FINAL

LOS OSOS BASIN PLAN
GROUNDWATER MONITORING PROGRAM
2016 ANNUAL MONITORING REPORT

Prepared for the

BASIN MANAGEMENT COMMITTEE

JUNE 2017

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EXECUTIVE SUMMARY

The 2016 Annual Report describes Basin activities related to the Los Osos Basin Plan (LOBP) Groundwater Monitoring Program, and provides results and interpretation of these activities in calendar year 2016. The LOBP Groundwater Monitoring Program is necessary to accomplish the following continuing goals set forth in Section 2.4 of the LOBP (ISJ Group, 2015):

1. Provide for a continuously updated hydrologic assessment of the Basin, its water resources and sustainable yield.

2. Create a water resource accounting which is able to meet the information needs for planning, monitoring, trading, environmental management, utility operations, land development and agricultural operations.

The LOBP Groundwater Monitoring Program is also necessary to support other goals of the LOBP, including prevention of seawater intrusion, establishing a long-term environmentally and economically sustainable and beneficial use of the Basin, and the equitable allocation of costs associated with Basin management.

Groundwater Production

Groundwater production for calendar year 2016 is summarized in Table ES-1 below. Purveyor production has declined by less than 1% compared to 2015 and by 19% compared to 2014.

Table ES-1. Groundwater Production for Calendar Year 2016

Description	Production in Acre-Feet
Los Osos Community Services District	520
Golden State Water Company	450
S&T Mutual Water Company	30
Purveyor Subtotal	**1,000**
Domestic wells	220
Community facilities	140
Agricultural wells	800
Total Estimated Production	**2,160**

Basin Status

The status of the Basin in terms of key parameters and the above-referenced metrics are as follows:

> **Precipitation**. The basin received below normal rainfall in 2016 based on records for Stations #152. San Luis Obispo County was in exceptional drought conditions (the greatest intensity level) during 2016, based on information from the U.S. Drought Monitor, a partnership of federal agencies (NDMC/USDA/NOAA, 2016).
>
> **Upper aquifer water levels**. The 10-year trend shows a 0.4 foot per year decline in the upper aquifer.
>
> **Lower aquifer water levels**. The 10-year trend shows a 0.3 foot per year increase in the lower aquifer.
>
> **Seawater intrusion front location**. The seawater intrusion front advanced inland up to 350 feet between Fall 2015 and Fall 2016.
>
> **Basin Yield Metric**. The Basin Yield Metric has improved by decreasing from 89 in 2015 to 78 in 2016, and the metric now meets the LOBP goal of 80 or less.
>
> **Water Level Metric**. The Water Level Metric rose by 0.4 feet between Spring 2015 and Spring 2016, indicating improvement in 2016, though it remains several feet below the target value.
>
> **Chloride Level Metric**. The Chloride Metric in the Basin has increased relative to target value since 2015, indicating a lack of improvement.
>
> **Nitrate Metric**. The Nitrate Metric increased slightly from 2015 to 2016, indicating a lack of improvement.

Recommendations for improving the quality and availability of data are contained in Chapter 9 of the Annual Report. The recommendations include construction of two new monitoring wells, reviewing and updating wellhead survey documentation, developing a rating curve for the stream gage on Los Osos Creek, and the performance of a sensitivity and error analysis for groundwater storage calculations. The cost of these items is estimated to be in the range of $10,000 to $15,000, and they will be considered by the BMC as part of the 2018 budget.

LOBP Metrics

As described in Section 7 ("Data Interpretation") of this Annual Report, the LOBP established several metrics to measure nitrate impacts to the Upper Aquifer, seawater intrusion into the Lower Aquifer, and the effect of management efforts of the Basin Management Committee (BMC). These metrics allow the Parties, the BMC, regulatory agencies, and the public to evaluate the status of nitrate levels and seawater intrusion, and the impact of implementation of the LOBP programs, in the Basin through objective, numerical criteria that can be tracked over time. The status of key Basin metrics is summarized in Table ES-2.

Table ES-2. LOBP Metric Summary			
Metric	**LOBP Goal**	**Calculated Value from 2016 Data**	**Recommended Actions in Addition to LOBP Programs**
Basin Yield Metric	80 or less	78	Implement additional conservation measures to reduce indoor and outdoor demands (See Section 10.3.2)
Water Level Metric	8 feet above mean sea level or higher	1.0 feet above mean sea level	Implement additional conservation measures to reduce indoor and outdoor demands (See Section 10.3.2)
Chloride Level Metric	100 mg/L or lower	225 mg/L	Implement additional conservation measures to reduce indoor and outdoor demands (See Section 10.3.2)
Nitrate Metric	10 mg/L or lower	26 mg/L (NO3-N)	None recommended

Increased Lower Aquifer production in the Western Area between 2015 and 2016, along with continued drought conditions resulted in a rising Chloride Metric and increased seawater intrusion, despite meeting the Basin Yield Metric goal in 2016. Analyses using the Basin Model confirms that this dynamic response would be expected.

Adaptive Management Program

In addition to the programs described in the LOBP, the following additional measures are recommended in the context of adaptive management. Details regarding each program are provided in Section 10 of this Annual Report:

Potential Adaptation of Urban Water Use Efficiency Program. The BMC plans to take a close look at the Urban Water Use Efficiency Program to determine which conservation measures are the most efficient and effective to meet the LOBP's goals. This analysis may result in adaptation of some of the conservation measure set forth in the LOBP, including the addition of outdoor measures as described in Section 10.

Development of Contingency Plan. The BMC plans to develop a contingency plan and related actions in the event Basin Metric trends fail to demonstrate progress toward LOBP goals, including defined schedules and milestones.

Discussion and Development of Metrics for Future Growth. The BMC plans to provide input into the Los Osos Community Plan, including consideration of Basin Metrics and defined goals as they relate to the timing of future growth.

Additional Water Quality Metrics. The BMC intends to consider developing additional metrics and/or numerical goals to protect the upper aquifer from water quality threats, such as seawater intrusion and chromium-6 contamination.

LOBP Infrastructure Programs

The status of LOBP infrastructure programs is summarized Table ES- 3.

Table ES-3. Basin Infrastructure Projects				
Project Name	**Parties Involved**	**Funding Status**	**Capital Cost**	**Status**
Program A				
Water Systems Interconnection	LOCSD/ GSWC	Fully Funded	Construction Value: $103,550	Project completed February 2017, with final approval in March 2017
Upper Aquifer Well (8th Street)	LOCSD	Fully Funded	$250,000	Well was drilled and cased in December 2016. Budget remaining $250,000 to equip the well. Design RFP was issued in April, and a consultant should be retained by June 2017. Project to be completed by June 2018 or earlier if possible.
South Bay Well Nitrate Removal	LOCSD	Completed		
Palisades Well Modifications	LOCSD	Completed		
Blending Project (Skyline Well)	GSWC	Fully Funded	Previously funded through rate case	Blending of Skyline Well and Rosina Well Project was completed. Project required modifications to include a new nitrate removal unit. Permits and equipment secured. Delivery of the treatment unit is estimated for the beginning of July. Assuming 4 weeks for installation, start-up is anticipated in September 2017.
Water Meters	S&T	Completed		
Program B				
LOCSD Wells	LOCSD	Not Funded	BMP: $2.7 mil	Project not initiated
GSWC Wells	GSWC	Not Funded	BMP: $3.2 mil	Project not initiated
Community Nitrate Removal Facility	LOCSD/GSWC	Partial	First phase combined with GSWC Program A	GSWC's Program A Blending Project allows for incremental expansion of the nitrate facility and can be considered a first phase in Program B.

Project Name	Parties Involved	Funding Status	Capital Cost	Status
Program C				
Expansion Well No. 1 (Los Olivos)	GSWC	Fully Funded	Previously funded through rate case	Well has been drilled and cased. GSWC is in the equipping phase. Well can be used, if needed, using on-site generator. Formal startup of the well with permanent equipment is anticipated in July 2017.
Expansion Well No. 2	GSWC	Pending Funding Vote	BMP: $2.0 mil	Property acquisition phase is on-going through efforts of LOCSD. Two sites are currently being reviewed, and both appear to be viable for new east side lower aquifer wells, Environmental studies initiated in December 2016 for expansion well #2.
Expansion Well 3 and LOVR Water Main Upgrade	GSWC	Pending Funding Vote	BMP: $1.6 mil	Property acquisition phase is on-going through efforts of LOCSD. Two sites are currently being reviewed, and both appear to be viable for new east side lower aquifer wells.
LOVR Water Main Upgrade	GSWC	Pending Funding Vote	BMP: $1.53 mil	Project not initiated
S&T/GSWC Interconnection	S&T/ GSWC	Pending	BMP: $30,000	Conceptual design
Program M				
New Zone D/E lower aquifer monitoring well in Cuesta by the Sea	All Parties	Not funded	$100,000	Pending funding plan

1. INTRODUCTION

The Los Osos groundwater basin was adjudicated in October 2015 (*Los Osos Community Services District v. Southern California Water Company [Golden State Water Company] et al.* (San Luis Obispo County Superior Court Case No. CV 040126) and is managed by the Los Osos Groundwater Basin Management Committee (BMC), consisting of representatives from Los Osos Community Services District (LOCSD), Golden State Water Company (GSWC), S&T Mutual Water Company (S&T), and the County of San Luis Obispo (County). This is the second Annual Report for the basin.

The 2016 Annual Report describes basin activities related to the Los Osos Basin Plan (LOBP) Groundwater Monitoring Program, and provides results and interpretation of these activities. The LOBP Groundwater Monitoring Program is necessary to accomplish the following continuing goals set forth in Section 2.4 of the LOBP (ISJ Group, 2015):

1. *Provide for a continuously updated hydrologic assessment of the Basin, its water resources and sustainable yield.*

2. *Create a water resource accounting which is able to meet the information needs for planning, monitoring, trading, environmental management, utility operations, land development and agricultural operations.*

The LOBP Groundwater Monitoring Program is also necessary to support other LOBP goals, including prevention of seawater intrusion, establishing a long-term environmentally and economically sustainable and beneficial use of the basin, and the equitable allocation of costs associated with basin management (ISJ Group, 2015). The program will provide significant overlap with several regulatory requirements, including:

- Senate Bill 1168, Senate Bill 1319, and Assembly Bill 1739 which collectively establish the Sustainable Groundwater Management Act (SGMA)

- California Statewide Groundwater Elevation Monitoring (CASGEM) Program

- State Water Resource Control Board's (SWRCB) salt and nutrient monitoring guidelines as adopted in the state Recycled Water Policy

- Recycled Water Management Plan requirements for the Los Osos Water Recycling Facility (LOWRF)

This report was prepared by Cleath-Harris Geologists (CHG). Wallace Group contributed to the Executive Summary and produced Chapter 10 (Adaptive Management). BMC member agency staff provided assistance during field monitoring activities and with Annual Report review.

2. BACKGROUND

In August 2008, the Superior Court of the State of California for the County of San Luis Obispo County (Court) approved an Interlocutory Stipulated Judgment (ISJ) between LOCSD, GSWC, S&T, and the County. Under the ISJ, these Parties formed a working group, undertaking technical studies and management discussions that produced the LOBP in January 2015. The LOBP presents a comprehensive groundwater management strategy and serves as the cornerstone of a physical solution to address the significant problems facing the basin, including seawater intrusion and elevated nitrate concentrations, and for restoration of basin water resources, while respecting existing water rights. The LOBP Groundwater Monitoring Program is a key component of the LOBP, providing water level and water quality data that serve as measures of effectiveness for LOBP programs and activities with respect to the restoration of basin water resources.

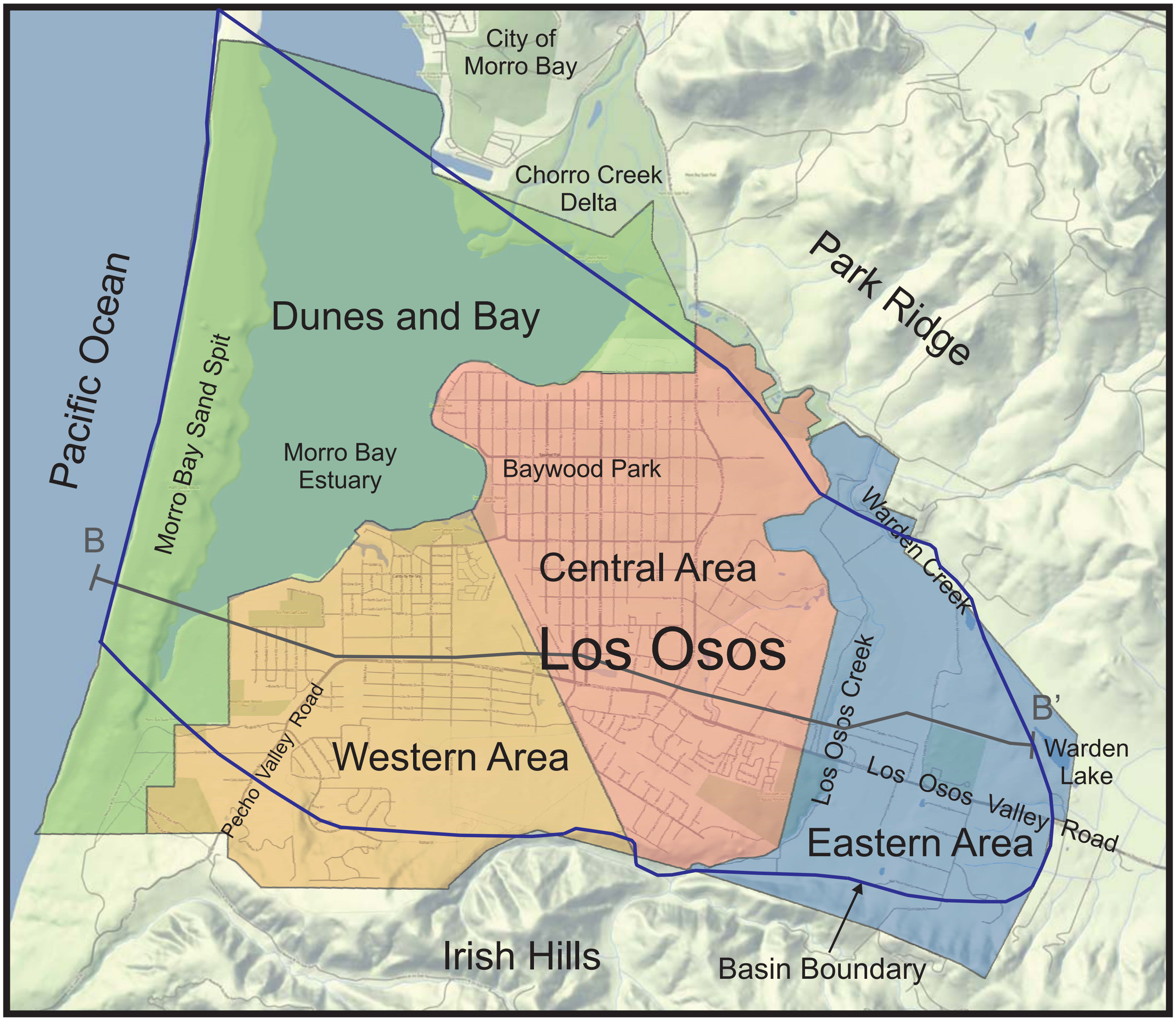
A basin boundary modification request (BBMR) was submitted by the County to the Department of Water Resources (DWR) in March 2016 (County of San Luis Obispo, 2016). The proposed scientific boundary modification was intended to move the current DWR Bulletin 118 boundary to coincide, with minor adjustments, to the basin boundary used in the LOBP. In October 2016, the BBMR was denied by the DWR due to lack of supporting scientific evidence. San Luis Obispo County intends to move forward with studies that may support a new BBMR or can be used for development of a Groundwater Sustainability Plan, as required under SGMA. The LOBP areas and basin boundary are shown in Figure 1.

2.1 Groundwater Monitoring History

Groundwater monitoring has been performed by public agencies, water purveyors, and consultants for various basin studies and programs over several decades. The following lists include historical investigations, monitoring reports, and monitoring programs with a major focus on basin water levels and water quality through December 31, 2016, which is the end of the period covered by this Annual Report.

Historical Investigations

- *Los Osos-Baywood Ground Water Protection Study* (DWR, 1973);
- *Morro Bay Sandspit Investigation* (DWR, 1979);
- *Los Osos - Baywood Park Phase I Water Quality Management Study* (Brown & Caldwell, 1983);
- *Hydrogeology and Water Resources of the Los Osos Valley Ground-Water Basin, San Luis Obispo County, Water-Resources Investigation 88-4081* (U.S. Geological Survey, 1988);
- *Task F - Sanitary Survey and Nitrate Source Study* (Metcalf & Eddy, 1995);



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Scale: 1 inch ≈ 4,000 feet

Explanation

Basin Plan Areas:

- Dunes and Bay Area
- Western Area
- Central Area
- Eastern Area

B — B' Cross-section alignment (Figures 5 and 19). Labeled B-B' to be consistent with Basin Plan.

Basin Boundary from Basin Plan

Figure 1
Basin Location and Plan Areas
Los Osos Groundwater Basin
2016 Annual Report

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- *Sea Water Intrusion Assessment and Lower Aquifer Source Investigation of the Los Osos Valley Groundwater Basin* (Cleath & Associates, 2005);

- *Task 3 Upper Aquifer Water Quality Characterization* (Cleath & Associates, 2006);

Monitoring Reports:

- *Baywood Groundwater Study - Fourth Quarter 1998 (San Luis Obispo County Engineering Department, 1999)*;

- *Quarterly and Semi-Annual Groundwater Monitoring Reports for the Los Osos Nitrate Monitoring Program* (Cleath & Associates, 2002-2006)

- *Water Quality Monitoring Results Summary, November 2009-January 2010, Los Osos Valley Groundwater Basin* (CHG, 2010);

- *Semi-Annual Groundwater Monitoring Reports for Los Osos Water Recycling Facility Baseline Groundwater Quality Monitoring* (CHG, 2012-2013);

- *Semi-Annual Groundwater Monitoring Reports for Los Osos Water Recycling Facility Baseline Groundwater Quality Monitoring* (Rincon Consultants, 2014a, 2014b, 2014c, 2017; CHG 2015c, 2015d);

- *Semi-Annual Groundwater Monitoring Reports for Lower Aquifer* (CHG, 2014-2015);

- *Annual Groundwater Monitoring Reports for Los Osos Basin Plan* (CHG, 2015);

- Consumer Confidence Reports (Water Quality Reports) published annually by the water purveyors.

Monitoring Programs:

- San Luis Obispo County Public Works, Semi-Annual Water Level Monitoring Program. Period of record for individual wells varies; most begin in 1970's and 1980's, and some end in 1999; program remains active.

- Purveyor Water Supply Well Monitoring per SWRCB-Division of Drinking Water requirements. Period of record for individual wells varies; program remains active.

- 2002-2006 Los Osos Nitrate Monitoring Program. Water levels measured quarterly to semi-annually; program ended October 2006.

- 2012-2016 Los Osos Water Recycling Facility Groundwater Monitoring Program. Water levels measured semi-annually, currently on a June and December schedule; program remains active.

- 2014-2015 Lower Aquifer Monitoring Program. Water levels measured semi-annually; program ended in 2015 (replaced by LOBP Groundwater Monitoring Program).

In addition to water quality and water level reporting, this 2016 Annual Report compiles groundwater production, precipitation, and stream flow data from the following sources:

- Water purveyors (LOCSD, GSWC, and S&T) provide metered production records.

- San Luis Obispo County Department of Public Works provides precipitation at the Los Osos Landfill and stream flow data for Los Osos Creek.

Production from domestic and agricultural irrigation wells is not metered. Production estimates for these wells are based on water use surveys performed in 2009 with adjustments from aerial photo review.

2.2 Groundwater Monitoring Program Design

The purpose of the LOBP Groundwater Monitoring Program is to collect and organize groundwater data on a regular basis for use in management of the basin. Design of the LOBP Groundwater Monitoring Program is detailed in Chapter 7 of the LOBP. The basic elements of the program are as follows:

- Monitor long-term groundwater level trends in a network of wells for three monitoring groups within the basin: First Water (FW), Upper Aquifer (UA), and Lower Aquifer (LA).

- Monitor seasonal fluctuations and long-term water quality trends at selected wells in each of the three monitoring groups.

- Compile hydrologic data pertinent to basin management, including groundwater production from the two principal water supply aquifers (Upper Aquifer and Lower Aquifer), wastewater disposal and recycled water use, local precipitation data and County stream gage records for Los Osos Creek.

- Organize historical and ongoing water production, water level and water quality monitoring data into three comprehensive databases, facilitating access and analysis.

- Collect data sufficient to evaluate the effectiveness of basin management strategies adopted in the LOBP via established metrics.

There were a total of 73 wells in the LOBP Groundwater Monitoring Program in 2015, including 35 monitoring wells, 15 municipal wells (active and inactive) and 23 private wells (pending well owner participation). Twelve existing wells have been added to the monitoring program, for a total of 85 network wells (see discussion in Section 9). Existing groundwater monitoring wells were chosen for their specific characteristics and to achieve, to the degree possible, horizontal and vertical coverage throughout the basin. The LOBP Groundwater Monitoring Program coverage within the basin is shown in Figures 2, 3, and 4. Correlation between LOBP Groundwater Monitoring Program well numbers and state well numbers, along with well construction information and monitoring tasks are included in Appendix A. Construction of nested Upper Aquifer and Lower Aquifer monitoring wells near the bay was recommended in the LOBP.

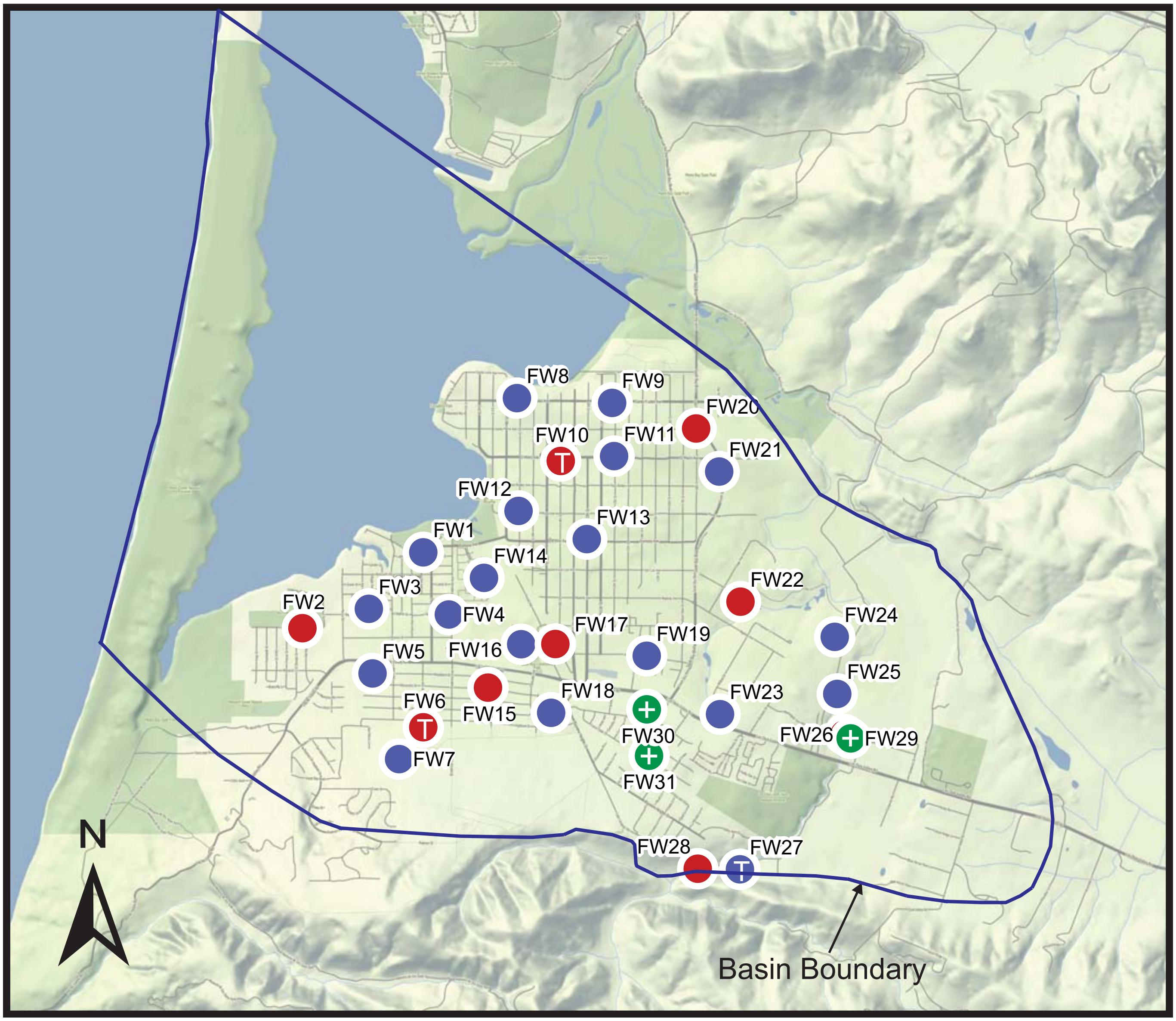
2.2.1 Water Level Monitoring

Groundwater elevations in wells are measures of hydraulic head at certain locations in an aquifer. Groundwater moves in the direction of declining head, and groundwater elevation contours can be used to show the general direction of, and hydraulic gradient associated with, groundwater movement. Changes to the amount of groundwater in storage within an aquifer can also be estimated by using changes in the hydraulic head with other parameters. Water level monitoring is a fundamental tool in characterizing basin hydrology, and will be performed at LOBP Groundwater Monitoring Program locations. Equipping of eight monitoring locations with water level transducers was planned, to provide an efficient and high level of resolution for tracking the dynamic changes in groundwater levels. Five of the eight locations were equipped with transducers in 2016 (see Section 7.2).

Of the 85 wells currently in the groundwater monitoring network, 31 are representative of First Water, 18 are representative of the Upper Aquifer, and 36 are representative of the Lower Aquifer. Spatially, 32 water level monitoring wells are located in the Western Area, 31 are located in the Central Area, and 12 are located in the Eastern Area.

First Water

The First Water group refers to wells screened within the first 50 feet of the water table across the basin, regardless of the aquifer (Figure 5). First Water is the interface where percolating waters, including precipitation and return flows from irrigation and wastewater, mix with basin waters. This 50-foot thick interface occurs within unconfined sediments and would rise and fall seasonally with water level fluctuations. Where First Water is close to ground surface, it also impacts drainage and is associated with flooding issues in low-lying areas. First Water extends areally throughout the basin, and may be present in dune sands, Paso Robles Formation deposits, or Los Osos Creek alluvium (Figure 5). Selected First Water wells, including those in downtown Los Osos are used to represent the perched aquifer (Zones A and B) and alluvial aquifer for water level contouring.



Base Image: Stamen-Terrain

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Scale: 1 inch ≈ 4,000 feet

Explanation

- LOBP Water Level Monitoring Well
- Water Level Monitoring Well Addition (existing well)
- Water Level Transducer
- Water Level and Water Quality Monitoring Well
- Water Level Transducer and Water Quality Monitoring Well

Figure 2
Groundwater Monitoring Program
First Water Wells
Los Osos Groundwater Basin
2016 Annual Report

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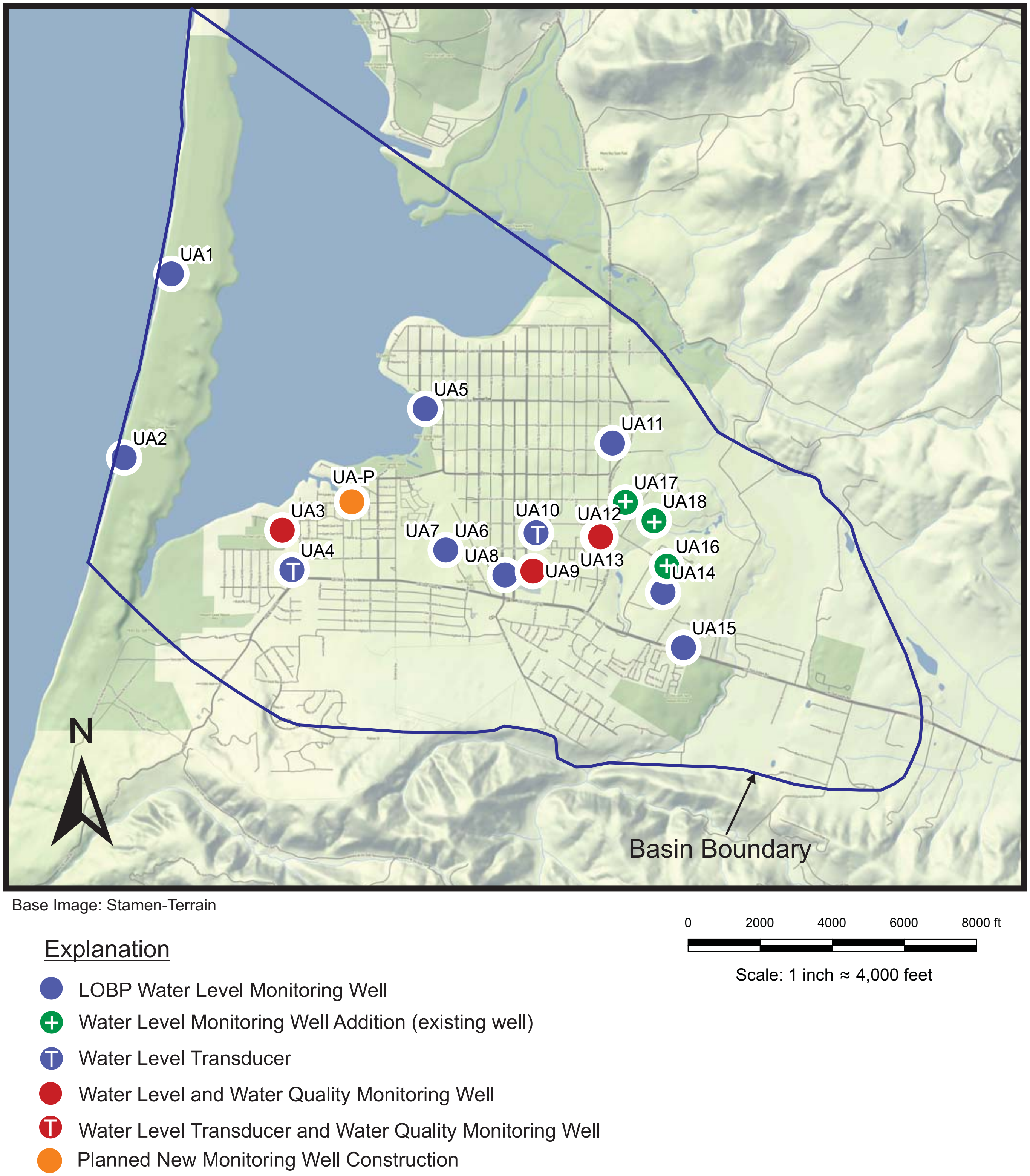

Figure 3
Groundwater Monitoring Program
Upper Aquifer Wells
Los Osos Groundwater Basin
2016 Annual Report

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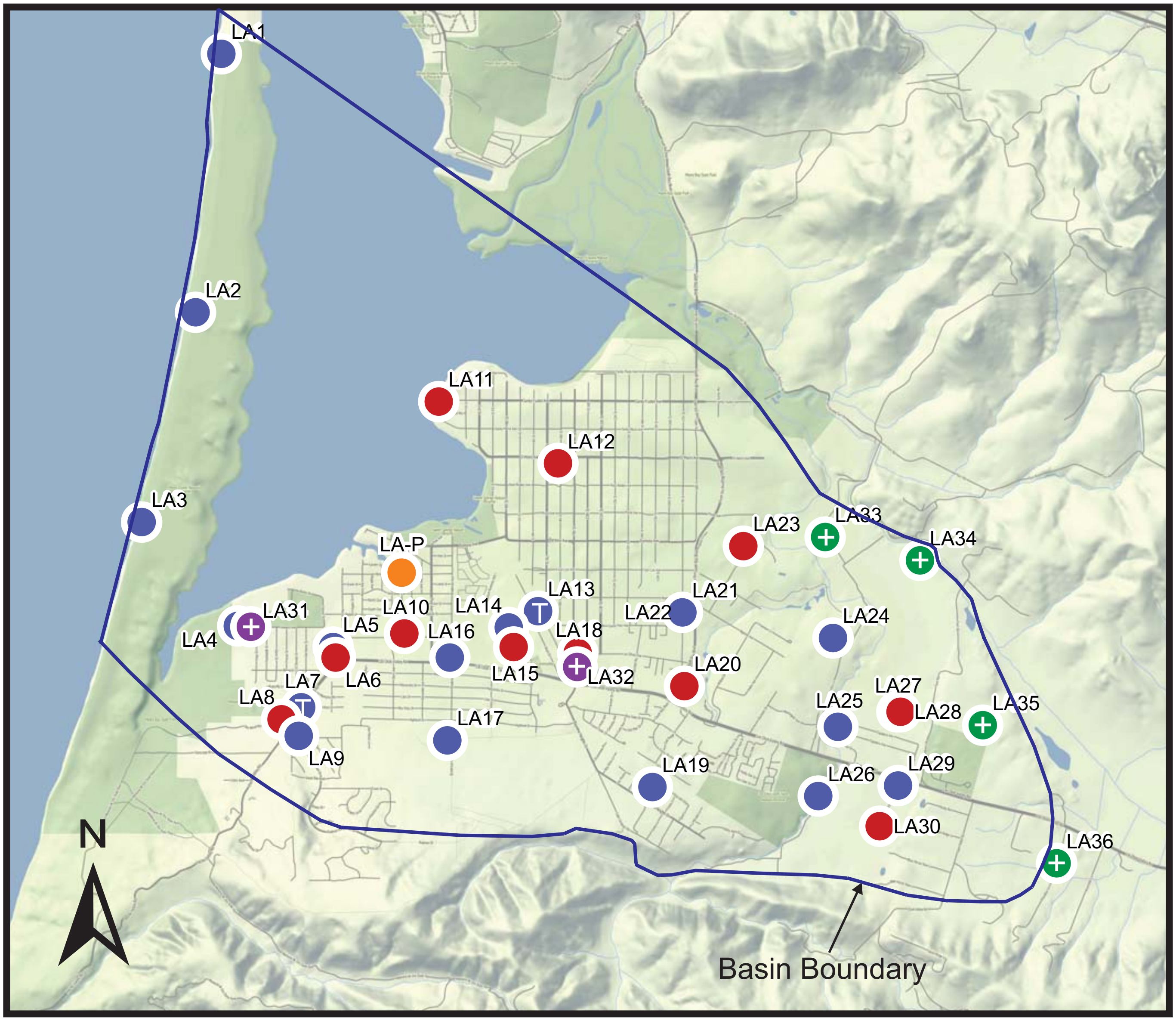

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Scale: 1 inch ≈ 4,000 feet

Explanation

- LOBP Water Level Monitoring Well
- Water Level Monitoring Well Addition (existing well)
- Water Level Transducer
- Water Level and Water Quality Monitoring Well
- Water Level Transducer and Water Quality Monitoring Well
- Recommended Water Quality Monitoring Well Addition (existing well)
- Planned New Monitoring Well Construction

Note: LA24 and FW24 are nested wells (same location)

Figure 4
Groundwater Monitoring Program
Lower Aquifer Wells
Los Osos Groundwater Basin
2016 Annual Report

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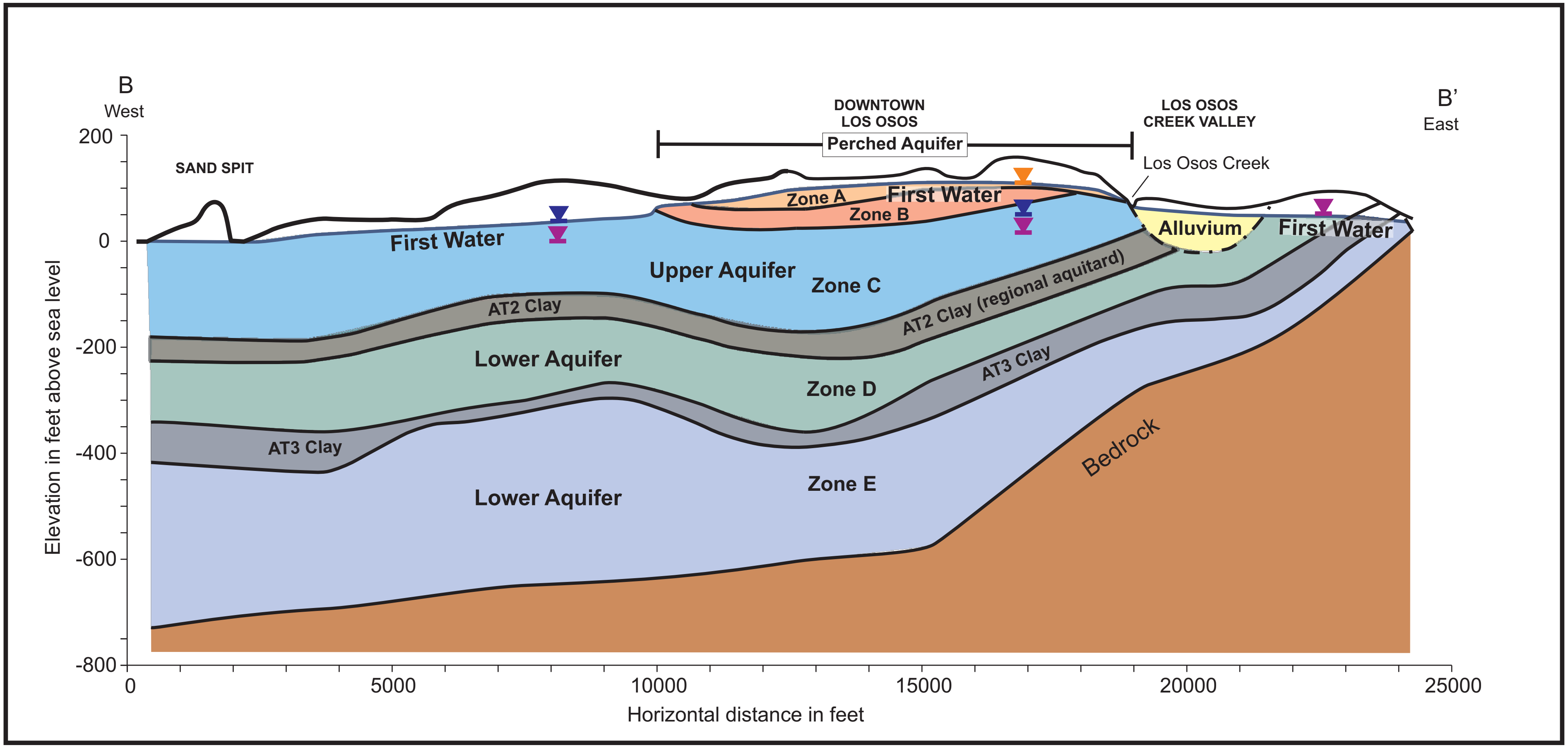

Cross-section alignment shown in Figure 1

Explanation

Perched Aquifer Water level

Upper Aquifer Water level

Lower Aquifer Water level

Figure 5
Basin Aquifers
Los Osos Groundwater Basin
2016 Annual Report

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Upper Aquifer

The upper aquifer (Zone C) refers to the non-perched aquifer above the regional aquitard (Figure 5). As noted above, a portion of the upper aquifer may also be considered first water in certain basin areas. Historically, the upper aquifer was developed as the main water supply for the community, and is still the main source of water for rural residential parcels. A significant increase in upper aquifer production is planned under infrastructure program B . Monitoring the upper aquifer in the urban area, those properties contained within the Urban Reserve Line as shown in Figure 10 of the LOBP, is important to both local purveyors and rural residential parcels.

Lower Aquifer

The lower aquifer refers to water bearing sediments below the regional aquitard. There are both Paso Robles Formation and Careaga Formation deposits in the lower aquifer. The base of the lower aquifer is claystone and sandstone bedrock, although the effective base of fresh water lies above bedrock at the western edge of the basin. There are two generalized aquifer zones within the lower aquifer. Zone D lies between the regional aquitard (AT2 clay) and a deeper aquitard (AT3 clay). Zone E is below the AT3 clay (Figure 5).

Lower aquifer Zone D is currently the main water supply source for the community. The seawater intrusion front has been advancing inland at increasing rates over time, and a significant reduction in lower aquifer production, together with other LOBP programs, is necessary to halt, slow and/or reverse intrusion.

2.2.2 Groundwater Quality Monitoring

Groundwater quality monitoring refers to the periodic collection and analysis of groundwater from wells. The analytical requirements are highly variable, depending on the purpose of monitoring. General minerals and nitrate are common water quality constituents of analysis for groundwater basin investigations. There are many other classes of water quality constituents of concern, however, such as volatile organic compounds, inorganic compounds (metals), petroleum hydrocarbons or emerging contaminants. Hexavalent Chromium has also been a concern in several shallow wells as described elsewhere in this report. Many of these are regulated and have drinking water standards. The purveyors monitor many of these constituents and data from those monitoring efforts will be incorporated into the LOBP Groundwater Monitoring Program.

Monitoring Constituents

Constituents of analysis for the LOBP Groundwater Monitoring Program have been selected to evaluate salt loading and associated nitrate impacts, seawater intrusion and wastewater disposal. Table 1 lists the general mineral constituents, including nitrate, which will be monitored as part of the program, although additional constituents are quantified in the general minerals suite performed by the analytical laboratory (See Appendix C). Total Dissolved Solids (TDS) and specific conductance are standard measures for groundwater mineralization and salinity. Temperature and pH are parameters that are routinely measured during sampling to confirm that the groundwater samples represent the aquifer. Table 1 presents constituents to be tested in the wells designated for water quality monitoring, which are distributed laterally and vertically across the basin (Figures 2, 3 and 4). Sampling at private wells will be pending private well owner participation in the LOBP Groundwater Monitoring Program.

Table 1. Water Quality Monitoring Constituents[1]		
Constituent	**Reporting Limit**	**Units**
Specific Conductance	1.0	µs/cm
pH (field)	0.01	pH units
Temperature (field)	0.1	°F
TDS	20	mg/L
Carbonate Alkalinity	10	mg/L
Bicarbonate Alkalinity	10	mg/L
Total Alkalinity	10	mg/L
Chloride	1.0	mg/L
Nitrate - Nitrogen	0.1	mg/L
Sulfate	2.0	mg/L
Boron	0.1	mg/L
Calcium	1.0	mg/L
Magnesium	1.0	mg/L
Potassium	1.0	mg/L
Sodium	1.0	mg/L

[1]From LOBP (ISJ Group, 2015)

The Lower Aquifer (via Well LA4 and Well LA14) will also be monitored using down hole geophysics once every three years (natural gamma and induction logs) to provide a unique measure of seawater intrusion over time in one location within the basin. LA4 is located near the Sea Pines Golf Course in the Western Area, and LA14 is located at the north end of Palisades Avenue. Seawater is highly conductive, compared to fresh water, and an induction log performed in a borehole penetrating the fresh water/seawater interface shows the vertical transition from fresh water to seawater. The next scheduled geophysical logging is for October 2018.

Constituents of Emerging Concern

Monitoring Constituents of Emerging Concern (CECs) is a requirement of salt and nutrient management plans adopted pursuant to the State Water Resources Control Board Recycled Water Policy (SWRCB, 2009). Such monitoring can measure potential dilution and soil-aquifer treatment of recycled water constituents, and travel time and movement of recycled water. As part of LOWRF operation, the County is also required by the Regional Water Quality Control Board

Monitoring and Reporting Program (MRP) Order No. R3-2011-0001 to monitor recycled water for CECs on an annual basis.

The initial CECs to be monitored are listed in Table 2, and were selected based on the Recycled Water Policy. There are three types of CECs, each of which has a different function. Health-based indicators directly monitor the presence of classes of constituents in groundwater, while performance-based and surrogate indicators measure the effectiveness of the wastewater treatment process. The list of CECs is not intended to be comprehensive, but meant to be representative. CECs may be added to (or removed from) the monitoring list once data has been collected and analyzed, subject to approval by the BMC.

Table 2. CEC Monitoring Constituents[1]

Constituent or Parameter	Type of Constituent	Type of Indicator	Reporting Limit (µg/L)
17β-estradiol	Steroid Hormones	Health	0.001
Triclosan	Antimicrobial	Health	0.050
Caffeine	Stimulant	Health	0.050
NDMA (Nitroso-dimethylamine)	Disinfection Byproduct	Health	0.002
Gemfibrozil	Pharmaceutical Residue	Performance	0.010
DEET (Diethyl-meta-toluamide)	Personal Care Product	Performance	0.050
Iopromide	Pharmaceutical Residue	Performance	0.050
Sucralose	Food additive	Performance	0.100
Ammonia	N/A	Surrogate	N/A
Nitrate-Nitrogen	N/A	Surrogate	N/A
Total Organic Carbon	N/A	Surrogate	N/A
UV Light Absorption	N/A	Surrogate	N/A
Specific Conductance	N/A	Surrogate	N/A

[1]From LOBP (ISJ Group, 2015)

2.2.3 Monitoring Frequency

Monitoring frequency is the time interval between data collection. Seasonal fluctuations relating to groundwater levels or quality are typically on quarterly or semi-annual cycles, correlating with seasonal precipitation, recharge, water levels, and often well production. The monitoring schedule for groundwater levels collected under the LOBP Groundwater Monitoring Program will coincide with seasonal water level fluctuations, with higher levels (i.e. elevations) in April (Spring) and lower levels in October (Fall). Spring water levels collected under the LOWRF Baseline Groundwater Monitoring Program (First Water and Upper Aquifer groups) may extend beyond April into June, and Fall water levels may extend beyond October into December. A semi-annual monitoring frequency provides a measure of these seasonal cycles, which can then be distinguishable from the long-term trends. At the transducer-monitored locations, water level measurements will be recorded automatically on a daily basis and downloaded during the regular semi-annual water level monitoring events.

The monitoring frequency for water quality sampling and analyses performed under the LOBP Groundwater Monitoring Program will generally be once per year in October (Fall), when groundwater levels (i.e. elevations) are seasonally low and many water quality constituents have historically been at a higher concentrations than their corresponding Spring measurement. Lower Aquifer groundwater monitoring will also be performed in April (Spring) as a means of tracking seawater intrusion in greater detail. The schedule for Fall water quality testing performed under the LOWRF Groundwater Monitoring Program (First Water and Upper Aquifer) has been moved by San Luis Obispo County from October to December.

3. CONDUCT OF WORK

This Groundwater Monitoring Program Annual Report covers monitoring activities performed during the 2016 calendar year. While information from prior years is included in data presentation and interpretation, the conduct of work and detailed groundwater monitoring results are reported for 2016.

3.1 Services Provided

All 2016 groundwater monitoring data compiled for this report, unless described otherwise, comes from the following monitoring programs:

- San Luis Obispo County Public Works, Semi-Annual Water Level Monitoring Program: water level data.
- Purveyor water supply well monitoring: water level, water quality and production data.
- LOWRF Baseline Groundwater Monitoring Program: water level and water quality data.
- LOBP Groundwater Monitoring Program: water level and water quality data.

3.2 Field Methods

Groundwater level measurement and groundwater sampling are the primary field activities performed for the LOBP Groundwater Monitoring Program. Field activities include measuring and recording water levels in wells and collecting groundwater samples for laboratory analytical testing. The field methods approved for use in the LOBP Groundwater Monitoring Program are presented in Appendix B. These methods are recommended for services performed directly for the

BMC and for other monitoring programs that contribute data to the LOBP Groundwater Monitoring Program.

3.2.1 Elevation Datum

The original survey for wells in the County's Semi-Annual Water Level Monitoring Program was likely based on the National Geodetic Vertical Datum of 1929 (NGVD 29), which has been replaced in land surveying practice by the North American Vertical Datum of 1988 (NAVD 88). Several wells were re-surveyed in 2003 and 2005 using NAVD 88, but there are still wells with elevations based on NGVD 29, along with wells with no known elevation survey. For the 2016 Annual Report, wellhead elevations reported in tables are from the latest available survey or estimated from topographic maps (with datum given). For water level contouring and storage calculations, the NGVD 29 reference point elevation have been adjusted to NAVD 88 datum using a 2.8 feet upward shift, based on North American Vertical Datum Conversion (VERTCON) data reviewed for the Los Osos area, as published by the National Geodetic Society. A review of all reference points by a licensed surveyor is recommended, after which all data may be expressed in the current NAVD 88 standard, including the Water Level Metric.

3.2.2 Water Level Monitoring Procedures

Groundwater level monitoring typically uses an electric sounder or steel tape. If the well is equipped and active, monitoring would take place when the pump is off and the water level is relatively static. Five monitoring network wells are currently equipped with a pressure transducer, allowing for automatic water level data collection between regular (manual) monitoring events. These devices are placed below water in a well and record changes in pressure that occur in response to changes in the height of the water column above the transducer. Detailed water level monitoring procedures are included in Appendix B.

3.2.3 Groundwater Sampling Procedures

Groundwater sampling procedures ensure collection of a representative groundwater sample from an aquifer for water quality analysis. Unused or unequipped wells are purged of standing or stagnant water prior to sampling. Stabilization of field measurements for conductivity, pH, and temperature, along with minimum purge volumes, are included in the approved methods. Active wells can be sampled with alternative purging requirements. Sampling procedures for general mineral and nitrate sampling (with additional procedures for wastewater indicator compounds) are presented in Appendix B.

An induction electric log, which is used periodically at Wells LA4 and LA14, measures formation specific conductance using high frequency alternating currents that are induced into the formation. The technique may be used in open boreholes or wells cased with PVC, but not in steel-cased wells. Seawater is highly conductive, compared to fresh water, and an induction log performed in a borehole penetrating the fresh water/seawater interface will show the vertical transition from fresh water to seawater. By convention, conductivity measurements from the induction tool are put through an electrical reciprocator and converted to a resistivity curve on the log. The gamma ray log, which is also performed periodically at Wells LA4 and LA14, measures naturally occurring gamma emissions from the formation surrounding the borehole. These emissions can penetrate both PVC and steel-cased wells, and are typically used to measure clay content when gamma active clays are present (Welenco, 1996). Since natural gamma emissions are not affected by changes in water quality, the gamma ray log can be used as a depth calibration tool when comparing induction logs from different monitoring events.

3.3 Monitoring Staff Affiliations

Monitoring services that contributed data to the 2016 Annual Report were performed by staff or consultants affiliated with the following agencies:

- San Luis Obispo County Department of Public Works, Water Resources Division. County staff performed semi-annual water level monitoring, collected and maintained precipitation and stream gage records. CHG (April 2016) and Rincon Consultants (December 2016) performed semi-annual water level monitoring, water quality sampling at private wells, monitoring wells, and municipal supply wells for the LOWRF Groundwater Monitoring Program.

- Los Osos Water Purveyors (LOCSD, GSWC, S&T). Water agency staff performed semi-annual water level monitoring and water quality sampling at municipal water supply wells.

- Los Osos BMC (LOCSD, GSWC, S&T, and County). CHG performed semi-annual water level monitoring, water quality sampling at private wells, monitoring wells, and municipal supply wells for the LOBP Groundwater Monitoring Program.

4. MONITORING RESULTS

The results of groundwater monitoring activities performed in 2016 for the various basin monitoring programs are summarized below. Overlap between the LOBP Groundwater Monitoring Program and other ongoing monitoring programs are shown in Appendix A. Laboratory analytical reports of groundwater samples collected for the LOWRF Groundwater Monitoring Program are contained in their respective April and December 2016 monitoring program reports (CHG, 2016a; Rincon Consultants, 2017).

4.1 Water Level Monitoring Results

Tables 3 through 8 present the results of groundwater level measurements at LOBP Groundwater Monitoring Program wells, as reported by the various monitoring programs. Available water levels for wells labeled "Private" are not reported herein, but those listed as measured have been used for aggregated water level contour maps. "Private" wells refer to domestic wells, agricultural irrigation wells, and monitoring wells that are not controlled by BMC member agencies.

Spring water levels were measured in April 2016 for the County Semi-Annual Water Level Monitoring Program and the Lower Aquifer Monitoring Program, and in April and May for the LOWRF Groundwater Monitoring Program. Fall water levels were measured in October 2016 for the County Semi-Annual Water Level Monitoring Program and the LOBP Groundwater Monitoring Program. The LOWRF Groundwater Monitoring Program schedule moved from October to December beginning in Fall 2016. For consistency with the LOBP and County programs, however, CHG also monitored water levels at selected LOWRF monitoring program wells in October 2016, rather than using the December 2016 LOWRF monitoring event values.

