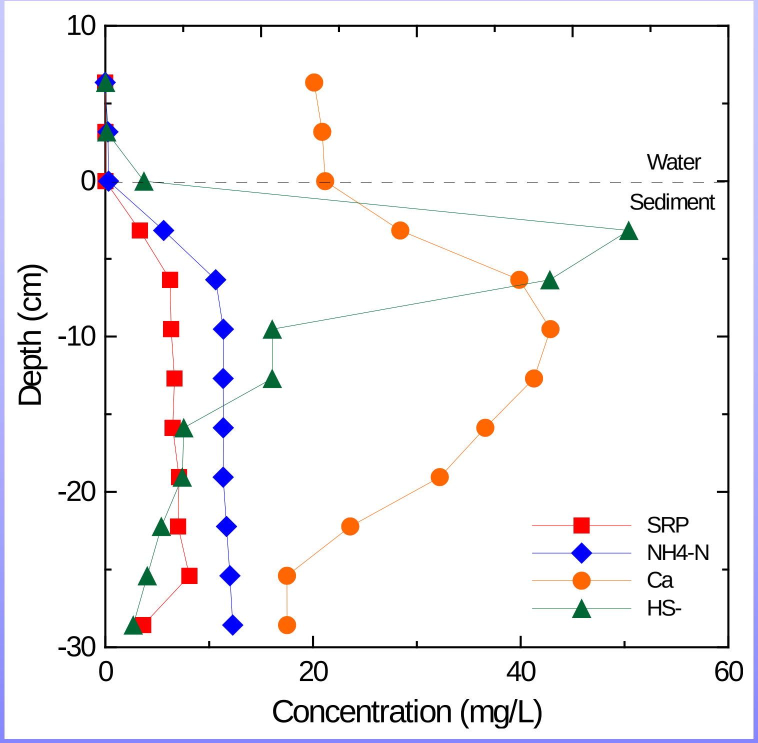
Lake Elsinore (2001)

Table 4. Table 3. Mineralization rate and half-life for total organic C, total N and organic P from a single core from Lake Elsinore (Anderson, 2001).				
	k (cm^{-1})	R^2 (n=10)	k_r (yr^{-1})	$t_{1/2}$ (yr)
Organic C	0.0218	0.59*	0.029	23.9
Total N	0.0166	0.68^{**}	0.023	30.1
Organic P	0.0085	0.50	0.011	60.4

- Lake Elsinore was found to have a slower apparent mineralization rate constant and corresponding (2x) longer nutrient half-lives
- Organic C and N were estimated to have t1/2 values of 24-30 yrs (2x longer than Canyon L.)
- Organic P half-life was 60 yrs or 9x longer than Canyon L.

Two-phase model





- Zone of most rapid loss of organic matter coincides with sulfide in porewater, suggesting that sulfate serves as a 1º oxidant in sediments in L. Elsinore
- Core from Kirby et al. indicates organic matter (LOI) persists within buried sediment

- Organic matter often consists of or degrades to a recalcitrant phase that undergoes very slow further mineralization
- We can model the sediments as a 2-phase system with a rapidly reacting organic matter and slow or negligibly reactive phase as:

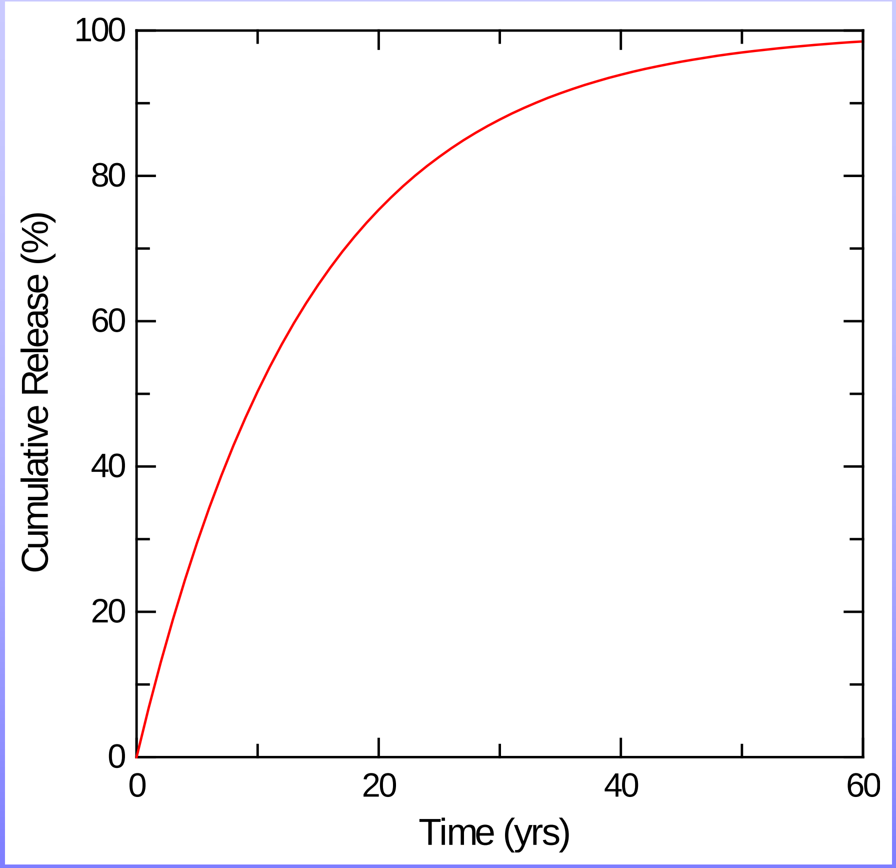
$$C_z = C_0 e^{-\frac{k_r}{\omega} z} + C_u$$

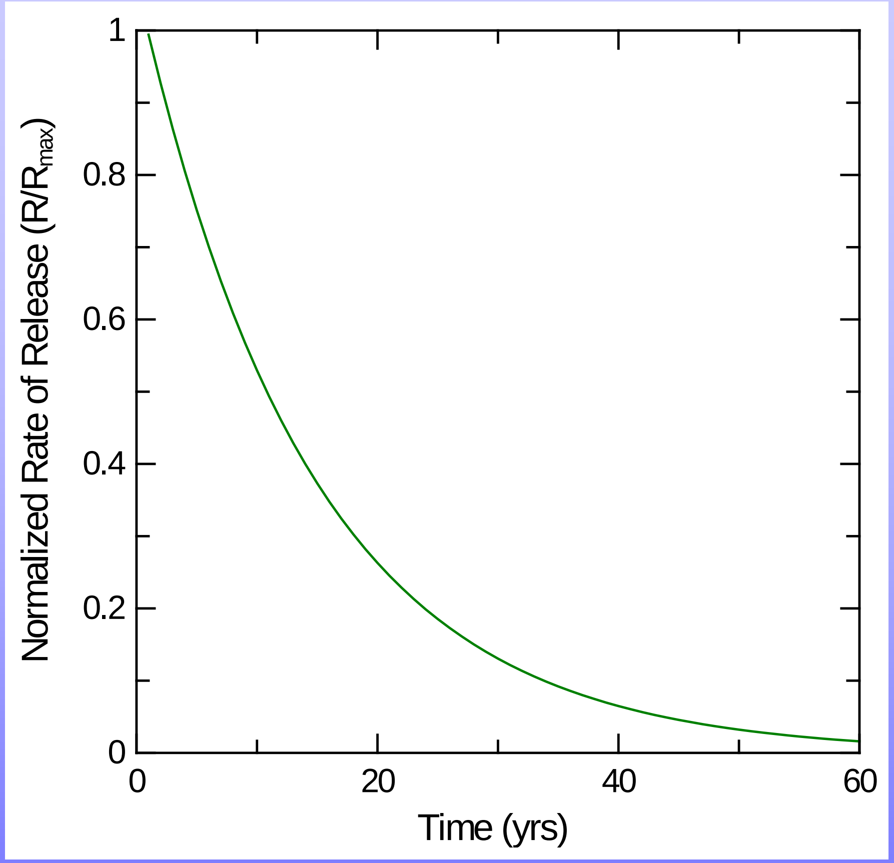
- It is assumed here than the unreactive phase at concentration C_u undergoes no reaction
- A nonlinear least-squares analysis for 3 unknowns (k_r, C_0 and C_u) was conducted

Table 5. Mineralization rate and half-life for total organic C, total N and organic P in Canyon Lake and Lake Elsinore.

	k_r (yr^{-1})		$t_{1/2}$	
	1-phase	**2-phase**	**1-phase**	**2-phase**
Canyon L.				
Organic C	0.050 0.010	0.113 0.081	13.9 2.9	8.2 5.9
Total N	0.042 0.002	0.065 0.018	16.5 0.8	11.1 3.1
Organic P	0.105 0.015	0.125 0.071	6.7 1.0	6.6 3.7
L. Elsinore				
Organic C	0.029 na	0.047 na	23.9 na	14.7 na
Total N	0.023 na	0.043 na	30.1 na	16.0 na
Organic P	0.011 na	0.023 na	60.4 na	29.7 na

- The 2-phase model yielded higher k_r values and shorter half-lives than the 1-phase model
- This indicates that half-lives of nutrients in Canyon L. and L. Elsinore are ~10 and 15 yrs, respectively





- With a half-life of ~10 yrs for Canyon L., by definition ~50% of the nutrients have been released from the sediments in 10 yrs
- After 30 yrs, only about 15% remain, with very slow rate of release

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Technical Memorandum

Task 2: Evaluation of Long-Term Reduction of Phosphorus Loads from Internal Recycling as a Result of Hypolimnetic Oxygenation in Canyon Lake

Objective

The objective of this task was to evaluate the long-term reduction in internal nutrient recycling from bottom sediments and water quality that would result from installation and operation of a hypolimnetic oxygenation system at Canyon Lake.

Approach

The DYRESM-CAEDYM model was used to predict water quality over a 10-yr time horizon. The period January 2002 – December 2011 was selected since a number of studies have been conducted at the lake and watershed over this time period, meteorological and flow data are available, and a wide range in precipitation regimes were present, including drought (2002, 2007-2009) and near-record rainfall (2005). The previous parameterization of the model (Anderson, 2007; Anderson, 2008) was used as the starting point for this modeling effort. The availability of monitoring data and related field studies allow for robust verification and use of the model over this extended period of time. Three (3) different scenarios were evaluated: (i) a reference scenario that reflected conditions present in the lake and watershed; (ii) a scenario in which no internal recycling of nutrients occurred, and thus predicted water quality subject only to external loading to the lake (this would thus represent the *theoretical best* water quality attainable through in-lake treatment); and (iii) hypolimnetic oxygenation of the lake following PACE design 10b.

Meteorology

The meteorological conditions for 2002-2011 as measured at the CIMIS station at UCR (CIMIS #44) were used in all simulations. Daily average values for shortwave solar radiation, air temperature, and rainfall were used as part of the input data used to drive the thermodynamic-hydrodynamic model (DYRESM) (Fig. 1). Daily average shortwave radiation flux (J_{sw}) exhibited a well-defined seasonal trend, with daily winter values generally 100-150 W m^{-2} and summer maximum values of about 350 W m^{-2} (Fig. 1a). Day-to-day variations were nonetheless apparent and result from absorption and scattering of the incoming solar radiation by the atmosphere, especially cloud cover. On particularly cloudy winter days, the shortwave solar radiation averaged over the 24-h period often dropped below 50 W m^{-2} (Fig. 1a) and resulted in net cooling of the water surface and/or low equilibrium temperatures in the lake.

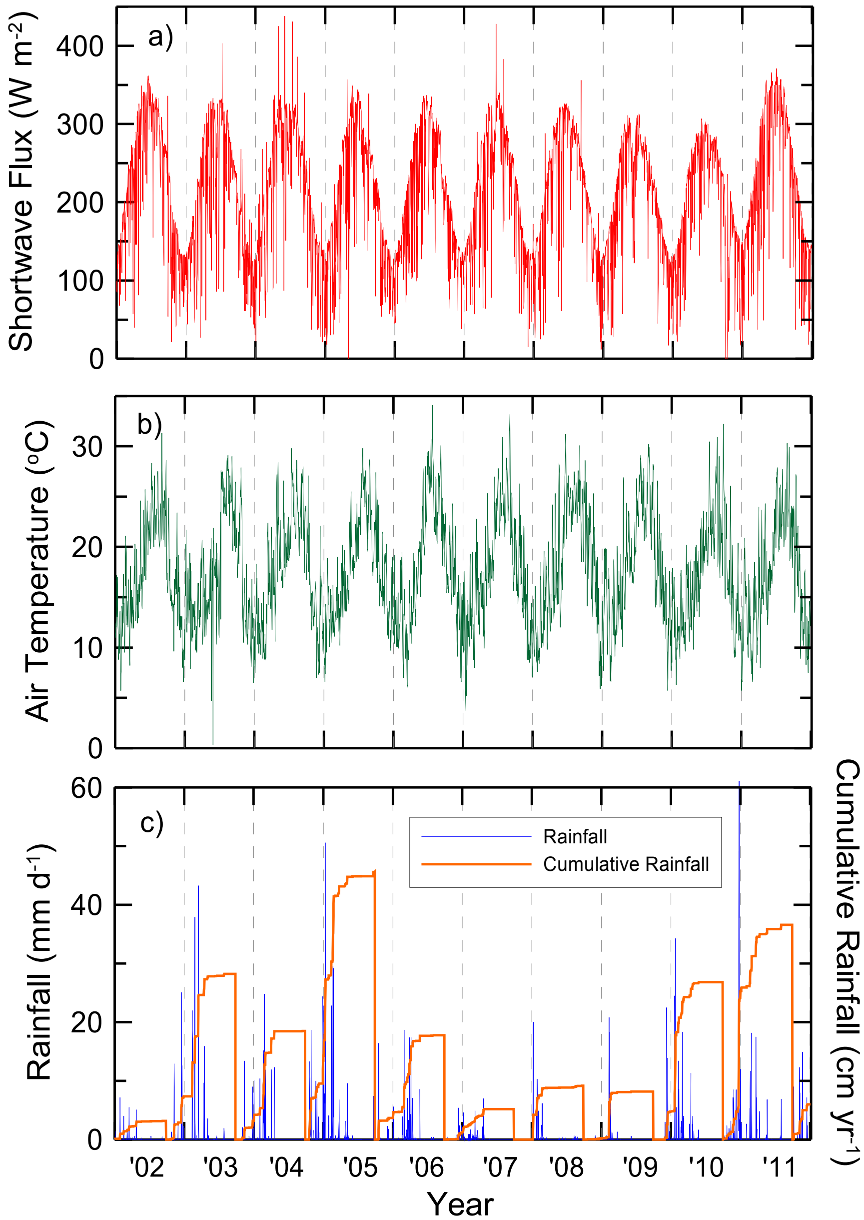

Fig. 1. Key meteorological data used to drive hydrodynamic-thermodynamic DYRESM model.

Daily average air temperatures exhibited strong seasonal trends as well (Fig. 1b). Daily values were typically around 10-12 ºC in the winter and 25-30 ºC in the summer. The atmosphere contributes longwave (>3000 nm wavelength) heat flux (J_l) to the lake (calculated from temperature and cloud cover) that, combined with shortwave heat flux, constitute the principal heat inputs to the lake (eq 1):

$$J_{net} = J_{sw} + J_l - (J_{br} + J_e + J_c) \tag{1}$$

where J_{net} is the net heat flux, J_{br} is back radiation, J_e is evaporative heat flux and J_c is convective heat flux. Several processes thus also result in *release* of heat from the lake. For example, back-radiation from the water surface (J_{br}) that is related to the surface water temperature, following the Stefan-Boltzmann law, exports a significant amount of heat, as does evaporative heat flux (J_e). Evaporative heat flux is especially important in this region, where very warm dry conditions, often combined with strong winds, can export a substantial amount of heat (2.3 kJ g^{-1} water evaporated). DYRESM also requires information about windspeed and humidity in the air (not shown).

While these meteorological parameters define the net heat flux to the lake and the mixing that results from wind shear on the water surface, rainfall is part of the water balance calculation:

$$\frac{dV}{dt} = \sum_i Q_i + PAs - (EAs + W + Q_{out}) \qquad (2)$$

where V is lake volume, t is time, Q_i is the daily flow rate of inflow I, P is the precipitation rate, As is the lake surface area, E is evaporation rate, W is the withdrawal from the lake by EVMWD, and Q_{out} is overflow to Lake Elsinore.

Rainfall varied markedly over the 10-yr period, with daily events ranging from <0.1 mm d^{-1} to >50 mm d^{-1} (blue lines, Fig. 1c). Rainfall was most abundant in the winter, with very strong differences in the total annual (based on water year) rainfall values that ranged from <5 cm (2002) to 45.7 cm (2005) (Fig. 1c). Rainfall directly on the lake surface is generally only a very small contribution to the water budget, although precipitation on the watershed that results in inflow (Q_i) can be very substantial (Fig. 2). Runoff to the lake was taken from USGS gaging stations for the San Jacinto River and Salt Creek near Sun City (USGS #11070365 and #11070465, respectively). The very high amount of rainfall in WY 2005 resulted in runoff events at the beginning of the year with flows in SJR >2500 cfs; in contrast, very little SJR flow was recorded in 2002 and 2006 (Fig. 2a). Generally substantially lower flow rates were present in Salt Creek (Fig. 2b).

Evaporation was determined from temperature (Fig. 1b), humidity (vapor pressure) and wind speed (not shown); it is widely recognized that evaporation removes 1.4-1.5 m of water from the lake surface each year. Detailed records on withdrawals by EVMWD for water treatment and distribution were provided by Julius Ma (EVMWMD). The final component of the water budget is that of overflow (O) that was calculated from water balance and information about lake hypsography and dam crest height. DYRESM dynamically calculated the heating of the water column (eq 1), wind mixing, and water budget (eq 2) over the 10-yr simulation period using a 60 min time step.

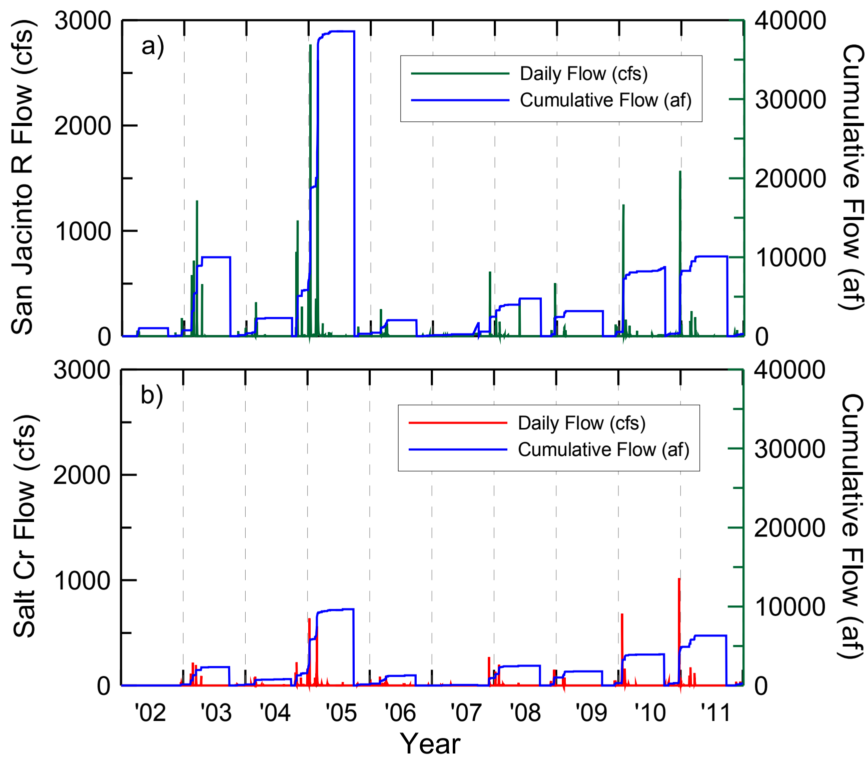

Fig. 2. Daily and cumulative flows to Canyon Lake from a) San Jacinto River and b) Salt Creek.

The model was also used to simulate water quality, including concentrations of nutrients, chlorophyll a, and dissolved oxygen (DO), as well as water transparency and pH and other properties. The model thus solves mass balance equations for each constituent that includes inputs associated with streamflow, recycling within the lake, atmospheric deposition (for N and P), as well as chemical, microbial and biological transformations, and losses via sedimentation and export (from overflow to Lake Elsinore and withdrawal of water by EVMWD).

The input of nutrients from external loading, especially associated with flows into Canyon Lake from San Jacinto River and Salt Creek (Fig. 2), is thus a critical part of the model calculations. Statistical analysis of the measured water quality at the TMDL sampling stations on the San Jacinto River and Salt Creek (2001-2010) yielded mean, geometric mean and median influent concentrations (Table 1). Median values were used as input for the model.

Rates of internal loading of nitrogen and phosphorus to the water column were calculated dynamically in the model based upon DO, temperature, and pH from rates measured in laboratory core-flux studies (Anderson, 2007a). The rates of NH_4-N and SRP release from bottom sediments were thus reduced with increased DO concentrations above the sediments from rates measured under anoxic conditions. Flux rates measured in 2001-2002 were used as the reference flux rates (Anderson, 2002). Sediment oxygen demand was also specified in the model using results from measurements conducted in 2006-2007 (SOD values of about 0.3 g/m^2/d, with modest difference between sites and dates) (Anderson, 2007a).

Table 1. Statistical analysis of watershed sampling data for San Jacinto River and Salt Creek.

Constituent	Source	Mean	Geomean	Median
NH_4-N	Salt Creek	0.39	0.32	0.30
	San Jacinto R	0.45	0.30	0.24
NO_3-N	Salt Creek	0.70	0.63	0.56
	San Jacinto R	0.74	0.59	0.61
TKN	Salt Creek	1.70	1.48	1.45
	San Jacinto R	1.83	1.56	1.60
PO_4-P	Salt Creek	0.44	0.39	0.39
	San Jacinto R	0.45	0.36	0.32
Total P	Salt Creek	0.70	0.58	0.57
	San Jacinto R	1.00	0.80	0.80
TSS	Salt Creek	153	105	88
	San Jacinto R	316	207	220

Results

External Loading

Modeling of the 10-yr period of time from 2002-2011 required daily meteorological data as well as information about inflow. It was thus helpful to first consider the hydrologic loading to the reservoir over this time interval. The individual rainfall events in Fig. 2 were summed within each water year (October 1 – September 30) and clearly show the bulk of the precipitation and runoff occurs near the end of the calendar year/beginning of the following year (x-axis shown as calendar year, so dashed lines correspond to beginning/end of each calendar.) One notes dramatically different total inflows to Canyon Lake (Fig. 3). Water year 2007 generated almost no runoff to the lake (1783 af), while the near-record rainfall in WY 2005 produced almost 50,000 af delivered to Canyon Lake from the San Jacinto River and Salt Creek (Fig. 3).

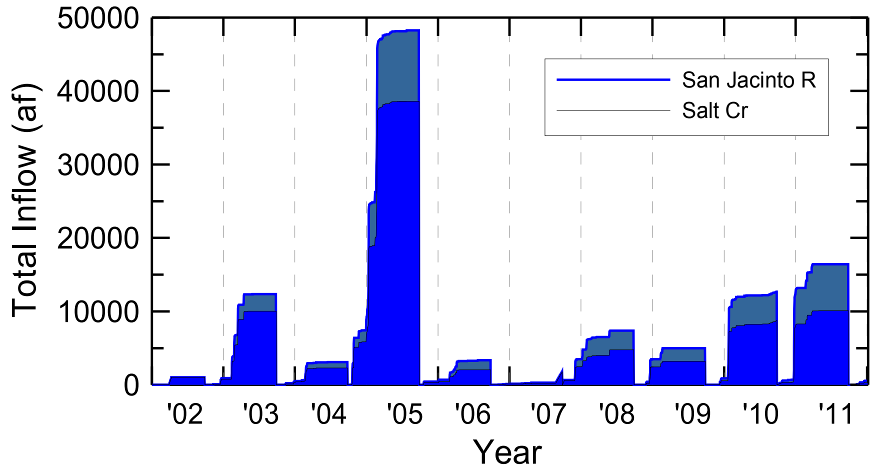

Fig. 3. Cumulative annual inflows to Canyon Lake by water year.

These very large flows also delivered more than 120,000 kg of N and 45,000 kg of P to the lake (Fig. 4). External loading in other years were generally much lower but still significant and associated with winter runoff events (Fig. 4; Table 3).

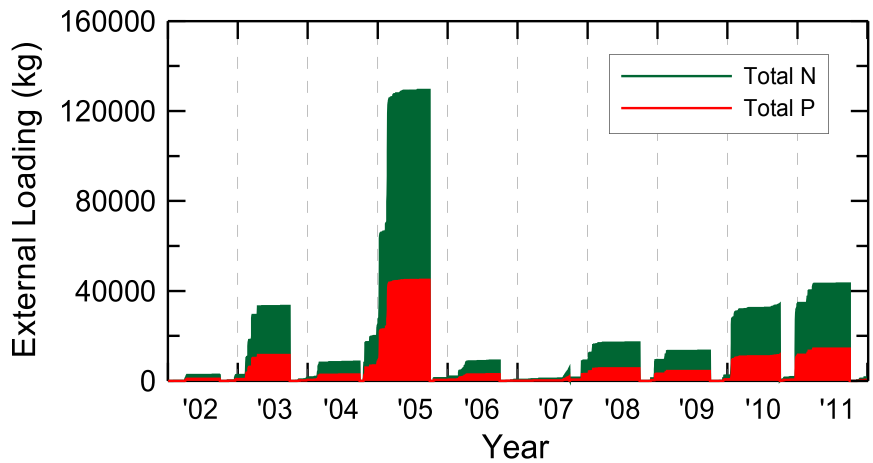

Fig. 4. Cumulative total external loading of N and P to Canyon Lake by water year.

This large volume of flow in 2005 displaced the entire volume of Canyon Lake about 5x, delivered a tremendous amount of nutrients, and effectively reset the water quality and biogeochemistry of the lake. For example, core-flux measurements made in 2006-07 yielded SRP and NH_4-N release rates that were about 60% larger than those found in 2001-02 (Anderson et al., 2007) (Table 2) that resulted from the associated very large external loading of nutrients in 2005 (Fig 4).

Table 2. Average nutrient internal recycling rates in Canyon Lake (Anderson 2002; Anderson et al., 2007).		
Year	**SRP Flux ($mg\ m^{-2}\ d^{-1}$)**	**NH_4-N Flux ($mg\ m^{-2}\ d^{-1}$)**
2001-02	9.4	25.8
2006-07	15.7	44.1

This external loading can be expressed on an areal basis for comparison with internal loading rates; expressed in this way, the gross external loading of nutrients to Canyon Lake, while quite low during intervals of limited runoff (e.g., 2002, 2007), is often comparable to that due to internal loading (Table 3).

Table 3. Gross external loading of N and P to Canyon Lake.				
Water Year	**Total N Load (kg)**	**Total P Load (kg)**	**Total N Load ($mg\ m^{-2}\ d^{-1}$)**	**Total P Load ($mg\ m^{-2}\ d^{-1}$)**
2002	2,635	965	4.7	1.7
2003	33,277	11,520	58.8	20.4
2004	8,470	2,835	15.0	5.0
2005	129,402	44,887	228.8	79.4
2006	9,002	2,933	15.9	5.2
2007	5,367	1,857	9.5	3.3
2008	17,028	5,616	30.1	9.9
2009	13,339	4,409	23.6	7.8
2010	33,982	11,462	60.1	20.3
2011	43,280	14,366	76.5	25.4

A portion of those externally loaded nutrients (as well as internally loaded nutrients) will be exported from the lake during flows sufficient to over-top the dam and to a lesser extent, with withdrawals by EVMWD, however. Outflows to downstream San Jacinto River and Lake Elsinore predictably varied with runoff conditions, with almost all runoff to the lake in 2005 spilling to Lake Elsinore (Fig. 5). Significant outflows from the lake were also seen in 2003, 2010 and 2011, while no flows were predicted (nor observed) in 2002 and 2007.

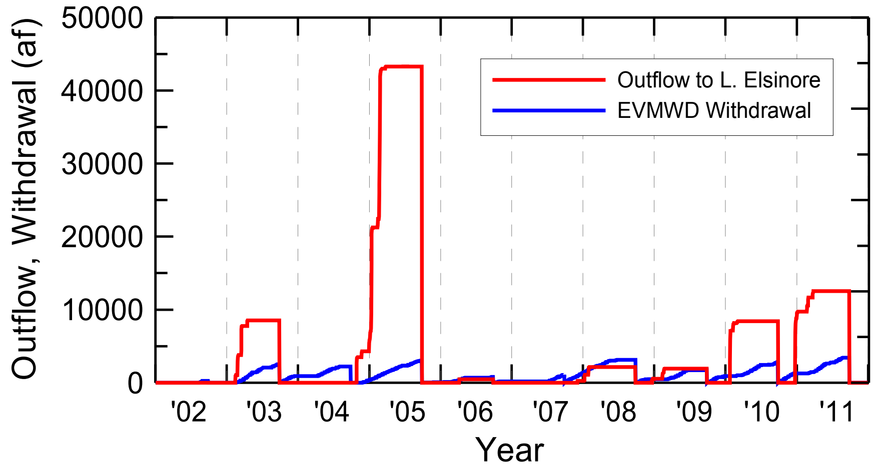

Fig. 5. Cumulative water removal from Canyon Lake via overflow from dam and EVMWD withdrawal by water year.

The water spilled over the dam (and the relatively small volumes withdrawn by EVMWD) removed nutrients from the lake. The gross external loads of total N and total P can be compared with those exported via outflow and withdrawal (Fig. 6). As one can see, years with outflow (Fig. 5) did export total N and P from the lake, up to about 10,000 kg of total P and 20,000 kg of total N in 2005, but only a modest proportion of the gross external load was exported (Fig. 6). Canyon Lake, as modeled in this reference scenario (no hypolimnetic oxygenation system or other in-lake management strategies implemented), thus has finite capacity to retain runoff and storm flows, but is generally quite effective at retaining nutrients.

The annual retention of N and P in Canyon Lake is summarized in Table 4. Phosphorus was generally retained more effectively than N, with an average net retention of P of 84.9%, compared with 68.2% for N. Expressed as % transported (15.1% and 31.8% for P and N respectively), we see that Canyon Lake is on average twice as effective at retaining P than N. Nonetheless, the % nutrients retained did vary from year to year that appeared to be a complex function of amount of water retained and, more importantly, the duration and timing of the inflows. Storms that quickly flushed through the lake would provide little residence time of water and thus result in limited opportunity for settling of particulate forms of nutrients, uptake, and biological transformation reactions. Conversely, flows and nutrient inputs from a series of storms over much of the winter would provide time for reaction and potentially greater in-basin removal.

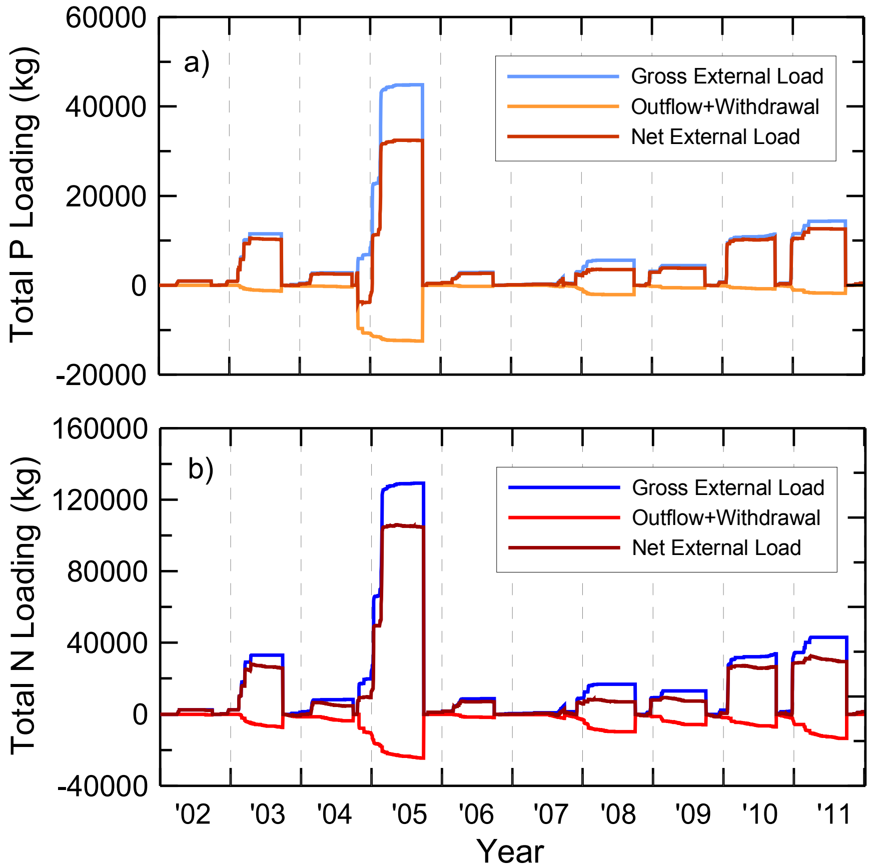

Fig. 6. Cumulative nutrient budgets for Canyon Lake by water year: a) total P and b) total N.

Table 4. Retention of inflow and externally loaded nutrients in Canyon Lake by water year.

Water Year	Water Volume Retained (af)	Total P Retained (kg)	Total N Retained (kg)
2002	814 (78.3%)	944 (97.1%)	2,162 (86.0%)
2003	1,225 (9.9%)	10,222 (88.7%)	25,730 (77.8%)
2004	871 (28.0%)	2,489 (87.8%)	4,667 (56.4%)
2005	1,998 (4.1%)	32,398 (72.2%)	104,679 (81.0%)
2006	2,807 (62.4%)	2,664 (90.8%)	7,033 (79.9%)
2007	706 (39.6%)	1,526 (82.2%)	2,932 (56.7%)
2008	4,237 (57.6)	3,501 (62.3%)	7,007 (41.6%)
2009	1,290 (25.9%)	3,806 (86.3%)	7,200 (54.8%)
2010	4,278 (33.7%)	10,620 (92.6%)	26,647 (78.9%)
2011	466 (2.8%)	12,571 (88.5%)	29,535 (68.6%)

Correcting for nutrients exported from the basin, we see that external loading expressed as a flux rate (Table 5) remains comparable to or exceeds the annual average internal recycling rate (Table 2) in 4 out of 10 year.

Table 5. Net external loading of N and P to Canyon Lake.

Water Year	Net Total N Load (kg)	Net Total P Load (kg)	Total N ($mg\ m^{-2}\ d^{-1}$)	Total P ($mg\ m^{-2}\ d^{-1}$)
2002	2,266	937	4.0	1.7
2003	25,890	10,218	45.7	18.1
2004	4,777	2,489	8.5	4.4
2005	104,816	32,408	185.3	57.3
2006	7,193	2,663	12.7	4.7
2007	3,043	1,526	5.4	2.7
2008	7,084	3,499	12.5	6.2
2009	7,310	3,805	12.9	6.7
2010	26,812	10,614	47.4	18.8
2011	29,690	12,714	52.5	22.5

Simulation #1: Reference Condition

DYRESM-CAEDYM was used to simulate water quality in Canyon Lake subject to the above meteorological and runoff conditions under the natural conditions in the lake (i.e., with no hypolimnetic oxygenation or other in-lake restoration efforts). As we have seen in previous simulations, the model predicted strongly stratified conditions in Canyon Lake through much of the year, with epilimnion temperatures exceeding 25 ºC and with much cooler temperatures in the hypolimnion, generally 10-12 ºC (Fig. 7a). The multi-year record simulated here demonstrated that there is some year-to-year variation in the hypolimnion temperature related to specific meteorological conditions present when stratification sets up in the early spring (Fig. 7a).

The model predicted high DO concentrations in the epilimnion in the summer and through much of the water column during the winter mixing condition, although the extent of mixing of DO varied from year-to-year, with weaker predicted mixing in early winter 2005 and 2011 and complete mixing in early winter 2007 (Fig. 7b).

Total N and total P concentrations also exhibited strong seasonal and vertical differences. Rapid development of anoxia in the hypolimnion promoted reductive dissolution of $Fe(OH)_3$-H_2PO_4 sorbed phases as well as mineralization of organic-N and organic-P phases resulting in internal loading of NH_4-N and PO_4-P to the water overlying the bottoms sediments (Fig. 7c,d). Total N (principally as NH_4-N) reached concentrations of 4-5 mg/L above the bottom sediments in the fall, while concentrations in the epilimnion were more typically 1-1.4 mg/L (Fig. 7c).

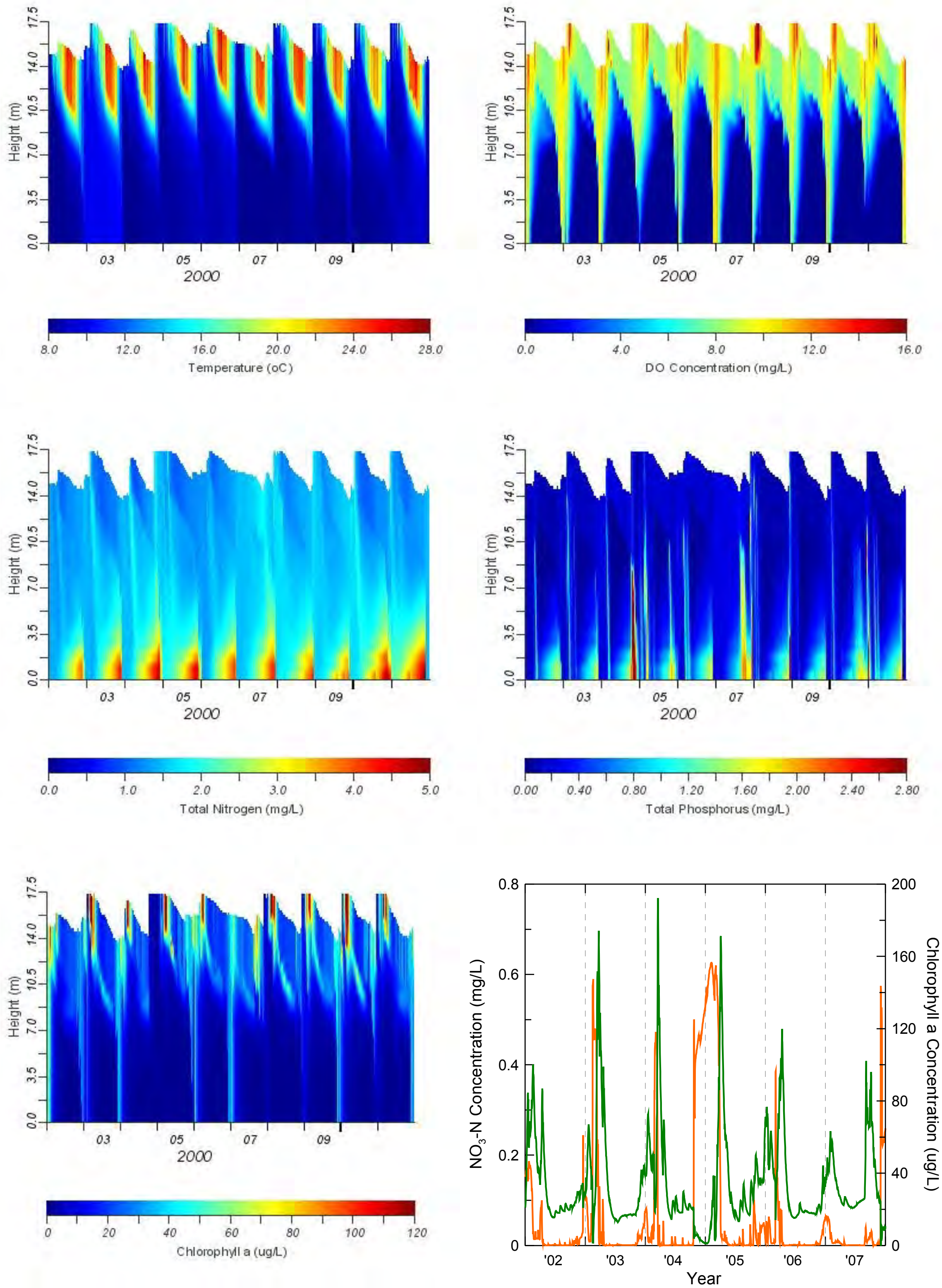

Fig. 7. Predicted water column conditions and water quality in Canyon Lake under reference scenario: a) temperature, b) DO, c) total N, d) total P, e) chlorophyll a, f) NO3+chlroophyll a.

Similar trends were seen for total P (principally as PO_4-P), with concentrations near 2 mg/L above the bottom sediments in the fall prior to mixing, although higher concentrations were seen in 2005 following the very large input of particulate inorganic P (Fig. 7d). Total P concentrations were generally much lower in the epilimnion (0.2-0.4 mg/L). Finally, chlorophyll a concentrations exhibited particularly strong seasonal and vertical differences. Very high concentrations were present in the epilimnion in the winter-spring, often exceeding 100 μg/L, while concentrations were predictably much lower deeper in the lake owing to light limitations (Fig. 7e). Mixing did distribute some phytoplankton with depth however. Simulations indicate that it is the availability NO_3-N that promotes or limits algal production in the lake, consistent with previous algal nutrient bioassays (Fig. 7f).

Simulation #2: No Internal Loading

The theoretical limit for in-lake restoration efforts aimed at reducing internal recycling would be complete elimination of all internal loading through, e.g., alum application combined with zeolite to remove all PO_4-P and NH_4-N release from bottom sediments. While complete suppression of internal recycling is not possible in reality, it is nonetheless useful to explore water quality in Canyon Lake due only to external loading. As we have seen, a substantial external load of nutrients is delivered to the lake with some frequency (e.g., Fig. 4). For this simulation, then, internal loading of both N and P was set to 0, while all other conditions were held unchanged from the reference simulation described above.

As expected, internal loading did not have a noticeable effect upon temperature or thermal structure in Canyon Lake (Fig. 8a) since this is regulated chiefly by meteorological conditions (Fig. 1). Moreover, the absence of internal loading had little effect on DO concentrations; significant photosynthetic production of DO was still observed in the upper part of the water column, and anoxia was present for much of the year in the hypolimnion (Fig. 8b). More dramatic effects were witnessed for N and P (Fig. 8c,d). Total N did not accumulate above the bottom sediments although concentrations in the upper water column were only modestly reduced (Fig. 8c). In a similar way, total P concentrations generally remained uniformly low throughout the water column, although the externally loaded P that included some particulate forms were evident and reached high concentrations for a period of time during large runoff events (especially winter 2004-2005, late fall 2007, and winter 2010-11) (Fig. 8d). The elevated concentrations deeper in the water column resulted from an “underflow” condition wherein the inflowing water was colder and more dense that the lake, and thereby plunged deeper in the water column. Chlorophyll a concentrations (Fig. 8e) appeared to be modestly reduced, but were not dramatically altered relative to the reference case (Fig. 7e)

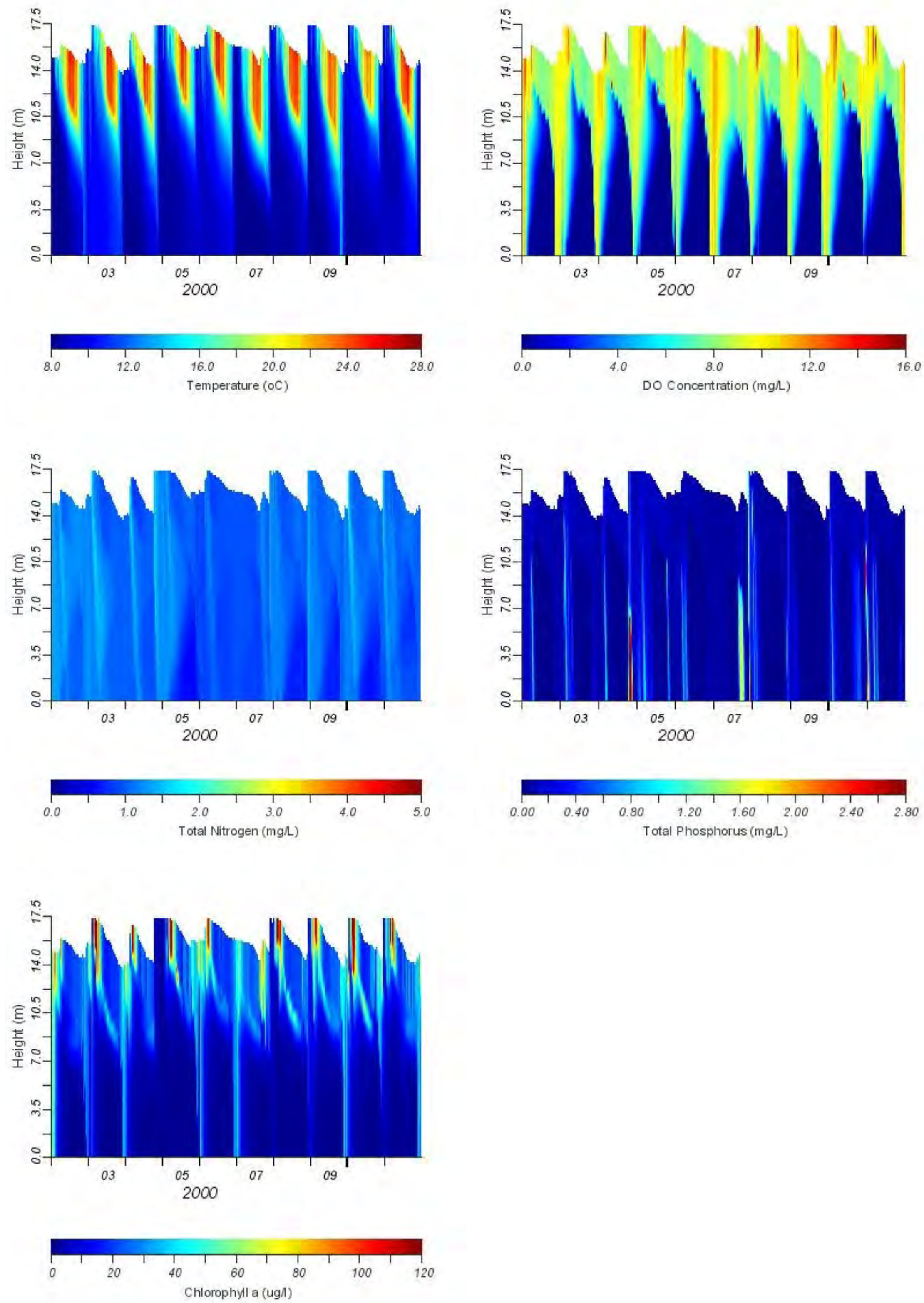

Fig. 8. Predicted water column conditions and water quality in Canyon Lake under no internal loading scenario: a) temperature, b) DO, c) total N, d) total P and e) chlorophyll a.

The effect of no internal loading can be seen more clearly when compared with concentrations at specific depths (Figs. 9-11). We thus see that with internal loading, the concentrations of total N (Fig. 9) and total P (Fig. 10) increased through the spring and summer, and then generally decreased (especially noticeable for the bottom depths (panel b on Figs. 9-10). An increase in concentrations in the surface waters in both scenarios was often seen in the winter as a result of external loading. Lower concentrations were consistently present in the simulation with no internal loading, reflecting the reduction in total loading to the water column. Very similar behavior was seen for both total N (Fig. 9) and total P (Fig. 10).

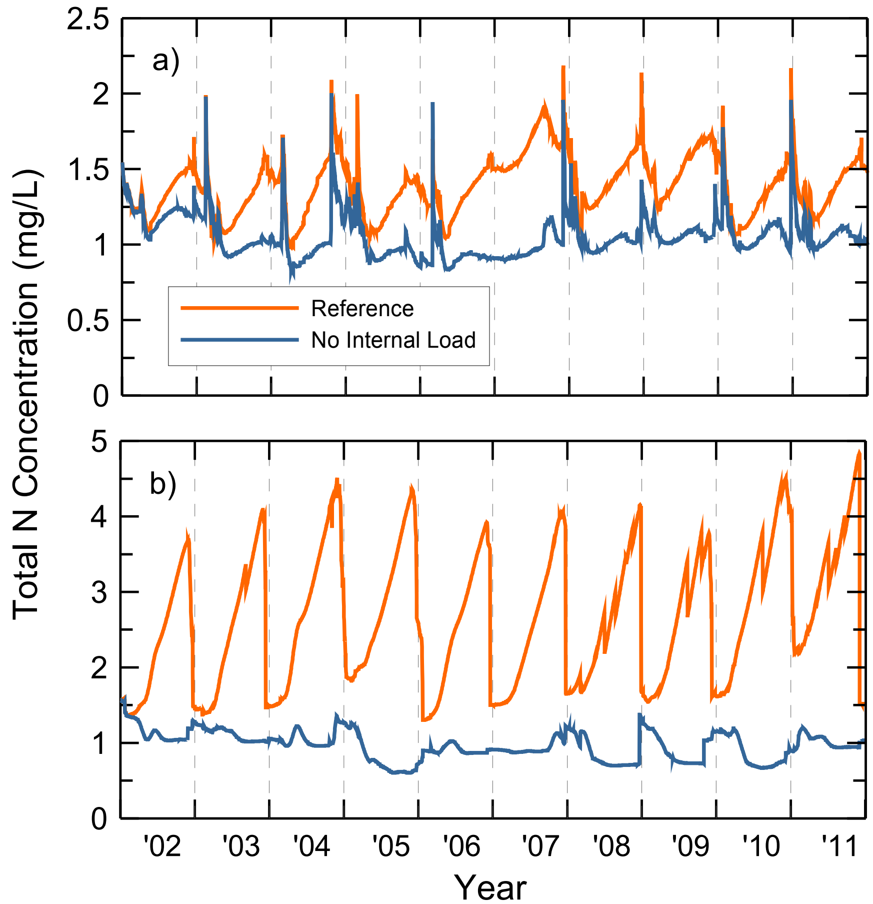

Fig. 9. Predicted total N concentrations comparing the reference scenario with the no-internal loading scenario: a) 1 m below surface and b) 1 m above bottom sediments.