Table 3. Spring 2016 Water Levels - First Water

Well ID	State Well Number	R. P. Elevation and Datum (feet)	Date	Water Level (Feet)	
				Depth	Elevation
FW1	30S/10E-13A7	PRIVATE (not measured)			
FW2	30S/10E-13L8	32.63 [1]	4/25/2016	23.49	9.1
FW3	30S/10E-13G	50.95 [1]	4/27/2016	41.46	9.5
FW4	30S/10E-13H	49.33 [1]	5/2/2016	32.04	17.3
FW5	30S/10E-13Q2	101.27 [1]	4/28/2016	88.90	12.4
FW6	30S/10E-24A	193.04 [1]	5/2/2016	160.24	32.8
FW7	30S/10E-24Ab	not measured			
FW8	30S/11E-7L4	45.76 [1]	4/27/2016	37.46	8.3
FW9	30S/11E-7K3	90.71 [1]	5/3/2016	54.15	36.6
FW10	30S/11E-7Q1	25.29 [1]	5/3/2016	9.00	16.3
FW11	30S/11E-7R2	61.93 [1]	4/26/2016	23.91	38.0
FW12	30S/11E-18C2	34.55 [1]	4/26/2016	20.16	14.4
FW13	30S/11E-18B2	79.89 [1]	4/26/2016	21.93	58.0
FW14	30S/11E-18E1	PRIVATE (measured)			
FW15	30S/11E-18N2	125.53 [1]	4/28/2016	83.42	42.1
FW16	30S/11E-18L11	88.02 [1]	4/25/2016	47.64	40.4
FW17	30S/11E-18L12	103.85 [1]	4/25/2016	21.38	82.5
FW18	30S/11E-18P	PRIVATE (not measured)			
FW19	30S/11E-18J7	125.74 [1]	5/2/2016	25.26	100.5
FW20	30S/11E-8Mb	95.00 [2]	(dry)		
FW21	30S/11E-8N4	95.99 [1]	4/27/2016	41.25	54.7
FW22	30S/11E-17F4	PRIVATE (measured)			
FW23	30S/11E-17N4	PRIVATE (measured)			
FW24	30S/11E-17J2	PRIVATE (measured)			
FW25	30S/11E-17R1	PRIVATE (measured)			
FW26	30S/11E-20A2	PRIVATE (not measured)			
FW27	30S/11E-20L1	PRIVATE (measured)			
FW28	30S/11E-20M2	PRIVATE (measured)			
FW29+	30S/11E-20A1	PRIVATE (measured)			
FW30+	30S/11E-18R1	PRIVATE (measured)			
FW31+	30S/11E-19A	213.00 [2]	not measured		

NOTES:
1 NAVD88 elevation as reported by licensed land surveyor
2 estimated elevation (NAVD88)
+ added to LOBP monitoring network

Table 4. Spring 2016 Water Levels - Upper Aquifer					
Well ID	State Well Number	R. P. Elevation and Datum (feet)	Date	Water Level (Feet)	
				Depth	Elevation
UA1	30S/10E-11A1	16.01 [1]	4/5/2016	12.10	3.9
UA2	30S/10E-14B1	19.48 [4]	4/5/2016	15.85	3.6
UA3	30S/10E-13F1	19.00 [2]	4/5/2016	10.00	9.0
UA4	30S/10E-13L1	39.00 [2]	5/3/2016	32.38	6.6
UA5	30S/11E-7N1	11.00 [2]	4/20/2016	3.60	7.4
UA6	30S/11E-18L8	75.80 [3]	4/12/2016	57.99	17.8
UA7	30S/11E-18L7	75.40 [3]	4/12/2016	66.01	9.4
UA8	30S/11E-18K7	135.65 [3]	4/12/2016	119.55	16.1
UA9	30S/11E-18K3	121.18 [3]	4/22/2016	120.00	1.2
UA10	30S/11E-18H1	107.10 [3]	4/29/16	94.34	12.8
UA11	30S/11E-17D	PRIVATE (not measured)			
UA12	30S/11E-17E9	105.85 [3]	4/12/2016	92.11	13.7
UA13	30S/11E-17E10	106.00 [2]	4/21/2016	91.00	15.0
UA14	30S/11E-17P4	PRIVATE (not measured)			
UA15	30S/11E-20B7	PRIVATE (not measured)			
UA16+	30S/11E-17L4	PRIVATE (measured)			
UA17+	30S/11E-17E1	PRIVATE (measured)			
UA18+	30S/11E-17F2	PRIVATE (measured)			

NOTES:
1 NAVD88 elevation as reported by licensed land surveyor
2 estimated elevation (assume NAVD88)
3 elevation as reported by County records (datum unknown, likely NGVD 29)
4 NAVD88 survey elevation with County adjustment for raising wellhead
+ added to LOBP monitoring network

Table 5. Spring 2016 Water Levels - Lower Aquifer					
		R. P. Elevation and Datum		Water Level (Feet)	
Well ID	State Well Number	(feet)	Date	Depth	Elevation
LA1	30S/10E-2A1	23.13 [4]	4/5/2016	15.89	7.2
LA2	30S/10E-11A2	16.07 [1]	4/5/2016	10.96	5.1
LA3	30S/10E-14B2	19.47 [4]	4/5/2016	17.42	2.1
LA4	30S/10E-13M1	41.20 [3]	4/12/2016	40.12	1.1
LA5	30S/10E-13L7	37.00 [2]	6/1/2016	34.00	3.0
LA6	30S/10E-13L4	68.00 [2]	not measured		
LA7	30S/10E-13P2	PRIVATE			
LA8	30S/10E-13N	138.50 [2]	6/1/2016	135.00	3.5
LA9	30S/10E-24C1	178.32 [3]	4/13/2016	174.00	4.3
LA10	30S/10E-13J1	95.31 [3]	4/6/2016	104.00	-8.7
LA11	30S/10E-12J1	8.43 [1]	4/12/2016	5.70	2.7
LA12	30S/11E-7Q3	24.30 [3]	4/20/2016	36.00	-11.7
LA13	30S/11E-18F2	100.00 [3]	4/29/2016	106.04	-6.0
LA14	30S/11E-18L6	78.08 [3]	4/12/2016	81.10	-3.0
LA15	30S/11E-18L2	85.00 [2]	4/20/2016	98.10	-13.1
LA16	30S/11E-18M1	106.82 [3]	4/12/2016	100.54	6.3
LA17	30S/11E-24A2	210.40 [3]	not measured		
LA18	30S/11E-18K8	135.74 [3]	4/12/2016	138.58	-2.8
LA19	30S/11E-19H2	256.20 [3]	4/12/2016	274.40	-18.2
LA20	30S/11E-17N10	140.00 [2]	4/13/2016	147.00	-7.0
LA21	30S/11E-17E7	105.85 [3]	4/12/2016	112.01	-6.2
LA22	30S/11E-17E8	105.85 [3]	4/12/2016	116.1	-10.2
LA23 to LA30		PRIVATE (measured LA24, LA29, LA29)			
LA31+	30S/10E-13M2	(Mixed aquifer - used for water quality only)			
LA32+	30S/11E-18K9	(Mixed aquifer - used for water quality only)			
LA33+	30S/11E-17A1	PRIVATE (measured)			
LA34+	30S/11E-8F	26.15 [1]	4/7/2016	5.40	20.8
LA35+	30S/11E-21Bb	96.00 [2]	not measured		
LA36+	30S/11E-21Ja	PRIVATE (measured)			

NOTES:
1 NAVD88 elevation as reported by licensed land surveyor
2 estimated elevation (assume NAVD88)
3 elevation as reported by County records (datum unknown, likely NGVD 29)
4 NAVD88 survey elevation with County adjustment for raising wellhead
+ added to LOBP monitoring network

Table 6. Fall 2016 Water Levels - First Water					
Well ID	State Well Number	R. P. Elevation and Datum (feet)	Date	Water Level (Feet)	
				Depth	Elevation
FW1	30S/10E-13A7	PRIVATE (not measured)			
FW2	30S/10E-13L8	32.63 [1]	10/10/2016	24.01	8.6
FW3	30S/10E-13G	50.95 [1]	10/19/2016	42.28	8.7
FW4	30S/10E-13H	49.33 [1]	10/19/2016	32.97	16.4
FW5	30S/10E-13Q2	101.27 [1]	10/24/2016	87.62	13.7
FW6	30S/10E-24A	193.04 [1]	10/10/2016	162.04	31.00
FW7	30S/10E-24Ab	not measured			
FW8	30S/11E-7L4	45.76 [1]	10/12/2016	38.01	7.8
FW9	30S/11E-7K3	90.71 [1]	10/12/2016	54.74	36.0
FW10	30S/11E-7Q1	25.29 [1]	10/11/2016	9.73	15.6
FW11	30S/11E-7R2	61.93 [1]	10/12/2016	24.96	37.0
FW12	30S/11E-18C2	34.55 [1]	10/18/2016	20.78	13.8
FW13	30S/11E-18B2	79.89 [1]	10/18/2016	23.47	56.4
FW14	30S/11E-18E1	PRIVATE (measured)			
FW15	30S/11E-18N2	125.53 [1]	10/19/2016	84.29	41.2
FW16	30S/11E-18L11	88.02 [1]	10/19/2016	48.72	39.3
FW17	30S/11E-18L12	103.85 [1]	10/19/2016	22.60	81.3
FW18	30S/11E-18P	150.00 [2]	not measured		
FW19	30S/11E-18J7	125.74 [1]	10/19/2016	26.65	99.1
FW20	30S/11E-8Mb	95.00 [2]	10/12/2016	0.00	95.0
FW21	30S/11E-8N4	95.99 [1]	10/12/2016	41.57	54.4
FW22	30S/11E-17F4	PRIVATE (measured)			
FW23	30S/11E-17N4	PRIVATE (measured)			
FW24	30S/11E-17J2	PRIVATE (measured)			
FW25	30S/11E-17R1	PRIVATE (not measured)			
FW26	30S/11E-20A2	PRIVATE (not measured)			
FW27	30S/11E-20L1	PRIVATE (measured)			
FW28	30S/11E-20M2	PRIVATE (measured)			
FW29+	30S/11E-20A1	PRIVATE (measured)			
FW30+	30S/11E-18R1	PRIVATE (Measured)			
FW31+	30S/11E-19A	213.00 [2]	not measured		

NOTES: 1 NAVD88 elevation as reported by licensed land surveyor

2 estimated elevation (NAVD88)

+ added to LOBP monitoring network

Table 7. Fall 2016 Water Levels - Upper Aquifer					
Well ID	State Well Number	R. P. Elevation and Datum (feet)	Date	Water Level (Feet)	
				Depth	Elevation
UA1	30S/10E-11A1	16.01 [1]	10/26/2016	12.66	3.4
UA2	30S/10E-14B1	19.48 [4]	10/26/2016	15.40	4.1
UA3	30S/10E-13F1	19.00 [2]	10/7/2016	11.00	8.0
UA4	30S/10E-13L1	39.00 [2]	11/3/2016	30.00	9.0
UA5	30S/11E-7N1	11.00 [2]	10/13/2016	4.25	6.8
UA6	30S/11E-18L8	75.80 [3]	10/19/2016	59.47	16.3
UA7	30S/11E-18L7	75.40 [3]	10/19/2016	67.77	7.6
UA8	30S/11E-18K7	135.65 [3]	10/24/2016	121.69	14.0
UA9	30S/11E-18K3	121.18 [3]	10/19/2016	122.00	-0.8
UA10	30S/11E-18H1	107.10 [3]	10/11/2016	96.58	10.5
UA11	30S/11E-17D	PRIVATE (not measured)			
UA12	30S/11E-17E9	105.85 [3]	10/24/2016	91.60	14.3
UA13	30S/11E-17E10	106.00 [2]	10/13/2016	96.85	9.2
UA14	30S/11E-17P4	PRIVATE (not measured)			
UA15	30S/11E-20B7	PRIVATE (not measured)			
UA16+	30S/11E-17L4	PRIVATE (measured)			
UA17+	30S/11E-17E1	PRIVATE (measured)			
UA18+	30S/11E-17F2	PRIVATE (measured)			

NOTES:
1 NAVD88 elevation as reported by licensed land surveyor
2 estimated elevation (assume NAVD88)
3 elevation as reported by County records (datum unknown, likely NGVD 29)
4 NAVD88 survey elevation with County adjustment for raising wellhead
+ added to LOBP monitoring network

Table 8. Fall 2016 Water Levels - Lower Aquifer

Well ID	State Well Number	R. P. Elevation and Datum (feet)	Date	Water Level (Feet) Depth	Elevation
LA1	30S/10E-2A1	23.13 [4]	10/26/2016	15.95	7.2
LA2	30S/10E-11A2	16.07 [1]	10/26/2016	11.66	4.4
LA3	30S/10E-14B2	19.47 [4]	10/26/2016	18.05	1.4
LA4	30S/10E-13M1	41.20 [3]	10/24/2016	45.65	-4.4
LA5	30S/10E-13L7	37.00 [2]	11/3/2016	30.00	7.0
LA6	30S/10E-13L4	68.00 [2]	not measured		
LA7	30S/10E-13P2	PRIVATE (not measured)			
LA8	30S/10E-13N	138.50 [2]	10/17/2016	135.00	3.5
LA9	30S/10E-24C1	178.32 [3]	10/19/2016	176.00	2.3
LA10	30S/10E-13J1	95.31 [3]	10/18/2016	88.00	7.3
LA11	30S/10E-12J1	8.43 [1]	10/24/2016	6.95	1.5
LA12	30S/11E-7Q3	24.30 [3]	10/14/2016	57.40	-33.1
LA13	30S/11E-18F2	100.00 [3]	10/12/2016	109.05	-9.0
LA14	30S/11E-18L6	78.08 [3]	10/19/2016	81.72	-3.6
LA15	30S/11E-18L2	85.00 [2]	10/13/2016	110.90	-25.9
LA16	30S/11E-18M1	106.82 [3]	10/19/2016	101.89	4.9
LA17	30S/11E-24A2	210.40 [3]	not measured		
LA18	30S/11E-18K8	135.74 [3]	10/24/2016	141.94	-6.2
LA19	30S/11E-19H2	256.20 [3]	10/24/2016	276.16	-20.0
LA20	30S/11E-17N10	140.00 [2]	10/6/2016	166.00	-26.0
LA21	30S/11E-17E7	105.85 [3]	10/24/2016	118.01	-12.2
LA22	30S/11E-17E8	105.85 [3]	10/24/2016	126.61	-20.8
LA23 to LA30		PRIVATE (measured LA24, LA 26, LA29)			
LA31+	30S/10E-13M2	(Mixed aquifer - used for water quality only)			
LA32+	30S/11E-18K9	(Mixed aquifer - used for water quality only)			
LA33+	30S/11E-17A1	PRIVATE (measured)			
LA34+	30S/11E-8F	26.15 [1]	10/24/2016	8.27	17.9
LA35+	30S/11E-21Bb	96.00 [2]	not measured		
LA36+	30S/11E-21Ja	PRIVATE (measured)			

NOTES:
1 NAVD88 elevation as reported by licensed land surveyor
2 estimated elevation (assume NAVD88)
3 elevation as reported by County records (datum unknown, likely NGVD 29)
4 NAVD88 survey elevation with County adjustment for raising wellhead
+ added to LOBP monitoring network

4.2 Water Quality Results

Available Fall 2016 water quality results for First Water and Upper Aquifer monitoring wells designated for water quality reporting in the LOBP Groundwater Monitoring Program are presented in Table 9. The LOBP Groundwater Monitoring Program does not include Spring water quality monitoring at First Water or Upper Aquifer Wells. Available Spring and Fall 2016 water quality for Lower Aquifer monitoring wells designated for water quality reporting in the LOBP Groundwater Monitoring Program are presented in Tables 10 and 11. Groundwater monitoring field logs and laboratory analytical reports for the 2016 LOBP Groundwater Monitoring Program are included in Appendix C.

"Private" wells refer to domestic wells, agricultural irrigation wells, and monitoring wells that are not controlled by BMC member agencies. Some private wells were not sampled due to lack of permission in 2016.

Results for First Water wells indicate elevated nitrate concentrations across much of the urban area. A more extensive compilation of shallow water quality, including nitrate and TDS concentration maps, are presented for April and December 2016 in the County's LOWRF Groundwater Monitoring Program reports (CHG, 2016 and Rincon Consultants, 2017).

Some of the constituents of analysis that are part of the LOBP Groundwater Monitoring Program listed in Table 1 are not included in the LOWRF Groundwater Monitoring Program. The missing constituents include specific conductance, alkalinity (bicarbonate, carbonate, and total), calcium, magnesium, and potassium.

Lower Aquifer water quality results for 2016 show two water supply wells (LA10 and LA31) impacted by seawater intrusion, based on chloride concentrations over 250 mg/L. The overall trend in chloride concentration and seawater intrusion is tracked using the Chloride Metric (see Section 7.5.2).

Lower Aquifer wells LA2 and LA3 were not sampled in 2016. These are Morro Bay sand spit wells that are scheduled for water quality monitoring every five years to track changes in salinity at the coast (2015 LOBP). The next scheduled water quality sampling event on the sand spit will be in 2020.

CEC sampling was conducted at well FW5 in October 2016 (Table 12). The LOBP specifies CEC sampling at FW6, but there was insufficient water in the well to provide a representative sample for testing. Wells FW5 and FW6 are both hydraulically downgradient of the Broderson leach field site, and use of FW5 as an alternate testing location was approved by the BMC Executive Director. Well FW5 had also been tested for CEC's in 2006 (Cleath &Associates, 2006). CEC results are presented in Table 12, with laboratory reports included in Appendix C.

LOBP Well	State Well Number	Date	SC	pH (field)	TDS	Alkalinity CO3	Alkalinity HCO3	Alkalinity Total as CaCO3	Cl	NO3-N	SO4	B	Ca	Mg	K	Na	T (field)
			µS/cm	pH units	mg/L												°F
FW2*	30S/10E-13L8	12/20/16	*879*[1]	6.39	670	--	--	--	120	28	28	0.14	--	--	--	120	66.2
FW6*	30S/10E-24A	12/22/16	*496*[1]	6.74	370	--	--	--	110	15	11	<0.1	--	--	--	47	63.1
FW10*	30S/11E-7Q1	12/20/16	*880*[1]	6.65	570	--	--	--	150	29	44	0.37	--	--	--	96	65.3
FW15*	30S/11E-18N2	12/21/16	*608*[1]	6.29	450	--	--	--	87	22	43	0.28	--	--	--	58	70.2
FW17*	30S/11E-18L12	12/21/16	*853*[1]	6.93	550	--	--	--	95	36	50	0.15	--	--	--	63	67.9
FW20*	30S/11E-8Mb	(DRY)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
FW22*	30S/11E-17F4	12/22/16	*607*[1]	7.02	410	--	--	--	150	1.1	25	<0.1	--	--	--	65	
FW26	PRIVATE (not sampled)																
FW28	PRIVATE (not sampled)																
UA3	30S/10E-13F1	10/12/2016	568	*6.90*[2]	380	<10	80	60	66	18.9	23.8	<0.1	23	16	1	52	--
UA9	30S/11E-18K3	10/12/2016	324	*6.10*[2]	230	<10	50	40	40	9.2	7.1	<0.1	14	11	<1	26	--
UA13	30S/11E-17E10	(OFFLINE)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

Table 9. Fall 2016 Water Quality Results - First Water and Upper Aquifer

NOTES: "--" = no result available; SC = specific conductance; TDS = total dissolved solids; CO3 = carbonate; HCO3= bicarbonate; CaCO3 = total alkalinity as calcium carbonate; Cl = chloride; NO3-N = nitrate as nitrogen; SO4 = sulfate; B = boron; Ca = calcium; Mg = magnesium; K = potassium; Na = sodium; T = temperature; µS/cm = microsiemens per centimeter; mg/L = milligrams per liter; °F = degrees Fahrenheit

* = readings from LOWRF Groundwater Monitoring Program sampling event in December 2016 (Rincon Consultants, 2017)

[1] *Only field readings available*

[2] *Only lab readings available*

Table 10. Spring 2016 Water Quality Results - Lower Aquifer

LOBP Well	State Well Number	Date	SC	pH (field)	TDS	Alkalinity			Cl	NO3-N	SO4	B	Ca	Mg	K	Na	T (field)
						CO3	HCO3	Total as CaCO3									
			µS/cm	pH units	mg/L												°F
LA8	30S/10E-13N	04/20/16	446	6.72	320	<10	20	97.5	76	7.2	12	<0.1	16	14	1	38	64.22
LA9	30S/10E24C1	04/26/16	499	*7.00*[1]	300	<10	70	60	90	5.6	16	<0.1	18	17	2	44	--
LA10	30S/10E-13J4	04/26/16	1,170	*7.10*[1]	840	<10	80	70	299	1.8	18	<0.1	66	60	2	37	--
LA11	30S/10E-12J1	04/20/16	840	7.34	840	<10	330	270	151	<0.1	193	0.2	73	83	5	83	69.98
LA12	30S10E-7Q3	04/20/16	907	7.09	520	<10	190	160	91	<0.1	49	0.2	49	45	2	54	69.26
LA15	30S/11E-18L2	04/27/16	796	7.21	450	<10	230	190	93	0.9	28	<0.1	43	38	2	36	67.46
LA18	30S/11E-18K8	04/20/16	700	7.58	390	<10	190	160	31	<0.1	38	<0.1	55	31	2	26	71.24
LA20	30S/11E-17N10	04/26/16	629	*7.10*[1]	360	<10	230	190	39	0.6	27	0.1	35	34	2	40	--
LA22	30S/11E-17E8	04/19/16	476	8.08	290	<10	150	120	45	6.9	12	<0.1	26	24	1	29	67.82
LA23	PRIVATE (not sampled)																
LA28	PRIVATE (not sampled)																
LA31+	30S/10E-13M2	04/20/16	3,520	6.44	2,190	<10	50	40	941	0.7	179	0.2	113	108	5	400	66.02
LA32+	30S/11E-18K9	04/20/16	382	7.38	220	<10	130	100	32	3.3	12	<0.1	19	18	1	27	68.54

NOTES: "--" = no result available; SC = specific conductance; TDS = total dissolved solids; CO3 = carbonate; HCO3= bicarbonate; CaCO3 = total alkalinity as calcium carbonate; Cl = chloride; NO3-N = nitrate as nitrogen; SO4 = sulfate; B = boron; Ca = calcium; Mg = magnesium; K = potassium; Na = sodium; T = temperature; µS/cm = microsiemens per centimeter; mg/L = milligrams per liter; °C = Celsius (some values converted from degrees Fahrenheit as reported on field logs); + indicates proposed addition to monitoring program; < indicates less than Practical Quantitation Limit as listed in laboratory report.

[1] *Only lab reading available*

Table 11. Fall 2016 Water Quality Results - Lower Aquifer Group

Basin Plan Well	State Well Number	Date	SC	pH (field)	TDS	Alkalinity			Cl	NO3-N	SO4	B	Ca	Mg	K	Na	T (field)
						CO3	HCO3	Total as CaCO3									
			µs/cm	pH units	mg/L												°F
LA8	30S/10E-13N	10/13/16	470	7.2	320	<10	50	40	79	7.2*	12	<0.1	17	15	1	40	64.8
LA9	30S/10E-24C1	10/12/16	506	*7.1*	320	<10	70	60	93	5.5	15.1	<0.1	18	16	1	44	--
LA10	30S/10E-13J4	10/12/16	1,430	*6.8*	1,100	<10	60	50	389	1.8	26.7	<0.1	82	74	2	44	--
LA11	30S/10E-12J1	10/10/16	1,370	7.55	930	<10	350	290	173	<0.5	189	0.2	69	79	4	81	69.6
LA12	30S10E-7Q3	10/11/16	827	7.44	490	<10	280	230	93	<0.5	46.2	0.2	44	41	2	52	69.8
LA15	30S/11E-18L2	10/11/16	694	7.29	380	<10	200	160	91	1.6	25.5	<0.1	36	32	1	35	67.5
LA18	30S/11E-18K8	10/18/16	615	7.76	370	<10	290	240	31	<0.5	35.9	<0.1	53	30	2	26	73.4
LA20	30S/11E-17N10	10/12/16	631	*7*	370	<10	290	240	40	0.6	25.2	0.1	34	33	2	40	--
LA22	30S/11E-17E8	10/13/16	521	7.34	290	<10	140	120	46	6.9*	11.9	<0.1	25	24	1	29	68.2
LA23	PRIVATE (not sampled)																
LA28	PRIVATE (not sampled)																
LA31+	30S/10E-13M2	10/19/16	3,420	6.75	2,190	<10	70	50	943	0.6	182	0.2	113	107	4	398	66.2
LA32+	30S/11E-18K9	10/11/16	511	7.58	270	<10	200	160	36	1.2	21.5	<0.1	26	25	1	34	71.2

NOTES: "--" = no result available; SC = specific conductance; TDS = total dissolved solids; CO3 = carbonate; HCO3= bicarbonate; CaCO3 = total alkalinity as calcium carbonate; Cl = chloride; NO3-N = nitrate as nitrogen; SO4 = sulfate; B = boron; Ca = calcium; Mg = magnesium; K = potassium; Na = sodium; T = temperature; µS/cm = microsiemens per centimeter; mg/L = milligrams per liter; °C = degrees Celsius; + indicates proposed addition to monitoring program; < indicates less than Practical Quantitation Limit as listed in laboratory report; *Sample holding time exceeded for NO3-N analyses at LA8 and LA22 (lab equipment malfunction).

Only lab reading available

Table12. CEC Monitoring Results					
Constituent or Parameter	**Units**	**13Q2 (FW-5)**	**QA1 Travel Blank**	**QA2 Equipment Blank**	**LOWRF Recycled Water[1]**
		October 19, 2016			**Aug-Sep, 2016**
Health-based					
17β-estradiol	ng/L	ND (<1)	ND (<1)	ND (<1)	ND (<5)[2]
Triclosan	ng/L	ND (<2)	ND (<2)	ND (<2)	ND (<10)
Caffeine	ng/L	ND (<1)	ND (<1)	1.8	ND (<5)
NDMA	ng/L	ND (<2)	--	--	ND (<2)
Performance-based					
Gemfibrozil	ng/L	ND (<1)	ND (<1)	ND (<1)	49
DEET[3]	ng/L	2	1.7	1.4	71
Iopromide	ng/L	ND (<5)	ND (<5)	ND (<5)	ND (<5)
Sucralose	ng/L	280	ND (<5)	ND (<5)	64,000
Surrogate					
Ammonia	mg/L	ND (<0.10)	--	--	--
Nitrate-Nitrogen	mg/L	26	--	--	6.4[4]
Total Organic Carbon	mg/L	0.54	--	--	--
UV Light Absorption	1/cm	0.015	--	--	--
Specific Conductance	µmhos/cm	910	--	--	--

1 2016 LOWRF CEC Blue Ribbon Report and Annual Report (SLO Co. 2016a, 2016b).
2 As 17-alpha Ethinyl Estradiol
3 Blank Contamination. Analyte also detected in the laboratory blank.
4 30-day average
ng/L = nanograms per liter; mg/L = milligrams per liter, µmhos/cm = micromhos per centimeter; : "--" = no result available

None of the health-based class indicators of CEC indicators were detected in the October 2016 sample from FW5. DEET (Diethyl-meta-toluamide), a personal care product used for insect repellent, was reported in groundwater at FW5, but was also detected in the field blanks (QA1 and QA2) as well as the laboratory blank (see page 10 of laboratory results in Appendix C). The laboratory blank contained more DEET than the submitted samples, which indicates that all the DEET reported was likely due to sample/equipment contamination at the laboratory. Sucralose, an artificial sweetener, was detected in groundwater from FW-5, and is an indicator of wastewater influence. The quality of recycled water from LOWRF is also provided in Table 12 for comparison. FW5 is hydraulically downgradient of the Broderson leach field.

4.3 Geophysics

Induction and natural gamma logging has been performed at Lower Aquifer monitoring well LA4 (30S/10E-13M1) and LA14 (30S/11E-18L6). Seawater is highly conductive, compared to fresh water, and an induction log performed in a borehole penetrating the fresh water/seawater interface will show the vertical transition from fresh water to seawater. Because natural gamma emissions are not affected by changes in water quality, the gamma ray log can be used as a depth calibration tool when comparing induction logs from different monitoring events.

Geophysical monitoring events were performed in 1985, 2004, 2009, 2014, and 2015. Results were discussed in the 2015 Annual Report (CHG, 2016). The next scheduled geophysical logging is in October 2018.

5. GROUNDWATER PRODUCTION

Annual basin groundwater production between 1970 and 2013 was reported in the LOBP (ISJ Group, 2015). Basin production for 2014 and 2015 was estimated at 2,400 acre-feet and 2,170 acre-feet, respectively (CHG, 2016). Basin production for the current reporting year is estimated to be 2,160 acre-feet. The data have been compiled by both user type and basin aquifer/area. Tables 13 and 14 present municipal and basin production beginning in calendar year 2013.

Table 13. Municipal Groundwater Production (2013-2016)

Year	LOCSD	GSWC	S&T	Total
	Acre-Feet			
2013	730	690	50	1,470
2014	630	560	50	1,240
2015	510	470	30	1,010
2016	520	450	30	1,000

Note: All figures rounded to the nearest 10 acre-feet

Table 14. Basin Groundwater Production (2013-2016)

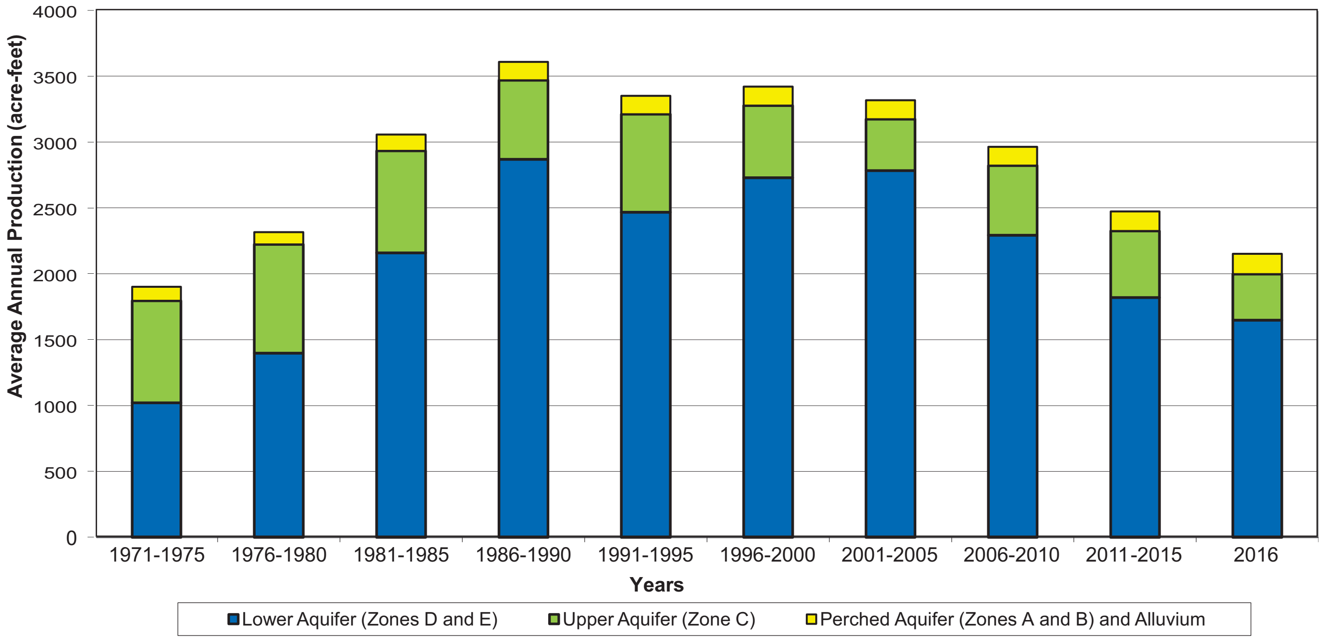
Year	Purveyors	Domestic	Community	Agriculture	Total
	Acre-Feet				
2013	1,470	200	140	750	2,560
2014	1,240	220	140	800	2,400
2015	1,010	220	140	800	2,170
2016	1,000	220	140	800	2,160

Note: All figures rounded to the nearest 10 acre-feet

Figure 6 shows the historical pumping distribution between basin aquifers since 1970, along with the pumping distribution in the Western Area. Figure 7 show the historical pumping distribution for the Central and Eastern areas. There has been a 30 percent reduction in basin production over the last 10 years, with current production similar to the values reported for the late 1970s. The largest reduction in pumping has occurred in the Lower Aquifer Western Area (Figure 6).

Land use and water use areas overlying the basin, including purveyor service areas, agricultural parcels, domestic parcels, and community facilities are included in Appendix D. Purveyor municipal production data are based on meter readings, while agricultural, domestic, and community facilities' water production estimates are based on the last reported water use estimates for 2013 from the LOBP with minor adjustments due to changes in land use based on aerial photo review. These adjustments include 20 acre-feet per year increased domestic water use, based on adding 19 existing residences located east of the Los Osos Creek Valley that were not previously included in the 2013 estimates. Agricultural water use was increased by 50 acre-feet per year, based on adding 10 acres of peas, 15 acres of truck crops, and 1 acre of pasture east of the Los Osos Creek Valley that were not previously included in the 2013 estimates. Prior estimates for domestic and agricultural water use are detailed in technical memorandums (CHG, 2009a, 2009b).

BASIN TOTAL
1971-2016 Groundwater Production
Los Osos Groundwater Basin



WESTERN AREA
1971-2016 Groundwater Production
Los Osos Groundwater Basin

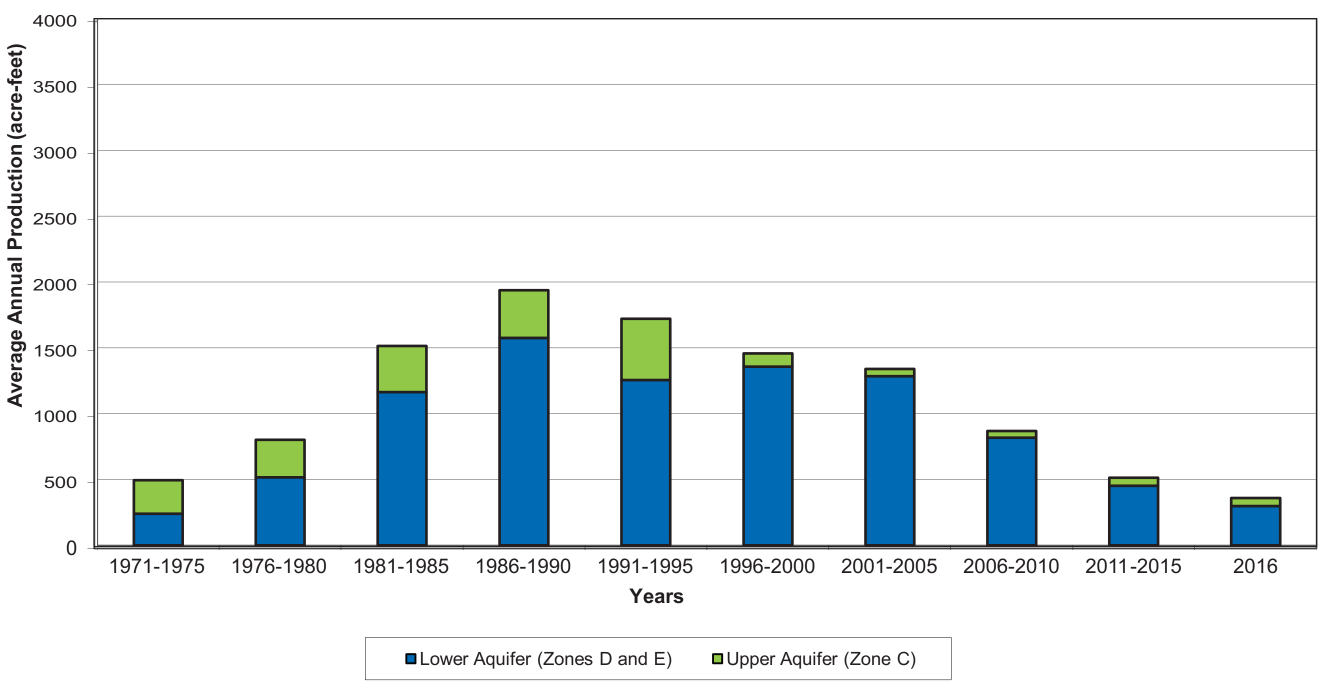


Figure 6
Basin Production 1971-2016
Basin Total and Western Area
Los Osos Goundwater Basin
2016 Annual Report

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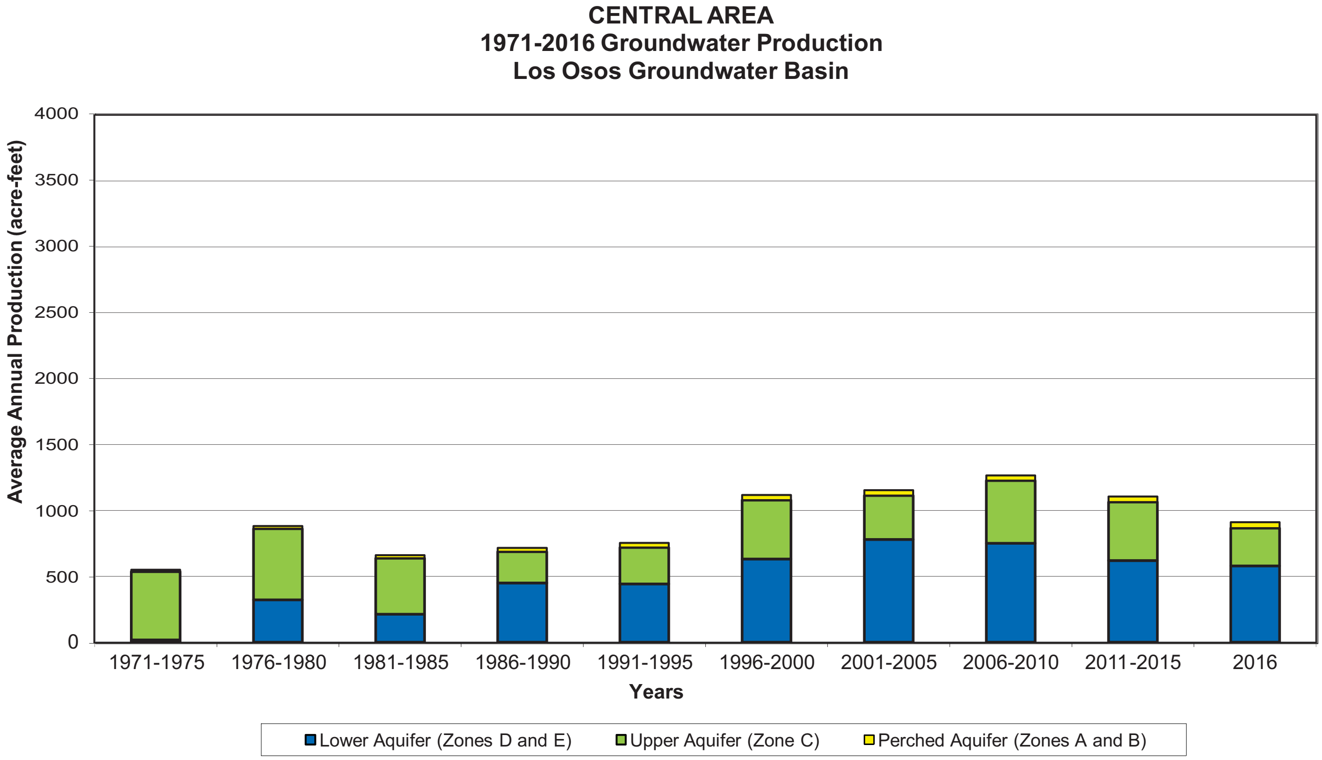

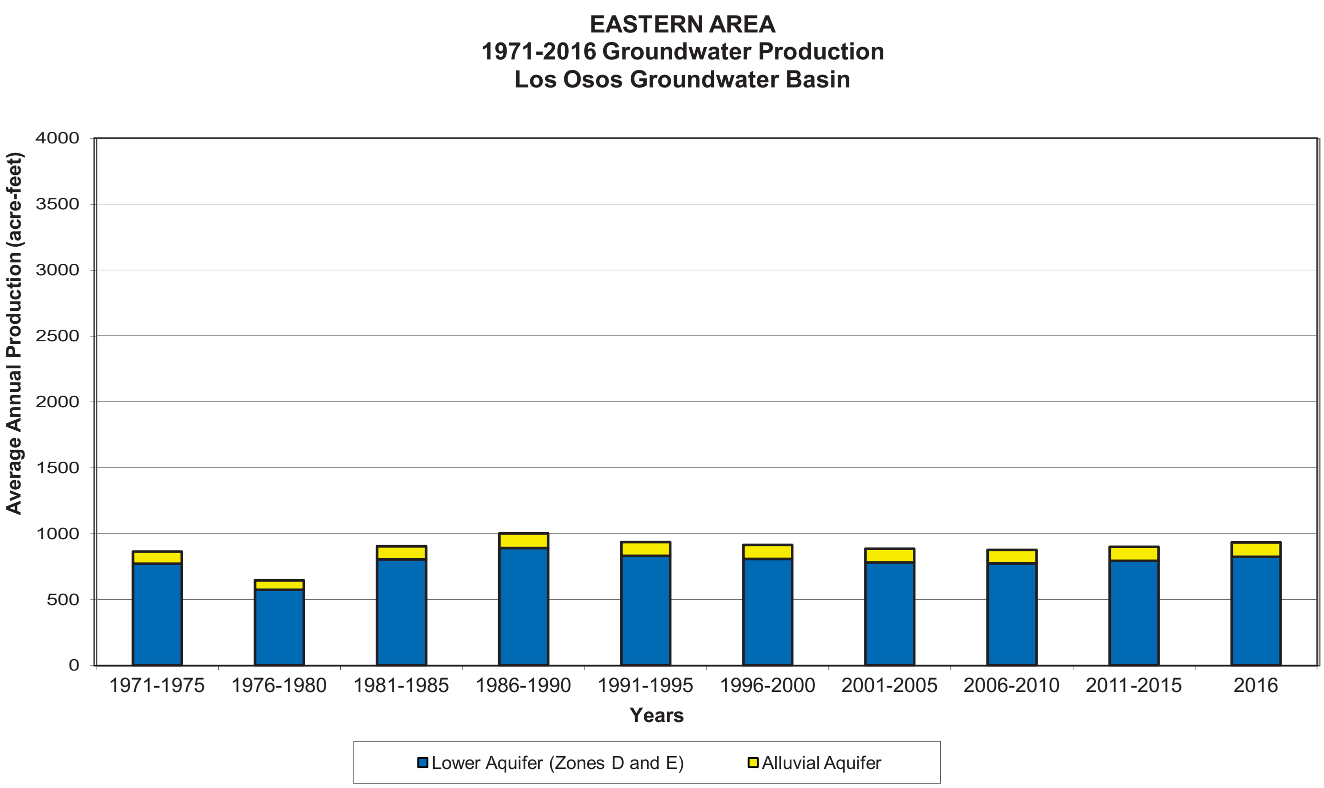

Figure 7
Basin Production 1971-2016
Central and Eastern Areas
Los Osos Groundwater Basin
2016 Annual Report

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6. PRECIPITATION AND STREAMFLOW

Precipitation data are currently available from a County gage located at the former Los Osos landfill (Station #727). Precipitation records for Station #727 began in July 2005, and show that rainfall has averaged 14.81 inches, with a minimum of 6.81 inches in the 2014 rainfall year (July 2013 through June 2014) and a maximum of 31.77 inches in the 2011 rainfall year (July 2010 through June 2011). Precipitation for the 2016 rainfall year was reported at 16.85 inches. Records for Station #727 through the calendar year 2016 are included in Appendix E. The average rainfall at Station #727 is lower compared to other local rain gages due to a short period of record that includes six years of below average rainfall.

Historically, precipitation records at rain gage stations were compiled by the County for the LOCSD maintenance yard on 8th Street (Station #177), at the South Bay fire station on 9th Street (Station #197), and at two private volunteer stations (Station #144.1 in the Los Osos Creek Valley and Station #201.1 on Broderson Avenue). The longest active period of record in the vicinity is at the Morro Bay fire department (Station #152). A summary of precipitation data for these stations is presented in Table 15.

Table 15. Active and Former Precipitation Stations

Station No.	Name	Period of Record (rainfall years)	Average Annual Precipitation (inches)
144.1	Bender	1955-1987	19.17
152	Morro Bay Fire Dept.	1959-2016 (active)	16.09
177	CSA9 Baywood Park	1967-1980	17.49
197	South Bay Fire	1975-2001	19.52
201.1	Simas	1976-1983	21.16
727	Los Osos Landfill	2006-2016 (active)	14.81*

NOTE: *lower average due to short period of record that includes six years of below normal rainfall.

Figure 8 shows the long term cumulative departure from mean precipitation at Station #152. Once data for Los Osos Landfill Station #727 becomes representative of long-term climatic conditions, it would be appropriate to use the gage in the cumulative departure from mean precipitation graph.

There have been five consecutive years of below normal rainfall from 2012 through 2016. Rainfall for 2016 was 2.3 inches below average at Station #152 (13.8 inches total). Rainfall for 2016 was 1.3 inches above average at Station #727 (16.15 inches total), although due to the short period of record and prevailing drought conditions, the current average (14.81 inches) is considered lower than would be expected for this station if a longer period of record were available. San Luis Obispo County was in exceptional drought conditions (the greatest intensity level) during 2016, based on information from the U.S. Drought Monitor, a partnership of federal agencies (NDMC/USDA/NOAA, 2016).

Los Osos Creek drains the Clark Valley watershed. Streamflow on Los Osos Creek is monitored by a County gage (formerly Gage #6, now Sensor 751) at the Los Osos Valley Road bridge. The location has been gaged intermittently since 1976, with 18 years of flow records through 2001. The average measured flow on Los Osos Creek at the gage (drainage area of 7.6 square miles) was 3,769 acre-feet per year between 1976 and 2001 (San Luis Obispo County, 2005). A summary of the available annual streamflow data is in Appendix E.

Streamflow was recorded at the gage on seven days during the 2016 water year (October 1, 2015 to September 30, 2016). The dates, maximum stage, and corresponding daily precipitation value from Station #727 are listed below in Table 16. There is no correlation or relationship between the quantities of rain to the reading on the stream gage. Table 15 is for information purposes only.

Table 16. Maximum Stream Stage for Los Osos Creek, 2016 Water Year

Date	Maximum Stream Stage County Sensor #751 (feet)	Daily Precipitation County Station #727 (inches)
12/11/2015	2.16	0.00
1/6/2016	2.31	0.76
1/31/2016	2.31	1.12
3/6/2016	3.45	0.36
3/7/2016	3.74	1.08
3/11/2016	3.38	1.24
3/14/2016	2.92	0.20

Hydrologic records from County Department of Public Works

There is no current rating curve for Sensor 751. A rating curve is needed to correlate stage records to streamflow volume records; therefore, no streamflow volumes are reported. Development of a rating curve for Sensor 751 is recommended. Graphs of the available stream stage data over time for water years 2011 through 2016 are included in Appendix E.

Warden Creek (Figure 1) drains approximately 9 square miles of the eastern Los Osos Valley. This creek flows along 3,700 feet of the northern basin boundary, at low invert elevations (less than 20 feet above sea level) in an area underlain by shallow bedrock. The U.S. Geological Survey reported winter flows in Warden Creek similar to Los Osos Creek, but with larger baseflow during the summer, because Warden Creek serves as a drain (point of groundwater discharge) for shallow groundwater at the north end of the Los Osos Creek floodplain (Yates and Wiese, 1988).

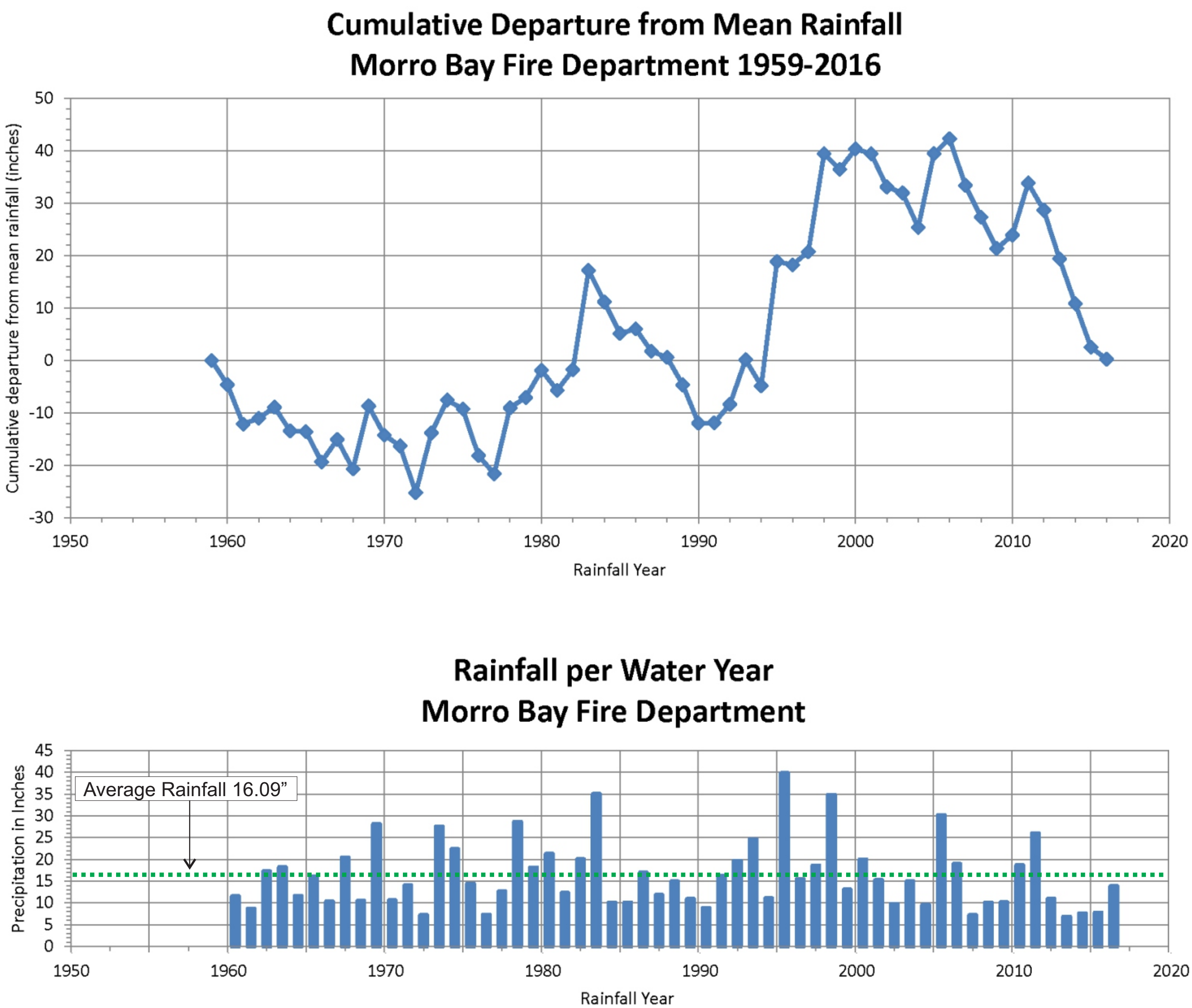

Figure 8
Cumulative Departure from
Mean Rainfall at Morro Bay Fire Department
Los Osos Groundwater Basin
2016 Annual Report

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7. DATA INTERPRETATION

Groundwater level and groundwater quality data for 2016, together with selected historical data, have been used to develop the following information:

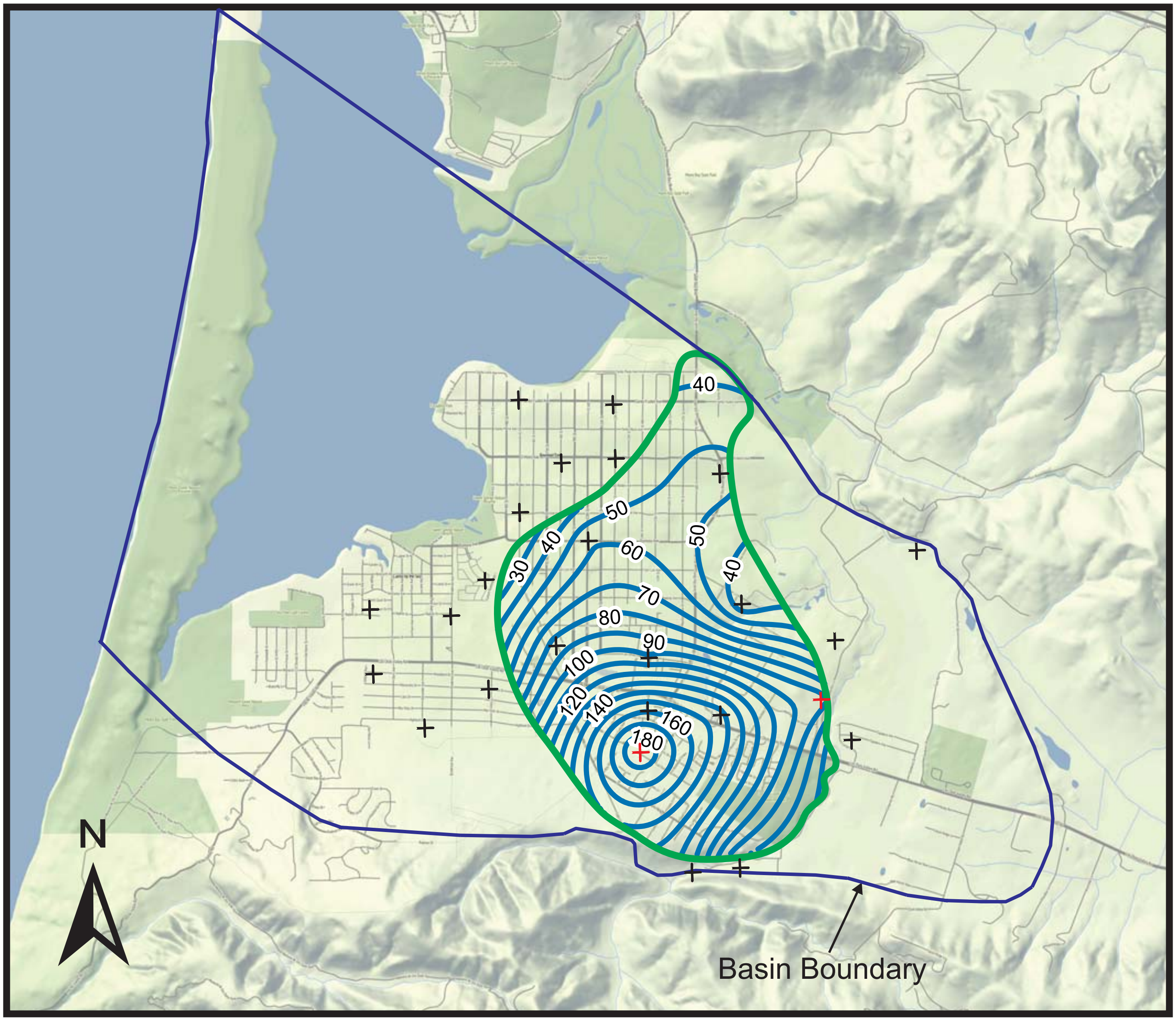
- Groundwater elevation contour maps for the Perched Aquifer, Upper Aquifer (with Alluvial Aquifer), and Lower Aquifer for both Spring and Fall 2016 conditions.
- Water level hydrographs for wells representative of aquifers in the Western, Central, and Eastern Areas of the basin.
- The lateral extent of seawater intrusion and the Fall 2016 position of the seawater intrusion front.
- Estimates of groundwater in storage for Spring and Fall 2016, including amount above mean sea level.
- Estimates of changes to groundwater in storage from Spring 2015 to Spring 2016, including the volume of seawater intrusion.
- Basin Yield Metric, Basin Development Metric, Water Level Metric, Chloride Metric, and Nitrate Metric.

7.1 Water Level Contour Maps

Water level contour maps for Spring 2016 are presented in Figures 9, 10, and 11 for the Perched Aquifer, Upper Aquifer with Alluvial Aquifer, and Lower Aquifer, respectively. Corresponding water level contour maps for Fall 2016 are presented in Figures 12, 13, and 14. The water level elevations are shown at a 5-foot contour interval based on the ordinary kriging interpolation method, which provides a best (least-squares) estimate of values at unmeasured points based on the mapped values.

Water level data available from irrigation and domestic wells were used in the development of the water level contour maps, although these water levels are not listed in the data tables in this report (Table 3 through 8). To develop contour maps useful for groundwater storage estimates, a few wells located along the basin boundaries were added to the monitoring network, along with additional control points in the perched and upper aquifers. Water levels from alternate dates (not from Spring or Fall 2016) were included in the contour maps at four locations. All groundwater elevations were adjusted to a common datum (NAVD 88) prior to contouring and groundwater storage calculations. These adjustments are approximate, pending a review of all reference point elevations by a licensed land surveyor.

Perched Aquifer water level contour maps (Figures 9 and 12) show the highest groundwater elevations at Bayridge Estates (Well FW31 at the Bayridge Estates wastewater disposal field), with a radial direction of groundwater flow from the higher topographic elevations to lower elevations. Perched Aquifer groundwater elevation contours are similar between Spring and Fall 2016, with an average water level decline over the period of approximately 1.5 feet.



Base Image: Stamen-Terrain

0 2000 4000 6000 8000 ft

Scale: 1 inch ≈ 4,000 feet

Explanation

40 — Groundwater elevation contour in feet above sea level (NAVD 88 datum)

Approximate limits of Perched Aquifer

+ Spring 2016 groundwater elevation data point (contours not applicable outside of Perched Aquifer limits)

+ Alternate date groundwater elevation data point

Figure 9
Spring 2016 Water Level Contours
Perched Aquifer
Los Osos Groundwater Basin
2016 Annual Report

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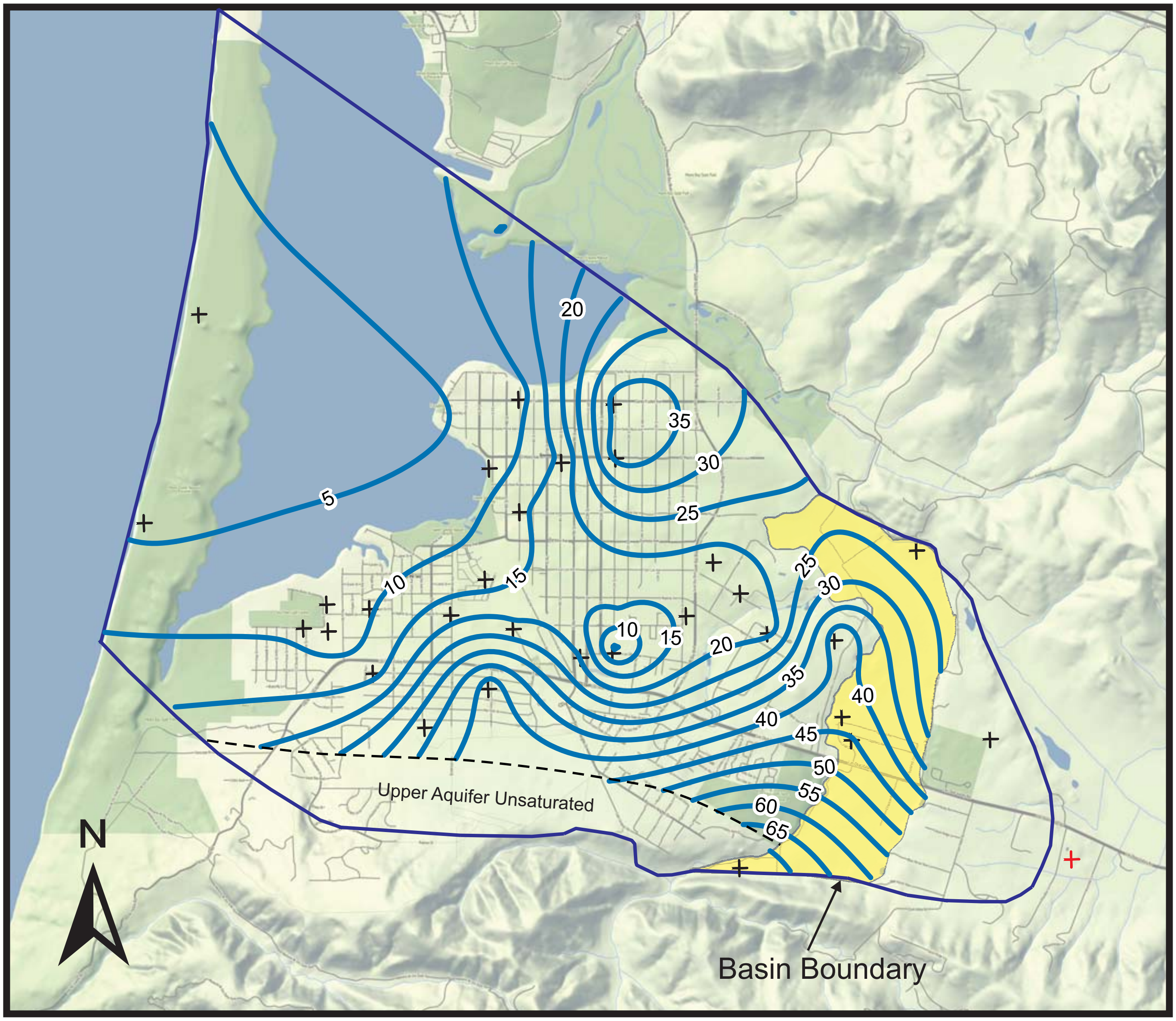

Base Image: Stamen-Terrain

0 2000 4000 6000 8000 ft

Scale: 1 inch ≈ 4,000 feet

Explanation

40 — Groundwater elevation contour in feet above sea level (NAVD 88 datum)

Limits of Alluvial Aquifer

+ Spring 2016 groundwater elevation data point (contours not applicable outside of Upper Aquifer and Alluvial Aquifer limits)

+ Alternate date groundwater elevation data point

NOTE: Area where Upper Aquifer is unsaturated along southern Basin boundary determined from comparison of water levels with aquifer base contours. This condition was present in 2015 but not shown in 2015 Annual Report.

Figure 10
Spring 2016 Water Level Contours
Upper Aquifer and Alluvial Aquifer
Los Osos Groundwater Basin
2016 Annual Report

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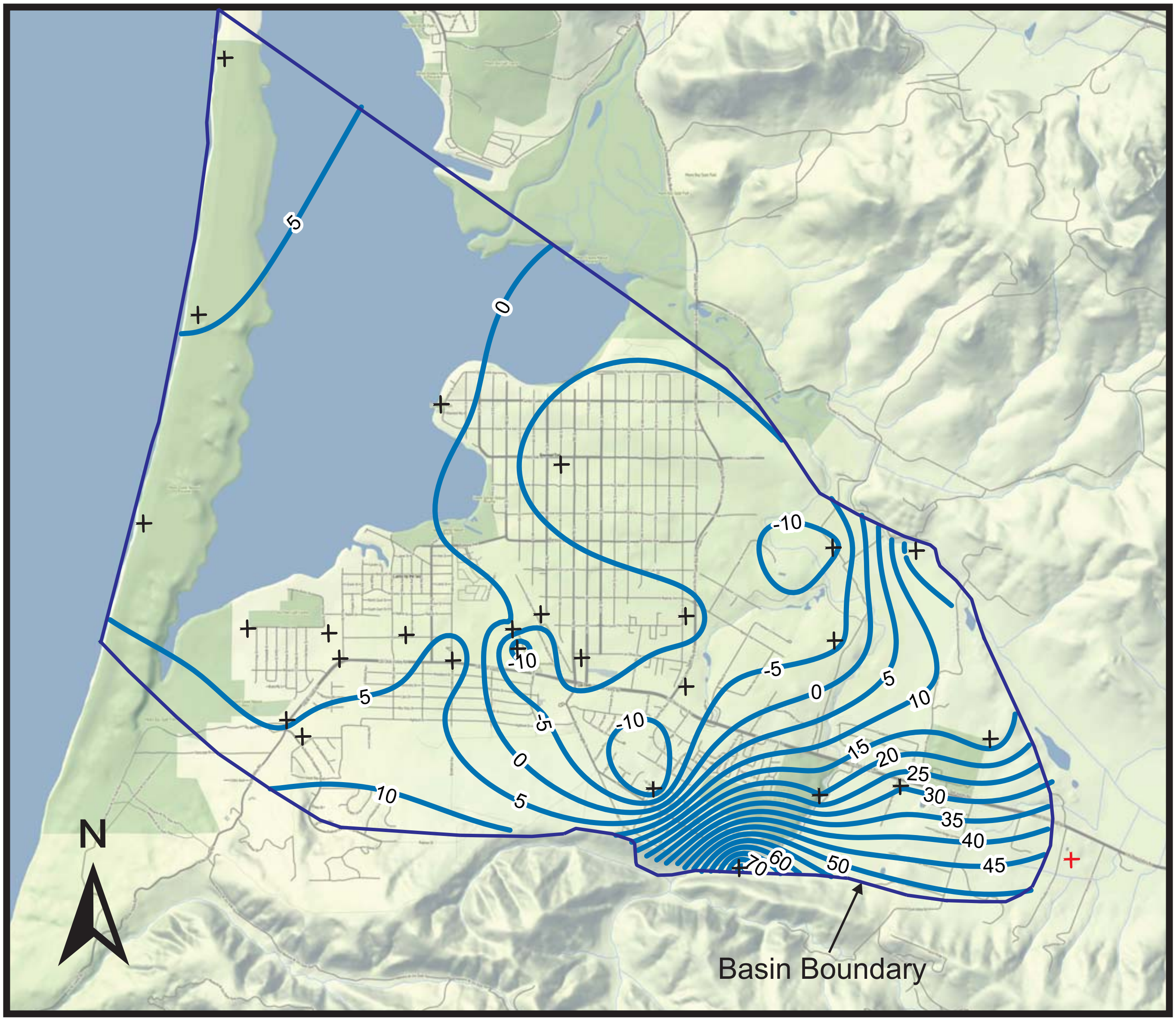

Base Image: Stamen-Terrain

0 2000 4000 6000 8000 ft

Scale: 1 inch ≈ 4,000 feet

Explanation

40 — Groundwater elevation contour in feet above sea level (NAVD 88 datum)

+ Spring 2016 groundwater elevation data point

+ Alternate date groundwater elevation data point

Figure 11
Spring 2016 Water Level Contours
Lower Aquifer
Los Osos Groundwater Basin
2016 Annual Report

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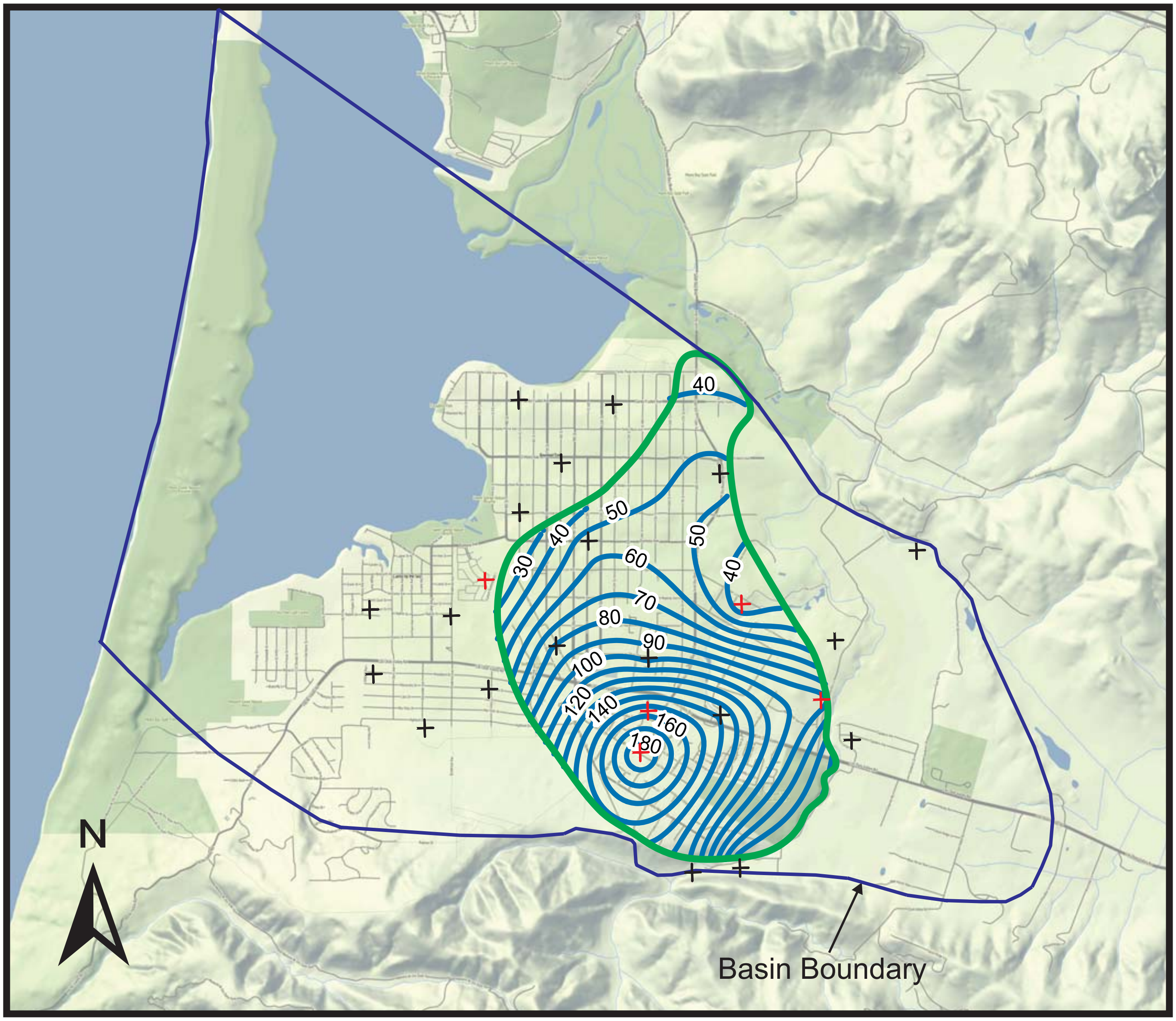

Base Image: Stamen-Terrain

0 2000 4000 6000 8000 ft

Scale: 1 inch ≈ 4,000 feet

Explanation

40 Groundwater elevation contour in feet above sea level (NAVD 88 datum)

Approximate limits of Perched Aquifer

+ Fall 2016 groundwater elevation data point (contours not applicable outside of Perched Aquifer limits)

+ Alternate date groundwater elevation data point (December 2016 for LOWRF program private wells)

Figure 12
Fall 2016 Water Level Contours
Perched Aquifer
Los Osos Groundwater Basin
2016 Annual Report

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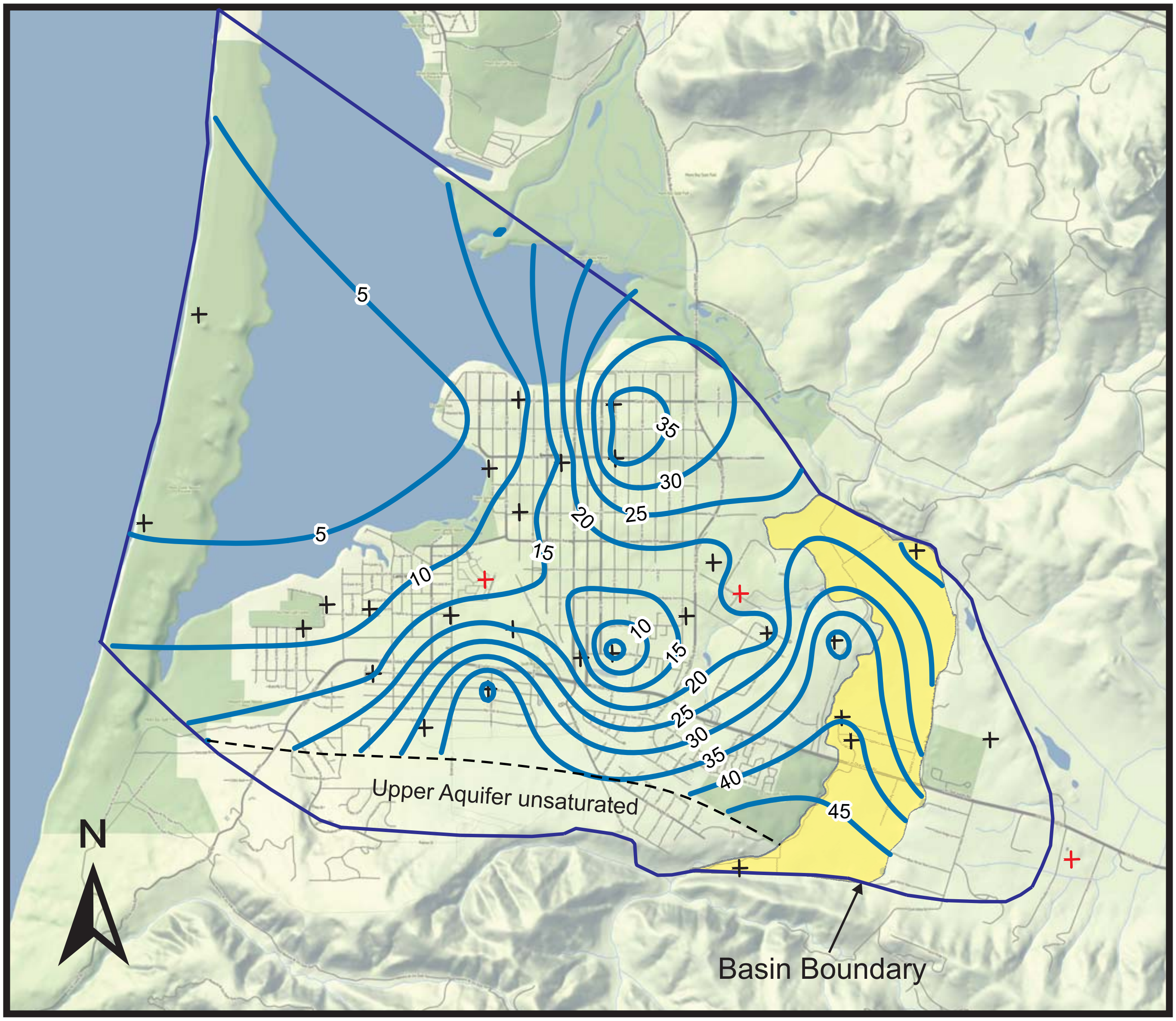

Base Image: Stamen-Terrain

0 2000 4000 6000 8000 ft

Scale: 1 inch ≈ 4,000 feet

Explanation

40 — Groundwater elevation contour in feet above sea level (NAVD 88 datum)

Limits of Alluvial Aquifer

+ Fall 2016 groundwater elevation data point (contours not applicable outside of Upper Aquifer and Alluvial Aquifer limits)

+ Alternate date groundwater elevation data point (December 2016 for LOWRF program private wells)

NOTE: Area where Upper Aquifer is unsaturated along southern Basin boundary determined from comparison of water levels with aquifer base contours. This condition was present in 2015 but not shown in 2015 Annual Report.

Figure 13
Fall 2016 Water Level Contours
Upper Aquifer and Alluvial Aquifer
Los Osos Groundwater Basin
2016 Annual Report

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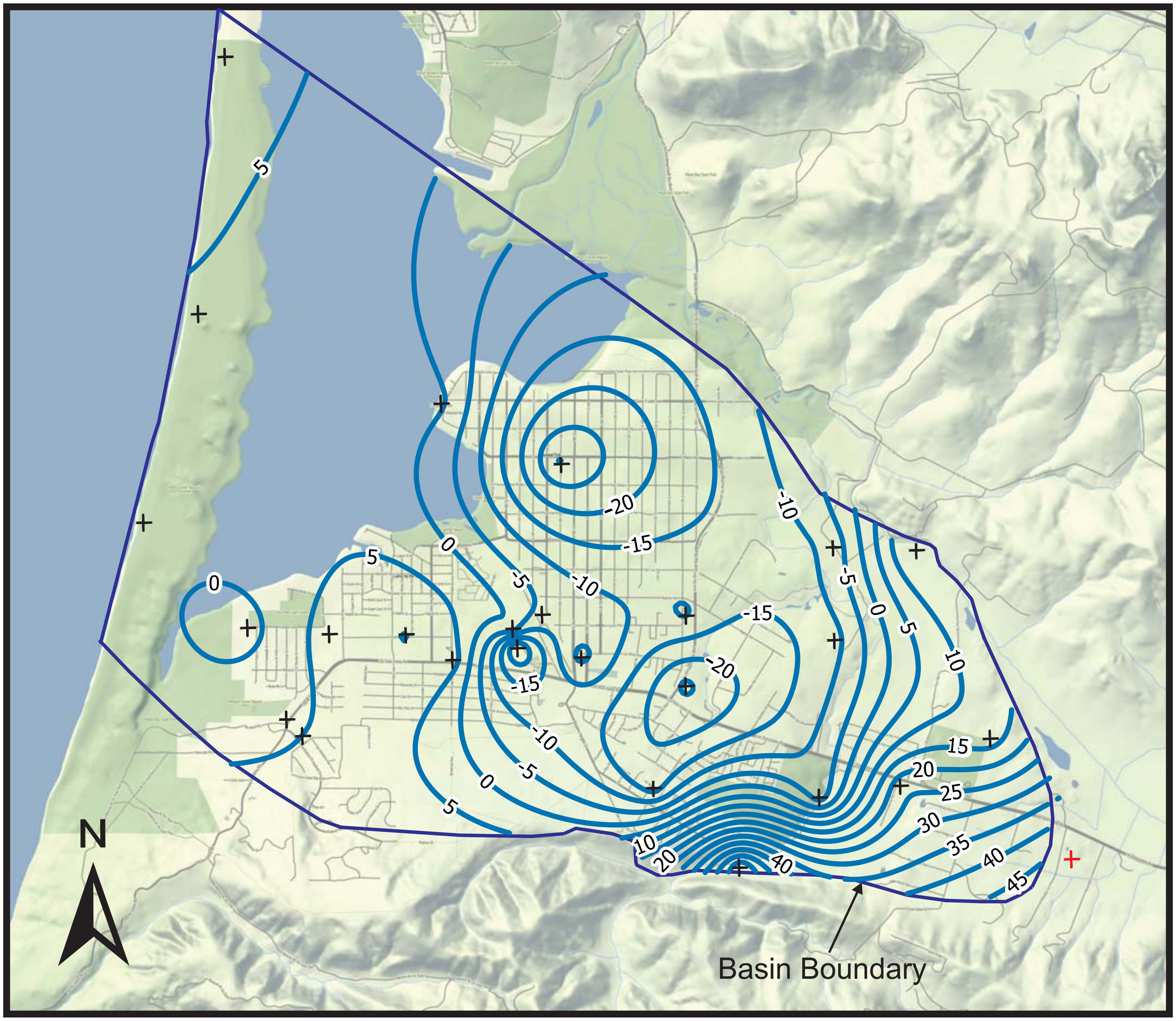

Base Image: Stamen-Terrain

0 2000 4000 6000 8000 ft

Scale: 1 inch ≈ 4,000 feet

Explanation

40 Groundwater elevation contour in feet above sea level (NAVD 88 datum)

\+ Fall 2016 Groundwater elevation data point

\+ Alternate date groundwater elevation data point

Figure 14
Fall 2016 Water Level Contours
Lower Aquifer
Los Osos Groundwater Basin
2016 Annual Report

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Contour maps for the Upper Aquifer and Alluvial Aquifer (Figures 10 and 13) show the highest groundwater elevations are at the southern edge of the Los Osos Creek valley. The general direction of groundwater flow is to the northeast along the creek valley and to the northwest toward the Morro Bay estuary. Significant features include a pumping depression interpreted to be present in the area of downtown Los Osos, and a groundwater high interpreted to be present beneath dune sand ridges in Baywood Park. Upper Aquifer groundwater elevation contours are similar between Spring and Fall 2016, averaging approximately 1.4 feet of water level decline over the period.

The Upper Aquifer contour maps have been updated for 2016 to show the area along the southern basin boundary where the aquifer rises above the water table and is unsaturated. The unsaturated area was determined through a comparison of water level elevation contours with contours on the base of the Upper Aquifer. This area was present in 2015 but not shown in the 2015 Annual Report.

Contour maps for the Lower Aquifer (Figures 11 and 14) show the highest groundwater elevations are at the southern edge of the Los Osos Creek valley and near the eastern basin boundary. Groundwater flow in the Lower Aquifer is generally toward Central Area pumping depressions. Lower aquifer groundwater elevations over most of the Western and Central Areas are below sea level. Lower Aquifer groundwater elevations averaged approximately 4.5 foot lower in Fall 2016 compared to Spring 2016.

7.2 Water Level Hydrographs

Water levels hydrographs for representative First Water, Upper Aquifer, and Lower Aquifer wells have been compiled for the Western and Central basin areas, including one of the Lower Aquifer wells in the Dunes and Bay area. These wells present the general water level trends, but other wells may be included in future Annual Reports. Eastern area water level hydrographs may also be presented in future Annual Reports, pending private well owner agreements. The hydrographs are shown in Figures 15, 16, and 17, respectively.

Spring to Spring water level trends over the last 10 years (2006-2016), based on the Western and Central area wells shown in the hydrographs, was 0.7 feet of decline per year in First Water, 0.4 feet of decline per year in the Upper Aquifer, and 0.3 feet of rise per year in Lower Aquifer water levels.

The declining water levels in First Water and Upper Aquifer wells are interpreted to be mainly in response to close to 40 inches of decline in the cumulative departure from mean precipitation curve between 2006 and 2016 (Figure 8). The rising water levels in Lower Aquifer wells are interpreted to be mainly in response to an average annual decline of over 4 percent per year in Lower Aquifer production in the Western and Central areas between 2006 and 2016.

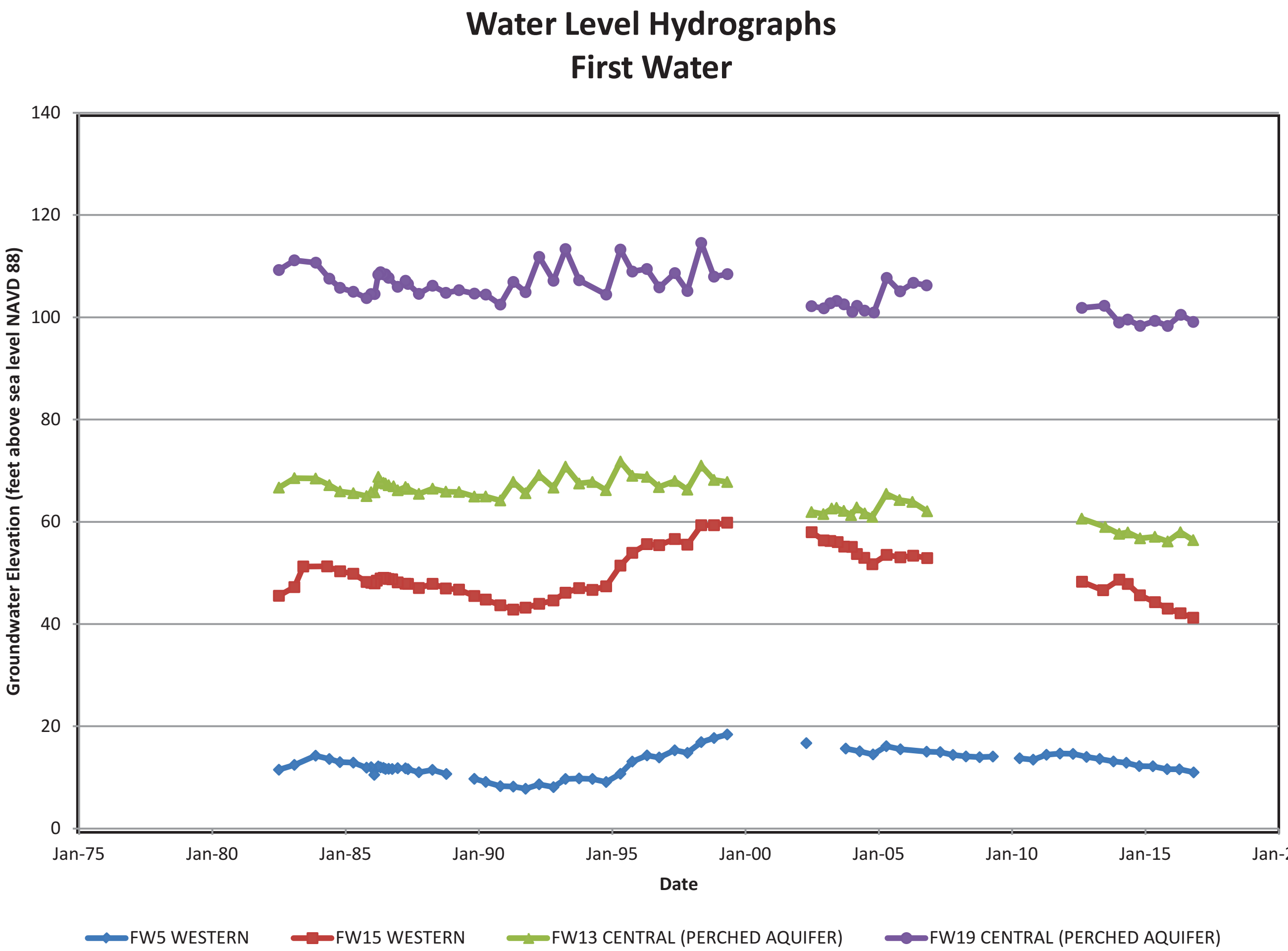

Figure 15
Water Level Hydrographs
Perched Aquifer/First Water
Los Osos Groundwater Basin
2016 Annual Report

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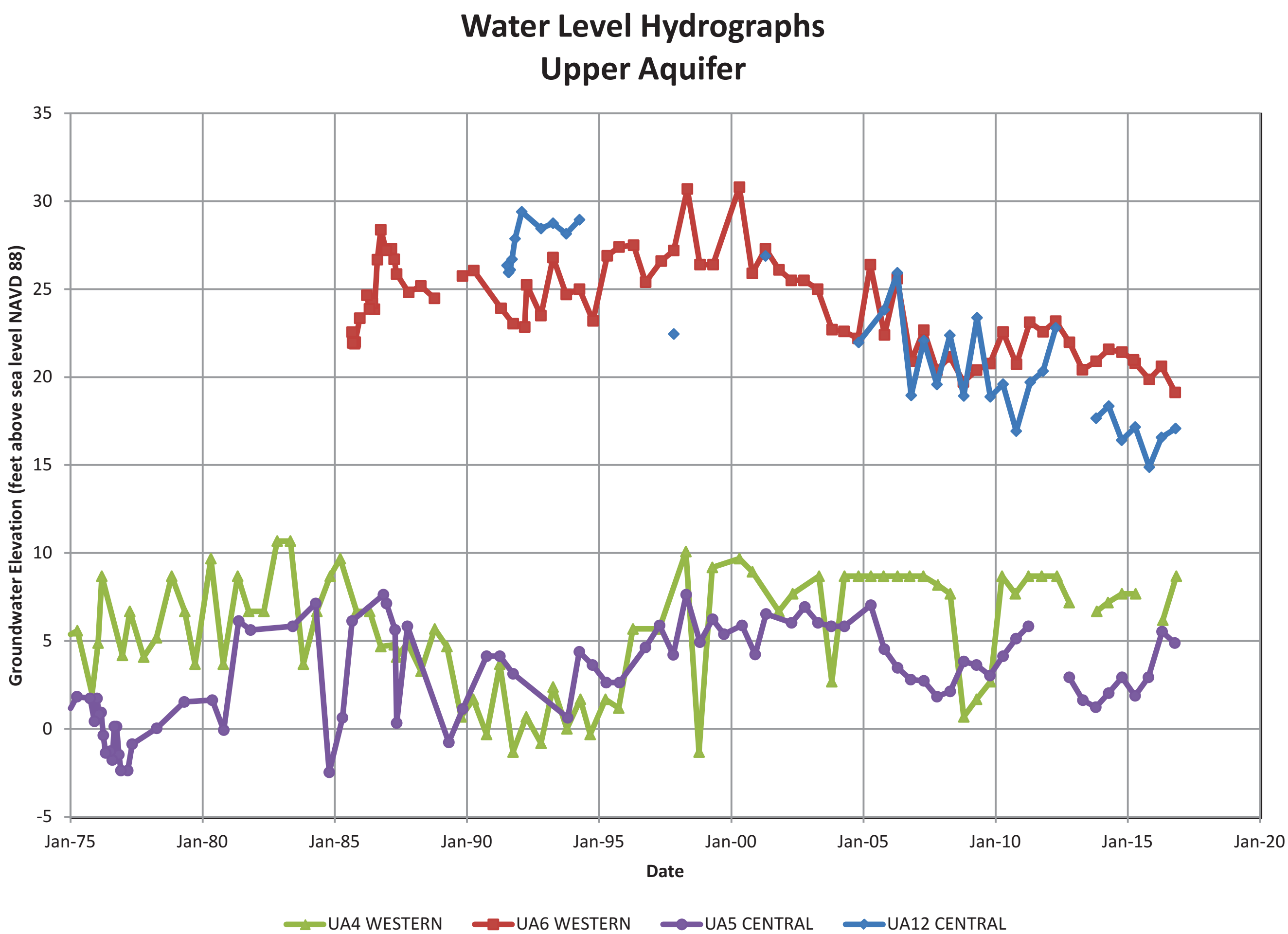

NOTE: Constant water level elevations over a few years (2004-2007) at well UA4 may indicate measuring equipment problem due to obstruction or falling water.

Figure 16
Water Level Hydrographs
Upper Aquifer
Los Osos Groundwater Basin
2016 Annual Report

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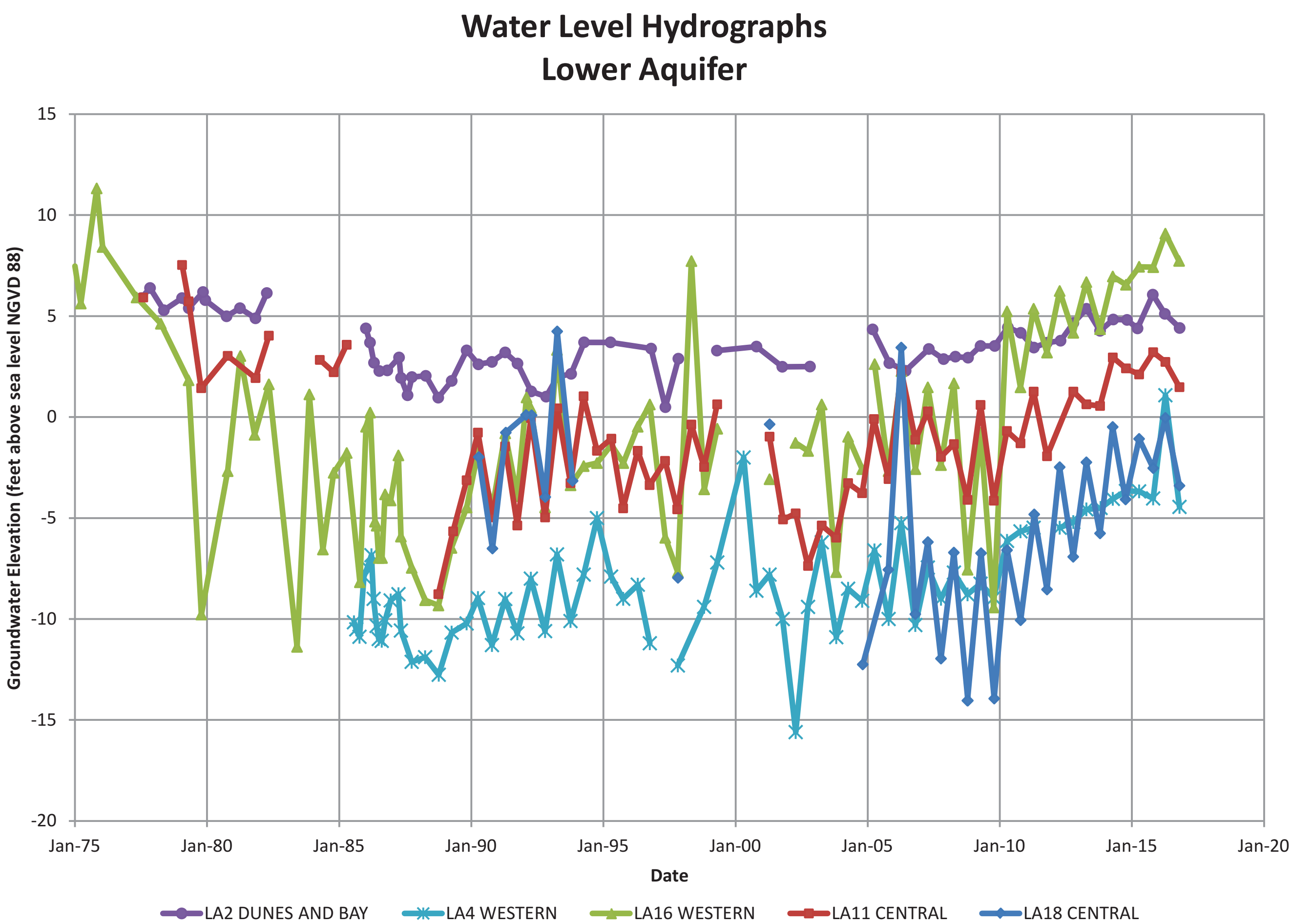

Figure 17
Water Level Hydrographs
Lower Aquifer
Los Osos Groundwater Basin
2016 Annual Report

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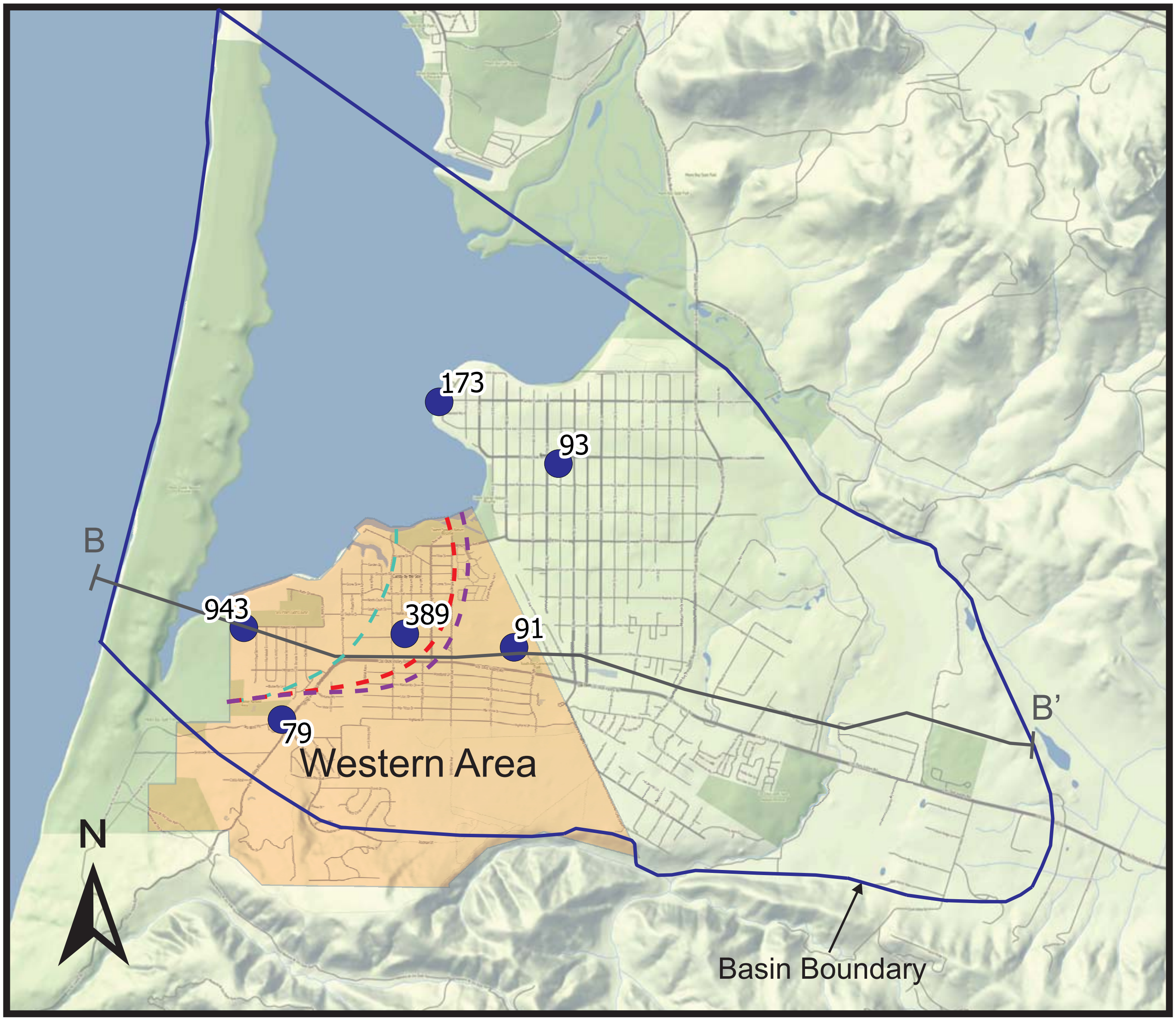
Hydrographs for the five wells equipped with pressure transducers are shown in Appendix F. The transducers have been installed to provide greater detail of water level trends and fluctuations. Well FW6, screened at the top of the upper aquifer (first water) near the Broderson leach field, showed a water level decline of less than one foot between Spring and Fall 2016, followed by unchanging to slightly rising water levels through December 2016. Well FW10, screened at the top of the upper aquifer (first water) in Baywood Park, showed a decline of 1.5 feet between Spring and Fall 2016, followed by approximately 1.5 feet of water level rise through December 2016. Well UA4, screened at the bottom of the upper aquifer near Sea Pines golf course, showed a mostly unchanging water level between Spring and Fall 2016, followed by approximately one foot of water level rise through December 2016. Well, UA10, screened at the bottom of the Upper Aquifer near downtown Los Osos, showed a decline of approximately two feet between Spring and Fall 2016, followed by about two feet of water level rise through December 2016. Well LA13, screened at the bottom of the Lower Aquifer, showed three feet of water level decline between Spring and Fall 2016, followed by approximately four feet of water level rise through December 2016.

Seawater has a density that is 1.025 times greater than fresh water. For every foot of fresh water head above sea level, the seawater interface will be displaced 40 feet below sea level, according to the Gyhben-Herzberg relation (Freeze and Cherry, 1979). Upper aquifer water levels at the bay front (wells UA3, UA4, and UA5) are currently high enough to avoid seawater intrusion in the Upper Aquifer at those locations.

7.3 Seawater Intrusion

Beginning with the 2015 Annual Report, CHG revised and simplified the methodology for tracking the seawater intrusion front in the Western Area (CHG, 2016). The revised methodology contours lower aquifer chloride concentrations directly to establish a vertical front, rather than using the leading edge (toe) of a sloped front. Six wells are used for developing the 250 mg/L chloride isopleth: LA8, LA10, LA11, LA12, LA15, and LA32.

The position of the Fall 2015 and Fall 2016 seawater intrusion front in Lower Aquifer Zone D is shown in Figure 18, along with the corresponding 2005 seawater intrusion front, using the revised methodology. The intrusion front moved inland up to 350 feet between Fall 2015 and Fall 2016, which is close to double the estimated intrusion rate of 190 feet per year between 2005 and 2015. However, it is worth noting that Figure 18 is a simplification of basin conditions, and the calculated position of the intrusion front and associated velocity of the intrusion front movement can vary significantly from year to year, and from Spring to Fall due to localized chloride fluctuations, particularly at well LA10. Contouring for the intrusion front (250 mg/L chloride isopleth) shown in Figure 18 uses the ordinary kriging interpolation method, which provides a best (least-squares) estimate of values at unmeasured points based on the mapped values. Chloride concentrations at Dunes and Bay Area wells LA2 and LA3 are two orders of magnitude greater than the Western Area wells and were not used for contouring the intrusion front in the Western Area. The ordinary kriging interpolation method involves weighted linear interpolation, whereas the chloride concentrations approaching wells LA2 and LA3 on the sandspit do not appear to follow linear gradients.



Base Image: Stamen-Terrain

0 2000 4000 6000 8000 ft

Scale: 1 inch ≈ 4,000 feet

Explanation

389
Groundwater with Fall 2016 Lower Aquifer Chloride Concentration in milligrams per liter (mg/L).

2016 seawater intrusion front in Western Area (250 mg/l chloride isopleth)

2015 seawater intrusion front in Western Area (250 mg/l chloride isopleth)

2005 seawater intrusion front in Western Area (250 mg/l chloride isopleth)

B B'
Cross-section alignment (Figures 5 and 19)

Figure 18
Seawater Intrusion Front
Western Area Lower Aquifer Zone D
Los Osos Groundwater Basin
2016 Annual Report

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The location of the intrusion front is also shown in cross-section on Figure 19. Lower Aquifer Zone D intrusion is discussed above. There is insufficient information to represent Lower Aquifer Zone E intrusion in a plan view figure. The only Western Area well which represents Zone E water quality is LA4, located near Sea Pines Golf Course. Water quality at LA4 has been close to seawater since first sampled in 1985 (Cleath & Associates, 2005). Other control points for Zone E water quality along the B-B' cross-section orientation in Figure 19 are LA15 and LA18 in the Central Area. The seawater front reached LA15 in 2009, but there has been no evidence of further inland movement toward LA18, and geophysics in 2015 at nearby deep monitoring well LA14 continues to show no sign of intrusion. This is interpreted as an indication that historical Zone E intrusion toward the Well LA15 was through a relatively narrow preferential pathway. In 2013, LA15 was modified to remove Zone E production (CHG, 2014).

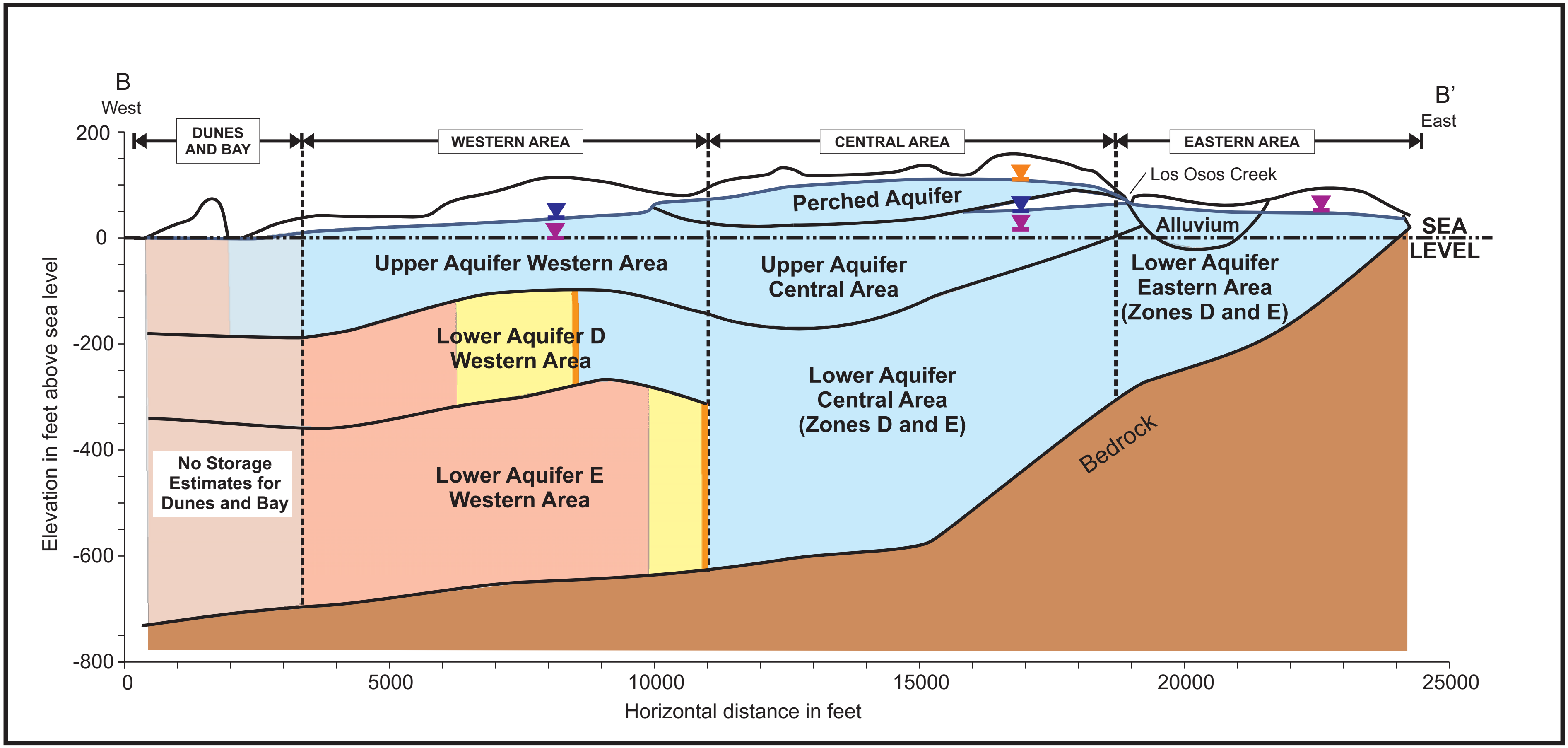
7.4 Groundwater in Storage

Groundwater in storage for basin areas and aquifers has been estimated through a systematic approach of water level contouring, boundary definition, volume calculations, and aquifer property estimation. The methodology was developed to facilitate change in storage calculations from year to year. An example storage calculation for the Eastern Area is shown in Appendix G. Storage estimates were performed for Spring and Fall 2016 and included separate estimates for the following areas and aquifers shown in Figure 19:

- Perched Aquifer
- Western Area Upper Aquifer
- Western Area Lower Aquifer
- Central Area Upper Aquifer
- Central Area Lower Aquifer
- Eastern Area Alluvial and Lower Aquifer

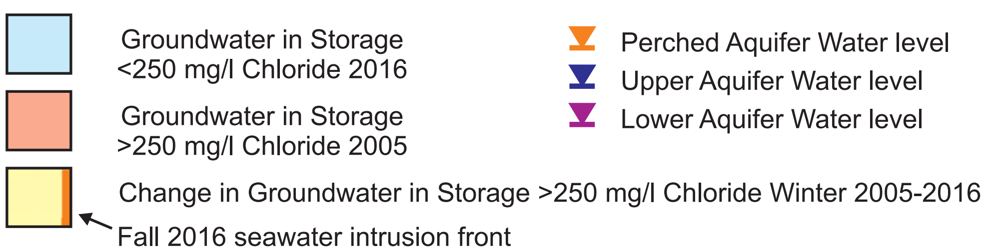
The various storage compartments are shown conceptually in Figure 19. Storage estimates for the Lower Aquifer in the Western and Central basin combine fixed pore space volume and confined pore space volume components. The fixed volume component of storage is based on the specific yield of the aquifer sediments, and is fixed because the Lower Aquifer is never dewatered in the Western and Central areas. The confined component adds a relatively small volume of transient storage associated with the aquifer pressure, and is based on the storativity of the aquifer. Confined and semi-confined aquifer storativity values are typically orders of magnitude less than the specific yield. The average specific yield for basin sediments is estimated at 0.1 (Appendix G). The storativity value used for the confined aquifer in the Western and Central areas is estimated at 0.0008 (Cleath & Associates, 2005).

The storage component of the Lower Aquifer in the Western Area Zone D represents the groundwater volume with a chloride concentration of 250 mg/L or less. Zone E in the Western Area is excluded from the storage calculations, because chloride concentrations are mostly above 250 mg/L (Figure 19).



Cross-section alignment shown in Figure 18

Explanation



NOTE: Inland movement of intrusion front between Fall 2015 and Fall 2016 shown in Figure 18 is for Lower Aquifer Zone D. There is no evidence of further inland movement of the intrusion front in Zone E.

Figure 19
Basin Storage Compartments
Los Osos Groundwater Basin
2016 Annual Report

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All storage calculations were based on upper and lower contoured surfaces specific to the aquifer (fixed volume and confined volume were combined). For example, elevation contours on the base of the Perched Aquifer were used as the lower bounding surface for Perched Aquifer storage calculations, so no storage was assigned to unsaturated pore space between the base of the perched aquifer and saturated Upper Aquifer sediments (Figure 19). Appendix G includes a list of wells used for 2016 groundwater elevation contours and associated upper surfaces for storage calculations. Fixed upper and lower surfaces used for storage calculations (base of perched aquifer, top and bottom of regional clay aquitard, and base of permeable sediments were developed from existing contour maps and control points presented in prior reports (Cleath & Associates, 2003, 2005; CHG, 2015). Table 17 summarizes the estimates of fresh groundwater in storage for 2016.

Table 17. Groundwater in Storage Spring and Fall 2016 (<250 mg/l Chloride)

Basin Area	Aquifer	Zone	Spring 2016		Fall 2016	
			Total	Above Sea Level	Total	Above Sea Level
			ACRE-FEET			
Western and Central	Perched	A, B	4,300	4,300	4,200	4,200
	Upper	C	27,000	5,100	26,400	4,500
Western	Lower[1]	D[2]	14,800	<10	13,700	<10
Central	Lower[1]	D, E	56,200	<10	56,200	<10
Eastern	Alluvial and Lower	Alluvial, D, E	18,000	3,500	17,600	3,100
TOTAL			120,300	12,900	118,100	11,800

NOTES: [1] Includes fixed and confined storage.
[2] Western Area Zone E not included due to chloride >250 mg/L.

Total fresh groundwater in storage for the basin (excluding Dunes and Bay area) averaged close to 120,000 acre-feet in Spring 2016, with approximately 13,000 acre-feet above sea level (Table 17). There was a calculated seasonal storage decline of 2,200 acre-feet between Spring 2016 and Fall 2016, including an estimated loss of 1,100 acre-feet of freshwater storage due to seawater intrusion into the western Lower Aquifer. The loss of freshwater storage from Spring to Fall is based on movement of the 250 mg/l chloride isopleth in Lower Aquifer Zone D, similar to what is shown in Figure 18. A sensitivity analysis would be recommended to evaluate the potential range of error associated with groundwater storage estimates and change in groundwater storage estimates.

There is approximately 70,000 acre-feet of storage within the Lower Aquifer in the Western Area Zone D and Central Area (Table 17). Because groundwater levels in the Lower Aquifer within the Western and Central areas average more than 100 feet above the top of the aquifer, dewatering is unlikely, and this volume of storage will not change. The Lower Aquifer storage includes a relatively small component (less than 200 acre-feet) of confined pore space volume, representing water that is available without dewatering any portion of the Lower Aquifer (the pressure component). Water is relatively incompressible, so once the pore spaces of an aquifer have been filled, substantial confining pressure is required to further increase the storage volume. Conversely, there is a much greater drop in aquifer water levels for storage withdrawals under confined conditions, compared to unconfined conditions. This smaller storage volume assumes a confined aquifer storativity of 0.0008, compared to the unconfined specific yield of 0.1.

Table 18 compares Spring 2015 groundwater in storage with Spring 2016. An adjustment was made to the volume of Upper Aquifer storage above sea level as previously reported in the 2015 Annual Report to exclude areas along the southern basin boundary where the base of the Upper Aquifer rises above sea level.

Table 18. Change in Storage Spring 2015 to Spring 2016 (<250 mg/l Chloride)

Basin Area	Aquifer	Zone	Spring 2015		Change from Spring 2015 to Spring 2016	
			Total	Above Sea Level	Total	Above Sea Level
			ACRE-FEET			
Western and Central	Perched	A, B	4,200	4,200	100	100
	Upper	C	26,400[3]	4,600[3]	600	500
Western	Lower[1]	D[2]	14,400	<10	400	0
Central	Lower[1]	D, E	56,200	<10	0	0
Eastern	Alluvial and Lower	Alluvial, D, E	17,900	3,400	100	100
TOTAL			119,100	12,200	1,200	700

NOTES: [1] Includes fixed and confined storage.
[2] Western Area Zone E not included due to chloride >250 mg/L.
[3] 2015 storage value for Upper Aquifer was adjusted to exclude area where the base rises above sea level. Well FW28 also removed from Upper Aquifer water level contouring group.

The values in Table 18 reflect an increase in freshwater storage between Spring 2015 and Spring 2016 of 1,200 acre-feet (as compared to a seasonal storage loss of 2,200 acre-feet between Spring and Fall 2016). The annual change in storage includes an increase in fresh groundwater storage (<250 mg/L chloride) of 400 acre-feet in the Lower Aquifer (as compared to a seasonal loss of 1,100 acre-feet during 2016). The increased spring storage is consistent with the increased precipitation in Los Osos, compared to the prior four years (16.15 inches of precipitation at Station #727 in 2016, compared to an average of 8.4 inches from 2012 to 2015).

Freshwater storage in the Western Area of Lower Aquifer Zone D was approximately 14,400 acre-feet in both Spring 2015 and Fall 2015 (rounded to closest 100 acre-feet; CHG, 2015). In 2016, Zone D freshwater storage increased by 400 acre-feet during the spring, then decreased by 1,100 acre-feet through the fall. Therefore, the change in Zone D freshwater storage between Fall 2015 and Fall 2016 was a loss of 700 acre-feet, as shown by the inland movement of the seawater intrusion front in Figure 18.

7.5 Basin Metrics

The LOBP established two methods for measuring progress in management of seawater intrusion (ISJ Group, 2015): one based on comparing annual groundwater extractions with the sustainable yield of the basin as calculated by the basin numerical groundwater model, and one based on evaluating water level and water quality data from the LOBP Groundwater Monitoring Program. The first method involves the Basin Yield Metric (BYM) and the Basin Development Metric (BDM), while the latter method involves the Water Level Metric, The Chloride Metric, and the Nitrate Metric.

7.5.1 Basin Yield Metric

The Basin Yield Metric compares the actual amount of groundwater extracted in a given year with the sustainable yield of the basin under then-current conditions. Sustainable yield is estimated using the basin model as the maximum amount of water that may be extracted from the basin with none of the active wells producing water with chloride concentration in excess of 250 mg/L (ISJ Group, 2015). A chloride concentration of 250 mg/L is the recommended limit for drinking water (one-half of the Secondary Maximum Contaminant Level Upper Limit of 500 mg/L). The Basin Yield Metric for 2016 is a ratio expressed as follows:

$$\frac{\text{2016 Groundwater Production}}{\text{2016 Sustainable Yield}} * 100$$

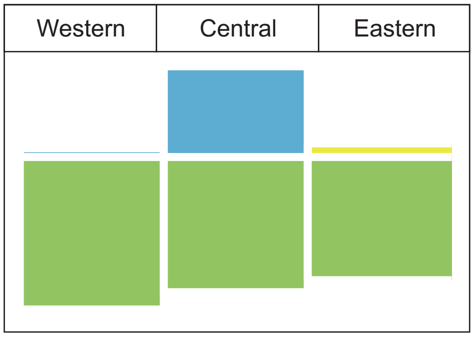
Groundwater production in 2016 was 2,160 acre-feet. The sustainable yield of the basin with the infrastructure in place at year-end 2016 was estimated using the basin model to be 2,760 acre-feet per year (CHG, 2017), therefore, the Basin Yield Metric in 2016 is 78. The corresponding Basin Yield Metric was 89 in 2015, which was the first year the metric has been below 100 since 1978. The LOBP objective for the Basin Yield Metric is 80 or less, and was met in 2016.

Figure 20 compares the Basin Yield Metric and area production in the basin since 2005. The Basin Yield Metric has dropped from an average of 128 between 2005 and 2009 to 78 in 2016. Two development scenarios from the LOBP are also provided for comparison in Figure 20.

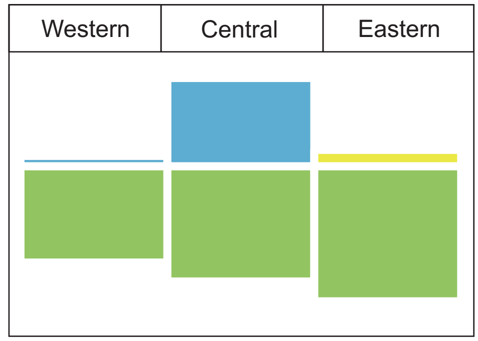
Sustainable yield in the equation above is not simply a volume of water, however, but is also the distribution of groundwater pumping across the basin that maintains a stationary seawater front, with no active well producing water with chloride concentrations above 250 mg/l. Long-term climatic conditions are assumed for the sustainable yield.

Between 2015 and 2016, Western Area production from the Lower Aquifer increased by over 50 percent, from 190 acre-feet to 300 acre-feet. There have also been five consecutive years of below normal rainfall from 2012 through 2016. The 2016 pumping distribution and drought condition have resulted in a rising Chloride Metric and increased seawater intrusion, despite meeting the Basin Yield Metric goal. Analyses using the Basin Model confirms that this dynamic response would be expected.

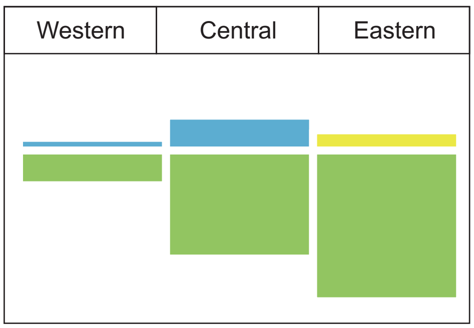
2005-2009
Average Production 3,060 AFY
Basin Yield Metric = 128



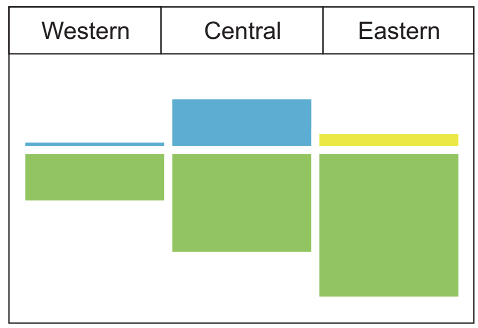
2010-2014
Average Production 2,600 AFY
Basin Yield Metric = 106



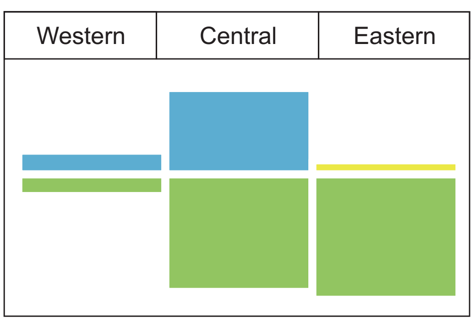
Year 2015
Average Production 2,170 AF
Basin Yield Metric = 89



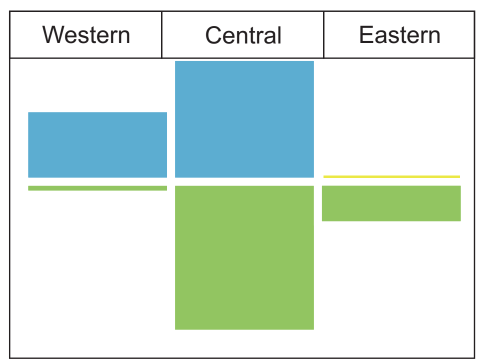
Year 2016
Average Production 2,160 AF
Basin Yield Metric = 78



E+AC+U (No Further Development Scenario)
refer to Basin Plan for full description
Average Production 2,230 AFY
Basin Yield Metric = 74



E+UG+ABC (Buildout Scenario)
refer to Basin Plan for full description
Average Production 2,380 AFY
Basin Yield Metric = 71



Explanation:

Size of rectangle is proportional to groundwater production

Alluvial Aquifer

Upper and Perched Aquifer

Lower Aquifer

Note: historical (pre-2015) and future/projected Basin Yield Metrics are from LOBP

Figure 20
Basin Yield Metric Comparison
Los Osos Groundwater Basin
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7.5.2 Basin Development Metric

The Basin Development Metric compares the sustainable yield of the basin in a given year with the maximum sustainable yield of the basin with all potential LOBP Projects implemented (ISJ Group, 2015) (see Section 10 for brief overview of LOBP Programs). The Basin Yield Metric for 2016 is a ratio expressed as follows:

$$\frac{\text{2016 Sustainable Yield}}{\text{Maximum Sustainable Yield}} * 100$$

The 2016 sustainable yield is estimated at 2,760 acre-feet. The maximum sustainable yield with all LOBP projects implemented is estimated at 3,500 acre-feet. Therefore, the Basin Development Metric in 2016 is 79, which is the first increase since calculated at 70 in 2013. The purpose of the metric is to inform the BMC on the percentage of the basin's maximum sustainable yield that has been developed (79 percent in 2016). There is no LOBP objective for the Basin Development Metric.

As presented in LOBP (ISJ Group, 2015), the estimated sustainable yield of the basin will increase beginning with urban water reinvestment Program U and basin infrastructure Program A, both of which are currently in progress (portions of Program A were completed in 2015 and 2016).

7.5.3 Water Level, Chloride, and Nitrate Metrics

The Water Level, Chloride, and Nitrate Metrics are measurements of the effectiveness of basin management. The Water Level and Chloride Metrics address changes in the Lower Aquifer related to seawater intrusion mitigation, while the Nitrate Metric addresses changes in First Water and the Upper Aquifer related to nitrate contamination mitigation.

<u>Water Level Metric</u>

The Water Level Metric is defined as the average Spring groundwater elevation, measured in feet above mean sea level, in five Lower Aquifer wells. These wells are LA2, LA3, LA11, LA14, and LA16 (Figure 4).

Two Water Level Metric wells (LA14 and LA16) are positioned in the Western Area near the current seawater intrusion front (250 mg/L chloride isopleth) and one well is in the Central Area on the bay front (LA11). As basin production is redistributed through the basin infrastructure program, these Water Level Metric wells will monitor Lower Aquifer groundwater levels in critical areas near the seawater intrusion front.

The last two Water Level Metric wells are located on the Morro Bay sand spit (LA2 and LA3), where monitoring will help evaluate regional effects, rather than just localized water level rebound. Table 19 presents the 2016 Water Level Metric. Figure 21 graphs historical trends in the metric.

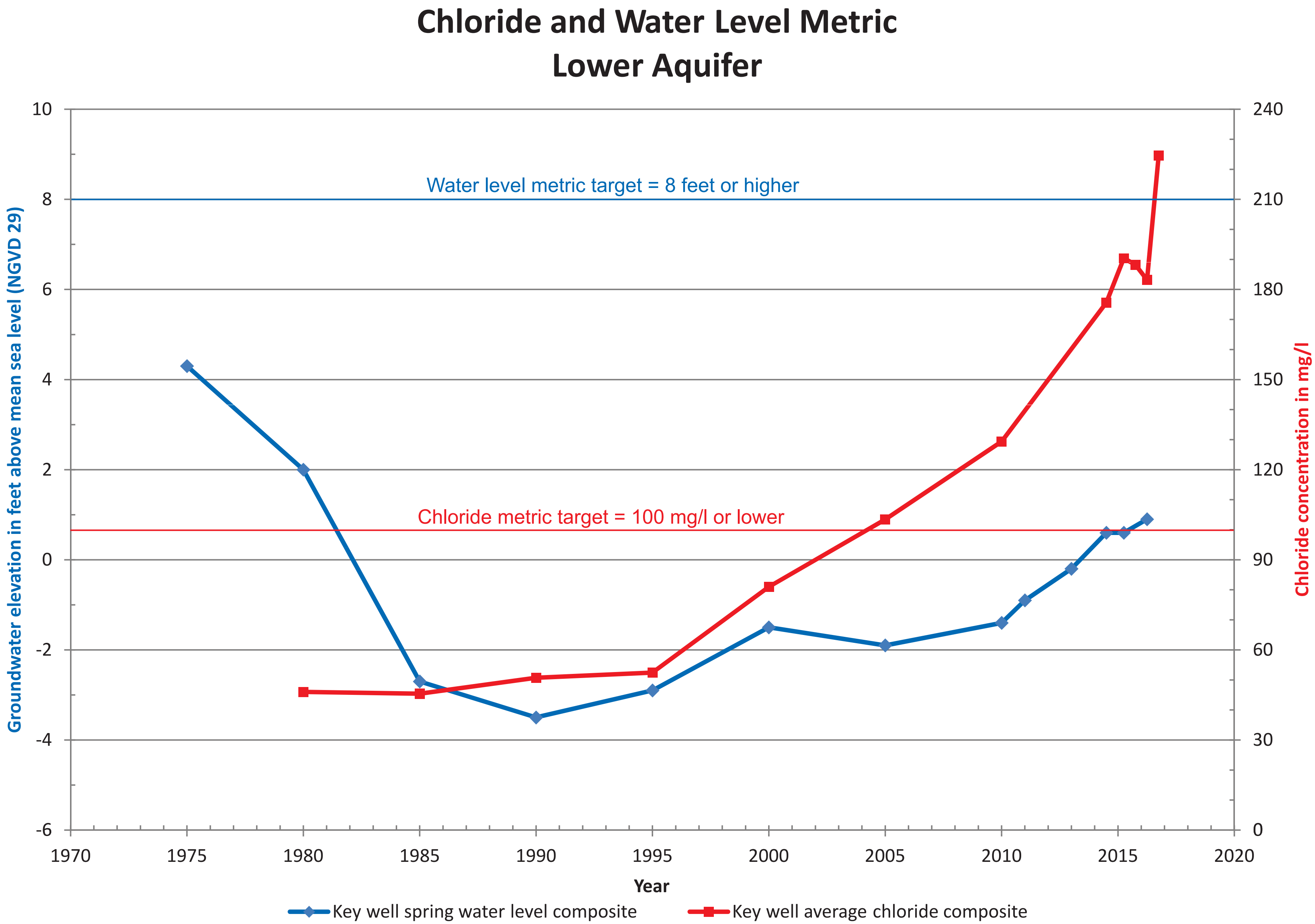

Figure 21
Chloride and Water Level Metric
Los Osos Groundwater Basin
2016 Annual Report

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Table 19. 2016 Water Level Metric	
Metric Well	**Spring 2016 Groundwater Elevation (feet above sea level - NGVD 29 Datum)**
LA2	2.3[1]
LA3	-0.7[1]
LA11	-0.1[1]
LA14	-3.0
LA16	6.3
Water Level Metric (average)	1.0 feet

Data Source: LOBP and County Groundwater Monitoring Programs
[1]Subtracted 2.8 feet from NAVD 88 elevations in Table 5 to convert to NVGD 29 datum for metric.