The absence of internal loading did result in somewhat lower chlorophyll concentrations in the epilimnion, although peak concentrations following external loading (especially of NO_3-N) were broadly similar (Fig. 11). Thus, even with no internal loading, chlorophyll a concentrations were predicted to remain relatively high (Fig. 11).

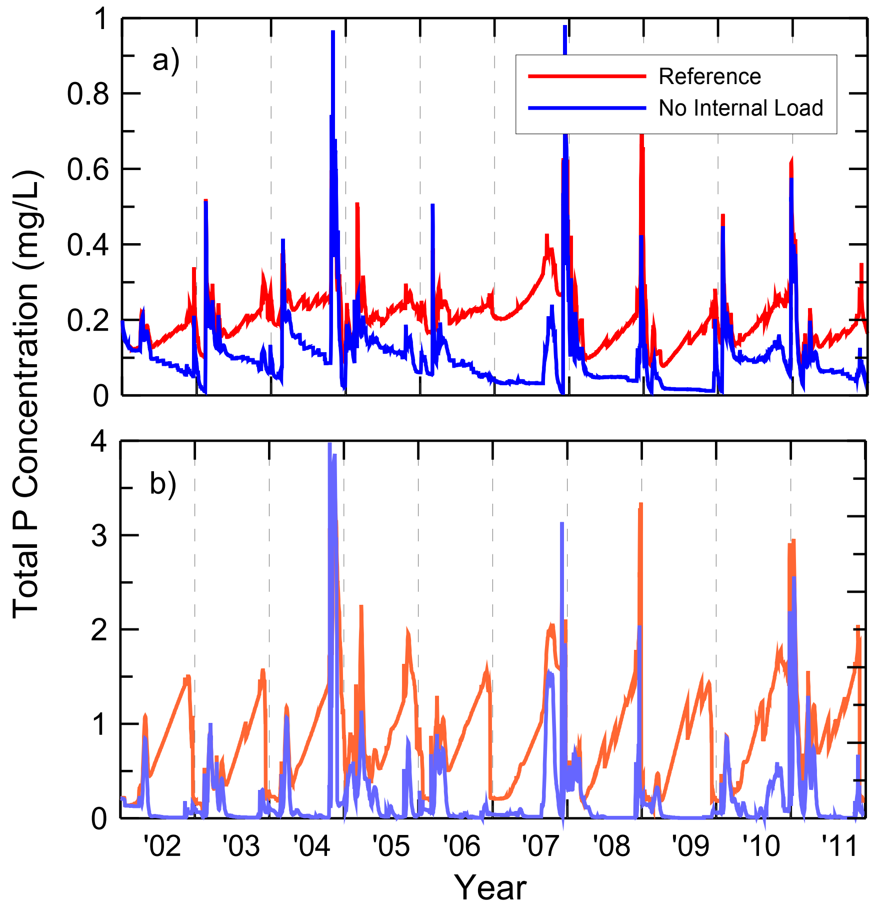

Fig. 10. Predicted total P concentrations comparing the reference scenario with the no-internal loading scenario: a) 1 m below surface and b) 1 m above bottom sediments.

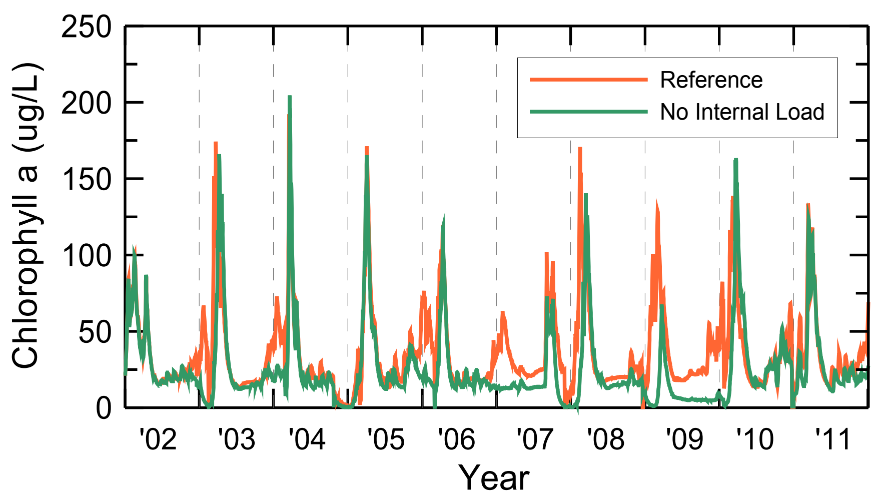

Fig. 11. Predicted chlorophyll a concentrations comparing the reference scenario with the no-internal loading scenario (1 m below surface).

Simulation #3: Hypolimnetic Oxygenation

The previous simulation is thought to represent a theoretical best-case outcome from in-lake restoration through, *e.g.*, use of alum in combination with zeolite sufficient to suppress all release of PO_4-P and NH_4-N. The purpose of this scenario is to evaluate the efficacy of a hypolimnetic oxygenation system for reducing internal loading of nutrients and improving overall water quality in Canyon Lake. Since the previous no internal loading simulation did not explicitly alter DO conditions (beyond those that would be achieved from changes in nutrient availability and productivity), changes in biogeochemical conditions and further transformations could potentially occur as a result of installation and operation of an oxygenation system.

As seen from other simulations (e.g., Anderson, 2007), hypolimnetic oxygenation has negligible effect on the thermal stratification in the lake (Fig. 12a). Conversely, it had a profound effect on the distribution of DO within the water column (Fig. 12b). Oxygen was delivered to the bottom of the lake at a rate of 1,700 lbs O_2 d^{-1} following PACE alternative #10b to offset sediment and water oxygen demands. This oxygen delivery was able to maintain strongly oxic conditions above the sediments, but due to limited vertical exchange, was not fully mixed within the hypolimnion. The model transported oxygen away from the bottom sediments principally by diffusion, and so did not fully capture the features of the hypolimnetic oxygenation system proposed by PACE in which care was taken to mix the DO throughout the hypolimnion (Fig. 12b). Nonetheless, DO concentrations remained above 2 mg L^{-1} even below the thermocline and would thus not meaningfully alter PO_4-P, Fe or related biogochemistry of the lake compared with a uniformly mixed DO condition in the hypolimnion.

Oxygenation did a very good job of suppressing accumulation of N and P above the bottom sediments (Fig. 12c,d), achieving conditions broadly similar to the no internal loading scenario (Fig. 8c,d). One does note slightly higher total N concentrations in the water column however. Total P levels here also show the delivery of nutrients with external loads in late fall-winter of large runoff years (Fig. 12d). Chlorophyll a concentrations also appear at this scale to be broadly similar to those found with no internal loading (Fig. 12e).

A more careful look at predicted concentrations at 1 m below the water surface and 1 m above the bottom sediments better shows the similarities and differences. Total N concentrations in the epilimnion (1 m below water surface) were found to be intermediate between those predicted for the reference scenario and that with no internal loading (Fig. 13a). The average total N concentration over the entire 10-yr simulation period was 1.26 mg L^{-1}, a value that was 10% lower than the reference value (1.40 mg L^{-1}), but 20% higher than the mean value for the no internal loading scenario (1.05 mg L^{-1}) (Table 6). The HOS system more dramatically lowered total N concentrations above the bottom sediments however (1.48 mg L^{-1} vs. 2.65 mg L^{-1} for the reference case), but still greater than the no internal loading scenario (Table 6).

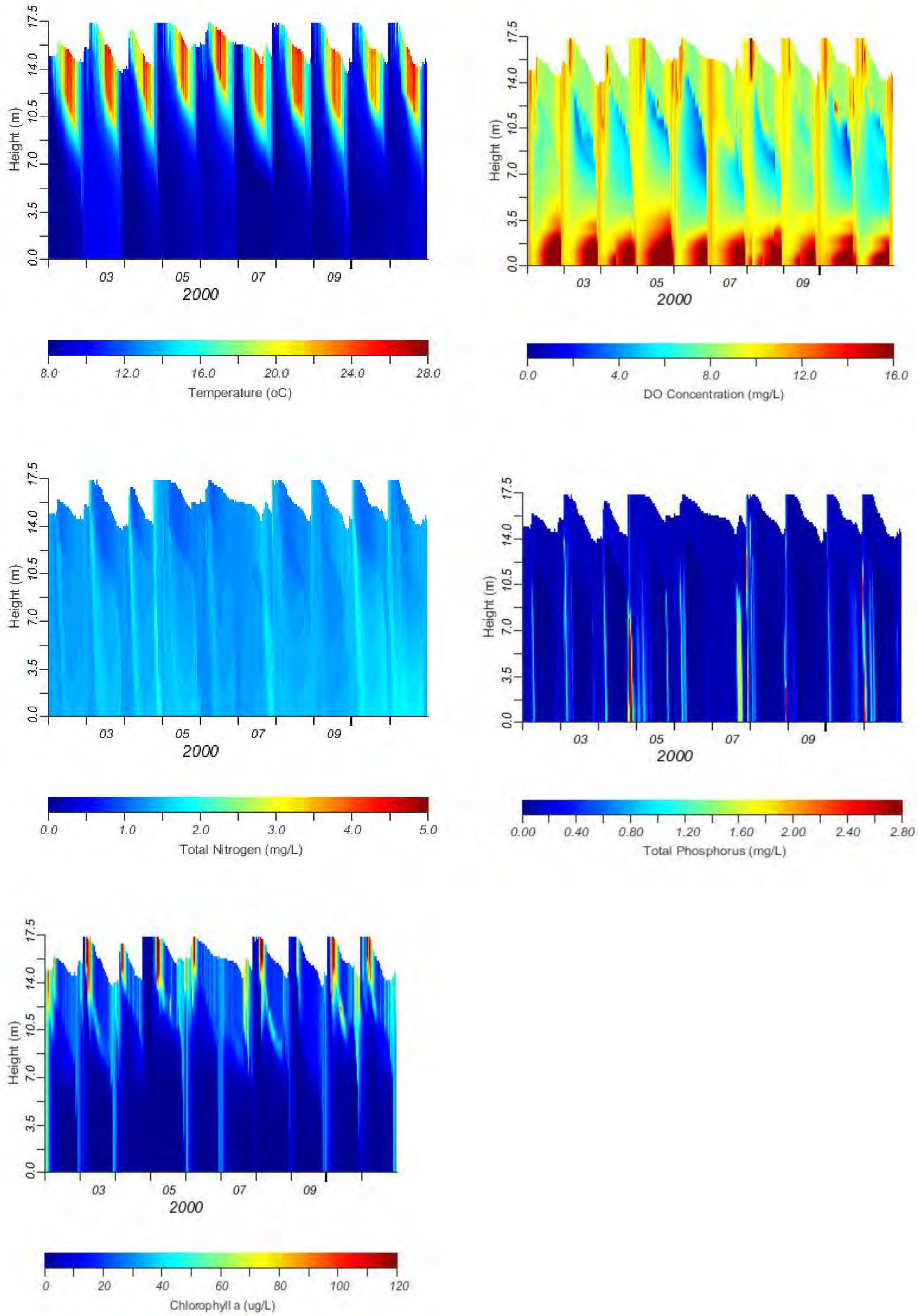

Fig. 12. Predicted water column conditions and water quality in Canyon Lake with hypolimnetic oxygenation: a) temperature, b) DO, c) total N, d) total P and e) chlorophyll a.

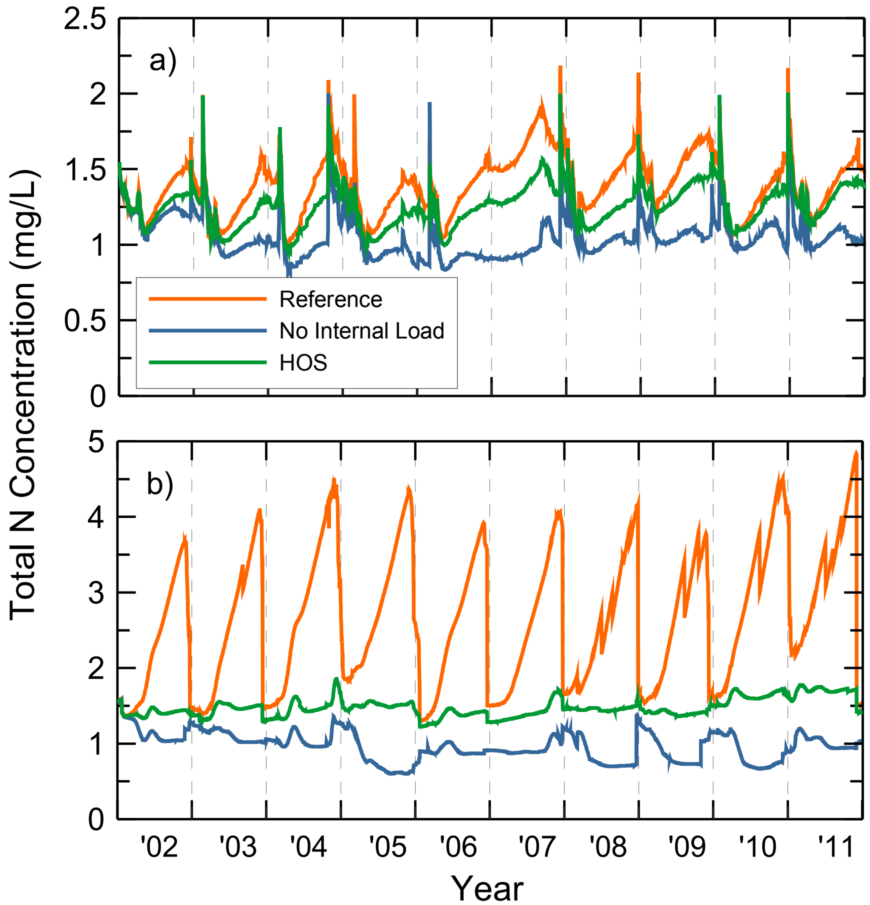

Fig.13. Predicted total N concentrations comparing the 3 scenarios: a) 1 m below surface and b) 1 m above bottom sediments.

The hypolimnetic oxygenation system was predicted to have a greater effect on total P (Fig. 14), achieving levels substantially lower 10-yr mean values than the reference scenario and only modestly larger than the no internal loading scenario (Table 6). The effect of HOS on chlorophyll was limited however (Fig. 15, Table 6). The N-limitation in the lake constrained the improvements in chlorophyll levels that were achieved with HOS despite substantial reductions in total and available P concentrations.

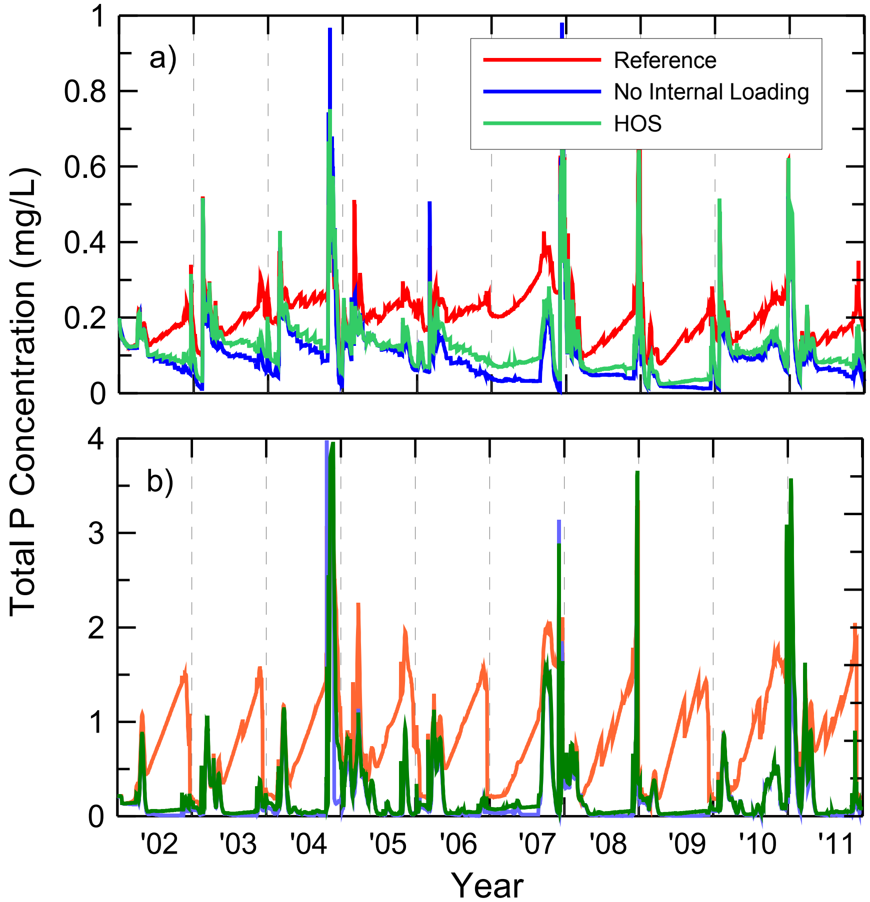

Fig. 14. Predicted total P concentrations comparing the 3 scenarios: a) 1 m below surface and b) 1 m above bottom sediments.

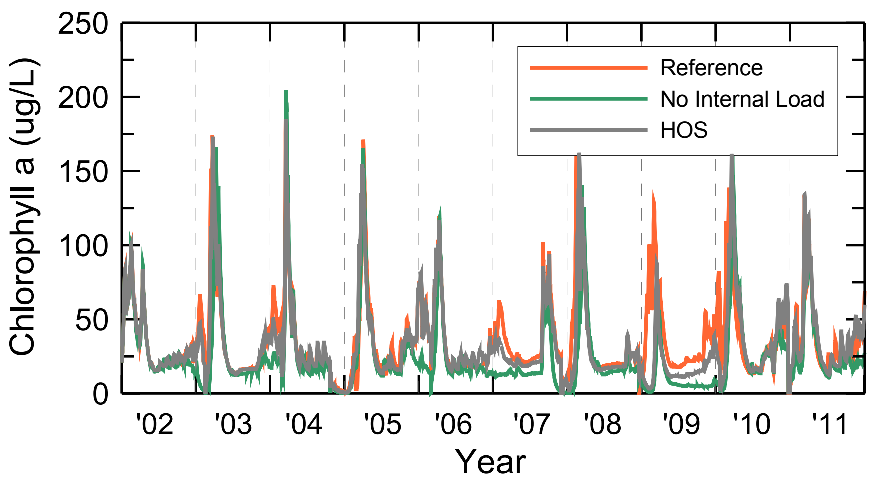

Fig. 15. Predicted chlorophyll a concentrations comparing the reference scenario with the no-internal loading scenario (1 m below surface).

Table 6. Predicted 10-yr average concentrations of total N, total P and chlorophyll a under the reference, no internal loading and HOS scenarios.

Constituent	Depth	Reference Scenario	No Internal Load Scenario	HOS Scenario
Total N	1 m Surface	1.40 ± 0.20	1.05 ± 0.14	1.26 ± 0.14
	1 m Bottom	2.65 ± 0.90	0.97 ± 0.19	1.48 ± 0.12
Total P	1 m Surface	0.21 ± 0.08	0.10 ± 0.09	0.12 ± 0.08
	1 m Bottom	0.85 ± 0.53	0.20 ± 0.46	0.25 ± 0.50
Chlorophyll a	1 m Surface	36.1 ± 27.6	25.5 ± 26.5	33.1 ± 27.0

Conclusions

Results of this study that involved simulation of water quality for the period 2002-2011 demonstrated a number of key findings:

(i) External loading events deliver nutrients to Canyon Lake at rates that can approach or exceed internal loading rates (this occurred 4 out of 10 years in this past 10-yr period of time).

(ii) Canyon Lake is very effective at retaining P and effective at retaining N delivered with runoff, achieving an average of about 84.9% retention of P and 68.2% retention of N based upon these simulations.

(iii) The preferential retention of P relative to N (by about a factor of 2x based upon transported mass) is thought to play a role in the typical P-limitation in Lake Elsinore.

(iv) Elimination of all internal loading to the water column, as would be the theoretical limit from, e.g., application of alum, in combination of zeolite, was found to achieve average reductions of total N in the epilimnion of 25%, total P of 52%, and chlorophyll a of 29% relative to the reference scenario.

(v) Installation and operation of a hypolimnetic oxygenation system achieved a 10% reduction in the average total N concentration, a 43% reduction in total P, and an 8% reduction in chlorophyll a relative to the reference scenario.

(vi) The close connection of Canyon Lake to the San Jacinto River watershed, with regular delivery of often very large external nutrient loads, presents challenges for typical in-lake restoration efforts to fully meet all water quality objectives.

(vii) It appears that control of internal loading will not be sufficient to meet all water quality objectives; in the absence of dramatic reductions in external loading of nutrients, aggressive stripping of nutrients (especially NO_3^-) out of the inflow or water column will also be required.

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Technical Memorandum

Task 3: Evaluation of Alum, Phoslock and Modified Zeolite To Sequester Nutrients in Inflow and Improve Water Quality in Canyon Lake

Objective

The objective of this task was to evaluate the effectiveness of alum, Phoslock and an Al-modified zeolite at sequestering nutrients within inflow and estimate corresponding doses required to meet chlorophyll a target of 25 $\mu g\ L^{-1}$ in Canyon Lake.

Approach

The DYRESM-CAEDYM model developed in task 2 was used to predict water quality in Canyon Lake under scenarios that included addition of alum, Phoslock and an Al-modified zeolite (Aqual-P) to inflows. As in task 2, the 10-yr period from 2002-2011 was simulated under both the reference (natural) condition at the lake that included strong thermal stratification and an anaerobic hypolimnion for most of the year, and with installation and operation of the PACE hypolimnetic oxygenation system (HOS). The simulations and associated calculations from task 2 demonstrated the strong linkage between the watershed and external loading of nutrients to the lake, with annual net external loading of nutrients exceeding internal loading 4 years out of 10. The simulations demonstrated that HOS, while effective at significantly reducing internal loading of P and to a lesser extent N, was unable to meet chlorophyll a and nutrient objectives in the lake owing to the annual and often very large loads of nutrients delivered from the watershed. Results from task 2 indicate that stripping of nutrients out of the inflows to Canyon Lake would also be needed to meet all TMDL water quality targets.

Numerical simulations were performed in which PO_4-P concentrations in the inflows from the San Jacinto River and Salt Creek were reduced through irreversible adsorption into a particulate inorganic form that was then allowed to settle out of the water column following Stokes Law. Data describing the adsorption of PO_4-P to each of these materials were taken from published studies; sorption data for alum were taken from Pilgrim et al. (2007), Phoslock data were taken from Haghersersht et al., (2009), and adsorption data for the Al-modified zeolite (Aqual-P) were taken from Gibbs and Ozkundakci (2011).

Results

<u>Sorbent Properties</u>

The capacity of alum, Phoslock and an Al-modified zeolite to bind PO_4-P in water varies significantly, with alum sorbing a greater amount of PO_4-P than Phoslock or Al-zeolite (Aqual-P) at a given equilibrium solution concentration (Fig.1). The amount of

PO_4-P sorbed onto these materials increases with increasing PO_4-P concentration in solution. For example, the concentration sorbed to Phoslock asymptotically approached its maximum value of about 10 mg PO_4-P/g (Haghereresht et al., 2009) at equilibrium dissolved concentrations somewhat greater than 0.3 mg/L (Fig. 1a). In this case, the available sites for uptake of PO_4-P are rapidly filled, while a much higher number of sites are available with the alum floc. The Al-zeolite has lower affinity for PO_4-P over these concentration ranges than either alum or Phoslock.

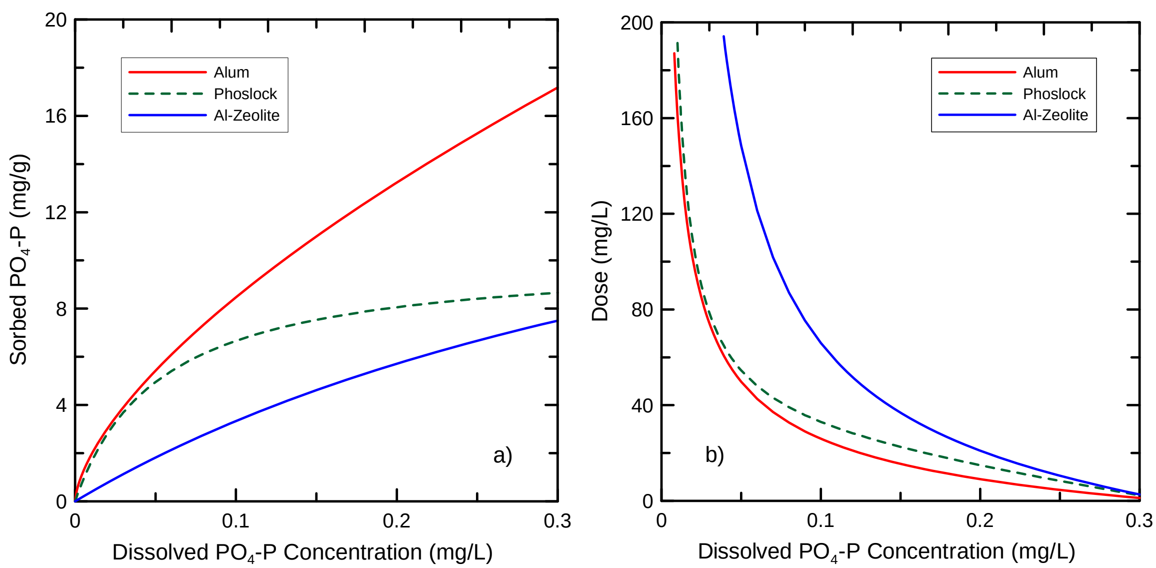

Fig. 1. Comparison of (a) PO_4-P adsorption isotherms and (b) treatment doses and corresponding equilibrium dissolved PO_4-P concentrations for liquid alum, Phoslock and Al-zeolite (Aqual-P).

As a result of the different affinities for PO_4-P, the doses required to achieve a given concentration of PO_4-P in the inflow varied as well (Fig. 1b). All sorbents exhibited a strongly non-linear increase in dose required to achieve lower equilibrium PO_4-P concentrations in solution. Alum required the smallest dose of the three materials to achieve a given equilibrium dissolved PO_4-P concentration, down to about 0.05 mg/L, below which liquid alum and Phoslock were calculated to require similar doses (Fig. 1b). Higher doses would be required to achieve similar dissolved PO_4-P concentrations using the Al-modified zeolite (Fig. 1b).

To reduce the PO_4-P concentration to, e.g., 0.20 mg/L in San Jacinto River inflow (a reduction of 0.12 mg/L from the average dissolved PO_4-P concentration (Anderson, 2012)), doses of 9.1 mg/L alum, 14.9 mg/L Phoslock, or 21.0 mg/L Aqual-P would be required. Higher doses would be needed to reduce PO_4-P in Salt Creek to 0.20 mg/L (a reduction of 0.19 mg/L from the average dissolved PO_4-P concentration in Salt Creek would require 14.4 mg/L alum, 23.6 mg/L Phoslock, or 33.3 mg/L Aqual-P). Greater doses would be needed to remove a larger fraction of the dissolved PO_4-P using any of the materials (*e.g.*, the required alum dose would increase from 9.1 mg/L to 26.0 mg/L to lower dissolved PO_4-P concentrations from 0.20 mg/L to 0.10 mg/L in the San Jacinto River).

Effects on Water Quality

DYRESM-CAEDYM simulations for the 2002-2011 time period were conducted for the (i) reference condition (no in-lake or external treatment), (ii) reduction in dissolved PO_4-P concentration in inflow through addition of alum, Phoslock or Al-zeolite, (iii) operation of the HOS following the PACE 10b design, and (iv) operation of the HOS with inflow treatment/reduction in dissolved PO_4-P. Simulation results for the photic zone (1 m depth) assuming a reduction in external PO_4-P concentrations to 0.10 mg/L are shown in Figs. 3-5. Reduction in PO_4-P concentrations in inflows to 0.10 mg/L predictably lowered the total P concentrations in the lake surface waters by a significant amount as this dissolved PO_4-P was converted to a particulate inorganic form that rapidly settled out of the water column (Fig. 2a).

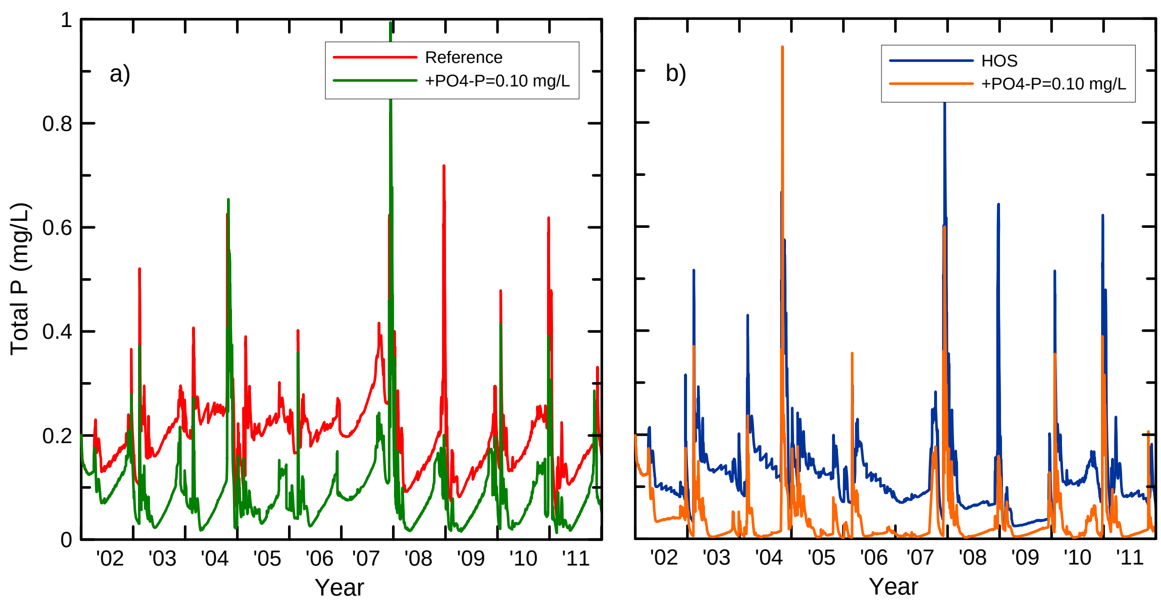

Fig. 2. Predicted total P concentrations for (a) the reference scenario and (b) operation of HOS (with and without treatment that reduced inflow PO_4-P concentration to 0.10 mg/L).

This was achieved without any in-lake treatment, although we do nonetheless see increases in total P during fall mixing and winter runoff events (Fig. 3a). Installation and operation of the HOS was previously shown to have a beneficial effect on total P in the lake (Anderson, 2012), while operation of the HOS in conjunction with treatment that lowered inflow PO_4-P concentration to 0.10 mg/L had the most dramatic effect, with very low total P concentrations (often <0.02 mg/L) present during the summer months (Fig. 2b).

The effects of PO_4-P reductions on total N levels in the epilimnion of the lake were quite modest and, interestingly, tended to increase slightly the predicted total N concentrations relative to both the reference (no HOS) scenario (Fig. 3a) and with operation of the HOS (Fig. 3b). Reductions in PO_4-P concentrations in the inflows to 0.10 mg/L moved the lake into P-limitation, such that less N was taken up by phytoplankton in the lake, less was available to be grazed by zooplankton or settled out of the water column as particulate organic N, and more consequently remained in the water column.

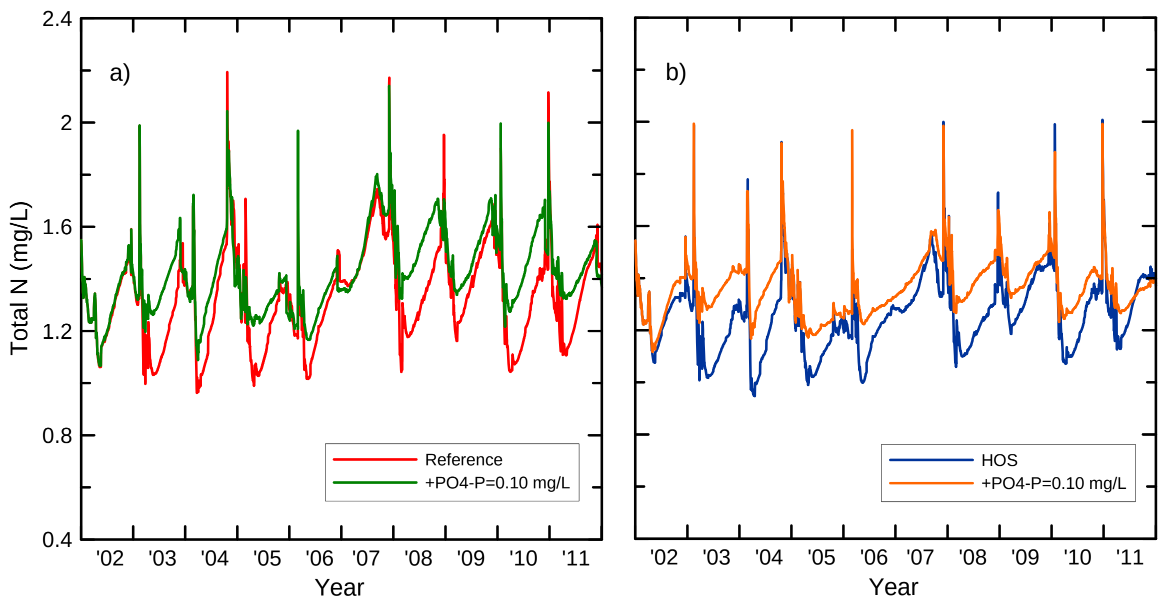

Fig. 3. Predicted total N concentrations for (a) the reference scenario and (b) operation of HOS (with and without treatment that reduced inflow PO_4-P concentration to 0.10 mg/L).

Most importantly, the reduction in PO_4-P concentration to 0.10 mg/L in inflows to the lake also lowered chlorophyll a concentrations (Fig. 4). While reductions in PO_4-P alone (i.e., without HOS or other in-lake treatment) markedly reduced both peak and summer chlorophyll a levels relative to the reference (natural) condition, concentrations nonetheless exceeded 80-100 μg/L late in the year owing to mixing of nutrients generated within the hypolimnion due to internal recycling (Fig. 4a). The combination of reductions in inflow PO_4-P concentrations (via alum, Phoslock or zeolite) and internal nutrient control (via HOS) was predicted to have the greatest beneficial impact on water quality (Fig. 4b). Except for the beginning of 2002, when both externally and internally derived nutrients would have been present, chlorophyll a concentrations were predicted to remain <20 μg/L essentially all of the time, and routinely <14 μg/L. While some uncertainty in these model predictions exists, simulations indicate that potentially quite dramatic improvements in water quality will likely result from the combination of HOS and PO_4-P stripping from inflows.

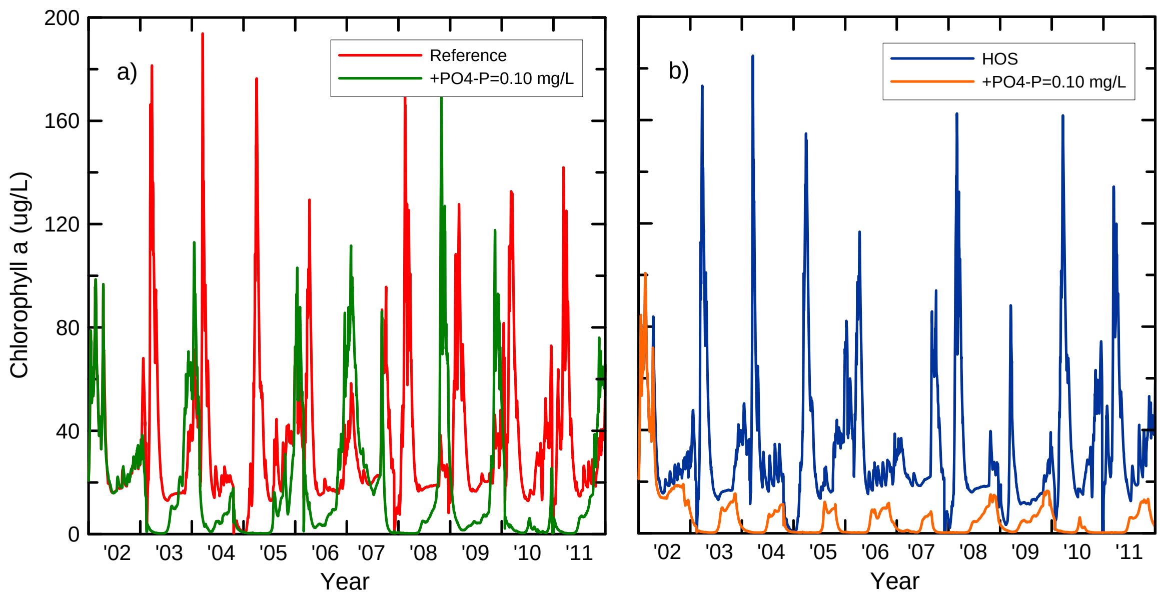

Fig. 4. Predicted chlorophyll a concentrations for (a) the reference scenario and (b) operation of HOS (with and without treatment that reduced inflow PO_4-P concentration to 0.10 mg/L).

A series of additional simulations predicted water quality for several inflow PO_4-P concentrations that would result from different inflow treatments, and results from simulations like those shown in Figs. 3-5 were averaged to yield the 10-yr mean total P, total N, chlorophyll a and hypolimnetic DO concentrations. Simulations thus allow comparison of both internal and external PO_4-P load reductions.

Reductions in inflow PO_4-P concentrations lowered the average total P concentration in the lake epilimnion assuming no in-lake treatment (i.e., no HOS) from more than 0.2 mg/L to about 0.08 mg/L with very low (0.01 mg/L) influent PO_4-P concentrations (Fig. 5a). Lowering the influent PO_4-P concentration to <0.16 mg/L was in fact predicted to lower the decadal average total P concentration in the epilimnion to levels below that prescribed in the TMDL, although this concentration does not reflect the accumulation within the hypolimnion (Fig. 6a).

Installation and operation of the HOS lowered the lake total P concentration by about 40% relative to the reference condition (with no external load treatment), and was predicted to require only a modest reduction in PO_4-P concentration in inflows for the average total P concentration in Canyon Lake to come in under the TMDL target of 0.1 mg/L (Fig. 5a). Reductions in PO_4-P concentrations in inflows below 0.2 mg/L provided comparatively little further improvements in lake total P levels however, indicating that particulate-P inputs from the watershed and remaining internal recycling of PO_4-P are regulating total P levels in the lake.

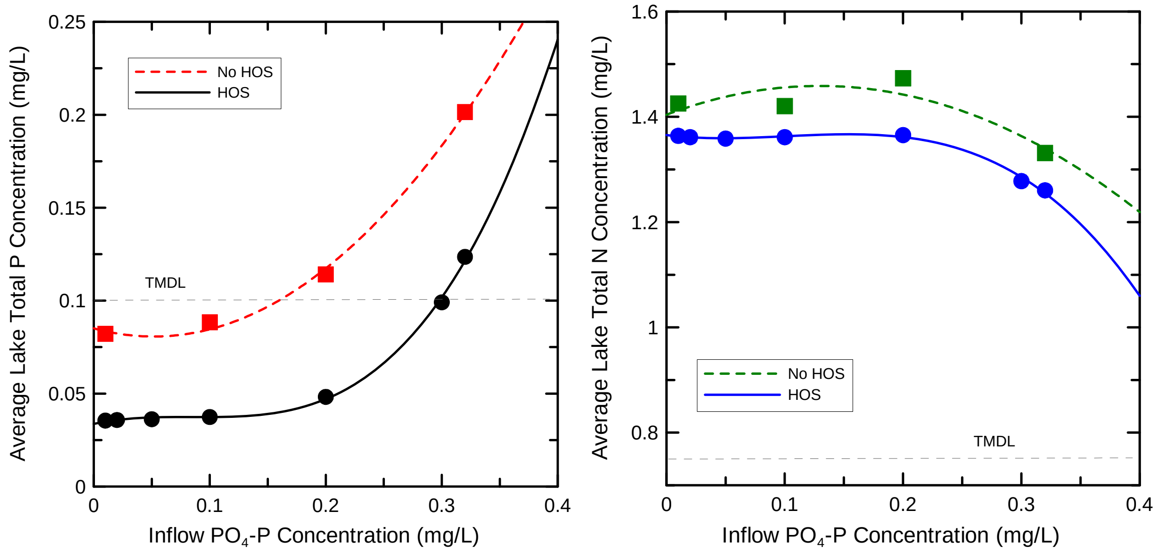

Fig. 5. Predicted average lake concentrations of (a) total P and (b) total N as a function of inflow PO_4-P concentrations.

Reductions in inflow PO_4-P concentrations were found to increase slightly (as shown in Fig. 3b) the average total N concentration in the upper part of the water column (e.g., reduction from 0.32 to 0.20 mg/L PO_4-P in inflow yielded an *increase* in lake total N from 1.26 to 1.37 mg/L) (Fig. 5b). As previously described, this somewhat paradoxical finding is thought to result from a decrease in algal biomass and reduced settling/loss of particulate organic N from the water column, thus maintaining slightly higher dissolved concentrations contributing to higher overall total N levels in the lake. Irrespective of treatment, total N concentrations in Canyon Lake are predicted to remain well-above the TMDL target of 0.75 mg/L.

The dissolved oxygen concentration above the bottom sediments were not strongly affected by changes in inflow PO_4-P concentrations, with the reference (no HOS) condition yielding a predicted 10-yr average concentration near 2 mg/L, well below the 5 mg/L target (Fig. 6a). Installation and operation of the HOS following the PACE design was predicted to yield quite high concentrations above the sediments, with a slight increase in DO with reduced external loading.

The average chlorophyll a concentration (in the epilimnion) responded favorably to reductions in external loading of PO_4-P, especially in combination with operation of the HOS (Fig. 6b). Simulation results indicate that a reduction in inflow PO_4-P concentrations to <0.28 mg/L with HOS or <0.19 mg/L under current conditions (in both San Jacinto River and Salt Creek) would yield a 10-yr average concentration (over the 2002-2011 time period) at or below the 25 μg/L chlorophyll a target (Fig. 6b). Greater reductions in inflow PO_4-P concentrations are predicted to yield correspondingly lower average chlorophyll a concentrations.

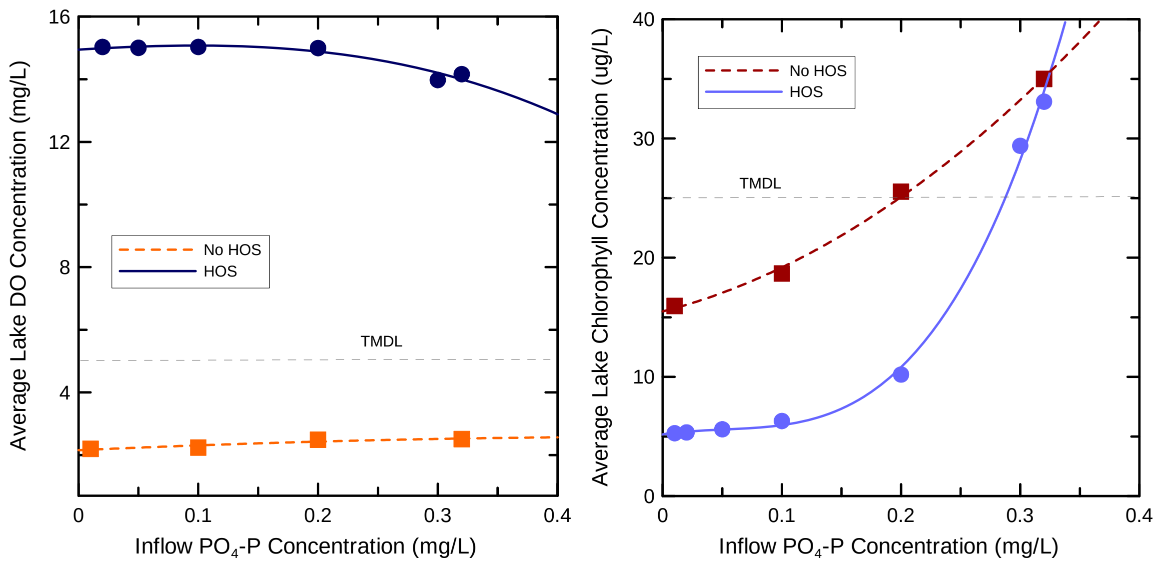

Fig. 6. Predicted average lake concentrations of (a) dissolved oxygen (1 m above bottom) and (b) chlorophyll a as a function of inflow PO_4-P concentrations.

This is a noteworthy result, indicating that reductions in the most bioavailable form of P (PO_4-P) within the runoff, especially when coupled to reductions in internal loading through operation of the HOS, achieve strong reductions in the 10-yr average chlorophyll a concentration in the lake. This combination of actions (installation and operation of the HOS in conjunction with reductions in PO_4-P within inflows to the lake) is thus predicted to meet the total P target (Fig. 5a), DO target (Fig. 6a) and chlorophyll a target (Fig. 6b). This combination of activities was not, however, predicted to approach the total N target of 0.75 mg/L (Fig. 5b), although has clearly shifted the lake to P-limitation (lake TN:TP ratio of about 27 with a reduction in inflow PO_4-P concentration to 0.20 mg/L).

<u>Costs for Treating External PO_4-P Loads</u>

The above modeling analysis was conducted assuming a fraction of PO_4-P was converted to an unreactive particulate inorganic form that would settle out of the water column by gravity. The simulation results shown in Figs. 2-6 are thus not specific to alum, Phoslock or Aqual-P. The amount of sorbent, and thus cost to achieve these reductions, are specific to the material, however. The differences in sorption properties (Fig.1a) were shown to influence the dose required to achieve a given dissolved PO_4-P concentration (Fig. 1b). The modeling suggests that a reduction in PO_4-P concentration to 0.20 mg/L in combination with HOS would achieve marked improvements in water quality and meet TMDL targets for total P, DO and chlorophyll with a significant margin for model uncertainty and error.

The costs for the materials vary (Table 1). The cost of liquid alum was estimated at $200/ton delivered, or $0.22/kg alum solution ($4.95 per kg Al) (Table 1). An approximate cost for Phoslock of $200 per lb of phosphorus removed was provided by SePro; based upon a claimed P capacity of 20 g P/kg Phoslock, this was converted to material cost of $8.82 per kg (Table 1). An approximate cost for Aqual-P, the Al-modified zeolite, was requested but has not yet been received.

Table 1. Material costs for inflow treatment.

Material	**Unit Cost**
Alum	$0.22/kg
Phoslock	$8.82/kg
Aqual-P	NA

As previously considered in greater detail in the task 2 technical memo (Anderson, 2012), hydraulic loading and total P and total N loading to Canyon Lake has varied markedly over the past decade (Table 2).

Table 2. Total flows and nutrient loads from San Jacinto River and Salt Creek: 2002-2011.

Water Year	**Total Flow In (af)**	**Total P Load (kg)**	**Total N Load (kg)**
2002	1,039	965	2,635
2003	12,345	11,520	33,277
2004	3,107	2,835	8,470
2005	48,264	44,887	129,402
2006	3,347	2,933	9,002
2007	1,783	1,857	5,367
2008	7,359	5,616	17,028
2009	4,981	4,409	13,339
2010	12,688	11,462	33,982
2011	16,435	14,366	43,280

The annual quantity of materials and associated costs needed to achieve a reduction to 0.20 mg/L PO_4-P in San Jacinto River and Salt Creek inflows vary for the 3 materials and over time (due to different annual flows) (Table 3). Relatively modest amounts of alum would be needed (subject to considerations discussed below) for years with low hydraulic loading to the lake (e.g., 23,129 kg or 23.1 metric tons of liquid alum estimated for 2002), although very large quantities would be needed during years with extreme runoff volumes (e.g., 2005). Greater quantities of Phoslock and Aqual-P would be needed owing to the lower binding efficiency for PO_4-P for these materials (Fig. 1a).

Table 3. Predicted annual application mass and material costs: 2002-2011 (0.20 mg/L PO_4-P).						
	Mass (kg)			Cost ($)		
Year	**Alum**	**Phoslock**	**Aqual-P**	**Alum**	**Phoslock**	**Aqual-P**
2002	23,129	36,106	53,377	$5,088	$318,451	na
2003	148,415	218,197	342,551	$32,651	$1,924,498	na
2004	146,466	217,849	349,443	$32,222	$1,921,431	na
2005	492,807	724,321	1,137,446	$108,417	$6,388,514	na
2006	41,841	55,743	96,585	$9,205	$491,649	na
2007	65,072	95,651	150,193	$14,316	$843,643	na
2008	89,332	119,254	206,215	$19,653	$1,051,822	na
2009	33,507	43,494	77,348	$7,371	$383,617	na
2010	329,352	457,573	772,965	$72,457	$4,035,793	na
2011	55,320	71,684	127,711	$12,170	$632,251	na

While the quantities of material needed vary within a factor of 3 or so, costs vary between materials by 2 orders of magnitude due to the very large cost differential between alum and Phoslock (Table 1) (as noted above, costs for Aqual-P have not been received, although material costs are likely to be at least broadly similar to Phoslock). Based upon this analysis, Phoslock does not appear to be an appropriate material for treating inflows such as this. Annual material costs for treating inflows with alum to a PO_4-P concentration of 0.20 mg/L ranged from an estimated low of $5,088 in 2002 to $108,417 in 2005. Total alum costs over the 2002-2011 time period, assuming the entirety of all San Jacinto River and Salt Creek flows were treated to 0.20 mg/L PO_4-P, are projected to have been $313,553 (subject to considerations discussed in the next section).

Annual treatment costs vary with dose; the annual average and median costs for the 2002-2011 time period for treatment of inflows with alum to different dissolved PO_4-P concentrations are illustrated in Fig. 7a. The large treatment in 2005 significantly shifted the average annual cost up relative to the median value for the 2002-2011 time period. Treatment with a lower dose of alum, yielding a higher PO_4-P influent concentration to Canyon Lake and correspondingly higher total P and chlorophyll a concentrations there (Figs. 5a and 6b), would decrease costs. This can also be seen in Fig. 7b, where the annual cost of alum based upon the 2002-2011 time period is plotted against the average chlorophyll a concentration. The TMDL chlorophyll a target is included for reference. The alum cost to achieve a given average chlorophyll a concentration varies depending upon operation of the HOS and the cost metric (median or average annual cost for the past 10 yrs) (Fig. 7b).

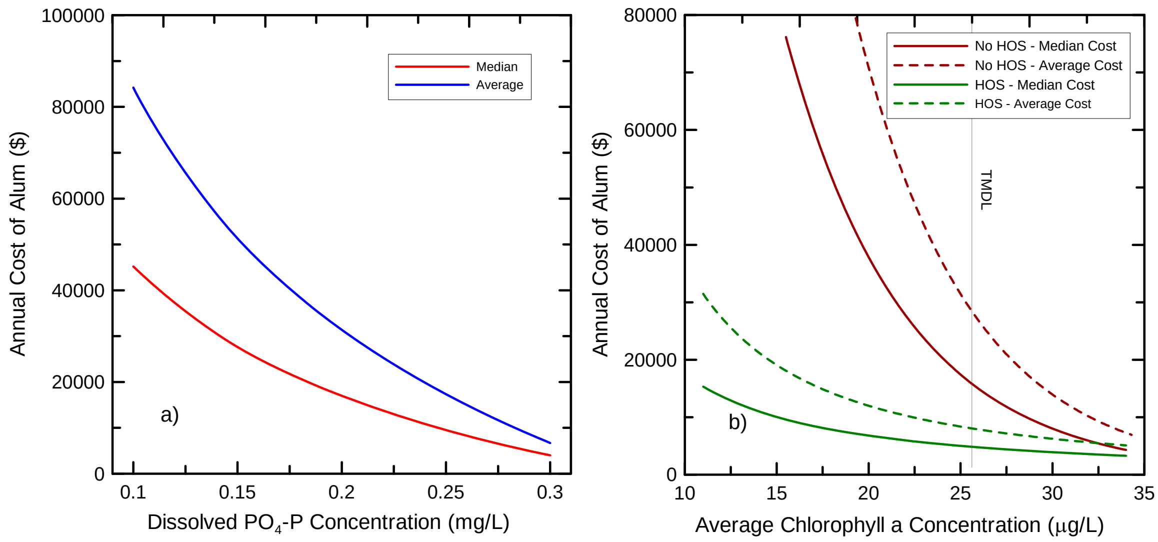

Fig. 7. Projected annual alum costs: a) average and median costs as a function of dissolved PO_4-P concentration in inflow to Canyon Lake, and b) median and average costs as a function of chlorophyll a concentration with and without operation of HOS.

Considerations for Treatment with Alum

Alum (aluminum sulfate) dissociates when added to water and dissolved Al undergoes a series hydrolysis reactions that result in the generation of acidity, decrease in pH, and the formation of an aluminum hydroxide ($Al(OH)_3$) floc with a high capacity for sorption of PO_4-P and/or formation of Al hydroxy-phosphates (Fig. 1a). The solubility of the $Al(OH)_3$ floc varies with pH, however, with minimum solubility near circumneutral pH (6-8) and markedly increased solubility at pH values above and below this range. Naturally occurring organic acid ligands derived from soil organic matter, leaf litter and other sources can also bind with Al and thus compete with sorption sites for PO_4-P, as well as inhibit formation of the floc. Dissolved Si can also potentially compete with PO_4-P and form aluminosilicates that would lower the capacity of the added alum to bind PO_4-P. The dose calculations above assume that favorable conditions will allow efficient formation of floc and binding of PO_4-P. Jar tests would be needed to confirm the removal efficiency at the doses proposed and verify low dissolved Al^{3+} concentrations present in treated San Jacinto River and Salt Creek inflow waters. Notwithstanding, Pilgrim et al. (2007) found that low doses of liquid alum (22 mg/L, about 2x that proposed here) reduced PO_4-P concentrations by 66-88% in jar tests conducted with runoff samples.

Ammonium Removal with Al-Modified Zeolite (Aqual-P)

Unlike alum or Phoslock, with which NH_4^+ has minimal interaction, the Al-modified zeolite (Aqual-P) potentially has a high affinity and retention capacity for NH_4^+. Published literature on the NH_4^+ retention of Aqual-P was not found, although Nguyen and Tanner (1998) previously reported on NH_4^+ removal from wastewaters using natural

New Zealand zeolites. Zeolites are naturally occurring minerals with relatively narrow pores through which NH_4^+ can diffuse and adsorb, and which larger, more strongly hydrated cations (such as Ca^{2+}, Mg^{2+} and Na^+) can not access. As a result, zeolites are well-known for their unique selectivity for NH_4^+.

Although costs were not available for this material, it is expected that they would be broadly similar to Phoslock and much higher than liquid alum (Table 1), and would thus not be competitive with alum for inflow treatment of PO_4-P. The unique capacity for this material to retain both PO_4-P and NH_4^+ could iincrease cost-effectiveness for improving overall water quality in Canyon Lake however. To understand the potential additional benefit, the NH_4^+ sorption properties of zeolites were considered further. Nguyen and Tanner (1998) performed laboratory sorption experiments with clinoptilolite and mordenite and developed sorption isotherms (similar to those shown in Fig. 1a for PO_4-P). While a high capacity for adsorption of NH_4^+ was demonstrated (6-8 mg NH_4-N/g zeolite), very high solution concentrations were required to reach these levels (>200 mg/L) (Nguyen and Tanner, 1998). Adsorption could be described by the Langmuir equation, which relates adsorbed concentration (q, in mg/g) to solution concentration (C, in mg/L):

$$q = \frac{Q_{\max} K_{ads} C}{1 + K_{ads} C} \qquad (1)$$

where Q_{max} is the sorption maximum (mg/g) and K_{ads} is an energy term that defines the shape of the isotherm. Nguyen and Tanner (1998) reported Q_{max} and K_{ads} values of 5.7 mg NH_4-N/g and 0.02 L/mg for clinoptilolite, and 8.2 mg NH_4-N/g and 0.034 for mordenite, respectively. We can thus calculate the concentration of NH_4-N adsorbed on these zeolites in San Jacinto River or Salt Creek water by substituting the average NH_4-N concentrations (0.24 and 0.30 mg/L) using these Langmuir parameters; doing so yields 0.027 and 0.034 mg NH_4-N/g clinoptilolite (and 0.066 and 0.083 mg NH_4-N/g mordenite). Thus we see that very little retention of NH_4-N would be expected at the low concentrations of NH_4-N present in these inflows and at zeolite doses of about 30 mg/L (removing only about 1% of the NH_4-N and 0.3% of total inorganic N in the inflows). Based upon this, the capacity for Al-modified zeolite to also bind NH_4-N is not sufficient to offset expected low PO_4-P retention and high relative costs.

Conclusions

Results of these simulations indicate:

(i) Reductions in influent PO_4-P concentrations entering Canyon Lake from the San Jacinto River and Salt Creek can be achieved via addition of alum, Phoslock or Al-modified zeolite.

(ii) Reductions in this readily bioavailable form of P can switch the lake to P-limitation and significantly lower chlorophyll a and total P concentrations in the lake.

(iii) Inflow treatment in conjunction with operation of the HOS was found to be more effective than inflow treatment alone at reducing lake total P and chlorophyll a concentrations, and operation of the HOS was necessary to meet the DO target specified for the lake.

(iv) Alum was found to be much more cost-effective than Phoslock at removing PO_4-P in runoff, and is also expected to be much more cost-effective than Aqual-P (although no cost estimates were available at the time of this report).

(v) The median annual alum cost for 2002-2011, assuming treatment of inflow to a PO_4-P concentration of 0.20 mg/L, was estimated at $16,985/yr, with annual costs that ranged from $5,088 - $108,417 due to variations in annual hydraulic loading from the watershed.

(vi) Jar tests are recommended to confirm dose requirements, Al solubility and PO_4-P removal efficiencies, while algal bioassays are suggested to verify conversion to P-limitation and suppression of algal production.

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Technical Memorandum

Task 4a: Evaluate Water Quality in Canyon Lake Under Pre-Development Conditions and TMDL-Prescribed External Load Reductions

Objective

The objective of this sub-task was to evaluate water quality conditions in Canyon Lake assuming no development in the watershed (i.e., under the pre-development scenario) and assuming external load reductions of 73% for total phosphorus and 31% for total nitrogen as prescribed in the TMDL (SARWQB, 2004).

Approach

The DYRESM-CAEDYM model developed and used in tasks 2 (Anderson, 2012a) and 3 (Anderson, 2012b) was utilized to predict water quality in Canyon Lake assuming (i) no development in the watershed and (ii) reductions of external loading of N and P as prescribed in the TMDL. As in the previous simulations, the 2002-2011 time period was evaluated, with the same meteorological and hydrological conditions, with the only difference being the nutrient concentrations in the San Jacinto River and Salt Creek runoff entering the lake. The pre-development scenario was simulated using the external nutrient loading predicted from the TetraTech watershed model for 2002-2009 (Table 1). Total N and total P loading for the equivalent 2010 and 2011 pre-development condition were extrapolated from the contemporary loading values reduced by the percentage reductions for 2003 owing to the similar hydrologic conditions present at that time.

Table 1. Total N and P loading to Canyon Lake under the 3 simulation scenarios: reference (existing conditions), TMDL-prescribed reductions in external loading, and the pre-development condition.

	Total N (kg)			Total P (kg)		
Year	**Ref**	**TMDL**	**Pre-Dev**	**Ref**	**TMDL**	**Pre-Dev**
2002	2,635	1,818	1	965	261	0
2003	33,277	22,961	1,546	11,520	3,110	599
2004	8,470	5,844	152	2,835	765	60
2005	129,402	89,287	35,769	44,887	12,119	13,714
2006	9,002	6,211	296	2,933	792	117
2007	5,367	3,703	0	1,857	501	0
2008	17,028	11,749	130	5,616	1,516	52
2009	13,339	9,204	224	4,409	1,190	89
2010	33,982	23,448	1,087	11,462	3,095	430
2011	43,280	29,863	1,385	14,366	3,879	540

Results

Predicted concentrations from 6 depths were combined with volume-elevation data to generate volume-weighted daily concentrations and annual concentrations of total N, total P, and chlorophyll a in Canyon Lake over the 2002-2011 simulation period (Figs. 1-6).

As shown in earlier simulation results, the total N concentration varied over the course of a year and also varied inter-annually in response to differences in external loading (Fig. 1). Reductions in external loading of N to comply with TMDL-prescribed target reductions (reductions of 31%) were found to reduce the daily volume-weighted total N concentrations present in the lake by about 30-35% in the latter half of the simulation period to about 1 - 1.75 mg/L (Fig. 1). The concentrations remained well above the pre-development condition, however, where volume-weighted total N concentrations were generally an order of magnitude lower (Fig. 1).

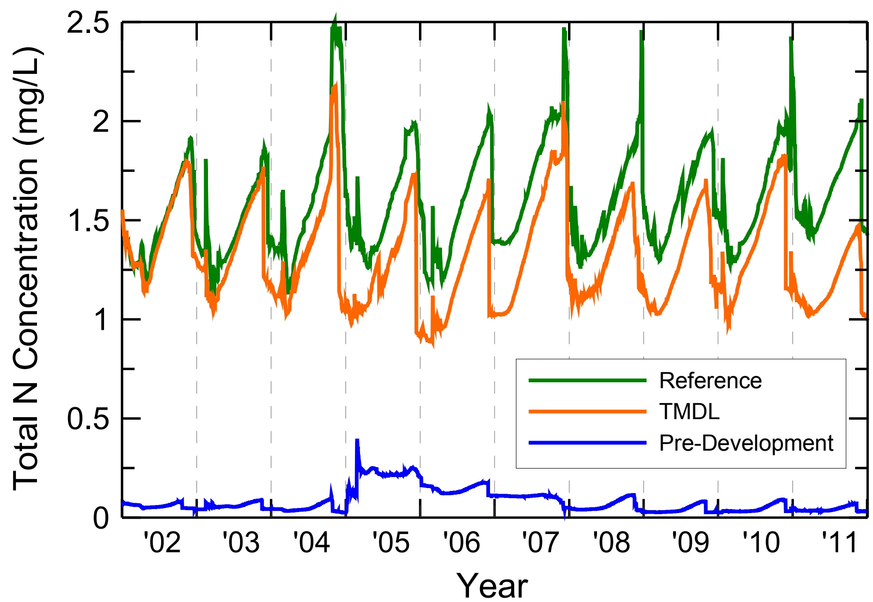

Fig. 1. Volume-weighted daily total N concentrations under the reference (existing) condition, TMDL-prescribed reductions in external loading, and the pre-development scenario.

The daily volume-weighted total N concentrations were then averaged over each calendar year to calculate annual average total N concentrations (Fig. 2). The solid horizontal line represents the 2020 TMDL annual average target of 0.75 mg/L. The annual average total N concentrations varied each year, but generally ranged from about 1.4 - 1.7 mg/L under the reference (existing) conditions, while implementation of BMPs in the watershed to reduce external N loading by 31% lowered the predicted annual average values to approximately 1.2 - 1.4 mg/L (Fig. 2). Thus, although reducing the annual average total N in the water column by a meaningful amount, the values remained above the TMDL target. Predictably, the pre-development (annual average) concentrations were much lower, at all times below the TMDL target by a wide margin (Fig. 2).

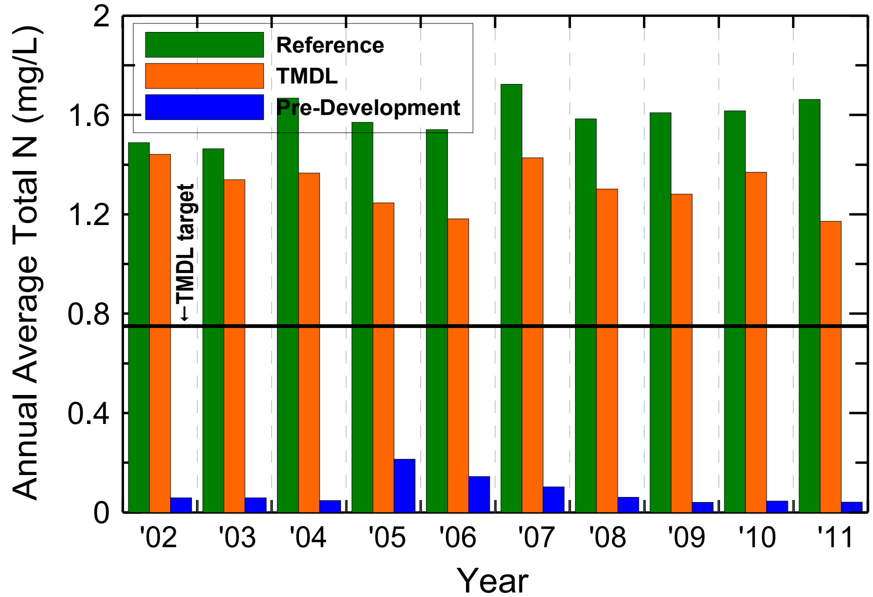

Fig. 2. Annual average total N concentrations under the reference (existing) condition, TMDL-prescribed reductions in external loading, and the pre-development scenario.

The volume-weighted daily total P concentrations in Canyon Lake also exhibited strong seasonal and interannual differences (Fig. 3). Large increases in total P were in fact seen under all 3 scenarios for at least short periods of time and associated with external loading and accumulation to high concentrations within the water column, as well as mixing events that lowered DO and stimulated release from bottom sediments. These events were quite short-lived for the pre-development case, however, as particulate P was rapidly settled out of the water column, resulting in quite low concentrations (<0.05 mg/L) for much of the year (Fig. 3). In contrast, higher volume-weighted total P concentrations (routinely 0.2 - 0.5 mg/L) were present through much of the year under the reference (existing) condition, with volume-weighted concentrations increasing each summer due to release and accumulation of PO_4-P within the (anoxic) hypolimnion. Reduction in external loading by 73% due, e.g., from watershed BMPs, lowered total P levels quite substantially, with concentrations typically 0.1 - 0.4 mg/L.

Reduction in external loading per the TMDL had a marked improvement on annual average total P concentrations relative to the reference (existing) condition (Fig. 4). Depending upon the magnitude of external loading, duration of stratification and other factors, annual average total P concentrations were often reduced by 50% relative to the existing conditions. That a 73% reduction in external loading achieved up to only about a 50% reduction in total P reflects the importance of internal nutrient recycling in Canyon Lake.

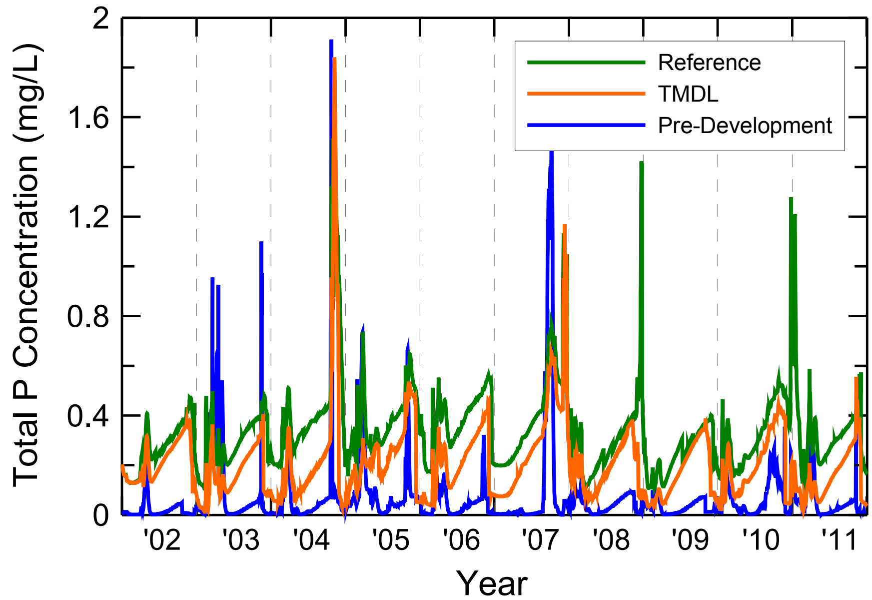

Fig. 3. Volume-weighted daily total P concentrations under the reference (existing) condition, TMDL-prescribed reductions in external loading, and the pre-development scenario.

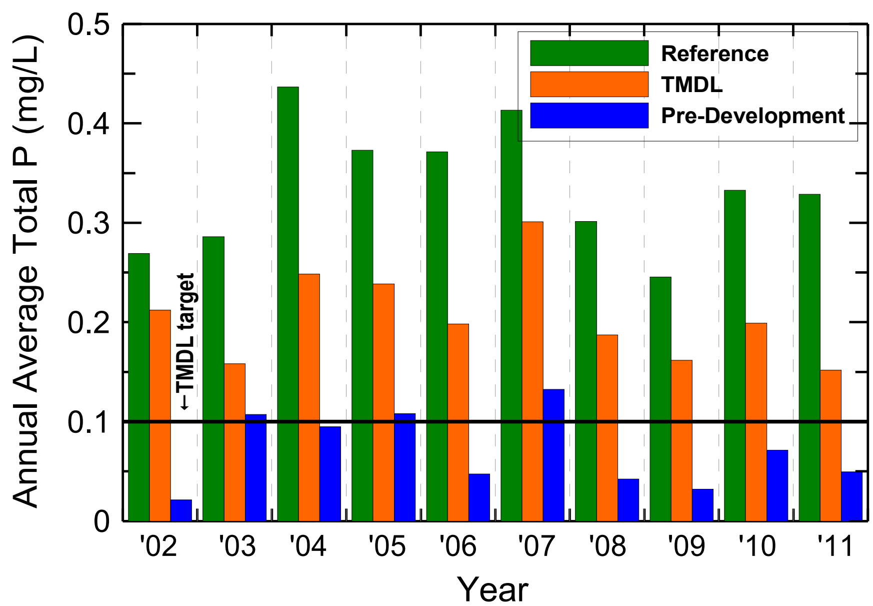

Fig. 4. Annual average total P concentrations under the reference (existing) condition, TMDL-prescribed reductions in external loading, and the pre-development scenario.

Volume-weighted chlorophyll a concentrations exhibited pronounced seasonal variations, with generally much higher concentrations in the fall after mixing and in the spring following external loading events (Fig. 5). Daily volume-weighted concentrations often approached 100 μg/L during these periods under existing conditions, while volume-weighted summer concentrations were more commonly 15-20 μg/L. The process of volume-weighting lowered the chlorophyll levels that one would see within the epilimnion, although this effect was relatively modest since much of the volume of Canyon Lake lies above the thermocline. External load reductions required in the TMDL yielded especially large reductions in chlorophyll levels in the winter and spring, although high concentrations of chlorophyll were generated in the fall, especially following mixing (Fig. 5). Very low concentrations of chlorophyll a were predicted at all times under the pre-development scenario, and only reached 10 μg/L in 2005 following the very large external loading that year (Table 1).

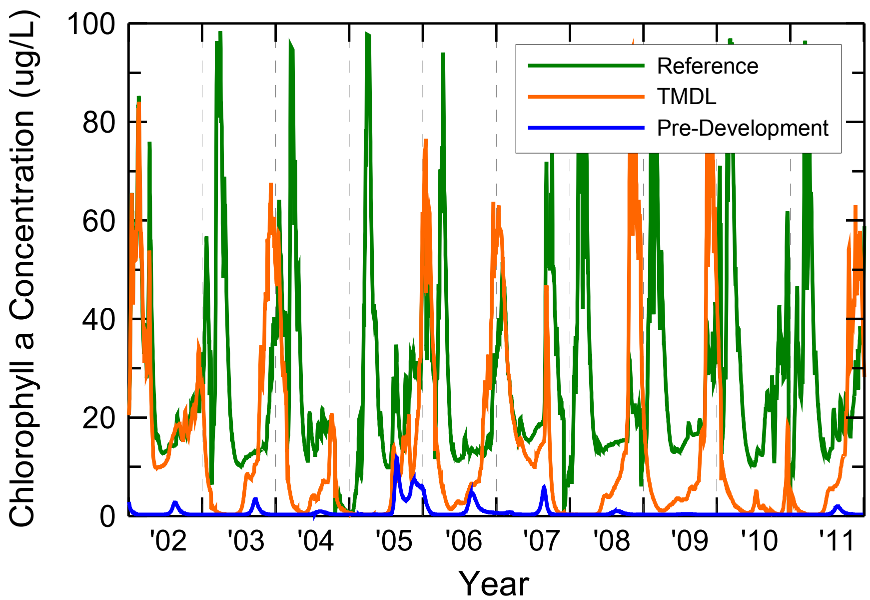

Fig. 5. Volume-weighted daily chlorophyll a concentrations under the reference (existing) condition, TMDL-prescribed reductions in external loading, and the pre-development scenario.

The annual average chlorophyll concentrations calculated from the data in Fig. 5 indicated that Canyon Lake is quite close to compliance with the 25 μg/L TMDL target (Fig. 6). These annual values were calculated from volume-weighted values from the entire water column, as opposed to concentrations reported for the photic zone, as in previous reports, and so are somewhat lower. Irrespective, successful implementation of BMPs to meet the TMDL-prescribed external load reductions is predicted to lower quite dramatically the annual average chlorophyll a concentrations, and should meet the numeric target for chlorophyll a in all but the initial year of the simulation (Fig. 6) (this reflects the lag in water quality, since external load reductions were assumed to be in place beginning only in 2002).

The very low external loading of nutrients in the pre-development scenario (Table 1) was predicted to yield annual average chlorophyll a concentrations of just 1-3 μg/L, with the lingering effect of high external loading in 2005 seen clearly here as well (Fig. 6). This El Nino event was predicted to demonstrably impact water quality for about 3 years.

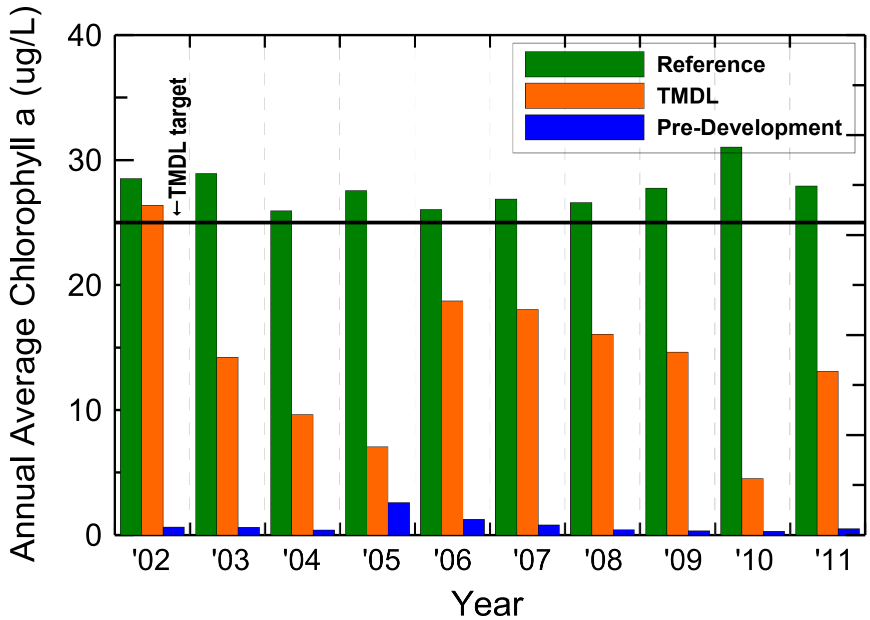

Fig. 6. Annual average chlorophyll a concentrations under the reference (existing) condition, TMDL-prescribed reductions in external loading, and the pre-development scenario.

Unlike nutrient and chlorophyll a concentrations, for which the TMDL specifies maximum annual average values, the DO numerical objective is a minimum daily average value for the hypolimnion (≥ 5 mg/L). Here daily volume-weighted dissolved oxygen (DO) concentrations were calculated for the lowermost 7 m of water column, up to the base of the metalimnion. The volume-weighted hypolimnetic DO concentrations were high during the winter but decreased below 5 mg/L for a considerable period of time each year under all 3 scenarios, including pre-development (Fig. 7). Concentrations were generally somewhat higher under the reference (existing) and TMDL scenarios relative to the pre-development scenario during the winter owing to greater overall productivity in the lake, but DO levels declined more rapidly in the late winter and early spring (Fig. 7). The model predicts a gradient in DO within the hypolimnion, with levels decreasing to almost 0 mg/L immediately above the sediments but several mg/L near the thermocline. Volume-weighting thus reflects more strongly the higher concentrations in the upper hypolimnion where the greatest volume is also found. As a result, the volume-weighted values were generally about 3 mg/L (Fig. 7), while concentrations close to the sediments (as shown in previous reports) were generally very close to 0 mg/L during summer thermal stratification.

The daily volume-weighted hypolimnetic concentrations in Fig. 7 were used to determine the number of days each year the hypolimnetic DO concentrations were below the 5 mg/L TMDL target (Fig. 8). The number of days each year varied from about 260 to 340 for the reference (existing) scenario (average duration of 294 days), while reduction in external loading per the TMDL lowered the number of days each year by approximately 20, to an average duration of 273 days or about 9 months (Fig. 8).

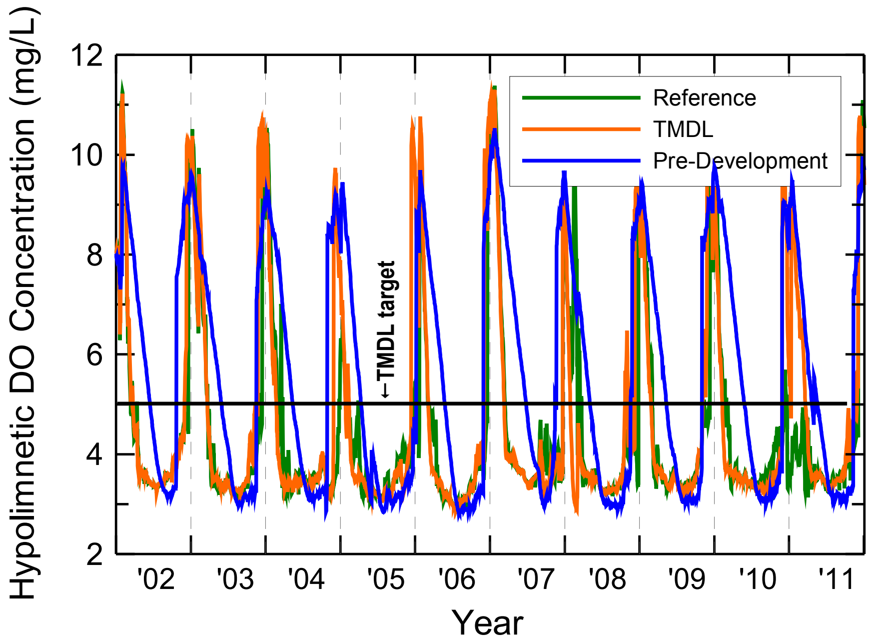

Fig. 7. Volume-weighted daily hypolimnetic DO concentrations under the reference (existing) condition, TMDL-prescribed reductions in external loading, and the pre-development scenario.

Importantly, even the pre-development scenario was predicted to yield hypolimnetic concentrations < 5 mg/L an average of 181 days or 50% of the year (Fig. 8)

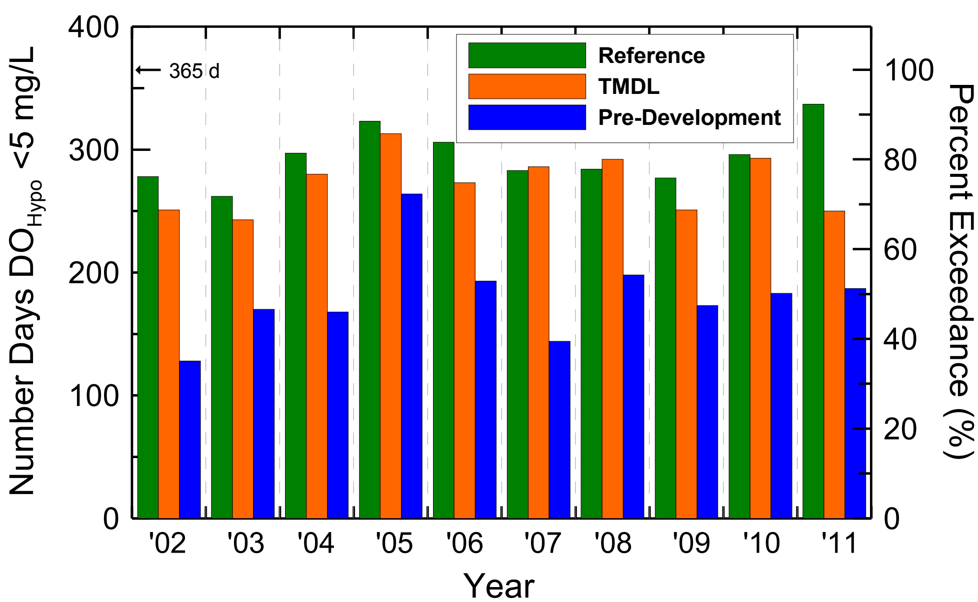

Fig. 8. Number of days each year when hypolimnetic DO concentrations were below the TMDL target of 5 mg/L under the reference (existing) condition, TMDL-prescribed reductions in external loading, and the pre-development scenario.

Conclusions

Results from these simulations indicate:

(i) Reductions in external loading of N by 31% and total P by 73% resulted in moderate reductions in total N concentrations and more substantial reductions in total P concentrations in Canyon Lake, although annual average values remained above TMDL numerical targets.

(ii) TMDL-prescribed external load reductions were predicted to achieve compliance with the 25 µg/L chlorophyll a target for the lake assuming volume-weighting within the entire water column.

(iii) Low concentrations of total P and very low concentrations of total N and chlorophyll a were predicted under the pre-development scenario.

(iv) Daily volume-weighted DO concentrations in the hypolimnion were below the DO TMDL target much of the year for all scenarios, including the pre-development scenario where DO in the hypolimnion was <5 mg/L approximately 50% of the year.

References

Anderson, M.A. 2012a. *Evaluation of Long-Term Reduction of Phosphorus Loads from Internal Recycling as a Result of Hypolimnetic Oxygenation in Canyon Lake.* Draft Technical Memorandum, Task 2, to LESJWA. 21 pp.

Anderson, M.A. 2012b. *Evaluation of Alum, Phoslock and Modified Zeolite to Sequester Nutrients in Inflow and Improve Water Quality in Canyon Lake.* Draft Technical Memorandum, Task 3, to LESJWA. 12 pp.

Santa Ana Regional Water Quality Control Board. 2004. *Resolution Amending the Water Quality Control Plan for the Santa Ana River Basin to Incorporate Nutrient Total Maximum Daily Loads (TMDLs) for Lake Elsinore and Canyon Lake.* Resolution R8-2004-0037. 4 pp + Attachment.

Task 5a: Simulations Using Refined Model Parameter Set Under Steady-State Conditions for Lake Elsinore

- A refinement of earlier model predictions made based upon information available at that time and prior to alum treatment for P removal at EVMWD and carp removal program
- Approach same as that used in Anderson (2006) that calculated a steady-state condition in Lake Elsinore under different management actions
- The average recycled H_2O flow from EVMWD (5660 af yr^{-1}) assumed to be added to lake at TP concentrations of 0.5, 0.4, 0.3, and 0.2 mg L^{-1}
- 75% reduction in carp populations also assumed

$$C = \frac{\dfrac{H(\sum_i Q_i C_i + PRA_w C_w)}{V} + iOC + fP_f M_f B + w_r A_r B}{\nu}$$

where:

- C – predicted steady state conc of TP
- H – mean depth
- Q_i – flow from source i
- P – precipitation rate
- R – runoff coefficient
- A_w – local watershed area
- C_w – conc in local runoff
- V – volume of lake
- i – slope of internal loading function
- O – scalar for aeration effects
- f – carp resuspension rate
- P – carp population
- M – average mass of carp
- B – bioavailable P in sediment
- W_r – wind resuspension rate
- A_r – fraction of sediments resuspended
- ν – settling velocity

Table 1. Hydrologic submodel results.

Scenario	Area (acres)	Elevation (ft)	Volume (af)	Mean Depth (m)
No EVMWD Flow	1190	1222.7	3752	0.96
5660 af Flow	2652	1238.1	33,224	3.80

- Assuming the geometric mean annual San Jacinto R. flow to lake (558 af yr^{-1}) persisted for a number of years, a very low lake level and very shallow depth are predicted
- Delivery of 5660 af yr^{-1} from EVMWD results in much higher lake level, 4x greater depth and a 9x greater volume

Table 2. Predicted median water quality and phosphorus loading assuming 0 af yr^{-1} (reference) and 5660 af yr^{-1} EVMWD recycled water input with TP 0.2-0.5 mg L^{-1}, geometric mean San Jacinto River flow to Lake Elsinore (558 af yr^{-1}) at 0.22 mg L^{-1} total P, and 75% reduction in carp population (226 carp ha^{-1}).

Scenario	**Water Quality Variables**			**Phosphorus Loading (mg m^{-2} d^{-1})**				
Influent P Conc	TP mg L^{-1}	Chl a ug L^{-1}	Z_{sd} m	Ext	Internal	Wind	Carp	Total
No flow	0.812	1201	0.05	0.7	67.7	11.0	0.7	80.1
0.5 mg L^{-1}	0.189	145	0.33	1.2	16.0	1.0	0.7	18.9
0.4 mg L^{-1}	0.181	137	0.35	1.1	15.3	1.0	0.7	18.1
0.3 mg L^{-1}	0.165	119	0.38	0.9	14.0	1.0	0.7	16.6
0.2 mg L^{-1}	0.152	107	0.41	0.7	12.9	1.0	0.7	15.3

- Delivery of recycled water predicted to have dramatic effect on water quality as well

• Relatively modest subsequent improvements predicted when total P concentrations further reduced in recycled water

• This results in part because of inputs from other external sources (e.g., local runoff and San Jacinto River), and from wind and carp resuspension

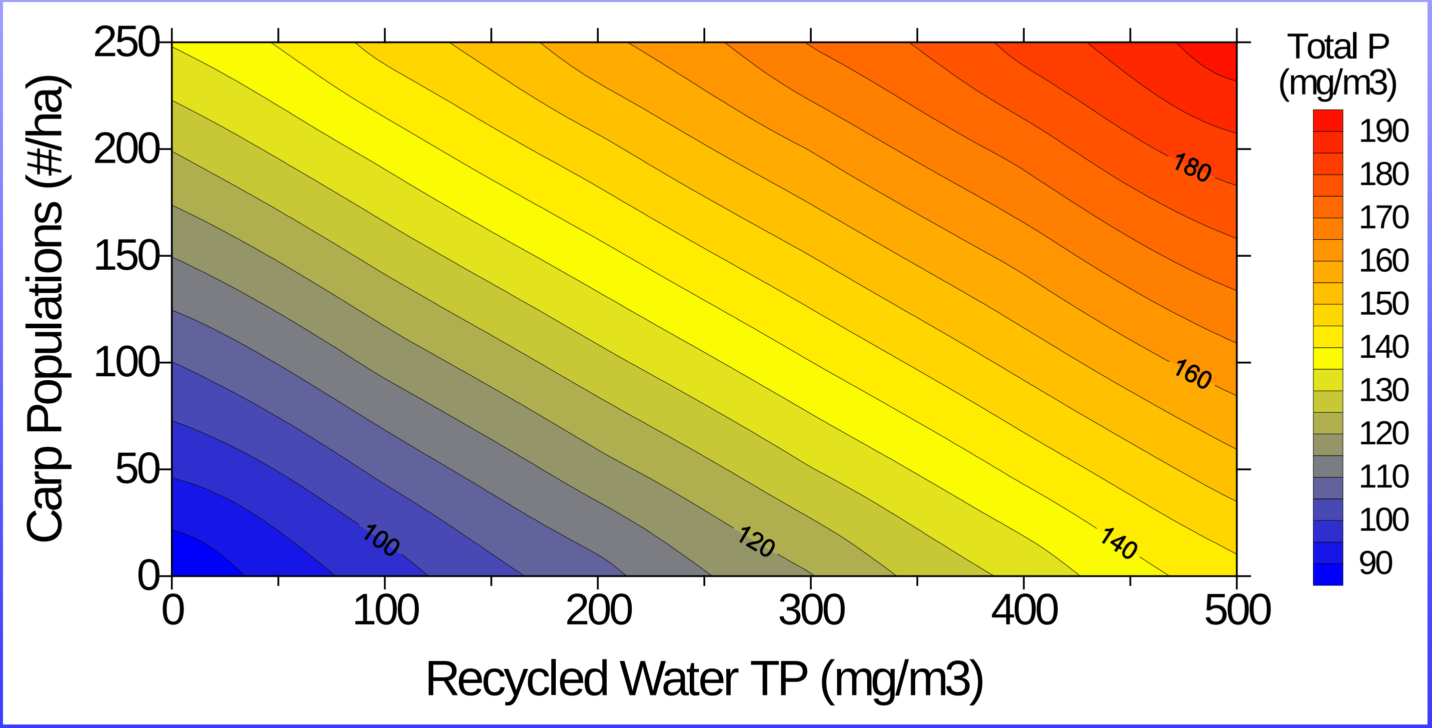

Table 3. Predicted median water quality and phosphorus loading assuming supplementation with 5560 af/yr EVMWD flow with TP concentration of 0.5 mg L^{-1}, geometric mean San Jacinto River flow to Lake Elsinore (558 af yr^{-1}) at 0.22 mg L^{-1} total P, 75% reduction in carp population (226 carp ha^{-1}), and aeration (as % reduction in internal loading)								
Scenario	Water Quality Variables			Phosphorus Loading (mg m^{-2} d^{-1})				
Aeration Reduction	TP mg L^{-1}	Chl a µg L^{-1}	Z_{sd} m	External	Internal	Wind	Carp	Total
0%	0.189	145	0.33	1.2	16.0	1.0	0.7	18.9
+10%	0.121	77	0.51	1.2	9.2	1.0	0.7	12.1
+20%	0.090	50	0.64	1.2	6.1	1.0	0.7	9.0
+35%	0.064	30	0.78	1.2	3.5	1.0	0.7	6.4

- Effective aeration predicted to more significantly improve water quality than reductions in TP in recycled H_2O
- Characterization of sediment Fe speciation, color, etc. suggest limited effectiveness of system

Table 4. Predicted median water quality and phosphorus loading assuming 5660 af/yr EVMWD recycled water input of 0.5 mg L^{-1} total P, geometric mean San Jacinto River flow to Lake Elsinore (558 af yr^{-1}) at 0.22 mg L^{-1} total P, 75% reduction in carp population (226 carp ha^{-1}), and 0-2000 af yr^{-1} groundwater inputs at 0.12 mg L^{-1} total P.								
Scenario	Water Quality Variables			Phosphorus Loading ($mg/m^2/d$)				
Island Well	TP (mg/L)	Chl a (ug/L)	Z_{sd} (m)	External	Internal	Wind	Carp	Total
0 af y^{-1}	0.189	145	0.33	1.2	16.0	1.0	0.7	18.9
+500 af y^{-1}	0.170	124	0.37	1.2	14.4	0.7	0.7	17.0
+1000 af y^{-1}	0.154	109	0.41	1.2	13.1	0.5	0.7	15.5
+2000 af y^{-1}	0.134	88	0.47	1.1	11.4	0.3	0.7	13.5

- Addition of groundwater predicted to raise lake level and further improve water quality through dilution and reduced wind resuspension

- The steady-state approach provides a useful theoretical basis for comparing hydrologic and water quality conditions, although such static conditions will not realistically be met
- Dynamic conditions and hydraulic linkages between watershed, Canyon Lake and Lake Elsinore will be undertaken in tasks 2-4 and 5b
- The model simulations will serve as a more comprehensive assessment and include P, N, DO, and related physical, chemical and ecological conditions in both Lake Elsinore and Canyon Lake

Technical Memorandum

Task 6: Predicted Water Quality in Canyon Lake with In-Lake Alum Treatments and Watershed BMPs

Objective

The objective of this task was to evaluate the predicted water quality in Canyon Lake that would result from implementation of watershed BMPs, in-lake alum treatments, and watershed BMPs in conjunction with alum treatments.

Approach

The DYRESM-CAEDYM model developed in earlier studies was used to assess water quality following in-lake alum treatments and with watershed BMPs. A total of 12 different scenarios were evaluated (Table 1). The existing scenario ("Existing") represents the model-predicted water quality in Canyon Lake over 2002-2011, while the BMPs scenario represents the predicted water quality that would result from a 15% reduction in total N and total P (assumed here to be a uniform reduction in both dissolved and particulate forms of N and P). This scenario thus differs from that evaluated in Task 4a that considered the TMDL-prescribed reductions of total N of 31% and that for total P of 73% (Anderson, 2012).

Table 1. Summary of the 12 simulations conducted evaluating BMPs, alum treatments, and BMPs in conjunction with alum treatments for Canyon Lake.

Scenario	**BMP**	**PO_4 Stripping**	**Int Load Red**
Existing	-	-	-
BMPs	√	-	-
Alum H	-	√	-
Alum W	-	√	-
Alum H + W	-	√	-
Alum H + IL	-	√	√
Alum H + W + IL	-	√	√
BMP + Alum H	√	√	-
BMP + Alum W	√	√	-
BMP + Alum H+ W	√	√	-
BMP + Alum H + IL	√	√	√
BMP + Alum H + W + IL	√	√	√

The effects of annual alum applications to the lake were also evaluated (with and without implementation of watershed BMPs) (Table 1). Whereas we previously considered microfloc alum injection into the San Jacinto River and Salt Creek to lower bioavailable PO_4-P (Task 3), these scenarios evaluated in-lake treatments. The “Alum H” scenario considered annual additions of alum on October 1 of each year at a dose sufficient to strip the hypolimnion (H) of almost all of the PO_4-P that had accumulated to that point, but assumed it would achieve no reductions in internal loading. Similarly, the “Alum W” scenario considered that which alum was also added annually at a lower effective dose to the entire water column during the winter (W) (potentially 60,000 kg yr^{-1}, on February 1). The winter treatment thus served as an alternative to inflow treatment and would strip much of the PO_4-P that had been delivered to the lake with inflows through the end of January (and remained in the basin, that is, not spilled to Lake Elsinore). The “Alum H + W” scenario considered both of these annual alum additions designed to strip PO_4-P out of the water column. These treatments were assumed to not substantively influence internal loading of PO_4-P from bottom sediments, however.

Larger doses during the hypolimnetic treatment (potentially 140,000 kg yr^{-1}) would be expected to also reduce internal loading rates. The effectiveness of such treatments would be strongly dependent upon external loading events, and such events would potentially yield short-lived benefits. For the purposes of these simulations, such reductions in internal loading (“IL”) were assumed to achieve an annual average reduction of 50%. The “Alum H + IL” scenario thus allowed for both hypolimnetic stripping of PO_4-P and a 50% reduction in the annual average internal PO_4-P loading rate. Similarly, the “Alum H + W +IL” scenario involved alum treatment and stripping of PO_4-P out of the water column on February 1 and hypolimnetic treatment on October 1 combined with a 50% reduction in annual average internal loading. The whole water column winter treatment (Alum W) was not assumed to substantively alter internal PO_4-P loading due to the lower dose and lower corresponding Al concentration in the lake (during a time when potentially large external inputs may yet still arrive with storms in February and March). These alum scenarios were also evaluated in combination with the 15% external load reductions achieved through BMPs in the watershed (designated with “BMP) (Table 1).

Results

A large volume of data was generated in these 12 different sets of simulations. Volume-weighted annual average and 10-yr average concentrations were calculated for total P, total N, and DO while surface concentrations for chlorophyll a were determined. Volume-weighted DO concentrations were calculated only for the lowermost 7 m of the water column. Volume-weighted nutrient concentrations are presented to reflect the total inventory of nutrients in the water column of Canyon Lake as was reported in Task 3. Annual average concentrations of total P, total N, chlorophyll a and DO are provided in Figs. 1-4 for (i) the existing condition, (ii) with BMPs implemented in the watershed (15% reductions in nutrient loading), and (iii) with annual alum treatments of the hypolimnion that stripped PO_4-P out of the lower water column and also lowered internal loading rates by 50%. Reduction of external loading of nutrients by 15% through implementation of watershed BMPs lowered annual average total P concentrations in the lake by an average of 0.05 mg/L, while alum treatment of the hypolimnion was predicted to lower volume-weighted concentrations by an average of 0.22 mg/L (Fig. 1). Hypolimnetic alum treatment was predicted to bring volume-weighted annual concentrations below the 0.1 mg/L total P target in 2 of 10 years (Fig. 1).

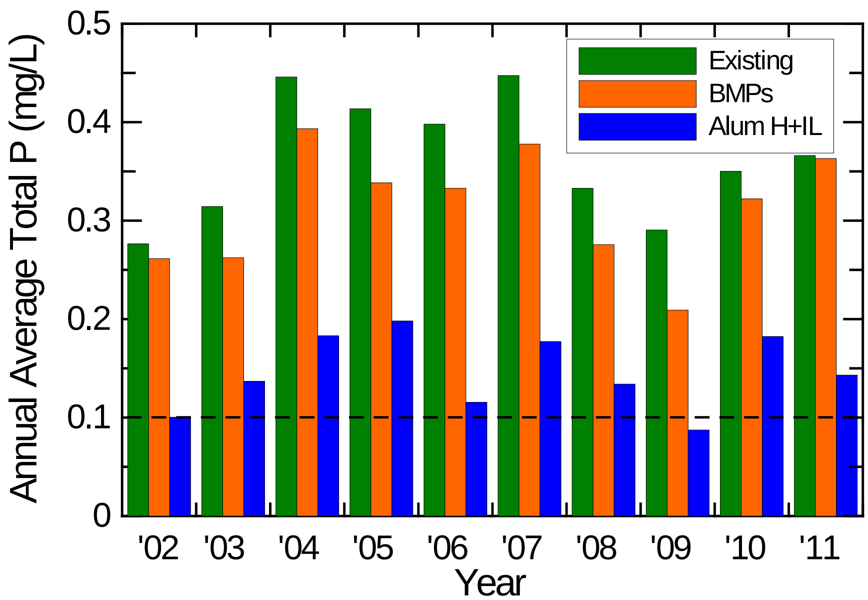

Fig. 1. Volume-weighted annual average total P concentrations in Canyon Lake under (i) model-simulated existing conditions, (ii) with implementation of watershed BMPs achieving 15% external load reductions, and (iii) with alum treatment of hypolimnion with internal PO_4 load reductions.

Total N concentrations were less strongly affected by BMPs or alum treatment (Fig. 2), with BMPs and hypolimnetic alum treatment with internal P load reductions predicted to yield an average reductions of 0.11 and 0.15 mg/L, respectively. While alum was not assumed to directly alter the rate of internal loading of N, it does appear that some relatively modest indirect reductions in total N were predicted.