The Spring 2016 Water Level Metric is 1.0 feet NGVD 29 (approximately 3.9 feet NAVD 88). Mean sea level is approximately 0 feet in the NVGD 29 datum. The metric was rising from 2005 through 2014, likely in response to a decrease in Lower Aquifer production, did not change between 2014 and 2015, and has begun rising again (Figure 21). The LOBP objective for the Water Level Metric is 8 feet or higher (ISJ Group, 2015). Removal of the density correction at the sandspit wells, and adjustment of reference point elevations to the NGVD datum has lowered the metric compared to prior calculations (CHG 2016b). Reevaluation of the metric objective may be appropriate, however, additional monitoring to establish the metric trend under Los Osos Wastewater Project conditions, along with a review of all well elevation reference points by a licensed surveyor is recommended prior to considering a change in the water level metric objective.

Chloride Metric

The Chloride Metric is defined as the weighted average concentration of chlorides in four key Lower Aquifer wells. One key well (LA10) is within the historical path of seawater intrusion (Cleath & Associates, 2005). Reduction in pumping from the Lower Aquifer should result in measurable declines in chloride concentrations at this well, as the hydraulic head in the Lower Aquifer increases and the hydraulic gradient toward land decreases or is reversed. The LOBP Groundwater Monitoring Program schedule for measuring the Chloride metric is in the Spring and Fall.

There are also three key wells on the perimeter of the seawater intrusion front (LA8, LA11, and LA12). Wells LA11 and LA12 monitor Lower Aquifer chloride concentrations in the northern portion of the basin, while LA8 monitors chloride concentrations in the southern portion. When calculating the Chloride Metric, the concentration of Well LA10 is given twice the weight of the other three wells, in order to increase the sensitivity of the metric to management actions (Refer to the LOBP for a description of the development of the Metric). Table 20 presents the Spring and Fall 2016 Chloride Metric. Figure 21 graphs historical values in the metric. The Chloride Metric is a simplification of basin conditions, and can vary significantly from year to year due to localized chloride fluctuations, particularly at well LA10. The Chloride Metric target level is 100 mg/L or lower.

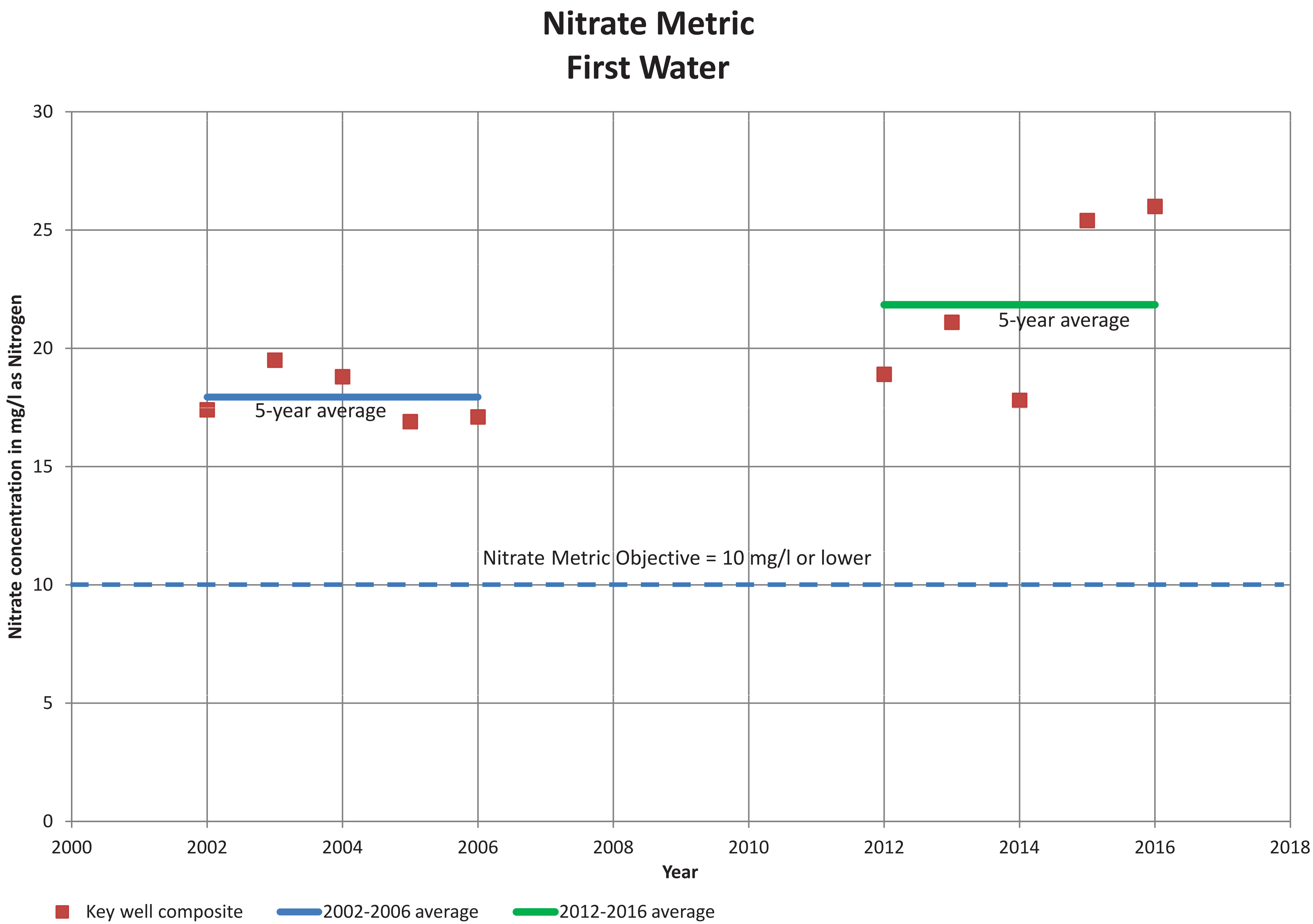
Table 20. 2016 Chloride Metric		
Metric Well	**Spring 2016 Chloride Concentrations**	**Fall 2016 Chloride Concentrations**
LA8	76 mg/L	79 mg/L
LA10	299 mg/l (double counted for average)	389 mg/l (double counted for average)
LA11	151 mg/L	173 mg/L
LA12	91 mg/L	93 mg/L
Chloride Metric (weighted average)	183 mg/L	225 mg/L

Data Source: LOBP Groundwater Monitoring Program (Appendix C)

The 2016 water quality monitoring results indicate continued advance of the seawater intrusion front. Seawater intrusion is typically greatest in the fall, when water level are lowest. A comparison between Spring 2016 and Fall 2016 shows a substantial increase in the chloride metric. The Chloride Metric has increased relative to the target value between Fall 2015 (188 mg/L) and Fall 2016 (225 mg/L), indicating a lack of improvement in 2016 (Figure 21). As previously mentioned, the 2016 pumping distribution and drought condition resulted in a rising Chloride Metric and increased seawater intrusion, despite meeting the Basin Yield Metric goal.

Nitrate Metric

The Nitrate Metric is defined as the average concentration of nitrate in five First Water key wells located in areas of the basin that have been impacted by elevated nitrate concentrations. Focusing on shallow, adversely impacted wells provides a sensitive method of tracking changes in nitrate concentrations in groundwater over time. The Nitrate Metric has historically been measured in October, however, the LOWRF Groundwater Monitoring Program, which collects the nitrate data, has moved to a June and December schedule. CHG recommends evaluating the potential effect of this monitoring schedule change on the nitrogen metric. Table 21 presents the Nitrate Metric for 2016. Figure 22 graphs historical values in the metric, along with 5-year average for 2002-2006 and 2012-2016.



Note: Nitrate metric wells reconstructed in 2002, sampled from 2002-2006 and 2012 to present.

Figure 22
Nitrate Metric
Los Osos Groundwater Basin
2016 Annual Report

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Table 21. 2016 Nitrate Metric	
Metric Well	**Winter 2016 Nitrate-Nitrogen (NO_3-N) Concentrations**
FW2	28 mg/L
FW6	15 mg/L
FW10	29 mg/L
FW15	22 mg/L
FW17	36 mg/L
Nitrate Metric (average)	26 mg/L

Data Source: LOWRF Groundwater Monitoring Program (Rincon Consultants, 2017)

The Nitrate Metric was measured at 26 mg/L nitrate-nitrogen (NO3-N), which is 2.6 times the Maximum Contaminant Level of 10 mg/L (the drinking water standard). Independent of LOBP actions, construction and operation of the community sewer system and LOWRF will largely stop nitrate loading in the basin from septic disposal within the wastewater service area. Nitrate concentrations in the basin are expected to begin declining over the next decade. The Nitrate Metric target is 10 mg/L or lower (ISJ Group, 2015). If nitrate-nitrogen concentrations in groundwater from the Nitrate Metric wells decrease to a 5-year running average of 10 mg/L or less, it may reasonably be inferred that nitrate concentrations are generally lower across the Upper Aquifer, or will be in the reasonably foreseeable future.

8. BASIN STATUS

The status of the Los Osos Groundwater Basin in 2016 is summarized as follows:

- The basin received below normal rainfall in 2016 based on records for Station #152. San Luis Obispo County was in exceptional drought conditions (the greatest intensity level) during 2016, based on information from the U.S. Drought Monitor, a partnership of federal agencies (NDMC/USDA/NOAA, 2016).

- Groundwater production for the basin totaled 2,160 acre-feet in the 2016 calendar year, compared to 2,170 acre-feet in 2015. Groundwater production in the Western Area of the Lower Aquifer, however, increased by over 50 percent, from 190 acre-feet in 2015 to 300 acre-feet in 2016.

- Long-term water level trends over the last 10 years, based on the Western and Central area well hydrographs shown in Figures 15-17, averaged 0.7 feet of decline per year in First Water, 0.4 feet of decline per year in Upper Aquifer, and 0.3 feet of rise per year in Lower Aquifer water levels.

- The basin gained 1,200 acre-feet of groundwater in storage between Spring 2015 and Spring 2016, and lost 2,200 acre-feet between Spring 2016 and Fall 2016.
- The seawater intrusion front advanced inland up to 350 feet between Fall 2015 and Fall 2016.
- The Basin Yield Metric has improved by decreasing from 89 in 2015 to 78 in 2016, and the metric now meets the LOBP goal of 80 or less.
- The Basin Development Metric in 2016 indicates that 70 percent of the maximum potential sustainable yield of the basin has been developed. There is no LOBP objective for the Basin Development Metric, and there has been no change in the metric value since last calculated in 2013.
- The Water Level Metric rose by 0.4 feet between Spring 2015 (0.6 feet) and Spring 2016 (1.0 feet), indicating improvement in 2016, though it remains several feet below the target value.
- The Chloride Metric increased relative to the target value between Fall 2015 (188 mg/L) and Fall 2016 (225 mg/L), indicating a lack of improvement in 2016. The 2016 pumping distribution and drought condition resulted in a rising Chloride Metric and increased seawater intrusion, despite meeting the Basin Yield Metric goal.
- The Nitrate Metric increased relative to the target value between 2015 (24.1 mg/L as N) and 2016 (26.0 mg/L as N), indicating a lack of improvement in 2016.

9. RECOMMENDATIONS

The following LOBP Groundwater Monitoring Program recommendations are provided for BMC consideration. Additional recommendations on Adaptive Management are provided in Section 10:

- Add a new Upper Aquifer and Lower Aquifer monitoring well near the bay, as recommended in the LOBP (ISJ Group, 2015).
- Retain a licensed surveyor to review all available documentation on reference point elevations and to perform wellhead surveys as needed (Section 3.2.1 and 7.5.3).
- Develop a rating curve for stream flow Sensor 751 on Los Osos Creek (Section 6).
- Perform a sensitivity analysis to evaluate the potential range of error associated with groundwater storage estimates and change in groundwater storage estimates to support future data interpretation (Section 7.4).
- Evaluate potential effects on the Nitrate Metric from changes to the LOWRF Groundwater Monitoring Program schedule (Section 7.5.3).

10. ADAPTIVE MANAGEMENT PROGRAM AND STATUS OF LOBP PROGRAM IMPLEMENTATION

The LOBP describes seven potential programs of action, each of which focuses on a different aspect of basin management (ISJ Group, 2015; see Section 10.3). Implementation of an identified combination of the LOBP Programs is expected to result in sustainable use of the basin.

The LOBP also provides for periodic review of the implementation of the LOBP through establishment of an Adaptive Management Plan that allows the BMC to do the following:

- Evaluate trends of key basin metrics;
- Identify additional data needs;
- Report the data analysis to various interested parties;
- Modify the LOBP programs and schedule, if necessary, in response to current conditions and observed trends in the groundwater basin;
- Modify procedures to utilize current best management practices; and
- Modify pumping, treatment, and/or water reuse procedures in response to groundwater basin conditions and trends that show signs of degradation of water quality, including increased levels of contamination and/or increased levels of seawater intrusion.

The Adaptive Management Program will provide a status update on the implementation of the LOBP Programs, assess the overall effectiveness of the LOBP, and offer a tool with which to modify the LOBP programs to better meet overall LOBP objectives.

10.1 Basin Metrics

As noted in Section 7 ("Data Interpretation") of this Annual Report, the LOBP established several metrics to measure nitrate impacts to the Upper Aquifer, seawater intrusion into the Lower Aquifer, and the effect of management efforts to the BMC. These metrics allow the Parties, the BMC, regulatory agencies and the public to evaluate the status of nitrate levels and seawater intrusion, and the impact of implementation of the LOBP programs, in the Basin through objective, numerical criteria that can be tracked over time. The 2016 metric values are summarized in Table 22 for easy reference during discussion and evaluation of the LOBP programs.

As discussed in Section 7.2, water levels continue to decline in the Upper Aquifer, therefore a water level metric for the upper aquifer may be appropriate. Water level and chloride metric development is recommended for the Upper Aquifer using bay front wells UA3, UA4, and UA5. These metrics would allow year-to-year tracking of seawater intrusion potential in the Upper Aquifer. Metric thresholds could be established through a combination of historical water level data review, Basin Model results, and correlation with the Gyhben-Herzberg relation. These additional Upper Aquifer metrics will be tracked throughout the year and presented in the 2017 Annual Monitoring Report.

10.2 Adaptations to LOBP Programs

Based on the basin status (Section 8) and recommendations (Section 9), the BMC intends to continuously develop and pursue additional measures related to the Groundwater Monitoring and Urban Water Use Efficiency programs. The following is an update on additional measures related to the Groundwater Monitoring and Urban Water Use Efficiency program:

Additional Water Quality Metrics. In addition to the recommended Upper Aquifer water level and chloride metrics discussed in Section 10.1, the BMC will continue to consider developing additional metrics and/or numerical goals to protect the upper aquifer from water quality threats.

Contingency Plan Development. As metric trends and basin response become better defined, the BMC intends to develop contingency plans to respond to unforeseen conditions. As funding and siting for Program C projects progress, detailed milestone schedules will also be developed.

Table 22. LOBP Metric Summary			
Metric	**LOBP Goal**	**Calculated Value from 2016 Data**	**Recommended Actions in Addition to LOBP Programs**
Basin Yield Metric: Comparison of current well production to sustainable yield	80 or less	78	Implement additional conservation measures to reduce indoor and outdoor demands (See Section 10.3.2)
Water Level Metric: Weighted average groundwater elevation in 5 key wells in the lower aquifer	8 feet above mean sea level or higher	1.0 feet above mean sea level	Implement additional conservation measures to reduce indoor and outdoor demands (See Section 10.3.2)
Chloride Level Metric: Average chloride concentration in 4 key wells in the lower aquifer	100 mg/L or lower	225 mg/L	Implement additional conservation measures to reduce indoor and outdoor demands (See Section 10.3.2)
Nitrate Metric: Average nitrate concentration in 5 key wells in the upper aquifer	10 mg/L or lower	26 mg/L (NO3-N)	None recommended

Adaptation of Water Conservation Measures. Evaluate the Urban Water Use Efficiency Program to determine which conservation measures are the most efficient and effective to meet the LOBP's goals.

Discussion and Recommendation of Criteria for Future Growth. Provide input into the Los Osos Community Plan (LOCP), including consideration of Basin Metrics and defined goals as they relate to the timing of future growth within the basin. In its May 2017 meeting, the BMC authorized the release of a letter to the County Planning Department and Coastal Commission staff recommending that future development should be subject to the following provisions:

1. Any growth projections in the updated Los Osos Community Plan should be consistent with the water supply estimates provided in the Basin Management Plan.
2. The Community Plan should acknowledge any infrastructure projects contemplated by the Basin Plan that would require coastal planning action subject to the authority of the

Coastal Commission. This provision would help expedite completion of any affected projects.

3. Amendments to the County's Growth Management Ordinance [separate from the Community Plan/LCP] should provide a growth rate for Los Osos consistent with the adaptive management provision of the Basin Plan. In particular, the rate of growth must be set so that the monitoring provisions of the Basin Plan confirms the adequacy of a sustainable water supply in support of any contemplated future growth.

10.3 LOBP Programs

The LOBP outlines a number of programs developed to meet the goals of the various metrics outlined above. The BMC has analyzed the impacts of implementing various combinations of programs on the Basin.[1] In particular, the BMC modeled the impact of each combination on the Basin Yield Metric, Water Level Metric and Chloride Metric. Based on this analysis, the LOBP recommends the following programs for immediate implementation:[2]

- Groundwater Monitoring Program;
- Urban Water Use Efficiency Program;
- Urban Water Reinvestment Program;
- Basin Infrastructure Programs A and C; and
- Wellhead Protection Program.

10.3.1 Groundwater Monitoring Program

In order to allow calculation of the above metrics with a higher degree of accuracy, the BMC has implemented the Groundwater Monitoring Program. The Groundwater Monitoring Program is designed to collect, organize and report data regarding the health of the Basin from a current network of 85 wells.[3] In addition to facilitating the calculation of metrics, this data provides information needed to manage the Basin for long-term sustainability. Implementation of the Groundwater Monitoring Program also satisfies various external monitoring requirements, such as the California Statewide Groundwater Elevation Monitoring Program (CASGEM) and waste discharge and recycled water permits for the LOWRF. Monitoring under the program began in 2014 and will continue to occur in the spring and fall of each year when water levels are typically at their highest and lowest. This Annual Report represents the second monitoring event under the Groundwater Monitoring Program. The BMC plans to continue to report the values for all Basin

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1 The LOBP analyzed the following seven potential programs: (1) Groundwater Monitoring Program; (2) Urban Water Use Efficiency Program: (3) Water Reinvestment Program; (4) Basin Infrastructure Program; (5) Supplemental Water Program; (6) Imported Water Program; (7) Wellhead Protection Program.

2 The LOBP also recommends the following programs for potential implementation if the County and the Coastal Commission were to allow future development in Los Osos as part of the LOCP and the Los Osos Habitat Conservation Plan (LOHCP): (1) Basin Infrastructure Program B; and (2) either Basin Infrastructure Program D or the Agricultural Water Reinvestment Program. Since additional development has not been authorized, these additional programs have not been included in this Annual Report.

3 The wells are distributed laterally across the Western, Central and Eastern Areas and vertically among First Water and the Upper and Lower Aquifers. Twelve existing wells were added to the program since 2015.

metrics and other relevant, non-proprietary data to the Parties, the Court and the public in its future Annual Reports. Additional recommendations and planned actions relating to the Groundwater Monitoring Program are described in Section 9. Table 23 summarizes the status of the various implementation tasks set forth in the LOBP that related to the Groundwater Monitoring Program.

10.3.2 Urban Water Use Efficiency Program

In order to reduce annual groundwater production from the Basin, and thus reduce the Basin Yield Metric, the LOBP recommends implementation of the Urban Water Use Efficiency Program. In October 2012, the San Luis Obispo County Board of Supervisors adopted a Water Conservation Implementation Plan ("County Water Conservation Plan"), the details of which are described in Table 24. The County Water Conservation Plan was configured to provide detailed financial and administrative structure, while substantially conforming to the LOBP. Under this program, all properties connecting to the sewer project are required to be retrofitted prior to connection, and completion is expected by end of 2017. By that time, it is anticipated that all properties will be connected to the sewer and all indoor water fixtures subject to the County Conservation Program will be upgraded. Table 25 shows the total fixtures retrofitted and the total rebates provided as of May 2017.

Table 23. Basin Groundwater Monitoring Program Status			
Recommended Implementation Measure	**Current Status**	**Funding Status**	**Projected Completion**
Wellhead Surveys: Perform wellhead surveys to establish reference point elevations and locations	Not initiated	Anticipated in 2017 Budget	February, 2018
Protocols and Objectives: Establish well monitoring protocols and data quality objectives	Complete		
Water Level Monitoring: Assign water level monitoring responsibilities to the Parties or other stakeholders	Complete		
Access to Private Wells: Contact private well owners to request permission for participation in the groundwater elevation and water quality portions of the Groundwater Monitoring Program	List is prepared, no contact has been made.	Fully funded	February, 2018
Water Quality Monitoring: Assign water quality monitoring responsibilities. The BMC will adopt a set of procedures for recording groundwater elevations and sampling for water quality.	Complete		
Data: Assign data compilation, organization and reporting duties	Complete		

Table 24. Summary from Adopted 2012 County Water Conservation Plan					
Implementation Program Plan Measure Number	**Measure**	**Customer Category**	**Program Length**	**Total Estimated Activities**	**Total Estimated Budget**
Category 1. Residential Programs					
1A	Subsidize Partial Community Retrofit, Residential	Single-Family Residential Toilets	3 Years	8,000	$2,061,375
		Single-Family Residential Showerheads	3 Years	8,000	$368,575
		Single-Family Residential Faucet Aerators	3 Years	13,500	$100,769
1B	Residential Clothes Washer Rebate	Single-Family Residential Washer	5 years	2,000	$385,000
1C	Options for Fully Retrofitted Residences	Hot Water on Demand; Dishwashers,	3 years	500	199,525
1D	Retrofit on Resale	Single-Family Residential: Owners complete retrofits through this ongoing water conservation measure.			$0
Category 2 - Commercial and Institutional					
2A	Subsidize Partial Community Retrofit, Commercial	Commercial	3 years	141	$192,223
2B	Replace Restaurant Spray Nozzles	Commercial	3 years	45	$3,649
2C	Institutional Building Retrofit	Institutional	3 years	13	$38,588
2D	Commercial High Efficiency Clothes Washer Rebate	Commercial	3 years	40	$14,280
Category 3 - Education and Outreach Program					
3A	Residential Water Surveys	Single-Family Residential	3years	5,000	$824,250
3B	Commercial, Industrial and	Commercial	3 years	141	$35,102

Table 24. Summary from Adopted 2012 County Water Conservation Plan

Implementation Program Plan Measure Number	Measure	Customer Category	Program Length	Total Estimated Activities	Total Estimated Budget
	Institutional Surveys				
3C	Public Information Program	Single-Family Residential	10 years	23,000	$220,500
3D	Media Campaign	Single-Family Residential	10 years	7,000	$178,500
Category 4 - New Development (developer pays to implement water conservation measures)					$0
Contingency for Additional Measures in Years 4-10					$327,600
Plan Development Cost to Date					$50,000
Total Funding Commitment					$5,000,000

Table 25. Summary of Conservation Rebates Provided through May, 2017

Fixture	2016 Cumulative Total	2017 Cumulative Total	6/2016 through 5/2017
Toilets	3,246	3,315	69
Showerheads	2,362	2,380	18
Faucet aerators	3,211	3,226	15
Clothes washers	101	109	8
Total Value of Provided Rebates	$907,270	$924,474	$17,204

In 2016 the BMC recommended programs to be added to the County Water Conservation Plan. The proposed BMC programs are outlined in Table 26. The County is currently processing an item for the Board of Supervisor's Consent Agenda for June or July of 2017 to modify the Water Conservation Rebate Program to incorporate some of the BMC's recommendations, and to establish rebates as an ongoing element of the County Water Conservation Program. The additional conservation measures recommended for adoption by the Board were intended to have a clear nexus with the Los Osos Wastewater Project, and they are outlined in Table 27.

Table 26. BMC Recommended Water Conservation Measures							
Item No.	**Conservation Measure Name**	**Draft Rebate Amount**	**Water Savings Potential and Assumptions (ac-ft/year)**	**Estimated Savings per Unit (gal/yr)**	**Fixture or Program Estimated Lifespan**	**Cost of rebate per acre-ft saved**	**Approximate Savings Potential (AFY)[4]**
Indoor-1	Hot water recirculation system	$300	EPA Water Sense estimates > 10,000 gal/year, assume 5,000 to 10,000 gal/year	7,000	10	$1,396	50 to 100
Indoor -2	High efficiency clothes washer	$250	3,000 to 5,000 gal/year, depending on household size	3,300	5	$4,936	40 to 60
Indoor - 3	Replace 1.6 gpf toilets with 1.28 or below	$250	1,000 to 2,000 gal/year, depending on use	1,500	20	$2,715	30 to 50 (See Note 5)
Indoor - 4	Replace 2.0 gpm showerheads with 1.5 gpm	$40	1,000 to 2,000 gal/year, depending on use	1,500	10	$869	30 to 50 (See Note 5)
Outdoor - 1	Septic tank repurpose - roof water only	$500 (see Note 3)	Assume 3 to 4 tank volumes, at 1,000 gallons each	3,500	20	$2,327	40 to 60 (See Note 1)
Outdoor - 2	Septic tank repurpose - with recycled water hauling	$500 (see Note 3)	Potentially eliminate outdoor potable usage	6,000	20	$1,358	70 to 90 (See Note 1)
Outdoor - 3	Gray water system	$500 (see Note 3)	Potentially eliminate outdoor potable usage	6,000	20	$1,358	70 to 90 (See Note 1)
Outdoor - 4	Laundry to landscape program	$50 (see Note 3)	1,000 to 1,500 gallons per year, depending on use	1,250	5	$2,606	10 to 20 (see Note 1)
Notes:	1. Total savings for outdoor programs are not additive. For example, outdoor use can be addressed through gray water or hauled recycled water. 2. All estimates depend on use patterns and other factors. Values are stated for comparison. 3. Only one $500 rebate will be provided per property under programs Outdoor -1, 2, and 3. Participants in these programs are not eligible for program Outdoor - 4. Property owners who have already backfilled their septic tank will receive a rebate of $500 for implementation of an alternative storage tank/basin with a minimum of 500 gallons of capacity. 4. Approximate Savings Potential assumes total 4,500 unit participation. 5. Assumes 2 replacement fixtures per household unit.						

Table 27. Updated County Water Conservation Plan Los Osos Wastewater Project Proposed Rebate Program			
Measures Required for Connection to the Wastewater System			
Fixture or Appliance	**Existing Fixture Flow Rate**	**New Fixture Flow Rate Eligible for Rebate**	**Rebates**
Toilets Residential & Commercial	Greater than 1.6 gpf	1.28 gpf or less	$250
Showerheads Residential & Commercial	Greater than 2.0 gpm	1.5 gpm or less	$40
Faucet Aerators Residential	Greater than 1.5 gpm	1.5 gpm or less	$5
Faucet Aerators Commercial	Greater than 0.5 gpm	0.5 gpm	$5
Urinals Commercial	Greater than 1.0 gpf	0.5 gpf or less	$500
Pre-rinse Spray valves Commercial	Greater than 1.15 gpm	1.15 gpm or less	N/A
Optional Measures Eligible for Rebates (Requires Connection to the Wastewater System and Compliance with Above Measures)			
Toilets Residential & Commercial	Equal to 1.6 gpf	1.28 gpf or less	$250
Washers Residential & Commercial	Less than Tier 3, Water Factor 4	Tier 3, Water Factor 4 or Less	$450[1]
Hot Water Recirc System Residential & Commercial	N/A	N/A	$350
Showerheads Residential & Commercial	1.5 gpm or more	Less than 1.5 gpm	$40
Complete Gray Water System	N/A	N/A	$500
Laundry only Gray Water System	N/A	N/A	$50
Recycled Water Irrigation Commercial & Institutional	N/A	N/A	Negotiated

gpf = gallons per flush
gpm = gallons per minute

Notes: [1] Rebate not retroactive to prior rebated or prior purchased appliances.

10.3.3 Urban Water Reinvestment Program

Implementation of the Urban Water Reinvestment Program was recommended in the LOBP to increase the sustainable yield of the Basin (and thus reduce the Basin Yield Metric). The Water Reinvestment Program will accomplish the LOBP's goal of reinvesting all water collected and treated by the LOWRF in the Basin, either through direct percolation to the aquifers or reuse. Water treated by the LOWRF will be of a sufficient quality to directly percolate into the Basin or to reuse for landscape or agricultural irrigation purposes. The planned uses of that water are listed in Table 28.[4]

Table 28. Planned Recycled Water Uses in the Urban Water Reinvestment Program

Potential Use	Estimated Annual Volume (AFY)
Broderson Leach Fields	448
Bayridge Estates Leach Fields	33
Urban Reuse	63
Sea Pines Golf Course	40
Los Osos Valley Memorial Park	50
Agricultural Reuse	146
Total	**780**

The LOWRF construction was completed in March 2016. As of May 2017 87% of the lateral connections have been completed (approximately 3,650 out of 4,200 laterals). Flows from the wastewater plant are averaging approximately 450,000 gallons per day, with weekend peaks of 470,000 gallons per day (approximately 504 AFY). With 87% of the lateral connections completed, average wastewater flows are lower than anticipated. Projecting the actual average flow per connection through the remainder of the project results in a total estimated volume of 580 AFY, which is 200 AFY less than the anticipated 780 AFY.

As of completion of the LOWRF in March 2016, all treated water is currently being transported to the Broderson leach fields. The County released a groundwater monitoring report in December 2016 which includes wells downgradient from Broderson. The anticipated groundwater mound has not yet been detected in these wells. Recycled water for irrigation will be provided to the schools, parks, and various agricultural areas within the basin once flows at the wastewater plant approach anticipated volumes.

4 This Table was reproduced (with slight edits) from Table 2 of the LOBP.

The BMC is currently analyzing the feasibility, cost, and water supply benefits of a dry weather discharge to Los Osos Creek as a means of recharging the lower aquifer and enhancing basin yield. The results of the current study will be summarized in future Annual Reports.

10.3.4 Basin Infrastructure Programs

Implementation of the Basin Infrastructure Program is designed to reduce Purveyor groundwater production from the Lower Aquifer in the Western Area and replace it with additional pumping from the Upper Aquifer and Central and Eastern Areas. This shift will also increase the Basin's sustainable yield, which in turn will help to drive down the Basin Yield Metric.

The Program is divided into four parts, designated Programs A through D. Programs A and B shift groundwater production from the Lower Aquifer to the Upper Aquifer, and Programs C and D shift production within the Lower Aquifer from the Western Area to the Central and Eastern Areas, respectively. A fifth program, Program M, was also established in the Basin Management Plan for the development of a Groundwater Monitoring Program (See Chapter 7 of the BMP), and a new lower aquifer monitoring well in the Cuesta by the Sea area was recommended in the 2015 Annual Report. Table 29 provides an overview of status of the Projects that are currently moving forward or have been completed. Note, no projects are currently moving forward in Program D, thus they are not shown in Table 29.

10.3.5 Wellhead Protection Program

The Wellhead Protection Program is designed to protect water quality in the Basin by managing activities within a delineated source area or protection zone around drinking water wells. This program consists primarily of the Purveyors conducting Drinking Water Source Assessment and Protection surveys for each of their wells, as well as construction and operation of the LOWRF. The BMC will identify specific actions to protect water quality in the Basin as deemed appropriate in the future, though no specific actions are recommended at this time.

Table 29. Basin Infrastructure Projects				
Project Name	**Parties Involved**	**Funding Status**	**Capital Cost**	**Status**
Program A				
Water Systems Interconnection	LOCSD/ GSWC	Fully Funded	Construction Value: $103,550	Project completed February 2017, with final approval in March 2017
Upper Aquifer Well (8th Street)	LOCSD	Fully Funded	$250,000	Well was drilled and cased in December 2016. Budget remaining $250,000 to equip the well. Design RFP was issued in April, and a consultant should be retained by June 2017. Project to be completed by June 2018 or earlier if possible.
South Bay Well Nitrate Removal	LOCSD	Completed		
Palisades Well Modifications	LOCSD	Completed		
Blending Project (Skyline Well)	GSWC	Fully Funded	Previously funded through rate case	Blending of Skyline Well and Rosina Well Project was completed. Project required modifications to include a new nitrate removal unit. Permits and equipment secured. Delivery of the treatment unit is estimated for the beginning of July. Assuming 4 weeks for installation, start-up is anticipated in September 2017.
Water Meters	S&T	Completed		
Program B				
LOCSD Wells	LOCSD	Not Funded	BMP: $2.7 mil	Project not initiated
GSWC Wells	GSWC	Not Funded	BMP: $3.2 mil	Project not initiated
Community Nitrate Removal Facility	LOCSD/GSWC	Partial	First phase combined with GSWC Program A	GSWC's Program A Blending Project allows for incremental expansion of the nitrate facility and can be considered a first phase in Program B.

Project Name	Parties Involved	Funding Status	Capital Cost	Status
Program C				
Expansion Well No. 1 (Los Olivos)	GSWC	Fully Funded	Previously funded through rate case	Well has been drilled and cased. GSWC is in the equipping phase. Well can be used, if needed, using on-site generator. Formal startup of the well with permanent equipment is anticipated in July 2017.
Expansion Well No. 2	GSWC	Pending Funding Vote	BMP: $2.0 mil	Property acquisition phase is on-going through efforts of LOCSD. Two sites are currently being reviewed, and both appear to be viable for new east side lower aquifer wells, Environmental studies initiated in December 2016 for expansion well #2.
Expansion Well 3 and LOVR Water Main Upgrade	GSWC	Pending Funding Vote	BMP: $1.6 mil	Property acquisition phase is on-going through efforts of LOCSD. Two sites are currently being reviewed, and both appear to be viable for new east side lower aquifer wells.
LOVR Water Main Upgrade	GSWC	Pending Funding Vote	BMP: $1.53 mil	Project not initiated
S&T/GSWC Interconnection	S&T/ GSWC	Pending	BMP: $30,000	Conceptual design
Program M				
New Zone D/E lower aquifer monitoring well in Cuesta by the Sea	All Parties	Not funded	$100,000	Pending funding plan

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APPENDIX A

Los Osos Basin Plan
Groundwater Monitoring Program Well Information

Los Osos Basin Plan
Montitoring Well Network
First Water/Perched Aquifer Group

Program ID	State Well Number	Name/Location	Basin Area	Coordinates			Well Type	Current Well Owner	Well Data			Aquifer				
				Latitude	Longitude	RP Elevation* (feet amsl)			Screened Interval (feet bgs)	Well Depth (feet bgs)	Casing Diameter (inches)	Creek Valley Alluvium	Zone A/B	Zone C	Zone D	Zone E
FW1	30S/10E-13A7							PRIVATE								
FW2	30S/10E-13L8	Howard/ Del Norte	Western	35.3149	120.8552	32.63	MW	LOCSD	26-36	37	2			x		
FW3	30S/10E-13G	South Court	Western	35.3162	120.8498	50.95	MW	LOCSD	47-52	54	2			x		
FW4	30S/10E-13H	Broderson/Skyline	Western	35.3158	120.8432	49.33	MW	LOCSD	154-164	164	2			x		
FW5	30S/10E-13Q2	Woodland Dr.	Western	35.3119	120.8495	101.27	MW	LOCSD	97-100	105	2			x		
FW6	30S/10E-24A	Highland/Alexander	Western	35.3083	120.8453	193.04	MW	LOCSD	154-164	164	2			x		
FW7	30S/10E-24Ab	Broderson leachfield	Western	35.3065	120.8460	255.00	MW	LOCSD	200-240	240	5			x		
FW8	30S/11E-7L4	Santa Ysabel/5th	Central	35.3302	120.8377	45.76	MW	LOCSD	40-50	50	2			x		
FW9	30S/11E-7K3	12th/ Santa Ysabel	Central	35.3299	120.8300	90.71	MW	LOCSD	55-65	70	2			x		
FW10	30S/11E-7Q1	LOCSD 8th Street - shallow	Central	35.3260	120.8342	25.29	MW	LOCSD	29-43, 54-75	75	8			x		
FW11	30S/11E-7R2	El Moro/12th St.	Central	35.3263	120.8298	61.93	MW	LOCSD	25-35	35	2			x		
FW12	30S/11E-18C2	Pismo Ave./ 5th St.	Central	35.3227	210.8376	34.55	MW	LOCSD	25-35	35	2			x		
FW13	30S/11E-18B2	Ramona/10th	Central	35.3208	120.8320	79.89	MW	LOCSD	25-35	35	2		x			
FW14	30S/11E-18E1							PRIVATE								
FW15	30S/11E-18N2	Manzanita/Ravenna	Central	35.3109	120.8401	125.53	MW	LOCSD	85-95	95	2		x			
FW16	30S/11E-18L11	Palisades Ave.	Western	35.3138	120.8374	88.02	MW	LOCSD	43-53	53	2		x			
FW17	30S/11E-18L12	Ferrell Ave.	Central	35.3138	120.8346	103.85	MW	LOCSD	25-35	35	2		x			
FW18	30S/11E-18P	Sunnyside #1	Western	35.3095	120.8352	150.00	MW	SLCUSD	15-35	35	2		x			
FW19	30S/11E-18J7	Los Olivos/Fairchild	Central	35.3130	120.8271	125.74	MW	LOCSD	25-35	35	2		x			
FW20	30S/11E-8Mb	Santa Maria/18th Street	Central	35.3287	120.8233	95.00	MW	LOCSD	37-47	47	2		x			
FW21	30S/11E-8N4	South Bay Blvd. OBS	Central	35.3253	120.8213	95.99	MW	LOCSD	40-50	50	2		x			
FW22	30S/11E-17F4							PRIVATE								
FW23	30S/11E-17N4							PRIVATE								
FW24	30S/11E-17J2	USGS Eto North - shallow	Eastern	35.3142	120.8119	71.67	MW	PRIVATE	50-70	70	2			x		
FW25	30S/11E-17R1							PRIVATE								
FW26	30S/11E-20A2							PRIVATE								
FW27	30S/11E-20L1							PRIVATE								
FW28	30S/11E-20M2							PRIVATE								

*Datum Varies	MW = Monitoring Well

State Well Numbers for Reconstructed Wells

	NEW (2002)	OLD (1982)
FW2	30S/10E-13L8	30S/10E-13L5
FW5	30S/10E-13Q2	30S/10E-13Q1
FW8	30S/11E-7L4	30S/11E-7L3
FW9	30S/11E-7K3	30S/11E-7K2
FW11	30S/11E-7R2	30S/11E-7R1
FW12	30S/11E-18C2	30S/11E-18C1
FW13	30S/11E-18B2	30S/11E-18B1
FW15	30S/11E-18N2	30S/11E-18N1
FW16	30S/11E-18L11	30S/11E-18L3
FW17	30S/11E-18L12	30S/11E-18L4
FW19	30S/11E-18J7	30S/11E-18J6
FW21	30S/11E-8N4	30S/11E-8N2

Los Osos Basin Plan
Montitoring Well Network
Upper Aquifer Group

Program ID	State Well Number	Name/Location	Basin Area	Coordinates			Well Type	Current Well Owner	Well Data			Aquifer				
				Latitude	Longitude	RP Elevation* (feet amsl)			Screened Interval (feet bgs)	Well Depth (feet bgs)	Casing Diameter (inches)	Creek Valley Alluvium	Zone A/B	Zone C	Zone D	Zone E
UA1	30S/10E-11A1	Sandspit #1 West	Dunes and bay	35.3358	120.8638	16.39	MW	SLO CO.	150-160	160	2			x		
UA2	30S/10E-14B1	Sandspit #3 Shallow	Dunes and bay	35.3219	120.8682	16.83	MW	SLO CO.	190-200	200	1.5			x		
UA3	30S/10E-13F1	GSWC Skyline #1	Western	35.3165	120.8533	19.00	M	GSWC	90-195	206	14			x		
UA4	30S/10E-13L1	S&T Mutual #1	Western	35.3148	120.8531	39.00	M	S&T	100-141	141	8			x		
UA5	30S/11E-7N1	LOCSD 3rd St. Well	Central	35.3256	120.8401	9.13	M	LOCSD	56-84	80	8			x		
UA6	30S/11E-18L8	USGS Palisades OBS East 2"	Western	35.3149	120.8381	75.80	MW	SLO CO.	100-140	140	2			x		
UA7	30S/11E-18L7	USGS Palisades OBS West 2"	Western	35.3149	120.8381	75.40	MW	SLO CO.	180-220	220	2			x		
UA8	30S/11E-18K7	LOCSD 10th St. Observation West	Central	35.3130	120.8326	135.65	MW	LOCSD	200-220	220	2			x		
UA9	30S/11E-18K3	GSWC Los Olivos #3	Central	35.3133	120.8300	121.18	M	GSWC	148-202, 222-232	232	8			x		
UA10	30S/11E-18H1	LOCSD - 12th St.	Central	35.3161	120.8297	107.10	M	LOCSD	112-125, 145-159, 172-186, 216-231	232	10			x		
UA11	30S/11E-17D							PRIVATE								
UA12	30S/11E-17E9	So. Bay Blvd OBS shallow	Central	35.3158	120.8240	105.85	MW	LOCSD	184-194	204	2			x		
UA13	30S/11E-17E10	LOCSD South Bay upper	Central	35.3159	120.8239	106.00	M	LOCSD	170-210	220	8			x		
UA14	30S/11E-17P4							PRIVATE								
UA15	30S/11E-20B7							PRIVATE								

*Datum Varies

M = Municipal
MW = Monitoring Well

Los Osos Basin Plan
Montitoring Well Network
Lower Aquifer Group

Program ID	State Well Number	Name/Location	Basin Area	Coordinates			Well Type	Well Owner	Well Data			Aquifer				
				Latitude	Longitude	RP Elevation* (feet amsl)			Screened Interval (feet bgs)	Well Depth (feet bgs)	Casing Diameter (inches)	Creek Valley Alluvium	Zone A/B	Zone C	Zone D	Zone E
LA1	30S/10E-2A1	Sandspit #2 North	Dunes and Bay	35.3530	120.8617	15.83	MW	SLO CO.	220-230	230	2					x
LA2	30S/10E-11A2	Sandspit #1 East	Dunes and Bay	35.3358	120.8638	16.39	MW	SLO CO.	234-244	244	2				x	
LA3	30S/10E-14B2	Sandspit #3 Deep	Dunes and	35.3219	120.8682	16.83	MW	SLO CO.	270-280	280	2				x	
LA4	30S/10E-13M1	USGS Howard West	Western	35.3149	120.8597	41.20	MW	PRIVATE	477-537	820	6					x
LA5	30S/10E-13L7	S&T Mutual #4	Western	35.3146	120.8531	37.00	M	S&T	160-300	300	8					
LA6	30S/10E-13L4	GSWC Pecho #1	Western	35.3129	120.8522	68.00	M	GSWC	240-380	675	14				x	
LA7	30S/10E-13P2							PRIVATE								
LA8	30S/10E-13N	S&T Mutual #5	Western	35.3088	120.8565	138.50	M	S&T	260-340	350	8				x	
LA9	30S/10E-24C1	GSWC Cabrillo #1	Western	35.3077	120.8552	178.32	M	GSWC	250-500	508	10				x	
LA10	30S/10E-13J1	GSWC Rosina #1	Western	35.3145	120.8468	95.31	M	GSWC	290-406	409	10				x	x
LA11	30S/10E-12J1	Morro Bay Observation #5	Central	35.3299	120.8440	8.43	MW	SLO CO.	349-389	389	2					x
LA12	30S/11E-7Q3	LOCSD 8th St. Lower	Central	35.3259	120.8342	24.30	M	LOCSD	230-270	270	10				x	
LA13	30S/11E-18F2	LOCSD Ferrell #2	Central	35.3159	120.8358	100.00	M	LOCSD	425-620	625	12				x	x
LA14	30S/11E-18L6	USGS Palisades OBS 6"	Western	35.3149	120.8381	75.84	MW	SLO CO.	355-375, 430-480, 550-600	620	6				x	x
LA15	30S/11E-18L2	LOCSD Palisades	Western	35.3136	120.8377	85.00	M	LOCSD	340-380	394	12				x	
LA16	30S/11E-18M1	Former CCW #5 - Broderson OBS	Western	35.3128	120.8430	107.00	MW	PRIVATE	330-355, 395-415, 465-505, 530-575	577	10				x	x
LA17	30S/11E-24A2	USGS Broderson	Western	35.3074	120.8433	210.40	MW	SLO CO.	800-860	860	6				x	x
LA18	30S/11E-18K8	10th St. Observation East	Central	35.3130	120.8325	135.74	MW	LOCSD	630-650	650	2					x
LA19	30S/11E-19H2	USGS Bayview Heights 6"	Central	35.3043	120.8266	256.20	MW	SLO CO.	280-380	740	6				x	
LA20	30S/11E-17N10	GSWC South Bay #1	Central	35.3111	120.8240	140.00	M	GSWC	225-295, 325-395, 485-695	715	12			x	x	x
LA21	30S/11E-17E7	So. Bay Blvd OBS deep #3	Central	35.3158	120.8240	105.85	MW	LOCSD	480-490, 500-510	520	2					x
LA22	30S/11E-17E8	So. Bay Blvd OBS middle #2	Central	35.3158	120.8240	105.85	MW	LOCSD	270-280, 370-380	390	2				x	
LA23	30S/11E-17C1							PRIVATE								
LA24	30S/11E-17J1	USGS Eto North - deep	Eastern	35.3142	120.8119	71.62	I	PRIVATE	160-190, 245-260	260	6				x	x
LA25	30S/11E-20Aa							PRIVATE								
LA26	30S/11E-20G2	USGS Eto South	Eastern	35.3037	120.8131	99.66	I	PRIVATE	300-360	370	6					x
LA27	30S/11E-16Ma							PRIVATE								
LA28	30S/11E-16Mb							PRIVATE								
LA29	30S/11E-21E3							PRIVATE								
LA30	30S/11E-20H1							PRIVATE								

*Datum Varies

M = Municipal
MW = Monitoring Well

Los Osos Basin Plan
Monitoring Well Network
Wells Added

Program ID	Well Number	Name/Location	Basin Area	Coordinates			Well Type	Well Status	Well Owner	Well Data			Aquifer				
				Latitude	Longitude	Reference Point Elev.				Screened Interval	Total Depth	Casing Diameter (inches)	Creek Valley Alluvium	Zone A/B	Zone C	Zone D	Zone E
FW29	30S/11E-20A1								PRIVATE								
FW30	30S/11E-18R1								PRIVATE								
FW31	30S/11E-19A	Bayridge Field #2	Central	35.3066	120.8276	213.00	MW		LOCSD	18-38	38	4		x			
UA16	30S/11E-17L4								PRIVATE								
UA17	30S/11E-17E1								PRIVATE								
UA18	30S/11E-17F2								PRIVATE								
LA31	30S/10E-13M2								PRIVATE								
LA32	30S/11E-18K9	LOCSD 10th Street production	Central	35.3103	120.8325	135.00	M	A	LOCSD	235-270, 350-490	490	14			x	x	
LA33	30S/11E-17A1								PRIVATE								
LA34	30S/11E-8F	Los Osos Landfill	Eastern	35.3201	120.8052	26.15	MW		SLO CO.	37.5-47.5						x	
LA35	30S/11E-21Bb	LOWRF South Well	Eastern	35.3076	120.7993	96.00	Ind	A	SLO CO.	180-230	230						x
LA36	30S/11E-21Ja								PRIVATE								

I = Irrigation
M = Municipal
D = Domestic
MW = Monitoring Well (not equipped)
Ind = Industrial Well
A = Active (equipped)
INE = Inactive not equipped
IE = Inactive equipped
tbd = to be determined

Los Osos Basin Plan
Monitoring Well Network
FIRST WATER

Program Well ID	CASGEM Program Reporting	Basin Plan Monitoring Code	County Water Level Program	LOWRF Groundwater Monitoring Program[1]	**Planned 2017 Monitoring for BMC[2]**
FW1	no	L			**L**
FW2	yes	L, G		L, G	**L**
FW3	yes	L		L	**L**
FW4	yes	L		L	**L**
FW5	yes	L		L	**L**
FW6	yes	TL, G, CEC		G	**TL, CEC**
FW7	yes	L			**L**
FW8	yes	L		L	**L**
FW9	yes	L		L	**L**
FW10	yes	TL, G		G	**TL**
FW11	yes	L		L	**L**
FW12	yes	L		L	**L**
FW13	yes	L		L	**L**
FW14	no	L		L	**L**
FW15	yes	L, G		L,G	**L**
FW16	yes	L		L	**L**
FW17	yes	L, G		L,G	**L**
FW18	no	L			**L**
FW19	yes	L		L	**L**
FW20	yes	L, G		L, G	**L**
FW21	yes	L		L	**L**
FW22	no	L, G		L, G	**L**
FW23	no	L		L	**L**
FW24	no	L	L		
FW25	no	L	L		
FW26	no	L, G, CEC			**L, G, CEC**
FW27	no	TL			**TL**
FW28	no	L, G	L		
FW29[3]	no	L	L		
FW30[3]	no	L		L	**L**
FW31[3]	no	L			**L**

L = WATER LEVEL
G = GENERAL MINERAL
CEC = CONSTITUENTS OF EMERGING CONCERN
TL = TRANSDUCER WATER LEVEL

NOTES:
1 - Summer and winter monitoring schedule
2 - Spring and fall monitoring schedule
3 - Well added to LOBP program

Los Osos Basin Plan
Monitoring Well Network
UPPER AQUIFER

Program Well ID	CASGEM Program Reporting	Basin Plan Monitoring Code	County Water Level Program	LOWRF Groundwater Monitoring Program[1]	**Planned 2017 Monitoring for BMC[2]**
UA2	yes	L	L		
UA3	yes	L, G			**L, G**
UA4	no	TL			**TL**
UA5	no	L		L	**L**
UA6	no	L	L		
UA7	yes	L	L		
UA8	yes	L			**L**
UA9	no	L, G			**L, G**
UA10	no	TL			**TL**
UA11	no	L		L	**L**
UA12	no	L		L	**L**
UA13	no	L, G			**L, G**
UA14	no	L			**L**
UA15	no	L			**L**
UA16[3]	no	L	L		
UA17[3]	no	L	L		
UA18[3]	no	L	L		

L = WATER LEVEL
G = GENERAL MINERAL
TL = TRANSDUCER WATER LEVEL

NOTES:
1 - Summer and winter monitoring schedule
2 - Spring and fall monitoring schedule
3 - Well added to LOBP program

Los Osos Basin Plan
Monitoring Well Network
LOWER AQUIFER

Program Well ID	CASGEM Program Reporting	Basin Plan Monitoring Code	County Water Level Program	**Planned 2017 Monitoring for BMC[2]**
LA2	yes	L	L	
LA3	yes	L	L	
LA4	yes	L, GL		**L**
LA5	no	L	L	
LA6	no	L , G[1]	L	
LA7	no	TL		**TL**
LA8	no	L, G		**L , G**
LA9	no	L		**L, G[2]**
LA10	no	L, G		**L , G**
LA11	no	L, G		**L , G**
LA12	no	L, G		**L , G**
LA13	no	TL		**TL**
LA14	no	L	L	
LA15	no	L, G		**L , G**
LA16	no	L	L	
LA17	no	L	L	
LA18	yes	L, G		**L , G**
LA19	yes	L	L	
LA20	no	L, G		**L , G**
LA21	no	L	L	
LA22	no	L	L	**G[2]**
LA23	no	L, G		**L, G**
LA24	no	L	L	
LA25	no	L		**L**
LA26	no	L	L	
LA27	no	TL		**TL**
LA28	no	L, G		**L, G**
LA29	no	L	L	
LA30	no	L, G		**L**
LA31[3]	no	G		**G**
LA32[3]	no	G		**G**
LA33[3]	no	L		**L**
LA34[3]	no	L	L	
LA35[3]	no	L		**L**
LA36[3]	no	L		**L**

L = WATER LEVEL
G = GENERAL MINERAL
GL = GEOPHYSICAL LOG (2018)
TL = TRANSDUCER WATER LEVEL

NOTES:
1 - Remove G from LA6 - out of service.
2 - Add G to LA9 and LA22
3 - Well added to LOBP program
Well IDs with both April and October water quality monitoring in Italics

APPENDIX B

Field Methods

Groundwater Level Measurement Procedures for the
Los Osos Basin Plan Groundwater Monitoring Program

Introduction

This document establishes procedures for measuring and recording groundwater levels for the Los Osos Basin Plan (LOBP) Groundwater Monitoring Program, and describes various methods used for collecting meaningful groundwater data.

Static groundwater levels obtained for the LOBP Groundwater Monitoring Program are determined by measuring the distance to water in a non-pumping well from a reference point that has been referenced to sea level. Subtracting the distance to water from the elevation of the reference point determines groundwater surface elevations above or below sea level. This is represented by the following equation:

$$E_{GW} = E_{RP} - D$$

Where:

E_{GW} = Elevation of groundwater above mean sea level (feet)

E_{RP} = Elevation above sea level at reference point (feet)

D = Depth to water (feet)

References

Procedures for obtaining and reporting water level data for the LOBP Groundwater Monitoring Program are based on a review of the following documents.

- State of California, Department of Water Resources, 2010, *Groundwater Elevation Monitoring Guidelines*, prepared for use in the California Statewide Groundwater Elevation Monitoring (CASGEM) program, December. http://www.water.ca.gov/groundwater/casgem/pdfs/CASGEM%20DWR%20GW%20Guidelines%20Final%20121510.pdf
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- U.S. Geological Survey, 1977, *National Handbook of Recommended Methods for Water-Data Acquisition*, a Unites States contribution to the International Hydrological Program. https://pubs.usgs.gov/chapter11/

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Well Information

Table 1 below lists important well information to be maintained in a well file or in a field notebook. Additional information that should be available to the person collecting water level data include a description of access to the property and the well, the presence and depth of cascading water, or downhole obstructions that could interfere with a sounding cable.

Table 1
Well File Information

Well Completion Report	Hydrologic Information	Additional Information to be Recorded
Well name	Map showing basin boundaries and wells	Township, Range, and ¼ ¼ Section
Well Owner	Name of groundwater basin	Latitude and Longitude (Decimal degrees)
Drilling Company	Description of aquifer	Assessor's Parcel Number
Location map or sketch	Confined, unconfined, or mixed aquifers	Description of well head and sounding access
Total depth	Pumping test data	Reference point elevations
Perforation interval	Hydrographs	Well use and pumping schedule if known
Casing diameter	Water quality data	Date monitoring began
Date of well completion	Property access instructions/codes	Land use

Reference Points and Reference Marks

Reference point (RP) elevations are the basis for determining groundwater elevations relative to sea level. The RP is generally that point on the well head that is the most convenient place to measure the water level in a well. In selecting an RP, an additional consideration is the ease of surveying either by Global Positioning System (GPS) or by leveling.

The RP must be clearly defined, well marked, and easily located. A description, sketch, and photograph of the point should be included in the well file. Additional Reference Marks (RMs) may be established near the wellhead on a permanent object. These additional RMs can serve as a benchmark by which the wellhead RP can be checked or re-surveyed if necessary. All RMs should be marked, sketched, photographed, and described in the well file.

All RPs for Groundwater Monitoring Program wells should be reported based on the same horizontal and vertical datum by a California licensed surveyor to the nearest tenth of one foot vertically, and the nearest one foot horizontally. The surveyor's report should be maintained in the project file.

In addition to the RP survey, the elevation of the ground surface adjacent to the well should also be measured and recorded in the well file. Because the ground surface adjacent to a well is rarely uniform, the average surface level should be estimated. This average ground surface elevation is referred to in the U.S.G.S. Procedural Document (GWPD-1, 1997) and DWR guidelines as the Land Surface Datum (LSD).

Water Level Data Collection

Prior to beginning the field work, the field technician should review each well file to determine which well owners require notification of the upcoming site visit, or which well pumps need to be turned off to allow for sufficient water level recovery. Because groundwater elevations are used to construct groundwater contour maps and to determine hydraulic gradients, the field technician should coordinate water level measurements to be collected within as short a period of time as practical. Any significant changes in groundwater conditions during monitoring events should be noted in the Annual Monitoring Report. For an individual well, the same measuring method and the same equipment should be used during each sampling event where practical.

A static water level should represent stable, non-pumping conditions at the well. When there is doubt about whether water levels in a well are continuing to recover following a pumping cycle, repeated measurements should be made. If an electric sounder is being used, it is possible to hold the sounder level at one point slightly above the known water level and wait for a signal that would indicate rising water. If applicable, the general schedule of pump operation should be determined and noted for active wells. If the well is capped but not vented, remove the cap and wait several minutes before measurement to allow water levels to equilibrate to atmospheric pressure.

When lowering a graduated steel tape (chalked tape) or electric tape in a well without a sounding tube in an equipped well, the tape should be played out slowly by hand to minimize the chance of the tape end becoming caught in a downhole obstruction. The tape should be held in such a way that any change in tension will be felt. When withdrawing a sounding tape, it should also be brought up slowly so that if an obstruction is encountered, tension can be relaxed so that the tape can be lowered again before attempting to withdraw it around the obstruction.

Despite all precautions, there is a small risk of measuring tapes becoming stuck in equipped wells without dedicated sounding tubes. If a tape becomes stuck, the equipment should be left on-site and re-checked after the well has gone through a few cycles of pumping, which can free the tape due to movement/vibration of the pump column. If the tape remains stuck, a pumping contractor will be needed to retrieve the equipment. A dedicated sounding tube may be installed by the pumping contractor at that time.

All water level measurements should be made to an accuracy of 0.01 feet. The field technician should make at least two measurements. If measurements of static levels do not agree to within 0.02 feet of each other, the technician should continue measurements until the reason for the disparity is determined, or the measurements are within 0.02 feet.

Record Keeping in the Field

The information recorded in the field is typically the only available reference for the conditions at the time of the monitoring event. During each monitoring event it is important to record any conditions at a well site and its vicinity that may affect groundwater levels, or the field technician's ability to obtain groundwater levels. Table 2 lists important information to record, however, additional information should be included when appropriate.

Table 2
Information Recorded at Each Well Site

Well name	Changes in land use	Presence of pump lubricating oil in well
Name and organization of field technician	Changes in RP	Cascading water
Date & time	Nearby wells in use	Equipment problems
Measurement method used	Weather conditions	Physical changes in wellhead
Sounder used	Recent pumping info	Comments
Reference Point Description	Measurement correction(s)	Well status

Measurement Techniques

Four standard methods of obtaining water levels are discussed below. The chosen method depends on site and downhole conditions, and the equipment limitations. In all monitoring situations, the procedures and equipment used should be documented in the field notes and in final reporting. Additional detail on methods of water level measurement is included in the reference documents.

<u>Graduated Steel Tape</u>
This method uses a graduated steel tape with a brass or stainless steel weight attached to its end. The tape is graduated in feet. The approximate depth to water should be known prior to measurement.

- Estimate the anticipated static water level in the well from field conditions and historical information;
- Chalk the lower few feet of the tape by applying blue carpenter's chalk.
- Lower the tape to just below the estimated depth to water so that a few feet of the chalked portion of the tape is submerged. Be careful not to lower the tape beyond its chalked length.
- Hold the tape at the RP and record the tape position (this is the "hold" position and should be at an even foot);
- Withdraw the tape rapidly to the surface;
- Record the length of the wetted chalk mark on the graduated tape;
- Subtract the wetted chalk number from the "hold" position number and record this number in the "Depth to Water below RP" column;
- Perform a check by repeating the measurement using a different RP hold value;
- All data should be recorded to the nearest 0.01 foot;
- Disinfect the tape by wiping down the submerged portion of the tape with single-use, unscented disinfectant wipe, or let stand for one minute in a dilute chlorine bleach solution and dry with clean cloth.