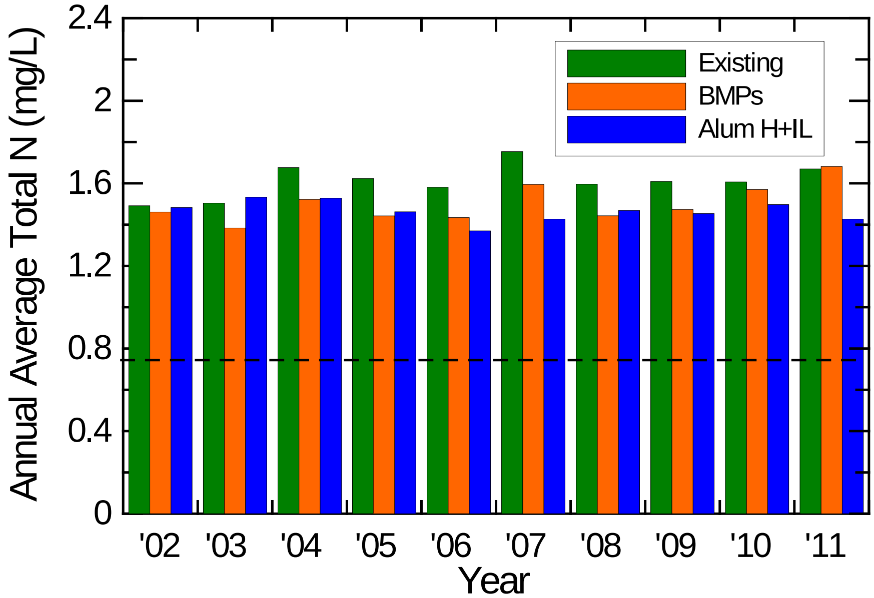

Fig. 2. Volume-weighted annual average total N concentrations in Canyon Lake under (i) model-simulated existing conditions, (ii) with implementation of watershed BMPs achieving 15% external load reductions, and (iii) with alum treatment of hypolimnion with internal PO_4 load reductions.

Alum treatment of the hypolimnion had a surprisingly dramatic effect on predicted annual average chlorophyll a levels in the lake, however (Fig. 3). Based upon these simulation results, such a treatment is sufficient to drive the lake to P-limitation and dramatically reduce chlorophyll concentrations. Detailed inspection of simulation results indicate that some diffusion-dispersion of alum across the thermocline and into the epilimnion occurred as a result of the large concentration gradient; these results are thus thought to reflect water quality from some limited surface treatment as well. (That is, a true hypolimnetic treatment would presumably yield somewhat higher predicted concentrations, although no additional simulations were conducted to assess the influence of depth of alum injection.) Implementation of BMPs also achieved some reductions in annual average chlorophyll a concentrations (Fig. 3), although reductions were much lower than for alum (0.7 - 5.8 μg/L, or 2.2 - 15.8%).

The annual average concentration of DO in the lower portion of the water column exhibited relatively modest interannual variation, ranging from 4-5 mg/L, with no meaningful difference between the existing condition and that when watershed BMPs were in place (Fig. 4). Annual treatment of the hypolimnion with alum was predicted to increase slightly annual average DO concentrations (Fig. 4).

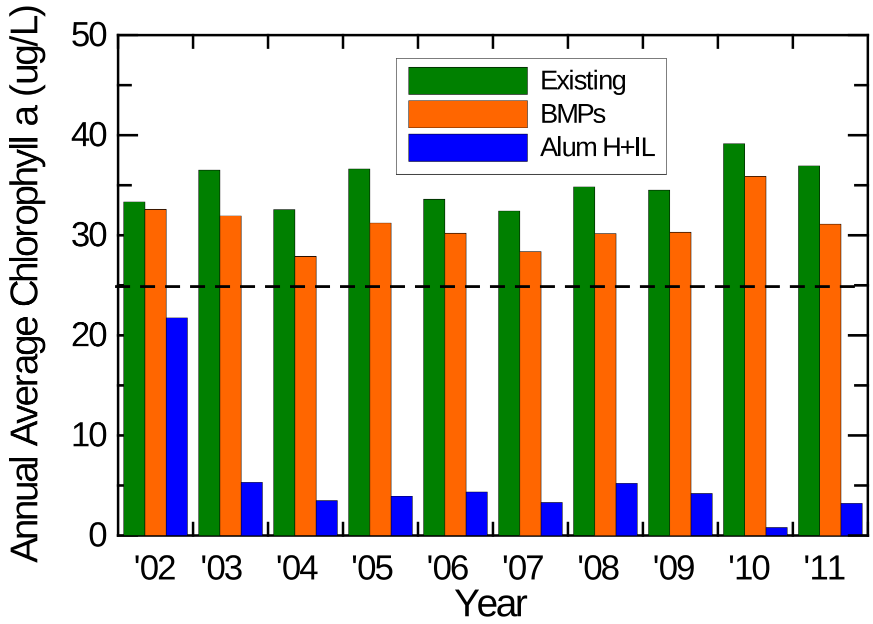

Fig. 3. Epilimnetic annual average chlorophyll a concentrations in Canyon Lake under (i) model-simulated existing conditions, (ii) with implementation of watershed BMPs achieving 15% external load reductions, and (iii) with alum treatment of hypolimnion with internal PO_4 load reductions.

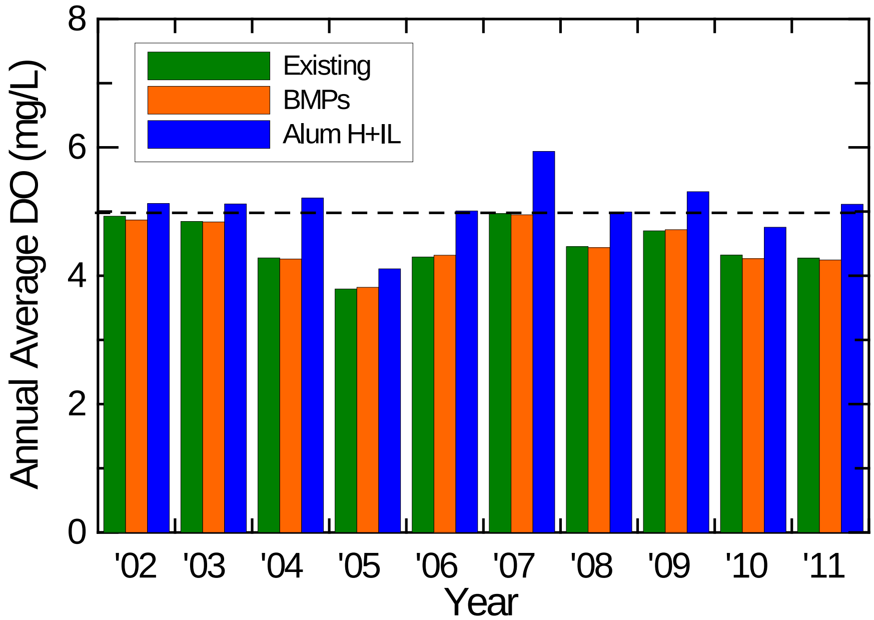

Fig. 4. Volume-weighted annual average dissolved oxygen (DO) concentrations in hypolimnion of Canyon Lake under (i) model-simulated existing conditions, (ii) with implementation of watershed BMPs achieving 15% external load reductions, and (iii) with alum treatment of hypolimnion with internal PO_4 load reductions.

Simulation results were also used to calculate the 10-year average concentrations of total N, total P, chlorophyll a and DO (Table 2). It is useful to compare these values with the TMDL numeric targets of 0.1 mg/L for total P, 0.75 mg/L for total N, and 25 μg/l for chlorophyll a. Here we consider the full range of simulations conducted, including winter alum treatments, BMPs and all combinations of scenarios. We note that, on a 10-yr average, no scenario met either the total P or total N targets, while all alum treatments successfully met the chlorophyll a target.

Table 2. 10-yr average volume-weighted total P and total N concentrations, surface chlorophyll a concentrations, and volume-weighted hypolimnetic DO concentrations.

Scenario	**Total P (mg/L)**	**Total N (mg/L)**	**Chlorophyll a (μg/L)**	**DO (mg/L)**
Existing	0.364±0.061	1.611±0.078	35.0±2.2	4.49±0.37
BMPs	0.314±0.059	1.501±0.091	31.0±2.3	4.47±0.36
Alum H	0.197±0.059	1.468±0.069	9.6±6.3	4.94±0.50
Alum W	0.250±0.087	1.481±0.075	12.2±6.7	4.88±0.42
Alum H + W	0.200±0.065	1.469±0.062	9.1±5.8	4.97±0.50
Alum H + IL	0.146±0.038	1.465±0.048	5.6±5.8	5.07±0.46
Alum H + W + IL	0.151±0.058	1.454±0.045	5.3±5.3	5.08±0.46
BMP + Alum H	0.191±0.045	1.343±0.080	8.6±6.4	4.96±0.49
BMP + Alum W	0.245±0.078	1.343±0.080	11.6±6.7	4.88±0.44
BMP + Alum H + W	0.190±0.045	1.348±0.083	8.6±6.0	4.96±0.45
BMP + Alum H + IL	0.138±0.036	1.336±0.080	4.9±5.5	5.11±0.47
BMP + Alum H+W+ IL	0.152±0.071	1.336±0.081	4.9±5.4	5.09±0.47

These results can also be considered in a probabilistic way through use of cumulative distribution functions (cdf) that describe the frequency of occurrence or exceedance (e.g., Fig. 5a). Here one sees that a 100% probability exists that volume-weighted total P concentrations in Canyon Lake will exceed 0.1 mg/L, with the predicted exceedance frequency decreasing with increasing total P concentrations (Fig 5a). For the existing condition, we see a very high (90%) frequency of exceeding 0.2 mg/L, a 50% probability of exceeding the median value of 0.35 mg/L, and about a 10% frequency in which total P concentrations exceed 0.5 mg/L (Fig. 5a, orange line). Implementation of BMPs shifted the concentrations to slightly lower values, e.g., lowering the median concentration from 0.35 to 0.29 mg/L (Fig. 5a). Total P concentrations nonetheless were predicted to remain quite high with implementation of watershed BMPs.

Treatment of the lake with alum further shifted the cdfs to lower concentrations, e.g., lowering the median total P concentration for hypolimnetic alum treatment (Alum+H) to 0.137 mg/L, and to 0.081 mg/L with winter and hypolimnetic treatments with internal loading control (Alum H+W+IL) (Fig. 5b). Alum treatment in combination with BMPs had a small effect (e.g., reducing the median total P concentration from 0.081 mg/L to 0.075 mg/L for the Alum H+W+IL scenario with BMPs) (Fig. 5c).

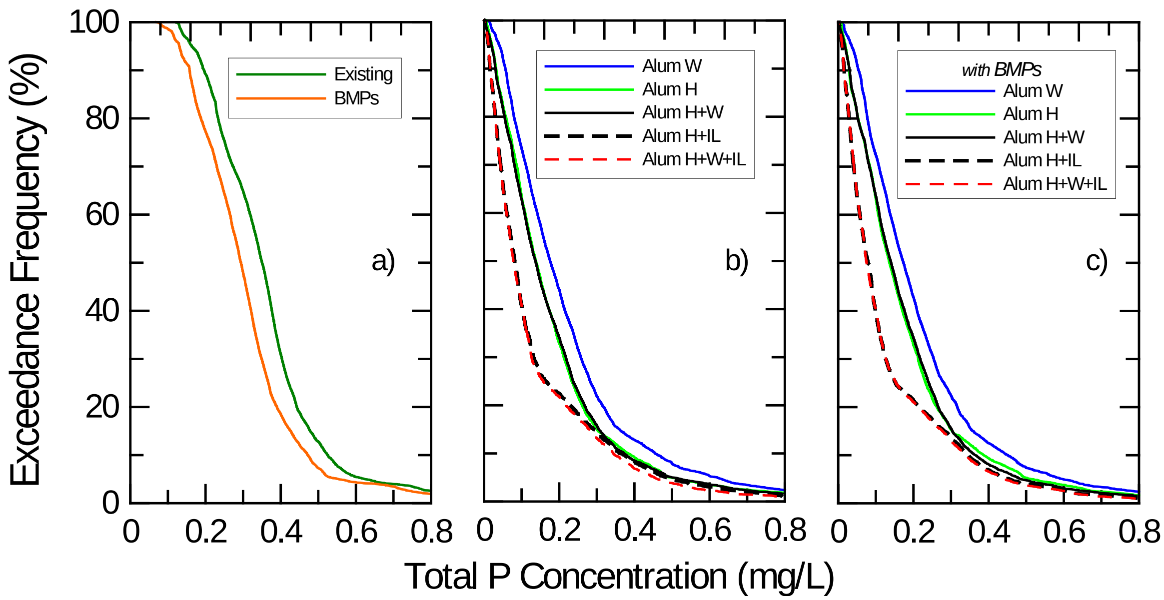

Fig. 5. Cumulative distribution functions showing exceedance frequency as function of simulated total P concentrations in Canyon Lake under (a) existing and BMP scenarios, (b) alum treatments, and (c) BMPs with alum treatments.

Volume-weighted total N concentrations for the different scenarios are also presented using cumulative distribution functions (Fig. 6). As inferred from the annual average (Fig. 2) and the 10-yr average data (Table 2), the different scenarios resulted in generally similar cdfs (Fig. 6). The BMPs shifted the cdfs to slightly (about 0.10 mg/L) lower concentrations relative to existing conditions, with median (50%) exceedance frequency reducing the concentration from 1.56 to 1.45 mg/L (Fig. 6). Alum treatments yielded very little differences in the distribution of predicted total N concentrations and slightly (about 0.03 mg/L) lower than levels predicted for BMPs. Implementation of BMPs in conjunction with alum treatments further shifted the cdfs to lower concentrations; the median concentration dropped to 1.29 mg/L for essentially all combinations of treatment (Fig. 6c).

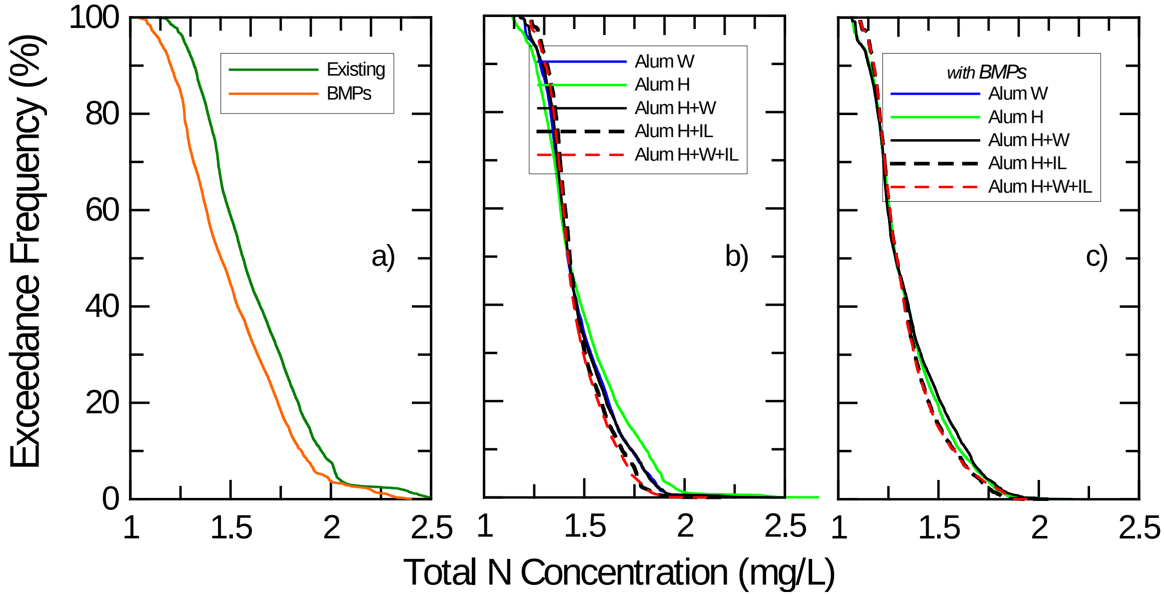

Fig. 6. Cumulative distribution functions showing exceedance frequency as function of simulated total N concentrations in Canyon Lake under (a) existing and BMP scenarios, (b) alum treatments, and (c) BMPs with alum treatments.

The cumulative distribution functions for predicted chlorophyll a concentrations are provided in Fig. 7. For the existing condition (Fig. 7a, green line), we see a very high (95.9%) frequency of exceeding 10 µg/L, although exceedance frequency drops rapidly at higher concentrations. The 50% exceedance frequency for the existing condition corresponds to a median chlorophyll a concentration of 23.5 µg/L. There is a finite probability/frequency of daily chlorophyll a concentrations exceeding 100 µg/L (4.3%). Implementation of BMPs had a small effect on the cdf for chlorophyll a concentration (Fig. 7a, orange line), e.g., shifting the median concentration from 23.5 µg/L to 21.5 µg/L and lowering the predicted frequency of exceeding 100 µg/L from 4.3% to 2.7%.

As indicated in Fig. 3 and Table 2, alum treatments had a dramatic effect on predicted chlorophyll a concentrations relative to existing conditions and with BMPs. This can also be seen clearly in the cdfs (Fig. 7b,c). Whereas chlorophyll a levels exceeded 10 µg/L 95.9% of the time in the simulated existing conditions, the frequency in which chlorophyll a concentrations exceeded 10 µg/L dropped to 37.8% when alum was added at moderate doses to strip PO_4 from the hypolimnion, and to only 16.5% when larger doses sufficient to also help control internal PO_4-P loading (Fig. 7b). Thus, only a small portion of time, generally during fall, did chlorophyll a levels exceed 10 µg/L. Concentrations exceeding 25 µg/L occurred only 12.5% with moderate doses of alum and 4.1% of the time at higher doses that also helped control internal recycling.

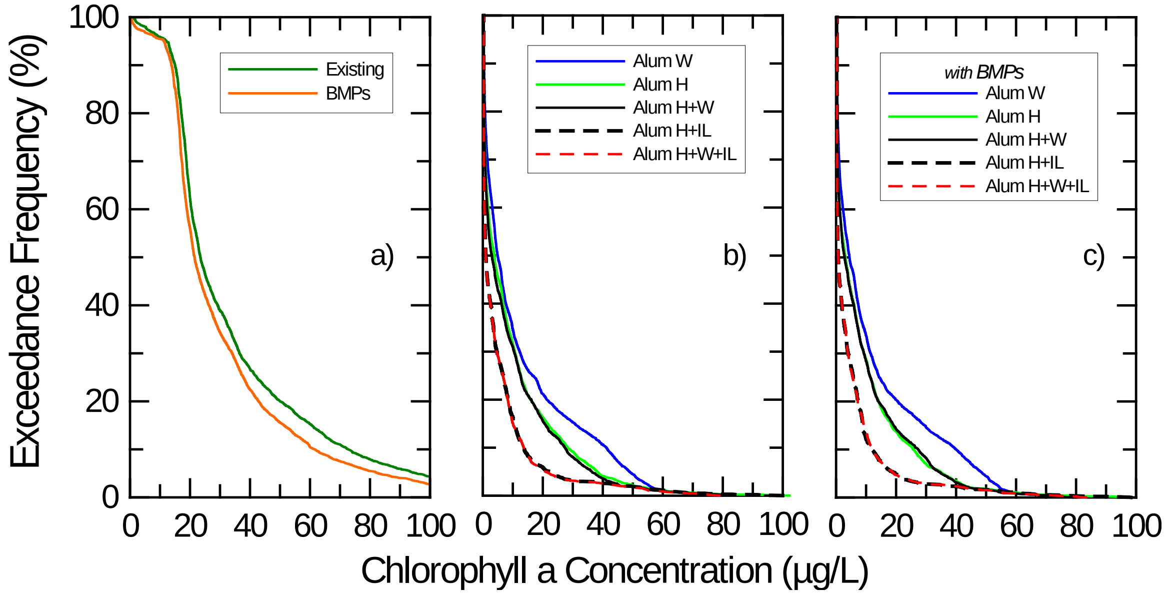

Fig. 7. Cumulative distribution functions showing exceedance frequency as function of simulated chlorophyll a concentrations in Canyon Lake under (a) existing and BMP scenarios, (b) alum treatments, and (c) BMPs with alum treatments.

Exceedance frequencies were also calculated for volume-weighted hypolimnetic DO concentrations (lowermost 7 m of the water column) (Fig. 8). Volume-weighted hypolimnetic DO concentrations were in all cases >2.8 mg/L (i.e., 100% frequency of exceeding this value), with identical median DO concentrations of 3.66 mg/L for both the existing condition and with implementation of BMPs (Fig. 8a). Volume-weighted hypolimnetic DO concentrations ≥5 mg/L were predicted 18.9% of the ti me under existing conditions and 18.4% with BMPs. Alum treatments were predicted to shift to somewhat higher frequencies the occurrence of DO concentrations ≥5 mg/L (27.6 - 33.2% of the time (Fig. 8b,c). Alum treatments sufficient to provide some control over internal PO_4 recycling in combination with BMPs provided the highest DO levels in the hypolimnion (median value of 3.63 mg/L, 33.2% frequency exceeding 5 mg/L).

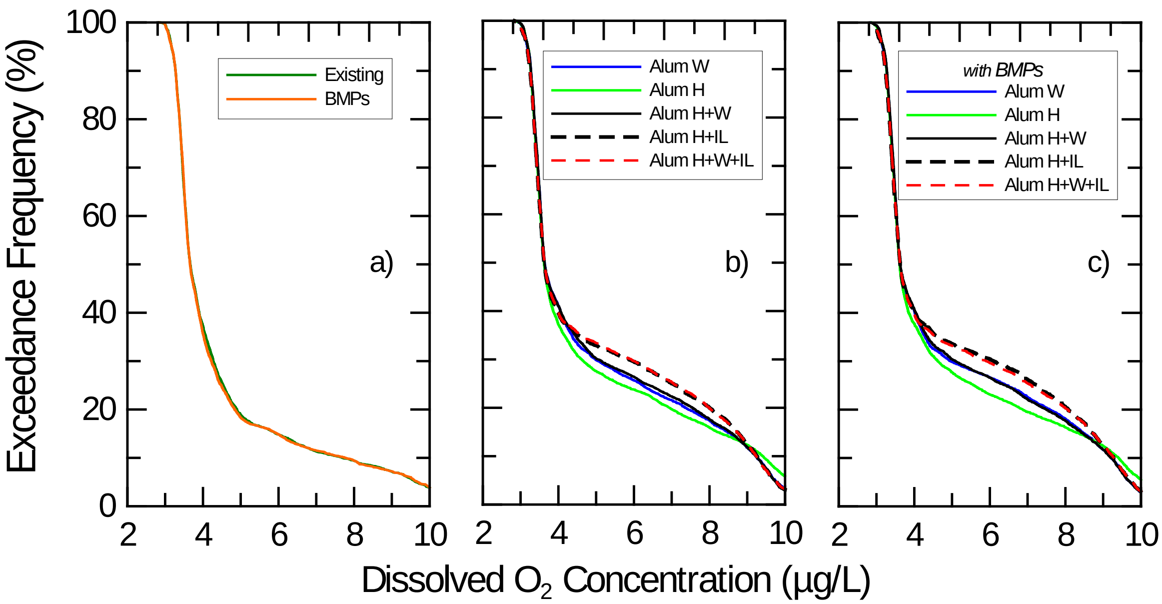

Fig. 8. Cumulative distribution functions showing exceedance frequency as function of simulated total P concentrations in Canyon Lake under (a) existing and BMP scenarios, (b) alum treatments, and (c) BMPs with alum treatments.

<u>Alum Treatment Considerations</u>

Due to the proton production associated with hydrolysis when alum is added to water, and the strong pH dependence of Al solubility, there are some constraints on alum treatment of natural waters. Specifically, the water has to have sufficient alkalinity to maintain circumneutral pH and yet not be too high to favor formation of aluminate ($Al(OH)_4^-$) and thereby diminish efficient formation of $Al(OH)_3$ floc and inhibit PO_4 retention.

Dr. Noblet recently completed jar tests that demonstrated efficient removal of PO_4 from hypolimnetic water from Canyon Lake, with >90% removal at an alum dose between 50-75 mg/L (or 2-3 mg/L Al) (Fig. 9). Such a dose would be expected to consume about 0.3 meq/L of alkalinity, so the lake would be well buffered against strong pH changes at this relatively modest alum dose (Canyon Lake in years past has had alkalinities >3 meq/L, or about 10x that value) (Anderson et al, 2007). The pH of hypolimnetic water decreased only modestly with alum doses up to 100 mg/L (by 0.4-0.7 units, to pH~7.3) (Noblet, 2012), Larger pH reductions were found for waters from East Bay, although outgassing of CO_2 resulted in an increase in pH over time, consistent with other studies (Berkowitz et al., 2005; Anderson et al., 2007).

Dissolved Al concentrations in hypolimnetic waters were found to be increased above background (72-83 µg/L) by a factor of 4-5x (to 236-389 µg/L) with alum addition however (Noblet, 2012). The dissolved Al concentrations following alum addition thus did exceed the chronic toxicity threshold of 87 µg/L, but was well below the acute toxicity threshold of 750 μg/L. It is nonetheless worth noting that the background concentrations were quite close to the chronic threshold. It is also worth noting that the very low DO concentrations and high levels of H_2S in the summer hypolimnion preclude use of this portion of the water column by essentially all aquatic invertebrates, zooplankton and fish. Elevated concentrations of dissolved Al for a moderate period of time in this part of the lake are thus not expected to have any negative ecological consequences. Moreover, dissolved Al concentrations have been found to decrease over time in both laboratory and field settings, including the alum treatment of Big Bear Lake in 2004 (Berkowitz, 2005).

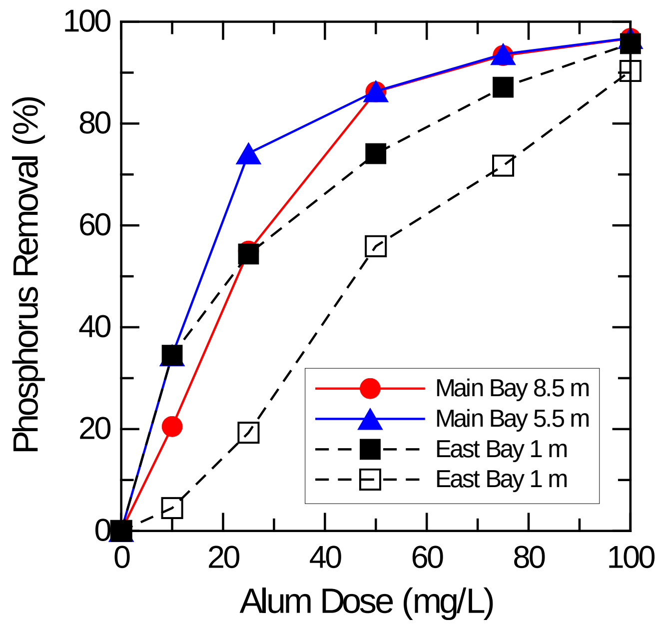

Fig. 9. Phosphorus removal from Canyon Lake water as function of alum dose.

The chemistry of Canyon Lake is not vastly different from that of Big Bear Lake (e.g., pH 8.2, alkalinity 3-4 meq/L), so it is useful to consider that case study further. Specifically, pH and alkalinities in the lake returned to pre-treatment levels within a couple months of treatment, and dissolved Al concentrations, while often near 200 μg/L (0.2 mg/L) during application, quickly decreased to <50 μg/L following the end of the application (due to the large size of the lake and scale of the treatment, application occurred over several weeks). Importantly, no significant short-term or longer-term negative ecological impacts were noted (e.g., no fish mortality was observed).

A small pilot treatment in Papoose Bay with a large (~400-500 mg/L alum) dose was conducted prior to that full-scale treatment; a small logger deployed there found pH to recover to pre-treatment levels within 14 days (dissolved Al measurements were not made, however).

Removal of phosphorus from water collected from East Bay water at about 1 m depth generally demonstrated somewhat lower total P removal efficiencies when compared with the hypolimnetic water; this presumably results from a much larger fraction of P in particulate forms and the higher initial pH that could result in less floc formation. Nonetheless, alum treatment of East Bay waters significantly reduced total P concentrations and lowered turbidity while yielding dissolved Al concentrations below the acute toxicity threshold.

These findings suggest that, with some care, an alum treatment of Canyon Lake should be an effective way to remove phosphorus from the water column and, for surface treatments, should also improve water clarity for at least a short period following application.

Conclusions

This set of simulations indicate:

(i) Implementation of watershed BMPs that achieve a 15% reduction in external loading of N and P was found to yield modest improvements in water quality in Canyon Lake.

(ii) Annual hypolimnetic alum treatment, especially with a sufficient dose to reduce internal PO_4 recycling, provided strong predicted reductions in total P and dramatic reductions in chlorophyll a concentrations.

(iii) Modest alum doses in early winter also yielded significant reductions in total P and chlorophyll levels, although the extent of improvements were lower than predicted with larger hypolimnetic doses.

(iv) BMPs and alum treatments had limited effects on total N and DO concentrations.

(v) Recent jar test results and past experience at Big Bear Lake suggest that, with some care, treatment of Canyon Lake with alum should shift the lake to P-limitation and provide significant reductions in chlorophyll a concentrations.

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A JAR TEST STUDY ON THE USE OF ALUM FOR TURBIDITY AND NUTRIENT REMOVAL IN CANYON LAKE, CA

FINAL REPORT

Submitted to

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Arcadia, CA

for

Elsinore Valley Municipal Water District
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INTRODUCTION

It has been suggested that treatment of excessive turbidity and algal growth in the east bay and main body of Canyon Lake may be treated with alum (hydrated Aluminum Sulfate, $Al_2(SO_4)_3{\cdot}nH_2O$, where n=14-18) a coagulating agent traditionally used in water treatment. In treating water with alum, the natural alkalinity of the water may be used as shown in the following reaction:

$$Al_2(SO_4)_3{\cdot}nH_2O + 3Ca(HCO_3)_2 \longrightarrow 2Al(OH)_3\downarrow + 3CaSO_4 + nH_2O + 6CO_2 \qquad (1)$$

It is preferable that the natural alkalinity of the water be used to form the aluminum hydroxide precipitate rather than adding a base such a lime both in terms of cost and the inability to control mixing dynamics in a natural lake setting. The pH of Canyon Lake (pH= 9.1 for recently collected east bay samples) is typically above the optimum range for alum treatment (i.e., 5.5-8) [1], but it still may be effective in removing turbidity while not adding to the overall Al concentration of the lake water. Previous studies by Dr. M.A. Anderson's group at UC-Riverside (UCR) [2, 3] have shown that effective doses of alum up to 40 mg Al/L (i.e., ~500 mg alum/L) did not increase the residual water concentration of Al. The pH of alum treated waters dropped significantly within the first hour (8.5 to 6.5) but returned to nearly the ambient pH within 24 hours. The UCR data show that alum doses of up to 10 mg Al/L (or ~125 mg alum/L) have virtually no persistent effect on the pH of the water.

The natural alkalinity of the lake is thus a key parameter for determining the allowable dosing of the water with alum. CSUSB recently collected samples from the east bay at Canyon Lake. Water samples from Station 9 (Road Runner Beach) and Station 10 (Indian Beach) were analyzed for alkalinity and found to have Total Alkalinities 130 mg/L and 150 mg/L as $CaCO_3$, respectively. The corresponding carbonate alkalinities (i.e., the phenolphthalein alkalinity, or pH=8.3) were 36 and 42 mg/L as $CaCO_3$ respectively. The total alkalinities were in fair agreement with the values found by UCR in 2007, which was a lake wide average of 170 mg/L as CaCO3 (i.e., 3.4 meq/L). Quantitative application of equation (1) shows that for every 1 mg/L of alum applied, alkalinity decreases by 0.5 mg/L. Thus our recent alkalinity data suggest that applications of up to 80 mg/L Alum should not decrease the water pH to less than 8.3 at any time during the application. And the UCR data from 2007 suggest that alum doses up to 250 mg/L may have no long term effect on water pH. A survey of environmental engineering textbooks gave typical ranges of 5-50 mg alum/L as being effective for turbidity removal in most waters.

METHODS and MATERIALS

Sampling

Water samples were collected from four stations at Canyon Lake on August 27, 2012, two locations in the Main Body and two locations in the East Bay. Samples from the main body of the lake (8 L) were collected from below the thermocline (i.e., in the hypolimnion). Samples from the east bay were taken at approximately 1 meter depth as the lake at these locations was not stratified. Samples were collected at the same CSUSB monitoring stations that have been used for the past 6 years. The main lake body stations were 7 (near the dam) and 8 (middle of main channel). Samples from the east bay (10 L) were collected at monitoring stations 9 and 10, from the middle of the channel adjacent to Road Runner and Indian beaches, respectively.

All water samples were collected using a 4.2 liter vertical beta type van Dorn sampler (with acrylic tube, Wildlife Supply Company). Repeat grab samples were collected at the appropriate depths until the desired volume was obtained. Samples were transferred to pre-cleaned 2.5 liter clear glass or 4.0 liter amber glass bottles. Samples were stored on ice in ice chests until returned to the lab, and then were stored in a walk-in refrigerator at 4°C until analyzed.

Depth profiles at each station were measured at 1 meter intervals using a Hach Hydrolab DS-5 water quality sonde. Parameters measured included depth, temperature, electrical conductivity, ORP, and turbidity. Dissolved oxygen data were not obtained as the LDO probe on the Hydrolab was not functioning properly. Data from the depth profile at each station were used to determine in the field at what depth to take the samples.

Laboratory Analyses

Jar Testing

Jar tests were performed on the collected samples using 1.0 L samples, on a six stirrer Phipps and Byrd programmable jar test apparatus (Figure 1). Jar test were performed as follows: The appropriate amount of 10,000 ppm alum stock was added to each sample, and flash mixed at 220 rpm for 1.25 minutes, then followed by flocculation at 25 rpm for 30 minutes. The samples were then allowed to settle for 2-3 hours until all of the floc had fully settled. Before and after treatment samples were measured for pH, temperature, turbidity, conductivity, dissolved aluminum concentration, total organic carbon (TOC), total nitrogen and total phosphorus. The goal of the testing was to identify the dose of alum required to achieve a turbidity of less than 1.0 NTU. The tests were performed at doses of 0 (control, before), 10, 25, 50, 75, and 100 mg/L Alum. Based upon the results of the initial testing, two additional alum concentrations were tested, 125 and 150 mg/L.

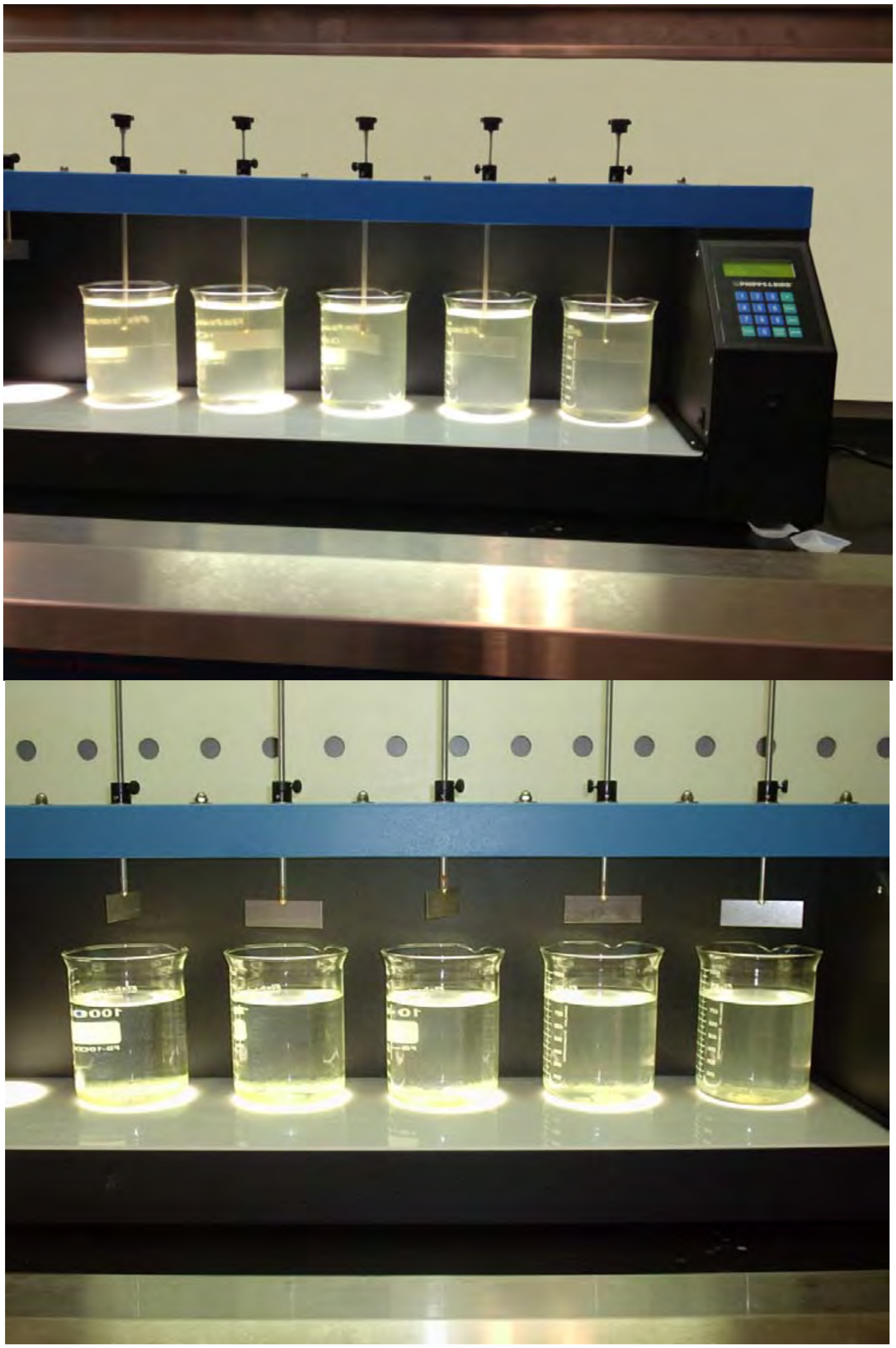

Figure 1. Phipps and Byrd jar testing apparatus used in this study, at the beginning (top) and at the end of the test procedure after settling of the flocs (bottom).

Water Quality Analyses

In the laboratory all water quality parameters were measured using methods and protocols as described in standard EPA methods or in *Standard Methods for the Examination of Water and Wastewater*, 21^{st} edition [4]. The temperature, pH and conductivity were measured using a WTW 350i multiparameter field probe. Turbidity was measured with a HF Scientific MicroPTW portable turbidimeter. TOC was measured on a Teledyne Tekmar Apollo 9000 combustion TOC analyzer. The total nitrogen (TN) and total phosphorus (TP) were measured on a LACHAT Quickchem 8500 Flow Injection Analysis (FIA) system. Samples were processed using the LACHAT method of persulfate digestion followed by simultaneous TN/TP analysis. The dissolved aluminum concentrations before and after treatment were measured using a Perkin Elmer AAnalyst 600 graphite furnace atomic absorption spectrophotometer, using the EPA Method 200.9 protocol [5]. Because of the critical nature of the dissolved aluminum concentrations, blank samples (i.e., deioniozed water) were subjected to the entire jar testing procedure to ensure that there was no aluminum contamination introduced by either laboratory cleaning and handling procedures or the testing apparatus. None of the blank samples analyzed showed detectable levels of aluminum.

RESULTS and DISCUSSION

Field Data

The results of the parameters measured in the field are shown in Tables 1-4. The results show that station 7 in the deepest part of the lake near the dam was well-stratified, as usual for that the time of year. Station 8 also in the main channel of the Lake was not really stratified with a thermocline appearing at approximately 1.5 meters above the bottom. Samples were collected at 8.5 meters and at 5.5 meters for stations 7 and 8, respectively. Plots of the temperature depth profiles for stations 7 and 8 are shown in Figures 2 and 3. Samples were collected at stations 9 and 10 at approximately 1 meter below the surface.

Laboratory Water Quality Data

The results of the laboratory water quality analyses are shown in Tables 5-9. For the hypolimnion samples from stations 7 and 8, a dose of 25-50 ppm alum is sufficient to achieve a turbidity of $\leq$1.0 NTU. However, doses of 100 ppm are required to achieve the lowest dissolved Al concentrations, and maximum phosphorus removal. For the east bay water samples, it appears that a dose of 100 ppm alum is required to achieve both turbidity reduction and the lowest dissolved Al concentrations, and maximum phosphorus removal. It is noteworthy that the pH of the sample from station 10 (farthest into the east bay) dropped almost two pH units with a 100 ppm alum dose. However, pH and turbidity measurements taken after 24 hrs showed that pH had gone back up by 0.6 pH units while turbidity dropped slightly.

These initial results show that alum is very effective in reducing the turbidity and phosphorus, and to lesser extent nitrogen content of the waters from throughout the lake, but the residual aluminum concentrations exceed the EPA chronic ambient water quality criterion for protection of aquatic biota, which is 87 µg/L for chronic toxicity (the acute toxicity criterion is 750 µg/L) [6]. In response to the initial results showing dissolved Al concentrations above the chronic criterion, two additional concentrations of alum were evaluated, 125 and 150 mg/L alum. The results of the higher concentrations showed that an alum dose of 150 mg/L was able to reduce the residual dissolved Al concentrations significantly to a range of 89-106 µg/L. This is only slightly above the chronic criterion and thus these residual concentrations may be acceptable. The EPA website showing the current ambient water quality criteria for protection of aquatic life has three footnotes associated with the water quality criteria for Al [6]:

1. The value of 87 µg/l is based on a toxicity test with the striped bass in water with pH = 6.5–6.6 and hardness <10 mg/L. Data in "Aluminum Water-Effect Ratio for the 3M Plant Effluent Discharge, Middleway, West Virginia" (May 1994) indicate that aluminum is substantially less toxic at higher pH and hardness, but the effects of pH and hardness are not well quantified at this time.
2. In tests with the brook trout at low pH and hardness, effects increased with increasing concentrations of total aluminum even though the concentration of dissolved aluminum was constant, indicating that total recoverable is a more appropriate measurement than dissolved, at least when particulate aluminum is primarily aluminum hydroxide particles. In surface waters, however, the total recoverable procedure might measure aluminum associated with clay particles, which might be less toxic than aluminum associated with aluminum hydroxide.
3. EPA is aware of field data indicating that many high quality waters in the U.S. contain more than 87 µg aluminum/L, when either total recoverable or dissolved is measured.

These statements highlight the fact that predicting Al toxicity in surface waters is complicated. It was decided to measure dissolved Al concentrations rather total Al concentration due to concern expressed in the latter part of footnote 2. Given the statements in footnotes 1 and 3, and the fact that Canyon Lake water has slightly higher pH after treatment, and relatively high hardness, the levels of residual aluminum of 89-106 µg/L may be acceptable for the protection of aquatic life within the lake.

SUMMARY OF RESULTS

The results of this study show that in-lake treatment with alum may be an effective way to remove both existing turbidity and nutrients from Canyon Lake water. The removal of nutrients will reduce the potential for future water quality problems in the lake. For Stations 7 and 8 below the thermocline, and for Station 9, an alum dose of 50 mg/L was sufficient to drop turbidity to less than 1.0 NTU. This dose also resulted in reductions in total nitrogen of 6%, 36%, and 28% for stations 7, 8 and 9 respectively. Even greater relative reductions in total phosphorus were achieved; with reductions of 86%, 86%, and 74% for stations 7, 8 and 9, respectively. The water samples from station 10 required a higher alum dose of 100 mg/L to drop the turbidity to less than 1.0 NTU. The 100 mg/L alum dose resulted in reductions in total nitrogen and total phosphorus of 64% and 92%, respectively. All of the alum doses studied resulted in residual dissolved aluminum concentrations below the EPA acute toxicity criterion for the protection of aquatic life, 750 μg/L. An alum dose of at least 150 mg/L is required to reduce the residual dissolved aluminum concentration in the treated waters to levels close to the EPA chronic ambient water quality criterion for the protection of aquatic life. Even higher doses of alum may be effective in lowering the residual Al concentrations, but practical doses are limited by the drop in pH and the natural alkalinity of the lake. While the results of these laboratory studies are promising, limited in-lake treatment studies should be conducted to determine the actual effects of alum treatment on the *in situ* water quality in Canyon Lake.

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Table 1. Depth profile data for Station 7.

Station 7	8/27/2012	8:44 am			
Depth (m)	**Temp** (C^{o})	**pH**	**ORP** (mV)	**EC** (mS/cm)	**Turb** (NTU)
0.5	28.5	8.60	199	1088	5.3
1.0	28.5	8.62	189	1087	5.9
2.0	28.5	8.58	185	1087	6.1
3.0	28.5	8.56	183	1088	5.8
4.0	28.5	8.48	182	1090	5.4
5.0	27.0	7.39	213	1096	10.7
6.0	23.3	7.11	290	1041	10.5
7.0	19.7	7.04	317	1006	7.2
8.0	17.6	7.05	329	991.4	6.3
9.0	16.1	7.00	335	985.3	5.8
10.0	15.5	6.97	340	984.6	5.1
11.0	15.2	6.94	343	990.3	5.9
12.0	15.0	6.85	346	992.8	6.5
12.5	14.9	6.85	348	993.3	11.6
13.0	Bottom				

Table 2. Depth profile data for Station 8.

Station 8	8/27/2012	9:30 am			
Depth (m)	**Temp** (C^{o})	**pH**	**ORP** (mV)	**EC** (mS/cm)	**Turb** (NTU)
0.5	28.7	8.59	40	1095	5.9
1.0	28.7	8.58	34	1095	6.5
2.0	28.6	8.55	33	1096	6.0
3.0	28.5	8.51	33	1095	6.0
4.0	28.4	8.40	36	1095	6.8
5.0	27.9	7.64	204	1103	9.3
6.0	22.15	7.08	310	1033	10.9
6.4	bottom				

Table 3. Depth profile data for Station 9.

Station 9	8/27/2012	10:00 am			
Depth (m)	**Temp** (C^{o})	**pH**	**ORP** (mV)	**EC** (mS/cm)	**Turb** (NTU)
0.5	28.2	8.78	40	1255	13.0
1.0	28.2	8.64	31	1256	12.7
2.0	27.9	8.40	37	1259	12.0
3.0	27.8	8.46	35	1255	11.2
4.0	26.3	7.01	313	1274	19.7
5.0	20.2	6.86	352	1285	19.7
5.5	Bottom				

Table 4. Depth profile data for Station 10.

Station 10	8/27/2012	10:30 am			
Depth (m)	**Temp** (C^{o})	**pH**	**ORP** (mV)	**EC** (mS/cm)	**Turb** (NTU)
0.5	28.3	8.71	10	1272	19.7
1.0	28.1	8.68	10	1278	20.0
2.0	27.6	8.46	18	1293	21.4
2.2	Bottom				

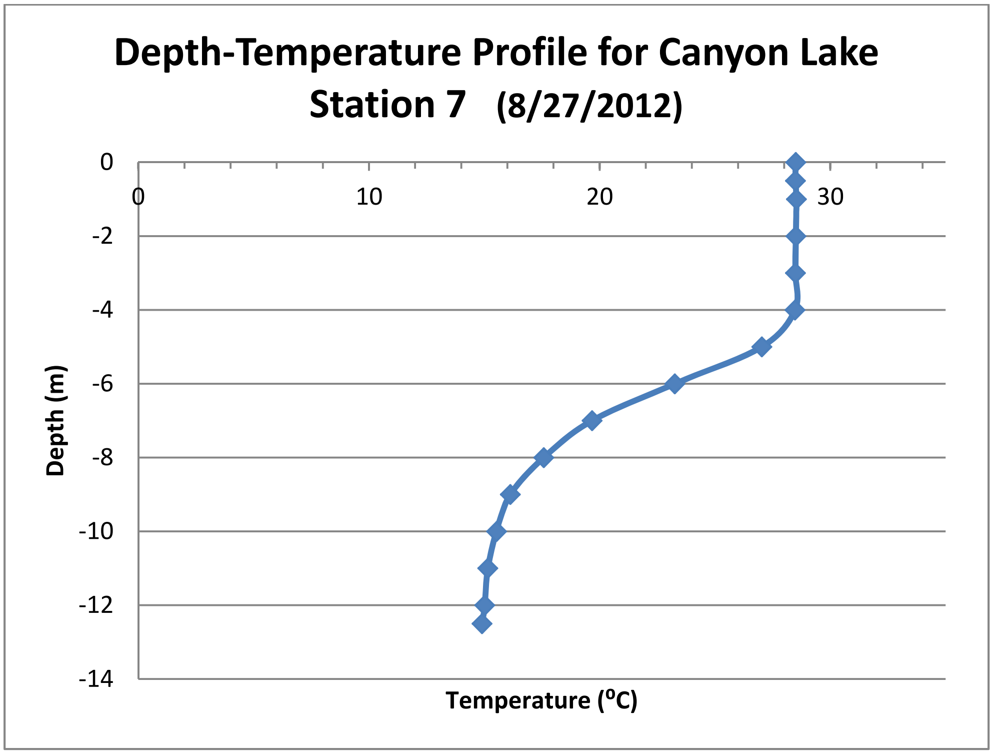

Figure 2. Depth-Temperature profile for Station 7, Canyon Lake.

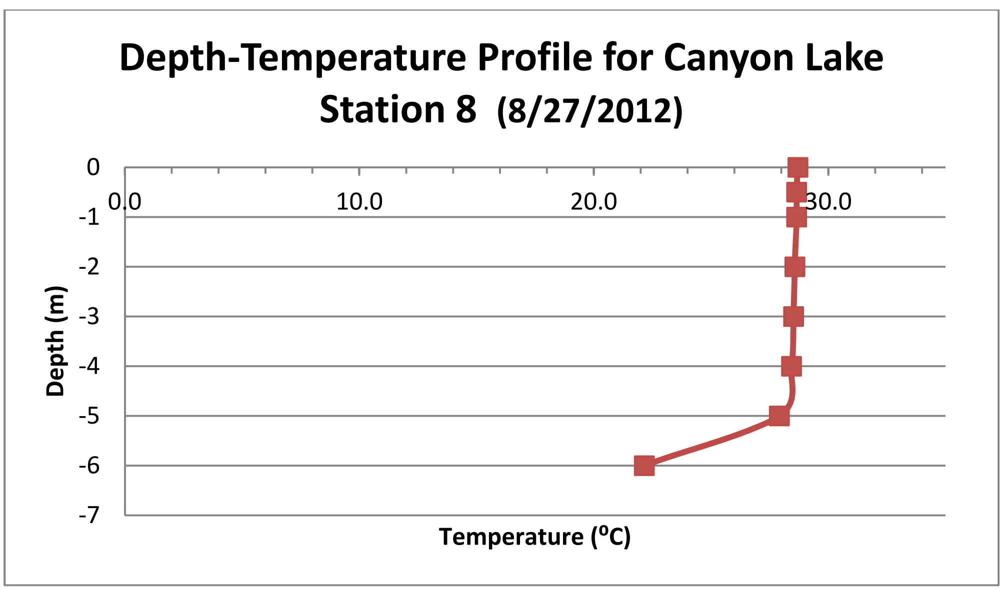

Figure 3. Depth-Temperature profile for Station 8, Canyon Lake.