The graduated steel tape is generally considered to be the most accurate method for measuring static water levels. Measuring water levels in wells with cascading water or with condensing water on the well casing causes potential errors, or can be impossible with a steel tape.

<u>Electric Tape</u>

An electric tape operates on the principle that an electric circuit is completed when two electrodes are submerged in water. Most electric tapes are mounted on a hand-cranked reel equipped with batteries and an ammeter, buzzer or light to indicate when the circuit is completed. Tapes are graduated in either one-foot intervals or in hundredths of feet depending on the manufacturer. Like graduated steel tapes, electric tapes are affixed with brass or stainless steel weights.

- Check the circuitry of the tape before lowering the probe into the well by dipping the probe into water and observe if the ammeter needle or buzzer/light signals that the circuit is completed;
- Lower the probe slowly and carefully into the well until the signal indicates that the water surface has been reached;
- Place a finger or thumb on the tape at the RP when the water surface is reached;
- If the tape is graduated in one-foot intervals, partially withdraw the tape and measure the distance from the RP mark to the nearest one-foot mark to obtain the depth to water below the RP. If the tape is graduated in hundredths of a foot, simply record the depth at the RP mark as the depth to water below the RP;
- Make all readings using the same needle deflection point on the ammeter scale (if equipped) so that water levels will be consistent between measurements;
- Make check measurements until agreement shows the results to be reliable;

- All data should be recorded to the nearest 0.01 foot;
- Disinfect the tape by wiping down the submerged portion of the tape with single-use, unscented disinfectant wipe, or let stand for one minute in a dilute chlorine bleach solution and dry with clean cloth;
- Periodically check the tape for breaks in the insulation. Breaks can allow water to enter into the insulation creating electrical shorts that could result in false depth readings.

The electric tape may give slightly less accurate results than the graduated steel tape. Errors can result from signal “noise” in cascading water, breaks in the tape insulation, tape stretch, or missing tape at the location of a splice. All electric tapes should be calibrated semi-annually against a steel tape that is maintained in the office and used only for calibration.

Air Line

The air line method is usually used only in wells equipped with pumps. This method typically uses a 1/8 or 1/4-inch diameter, seamless copper tubing, brass tubing, stainless steel tubing, or galvanized pipe with a suitable pipe tee for connecting an altitude or pressure gage. Plastic (i.e. polyethylene) tubing may also be used, but is considered less desirable because it can develop leaks as it degrades. An air line must extend far enough below the water level that the lower end remains submerged during pumping of the well. The air line is connected to an altitude gage that reads directly in feet of water, or to a pressure gage that reads pressure in pounds per square inch (psi). The gage reading indicates the length of the submerged air line.

The formula for determining the depth to water below the RP is: **d = k – h** where d = depth to water; k = constant; and h = height of the water displaced from the air line. In wells where a pressure gage is used, h is equal to 2.31 ft/psi multiplied by the gage reading. The constant value for k is approximately equivalent to the length of the air line.

- Calibrate the air line by measuring an initial depth to water (d) below the RP with a graduated steel tape. Use a tire pump, air tank, or air compressor to pump compressed air into the air line until all the water is expelled from the line. When all the water is displaced from the line, record the stabilized gage reading (h). Add d to h to determine the constant value for k.
- To measure subsequent depths to water with the air line, expel all the water from the air line, subtract the gage reading (h) from the constant k, and record the result as depth to water (d) below the RP.

The air line method is not as accurate as a graduated steel tape or electric and is typically accurate to the nearest one foot at best. Errors can occur from leaky air lines, or when tubing becomes clogged with mineral deposits or bacterial growth. The air line method is not desirable for use in the Groundwater Monitoring Program.

Pressure Transducer

Electrical pressure transducers make it possible to collect frequent and long-term water level or pressure data from wells. These pressure-sensing devices, installed at a fixed depth in a well, sense the change in pressure against a membrane. The pressure changes occur in response to changes in the height of the water column in the well above the transducer membrane. To compensate for atmospheric changes, transducers may have vented cables or they can be used in conjunction with a barometric transducer that is installed in the same well or a nearby observation well above the water level.

Transducers are selected on the basis of expected water level fluctuation. The smallest range in water levels provides the greatest measurement resolution. Accuracy is generally 0.01 to 0.1 percent of the full scale range.

Retrieving data in the field is typically accomplished by downloading data through a USB connection to a portable computer or data logger. A site visit to retrieve data should involve several steps designed to safeguard the stored data and the continued useful operation of the transducer:

- Inspect the wellhead and check that the transducer cable has not moved or slipped (the cable can be marked with a reference point that can be used to identify movement);
- Ensure that the instrument is operating properly;
- Measure and record the depth to water with a graduated steel or electric tape;
- Document the site visit, including all measurements and any problems;
- Retrieve the data and document the process;
- Review the retrieved data by viewing the file or plotting the original data;
- Recheck the operation of the transducer prior to disconnecting from the computer.

A field notebook with a checklist of steps and measurements should be used to record all field observations and the current data from the transducer. It provides a historical record of field activities. In the office, maintain a binder with field information similar to that recorded in the field notebook so that a general historical record is available and can be referred to before and after a field trip.

Quality Control

The field technician should compare water level measurements collected at each well with the available historical information to identify and resolve anomalous and potentially erroneous measurements prior to moving to the next well location. Pertinent information, such as insufficient recovery of a pumping well, proximity to a pumping well, falling water in the casing, and changes in the measurement method, sounding equipment, reference point, or groundwater conditions should be noted. Office review of field notes and measurements should also be performed by a second staff member.

Groundwater Sampling Procedures for the
Los Osos Basin Plan Groundwater Monitoring Program

Introduction

This document establishes groundwater sampling procedures for the Los Osos Basin Plan (LOBP) Groundwater Monitoring Program. Groundwater sampling procedures facilitate obtaining a representative groundwater sample from an aquifer for water quality analysis. The water sampling procedures for general mineral and dissolved nitrogen sampling are presented below, along with special procedures for collecting samples for analyzing Constituents of Emerging Concern (CECs).

References

The procedures used for the LOBP Groundwater Monitoring Program have been developed through consideration of the constituents of analysis, well construction and type, and a review of the following references:

- U.S. Environmental Protection Agency, 1999, *Compendium of ERT Groundwater Sampling Procedures*, EPA/540/P-91/007, January 1999. https://www.epa.gov/sites/production/files/2015-06/documents/fieldsamp-ertsops.pdf
- Wilde, F. D., 2004, *Cleaning of Equipment for Water Sampling* (ver 2.0): U.S. Geological Survey Techniques of Water-Resources Investigations, Book 9, Chapter A3, revised April 2004. http://water.usgs.gov/owq/FieldManual/chapter3/Ch3_contents.html
- Wilde, F. D., 2008, *Guidelines for Field-Measured Water Quality Properties* (ver. 2.0): U.S. Geological Survey Techniques of Water-Resources Investigations, Book 9, Chapter A6, Section 6, October 2008. http://water.usgs.gov/owq/FieldManual/Chapter6/6.0_contents.html

Well Information

Table 1 below lists important well information to be maintained in a well file or in a field notebook. Additional information that should be available to the person collecting groundwater samples include a description of access to the property and the well, the presence and depth of cascading water, or downhole obstructions that could interfere with sampling equipment.

Table 1
Well File Information

Well Completion Report	Hydrologic Information	Additional Information to be Recorded
Well name	Map showing basin boundaries and wells	Township, Range, and ¼ ¼ Section
Well Owner	Name of groundwater basin	Latitude and Longitude (Decimal degrees)
Drilling Company	Description of aquifer	Assessor's Parcel Number
Location map or sketch	Confined, unconfined, or mixed aquifers	Description of well head and sounding access
Total depth	Pumping test data	Reference point elevations
Perforation interval	Hydrographs	Well use and pumping schedule if known
Casing diameter	Water quality data	Date monitoring began
Date of well completion	Property access instructions/codes	Land use

Groundwater Sampling Procedures

Non-equipped wells

1) Calibrate field monitoring instruments each day prior to sampling;
2) Inspect wellhead condition and note any maintenance required (perform at earliest convenience);
3) Measure depth to static water (record to 0.01 inches) from surveyed reference point;
4) Install temporary purge pump to at least three feet below the water surface (deeper setting may be needed if water level draw down is too great);
5) Begin well purge, record flow rate;
6) Measure discharge water EC (measured to 10 µmhos/cm), pH (measured to 0.01 units), and temperature (measured to 0.1 degrees C) at regular intervals during well purging. Record time and gallons purged. Note discharge water color, odor, and turbidity (visual);
7) A minimum of three casing volumes of water should be removed during purging, or one borehole volume opposite perforated interval, whichever is greater*. In addition, a set of at least three consecutive field monitoring measurements with stable values should be recorded. For EC, stability within 5 percent of the first value in the set is sufficient (typically within 20-50 µmhos/cm). For pH, stability within 0.3 units is sufficient. For temperature, stability within 0.2 degrees C is sufficient;
8) Collect sample directly from discharge tube, note sample color, odor, turbidity (visual). Use only laboratory-provided containers. Wear powder-free nitrile gloves when collecting groundwater samples;
9) Place samples on-ice for transport to the laboratory;
10) Remove temporary pump and rinse with clean water;
11) Close well and secure well box lid;

*note: If well is pumped dry at the minimum pumping rate, the well may be allowed to recover and then sampled by bailer within 24 hours.

Equipped wells

The sampling port for an equipped well must be upstream of any water filtration or chemical feeds. Sample from the discharge line as close to the wellhead as possible. Sampling procedures for equipped wells will vary. For active wells (i.e. wells used daily), the need for purging three casing volumes is unnecessary. Flush supply line from well or holding tank to sampling port, and record one set of EC, pH, and temperature readings prior to sampling. For inactive wells, a field monitoring procedure similar to that described for non-equipped wells above is appropriate. Static water level measurements should also be taken before sampling. Water samples should always be transported on-ice to the laboratory.

Chain-of-Custody

The chain-of-custody and associated sample bottle labels are used to document sample identification, specify the analyses to be performed, and trace possession and handling of a sample from the time of collection through delivery to the analytical laboratory. The sampler should fill out the sample identification labels and affix them to the sample bottles prior to, or upon, sample collection. A chain-of-custody form should be filled out by the sampler and a signature and date/time of sample transfers are required for each relinquishing and receiving party between sample collection and laboratory delivery.

Groundwater Sampling Equipment Decontamination

Field equipment should be cleaned prior to the sampling event and between sampling locations. Sampling pumps and hand bailers should be brushed with a nylon-bristle brush using a solution of 0.1 to 0.2-percent (volume/volume) non-phosphate soap in municipal-source tap water. The equipment should then be triple-rinsed with deionized water. Purge the pump hose of well water between sampling locations by pumping deionized through the hose. Groundwater sampling equipment should be protected from contact with the ground, or other potentially contaminating materials, at all times.

Special procedures for sampling for CEC compounds from unequipped well:

1) A new, teflon-lined polyethylene discharge hose or bailer will be used at each unequipped well sampling location;
2) The sampling pump will be decontaminated prior to each well sampled: Decontamination will consist of brushing pump body, inlet screen, and submerged portion of power cable in a phosphate-free cleaning solution, followed by rinsing, pumping distilled water, and final rinse;

3) Personnel collecting the sample will use powder-free nitrile gloves and observe special precautions for testing as directed by the laboratory (such as no caffeinated drink consumption on day of sampling, standing downwind of sampling port during sample collection, double-bag sample bottles, etc.);
4) Equipment blanks of distilled water pumped through the sampling pump are recommended;
5) A clean water/travel blank of distilled water (from the same source used for pump decontamination) is recommended.

APPENDIX C

Field Logs and Laboratory Analytical Reports for 2016 Lower Aquifer Monitoring

Note: There are no Groundwater Monitoring Field Logs for Wells LA9, LA10, LA20, UA9, and UA3; These wells were sampled by owner (GSWC).

Spring 2016 Field Logs and Analytical Results

Groundwater Monitoring Field Log
LOBP Monitoring Program

Date: 4/20/2016
Operator: SJH
Well number and location: 30S11E-13N, LA8
Site and wellhead conditions: Site secure, clear, cool. Active well.

Static water depth (feet): (pumping)
Well depth (feet): 350
Water column (feet):
Casing diameter (inches): 8
Minimum purge volume (gal) flush line
Purge rate (gpm):
Pumping water level (feet):
Pump setting (feet):
Minimum purge time (min): flush line
Time begin purge: 9:12

Time	Gallons	EC µS/cm	pH	Temp. °c	Comments*
9:13	200	454	6.72	17.9	Clear, colorless, odorless
					Sampled @ 9:13 AM

*Turbidity, color, odor, sheen, debris, etc.

Groundwater Monitoring Field Log
LOBP Monitoring Program

Date: 4/20/2016
Operator: SBH
Well number and location: 30S/10E-12J1, LA11
Site and wellhead conditions: Sunny, breezy, warm. Cap intact and clean

Static water depth (feet): 5.23
Well depth (feet): 359
Water column (feet): 353.77
Casing diameter (inches): 2
Minimum purge volume (gal) 173
Purge rate (gpm): 2.5
Pumping water level (feet): 12.35
Pump setting (feet): --
Minimum purge time (min): --
Time begin purge: 12:06

Time	Gallons	EC µS/cm	pH	Temp. °c	Comments*
12:08	5	1,410	7.18	21.7	Clear, colorless, odorless
12:10	10	1,160	7.39	18.8	Clear, colorless, odorless
12:14	20	1,143	7.35	19.1	Clear, colorless, odorless
12:18	30	1,135	7.37	19.6	Clear, colorless, odorless
12:22	40	1,132	7.36	19.8	Clear, colorless, odorless
12:26	50	1,162	7.34	20.6	Clear, colorless, odorless
12:30	60	1,320	7.32	20.8	Slightly turbid, gray, odorless
12:34	70	1,335	7.34	20.9	Slightly turbid, gray, odorless, fine silt present
12:42	90	1,323	7.36	21.1	Slightly turbid, gray, odorless, fine silt present
12:50	110	1,322	7.38	21	Clear, colorless, odorless
12:58	130	1,317	7.4	21.1	Clear, colorless, odorless
13:06	150	1,314	7.35	21.1	Clear, colorless, odorless
13:16	180	1,315	7.34	21.1	Clear, colorless, odorless
					Sampled @ 13:17 PM

*Turbidity, color, odor, sheen, debris, etc.

Groundwater Monitoring Field Log
LOBP Monitoring Program

Date: 4/20/2016
Operator: SBH
Well number and location: 30S/11E-7Q3, LA12
Site and wellhead conditions: Overcast, cool. Active well.

Static water depth (feet): 36
Well depth (feet): 270
Water column (feet): 234
Casing diameter (inches): 10
Minimum purge volume (gal) flush line
Purge rate (gpm): --
Pumping water level (feet): --
Pump setting (feet): --
Minimum purge time (min): flush line
Time begin purge: 10:19

Time	Gallons	EC µS/cm	pH	Temp. °c	Comments*
10:19	360	871	7.09	20.7	Clear, colorless, odorless
					Sampled @ 10:20 AM

*Turbidity, color, odor, sheen, debris, etc.

Groundwater Monitoring Field Log
LOBP Monitoring Program

Date: 4/27/2016
Operator: SJH
Well number and location: 30S/11E-18L2, LA15
Site and wellhead conditions: Sunny, breezy. Cover and cap secure. Active well.

Static water depth (feet): 98.1' (on 4/20/16)
Well depth (feet): 394
Water column (feet): 295.9
Casing diameter (inches): 12
Minimum purge volume (gal) flush line
Purge rate (gpm): --
Pumping water level (feet): --
Pump setting (feet): --
Minimum purge time (min): flush line
Time begin purge: 10:07

Time	Gallons	EC µS/cm	pH	Temp. °c	Comments*
10:07	350	686	7.21	19.7	
					Sampled @ 10:08

*Turbidity, color, odor, sheen, debris, etc.

Groundwater Monitoring Field Log
LOBP Monitoring Program

Date: 4/19/2016

Operator: A. Berge, SBH

Well number and location: 30S/11E-18K8, LA18

Site and wellhead conditions: Very warm, breezy. Cover & cap secure

18K7 static water level 120.26' @ 12:27 PM

Static water depth (feet): 139.08

Well depth (feet): 650

Water column (feet): 510.92

Casing diameter (inches): 2

Minimum purge volume (gal) 250

Purge rate (gpm): 1

Pumping water level (feet): --

Pump setting (feet): 190

Minimum purge time (min): 240

Time begin purge: 13:00

Time	Gallons	EC µS/cm	pH	Temp. °c	Comments*
13:04	5	457	8.11	21	Clear with slight yellow tinge, no odor
13:09	10	545	7.86	20.5	Clear, colorless, odorless
13:19	20	587	7.95	20.9	Clear, colorless, odorless
13:29	30	584	8.02	20.9	Clear, colorless, odorless
13:46	50	598	7.62	21.5	Clear, colorless, odorless
14:14	80	598	7.61	21.7	Clear, colorless, odorless
14:51	120	595	7.59	21.8	Clear, colorless, odorless
16:02	170	596	7.62	21.5	Clear, colorless, odorless; 1.2 gpm
16:44	220	596	7.58	21.7	Clear, colorless, odorless
17:01	240	595	7.58	21.8	Clear, colorless, odorless
					25 minute break to rest pump; 14:55 to 15:20
					Sampled @ 17:01 pm

*Turbidity, color, odor, sheen, debris, etc.

Groundwater Monitoring Field Log
LOBP Monitoring Program

Date: 4/19/2016
Operator: A. Berge
Well number and location: 30S/11E-17E8, LA22
Site and wellhead conditions: Well cap and gate secure. Sunny, hot, still.

Static water depth (feet): 119.52
Well depth (feet): 390
Water column (feet): 270.48
Casing diameter (inches): 2
Minimum purge volume (gal) 132
Purge rate (gpm): 1.25
Pumping water level (feet):
Pump setting (feet): 150
Minimum purge time (min): 106
Time begin purge: 9:45

Time	Gallons	EC µS/cm	pH	Temp. °c	Comments*
9:49	5	500	8.17	20.5	Clear, colorless, odorless
9:52	10	486	8.17	19.6	Clear, colorless, odorless
9:56	15	476	7.98	19.6	Clear, colorless, odorless
10:00	20	468	7.97	19.6	Clear, colorless, odorless
10:04	25	460	7.95	19.6	Clear, colorless, odorless
10:12	35	458	7.67	19.5	Clear, colorless, odorless
10:20	45	459	7.58	19.5	Clear, colorless, odorless
10:28	55	455	7.71	19.7	Clear, colorless, odorless
10:36	65	454	7.88	20	Clear, colorless, odorless
10:52	85	457	7.9	20.6	Clear, colorless, odorless
11:08	105	458	7.56	19.1	Clear, colorless, odorless
11:24	125	456	8.08	19.9	Clear, colorless, odorless
					Sampled @ 11:37

*Turbidity, color, odor, sheen, debris, etc.

Groundwater Monitoring Field Log
LOBP Monitoring Program

Date: 4/20/2016
Operator: SJH
Well number and location: 30S/10E-13M2, LA31
Site and wellhead conditions: Overcast, cool. Active well.

Static water depth (feet): (pumping)
Well depth (feet): 292
Water column (feet): --
Casing diameter (inches): 6
Minimum purge volume (gal) flush line
Purge rate (gpm): --
Pumping water level (feet): --
Pump setting (feet): --
Minimum purge time (min): flush line
Time begin purge: 9:52

Time	Gallons	EC µS/cm	pH	Temp. °c	Comments*
9:53	5	3,480	6.44	18.9	Clear, colorless, odorless
					Sampled @ 10:01 AM

*Turbidity, color, odor, sheen, debris, etc.

Groundwater Monitoring Field Log
LOBP Monitoring Program

Date: 4/20/2016
Operator: SJH
Well number and location: 30S/11E-18K9, LA32
Site and wellhead conditions: Overcast, cool. Active well.

Static water depth (feet): 157
Well depth (feet): 490
Water column (feet): 333
Casing diameter (inches): 14
Minimum purge volume (gal) flush line
Purge rate (gpm): --
Pumping water level (feet): --
Pump setting (feet): --
Minimum purge time (min): flush line
Time begin purge: 10:34

Time	Gallons	EC µS/cm	pH	Temp. °c	Comments*
10:35	300	379	7.38	20.3	Clear, colorless, odorless
					Sampled @ 10:35 AM

*Turbidity, color, odor, sheen, debris, etc.

May 10, 2016

Cleath-Harris Geologists
Attn: Spencer Harris
71 Zaca Lane
Suite 140
San Luis Obispo, CA 93401
Description : 30S/10E-13N LA-8
Project : SWI Monitoring

Lab ID : CC 1681209-002
Customer ID : 8-514

Sampled On : April 20, 2016-09:12
Sampled By : Spencer Harris
Received On : April 20, 2016-14:10
Matrix : Ground Water

Sample Result - Inorganic

Constituent	Result	PQL	Units	Note	Sample Preparation Method	Sample Preparation Date/ID	Sample Analysis Method	Sample Analysis Date/ID
General MineralP:1'5								
Total Hardness as CaCO3	97.5	--	mg/L		200.7	04/21/16:204592	200.7	04/21/16:205588
Calcium	16	1	mg/L		200.7	04/21/16:204592	200.7	04/21/16:205588
Magnesium	14	1	mg/L		200.7	04/21/16:204592	200.7	04/21/16:205588
Potassium	1	1	mg/L		200.7	04/21/16:204592	200.7	04/21/16:205588
Sodium	38	1	mg/L		200.7	04/21/16:204592	200.7	04/21/16:205588
Total Cations	3.6	--	meq/L		200.7	04/21/16:204592	200.7	04/21/16:205588
Boron	ND	0.1	mg/L		200.7	04/21/16:204592	200.7	04/21/16:205588
Copper	ND	10	ug/L		200.7	04/21/16:204592	200.7	04/21/16:205588
Iron	ND	30	ug/L		200.7	04/21/16:204592	200.7	04/21/16:205588
Manganese	ND	10	ug/L		200.7	04/21/16:204592	200.7	04/21/16:205588
Zinc	ND	20	ug/L		200.7	04/21/16:204592	200.7	04/21/16:205588
SAR	1.7	--	--		200.7	04/21/16:204592	200.7	04/21/16:205588
Total Alkalinity (as CaCO3)	20	10	mg/L		2320B	04/25/16:204689	2320B	04/25/16:205678
Hydroxide as OH	ND	10	mg/L		2320B	04/25/16:204689	2320B	04/25/16:205678
Carbonate as CO3	ND	10	mg/L		2320B	04/25/16:204689	2320B	04/25/16:205678
Bicarbonate as HCO3	20	10	mg/L		2320B	04/25/16:204689	2320B	04/25/16:205678
Sulfate	12	2	mg/L		300.0	04/21/16:204722	300.0	04/21/16:205703
Chloride	76	1	mg/L		300.0	04/21/16:204722	300.0	04/21/16:205703
Nitrate as NO3	32.0	0.5	mg/L		300.0	04/21/16:204722	300.0	04/21/16:205703
Nitrite as N	ND	0.2	mg/L		300.0	04/21/16:204722	300.0	04/21/16:205703
Nitrate + Nitrite as N	7.2	0.1	mg/L		300.0	04/21/16:204722	300.0	04/21/16:205703
Fluoride	ND	0.1	mg/L		300.0	04/21/16:204722	300.0	04/21/16:205703
Total Anions	3.2	--	meq/L		2320B	04/25/16:204689	2320B	04/25/16:205678
pH	7.0	--	units		4500-H B	04/22/16:204637	4500HB	04/22/16:205606
Specific Conductance	446	1	umhos/cm		2510B	04/22/16:204621	2510B	04/22/16:205594
Total Dissolved Solids	320	20	mg/L		2540CE	04/21/16:204594	2540C	04/22/16:205602
MBAS Screen	Negative	0.1	mg/L		5540C	04/21/16:204776	5540C	04/21/16:205775
Aggressiveness Index	9.9	--	--		4500-H B	04/22/16:204637	4500HB	04/22/16:205606
Langelier Index (20°C)	-1.9	--	--		4500-H B	04/22/16:204637	4500HB	04/22/16:205606
Nitrate Nitrogen	7.2	--	mg/L		300.0	04/21/16:204722	300.0	04/21/16:205703

ND=Non-Detected. PQL=Practical Quantitation Limit. Containers: (P) Plastic Preservatives: HNO3 pH < 2 ‡Surrogate. * PQL adjusted for dilution.

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May 11, 2016

Lab ID : CC 1681281-002
Customer ID : 8-514

Cleath-Harris Geologists
Attn: Spencer Harris
71 Zaca Lane
Suite 140
San Luis Obispo, CA 93401

Sampled On : April 26, 2016-12:00
Sampled By : Zac Reineke
Received On : April 26, 2016-14:47
Matrix : Ground Water

Description : CABRILLO-24C1 LA-9
Project : SWI Monitoring

Sample Result - Inorganic

Constituent	Result	PQL	Units	Note	Sample Preparation		Sample Analysis	
					Method	Date/ID	Method	Date/ID
General Mineral P:1'5								
Total Hardness as CaCO3	115	--	mg/L		200.7	04/27/16:204838	200.7	04/27/16:205870
Calcium	18	1	mg/L		200.7	04/27/16:204838	200.7	04/27/16:205870
Magnesium	17	1	mg/L		200.7	04/27/16:204838	200.7	04/27/16:205870
Potassium	2	1	mg/L		200.7	04/27/16:204838	200.7	04/27/16:205870
Sodium	44	1	mg/L		200.7	04/27/16:204838	200.7	04/27/16:205870
Total Cations	4.3	--	meq/L		200.7	04/27/16:204838	200.7	04/27/16:205870
Boron	ND	0.1	mg/L		200.7	04/27/16:204838	200.7	04/27/16:205870
Copper	ND	10	ug/L		200.7	04/27/16:204838	200.7	04/27/16:205870
Iron	ND	30	ug/L		200.7	04/27/16:204838	200.7	04/27/16:205870
Manganese	ND	10	ug/L		200.7	04/27/16:204838	200.7	04/27/16:205870
Zinc	ND	20	ug/L		200.7	04/27/16:204838	200.7	04/27/16:205870
SAR	1.8	--	--		200.7	04/27/16:204838	200.7	04/27/16:205870
Total Alkalinity (as CaCO3)	60	10	mg/L		2320B	04/28/16:204882	2320B	04/28/16:205961
Hydroxide as OH	ND	10	mg/L		2320B	04/28/16:204882	2320B	04/28/16:205961
Carbonate as CO3	ND	10	mg/L		2320B	04/28/16:204882	2320B	04/28/16:205961
Bicarbonate as HCO3	70	10	mg/L		2320B	04/28/16:204882	2320B	04/28/16:205961
Sulfate	16	2	mg/L		300.0	04/27/16:204932	300.0	04/27/16:205947
Chloride	90	1	mg/L		300.0	04/27/16:204932	300.0	04/27/16:205947
Nitrate as NO3	24.6	0.5	mg/L		300.0	04/27/16:204932	300.0	04/27/16:205947
Nitrite as N	ND	0.2	mg/L		300.0	04/27/16:204932	300.0	04/27/16:205947
Nitrate + Nitrite as N	5.6	0.1	mg/L		300.0	04/27/16:204932	300.0	04/27/16:205947
Fluoride	ND	0.1	mg/L		300.0	04/27/16:204932	300.0	04/27/16:205947
Total Anions	4.4	--	meq/L		2320B	04/28/16:204882	2320B	04/28/16:205961
pH	7.0	--	units		4500-H B	04/28/16:204902	4500HB	04/28/16:205908
Specific Conductance	499	1	umhos/cm		2510B	04/28/16:204886	2510B	04/28/16:205884
Total Dissolved Solids	300	20	mg/L		2540CE	04/28/16:204920	2540C	04/29/16:205977
MBAS Screen	Negative	0.1	mg/L		5540C	04/27/16:205138	5540C	04/27/16:206188
Aggressiveness Index	10.4	--	--		4500-H B	04/28/16:204902	4500HB	04/28/16:205908
Langelier Index (20°C)	-1.4	--	--		4500-H B	04/28/16:204902	4500HB	04/28/16:205908
Nitrate Nitrogen	5.6	--	mg/L		300.0	04/27/16:204932	300.0	04/27/16:205947

ND=Non-Detected. PQL=Practical Quantitation Limit. Containers: (P) Plastic Preservatives: HNO3 pH < 2 ‡Surrogate. * PQL adjusted for dilution.

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May 11, 2016

Cleath-Harris Geologists
Attn: Spencer Harris
71 Zaca Lane
Suite 140
San Luis Obispo, CA 93401
Description : ROSINA-13J4 LA-10
Project : SWI Monitoring

Lab ID : CC 1681281-001
Customer ID : 8-514

Sampled On : April 26, 2016-11:30
Sampled By : Zac Reineke
Received On : April 26, 2016-14:47
Matrix : Ground Water

Sample Result - Inorganic

Constituent	Result	PQL	Units	Note	Sample Preparation Method	Sample Preparation Date/ID	Sample Analysis Method	Sample Analysis Date/ID
General Mineral[P:1'5]								
Total Hardness as CaCO3	412	--	mg/L		200.7	04/27/16:204838	200.7	04/27/16:205870
Calcium	66	1	mg/L		200.7	04/27/16:204838	200.7	04/27/16:205870
Magnesium	60	1	mg/L		200.7	04/27/16:204838	200.7	04/27/16:205870
Potassium	2	1	mg/L		200.7	04/27/16:204838	200.7	04/27/16:205870
Sodium	37	1	mg/L		200.7	04/27/16:204838	200.7	04/27/16:205870
Total Cations	9.9	--	meq/L		200.7	04/27/16:204838	200.7	04/27/16:205870
Boron	ND	0.1	mg/L		200.7	04/27/16:204838	200.7	04/27/16:205870
Copper	ND	10	ug/L		200.7	04/27/16:204838	200.7	04/27/16:205870
Iron	120	30	ug/L		200.7	04/27/16:204838	200.7	04/27/16:205870
Manganese	ND	10	ug/L		200.7	04/27/16:204838	200.7	04/27/16:205870
Zinc	ND	20	ug/L		200.7	04/27/16:204838	200.7	04/27/16:205870
SAR	0.8	--	--		200.7	04/27/16:204838	200.7	04/27/16:205870
Total Alkalinity (as CaCO3)	70	10	mg/L		2320B	04/28/16:204882	2320B	04/28/16:205961
Hydroxide as OH	ND	10	mg/L		2320B	04/28/16:204882	2320B	04/28/16:205961
Carbonate as CO3	ND	10	mg/L		2320B	04/28/16:204882	2320B	04/28/16:205961
Bicarbonate as HCO3	80	10	mg/L		2320B	04/28/16:204882	2320B	04/28/16:205961
Sulfate	18	2	mg/L		300.0	04/27/16:204932	300.0	04/27/16:205947
Chloride	299	6*	mg/L		300.0	04/27/16:204932	300.0	04/27/16:205947
Nitrate as NO3	8.0	0.5	mg/L		300.0	04/27/16:204932	300.0	04/27/16:205947
Nitrite as N	ND	0.2	mg/L		300.0	04/27/16:204932	300.0	04/27/16:205947
Nitrate + Nitrite as N	1.8	0.1	mg/L		300.0	04/27/16:204932	300.0	04/27/16:205947
Fluoride	ND	0.1	mg/L		300.0	04/27/16:204932	300.0	04/27/16:205947
Total Anions	10.2	--	meq/L		2320B	04/28/16:204882	2320B	04/28/16:205961
pH	7.1	--	units		4500-H B	04/28/16:204902	4500HB	04/28/16:205908
Specific Conductance	1170	1	umhos/cm		2510B	04/28/16:204886	2510B	04/28/16:205884
Total Dissolved Solids	840	20	mg/L		2540CE	04/28/16:204920	2540C	04/29/16:205977
MBAS Screen	Negative	0.1	mg/L		5540C	04/27/16:205138	5540C	04/27/16:206188
Aggressiveness Index	11.2	--	--		4500-H B	04/28/16:204902	4500HB	04/28/16:205908
Langelier Index (20°C)	-0.7	--	--		4500-H B	04/28/16:204902	4500HB	04/28/16:205908
Nitrate Nitrogen	1.8	--	mg/L		300.0	04/27/16:204932	300.0	04/27/16:205947

ND=Non-Detected. PQL=Practical Quantitation Limit. Containers: (P) Plastic Preservatives: HNO3 pH < 2 ‡Surrogate. * PQL adjusted for dilution.

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May 10, 2016

Cleath-Harris Geologists
Attn: Spencer Harris
71 Zaca Lane
Suite 140
San Luis Obispo, CA 93401
Description : 30S/10E-12J1 LA-11
Project : SWI Monitoring

Lab ID : CC 1681209-006
Customer ID : 8-514

Sampled On : April 20, 2016-13:17
Sampled By : Spencer Harris
Received On : April 20, 2016-14:10
Matrix : Ground Water

Sample Result - Inorganic

Constituent	Result	PQL	Units	Note	Sample Preparation Method	Sample Preparation Date/ID	Sample Analysis Method	Sample Analysis Date/ID
General MineralP:1'5								
Total Hardness as CaCO3	524	--	mg/L		200.7	04/21/16:204592	200.7	04/21/16:205588
Calcium	73	1	mg/L		200.7	04/21/16:204592	200.7	04/21/16:205588
Magnesium	83	1	mg/L		200.7	04/21/16:204592	200.7	04/21/16:205588
Potassium	5	1	mg/L		200.7	04/21/16:204592	200.7	04/21/16:205588
Sodium	83	1	mg/L		200.7	04/21/16:204592	200.7	04/21/16:205588
Total Cations	14.2	--	meq/L		200.7	04/21/16:204592	200.7	04/21/16:205588
Boron	0.2	0.1	mg/L		200.7	04/21/16:204592	200.7	04/21/16:205588
Copper	ND	10	ug/L		200.7	04/21/16:204592	200.7	04/21/16:205588
Iron	180	30	ug/L		200.7	04/21/16:204592	200.7	04/21/16:205588
Manganese	40	10	ug/L		200.7	04/21/16:204592	200.7	04/21/16:205588
Zinc	ND	20	ug/L		200.7	04/21/16:204592	200.7	04/21/16:205588
SAR	1.6	--	--		200.7	04/21/16:204592	200.7	04/21/16:205588
Total Alkalinity (as CaCO3)	270	10	mg/L		2320B	04/25/16:204689	2320B	04/25/16:205678
Hydroxide as OH	ND	10	mg/L		2320B	04/25/16:204689	2320B	04/25/16:205678
Carbonate as CO3	ND	10	mg/L		2320B	04/25/16:204689	2320B	04/25/16:205678
Bicarbonate as HCO3	330	10	mg/L		2320B	04/25/16:204689	2320B	04/25/16:205678
Sulfate	193	2	mg/L		300.0	04/21/16:204722	300.0	04/21/16:205703
Chloride	151	3*	mg/L		300.0	04/21/16:204722	300.0	04/22/16:205703
Nitrate as NO3	ND	0.5	mg/L		300.0	04/21/16:204722	300.0	04/21/16:205703
Nitrite as N	ND	0.2	mg/L		300.0	04/21/16:204722	300.0	04/21/16:205703
Nitrate + Nitrite as N	ND	0.1	mg/L		300.0	04/21/16:204722	300.0	04/21/16:205703
Fluoride	0.1	0.1	mg/L		300.0	04/21/16:204722	300.0	04/21/16:205703
Total Anions	13.7	--	meq/L		2320B	04/25/16:204689	2320B	04/25/16:205678
Specific Conductance	1370	1	umhos/cm		2510B	04/22/16:204621	2510B	04/22/16:205594
Total Dissolved Solids	840	20	mg/L		2540CE	04/22/16:204636	2540C	04/25/16:205686
MBAS Screen	Negative	0.1	mg/L		5540C	04/21/16:204776	5540C	04/21/16:205775
Nitrate Nitrogen	ND	--	mg/L		300.0	04/21/16:204722	300.0	04/21/16:205703

ND=Non-Detected. PQL=Practical Quantitation Limit. Containers: (P) Plastic Preservatives: HNO3 pH < 2 ‡Surrogate. * PQL adjusted for dilution.

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ENVIRONMENTAL FGL AGRICULTURAL
Analytical Chemists

May 10, 2016

Cleath-Harris Geologists
Attn: Spencer Harris
71 Zaca Lane
Suite 140
San Luis Obispo, CA 93401
Description : 30S/11E-7Q3 LA-12
Project : SWI Monitoring

Lab ID : CC 1681209-004
Customer ID : 8-514

Sampled On : April 20, 2016-10:20
Sampled By : Spencer Harris
Received On : April 20, 2016-14:10
Matrix : Ground Water

Sample Result - Inorganic

Constituent	Result	PQL	Units	Note	Sample Preparation Method	Sample Preparation Date/ID	Sample Analysis Method	Sample Analysis Date/ID
General Mineral[P:1'5]								
Total Hardness as CaCO3	307	--	mg/L		200.7	04/21/16:204592	200.7	04/21/16:205588
Calcium	49	1	mg/L		200.7	04/21/16:204592	200.7	04/21/16:205588
Magnesium	45	1	mg/L		200.7	04/21/16:204592	200.7	04/21/16:205588
Potassium	2	1	mg/L		200.7	04/21/16:204592	200.7	04/21/16:205588
Sodium	54	1	mg/L		200.7	04/21/16:204592	200.7	04/21/16:205588
Total Cations	8.5	--	meq/L		200.7	04/21/16:204592	200.7	04/21/16:205588
Boron	0.2	0.1	mg/L		200.7	04/21/16:204592	200.7	04/21/16:205588
Copper	ND	10	ug/L		200.7	04/21/16:204592	200.7	04/21/16:205588
Iron	50	30	ug/L		200.7	04/21/16:204592	200.7	04/21/16:205588
Manganese	60	10	ug/L		200.7	04/21/16:204592	200.7	04/21/16:205588
Zinc	20	20	ug/L		200.7	04/21/16:204592	200.7	04/21/16:205588
SAR	1.3	--	--		200.7	04/21/16:204592	200.7	04/21/16:205588
Total Alkalinity (as CaCO3)	160	10	mg/L		2320B	04/25/16:204689	2320B	04/25/16:205678
Hydroxide as OH	ND	10	mg/L		2320B	04/25/16:204689	2320B	04/25/16:205678
Carbonate as CO3	ND	10	mg/L		2320B	04/25/16:204689	2320B	04/25/16:205678
Bicarbonate as HCO3	190	10	mg/L		2320B	04/25/16:204689	2320B	04/25/16:205678
Sulfate	49	2	mg/L		300.0	04/21/16:204722	300.0	04/21/16:205703
Chloride	91	1	mg/L		300.0	04/21/16:204722	300.0	04/21/16:205703
Nitrate as NO3	ND	0.5	mg/L		300.0	04/21/16:204722	300.0	04/21/16:205703
Nitrite as N	ND	0.2	mg/L		300.0	04/21/16:204722	300.0	04/21/16:205703
Nitrate + Nitrite as N	ND	0.1	mg/L		300.0	04/21/16:204722	300.0	04/21/16:205703
Fluoride	ND	0.1	mg/L		300.0	04/21/16:204722	300.0	04/21/16:205703
Total Anions	6.7	--	meq/L		2320B	04/25/16:204689	2320B	04/25/16:205678
pH	7.7	--	units		4500-H B	04/22/16:204637	4500HB	04/22/16:205606
Specific Conductance	907	1	umhos/cm		2510B	04/22/16:204621	2510B	04/22/16:205594
Total Dissolved Solids	520	20	mg/L		2540CE	04/21/16:204594	2540C	04/22/16:205602
MBAS Screen	Negative	0.1	mg/L		5540C	04/21/16:204776	5540C	04/21/16:205775
Aggressiveness Index	12.0	--	--		4500-H B	04/22/16:204637	4500HB	04/22/16:205606
Langelier Index (20°C)	0.1	--	--		4500-H B	04/22/16:204637	4500HB	04/22/16:205606
Nitrate Nitrogen	ND	--	mg/L		300.0	04/21/16:204722	300.0	04/21/16:205703

ND=Non-Detected. PQL=Practical Quantitation Limit. Containers: (P) Plastic Preservatives: HNO3 pH < 2 ‡Surrogate. * PQL adjusted for dilution.

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ENVIRONMENTAL FGL AGRICULTURAL
Analytical Chemists

May 11, 2016

Cleath-Harris Geologists
Attn: Spencer Harris
71 Zaca Lane
Suite 140
San Luis Obispo, CA 93401
Description : 30S/11E-18L2 LA-15
Project : SWI Monitoring

Lab ID : CC 1681289-001
Customer ID : 8-514

Sampled On : April 27, 2016-10:08
Sampled By : Spencer Harris
Received On : April 27, 2016-14:04
Matrix : Ground Water

Sample Result - Inorganic

Constituent	Result	PQL	Units	Note	Sample Preparation Method	Sample Preparation Date/ID	Sample Analysis Method	Sample Analysis Date/ID
General Mineral[P:1'5]								
Total Hardness as CaCO3	264	--	mg/L		200.7	04/28/16:204916	200.7	04/28/16:205956
Calcium	43	1	mg/L		200.7	04/28/16:204916	200.7	04/28/16:205956
Magnesium	38	1	mg/L		200.7	04/28/16:204916	200.7	04/28/16:205956
Potassium	2	1	mg/L		200.7	04/28/16:204916	200.7	04/28/16:205956
Sodium	36	1	mg/L		200.7	04/28/16:204916	200.7	04/28/16:205956
Total Cations	6.9	--	meq/L		200.7	04/28/16:204916	200.7	04/28/16:205956
Boron	ND	0.1	mg/L		200.7	04/28/16:204916	200.7	04/28/16:205956
Copper	ND	10	ug/L		200.7	04/28/16:204916	200.7	04/28/16:205956
Iron	ND	30	ug/L		200.7	04/28/16:204916	200.7	04/28/16:205956
Manganese	ND	10	ug/L		200.7	04/28/16:204916	200.7	04/28/16:205956
Zinc	ND	20	ug/L		200.7	04/28/16:204916	200.7	04/28/16:205956
SAR	1.0	--	--		200.7	04/28/16:204916	200.7	04/28/16:205956
Total Alkalinity (as CaCO3)	190	10	mg/L		2320B	04/29/16:204948	2320B	04/29/16:206094
Hydroxide as OH	ND	10	mg/L		2320B	04/29/16:204948	2320B	04/29/16:206094
Carbonate as CO3	ND	10	mg/L		2320B	04/29/16:204948	2320B	04/29/16:206094
Bicarbonate as HCO3	230	10	mg/L		2320B	04/29/16:204948	2320B	04/29/16:206094
Sulfate	28	2	mg/L		300.0	04/28/16:205078	300.0	04/28/16:206203
Chloride	93	1	mg/L		300.0	04/28/16:205078	300.0	04/28/16:206203
Nitrate as NO3	4.1	0.5	mg/L		300.0	04/28/16:205078	300.0	04/28/16:206203
Nitrite as N	ND	0.2	mg/L		300.0	04/28/16:205078	300.0	04/28/16:206203
Nitrate + Nitrite as N	0.9	0.1	mg/L		300.0	04/28/16:205078	300.0	04/28/16:206203
Fluoride	ND	0.1	mg/L		300.0	04/28/16:205078	300.0	04/28/16:206203
Total Anions	7.0	--	meq/L		2320B	04/29/16:204948	2320B	04/29/16:206094
pH	7.3	--	units		4500-H B	04/29/16:204966	4500HB	04/29/16:205987
Specific Conductance	796	1	umhos/cm		2510B	04/29/16:204956	2510B	04/29/16:205973
Total Dissolved Solids	450	20	mg/L		2540CE	05/04/16:205117	2540C	05/05/16:206223
MBAS Screen	Negative	0.1	mg/L		5540C	04/28/16:205139	5540C	04/28/16:206189
Aggressiveness Index	11.6	--	--		4500-H B	04/29/16:204966	4500HB	04/29/16:205987
Langelier Index (20°C)	-0.3	--	--		4500-H B	04/29/16:204966	4500HB	04/29/16:205987
Nitrate Nitrogen	0.9	--	mg/L		300.0	04/28/16:205078	300.0	04/28/16:206203

ND=Non-Detected. PQL=Practical Quantitation Limit. Containers: (P) Plastic Preservatives: HNO3 pH < 2 ‡Surrogate. * PQL adjusted for dilution.

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May 10, 2016

Lab ID : CC 1681209-001
Customer ID : 8-514

Cleath-Harris Geologists
Attn: Spencer Harris
71 Zaca Lane
Suite 140
San Luis Obispo, CA 93401
Description : 30S/11E-18K8 LA-18
Project : SWI Monitoring

Sampled On : April 19, 2016-17:01
Sampled By : Spencer Harris
Received On : April 20, 2016-14:10
Matrix : Ground Water

Sample Result - Inorganic

Constituent	Result	PQL	Units	Note	Sample Preparation Method	Sample Preparation Date/ID	Sample Analysis Method	Sample Analysis Date/ID
General MineralP:1'5								
Total Hardness as CaCO3	265	--	mg/L		200.7	04/21/16:204592	200.7	04/21/16:205588
Calcium	55	1	mg/L		200.7	04/21/16:204592	200.7	04/21/16:205588
Magnesium	31	1	mg/L		200.7	04/21/16:204592	200.7	04/21/16:205588
Potassium	2	1	mg/L		200.7	04/21/16:204592	200.7	04/21/16:205588
Sodium	26	1	mg/L		200.7	04/21/16:204592	200.7	04/21/16:205588
Total Cations	6.5	--	meq/L		200.7	04/21/16:204592	200.7	04/21/16:205588
Boron	ND	0.1	mg/L		200.7	04/21/16:204592	200.7	04/21/16:205588
Copper	ND	10	ug/L		200.7	04/21/16:204592	200.7	04/21/16:205588
Iron	ND	30	ug/L		200.7	04/21/16:204592	200.7	04/21/16:205588
Manganese	80	10	ug/L		200.7	04/21/16:204592	200.7	04/21/16:205588
Zinc	ND	20	ug/L		200.7	04/21/16:204592	200.7	04/21/16:205588
SAR	0.7	--	--		200.7	04/21/16:204592	200.7	04/21/16:205588
Total Alkalinity (as CaCO3)	160	10	mg/L		2320B	04/25/16:204689	2320B	04/25/16:205678
Hydroxide as OH	ND	10	mg/L		2320B	04/25/16:204689	2320B	04/25/16:205678
Carbonate as CO3	ND	10	mg/L		2320B	04/25/16:204689	2320B	04/25/16:205678
Bicarbonate as HCO3	190	10	mg/L		2320B	04/25/16:204689	2320B	04/25/16:205678
Sulfate	38	2	mg/L		300.0	04/21/16:204722	300.0	04/21/16:205703
Chloride	31	1	mg/L		300.0	04/21/16:204722	300.0	04/21/16:205703
Nitrate as NO3	ND	0.5	mg/L		300.0	04/21/16:204722	300.0	04/21/16:205703
Nitrite as N	ND	0.2	mg/L		300.0	04/21/16:204722	300.0	04/21/16:205703
Nitrate + Nitrite as N	ND	0.1	mg/L		300.0	04/21/16:204722	300.0	04/21/16:205703
Fluoride	0.2	0.1	mg/L		300.0	04/21/16:204722	300.0	04/21/16:205703
Total Anions	4.8	--	meq/L		2320B	04/25/16:204689	2320B	04/25/16:205678
pH	7.5	--	units		4500-H B	04/22/16:204637	4500HB	04/22/16:205606
Specific Conductance	700	1	umhos/cm		2510B	04/22/16:204621	2510B	04/22/16:205594
Total Dissolved Solids	390	20	mg/L		2540CE	04/21/16:204594	2540C	04/22/16:205602
MBAS Screen	Negative	0.1	mg/L		5540C	04/21/16:204776	5540C	04/21/16:205775
Aggressiveness Index	11.8	--	--		4500-H B	04/22/16:204637	4500HB	04/22/16:205606
Langelier Index (20°C)	-0.01	--	--		4500-H B	04/22/16:204637	4500HB	04/22/16:205606
Nitrate Nitrogen	ND	--	mg/L		300.0	04/21/16:204722	300.0	04/21/16:205703

ND=Non-Detected. PQL=Practical Quantitation Limit. Containers: (P) Plastic Preservatives: HNO3 pH < 2 ‡Surrogate. * PQL adjusted for dilution.

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May 11, 2016

Cleath-Harris Geologists
Attn: Spencer Harris
71 Zaca Lane
Suite 140
San Luis Obispo, CA 93401
Description : SO.Bay@1-17N10 LA-20
Project : SWI Monitoring

Lab ID : CC 1681281-003
Customer ID : 8-514

Sampled On : April 26, 2016-11:15
Sampled By : Zac Reineke
Received On : April 26, 2016-14:47
Matrix : Ground Water

Sample Result - Inorganic

Constituent	Result	PQL	Units	Note	Sample Preparation Method	Sample Preparation Date/ID	Sample Analysis Method	Sample Analysis Date/ID
General MineralP:1'5								
Total Hardness as CaCO3	227	--	mg/L		200.7	04/27/16:204838	200.7	04/27/16:205870
Calcium	35	1	mg/L		200.7	04/27/16:204838	200.7	04/27/16:205870
Magnesium	34	1	mg/L		200.7	04/27/16:204838	200.7	04/27/16:205870
Potassium	2	1	mg/L		200.7	04/27/16:204838	200.7	04/27/16:205870
Sodium	40	1	mg/L		200.7	04/27/16:204838	200.7	04/27/16:205870
Total Cations	6.3	--	meq/L		200.7	04/27/16:204838	200.7	04/27/16:205870
Boron	0.1	0.1	mg/L		200.7	04/27/16:204838	200.7	04/27/16:205870
Copper	ND	10	ug/L		200.7	04/27/16:204838	200.7	04/27/16:205870
Iron	ND	30	ug/L		200.7	04/27/16:204838	200.7	04/27/16:205870
Manganese	ND	10	ug/L		200.7	04/27/16:204838	200.7	04/27/16:205870
Zinc	ND	20	ug/L		200.7	04/27/16:204838	200.7	04/27/16:205870
SAR	1.2	--	--		200.7	04/27/16:204838	200.7	04/27/16:205870
Total Alkalinity (as CaCO3)	190	10	mg/L		2320B	04/28/16:204882	2320B	04/28/16:205961
Hydroxide as OH	ND	10	mg/L		2320B	04/28/16:204882	2320B	04/28/16:205961
Carbonate as CO3	ND	10	mg/L		2320B	04/28/16:204882	2320B	04/28/16:205961
Bicarbonate as HCO3	230	10	mg/L		2320B	04/28/16:204882	2320B	04/28/16:205961
Sulfate	27	2	mg/L		300.0	04/27/16:204932	300.0	04/27/16:205947
Chloride	39	1	mg/L		300.0	04/27/16:204932	300.0	04/27/16:205947
Nitrate as NO3	2.6	0.5	mg/L		300.0	04/27/16:204932	300.0	04/27/16:205947
Nitrite as N	ND	0.2	mg/L		300.0	04/27/16:204932	300.0	04/27/16:205947
Nitrate + Nitrite as N	0.6	0.1	mg/L		300.0	04/27/16:204932	300.0	04/27/16:205947
Fluoride	0.2	0.1	mg/L		300.0	04/27/16:204932	300.0	04/27/16:205947
Total Anions	5.5	--	meq/L		2320B	04/28/16:204882	2320B	04/28/16:205961
pH	7.1	--	units		4500-H B	04/28/16:204902	4500HB	04/28/16:205908
Specific Conductance	629	1	umhos/cm		2510B	04/28/16:204886	2510B	04/28/16:205884
Total Dissolved Solids	360	20	mg/L		2540CE	04/28/16:204920	2540C	04/29/16:205977
MBAS Screen	Negative	0.1	mg/L		5540C	04/27/16:205138	5540C	04/27/16:206188
Aggressiveness Index	11.3	--	--		4500-H B	04/28/16:204902	4500HB	04/28/16:205908
Langelier Index (20°C)	-0.5	--	--		4500-H B	04/28/16:204902	4500HB	04/28/16:205908
Nitrate Nitrogen	0.6	--	mg/L		300.0	04/27/16:204932	300.0	04/27/16:205947

ND=Non-Detected. PQL=Practical Quantitation Limit. Containers: (P) Plastic Preservatives: HNO3 pH < 2 ‡Surrogate. * PQL adjusted for dilution.

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May 10, 2016

Cleath-Harris Geologists
Attn: Spencer Harris
71 Zaca Lane
Suite 140
San Luis Obispo, CA 93401
Description : 30S/11E-17E8 LA-22
Project : SWI Monitoring

Lab ID : CC 1681200-001
Customer ID : 8-514

Sampled On : April 19, 2016-11:37
Sampled By : Andrea Berge
Received On : April 19, 2016-15:30
Matrix : Ground Water

Sample Result - Inorganic

Constituent	Result	PQL	Units	Note	Sample Preparation		Sample Analysis	
					Method	Date/ID	Method	Date/ID
General Mineral[P:1]								
Total Hardness as CaCO3	164	--	mg/L		200.7	04/21/16:204592	200.7	04/21/16:205588
Calcium	26	1	mg/L		200.7	04/21/16:204592	200.7	04/21/16:205588
Magnesium	24	1	mg/L		200.7	04/21/16:204592	200.7	04/21/16:205588
Potassium	1	1	mg/L		200.7	04/21/16:204592	200.7	04/21/16:205588
Sodium	29	1	mg/L		200.7	04/21/16:204592	200.7	04/21/16:205588
Total Cations	4.6	--	meq/L		200.7	04/21/16:204592	200.7	04/21/16:205588
Boron	ND	0.1	mg/L		200.7	04/21/16:204592	200.7	04/21/16:205588
Copper	ND	10	ug/L		200.7	04/21/16:204592	200.7	04/21/16:205588
Iron	ND	30	ug/L		200.7	04/21/16:204592	200.7	04/21/16:205588
Manganese	ND	10	ug/L		200.7	04/21/16:204592	200.7	04/21/16:205588
Zinc	ND	20	ug/L		200.7	04/21/16:204592	200.7	04/21/16:205588
SAR	1.0	--	--		200.7	04/21/16:204592	200.7	04/21/16:205588
Total Alkalinity (as CaCO3)	120	10	mg/L		2320B	04/21/16:204566	2320B	04/21/16:205583
Hydroxide as OH	ND	10	mg/L		2320B	04/21/16:204566	2320B	04/21/16:205583
Carbonate as CO3	ND	10	mg/L		2320B	04/21/16:204566	2320B	04/21/16:205583
Bicarbonate as HCO3	150	10	mg/L		2320B	04/21/16:204566	2320B	04/21/16:205583
Sulfate	12	2	mg/L		300.0	04/20/16:204717	300.0	04/20/16:205492
Chloride	45	1	mg/L		300.0	04/20/16:204717	300.0	04/20/16:205492
Nitrate as NO3	30.5	0.5	mg/L		300.0	04/20/16:204717	300.0	04/20/16:205492
Nitrite as N	ND	0.2	mg/L		300.0	04/20/16:204717	300.0	04/20/16:205492
Nitrate + Nitrite as N	6.9	0.1	mg/L		300.0	04/20/16:204717	300.0	04/20/16:205492
Fluoride	ND	0.1	mg/L		300.0	04/20/16:204717	300.0	04/20/16:205492
Total Anions	4.5	--	meq/L		2320B	04/21/16:204566	2320B	04/21/16:205583
pH	6.9	--	units		4500-H B	04/21/16:204590	4500HB	04/21/16:205549
Specific Conductance	476	1	umhos/cm		2510B	04/21/16:204562	2510B	04/21/16:205517
Total Dissolved Solids	290	20	mg/L		2540CE	04/21/16:204594	2540C	04/22/16:205602
MBAS Screen	Negative	0.1	mg/L		5540C	04/20/16:204775	5540C	04/20/16:205774
Aggressiveness Index	10.8	--	--		4500-H B	04/21/16:204590	4500HB	04/21/16:205549
Langelier Index (20°C)	-1.0	--	--		4500-H B	04/21/16:204590	4500HB	04/21/16:205549
Nitrate Nitrogen	6.9	--	mg/L		300.0	04/20/16:204717	300.0	04/20/16:205492

ND=Non-Detected. PQL=Practical Quantitation Limit. Containers: (P) Plastic Preservatives: HNO3 pH < 2 ‡Surrogate. * PQL adjusted for dilution.

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May 10, 2016

Lab ID : CC 1681209-003
Customer ID : 8-514

Cleath-Harris Geologists
Attn: Spencer Harris
71 Zaca Lane
Suite 140
San Luis Obispo, CA 93401
Description : 30S/10E-13M2 LA-31
Project : SWI Monitoring

Sampled On : April 20, 2016-10:01
Sampled By : Spencer Harris
Received On : April 20, 2016-14:10
Matrix : Ground Water

Sample Result - Inorganic

Constituent	Result	PQL	Units	Note	Sample Preparation Method	Sample Preparation Date/ID	Sample Analysis Method	Sample Analysis Date/ID
General MineralP:1'5								
Total Hardness as CaCO3	726	--	mg/L		200.7	04/21/16:204592	200.7	04/21/16:205588
Calcium	113	1	mg/L		200.7	04/21/16:204592	200.7	04/21/16:205588
Magnesium	108	1	mg/L		200.7	04/21/16:204592	200.7	04/21/16:205588
Potassium	5	1	mg/L		200.7	04/21/16:204592	200.7	04/21/16:205588
Sodium	400	2*	mg/L		200.7	04/21/16:204592	200.7	04/22/16:205680
Total Cations	32.1	--	meq/L		200.7	04/21/16:204592	200.7	04/21/16:205588
Boron	0.2	0.1	mg/L		200.7	04/21/16:204592	200.7	04/21/16:205588
Copper	ND	10	ug/L		200.7	04/21/16:204592	200.7	04/21/16:205588
Iron	ND	30	ug/L		200.7	04/21/16:204592	200.7	04/21/16:205588
Manganese	ND	10	ug/L		200.7	04/21/16:204592	200.7	04/21/16:205588
Zinc	ND	20	ug/L		200.7	04/21/16:204592	200.7	04/21/16:205588
SAR	6.5	--	--		200.7	04/21/16:204592	200.7	04/21/16:205588
Total Alkalinity (as CaCO3)	40	10	mg/L		2320B	04/25/16:204689	2320B	04/25/16:205678
Hydroxide as OH	ND	10	mg/L		2320B	04/25/16:204689	2320B	04/25/16:205678
Carbonate as CO3	ND	10	mg/L		2320B	04/25/16:204689	2320B	04/25/16:205678
Bicarbonate as HCO3	50	10	mg/L		2320B	04/25/16:204689	2320B	04/25/16:205678
Sulfate	179	2	mg/L		300.0	04/21/16:204722	300.0	04/21/16:205703
Chloride	941	19*	mg/L		300.0	04/21/16:204722	300.0	04/22/16:205703
Nitrate as NO3	3.1	0.5	mg/L		300.0	04/21/16:204722	300.0	04/21/16:205703
Nitrite as N	ND	0.2	mg/L		300.0	04/21/16:204722	300.0	04/21/16:205703
Nitrate + Nitrite as N	0.7	0.1	mg/L		300.0	04/21/16:204722	300.0	04/21/16:205703
Fluoride	ND	0.1	mg/L		300.0	04/21/16:204722	300.0	04/21/16:205703
Total Anions	31.1	--	meq/L		2320B	04/25/16:204689	2320B	04/25/16:205678
pH	7.2	--	units		4500-H B	04/22/16:204637	4500HB	04/22/16:205606
Specific Conductance	3520	1	umhos/cm		2510B	04/22/16:204621	2510B	04/22/16:205594
Total Dissolved Solids	2190	20	mg/L		2540CE	04/21/16:204594	2540C	04/22/16:205602
MBAS Screen	Negative	0.1	mg/L		5540C	04/21/16:204776	5540C	04/21/16:205775
Aggressiveness Index	11.3	--	--		4500-H B	04/22/16:204637	4500HB	04/22/16:205606
Langelier Index (20°C)	-0.7	--	--		4500-H B	04/22/16:204637	4500HB	04/22/16:205606
Nitrate Nitrogen	0.7	--	mg/L		300.0	04/21/16:204722	300.0	04/21/16:205703

ND=Non-Detected. PQL=Practical Quantitation Limit. Containers: (P) Plastic Preservatives: HNO3 pH < 2 ‡Surrogate. * PQL adjusted for dilution.