Table 5. Jar test results for water from Station 7.

Station 7 (hypolimnion, 8.5 m)

Alum Dose (mg/L)	pH	Temp (°C)	Turbidity* (NTU)	Cond. (μS/cm	Diss. Al (μg/L)	TOC (mg/L)	Tot N (mg/L)	Tot P (mg/L)
0	7.57	22.1	90.25	1032	72	11.1	2.290	1.010
10	7.45	21.3	1.51	1030	289	12.9	2.310	0.803
25	7.50	21.6	0.91	1032	366	12.1	2.210	0.455
50	7.44	21.5	0.54	1036	321	10.9	2.160	0.139
75	7.30	21.7	0.43	1037	298	9.2	2.060	0.067
100	7.29	21.3	0.89	1042	258	10.8	1.770	0.033
125	7.05	21.2	0.18	1037	86			
150	7.00	21.2	0.22	1044	89			

* High Turbidity was due to a precipitation reaction that occurred during storage at 4°C.
Field turbidity was around 6.0 NTU

Table 6. Jar test results for water from Station 8.

Station 8 (hypolimnion, 5.5 m)

Alum Dose (mg/L)	pH	Temp (°C)	Turbidity (NTU)	Cond. (μS/cm	Diss. Al (μg/L)	TOC (mg/L)	Tot N (mg/L)	Tot P (mg/L)
0	7.97	22.10	5.89	1100	83	14.5	1.100	0.313
10	8.06	22.20	2.00	1117	374	15.0	0.960	0.205
25	7.91	21.60	1.03	1124	389	14.7	0.809	0.081
50	7.66	22.00	0.71	1118	355	12.8	0.705	0.043
75	7.41	21.60	0.62	1118	276	11.3	0.676	0.020
100	7.31	22.00	0.18	1127	236	9.7	0.688	0.010
125	7.16	21.00	0.16	1130	106			
150	7.01	21.00	0.18	1141	101			

Table 7. Jar test results for water from Station 9.

Station 9 (East Bay, Road Runner Beach)

Alum Dose (mg/L)	pH	Temp (^oC)	Turbidity * (NTU)	Cond. (μS/cm	Diss. Al (μg/L)	TOC (mg/L)	Tot N (mg/L)	Tot P (mg/L)
0	8.55	21.8	2.17	1270	134	18.7	1.348	0.098
10	8.01	21.3	1.96	1299	287	20.4	1.460	0.064
25	7.81	21.6	1.37	1290	331	19.5	1.210	0.045
50	7.64	21.3	0.95	1290	285	16.6	0.971	0.025
75	7.52	21.8	0.52	1305	231	14.4	0.813	0.013
100	7.33	21.3	0.69	1299	146	13.2	0.647	0.004
125	7.00	20.9	0.19	1306	107			
150	6.81	20.9	0.23	1299	104			

* Turbidity changed during storage at 4^o C. Field turbidity was 12.7

Table 8. Jar test results for water from Station 10.

Station 10 (East Bay, Indian Beach)

Alum Dose (mg/L)	pH	Temp (^oC)	Turbidity* (NTU)	Cond. (μS/cm	Diss. Al (μg/L)	TOC (mg/L)	Tot N (mg/L)	Tot P (mg/L)
0	8.56	22.1	7.84	1277	17	20.7	1.635	0.106
10	8.06	22.1	4.60	1286	607	17.3	1.480	0.094
25	7.66	21.8	3.55	1287	511	19.7	1.310	0.079
50	7.17	21.9	1.77	1294	456	18.1	0.994	0.043
75	6.95	22.0	1.47	1296	441	16.0	0.801	0.028
100	6.69	22.0	0.71	1297	280	13.8	0.585	0.009
125	6.91	21.1	0.29	1332	136			
150	6.76	20.9	0.24	1329	106			

* Turbidity changed during storage at 4^o C. Field turbidity was 20.0 NTU

Table 9. The pH and turbidity values for Station 10 jar test after 24 hours.

Alum Dose (mg/L)	pH	Turbidity (NTU)
0	8.56	7.84
10	8.10	4.04
25	7.88	2.70
50	7.63	1.85
75	7.46	1.46
100	7.30	0.53

Attachment D
Table of Contents

Tables

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Attachment D
Existing Nutrient Source Control Programs

D.1 Introduction

The MS4 permittees within the watersheds draining to Canyon Lake and Lake Elsinore are in compliance with the MS4 permit requirements applicable to this area of Riverside County. Compliance activities include implementation of both non-structural and structural BMPs. This section documents permit-related activities implemented by the MS4 permittees since January 1, 2005, essentially the time period since adoption of the Nutrient TMDLs (adopted December 20, 2004). Implementation of these activities has supported efforts to reduce the runoff of nutrients from urban areas covered by the MS4 permit, thus providing water quality benefits to the area.

D.2 Non-Structural BMPs

Non-structural BMPs that can reduce the presence of nutrients in urban runoff include:

- Public Education and Outreach
- Ordinance Adoption
- Inspection and Enforcement Activities
- Street Sweeping
- MS4 Facility Inspection and Cleaning Programs
- Septic System Management
- Fertilizer Application Management

The following sections describe each of the above BMPs. Where it is possible to quantify water quality benefits, this information has been included in the CNRP compliance analysis (see Section 3). Where it is not possible to quantify the benefits, the expected water quality benefits are considered qualitatively as part of the margin of safety that is implicit in the compliance analysis calculations.

D.2.1 Public Education and Outreach

The MS4 permittees collectively participate in public education and outreach efforts that promote stormwater pollution prevention. Although outreach events may not specifically focus on reducing nutrient levels, events which highlight the elimination or reduction of debris or pollutants from entering the MS4 or runoff have the potential to reduce nutrient loads.

Emphasis of BMPs is on management of pet waste, fertilizer use, proper operation and maintenance of septic systems, and prevention of sedimentation. Example public education BMPs and outreach activities in the watershed that reduce nutrients in urban runoff include (see MS4 Program Annual Reports for more details regarding ongoing public education and outreach activities):

- *What's the Scoop* and *After the Storm* brochures address the need to pick up animal waste and to dispose of it properly.
- *After the Storm* brochure addresses the need to pick up pet wastes and minimize sedimentation.
- RCFC&WCD, in partnership with San Bernardino County, sponsored a 1-hour episode of a PBS show for kids called *Curiosity Quest.* The episode focused on the impacts residential activities can have on stormwater, e.g., improper pet waste disposal.
- A school activity book and "Fancy Fin" presentation discuss proper disposal of pet waste.
- The *Keep Our Water Clean* video focuses on the proper disposal of pet waste and proper uses of fertilizers and avoiding excess runoff from sprinklers.
- The adult-focused presentation, *Only Rain Down the Storm Drain*, discusses various pollutant concerns associated with stormwater. The Agricultural Commissioner, University of California Riverside Cooperative Extension and local nurseries assist with distribution of materials. Mission Resource Conservation District presentations discuss the effects fertilizers can have on local waters.
- Construction, municipal, industrial/commercial and new development training activities focus on the need to address pollutant sources, including nutrients, erosion control and sedimentation, in the watershed. A specific section of the municipal employee training focuses on the need to manage nutrients in the watershed.
- RCFC&WCD contracts with S. Groner and Associates to distribute pet waste information in pet stores, veterinarian clinics, kennels and pet grooming facilities.
- The MS4 program coordinates with the Riverside County Animal Control Department and private "no kill" pet shelters to distribute *What's the Scoop* and *After the Storm* brochures to families adopting pets at these shelters.
- The MS4 program distributes a variety of materials that promote reduction of pollutants at the source. Distributed materials include:
- Landscape and Gardening brochures;
- Tips for Maintaining a Septic Tank System brochure *(information is also included in the County*'s Septic Tank Guide Booklet);
- *Tips for Horse Care* brochure that addresses equestrian care and management; and
- Dust pans featuring the Only Rain Down the Storm Drain message to promote dry cleaning of driveways and impervious surfaces.

- An Earth Day flyer (April), offers user-friendly suggestions for reducing the use of chemicals, considering integrated pest management in gardening, and understanding problems with unrecovered pet waste.

- The County's *Environmental Calendar* includes a variety of information regarding stormwater management and promotes the "Only Rain Down the Storm Drain" message and provides the stormwater program's 800 hotline number to report water quality concerns.

- RCFC&WCD does not allow the disposal of pet waste or other trash within its facilities. Signage has been installed at access gates to discourage illegal dumping and encourage the reporting thereof. At the start of the program, RCFC&WCD purchased "Dogipots" (containers that hold pet waste bags) and installed them in County Parks. Upkeep and additional purchases of Dogipots are the responsibility of County Park staff.

It is not possible to directly quantify reductions in nutrient loads in urban runoff to specific public education and outreach activities. Accordingly, the water quality benefits that occur as a result of these activities are considered qualitatively as part of the margin of safety associated with implementation of the CNRP.

D.2.2 Ordinance Adoption

The MS4 permittees in the Santa Ana Region have adopted ordinances which provide legal authority to control non-permitted discharges from entering MS4 facilities. These ordinances prevent the following types of discharges to MS4 facilities:

- Sewage to MS4 facilities

- Wash water resulting from hosing or cleaning of gas stations and other types of automobile stations

- Discharges resulting from the cleaning, repair, or maintenance of equipment, machinery or facilities, including motor vehicles, concrete mixing equipment, and portable toilet servicing

- Wash water from mobile auto detailing and washing, steam and pressure cleaning, and carpet cleaning

- Water from cleaning of municipal, industrial, and commercial areas including parking lots, streets, sidewalks, driveways, patios, plazas, work yards and outdoor eating or drinking areas, containing chemicals or detergents and without prior sweeping

- Runoff from material storage areas or uncovered receptacles that contain chemicals, fuels, grease, oil or other hazardous materials

- Discharges of runoff from the washing of toxic materials from paved or unpaved areas

- Discharges from pool or fountain water containing chlorine, biocides, or other chemicals; pool filter backwash containing debris and chlorine

- Pet waste, yard waste, debris, and sediment

- Restaurant or food processing facility wastes such as grease, floor mat and trash bin wash water, and food waste

Table D-1 summarizes the ordinances adopted by jurisdiction. Most ordinance updates in recent years have focused on landscape water use efficiency. Of particular note in Table D-1 are the ordinances adopted by (a) City of Canyon Lake (Ordinance No. 134U), which prohibits animal and human waste and illegal dumping in Bureau of Land Management lands in the vicinity of Canyon Lake and Ordinance No. 138U which requires proper disposal of pet waste by owners; and (b) Riverside County Ordinance, which prohibits septic tanks in specified areas in Quail Valley (now incorporated as part of City of Menifee) and requiring connection to existing septic systems to sewer systems.

It is not possible to directly quantify reductions in nutrient loads in urban runoff to ordinance adoption. Accordingly, the water quality benefits that occur as a result of the adoption and implementation of ordinances are not included in the set of BMPs used to demonstrate compliance.

D.2.3 Inspection and Enforcement Activities

MS4 permittees conduct inspections of commercial and industrial facilities as part of municipal NPDES programs to assess compliance of facilities with local stormwater ordinances and, where applicable, potential noncompliance with California's General Permit for Storm Water Discharges Associated with Industrial Activities. In evaluation of these programs for water quality benefits, restaurant inspections are of particular interest since restaurant activities are potential sources of nutrients.

Riverside County MS4 permittees implement a Commercial/Industrial Compliance Assistance Program (CAP) to conduct focused outreach to restaurants, automotive repair shops and certain other commercial and industrial establishments to encourage implementation of stormwater BMPs and facilitate consistent and coordinated enforcement of local stormwater quality ordinances. This program is conducted regionally through the County Department of Environmental Health. Site visits include use of survey checklists to document stormwater management practices for each facility.

In Riverside County, there are approximately 6,750 retail food facilities. Inspections are conducted one to three times per year. In addition, CAP has a specific compliance survey for food facilities to verify that:

- Oil and grease wastes are not discharged onto a parking lot, street or adjacent catch basin
- Trash bin areas are clean; bin lids are closed, not filled with liquid, and bins have not been washed out into the MS4
- Floor mats, filters and garbage containers are not washed in adjacent parking lots, alleys, sidewalks, or streets and that no wash water is discharged to MS4s
- Parking lot areas are cleaned by sweeping, not by hosing down, and that facility operators use dry methods for spill cleanup

Table D-1. Existing Ordinances Adopted by MS4 Permittees in the San Jacinto River Watershed

Jurisdiction	Ordinance Name	Key Provisions
Beaumont		▪ No data /info submitted
Canyon Lake	Landscape Water Use Efficiency	▪ Establishes landscape water use efficiency requirements
	Ordinance No. 107	▪ City permit required for all commencing projects that can lead to illegal discharge to Canyon Lake
	Ordinance No. 123	▪ Adopts 2007 California Plumbing Code, prevent leaks and spillage within City of Canyon Lake
	Ordinance No. 134U	▪ Prohibit animal, human waste, and illegal dumping in undeveloped City jurisdiction - Bureau of Land Management (BLM) lands in vicinity of Canyon Lake
	Ordinance No. 138U	▪ Establishes in municipal code requirements for proper disposal of animal waste by a pet owner/keeper from any public or private property regardless of property ownership or possession
Hemet	Water Efficient Landscape Ordinance	▪ Promote water conservation through efficient irrigation and climate appropriate plant material
Lake Elsinore	Water Efficient Ordinance No. 19.08	▪ Reduce water demand from landscapes; attain water efficient landscape goals
Menifee	Landscape Water Use Efficiency Ordinance	▪ Purpose of ordinance is to eliminate irrigation overspray and runoff
Moreno Valley	Ordinance No. 826	▪ Establishes landscape and irrigation design standards
	Ordinance No. 827	▪ Repeal and reenact stormwater urban runoff management & discharge control
Murrieta	Ordinance No. 335-05	▪ NPDES stormwater runoff quality
City of Riverside	Water Conservation	▪ Addresses irrigation water leaving the property
County of Riverside	Water Efficient Landscaping – Ordinance 859	▪ Addresses irrigation water leaving the property with greater than 1 acre of landscaping
	Ordinance 427	▪ Regulates land application of manure
	Ordinance 856	▪ Prohibits septic tanks in specified areas in Quail Valley, requiring connection to existing septic systems to sewer
	Ordinance 650	▪ Regulates discharge of sewage in unincorporated areas
San Jacinto	Water Conservation – Ordinance 09-16	▪ Prohibits excessive water flow or runoff onto sidewalks, driveways, streets, alleys, and gutters
Wildomar	Ordinance adoption at incorporation	▪ City adopted County of Riverside ordinances as they existed on July 1, 2008 (date of City incorporation); includes septic system management

Each Permittee also develops an inventory of commercial facilities that include industries such as nurseries and greenhouses as well as landscape and hardscape installation. Having a list of these types of businesses is critical when conducting inspections and training regarding practices which may be sources of nutrients.

Additional inspections conducted by individual jurisdictions since January 1, 2005 that provide benefits to water quality include:

- City of Canyon Lake conducted 3 commercial inspections in 2011 calendar year and inspected a Property Owners Association-owned campground, which has close proximity to Canyon Lake.
- In addition to the commercial and industrial facility programs, Menifee conducts 120 inspections yearly. The increase in inspections provides increased public and business awareness of stormwater pollution which in turn reduces the potential for pollutants to enter the storm drain system.

It is not possible to directly quantify reductions in nutrient loads in urban runoff to inspection and enforcement programs. Accordingly, the water quality benefits that occur as a result of these activities are considered qualitatively as part of the margin of safety associated with implementation of the CNRP.

D.2.4 Construction Site Inspections

MS4 permittees conduct construction site inspections as part of their permit requirements. Reducing sediment and other pollutants in discharges from a construction site is particularly important when reducing nutrient loading to the MS4. This inspection program involves maintaining an inventory database of construction sites 1-acre or larger which are issued a building or grading permits by the permittee. This inventory of construction projects is inspected and reported as part of the Annual Progress Report. Permittees inspect all inventoried constructions sites for compliance with local stormwater ordinances and WQMP requirements. Projects within the San Jacinto watershed are verified to have submitted a Notice of Intent (NOI) with the Regional Board for a Construction General Permit and issued a Waste Discharge Identification (WDID) Number. The inspector also verifies that a Stormwater Pollution Prevention Plan (SWPPP) is on-site and checks that construction BMPs are being implemented. Inspector training is also part of the construction inspection program. Permittee staff inspectors receive annual training in the requirements of the MS4 permits, Construction General Permit, and local stormwater ordinances and enforcement policy.

D.2.5 Street Sweeping and Other Debris Removal Programs

Street sweeping removes debris, which contains nutrients that may potentially be mobilized in urban runoff. The benefits of street sweeping are most closely associated with wet weather runoff which has the greatest capacity to flush unswept and accumulated debris into the storm drain. Table D-2 summarizes the quantity of debris collected by street sweeping programs for each jurisdiction from 2005 through 2010.

The MS4 permittees implement MS4 facility inspection and cleaning programs to satisfy minimum facility maintenance requirements contained in their MS4 permits. The debris that builds up in MS4 facilities has the potential to be a nutrient source that can be mobilized particularly by wet weather flows. The Riverside County permittees annually document the length and percent of pipeline and channel facilities inspected in the Annual Progress Report (Tables D-3 and D-4). Table D-5 summarizes the amount of debris removed annually from MS4 facilities from 2005 to 2010.

Relationships between the volume of debris removed (through street sweeping or MS4 facility cleaning activities) and nutrient load reductions have been established by various studies (CWP, 2008). This information was used to quantify benefits expected from implementation of street sweeping and debris removal programs under the CNRP.

Table D-2. Debris Collected (metric tons) as a Result of Street Sweeping in San Jacinto Watershed, 2005-2010

Jurisdiction	2005	2006	2007	2008	2009	2010
Beaumont[1]	-	-	23	23	23	23
Canyon Lake	-	-	1	2	2	25
Hemet[1]	-	-	1591	909	909	909
Lake Elsinore	-	-	NR	NR	NR	350
Menifee	NA	NA	NA	NA	36	36
Moreno Valley	-	-	1050	1010	706	805
Murrieta	-	-	-	5	5	5
Perris	-	-	588	600	342	495
Riverside[2]	30	30	30	30	28	28
County of Riverside[1]	-	-	797	55	760	540
RCFC&WCD[3]	-	-	-	-	-	-
San Jacinto[1]	-	-	205	189	59	59
Wildomar	NA	NA	NA	NA	25	25

Source: Riverside County Annual Progress Reports, 2005 to 2010
(-): In 2005, 2006, 2007 not all jurisdictions reported this measurement
NA; Wildomar and Menifee incorporated as cities in 2008.
NR; Not reported
[1] Values include debris removal from sweeping performed upstream of Mystic Lake.
[2] City of Riverside data based on reported average removal rate of 0.07 tons/curb mile swept in San Jacinto Watershed portion of City.
[3] RCFC&WCD does not own or maintain streets.

Table D-3. Linear Feet of Pipe and Percent of Pipe Inspected in San Jacinto Watershed, 2005 - 2010

Jurisdiction	Linear Feet or Miles (mi) of Pipe Inspected						Percent Pipe Inspected					
	2005	2006	2007	2008	2009	2010	2005	2006	2007	2008	2009	2010
Beaumont	1,000	1,000	1,000	250	250	250	50	50	50	10	10	10
Canyon Lake	900	900	900	900	900	NR	100	100	100	100	100	100
Hemet	0	0	15,600	0	0	0	0	0	0	0	0	0
Lake Elsinore	ND	ND	ND	4,600	0	0	ND	100	100	100	0	100
Menifee	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	ND	ND
Moreno Valley	100,000	100,000	100,000	100,000	100,000	100,000	100	100	100	100	100	100
Murrieta	0	ND	ND	0	110	0	0	ND	ND	0	0	0
Perris	3,955	402	26,094	28,041	3,013	67,346	4	0.3	17	16	2	36
City of Riverside[1]	0	ND	ND	ND	ND	ND	0	ND	10	10	10	10
County of Riverside[1]	ND	ND	ND	All[2]	6,150	6,150	ND	80	80	100	82	82
RCFC&WCD[1]	ND	ND	All[2]	300 mi	All[2]	All[2]	100	100	100	100	100	100
San Jacinto	12,000	12,000	12,000	9,000	800	1,500	76	76	75	50	5	9
Wildomar	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	ND	ND

[1] Data reflects inspections conducted over entire jurisdiction
[2] All components that can be visually inspected
[3] Data reflects inspections conducted over entire jurisdiction
ND: No data shown
NA: Menifee and Wildomar incorporated as cities in 2008.
Source: Riverside County Annual Progress Reports, 2005 to 2010

Table D-4. Linear Feet of Channel and Percent of Channel Inspected in San Jacinto Watershed, 2005 - 2010

Jurisdiction	Linear Feet or Miles (mi) of Channel Inspected						Percent Channel Inspected					
	2005	2006	2007	2008	2009	2010	2005	2006	2007	2008	2009	2010
Beaumont	2,000	2,000	2,000	2,000	2,000	2,000	100	100	100	100	100	100
Canyon Lake	NA	NA	NA	NA	NA	ND	NA	NA	NA	NA	NA	100
Hemet	15,600	15,600	ND	15,600	15,600	15,600	100	100	100	100	100	100
Lake Elsinore	ND	ND	ND	1,000	1,000	0	ND	100	100	100	100	100
Menifee	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	ND	ND
Moreno Valley	950	950	950	950	950	950	100	100	100	100	100	100
Murrieta	0	ND	ND	7,969	7,969	8,268	0	ND	ND	100	100	100
Perris	16,476	18,181	12,500	10,320	6,557	5,320	78	86	58	48	29	29
City of Riverside[1]	199,000	199,000	ND	ND	ND	ND	100	100	100	100	100	ND
County of Riverside[1]	ND	ND	ND	ND	57,855	60,900	ND	92	92	100	95	100
RCFC&WCD[1]	133 mi	59 mi	160 mi	103 mi	95 mi	230 mi	100	100	100	100	100	100
San Jacinto	16,000	16,000	16,000	19,000	12,000	12,000	94	94	94	100	100	67
Wildomar	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	ND	ND

[1] Data reflect inspections conducted over entire jurisdiction

ND: No data shown

NA: Menifee and Wildomar incorporated as cities in 2008.

Source: Riverside County Annual Progress Reports, 2005 to 2010

Table D-5. Debris (tons) Collected from MS4 Facilities in San Jacinto Watershed, 2005-2010

Jurisdiction	2005	2006	2007	2008	2009	2010
Beaumont	-	-	50	50	50	50
Canyon Lake	-	-	2	1.5	1	1.5
Hemet	-	-	6	5.4	4.9	5
Lake Elsinore	-	-	NR	NR	NR	NR
Menifee	NA	NA	NA	NA	NA	79
Moreno Valley[1]	-	-	1,620	753	408	429
Murrieta[2]	-	-	NR	40	40	42
Perris	-	-	NR	16	113	31
Riverside	-	-	NR	NR	NR	NR
County of Riverside	-	-	15	125	24	25
RCFC&WCD	433	101	263	523	535	260
	11,605	4,331	31,064	5,688	1,840	10,979
San Jacinto	-	-	4	NR	19	19
Wildomar	NA	NA	NA	NA	NR	NR

(-): In 2005 and 2006, not all jurisdictions reported this measurement since Annual Report format did not include this metric.
NA: Wildomar and Menifee incorporated as cities in 2008.
[1]: Reported in cubic feet
[2]: Reported in cubic yards
NR: Not reported
Source: Riverside County Annual Progress Reports, 2005 to 2010

D.2.6 Septic System Management

The Riverside County MS4 permit requires permittees to develop an inventory of septic systems within their jurisdictions to be added to a database managed by County Environmental Health. Poorly operating septic systems can potentially lead to the discharge of pollutants to surface waters. The County Department of Health (DEH) is conducting the following actions in response to MS4 permit requirements for septic systems:

- *Develop a septic system inventory* - Inventories are maintained for any new septic systems which are being installed. Historical data are being captured as resources are available.
- *Evaluate potential water quality impacts* - DEH is considering how to incorporate a GIS/mapping system overlay with current database programs to facilitate septic system evaluations.
- *Conduct public health education* - DEH currently provides both written and electronic information to septic system owners to inform and educate owners to understand proper routine maintenance activities.
- *Conduct inspections & initiate enforcement* - DEH currently responds to all notifications of surfacing sewage in areas within the County served by septic systems. Appropriate enforcement is initiated to ensure any system failures are remedied correctly and promptly.

Additionally, the County of Riverside Environmental Health Division, MS4 Permittees, RCFC&WCD and other stakeholders in the San Jacinto watershed participated in the development of the San Jacinto Septic System Management Plan (SSMP) in 2007. The SSMP includes the following key components and recommendations:

- *Public Education* – Include general public awareness, system owner education, and targeted outreach in critical management zones using a variety of media outlets, workshops, meetings, and direct consultations.
- *Planning* – Include an inventory of the community's wastewater treatment systems, as well as an onsite wastewater plan, to assess onsite wastewater treatment system alternatives.
- *Operation and Maintenance* – Establish maintenance rules, based upon system manufacturers' requirements and qualified septic system experts, and require maintenance contracts with qualified private service providers for systems of a certain size, type, and location. Regular inspection requirements and plumbing frequency recommendations are included in the operation and maintenance component.
- *Reporting and Tracking* – System owners should maintain operation and maintenance records and provide inspection reports to the Regional Board. The management program also recommends developing an online tracking and reporting system where information can be stored and easily retrieved.
- *Site Evaluation, System Design, Installation, Construction* – Site specific observations and characterization shall be performed by a qualified professional when the seasonal high groundwater level is unknown or known to be greater than 10 feet below the ground surface. New and replacement septic tanks installation shall meet California standards.
- *Performance Requirements* – Pollutants of concern should be targeted to reduce bacteria and nutrient loading using performance standards. Supplemental treatment systems will be required for new and replacement septic tanks systems in the critical management zones as well as existing systems that are suspected to be contributing to surface water and groundwater impairment.
- *Monitoring* – Include regular inspections during installation and operation to help identify performance problems quickly.
- *Enforcement and Compliance* – The wastewater management program should be enforced by a regulatory agency such as DEH using appropriate enforcement tools for compliance.

The State Water Resources Control Board (State Board) is in the process of adopting new regulations for septic systems to meet the legal mandate of Assembly Bill (AB) 885[1]. When the new regulations are adopted, the Permittees in the San Jacinto watershed will evaluate the SSMP and revise the SSMP as required.

The conversion of septic systems to a sewer system connection can provide significant water quality benefits. These benefits, in terms of expected nutrient load reductions can be quantified. As a

1 AB 885 was passed by the California State Legislature in 2000 requiring the State Board to adopt regulations or standards by January 1, 2004.

consequence, this information was used to quantify benefits expected from septic system conversions that may occur under the CNRP.

D.2.7 Fertilizer Application Management

The MS4 permittees provide Fertilizer Applicator Training on an annual basis. As required by the 2002 MS4 permit, staff responsible for fertilizer application attended at least three training sessions during a permit term. Permittees continue to provide training for public agency staff and contract field operations staff on fertilizer management and model maintenance procedures under the existing MS4 permit. Training includes emphasis on applying fertilizers according to manufacturer specifications, rates, and ratios. Specific fertilizer management practices implemented by MS4 Permittees in the San Jacinto Watershed include:

- *Lake Elsinore* - Staff apply fertilizer to park landscapes at manufacturer specifications, rates, and ratios so as to not over fertilize or under fertilize. Staff ensures excess fertilizer is blown, swept, or removed from the environment.
- *Murrieta* – Staff use organic phosphorus-free fertilizer.
- *Riverside* – Park maintenance staff conduct bi-weekly meetings which include fertilizer application topics. Two City staff are certified Fertilizer/Pesticide Applicators.
- *San Jacinto* – The city requires contract vendors to apply fertilizer three times per year and specifies that the vendor notify City staff prior to each application.

It is not possible to directly quantify reductions in nutrient loads in urban runoff to fertilizer application and training activities. Accordingly, the water quality benefits that occur as a result of these activities are considered qualitatively as part of the margin of safety associated with implementation of the CNRP.

D.3 Structural BMPs

The MS4 Permittees have been implementing structural BMPs in the watershed to fulfill new development and significant redevelopment requirements incorporated into the 2002 MS4 permit adopted for the Santa Ana Region within Riverside County and as required by Watershed-wide Waste Discharge Requirements for Discharges of Stormwater runoff Associated with New Developments in the San Jacinto Watershed (Regional Board Order 01-34). These structural BMP requirements have been implemented through the development of Water Quality Management Plans for development projects. Table D-6 summarizes the number of projects and number of acres of runoff impacted by the implementation of WQMPs since January 1, 2005, shortly after adoption of the Nutrient TMDLs.

Table D-6. Summary of Structural BMPs Implemented as Required by Implementation of WQMP Requirements for New Development or Significant Redevelopment Activities

Jurisdiction	No. of Projects	Total Acres	Description
Beaumont			
Canyon Lake	-	-	
Hemet	22	108	Infiltration basins, extended detention, bioretention basins, grass swales, underground chamber
Lake Elsinore	38	2,710	Water quality basins, swales, bio-retention
Menifee	12	75	Extended detention basins
Moreno Valley	20	1,220	Extended detention basins, vegetated swales, media filter
Murrieta	2	34	Infiltration basin, swale
Perris	73	2,233	Extended detention, infiltration basins, bioswales, and media filters
Riverside	-	511	
Riverside County	6	25	Extended detention basins. County did not have a tracking mechanism for San Jacinto Construction Permit SWPPP projects that deployed BMPs. As they could not be accounted for, they are not tracked here. The numbers here represent only projects subject to WQMP requirements that have been constructed within the unincorporated County. These numbers also do not include additional WQMP projects originally constructed within the County that have since been incorporated into cities.
San Jacinto			
Wildomar	-	-	
Total	**176**	**6,916**	

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Attachment E
Table of Contents

Tables

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Attachment E
CNRP Implementation Plan

E.1 Introduction

As noted in Section 2.4, the MS4 permit requires that the CNRP include a detailed schedule includes the following:

- Discrete milestones, decision points and alternative analyses necessary to assess satisfactory progress toward meeting the urban WLAs for nutrient by December 31, 2020.
- Agency or agencies are responsible for meeting each milestone.
- Specific metric(s) that demonstrate the effectiveness of the CNRP and acceptable progress toward meeting the urban WLAs for nutrient by December 31, 2020

Section 2.4 provided an illustration of the key CNRP elements in a timeline. In this attachment, Table E-1 provides the detailed information required above for each CNRP task, specifically:

- *CNRP Activity* – Programmatic area to be implemented;
- *Milestones* – Discrete actions associated with the completion of each CNRP activity;
- *Metrics* – Specific outcomes to demonstrate completion of each milestone;
- *Lead Agency* – Assignment of the activity to the appropriate jurisdiction or group of stakeholders; and
- *Completion Date* – Completion dates for the CNRP activities.

E.2 CNRP Activities

The following sections provide a brief summary of the activities that will be completed under each key CNRP element.

E.2.1 Watershed-based BMPs

Three BMPs will be evaluated by the permittees to determine if modifications or enhancements can and need to be made that will provide additional reduction of nutrient sources within their jurisdictions:

- Ordinances
- Street Sweeping
- Debris Removal

The implementation schedule includes milestones for the evaluation of these BMPs and, if appropriate, completion of program modifications.

Two BMPs will continue to be implemented as currently designed. Public education and outreach activities (PEO) that target nutrients are already routinely implemented. The MS4 program will continue to regularly evaluate these activities and update PEO programs as needed. Septic system management will continue as described by the approved San Jacinto Onsite Wastewater Management Program.

Future development in the watershed is subject to recently revised WQMP requirements that require implementation of LID-based BMPs. The revised WQMP will be fully implemented April 22, 2013, likely prior to the expected CNRP approval date.

E.2.2 In-lake Remediation Projects

Lake Elsinore

The Lake Elsinore aeration system, incorporated into the CNRP, is already being implemented. During CNRP implementation the MS4 permittees will support the continued operation of this system as needed to comply with urban WLAs. However, as noted in Section 2.2.2., the permittees will continue to evaluate alternative compliance approaches including use of chemical additives such as alum. If it is determined that an alternative approach is more cost effective for achieving compliance with the urban WLAs and septic LAs, the Permittees will recommend revision to the CNRP.

Canyon Lake

The Taskforce has completed detailed evaluations of aeration, oxygenation, and chemical addition (Anderson, 2008; CDM, 2011; Anderson, 2012b; Anderson, 2012c). Based on these evaluations, the Taskforce has determined that chemical addition, using aluminum sulfate (alum), is the most effective in-lake nutrient control strategy to achieve interim numeric targets for the response variables, chlorophyll-a and DO. Appendix C provides the basis for this determination. Beginning in September 2013, assuming CEQA compliance is complete, alum application will be performed according to the schedule shown in Table 3-19. After the fifth alum application in September of 2015, the MS4 Permittees will evaluate water quality data in the lake, and determine whether response targets are achieved or if modification to the alum application plan or potential supplemental BMPs may be needed to achieve response targets for chlorophyll-a and DO (see Table E-1 in Attachment E for detailed implementation schedule).

In 2016, the TMDL will be reopened to revise the final numeric target for DO to incorporate controllability by means of an allowable exceedence frequency representative of a pre-development condition in the watershed. The 2012 DYRESM-CAEDYM simulations of lake water quality expected for a pre-development level of watershed nutrient loads will be used as the basis for determining the uncontrollable frequency of exceeding a final DO target of at least 5 mg/L in the hypolimnion. A cumulative frequency plot of average daily DO data from the two year period of alum applications (Sep 2013 through Sep 2015) will be compared to the pre-development cumulative frequency to determine whether sufficient improvement to DO was achieved with the alum applications. If not, the Permittees will consider a supplemental in-lake project for DO, such as aeration or oxygenation.

E.2.3 Monitoring Program

Watershed-based monitoring will continue at current levels through fiscal year 2014-2015. The Permittees propose to eliminate existing in-lake monitoring programs through the same period to ensure that resources are dedicated to implementation of projects contained in the CNRP. By December 31, 2014, the permittees will propose a revised comprehensive watershed and in-lake monitoring program for implementation beginning in fiscal year 2015-2016. The level of effort associated with this revised program will be sufficient to provide data to assess compliance with the 2015 interim and 2020 final TMDL compliance requirements. These compliance assessments will provide the basis for determining whether the CNRP requires revision to ensure compliance with TMDL requirements. Annual monitoring reports will be submitted to the Regional Board by November 30th of each year, at the same time that the MS4 Annual Report is submitted to the Regional Board.

E.2.4 Special Studies (optional)

The CNRP identifies several special studies that may be completed during implementation. Their primary purpose is to develop new data or information that could provide the basis for revisions to the Nutrient TMDLs or CNRP. Two studies listed in Table E-1 (land use updates and TMDL model update) may be implemented by the MS4 Permittees, but only if it is determined that the expenditure of resources on these efforts would yield appropriate outcomes. For that reason, Table E-1 notes that these tasks are optional and only lists general milestones and metrics. If the studies were to be implemented, the efforts would be coordinated with other stakeholders to the extent necessary. Currently, given the TMDL triennial review schedule, which provides periodic opportunity to revise the TMDL, these studies would be completed in a timely manner to inform the triennial review process.

E.2.5 Adaptive Implementation

This CNRP element covers activities associate with continued participation in the Task Force, the development project specific PTPs or functionally equivalent agreements, and the need, where appropriate, for revisions to the CNRP or Nutrient TMDLs. The need for modification of the CNRP will be determined by the findings of any special studies (if implemented) and the results of ongoing monitoring efforts which provide the basis for assessments of compliance with TMDL requirements. This assessment will include completion of a trend analysis for the response targets and nutrient levels in Lake Elsinore and Canyon Lake by November 30, 2018. This analysis will be included in the fiscal year 2018-2019 MS4 Annual Report. Based on the outcome of this analysis, the permittees may make recommendations for additional BMPs and a schedule for deployment of those BMPs for incorporation into a revised CNRP by June 30, 2019.

Adaptive implementation also includes a provision for providing support to the TMDL revision process. Recommendations for revisions to the TMDL would be made by the Permittees working in collaboration with other TMDL stakeholders. Any recommendations made would be based on the findings of special studies or the data obtained from the monitoring program. The schedule for TMDL revisions is based on the TMDL review schedule that anticipates opportunity for TMDL revisions every three years.

Table E-1. CNRP Implementation Plan

CNRP Activity	CNRP Element	Milestones	Metrics	Lead	Estimated Complete by
Watershed-based BMPs	Ordinances Development	Evaluate need to revise existing or establish new ordinances to reduce sources of nutrients in the watershed	Complete ordinance evaluation	Permittees	March 31, 2014
			Develop revised or new ordinances (where needed)	Permittees	December 31,2014
	Street Sweeping & Debris Removal	Street Sweeping & Debris Removal	Evaluate existing street sweeping and debris removal programs to identify opportunities to enhance program	Permittees	March 31, 2014
			Implement program enhancements, where identified, and as approved in local jurisdiction	Permittees	December 31, 2014
			Annual reporting of regular street sweeping and debris removal outcomes in Annual Report, with emphasis on TMDL benefits	Permittees/MS4 Program	November 30, each year
	Inspection & Enforcement	Continued implementation of inspection and enforcement program	Update inspection and enforcement program if needed based on outcome of ordinance evaluation	Permittees	March 31, 2015
			Annual reporting of regular inspection and enforcement activities in Annual Report	Permittees/MS4 Program	November 30, each year
	Septic System Management	Continued implementation of Septic System Management Plan for the watershed; modify implementation as needed to comply with State OWTS Policy	Annual reporting of septic system management activities in Annual Report,	Permittees	November 30, each year
	Public Education & Outreach	Continued implementation of PEO program	As part of Annual Report preparation evaluate PEO program to determine need to modify or expand PEO activities that target nutrient sources	Permittees/MS4 Program	November 30, each year
			Update PEO materials, as needed; implement PEO program	Permittees/MS4 Program	Annually, as needed
	WQMP Implementation	Implement approved LID-based WQMP following Regional Board approval	Prepare final WQMP, obtain Regional Board approval, and implement in watershed	Permittees/MS4 Program	Full WQMP Implementation-April 22, 2013

Table E-1. CNRP Implementation Plan

CNRP Activity	CNRP Element	Milestones	Metrics	Lead	Estimated Complete by
In-Lake Remediation Projects	Lake Elsinore	Support implementation of existing lake aeration system	Establish necessary agreements among aeration system participants	MS4 Program in collaboration with stakeholders	June 30, 2013
	Canyon Lake	Conduct tests to evaluate potential for chronic aluminum toxicity with planned doses of alum	Toxicity test results to support CEQA initial study	MS4 Program in collaboration with stakeholders	March 15, 2013
		Complete CEQA process	CEQA initial study and approval of alum addition plan	MS4 Program in collaboration with stakeholders	July 31, 2013
		Implement process to obtain all permits and approvals	Secure permits and approvals to add alum from barge at surface	MS4 Program in collaboration with stakeholders	September 30, 2013
		Implement planned alum additions	Completion of planned alum additions to surface of Main Body and East Bay using barge	MS4 Program in collaboration with stakeholders	September , 2013, February, 2014, September 2014, February, 2015, September, 2015
		TMDL reopener for DO response target	Revision of response target that takes into account controllability considerations	MS4 Program in collaboration with stakeholders	June 30, 2016
		Support implementation of long-term in-lake nutrient management BMPs	If needed, establish additional watershed or in-lake BMPs to meet final response targets (e.g. regular alum additions, aeration, HOS, etc.)	MS4 Program in collaboration with stakeholders	December 31, 2020
Monitoring Program	In-Lake Monitoring	Implement alum treatment effectiveness monitoring	Develop and begin implementation of a plan for effectiveness monitoring to obtain sufficient data to evaluate performance of alum treatment in Canyon Lake.	MS4 Program in collaboration with stakeholders	June, 2014
		Prepare revised comprehensive monitoring program	Submit revised comprehensive monitoring program to the Regional Board for approval	MS4 Program in collaboration with stakeholders	December 31, 2014
		Implement Regional Board-approved revised comprehensive monitoring program	Completion of annual monitoring as required by revised program	MS4 Program in collaboration with stakeholders	December 31, 2020

Table E-1. CNRP Implementation Plan

CNRP Activity	CNRP Element	Milestones	Metrics	Lead	Estimated Complete by
	Watershed-based Monitoring	Continue implementation of Phase I watershed monitoring program	Completion of annual monitoring as required by current approved monitoring program	MS4 Program in collaboration with stakeholders	June 30, 2015
		Prepare revised comprehensive monitoring program	Submit revised comprehensive monitoring program to the Regional Board for approval	MS4 Program in collaboration with stakeholders	December 31, 2014
		Implement Regional Board-approved revised comprehensive monitoring program	Completion of annual monitoring as required by revised program	MS4 Program in collaboration with stakeholders	December 31, 2020
	Annual Reports	Complete annual reports to assess effectiveness of CNRP	Submittal of annual reports to Regional Board	MS4 Program in collaboration with stakeholders	November 30, annually
	Interim Compliance Assessment	Demonstrate compliance with interim TMDL requirements	Submittal of assessment of compliance with interim TMDL requirements	MS4 Program in collaboration with stakeholders	June 30, 2016
	Final Compliance Assessment	Demonstrate compliance with WLAs	Submittal of assessment of expected compliance with final TMDL requirements including any recommended supplemental actions.	MS4 Program in collaboration with stakeholders	December 31, 2020
Special Studies (Optional)	Land Use Updates	Update watershed urban land use based on 2010 data	Submit land use revision to the Regional Board	MS4 Program in collaboration with stakeholders	June 30, 2018
	TMDL Model Update	Revise/update TMDL models for Canyon Lake/ Lake Elsinore based on new data (e.g., land use, water quality)	Submit TMDL models to the Regional Board	MS4 Program in collaboration with stakeholders	December 31, 2018

Table E-1. CNRP Implementation Plan

CNRP Activity	CNRP Element	Milestones	Metrics	Lead	Estimated Complete by
Adaptive Implementation	Task Force	Participate in Task Force process	Regular attendance at Task Force meetings	MS4 Program in collaboration with stakeholders	Ongoing
	CNRP Revisions	Review progress towards achieving TMDL requirements based on compliance assessments; modify CNRP as needed	Prepare compliance assessment; if needed, submit revised CNRP to the Regional Board	MS4 Program/Permittees	November 30, 2016
		Review progress towards achieving final TMDL requirements based on compliance assessments; modify CNRP as needed	Prepare compliance assessment; if needed, submit revised CNRP to the Regional Board	MS4 Program/Permittees	June 30, 2020
	TMDL Revision	Based on degree of Regional Board support, prepare materials to support revision to the TMDL, coordinate with Triennial Review process, if revision is appropriate and feasible.	Submit recommendations and supporting material for revisions to the TMDL to the Regional Board	MS4 Program in collaboration with stakeholders	Prior to potential triennial review dates in 2015 and 2019

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Attachment F
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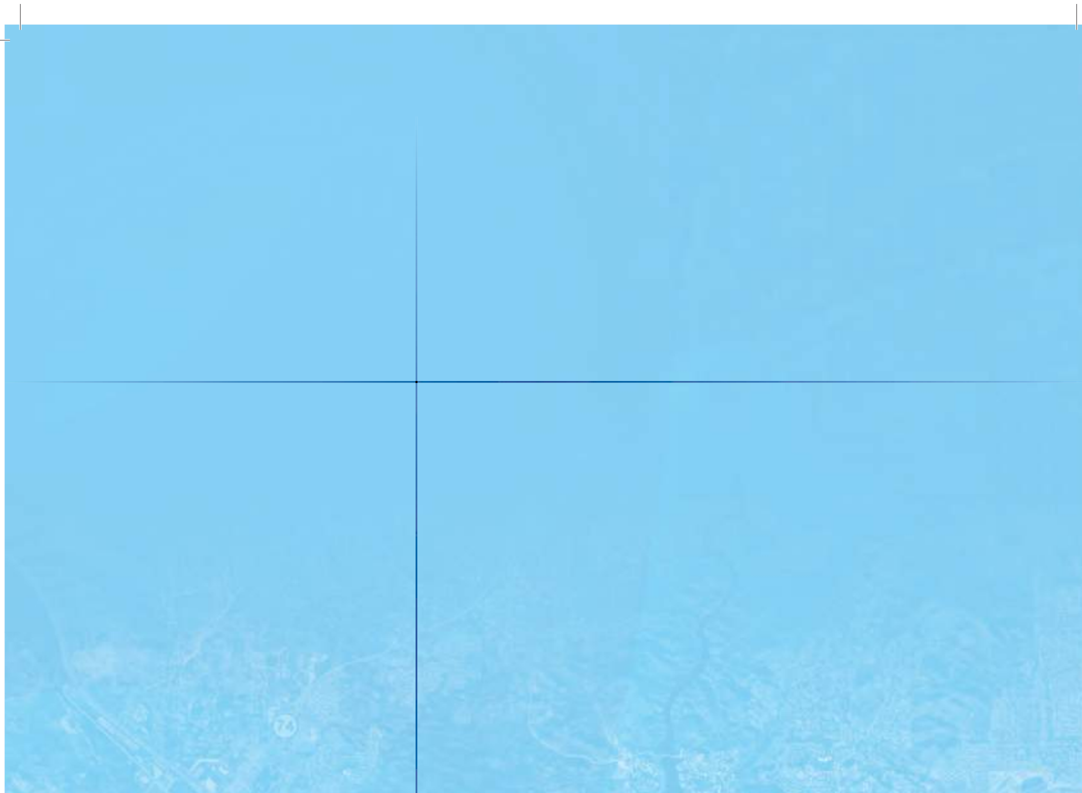
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WATER QUALITY MANAGEMENT PLAN AND STORMWATER BEST MANAGEMENT PRACTICES OPERATION, TRANSFER, MAINTENANCE AND RIGHT OF ENTRY AGREEMENT

PROJECT NAME: ROCKPORT RANCH

PROPERTY OWNER NAME: ABECHERLI FAMILY TRUST

PROPERTY ADDRESS: 29875 NEWPORT RD. & BRIGGS RD, MENIFEE, CA 92584

APN: 364-190-004 & 361-190-005

THIS AGREEMENT is made and entered into in

____, California, this ___________ day of

_______________________________, 201___, by and between

____, herein after

referred to as "Owner", and the CITY OF MENIFEE, a municipal corporation, located in the County of Riverside, State of California hereinafter referred to as "CITY";

WHEREAS, the City is a Co-Permittee for discharging stormwater from its MS4 facilities pursuant to the Santa Ana Regional Water Quality Control Board Order No. R8-2010-0033, MS4 NPDES Permit No. CAS 618033. Under the terms of the permit the City is required to enforce the provisions of the permit within its jurisdiction. The requirements contained in this agreement are intended to achieve the goals of the MS4 permit;

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

WHEREAS, at the time of initial approval of development project known as:

____ within the Property described herein, the City required the project to employ Best Management Practices, hereinafter referred to as "BMPs," to minimize pollutants in urban runoff;

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

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

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

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

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

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

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

3. City Maintenance at Owner's Expense: In the event Owner, or its successors or assigns, fails to accomplish the necessary maintenance contemplated by this

Agreement, the City may cause such maintenance to be conducted on Owner's Property at Owner's expense if Owner does not commence and diligently work to perform the maintenance within five (5) days of receiving written notice from the City, in accordance with paragraph 10 below, of Owner's failure to comply with the terms of this Agreement. The City may charge the entire cost and expense of any maintenance undertaken by the City, whether performed as a response to an emergency situation or following five (5) day written notice by the City, to the Owner or Owner's successors or assigns, including administrative costs, attorney's fees and interest thereon at the maximum rate authorized by the Civil Code from the Date of the notice of expense until paid in full. The City, at its sole election, may take these costs to be a lien upon the property that may be collected at the same time and in the same manner as ordinary municipal taxes as provided in Government Code section 38773.5. Nothing in this section or this Agreement creates an obligation by the City to maintain or repair any BMP, nor does this section prohibit the City from pursuing other legal recourse against Owner.

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

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

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

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

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

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

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

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

IF TO CITY:	**IF TO OWNER:**
City of Menifee	______________________________
29714 Haun Road	______________________________
Menifee, CA 92586-6540	______________________________
	______________________________

CITY:	**OWNER:**
By:___________________________ Robert A. Johnson, City Manager	By:______________________________ NAME
	Title:______________________________
APPROVED AS TO FORM:	
	OWNER:
___________________________ Jeffery T. Melching, City Attorney	
	By:______________________________
ATTEST:	
	NAME
	Title:______________________________
___________________________ Sarah Manwaring, City Clerk	

NOTARY ACKNOWLEDGEMENTS ON FOLLOWING PAGE

<u>EXHIBIT A</u>

<u>(Legal Description)</u>

EXHIBIT "A"

LEGAL DESCRIPTION

THE LAND REFERRED TO HEREIN BELOW IS SITUATED IN THE CITY OF MENIFEE, IN THE COUNTY OF RIVERSIDE, STATE OF CALIFORNIA, AND IS DESCRIBED AS FOLLOWS:

PARCEL 1:

THE EAST HALF OF THE NORTHEAST QUARTER OF SECTION 1, TOWNSHIP 6 SOUTH, RANGE 3 WEST, IN THE CITY OF MENIFEE, COUNTY OF RIVERSIDE, STATE OF CALIFORNIA, SAN BERNARDINO BASE AND MERIDIAN, ACCORDING TO THE OFFICIAL PLAT THEREOF.