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May 10, 2016

Cleath-Harris Geologists
Attn: Spencer Harris
71 Zaca Lane
Suite 140
San Luis Obispo, CA 93401
Description : 30S/11E-18K9 LA-32
Project : SWI Monitoring

Lab ID : CC 1681209-005
Customer ID : 8-514

Sampled On : April 20, 2016-10:35
Sampled By : Spencer Harris
Received On : April 20, 2016-14:10
Matrix : Ground Water

Sample Result - Inorganic

Constituent	Result	PQL	Units	Note	Sample Preparation Method	Sample Preparation Date/ID	Sample Analysis Method	Sample Analysis Date/ID
General Mineral[P:1'5]								
Total Hardness as CaCO3	121	--	mg/L		200.7	04/21/16:204592	200.7	04/21/16:205588
Calcium	19	1	mg/L		200.7	04/21/16:204592	200.7	04/21/16:205588
Magnesium	18	1	mg/L		200.7	04/21/16:204592	200.7	04/21/16:205588
Potassium	1	1	mg/L		200.7	04/21/16:204592	200.7	04/21/16:205588
Sodium	27	1	mg/L		200.7	04/21/16:204592	200.7	04/21/16:205588
Total Cations	3.6	--	meq/L		200.7	04/21/16:204592	200.7	04/21/16:205588
Boron	ND	0.1	mg/L		200.7	04/21/16:204592	200.7	04/21/16:205588
Copper	ND	10	ug/L		200.7	04/21/16:204592	200.7	04/21/16:205588
Iron	ND	30	ug/L		200.7	04/21/16:204592	200.7	04/21/16:205588
Manganese	ND	10	ug/L		200.7	04/21/16:204592	200.7	04/21/16:205588
Zinc	ND	20	ug/L		200.7	04/21/16:204592	200.7	04/21/16:205588
SAR	1.1	--	--		200.7	04/21/16:204592	200.7	04/21/16:205588
Total Alkalinity (as CaCO3)	100	10	mg/L		2320B	04/25/16:204689	2320B	04/25/16:205678
Hydroxide as OH	ND	10	mg/L		2320B	04/25/16:204689	2320B	04/25/16:205678
Carbonate as CO3	ND	10	mg/L		2320B	04/25/16:204689	2320B	04/25/16:205678
Bicarbonate as HCO3	130	10	mg/L		2320B	04/25/16:204689	2320B	04/25/16:205678
Sulfate	12	2	mg/L		300.0	04/21/16:204722	300.0	04/21/16:205703
Chloride	32	1	mg/L		300.0	04/21/16:204722	300.0	04/21/16:205703
Nitrate as NO3	14.6	0.5	mg/L		300.0	04/21/16:204722	300.0	04/21/16:205703
Nitrite as N	ND	0.2	mg/L		300.0	04/21/16:204722	300.0	04/21/16:205703
Nitrate + Nitrite as N	3.3	0.1	mg/L		300.0	04/21/16:204722	300.0	04/21/16:205703
Fluoride	0.1	0.1	mg/L		300.0	04/21/16:204722	300.0	04/21/16:205703
Total Anions	3.5	--	meq/L		2320B	04/25/16:204689	2320B	04/25/16:205678
pH	7.5	--	units		4500-H B	04/22/16:204637	4500HB	04/22/16:205606
Specific Conductance	382	1	umhos/cm		2510B	04/22/16:204621	2510B	04/22/16:205594
Total Dissolved Solids	220	20	mg/L		2540CE	04/21/16:204594	2540C	04/22/16:205602
MBAS Screen	Negative	0.1	mg/L		5540C	04/21/16:204776	5540C	04/21/16:205775
Aggressiveness Index	11.2	--	--		4500-H B	04/22/16:204637	4500HB	04/22/16:205606
Langelier Index (20°C)	-0.6	--	--		4500-H B	04/22/16:204637	4500HB	04/22/16:205606
Nitrate Nitrogen	3.3	--	mg/L		300.0	04/21/16:204722	300.0	04/21/16:205703

ND=Non-Detected. PQL=Practical Quantitation Limit. Containers: (P) Plastic Preservatives: HNO3 pH < 2 ‡Surrogate. * PQL adjusted for dilution.

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Fall 2016 Field Logs and Analytical Results

Groundwater Monitoring Field Log
LOBP Monitoring Program

Date: 10/13/2016
Operator: A. Berge, W. Forbes
Well number and location: 30S/10E-13N, LA8
Site and wellhead conditions: Sunny. Active well.

Static water depth (feet): (pumping)
Well depth (feet): 350
Water column (feet): 215
Casing diameter (inches): 8
Minimum purge volume (gal) flush line
Purge rate (gpm): --
Pumping water level (feet): --
Pump setting (feet): --
Minimum purge time (min): flush line
Time begin purge: 9:07

Time	Gallons	EC µS/cm	pH	Temp. °c	Comments*
9:08	150	473	7.20	18.2	Clear, colorless, odorless
					Sampled @ 9:08 AM

*Turbidity, color, odor, sheen, debris, etc.

Groundwater Monitoring Field Log
LOBP Monitoring Program

Date: 10/10/2016
Operator: A. Berge, W. Forbes
Well number and location: 30S/11E-12J1, LA11
Site and wellhead conditions: Cloudy, cap on and secure, ice plant overgrowth.

Static water depth (feet): 7.61
Well depth (feet): 389
Water column (feet): 381.39
Casing diameter (inches): 2
Minimum purge volume (gal) 187
Purge rate (gpm): 2
Pumping water level (feet): 13.98
Pump setting (feet): 26
Minimum purge time (min): 93
Time begin purge: 10:34

Time	Gallons	EC µS/cm	pH	Temp. °c	Comments*
10:34	2	1,571	8.41	18	Clear, colorless, odorless
10:37	5	1,212	8.15	18.1	Clear, colorless, odorless
10:40	10	1,192	7.87	18.1	Clear, colorless, odorless
10:46	20	1,174	7.73	18.6	Clear, colorless, odorless
10:58	45	1,167	7.57	19.6	Clear, colorless, odorless
11:12	70	1,370	7.53	20.1	Cloudy, turbid, odorless
11:24	95	1,370	7.55	20.2	Cloudy, slightly turbid, odorless
11:38	120	1,348	7.43	20.5	Very cloudy, colorless, odorless
11:51	145	1,355	7.54	20.7	Clear, colorless, odorless
12:04	170	1,351	7.53	20.6	Clear, colorless, odorless
12:15	190	1,351	7.55	20.9	Slightly cloudy, colorless, odorless
					Sampled @ 12:15 PM

*Turbidity, color, odor, sheen, debris, etc.

Groundwater Monitoring Field Log
LOBP Monitoring Program

Date: 10/11/2016
Operator: A. Berge, W. Forbes
Well number and location: 30S/11E-7Q3, LA12
Site and wellhead conditions: Wellhead secure. Active well.

Static water depth (feet): (pumping)
Well depth (feet): 270
Water column (feet):
Casing diameter (inches): 10
Minimum purge volume (gal) flush line
Purge rate (gpm): --
Pumping water level (feet): --
Pump setting (feet): --
Minimum purge time (min): flush line
Time begin purge: 13:22

Time	Gallons	EC µS/cm	pH	Temp. °c	Comments*
13:23	360				Clear, colorless, odorless
					Sampled @ 13:23 PM
12:14	360	853	7.44	21	Field measurements obtained on 10/12/16

*Turbidity, color, odor, sheen, debris, etc.

Groundwater Monitoring Field Log
LOBP Monitoring Program

Date: 10/11/2016
Operator: A. Berge
Well number and location: 30S/11E-18L2, LA15
Site and wellhead conditions: Site secure, sampled from spigot. Active well.

Static water depth (feet): (pumping)
Well depth (feet): 394
Water column (feet): --
Casing diameter (inches): 12
Minimum purge volume (gal) flush line
Purge rate (gpm): --
Pumping water level (feet): --
Pump setting (feet): --
Minimum purge time (min): flush line
Time begin purge: 13:42

Time	Gallons	EC µS/cm	pH	Temp. °c	Comments*
13:43	350				Clear, colorless, odorless
					Sampled @13:43 PM
12:02	350	678	7.29	19.7	Field measurements obtained on 10/12/16

*Turbidity, color, odor, sheen, debris, etc.

Groundwater Monitoring Field Log
LOBP Monitoring Program

Date: 10/18/2016
Operator: A. Berge, W. Forbes
Well number and location: 30S/11E-18K8, LA18
Site and wellhead conditions: Sunny, breezy, warm. Both monuments intact.
Caps on and secure.

Static water depth (feet): 142.35
Well depth (feet): 650
Water column (feet): 507.65
Casing diameter (inches): 2
Minimum purge volume (gal) 249
Purge rate (gpm): 1.6
Pumping water level (feet): 142.32
Pump setting (feet): 150
Minimum purge time (min): 3
Time begin purge: 10:00

Time	Gallons	EC µS/cm	pH	Temp. °c	Comments*
10:00	1	471	7.42	20.3	Clear, Colorless, Odorless
10:07	5	585	7.35	21.5	Clear, Colorless, Odorless
10:12	10	627	7.41	21.1	Clear, Colorless, Odorless
10:19	20	641	7.53	21.1	CCO, pumped moved up to 350 Hz
10:25	30	643	7.57	21.5	Clear, Colorless, Odorless
10:37	50	644	7.55	21.9	Clear, Colorless, Odorless
10:56	80	641	7.58	22.6	Clear, Colorless, Odorless
11:20	120	642	7.64	22.8	Clear, Colorless, Odorless
11:51	170	640	7.65	22.9	Clear, Colorless, Odorless
12:23	220	644	7.71	23.2	Clear, Colorless, Odorless
12:35	240	639	7.76	23	Clear, Colorless, Odorless
					Sampled @ 12:36 PM

*Turbidity, color, odor, sheen, debris, etc.

Groundwater Monitoring Field Log
LOBP Monitoring Program

Date: 10/13/2016
Operator: A. Berge, W. Forbes
Well number and location: 30S/11E-17E8, LA22
Site and wellhead conditions: Sunny, monument intact

Static water depth (feet): 129.27
Well depth (feet): 390
Water column (feet): 260.73
Casing diameter (inches): 2
Minimum purge volume (gal) 128
Purge rate (gpm): 1
Pumping water level (feet): 129.78
Pump setting (feet): 140
Minimum purge time (min): 123
Time begin purge: 11:42

Time	Gallons	EC µS/cm	pH	Temp. °c	Comments*
11:42	1	125.5	8.07	19.5	Cloudy, no odor
11:49	5	493	7.67	19.3	Slightly cloudy, no color, no odor
11:54	10	520	7.74	19.3	Clear, colorless, odorless
12:00	15	510	7.69	19.4	Clear, colorless, odorless
12:06	20	507	7.55	19.5	Clear, colorless, odorless
12:12	25	503	7.46	19.6	Clear, colorless, odorless
12:24	35	497	7.37	19.3	Clear, colorless, odorless
12:36	45	500	7.30	20	Clear, colorless, odorless
12:50	55	499	7.26	20.1	Clear, colorless, odorless
13:02	65	499	7.23	19.9	Clear, colorless, odorless
13:24	85	503	7.23	20.1	Clear, colorless, odorless
13:50	105	505	7.24	19.9	Clear, colorless, odorless
13:17	125	504	7.34	20.1	Clear, colorless, odorless
					Sampled @ 13:19 PM

*Turbidity, color, odor, sheen, debris, etc.

Groundwater Monitoring Field Log
LOBP Monitoring Program

Date: 10/19/2016
Operator: A. Berge, W. Forbes
Well number and location: 30S/11E-13M2, LA31
Site and wellhead conditions: Sunny, warm. Active well.

Static water depth (feet): 38.63
Well depth (feet): 492
Water column (feet): 453.37
Casing diameter (inches): 6
Minimum purge volume (gal) flush line
Purge rate (gpm): --
Pumping water level (feet): --
Pump setting (feet): --
Minimum purge time (min): flush line
Time begin purge: 11:05

Time	Gallons	EC µS/cm	pH	Temp. °c	Comments*
11:05	1	3.56	6.44	19.2	Clear, colorless, odorless
11:07	5	3.58	6.58	18.9	Clear, colorless, odorless
11:10	10	3.56	6.66	18.8	Clear, colorless, odorless
11:11	15	3.57	6.75	19	Clear, colorless, odorless
					Sampled @ 11:13 AM

*Turbidity, color, odor, sheen, debris, etc.

Groundwater Monitoring Field Log
LOBP Monitoring Program

Date: 10/11/2016
Operator: A. Berge
Well number and location: 30S/11E-18K9, LA32
Site and wellhead conditions: Wellhead secure. Sampled from spigot. Active Well.

Static water depth (feet): (pumping)
Well depth (feet): 490
Water column (feet): --
Casing diameter (inches): 14
Minimum purge volume (gal) flush line
Purge rate (gpm): --
Pumping water level (feet): --
Pump setting (feet): --
Minimum purge time (min): flush line
Time begin purge: 13:34

Time	Gallons	EC µS/cm	pH	Temp. °c	Comments*
13:35	300				Clear, colorless, odorless
					Sampled @ 13:35 PM
11:53	300	538	7.58	21.8	Field measurements obtained on 10/12/16

*Turbidity, color, odor, sheen, debris, etc.

October 27, 2016

Lab ID : CC 1683577-002
Customer ID : 8-514

Cleath-Harris Geologists
Attn: Spencer Harris
71 Zaca Lane
Suite 140
San Luis Obispo, CA 93401

Sampled On : October 13, 2016-09:08
Sampled By : Wolfgang Forbes
Received On : October 13, 2016-15:01
Matrix : Ground Water

Description : LA-8-(13N) LA-8
Project : Los Osos BMC Monitoring

Sample Result - Inorganic

Constituent	Result	PQL	Units	Note	Sample Preparation Method	Sample Preparation Date/ID	Sample Analysis Method	Sample Analysis Date/ID
General Mineral[P:1'5]								
Total Hardness as CaCO3	104	--	mg/L		200.7	10/17/16:212475	200.7	10/17/16:215185
Calcium	17	1	mg/L		200.7	10/17/16:212475	200.7	10/17/16:215185
Magnesium	15	1	mg/L		200.7	10/17/16:212475	200.7	10/17/16:215185
Potassium	1	1	mg/L		200.7	10/17/16:212475	200.7	10/17/16:215185
Sodium	40	1	mg/L		200.7	10/17/16:212475	200.7	10/17/16:215185
Total Cations	3.8	--	meq/L		200.7	10/17/16:212475	200.7	10/17/16:215185
Boron	ND	0.1	mg/L		200.7	10/17/16:212475	200.7	10/17/16:215185
Copper	ND	10	ug/L		200.7	10/17/16:212475	200.7	10/17/16:215185
Iron	ND	30	ug/L		200.7	10/17/16:212475	200.7	10/17/16:215185
Manganese	ND	10	ug/L		200.7	10/17/16:212475	200.7	10/17/16:215185
Zinc	ND	20	ug/L		200.7	10/17/16:212475	200.7	10/17/16:215185
SAR	1.7	--	--		200.7	10/17/16:212475	200.7	10/17/16:215185
Total Alkalinity (as CaCO3)	40	10	mg/L		2320B	10/15/16:212469	2320B	10/15/16:215109
Hydroxide as OH	ND	10	mg/L		2320B	10/15/16:212469	2320B	10/15/16:215109
Carbonate as CO3	ND	10	mg/L		2320B	10/15/16:212469	2320B	10/15/16:215109
Bicarbonate as HCO3	50	10	mg/L		2320B	10/15/16:212469	2320B	10/15/16:215109
Sulfate	12.0	0.5	mg/L		300.0	10/17/16:212544	300.0	10/17/16:215437
Chloride	79	1	mg/L		300.0	10/17/16:212544	300.0	10/17/16:215437
Nitrate as NO3	31.9	0.5	mg/L		300.0	10/17/16:212544	300.0	10/17/16:215437
Nitrite as N	ND	0.2	mg/L		300.0	10/17/16:212544	300.0	10/17/16:215437
Nitrate + Nitrite as N	7.2	0.1	mg/L		300.0	10/17/16:212544	300.0	10/17/16:215437
Fluoride	0.1	0.1	mg/L		300.0	10/17/16:212544	300.0	10/17/16:215437
Total Anions	3.8	--	meq/L		2320B	10/15/16:212469	2320B	10/15/16:215109
pH	8.0	--	units		4500-H B	10/19/16:212636	4500HB	10/19/16:215310
Specific Conductance	470	1	umhos/cm		2510B	10/17/16:212505	2510B	10/17/16:215123
Total Dissolved Solids	320	20	mg/L		2540CE	10/18/16:212564	2540C	10/19/16:215271
MBAS Screen	Negative	0.1	mg/L		5540C	10/14/16:212846	5540C	10/14/16:215558
Aggressiveness Index	11.2	--	--		4500-H B	10/19/16:212636	4500HB	10/19/16:215310
Langelier Index (20°C)	-0.6	--	--		4500-H B	10/19/16:212636	4500HB	10/19/16:215310
Nitrate Nitrogen	7.2	--	mg/L		300.0	10/17/16:212544	300.0	10/17/16:215437

ND=Non-Detected. PQL=Practical Quantitation Limit. Containers: (P) Plastic Preservatives: HNO3 pH < 2 ‡Surrogate. * PQL adjusted for dilution.

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November 3, 2016

Cleath-Harris Geologists
Attn: Spencer Harris
71 Zaca Lane
Suite 140
San Luis Obispo, CA 93401
Description : Cabrillo Well LA-9
Project : Los Osos BMC Monitoring

Lab ID : CC 1683569-003
Customer ID : 8-514

Sampled On : October 12, 2016-11:30
Sampled By : Zac Reineke
Received On : October 12, 2016-14:59
Matrix : Ground Water

Sample Result - Inorganic

Constituent	Result	PQL	Units	Note	Sample Preparation Method	Sample Preparation Date/ID	Sample Analysis Method	Sample Analysis Date/ID
General Mineral								
Total Hardness as CaCO3	111	--	mg/L		200.7	10/13/16:212393	200.7	10/13/16:215025
Calcium	18	1	mg/L		200.7	10/13/16:212393	200.7	10/13/16:215025
Magnesium	16	1	mg/L		200.7	10/13/16:212393	200.7	10/13/16:215025
Potassium	1	1	mg/L		200.7	10/13/16:212393	200.7	10/13/16:215025
Sodium	44	1	mg/L		200.7	10/13/16:212393	200.7	10/13/16:215025
Total Cations	4.2	--	meq/L		200.7	10/13/16:212393	200.7	10/13/16:215025
Boron	ND	0.1	mg/L		200.7	10/13/16:212393	200.7	10/13/16:215025
Copper	ND	10	ug/L		200.7	10/13/16:212393	200.7	10/13/16:215025
Iron	ND	30	ug/L		200.7	10/13/16:212393	200.7	10/13/16:215025
Manganese	ND	10	ug/L		200.7	10/13/16:212393	200.7	10/13/16:215025
Zinc	ND	20	ug/L		200.7	10/13/16:212393	200.7	10/13/16:215025
SAR	1.8	--	--		200.7	10/13/16:212393	200.7	10/13/16:215025
Total Alkalinity (as CaCO3)	60	10	mg/L		2320B	10/14/16:212420	2320B	10/14/16:215083
Hydroxide as OH	ND	10	mg/L		2320B	10/14/16:212420	2320B	10/14/16:215083
Carbonate as CO3	ND	10	mg/L		2320B	10/14/16:212420	2320B	10/14/16:215083
Bicarbonate as HCO3	70	10	mg/L		2320B	10/14/16:212420	2320B	10/14/16:215083
Sulfate	15.1	0.5	mg/L		300.0	10/13/16:212402	300.0	10/13/16:215189
Chloride	93	1	mg/L		300.0	10/13/16:212402	300.0	10/13/16:215189
Nitrate as NO3	24.4	0.5	mg/L		300.0	10/13/16:212402	300.0	10/13/16:215189
Nitrite as N	ND	0.2	mg/L		300.0	10/13/16:212402	300.0	10/13/16:215189
Nitrate + Nitrite as N	5.5	0.1	mg/L		300.0	10/13/16:212402	300.0	10/13/16:215189
Fluoride	0.3	0.1	mg/L		300.0	10/13/16:212402	300.0	10/13/16:215189
Total Anions	4.5	--	meq/L		2320B	10/14/16:212420	2320B	10/14/16:215083
pH	7.1	--	units		4500-H B	10/14/16:212437	4500HB	10/14/16:215047
Specific Conductance	506	1	umhos/cm		2510B	10/14/16:212424	2510B	10/14/16:215034
Total Dissolved Solids	320	20	mg/L		2540CE	10/13/16:212384	2540C	10/14/16:215035
MBAS Screen	Negative	0.1	mg/L		5540C	10/13/16:212453	5540C	10/13/16:215061
Aggressiveness Index	10.5	--	--		4500-H B	10/14/16:212437	4500HB	10/14/16:215047
Langelier Index (20°C)	-1.3	--	--		4500-H B	10/14/16:212437	4500HB	10/14/16:215047
Nitrate Nitrogen	5.5	--	mg/L		300.0	10/13/16:212402	300.0	10/13/16:215189

ND=Non-Detected. PQL=Practical Quantitation Limit. * PQL adjusted for dilution.

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November 3, 2016

Lab ID : CC 1683569-002
Customer ID : 8-514

Cleath-Harris Geologists
Attn: Spencer Harris
71 Zaca Lane
Suite 140
San Luis Obispo, CA 93401

Sampled On : October 12, 2016-10:50
Sampled By : Zac Reineke
Received On : October 12, 2016-14:59
Matrix : Ground Water

Description : Rosina Well LA-10
Project : Los Osos BMC Monitoring

Sample Result - Inorganic

Constituent	Result	PQL	Units	Note	Sample Preparation		Sample Analysis	
					Method	Date/ID	Method	Date/ID
General Mineral								
Total Hardness as CaCO3	509	--	mg/L		200.7	10/13/16:212393	200.7	10/13/16:215025
Calcium	82	1	mg/L		200.7	10/13/16:212393	200.7	10/13/16:215025
Magnesium	74	1	mg/L		200.7	10/13/16:212393	200.7	10/13/16:215025
Potassium	2	1	mg/L		200.7	10/13/16:212393	200.7	10/13/16:215025
Sodium	44	1	mg/L		200.7	10/13/16:212393	200.7	10/13/16:215025
Total Cations	12.1	--	meq/L		200.7	10/13/16:212393	200.7	10/13/16:215025
Boron	ND	0.1	mg/L		200.7	10/13/16:212393	200.7	10/13/16:215025
Copper	ND	10	ug/L		200.7	10/13/16:212393	200.7	10/13/16:215025
Iron	90	30	ug/L		200.7	10/13/16:212393	200.7	10/13/16:215025
Manganese	ND	10	ug/L		200.7	10/13/16:212393	200.7	10/13/16:215025
Zinc	ND	20	ug/L		200.7	10/13/16:212393	200.7	10/13/16:215025
SAR	0.8	--	--		200.7	10/13/16:212393	200.7	10/13/16:215025
Total Alkalinity (as CaCO3)	50	10	mg/L		2320B	10/21/16:212707	2320B	10/21/16:215390
Hydroxide as OH	ND	10	mg/L		2320B	10/21/16:212707	2320B	10/21/16:215390
Carbonate as CO3	ND	10	mg/L		2320B	10/21/16:212707	2320B	10/21/16:215390
Bicarbonate as HCO3	60	10	mg/L		2320B	10/21/16:212707	2320B	10/21/16:215390
Sulfate	26.7	0.5	mg/L		300.0	10/25/16:212912	300.0	10/25/16:215664
Chloride	389	5*	mg/L		300.0	10/25/16:212912	300.0	10/25/16:215664
Nitrate as NO3	8.0	0.5	mg/L		300.0	10/13/16:212402	300.0	10/13/16:215189
Nitrite as N	ND	0.2	mg/L		300.0	10/13/16:212402	300.0	10/13/16:215189
Nitrate + Nitrite as N	1.8	0.1	mg/L		300.0	10/13/16:212402	300.0	10/13/16:215189
Fluoride	ND	0.1	mg/L		300.0	10/13/16:212402	300.0	10/13/16:215189
Total Anions	12.6	--	meq/L		2320B	10/21/16:212707	2320B	10/21/16:215390
pH	6.8	--	units		4500-H B	10/14/16:212437	4500HB	10/14/16:215047
Specific Conductance	1430	1	umhos/cm		2510B	10/14/16:212424	2510B	10/14/16:215034
Total Dissolved Solids	1100	20	mg/L		2540CE	10/13/16:212384	2540C	10/14/16:215035
MBAS Screen	Negative	0.1	mg/L		5540C	10/13/16:212453	5540C	10/13/16:215061
Aggressiveness Index	10.8	--	--		4500-H B	10/14/16:212437	4500HB	10/14/16:215047
Langelier Index (20°C)	-1.1	--	--		4500-H B	10/14/16:212437	4500HB	10/14/16:215047
Nitrate Nitrogen	1.8	--	mg/L		300.0	10/13/16:212402	300.0	10/13/16:215189

ND=Non-Detected. PQL=Practical Quantitation Limit. * PQL adjusted for dilution.

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October 25, 2016

Lab ID : CC 1683528-001
Customer ID : 8-514

Cleath-Harris Geologists
Attn: Spencer Harris
71 Zaca Lane
Suite 140
San Luis Obispo, CA 93401

Sampled On : October 10, 2016-12:15
Sampled By : Wolfgang Forbes, And
Received On : October 10, 2016-14:57
Matrix : Ground Water

Description : LA-11-(12J1) LA-11
Project : Los Osos BMC Monitoring

Sample Result - Inorganic

Constituent	Result	PQL	Units	Note	Sample Preparation		Sample Analysis	
					Method	Date/ID	Method	Date/ID
General Mineral[P:1'5]								
Total Hardness as CaCO3	497	--	mg/L		200.7	10/12/16:212320	200.7	10/12/16:214946
Calcium	69	1	mg/L		200.7	10/12/16:212320	200.7	10/12/16:214946
Magnesium	79	1	mg/L		200.7	10/12/16:212320	200.7	10/12/16:214946
Potassium	4	1	mg/L		200.7	10/12/16:212320	200.7	10/12/16:214946
Sodium	81	1	mg/L		200.7	10/12/16:212320	200.7	10/12/16:214946
Total Cations	13.6	--	meq/L		200.7	10/12/16:212320	200.7	10/12/16:214946
Boron	0.2	0.1	mg/L		200.7	10/12/16:212320	200.7	10/12/16:214946
Copper	ND	10	ug/L		200.7	10/12/16:212320	200.7	10/12/16:214946
Iron	140	30	ug/L		200.7	10/12/16:212320	200.7	10/12/16:214946
Manganese	40	10	ug/L		200.7	10/12/16:212320	200.7	10/12/16:214946
Zinc	ND	20	ug/L		200.7	10/12/16:212320	200.7	10/12/16:214946
SAR	1.6	--	--		200.7	10/12/16:212320	200.7	10/12/16:214946
Total Alkalinity (as CaCO3)	290	10	mg/L		2320B	10/13/16:212351	2320B	10/13/16:214944
Hydroxide as OH	ND	10	mg/L		2320B	10/13/16:212351	2320B	10/13/16:214944
Carbonate as CO3	ND	10	mg/L		2320B	10/13/16:212351	2320B	10/13/16:214944
Bicarbonate as HCO3	350	10	mg/L		2320B	10/13/16:212351	2320B	10/13/16:214944
Sulfate	189	0.5	mg/L		300.0	10/11/16:212304	300.0	10/11/16:214892
Chloride	173	5*	mg/L		300.0	10/11/16:212304	300.0	10/11/16:214892
Nitrate as NO3	ND	0.5	mg/L		300.0	10/11/16:212304	300.0	10/11/16:214892
Nitrite as N	ND	0.2	mg/L		300.0	10/11/16:212304	300.0	10/11/16:214892
Nitrate + Nitrite as N	ND	0.1	mg/L		300.0	10/11/16:212304	300.0	10/11/16:214892
Fluoride	0.3	0.1	mg/L		300.0	10/11/16:212304	300.0	10/11/16:214892
Total Anions	14.6	--	meq/L		2320B	10/13/16:212351	2320B	10/13/16:214944
pH	7.1	--	units		4500-H B	10/13/16:212389	4500HB	10/13/16:214983
Specific Conductance	1370	1	umhos/cm		2510B	10/12/16:212301	2510B	10/12/16:214883
Total Dissolved Solids	930	20	mg/L		2540CE	10/11/16:212282	2540C	10/12/16:214884
MBAS Extraction	ND	0.1	mg/L		5540C	10/11/16:212339	5540C	10/11/16:214927
Aggressiveness Index	11.8	--	--		4500-H B	10/13/16:212389	4500HB	10/13/16:214983
Langelier Index (20°C)	-0.1	--	--		4500-H B	10/13/16:212389	4500HB	10/13/16:214983
Nitrate Nitrogen	ND	--	mg/L		300.0	10/11/16:212304	300.0	10/11/16:214892

ND=Non-Detected. PQL=Practical Quantitation Limit. Containers: (P) Plastic Preservatives: HNO3 pH < 2 ‡Surrogate. * PQL adjusted for dilution.

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ENVIRONMENTAL FGL AGRICULTURAL
Analytical Chemists

October 25, 2016

Cleath-Harris Geologists
Attn: Spencer Harris
71 Zaca Lane
Suite 140
San Luis Obispo, CA 93401
Description : LA-12-(7Q3) LA-12
Project : Los Osos BMC Monitoring

Lab ID : CC 1683549-001
Customer ID : 8-514

Sampled On : October 11, 2016-13:23
Sampled By : Wolfgang Forbes
Received On : October 11, 2016-14:45
Matrix : Ground Water

Sample Result - Inorganic

Constituent	Result	PQL	Units	Note	Sample Preparation		Sample Analysis	
					Method	Date/ID	Method	Date/ID
General MineralP:1'5								
Total Hardness as CaCO3	278	--	mg/L		200.7	10/12/16:212320	200.7	10/12/16:214946
Calcium	44	1	mg/L		200.7	10/12/16:212320	200.7	10/12/16:214946
Magnesium	41	1	mg/L		200.7	10/12/16:212320	200.7	10/12/16:214946
Potassium	2	1	mg/L		200.7	10/12/16:212320	200.7	10/12/16:214946
Sodium	52	1	mg/L		200.7	10/12/16:212320	200.7	10/12/16:214946
Total Cations	7.9	--	meq/L		200.7	10/12/16:212320	200.7	10/12/16:214946
Boron	0.2	0.1	mg/L		200.7	10/12/16:212320	200.7	10/12/16:214946
Copper	ND	10	ug/L		200.7	10/12/16:212320	200.7	10/12/16:214946
Iron	60	30	ug/L		200.7	10/12/16:212320	200.7	10/12/16:214946
Manganese	50	10	ug/L		200.7	10/12/16:212320	200.7	10/12/16:214946
Zinc	40	20	ug/L		200.7	10/12/16:212320	200.7	10/12/16:214946
SAR	1.4	--	--		200.7	10/12/16:212320	200.7	10/12/16:214946
Total Alkalinity (as CaCO3)	230	10	mg/L		2320B	10/13/16:212357	2320B	10/13/16:214981
Hydroxide as OH	ND	10	mg/L		2320B	10/13/16:212357	2320B	10/13/16:214981
Carbonate as CO3	ND	10	mg/L		2320B	10/13/16:212357	2320B	10/13/16:214981
Bicarbonate as HCO3	280	10	mg/L		2320B	10/13/16:212357	2320B	10/13/16:214981
Sulfate	46.2	0.5	mg/L		300.0	10/12/16:212365	300.0	10/12/16:214995
Chloride	93	1	mg/L		300.0	10/12/16:212365	300.0	10/12/16:214995
Nitrate as NO3	ND	0.5	mg/L		300.0	10/12/16:212365	300.0	10/12/16:214995
Nitrite as N	ND	0.2	mg/L		300.0	10/12/16:212365	300.0	10/12/16:214995
Nitrate + Nitrite as N	ND	0.1	mg/L		300.0	10/12/16:212365	300.0	10/12/16:214995
Fluoride	0.2	0.1	mg/L		300.0	10/12/16:212365	300.0	10/12/16:214995
Total Anions	8.2	--	meq/L		2320B	10/13/16:212357	2320B	10/13/16:214981
pH	4.9	--	units		4500-H B	10/14/16:212437	4500HB	10/14/16:215047
Specific Conductance	827	1	umhos/cm		2510B	10/13/16:212367	2510B	10/13/16:214961
Total Dissolved Solids	490	20	mg/L		2540CE	10/12/16:212318	2540C	10/13/16:214959
MBAS Screen	Negative	0.1	mg/L		5540C	10/12/16:212452	5540C	10/12/16:215060
Aggressiveness Index	9.3	--	--		4500-H B	10/14/16:212437	4500HB	10/14/16:215047
Langelier Index (20°C)	-2.6	--	--		4500-H B	10/14/16:212437	4500HB	10/14/16:215047
Nitrate Nitrogen	ND	--	mg/L		300.0	10/12/16:212365	300.0	10/12/16:214995

ND=Non-Detected. PQL=Practical Quantitation Limit. Containers: (P) Plastic Preservatives: HNO3 pH < 2 ‡Surrogate. * PQL adjusted for dilution.

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CA ELAP Certification No. 2810

October 25, 2016

Cleath-Harris Geologists
Attn: Spencer Harris
71 Zaca Lane
Suite 140
San Luis Obispo, CA 93401
Description : LA-15-(18L2) LA-15
Project : Los Osos BMC Monitoring

Lab ID : CC 1683549-003
Customer ID : 8-514

Sampled On : October 11, 2016-13:43
Sampled By : Wolfgang Forbes
Received On : October 11, 2016-14:45
Matrix : Ground Water

Sample Result - Inorganic

Constituent	Result	PQL	Units	Note	Sample Preparation Method	Sample Preparation Date/ID	Sample Analysis Method	Sample Analysis Date/ID
General Mineral[P:1'5]								
Total Hardness as CaCO3	221	--	mg/L		200.7	10/12/16:212320	200.7	10/12/16:214946
Calcium	36	1	mg/L		200.7	10/12/16:212320	200.7	10/12/16:214946
Magnesium	32	1	mg/L		200.7	10/12/16:212320	200.7	10/12/16:214946
Potassium	1	1	mg/L		200.7	10/12/16:212320	200.7	10/12/16:214946
Sodium	35	1	mg/L		200.7	10/12/16:212320	200.7	10/12/16:214946
Total Cations	6.0	--	meq/L		200.7	10/12/16:212320	200.7	10/12/16:214946
Boron	ND	0.1	mg/L		200.7	10/12/16:212320	200.7	10/12/16:214946
Copper	ND	10	ug/L		200.7	10/12/16:212320	200.7	10/12/16:214946
Iron	70	30	ug/L		200.7	10/12/16:212320	200.7	10/12/16:214946
Manganese	ND	10	ug/L		200.7	10/12/16:212320	200.7	10/12/16:214946
Zinc	ND	20	ug/L		200.7	10/12/16:212320	200.7	10/12/16:214946
SAR	1.0	--	--		200.7	10/12/16:212320	200.7	10/12/16:214946
Total Alkalinity (as CaCO3)	160	10	mg/L		2320B	10/13/16:212357	2320B	10/13/16:214981
Hydroxide as OH	ND	10	mg/L		2320B	10/13/16:212357	2320B	10/13/16:214981
Carbonate as CO3	ND	10	mg/L		2320B	10/13/16:212357	2320B	10/13/16:214981
Bicarbonate as HCO3	200	10	mg/L		2320B	10/13/16:212357	2320B	10/13/16:214981
Sulfate	25.5	0.5	mg/L		300.0	10/12/16:212365	300.0	10/12/16:214995
Chloride	91	1	mg/L		300.0	10/12/16:212365	300.0	10/12/16:214995
Nitrate as NO3	7.3	0.5	mg/L		300.0	10/12/16:212365	300.0	10/12/16:214995
Nitrite as N	ND	0.2	mg/L		300.0	10/12/16:212365	300.0	10/12/16:214995
Nitrate + Nitrite as N	1.6	0.1	mg/L		300.0	10/12/16:212365	300.0	10/12/16:214995
Fluoride	0.2	0.1	mg/L		300.0	10/12/16:212365	300.0	10/12/16:214995
Total Anions	6.5	--	meq/L		2320B	10/13/16:212357	2320B	10/13/16:214981
pH	7.0	--	units		4500-H B	10/14/16:212437	4500HB	10/14/16:215047
Specific Conductance	694	1	umhos/cm		2510B	10/13/16:212367	2510B	10/13/16:214961
Total Dissolved Solids	380	20	mg/L		2540CE	10/12/16:212318	2540C	10/13/16:214959
MBAS Screen	Negative	0.1	mg/L		5540C	10/12/16:212452	5540C	10/12/16:215060
Aggressiveness Index	11.2	--	--		4500-H B	10/14/16:212437	4500HB	10/14/16:215047
Langelier Index (20°C)	-0.7	--	--		4500-H B	10/14/16:212437	4500HB	10/14/16:215047
Nitrate Nitrogen	1.6	--	mg/L		300.0	10/12/16:212365	300.0	10/12/16:214995

ND=Non-Detected. PQL=Practical Quantitation Limit. Containers: (P) Plastic Preservatives: HNO3 pH < 2 ‡Surrogate. * PQL adjusted for dilution.

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November 3, 2016

Cleath-Harris Geologists
Attn: Spencer Harris
71 Zaca Lane
Suite 140
San Luis Obispo, CA 93401
Description : LA-18 18K8 LA-18
Project : Los Osos BMC Monitoring

Lab ID : CC 1683632-001
Customer ID : 8-514

Sampled On : October 18, 2016-12:36
Sampled By : Andrea Berge
Received On : October 18, 2016-14:42
Matrix : Ground Water

Sample Result - Inorganic

Constituent	Result	PQL	Units	Note	Sample Preparation Method	Sample Preparation Date/ID	Sample Analysis Method	Sample Analysis Date/ID
General Mineral								
Total Hardness as CaCO3	256	--	mg/L		200.7	10/19/16:212632	200.7	10/19/16:215334
Calcium	53	1	mg/L		200.7	10/19/16:212632	200.7	10/19/16:215334
Magnesium	30	1	mg/L		200.7	10/19/16:212632	200.7	10/19/16:215334
Potassium	2	1	mg/L		200.7	10/19/16:212632	200.7	10/19/16:215334
Sodium	26	1	mg/L		200.7	10/19/16:212632	200.7	10/19/16:215334
Total Cations	6.3	--	meq/L		200.7	10/19/16:212632	200.7	10/19/16:215334
Boron	ND	0.1	mg/L		200.7	10/19/16:212632	200.7	10/19/16:215334
Copper	ND	10	ug/L		200.7	10/19/16:212632	200.7	10/19/16:215334
Iron	ND	30	ug/L		200.7	10/19/16:212632	200.7	10/19/16:215334
Manganese	80	10	ug/L		200.7	10/19/16:212632	200.7	10/19/16:215334
Zinc	ND	20	ug/L		200.7	10/19/16:212632	200.7	10/19/16:215334
SAR	0.7	--	--		200.7	10/19/16:212632	200.7	10/19/16:215334
Total Alkalinity (as CaCO3)	240	10	mg/L		2320B	10/21/16:212704	2320B	10/21/16:215415
Hydroxide as OH	ND	10	mg/L		2320B	10/21/16:212704	2320B	10/21/16:215415
Carbonate as CO3	ND	10	mg/L		2320B	10/21/16:212704	2320B	10/21/16:215415
Bicarbonate as HCO3	290	10	mg/L		2320B	10/21/16:212704	2320B	10/21/16:215415
Sulfate	35.9	0.5	mg/L		300.0	10/19/16:212660	300.0	10/19/16:215760
Chloride	31	1	mg/L		300.0	10/19/16:212660	300.0	10/19/16:215760
Nitrate as NO3	ND	0.5	mg/L		300.0	10/19/16:212660	300.0	10/19/16:215760
Nitrite as N	ND	0.2	mg/L		300.0	10/19/16:212660	300.0	10/19/16:215760
Nitrate + Nitrite as N	ND	0.1	mg/L		300.0	10/19/16:212660	300.0	10/19/16:215760
Fluoride	0.4	0.1	mg/L		300.0	10/19/16:212660	300.0	10/19/16:215760
Total Anions	6.4	--	meq/L		2320B	10/21/16:212704	2320B	10/21/16:215415
pH	6.8	--	units		4500-H B	10/21/16:212745	4500HB	10/21/16:215435
Specific Conductance	615	1	umhos/cm		2510B	10/20/16:212670	2510B	10/20/16:215343
Total Dissolved Solids	370	20	mg/L		2540CE	10/21/16:212739	2540C	10/24/16:215485
MBAS Extraction	ND	0.1	mg/L		5540C	10/19/16:212652	5540C	10/19/16:215327
Aggressiveness Index	11.3	--	--		4500-H B	10/21/16:212745	4500HB	10/21/16:215435
Langelier Index (20°C)	-0.5	--	--		4500-H B	10/21/16:212745	4500HB	10/21/16:215435
Nitrate Nitrogen	ND	--	mg/L		300.0	10/19/16:212660	300.0	10/19/16:215760

ND=Non-Detected. PQL=Practical Quantitation Limit. * PQL adjusted for dilution.

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November 3, 2016

Cleath-Harris Geologists
Attn: Spencer Harris
71 Zaca Lane
Suite 140
San Luis Obispo, CA 93401
Description : South Bay Well LA-20
Project : Los Osos BMC Monitoring

Lab ID : CC 1683569-001
Customer ID : 8-514

Sampled On : October 12, 2016-10:35
Sampled By : Zac Reineke
Received On : October 12, 2016-14:59
Matrix : Ground Water

Sample Result - Inorganic

Constituent	Result	PQL	Units	Note	Sample Preparation Method	Sample Preparation Date/ID	Sample Analysis Method	Sample Analysis Date/ID
General Mineral								
Total Hardness as CaCO3	221	--	mg/L		200.7	10/13/16:212393	200.7	10/13/16:215025
Calcium	34	1	mg/L		200.7	10/13/16:212393	200.7	10/13/16:215025
Magnesium	33	1	mg/L		200.7	10/13/16:212393	200.7	10/13/16:215025
Potassium	2	1	mg/L		200.7	10/13/16:212393	200.7	10/13/16:215025
Sodium	40	1	mg/L		200.7	10/13/16:212393	200.7	10/13/16:215025
Total Cations	6.2	--	meq/L		200.7	10/13/16:212393	200.7	10/13/16:215025
Boron	0.1	0.1	mg/L		200.7	10/13/16:212393	200.7	10/13/16:215025
Copper	ND	10	ug/L		200.7	10/13/16:212393	200.7	10/13/16:215025
Iron	90	30	ug/L		200.7	10/13/16:212393	200.7	10/13/16:215025
Manganese	10	10	ug/L		200.7	10/13/16:212393	200.7	10/13/16:215025
Zinc	ND	20	ug/L		200.7	10/13/16:212393	200.7	10/13/16:215025
SAR	1.2	--	--		200.7	10/13/16:212393	200.7	10/13/16:215025
Total Alkalinity (as CaCO3)	240	10	mg/L		2320B	10/14/16:212420	2320B	10/14/16:215083
Hydroxide as OH	ND	10	mg/L		2320B	10/14/16:212420	2320B	10/14/16:215083
Carbonate as CO3	ND	10	mg/L		2320B	10/14/16:212420	2320B	10/14/16:215083
Bicarbonate as HCO3	290	10	mg/L		2320B	10/14/16:212420	2320B	10/14/16:215083
Sulfate	25.2	0.5	mg/L		300.0	10/13/16:212402	300.0	10/13/16:215189
Chloride	40	1	mg/L		300.0	10/13/16:212402	300.0	10/13/16:215189
Nitrate as NO3	2.5	0.5	mg/L		300.0	10/13/16:212402	300.0	10/13/16:215189
Nitrite as N	ND	0.2	mg/L		300.0	10/13/16:212402	300.0	10/13/16:215189
Nitrate + Nitrite as N	0.6	0.1	mg/L		300.0	10/13/16:212402	300.0	10/13/16:215189
Fluoride	0.2	0.1	mg/L		300.0	10/13/16:212402	300.0	10/13/16:215189
Total Anions	6.5	--	meq/L		2320B	10/14/16:212420	2320B	10/14/16:215083
pH	7.0	--	units		4500-H B	10/14/16:212437	4500HB	10/14/16:215047
Specific Conductance	631	1	umhos/cm		2510B	10/14/16:212424	2510B	10/14/16:215034
Total Dissolved Solids	370	20	mg/L		2540CE	10/13/16:212384	2540C	10/14/16:215035
MBAS Screen	Negative	0.1	mg/L		5540C	10/13/16:212453	5540C	10/13/16:215061
Aggressiveness Index	11.3	--	--		4500-H B	10/14/16:212437	4500HB	10/14/16:215047
Langelier Index (20°C)	-0.5	--	--		4500-H B	10/14/16:212437	4500HB	10/14/16:215047
Nitrate Nitrogen	0.6	--	mg/L		300.0	10/13/16:212402	300.0	10/13/16:215189

ND=Non-Detected. PQL=Practical Quantitation Limit. * PQL adjusted for dilution.

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ENVIRONMENTAL FGL AGRICULTURAL
Analytical Chemists

October 27, 2016

Lab ID : CC 1683577-001
Customer ID : 8-514

Cleath-Harris Geologists
Attn: Spencer Harris
71 Zaca Lane
Suite 140
San Luis Obispo, CA 93401
Description : LA-22-(17E8) LA-22
Project : Los Osos BMC Monitoring

Sampled On : October 13, 2016-14:19
Sampled By : Wolfgang Forbes
Received On : October 13, 2016-15:01
Matrix : Ground Water

Sample Result - Inorganic

Constituent	Result	PQL	Units	Note	Sample Preparation		Sample Analysis	
					Method	Date/ID	Method	Date/ID
General Mineral[P:1'5]								
Total Hardness as CaCO3	161	--	mg/L		200.7	10/17/16:212475	200.7	10/17/16:215185
Calcium	25	1	mg/L		200.7	10/17/16:212475	200.7	10/17/16:215185
Magnesium	24	1	mg/L		200.7	10/17/16:212475	200.7	10/17/16:215185
Potassium	1	1	mg/L		200.7	10/17/16:212475	200.7	10/17/16:215185
Sodium	29	1	mg/L		200.7	10/17/16:212475	200.7	10/17/16:215185
Total Cations	4.5	--	meq/L		200.7	10/17/16:212475	200.7	10/17/16:215185
Boron	ND	0.1	mg/L		200.7	10/17/16:212475	200.7	10/17/16:215185
Copper	ND	10	ug/L		200.7	10/17/16:212475	200.7	10/17/16:215185
Iron	ND	30	ug/L		200.7	10/17/16:212475	200.7	10/17/16:215185
Manganese	ND	10	ug/L		200.7	10/17/16:212475	200.7	10/17/16:215185
Zinc	ND	20	ug/L		200.7	10/17/16:212475	200.7	10/17/16:215185
SAR	1.0	--	--		200.7	10/17/16:212475	200.7	10/17/16:215185
Total Alkalinity (as CaCO3)	120	10	mg/L		2320B	10/15/16:212469	2320B	10/15/16:215109
Hydroxide as OH	ND	10	mg/L		2320B	10/15/16:212469	2320B	10/15/16:215109
Carbonate as CO3	ND	10	mg/L		2320B	10/15/16:212469	2320B	10/15/16:215109
Bicarbonate as HCO3	140	10	mg/L		2320B	10/15/16:212469	2320B	10/15/16:215109
Sulfate	11.9	0.5	mg/L		300.0	10/17/16:212544	300.0	10/17/16:215437
Chloride	46	1	mg/L		300.0	10/17/16:212544	300.0	10/17/16:215437
Nitrate as NO3	30.6	0.5	mg/L		300.0	10/17/16:212544	300.0	10/17/16:215437
Nitrite as N	ND	0.2	mg/L		300.0	10/17/16:212544	300.0	10/17/16:215437
Nitrate + Nitrite as N	6.9	0.1	mg/L		300.0	10/17/16:212544	300.0	10/17/16:215437
Fluoride	ND	0.1	mg/L		300.0	10/17/16:212544	300.0	10/17/16:215437
Total Anions	4.3	--	meq/L		2320B	10/15/16:212469	2320B	10/15/16:215109
pH	7.3	--	units		4500-H B	10/19/16:212636	4500HB	10/19/16:215310
Specific Conductance	521	1	umhos/cm		2510B	10/17/16:212505	2510B	10/17/16:215123
Total Dissolved Solids	290	20	mg/L		2540CE	10/18/16:212564	2540C	10/19/16:215271
MBAS Screen	Negative	0.1	mg/L		5540C	10/14/16:212846	5540C	10/14/16:215558
Aggressiveness Index	11.2	--	--		4500-H B	10/19/16:212636	4500HB	10/19/16:215310
Langelier Index (20°C)	-0.7	--	--		4500-H B	10/19/16:212636	4500HB	10/19/16:215310
Nitrate Nitrogen	6.9	--	mg/L		300.0	10/17/16:212544	300.0	10/17/16:215437

ND=Non-Detected. PQL=Practical Quantitation Limit. Containers: (P) Plastic Preservatives: HNO3 pH < 2 ‡Surrogate. * PQL adjusted for dilution.

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November 9, 2016

Lab ID : CC 1683637-001
Customer ID : 8-514

Cleath-Harris Geologists
Attn: Spencer Harris
71 Zaca Lane
Suite 140
San Luis Obispo, CA 93401

Sampled On : October 19, 2016-11:13
Sampled By : Andrea Berge
Received On : October 19, 2016-13:30
Matrix : Ground Water

Description : LA-31 (13M2) LA-31
Project : Los Osos BMC Monitoring

Sample Result - Inorganic

Constituent	Result	PQL	Units	Note	Sample Preparation		Sample Analysis	
					Method	Date/ID	Method	Date/ID
General Mineral								
Total Hardness as CaCO3	722	--	mg/L		200.7	10/24/16:212804	200.7	10/24/16:215539
Calcium	113	1	mg/L		200.7	10/24/16:212804	200.7	10/24/16:215539
Magnesium	107	1	mg/L		200.7	10/24/16:212804	200.7	10/24/16:215539
Potassium	4	1	mg/L		200.7	10/24/16:212804	200.7	10/24/16:215539
Sodium	398	2*	mg/L		200.7	10/24/16:212804	200.7	10/25/16:215638
Total Cations	31.9	--	meq/L		200.7	10/24/16:212804	200.7	10/24/16:215539
Boron	0.2	0.1	mg/L		200.7	10/24/16:212804	200.7	10/24/16:215539
Copper	ND	10	ug/L		200.7	10/24/16:212804	200.7	10/24/16:215539
Iron	40	30	ug/L		200.7	10/24/16:212804	200.7	10/24/16:215539
Manganese	ND	10	ug/L		200.7	10/24/16:212804	200.7	10/24/16:215539
Zinc	ND	20	ug/L		200.7	10/24/16:212804	200.7	10/24/16:215539
SAR	6.4	--	--		200.7	10/24/16:212804	200.7	10/24/16:215539
Total Alkalinity (as CaCO3)	50	10	mg/L		2320B	10/21/16:212704	2320B	10/21/16:215415
Hydroxide as OH	ND	10	mg/L		2320B	10/21/16:212704	2320B	10/21/16:215415
Carbonate as CO3	ND	10	mg/L		2320B	10/21/16:212704	2320B	10/21/16:215415
Bicarbonate as HCO3	70	10	mg/L		2320B	10/21/16:212704	2320B	10/21/16:215415
Sulfate	182	0.5	mg/L		300.0	10/20/16:212702	300.0	10/20/16:215449
Chloride	943	19*	mg/L		300.0	10/20/16:212702	300.0	10/21/16:215449
Nitrate as NO3	2.8	0.5	mg/L		300.0	10/20/16:212702	300.0	10/20/16:215449
Nitrite as N	ND	0.2	mg/L		300.0	10/20/16:212702	300.0	10/20/16:215449
Nitrate + Nitrite as N	0.6	0.1	mg/L		300.0	10/20/16:212702	300.0	10/20/16:215449
Fluoride	ND	0.1	mg/L		300.0	10/20/16:212702	300.0	10/20/16:215449
Total Anions	31.6	--	meq/L		2320B	10/21/16:212704	2320B	10/21/16:215415
pH	7.4	--	units		4500-H B	10/25/16:212875	4500HB	10/25/16:215577
Specific Conductance	3420	1	umhos/cm		2510B	10/21/16:212708	2510B	10/21/16:215393
Total Dissolved Solids	2190	20	mg/L		2540CE	10/24/16:212803	2540C	10/25/16:215563
MBAS Screen	Negative	0.1	mg/L		5540C	10/20/16:212858	5540C	10/20/16:215566
Aggressiveness Index	11.5	--	--		4500-H B	10/25/16:212875	4500HB	10/25/16:215577
Langelier Index (20°C)	-0.4	--	--		4500-H B	10/25/16:212875	4500HB	10/25/16:215577
Nitrate Nitrogen	0.6	--	mg/L		300.0	10/20/16:212702	300.0	10/20/16:215449

ND=Non-Detected. PQL=Practical Quantitation Limit. * PQL adjusted for dilution.

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October 25, 2016

Cleath-Harris Geologists
Attn: Spencer Harris
71 Zaca Lane
Suite 140
San Luis Obispo, CA 93401
Description : LA-32-(18K9) LA-32
Project : Los Osos BMC Monitoring

Lab ID : CC 1683549-002
Customer ID : 8-514

Sampled On : October 11, 2016-13:35
Sampled By : Wolfgang Forbes
Received On : October 11, 2016-14:45
Matrix : Ground Water

Sample Result - Inorganic

Constituent	Result	PQL	Units	Note	Sample Preparation Method	Sample Preparation Date/ID	Sample Analysis Method	Sample Analysis Date/ID
General Mineral[P:1'5]								
Total Hardness as CaCO3	168	--	mg/L		200.7	10/12/16:212320	200.7	10/12/16:214946
Calcium	26	1	mg/L		200.7	10/12/16:212320	200.7	10/12/16:214946
Magnesium	25	1	mg/L		200.7	10/12/16:212320	200.7	10/12/16:214946
Potassium	1	1	mg/L		200.7	10/12/16:212320	200.7	10/12/16:214946
Sodium	34	1	mg/L		200.7	10/12/16:212320	200.7	10/12/16:214946
Total Cations	4.9	--	meq/L		200.7	10/12/16:212320	200.7	10/12/16:214946
Boron	ND	0.1	mg/L		200.7	10/12/16:212320	200.7	10/12/16:214946
Copper	ND	10	ug/L		200.7	10/12/16:212320	200.7	10/12/16:214946
Iron	ND	30	ug/L		200.7	10/12/16:212320	200.7	10/12/16:214946
Manganese	ND	10	ug/L		200.7	10/12/16:212320	200.7	10/12/16:214946
Zinc	ND	20	ug/L		200.7	10/12/16:212320	200.7	10/12/16:214946
SAR	1.1	--	--		200.7	10/12/16:212320	200.7	10/12/16:214946
Total Alkalinity (as CaCO3)	160	10	mg/L		2320B	10/13/16:212357	2320B	10/13/16:214981
Hydroxide as OH	ND	10	mg/L		2320B	10/13/16:212357	2320B	10/13/16:214981
Carbonate as CO3	ND	10	mg/L		2320B	10/13/16:212357	2320B	10/13/16:214981
Bicarbonate as HCO3	200	10	mg/L		2320B	10/13/16:212357	2320B	10/13/16:214981
Sulfate	21.5	0.5	mg/L		300.0	10/12/16:212365	300.0	10/12/16:214995
Chloride	36	1	mg/L		300.0	10/12/16:212365	300.0	10/12/16:214995
Nitrate as NO3	5.3	0.5	mg/L		300.0	10/12/16:212365	300.0	10/12/16:214995
Nitrite as N	ND	0.2	mg/L		300.0	10/12/16:212365	300.0	10/12/16:214995
Nitrate + Nitrite as N	1.2	0.1	mg/L		300.0	10/12/16:212365	300.0	10/12/16:214995
Fluoride	0.2	0.1	mg/L		300.0	10/12/16:212365	300.0	10/12/16:214995
Total Anions	4.8	--	meq/L		2320B	10/13/16:212357	2320B	10/13/16:214981
pH	6.6	--	units		4500-H B	10/14/16:212437	4500HB	10/14/16:215047
Specific Conductance	511	1	umhos/cm		2510B	10/13/16:212367	2510B	10/13/16:214961
Total Dissolved Solids	270	20	mg/L		2540CE	10/12/16:212318	2540C	10/13/16:214959
MBAS Screen	Negative	0.1	mg/L		5540C	10/12/16:212452	5540C	10/12/16:215060
Aggressiveness Index	10.6	--	--		4500-H B	10/14/16:212437	4500HB	10/14/16:215047
Langelier Index (20°C)	-1.2	--	--		4500-H B	10/14/16:212437	4500HB	10/14/16:215047
Nitrate Nitrogen	1.2	--	mg/L		300.0	10/12/16:212365	300.0	10/12/16:214995

ND=Non-Detected. PQL=Practical Quantitation Limit. Containers: (P) Plastic Preservatives: HNO3 pH < 2 ‡Surrogate. * PQL adjusted for dilution.