EXCEPTING THEREFROM THAT PORTION OF THE EAST HALF OF THE NORTHEAST QUARTER OF SECTION 1, TOWNSHIP 6 SOUTH, RANGE 3 WEST, SAN BERNARDINO MERIDIAN, BEING DESCRIBED AS FOLLOWS:

BEGINNING AT THE EAST QUARTER OF SAID SECTION; THENCE N. 0°41'39" E., 56.20 FEET ALONG THE EASTERLY LINE OF THE NORTHEAST QUARTER OF SAID SECTION TO THE POINT OF BEGINNING; THENCE S. 89°34'27" W., 945.32 FEET; THENCE S. 0°25'33" E., 22.50 FEET; THENCE S. 89°34'27" W., 60.00 FEET; THENCE N. 0°25'33" W., 60.00 FEET; THENCE N. 89°34'27" E., 60.00 FEET; THENCE S. 0°25'33" E., 22.50 FEET; THENCE N. 89°34'27" E., 946.11 FEET TO THE EASTERLY LINE OF THE NORTHEAST QUARTER OF SAID SECTION; THENCE S. 0°41'39" W., 15.00 FEET TO THE POINT OF BEGINNING.

PARCEL 2:

THAT PORTION OF THE EAST HALF OF THE NORTHEAST QUARTER OF SECTION 1; TOWNSHIP 6 SOUTH, RANGE 3 WEST, IN THE CITY OF MENIFEE, COUNTY OF RIVERSIDE, STATE OF CALIFORNIA, SAN BERNARDINO MERIDIAN, BEING DESCRIBED AS FOLLOWS:

BEGINNING AT THE EAST QUARTER OF SAID SECTION; THENCE N. 0°41'39" E., 56.20 FEET ALONG THE EASTERLY LINE OF THE NORTHEAST QUARTER OF SAID SECTION TO THE POINT OF BEGINNING; THENCE S. 89°34'27" W., 945.32 FEET; THENCE S. 0°25'33" E., 22.50 FEET; THENCE S. 89°34'27" W., 60.00 FEET; THENCE N. 0°25'33" W., 60.00 FEET; THENCE N. 89°34'27" E., 60.00 FEET; THENCE S. 0°25'33" E., 22.50 FEET; THENCE 89°34'27" E., 946.11 FEET TO THE EASTERLY LINE OF THE NORTHEAST QUARTER OF SAID SECTION; THENCE S. 0°41'39" W., 15.00 FEET TO THE POINT OF BEGINNING,.

APN: 364-190-004-1 AND 364-190-005-2

EXHIBIT B
(Map/Illustration)


PROJECT SITE
Domenigoni Pkwy
Newport Rd
Old Newport Rd
Tierra Shores Ln
Cottonwood Cove Dr
Pinckney Way
Oakhaven Ln
Whisperwood Dr
Long Meadow Dr
Baywater Dr
Palm Villa Dr
Via Marsala
Menifee Lakes Dr
Rockport Rd
Rockledge Dr
Laguna Vista Dr
Skystone Way
Lamplighter Ln
Antelope Rd
215
Haun Rd
Loire Valley Ln
Inspiration Lake Dr
Tres Lagos Dr
Gold Crest Dr
N Port Ln
Bayport Ln
La Piedra Rd
Menifee Rd
Fenwick Cir
Fall River Ln
View Ridge Ln
Carriage Hill Dr
Alston Ln
Southshore Dr
Briggs Rd
Bouris Dr
Saxony Dr
Albion Ln
Midsummer Ln
Holland Rd
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Wet Ponds TC-20

Design Considerations

- Area Required
- Slope
- Water Availability
- Aesthetics
- Environmental Side-effects

Description

Wet ponds (a.k.a. stormwater ponds, retention ponds, wet extended detention ponds) are constructed basins that have a permanent pool of water throughout the year (or at least throughout the wet season) and differ from constructed wetlands primarily in having a greater average depth. Ponds treat incoming stormwater runoff by settling and biological uptake. The primary removal mechanism is settling as stormwater runoff resides in this pool, but pollutant uptake, particularly of nutrients, also occurs to some degree through biological activity in the pond. Wet ponds are among the most widely used stormwater practices. While there are several different versions of the wet pond design, the most common modification is the extended detention wet pond, where storage is provided above the permanent pool in order to detain stormwater runoff and promote settling. The schematic diagram is of an on-line pond that includes detention for larger events, but this is not required in all areas of the state.

Targeted Constituents

☑	Sediment	■
☑	Nutrients	▲
☑	Trash	■
☑	Metals	■
☑	Bacteria	■
☑	Oil and Grease	■
☑	Organics	■

Legend *(Removal Effectiveness)*

● Low ■ High

▲ Medium

California Experience

Caltrans constructed a wet pond in northern San Diego County (I-5 and La Costa Blvd.). Largest issues at this site were related to vector control, vegetation management, and concern that endangered species would become resident and hinder maintenance activities.

Advantages

- If properly designed, constructed and maintained, wet basins can provide substantial aesthetic/recreational value and wildlife and wetlands habitat.

- Ponds are often viewed as a public amenity when integrated into a park setting.

- Due to the presence of the permanent wet pool, properly designed and maintained wet basins can provide significant water quality improvement across a relatively broad spectrum of constituents including dissolved nutrients.

- Widespread application with sufficient capture volume can provide significant control of channel erosion and enlargement caused by changes to flow frequency relationships resulting from the increase of impervious cover in a watershed.

Limitations

- Some concern about safety when constructed where there is public access.

- Mosquito and midge breeding is likely to occur in ponds.

- Cannot be placed on steep unstable slopes.

- Need for base flow or supplemental water if water level is to be maintained.

- Require a relatively large footprint

- Depending on volume and depth, pond designs may require approval from the State Division of Safety of Dams

Design and Sizing Guidelines

- Capture volume determined by local requirements or sized to treat 85% of the annual runoff volume.

- Use a draw down time of 48 hours in most areas of California. Draw down times in excess of 48 hours may result in vector breeding, and should be used only after coordination with local vector control authorities. Draw down times of less than 48 hours should be limited to BMP drainage areas with coarse soils that readily settle and to watersheds where warming may be detrimental to downstream fisheries.

- Permanent pool volume equal to twice the water quality volume.

- Water depth not to exceed about 8 feet.

- Wetland vegetation occupying no more than 25% of surface area.

- Include energy dissipation in the inlet design and a sediment forebay to reduce resuspension of accumulated sediment and facilitate maintenance.

- A maintenance ramp should be included in the design to facilitate access to the forebay for maintenance activities and for vector surveillance and control.

- To facilitate vector surveillance and control activities, road access should be provided along at least one side of BMPs that are seven meters or less in width. Those BMPs that have shoreline-to-shoreline distances in excess of seven meters should have perimeter road access on both sides or be designed such that no parcel of water is greater than seven meters from the road.

Construction/Inspection Considerations

- In areas with porous soils an impermeable liner may be required to maintain an adequate permanent pool level.

- Outlet structures and piping should be installed with collars to prevent water from seeping through the fill and causing structural failure.

- Inspect facility after first large storm to determine whether the desired residence time has been achieved.

Performance

The observed pollutant removal of a wet pond is highly dependent on two factors: the volume of the permanent pool relative to the amount of runoff from the typical event in the area and the quality of the base flow that sustains the permanent pool. A recent study (Caltrans, 2002) has documented that if the permanent pool is much larger than the volume of runoff from an average event, then displacement of the permanent pool by the wet weather flow is the primary process. A statistical comparison of the wet pond discharge quality during dry and wet weather shows that they are not significantly different. Consequently, there is a relatively constant discharge quality during storms that is the same as the concentrations observed in the pond during ambient (dry weather) conditions. Consequently, for most constituents the performance of the pond is better characterized by the average effluent concentration, rather than the "percent reduction," which has been the conventional measure of performance. Since the effluent quality is essentially constant, the percent reduction observed is mainly a function of the influent concentrations observed at a particular site.

The dry and wet weather discharge quality is, therefore, related to the quality of the base flow that sustains the permanent pool and of the transformations that occur to those constituents during their residence in the basin. One could potentially expect a wide range of effluent concentrations at different locations even if the wet ponds were designed according to the same guidelines, if the quality of the base flow differed significantly. This may explain the wide range of concentration reductions reported in various studies.

Concentrations of nutrients in base flow may be substantially higher than in urban stormwater runoff. Even though these concentrations may be substantially reduced during the residence time of the base flow in the pond, when this water is displaced by wet weather flows, concentrations may still be quite elevated compared to the levels that promote eutrophication in surface water systems. Consequently comparing influent and effluent nutrient concentrations during wet weather can make the performance seem highly variable.

Relatively small perennial flows may often substantially exceed the wet weather flow treated. Consequently, one should also consider the load reduction observed under ambient conditions when assessing the potential benefit to the receiving water.

Siting Criteria

Wet ponds are a widely applicable stormwater management practice and can be used over a broad range of storm frequencies and sizes, drainage areas and land use types. Although they have limited applicability in highly urbanized settings and in arid climates, they have few other restrictions. Wet basins may be constructed on- or off-line and can be sited at feasible locations along established drainage ways with consistent base flow. An off-line design is preferred. Wet basins are often utilized in smaller sub-watersheds and are particularly appropriate in areas with residential land

uses or other areas where high nutrient loads are considered to be potential problems (e.g., golf courses).

Ponds do not consume a large area (typically 2–3 percent of the contributing drainage area); however, these facilities are generally large. Other practices, such as filters or swales, may be "squeezed" into relatively unusable land, but ponds need a relatively large continuous area. Wet basins are typically used in drainage basins of more than ten acres and less than one square mile (Schueler et al., 1992). Emphasis can be placed in siting wet basins in areas where the pond can also function as an aesthetic amenity or in conjunction with other stormwater management functions.

Wet basin application is appropriate in the following settings: (1) where there is a need to achieve a reasonably high level of dissolved contaminant removal and/or sediment capture; (2) in small to medium-sized regional tributary areas with available open space and drainage areas greater than about 10 ha (25 ac.); (3) where base flow rates or other channel flow sources are relatively consistent year-round; (4) in residential settings where aesthetic and wildlife habitat benefits can be appreciated and maintenance activities are likely to be consistently undertaken.

Traditional wet extended detention ponds can be applied in most regions of the United States, with the exception of arid climates. In arid regions, it is difficult to justify the supplemental water needed to maintain a permanent pool because of the scarcity of water. Even in semi-arid Austin, Texas, one study found that 2.6 acre-feet per year of supplemental water was needed to maintain a permanent pool of only 0.29 acre-feet (Saunders and Gilroy, 1997). Seasonal wet ponds (i.e., ponds that maintain a permanent pool only during the wet season) may prove effective in areas with distinct wet and dry seasons; however, this configuration has not been extensively evaluated.

Wet ponds may pose a risk to cold water systems because of their potential for stream warming. When water remains in the permanent pool, it is heated by the sun. A study in Prince George's County, Maryland, found that stormwater wet ponds heat stormwater by about 9°F from the inlet to the outlet (Galli, 1990).

Additional Design Guidelines

Specific designs may vary considerably, depending on site constraints or preferences of the designer or community. There are several variations of the wet pond design, including constructed wetlands, and wet extended detention ponds. Some of these design alternatives are intended to make the practice adaptable to various sites and to account for regional constraints and opportunities. In conventional wet ponds, the open water area comprises 50% or more of the total surface area of the pond. The permanent pool should be no deeper than 2.5 m (8 feet) and should average 1.2 – 2 m (4-6 feet) deep. The greater depth of this configuration helps limit the extent of the vegetation to an aquatic bench around the perimeter of the pond with a nominal depth of about 1 foot and variable width. This shallow bench also protects the banks from erosion, enhances habitat and aesthetic values, and reduces the drowning hazard.

The wet extended detention pond combines the treatment concepts of the dry extended detention pond and the wet pond. In this design, the water quality volume is detained above the permanent pool and released over 24 hours. In addition to increasing the residence time, which improves pollutant removal, this design also attenuates peak runoff rates. Consequently, this design alternative is recommended.

Pretreatment incorporates design features that help to settle out coarse sediment particles. By removing these particles from runoff before they reach the large permanent pool, the maintenance burden of the pond is reduced. In ponds, pretreatment is achieved with a sediment forebay. A sediment forebay is a small pool (typically about 10 percent of the volume of the permanent pool). Coarse particles remain trapped in the forebay, and maintenance is performed on this smaller pool, eliminating the need to dredge the entire pond.

There are a variety of sizing criteria for determining the volume of the permanent pool, mostly related to the water quality volume (i.e., the volume of water treated for pollutant removal) or the average storm size in a particular area. In addition, several theoretical approaches to determination of permanent pool volume have been developed. However, there is little empirical evidence to support these designs. Consequently, a simplified method (i.e., permanent pool volume equal to twice the water quality volume) is recommended.

Other design features do not increase the volume of a pond, but can increase the amount of time stormwater remains in the device and eliminate short-circuiting. Ponds should always be designed with a length-to-width ratio of at least 1.5:1, where feasible. In addition, the design should incorporate features to lengthen the flow path through the pond, such as underwater berms designed to create a longer route through the pond. Combining these two measures helps ensure that the entire pond volume is used to treat stormwater. Wet ponds with greater amounts of vegetation often have channels through the vegetated areas and contain dead areas where stormwater is restricted from mixing with the entire permanent pool, which can lead to less pollutant removal. Consequently, a pond with open water comprising about 75% of the surface area is preferred.

Design features are also incorporated to ease maintenance of both the forebay and the main pool of ponds. Ponds should be designed with a maintenance access to the forebay to ease this relatively routine (every 5–7 year) maintenance activity. In addition, ponds should generally have a drain to draw down the pond for vegetation harvesting or the more infrequent dredging of the main cell of the pond.

Cold climates present many challenges to designers of wet ponds. The spring snowmelt may have a high pollutant load and a large volume to be treated. In addition, cold winters may cause freezing of the permanent pool or freezing at inlets and outlets. Finally, high salt concentrations in runoff resulting from road salting, and sediment loads from road sanding, may impact pond vegetation as well as reduce the storage and treatment capacity of the pond.

One option to deal with high pollutant loads and runoff volumes during the spring snowmelt is the use of a seasonally operated pond to capture snowmelt during the winter and retain the permanent pool during warmer seasons. In this option, proposed by Oberts (1994), the pond has two water quality outlets, both equipped with gate valves. In the summer, the lower outlet is closed. During the fall and throughout the winter, the lower outlet is opened to draw down the permanent pool. As the spring melt begins, the lower outlet is closed to provide detention for the melt event. The manipulation of this system requires some labor and vigilance; a careful maintenance agreement should be confirmed.

Several other modifications may help to improve the performance of ponds in cold climates. Designers should consider planting the pond with salt-tolerant vegetation if the facility receives road runoff. In order to counteract the effects of freezing on inlet and outlet structures, the use of inlet and outlet structures that are resistant to frost, including weirs and larger diameter pipes, may be

useful. Designing structures on-line, with a continuous flow of water through the pond, will also help prevent freezing of these structures. Finally, since freezing of the permanent pool can reduce the effectiveness of pond systems, it is important to incorporate extended detention into the design to retain usable treatment area above the permanent pool when it is frozen.

Summary of Design Recommendations

(1) Facility Sizing – The basin should be sized to hold the permanent pool as well as the required water quality volume. The volume of the permanent pool should equal twice the water quality volume.

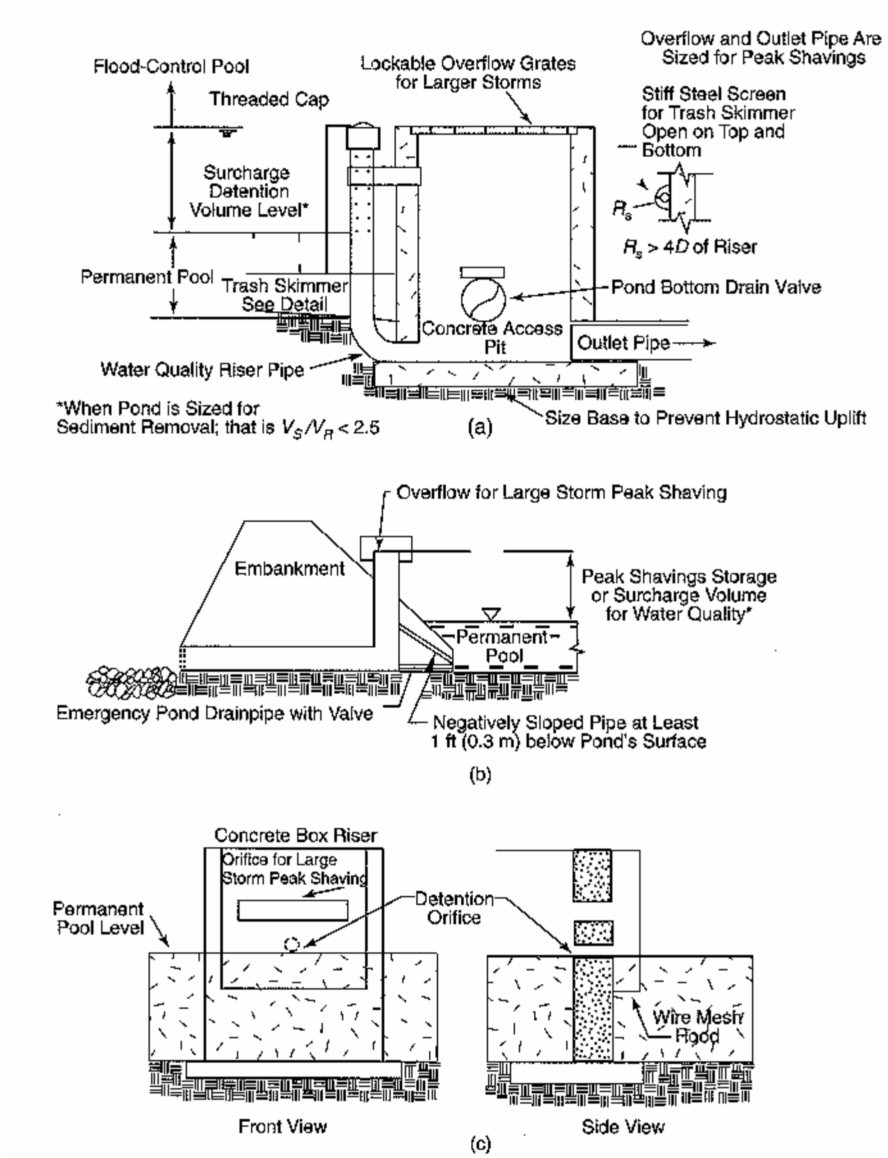
(2) Pond Configuration - The wet basin should be configured as a two stage facility with a sediment forebay and a main pool. The basins should be wedge-shaped, narrowest at the inlet and widest at the outlet. The minimum length to width ratio should be 1.5 where feasible. The perimeter of all permanent pool areas with depths of 4.0 feet or greater should be surrounded by an aquatic bench. This bench should extend inward 5-10 feet from the perimeter of the permanent pool and should be no more than 18 inches below normal depth. The area of the bench should not exceed about 25% of pond surface. The depth in the center of the basin should be 4 – 8 feet deep to prevent vegetation from encroaching on the pond open water surface.

(3) Pond Side Slopes - Side slopes of the basin should be 3:1 (H:V) or flatter for grass stabilized slopes. Slopes steeper than 3:1 should be stabilized with an appropriate slope stabilization practice.

(4) Sediment Forebay - A sediment forebay should be used to isolate gross sediments as they enter the facility and to simplify sediment removal. The sediment forebay should consist of a separate cell formed by an earthen berm, gabion, or loose riprap wall. The forebay should be sized to contain 15 to 25% of the permanent pool volume and should be at least 3 feet deep. Exit velocities from the forebay should not be erosive. Direct maintenance access should be provided to the forebay. The bottom of the forebay may be hardened (concrete) to make sediment removal easier. A fixed vertical sediment depth marker should be installed in the forebay to measure sediment accumulation.

(5) Outflow Structure - Figure 2 presents a schematic representation of suggested outflow structures. The outlet structure should be designed to drain the water quality volume over 24 hours with the orifice sized according to the equation presented in the Extended Detention Basin fact sheet. The facility should have a separate drain pipe with a manual valve that can completely or partially drain the pond for maintenance purposes. To allow for possible sediment accumulation, the submerged end of the pipe should be protected, and the drain pipe should be sized to drain the pond within 24 hours. The valve should be located at a point where it can be operated in a safe and convenient manner.

For on-line facilities, the principal and emergency spillways must be sized to provide 1.0 foot of freeboard during the 25-year event and to safely pass the 100-year flood. The embankment should be designed in accordance with all relevant specifications for small dams.



(6) Splitter Box - When the pond is designed as an off-line facility, a splitter structure is used to isolate the water quality volume. The splitter box, or other flow diverting approach, should be designed to convey the 25-year event while providing at least 1.0 foot of freeboard along pond side slopes.

(7) Vegetation - A plan should be prepared that indicates how aquatic and terrestrial areas will be vegetatively stabilized. Wetland vegetation elements should be placed along the aquatic bench or in the shallow portions of the permanent pool. The optimal elevation for planting of wetland vegetation is within 6 inches vertically of the normal pool elevation. A list of some wetland vegetation native to California is presented in Table 1.

Table 1 California Wetland Vegetation	
Botanical Name	**Common Name**
BACCHARIS SALICIFOLIA	MULE FAT
FRANKENIA GRANDIFOLIA	HEATH
SALIX GOODINGII	BLACK WILLOW
SALIX LASIOLEPIS	ARROYO WILLOW
SAMUCUS MEXICANUS	MEXICAN ELDERBERRY
HAPLOPAPPUS VENETUS	COAST GOLDENBRUSH
DISTICHIS SPICATA	SALT GRASS
LIMONIUM CALIFORNICUM	COASTAL STATICE
ATRIPLEX LENTIFORMIS	COASTAL QUAIL BUSH
BACCHARIS PILULARIS	CHAPARRAL BROOM
MIMULUS LONGIFLORUS	MONKEY FLOWER
SCIRPUS CALIFORNICUS	BULRUSH
SCIRPUS ROBUSTUS	BULRUSH
TYPHA LATIFOLIA	BROADLEAF CATTAIL
JUNCUS ACUTUS	RUSH

Maintenance

The amount of maintenance required for a wet pond is highly dependent on local regulatory agencies, particular health and vector control agencies. These agencies are often extremely concerned about the potential for mosquito breeding that may occur in the permanent pool. Even though mosquito fish (*Gambusia affinis*) were introduced into a wet pond constructed by Caltrans in the San Diego area, mosquito breeding was routinely observed during inspections. In addition, the vegetation at this site became sufficiently dense on the bench around the edge of the pool that mosquito fish were unable to enter this area to feed upon the mosquito larvae. The vegetation at this site was particularly vigorous because of the high nutrient concentrations in the perennial base flow (15.5 mg/L NO3-N) and the mild climate, which permitted growth year round. Consequently, the vector control agency required an annual harvest of vegetation to address this situation. This harvest can be very expensive.

On the other hand, routine harvesting may increase nutrient removal and prevent the export of these constituents from dead and dying plants falling in the water. A previous study (Faulkner and Richardson, 1991) documented dramatic reductions in nutrient removal after the first several years of operation and related it to the vegetation achieving a maximum density. That content then decreases through the growth season, as the total biomass increases. In effect, the total amount of

nutrients/m2 of wetland remains essentially the same from June through September, when the plants start to put the P back into the rhizomes. Therefore harvesting should occur between June and September. Research also suggests that harvesting only the foliage is less effective, since a very small percentage of the removed nutrients is taken out with harvesting.

Since wet ponds are often selected for their aesthetic considerations as well as pollutant removal, they are often sited in areas of high visibility. Consequently, floating litter and debris are removed more frequently than would be required simply to support proper functioning of the pond and outlet. This is one of the primary maintenance activities performed at the Central Market Pond located in Austin, Texas. In this type of setting, vegetation management in the area surrounding the pond can also contribute substantially to the overall maintenance requirements.

One normally thinks of sediment removal as one of the typical activities performed at stormwater BMPs. This activity does not normally constitute one of the major activities on an annual basis. At the concentrations of TSS observed in urban runoff from stable watersheds, sediment removal may only be required every 20 years or so. Because this activity is performed so infrequently, accurate costs for this activity are lacking.

In addition to regular maintenance activities needed to maintain the function of wet ponds, some design features can be incorporated to ease the maintenance burden. In wet ponds, maintenance reduction features include techniques to reduce the amount of maintenance needed, as well as techniques to make regular maintenance activities easier.

One potential maintenance concern in wet ponds is clogging of the outlet. Ponds should be designed with a non-clogging outlet such as a reverse-slope pipe, or a weir outlet with a trash rack. A reverse-slope pipe draws from below the permanent pool extending in a reverse angle up to the riser and establishes the water elevation of the permanent pool. Because these outlets draw water from below the level of the permanent pool, they are less likely to be clogged by floating debris.

Typical maintenance activities and frequencies include:

- Schedule semiannual inspections for burrows, sediment accumulation, structural integrity of the outlet, and litter accumulation.

- Remove accumulated trash and debris in the basin at the middle and end of the wet season. The frequency of this activity may be altered to meet specific site conditions and aesthetic considerations.

- Where permitted by the Department of Fish and Game or other agency regulations, stock wet ponds/constructed wetlands regularly with mosquito fish (*Gambusia spp.*) to enhance natural mosquito and midge control.

- Introduce mosquito fish and maintain vegetation to assist their movements to control mosquitoes, as well as to provide access for vector inspectors. An annual vegetation harvest in summer appears to be optimum, in that it is after the bird breeding season, mosquito fish can provide the needed control until vegetation reaches late summer density, and there is time for re-growth for runoff treatment purposes before the wet season. In certain cases, more frequent plant harvesting may be required by local vector control agencies.

- Maintain emergent and perimeter shoreline vegetation as well as site and road access to facilitate vector surveillance and control activities.

- Remove accumulated sediment in the forebay and regrade about every 5-7 years or when the accumulated sediment volume exceeds 10 percent of the basin volume. Sediment removal may not be required in the main pool area for as long as 20 years.

Cost

Construction Cost

Wet ponds can be relatively inexpensive stormwater practices; however, the construction costs associated with these facilities vary considerably. Much of this variability can be attributed to the degree to which the existing topography will support a wet pond, the complexity and amount of concrete required for the outlet structure, and whether it is installed as part of new construction or implemented as a retrofit of existing storm drain system.

A recent study (Brown and Schueler, 1997) estimated the cost of a variety of stormwater management practices. The study resulted in the following cost equation, adjusting for inflation:

$$C = 24.5^{V0.705}$$

where:

C = Construction, design and permitting cost;

V = Volume in the pond to include the 10-year storm (ft^3).

Using this equation, typical construction costs are:

$45,700 for a 1 acre-foot facility

$232,000 for a 10 acre-foot facility

$1,170,000 for a 100 acre-foot facility

In contrast, Caltrans (2002) reported spending over $448,000 for a pond with a total permanent pool plus water quality volume of only 1036 m^3 (0.8 ac.-ft.), while the City of Austin spent $584,000 (including design) for a pond with a permanent pool volume of 3,100 m^3 (2.5 ac.-ft.). The large discrepancies between the costs of these actual facilities and the model developed by Brown and Schueler indicate that construction costs are highly site specific, depending on topography, soils, subsurface conditions, the local labor, rate and other considerations.

Maintenance Cost

For ponds, the annual cost of routine maintenance has typically been estimated at about 3 to 5 percent of the construction cost; however, the published literature is almost totally devoid of actual maintenance costs. Since ponds are long-lived facilities (typically longer than 20 years), major maintenance activities are unlikely to occur during a relatively short study.

Caltrans (2002) estimated annual maintenance costs of $17,000 based on three years of monitoring of a pond treating runoff from 1.7 ha. Almost all the activities are associated with the annual vegetation harvest for vector control. Total cost at this site falls within the 3-5% range reported

above; however, the construction costs were much higher than those estimated by Brown and Schueler (1997). The City of Austin has been reimbursing a developer about $25,000/yr for wet pond maintenance at a site located at a very visible location. Maintenance costs are mainly the result of vegetation management and litter removal. On the other hand, King County estimates annual maintenance costs at about $3,000 per pond; however, this cost likely does not include annual extensive vegetation removal. Consequently, maintenance costs may vary considerably at sites in California depending on the aggressiveness of the vegetation management in that area and the frequency of litter removal.

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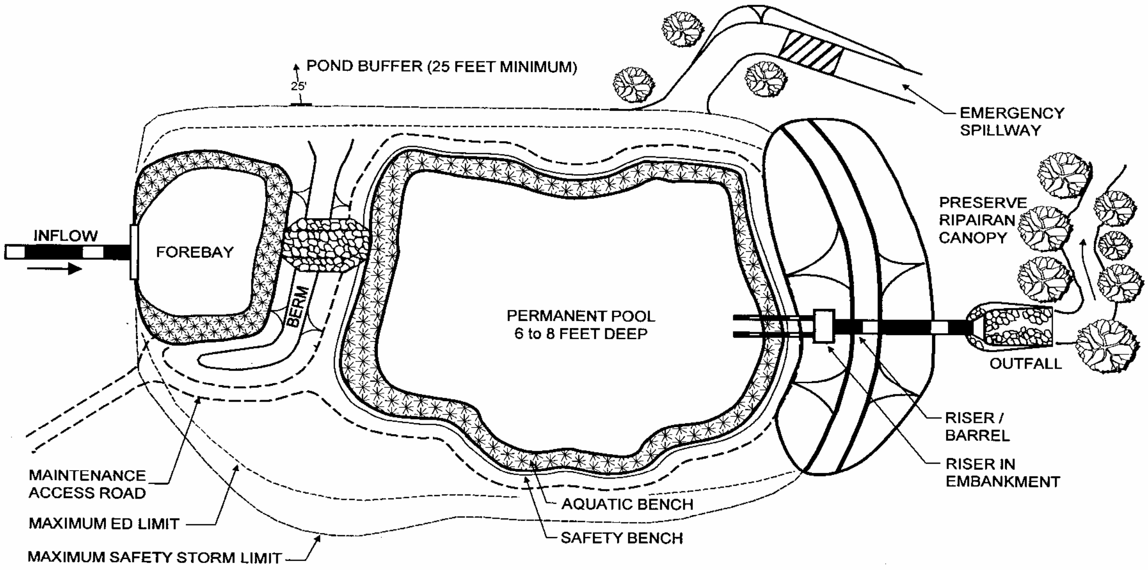
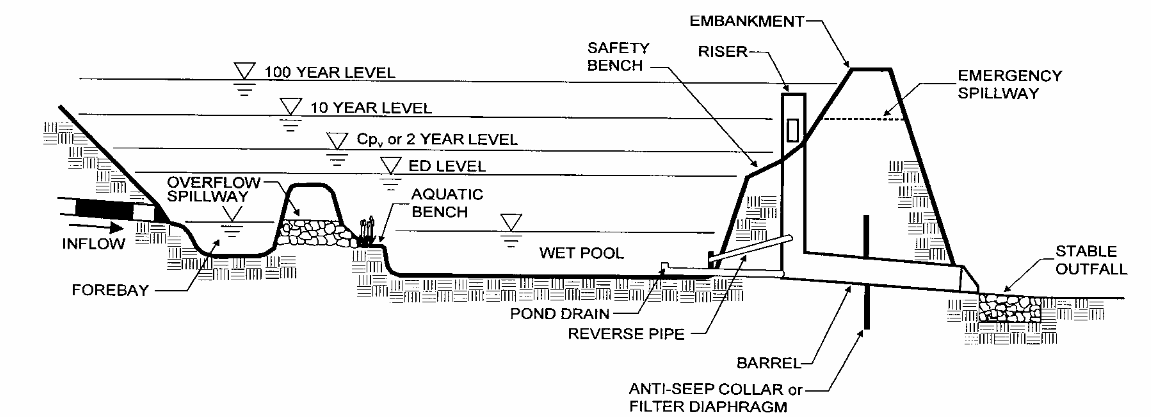
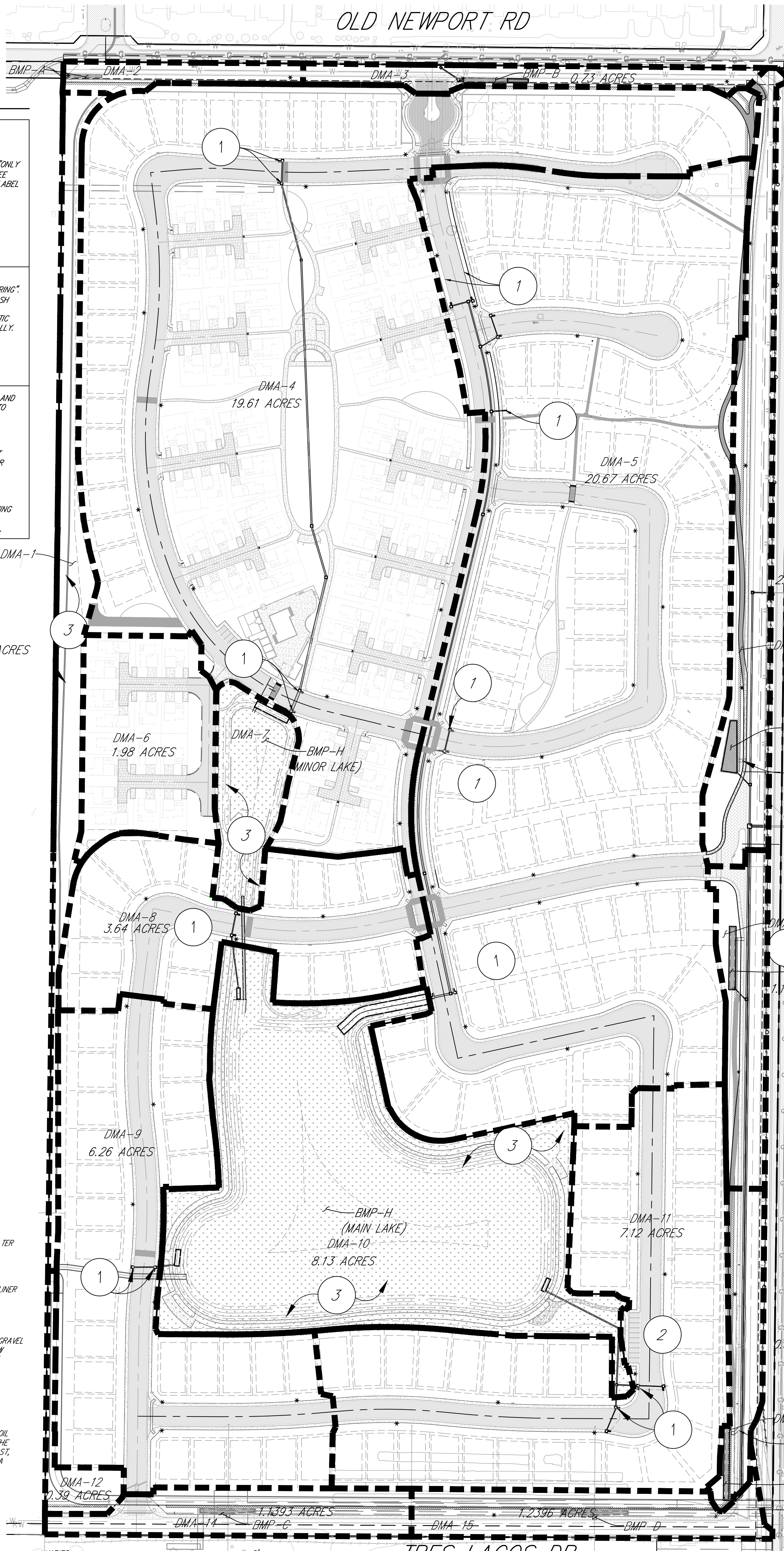


PLAN VIEW



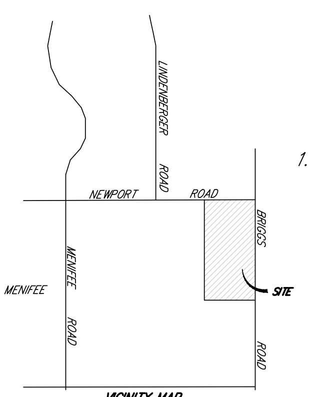
PROFILE

TENTATIVE DMA MAP
ROCKPORT RANCH



SOURCE CONTROL

POTENTIAL SOURCES OF RUNOFF POLLUTANS	PERMANENT CONTROLS
STORM DRAIN INLETS 1	MARK ALL INLETS WITH THE WORDS "ONLY RAIN DOWN THE STORM DRAIN" SEE APPENDIX 8 IN WQMP REPORT FOR LABEL DETAILS.
PUBLIC PLAZAS, SIDEWALKS, AND PARKING LOTS 2	• SIGN WITH THE WORDS "NO LITTERING". • "TRASH BINS" SIGNS NEARBY TRASH BINS. • COVERED TRASH BINS WITH PLASTIC BAG INSIDE LOCATED STRATEGICALLY. • STREET SWEEPING.
LANDSCAPE/ OUTDOOR PESTICIDE USE 3	• EXISTING NATIVE TREES, SHRUBS, AND GROUND COVER ARE PRESERVED TO THE MAXIMUM EXTENT POSSIBLE. • LANDSCAPING IS DESIGNED TO MINIMIZE IRRIGATION AND RUNOFF, AND TO MINIMIZE THE USE OF FERTILIZERS AND PESTICIDES THAT CAN CONTRIBUTE TO STORM WATER POLLUTION. • FOR THE LANDSCAPING IN THE BIO-RETENTION AREAS USE CALIFORNIAN DROUGHT TOLERANT NATIVE GRASSES SUCH AS: HUMMING BIRD SAGE, COMMON YARROW, POLYPODY FERN AND/OR FUSCHIA.



VICINITY MAP
NOT TO SCALE
THOMAS GUIDE PG. 868 C-3

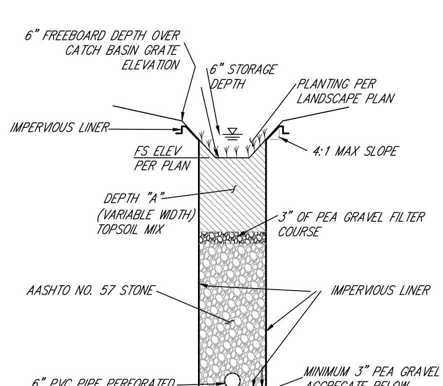
BIORETENTION

WET POND

CONCRETE

A/C SURFACE

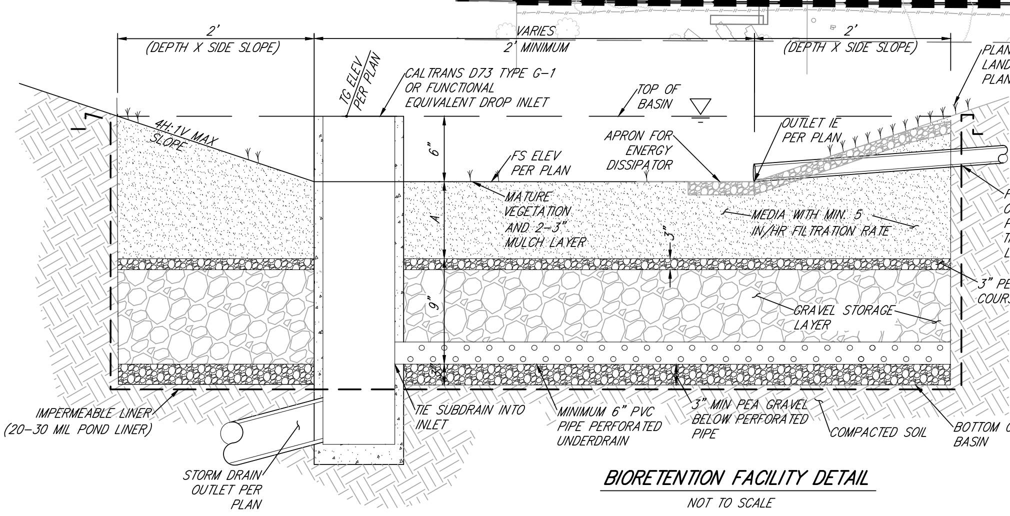
DMA BOUNDARY



BIORETENTION FACILITY DETAIL
TYPICAL SECTION
NOT TO SCALE

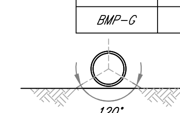
NOTE: ENGINEERED SOIL MEDIA REQUIREMENTS
85% MINERAL COMPONENT, 15% ORGANIC COMPONENT.
MINERAL COMPONENT SHALL BE CLASS A SANDY LOAM TOPSOIL THAT CONTAINS 70-80% SAND, 15-20% SILT, 5-10% CLAY. THE ORGANIC COMPONENT SHALL BE NITROGEN STABILIZED COMPOST, SUCH THAT THE NITROGEN DOES NOT LEACH FROM THE MEDIA

PEA GRAVEL REQUIREMENTS ASTM C-C33 3/8" CRUSHED AGGREGATE (OR EQUIVALENT)



BIORETENTION FACILITY DETAIL
NOT TO SCALE

BIORETENTION FACILITY SOIL MEDIA DEPTH	
BMP ID	DIMENSION "A" MEDIA (INCH)
BMP-A	36
BMP-B	21
BMP-C	24
BMP-D	18
BMP-E	18
BMP-F	18
BMP-G	18



6" PVC PIPE PERFORATION UNDERDRAIN LAYOUT DETAIL
NOT TO SCALE

BMP NAME	TYPE	PUBLIC/PRIVATE	RESPONSIBLE PARTY	FUNDED BY
BMP-A	BIORETENTION	PUBLIC	CITY OF MENIFEE	COMMUNITY FACILITIES DISTRICT
BMP-B	BIORETENTION	PUBLIC	CITY OF MENIFEE	COMMUNITY FACILITIES DISTRICT
BMP-C	BIORETENTION	PUBLIC	CITY OF MENIFEE	COMMUNITY FACILITIES DISTRICT
BMP-D	BIORETENTION	PUBLIC	CITY OF MENIFEE	COMMUNITY FACILITIES DISTRICT
BMP-E	BIORETENTION	PUBLIC	CITY OF MENIFEE	COMMUNITY FACILITIES DISTRICT
BMP-F	BIORETENTION	PUBLIC	CITY OF MENIFEE	COMMUNITY FACILITIES DISTRICT
BMP-G	BIORETENTION	PUBLIC	CITY OF MENIFEE	COMMUNITY FACILITIES DISTRICT
BMP-H	BIORETENTION	PRIVATE	FUTURE HOA	FUTURE HOA

SCALE: 1"=100'
0 100 200 300 400

EXCEL ENGINEERING
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PH (760)745-8118 FX (760)745-1890

FOR:
W.O.
DATE:
DEVELOPER:
RECOMMENDED FOR APPROVAL
DATE:
CHECKED BY:
DATE:

Appendix 10: Educational Materials

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

After the Storm

A Citizen's Guide to Understanding Stormwater

For more information contact:

or visit

www.epa.gov/npdes/stormwater

www.epa.gov/nps

United States Environmental Protection Agency

EPA 833-B-03-002

January 2003

Internet Address (URL) ● HTTP://www.epa.gov
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Oil Based Inks on 100% Postconsumer,
Process Chlorine Free Recycled Paper

THE YEAR OF CLEAN WATER

Celebration + Recommitment

WHEN IT RAINS IT DRAINS

What is stormwater runoff?

Stormwater runoff occurs when precipitation from rain or snowmelt flows over the ground. Impervious surfaces like driveways, sidewalks, and streets prevent stormwater from naturally soaking into the ground.

Why is stormwater runoff a problem?

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

The effects of pollution

Polluted stormwater runoff can have many adverse effects on plants, fish, animals, and people.

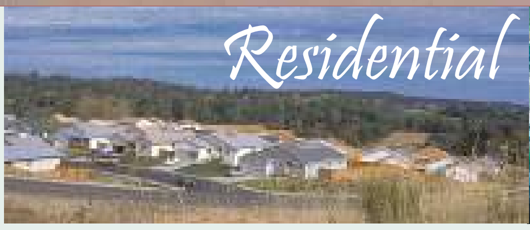
- Sediment can cloud the water and make it difficult or impossible for aquatic plants to grow. Sediment also can destroy aquatic habitats.
- Excess nutrients can cause algae blooms. When algae die, they sink to the bottom and decompose in a process that removes oxygen from the water. Fish and other aquatic organisms can't exist in water with low dissolved oxygen levels.
- Bacteria and other pathogens can wash into swimming areas and create health hazards, often making beach closures necessary.

- Debris—plastic bags, six-pack rings, bottles, and cigarette butts—washed into waterbodies can choke, suffocate, or disable aquatic life like ducks, fish, turtles, and birds.
- Household hazardous wastes like insecticides, pesticides, paint, solvents, used motor oil, and other auto fluids can poison aquatic life. Land animals and people can become sick or die from eating diseased fish and shellfish or ingesting polluted water.
- Polluted stormwater often affects drinking water sources. This, in turn, can affect human health and increase drinking water treatment costs.

Stormwater Pollution Solutions

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




Recycle or properly dispose of household products that contain chemicals, such as insecticides, pesticides, paint, solvents, and used motor oil and other auto fluids. Don't pour them onto the ground or into storm drains.

Lawn care

Excess fertilizers and pesticides applied to lawns and gardens wash off and pollute streams. In addition, yard clippings and leaves can wash into storm drains and contribute nutrients and organic matter to streams.

- Don't overwater your lawn. Consider using a soaker hose instead of a sprinkler.
- Use pesticides and fertilizers sparingly. When use is necessary, use these chemicals in the recommended amounts. Use organic mulch or safer pest control methods whenever possible.
- Compost or mulch yard waste. Don't leave it in the street or sweep it into storm drains or streams.
- Cover piles of dirt or mulch being used in landscaping projects.

Auto care

Washing your car and degreasing auto parts at home can send detergents and other contaminants through the storm sewer system. Dumping automotive fluids into storm drains has the same result as dumping the materials directly into a waterbody.

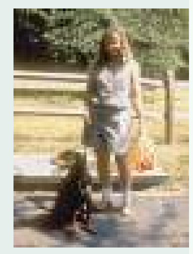
- Use a commercial car wash that treats or recycles its wastewater, or wash your car on your yard so the water infiltrates into the ground.
- Repair leaks and dispose of used auto fluids and batteries at designated drop-off or recycling locations.

Septic systems

Leaking and poorly maintained septic systems release nutrients and pathogens (bacteria and viruses) that can be picked up by stormwater and discharged into nearby waterbodies. Pathogens can cause public health problems and environmental concerns.

- Inspect your system every 3 years and pump your tank as necessary (every 3 to 5 years).
- Don't dispose of household hazardous waste in sinks or toilets.

Pet waste



Pet waste can be a major source of bacteria and excess nutrients in local waters.

- When walking your pet, remember to pick up the waste and dispose of it properly. Flushing pet waste is the best disposal method. Leaving pet waste on the ground increases public health risks by allowing harmful bacteria and nutrients to wash into the storm drain and eventually into local waterbodies.

Residential landscaping

Permeable Pavement—Traditional concrete and asphalt don't allow water to soak into the ground. Instead these surfaces rely on storm drains to divert unwanted water. Permeable pavement systems allow rain and snowmelt to soak through, decreasing stormwater runoff.

Rain Barrels—You can collect rainwater from rooftops in mosquito-proof containers. The water can be used later on lawn or garden areas.

Rain Gardens and Grassy Swales—Specially designed areas planted with native plants can provide natural places for rainwater to collect and soak into the ground. Rain from rooftop areas or paved areas can be diverted into these areas rather than into storm drains.

Vegetated Filter Strips—Filter strips are areas of native grass or plants created along roadways or streams. They trap the pollutants stormwater picks up as it flows across driveways and streets.

Commercial

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

- Sweep up litter and debris from sidewalks, driveways and parking lots, especially around storm drains.
- Cover grease storage and dumpsters and keep them clean to avoid leaks.
- Report any chemical spill to the local hazardous waste cleanup team. They'll know the best way to keep spills from harming the environment.

Construction

Erosion controls that aren't maintained can cause excessive amounts of sediment and debris to be carried into the stormwater system. Construction vehicles can leak fuel, oil, and other harmful fluids that can be picked up by stormwater and deposited into local waterbodies.

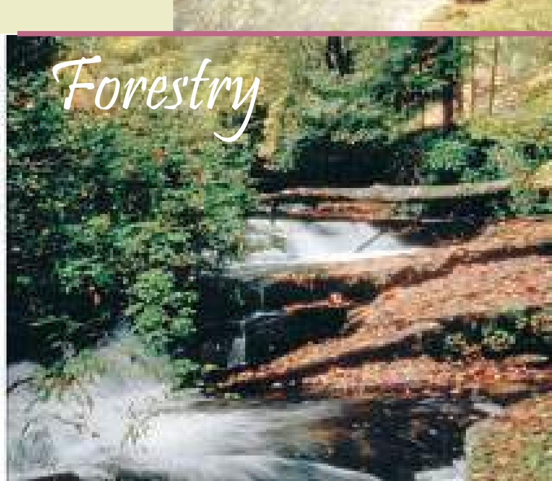
- Divert stormwater away from disturbed or exposed areas of the construction site.
- Install silt fences, vehicle mud removal areas, vegetative cover, and other sediment and erosion controls and properly maintain them, especially after rainstorms.
- Prevent soil erosion by minimizing disturbed areas during construction projects, and seed and mulch bare areas as soon as possible.

Agriculture

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

- Keep livestock away from streambanks and provide them a water source away from waterbodies.
- Store and apply manure away from waterbodies and in accordance with a nutrient management plan.
- Vegetate riparian areas along waterways.
- Rotate animal grazing to prevent soil erosion in fields.
- Apply fertilizers and pesticides according to label instructions to save money and minimize pollution.

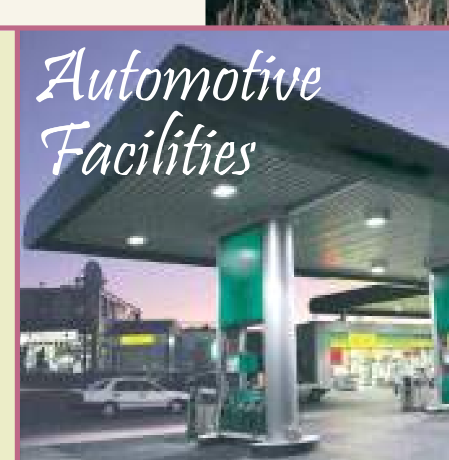
Forestry



Improperly managed logging operations can result in erosion and sedimentation.