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November 3, 2016

Lab ID : CC 1683569-004
Customer ID : 8-514

Cleath-Harris Geologists
Attn: Spencer Harris
71 Zaca Lane
Suite 140
San Luis Obispo, CA 93401
Description : Skyline Well UA-3
Project : Los Osos BMC Monitoring

Sampled On : October 12, 2016-11:50
Sampled By : Zac Reineke
Received On : October 12, 2016-14:59
Matrix : Ground Water

Sample Result - Inorganic

Constituent	Result	PQL	Units	Note	Sample Preparation Method	Sample Preparation Date/ID	Sample Analysis Method	Sample Analysis Date/ID
General Mineral								
Total Hardness as CaCO3	123	--	mg/L		200.7	10/13/16:212393	200.7	10/13/16:215025
Calcium	23	1	mg/L		200.7	10/13/16:212393	200.7	10/13/16:215025
Magnesium	16	1	mg/L		200.7	10/13/16:212393	200.7	10/13/16:215025
Potassium	1	1	mg/L		200.7	10/13/16:212393	200.7	10/13/16:215025
Sodium	52	1	mg/L		200.7	10/13/16:212393	200.7	10/13/16:215025
Total Cations	4.8	--	meq/L		200.7	10/13/16:212393	200.7	10/13/16:215025
Boron	ND	0.1	mg/L		200.7	10/13/16:212393	200.7	10/13/16:215025
Copper	20	10	ug/L		200.7	10/13/16:212393	200.7	10/13/16:215025
Iron	90	30	ug/L		200.7	10/13/16:212393	200.7	10/13/16:215025
Manganese	ND	10	ug/L		200.7	10/13/16:212393	200.7	10/13/16:215025
Zinc	ND	20	ug/L		200.7	10/13/16:212393	200.7	10/13/16:215025
SAR	2.0	--	--		200.7	10/13/16:212393	200.7	10/13/16:215025
Total Alkalinity (as CaCO3)	60	10	mg/L		2320B	10/14/16:212420	2320B	10/14/16:215083
Hydroxide as OH	ND	10	mg/L		2320B	10/14/16:212420	2320B	10/14/16:215083
Carbonate as CO3	ND	10	mg/L		2320B	10/14/16:212420	2320B	10/14/16:215083
Bicarbonate as HCO3	80	10	mg/L		2320B	10/14/16:212420	2320B	10/14/16:215083
Sulfate	23.8	0.5	mg/L		300.0	10/13/16:212402	300.0	10/13/16:215189
Chloride	66	1	mg/L		300.0	10/13/16:212402	300.0	10/13/16:215189
Nitrate as NO3	83.8	0.5	mg/L		300.0	10/13/16:212402	300.0	10/13/16:215189
Nitrite as N	ND	0.2	mg/L		300.0	10/13/16:212402	300.0	10/13/16:215189
Nitrate + Nitrite as N	18.9	0.1	mg/L		300.0	10/13/16:212402	300.0	10/13/16:215189
Fluoride	ND	0.1	mg/L		300.0	10/13/16:212402	300.0	10/13/16:215189
Total Anions	5.0	--	meq/L		2320B	10/14/16:212420	2320B	10/14/16:215083
pH	6.9	--	units		4500-H B	10/14/16:212437	4500HB	10/14/16:215047
Specific Conductance	568	1	umhos/cm		2510B	10/14/16:212424	2510B	10/14/16:215034
Total Dissolved Solids	380	20	mg/L		2540CE	10/13/16:212384	2540C	10/14/16:215035
MBAS Screen	Negative	0.1	mg/L		5540C	10/13/16:212453	5540C	10/13/16:215061
Aggressiveness Index	10.4	--	--		4500-H B	10/14/16:212437	4500HB	10/14/16:215047
Langelier Index (20°C)	-1.4	--	--		4500-H B	10/14/16:212437	4500HB	10/14/16:215047
Nitrate Nitrogen	18.9	--	mg/L		300.0	10/13/16:212402	300.0	10/13/16:215189

ND=Non-Detected. PQL=Practical Quantitation Limit. * PQL adjusted for dilution.

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November 3, 2016

Cleath-Harris Geologists
Attn: Spencer Harris
71 Zaca Lane
Suite 140
San Luis Obispo, CA 93401
Description : Los Olivos Well UA-9
Project : Los Osos BMC Monitoring

Lab ID : CC 1683569-005
Customer ID : 8-514

Sampled On : October 12, 2016-12:00
Sampled By : Zac Reineke
Received On : October 12, 2016-14:59
Matrix : Ground Water

Sample Result - Inorganic

Constituent	Result	PQL	Units	Note	Sample Preparation		Sample Analysis	
					Method	Date/ID	Method	Date/ID
General Mineral								
Total Hardness as CaCO3	80.2	--	mg/L		200.7	10/13/16:212393	200.7	10/13/16:215025
Calcium	14	1	mg/L		200.7	10/13/16:212393	200.7	10/13/16:215025
Magnesium	11	1	mg/L		200.7	10/13/16:212393	200.7	10/13/16:215025
Potassium	ND	1	mg/L		200.7	10/13/16:212393	200.7	10/13/16:215025
Sodium	26	1	mg/L		200.7	10/13/16:212393	200.7	10/13/16:215025
Total Cations	2.7	--	meq/L		200.7	10/13/16:212393	200.7	10/13/16:215025
Boron	ND	0.1	mg/L		200.7	10/13/16:212393	200.7	10/13/16:215025
Copper	ND	10	ug/L		200.7	10/13/16:212393	200.7	10/13/16:215025
Iron	ND	30	ug/L		200.7	10/13/16:212393	200.7	10/13/16:215025
Manganese	ND	10	ug/L		200.7	10/13/16:212393	200.7	10/13/16:215025
Zinc	ND	20	ug/L		200.7	10/13/16:212393	200.7	10/13/16:215025
SAR	1.3	--	--		200.7	10/13/16:212393	200.7	10/13/16:215025
Total Alkalinity (as CaCO3)	40	10	mg/L		2320B	10/14/16:212420	2320B	10/14/16:215083
Hydroxide as OH	ND	10	mg/L		2320B	10/14/16:212420	2320B	10/14/16:215083
Carbonate as CO3	ND	10	mg/L		2320B	10/14/16:212420	2320B	10/14/16:215083
Bicarbonate as HCO3	50	10	mg/L		2320B	10/14/16:212420	2320B	10/14/16:215083
Sulfate	7.1	0.5	mg/L		300.0	10/13/16:212402	300.0	10/13/16:215189
Chloride	40	1	mg/L		300.0	10/13/16:212402	300.0	10/13/16:215189
Nitrate as NO3	40.5	0.5	mg/L		300.0	10/13/16:212402	300.0	10/13/16:215189
Nitrite as N	ND	0.2	mg/L		300.0	10/13/16:212402	300.0	10/13/16:215189
Nitrate + Nitrite as N	9.2	0.1	mg/L		300.0	10/13/16:212402	300.0	10/13/16:215189
Fluoride	0.2	0.1	mg/L		300.0	10/13/16:212402	300.0	10/13/16:215189
Total Anions	2.8	--	meq/L		2320B	10/14/16:212420	2320B	10/14/16:215083
pH	6.1	--	units		4500-H B	10/14/16:212437	4500HB	10/14/16:215047
Specific Conductance	324	1	umhos/cm		2510B	10/14/16:212424	2510B	10/14/16:215034
Total Dissolved Solids	230	20	mg/L		2540CE	10/13/16:212384	2540C	10/14/16:215035
MBAS Screen	Negative	0.1	mg/L		5540C	10/13/16:212453	5540C	10/13/16:215061
Aggressiveness Index	9.2	--	--		4500-H B	10/14/16:212437	4500HB	10/14/16:215047
Langelier Index (20°C)	-2.6	--	--		4500-H B	10/14/16:212437	4500HB	10/14/16:215047
Nitrate Nitrogen	9.2	--	mg/L		300.0	10/13/16:212402	300.0	10/13/16:215189

ND=Non-Detected. PQL=Practical Quantitation Limit. * PQL adjusted for dilution.

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CEC Testing

Groundwater Monitoring Field Log
LOBP Monitoring Program

Date: 10/18/2016
Operator: W. Forbes
Well number and location: 30S/10E-13Q2, FW5
Site and wellhead conditions: Cool, breezy, sunny, well head intact, cap intact and secure

Static water depth (feet): 87.47
Well depth (feet): 105
Water column (feet): 17.53
Casing diameter (inches): 2
Minimum purge volume (gal) 8.58
Purge rate (gpm): 1.6
Pumping water level (feet): --
Pump setting (feet): --
Minimum purge time (min): 5
Time begin purge: 9:38

Time	Gallons	EC µS	pH	Temp. °c	Comments*
9:38	0.25	863	7.03	19.2	Cloudy, tan-colored
9:41	5	949	6.57	19	Cloudy, stale odor
9:45	10	948	6.29	19.1	Clear, colorless odorless
9:48	15	950	6.16	19	Clear, colorless odorless
9:52	20	952	6.13	18.9	Clear, colorless odorless
9:56	25	952	6.10	19	Clear, colorless odorless
9:59	30	955	6.09	19	Clear, colorless odorless
					Sampled @10:00AM

*Turbidity, color, odor, sheen, debris, etc.

WECK LABORATORIES, INC.

Certificate of Analysis

FINAL REPORT

Work Orders:	6J20012	**Report Date:**	11/18/2016
		Received Date:	10/20/2016
Project:	LOS OSOS CEC MONITORING	**Turnaround Time:**	Normal
		Phones:	(805) 543-1413
		Fax:	-
Attn:	Spencer Harris	**P.O. #:**	
Client:	Cleath-Harris Geologists, Inc. 71 Zaca Lane, Suite 140 San Luis Obispo, CA 93401		

DoD-ELAP #L15-366 • ELAP-CA #1132 • EPA-UCMR #CA00211 • HW-DOH # • ISO 17025 #L15-365 • LACSD #10143 • NELAP-OR #4047 • NJ-DEP #CA015 • NV-DEP #NAC 445A

This is a complete final report. The information in this report applies to the samples analyzed in accordance with the chain-of-custody document. Weck Laboratories certifies that the test results meet all requirements of TNI unless noted by qualifiers or written in the Case Narrative. This analytical report must be reproduced in its entirety.

Dear Spencer Harris,

Enclosed are the results of analyses for samples received 10/20/16 with the Chain-of-Custody document. The samples were received in good condition, at 7.4 °C and on ice. All analyses met the method criteria except as noted in the case narrative or in the report with data qualifiers.

Reviewed by:

Brandon Gee
Operations Manager/Senior PM

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www.wecklabs.com

Certificate of Analysis

FINAL REPORT

Cleath-Harris Geologists, Inc.
71 Zaca Lane, Suite 140
San Luis Obispo, CA 93401

Project Number: LOS OSOS CEC MONITORING

Project Manager: Spencer Harris

Reported: 11/18/2016 11:17

Sample Summary

Sample ID	Sampled By	Lab ID	Matrix	Sampled	Qualifiers
QA2-Equipment Blank	S.HARRIS	6J20012-01	Water	10/19/16 09:00	
FW5 (13Q2)	S.HARRIS	6J20012-02	Water	10/19/16 10:00	
QA1 - Clean Water/Travel Blank	S.HARRIS	6J20012-03	Water	10/19/16 10:15	

Not Certified Analyses Summary

Analyte	CAS #	Not Accredited By
SM 5910B in Water		
UV 254		NELAP

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Cleath-Harris Geologists, Inc.
71 Zaca Lane, Suite 140
San Luis Obispo, CA 93401

Project Number: LOS OSOS CEC MONITORING

Project Manager: Spencer Harris

Reported: 11/18/2016 11:17

Sample Results

Sample: QA2-Equipment Blank
6J20012-01 (Water)

Sampled: 10/19/16 9:00 by S.HARRIS

Analyte	Result	MRL	Units	Dil	Analyzed	Qualifier
PPCPs - Pharmaceuticals by LC/MSMS-ESI+						
Method: EPA 1694M-ESI+	**Batch ID:** W6K0352	**Prepared:** 11/07/16 11:09				**Analyst:** kan
Caffeine	**1.8**	1.0	ng/l	1	11/16/16 18:20	
DEET	**1.4**	1.0	ng/l	1	11/16/16 18:20	B
Sucralose	ND	5.0	ng/l	1	11/16/16 18:20	
PPCPs - Pharmaceuticals by LC/MSMS-ESI-						
Method: EPA 1694M-ESI-	**Batch ID:** W6K0353	**Prepared:** 11/07/16 11:20				**Analyst:** kan
Gemfibrozil	ND	1.0	ng/l	1	11/17/16 21:15	
Iopromide	ND	5.0	ng/l	1	11/17/16 21:15	
Triclosan	ND	2.0	ng/l	1	11/17/16 21:15	
PPCPs - Hormones by LC/MSMS-APCI						
Method: EPA 1694M-APCI	**Batch ID:** W6K0354	**Prepared:** 11/07/16 11:23				**Analyst:** kan
17-b-Estradiol	ND	1.0	ng/l	1	11/17/16 15:23	

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Cleath-Harris Geologists, Inc.
71 Zaca Lane, Suite 140
San Luis Obispo, CA 93401

Project Number: LOS OSOS CEC MONITORING

Project Manager: Spencer Harris

Reported: 11/18/2016 11:17

Sample Results

(Continued)

Sample: FW5 (13Q2) — Sampled: 10/19/16 10:00 by S.HARRIS

6J20012-02 (Water)

Analyte	Result	MRL	Units	Dil	Analyzed	Qualifier
Conventional Chemistry/Physical Parameters by APHA/EPA/ASTM Methods						
Method: EPA 353.2 — **Batch ID:** W6J1112 — **Prepared:** 10/20/16 14:45 — **Analyst:** AJK						
Nitrate as N	**26**	0.50	mg/l	5	10/20/16 16:39	
Method: SM 5910B — **Batch ID:** W6J1146 — **Prepared:** 10/21/16 09:00 — **Analyst:** ajk						
UV 254	**0.015**	0.009	1/cm	1	10/21/16 09:34	
Method: SM 2510B — **Batch ID:** W6J1178 — **Prepared:** 10/21/16 12:35 — **Analyst:** nat						
Specific Conductance (EC)	**910**	2.0	umhos/cm	1	10/21/16 14:31	
Method: SM 5310B — **Batch ID:** W6J1317 — **Prepared:** 10/24/16 16:50 — **Analyst:** jlp						
Total Organic Carbon (TOC)	**0.54**	0.10	mg/l	1	10/24/16 17:37	
Method: EPA 350.1 — **Batch ID:** W6J1399 — **Prepared:** 10/25/16 18:05 — **Analyst:** mnq						
Ammonia as N	ND	0.10	mg/l	1	10/28/16 17:46	
Nitrosamines by isotopic dilution GC/MS CI Mode						
Method: EPA 1625M — **Batch ID:** W6J1247 — **Prepared:** 10/24/16 09:32 — **Analyst:** smr						
N-Nitrosodimethylamine	ND	2.0	ng/l	1	10/26/16 08:51	
PPCPs - Pharmaceuticals by LC/MSMS-ESI+						
Method: EPA 1694M-ESI+ — **Batch ID:** W6K0352 — **Prepared:** 11/07/16 11:09 — **Analyst:** kan						
Caffeine	ND	1.0	ng/l	1	11/16/16 18:36	
DEET	**2.0**	1.0	ng/l	1	11/16/16 18:36	B
Sucralose	**280**	5.0	ng/l	1	11/16/16 18:36	
PPCPs - Pharmaceuticals by LC/MSMS-ESI-						
Method: EPA 1694M-ESI- — **Batch ID:** W6K0353 — **Prepared:** 11/07/16 11:20 — **Analyst:** kan						
Gemfibrozil	ND	1.0	ng/l	1	11/17/16 21:32	
Iopromide	ND	5.0	ng/l	1	11/17/16 21:32	
Triclosan	ND	2.0	ng/l	1	11/17/16 21:32	
PPCPs - Hormones by LC/MSMS-APCI						
Method: EPA 1694M-APCI — **Batch ID:** W6K0354 — **Prepared:** 11/07/16 11:23 — **Analyst:** kan						
17-b-Estradiol	ND	1.0	ng/l	1	11/17/16 15:43	

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Cleath-Harris Geologists, Inc.
71 Zaca Lane, Suite 140
San Luis Obispo, CA 93401

Project Number: LOS OSOS CEC MONITORING

Project Manager: Spencer Harris

Reported: 11/18/2016 11:17

Sample Results

(Continued)

Sample: QA1 - Clean Water/Travel Blank
6J20012-03 (Water)

Sampled: 10/19/16 10:15 by S.HARRIS

Analyte	Result	MRL	Units	Dil	Analyzed	Qualifier
PPCPs - Pharmaceuticals by LC/MSMS-ESI+						
Method: EPA 1694M-ESI+	**Batch ID:** W6K0352	**Prepared:** 11/07/16 11:09				**Analyst:** kan
Caffeine	ND	1.0	ng/l	1	11/16/16 18:53	
DEET	**1.7**	1.0	ng/l	1	11/16/16 18:53	B
Sucralose	ND	5.0	ng/l	1	11/16/16 18:53	
PPCPs - Pharmaceuticals by LC/MSMS-ESI-						
Method: EPA 1694M-ESI-	**Batch ID:** W6K0353	**Prepared:** 11/07/16 11:20				**Analyst:** kan
Gemfibrozil	ND	1.0	ng/l	1	11/17/16 21:48	
Iopromide	ND	5.0	ng/l	1	11/17/16 21:48	
Triclosan	ND	2.0	ng/l	1	11/17/16 21:48	
PPCPs - Hormones by LC/MSMS-APCI						
Method: EPA 1694M-APCI	**Batch ID:** W6K0354	**Prepared:** 11/07/16 11:23				**Analyst:** kan
17-b-Estradiol	ND	1.0	ng/l	1	11/17/16 16:03	

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Cleath-Harris Geologists, Inc.
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San Luis Obispo, CA 93401

Project Number: LOS OSOS CEC MONITORING

Project Manager: Spencer Harris

Reported: 11/18/2016 11:17

Quality Control Results

Conventional Chemistry/Physical Parameters by APHA/EPA/ASTM Methods

Analyte	Result	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qualifier
Batch: W6J1112 - EPA 353.2										
Blank (W6J1112-BLK1)				**Prepared & Analyzed: 10/20/16**						
Nitrate as N	ND	0.10	mg/l							
LCS (W6J1112-BS1)				**Prepared & Analyzed: 10/20/16**						
Nitrate as N	0.902	0.10	mg/l	1.00		90	90-110			
Matrix Spike (W6J1112-MS1)	**Source: 6J19036-01**			**Prepared & Analyzed: 10/20/16**						
Nitrate as N	3.77	0.20	mg/l	4.00	ND	94	90-110			
Matrix Spike Dup (W6J1112-MSD1)	**Source: 6J19036-01**			**Prepared & Analyzed: 10/20/16**						
Nitrate as N	3.69	0.20	mg/l	4.00	ND	92	90-110	2	20	
Batch: W6J1146 - SM 5910B										
Blank (W6J1146-BLK1)				**Prepared & Analyzed: 10/21/16**						
UV 254	ND	0.009	1/cm							
LCS (W6J1146-BS1)				**Prepared & Analyzed: 10/21/16**						
UV 254	0.090	0.009	1/cm	0.0880		102	90-110			
Duplicate (W6J1146-DUP1)	**Source: 6J20012-02**			**Prepared & Analyzed: 10/21/16**						
UV 254	0.015	0.009	1/cm		0.015			0	10	
Batch: W6J1178 - SM 2510B										
Blank (W6J1178-BLK1)				**Prepared & Analyzed: 10/21/16**						
Specific Conductance (EC)	ND	2.0	umhos/cm							

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WECK LABORATORIES, INC.

Certificate of Analysis

FINAL REPORT

Cleath-Harris Geologists, Inc.
71 Zaca Lane, Suite 140
San Luis Obispo, CA 93401

Project Number: LOS OSOS CEC MONITORING

Project Manager: Spencer Harris

Reported: 11/18/2016 11:17

Quality Control Results

(Continued)

Conventional Chemistry/Physical Parameters by APHA/EPA/ASTM Methods (Continued)

Analyte	Result	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qualifier
Batch: W6J1178 - SM 2510B (Continued)										
LCS (W6J1178-BS1)				**Prepared & Analyzed: 10/21/16**						
Specific Conductance (EC)	204	2.0	umhos/cm	200		102	95-105			
Duplicate (W6J1178-DUP1)	**Source: 6J19087-03**			**Prepared & Analyzed: 10/21/16**						
Specific Conductance (EC)	94.7	2.0	umhos/cm		94.6			0.1	5	
Batch: W6J1317 - SM 5310B										
Blank (W6J1317-BLK1)				**Prepared & Analyzed: 10/24/16**						
Total Organic Carbon (TOC)	ND	0.10	mg/l							
LCS (W6J1317-BS1)				**Prepared & Analyzed: 10/24/16**						
Total Organic Carbon (TOC)	0.976	0.10	mg/l	1.00		98	85-115			
LCS Dup (W6J1317-BSD1)				**Prepared & Analyzed: 10/24/16**						
Total Organic Carbon (TOC)	0.985	0.10	mg/l	1.00		98	85-115	0.9	20	
Batch: W6J1399 - EPA 350.1										
Blank (W6J1399-BLK1)				**Prepared: 10/25/16 Analyzed: 10/28/16**						
Ammonia as N	ND	0.10	mg/l							
Blank (W6J1399-BLK2)				**Prepared: 10/25/16 Analyzed: 10/28/16**						
Ammonia as N	ND	0.10	mg/l							
LCS (W6J1399-BS1)				**Prepared: 10/25/16 Analyzed: 10/28/16**						
Ammonia as N	0.253	0.10	mg/l	0.250		101	90-110			

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Reported: 11/18/2016 11:17

Quality Control Results

(Continued)

Conventional Chemistry/Physical Parameters by APHA/EPA/ASTM Methods (Continued)

Analyte	Result	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qualifier
Batch: W6J1399 - EPA 350.1 (Continued)										
LCS (W6J1399-BS2)				**Prepared: 10/25/16**	**Analyzed: 10/28/16**					
Ammonia as N	0.252	0.10	mg/l	0.250		101	90-110			
LCS Dup (W6J1399-BSD1)				**Prepared: 10/25/16**	**Analyzed: 10/28/16**					
Ammonia as N	0.260	0.10	mg/l	0.250		104	90-110	3	15	
Duplicate (W6J1399-DUP1)	**Source: 6J25061-01**			**Prepared: 10/25/16**	**Analyzed: 10/28/16**					
Ammonia as N	ND	0.10	mg/l		ND				15	
Matrix Spike (W6J1399-MS1)	**Source: 6J25043-07**			**Prepared: 10/25/16**	**Analyzed: 10/28/16**					
Ammonia as N	0.262	0.10	mg/l	0.250	ND	105	90-110			
Matrix Spike (W6J1399-MS2)	**Source: 6J25060-01**			**Prepared: 10/25/16**	**Analyzed: 10/28/16**					
Ammonia as N	0.253	0.10	mg/l	0.250	ND	101	90-110			
Matrix Spike Dup (W6J1399-MSD1)	**Source: 6J25043-07**			**Prepared: 10/25/16**	**Analyzed: 10/28/16**					
Ammonia as N	0.260	0.10	mg/l	0.250	ND	104	90-110	0.8	15	
Matrix Spike Dup (W6J1399-MSD2)	**Source: 6J25060-01**			**Prepared: 10/25/16**	**Analyzed: 10/28/16**					
Ammonia as N	0.251	0.10	mg/l	0.250	ND	100	90-110	0.9	15	

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Quality Control Results

(Continued)

Nitrosamines by isotopic dilution GC/MS CI Mode

Analyte	Result	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qualifier
Batch: W6J1247 - EPA 1625M										
Blank (W6J1247-BLK1)				**Prepared: 10/24/16 Analyzed: 10/26/16**						
N-Nitrosodimethylamine	ND	2.0	ng/l							
LCS (W6J1247-BS1)				**Prepared: 10/24/16 Analyzed: 10/26/16**						
N-Nitrosodimethylamine	1.96	2.0	ng/l	3.00		65	50-150			
LCS Dup (W6J1247-BSD1)				**Prepared: 10/24/16 Analyzed: 10/26/16**						
N-Nitrosodimethylamine	2.26	2.0	ng/l	3.00		75	50-150	14	50	

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Quality Control Results (Continued)

PPCPs - Pharmaceuticals by LC/MSMS-ESI+

Analyte	Result	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qualifier
Batch: W6K0352 - EPA 1694M-ESI+										
Blank (W6K0352-BLK1)				**Prepared: 11/07/16 Analyzed: 11/16/16**						
Caffeine	ND	1.0	ng/l							
DEET	3.52	1.0	ng/l							B
Sucralose	ND	5.0	ng/l							
LCS (W6K0352-BS1)				**Prepared: 11/07/16 Analyzed: 11/16/16**						
Caffeine	15.5	1.0	ng/l	20.0		78	55-152			
DEET	20.4	1.0	ng/l	20.0		102	45-135			
Sucralose	88.5	5.0	ng/l	100		88	50-150			
LCS Dup (W6K0352-BSD1)				**Prepared: 11/07/16 Analyzed: 11/16/16**						
Caffeine	19.9	1.0	ng/l	20.0		100	55-152	25	30	
DEET	22.5	1.0	ng/l	20.0		112	45-135	10	30	
Sucralose	86.5	5.0	ng/l	100		86	50-150	2	30	

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Reported: 11/18/2016 11:17

Quality Control Results

(Continued)

PPCPs - Pharmaceuticals by LC/MSMS-ESI-

Analyte	Result	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qualifier
Batch: W6K0353 - EPA 1694M-ESI-										
Blank (W6K0353-BLK1)				**Prepared: 11/07/16 Analyzed: 11/17/16**						
Gemfibrozil	ND	1.0	ng/l							
Iopromide	ND	5.0	ng/l							
Triclosan	ND	2.0	ng/l							
LCS (W6K0353-BS1)				**Prepared: 11/07/16 Analyzed: 11/17/16**						
Gemfibrozil	16.3	1.0	ng/l	20.0		82	76-122			
Iopromide	134	5.0	ng/l	100		134	0.1-163			
Triclosan	19.8	2.0	ng/l	20.0		99	76-139			
LCS Dup (W6K0353-BSD1)				**Prepared: 11/07/16 Analyzed: 11/17/16**						
Gemfibrozil	17.8	1.0	ng/l	20.0		89	76-122	9	30	
Iopromide	96.5	5.0	ng/l	100		96	0.1-163	33	30	Q-12
Triclosan	19.6	2.0	ng/l	20.0		98	76-139	1	30	

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Reported: 11/18/2016 11:17

Quality Control Results (Continued)

PPCPs - Hormones by LC/MSMS-APCI

Analyte	Result	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qualifier
Batch: W6K0354 - EPA 1694M-APCI										
Blank (W6K0354-BLK1)				**Prepared: 11/07/16 Analyzed: 11/17/16**						
17-b-Estradiol	ND	1.0	ng/l							
LCS (W6K0354-BS1)				**Prepared: 11/07/16 Analyzed: 11/17/16**						
17-b-Estradiol	21.1	1.0	ng/l	20.0		106	65-146			
LCS Dup (W6K0354-BSD1)				**Prepared: 11/07/16 Analyzed: 11/17/16**						
17-b-Estradiol	19.2	1.0	ng/l	20.0		96	65-146	9	30	

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Project Number: LOS OSOS CEC MONITORING

Project Manager: Spencer Harris

Reported: 11/18/2016 11:17

Notes and Definitions

Item	Definition
B	Blank contamination. The analyte was found in the associated blank as well as in the sample.
Q-12	The RPD result exceeded the QC control limits; however, both percent recoveries were acceptable. Sample results for the QC batch were accepted based on the percent recoveries and/or other acceptable QC data.
ND	NOT DETECTED at or above the Method Reporting Limit (MRL). If Method Detection Limit (MDL) is reported, then ND means not detected at or above the MDL.
Dil	Dilution
dry	Sample results reported on a dry weight basis
RPD	Relative Percent Difference
% Rec	Percent Recovery
Source	Sample that was matrix spiked or duplicated.
MDL	Method Detection Limit
MRL	The minimum levels, concentrations, or quantities of a target variable (e.g., target analyte) that can be reported with a specified degree of confidence. The MRL is also known as Limit of Quantitation (LOQ) and Detection Limit for Reporting (DLR)
MDA	Minimum Detectable Activity
NR	Not Reportable
TIC	Tentatively Identified Compound (TIC) using mass spectrometry. The reported concentration is relative concentration based on the nearest internal standard. If the library search produces no matches at, or above 85%, the compound is reported as unknown.

Any remaining sample(s) will be disposed of one month from the final report date unless other arrangements are made in advance.
An Absence of Total Coliform meets the drinking water standards as established by the California State Water Resources Control Board (SWRCB)
All results are expressed on wet weight basis unless otherwise specified.
All samples collected by Weck Laboratories have been sampled in accordance to laboratory SOP Number MIS 002.

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APPENDIX D

Land Use and Water Use Areas
(from LOBP)

Figure 5. Land Uses in the Plan Area

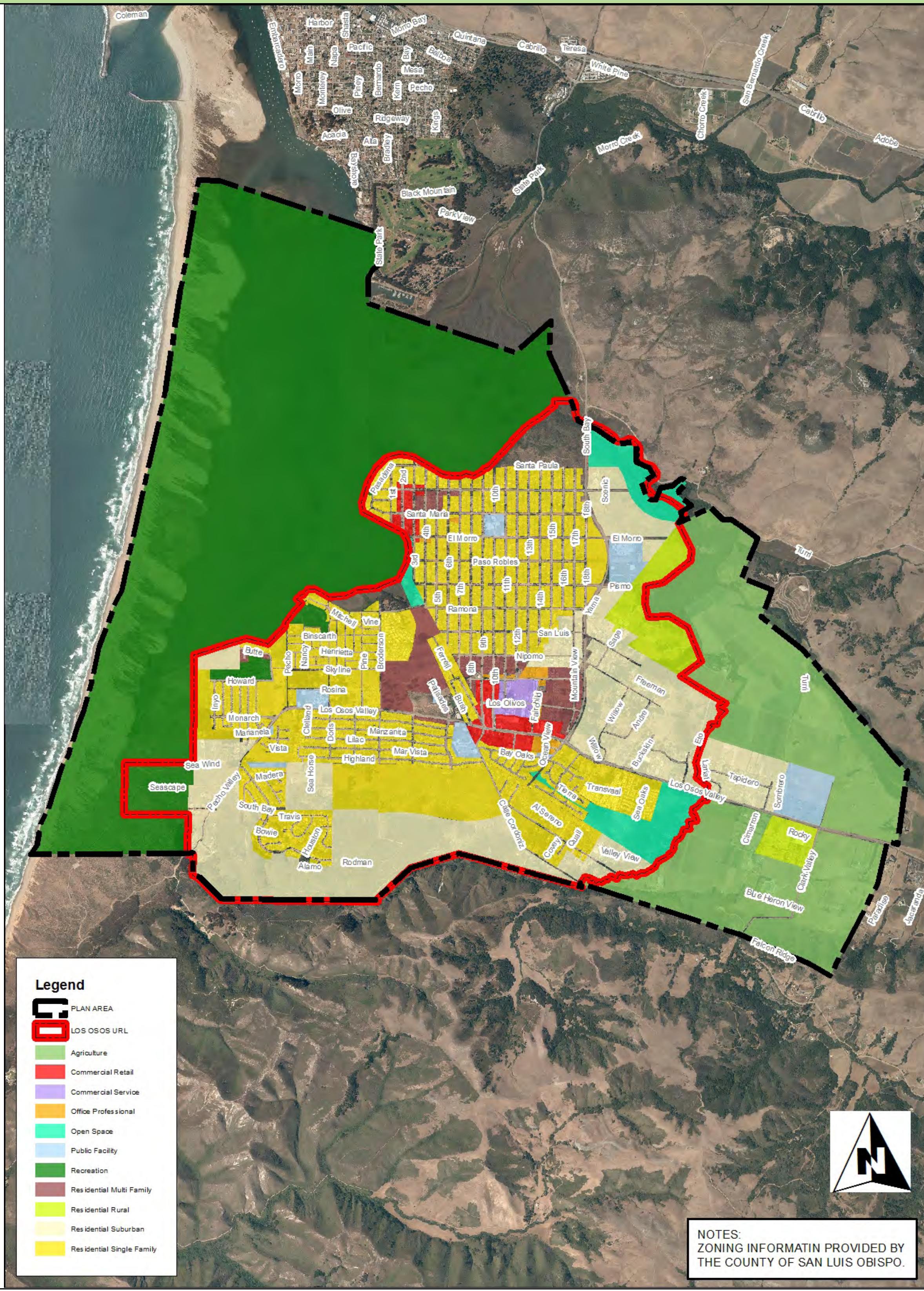
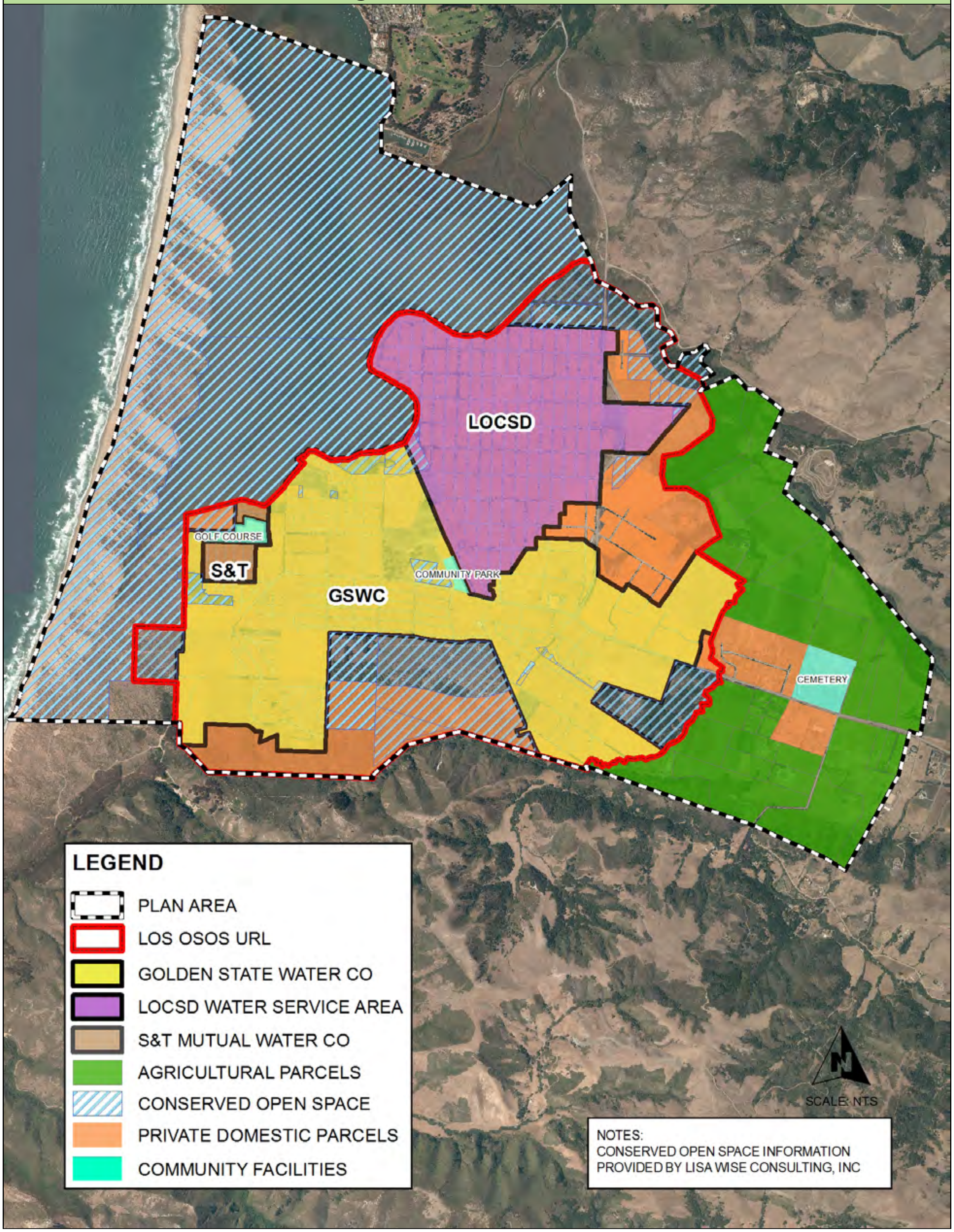


Figure 10. Water Use Areas



APPENDIX E

Precipitation and Streamflow Data

San Luis Obispo County Public Works

Recording Rain Station

MONTHLY PRECIPITATION REPORT

Station Name - Los Osos Landfill # 727

Station Location -

Latitude - 35° 19' 19"

Longitude - 120° 48' 03"

Description - Northeast Los Osos South of Turri Road

Water Years -

Beginning - 2005-2006

Ending - 2016-2017

Station Statistics -

Month	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	TOTAL
Minimum	0.00	0.00	0.00	0.00	0.04	0.12	0.00	0.35	0.00	0.20	0.00	0.00	6.81
Average	0.16	0.02	0.08	1.07	0.97	2.99	3.93	3.02	2.22	0.98	0.34	0.14	14.81
Maximum	1.93	0.20	0.63	6.22	2.76	11.46	10.47	7.65	8.03	3.70	2.64	1.10	31.77

Notes -

Earlier data may be available. Contact Public Works for more information.

San Luis Obispo County Public Works

Recording Rain Station

MONTHLY PRECIPITATION REPORT

Station Name and no. Los Osos Landfill # 727

*** All units are in inches ***

Water Year	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	Total
2016-2017	0.00	0.00	0.00	1.65	2.76	3.39	9.02	7.65					
2015-2016	1.93	0.00	0.08	0.08	1.26	1.85	5.04	0.86	4.85	0.20	0.00	0.00	16.15
2014-2015	0.00	0.00	0.00	0.00	0.28	5.20	0.08	0.91	0.43	0.67	0.12	0.00	7.68
2013-2014	0.00	0.00	0.00	0.24	0.28	0.12	0.00	4.06	1.42	0.71	0.00	0.00	6.81
2012-2013	0.00	0.00	0.00	1.18	1.69	2.64	1.02	0.67	0.43	0.31	0.12	0.04	8.11
2011-2012	0.00	0.08	0.04	1.06	2.17	0.16	2.28	0.35	2.68	2.24	0.00	0.00	11.06
2010-2011	0.00	0.00	0.12	1.54	1.85	11.46	3.03	3.78	8.03	0.28	0.59	1.10	31.77
2009-2010	0.00	0.00	0.04	6.22	0.04	2.87	9.76	4.13	1.14	1.93	0.04	0.00	26.18
2008-2009	0.00	0.00	0.00	0.04	0.04	0.75	0.71	4.61	1.06	0.20	0.20	0.35	7.95
2007-2008	0.00	0.00	0.00	0.43	0.12	2.68	10.47	2.99	0.00	0.24	0.00	0.00	16.93
2006-2007	0.00	0.00	0.00	0.12	0.43	2.28	1.26	2.56	0.43	0.35	0.04	0.00	7.48
2005-2006	0.04	0.20	0.63	0.24	0.75	2.52	4.45	3.70	3.90	3.70	2.64	0.00	22.76

San Luis Obispo County Public Works

DAILY PRECIPITATION

(inches)

Station Name and no. **Los Osos Landfill # 727** Season **2016-2017**

Day	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	Day
1								CURRENT THROUGH 2-28					1
2								0.24					2
3								0.16					3
4							2.25						4
5							0.23	0.55					5
6								0.51					6
7							0.52	0.63					7
8						1.18	1.10	0.04					8
9						0.08	0.12	0.28					9
10						0.12	0.23	0.43					10
11							0.04	0.04					11
12							0.59						12
13													13
14													14
15				0.08		1.07							15
16				0.08		0.55		0.31					16
17				0.08				3.27					17
18							0.56	0.32					18
19							0.27	0.08					19
20					1.90		1.22	0.51					20
21					0.04		0.16	0.24					21
22							1.26						22
23						0.35	0.43						23
24							0.04						24
25													25
26					0.67			0.04					26
27				0.67	0.15								27
28				0.71									28
29													29
30				0.03		0.04							30
31													31
Total	0.00	0.00	0.00	1.65	2.76	3.39	9.02	7.65					
Cum. Total	0.00	0.00	0.00	1.65	4.41	7.80	16.82	24.47	24.47	24.47	24.47	24.47	

Season Total **24.47**

San Luis Obispo County Public Works

DAILY PRECIPITATION
(inches)

Station Name and no. **Los Osos Landfill # 727** Season **2015-2016**

Day	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	Day
1													1
2					0.59								2
3						0.04							3
4				0.04									4
5							1.02		1.54				5
6							0.75		0.35				6
7							0.23		1.06				7
8					0.23					0.08			8
9					0.04		0.04						9
10					0.04	0.04	0.08		0.04				10
11						0.39			1.22				11
12													12
13						0.08	0.04		0.36				13
14			0.08						0.20				14
15				0.04	0.28		0.04						15
16							0.08						16
17								0.67					17
18							0.28	0.19					18
19	1.69					0.51	0.86						19
20	0.24								0.04				20
21						0.28			0.04				21
22						0.47	0.16			0.12			22
23							0.08						23
24						0.04							24
25					0.08								25
26													26
27													27
28													28
29													29
30							0.27						30
31							1.11						31

Total	1.93	0.00	0.08	0.08	1.26	1.85	5.04	0.86	4.85	0.20	0.00	0.00	
Cum. Total	1.93	1.93	2.01	2.09	3.35	5.20	10.24	11.10	15.95	16.15	16.15	16.15	

Season Total **16.15**

San Luis Obispo County Public Works

DAILY PRECIPITATION
(inches)

Station Name and no. **Los Osos Landfill # 727** Season **2014-2015**

Day	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	Day
1									0.43				1
2						0.51							2
3													3
4						0.67							4
5						0.04							5
6								0.12					6
7								0.51					7
8					0.04			0.20					8
9													9
10								0.08					10
11					0.04	1.22							11
12						1.22							12
13					0.04								13
14											0.12		14
15						0.71				0.47			15
16						0.71							16
17						0.08							17
18						0.04							18
19					0.08								19
20													20
21													21
22					0.04								22
23													23
24													24
25										0.20			25
26													26
27							0.08						27
28													28
29					0.04								29
30													30
31													31
Total	0.00	0.00	0.00	0.00	0.28	5.20	0.08	0.91	0.43	0.67	0.12	0.00	
Cum. Total	0.00	0.00	0.00	0.00	0.28	5.47	5.55	6.46	6.89	7.56	7.68	7.68	

Season Total **7.68**

San Luis Obispo County Public Works

DAILY PRECIPITATION
(inches)

Station Name and no. **Los Osos Landfill # 727** Season **2013-2014**

Day	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	Day
1									0.59	0.24			1
2								0.87	0.20	0.28			2
3								0.04					3
4													4
5													5
6								0.31					6
7						0.12							7
8								0.04					8
9								0.04					9
10								0.08					10
11													11
12													12
13													13
14								0.04					14
15													15
16													16
17													17
18													18
19													19
20					0.20								20
21					0.08								21
22													22
23													23
24													24
25										0.16			25
26								0.87	0.04	0.04			26
27								0.28					27
28				0.24				1.50					28
29									0.16				29
30									0.04				30
31									0.39				31

Total	0.00	0.00	0.00	0.24	0.28	0.12	0.00	4.06	1.42	0.71	0.00	0.00	
Cum. Total	0.00	0.00	0.00	0.24	0.51	0.63	0.63	4.69	6.10	6.81	6.81	6.81	

Season Total **6.81**

San Luis Obispo County Public Works

DAILY PRECIPITATION
(inches)

Station Name and no. **Los Osos Landfill # 727** Season **2012-2013**

Day	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	Day
1						0.12				0.28			1
2						0.55							2
3													3
4										0.04			4
5							0.39						5
6							0.31				0.12		6
7									0.24				7
8								0.47	0.08				8
9					0.04								9
10				0.24									10
11				0.87									11
12						0.04							12
13													13
14									0.04				14
15						0.04							15
16					0.08	0.08							16
17					0.47	0.16							17
18					0.24								18
19								0.20					19
20													20
21				0.04									21
22						0.75							22
23						0.24							23
24							0.28					0.04	24
25						0.28	0.04						25
26						0.04							26
27													27
28					0.55								28
29					0.08	0.35							29
30				0.04	0.24				0.04				30
31									0.04				31
Total	0.00	0.00	0.00	1.18	1.69	2.64	1.02	0.67	0.43	0.31	0.12	0.04	
Cum. Total	0.00	0.00	0.00	1.18	2.87	5.51	6.54	7.20	7.64	7.95	8.07	8.11	

Season Total **8.11**

San Luis Obispo County Public Works

DAILY PRECIPITATION
(inches)

Station Name and no. **Los Osos Landfill # 727** Season **2011-2012**

Day	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	Day
1													1
2													2
3				0.08	0.04								3
4				0.04	0.28								4
5				0.91									5
6					0.28								6
7								0.04					7
8													8
9													9
10				0.04				0.04		0.55			10
11					0.31					0.16			11
12						0.16				0.28			12
13								0.08		1.02			13
14													14
15								0.08					15
16									0.12				16
17									1.46				17
18									0.12				18
19													19
20					1.26		0.20						20
21							0.87						21
22													22
23							1.22						23
24													24
25									0.63	0.20			25
26		0.04								0.04			26
27													27
28									0.16				28
29								0.12					29
30		0.04	0.04										30
31									0.20				31

Total	0.00	0.08	0.04	1.06	2.17	0.16	2.28	0.35	2.68	2.24	0.00	0.00	
Cum. Total	0.00	0.08	0.12	1.18	3.35	3.50	5.79	6.14	8.82	11.06	11.06	11.06	

Season Total **11.06**

San Luis Obispo County Public Works

DAILY PRECIPITATION

(inches)

Station Name and no. **Los Osos Landfill # 727** Season **2010-2011**

Day	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	Day
1							0.39						1
2							2.52		0.08				2
3													3
4			0.04			0.04			0.04			0.59	4
5				0.31		0.75						0.35	5
6				0.24	0.04				0.12			0.12	6
7					0.47								7
8													8
9						0.04							9
10					0.04								10
11									0.04				11
12													12
13						0.04							13
14								0.04					14
15						0.04					0.16		15
16								0.59	0.08		0.16		16
17			0.04	0.04		0.43		0.47			0.16		17
18				0.08		2.95		1.54	0.47		0.08		18
19					0.24	2.24		0.55	2.28				19
20			0.04		0.71	1.06		0.04	2.91				20
21				0.04	0.24	0.35			0.24	0.28			21
22				0.04		1.57			0.04				22
23				0.08	0.12				0.87				23
24				0.28					0.63				24
25						0.79		0.51	0.04				25
26								0.04	0.16				26
27													27
28						0.31			0.04				28
29				0.35		0.83					0.04	0.04	29
30				0.08									30
31							0.12						31
Total	0.00	0.00	0.12	1.54	1.85	11.46	3.03	3.78	8.03	0.28	0.59	1.10	
Cum. Total	0.00	0.00	0.12	1.65	3.50	14.96	17.99	21.77	29.80	30.08	30.67	31.77	

Season Total **31.77**

San Luis Obispo County Public Works

DAILY PRECIPITATION
(inches)

Station Name and no. **Los Osos Landfill # 727** Season **2009-2010**

Day	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	Day
1										0.04			1
2									0.08				2
3									0.43				3
4								0.08	0.04				4
5								0.51		0.31			5
6								0.39	0.20				6
7						0.47							7
8									0.04				8
9								0.63					9
10						0.75			0.04				10
11										0.98			11
12						1.22	0.51		0.08	0.08			12
13				5.43		0.04	0.31	0.04					13
14				0.79		0.04							14
15													15
16													16
17							0.55				0.04		17
18							1.14						18
19							0.91						19
20					0.04		2.36	0.04		0.51			20
21						0.16	2.01	0.12					21
22							1.22		0.04				22
23			0.04				0.04	0.04					23
24								0.39					24
25													25
26							0.59	1.42					26
27						0.08		0.47					27
28													28
29							0.08		0.04				29
30						0.12	0.04		0.04				30
31									0.12				31
Total	0.00	0.00	0.04	6.22	0.04	2.87	9.76	4.13	1.14	1.93	0.04	0.00	
Cum. Total	0.00	0.00	0.04	6.26	6.30	9.17	18.94	23.07	24.21	26.14	26.18	26.18	

Season Total **26.18**

San Luis Obispo County Public Works

DAILY PRECIPITATION
(inches)

Station Name and no. **Los Osos Landfill # 727** Season **2008-2009**

Day	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	Day
1					0.04						0.04		1
2							0.08		0.16		0.12		2
3									0.59				3
4				0.04					0.08				4
5											0.04	0.35	5
6								0.87					6
7										0.20			7
8													8
9								1.10					9
10													10
11								0.04					11
12								0.04					12
13								0.63					13
14								0.04					14
15													15
16						0.12							16
17								1.10					17
18													18
19													19
20													20
21						0.08							21
22						0.43		0.47	0.24				22
23							0.51	0.31					23
24							0.12						24
25						0.12							25
26													26
27													27
28													28
29													29
30													30
31													31

Total	0.00	0.00	0.00	0.04	0.04	0.75	0.71	4.61	1.06	0.20	0.20	0.35	
Cum. Total	0.00	0.00	0.00	0.04	0.08	0.83	1.54	6.14	7.20	7.40	7.60	7.95	

Season Total **7.95**

San Luis Obispo County Public Works

DAILY PRECIPITATION
(inches)

Station Name and no. **Los Osos Landfill # 727** Season **2007-2008**

Day	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	Day
1								0.08					1
2					0.04			0.24		0.20			2
3								1.02		0.04			3
4							3.66						4
5							0.20						5
6						0.24	0.39						6
7						0.08							7
8							0.08						8
9							0.04						9
10													10
11					0.08								11
12													12
13													13
14													14
15													15
16				0.28									16
17				0.08									17
18						2.24							18
19								0.20					19
20						0.12		0.16					20
21							0.08	0.08					21
22							2.32	0.12					22
23							1.06	0.87					23
24							0.87	0.24					24
25							0.31						25
26							0.63						26
27				0.08			0.67						27
28							0.08						28
29							0.04						29
30							0.04						30
31													31

Total	0.00	0.00	0.00	0.43	0.12	2.68	10.47	2.99	0.00	0.24	0.00	0.00	
Cum. Total	0.00	0.00	0.00	0.43	0.55	3.23	13.70	16.69	16.69	16.93	16.93	16.93	

Season Total **16.93**

San Luis Obispo County Public Works

DAILY PRECIPITATION
(inches)

Station Name and no. **Los Osos Landfill # 727** Season **2006-2007**

Day	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	Day
1													**1**
2								0.04					**2**
3													**3**
4							0.12				0.04		**4**
5													**5**
6													**6**
7								0.20					**7**
8						0.39							**8**
9						0.94							**9**
10						0.31		0.71					**10**
11					0.08								**11**
12								0.04					**12**
13				0.08	0.20								**13**
14					0.08								**14**
15													**15**
16													**16**
17					0.04	0.04	0.04						**17**
18													**18**
19										0.04			**19**
20									0.28	0.24			**20**
21						0.04							**21**
22								0.87		0.08			**22**
23				0.04				0.12					**23**
24													**24**
25								0.08					**25**
26					0.04	0.43		0.16	0.08				**26**
27						0.12	0.83	0.20	0.08				**27**
28							0.20	0.16					**28**
29							0.08						**29**
30													**30**
31													**31**
Total	0.00	0.00	0.00	0.12	0.43	2.28	1.26	2.56	0.43	0.35	0.04	0.00	
Cum. Total	0.00	0.00	0.00	0.12	0.55	2.83	4.09	6.65	7.09	7.44	7.48	7.48	

Season Total **7.48**

San Luis Obispo County Public Works

DAILY PRECIPITATION
(inches)

Station Name and no. **Los Osos Landfill # 727** Season **2005-2006**

Day	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	Day
1							1.61						1
2			0.63			0.55	2.32			0.24			2
3								0.04		1.18			3
4										0.59			4
5										0.39			5
6													6
7										0.08			7
8						0.47							8
9					0.59				0.04				9
10									0.28	0.43			10
11		0.16			0.04				0.12				11
12		0.04							0.28				12
13													13
14	0.04						0.24		0.04	0.04			14
15													15
16										0.08			16
17				0.12					0.24	0.04			17
18						0.16	0.16	3.66					18
19													19
20				0.04					0.35				20
21						0.04			0.04		2.60		21
22						0.04					0.04		22
23						0.04							23
24													24
25					0.08	0.12			0.12				25
26				0.08		0.04	0.08			0.63			26
27									0.43				27
28						0.12			1.38				28
29									0.16				29
30					0.04		0.04						30
31						0.94			0.43				31
Total	0.04	0.20	0.63	0.24	0.75	2.52	4.45	3.70	3.90	3.70	2.64	0.00	
Cum. Total	0.04	0.24	0.87	1.10	1.85	4.37	8.82	12.52	16.42	20.12	22.76	22.76	

Season Total **22.76**

Stream Flow

Stream Gage Name: **Los Osos Creek (#6)**
Water Planning Area: **3**

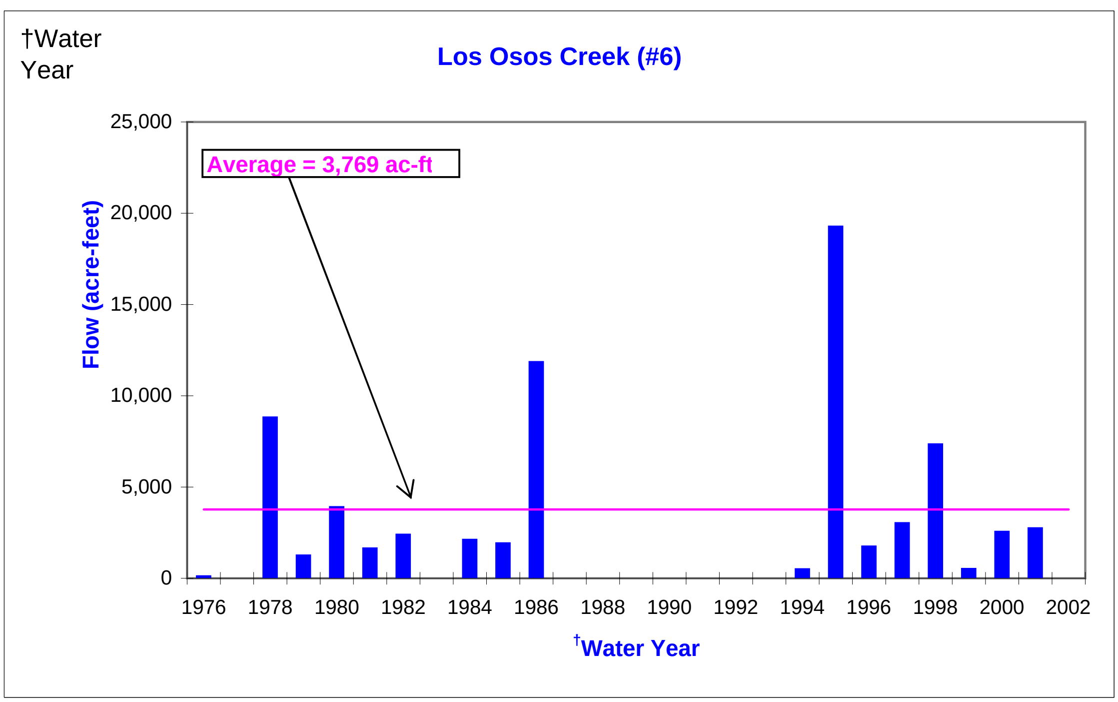
Water Year†	Annual Stream Flow (acre-feet)		Water Year†	Annual Stream Flow (acre-feet)	
1976	110	[1]	1990		[9]
1977	0		1991		[10]
1978	8,810		1992		[11]
1979	1,240		1993		[12]
1980	3,890	[2]	1994	497	
1981	1,630		1995	19,270	
1982	2,390	[3]	1996	1,740	
1983		[4]	1997	3,020	
1984	2,110		1998	7,340	
1985	1,920		1999	505	
1986	11,850	[5]	2000	2,540	
1987		[6]	2001	2,470	
1988		[7]	2002	0	
1989		[8]	2003	NA	[13]

From Annual Stream Flow Records	
Average Flow:	3,769 AFY
Median Flow:	2,110 AFY
Minimum Flow (2002):	0 AFY
Maximum Flow (1995):	19,270 AFY

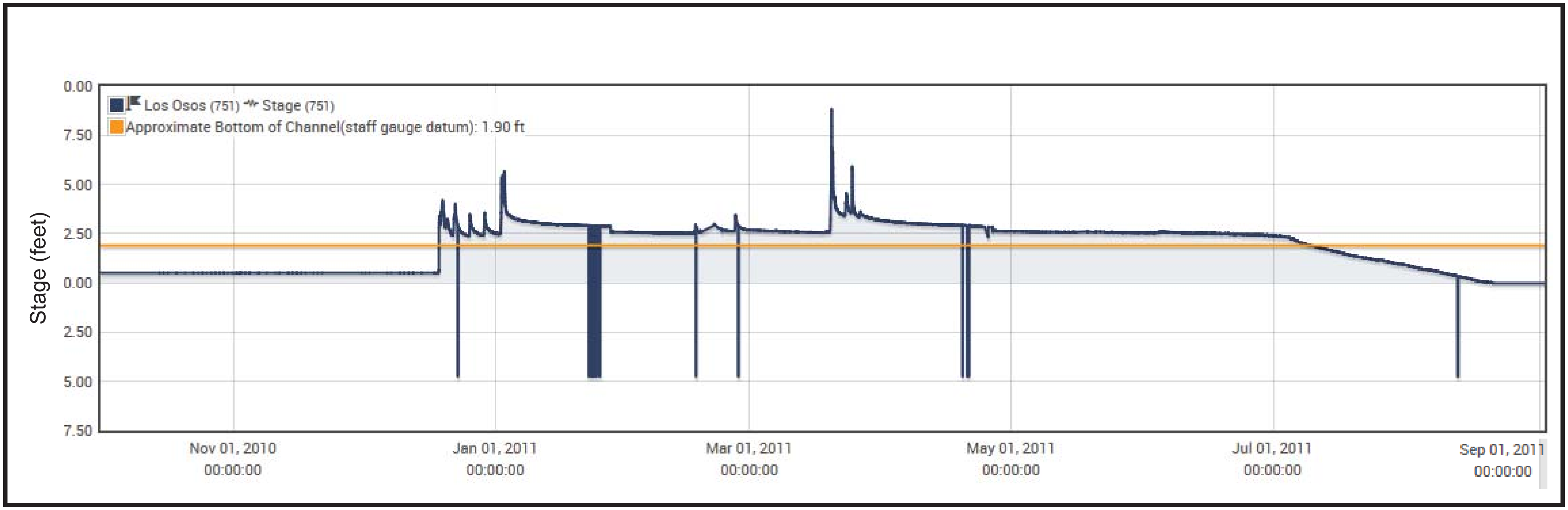
[1] gage put into operation in February
[2] missing data for one day in February
[3] missing data for various days in February, March, and April
[4] only visual observations were available for this year
[5] missing data for the end of February and beginning of March

[6-12] no data available for this time period
[13] Data not available at the time the report was published

(notations as recorded in San Luis Obispo County stream flow log books)