- Conduct preharvest planning to prevent erosion and lower costs.
- Use logging methods and equipment that minimize soil disturbance.
- Plan and design skid trails, yard areas, and truck access roads to minimize stream crossings and avoid disturbing the forest floor.
- Construct stream crossings so that they minimize erosion and physical changes to streams.
- Expedite revegetation of cleared areas.

Automotive Facilities



Uncovered fueling stations allow spills to be washed into storm drains. Cars waiting to be repaired can leak fuel, oil, and other harmful fluids that can be picked up by stormwater.

- Clean up spills immediately and properly dispose of cleanup materials.
- Provide cover over fueling stations and design or retrofit facilities for spill containment.
- Properly maintain fleet vehicles to prevent oil, gas, and other discharges from being washed into local waterbodies.
- Install and maintain oil/water separators.

StormWater Pollution . . . What You Should Know

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

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

Stormwater runoff is a part of the natural hydrologic process. However, land development and construction activities can significantly alter natural drainage processes and introduce pollutants into stormwater runoff. Polluted stormwater runoff from construction sites has been identified as a major source of water pollution in California. It jeopardizes the quality of our local waterways and can pose a serious threat to the health of our aquatic ecosystems.

The Cities and County of Riverside StormWater/CleanWater Protection Program

Because 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 on pollution prevention activities. This pamphlet describes various Best Management Practices (BMPs) that construction site operators can use to prevent stormwater pollution.

In accordance with applicable federal and state law, the Cities and County of Riverside have adopted ordinances for stormwater management and discharge control that **prohibit** the discharge of pollutants into the storm drain system or local surface water. This includes discharges from construction sites containing sediment, concrete, mortar, paint, solvents, lubricants, vehicle fluids, fuel, pesticides, and construction debris.

PLEASE NOTE: The Federal, State and local regulations strictly prohibit the discharge of sediment and pollutants into the streets, the storm drain system or waterways. As an owner, operator or supervisor of a construction site, you may be held financially responsible for any environmental damage caused by your subcontractors or employees.

STORMWATER POLLUTION FROM CONSTRUCTION ACTIVITIES

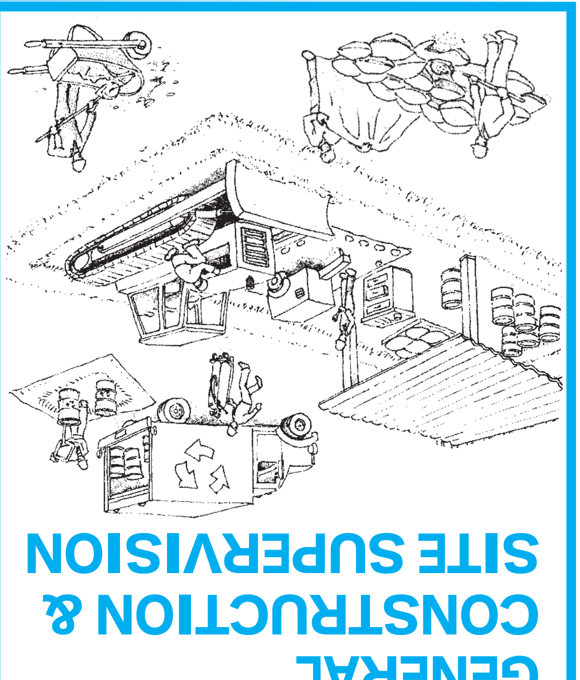
The two most common sources of stormwater pollution problems associated with construction activities are ***erosion*** and ***sedimentation***. Failure to maintain adequate erosion and sediment controls at construction sites often results in sediment discharges into the storm drain system, creating multiple problems once it enters local waterways.

Construction vehicles and heavy equipment can also track significant amounts of mud and sediment onto adjacent streets. Additionally, wind may transport construction materials and wastes into streets storm drains, or directly into our local waterways.

StormWater Pollution

What you should know for...

GENERAL CONSTRUCTION & SITE SUPERVISION



Best Management Practices (BMPs) for:

- Developers
- General Contractors
- Home Builders
- Construction Inspectors
- Anyone in the construction business

To report a hazardous materials spill, call:

Riverside County Hazardous Materials Emergency Response Team
(909) 358-5055 8:00 a.m. – 5:00 p.m.
(909) 358-5245 after 5:00 p.m.

In an emergency call: **911**

For recycling and hazardous waste disposal, call:

(909) 358-5055

To report an illegal dumping or a clogged storm drain, call:

1-800-506-2555

To order additional brochures or to obtain information on other pollution prevention activities, please call (909) 955-1200 or visit the StormWater/CleanWater Protection Program website at:
www.co.riverside.ca.us/depts/flood/waterquality npdes.asp

StormWater CleanWater
PROTECTION PROGRAM

The StormWater/CleanWater Protection Program gratefully acknowledges the Santa Clara Valley Nonpoint Pollution Control Program, Alameda Countywide CleanWater Program and the City of Los Angeles Stormwater Management Division for information provided in this brochure.

Resources

State Water Resources Control Board
Division of Water Quality
1001 I Street
Sacramento CA 95814
(916) 341-5455
www.swrcb.ca.gov/stormwtr/

Colorado River Basin Regional Water Quality Control Board - Region 7
73-720 Fred Waring Drive, Suite 100
Palm Desert, CA 92260
(760) 346-7491
www.swrcb.ca.gov/~rwqcb7/

Santa Ana Regional Water Quality Control Board - Region 8
3737 Main Street, Suite 500
Riverside, CA 92501-3348
(909) 782-4130
www.swrcb.ca.gov/~rwqcb8/

San Diego Regional Water Quality Control Board - Region 9
9771 Clairemont Mesa Blvd., Suite A
San Diego, CA 92124
(858) 467-2952
www.swrcb.ca.gov/~rwqcb9/

What Should You Do?

Advance Planning to Prevent Pollution

- ❑ Remove existing vegetation only as needed.
- ❑ Schedule excavation, grading, and paving operations for dry weather periods, if possible.
- ❑ Designate a specific area of the construction site, well away from storm drain inlets or watercourses, for material storage and equipment maintenance.
- ❑ Develop and implement an effective combination of erosion and sediment controls for the construction site.
- ❑ Practice source reduction by ordering only the amount of materials that are needed to finish the project.
- ❑ Educate your employees and subcontractors about stormwater management requirements and their pollution prevention responsibilities.
- ❑ Control the amount of surface runoff at the construction site by impeding internally generated flows and using berms or drainage ditches to direct incoming offsite flows to go around the site. ***Note:*** *Consult local drainage policies for more information.*

Best Management Practices

The following Best Management Practices (BMPs) can significantly reduce pollutant discharges from your construction site. Compliance with stormwater regulations can be as simple as minimizing stormwater contact with potential pollutants by providing covers and secondary containment for construction materials, designating areas away from storm drain systems for storing equipment and materials and implementing good housekeeping practices at the construction site.

- ❑ Protect all storm drain inlets and streams located near the construction site to prevent sediment-laden water from entering the storm drain system.
- ❑ Limit access to and from the site. Stabilize construction entrances/exits to minimize the track out of dirt and mud onto adjacent streets. Conduct frequent street sweeping.
- ❑ Protect stockpiles and construction materials from winds and rain by storing them under a roof, secured impermeable tarp or plastic sheeting.
- ❑ Avoid storing or stockpiling materials near storm drain inlets, gullies or streams.
- ❑ Phase grading operations to limit disturbed areas and duration of exposure.
- ❑ Perform major maintenance and repairs of vehicles and equipment offsite.
- ❑ Wash out concrete mixers only in designated washout areas at the construction site.
- ❑ Set-up and operate small concrete mixers on tarps or heavy plastic drop cloths.
- ❑ Keep construction sites clean by removing trash, debris, wastes, etc. on a regular basis.
- ❑ Clean-up spills immediately using dry clean-up methods (e.g., absorbent materials such as cat litter, sand or rags for liquid spills; sweeping for dry spills such as cement, mortar or fertilizer) and by removing the contaminated soil from spills on dirt areas. .
- ❑ Prevent erosion by implementing any or a combination of soil stabilization practices such as mulching, surface roughening, permanent or temporary seeding.
- ❑ Maintain all vehicles and equipment in good working condition. Inspect frequently for leaks, and repair promptly.
- ❑ Practice proper waste disposal. Many construction materials and wastes, including solvents, water-based paint, vehicle fluids, broken asphalt and concrete, wood, and cleared vegetation can be recycled. Materials that cannot be recycled must be taken to an appropriate landfill or disposed of as hazardous waste.
- ❑ Cover open dumpsters with secured tarps or plastic sheeting. Never clean out a dumpster by washing it down on the construction site.
- ❑ Arrange for an adequate debris disposal schedule to insure that dumpsters do not overflow.

General Construction Activities Stormwater Permit

(Construction Activities General Permit)

The State Water Resources Control Board (SWRCB) adopted a new Construction Activities General Permit (WQ Order No. 99-08DWQ) on August 19, 1999, superseding the now expired SWRCB statewide General Permit (WQ Order No. 92-08DWQ). This permit is administered and enforced by the SWRCB and the local Regional Water Quality Control Boards (RWQCB). The updated Construction Activities General Permit establishes a number of new stormwater management requirements for construction site operator.

NOTE: *Some construction activies stormwater permits are issued on a regional basis. Consult your local RWQCB to find out if your project requires coverage under any of these permits.*

Frequently Asked Questions:

Does my construction site require coverage under the Construction Activities General Permit?

Yes, if construction activity results in the disturbance of five or more acres of total land area or is part of a common plan of development that results in the disturbance of five or more acres.

How do I obtain coverage under the Construction Activities General Permit?

Obtain the permit package and submit the completed Notice of Intent (NOI) form to the SWRCB prior to grading or disturbing soil at the construction site. For ongoing construction activity involving a change of ownership, the new owner must submit a new NOI within 30 days of the date of change of ownership. The completed NOI along with the required fee should be mailed to the SWRCB.

What must I do to comply with the requirements of the Construction Activities General Permit?

- Implement BMPs for non-stormwater discharges year-round.
- Prepare and implement a Stormwater Pollution Prevention Plan (SWPPP) prior to commencing construction activities.
- Keep a copy of the SWPPP at the construction site for the entire duration of the project.
- Calculate the anticipated stormwater run-off.
- Implement an effective combination of erosion and sediment control on all soil disturbed areas.
- Conduct site inspections prior to anticipated storm events, every 24-hours during extended storm events, and after actual storm event.
- Perform repair and maintenance of BMPs as soon as possible after storm events depending upon worker safety.
- Update the SWPPP as needed, to manage pollutants or reflect changes in site conditions.
- Include description of post construction BMPs at the construction site, including parties responsible for long-term maintenance.

NOTE: *Please refer to the Construction Activities General Permit for detailed information. You may contact the SWRCB, your local RWQCB, or visit the SWRCB website at www.swrcb.ca.gov/stormwtr/ to obtain a State Construction Activities Stormwater General Permit packet.*

How long is this Construction Activities General Permit in effect?

The Permit coverage stays in effect untilyou submit a Notice of Termination (NOT) to the SWRCB. For the purpose of submitting a NOT, all soil disturbing activities have to be completed and one of the three following criteria has to be met:

1. Change of ownership;
2. A uniform vegetative cover with 70 percent coverage has been established; or,
3. Equivalent stabilization measures such as the use of reinforced channel liners, soil cement, fiber matrices, geotextiles, etc., have been employed.

Stormwater and the Construction Industry

Protect Natural Features

Bad

Good

- Minimize clearing.
- Minimize the amount of exposed soil.
- Identify and protect areas where existing vegetation, such as trees, will not be disturbed by construction activity.
- Protect streams, stream buffers, wild woodlands, wetlands, or other sensitive areas from any disturbance or construction activity by fencing or otherwise clearly marking these areas.

Construction Phasing

- Sequence construction activities so that the soil is not exposed for long periods of time.
- Schedule or limit grading to small areas.
- Install key sediment control practices before site grading begins.
- Schedule site stabilization activities, such as landscaping, to be completed immediately after the land has been graded to its final contour.

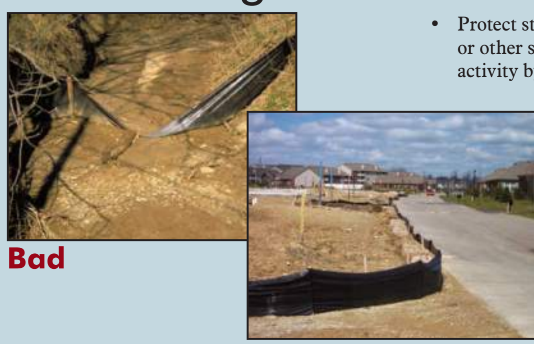
Vegetative Buffers

Bad

Good

- Protect and install vegetative buffers along waterbodies to slow and filter stormwater runoff.
- Maintain buffers by mowing or replanting periodically to ensure their effectiveness.

Silt Fencing



Bad

Good

- Inspect and maintain silt fences after each rainstorm.
- Make sure the bottom of the silt fence is buried in the ground.
- Securely attach the material to the stakes.
- Don't place silt fences in the middle of a waterway or use them as a check dam.
- Make sure stormwater is not flowing around the silt fence.

Maintain your BMPs!

IN RIVERSIDE COUNTY....Call 1-800-506-2555

TO REPORT ILLEGAL STORMDRAIN DISPOSAL

E-mail: Flood.fcnpdes@co.riverside.ca.us

Visit our website: www.floodcontrol.co.riverside.ca.us

Brought to you by the Storm Water/Clean Water Pollution Protection Program.....

REMEMBER, ONLY RAIN IN THE STORMDRAIN!

Site Stabilization

Bad

Good

- Vegetate, mulch, or otherwise stabilize all exposed areas as soon as land alterations have been completed.

Construction Entrances

Bad

Good

- Remove mud and dirt from the tires of construction vehicles before they enter a paved roadway.
- Properly size entrance BMPs for all anticipated vehicles.
- Make sure that the construction entrance does not become buried in soil.

Slopes

Bad

Good

- Rough grade or terrace slopes.
- Break up long slopes with sediment barriers, or under drain, or divert stormwater away from slopes.

Dirt Stockpiles

Bad

Good

- Cover or seed all dirt stockpiles.

Storm Drain Inlet Protection

Bad

Good

- Use rock or other appropriate material to cover the storm drain inlet to filter out trash and debris.
- Make sure the rock size is appropriate (usually 1 to 2 inches in diameter).
- If you use inlet filters, maintain them regularly.

www.epa.gov/npdes/menuofbmps

Stormwater and the Construction Industry

Planning and Implementing Erosion and Sediment Control Practices

The construction industry is a critical participant in the nation's efforts to protect streams, rivers, lakes, wetlands, and oceans. Through the use of best management practices (BMPs), construction site operators are the key defense against erosion and sedimentation.

As stormwater flows over a construction site, it picks up pollutants like sediment, debris, and chemicals. High volumes of stormwater can also cause stream bank erosion, and destroy downstream aquatic habitat. Preventing soil erosion and sedimentation is an important responsibility at all construction sites.

In addition to the environmental impact, uncontrolled erosion can have a significant financial impact on a construction project. It costs money and time to repair gullies, replace vegetation, clean sediment-clogged storm drains, replace poorly installed BMPs, and mitigate damage to other people's property or to natural resources.

Best Management Practice (BMP)
A BMP is a method used to prevent or control stormwater runoff and the discharge of pollutants, including sediment, into local waterbodies. Silt fences, inlet protection, and site-stabilization techniques are typical BMPs on a construction site.

Operator
An operator is someone who has control over and the ability to modify construction plans and specifications (e.g. owner, general contractor)

or

Someone who has control over the day-to-day operations at a site (e.g., owner, general contractor) that are necessary to ensure compliance with the permit requirements. It is the responsibility of a construction site owner or operator to contain stormwater runoff and prevent erosion during **all** stages of a project.

There may be more than one person at a site who meets these definitions and must apply for permit coverage. (States may have different definitions of the term "operator.")

So what's being done about polluted runoff?

The Clean Water Act includes the National Pollutant Discharge Elimination System (NPDES) permitting program. As of January 2003, 44 states and territories are authorized to issue NPDES stormwater permits. If your state isn't authorized to operate the NPDES stormwater permit program, EPA issues the permits. Permits vary from state to state, so contact your state or EPA for specific information. Your permitting authority has specific information on your state's NPDES stormwater permit program. In general, construction permits require construction operators to do all of the following:

- Develop and implement a stormwater pollution prevention plan
- Submit a permit application or notice of intent (NOI)
- Comply with the permit, including maintaining BMPs and inspecting the site

Under the NPDES program, construction activities that disturb 1 or more acres are required to obtain stormwater permit coverage. States have different names for the plans that construction operators must develop, such as

- Stormwater pollution prevention plan
- Erosion and sediment control plan
- Erosion control and stormwater management plan
- Stormwater management plan
- Water pollution control plan
- Pollution prevention plan

This document uses the term "*Plan*."

I think I need a permit... Where do I start?

All land-disturbing activities, including clearing, grading, and excavation, that disturb **1 or more acres** are required to be covered under a state or EPA-issued NPDES construction stormwater permit **prior to land disturbance**. Permit requirements vary by state. Begin by researching the specific requirements in your state. You might already be subject to local erosion and sediment control requirements, but that doesn't release you from the requirements of the NPDES program at the state or EPA level. Although you must comply with both sets of requirements, in most cases they have been designed to be complementary. Contact your permitting authority to find out exactly what you need to do. A good place to start your search is the Construction Industry Compliance Assistance web site at http://www.envcap.org/cica.

The NPDES permit requirements include small construction activities that are part of a larger common plan of development or sale, such as a single lot within a larger subdivision. For developments with multiple operators, all operators must have permit coverage for their individual parts of the larger development, no matter how large or small each operation happens to be. When there are multiple operators at one site, they're encouraged to develop and share one comprehensive Plan and obtain permit coverage as co-permitees.

The **owner or operator** of the construction site is responsible for complying with the requirements of the permit. Responsibilities include developing a Plan, obtaining permit coverage, implementing BMPs, and stabilizing the site at the end of the construction activity.

Construction sites that discharge unpermitted stormwater are in violation of the Clean Water Act and may be subject to fines of up to $27,500 a day per violation.

Determine your eligibility

All construction activity that disturbs 1 or more acres of land, as well as activity that disturbs less than 1 acre but is part of a larger common plan of development, must obtain permit coverage.

Read and understand your stormwater permit requirements

Get a copy of the permit for construction activities and a permit application (or notice of intent form) from your state or EPA permitting authority.

Develop a Plan

Most states do not require you to submit your Plan. However, you do need to keep the Plan on site. If that's impractical, you may post a notice that tells where the Plan is kept so it can be accessed by the permitting authority and other interested parties.

You'll need to post a copy of your completed application on site. Put it in a place where the public can see it so they'll know your site is covered by an NPDES permit!

Apply for permit coverage

Once you understand your permit requirements and have developed a Plan, you can submit a stormwater permit application (or notice of intent) to your permitting authority. This must be done before beginning any land disturbance on the site. Some states require a few days of lead time, so check with your permitting authority. Once you've submitted the application, you must satisfy the conditions of the permit.

Implement the Plan

Be prepared to implement the BMPs in your Plan before construction begins. Ensure that BMPs are properly maintained, and upgrade and repair them as necessary.

Developing and Implementing a Plan

You must have a Plan that includes erosion and sediment control and pollution prevention BMPs. These Plans require

- Advance planning and training to ensure proper implementation of the BMPs
- Erosion and sediment control BMPs in place until the area is permanently stabilized
- Pollution prevention BMPs to keep the construction site "clean"
- Regular inspection of the construction site to ensure proper installation and maintenance of BMPs

Fortunately, the practices and measures that must be included in your Plan are already part of the standard operating procedures at many construction sites.

Six steps are associated with developing and implementing a stormwater Plan. There's a wealth of information available on developing pollution prevention plans. Please contact your permitting authority for help in finding additional guidance materials, or visit www.epa.gov/npdes/stormwater. A sample construction plan is available at www.epa.gov/npdes/pubs/sample_swppp.pdf.

1. Site Evaluation and Design Development

- **Collect site information**
- **Develop site plan design**
- **Prepare pollution prevention site map**

The first step in preparing a Plan is to define the characteristics of the site and the type of construction that will occur. This involves collecting site information, identifying natural features that should be protected, developing a site plan design, describing the nature of the construction activity, and preparing a pollution prevention site map.

2. Assessment

- **Measure the site area**
- **Determine the drainage areas**
- **Calculate the runoff coefficient**

The next step is assessing the impact the project will have on stormwater runoff. Determine the drainage areas and estimate the runoff amounts and velocities. For more information on calculating the runoff coefficient, go to www.epa.gov/npdes/pubs/chap02_conguide.pdf, page 11.

3. Control Selection and Plan Design

- **Review and incorporate state or local requirements**
- **Select erosion and sediment controls**
- **Select other controls**
- **Select stormwater management controls**
- **Indicate the location of controls on the site map**
- **Prepare an inspection and maintenance plan**
- **Coordinate controls with construction activity**
- **Prepare sequence of major activities**

In the third step you'll actually document your procedures to prevent and control polluted stormwater runoff. You must delineate areas that will not be disturbed, including critical natural areas like streamside areas, floodplains, and trees. You must also identify the measures (or BMPs) you'll use to protect these areas.

Soil erosion control tips...

- Design the site to infiltrate stormwater into the ground and to keep it out of storm drains. Eliminate or minimize the use of stormwater collection and conveyance systems while maximizing the use of stormwater infiltration and bioretention techniques.
- Minimize the amount of exposed soil on site.
  - To the extent possible, plan the project in stages to minimize the amount of area that is bare and subject to erosion. The less soil exposed, the easier and cheaper it will be to control erosion.
  - Vegetate disturbed areas with permanent or temporary seeding immediately upon reaching final grade.
  - Vegetate or cover stockpiles that will not be used immediately.
- Reduce the velocity of stormwater both onto and away from the project area.
  - Interceptors, diversions, vegetated buffers, and check dams are a few of the BMPs that can be used to slow down stormwater as it travels across and away from the project site.
  - Diversion measures can also be used to direct flow away from exposed areas toward stable portions of the site.
  - Silt fences and other types of perimeter filters should never be used to reduce the velocity of runoff.
- Protect defined channels immediately with measures adequate to handle the storm flows expected.
  - Sod, geotextile, natural fiber, riprap, or other stabilization measures should be used to allow the channels to carry water without causing erosion. Use softer measures like geotextile or vegetation where possible to prevent downstream impacts.
- Keep sediment on site.
  - Place aggregate or stone at construction site vehicle exits to accommodate at least two tire revolutions of large construction vehicles. Much of the dirt on the tires will fall off before the vehicle gets to the street.
  - Regular street sweeping at the construction entrance will prevent dirt from entering storm drains. Do not hose paved areas.
  - Sediment traps and basins are temporary structures and should be used in conjunction with other measures to reduce the amount of erosion.
- Maintaining all BMPs is critical to ensure their effectiveness during the life of the project.
  - Regularily remove collected sediment from silt fences, berms, traps, and other BMPs.
  - Ensure that geotextiles and mulch remain in place until vegetation is well established.
  - Maintain fences that protect sensitive areas, silt fences, diversion structures, and other BMPs.

Phasing your project to minimize the amount of exposed soil at any given time is a highly effective way to prevent erosion. Erosion control measures designed to prevent soil from being mobilized include diversions to route stormwater away from exposed soils and stabilization with vegetation, mulch, and geotextiles. Sedimentation control measures designed to remove sediment from stormwater or prevent it from leaving the site include silt fences, sediment traps, and diversions.

You'll need to select erosion and sediment controls—including stabilization measures for protecting disturbed areas and structural controls for diverting runoff and removing sediment—that are appropriate for your particular site. The appropriateness of the control measures will depend on several factors, but will be influenced most directly by the site characteristics. Some stabilization measures you might consider are temporary seeding, permanent seeding, and mulching. Structural control measures include earth dikes, silt fences, and sediment traps. No single BMP will meet all of the erosion and sedimentation control needs of a construction site. A combination of BMPs is necessary. For more information on the types of BMPs appropriate for your construction site, see the BMP fact sheet series available at www.epa.gov/npdes/menuofbmps.

Other BMPs and Activities to Control Polluted Runoff

You'll need to select other controls to address potential pollutant sources on your site. Construction materials, debris, trash, fuel, paint, and stockpiles become pollution sources when it rains. Basic pollution prevention practices can significantly reduce the amount of pollution leaving construction sites. The following are some simple practices that should be included in the Plan and implemented on site:

- Keep potential sources of pollution out of the rain as practicable (e.g., inside a building, covered with plastic or tarps, or sealed tightly in a leak-proof container).
- Clearly identify a protected, lined area for concrete truck washouts. This area should be located away from streams, storm drain inlets, or ditches and should be cleaned out periodically.
- Park, refuel, and maintain vehicles and equipment in one area of the site to minimize the area exposed to possible spills and fuel storage. This area should be well away from streams, storm drain inlets, or ditches. Keep spill kits close by and clean up any spills or leaks immediately, including spills on pavement or earthen surfaces.
- Practice good housekeeping. Keep the construction site free of litter, construction debris, and leaking containers. Keep all waste in one area to minimize cleaning.
- Never hose down paved surfaces to clean dust, debris, or trash. This water could wash directly into storm drains or streams. Sweep up materials and dispose of them in the trash. Never bury trash or debris!
- Dispose of hazardous materials properly.

4. Certification and Notification

- **Certify the Plan**
- **Submit permit application or notice of intent**

Once the Plan has been developed, an authorized representative must sign it. Now is the time to submit the permit application or notice of intent. Your permit might require that the Plan be kept on site, so be sure to keep it available for the staff implementing the Plan.

Erosion and sedimentation control practices are only as good as their installation and maintenance.

5. Implementing and Maintaining a Plan

- **Implement controls**
- **Inspect and maintain controls**
- **Update/change the Plan**
- **Report releases of hazardous materials**

A Plan describes the practices and activities you'll use to prevent stormwater contamination and meet the NPDES permit requirements. Make sure that the Plan is implemented and that the Plan is updated as necessary to reflect changes on the site.

Erosion and sedimentation control practices are only as good as their installation and maintenance. Train the contractors that will install the BMPs and inspect immediately to ensure that the BMPs have been installed correctly.

Regularly inspect the BMPs (especially before and after rain events) and perform any necessary repairs or maintenance immediately. Many BMPs are designed to handle a limited amount of sediment. If not maintained, they'll become ineffective and a source of sediment pollution.

It's also important to keep records of BMP installation, implementation, and maintenance. Keep track of major grading activities that occur on the site, when construction activities cease (temporarily or permanently), and when a site is temporarily or permanently stabilized.

If construction plans change at any time, or if more appropriate BMPs are chosen for the site, update the Plan accordingly.

6. Completing the Project: Final Stabilization and Termination of the Permit

- **Final stabilization**
- **Notice of Termination**
- **Record retention**

Many states and EPA require a Notice of Termination (NOT) or other notification signifying that the construction activity is completed. An NOT is required when

- Final stabilization has been achieved on all portions of the site for which the permittee is responsible.
- Another operator has assumed control over all areas of the site that have not been finally stabilized. That operator would need to submit a new permit application to the permitting authority.
- For residential construction only, temporary stabilization of a lot has been completed prior to transference of ownership to the homeowner, with the homeowner being made aware of the need to perform final stabilization.

Permittees must keep a copy of their permit application and their Plan for at least 3 years following final stabilization. This period may be longer depending on state and local requirements.

Preconstruction Checklist

- A site description, including
  - Nature of the activity
  - Intended sequence of major construction activities
  - Total area of the site
  - Existing soil type and rainfall runoff data
  - A site map with:
    - Drainage patterns
    - Approximate slopes after major grading
    - Area of soil disturbance
    - Outline of areas which will not be disturbed
    - Location of major structural and nonstructural soil erosion controls
    - Areas where stabilization practices are expected to occur
    - Surface waters
    - Stormwater discharge locations
  - Name of the receiving water(s)
- A description of controls:
  - Erosion and sediment controls, including
    - Stabilization practices for all areas disturbed by construction
    - Structural practices for all drainage/discharge locations
  - Stormwater management controls, including
    - Measures used to control pollutants occurring in stormwater discharges after construction activities are complete
    - Velocity dissipation devices to provide nonerosive flow conditions from the discharge point along the length of any outfall channel
  - Other controls, including
    - Waste disposal practices that prevent discharge of solid materials
    - Measures to minimize offset tracking of sediments by construction vehicles
    - Measures to ensure compliance with state or local waste disposal, sanitary sewer, or septic system regulations
  - Description of the timing during the construction when measures will be implemented
- State or local requirements incorporated into the Plan
- Inspection and maintenance procedures for control measures identified in the Plan
- Contractor certification and Plan certification

Implementation Checklist

- Maintain records of construction activities, including
  - Dates when major grading activities occur
  - Dates when construction activities temporarily cease on the site or a portion of the site
  - Dates when construction activities permanently cease on the site or a portion of the site
  - Dates when stabilization measures are completed on the site
- Prepare inspection reports summarizing
  - Name of person conducting BMP inspections
  - Qualifications of person conducting BMP inspections
  - BMPs/areas inspected
  - Observed conditions
  - Necessary changes to the Plan
- Report releases of reportable quantities of oil or hazardous materials
  - Notify the National Response Center at 800-424-8802 immediately
  - Report releases to your permitting authority immediately, or as specified in your permit. You must also provide a written report within 14 days.
  - Modify the Plan to include
    - The date of release
    - Circumstances leading to the release
    - Steps taken to prevent reoccurrence of the release
- Modify Plan as necessary
  - Incorporate requests of the permitting authority to bring the Plan into compliance
  - Address changes in design, construction operation, or maintenance that affect the potential for discharge of pollutants

An ounce of prevention is worth a pound of cure! It's far more efficient and cost-effective to prevent pollution than it is to try to correct problems later. Installing and maintaining simple BMPs and pollution prevention techniques on site can greatly reduce the potential for stormwater pollution and can also save you money!

Visit www.epa.gov/npdes/stormwater for more information.

StormWater CleanWater
PROTECTION PROGRAM

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

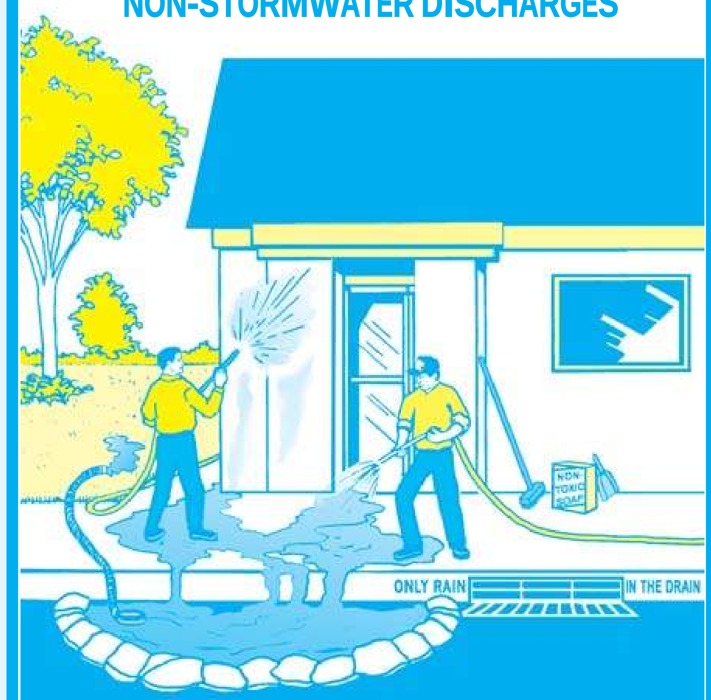
Riverside County gratefully acknowledges the Bay Area Stormwater Management Agencies Association and the Cleaning Equipment Trade Association for information provided in this brochure.

StormWater Pollution

What you should know for...

OUTDOOR CLEANING ACTIVITIES

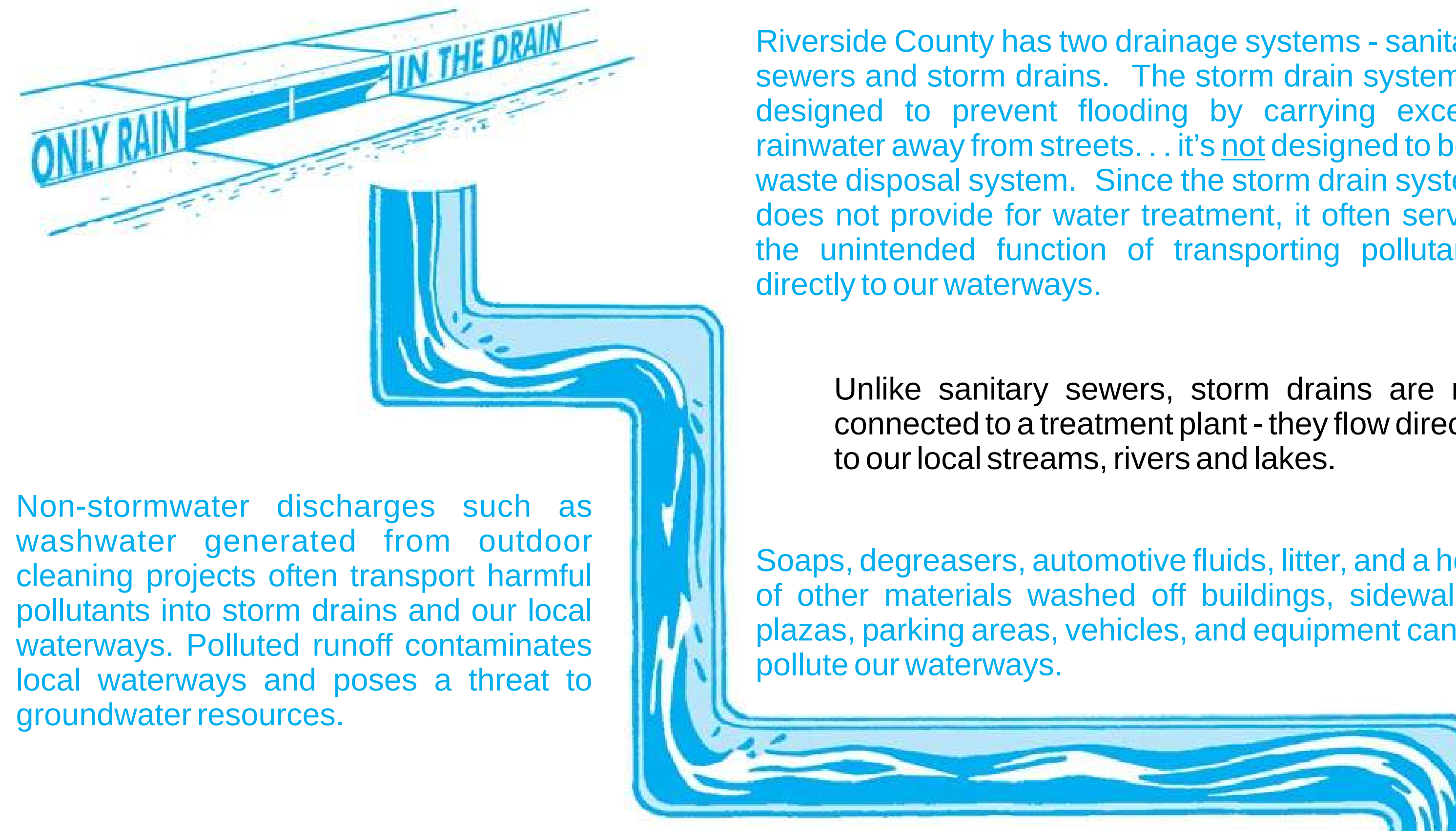
NON-STORMWATER DISCHARGES



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 <u>not</u> 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.

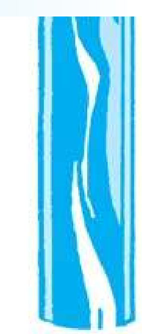
Non-stormwater discharges such as washwater generated from outdoor cleaning projects often transport harmful pollutants into storm drains and our local waterways. Polluted runoff contaminates local waterways and poses a threat to groundwater resources.

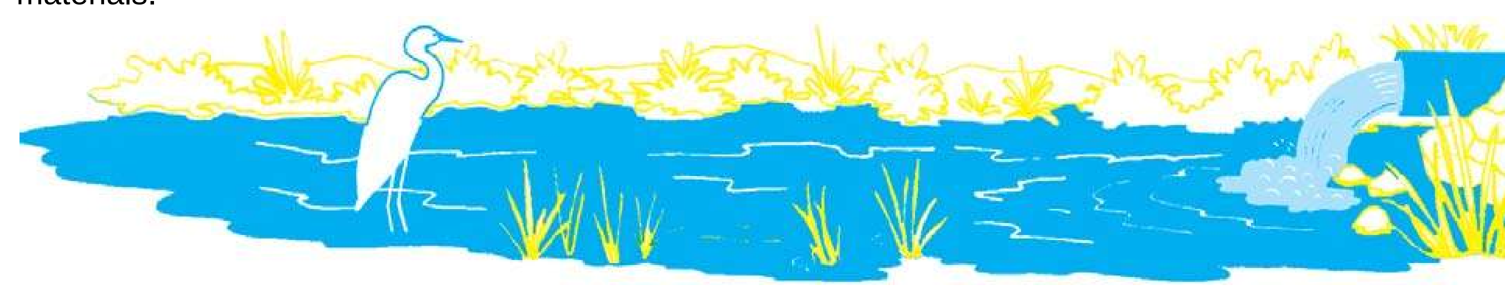
Soaps, degreasers, automotive fluids, litter, and a host of other materials washed off buildings, sidewalks, plazas, parking areas, vehicles, and equipment can all pollute our waterways.

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 **<u>prohibit</u>** 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.

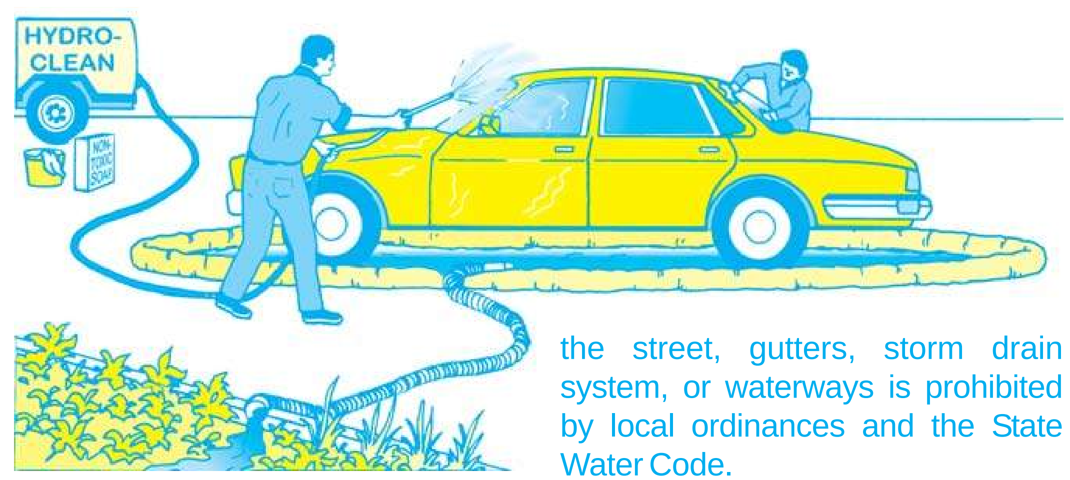
DO NOT . . . Dispose of water containing **soap or any other type of cleaning agent** into a storm drain or water body. This is a direct violation of state and/or local regulations. Because **wastewater from cleaning parking areas or roadways** normally contains metallic brake pad dust, oil and other 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).

Efficient Irrigation SD-12

Design Objectives

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

Description

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

Approach

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

Suitable Applications

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

Design Considerations

Designing New Installations

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

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

- Design timing and application methods of irrigation water to minimize the runoff of excess irrigation water into the storm water drainage system.

- Group plants with similar water requirements in order to reduce excess irrigation runoff and promote surface filtration. Choose plants with low irrigation requirements (for example, native or drought tolerant species). Consider design features such as:

  - Using mulches (such as wood chips or bar) in planter areas without ground cover to minimize sediment in runoff

  - Installing appropriate plant materials for the location, in accordance with amount of sunlight and climate, and use native plant materials where possible and/or as recommended by the landscape architect

  - Leaving a vegetative barrier along the property boundary and interior watercourses, to act as a pollutant filter, where appropriate and feasible

  - Choosing plants that minimize or eliminate the use of fertilizer or pesticides to sustain growth

- Employ other comparable, equally effective methods to reduce irrigation water runoff.

Redeveloping Existing Installations

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

Other Resources

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

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

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

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

Drainage System Maintenance SC-44

Objectives

- Cover
- Contain
- Educate
- Reduce/Minimize

Targeted Constituents

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

Description

As a consequence of its function, the stormwater conveyance system collects and transports urban runoff and stormwater that may contain certain pollutants. The protocols in this fact sheet are intended to reduce pollutants reaching receiving waters through proper conveyance system operation and maintenance.

Approach

Pollution Prevention

Maintain catch basins, stormwater inlets, and other stormwater conveyance structures on a regular basis to remove pollutants, reduce high pollutant concentrations during the first flush of storms, prevent clogging of the downstream conveyance system, restore catch basins' sediment trapping capacity, and ensure the system functions properly hydraulically to avoid flooding.

Suggested Protocols

Catch Basins/Inlet Structures

- Staff should regularly inspect facilities to ensure compliance with the following:
  - Immediate repair of any deterioration threatening structural integrity.
  - Cleaning before the sump is 40% full. Catch basins should be cleaned as frequently as needed to meet this standard.
  - Stenciling of catch basins and inlets (see SC34 Waste Handling and Disposal).

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- Clean catch basins, storm drain inlets, and other conveyance structures before the wet season to remove sediments and debris accumulated during the summer.

- Conduct inspections more frequently during the wet season for problem areas where sediment or trash accumulates more often. Clean and repair as needed.

- Keep accurate logs of the number of catch basins cleaned.

- Store wastes collected from cleaning activities of the drainage system in appropriate containers or temporary storage sites in a manner that prevents discharge to the storm drain.

- Dewater the wastes if necessary with outflow into the sanitary sewer if permitted. Water should be treated with an appropriate filtering device prior to discharge to the sanitary sewer. If discharge to the sanitary sewer is not allowed, water should be pumped or vacuumed to a tank and properly disposed. Do not dewater near a storm drain or stream.

Storm Drain Conveyance System

- Locate reaches of storm drain with deposit problems and develop a flushing schedule that keeps the pipe clear of excessive buildup.

- Collect and pump flushed effluent to the sanitary sewer for treatment whenever possible.

Pump Stations

- Clean all storm drain pump stations prior to the wet season to remove silt and trash.

- Do not allow discharge to reach the storm drain system when cleaning a storm drain pump station or other facility.

- Conduct routine maintenance at each pump station.

- Inspect, clean, and repair as necessary all outlet structures prior to the wet season.

Open Channel

- Modify storm channel characteristics to improve channel hydraulics, increase pollutant removals, and enhance channel/creek aesthetic and habitat value.

- Conduct channel modification/improvement in accordance with existing laws. Any person, government agency, or public utility proposing an activity that will change the natural (emphasis added) state of any river, stream, or lake in California, must enter into a Steam or Lake Alteration Agreement with the Department of Fish and Game. The developer-applicant should also contact local governments (city, county, special districts), other state agencies (SWRCB, RWQCB, Department of Forestry, Department of Water Resources), and Federal Corps of Engineers and USFWS.

Illicit Connections and Discharges

- Look for evidence of illegal discharges or illicit connections during routine maintenance of conveyance system and drainage structures:

  - Is there evidence of spills such as paints, discoloring, etc?

- Are there any odors associated with the drainage system?

- Record locations of apparent illegal discharges/illicit connections?

- Track flows back to potential dischargers and conduct aboveground inspections. This can be done through visual inspection of upgradient manholes or alternate techniques including zinc chloride smoke testing, fluorometric dye testing, physical inspection testing, or television camera inspection.

- Eliminate the discharge once the origin of flow is established.

■ Stencil or demarcate storm drains, where applicable, to prevent illegal disposal of pollutants. Storm drain inlets should have messages such as “Dump No Waste Drains to Stream” stenciled next to them to warn against ignorant or intentional dumping of pollutants into the storm drainage system.

■ Refer to fact sheet SC-10 Non-Stormwater Discharges.

Illegal Dumping

■ Inspect and clean up hot spots and other storm drainage areas regularly where illegal dumping and disposal occurs.

■ Establish a system for tracking incidents. The system should be designed to identify the following:

- Illegal dumping hot spots

- Types and quantities (in some cases) of wastes

- Patterns in time of occurrence (time of day/night, month, or year)

- Mode of dumping (abandoned containers, “midnight dumping” from moving vehicles, direct dumping of materials, accidents/spills)

- Responsible parties

■ Post “No Dumping” signs in problem areas with a phone number for reporting dumping and disposal. Signs should also indicate fines and penalties for illegal dumping.

■ Refer to fact sheet SC-10 Non-Stormwater Discharges.

Training

■ Train crews in proper maintenance activities, including record keeping and disposal.

■ Allow only properly trained individuals to handle hazardous materials/wastes.

■ Have staff involved in detection and removal of illicit connections trained in the following:

- OSHA-required Health and Safety Training (29 CFR 1910.120) plus annual refresher training (as needed).

- OSHA Confined Space Entry training (Cal-OSHA Confined Space, Title 8 and Federal OSHA 29 CFR 1910.146).

- Procedural training (field screening, sampling, smoke/dye testing, TV inspection).

Spill Response and Prevention

- Investigate all reports of spills, leaks, and/or illegal dumping promptly.

- Clean up all spills and leaks using "dry" methods (with absorbent materials and/or rags) or dig up, remove, and properly dispose of contaminated soil.

- Refer to fact sheet SC-11 Spill Prevention, Control, and Cleanup.

Other Considerations (Limitations and Regulations)

- Clean-up activities may create a slight disturbance for local aquatic species. Access to items and material on private property may be limited. Trade-offs may exist between channel hydraulics and water quality/riparian habitat. If storm channels or basins are recognized as wetlands, many activities, including maintenance, may be subject to regulation and permitting.

- Storm drain flushing is most effective in small diameter pipes (36-inch diameter pipe or less, depending on water supply and sediment collection capacity). Other considerations associated with storm drain flushing may include the availability of a water source, finding a downstream area to collect sediments, liquid/sediment disposal, and prohibition against disposal of flushed effluent to sanitary sewer in some areas.

- Regulations may include adoption of substantial penalties for illegal dumping and disposal.

- Local municipal codes may include sections prohibiting discharge of soil, debris, refuse, hazardous wastes, and other pollutants into the storm drain system.

Requirements

Costs

- An aggressive catch basin cleaning program could require a significant capital and O&M budget.

- The elimination of illegal dumping is dependent on the availability, convenience, and cost of alternative means of disposal. The primary cost is for staff time. Cost depends on how aggressively a program is implemented. Other cost considerations for an illegal dumping program include:

  - Purchase and installation of signs.

  - Rental of vehicle(s) to haul illegally-disposed items and material to landfills.

  - Rental of heavy equipment to remove larger items (e.g., car bodies) from channels.

  - Purchase of landfill space to dispose of illegally-dumped items and material.

- Methods used for illicit connection detection (smoke testing, dye testing, visual inspection, and flow monitoring) can be costly and time-consuming. Site-specific factors, such as the level of impervious area, the density and ages of buildings, and type of land use will determine the level of investigation necessary.

Maintenance

- Two-person teams may be required to clean catch basins with vactor trucks.
- Teams of at least two people plus administrative personnel are required to identify illicit discharges, depending on the complexity of the storm sewer system.
- Arrangements must be made for proper disposal of collected wastes.
- Technical staff are required to detect and investigate illegal dumping violations.

Supplemental Information

Further Detail of the BMP

Storm Drain Flushing

Flushing is a common maintenance activity used to improve pipe hydraulics and to remove pollutants in storm drainage systems. Flushing may be designed to hydraulically convey accumulated material to strategic locations, such as an open channel, another point where flushing will be initiated, or the sanitary sewer and the treatment facilities, thus preventing resuspension and overflow of a portion of the solids during storm events. Flushing prevents "plug flow" discharges of concentrated pollutant loadings and sediments. Deposits can hinder the designed conveyance capacity of the storm drain system and potentially cause backwater conditions in severe cases of clogging.

Storm drain flushing usually takes place along segments of pipe with grades that are too flat to maintain adequate velocity to keep particles in suspension. An upstream manhole is selected to place an inflatable device that temporarily plugs the pipe. Further upstream, water is pumped into the line to create a flushing wave. When the upstream reach of pipe is sufficiently full to cause a flushing wave, the inflated device is rapidly deflated with the assistance of a vacuum pump, thereby releasing the backed up water and resulting in the cleaning of the storm drain segment.

To further reduce impacts of stormwater pollution, a second inflatable device placed well downstream may be used to recollect the water after the force of the flushing wave has dissipated. A pump may then be used to transfer the water and accumulated material to the sanitary sewer for treatment. In some cases, an interceptor structure may be more practical or required to recollect the flushed waters.

It has been found that cleansing efficiency of periodic flush waves is dependent upon flush volume, flush discharge rate, sewer slope, sewer length, sewer flow rate, sewer diameter, and population density. As a rule of thumb, the length of line to be flushed should not exceed 700 feet. At this maximum recommended length, the percent removal efficiency ranges between 65-75% for organics and 55-65% for dry weather grit/inorganic material. The percent removal efficiency drops rapidly beyond that. Water is commonly supplied by a water truck, but fire hydrants can also supply water. To make the best use of water, it is recommended that reclaimed water be used or that fire hydrant line flushing coincide with storm sewer flushing.

References and Resources

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

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

Ferguson, B.K. 1991. Urban Stream Reclamation, p. 324-322, Journal of Soil and Water Conservation.

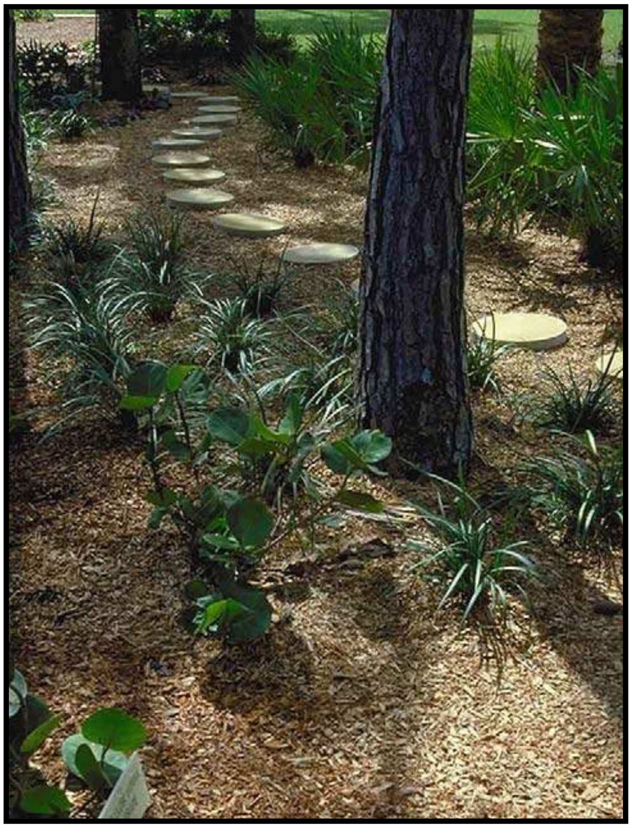
King County Storm Water Pollution Control Manual http://dnr.metrokc.gov/wlr/dss/spcm.htm

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

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

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

United States Environmental Protection Agency (USEPA). 2002. Pollution Prevention/Good Housekeeping for Municipal Operations Storm Drain System Cleaning. On line: http://www.epa.gov/npdes/menuofbmps/poll_16.htm



Design Objectives

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

Description

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

Approach

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

Suitable Applications

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

Design Considerations

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

Designing New Installations

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

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

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

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

Conserve Natural Areas during Landscape Planning

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

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

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

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

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

- Preserve riparian areas and wetlands.

Maximize Natural Water Storage and Infiltration Opportunities Within the Landscape Unit

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

- Maintain natural storage reservoirs and drainage corridors, including depressions, areas of permeable soils, swales, and intermittent streams. Develop and implement policies and regulations to discourage the clearing, filling, and channelization of these features. Utilize them in drainage networks in preference to pipes, culverts, and engineered ditches.

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

Protection of Slopes and Channels during Landscape Design

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

Redeveloping Existing Installations

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

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

Other Resources

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

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

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

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

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

Storm Drain Signage SD-13

Design Objectives

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

Description

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

Approach

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

Suitable Applications

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

Design Considerations

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

Designing New Installations

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

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

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

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

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

Redeveloping Existing Installations

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

Additional Information

Maintenance Considerations

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

Placement

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

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

Supplemental Information

Examples

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

Other Resources

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

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

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

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

Bioretention TC-32

Design Considerations

- Soil for Infiltration
- Tributary Area
- Slope
- Aesthetics
- Environmental Side-effects

Description

The bioretention best management practice (BMP) functions as a soil and plant-based filtration device that removes pollutants through a variety of physical, biological, and chemical treatment processes. These facilities normally consist of a grass buffer strip, sand bed, ponding area, organic layer or mulch layer, planting soil, and plants. The runoff's velocity is reduced by passing over or through buffer strip and subsequently distributed evenly along a ponding area. Exfiltration of the stored water in the bioretention area planting soil into the underlying soils occurs over a period of days.

Targeted Constituents

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

Legend ***(Removal Effectiveness)***

● Low ■ High

▲ Medium

California Experience

None documented. Bioretention has been used as a stormwater BMP since 1992. In addition to Prince George's County, MD and Alexandria, VA, bioretention has been used successfully at urban and suburban areas in Montgomery County, MD; Baltimore County, MD; Chesterfield County, VA; Prince William County, VA; Smith Mountain Lake State Park, VA; and Cary, NC.

Advantages

- Bioretention provides stormwater treatment that enhances the quality of downstream water bodies by temporarily storing runoff in the BMP and releasing it over a period of four days to the receiving water (EPA, 1999).

- The vegetation provides shade and wind breaks, absorbs noise, and improves an area's landscape.

Limitations

- The bioretention BMP is not recommended for areas with slopes greater than 20% or where mature tree removal would

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be required since clogging may result, particularly if the BMP receives runoff with high sediment loads (EPA, 1999).

- Bioretention is not a suitable BMP at locations where the water table is within 6 feet of the ground surface and where the surrounding soil stratum is unstable.
- By design, bioretention BMPs have the potential to create very attractive habitats for mosquitoes and other vectors because of highly organic, often heavily vegetated areas mixed with shallow water.
- In cold climates the soil may freeze, preventing runoff from infiltrating into the planting soil.

Design and Sizing Guidelines

- The bioretention area should be sized to capture the design storm runoff.
- In areas where the native soil permeability is less than 0.5 in/hr an underdrain should be provided.
- Recommended minimum dimensions are 15 feet by 40 feet, although the preferred width is 25 feet. Excavated depth should be 4 feet.
- Area should drain completely within 72 hours.
- Approximately 1 tree or shrub per 50 ft^2 of bioretention area should be included.
- Cover area with about 3 inches of mulch.

Construction/Inspection Considerations

Bioretention area should not be established until contributing watershed is stabilized.

Performance

Bioretention removes stormwater pollutants through physical and biological processes, including adsorption, filtration, plant uptake, microbial activity, decomposition, sedimentation and volatilization (EPA, 1999). Adsorption is the process whereby particulate pollutants attach to soil (e.g., clay) or vegetation surfaces. Adequate contact time between the surface and pollutant must be provided for in the design of the system for this removal process to occur. Thus, the infiltration rate of the soils must not exceed those specified in the design criteria or pollutant removal may decrease. Pollutants removed by adsorption include metals, phosphorus, and hydrocarbons. Filtration occurs as runoff passes through the bioretention area media, such as the sand bed, ground cover, and planting soil.

Common particulates removed from stormwater include particulate organic matter, phosphorus, and suspended solids. Biological processes that occur in wetlands result in pollutant uptake by plants and microorganisms in the soil. Plant growth is sustained by the uptake of nutrients from the soils, with woody plants locking up these nutrients through the seasons. Microbial activity within the soil also contributes to the removal of nitrogen and organic matter. Nitrogen is removed by nitrifying and denitrifying bacteria, while aerobic bacteria are responsible for the decomposition of the organic matter. Microbial processes require oxygen and can result in depleted oxygen levels if the bioretention area is not adequately aerated. Sedimentation occurs in the swale or ponding area as the velocity slows and solids fall out of suspension.

The removal effectiveness of bioretention has been studied during field and laboratory studies conducted by the University of Maryland (Davis et al, 1998). During these experiments, synthetic stormwater runoff was pumped through several laboratory and field bioretention areas to simulate typical storm events in Prince George's County, MD. Removal rates for heavy metals and nutrients are shown in Table 1.

Table 1 Laboratory and Estimated Bioretention Davis et al. (1998); PGDER (1993)

Pollutant	Removal Rate
Total Phosphorus	70-83%
Metals (Cu, Zn, Pb)	93-98%
TKN	68-80%
Total Suspended Solids	90%
Organics	90%
Bacteria	90%

Results for both the laboratory and field experiments were similar for each of the pollutants analyzed. Doubling or halving the influent pollutant levels had little effect on the effluent pollutants concentrations (Davis et al, 1998).

The microbial activity and plant uptake occurring in the bioretention area will likely result in higher removal rates than those determined for infiltration BMPs.

Siting Criteria

Bioretention BMPs are generally used to treat stormwater from impervious surfaces at commercial, residential, and industrial areas (EPA, 1999). Implementation of bioretention for stormwater management is ideal for median strips, parking lot islands, and swales. Moreover, the runoff in these areas can be designed to either divert directly into the bioretention area or convey into the bioretention area by a curb and gutter collection system.

The best location for bioretention areas is upland from inlets that receive sheet flow from graded areas and at areas that will be excavated (EPA, 1999). In order to maximize treatment effectiveness, the site must be graded in such a way that minimizes erosive conditions as sheet flow is conveyed to the treatment area. Locations where a bioretention area can be readily incorporated into the site plan without further environmental damage are preferred. Furthermore, to effectively minimize sediment loading in the treatment area, bioretention only should be used in stabilized drainage areas.

Additional Design Guidelines

The layout of the bioretention area is determined after site constraints such as location of utilities, underlying soils, existing vegetation, and drainage are considered (EPA, 1999). Sites with loamy sand soils are especially appropriate for bioretention because the excavated soil can be backfilled and used as the planting soil, thus eliminating the cost of importing planting soil.

The use of bioretention may not be feasible given an unstable surrounding soil stratum, soils with clay content greater than 25 percent, a site with slopes greater than 20 percent, and/or a site with mature trees that would be removed during construction of the BMP.

Bioretention can be designed to be off-line or on-line of the existing drainage system (EPA, 1999). The drainage area for a bioretention area should be between 0.1 and 0.4 hectares (0.25 and 1.0 acres). Larger drainage areas may require multiple bioretention areas. Furthermore, the maximum drainage area for a bioretention area is determined by the expected rainfall intensity and runoff rate. Stabilized areas may erode when velocities are greater than 5 feet per second (1.5 meter per second). The designer should determine the potential for erosive conditions at the site.

The size of the bioretention area, which is a function of the drainage area and the runoff generated from the area is sized to capture the water quality volume.

The recommended minimum dimensions of the bioretention area are 15 feet (4.6 meters) wide by 40 feet (12.2 meters) long, where the minimum width allows enough space for a dense, randomly-distributed area of trees and shrubs to become established. Thus replicating a natural forest and creating a microclimate, thereby enabling the bioretention area to tolerate the effects of heat stress, acid rain, runoff pollutants, and insect and disease infestations which landscaped areas in urban settings typically are unable to tolerate. The preferred width is 25 feet (7.6 meters), with a length of twice the width. Essentially, any facilities wider than 20 feet (6.1 meters) should be twice as long as they are wide, which promotes the distribution of flow and decreases the chances of concentrated flow.

In order to provide adequate storage and prevent water from standing for excessive periods of time the ponding depth of the bioretention area should not exceed 6 inches (15 centimeters). Water should not be left to stand for more than 72 hours. A restriction on the type of plants that can be used may be necessary due to some plants' water intolerance. Furthermore, if water is left standing for longer than 72 hours mosquitoes and other insects may start to breed.

The appropriate planting soil should be backfilled into the excavated bioretention area. Planting soils should be sandy loam, loamy sand, or loam texture with a clay content ranging from 10 to 25 percent.

Generally the soil should have infiltration rates greater than 0.5 inches (1.25 centimeters) per hour, which is typical of sandy loams, loamy sands, or loams. The pH of the soil should range between 5.5 and 6.5, where pollutants such as organic nitrogen and phosphorus can be adsorbed by the soil and microbial activity can flourish. Additional requirements for the planting soil include a 1.5 to 3 percent organic content and a maximum 500 ppm concentration of soluble salts.

Soil tests should be performed for every 500 cubic yards (382 cubic meters) of planting soil, with the exception of pH and organic content tests, which are required only once per bioretention area (EPA, 1999). Planting soil should be 4 inches (10.1 centimeters) deeper than the bottom of the largest root ball and 4 feet (1.2 meters) altogether. This depth will provide adequate soil for the plants' root systems to become established, prevent plant damage due to severe wind, and provide adequate moisture capacity. Most sites will require excavation in order to obtain the recommended depth.

Planting soil depths of greater than 4 feet (1.2 meters) may require additional construction practices such as shoring measures (EPA, 1999). Planting soil should be placed in 18 inches or greater lifts and lightly compacted until the desired depth is reached. Since high canopy trees may be destroyed during maintenance the bioretention area should be vegetated to resemble a terrestrial forest community ecosystem that is dominated by understory trees. Three species each of both trees and shrubs are recommended to be planted at a rate of 2500 trees and shrubs per hectare (1000 per acre). For instance, a 15 foot (4.6 meter) by 40 foot (12.2 meter) bioretention area (600 square feet or 55.75 square meters) would require 14 trees and shrubs. The shrub-to-tree ratio should be 2:1 to 3:1.

Trees and shrubs should be planted when conditions are favorable. Vegetation should be watered at the end of each day for fourteen days following its planting. Plant species tolerant of pollutant loads and varying wet and dry conditions should be used in the bioretention area.

The designer should assess aesthetics, site layout, and maintenance requirements when selecting plant species. Adjacent non-native invasive species should be identified and the designer should take measures, such as providing a soil breach to eliminate the threat of these species invading the bioretention area. Regional landscaping manuals should be consulted to ensure that the planting of the bioretention area meets the landscaping requirements established by the local authorities. The designers should evaluate the best placement of vegetation within the bioretention area. Plants should be placed at irregular intervals to replicate a natural forest. Trees should be placed on the perimeter of the area to provide shade and shelter from the wind. Trees and shrubs can be sheltered from damaging flows if they are placed away from the path of the incoming runoff. In cold climates, species that are more tolerant to cold winds, such as evergreens, should be placed in windier areas of the site.

Following placement of the trees and shrubs, the ground cover and/or mulch should be established. Ground cover such as grasses or legumes can be planted at the beginning of the growing season. Mulch should be placed immediately after trees and shrubs are planted. Two to 3 inches (5 to 7.6 cm) of commercially-available fine shredded hardwood mulch or shredded hardwood chips should be applied to the bioretention area to protect from erosion.

Maintenance

The primary maintenance requirement for bioretention areas is that of inspection and repair or replacement of the treatment area's components. Generally, this involves nothing more than the routine periodic maintenance that is required of any landscaped area. Plants that are appropriate for the site, climatic, and watering conditions should be selected for use in the bioretention cell. Appropriately selected plants will aide in reducing fertilizer, pesticide, water, and overall maintenance requirements. Bioretention system components should blend over time through plant and root growth, organic decomposition, and the development of a natural soil horizon. These biologic and physical processes over time will lengthen the facility's life span and reduce the need for extensive maintenance.

Routine maintenance should include a biannual health evaluation of the trees and shrubs and subsequent removal of any dead or diseased vegetation (EPA, 1999). Diseased vegetation should be treated as needed using preventative and low-toxic measures to the extent possible. BMPs have the potential to create very attractive habitats for mosquitoes and other vectors because of highly organic, often heavily vegetated areas mixed with shallow water. Routine inspections for areas of standing water within the BMP and corrective measures to restore proper infiltration rates are necessary to prevent creating mosquito and other vector habitat. In addition, bioretention BMPs are susceptible to invasion by aggressive plant species such as cattails, which increase the chances of water standing and subsequent vector production if not routinely maintained.

In order to maintain the treatment area's appearance it may be necessary to prune and weed. Furthermore, mulch replacement is suggested when erosion is evident or when the site begins to look unattractive. Specifically, the entire area may require mulch replacement every two to three years, although spot mulching may be sufficient when there are random void areas. Mulch replacement should be done prior to the start of the wet season.

New Jersey's Department of Environmental Protection states in their bioretention systems standards that accumulated sediment and debris removal (especially at the inflow point) will normally be the primary maintenance function. Other potential tasks include replacement of dead vegetation, soil pH regulation, erosion repair at inflow points, mulch replenishment, unclogging the underdrain, and repairing overflow structures. There is also the possibility that the cation exchange capacity of the soils in the cell will be significantly reduced over time. Depending on pollutant loads, soils may need to be replaced within 5-10 years of construction (LID, 2000).

Cost

Construction Cost

Construction cost estimates for a bioretention area are slightly greater than those for the required landscaping for a new development (EPA, 1999). A general rule of thumb (Coffman, 1999) is that residential bioretention areas average about $3 to $4 per square foot, depending on soil conditions and the density and types of plants used. Commercial, industrial and institutional site costs can range between $10 to $40 per square foot, based on the need for control structures, curbing, storm drains and underdrains.

Retrofitting a site typically costs more, averaging $6,500 per bioretention area. The higher costs are attributed to the demolition of existing concrete, asphalt, and existing structures and the replacement of fill material with planting soil. The costs of retrofitting a commercial site in Maryland, Kettering Development, with 15 bioretention areas were estimated at $111,600.

In any bioretention area design, the cost of plants varies substantially and can account for a significant portion of the expenditures. While these cost estimates are slightly greater than those of typical landscaping treatment (due to the increased number of plantings, additional soil excavation, backfill material, use of underdrains etc.), those landscaping expenses that would be required regardless of the bioretention installation should be subtracted when determining the net cost.

Perhaps of most importance, however, the cost savings compared to the use of traditional structural stormwater conveyance systems makes bioretention areas quite attractive financially. For example, the use of bioretention can decrease the cost required for constructing stormwater conveyance systems at a site. A medical office building in Maryland was able to reduce the amount of storm drain pipe that was needed from 800 to 230 feet - a cost savings of $24,000 (PGDER, 1993). And a new residential development spent a total of approximately $100,000 using bioretention cells on each lot instead of nearly $400,000 for the traditional stormwater ponds that were originally planned (Rappahanock,). Also, in residential areas, stormwater management controls become a part of each property owner's landscape, reducing the public burden to maintain large centralized facilities.

Maintenance Cost

The operation and maintenance costs for a bioretention facility will be comparable to those of typical landscaping required for a site. Costs beyond the normal landscaping fees will include the cost for testing the soils and may include costs for a sand bed and planting soil.

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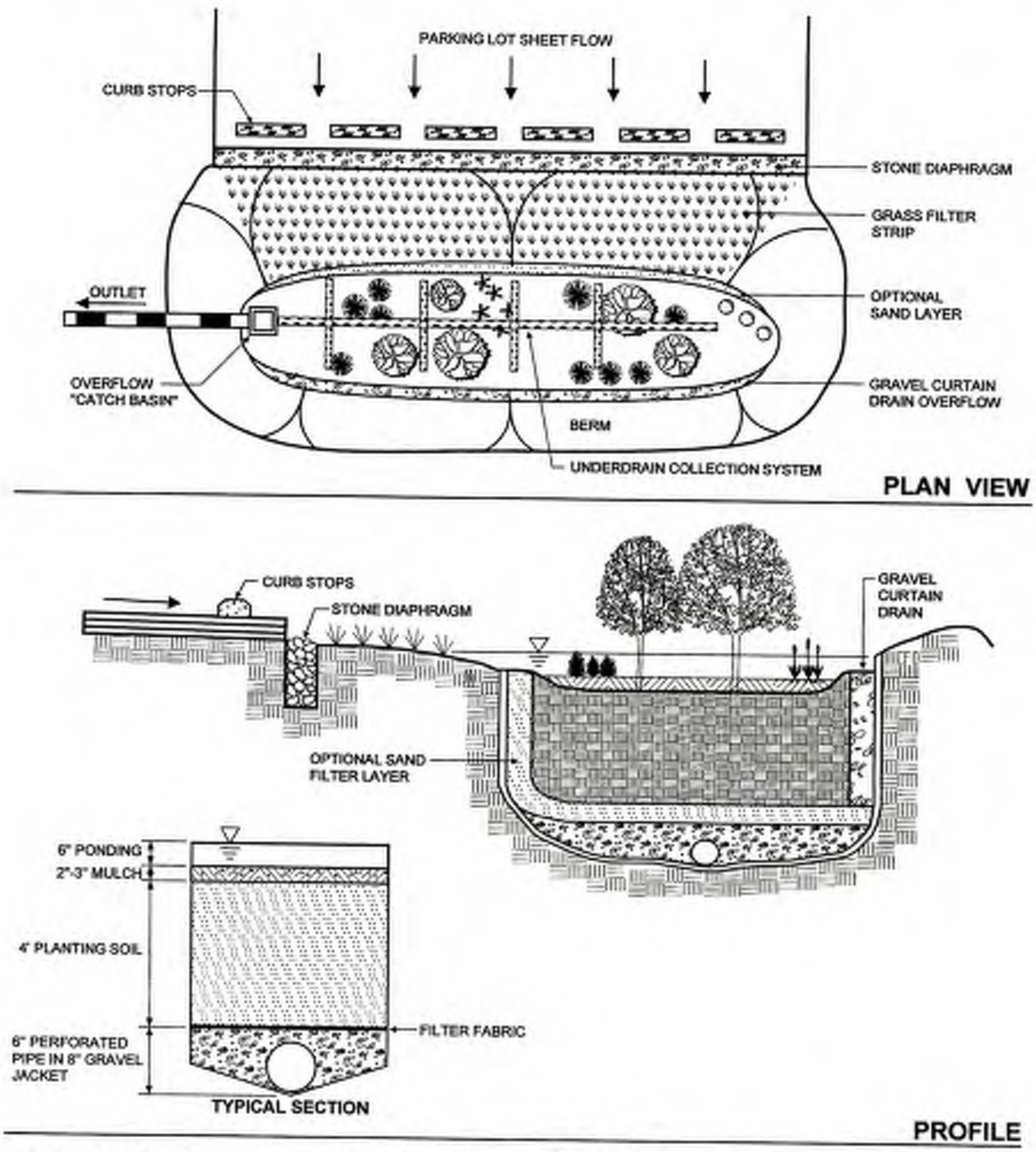

Schematic of a Bioretention Facility (MDE, 2000)

Design Considerations

- Area Required
- Slope
- Water Availability
- Aesthetics
- Environmental Side-effects

Description

Wet ponds (a.k.a. stormwater ponds, retention ponds, wet extended detention ponds) are constructed basins that have a permanent pool of water throughout the year (or at least throughout the wet season) and differ from constructed wetlands primarily in having a greater average depth. Ponds treat incoming stormwater runoff by settling and biological uptake. The primary removal mechanism is settling as stormwater runoff resides in this pool, but pollutant uptake, particularly of nutrients, also occurs to some degree through biological activity in the pond. Wet ponds are among the most widely used stormwater practices. While there are several different versions of the wet pond design, the most common modification is the extended detention wet pond, where storage is provided above the permanent pool in order to detain stormwater runoff and promote settling. The schematic diagram is of an on-line pond that includes detention for larger events, but this is not required in all areas of the state.

Targeted Constituents

☑	Sediment	■
☑	Nutrients	▲
☑	Trash	■
☑	Metals	■
☑	Bacteria	■
☑	Oil and Grease	■
☑	Organics	■

Legend *(Removal Effectiveness)*

● Low ■ High

▲ Medium

California Experience

Caltrans constructed a wet pond in northern San Diego County (I-5 and La Costa Blvd.). Largest issues at this site were related to vector control, vegetation management, and concern that endangered species would become resident and hinder maintenance activities.

Advantages

- If properly designed, constructed and maintained, wet basins can provide substantial aesthetic/recreational value and wildlife and wetlands habitat.

- Ponds are often viewed as a public amenity when integrated into a park setting.

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- Due to the presence of the permanent wet pool, properly designed and maintained wet basins can provide significant water quality improvement across a relatively broad spectrum of constituents including dissolved nutrients.

- Widespread application with sufficient capture volume can provide significant control of channel erosion and enlargement caused by changes to flow frequency relationships resulting from the increase of impervious cover in a watershed.

Limitations

- Some concern about safety when constructed where there is public access.

- Mosquito and midge breeding is likely to occur in ponds.

- Cannot be placed on steep unstable slopes.

- Need for base flow or supplemental water if water level is to be maintained.

- Require a relatively large footprint

- Depending on volume and depth, pond designs may require approval from the State Division of Safety of Dams

Design and Sizing Guidelines

- Capture volume determined by local requirements or sized to treat 85% of the annual runoff volume.

- Use a draw down time of 48 hours in most areas of California. Draw down times in excess of 48 hours may result in vector breeding, and should be used only after coordination with local vector control authorities. Draw down times of less than 48 hours should be limited to BMP drainage areas with coarse soils that readily settle and to watersheds where warming may be detrimental to downstream fisheries.

- Permanent pool volume equal to twice the water quality volume.

- Water depth not to exceed about 8 feet.

- Wetland vegetation occupying no more than 25% of surface area.

- Include energy dissipation in the inlet design and a sediment forebay to reduce resuspension of accumulated sediment and facilitate maintenance.

- A maintenance ramp should be included in the design to facilitate access to the forebay for maintenance activities and for vector surveillance and control.

- To facilitate vector surveillance and control activities, road access should be provided along at least one side of BMPs that are seven meters or less in width. Those BMPs that have shoreline-to-shoreline distances in excess of seven meters should have perimeter road access on both sides or be designed such that no parcel of water is greater than seven meters from the road.

Construction/Inspection Considerations

- In areas with porous soils an impermeable liner may be required to maintain an adequate permanent pool level.
- Outlet structures and piping should be installed with collars to prevent water from seeping through the fill and causing structural failure.
- Inspect facility after first large storm to determine whether the desired residence time has been achieved.

Performance

The observed pollutant removal of a wet pond is highly dependent on two factors: the volume of the permanent pool relative to the amount of runoff from the typical event in the area and the quality of the base flow that sustains the permanent pool. A recent study (Caltrans, 2002) has documented that if the permanent pool is much larger than the volume of runoff from an average event, then displacement of the permanent pool by the wet weather flow is the primary process. A statistical comparison of the wet pond discharge quality during dry and wet weather shows that they are not significantly different. Consequently, there is a relatively constant discharge quality during storms that is the same as the concentrations observed in the pond during ambient (dry weather) conditions. Consequently, for most constituents the performance of the pond is better characterized by the average effluent concentration, rather than the “percent reduction,” which has been the conventional measure of performance. Since the effluent quality is essentially constant, the percent reduction observed is mainly a function of the influent concentrations observed at a particular site.

The dry and wet weather discharge quality is, therefore, related to the quality of the base flow that sustains the permanent pool and of the transformations that occur to those constituents during their residence in the basin. One could potentially expect a wide range of effluent concentrations at different locations even if the wet ponds were designed according to the same guidelines, if the quality of the base flow differed significantly. This may explain the wide range of concentration reductions reported in various studies.

Concentrations of nutrients in base flow may be substantially higher than in urban stormwater runoff. Even though these concentrations may be substantially reduced during the residence time of the base flow in the pond, when this water is displaced by wet weather flows, concentrations may still be quite elevated compared to the levels that promote eutrophication in surface water systems. Consequently comparing influent and effluent nutrient concentrations during wet weather can make the performance seem highly variable.

Relatively small perennial flows may often substantially exceed the wet weather flow treated. Consequently, one should also consider the load reduction observed under ambient conditions when assessing the potential benefit to the receiving water.

Siting Criteria

Wet ponds are a widely applicable stormwater management practice and can be used over a broad range of storm frequencies and sizes, drainage areas and land use types. Although they have limited applicability in highly urbanized settings and in arid climates, they have few other restrictions. Wet basins may be constructed on- or off-line and can be sited at feasible locations along established drainage ways with consistent base flow. An off-line design is preferred. Wet basins are often utilized in smaller sub-watersheds and are particularly appropriate in areas with residential land

uses or other areas where high nutrient loads are considered to be potential problems (e.g., golf courses).

Ponds do not consume a large area (typically 2–3 percent of the contributing drainage area); however, these facilities are generally large. Other practices, such as filters or swales, may be "squeezed" into relatively unusable land, but ponds need a relatively large continuous area. Wet basins are typically used in drainage basins of more than ten acres and less than one square mile (Schueler et al., 1992). Emphasis can be placed in siting wet basins in areas where the pond can also function as an aesthetic amenity or in conjunction with other stormwater management functions.

Wet basin application is appropriate in the following settings: (1) where there is a need to achieve a reasonably high level of dissolved contaminant removal and/or sediment capture; (2) in small to medium-sized regional tributary areas with available open space and drainage areas greater than about 10 ha (25 ac.); (3) where base flow rates or other channel flow sources are relatively consistent year-round; (4) in residential settings where aesthetic and wildlife habitat benefits can be appreciated and maintenance activities are likely to be consistently undertaken.

Traditional wet extended detention ponds can be applied in most regions of the United States, with the exception of arid climates. In arid regions, it is difficult to justify the supplemental water needed to maintain a permanent pool because of the scarcity of water. Even in semi-arid Austin, Texas, one study found that 2.6 acre-feet per year of supplemental water was needed to maintain a permanent pool of only 0.29 acre-feet (Saunders and Gilroy, 1997). Seasonal wet ponds (i.e., ponds that maintain a permanent pool only during the wet season) may prove effective in areas with distinct wet and dry seasons; however, this configuration has not been extensively evaluated.

Wet ponds may pose a risk to cold water systems because of their potential for stream warming. When water remains in the permanent pool, it is heated by the sun. A study in Prince George's County, Maryland, found that stormwater wet ponds heat stormwater by about 9°F from the inlet to the outlet (Galli, 1990).

Additional Design Guidelines

Specific designs may vary considerably, depending on site constraints or preferences of the designer or community. There are several variations of the wet pond design, including constructed wetlands, and wet extended detention ponds. Some of these design alternatives are intended to make the practice adaptable to various sites and to account for regional constraints and opportunities. In conventional wet ponds, the open water area comprises 50% or more of the total surface area of the pond. The permanent pool should be no deeper than 2.5 m (8 feet) and should average 1.2 – 2 m (4-6 feet) deep. The greater depth of this configuration helps limit the extent of the vegetation to an aquatic bench around the perimeter of the pond with a nominal depth of about 1 foot and variable width. This shallow bench also protects the banks from erosion, enhances habitat and aesthetic values, and reduces the drowning hazard.

The wet extended detention pond combines the treatment concepts of the dry extended detention pond and the wet pond. In this design, the water quality volume is detained above the permanent pool and released over 24 hours. In addition to increasing the residence time, which improves pollutant removal, this design also attenuates peak runoff rates. Consequently, this design alternative is recommended.

Pretreatment incorporates design features that help to settle out coarse sediment particles. By removing these particles from runoff before they reach the large permanent pool, the maintenance burden of the pond is reduced. In ponds, pretreatment is achieved with a sediment forebay. A sediment forebay is a small pool (typically about 10 percent of the volume of the permanent pool). Coarse particles remain trapped in the forebay, and maintenance is performed on this smaller pool, eliminating the need to dredge the entire pond.

There are a variety of sizing criteria for determining the volume of the permanent pool, mostly related to the water quality volume (i.e., the volume of water treated for pollutant removal) or the average storm size in a particular area. In addition, several theoretical approaches to determination of permanent pool volume have been developed. However, there is little empirical evidence to support these designs. Consequently, a simplified method (i.e., permanent pool volume equal to twice the water quality volume) is recommended.

Other design features do not increase the volume of a pond, but can increase the amount of time stormwater remains in the device and eliminate short-circuiting. Ponds should always be designed with a length-to-width ratio of at least 1.5:1, where feasible. In addition, the design should incorporate features to lengthen the flow path through the pond, such as underwater berms designed to create a longer route through the pond. Combining these two measures helps ensure that the entire pond volume is used to treat stormwater. Wet ponds with greater amounts of vegetation often have channels through the vegetated areas and contain dead areas where stormwater is restricted from mixing with the entire permanent pool, which can lead to less pollutant removal. Consequently, a pond with open water comprising about 75% of the surface area is preferred.

Design features are also incorporated to ease maintenance of both the forebay and the main pool of ponds. Ponds should be designed with a maintenance access to the forebay to ease this relatively routine (every 5–7 year) maintenance activity. In addition, ponds should generally have a drain to draw down the pond for vegetation harvesting or the more infrequent dredging of the main cell of the pond.

Cold climates present many challenges to designers of wet ponds. The spring snowmelt may have a high pollutant load and a large volume to be treated. In addition, cold winters may cause freezing of the permanent pool or freezing at inlets and outlets. Finally, high salt concentrations in runoff resulting from road salting, and sediment loads from road sanding, may impact pond vegetation as well as reduce the storage and treatment capacity of the pond.

One option to deal with high pollutant loads and runoff volumes during the spring snowmelt is the use of a seasonally operated pond to capture snowmelt during the winter and retain the permanent pool during warmer seasons. In this option, proposed by Oberts (1994), the pond has two water quality outlets, both equipped with gate valves. In the summer, the lower outlet is closed. During the fall and throughout the winter, the lower outlet is opened to draw down the permanent pool. As the spring melt begins, the lower outlet is closed to provide detention for the melt event. The manipulation of this system requires some labor and vigilance; a careful maintenance agreement should be confirmed.

Several other modifications may help to improve the performance of ponds in cold climates. Designers should consider planting the pond with salt-tolerant vegetation if the facility receives road runoff. In order to counteract the effects of freezing on inlet and outlet structures, the use of inlet and outlet structures that are resistant to frost, including weirs and larger diameter pipes, may be

useful. Designing structures on-line, with a continuous flow of water through the pond, will also help prevent freezing of these structures. Finally, since freezing of the permanent pool can reduce the effectiveness of pond systems, it is important to incorporate extended detention into the design to retain usable treatment area above the permanent pool when it is frozen.

Summary of Design Recommendations

(1) Facility Sizing – The basin should be sized to hold the permanent pool as well as the required water quality volume. The volume of the permanent pool should equal twice the water quality volume.

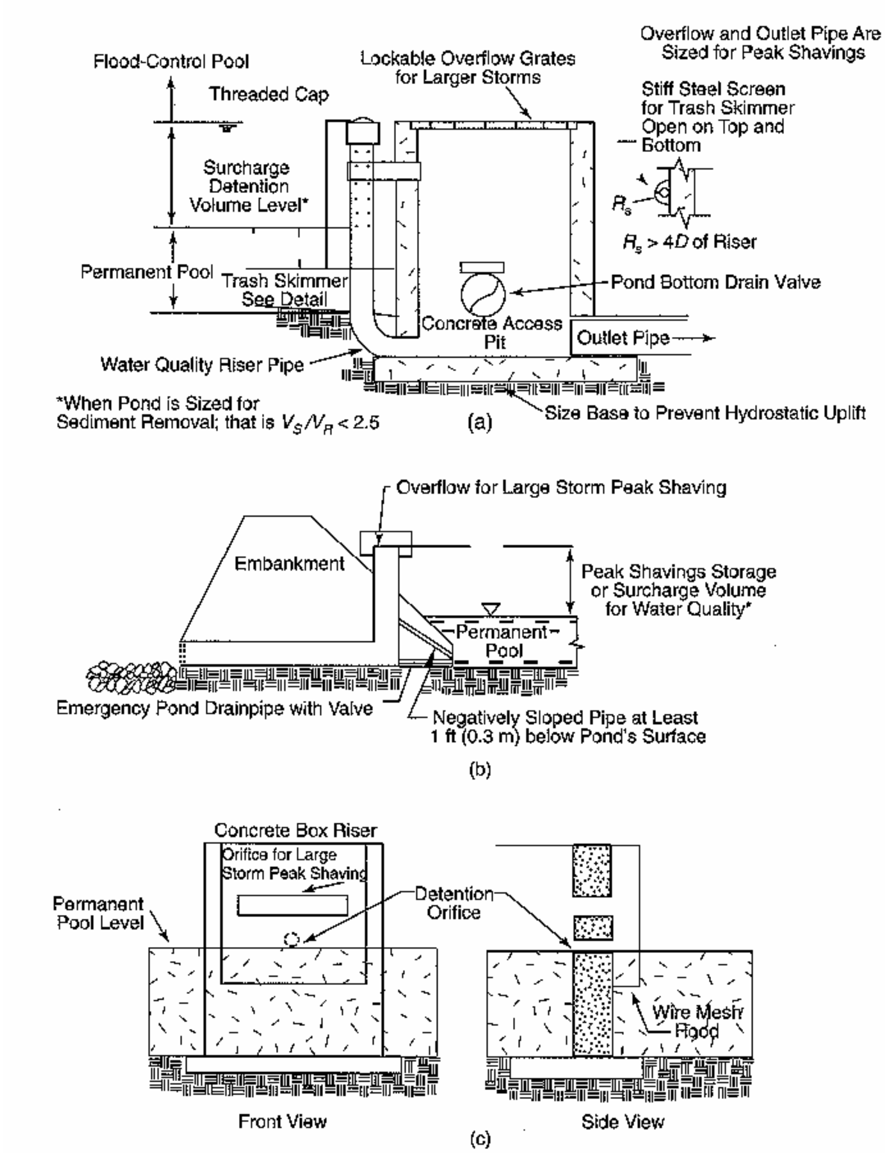
(2) Pond Configuration - The wet basin should be configured as a two stage facility with a sediment forebay and a main pool. The basins should be wedge-shaped, narrowest at the inlet and widest at the outlet. The minimum length to width ratio should be 1.5 where feasible. The perimeter of all permanent pool areas with depths of 4.0 feet or greater should be surrounded by an aquatic bench. This bench should extend inward 5-10 feet from the perimeter of the permanent pool and should be no more than 18 inches below normal depth. The area of the bench should not exceed about 25% of pond surface. The depth in the center of the basin should be 4 – 8 feet deep to prevent vegetation from encroaching on the pond open water surface.

(3) Pond Side Slopes - Side slopes of the basin should be 3:1 (H:V) or flatter for grass stabilized slopes. Slopes steeper than 3:1 should be stabilized with an appropriate slope stabilization practice.

(4) Sediment Forebay - A sediment forebay should be used to isolate gross sediments as they enter the facility and to simplify sediment removal. The sediment forebay should consist of a separate cell formed by an earthen berm, gabion, or loose riprap wall. The forebay should be sized to contain 15 to 25% of the permanent pool volume and should be at least 3 feet deep. Exit velocities from the forebay should not be erosive. Direct maintenance access should be provided to the forebay. The bottom of the forebay may be hardened (concrete) to make sediment removal easier. A fixed vertical sediment depth marker should be installed in the forebay to measure sediment accumulation.

(5) Outflow Structure - Figure 2 presents a schematic representation of suggested outflow structures. The outlet structure should be designed to drain the water quality volume over 24 hours with the orifice sized according to the equation presented in the Extended Detention Basin fact sheet. The facility should have a separate drain pipe with a manual valve that can completely or partially drain the pond for maintenance purposes. To allow for possible sediment accumulation, the submerged end of the pipe should be protected, and the drain pipe should be sized to drain the pond within 24 hours. The valve should be located at a point where it can be operated in a safe and convenient manner.

For on-line facilities, the principal and emergency spillways must be sized to provide 1.0 foot of freeboard during the 25-year event and to safely pass the 100-year flood. The embankment should be designed in accordance with all relevant specifications for small dams.



(6) Splitter Box - When the pond is designed as an off-line facility, a splitter structure is used to isolate the water quality volume. The splitter box, or other flow diverting approach, should be designed to convey the 25-year event while providing at least 1.0 foot of freeboard along pond side slopes.

(7) Vegetation - A plan should be prepared that indicates how aquatic and terrestrial areas will be vegetatively stabilized. Wetland vegetation elements should be placed along the aquatic bench or in the shallow portions of the permanent pool. The optimal elevation for planting of wetland vegetation is within 6 inches vertically of the normal pool elevation. A list of some wetland vegetation native to California is presented in Table 1.

Table 1 California Wetland Vegetation

Botanical Name	Common Name
BACCHARIS SALICIFOLIA	MULE FAT
FRANKENIA GRANDIFOLIA	HEATH
SALIX GOODINGII	BLACK WILLOW
SALIX LASIOLEPIS	ARROYO WILLOW
SAMUCUS MEXICANUS	MEXICAN ELDERBERRY
HAPLOPAPPUS VENETUS	COAST GOLDENBRUSH
DISTICHIS SPICATA	SALT GRASS
LIMONIUM CALIFORNICUM	COASTAL STATICE
ATRIPLEX LENTIFORMIS	COASTAL QUAIL BUSH
BACCHARIS PILULARIS	CHAPARRAL BROOM
MIMULUS LONGIFLORUS	MONKEY FLOWER
SCIRPUS CALIFORNICUS	BULRUSH
SCIRPUS ROBUSTUS	BULRUSH
TYPHA LATIFOLIA	BROADLEAF CATTAIL
JUNCUS ACUTUS	RUSH

Maintenance

The amount of maintenance required for a wet pond is highly dependent on local regulatory agencies, particular health and vector control agencies. These agencies are often extremely concerned about the potential for mosquito breeding that may occur in the permanent pool. Even though mosquito fish (*Gambusia affinis*) were introduced into a wet pond constructed by Caltrans in the San Diego area, mosquito breeding was routinely observed during inspections. In addition, the vegetation at this site became sufficiently dense on the bench around the edge of the pool that mosquito fish were unable to enter this area to feed upon the mosquito larvae. The vegetation at this site was particularly vigorous because of the high nutrient concentrations in the perennial base flow (15.5 mg/L NO3-N) and the mild climate, which permitted growth year round. Consequently, the vector control agency required an annual harvest of vegetation to address this situation. This harvest can be very expensive.

On the other hand, routine harvesting may increase nutrient removal and prevent the export of these constituents from dead and dying plants falling in the water. A previous study (Faulkner and Richardson, 1991) documented dramatic reductions in nutrient removal after the first several years of operation and related it to the vegetation achieving a maximum density. That content then decreases through the growth season, as the total biomass increases. In effect, the total amount of

nutrients/m2 of wetland remains essentially the same from June through September, when the plants start to put the P back into the rhizomes. Therefore harvesting should occur between June and September. Research also suggests that harvesting only the foliage is less effective, since a very small percentage of the removed nutrients is taken out with harvesting.

Since wet ponds are often selected for their aesthetic considerations as well as pollutant removal, they are often sited in areas of high visibility. Consequently, floating litter and debris are removed more frequently than would be required simply to support proper functioning of the pond and outlet. This is one of the primary maintenance activities performed at the Central Market Pond located in Austin, Texas. In this type of setting, vegetation management in the area surrounding the pond can also contribute substantially to the overall maintenance requirements.

One normally thinks of sediment removal as one of the typical activities performed at stormwater BMPs. This activity does not normally constitute one of the major activities on an annual basis. At the concentrations of TSS observed in urban runoff from stable watersheds, sediment removal may only be required every 20 years or so. Because this activity is performed so infrequently, accurate costs for this activity are lacking.

In addition to regular maintenance activities needed to maintain the function of wet ponds, some design features can be incorporated to ease the maintenance burden. In wet ponds, maintenance reduction features include techniques to reduce the amount of maintenance needed, as well as techniques to make regular maintenance activities easier.

One potential maintenance concern in wet ponds is clogging of the outlet. Ponds should be designed with a non-clogging outlet such as a reverse-slope pipe, or a weir outlet with a trash rack. A reverse-slope pipe draws from below the permanent pool extending in a reverse angle up to the riser and establishes the water elevation of the permanent pool. Because these outlets draw water from below the level of the permanent pool, they are less likely to be clogged by floating debris.

Typical maintenance activities and frequencies include:

- Schedule semiannual inspections for burrows, sediment accumulation, structural integrity of the outlet, and litter accumulation.

- Remove accumulated trash and debris in the basin at the middle and end of the wet season. The frequency of this activity may be altered to meet specific site conditions and aesthetic considerations.

- Where permitted by the Department of Fish and Game or other agency regulations, stock wet ponds/constructed wetlands regularly with mosquito fish (*Gambusia spp.*) to enhance natural mosquito and midge control.

- Introduce mosquito fish and maintain vegetation to assist their movements to control mosquitoes, as well as to provide access for vector inspectors. An annual vegetation harvest in summer appears to be optimum, in that it is after the bird breeding season, mosquito fish can provide the needed control until vegetation reaches late summer density, and there is time for re-growth for runoff treatment purposes before the wet season. In certain cases, more frequent plant harvesting may be required by local vector control agencies.

- Maintain emergent and perimeter shoreline vegetation as well as site and road access to facilitate vector surveillance and control activities.
- Remove accumulated sediment in the forebay and regrade about every 5-7 years or when the accumulated sediment volume exceeds 10 percent of the basin volume. Sediment removal may not be required in the main pool area for as long as 20 years.

Cost

Construction Cost

Wet ponds can be relatively inexpensive stormwater practices; however, the construction costs associated with these facilities vary considerably. Much of this variability can be attributed to the degree to which the existing topography will support a wet pond, the complexity and amount of concrete required for the outlet structure, and whether it is installed as part of new construction or implemented as a retrofit of existing storm drain system.

A recent study (Brown and Schueler, 1997) estimated the cost of a variety of stormwater management practices. The study resulted in the following cost equation, adjusting for inflation:

$$C = 24.5^{V0.705}$$

where:

C = Construction, design and permitting cost;

V = Volume in the pond to include the 10-year storm (ft^3).

Using this equation, typical construction costs are:

$45,700 for a 1 acre-foot facility

$232,000 for a 10 acre-foot facility

$1,170,000 for a 100 acre-foot facility

In contrast, Caltrans (2002) reported spending over $448,000 for a pond with a total permanent pool plus water quality volume of only 1036 m^3 (0.8 ac.-ft.), while the City of Austin spent $584,000 (including design) for a pond with a permanent pool volume of 3,100 m^3 (2.5 ac.-ft.). The large discrepancies between the costs of these actual facilities and the model developed by Brown and Schueler indicate that construction costs are highly site specific, depending on topography, soils, subsurface conditions, the local labor, rate and other considerations.

Maintenance Cost

For ponds, the annual cost of routine maintenance has typically been estimated at about 3 to 5 percent of the construction cost; however, the published literature is almost totally devoid of actual maintenance costs. Since ponds are long-lived facilities (typically longer than 20 years), major maintenance activities are unlikely to occur during a relatively short study.

Caltrans (2002) estimated annual maintenance costs of $17,000 based on three years of monitoring of a pond treating runoff from 1.7 ha. Almost all the activities are associated with the annual vegetation harvest for vector control. Total cost at this site falls within the 3-5% range reported

above; however, the construction costs were much higher than those estimated by Brown and Schueler (1997). The City of Austin has been reimbursing a developer about $25,000/yr for wet pond maintenance at a site located at a very visible location. Maintenance costs are mainly the result of vegetation management and litter removal. On the other hand, King County estimates annual maintenance costs at about $3,000 per pond; however, this cost likely does not include annual extensive vegetation removal. Consequently, maintenance costs may vary considerably at sites in California depending on the aggressiveness of the vegetation management in that area and the frequency of litter removal.

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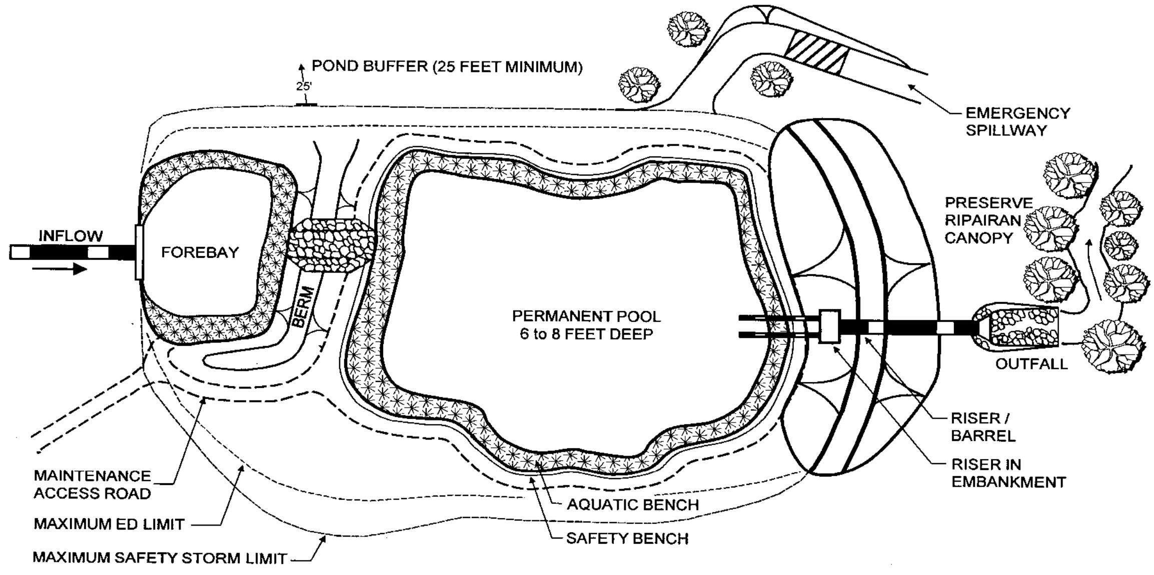
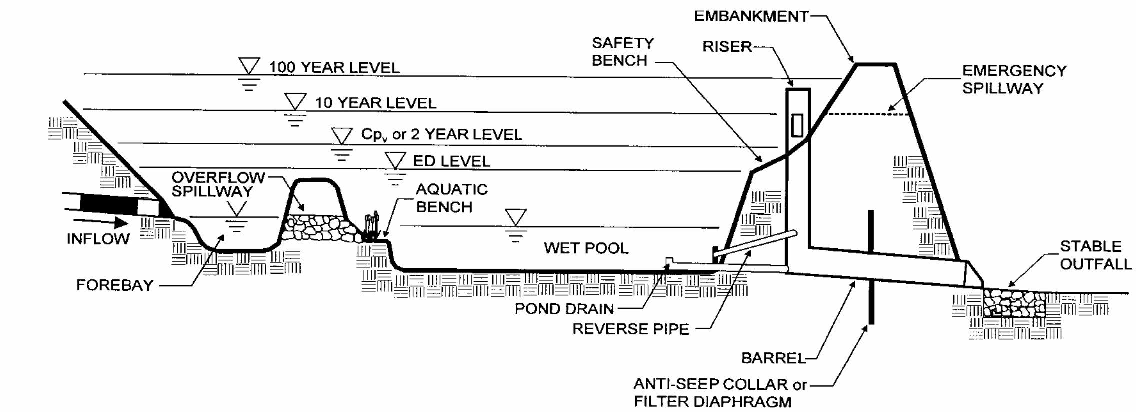


PLAN VIEW



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