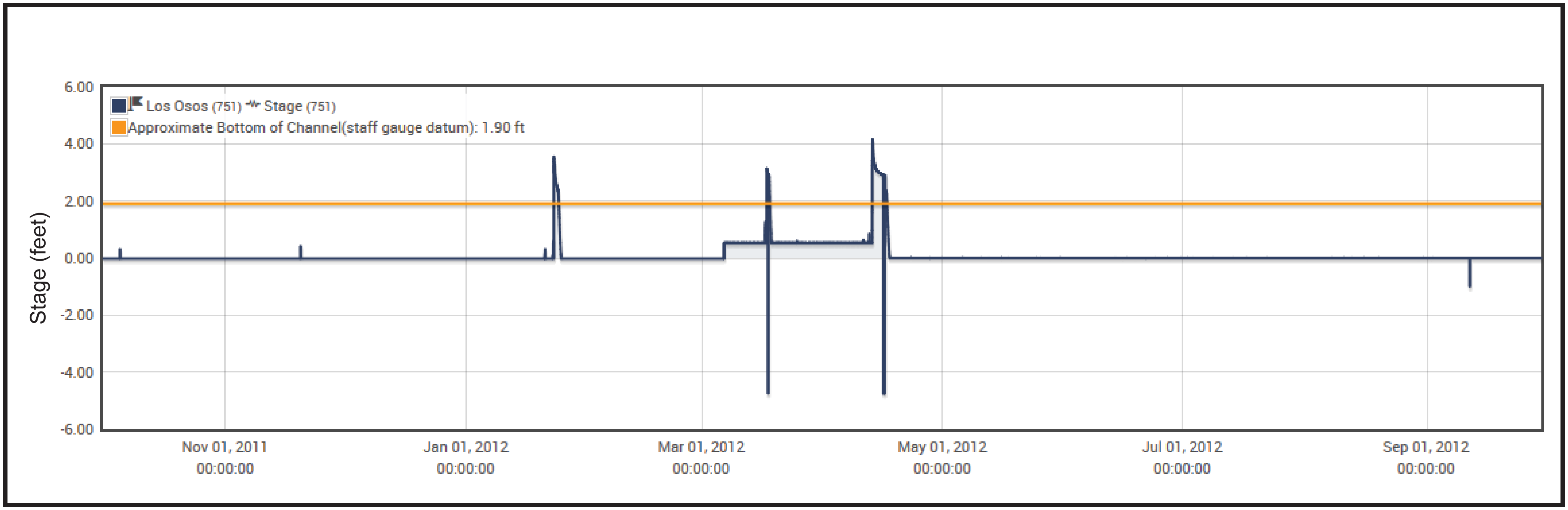


† October 1 - September 30



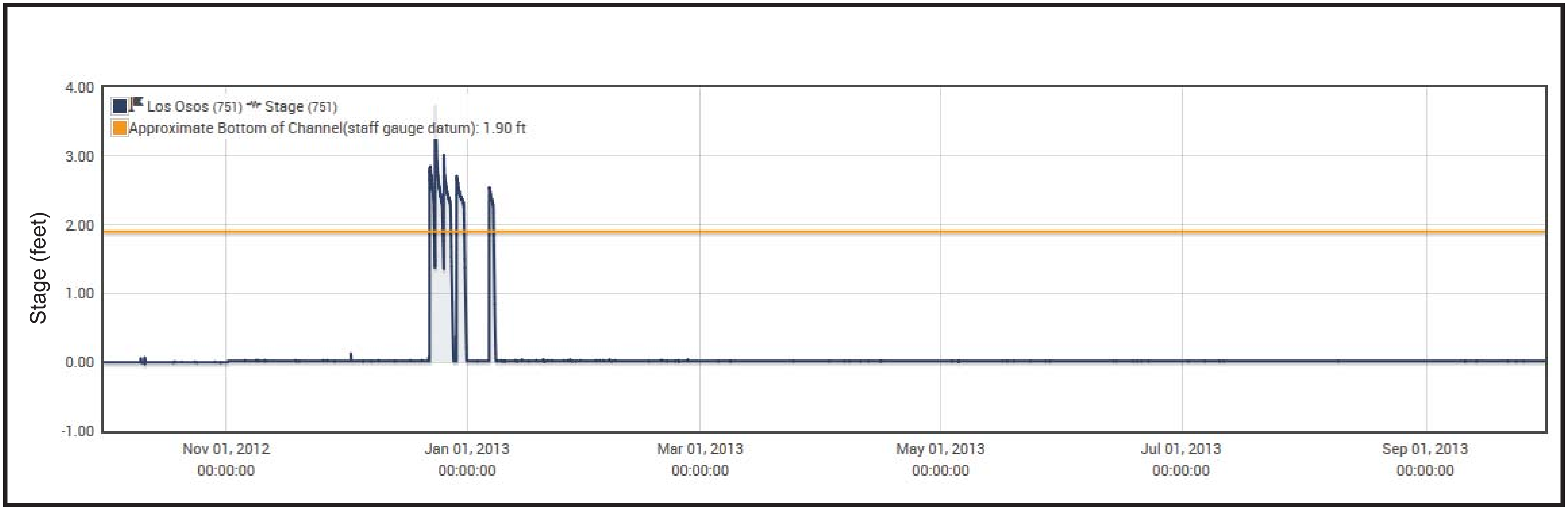
Source: County of San Luis Obispo Public Works Department, Stream Gage #751

Figure E1
Stream Stage for 2011 Water Year
Los Osos Creek, Gage #751



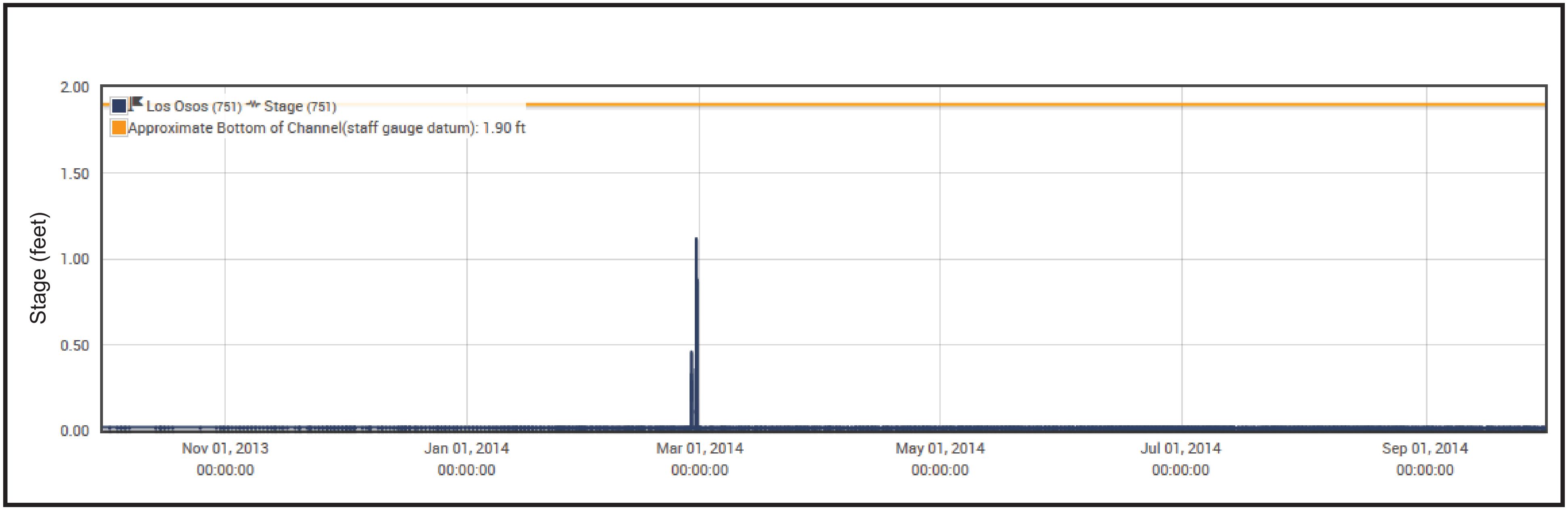
Source: County of San Luis Obispo Public Works Department, Stream Gage #751

Figure E2
Stream Stage for 2012 Water Year
Los Osos Creek, Gage #751



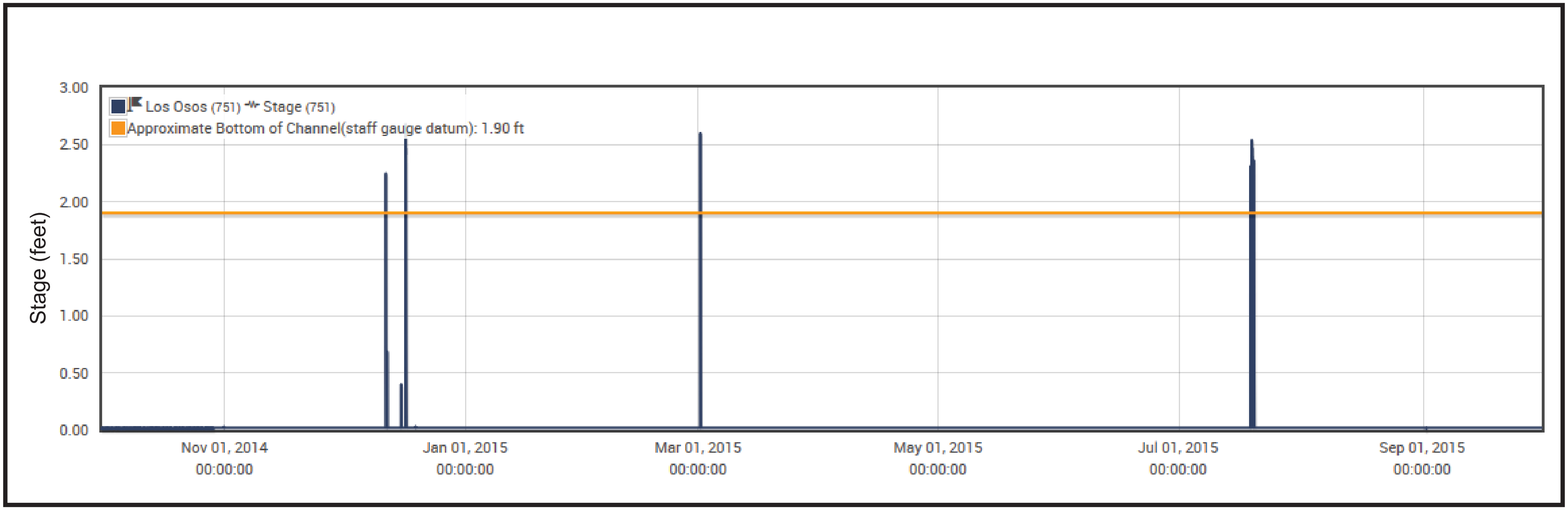
Source: County of San Luis Obispo Public Works Department, Stream Gage #751

Figure E3
Stream Stage for 2013 Water Year
Los Osos Creek, Gage #751



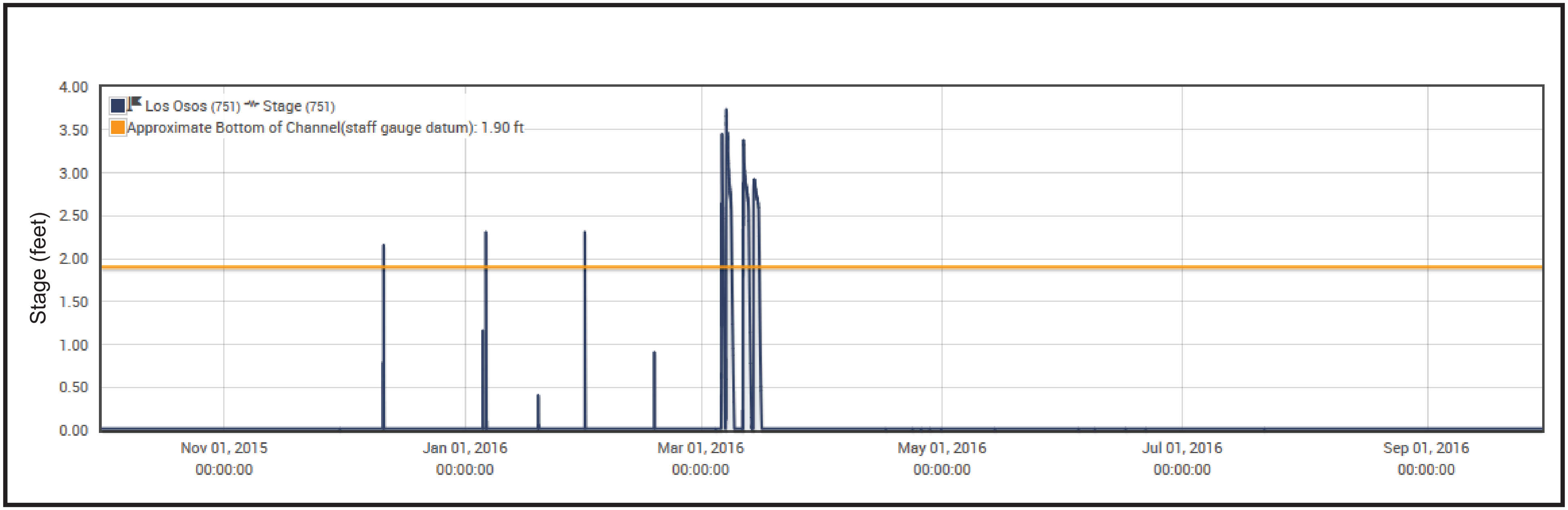
Source: County of San Luis Obispo Public Works Department, Stream Gage #751

Figure E4
Stream Stage for 2014 Water Year
Los Osos Creek, Gage #751



Source: County of San Luis Obispo Public Works Department, Stream Gage #751

Figure E5
Stream Stage for 2015 Water Year
Los Osos Creek, Gage #751



Source: County of San Luis Obispo Public Works Department, Stream Gage #751

Figure E6
Stream Stage for 2016 Water Year
Los Osos Creek, Gage #751

APPENDIX F

Transducer Hydrographs

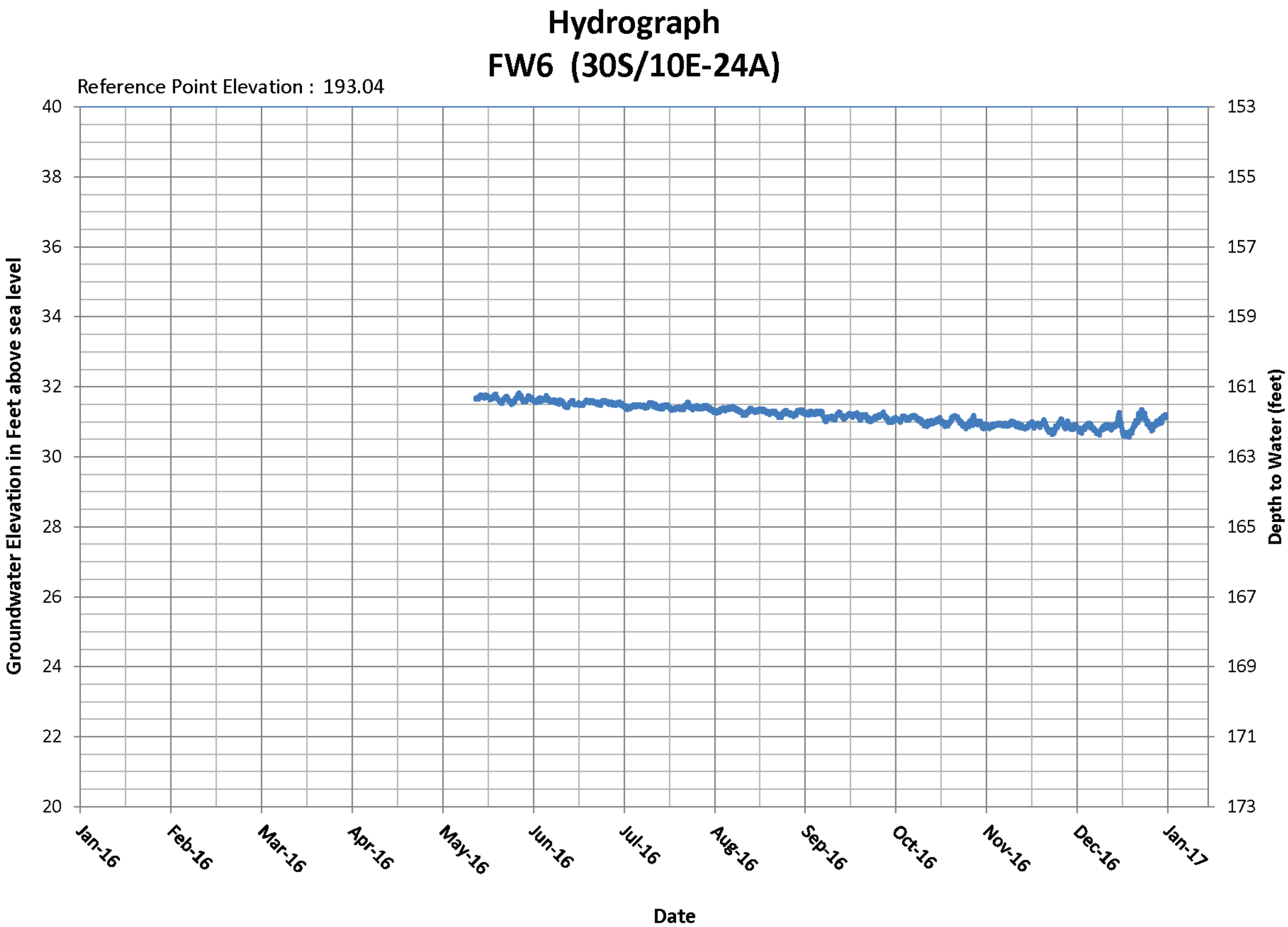


Figure F-1
FW-6 Hydrograph

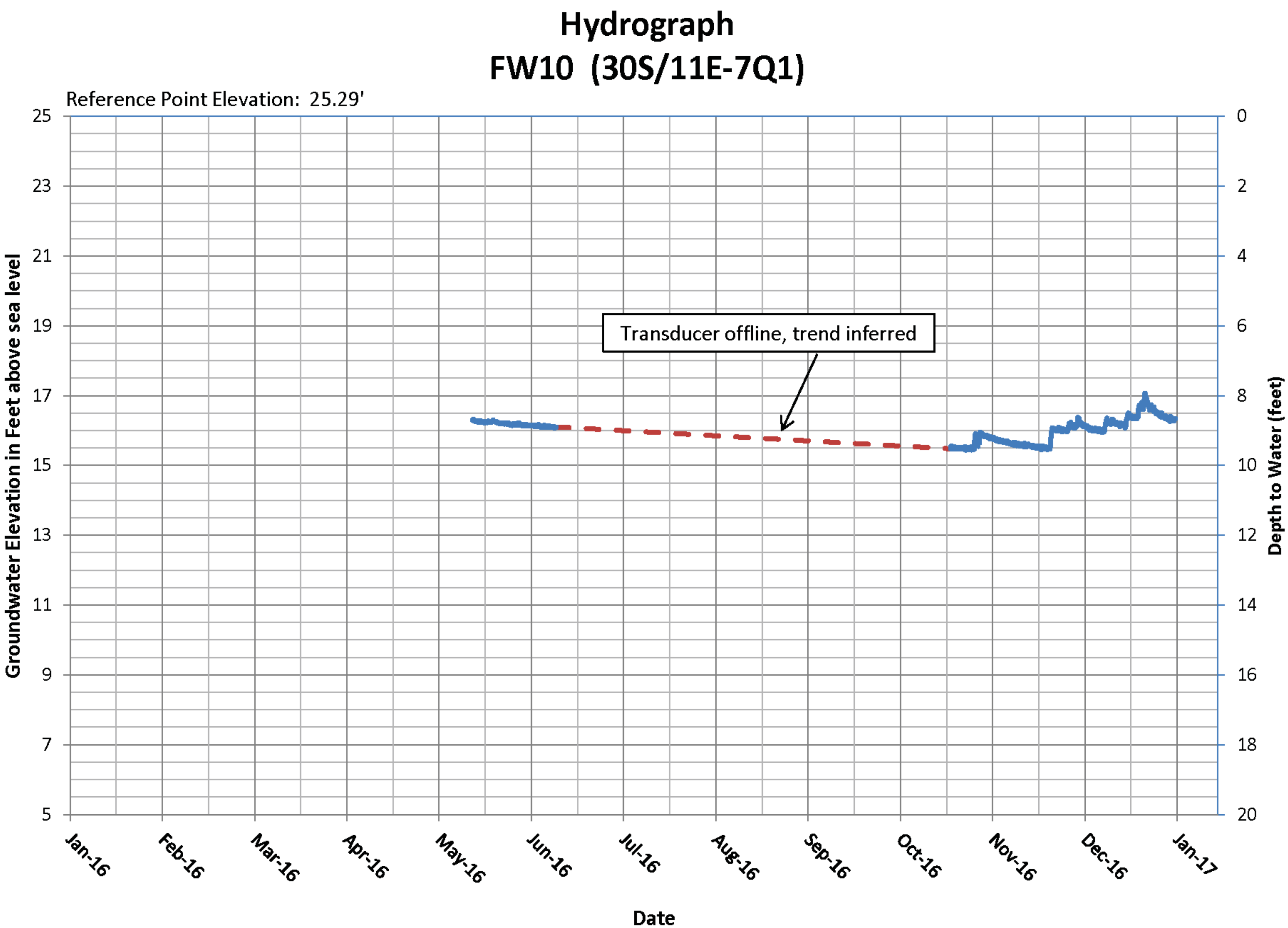


Figure F-2
FW-10 Hydrograph

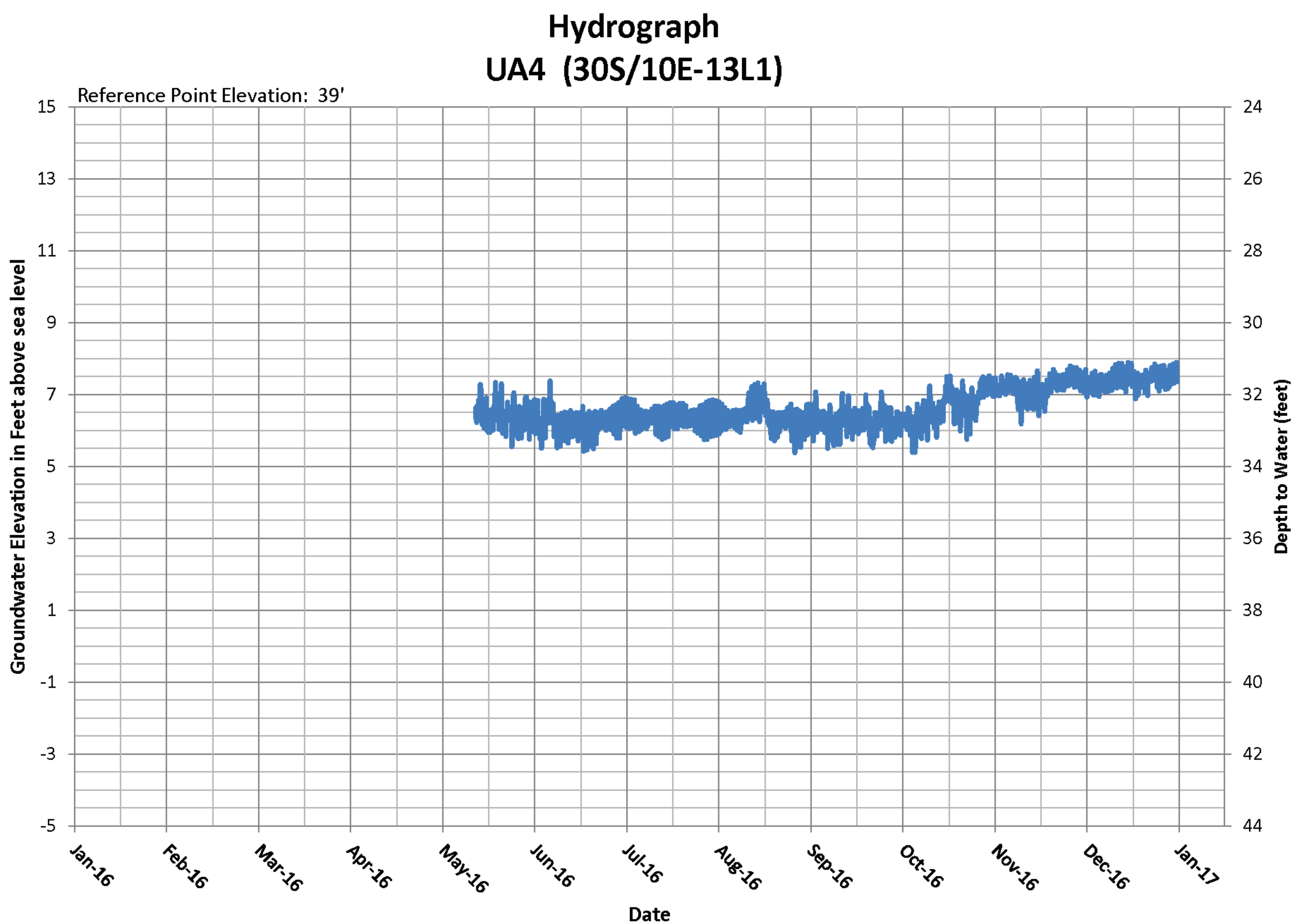


Figure F-3
UA-4 Hydrograph

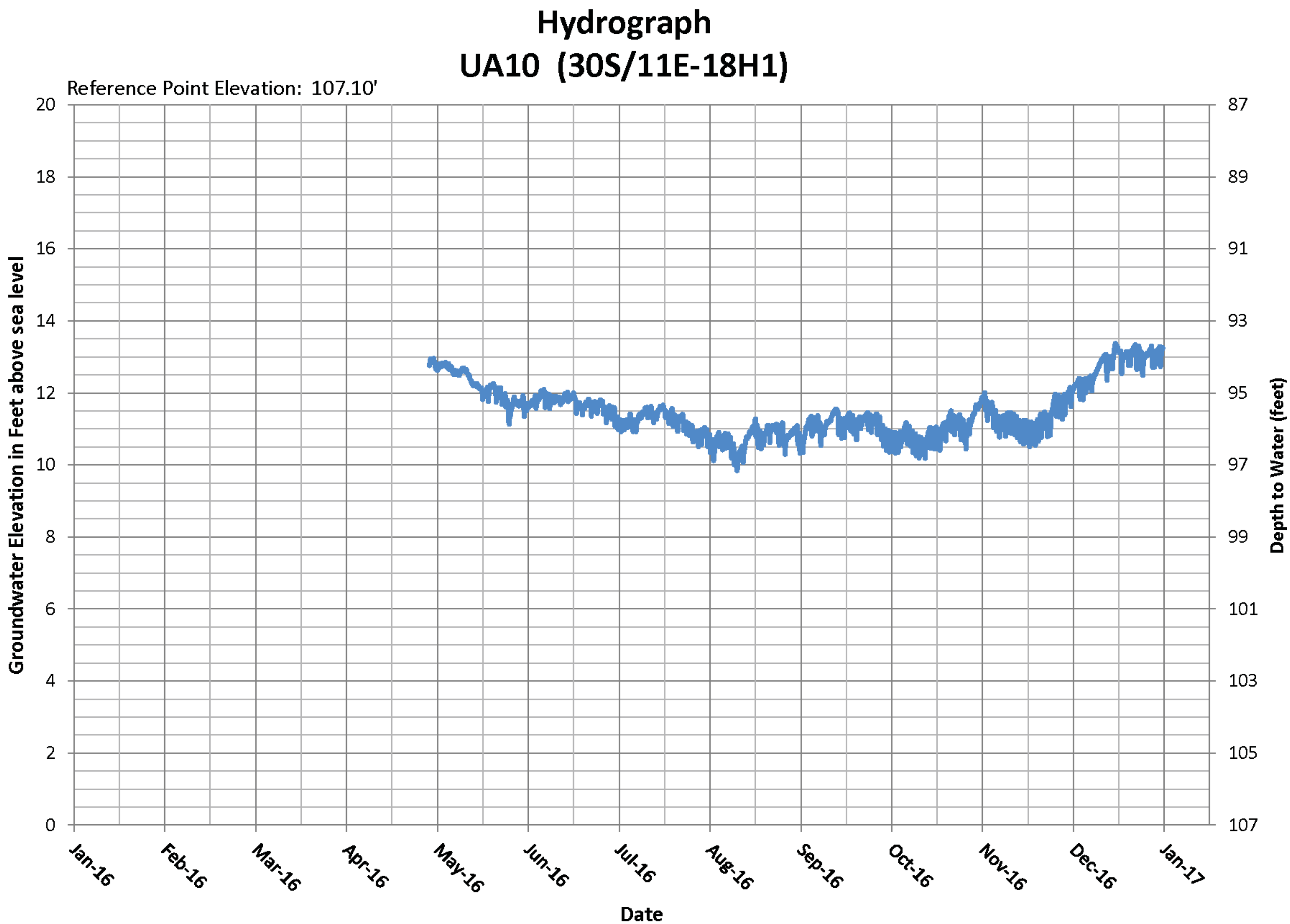


Figure F-4
UA-10 Hydrograph

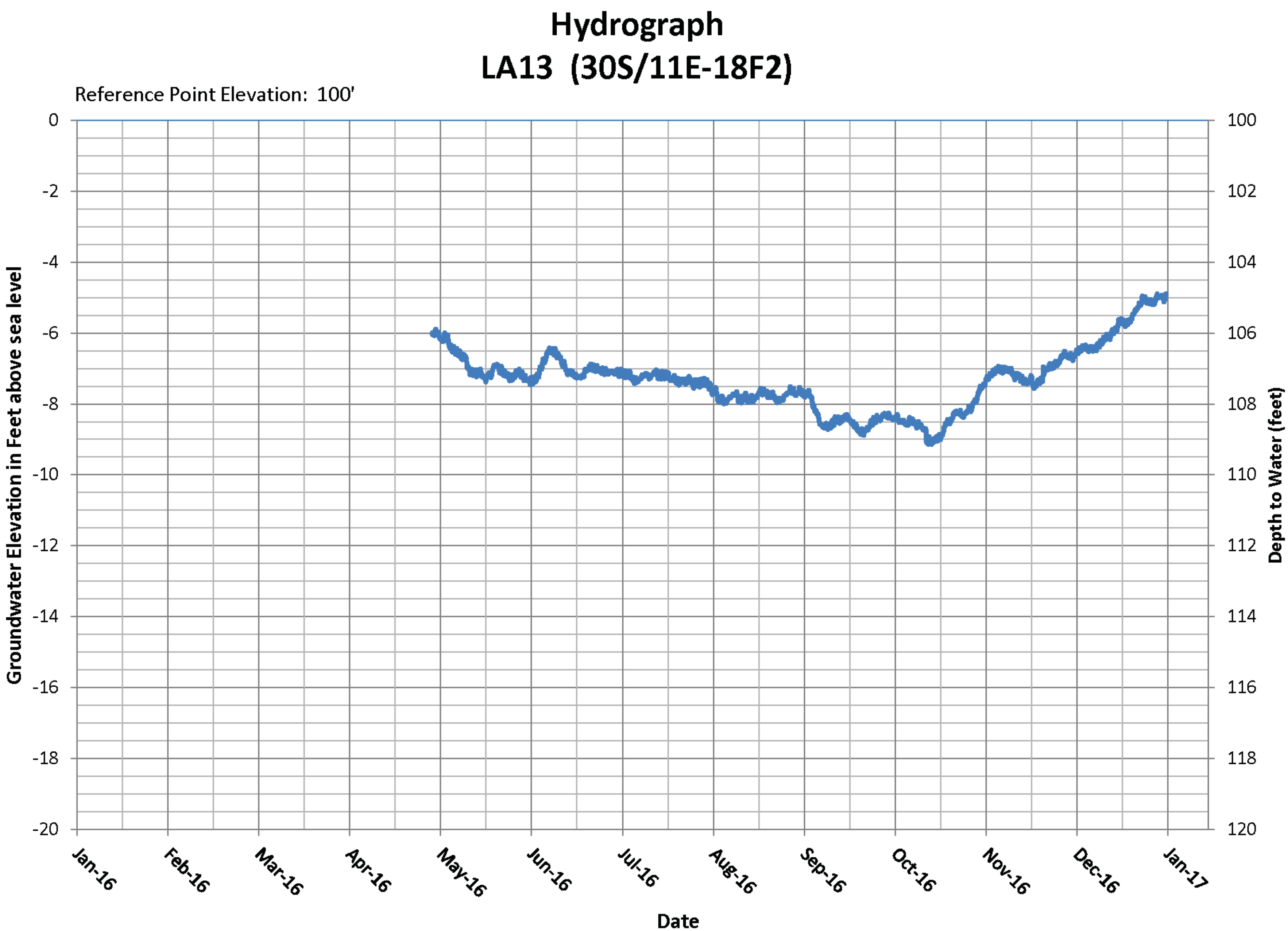


Figure F-5
LA-13 Hydrograph

APPENDIX G

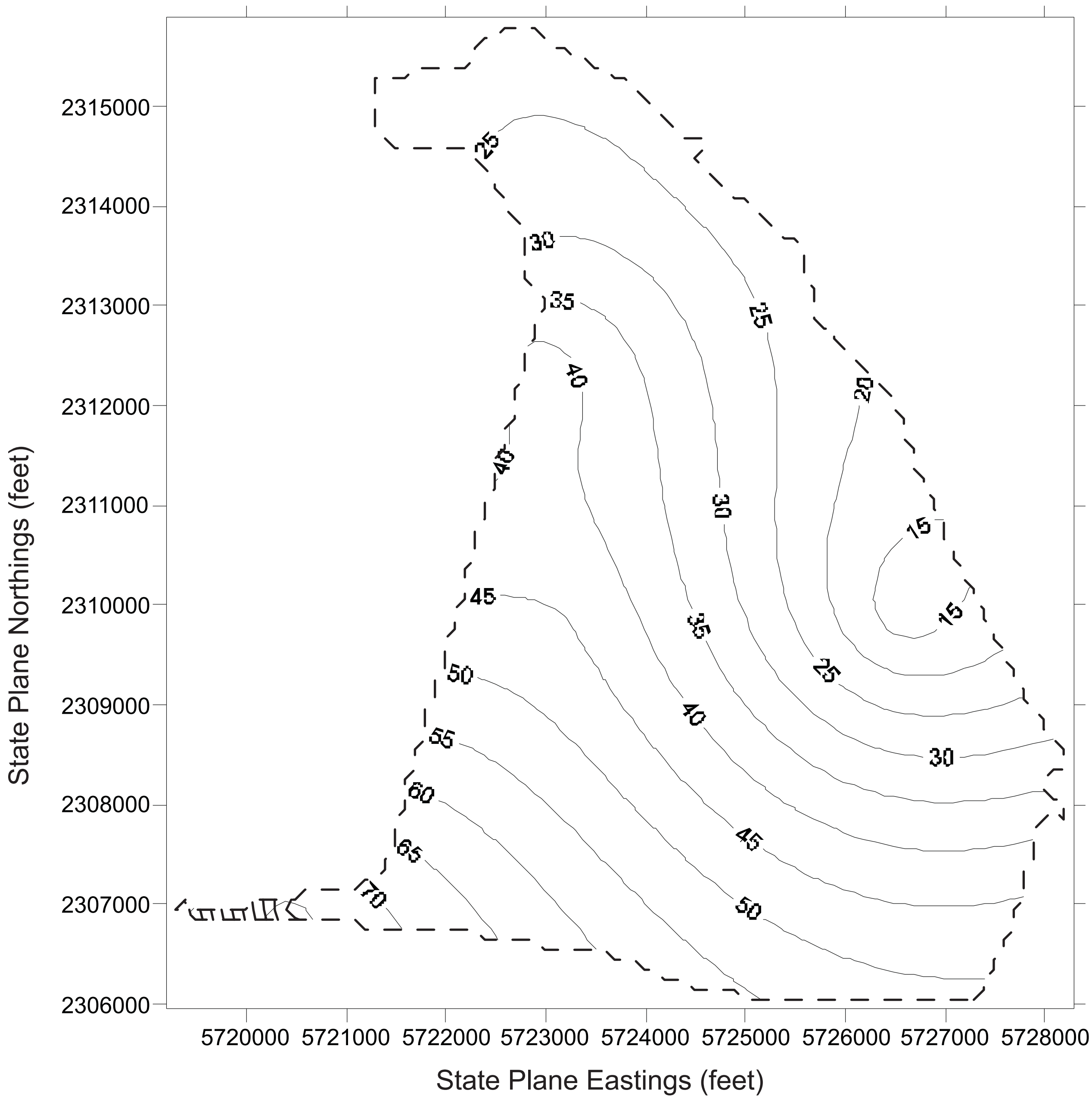
Groundwater Storage Calculation Example and Specific Yield Estimates

WELLS USED FOR GROUNDWATER ELEVATION CONTOURS
2016 GROUNDWATER STORAGE CALCULATIONS

FIRST WATER		UPPER AQUIFER		LOWER AQUIFER	
SPRING	FALL	SPRING	FALL	SPRING	FALL
FW3	FW3	UA1	UA1	LA1	LA1
FW4	FW4	UA2	UA2	LA2	LA2
FW5	FW5	UA3	UA3	LA3	LA3
FW6	FW6	UA4	UA4	LA4	LA4
FW8	FW8	UA5	UA5	LA5	LA5
FW9	FW9	UA6	UA6	LA8	LA8
FW10	FW10	UA8	UA8	LA9	LA9
FW11	FW11	UA9	UA9	LA10	LA10
FW12	FW12	UA10	UA10	LA11	LA11
FW13	FW13	UA12	UA12	LA12	LA12
FW14	FW14	UA16+	UA16+	LA13	LA13
FW15	FW15	UA17+	UA17+	LA14	LA14
FW17	FW17	UA18+	UA18+	LA15	LA15
FW19	FW19	FW2	FW2	LA16	LA16
FW21	FW21	FW3	FW3	LA18	LA18
FW22	FW22	FW4	FW4	LA19	LA19
FW23	FW23	FW5	FW5	LA20	LA20
FW24	FW24	FW6	FW6	LA21	LA21
FW27	FW27	FW8	FW8	LA24	LA24
FW28	FW28	FW9	FW9	LA26	LA26
FW29+	FW29+	FW10	FW10	LA29	LA29
FW30+	FW30+	FW11	FW11	LA33+	LA33+
FW31+	FW31+	FW12	FW12	LA34+	LA34+
LA31+	LA31+	FW14	FW14	LA35+	LA35+
		FW15	FW15	LA36+	LA36+
		FW24	FW24	FW27	FW27
		FW27	FW27		
		FW29+	FW29+		
		LA34+	LA34+		
		LA35+	LA35+		
		LA36+	LA36+		

EXAMPLE STORAGE CALCULATION FOR EASTERN AREA:

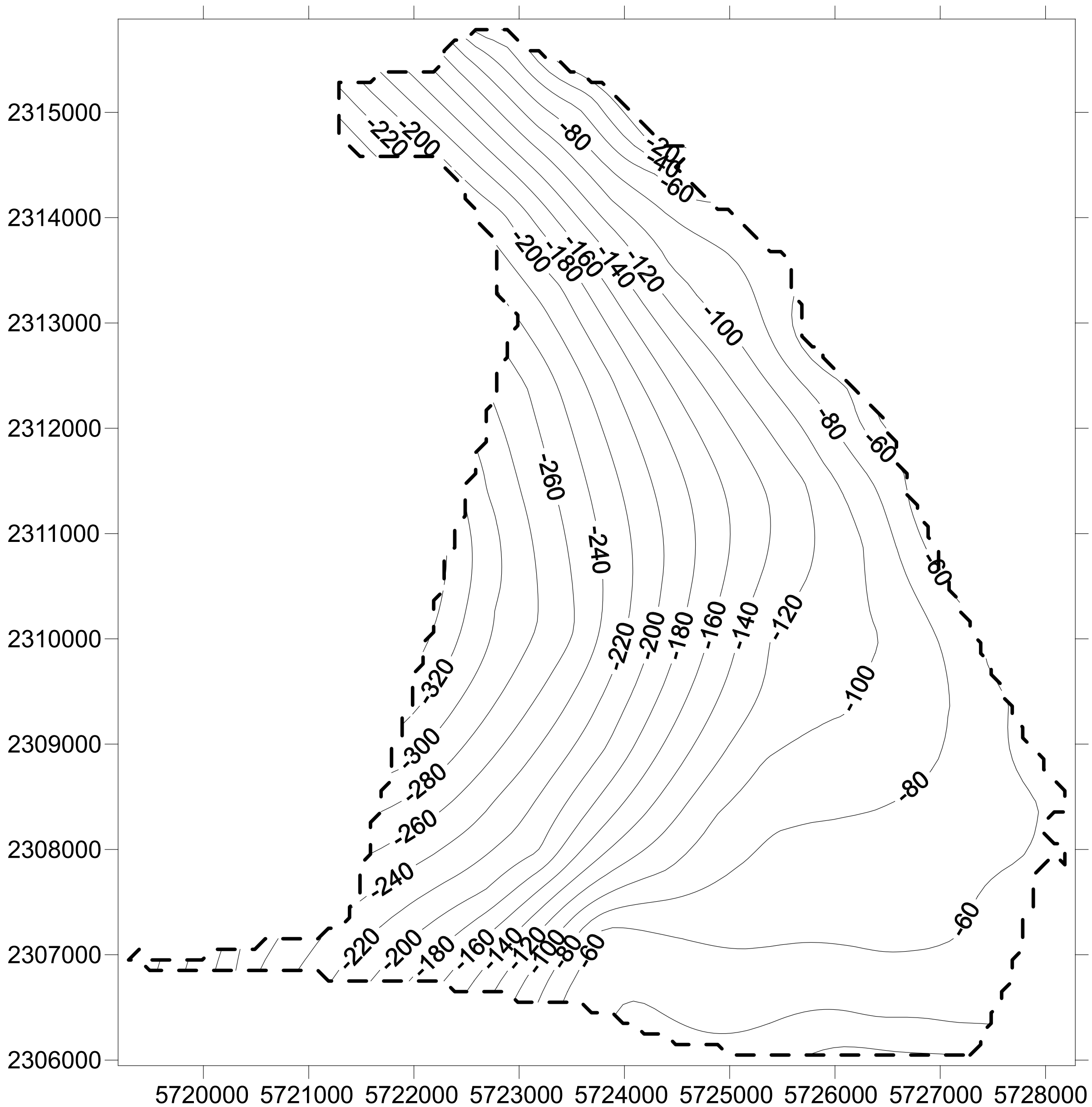
STEP 1: GRID AND TRIM WATER LEVEL CONTOURS



Spring 2016
Eastern Area Water Levels
Alluvial Aquifer and Lower Aquifer

EXAMPLE STORAGE CALCULATION FOR EASTERN AREA:

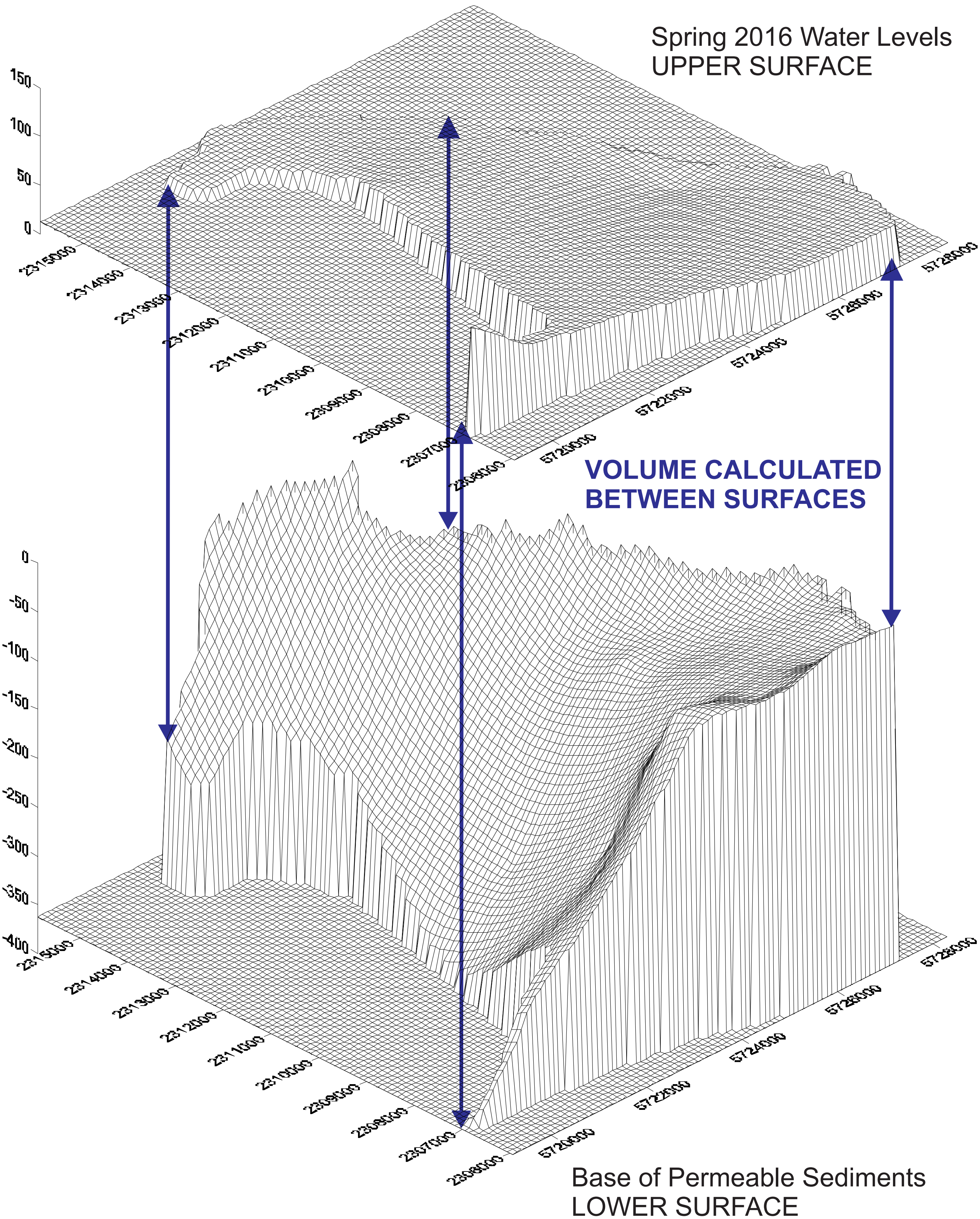
STEP 2: GRID AND TRIM BASE OF PERMEABLE SEDIMENTS



Eastern Area
Base of Permeable Sediments

EXAMPLE STORAGE CALCULATION FOR EASTERN AREA:

STEP 3: MATCH UPPER AND LOWER SURFACE GRIDS



EXAMPLE STORAGE CALCULATION FOR EASTERN AREA:

STEP 4: VOLUME COMPUTATION

Grid Volume Computations

Thu May 18 10:56:18 2017

Upper Surface

Grid File Name: C:\CHG 2017\Projects\LOS OSOS BMC\2016 ANNUAL RPT\SURFER 2016\BLANKED FILES\EASTERN\UA_Eastern spring 2016 blanked REV.grd
Grid Size: 100 rows x 92 columns

X Minimum: 5719189
X Maximum: 5728284
X Spacing: 99.945054945055

Y Minimum: 2305947
Y Maximum: 2315886
Y Spacing: 100.39393939394

Z Minimum: 12.015740307401
Z Maximum: 76.055511220678

Lower Surface

Grid File Name: C:\CHG 2017\Projects\LOS OSOS BMC\2016 ANNUAL RPT\SURFER 2016\BASE GEOMETRY\EASTERN\BOP Eastern blanked.grd
Grid Size: 100 rows x 92 columns

X Minimum: 5719189
X Maximum: 5728284
X Spacing: 99.945054945055

Y Minimum: 2305947
Y Maximum: 2315886
Y Spacing: 100.39393939394

Z Minimum: -362.32467224801
Z Maximum: 2.39586300134

Volumes

Z Scale Factor: 1

Total Volumes by:

Trapezoidal Rule: 7832331112.1982
Simpson's Rule: 7827975486.9401
Simpson's 3/8 Rule: 7824570418.6546

EXAMPLE STORAGE CALCULATION FOR EASTERN AREA:

STEP 5: CALCULATE GROUNDWATER IN STORAGE

Cut & Fill Volumes

Positive Volume [Cut]:	7832331112.1982
Negative Volume [Fill]:	0
Net Volume [Cut-Fill]:	7832331112.1982

Areas

Planar Areas

Positive Planar Area [Cut]:	41665677.518315
Negative Planar Area [Fill]:	0
Blanked Planar Area:	48729527.481685
Total Planar Area:	90395205

Surface Areas

Positive Surface Area [Cut]:	41781297.377816
Negative Surface Area [Fill]:	0

STORAGE CALCULATION

Positive Volume: 7,832,331,112 ft^3 * 0.1 specific yield ÷ 43,560 acre-feet per ft^3 = 17,980 acre-feet

WELL 30S/10E-12J01 (LA11)

Lithology	*Start Depth*	*End Depth*	*Thickness*	*Specific Yield (percent)**	*Zone*	*Weighted Specific Yields (percent)*
sand	5	27	22	20		
clay	27	32	5	3		
sand (peat)	32	70	38	5	C	
clay	70	72	2	3		Weighted Specific Yield
gravel	72	82	10	18		10.8
clay	82	96	14	3		
sand	96	100	4	20		
silt	100	135	35	5		
clay	135	157	22	3		
gravel	157	158	1	18	D	
sand	158	169	11	20		
sand and clay	169	194	25	5		
gravel	194	205	11	18		Weighted Specific Yield
sand and clay	205	217	12	5		7.3
clay	217	222	5	3		
sand and clay	222	245	23	5		
sand and gravel	245	257	12	18		
sand	257	264	7	20		
sand and gravel	264	274	10	18		
sand	274	290	16	20		
sand and silt	290	304	14	5		
sand	304	323	19	20	E	
sand and clay	323	330	7	5		
clay	330	339	9	3		
sand	339	341	2	20		
clay	341	346	5	3		
sand	346	352	6	20		
sand and clay	352	356	4	5		
sand	356	370	14	20		Weighted Specific Yield
sand and gravel	370	386	16	18		13.4
clay	386	392	6	3	BEDROCK	Weighted Specific Yield
shale	392	402	10	13		8
Total Depth	402			**BOREHOLE WEIGHTED SPECIFIC YIELD (PERCENT)**		**10.6**

** Johnson, A. I., 1967, Specific Yield - Compilation of Specific Yields for Various Materials, U.S. Geological Survey Water Supply Paper 1662-D*

WELL 30S/10E-13L04 (LA6)

Lithology	*Start Depth*	*End Depth*	*Thickness*	*Specific Yield (percent)**	*Zone*	*Weighted Specific Yields (percent)*
top soil	0	19	19	unsaturated	C	
clay, some gravel and sand	19	26	7			
gravel, clay and sand	26	41	15			
fine sand	41	61	20	20		
clay, sand, small rocks	61	71	10	7		
clay, few pebbles	71	75	4	7		
fine gravel and sand	75	81	6	18		
sandy clay	81	95	14	5		
hard clay	95	97	2	3		
fine sand	97	115	18	20		
clay	115	118	3	3		
sand and gravel	118	149	31	18		
reddish brown clay, pebbly	149	164	15	7		
gravel	164	170	6	18		Weighted Specific Yield
sand and clay	170	190	20	5		12.9
tan clay, some gravel	190	210	20	7	D	
hard green clay	210	240	30	3		
tan sand	240	248	8	20		
clay and sand	248	260	12	5		
fine sand	260	277	17	20		
gravel	277	283	6	18		
fine sand	283	293	10	20		
fine gravel	293	310	17	18		
sand and clay	310	340	30	5		
coarse gravel	340	356	16	18		Weighted Specific Yield
gravel and clay	356	370	14	7		10.8
fine sand	370	394	24	20	E	
coarse gravel boulders	394	426	32	18		
gravel	426	456	30	18		
clay sand and gravel	456	500	44	7		
sand clay and gravel	500	570	70	7		
gravel and clay	570	600	30	7		
silt and clay	600	619	19	5		
black mud	619	621	2	3		Weighted Specific Yield
gravel	621	670	49	18		12
hard clay, sandstone	670	675	5	3	BEDROCK	Weighted Specific Yield
						3
Total Depth	675			**BOREHOLE WEIGHTED SPECIFIC YIELD (PERCENT)**		**11.8**

** Johnson, A. I., 1967, Specific Yield - Compilation of Specific Yields for Various Materials, U.S. Geological Survey Water Supply Paper 1662-D*

WELL 30S/11E-7Q03 (LA12)						
Lithology	***Start Depth***	***End Depth***	***Thickness***	***Specific Yield (percent)****	***Zone***	***Weighted Specific Yields (percent)***
sandy brown soil	0	6	6	unsaturated	A	Weighted Specific Yield
sand	6	17	11	20		20
clay some gravel	17	20	3	7	C	
sand	20	48	28	20		
clay	48	52	4	3		Weighted Specific Yield
cemented sand	52	127	75	15		15.6
clay	127	230	103	3	D	
sand some gravel	230	245	15	18		Weighted Specific Yield
gravel	245	276	31	18		7.6
clay	276	325	49	3	E	
sand	325	332	7	20		
clay	332	343	11	3		
sand	343	350	7	20		
sand and gravel	350	356	6	18		
rock	356	357	1	15		Weighted Specific Yield
sand and gravel	357	402	45	18		11.1
clay	402	411	9	3	BEDROCK	Weighted Specific Yield
						3
Total Depth	411			**BOREHOLE WEIGHTED SPECIFIC YIELD (PERCENT)**		**11.3**

#	corrected depth using e-log

** Johnson, A. I., 1967, Specific Yield - Compilation of Specific Yields for Various Materials, U.S. Geological Survey Water Supply Paper 1662-D*

WELL 30S/11E-17C01 (LA23)						
Lithology	***Start Depth***	***End Depth***	***Thickness***	***Specific Yield (percent)****	***Zone***	***Weighted Specific Yields (percent)***
sandy soil	0	3	3	unsaturated	A	
sand	3	28	25			
sandy clay	28	34	6	5		Weighted Specific Yield
sand	34	48	14	20		15.5
clay	48	52	4	3	C	
sand and gravel	52	56	4	18		
clay	56	76	20	3		
clay and gravel	76	80	4	7		
sandy clay	80	91	11	5		
sand	91	104	13	20		
clay	104	108	4	3		Weighted Specific Yield
sand	108	114	6	20		9.4
silty clay	114	148	34	5	D	
sandy clay	148	165	17	5		
sand	165	183	18	20		Weighted Specific Yield
sand and gravel	183	230	47	18		12.6
clay	230	236	6	3	E	
sandy clay	236	246	10	5		
sand and gravel	246	254	8	18		Weighted Specific Yield
clay	254	270	16	3		6.5
Total Depth	270			**BOREHOLE WEIGHTED SPECIFIC YIELD (PERCENT)**		**11**

** Johnson, A. I., 1967, Specific Yield - Compilation of Specific Yields for Various Materials, U.S. Geological Survey Water Supply Paper 1662-D*

WELL 30S/11E-17J01 (LA24)						
Lithology	***Start Depth***	***End Depth***	***Thickness***	***Specific Yield (percent)****	***Zone***	***Weighted Specific Yields (percent)***
all inferred from e-log						
no data	0	8	8	unsaturated	C	
clay	8	15	7			
sandy clay	15	37	22	5		
clay	37	40	3	3		
sandy clay	40	48	8	5		Weighted Specific Yield
sand	48	72	24	20		11.2
sandy clay	72	118	46	5	D	
sand	118	128	10	20		
sandy clay	128	150	22	5		
sand	150	163	13	20		
clay	163	168	5	3		Weighted Specific Yield
sand	168	189	21	20		10.6
sandy clay	189	214	25	5	E	
sand	214	220	6	20		
clay with sand beds	220	232	12	5		
sand, some clay	232	244	12	15		
clay	244	262	18	3		
sandy clay	262	271	9	5		
clay	271	278	7	3		
sandy clay	278	291	13	5		
clay	291	297	6	3		
sandy clay and clay	297	315	18	5		
clay	315	319	4	3		Weighted Specific Yield
sand	319	329	10	20		7.1
rock	329	333	4	13	BEDROCK	Weighted Specific Yield
						13
Total Depth	333			**BOREHOLE WEIGHTED SPECIFIC YIELD (PERCENT)**		**9.1**

** Johnson, A. I., 1967, Specific Yield - Compilation of Specific Yields for Various Materials, U.S. Geological Survey Water Supply Paper 1662-D*

WELL 30S/11E-17N10 (LA20)						
Lithology	***Start Depth***	***End Depth***	***Thickness***	***Specific Yield (percent)****	***Zone***	***Weighted Specific Yields (percent)***
fill	0	3	3		A	Weighted Specific Yield
sand	3	37	34	20		20
clay	37	42	5	3	B	
gravelly clay	42	50	8	7		
clay	50	58	8	3		
sand and gravel	58	81	23	18		
sand	81	92	11	20		Weighted Specific Yield
sand and gravel	92	98	6	18		13.7
clayey sand	98	120	22	5	C	
sand and gravel	120	150	30	18		
clayey gravel	150	170	20	7		
gravelly sand	170	187	17	18		
gravelly clay	187	197	10	7		Weighted Specific Yield
sandy gravel	197	210	13	18		12.5
clay	210	225	15	3	D	
sand and gravel	225	250	25	18		
sandy clay	250	260	10	5		
sand and gravel	260	270	10	18		
gravelly clay	270	275	5	7		
gravelly sand	275	290	15	18		
sandy clay	290	320	30	5		Weighted Specific Yield
sand	320	400	80	20		14.6
sandy clay	400	480	80	5	E	
gravelly sand	480	530	50	18		
sand / silty sand	530	630	100	5		Weighted Specific Yield
sandy clay	630	750	120	5		6.9
Total Depth	750			**BOREHOLE WEIGHTED SPECIFIC YIELD (PERCENT)**		**10.8**

** Johnson, A. I., 1967, Specific Yield - Compilation of Specific Yields for Various Materials, U.S. Geological Survey Water Supply Paper 1662-D*

WELL 30S/11E-18K08 (LA18)						
Lithology	***Start Depth***	***End Depth***	***Thickness***	***Specific Yield (percent)****	***Zone***	***Weighted Specific Yields (percent)***
						Weighted Specific Yield
sand	50	110	60	20	**A & B**	20.00
sandy clay	110	132	22	5	**C**	
cemented sand	132	151	19	15		
sandy clay	151	158	7	5		
sand	158	195	37	20		
sandy clay	195	200	5	5		
sand	200	225	25	20		
sandy clay	225	235	10	5		
sand	235	254	19	20		
sandy clay	254	260	6	5		Weighted Specific Yield
sand with gravel	260	264	4	18		14.5
sandy clay	264	288	24	5	**D**	
clayey sand	288	305	17	5		
sandy clay	305	310	5	5		
clayey sand	310	324	14	5		
clay with sand	324	350	26	5		
silty sand	350	370	20	3		
sandy clay	370	380	10	5		
sand	380	386	6	20		
sandy clay	386	395	9	5		Weighted Specific Yield
silty sand	395	490	95	3		4.4
clay sandy clay	490	515	25	5	**E**	
silty sand	515	592	77	3		Weighted Specific Yield
sand with seashells	592	660	68	20		10.1
Total Depth	660			**BOREHOLE WEIGHTED SPECIFIC YIELD (PERCENT)**		**10.1**

** Johnson, A. I., 1967, Specific Yield - Compilation of Specific Yields for Various Materials, U.S. Geological Survey Water Supply Paper 1662-D*

WELL 30S/11E-18M01 (LA16)						
Lithology	***Start Depth***	***End Depth***	***Thickness***	***Specific Yield (percent)****	***Zone***	***Weighted Specific Yields (percent)***
fine brown sand	40	70	30	20	C	
sand, sandy clay	70	160	90	5		Weighted Specific Yield
sand	160	165	5	20		9.2
sandy clay	165	245	80	5	D	
sandy clay with gravel	245	275	30	7		
sandy clay	275	350	75	5		Weighted Specific Yield
sand and gravel	350	372	22	18		6.7
sandy clay with gravel	372	392	20	5	E	
sandy clay	392	460	68	7		
sandy clay with gravel	460	490	30	5		
sandy clay	490	536	46	7		
sand and gravel	536	562	26	18		Weighted Specific Yield
sandy clay with gravel	562	630	68	7		7.7
Total Depth	630			**BOREHOLE WEIGHTED SPECIFIC YIELD (PERCENT)**		**7.7**

** Johnson, A. I., 1967, Specific Yield - Compilation of Specific Yields for Various Materials, U.S. Geological Survey Water Supply Paper 1662-D*

WELL 30S/11E-20G02 (LA26)						
Lithology	***Start Depth***	***End Depth***	***Thickness***	***Specific Yield (percent)****	***Zone***	***Weighted Specific Yields (percent)***
silty-clay-soil	0	11	11	unsaturated	C	
gravel	11	15	4			
clayey sand	15	53	38	5		
gravel	53	55	2	18		Weighted Specific Yield
clayey sand	55	75	20	5		5.4
clay	75	117	42	3	D	
gravel	117	120	3	18		
sand	120	197	77	20		Weighted Specific Yield
coarse sand and gravel	197	213	16	18		14.6
clayey sand	213	290	77	5	E	
sand	290	315	25	20		Weighted Specific Yield
gravelly sand	315	335	20	18		10.2
bedrock, tight rock	335	380	45	15	BEDROCK	Weighted Specific Yield
						15
Total Depth	380			**BOREHOLE WEIGHTED SPECIFIC YIELD (PERCENT)**		**11.2**

** Johnson, A. I., 1967, Specific Yield - Compilation of Specific Yields for Various Materials, U.S. Geological Survey Water Supply Paper 1662-D*